Kildare County Council
Comhairle Contae Chill Dara

JACOBS

Kerdiffstown Landfill Remediation Project

Kildare County Council

Environmental Impact Assessment Report (EIAR) Volume 2 of 4: Main Report

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Table of Authors

Chapter	Author(s)	Company
Chapter 1 Introduction	Rachel Kelly	Jacobs Engineering Ireland Ltd.
Chapter 2 Approach to Environmental Impact Assessment	Rachel Kelly	Jacobs Engineering Ireland Ltd.
Chapter 3 The Need for the Proposed Project	Colin Dunsmuir	Jacobs Engineering Ireland Ltd.
Chapter 4 Description of the Proposed Project	Colin Dunsmuir	Jacobs Engineering Ireland Ltd.
Chapter 5 Consideration of Alternatives	Colin Dunsmuir	Jacobs Engineering Ireland Ltd.
Chapter 6 The Consultation Process	Muriel Ennis	Jacobs Engineering Ireland Ltd.
Chapter 7 Air Quality, Odour and Climate	Imelda Shanahan	TMS Environment Ltd on behalf of Jacobs Engineering Ireland Ltd.
Chapter 8 Noise and Vibration	Tom Ryan	TMS Environment Ltd on behalf of Jacobs Engineering Ireland Ltd.
Chapter 9 Landscape and Visual	Richard Barker	Macro Works Ltd on behalf of Jacobs Engineering Ireland Ltd.
Chapter 10 Archaeology, Cultural Heritage and Architectural Heritage	Faith Bailey	Irish Archaeological Consultancy on behalf of Jacobs Engineering Ireland Ltd.
Chapter 11 Biodiversity	Corey Cannon	Jacobs Engineering Ireland Ltd.
Chapter 12 Soils, Geology, Contaminated Land and Groundwater	Mark Burston	Jacobs Engineering Ireland Ltd.
Chapter 13 Water – Hydrology	Oonagh Duffy	Jacobs Engineering Ireland Ltd.
Chapter 14 Traffic and Transport	Joseph Campbell	Jacobs Engineering Ireland Ltd.
Chapter 15 Waste	Rachel Kelly	Jacobs Engineering Ireland Ltd.
Chapter 16 Population and Human Health	Emily King	Jacobs Engineering Ireland Ltd.
Chapter 17 Material Assets	Rachel Kelly	Jacobs Engineering Ireland Ltd.
Chapter 18 Environmental Interactions	Rachel Kelly	Jacobs Engineering Ireland Ltd.
Chapter 19 Schedule of Environmental Commitments	Rachel Kelly	Jacobs Engineering Ireland Ltd.
Chapter 20 Summary of Residual Impacts	Rachel Kelly	Jacobs Engineering Ireland Ltd.

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Glossary

Below is provided a partial glossary of terms used in this Environmental Impact Assessment Report. The definitions therein are not to be taken as comprehensive but solely as an aid to the non-technical reader.

Term	Definition
AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AASS	Appropriate Assessment Screening Statement
AEP	Annual Exceedance Probability
AG	Air Guidance – Guidance notes published by the Environmental Protection Agency
Alluvium	Deposits from a river or stream.
Amelioration (of impacts, etc.)	"Ameliorate" means to make less severe or to amend. Impact amelioration proposals suggest ways to improve the negative effects of a project on the environment.
Annual Mean Concentration	The average concentration of a substance over the period of a year
Anthropocentric	Human-centric
Anthropogenic	"Anthropogenic" is a term of, relating to, or resulting from the influence of human beings on nature
AOD	Above Ordnance Datum
AQS	Air Quality Standards
Aquifer	A subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater.
Archaeology	The study of past societies through its surviving structures, artefacts and environmental data.
Architectural Heritage	Structures, buildings, traditional and designed, and groups of buildings including streetscapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents.
ATCs	Automatic Traffic Counters
At-Grade Junction	Road junction at which at least one road meets another at the same level.
BAP	Biodiversity Action Plan
Baseline survey	A description of the existing environment against which future changes can be measured.
BAT	Best Available Techniques
BCI	Bat Conservation Ireland
BCT	Bat Conservation Trust
BH	Borehole
Biotic	Processes which relate to living organisms.
BoCCI	Birds of Conservation Concern in Ireland
BOD	Biochemical Oxygen Demand / Biological Oxygen Demand
BRE	Building Research Establishment
BRP	Bat Roost Potential
BS	British Standard
BSBI	Botanical Society of Britain & Ireland
BTEX	Benzene, Toluene, Ethyl Benzene and Xylenes
BTO	British Trust for Ornithology
C&D	Construction and Demolition
c.	Circa (approximately)
$CaCO_3$	Calcium Carbonate
CAFE	Clean Air for Europe
Catchment	That area determined by topographic features within which falling rain will contribute to runoff at a particular point under consideration.
CDP	County Development Plan
CEMP	Construction Environmental Management Plan
CER	Commission for Energy Regulation
CFRAM	Catchment Flood Risk Assessment and Management
CH_4	Methane

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Term	Definition
CIE	Coras Iompair Éireann
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CLG	Community Liaison Group
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COBA	Cost Benefit Analysis
COD	Chemical Oxygen Demand
COMXXX	Commercial Receptor
CORINE	Coordination of Information on the Environment
CPO	Compulsory Purchase Order
CQA	Construction Quality Assurance
CQC	Construction Quality Control
cSAC	candidate Special Area of Conservation
CSM	Conceptual Site Model
CSO	Central Statistics Office
CTMP	Construction Traffic Management Plan
Cumulative Impact	The addition of many small impacts to create one larger, more significant, impact.
DAHG	Department of Arts, Heritage and the Gaeltacht
DAU	Development Application Unit
dB	decibels
DCC	Dublin City Council
DCCAE	Department of Communications, Climate Action and Environment
DECLG	Department of Environment, Community and Local Government
DEFRA	Department of Environment, Food and Rural Affairs
DHPCLG	Department of Housing, Planning, Community and Local Government
DMURS	Design Manual for Urban Roads and Streets
DO	Dissolved Oxygen
DoAHRRGA	Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs
DoEHLG	Department of the Environment, Heritage and Local Government
"Do-Minimum" Scenario	The situation or environment that would exist if minimal intervention or development were carried out.
DQRA	Detailed Quantitative Risk Assessment
EC	Electrical Conductivity
EC	European Commission
Eh	Redox potential
EHS	Environmental Health Service
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
EOP	Environmental Operating Plan
EPA	Environmental Protection Agency
EQS	Environmental Quality Standards
ERBD	Eastern River Basin District
ESB	Electricity Supply Board
ESCP	Erosion and Sediment Control Plan
Estuarine	Environment associated with semi-enclosed coastal body of water which has a free connection with the open sea and where fresh water, derived from land drainage, is mixed with sea water.
EU	European Union
EWC	European Waste Catalogue
Fauna	A collective term for the animals of a region.
FBA	Freshwater Biological Association
FID	Flame Ionisation Detector

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Term	Definition
Flora	A collective term for the plants of a region.
Fluvial	Pertaining to a river.
FML	Flexible Membrane Liner
FPO	Flora Protection Order
FRA	Flood Risk Assessment
FTE	Full Time Equivalent
g/m^3	Grams per metre cubed.
GAC	Generic Assessment Criteria
GDA	Greater Dublin Area – the area encompassing the Dublin and Mid-East Regions, respectively, comprising Dublin City and counties Dun Laoghaire-Rathdown, Fingal and South Dublin in the Dublin Region, together with the counties of Kildare, Meath and Wicklow in the Mid-East Region
GDL	Geocomposite Drainage Layer
GHG	Greenhouse Gases
GI	Green Infrastructure
GLC	Ground Level Concentration
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GPA	Guidelines for Planning Authorities
GSI	Geological Survey of Ireland
H_2S	Hydrogen Sulphide
ha	Hectares = 10,000 square metres.
HA	Hydrometric Area
HAZOP	Hazard and Operability Study
HDPE	High-Density Polyethylene
HGVs	Heavy Goods Vehicles
HMWB	Heavily Modified Water Bodies
HSA	Health and Safety Authority
HSE	Health Service Executive
Hydrocarbons	A compound of hydrogen and carbon, such as any of those which are the chief components of petroleum and natural gas.
Hz	Hertz
ID	Identification
IED	Industrial Emissions Directive
IEAL	Industrial Emissions Activities Licence
IEMA	Institute of Environmental Management and Assessment
IFI	Inland Fisheries Ireland
IGI	Institute of Geologists of Ireland
Impact Interactions	The reactions between impacts on different environmental factors, whether between the impacts of just one project or between the impacts of the other projects in the area.
IMS	Industrial Methylated Spirits
Indirect Impact	Impacts on the environment which are not a direct result of the project, often produced away from the project or as a result of a complex pathway.
Infrastructure	Basic public facilities e.g. roads, sewers, water supply, telephones and electricity.
IPH	Institute of Public Health in Ireland
IPPC	Integrated Pollution Prevention and Control
Isopleth	A line on a map connecting points having equal values.
ISR	In Stack Ratio
IUCN	International Union for Conservation of Nature and Natural Resources
IW	Irish Water
IWAI	Inland Waterways Association of Ireland
IWeBS	Irish Wetland Bird Survey Data
KCC	Kildare County Council
KCDP	Kildare County Development Plan
KER's	Key Ecological Receptor's

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Term	Definition
KLRP	Kerdiffstown Landfill Remediation Project
km	Kilometre
kph	Kilometres per hour
l/s	Litres per second.
LAP	Local Area Plan
LCA	Landscape Character Area
LCT	Landscape Character Types
LFG	Landfill Gas
LGV	Light Goods Vehicles
LI	Locally Important
LIA	Landscape Impact Assessment
LLDPE	Linear Low Density Polyethylene
LoW	List of Waste
LVIA	Landscape and Visual Impact Assessment
m/s	Metres per second.
m^3/s	Metres cubed per second
MDPE	Medium Density Polyethylene Pipe
Method Statement	A document outlining the work task or process to be completed, along with the potential hazards involved and mitigation measures to reduce or avoid risk.
Methodology	The specific approach or techniques used to analyse impacts or describe environmental features and conditions
mg/l	Milligrams per litre.
mg/m^2-day	Milligrams per metre squared per day.
mg/m^3	Milligrams per metre cubed.
Mitigation	Measures designed to avoid, reduce, remedy or compensate for adverse impacts
mm	Millimetre
MMP	Mobility Management Plan
mOD	Metres above Ordnance Datum
Moderate Impact	An impact that alters the character of the environment in a manner that is consistent with the existing and emerging trends.
MSW	Municipal Solid Wastes
N	Nitrogen
N_2O	Nitrous oxide
NAAQS	National Ambient Air Quality Standard
NBDC	National Biodiversity Data Centre
NCM	National Cycle Manual
NECD	National Emissions Ceiling Directive
Negative Impact	A change which reduces the quality of the environment (for example, by lessening species diversity and the reproductive capacity of the ecosystem, by damaging health, property or by causing nuisance).
Neutral Impact	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
NG	Noise Guidance – Guidance notes published by the Environmental Protection Agency
NH_3	Ammonia
NHA	National Heritage Area
NIAH	National Inventory of Architectural Heritage
NMI	National Museum of Ireland
NMVOCs	Non-methane VOCs
NNG	Naas Neighbourhood Greenway
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NPWS	National Parks and Wildlife Service
NRA	National Road Authority (Now Transport Infrastructure Ireland)

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Term	Definition
NRS	National Road Schemes
NSR	Noise Sensitive Receptor
NTA	National Transport Authority
NTS	Non-Technical Summary
NTS (in relation to drawings)	Not to scale
NVMP	Noise and Vibration Management Plan
OCP	Odour Control Plan
OPW	Office of Public Works
OS	Ordnance Survey
OSI	Ordnance Survey Ireland
OUE/m^3	Odour Unit per Cubic Metre
P	Phosphorus
P & ID	Piping and Instrumentation Drawing
PAH	Polycyclic Aromatic Hydrocarbons
pESCP	Preliminary Erosion and Sediment Control Plan
PM_{10}	PM_{10} is particulate matter 10 micrometres (µm) or less in diameter
$PM_{2.5}$	$PM_{2.5}$ is particulate matter 2.5 micrometres (µm) or less in diameter
pNHA	Proposed Natural Heritage Area
Positive Impact	A change which improves the quality of the environment (for example, by increasing species diversity and the reproductive capacity of the ecosystem, or by removing nuisances or improving amenities).
ppb	Parts per Billion
ppmv	Parts per Million by Volume
PPV	Peak Particle Velocity
PRFs	Potential Roost Features
Profound Impact	An impact which obliterates all previous characteristics.
PVMRM	Plume Volume Molar Ratio Method
QI	Qualifying Interest
RBD	River Basin District
RBMPs	River Basin Management Plans
Receptor	Any element in the environment which is subject to impacts.
RECXXX	Residential Receptor
Residual Impact	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
Return Period	The frequency with which a certain event would be expected to occur on average over a long period of record.
RFCs	Ratios of flow to capacity
RMP	Record of Monuments and Places
RMS	Root Mean Square
RPA	Root Protection Area
RPSs	Record of Protected Structures
RQD	Rock Quality Designation
RSA	Road Safety Audit
S.I.	Statutory Instrument - An order, regulation, rule, scheme or bye-law made in exercise of power conferred by statute.
SAC	Special Area of Conservation
SCADA	Supervisory Control and Data Acquisition
SCI	Site of Community Importance
Scope / Scoping	The process of identifying the significant issues (scope) which should be addressed by a particular Environmental Impact Assessment.
Sensitivity	The potential of a receptor to be significantly impacted.
SEPA	Scottish Environmental Protection Agency

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Term	Definition
Services	The conduits, pipes and lines that carry water, telephone signal, electricity, sewage, etc.
Severance	A term used to describe the possibility that a development may disrupt activities or movements in an area or divide an area, community, etc. in an adverse manner.
Significance	The sensitivity of the environment to change or the consequence of change for the receiving environment.
SMR	Sites and Monuments Record
SO_2	Sulfur Dioxide
SPA	Special Protection Area
SPL	Sound pressure levels
SPM	Suspended particulate matter
Spring	A flow of water that occurs where the water table intercepts the ground surface.
SuDS	Sustainable Drainage System
SVOCs	Semi-Volatile Organic Compounds
SVP	Saint Vincent de Paul
SW01	Surface Water Monitoring Point 1
SW02	Surface Water Monitoring Point 2
SWMP	Surface Water Management Ponds
Temporary Impact	An impact which is not permanent or lasting.
TFS	Transfrontier Shipment
TII	Transport Infrastructure Ireland
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
TTA	Traffic and Transport Assessment
µg	Micrograms
$\mu g/m^3$	Micrograms per metre cubed
µm	Micrometres
UNESCO	United Nations Educational, Scientific and Cultural Organisation
Unsaturated zone	The zone between the land surface and the water table, in which pores and fissures are only partially filled with water. Also known as the vadose zone.
UWWTP	Urban Wastewater Treatment Plant
VIA	Visual Impact Assessment
VOCs	Volatile Organic Compounds
VP	View Point
VRP	Viewshed Reference Point
VRU	Vulnerable Road Users
Water Table	The surface at which pore water pressure in an aquifer is equal to atmospheric pressure, and which separates the saturated zone from the unsaturated zone.
WBXXX	Waterbody receptors
WeBS	Wetland Bird Survey
WFD	Water Framework Directive
WFP	Waste Facility Permit
WHO	World Health Organisation
WIR	Water Industry Research
WMU	Water Management Unit
WTF	Waste Transfer Form
WWTP	Wastewater Treatment Plant
ZoI	Zone of Influence
250 Flare	The current operational landfill gas flare operating at Kerdiffstown Landfill
500 Flare	The current back-up landfill gas flare available at Kerdiffstown Landfill,
600 Flare	The proposed new landfill gas flare to be installed in the Landfill Infrastructure Compound as part of the remediation works

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Term	Definition
98 Percentile Flow	The flow rate (expressed in m^3/s) at a given location on a river which over the long-term is equalled or exceeded 98% of the time.
99.8 Percentile Flow	The flow rate (expressed in m^3/s) at a given location on a river which over the long-term is equalled or exceeded 99.8% of the time.

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1. Introduction

1.1 Purpose of this Report

This Environmental Impact Assessment Report (EIAR) presents the assessment of environmental impacts and applicable mitigation measures associated with the proposed Kerdiffstown Landfill Remediation Project (hereafter referred to as the proposed Project).

1.2 Kerdiffstown Landfill Remediation Project (the proposed Project)

Kerdiffstown Landfill in County Kildare is a former quarry which has been progressively backfilled with wastes. In June 2010, the former operator of the landfill vacated the site and it was left in an unsecured condition. In January 2011, a major fire developed within the mass of mounded waste material present in the site which required the intervention of a number of state agencies, including Kildare County Council (KCC) and the Environmental Protection Agency (EPA). The former landfill poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures on-site, man-made ponds, steep slopes and the lined cell with a temporary cap. As part of their commitment to manage the immediate environmental and health and safety risks the EPA and, latterly, KCC have implemented a range of interim measures to address the key environmental and health and safety concerns posed by the site, particularly addressing leachate and landfill gas production at the site.

The former landfill requires remediation to reduce the risks to public health and safety and the environment. The proposed Project is to remediate the site by providing an engineered capping system, providing a landscaped profile and improving the management of landfill gas, leachate and surface water to ultimately provide a multi-use public park. More details on the background and site history can be found in Chapter 3 The Need for the Proposed Project.

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1.3 Client

The Client for this proposed Project is KCC following the novation of a Framework Contract from the EPA in 2015.

1.4 Objectives of the Proposed Project

The overall objective of the proposed Project is to remediate the land contained within the Kerdiffstown Landfill site. Currently the site is in a disused state and poses a risk to the environment.

Specific objectives of the proposed Project are:

- The removal of risks to public health and safety;
- A reduction in the environmental risk profile of the site to an acceptable level;
- Delivery of a remediation solution which is acceptable to the local community;
- Completion of the remediation works within 8 years; and
- Integration of sustainability and sustainable design and development in both the remediation and post closure works (operation of the multi-use public park).

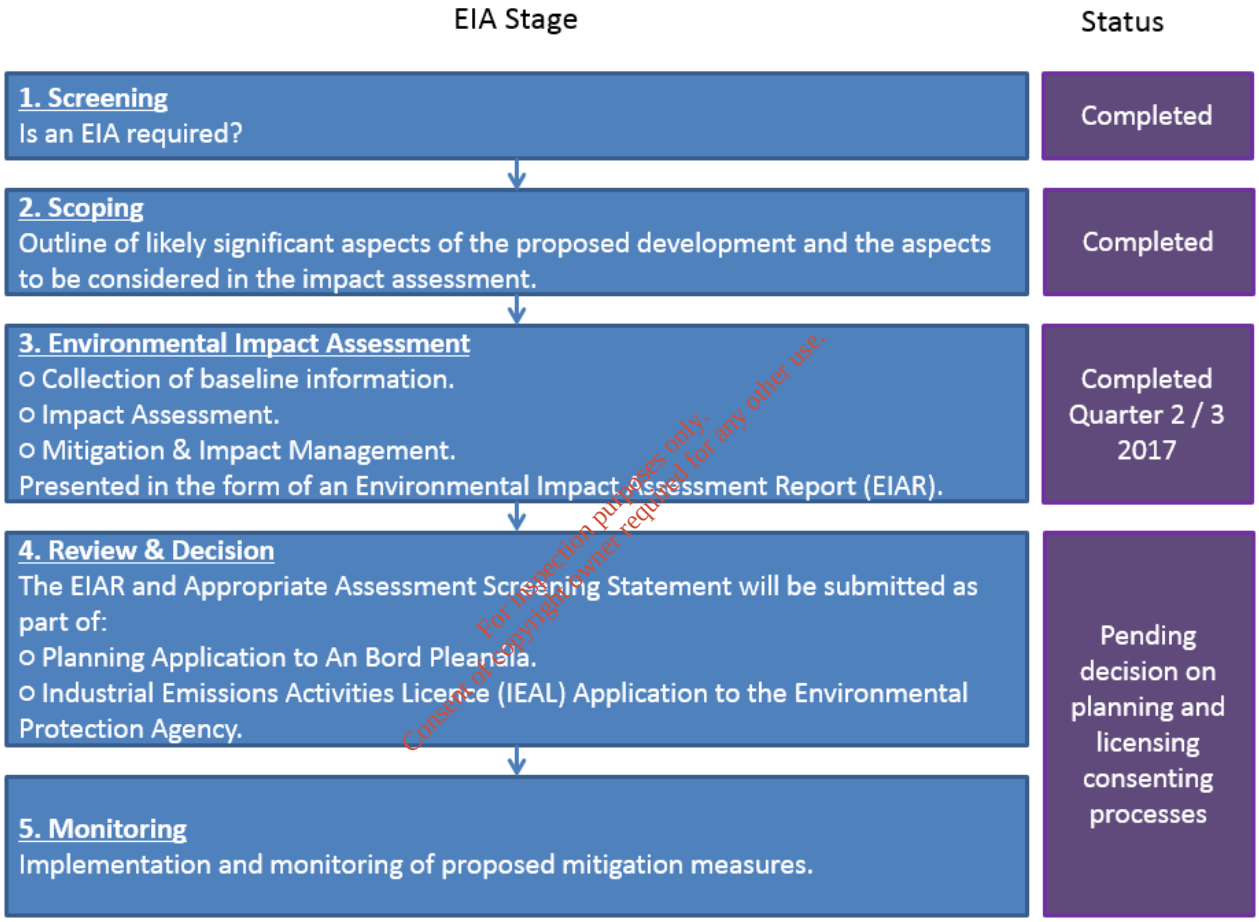
1.5 Environmental Impact Assessment

Environmental Impact Assessment (EIA) is the process by which the anticipated effects on the environment of a proposed development or project are measured. The assessment has evaluated the Remediation Phase (construction works to remediate the site and achieve the proposed end-use as a multi-use public park) and Operational Phase (operation of the multi-use public park) of the proposed Project. If the anticipated effects are unacceptable, design measures or other relevant mitigation measures have been identified to reduce or avoid those effects.

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The EIAR generally focuses on describing the existing environment, identifying the potential impacts and describing any mitigation measures required to reduce or eliminate potential impacts and is the document produced and used to record this assessment.

Diagram 1.1 below provides a high level overview of the EIA Process and the steps involved. Further information on the approach to EIA can be found in Chapter 2 Approach to Environmental Impact Assessment (EIA).



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Diagram 1.1 High Level Overview of the EIA Process

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1.6 Report Structure

Table 1.1 sets out the structure of the EIAR along with a summary of what is included in each Chapter.

Table 1.1: Structure of the Environmental Impact Assessment Report

Title	Description
Volume 1: Non-Technical Summary	
Non-Technical Summary	Summary of the EIAR in non-technical language.
Volume 2: Main EIAR Report	
Chapters 1 – 4	Provide project background and information on the proposed Project assessed in the EIA, including the need for the proposed Project and descriptions of the works required as part of the Remediation Phase and Operational Phase.
Chapter 5	Presents the alternatives considered for remediation and end-use of Kerdiffstown Landfill.
Chapter 6	Presents the consultation process associated with the EIA
Chapters 7 – 17	Reporting of the EIA for each specialist environmental topic, including the introduction of the subject area, approach and methodology of assessment, a description of the existing environment, assessment of the potential effects of the proposed Project, mitigation and potential residual effects. As part of this report the following environmental aspects are assessed. The environmental aspect as defined under the EIA Directive is stated in brackets: • Air Quality, Odour and Climate (Air and Climate); • Noise and Vibration; • Landscape and Visual (Landscape); • Archaeology, Cultural Heritage and Architectural Heritage (Cultural Heritage); • Biodiversity; • Soils, Geology, Contaminated Land and Groundwater (Land & Soils); • Water – Hydrology (Water); • Traffic and Transport (Material Assets); • Waste (Material Assets); • Population and Human Health - Socio Economics (Population and Human Health); • Material Assets
Chapter 18	Presents an overview of all the major interactions between the different environmental aspects as outlined above.
Chapter 19	Presents a summary of environmental commitments made in the EIAR.
Chapter 20	Summarises any significant residual impacts after the implementation of mitigation measures.
Volume 3: Figures	
Figures 3.1 – 17.1	Graphics and plans supporting the EIAR Chapters, illustrating the proposed Project and environmental information. Figure reference numbers correspond to the relevant EIAR Chapter (e.g. Figure 3.1 relates to Chapter 3)
Volume 3A: Photomontages	
Photomontages for Viewpoints 1 to 9	Imagery depicting the current view of the site and representing the way in which the proposed Project will appear within a particular view
Volume 4: Appendices	
Appendices A4.1 – A14.3	Technical reference information supporting the EIAR Chapters, such as calculations and detailed background data. Appendix numbers correspond to the relevant EIAR Chapter (e.g. Appendix A4.1 relates to Chapter 4)

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2. Approach to Environmental Impact Assessment (EIA)

2.1 Introduction to the EIA Process

EIA is the process for anticipating the effects on the environment caused by a proposed development or project at a particular site. Where effects are unacceptable, design or other measures can be taken to avoid or reduce these effects to acceptable levels.

The initial Environmental Impact Assessment (EIA) Directive has been in place since 1985 (85/337/EEC). This Directive along with three amendments was amalgamated into Directive 2011/92/EU in December 2011.

Proposed changes to the directive were adopted by the Council of the European Union in May 2014 with a 3-year period to transpose the changes. These changes will form the first revision of the Directive 2011/92/EU and it is expected that Ireland along with all other member states will adopt the revised directive in 2017.

The EIA Directive aims to provide a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation of proposed developments with a view to reducing their environmental impact. EIA ensures public participation in decision-making and thereby strengthens the quality of decisions.

The EIA Directive requires that certain developments be assessed for the likely environmental effects before planning approval can be granted. When submitting a planning application for such a development, the applicant must also submit an EIAR.

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Ahead of the transposition of the directive, the Department of Housing, Planning, Community and Local Government has issued Circular letter PL1/2017 on Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive) - Advice on Administrative Provisions in Advance of Transposition. This circular advises that:

> *"In respect of applications for planning permission or other development consent received on or after 16 May 2017 falling within the scope of Directive 2011/92/EU, or within the scope of Directive 2014/52/EU, competent authorities are advised to consider applying the requirements of Directive 2014/52/EU by way of administrative provisions in advance of the transposition of Directive 2014/52/EU into Irish law."*

It is noted that the provisions of the Directive 2014/52/EU had not been transposed into Irish law by the date for transposition, 16 May 2017. In accordance with the advice contained within the Circular and in order to ensure compliance with the requirements of EU law, this Environmental Impact Assessment Report (EIAR) has been prepared in order to meet the requirements of Directive 2014/52/EU.

It is noted, in this regard, that the terminology used in the Directive for what has previously been described as an Environmental Impact Statement (EIS) in Irish law, is Environmental Impact Assessment Report (EIAR). That term has been used here with a view to making clear that it is intended that the EIAR meet the requirements of the new Directive. It should be noted, however, that the EIAR, in meeting the requirements of Directive 2014/52/EU, necessarily satisfies the requirements for an EIS.

The EIA process can generally be summarised as follows:

- Screening – Is an EIA required?;
- Scoping – What issues should be considered with the EIAR?;
- Baseline Data Collection – Establishing a robust baseline of the existing environment on and around the site. The stage includes a review of existing available information and undertaking any surveys identified during the scoping phase;
- Impact Assessment – Assessment of the environmental impacts and establishing their significance;

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- Mitigation – Formulation of mitigation measures to ameliorate the potential impacts of the proposed Project which cannot be avoided practically through design;
- Consultation – With Statutory Stakeholders, the public and other bodies;
- Decision – The competent authority, in this case An Bord Pleanála, decides, taking into consideration the results of consultations, if the proposed Project can be authorised;
- Announcement – The public is informed of the decision; and
- Monitoring – Implementation and monitoring of mitigation measures.

2.2 EIA Screening Assessment

2.2.1 Is an EIA Required?

In order to determine whether an environmental impact assessment is required for the proposed Project, it is necessary to determine whether it is a project listed in one of the Annexes to the Directive 2011/92/EU (as amended by Directive 2014/52/EU).

These Annexes have been transposed in to domestic law. The prescribed classes of development which require EIA are outlined in Schedule 5 of the Planning and Development Regulations 2001 (S.I. 600 of 2001, as amended). The proposed Project is not listed in Part 1 of that Schedule (or Annex 1 of the EIA Directive) and therefore an EIA is not mandatory. The relevant classes of development from Part 2 are as follows:

- 11(b): “Installations for the disposal of waste with an annual intake greater than 25,000 tonnes not included in Part 1 of this Schedule.”;
- 13(c): Any change or extension of development being of a class listed in Part 1 or paragraphs 1 to 12 of Part 2 of this Schedule, which would result in the demolition of structures, the demolition of which had not previously been authorised, and where such demolition would be likely to have significant effects on the environment, having regard to the criteria set out under Schedule 7; and
- 15: Any project listed in this Part which does not exceed a quantity, area or other limit specified in this Part in respect of the relevant class of development but which would be likely to have significant effects on the environment, having regard to the criteria set out in Schedule 7.

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As part of the proposed Project it is not anticipated that the site will accept waste for disposal at the site, however the construction works associated with the Remediation Phase will require the importation of engineering materials, such as aggregate, subsoil and top soil which may still be classed as waste, depending on its origin. In addition, some waste will be moved within the footprint of the proposed Project for deposition in the lined cell in Zone 3. On this basis, an application for an Industrial Emissions Activities Licence (IEAL) will be submitted by KCC to the Environmental Protection Agency (EPA). Acceptance of such engineering material will be controlled under specifications and acceptance criteria, to comply with the IEAL regulated by the EPA. There will also be a requirement to re-profile and relocate some areas of existing waste within the site boundary in order to reduce the risk to health and safety and the risk of environmental harm.

The existing Kerdiffstown development can be regarded as a development falling within Class 11(b) of Part 2 of Schedule 5 of the Planning and Development Regulations 2001. The proposed Project involves changes to that development, including the demolition of certain structures. It can therefore be regarded as a development listed in Part 2 of the Schedule which does not meet a limit specified in the Schedule and/or as a change to an existing development involving the demolition of structures. In the circumstances, although a mandatory EIA is not triggered for the proposed Project, if it is likely to have a significant effect on the environment having regard to the criteria set out in Schedule 7, an EIA will be required.

The criteria set out in Schedule 7 require regard to be had to:

- The characteristics of the proposed development;
- The location of the proposed development; and
- The characteristics of potential impacts.

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Having regard to those criteria and the matters more particularly set out in Schedule 7, it is considered that the works required to remediate the site and develop the proposed multi-use public park end-use, including the excavation and movement of waste material within the site boundary would be likely to have significant effects on the environment and that an EIA should be carried out to fully assess potential impacts and to make recommendations for mitigation measures to reduce or eliminate impacts.

2.2.2 Industrial Emissions Activities Licensing Process

The Industrial Emissions Directive (IED) (EU 2010/75/EU) was implemented in Ireland in 2013 by the following regulations:

- EU (Industrial Emissions) (Licensing) Regulations 2013 (S.I. No. 137 of 2013); and
- EU (Industrial Emissions) Regulations 2013 (S.I. No. 138 of 2013).

The IED includes licensing of major waste management activities, such as landfill sites and their remediation, which previously required Waste Licensing under the Waste Management Act 1996 (as amended). The waste activities that are subject to the IED are contained in Annex I to the Directive, and set out in amendments to the First Schedule to the EPA Act 1992 (as amended), Section 11.5, Waste Activities. This sets out the following thresholds:

> *"Landfills, within the meaning of section 5 (amended by Regulation 11(1) of the Waste Management (Certification of Historic Unlicenced Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008)) of the Act of 1996, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25,000 tonnes, other than landfills of inert waste."*

Note: Landfills that receive less than 10 tonnes of waste per day or less than 25,000 tonnes per year continue to be licensed by the EPA under the Waste Management Act 1996 (as amended).

As part of the proposed Project it is not anticipated that the site will accept waste for disposal at the site, however the construction works associated with the Remediation Phase will require the importation of engineering materials, such as aggregate, subsoil and top soil which may still be classed as waste, depending on its origin. Acceptance of such material will be controlled under specifications and acceptance criteria, to comply with the IEAL regulated by the EPA.

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2.2.3 Appropriate Assessment

The Birds Directive (79/409/EEC) and the Habitats Directive (92/43/EEC) set out various procedures and obligations in relation to nature conservation management, and in particular the conservation of European sites. "European site" replaced the term "Natura 2000 site" under the EU Environmental Impact Assessment and Habitats Regulations 2011 (S.I. No. 473 of 2011). European sites comprise Special Area of Conservation (SAC) and Special Protection Areas (SPAs). A key protection mechanism is the requirement to consider the possible nature conservation implications of any plan or project on European sites. Appropriate Assessment (AA) is the process which considers the possible effects of a plan or project on the European sites network.

In accordance with these requirements the proposed Project has been assessed to consider whether there are likely significant effects from the proposed Project on European sites. The Appropriate Assessment Screening Statement (AASS) has concluded that an Appropriate Assessment of the proposed Project is not required. It can be excluded, on the basis of objective scientific information, and in light of no implications for the conservation objectives of relevant sites from the proposed Project that the proposed Project, either individually or in-combination with other plans or projects, will have likely significant effects on any European site. Refer to Chapter 11 Biodiversity for further details and Appendix A11.10 for a copy of the AASS.

2.3 EIA Scoping

Following screening, 'scoping' is the process of determining the content and extent of matters that should be covered in the environmental information submitted to the competent authority. Scoping requires the consideration of the nature and likely scale of the potential environmental impacts likely to arise from a proposed

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development or project. As part of the scoping process for the proposed Project the Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report (Jacobs, September 2016) has been provided to stakeholders for review and comment. Details on the consultation process undertaken as part of the proposed Project can be found in Chapter 6 The Consultation Process.

2.4 EIA Methodology

2.4.1 EIA Guidance

This assessment of environmental impacts has been conducted in accordance with current industry practice and relevant guidance. The EPA has produced the following guidance for the development of an EIAR:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017); and
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015).

In addition to these overarching guidance documents, each environmental aspect (e.g. Air Quality) has been assessed in accordance with specific guidance and best practice for the environmental aspect. The specific guidance which has been used is detailed under each environmental aspect in Chapters 7 to 17 of this report.

The following key stages formed the basis of the assessment process:

- Consultation with statutory and non-statutory bodies and relevant interested parties/stakeholders;
- Establishing a robust baseline of the existing environment on and around the proposed Project. The existing environmental baseline of the proposed Project and its surroundings has been established for each environmental aspect under consideration. This has been achieved by close co-operation with the Client and other relevant authorities and organisations, a desktop review of available data, and literature and detailed interpretation of field surveys. The ultimate goal of the proposed Project is to take the existing condition of the site and remediate it to a satisfactory standard which presents significantly reduced adverse effects to the surrounding and wider environment;
- Assessment of the environmental impact and establishing their significance (primarily the assessment of residual effects once mitigation has been adopted); and
- Formulation of mitigation measures to ameliorate the potential impacts of the proposed Project that cannot be avoided practically through site design.

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2.4.2 Consultation

Consultation with relevant authorities, organisations and stakeholders has already commenced and will be continued throughout the assessment and development design process. The consultations serve three main purposes:

- To establish a sufficiently robust environmental baseline of the proposed Project and its surroundings;
- To identify, early in the process, specific concerns and issues relating to the proposed Project in order that they can be discussed and appropriately accounted for in the design and assessment; and
- To ensure the appropriate involvement of the public and authorities in the assessment and design process.

To date consultation has included:

- Liaison between the EPA/KCC and members of a Community Liaison Group, which includes the Kerdiffstown Residents Association, St. Vincent de Paul, Clean Air Naas and the Naas Chamber of Commerce.
- In April 2016 a Public Consultation Day was held in the Kildare County Council offices to announce potential end-use options for the site and welcoming comments and observations from the public.

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- In October 2016 a consultation letter and copy of the Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report (Jacobs, September 2016) was issued to statutory stakeholders, inviting their review of the proposed EIA approach and inviting comments.
- Presentation to the Municipal District Council and public announcement in November 2016 that the proposed end-use for the Project is a multi-use public park.
- In March 2017 a Public Information Day was held in Naas to provide a public update on project progress and to invite any comments or concerns on the scope of the EIA.

Refer to Chapter 6 The Consultation Process for details on the consultation undertaken as part of the proposed Project.

2.4.3 Impact Assessment

The assessment has been structured to ensure that assessment criteria which includes the receptors which are considered sensitive, standards of significance and magnitude used as part of the assessment are identified and documented and that the level of certainty of data is recorded. An explanation has been provided for each environmental aspect on the criteria that have been applied, including reference to the appropriate published guidance for each of the environmental aspects. Direct and indirect impacts of the proposed Project have been considered as well as impacts which could occur in the short, medium and long term.

The assessments have evaluated:

- The Remediation Phase – this is the construction works required to remediate the site and achieve the proposed final landform. The Remediation Phase will involve profiling works to minimise volumes associated with the excavation, movement and deposition of materials within the site, the installation of an engineered capping system, the installation of new environmental management and control systems including leachate and landfill gas management, upgrading the road, pedestrian access to the proposed Project from the L2005 Kerdiffstown Road and development of a multi-use public park including construction of multi-use sports pitches, car parking, changing room building, children's playground and a network of paths across the site and appropriate seeding and planting; and
- The Operational Phase – this is the operation of the proposed Project as a multi-use public park as well as the ongoing operation and maintenance of the landfill management infrastructure.

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For all environmental aspects, the significance of residual impacts, i.e. those impacts predicted once mitigation is taken into account, have also been assessed, along with potential cumulative impacts with other developments and potential interactions between environmental topics.

2.4.4 Mitigation Measures

The EIAR addresses all potential environmental effects associated with the proposed Project and proposes mitigation where significant effects have been identified. All measures proposed as mitigation for the proposed Project are reported within the relevant Sections of the EIAR. The EIAR also includes a Schedule of Environmental Commitments, which brings together all of the mitigation measures recommended in the various EIAR Chapters for ease of reference. Refer to Chapter 19 for the Schedule of Environmental Commitments.

2.4.5 Monitoring

The continued measurement of effects on the environment through monitoring provides assurance that the proposed systems and mitigation measures are operating as intended. It is anticipated that ongoing monitoring of the proposed Project will be agreed by the EPA as part of the IEAL. Monitoring required as part of the Remediation Phase and the Operational Phase are outlined within the relevant Sections of the EIAR.

Maintenance and active management of the landfill infrastructure is integral to the Operational Phase of the proposed Project. As described in this EIAR the continued monitoring and management of the site will provide assurance that the landfill management systems are operating effectively. KCC will appoint a Site Manager for the Operational Phase who shall be responsible for the control, operation and maintenance of the site and emissions shall take place as set out in the IEAL.

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The KCC Site Manager will be responsible for managing the sampling, analyses, measurements, examinations, maintenance and calibrations as set out in the IEAL and for reporting to the EPA, in the format specified in the IEAL.

The KCC Site Manager will establish procedures to ensure that corrective action is taken should the specified limits of the IEAL not be fulfilled. These procedures will include the actions for initiating further investigation and implementing corrective action where appropriate. In the development of the outline design of the proposed Project consideration has been given to the nature of the works and where appropriate potential future management solutions have been identified. These solutions are available for KCC to implement in the future should they be required.

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3. The Need for the Proposed Project

3.1 Introduction

The Kerdiffstown Landfill site is currently closed, in a disused state and poses a long term risk to human health and the environment due to pollution by landfill gases, odour and leachate. If the site continues in its current scenario (Do Minimum) it will breach current environmental legislation, a Do Nothing scenario would increase the risks still further. Therefore, there is a need to remediate the site as soon as practicable to reduce or avoid the risks to human health and the environment.

Remediation is required to meet the following broad objectives:

- Reduce or limit future leachate impact upon groundwater and surface water receptors and reduce/control the future production of leachate from the site;
- Ensure landfill gas is managed and controlled in such a way that it does not pose a future risk to nearby properties, residents and other identified receptors;
- Stabilise steep and undulating slopes across the landform;
- Address odour generation, both in the long term and during future remedial works; and
- Provide an end-use which fits within planning and any other relevant licencing conditions.

This Chapter sets out the site history, the site layout, expands on the need for the project, details the area around the proposed Project and explains the current environmental controls on site.

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3.2 Site History

Kerdiffstown Landfill is a former sand and gravel quarry which had been progressively backfilled with wastes by a variety of operators from the 1950s onwards (Evaluation of Environmental Liabilities at Kerdiffstown Landfill, SKM Enviros 2010). The site is located approximately 3km north-east of central Naas and the closest site boundary is approximately 400m north-west of Johnstown village as shown in full in Figure 3.1 and indicated on Diagram 3.1 below.

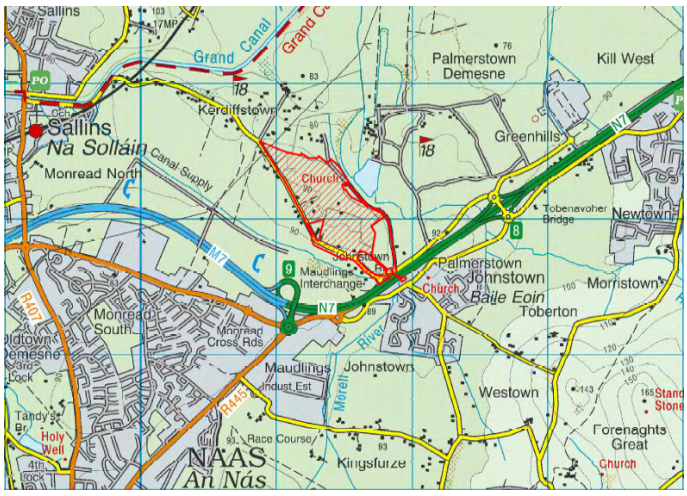


Diagram 3.1: Location of Kerdiffstown Landfill – Indicative Proposed Project Boundary shown in Red

The facility at Kerdiffstown was operated under a local authority waste permit followed by a waste licence, W0047-01, issued by the Environmental Protection Agency (EPA) in 2003, with a revised licence W0047-02 issued in 2006. Most recently the site consisted of an extensive recycling facility, a lined landfill cell which had been partially filled with waste and large areas of the site in which substantial quantities of waste have been

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deposited in a non-compliant manner. The main area of waste deposition is in the unlined north-western area of the landfill. There are also smaller quantities of waste stockpiled around the site. The presence of such large quantities of waste and the lack of appropriate infrastructure to manage polluting emissions arising from this waste gives rise to significant risk of environmental pollution.

In June 2010 all waste disposal activities ceased when the former operator of the landfill vacated the site and it was left in an unsecured condition. In January 2011 a major fire developed within the mass of mounded waste material present in the centre of the site which required the intervention of a number of state agencies, including Kildare County Council (KCC) and the EPA.

The facility at Kerdiffstown is now in the early stages of remediation. In February 2011 the EPA intervened under Section 56 of the Waste Management Act 1996 (as amended), taking control of the site as a temporary measure to limit impacts in absence of the operator. The EPA retained control until the transfer of the project in June 2015 to KCC. Since February 2011 the EPA and then KCC have been using powers under Section 56 of the Waste Management Act 1996 (as amended) in order to take measures to prevent or limit environmental pollution arising from the site.

Section 56 of the Waste Management Act 1996 (as amended) allows a local authority to take measures to prevent or limit environmental pollution caused by waste:

> *"Where it appears to a local authority that measures are required to be taken in order to prevent or limit environmental pollution in its functional area caused, or likely to be caused, by the holding, recovery or disposal of waste, the local authority may take such steps, carry out such operations, recover or dispose of, or arrange for the recovery or disposal of, such waste or give such assistance as it considers necessary to prevent or limit such pollution or to mitigate or remedy the effects on the environment of any such activity."*

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The Kerdiffstown Landfill Remediation Project (hereafter referred to as the proposed Project) is intended to remediate the former landfill to reduce risks to the environment and to public health and safety. The remediation of the site and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site, see Section 4.3.1 for details on the outline phasing of the works. The Operational Phase will create a public park with multi-use sports pitches, changing rooms, a children's playground, etc. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project.

Section 56

Section 56 of the Waste Management Act 1996 (as amended) empowers local authorities to takes measures to prevent or limit environmental pollution due to waste activities. While the scope of Section 56 is not defined in the legislation it could be argued that the scope of the powers is very wide-ranging and allow a Local Authority to undertake very large-scale works. To date both the EPA and KCC have taken limited actions at the Kerdiffstown Landfill site to limit the impact the site was having by installation of temporary containment measures such as placement of a temporary cap on part of the site and capturing and flaring landfill gas from certain areas. Some dangerous structures have also been demolished to improve health and safety conditions at the site.

However, with regards to the full remediation of the site and any significant engineering works proposed, KCC has chosen to use the route of applying to An Bord Pleanála for planning approval; and applying to the EPA for an Industrial Emissions Activities Licence (IEAL). Therefore, the proposed remediation solution for the site will be subjected to external scrutiny and decided upon by independent state bodies rather than KCC itself. The applications for formal consents from An Bord Pleanála and the EPA will also facilitate formal public consultation, with opportunities for 3rd parties to make submissions and object to the proposals or any proposed decision. Subsequent to any licence being granted by the EPA, the conditions of that licence and the implementation of the remediation will be subject to enforcement by the EPA, again providing oversight to the performance of KCC in undertaking the remediation.

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3.3 Project Boundaries

For the purposes of developing the remediation strategy and describing and undertaking the impact assessment, a number of boundaries have been relevant to the proposed Project.

These boundaries along with their purpose are described below. Note that each figure relevant to the EIAR (Volume 3) will reference the appropriate boundary being shown.

Permanent CPO Boundary: The permanent Compulsory Purchase Order (CPO) boundary represents the areas of land where the ownership will transfer to KCC on a permanent basis.

Temporary CPO Boundary: This boundary represents the extents of the temporary land required to be under the control of KCC in order to execute the proposed Project during the Remediation Phase. Areas include the L2005 Kerdiffstown Road to be realigned and areas beyond the extents of the permanent CPO boundary to facilitate access for construction activities.

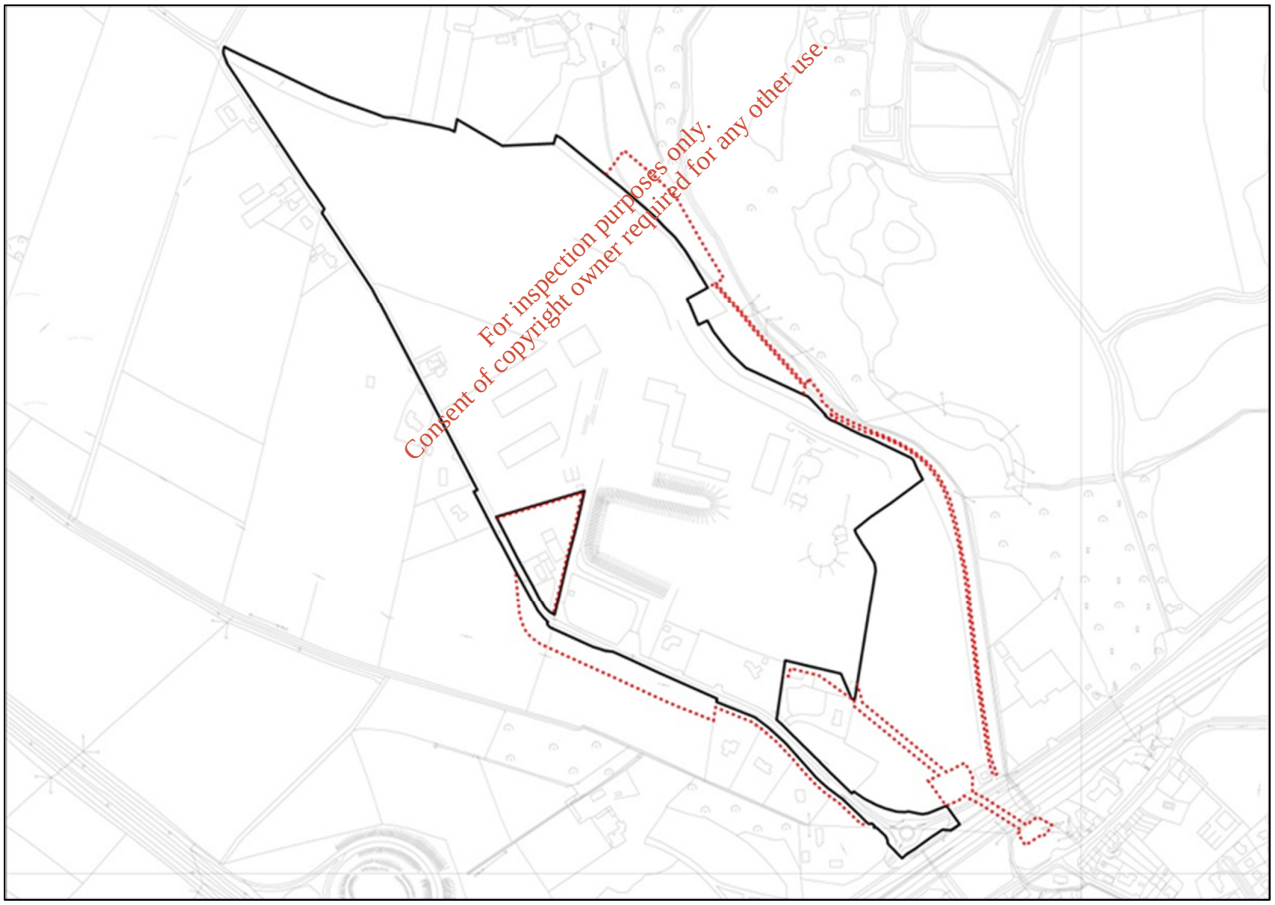

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Diagram 3.2: Permanent and Temporary CPO Boundary (Permanent CPO areas are shown in black and temporary CPO areas are shown in red)

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Industrial Emissions Activities Licence Boundary: The IEAL boundary falls within the permanent CPO boundary and represents the area of the site that will be subject to control under the IEAL as licenced by the EPA (subject to application).

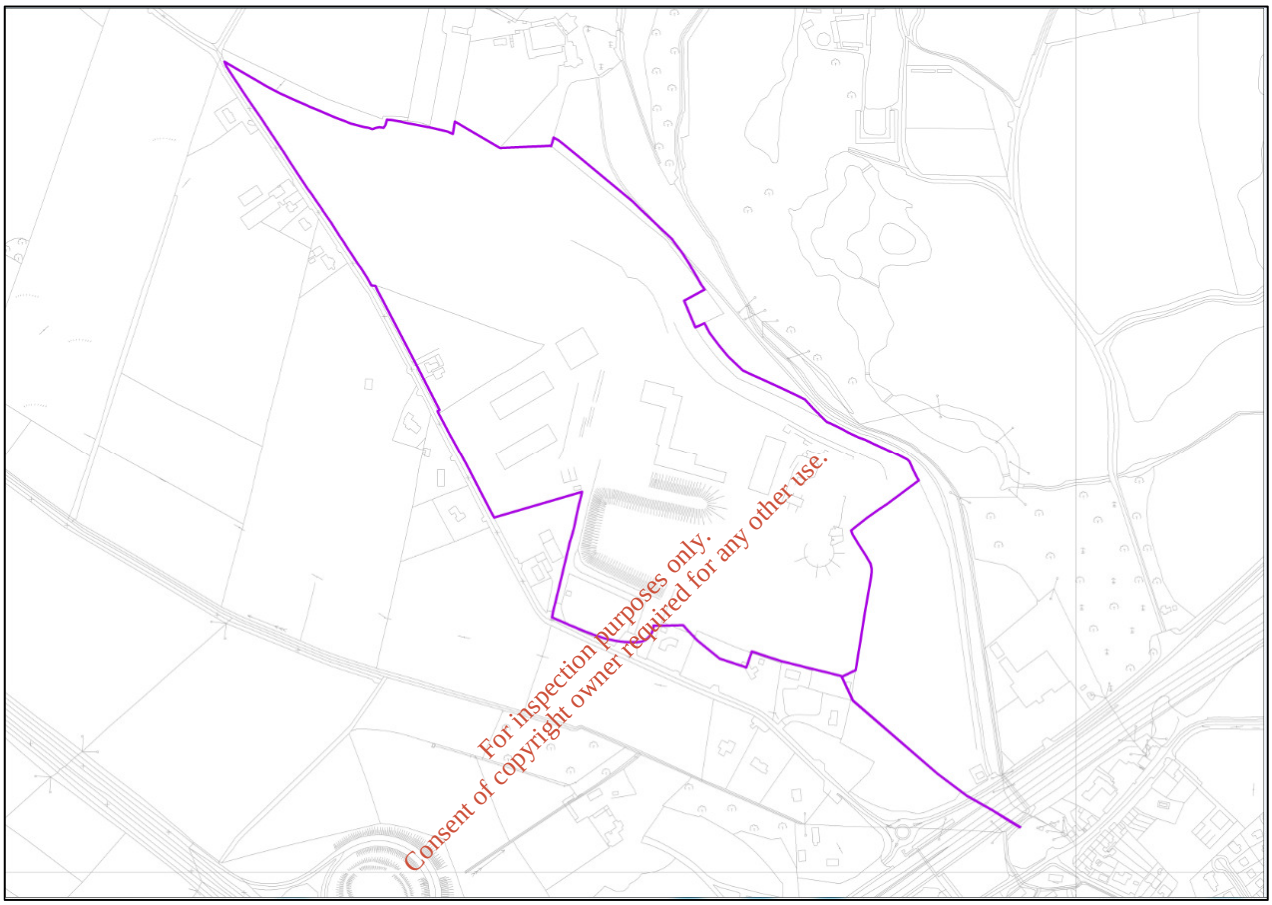


Diagram 3.3: Industrial Emissions Activities Licence Boundary

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End-Use / Park Boundary: This boundary represents the area of the proposed Project that will be used as part of the multi-use public park during the Operational Phase.

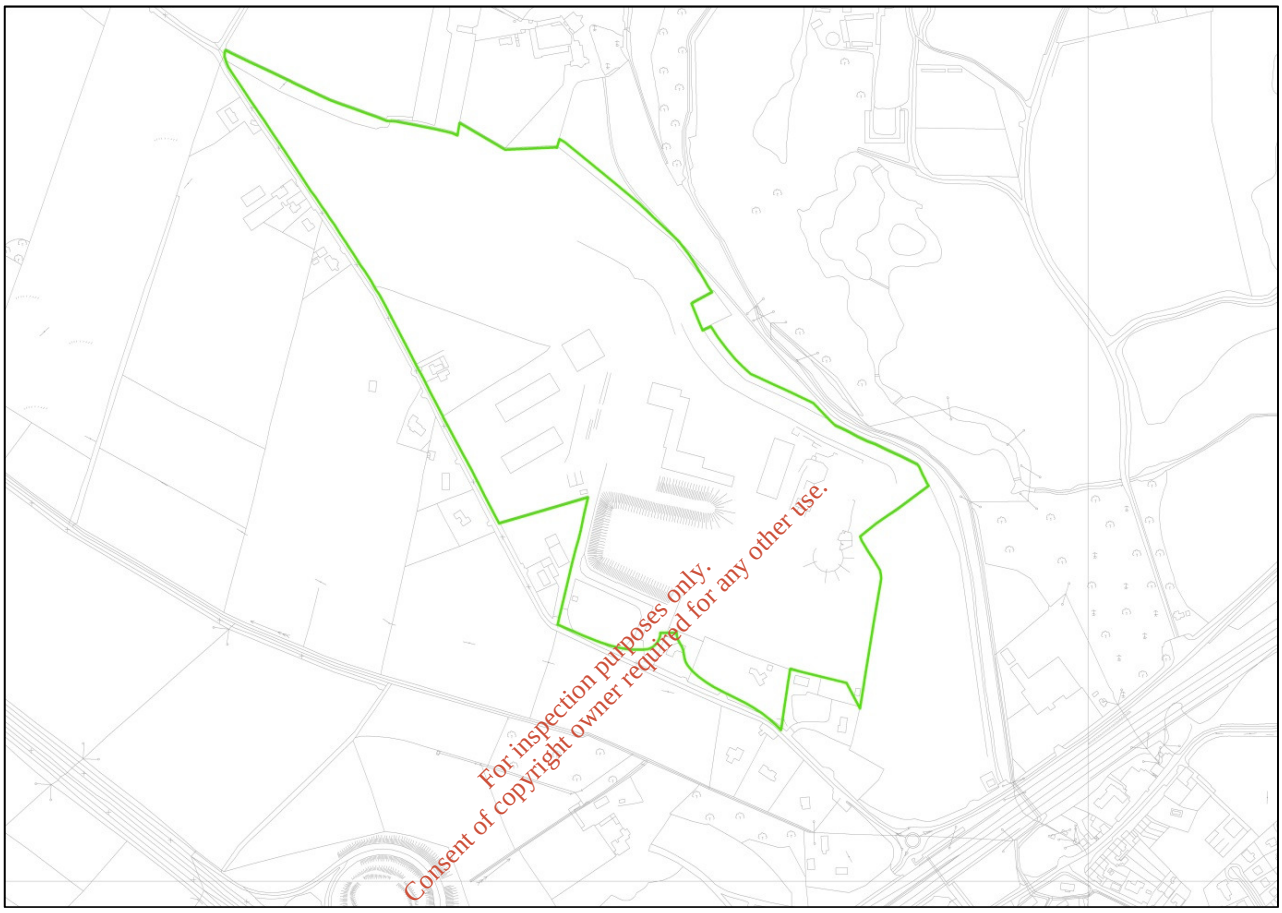

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Diagram 3.4: End-Use / Park Boundary

In the consideration of environmental impacts, the assessments have been undertaken using the permanent and temporary CPO boundaries, as the area within these boundaries requires the greatest extent of land and incorporates the areas included within the Industrial Emission Activities Licence boundary and the End-Use / Park boundary.

3.4 Current Site Layout

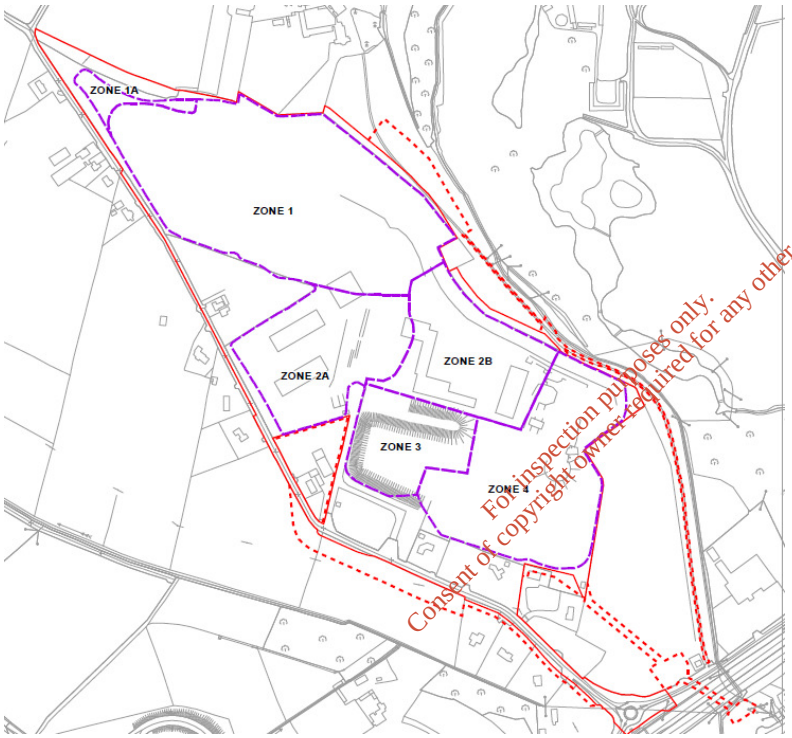
Infrastructure currently present on site includes:

- Residual concrete walls and hardstandings from buildings and structures used as part of the historical waste processing and concrete batching activities;
- Temporary buildings housing KCC project staff and site security;
- Roads and pathways;
- Landfill gas flares (2 No.) and associated gas wells/pipework;
- Temporary low permeability cap placed over the waste mass in the lined cell to limit fugitive landfill gas emissions;
- Environmental monitoring boreholes (gas, groundwater);
- Surface water drainage infrastructure (silt separation tank, interceptor etc.);

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- Lighting infrastructure; and
- Leachate collection system in Zone 3 and leachate tankers for the storage of leachate prior to off-site disposal.

The current site layout is sub-divided into a number of discrete geographical areas, or zones, each of which has its own unique characteristics, as outlined in Diagram 3.5 below. The layout of the various zones along with information on the key characteristics of the materials within each zone is summarised in the Table 3.1. The indicative location of these zones within the site is shown on Figure 3.2. Figure 3.3 shows the results of an aerial survey of the proposed Project carried out in February 2016. Refer to Chapter 12 Soils, Geology, Contaminated Land and Groundwater for information on ground investigations at the site and refer to the drawings associated with this Chapter for the locations of boreholes (BH).

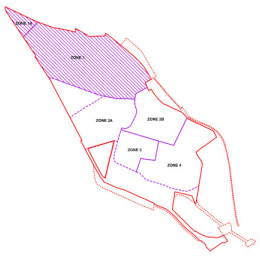


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Diagram 3.5: Existing Site Layout

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Table 3.1: Zones within the Proposed Project and Key Characteristics of Each Zone

Zone Number	Zone Key Characteristics
Zone 1; comprising sub Zones 1 & 1A 	• Estimated Area: 100,000m^2 • Estimated Waste Volume: 2,023,000m^3 Wastes deposited in Zone 1 located to the north-west area of the site accounts for approximately 65% of the entire estimated volume of waste on site. The wastes in this area are typically unprocessed, highly odorous and principally comprise non-hazardous mixed construction and demolition (C&D) wastes and household / Municipal Solid Wastes (MSW). C&D wastes are noted to contain varying amounts of clay, gravel, concrete, brick, wood, textile, plastic, rubber and metal. The MSW within this zone is described as having plastic, textiles, wood, ash paper, cables and steel in varying proportions. The MSW wastes are found over most of the zone, although there appears to be more C&D waste in the north-west corner of the zone (e.g. borehole EMW12 and BH18). This area has therefore been designated as Zone 1A to reflect this reduced risk profile. To the southern end of Zone 1, wastes are observed to be more silty (e.g. BH11, BH12) with C&D and MSW waste within the silt. Throughout Zone 1, where waste is encountered, it is considered that there is sufficient putrescible material (material that contains organic material which capable of decomposing) within the waste to class the wastes as non-hazardous biodegradable waste. Zone 1 is unlined and uncapped, with no means of limiting leachate generation or management. There are a series of landfill gas wells present across Zone 1, extracting gas to a flare. The average overall quality of gas from Zone 1, based on values recorded in the landfill gas extraction wells, is methane 23%v/v carbon dioxide 25% v/v and <1% v/v oxygen. The gas wells cover selected areas of the zone based on targeting areas of odour generation.
Zone 2; comprising sub Zones 2A & 2B 	• Estimated Area: 83,000m^2 • Estimated Waste Volume: 660,000m^3 Zone 2 comprises largely flat areas with thick reinforced concrete hardstandings covering an area of approximately 58,000m^2 which form an impermeable layer over the wastes and prevent direct rainwater ingress. Walls from the former buildings of the waste processing facility also remain. Wastes in this zone were observed to be unprocessed non-hazardous mixed C&D waste with varying amounts of clay, gravel, brick, concrete, wood, textile, paper, plastic, rubber and metal. Domestic waste (MSW) is also present in this area at varying depths mixed in with C&D materials. This area was originally assessed as one zone, however, review of ground investigations and subsequent monitoring data confirms that wastes in Zone 2A comprise more MSW than that in Zone 2B. Initial readings of gas shown on borehole logs show that relatively high concentrations of methane and carbon dioxide have been present in Zone 2A and 2B with two locations exceeding 20% methane. Monitoring undertaken in May and June 2017 shows a variable picture in Zone 2A with the average methane concentration ranging between 1.4% and 30 % v/v. Zone 2B shows very low concentrations of methane between 0.0% v/v and 0.9% v/v. The majority of waste in Zone 2B is reported in the borehole logs to comprise unprocessed non-hazardous mixed C&D waste with varying amounts of clay, gravel, brick, concrete, wood, textile, paper, plastic, rubber (including tyres) and metal but with MSW also present at varying depths mixed in within the C&D materials. The wastes are generally described as being dry, although damp or wet wastes are identified closer to the groundwater table with saturated wastes shown in the boreholes where waste is at the lowest elevation in Zone 2B (e.g. in BH9 and BH50). No saturated wastes have been identified in Zone 2A. The areas beyond the hardstandings are uncapped in Zones 2A and 2B. Like Zone 1, there is no means of managing leachate generated in the waste although the presence of hardstanding will limit leachate generation through infiltration.

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Zone Number	Zone Key Characteristics
Zone 3 	• Estimated Area: 24,000m^2 • Estimated Waste Volume: 193,000m^3 Zone 3 comprises a cell with engineered basal and side slopes lining system, and is referred to as the 'Lined Cell'. The wastes in Zone 3 comprise a mixture of waste similar to the wastes elsewhere on site including processed non-hazardous waste derived from composting tunnels, C&D materials and unprocessed domestic waste mixed through. Substantial quantities of woodchip were used as daily cover for the waste in the cell. C&D wastes contain varying amounts of clay, gravel, concrete, brick, wood, textile, plastic, rubber and metal. Non-hazardous waste excavated from the location of the fire at the site in 2011 was also deposited in the lined cell; volume approximately 35,000m^3. Following demolition of the site buildings in 2016, non-hazardous wastes that had been stockpiled in and around the buildings was removed and deposited to the lined cell; approximate volume 14,000m^3. Zone 3 has a temporary cap applied over the existing waste mass. Landfill gas wells extract gas to a flare. The average overall quality of gas from Zone 3, based on values recorded in the landfill gas extraction wells, is methane 25%v/v, carbon dioxide 25 %v/v and <1%v/v oxygen. Pumps located within inclined risers extending to the base of the cell extract leachate for transfer to tankers and removal from the site.
Zone 4 	• Estimated Area: 45,000m^2 • Estimated Waste Volume: 227,000m^3 Zone 4 contains large waste stockpiles, redundant infrastructure and concrete tanks/bays/walls in the lower yard area, with thick reinforced concrete hardstandings covering an area of approximately 12,000m^2. The area also contains a surface water soakaway lagoon which is cut into waste deposits and into which leachate from the adjacent waste stockpiles currently drains. Stockpiles comprise both processed and unprocessed non-hazardous mixed C&D waste and household waste. The majority of waste in Zone 4 is reported in borehole and trial pit logs to comprise C&D waste with a high proportion of inert material (predominantly reported as gravelly clay) with varying amounts of plastic, timber, textiles, steel, concrete, brick, PVC pipes. The logs (30 No.) do not generally report any MSW to be present (although the logs for BH4 to BH6 do describe the wastes as MSW. However, based on the actual description of the materials and proportion of these the materials are indicative of C&D waste rather than MSW). Where gas readings have been taken and reported in the borehole logs, it is reported that methane and carbon dioxide concentrations are largely absent from the wastes or less than 1%v/v within this zone. The bottom 1 to 2m of wastes are below the water table in this area. The areas beyond the hardstandings are uncapped. The hardstandings will limit rainwater and surface water infiltration to an extent.

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Interim environmental control measures currently being employed at the site are outlined in Section 3.7.

3.5 The Need for the Proposed Project

Notwithstanding the environmental controls that have been established on the site since 2011 the site (refer to Section 3.7), in its current condition, presents a significant risk and likelihood of impacts to the environment. These risks and impacts are primarily due to the presence of approximately 3.1Mm^3 of waste, off-site migration of gases, odours emanating from the uncapped waste mass, leachate migration from the site, the inability to control surface water runoff and steep and undulating slopes across the waste landform. An outline of typical key infrastructure that would be required in the development of a landfill site is provided in Table 3.2 below in comparison to the current context of the Kerdiffstown Landfill site.

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Table 3.2: Typical Key Landfill Infrastructure and Current Site Condition

Site Design Element	Typical Infrastructure Provision	Current Site Condition
Groundwater Management	Landfill liner system and capping system	Minimal
Surface Water Management	Separation of waste from restored areas	Minimal
Lining System	Landfill liner system and capping system	Minimal
Leachate Management	Landfill liner system, with collection and extraction system, and capping system	Minimal
Leachate Handling	Sewer Discharge/Sustainable tankering solution	None
Landfill Gas Management	Landfill gas wells and flare/ or utilisation plant and capping system	Partial
Capping	Engineered capping system	Minimal

Key

None	no current provision
Minimal	lined cell only; 24,000m^2 of 252,000m^2, or 9%of site area
Partial	local areas across Zones 1 and 3 only.

It is of note that the provision of an adequate capping system would assist in the management of several key environmental issues at the site, namely: groundwater, surface water, leachate and landfill gas control.

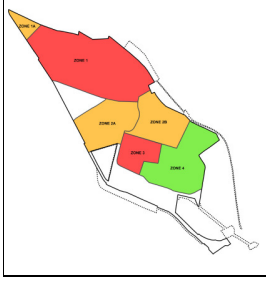
Table 3.2 demonstrates that there is an environmental imperative to remediate the site. This is further examined on a zonal basis below, where Table 3.1 above had shown that each zone currently has varying characteristics posing environmental risks. Identification of these key risks utilising a simplistic Red-Amber-Green (RAG) assessment based on the site layout with indicative zone layout is shown below in Table 3.3 and illustrates in broad terms the identified environmental risks posed by each of the discrete zones. Further details are presented in the relevant Chapters as referenced in the table.

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Table 3.3: Current Environmental Risks Associated with each Zone

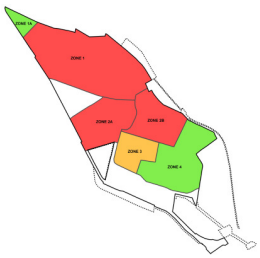
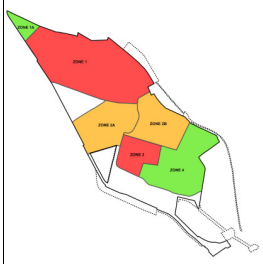
Waste Types

Results of ground investigations have been reviewed and allowed for the assignment of relevant European Waste Catalogue (EWC) from harmonised List of Waste (LoW) codes to the waste types recorded in the borehole logs and trial pits. Further details are provided in Section 12.3.5.



Zones 1 & 3	Zones 1 and 3 present the highest risk in terms of waste types present on site as borne out by the details below in relation to groundwater contamination, landfill gas risk and odour potential. The predominant waste type located in Zone 1 and 3 is '20 03 01 Mixed Municipal Waste'.
Zones 1A, 2A & 2B	Zones 1A, 2A & 2B present a moderate risk with respect to waste types due to no '20 03 01 Mixed Municipal Waste' being identified in Zone 1A or 2A and one recorded instance in Zone 2B.
Zone 4	Principally the waste in Zone 4 has been found to be C&D waste with varying quantities of hard-core, timber, concrete and brick representing a low risk with respect to groundwater, odour and gas risk.

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Groundwater Contamination For further description details see hydrogeology risk assessment in Section 12.3.17.		
	**Zones 1, 2A & 2B**	Zone 1 contains waste that lies both above and below the water table thereby representing the highest risk to groundwater contamination. Zones 2A and 2B contain both MSW and C&D waste above the groundwater table.
	Zone 3	Zone 3 (the lined cell) currently presents a low risk to groundwater as the cell was constructed with a composite liner system in accordance with EPA landfill site design guidance (compacted clay liner, GCL, geomembrane (welded)) with CQA records produced at the time of construction. However due to the presence of mixed municipal waste, the potential for rainfall infiltration through the capping system, leaching of contaminants from the wastes, deterioration of the basal liner (circa 60 years) and thus leakage through the basal liner over time with vertical and lateral groundwater migration the future risk of groundwater contamination is moderate.
	Zone 1A & 4	Zone 1A contains no significant putrescible waste deposits. This area therefore presents a low risk of groundwater contamination. In Zone 4 the principal wastes are C&D in nature and as a result largely inert. Thereby presenting a low risk of groundwater contamination.
Landfill Gas Chapter 7 Air Quality, Odour and Climate details the impacts associated with the generation of landfill gas on the site. Appendix A4.5 Landfill Gas Management Plan presents a risk assessment undertaken for the proposed Project.		
	**Zones 1 & 3**	Zones 1 and 3 will continue to generate significant quantities of landfill gas requiring active extraction and management. These zones therefore present the highest risk associated with landfill gas generation.
	Zones 2A & 2B	Zones 2A and 2B have varying depths of waste materials which have relatively lower biodegradability than the wastes within Zones 1 and 3 and are therefore predicted to produce lower quantities of landfill gas. The overall risk of landfill gas generation from these zones is considered to be moderate.
	Zone 1A & 4	In Zone 4 the principal wastes are C&D in nature and as a result are largely inert. There are no significant putrescible waste deposits present in Zone 1A. These zones present a low risk of landfill gas generation.
Odour Potential The below assessment is based upon the nature of the waste as recorded in the ground investigations, site observations and monitoring undertaken since 2011. Chapter 7 Air Quality, Odour and Climate provides details of the impact assessment of odour as part of the proposed Project.		
	**Zones 1 & 3**	Zones 1 and 3 present the highest risk in terms of odour generation potential due to the presence of MSW and C&D waste. Zone 1 is currently unlined and uncapped with a series of landfill gas wells extracting gas to a flare. Zone 3 has a temporary cap applied over the existing waste mass.
	Zones 2A & 2B	Across Zones 2A and 2B the wastes are generally described as being dry, although damp or wet wastes are identified closer to the groundwater table with saturated wastes shown in the boreholes where waste is at the lowest elevation in Zone 2B. No saturated wastes have been identified in Zone 2A. The zones are also covered with thick concrete hardstanding which act as a cap to the waste mass.
	Zone 1A and 4	Zone 1A to the north-west extents of the site does not contain MSW and hence is unlikely to generate odour. Zone 4 contains predominantly C&D waste with a high proportion of inert material and presents a low risk in terms of odour generation.

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The remediation proposals are discussed in Chapter 4 Description of the Proposed Project.

In terms of engagement and consultation with the public and commitment to the Aarhus Convention, KCC is committed to:

- Clearly articulating how key decisions forced on the project by the constraints of the site have been arrived at; and
- How alternatives were considered, including the grounds on which they were rejected in favour of the overall best environmental risk reduction profile.

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A description of the alternative remediation options is provided in Chapter 5 Consideration of Alternatives. A range of consultation has been undertaken with statutory stakeholders and the public, with details of the consultations provided in Chapter 6 The Consultation Process.

3.5.1 Remediation

Potential scenarios for long term remediation of the site were identified to address the key environmental liability issues. Remediation is required to meet the following broad objectives:

- Reduce or limit future leachate impact upon groundwater and surface water receptors and reduce/control the future production of leachate from the site;
- Ensure landfill gas is managed and controlled in such a way that it does not constitute a future risk to nearby properties, residents and other identified receptors;
- Address odour generation, both in the long term and also potentially of more significance during future remedial works; and
- Provide a future landform and end-use which fits within planning and any other relevant licencing conditions.

Taking cognisance of these objectives, current on-site environmental controls, and constraints of planning and licensing status of the site, the following Sections set out the key activities and the requirements for remediation.

3.5.2 Leachate Management and Groundwater Control

Contamination of groundwater beneath the site largely arises from the high organic and inorganic contaminant concentrations found in landfill leachate. The majority of the site is unlined and therefore there is a potential migration pathway for the leachate into the underlying aquifer systems.

Contaminants typical of landfill leachate have been found in groundwater samples taken from the sand and gravel overburden deposits beneath the site.

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The absence of current evidence to show contamination linkage between the site and the Morell River does not remove the need for remediation measures. The European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No. 9 of 2010) places a duty on public authorities to take all reasonable steps to prevent the input of hazardous substances and limit the input of non-hazardous substances to groundwater and reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater. The 'prevent' objective relates to hazardous substances, whereby all necessary and reasonable measures should be taken to avoid the entry of such substances into groundwater and to avoid any significant increase in concentration in groundwater, even at a local scale. The 'limit' objective relates to non-hazardous substances, whereby all necessary measures should be taken to limit inputs into groundwater to ensure that such inputs do not cause deterioration in status of groundwater bodies, or a significant and sustained upward trends in groundwater concentrations.

Given the potential impacts of the contaminants associated with leachate on water quality and ecology within the Morell River, principally through potential migration in a shallow groundwater pathway, leachate must be managed to prevent it entering water or to ensure the risk of impact is at an acceptable level. This would be achieved by installing a capping system over the predominant areas of waste in the site to reduce infiltration and managing leachate head in Zone 3 (lined cell) to an appropriate level. The assessment of viable remediation options has established that the complete prevention of leachate ingress into the groundwater system is not technically feasible and/or would be disproportionally costly, where the Groundwater Directive permits exemptions in this scenario.

Leachate abstracted from the lined cell is also managed through use of road tankers, travelling over 100km on a round trip to a licensed Wastewater Treatment Plant (WWTP) for disposal. This is not considered to be a sustainable long-term option.

The installation of engineered capping and soil cover systems across the site will reduce infiltration of water and hence the potential for leachate generation and migration to groundwater, giving a reduction to the environmental risk profile of the site to a likely acceptable level.

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Further information with respect to hydrogeological conditions at the site is presented in Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

3.5.3 Landfill Gas and Odour Control

Odour emissions at the site are primarily linked with diffuse landfill gas emissions, while other potential secondary odour sources include the lined cell and gas flare emissions from the current landfill gas flares on site, one operational flare and one back-up flare. The lack of a capping system across the largest area of gas generating wastes (Zone 1) affects capture efficiencies and permits the continued release of methane to the atmosphere. Works to control odour release is reactive, based on monitoring and hence is not considered to be a sustainable long-term option.

Remediating the site will include the completion of the lined cell, installing a permanent engineered capping system across the site and installation of new landfill infrastructure to manage landfill gas generated at the site.

Further information with respect to air quality at the site is presented in Chapter 7 Air Quality, Odour and Climate.

3.5.4 Surface Water Control

The Morell River to the east of the site and the Canal Feeder Stream to the west are the key surface water receptors in the vicinity of the site and a potential environmental pathway exists via migration of leachate through shallow groundwater towards the surface waterbodies. Chemical analysis of the river water undertaken to date does not indicate any impacts caused by contamination from the site and there is no evidence to suggest deterioration in the ecological status of the Morell River in the vicinity of the site. However, in terms of contamination issues potentially affecting the Morell River two key risks remain:

- Direct contamination from the site in its unremediated state; and
- Management of surface water during and following future site remediation.

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Currently, as rain falls on the site there is the potential that it may become contaminated due to contact with wastes at the surface which may either dissolve into the surface water runoff or the surface water runoff may carry suspended particles. These particles may be contaminated with, for example, metals or the silts themselves may cause a problem by settling out on the beds of rivers and smothering flora and fauna that grow on the river bed or block channels leading to an increased flood risk.

Remediating the site using capping systems will assist in separating surface waters from wastes, allowing the management of clean surface water and its discharge to the Morell River.

3.5.5 Landform Design

The landform created by future remedial works needs to be stable and safe, avoiding steep slopes, eliminating drops and sudden changes in gradient. The landform also needs to be able to accommodate potential future settlement caused by the continuing degradation of waste beneath the surface while at all times needing to facilitate drainage of surface waters efficiently to minimise infiltration and avoid the potential for surface ponding, waterlogging and flooding.

3.5.6 Site Use

The site is presently not in a condition that is beneficial to any end-use, and continues to pose a risk to the environment and human health. With the remediation works mitigating the risks to an acceptable level there is also an opportunity to develop the site to provide a positive amenity use for the local community, whilst protecting the site infrastructure and managing the site during the remainder of its lifecycle.

The proposed Project is outlined in Chapter 4 Description of the Proposed Project and the potential environmental impacts have been assessed in Chapters 7 to 17 inclusive and, where appropriate, mitigation has been proposed.

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3.6 Area Surrounding the Proposed Project

The proposed Project is located in an area with a mix of land uses, including golf courses to the north and east and lands associated with Kerdiffstown House to the north-east and east. Properties to the south and east comprise a number of residential, commercial and agricultural properties and worked out quarries to the north-west. The L2005 Kerdiffstown Road from Sallins to Johnstown bounds the western site perimeter. The Morell River is the closest surface water body, located immediately to the east of the site.

Key residential and commercial receptors in proximity located within 1km of the proposed Project boundary are identified on Figure 3.4, listed with a receptor identification (ID) number as outlined in Table 3.4. Where Chapters 7 to 17 of this EIAR identify potential impacts of the proposed Project on the receptors the receptor ID is stated for reference and clarity.

Table 3.4: Receptors within 1km of the Proposed Project Boundary

Receptor ID	Full Receptor Name
Residential Receptors (or group of Receptors)	
REC001	Kerdiffstown House and lands – a recreational facility run by the Saint Vincent de Paul
REC002 to REC037	Residential Dwellings (or group of dwellings)
REC038	Larchfield Nursing Home
REC039 to REC041	Residential Dwellings (or group of dwellings)
Commercial Receptors	
COM001	Palmerstown House Estate (and Golf Club)
COM002	Johnstown Garden Centre
COM003	The Johnstown Inn
COM004	Centra (Johnstown)
COM005	Discount Designer Tiles and Bathrooms Showroom
COM006	Londis Logistical Distribution Centre
COM007	Mike Brown Caravans
COM008	Former Cement Factory / Proposed Applegreen Service Station (planning application status: withdrawn)
COM009	Naas Industrial Estate
COM010	The Globe Retail Park
COM011	Monread Commercial Park
COM012	Centra (Monread Rd, Naas)
COM013	FirstStop/Healy's Car Repair and Maintenance
COM014	Green Isle Foods
COM015	ESB Electricity Sub-station
COM016	Former/Inactive Quarry
COM017	Naas Golf Club
COM018	Naas Driving Range

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3.7 Current Environmental Controls

3.7.1 Summary

As part of their commitment to manage the immediate environmental and health and safety risks the EPA and, latterly, KCC have implemented a range of interim measures to address the key environmental and health and safety concerns posed by the site, particularly addressing leachate and landfill gas production at the site. The principal interim measures put in place under Section 56 of the Waste Management Act 1996 (as amended) to prevent and limit environmental pollution are summarised below:

- Control of landfill gas through the use of gas well fields and gas flares. Currently only one flare is required (known as the 250 flare), and operates 24 hours a day seven days a week, fed from two independent gas fields: one within the lined cell (Zone 3) and one across Zone 1.
- Reduction of odours generated from the landfill through use of the gas management system. Gas and odour generation is, to a large degree, interlinked.
- Temporary capping of waste in the lined cell (Zone 3). Wastes generated from the post-fire clean-up operations were deposited to the lined cell (Zone 3). Further wastes, compliant with the acceptance criteria for a non-hazardous landfill, removed from within the buildings and structures demolished in 2016 have also been transferred to the lined cell. The temporary capping system limits landfill gas and odour release as well as reducing leachate generation.
- Non-compliant wastes removed from the site for re-use, recycling or disposal, including wooden poles, tyres and gas bottles.
- Provision of leachate extraction facilities in the lined cell located in Zone 3. Leachate collected in the base of the cell is extracted via pumps in inclined risers, for temporary storage in tanks. Road tankers then extract the leachate from the tanks on a daily basis for off-site disposal at Ringsend Wastewater Treatment Plant (WWTP).
- Demolition of unsafe buildings and structures on the site. Several supporting structural members had been previously removed from buildings and structures which were part of the former waste processing facility as a result of scavenging of metals at the site. The buildings were thus unsafe to access and represented a health and safety risk.
- Employment of a full time KCC Site Manager. The KCC Site Manager is involved in the daily management of the gas and leachate systems and oversees a number of other key environmental monitoring and surveillance activities at the site (e.g. monitoring of surface water, supervision of appointed contractors, security, health and safety inductions, and liaison with interested third parties).

The above measures are currently maintaining a stable condition in terms of environmental impacts. However, the measures are insufficient to fully mitigate the risks to public health and safety and the environment, and are not technically sustainable in the longer term.

3.7.2 Leachate

Wastes deposited in the lined cell in Zone 3 during the operation of the landfill, a portion of waste deposited during the post-fire clean-up operations and waste arising from the demolition of buildings have been covered using a temporary capping system to reduce water infiltration and hence leachate generation. Surface water runoff from the cap is directed away from the waste mass into a channel which flows towards a surface water soakaway located in Zone 4.

Leachate that collects in the lined cell in Zone 3 drains under gravity towards the south-west and north-west corners where pumps, located in inclined risers, remove leachate. Leachate is pumped to two temporary static leachate storage tanks at the top of the south slope of the cell. The leachate pumps are operated through a fully automated system with low and high level sensors located within the sumps and automatic cut-off float switches positioned within the storage tanks. When the level in the cell is high and the tank connected to the riser is empty the pump positioned in the riser turns on. The pump is switched off automatically when the storage tank is full (controlled by a float switch). The two tanks hold approximately 28m^3 in total when filled. The tanks are used to

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store leachate prior to removal off site by road tanker for treatment/disposal to Ringsend Wastewater Treatment Plant. As the storage tanks are emptying, the float switches drop down and the leachate pump is switched back on allowing the tanks to fill again. This cycle continues until the leachate within the sump hits a low level mark and the pump is switched off automatically. The pump will then only switch back on when a high level has been reached within the sump.

Up to four tanker loads are removed from the site on a daily basis, each requiring a more than 100km round trip. This is not considered to be a sustainable long-term solution.

3.7.3 Landfill Gas

Currently landfill gas is controlled in Zones 1 and 3 through the use of gas well fields and a landfill gas flare. The positioning of gas wells in Zone 1 has been targeted to reduce effects where odours have been detected during routine monitoring. Currently there are 25 gas wells in Zone 1, covering an approximate area of 9,200m^2. As Zone 1 represents a total area of approximately 100,000m^2 the capture of landfill gas is currently achieved across only 9% of the zone.

In Zone 3 wastes have been covered with temporary capping comprising a heavy duty membrane to assist with odour management and to reduce air from being drawn in during gas extraction operations. There are currently 14 gas wells located in the cell to enable gas extraction.

There are two flares on site: one with 250m^3/hr capacity (known as the “250 flare”); the second with 500m^3/hr capacity (known as the “500 flare”). Valves are incorporated within the pipework systems to enable gas from both Zone 1 and Zone 3 fields to be directed to a single flare, or to separate flares, depending on gas yields and quality. Currently, all gas extracted is being burned at the 250 flare, with the 500 flare acting as standby flaring unit. This is due to poor gas extraction rates (a function of Zone 1 being uncapped) and limited gas quality due to waste types and degradation rates present at the site. Continuous flare stack monitoring has been set up on site with remote access from a portable device managed via a data logger supplied by the flare manufacturer.

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3.7.4 Environmental Monitoring

Since 2011 groundwater and surface water monitoring has been routinely undertaken both on-site and off-site. In June 2014 a robust environmental monitoring programme was established, and includes:

- Groundwater;
- Surface water;
- Leachate;
- Landfill gas;
- Dust;
- Odour;
- Geotechnical assessments;
- Geophysical surveys;
- Volatile Organic Compounds (VOC) surveys;
- Meteorological data; and
- Noise.

A summary of current conditions observed from the monitoring data is outlined below.

Groundwater

Groundwater monitoring shows high hydraulic conductivity in sand and gravel deposits, particularly to the east and north-east of Zone 1. Clay deposits are reported to be more present to the west of Zone 3 and as a consequence the hydraulic conductivity is considerably lower. Estimated groundwater velocity is quite high and

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the sand and gravel aquifer appears to have high permeability, with the hydraulic gradient inevitably steep as the topographic gradient steeply falls away from the site towards the Morell River. Therefore, there is a potential flow pattern from the site towards the Morell River. The mean flow in the Morell River has been measured at around 66,500m^3/day and based on the estimated groundwater flux to the river contaminant concentrations in groundwater discharging to the river would be diluted within the river.

The principal contaminants associated with leachate include ammonia (directly toxic to fish and other aquatic life), dissolved organic material (mainly organic acids) which give rise to high demands for oxygen chemical oxygen demand (COD), and biological oxygen demand (BOD) which can deoxygenate waters (leading to fish kills) and chloride (which increases salinity of water and changes ecological make-up).

Investigations and monitoring undertaken at the site have identified a number of potential contaminants of concern (e.g. ammoniacal nitrogen and chloride) and other physical indicators (e.g. reduced oxygen levels) within shallow groundwater beneath and adjacent to the site which are generally indicative of a plume of contamination which shares many of the characteristics of landfill leachate. The existing groundwater conditions are discussed in more detail in Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Groundwater levels in the overburden deposits show a general fall from south to north indicating a broadly northerly flow of groundwater. However, the data also shows a complex pattern of radial flow with an area of high groundwater levels across Zone 1. Available groundwater level data in the bedrock indicates a south to north flow direction. Information available on the Morell River indicates hydraulic continuity between water in the River and the surrounding groundwater. It is likely that groundwater to the east of the site is in hydraulic connection with the river.

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Surface Water

Surface water sampling from the Morell River and Canal Feeder Stream is undertaken at key locations during monthly monitoring rounds to assess whether the landfill is having an adverse impact upon water quality within these water bodies.

Results from the surface water samples indicate that water quality in both the Morell River and the Canal Feeder Stream is good. Water quality in the downstream samples was very similar to water quality in the respective upstream samples. However, with respect to chloride, concentrations in the Morell River have been observed in past monitoring rounds to increase very slightly (generally by 1 to 2 mg/l) as the river flows past the site. These slight increases may be attributed to other sources unrelated to the site i.e. runoff from roads or sampling/ analytical error.

The most recent biological quality rating assessment took place in September 2016 in the Morell River and the Rathmore Stream. The Rathmore Stream is also known as the Hartwell River in some reports including the Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to Kerdiffstown Facility in Co. Kildare, Aquens, 2016. It was found that there was a slight deterioration in Q-values both upstream and downstream of the site since the previous assessments (refer to Section 11.3.2 and Section 13.4.4 for further information. However, there was no indication that the site is currently causing any discernible impact on the Morell River as it passes the site.

Leachate Analysis

Monitoring of leachate from the lined cell in Zone 3 is undertaken via a sample recovered from the leachate storage tanks sampling leachate as pumped from the lined cell only. Sampling is carried out on a weekly basis.

In late 2016 wastes from buildings at the site were deposited into the lined cell in Zone 3, covering over the remaining open area of the basal aggregate drainage blanket. Prior to this rainfall would have affected the concentrations of leachate due to the capture on the drainage blanket, varying leachate production and quality. High or prolonged rainfall events had been seen to lead to increased amounts of leachate being produced in the lined cell, whilst diluting the leachate lowering concentrations of pollutants. Contaminant peaks generally corresponded with drier periods (e.g. July) while wetter periods (e.g. December) show decreases in pollutant concentrations.

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Landfill Gas

The amount of landfill gas being produced from both the lined cell and the Zone 1 gas fields has been observed as falling since flaring began in 2011. Due to frequent flare shutdowns as a result of poor gas quality, wells in the lined cell have been closed off for periods of three to four days each week in order to allow the methane concentration to build up to a sufficient level to support the continued operation of the flare. Gas models which assess the gas potential from the site have demonstrated that approximately 600m^3/hr should be produced in 2017, whereas currently 100m^3/hr is captured through the flare. This is due to the gas field only covering a proportion of the site. Modelling suggests that gas potential will continue to decrease, with a level of 150m^3/hr indicated by 2040.

There are a limited number of perimeter gas monitoring boreholes at the site. Migration has not been detected in existing boreholes. Migration is unlikely due to the current uncapped condition of the site, where gas discharges to air. New boreholes were installed in 2016 and further perimeter gas monitoring boreholes are programmed to be installed during 2017 to assist in development of baseline information in advance of the Remediation Phase commencing.

Dust

Dust monitoring has been undertaken routinely since June 2014, using Bergerhoff dust deposition gauges erected at eight sampling locations to 2016 and at nine sampling locations since 2016. Sampling locations are positioned in and around the site. These gauges are exposed to the ambient air for 28 days before being collected and sent to an accredited laboratory for analysis. This analysis is carried out twice per year with results showing that the site is not currently a source of nuisance from dust emissions.

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Odour

Odour monitoring has been conducted on a monthly basis since 2014. Odour monitoring has also been undertaken in the past in response to odour complaints to the EPA or KCC. Odours were not detected at any of the ten off-site monitoring locations in 2015. At the two on-site monitoring locations intermittent faint to strong odours were observed within the site around the '250 flare' and at the security cabin located on Zone 1. Odours are commonly detected in both these areas depending on prevailing winds. Odour occurrences are currently being minimised through best practice and regular monitoring. Five further gas wells were installed in 2016 targeting areas where odours had been detected. Monitoring will continue and where necessary, remedial works undertaken to control odour emissions.

Geotechnical Assessments

Geotechnical assessments have shown that existing waste slopes are undulating and, in places, at gradients of up to 1v:1.5h. This is considered over-steep for waste profiles and although no signs of slippage have been observed in the biannual surveys undertaken since 2014, insufficient information exists to demonstrate that slope failure will not occur. Due to the nature of the wastes (largely C&D wastes) it is considered unlikely that catastrophic slope failure will occur. However, the current gradients on the site are insufficient to permit installation of a capping system or to manage surface water runoff effectively.

Geophysical Surveys

Geophysical surveys have been undertaken annually since 2011 along the eastern boundary of the site. The purpose of conducting a geophysical survey is to highlight any potential contaminant plumes in the area of the Morell River.

Surveys have found elevated electrical conductivity levels indicative of groundwater contamination along the eastern boundary with these results matching well with groundwater monitoring results. Subsequent surveys have not confirmed elevated conductivities in the area suggesting that the results may have been anomalous due to interference. Monitoring has continued with conductivity readings suggesting a plume exists immediately adjacent to the site boundary though not discharging to the river.

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VOC Surveys

VOC surface emissions surveys have been undertaken since 2011 to detect surface emissions of gas and make recommendations regarding potential improvements to the landfill gas infrastructure. Surveys were carried out at the site in 2011, 2012, 2014, 2015 and 2016. Surface emissions zones have been found at greater than or equal to 500ppm maximum VOC concentration around identified features e.g. landfill gas wells, and at greater than or equal to 100ppm VOC (instantaneous reading) on open surfaces.

Meteorological Data

Meteorological information is obtained on a monthly basis from the on-site weather station and from Casement Aerodrome available from Met Éireann. Information on rainfall, temperature, wind speed and direction is collated for inclusion in relevant reports including the monthly and annual environmental reports.

Noise

Various noise surveys have been carried out at the Kerdiffstown site in the past. A baseline noise survey was conducted in September 2016, comprising day and evening time surveying. Noise surveys have found that the main source of noise in the vicinity of the site is traffic noise from the N7 dual carriageway and M7 motorway, as well as occasional traffic on the L2005 Kerdiffstown Road adjacent to the site.

3.7.5 Investigations to Characterise Site Conditions

Since 2010 a series of intrusive and non-intrusive investigations have been carried out to provide detailed characterisation of the site and the surroundings. The primary objective of these investigations was:

- To evaluate the depth and extent of waste across the site;
- To assess the characteristics of the waste in terms of composition and leachate presence;
- To identify the nature of the natural ground underlying the wastes;
- Evaluation of groundwater conditions beneath and surrounding the site; and
- To install monitoring boreholes for ongoing sampling of landfill gas and groundwater samples.

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These investigations have been used to inform the outline design of the remediation works. Further details on the ground investigations can be found in Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

3.7.6 Demolition and Waste Removal Works

A number of substantial steel framed buildings and structures had been left in an unsafe state following the deterioration over time of structural members for scrap. This had meant that substantial areas of the site were inaccessible to project personnel. Wastes were also known to be contained within the buildings and thus could not be removed for storage within the lined cell.

Works were undertaken in 2016 to demolish these unsafe buildings and other disused infrastructure to allow unrestricted access to these areas of the site. Steel superstructures were demolished and materials removed from the site for recycling. Waste materials located within and around these structures were deposited in the lined cell (Zone 3) and were determined to be compliant with the acceptance criteria for a non-hazardous landfill. Wastes which were categorised as non-compliant, such as gas bottles, tyres, and timber (creosote coated) poles, were removed from the site for re-use or recycling. Contents of silo's and a tank were categorised and the liquid contained in the tank assessed as hazardous due to elevated total petroleum hydrocarbons (TPH) concentrations.

A significant number of tyres remain on the site, being utilised as a wind anchor to the temporary capping system in the lined cell (Zone 3).

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3.8 Needs for the Proposed Project – Waste Policy Perspective

The development of the proposed Project is supported by waste policy set out at both national and regional levels.

3.8.1 A Resource Opportunity – Waste Management Policy in Ireland 2012

Current National Waste Management Policy – *'A Resource Opportunity – Waste Management Policy in Ireland, 2012',* notes the further investment required by the State to deal with landfill sites and illegal landfill sites. A 2005 European court of justice judgement, which found systematic failures in the waste management regulatory regime, dealt with such illegal landfill sites through an agreed programme of measures. While the proposed Project did not form part of the judgement, the commitment to the programme of measures demonstrates the States ongoing commitment to investing in the remediation of problem sites.

Furthermore, the policy commits to reviewing options in relation to the beneficial use of closed landfill facilities.

The development of the proposed Project will demonstrate remediation of the landfill site with a beneficial end-use in the operation of the multi-use public park.

3.8.2 Eastern–Midlands Region Waste Management Plan (EMRWMP) 2015 – 2021.

The Eastern-Midlands Region Waste Management Plan (EMRWMP) 2015–2021 advocates the protection of the environment and health of citizens in the region from potential adverse impacts resulting from waste management activities. The strategic objective agreed by the Local Authorities is to *'apply the relevant environmental and planning legislation to waste activities in order to protect the environment, in particular European Sites and human health against adverse impacts of waste generated'.*

The EMRWMP also recognises the need to address legacy, historic and closed landfills in the region within which the proposed Project is located.

The Plan identifies that risk to environmental receptors, such as groundwater and surface water, from waste buried at these sites needs to be tackled and minimised. The approach to the management of these environmental risks has been addressed in the EIAR, Industrial Emissions Activities Licence (subject to approval by the EPA) and other supporting environmental and engineering assessments for the proposed Project.

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3.9 Local Policy Context

3.9.1 Kildare County Development Plan 2017 – 2023

The preferred development strategy of the Kildare County Development Plan 2017-2023 (KCDP) has been informed by the Regional Planning Guidelines and the environmental sensitivities of the county. It is based on building strong urban centres while protecting the rural hinterlands. The KCDP contains a specific policy in relation to the proposed Project. Policy WM16 states that the KCC will:

> *"Work in conjunction with Government departments and agencies and all other relevant stakeholders to remediate Kerdiffstown landfill in a socially, economically and environmentally sustainable manner that will both manage and reduce environmental risk and accommodate an appropriate end – use that is compatible with the established character of the area."*

The proposed Project is located in proximity to Naas which is classified as 'Large Growth Town 1' and within the multi-modal transport corridor. The proposal seeks to manage the environmental risk that exists on the site, while providing an appropriate end-use that will benefit the local and wider community and environment.

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3.10 References

- Environmental Protection Agency (2010). Evaluation of Environmental Liabilities at Kerdiffstown Landfill, SKM Enviros, Final Report
- SKM Enviros (2013). Kerdiffstown Landfill Remediation Project Remedial Options.
- Aquens Ltd (2012). Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare
- Aquens Ltd (2015). Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare
- Aquens Ltd (2016). Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare
- S.I. No. 9 of 2010. Environmental Objectives (Groundwater) Regulations (2010).

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4. Description of the Proposed Project

4.1 Introduction

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility, occupying an area of approximately 30 hectares. The site has been progressively backfilled with wastes since around 1950 until 2010. Further details of the site history are outlined in Chapter 3 The Need for the Proposed Project. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the Environmental Protection Agency (EPA), as a remediated landfill, whilst operating as a multi-use public park (the Operational Phase).

The main features associated with the proposed Project comprise:

- Instigation of a remediation solution including the reduction of waste footprint at the site and installation of an engineered capping system (see Section 4.2.7);
- Installation of new environmental management and control systems including leachate and landfill gas. The leachate management system will include construction of a buried pipe to transfer leachate from the site, crossing under the Morell River and connecting to Johnstown Pumping Station and then onward to Osberstown Wastewater Treatment Plant (WWTP) (see Section 4.2.8);
- Development of a public park with multi-use sports pitches, car parking, changing room building, children's playground and a network of paths across the site including provision of services and foul drainage to the public sewer network (see Section 4.7); and
- Upgrading access to the site from the L2005 Kerdiffstown Road including the realignment of the L2005 Kerdiffstown Road and provision of footpath and cycleways adjacent to the realigned road to enable safe passage of passers-by during remediation works and for access to the multi-use public park during the Operational Phase (see Section 4.2.3).

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This Chapter of the EIAR describes the main features of the proposed Project including maintenance and aftercare requirements for the proposed end-use. The details presented in this Chapter are the result of the outline design stage only and refinements in relation to the proposed Project will be further defined at the detailed design stage(s). However, sufficient design detail has been provided to ensure that comprehensive impact assessments have been completed and documented in this EIAR. Assessments of the 'worst case' scenario have been undertaken where detailed design may consider a number of options. Whilst the proposed Project is not a new landfill development the remediation proposals take cognisance of relevant guidance and good industry practice, most notably that from the Environmental Protection Agency, as referenced in Section 4.9.

Embedded within the design for the Kerdiffstown Landfill Remediation Project (KLRP) are the following broad objectives:

- The removal of risks to public health and safety;
- A reduction in the environmental risk profile of the site to an acceptable level;
- Delivery of a remediation solution which is acceptable to the local community;
- Completion of the remediation works within 8 years; and
- Integration of sustainability and sustainable design and development in both the remediation and post closure works (operation of the multi-use public park).

A description of the existing site is provided in Chapter 3 The Need for the Proposed Project with existing site layout shown on Figure 4.1. The main features of the proposed Project are outlined in Section 4.2, with descriptions of the key aspects detailed in the following Sections. The end-use proposals for the site are provided in Section 4.7.

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Section 4.3.3 outlines the materials required to be imported to facilitate the remediation of the site and achieve the proposed end-use. The site will not be operated as a landfill for the deposition of new wastes except for the acceptance of inert soils to be imported to the site to facilitate remediation, end-use, environmental management and maintenance/ aftercare requirements as applicable. All materials imported to the site will be required to meet detailed specifications associated with the proposed engineering use. Section 4.6 provides a description of existing waste materials at the site that will be recovered or require to be disposed of as part of the proposed Project. Chapter 5 Consideration of Alternatives presents the alternatives considered for the site remediation and end-use proposals.

4.2 Main Features of the Proposed Project

4.2.1 Remediation Strategy

Optioneering to assess remediation strategies for the proposed Project (Kerdiffstown Landfill Remediation Project Remedial Options Report, SKM Enviros 2013) concluded that the most practical and sustainable remediation solution, with the lowest environmental impact, comprises capping of predominant areas of wastes in-situ, following a re-profiling exercise to achieve a suitable landform to improve slope stability, provide adequate surface water management and reduce the visual impact of the site. Alternatives considered are described in Chapter 5 Consideration of Alternatives.

A Detailed Quantitative Risk Assessment (DQRA) undertaken as part of the Environmental Impact Assessment (EIA) confirms the requirement to remediate the site and reduce risks associated with source-pathway-receptor linkages (refer to Chapter 12 Soils, Geology, Contaminated Land and Groundwater). Having assessed the need outlined in Chapter 3 The Need for the Proposed Project, the remediation solution presented herein involves the reduction of waste footprint at the site, minimisation of nuisance impacts (such as odour, dust, noise), provision of a stable landform and installation an engineered capping system to break the pathway associated with risks to human health by preventing direct contact with waste materials and to reduce the infiltration of rainwater.

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The remediation solution comprises the main elements and supporting infrastructure outlined in Table 4.1.

Table 4.1: Overview of Main Features of the Proposed Project

Main Feature/ Infrastructure	Outline Description	Section	Figures
Site Access	New roundabout and realignment of the L2005 Kerdiffstown Road, including provision of footpaths and cycleways, to facilitate continued safe passage via L2005 Kerdiffstown Road during Remediation Phase and Operational Phase.	4.2.3	4.10 to 4.12
Demolition Works	Demolition of 3 houses and outbuildings and the removal of remaining concrete walls, to provide areas for storage/ stockpiling of imported and processed materials (short-term) and giving an opportunity to re-use crushed and screened materials in the remediation of the site.	4.2.4	4.1
Landfill Infrastructure Compound	Construction of new landfill gas and leachate management facilities in one location as well as a site office and storage area for the management and maintenance requirements of the site.	4.2.5	4.13 to 4.15
Site Re-profiling	Re-profiling the site to address current over-steep slopes to permit installation of an engineered capping and/or soil cover system, to allow for surface water drainage, and provide mitigation of long-term settlement of the waste mass.	4.2.6	4.2 to 4.7
Engineered capping and soil cover systems	Capping predominant areas of waste to prevent infiltration of rainwater, reducing leachate production, and to enable management of landfill gas and odour. Soil cover systems to provide suitable growing media for the landscaping of the site, providing stability to slopes and an opportunity for future enhancement in end-use proposals.	4.2.7	See detail in Section 4.2.7
Leachate and landfill gas management systems	Improved leachate management systems to remove and transfer leachate to a wastewater treatment plant via the public sewer network.	4.2.8	4.16 to 4.18
	Gas management to be improved across the site following capping works, with extraction being undertaken from predominant, gas generating wastes population		4.18

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Main Feature/ Infrastructure	Outline Description	Section	Figures
Surface water drainage system	Surface water drainage to manage runoff post-capping completion, to treat and control discharges from the site.	4.2.9	4.19

Through all stages in the development of the remediation solution the principles of BAT (Best Available Techniques) have been considered. BAT is defined in Section 5 of the Environmental Protection Agency Acts, 1992 to 2007, and Section 5(2) of the Waste Management Acts 1996 (as amended) as:

> *the "most effective and advanced stage in the development of an activity and its methods of operation, which indicate the practical suitability of particular techniques for providing, in principle, the basis for emission limit values designed to prevent or eliminate or where that is not practicable, generally to reduce an emission and its impacts on the environment as a whole" where:*
>
> > *B 'best' in relation to techniques, means the most effective in achieving a high general level of protection of the environment as a whole;*
> >
> > *A 'available techniques' means those techniques developed on a scale which allows implementation in the relevant class of activity under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the person carrying on the activity.*
> >
> > *T 'techniques' includes both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned.*

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Where relevant, BAT compliance is reaffirmed in the following Sections.

4.2.2 Land Use Requirements

The current site condition, existing land uses and extent of land-take required for the proposed Project is shown on Figure 4.1. As outlined in Chapter 3 The Need for the Proposed Project, the site is sub-divided into a number of discrete zones characterised mainly by the types and arrangement of deposited material in each area, as outlined in Table 4.2.

Table 4.2: Zone Description and Current Condition

Zone	Estimated (plan) Area	Estimated Waste Volume		Basal & Side Lining	Cap Status	Other
1	100,000m^2	2,023,000m^3	(65.2%)	Unlined	None	-
2	83,000m^2	660,000m^3	(21.3%)	Unlined	25,000m^2 uncapped	58,000m^2 concrete hardstanding
3	24,000m^2	193,000m^3	(6.2%)	Lined	Temporary cap	-
4	45,000m^2	227,000m^3	(7.3%)	Unlined	33,000m^2 uncapped	12,000m^2 concrete hardstanding
Total	**252,000m^2**	**3,103,000m^3**				

The land requirements for the project are explained in detail in Table 4.3 and subsequent sections. In addition to the land that is underlain by waste at the site; there is a need to permanently acquire further lands, specifically lands:

- To the north and west of the landfill site, to facilitate drainage of clean surface water from sections of the remediated site that could not otherwise be managed;
- To the south to facilitate a safe entrance and access to the site for works vehicles and future park visitors. The new entrance, realignment of the L2005 Kerdiffstown Road and the addition of a footway and cycleway allows for the safe use of the road for current passing traffic and vulnerable road users during the

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Remediation Phase and for access to the multi-use public park during the Operational Phase of the proposed Project;

- To the south, land is required to facilitate the construction of the Landfill Infrastructure Compound to house a new site office, landfill gas flares and leachate tanks which must be constructed on waste-free ground for stability reasons;
- To the east, land is required to ensure the viability of the park amenity, by maximising the space to be provided for sports and recreation. Following a request by Kildare Sports Partnership (part of the Kildare County Council and the County Development Board structure) recommending that options for more sports pitches be included in the project, to cope with local demand, additional land requirement was identified;
- Two wayleaves are required to facilitate pipelines from the site: one to convey surface water runoff to the Morell River; and a wayleave to accommodate two pipelines to convey leachate and foul water from the site to Johnstown Pumping Station; and
- Temporary land take is also required to give access to contractors to construct the project in a safe manner. Each of the areas where temporary land take has been identified as required is based upon the judgement of the Project Supervisor Design Process (PSDP) for the project.

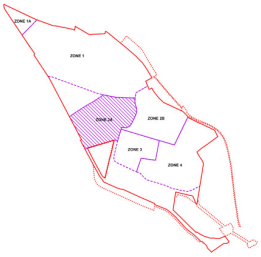
Land use requirements for the Remediation and Operational Phases are summarised in Table 4.3, with detail provided in the following Sections.

Table 4.3: Land Use Requirements

Area (Indicative areas are showing in thumbnails)	Remediation Phase	Operational Phase
Site Entrance 	Demolition of existing residential properties. Construction of new site access. Realignment of a section of the L2005 Kerdiffstown Road, including provision of footpaths and cycleways. Construction of new Landfill Infrastructure Compound. Installation of the leachate transfer pipeline and foul sewer pipeline to Johnstown Pumping Station Realignment of private access road to Kerdiffstown House	Vehicle, pedestrian and cyclist access to multi-use public park. Car parking provision. Road tanker and site management access to Landfill Infrastructure Compound. Installation of third multi-use sports pitch.
Zone 1 	Re-profiling of existing over-steep slopes. Infilling with wastes to achieve suitable landform. Installation of capping system. Construction of new infiltration swale (north flank). Installation of landfill gas and leachate infrastructure.	Paths. Access for monitoring and maintenance of landfill gas, leachate and surface water infrastructure. Access for maintenance to swale and remediated slopes.
Zone 1A 	Reduction in waste footprint. Infilling to remediate existing over-steep slopes. Construction of new surface water pond. Installation of capping system.	Commissioning of new surface water soakaway. Access restricted due to location of pond and to encourage biodiversity.

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Area (Indicative areas are showing in thumbnails)	Remediation Phase	Operational Phase
Zone 2A 	Demolition of existing concrete walls. Reduction in waste footprint. Temporary materials stockpile area. Remedial works to existing concrete hardstanding. Installation of capping system. Installation of surface water management scheme. Installation of landfill gas vent trenches.	Car parking provision. Multi-use sports pitch and paths. Changing room building. Children's playground.
Zone 2B 	Demolition of existing concrete walls, including retaining wall in east bund. Reduction in waste footprint. Re-profiling of existing over-steep slopes. Temporary materials processing and stockpile area. Remedial works to existing concrete hardstanding. Installation of capping system. Installation of surface water management scheme. Installation of landfill gas vent trenches.	Multi-use sports pitch and paths. Access for maintenance to surface water management scheme and remediated slopes.
Zone 3 	Infilling with wastes to achieve suitable landform. Installation of capping system. Installation of surface water management system. Installation of landfill gas and leachate infrastructure.	Paths. Access for monitoring and maintenance of landfill gas, leachate and surface water infrastructure.
Zone 4 	Demolition of existing concrete walls. Re-profiling of existing over-steep slopes and removal of stockpiles. Placement of low permeable soils. Construction of new surface water ponds.	Commissioning of discharge from surface water pond to Morell River. Paths and opportunity for ecological enhancements. Access restricted due to location of ponds and to encourage biodiversity.

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4.2.3 Site Access

A new junction arrangement including realignment of the L2005 Kerdiffstown Road is required to facilitate safe access to the site by, primarily, heavy goods vehicles (HGVs) during the Remediation Phase. These works will also comprise provision of a new footpath and cycleway as shown on Figure 4.11. The path and cycleway will link to Johnstown via the footbridge over the N7 to the south-east of the site and offer linkage to Kill further to the east and Naas to the south-west. This improvement will provide safe passage to passers-by during remediation works and access by vehicles, cycles and pedestrians to the park during the Operational Phase. Design criteria is set out in the Road and New Site Access Design Technical Note (refer to Appendix A4.1).

The existing junction arrangement has restricted visibility splays and requires crossing of the L2005 Kerdiffstown Road (a secondary road) in order to access the entrance of the site (from the east). With the speed limit of 60kph

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and carriageway width, currently a maximum of 5.6m, the existing access arrangements were considered inappropriate for frequent use by wider vehicles such as HGVs and the increased numbers that are likely during the Remediation Phase. The anticipated number of vehicles likely to use the site is discussed in Chapter 14 Traffic and Transport. It is also noted that HGVs will not be permitted to access the site from the west (from Sallins), instead HGVs will utilise the road network off the N7 (to the east of the site) as there is a posted 3 tonne weight limit on the railway bridge on the L2005 Kerdiffstown Road to the west of Sallins. The access arrangements will be designed to ensure that safety is maintained to all road users, following the outline design shown on Figure 4.10.

The proposed site access works comprise construction of a new roundabout, taking the existing road alignment off to the north, to satisfy road design guidelines, and providing one arm for access to the site. Temporary works will be required to facilitate tie-in of the east and west arms of the L2005 Kerdiffstown Road to the new road alignment. Site access design profiles are shown on Figure 4.12. A full description of the proposed access arrangements to the site is outlined in Chapter 14 Traffic and Transport.

As part of the first phase of works at the site a new perimeter fence will be erected around the site, comprising a 2.2m high palisade fence (or similar) with security gates at the site entrance. Pedestrian access points to the north-west and east of the site will also be provided for Project personnel to access key locations outwith the site boundary for monitoring and inspection purposes. During the Operational Phase the access point to the north-west will be available for use by the public to access the park. The Landfill Infrastructure Compound will also be secured within a fenced area, using 2.2m high chain-link security fencing (or similar) with security gates.

4.2.4 Demolition Works

Following removal of the last unsafe buildings and structures located in Zones 2B and 4 in 2016 only concrete walls and surface intrusions remain. Walls of previously demolished buildings in Zone 2A also remain presently.

Areas for temporary stockpiling and processing of materials are required to facilitate the site re-profiling and remediation works, hence these residual concrete structures will be demolished. Construction of the new site entrance and adjacent Landfill Infrastructure Compound will require the demolition of two existing residential dwellings located off Kerdiffstown Road to the south of the site (refer to Figure 3.4; REC010 and REC011).

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During the consultation process it was recommended that an additional multi-use sports pitch be provided. As a result, it was identified that a residential property located to the south of Zone 1 and north of Zone 2A, off the L2005 Kerdiffstown Road, would provide a suitable area for a third pitch. This area is greenfield but also offers an area for temporary stockpiling of clean, imported fill materials. This area will form part of the new site and hence the dwelling will be demolished as part of the remediation works (refer to Figure 3.4; REC016).

On-site concrete structures are envisaged to be demolished by pneumatic breakers fitted to excavators. Where noise limits are likely to be exceeded noise barriers will be provided between the works and identified receptors in proximity to the working area. The assessment of noise and proposed mitigation measures are presented in Chapter 8 Noise and Vibration. The broken out material will be processed using mobile crushing and screening plant to be located in Zone 2B, due to its reduced exposure to surrounding environs compared to Zone 2A. Dust suppression techniques will be employed, by spraying water from a site bowser or similar, in accordance with the Dust Management Plan developed as part of the Construction Environmental Management Plan (CEMP).

It is envisaged that fines (small particles) produced from the crushing and screening operations will be used as fill material in the proposed Project to make up levels (below cap). Reinforced steel extracted from the structures will be removed from site for recycling. Aggregate produced from the crushing and screening will be re-used in drainage infrastructure (subject to appropriate geotechnical and geo-environmental testing).

4.2.5 Landfill Infrastructure Compound

Currently landfill gas is managed via two flares on the site; one located adjacent to Zone 3 (lined cell) and another located in Zone 1. These flares will be maintained throughout the Remediation Phase and two new flares will be installed within the Landfill Infrastructure Compound to manage landfill gas during the Operational Phase.

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Leachate is currently extracted from Zone 3 only, pumped to tanks and removed to Ringsend WWTP by road tanker.

As the site is to be utilised as an amenity space with a public park with multi-use sports pitches, changing rooms and a children's playground, etc. it was determined that siting landfill gas and leachate infrastructure in a single, secure compound on site would be preferred. Due to the nature of the site and risks to the environment should any such facilities fail, the new compound is proposed to be positioned off-waste such that ground conditions are not liable to settlement due to waste degradation or loading. The new compound will be located immediately adjacent to the new site entrance to enable ready access by road tankers and maintenance contractors as necessary.

Similarly, the new (buried) pipeline required to discharge treated leachate to the local sewer network can be positioned predominately off-waste, along the boundary of the site, extending south-east to Johnstown Pumping Station. This pipeline is proposed to be commissioned at an early stage in the remediation works to reduce current leachate tankering costs and risks to the environment through road usage.

The location of the new Landfill Infrastructure Compound is shown on Figure 4.13, while layout details are shown in Figure 4.14 and Figure 4.15.

Gas management infrastructure within the compound will comprise the installation of two landfill gas flares; one duty and one stand-by, which will be utilised to control off-site migration and reduce emissions to atmosphere in order to control odours. Leachate management will involve treatment of the leachate extracted from the waste mass via methane stripping plant to be located within the leachate management building as shown on Figure 4.14. Methane will be directed to the adjacent landfill gas flare. Leachate will be transferred to Johnstown Pumping Station for discharge to the local public sewer network and subsequent treatment at Osberstown WWTP.

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A KCC Site Manager will also be in attendance at the site during week days and whenever emergency procedures are required where plant failures occur. A site office will be required with amenity facilities for such attendance. An indicative layout of the site office building is shown on Figure 4.15. In addition, maintenance equipment and plant, such as quad bikes or 4x4, to facilitate monitoring at the site may also be stored within the Landfill Infrastructure Compound.

4.2.6 Site Re-profiling

Re-profiling works are intended to minimise volumes associated with the excavation, movement and deposition of materials within the site. Design of the remediation profiles has achieved an approximate balance such that materials will not require to be removed from the site, reducing the impact of the works on the local community and environment.

The extent of waste was determined from ground investigation locations shown on Figure 12.2 in Chapter 12 Soils, Geology, Contaminated Land and Groundwater. An intention of the remediation works is to reduce the footprint of the waste mass where practicable. The main areas where waste deposit footprints are to be reduced are as follows:

- The southern boundary of Zone 2A where shallow deposits of waste will be excavated and deposited to Zone 1. This location also has a screening bund which appears to comprise waste deposits. This bund will be removed and replaced with clean material to maintain screening for the adjacent property.
- The boundary between Zone 4 and an adjacent residential property comprises wastes overtopping the quarry deep wall. These wastes will be excavated and deposited to Zone 3 (lined cell).
- East of Zone 2B, bordering on Zone 4, a large bund had been constructed around a concrete retaining wall. A new surface water discharge point is to be located from the surface water management pond in Zone 4 through this area, to connect to the Morell River (in the Operational Phase). Wastes will be removed to reduce this footprint of wastes, reduce the over-steep slopes in this location, enable partial demolition of the retaining wall (to a height below the re-profiled site contours) and create an opening for the new connection to the Morell River.

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- Zone 1 north flank has shallow deposits of waste located adjacent to the pre-Norman era Church (ruins) in the Kerdiffstown House lands. Wastes will be removed from this area to facilitate construction of a new surface water swale to reduce potential flooding risk to the Church ruins.
- North-west extent of Zone 1 comprises largely inert type wastes, typically construction and demolition (C&D) wastes. This area will include a new surface water pond and soakaway hence wastes will be excavated to provide suitable ground conditions for the construction and operation of the soakaway.

Figure 4.2 shows the re-profiled site contours, representing the new 'top of waste'. The movement of material within the site is required in order to achieve a suitable landform to improve slope stability, provide adequate surface water management and reduce the visual impact of the site. A modelled assessment of current ground conditions at the site in comparison to the re-profiled site contours as shown on Figure 4.3 was undertaken to highlight areas of cut and fill. Existing boundary slopes are predominately steep, having been formed at gradients of maximum 1v:1.5h. The depth of soils associated with the proposed capping system was then added to the model to determine the remediation contours as shown on Figure 4.4. Assessment of predicted settlement (refer to Appendix A4.2) was undertaken to determine post-settlement contours as shown on Figure 4.5, to confirm that a suitable final landform for the site will be achieved, maintaining surface water management. Cross sections outlining the various stages of re-profiling, remediation and post-settlement are provided on Figures 4.6 and 4.7.

Excluding existing hardstanding areas in Zones 2A, 2B and 4 surface profiles across the site are typically undulating with a number of large voids and stockpiles present. Proposed re-profiling works in Zones 2A and 2B are limited given the end-use design and the positioning of multi-use sports pitches above these hardstanding areas. Earthworks will be required to enable placement of low permeable soils and for the end-use construction to facilitate drainage runoff.

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A preliminary capping and waste slope stability assessment (refer to Appendix A4.3) has been completed adopting typical geotechnical parameters from published sources for waste materials. The assessment demonstrates that the permanent slopes to be formed in waste materials will need a maximum slope gradient of 1v:2.5h to provide acceptable long term stability. The minimum slope gradient (post-settlement) has been assessed to be 1v:30h, sufficient to maintain drainage runoff.

A preliminary assessment of the volumes to be cut and filled in each zone to achieve the required profiles is summarised in Table 4.4.

Table 4.4: Bulk Re-Profiling Material Volumes

Zone	Cut (m^3)	Fill (m^3)	Balance (m^3)
1 (& 1A)	47,000	111,500	-64,500
2A & 2B	26,300	19,900	6,400
3	0	85,500	-85,500
4	183,000	36,000	147,000
Totals	**256,300**	**252,900**	**3,400**

It is likely that volumes calculated for re-profiling works may be adjusted during detailed design and / or construction works due to the nature of the material exposed. It is considered from borehole logs that a large proportion of the waste mass comprises C&D wastes, where rubble and concrete blocks may be anticipated. Encountering such materials for excavation may generate a greater volume of material to be moved around the site and subsequent materials required for backfill or adjustment (typically reduction) of site profiles or gradients. Similarly, there is an opportunity to re-use site won soils in the remediation works, subject to appropriate testing and classification.

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4.2.7 Engineered Capping and Cover Systems

Capping System Principles

The primary role of any landfill capping system for non-hazardous landfill sites is to control leachate production by preventing or significantly limiting the infiltration of rainfall into the waste mass. The capping system is therefore required to include a barrier layer of very low permeability to intercept rainwater and an overlying drainage layer to convey the water away efficiently to the perimeter of the capped area. By eliminating this incoming water source from the waste body, the amount of leachate produced is limited to that from waste degradation alone and the rate at which that leachate pollutes the underlying groundwater is restricted to the degradation rate (of primarily MSW) rather than the flushing through according to rainfall events.

The capping system will also restrict vertical migration of landfill gas and will convey the gas to collection points for controlled burning via a landfill gas flare. Lateral migration of gas may be observed post-capping works, with the landfill gas management system designed to reduce this effect.

The proposed Project relates to the remediation of an existing body of waste that has been placed over a number of years, to mitigate impacts from the remediation works and effects on the local community as far as practicable whilst integrating sustainability into the design. These principles have been embedded in the design considerations and through assessment of the nature and extent of the wastes determined from the various ground investigation works that have been undertaken at the site, a zonal approach to capping system proposals has been adopted for the proposed Project. One stockpile of inert material, circa 10,000m^3, is available on site currently, with import of capping materials including cover soils required to facilitate remediation of the proposed Project. The adoption of these principles will reduce risks to human health and the environment by preventing rainwater and surface water infiltration and by controlling gas migration.

The EPA Landfill Manuals Landfill Site Design (EPA 2000) outlines the recommended components of a landfill capping system for non-hazardous and inert landfills. EPA guidance states that the need for each component should be assessed on a site by site basis and recognises that not all the components of the capping system will be necessary for every site. The EPA capping system recommendations are shown in Table 4.5 in comparison to the components being promoted for use in the proposed Project.

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Table 4.5: Recommended Non-Hazardous and Inert Landfill Capping System Components (EPA; Landfill Manuals, Site Design, 2000; Figure 10.1) Compared to Proposals for each Zone

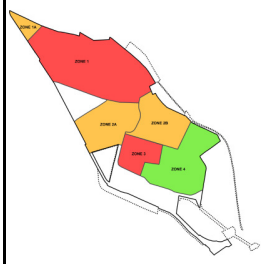
Non-Hazardous Landfill Capping System Components	Zones 1 & 3	Zones 1A, 2A & 2B
Topsoil (min. thickness 150mm)	✓	✓
Subsoil Layer	✓	
Drainage Layer $k > 1 \times 10^{-4}$ m/s	✓	
Barrier Layer $k \leq 1 \times 10^{-9}$ m/s or equivalent	✓	✓
Gas Drainage Layer (if required) $k > 1 \times 10^{-4}$ m/s		
Waste		

Inert Landfill Capping System Components	Zone 4
Topsoil	✓
Subsoil Layer	✓
Waste	

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Based on the identified environmental risks outlined in Chapter 3 The Need for the Proposed Project and Table 3.2. The capping system design has been determined as outlined in Table 4.6 below.

Table 4.6: Capping Proposals by Zone

Capping Proposals		
	**Zones 1 & 3**	Zones 1 and 3 present the highest environmental risk in terms of waste, groundwater, landfill gas and odour generation potential due to the presence of MSW and C&D waste. An engineered capping system is proposed to mitigate those risks.
	Zones 1A, 2A & 2B	Zones 1A, 2A and 2B present a moderate environmental risk in terms of waste, groundwater, landfill gas and odour generation potential due to the lack of MSW, proposed reduction in waste footprint and retention of existing thick concrete hardstandings (Zones 2A and 2B). However, an engineered capping system is proposed to mitigate those remaining risks, taking cognisance of the topography.
	Zone 4	Zone 4 presents a low environmental risk considering proposals to reduce the existing volume of waste present, re-profiling over-steep slopes, retention of existing thick concrete hardstanding and application of a geomembrane to the ponds area. A soil cover system is proposed for this zone.

Further detail on the proposals for the engineered capping and cover systems for each zone are outlined below.

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Zones 1 & 3 Capping System

Assessment of waste types in Zones 1 and 3 indicates that the body of waste would be classified as predominately non-hazardous with C&D and inert wastes mixed through.

Zone 1 represents the largest volumes of waste at the site, with the majority of waste in this zone reported to comprise Municipal Solid Wastes (MSW), although some logs do show C&D waste to also be present. The MSW wastes are found over most of the zone, although there appears to be more C&D waste in the north-west corner. This area has therefore been designated as Zone 1A to reflect this reduced risk profile (discussed further below). Throughout Zone 1, where waste is encountered, it is considered that there is sufficient putrescible material to classify this zone as comprising non-hazardous biodegradable wastes.

Zone 3 comprises a cell with engineered basal and side slopes lining system, and is referred to as the 'Lined Cell'. Full details of the waste contained in the cell are uncertain. However, the wastes are likely to be similar to the wastes elsewhere on site and thought to comprise processed non-hazardous C&D materials with domestic waste mixed through.

The capping proposals for Zones 1 and 3 are based the assessment of the waste classification, the recommendations of the EPA Site Design Guidance, and take into consideration the absence of the requisite quantity of suitable materials on site, as outlined in Table 4.7.

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Table 4.7: Zones 1 and 3: Proposed Multilayer Capping System – Components and Depths

Component	Zones 1 & 3 Proposals		Function & Justification
Topsoil	Top soil / soil forming material cover	min 150mm	Function: to provide suitable growing medium for restoration. Depth required to provide suitable growing medium for landscaping, primarily grasses in low maintenance use. Depth may be increased in local areas where scrub and shrub planting is proposed.
Subsoil	Subsoil	min 350mm	Function: to protect barrier layer and assist restoration. Reduced thickness from recommended 850mm due to absence of suitable materials on site and sustainability impacts of importation, whilst providing appropriate protection to the barrier layer. Depth to be increased in local areas where scrub and shrub planting is proposed.
Drainage layer	Geocomposite drainage layer	Negligible combined thickness (<15mm, incl. 2mm FML)	Function: to assist drainage off cap (barrier layer) and increase slope stability of the capping system. Use of a geocomposite liner, of minimum permeability $1x10^{-4}$m/s, provides the equivalent function of an aggregate drainage layer, whilst significantly reducing material import requirements including use of quarried material.
Barrier layer	Flexible membrane liner (FML)		Function: to provide protection and a separation between waste and clean restoration soils, reducing infiltration (hence leachate generation) and vertical gas migration. Use of a High Density Polyethylene (HDPE*) liner, of maximum hydraulic conductivity $1x10^{-9}$m/s, provides the equivalent function of a compacted mineral layer, e.g. clay, whilst significantly reducing material import requirements.
Gas drainage layer	Regulation layer	min 150mm	Function: to provide suitable formation for the installation of a FML. A gas drainage layer is not required as the landfill gas proposals include for gas wells at sufficient spacing to permit draw off to the flare. The regulation layer would comprise fine grained material, e.g. sand, with minimum equivalent permeability $1x10^{-4}$m/s., placed above prepared waste profile with any surface protrusions removed.

* HDPE to be selected for slopes >1v:3h. LLDPE may be adopted for other areas. To be confirmed during detailed design.

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The proposed capping system for Zones 1 and 3 provides a 1.75m reduction in the total thickness of the capping system when compared to recommended depths as specified within the EPA Landfill Manuals Landfill Site Design (EPA 2000) including 600mm for a mineral barrier layer. As a result, an approximate 75% reduction in imported soil volumes with associated vehicle movements would be realised using this approach for Zones 1 and 3.

The proposed capping system components for Zones 1 and 3 are shown below in Diagram 4.1.

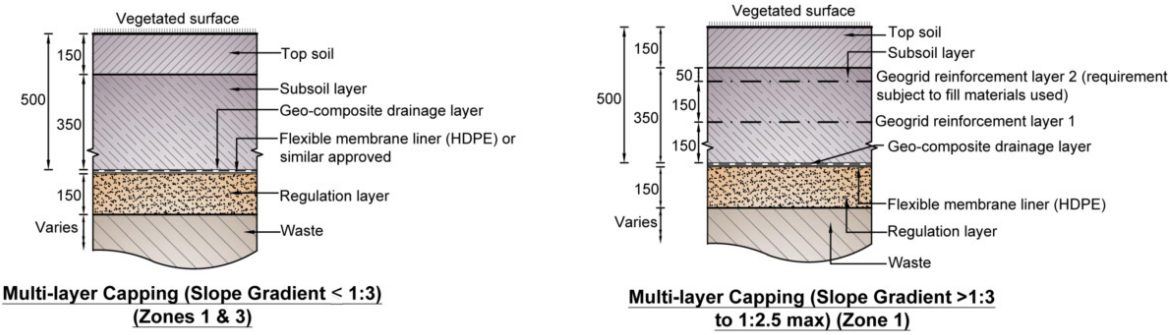


Diagram 4.1: Capping System: Zones 1 and 3

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In order to prevent damage to the capping system only selected waste, to exclude large and bulky or sharp items such as concrete blocks and rebar, will be used to form the final lift of waste across Zones 1 and 3 immediately below the regulation layer. Selection and placement of the final layer of waste will be carried out under the supervision of a suitably trained and qualified person. Each waste layer placed will be covered at least by the end of the working day with the application of daily cover to assist with control of odours as well. This may comprise soils or geosynthetics, widely used for such purposes in the waste management industry as a temporary cover. The objective of the daily cover is to ensure windblown litter and debris are minimised, vermin is prevented from entering the waste mass and scavenging is prevented as far as practicable and the depth of cover is sufficient to avoid future problems of perched leachate. A stockpile of cover materials will be maintained, as necessary, in the vicinity of the operational area in order to ensure that exposed waste can be covered at the end of each working day. The use of alternative cover methods (e.g. proprietary geosynthetic sheeting) will be agreed with the EPA prior to use.

The regulation layer will comprise site processed materials or imported inert waste (fine grained soils, sands or similar) compacted to a minimum thickness of 150mm and will be placed above the daily cover layer previously applied. The regulation layer will be free of material likely to damage the capping barrier.

The barrier layer will consist of a FML comprising 2mm thick high-density polyethylene (HDPE) (on slopes >1v:3h) or 1mm thick Linear Low Density Polyethylene (LLDPE) (slopes <1v:3h). Panels of FML, typically 4m wide, will be welded together down slopes to then be overlain by a geocomposite drainage layer (GDL). For Zone 3, the FML can be anchored at the perimeter of the cell in intimate contact with the existing cell (basal/ side wall) liner system. Around the extents of Zone 1, a toe anchor detail will be applied, such as that indicated in Diagram 4.2.

The GDL is a geosynthetic composite of geotextiles supporting a drainage core, offering protection to the FML from the overlying soils whilst performing a drainage function. The subsoil layer shall be specified according to the grading that is acceptable for use in contact with the GDL, and method of placement subject to agreement with the GDL manufacturer. The final top layer of top soil or soil forming material will provide a suitable growing medium for the landscaping proposed across the site and will be increased locally where specific planting is proposed. On slope gradients up to 1v:3h an additional layer of geogrid will be required to reinforce the capping system and will be installed in the subsoil layer, as shown in Diagram 4.2.

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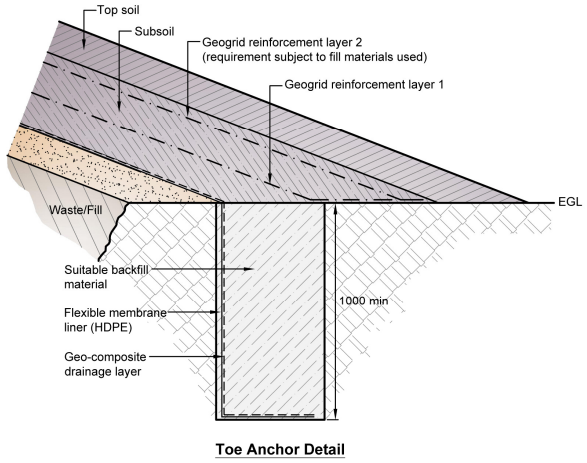


Diagram 4.2: Perimeter Toe Anchor Detail: Zone 1

Design, specification and installation of the capping system in Zones 1 and 3 will be subject to Construction Quality Assurance (CQA), discussed further in Section 4.3.5.

Zones 1A, 2A & 2B Capping System

Zone 1A comprises more C&D waste than the immediately adjacent Zone 1. The remediation works proposals include the reduction in the waste footprint in Zone 1A with wastes excavated for emplacement in Zone 1.

Zone 2A & Zone 2B comprise largely flat areas with concrete hardstandings and remnants of buildings from the former waste processing facility. Review of ground investigations and subsequent monitoring data confirms that wastes in Zone 2A comprise more MSW than in Zone 2B and initial readings of gas shown on borehole logs show that relatively high concentrations of methane and carbon dioxide have been present in Zone 2A.

The majority of waste in Zone 2B is reported to comprise unprocessed non-hazardous mixed C&D waste but with MSW also present at varying depths mixed in within the C&D materials. The methane results within the borehole logs show lower concentrations of methane than in Zone 2A.

The proposed capping solution for Zones 1A, 2A and 2B reflects an assessed lower risk to groundwater from surface water infiltration in these areas resulting from a combination of reduced waste thicknesses and footprint and predominant C&D waste composition with a reduced proportion of MSW compared to Zones 1 and 3. The variation in capping solutions also reflects the maintenance of a barrier to waste materials by the retention of existing concrete hardstanding areas in Zones 2A and 2B. The capping proposals for Zones 1A, 2A and 2B are outlined in Table 4.8.

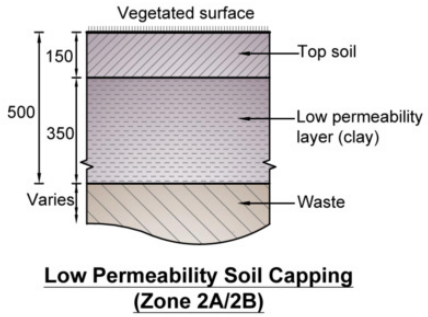
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Table 4.8: Zones 1A, 2A and 2B: Proposed Capping System – Components and Depths

Component	Zones 1A, 2A & 2B Proposals		Function & Justification
Topsoil	Top soil / soil forming material cover	min 150mm	Function: to provide suitable growing medium for restoration. Depth required to provide suitable growing medium for landscaping, primarily grasses in low maintenance use. With park construction depth will be increased to facilitate tie-in to pitches and construction of paths.
Barrier layer	Low permeability compacted clay liner	min 350mm	Function: to provide protection and a separation between waste and clean restoration soils, reducing infiltration (hence leachate generation) and vertical gas migration. Due to relatively flat surface profile clay is selected for the barrier layer as it provides an advantage where maintenance may be required, e.g. due to settlement of the waste and creation of low spots, whilst providing adequate protection to the environment.

The proposed capping system for Zones 1A, 2A and 2B are shown below in Diagram 4.3.



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Diagram 4.3: Low Permeability Soil Capping (Zone 2A & Zone 2B)

Drainage across the capped areas of Zones 2A and 2B will be facilitated by tie-in to the multi-use sports pitch design. Gas is predicted to be at low levels insufficient for active abstraction hence perimeter venting trenches are proposed as outlined in Section 4.2.8.

In Zones 2A and 2B separation to waste materials will also be provided by retention of existing concrete hardstanding areas (circa 58,000m^2). Description of remedial works that are required to the concrete hardstandings is described further below. The low permeability capping system in Zones 2A and 2B will be tied-in to those hardstanding areas as shown in Diagram 4.4.

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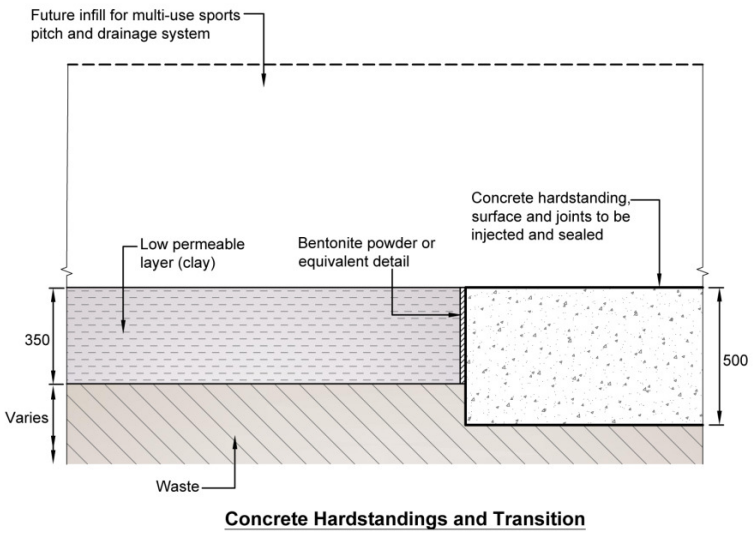


Diagram 4.4: Hardstanding Tie-in to Capping System: Zones 2A & 2B

The existing ground profile in Zone 1A is suited, with profiling using insert soils, to the formation of a geomembrane lined pond which will be installed to retain surface water prior to discharge (to ground via a soakaway). This use of geomembrane will further provide separation of clean surface water from the underlying materials.

Design, specification and installation of the capping system in Zones 1A, 2A and 2B will be subject to Construction Quality Assurance (CQA), discussed further in Section 4.3.5.

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Zone 4 Cover System

The majority of waste in Zone 4 is reported in borehole and trial pit logs to comprise C&D waste with a high proportion of inert material (dominantly reported as gravelly clay). The logs do not generally report any MSW to be present as outlined in Chapter 3 The Need for the Proposed Project. Where gas readings have been taken and reported in the borehole logs, it is reported that methane and carbon dioxide concentrations are largely absent from the wastes or less than 1%v/v within this zone. Zone 4 also includes a large area covered with concrete hardstandings, approximately 12,000m^2.

Zone 4 poses a lower risk to groundwater from surface water infiltration due to a reduced waste thickness, and predominant C&D waste composition with minimal MSW. Re-profiling works in this area will further remove a significant proportion of the existing waste mass. The remediation profile will also reduce the risk in this zone due to the slope gradients and installation of (lined) surface water ponds. Gas management in Zone 4 is not required due to a lack of degradable wastes and due to the re-profiling works proposed. Taking cognisance of the above and for the purposes of design it is considered that the inert capping system is appropriate for this zone.

The solution reflects an assessed lower risk to groundwater from surface water infiltration in Zone 4 resulting from a combination of reduced waste thicknesses, predominant C&D waste composition with minimal MSW, proposed removal of wastes as identified during in the remediation of slopes, re-profiled slope gradients. A geosynthetic liner will also be used in the new surface water management ponds covering a large area of the zone.

The proposed cover system for Zone 4 is summarised in Table 4.9.

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Table 4.9: Zone 4 Proposed Cover System – Components and Depths

Component	Zone 4 Proposals		Function & Justification
Topsoil	Top soil / soil forming material cover	min 150mm	Function: to provide suitable growing medium for restoration. Depth required to provide suitable growing medium for landscaping, primarily grasses in low maintenance use. Depth may be increased in local areas where scrub and shrub planting is proposed.
Subsoil	Subsoil	min 350mm	Function: to assist restoration. Depth to be increased in local areas where scrub and shrub planting is proposed.

The proposed cover system for Zone 4 is shown below in Diagram 4.5.

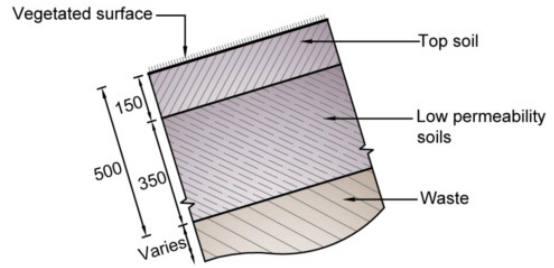


Diagram 4.5: Cover System: Zone 4

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The retained concrete hardstanding area in Zone 4 will be buried below the new surface water ponds and remediated slope profiles.

Retained Concrete Hardstandings (Zones 2A, 2B & 4)

The existing hardstanding areas in Zones 2A, 2B and 4 currently provide a positive capping function over the deposits of wastes below. The removal of these hardstandings would increase the volume of materials to be processed and deposited on site, creating nuisance such as dust and noise, as well as requiring importation of fill material to backfill the void left by these hardstanding areas.

The utilisation of existing hardstanding areas in Zones 2A, 2B and 4, where these have been shown to be around 500mm thick providing a capping function, assumes that minor remedial sealing works will be undertaken to restrict possible future infiltration. This includes inspection for and remediation of surface cracks, re-sealing of all construction joints, filling and capping over voids and grouting up of redundant drainage. There are a number of available techniques based on a variety of factors. The method to be adopted will be confirmed in detailed design and subject to Construction Quality Assurance (refer to Section 4.3.5). Design of the multi-use sports pitches will require installation of a drainage system which will transfer runoff away from the hardstanding areas.

4.2.8 Leachate and Landfill Gas Management Systems

Leachate Management

Following remediation, the site will continue to generate leachate (in smaller volumes but more concentrated). The need to manage this leachate remains a long term maintenance liability for the site. This requires the integration of the existing leachate collection infrastructure collecting leachate generated from Zone 3 (lined cell) to a new treatment and transfer system, discharged to Johnstown Pumping Station. The leachate will then be transferred in the public sewer network to Osberstown Wastewater Treatment Plant. Leachate generated following capping of the lined cell is expected to be typical of municipal waste landfill leachate.

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From the EPA Landfill Manual on Landfill Monitoring (EPA 2003) it is stated that, for unlined landfills, three leachate monitoring points should be provided per five hectares of filled area. Therefore, given Zone 1 represents the largest volume of waste at the site five leachate monitoring wells are proposed be provided in Zone 1. The leachate management system, comprising extraction to the Landfill Infrastructure Compound for treatment and onward transfer to the public sewer network, will be extended to each of the monitoring points allowing extraction of leachate when monitoring confirms leachate to be present at levels sufficient to facilitate extraction. The leachate management system design, as outlined in the Leachate Management Plan (Appendix A4.4), will function as follows:

- Submerged pumps transfer leachate from the waste mass (where identified) along a rising main into an untreated leachate balancing tank housed in a building within the Landfill Infrastructure Compound;
- The leachate then gravitates from the balancing tank into a methane stripping plant within the building, where dissolved methane is removed. Leachate is transferred into a treated leachate balance tank;
- Treated leachate is then pumped from the treated leachate balancing tank to a buried rising main, discharging into the gravity main (as shown on Figure 4.17), subsequently crossing under the N7 and the Morell River connecting to Johnstown Pumping Station for onward transfer to Osberstown Wastewater Treatment Plant via the public sewer network;
- A treated leachate storage tank is included to store leachate in the event that Irish Water restrict discharge to the public sewer network (for example due to high flows in network or maintenance downtime in the network or treatment works) with capacity agreed with Irish Water on basis of likelihood of downtime and availability of other storage and disposal options (see below);
- Further storage will be provided with recirculation facilities in the lined cell (Zone 3) and
- Road tankers will be available via call-off contract to remove leachate from the site for transport to a treatment plant (to be agreed with Irish Water).

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A piping and instrumentation drawing (P&ID) of the leachate management system is shown in the Leachate Management Plan in Appendix A4.4.

Security measures for the leachate management system are proposed in the Leachate Management Plan, to include provision for an underground storage tank which will be used in the event of spillage from the valves connecting to road tankers or the tankers. The operation of this system will be controlled and alarms set using a supervisory control and data acquisition (SCADA) system or similar, with proposals developed during detailed design.

During the Remediation Phase the generation of leachate will be managed through a number of on-site management operations, including:

- Working in discrete areas to minimise the area of exposed waste;
- Interception of any leachate outbreaks identified during waste excavation and re-profiling activities, by installing a drain point to direct leachate back in to the waste mass;
- Provision of daily cover to exposed wastes, occurring as part of the remediation works; and
- Progressively remediate the site with a landfill cap.

A Leachate Management Plan has been prepared and is provided in Appendix A4.4, which provides further detail on the leachate management system. Having an appropriate plan in place is a requirement of the Industrial Emissions Activities Licence (IEAL) licensing process and the Leachate Management Plan will be maintained and updated as required through the Remediation and Operational Phases.

Landfill Gas Management

At all stages the aim of the landfill gas management infrastructure is to:

- Prevent lateral gas migration off-site;
- Control emissions of gas to atmosphere to acceptable levels to reduce odour impact;

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- Minimise global warming potential of gas emissions;
- Ensure safety of site operatives and appointed contractors working on site;
- Be sufficiently flexible to control gas occurrence throughout different phases of the remediation works;
- Integrate with leachate management and other environmental control systems; and
- Be compatible with final remediation and after-use of the site.

Due to the risks posed by landfill gas and the location of sensitive gas management receptors in proximity to the site (as shown on Figure 12.32), and the proposed amenity end-use a detailed assessment has been undertaken to determine the risks associated with the site. The migration potential for landfill gas from each zone is shown in the Landfill Gas Conceptual Site Models (Figures 12.28 to 12.31), which consider the potential for gas migration prior to and after remediation works. A framework will be put in place to ensure that the landfill gas is appropriately controlled and managed throughout the gassing life of the site.

Control measures have been developed on a zone specific basis for the site to take account of the differing gassing potential of each zone and their final end-use following remediation works. The landfill gas management system design comprises the following:

- In-waste vertical landfill gas extraction wells linked to active extraction;
- Gas wells in Zones 1 and 3 will be connected individually to manifolds, with the connecting pipework being designed to ensure that a high velocity is maintained to aid condensate management.
- Perimeter gas venting trenches (adaptable to active extraction system if required) will be installed in Zones 2A and 2B where low levels of gas generation have been identified);
- The design of the venting trenches will also allow the installation of vent stacks and cowls if the gassing potential is greater than models currently predict. This system can also be adapted to the extraction system as a further measure of control, though the quality of gas may affect the efficiency of the flare operation;
- Carrier mains will carry the landfill gas to the flare, which will be of an enclosed design providing high temperature flaring; and
- During remediation works the flare will be moved around the site to support key extraction areas, to reduce emissions and odour if observed during the works. Following remediation works gas flares will be sited within the Landfill Infrastructure Compound. The flares will be fitted with telemetry systems to inform of shutdowns and the flare stack height will be suitable to achieve the required air dispersion of the emissions products (refer to Chapter 7 Air Quality, Odour and Climate).

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Due to the assessment of wastes and taking cognisance of the proposed remediation works in Zone 4 landfill gas management is not proposed for that part of the site.

A Landfill Gas Management Plan has been prepared and is provided in Appendix A4.5, which provides further detail on the proposals for landfill gas management. Having an appropriate plan in place is a requirement of the IEAL process and the Landfill Gas Management Plan will be maintained and updated as required through the Remediation and Operational Phases.

4.2.9 Surface Water Drainage System

At all stages the aim of the surface water management infrastructure is to:

- Not increase the future flood risk to land or properties outside the site boundary;
- Avoid adverse impacts and increased pollution risk to local streams and rivers;
- Prevent the escape of excessive sediment that may arise in the initial years following remediation works;
- Be sufficiently flexible to control surface water throughout different phases of the remediation works;
- Integrate with other environmental control systems to be employed as part of the remediation works; and
- Be compatible with final remediation and after-use of the site.

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Surface water management measures for the Remediation and Operational Phases have been designed to mitigate the risk of environmental pollution and flooding generated from within the licensed extents the site. The proposed drainage system for the site, as shown on Figure 4.19, will include a network of open ditches, channels, swales and wetlands to intercept and control surface water runoff generated from with the licensed extents of the site and direct it towards three storage ponds. Topographical review has shown that runoff will not enter the site from outside the licensed boundary.

Review of the Flood Risk Assessment (refer to Chapter 13 Water - Hydrology) indicates that the site is located just outside the fluvial flood risk zone. However, an area located to the north extents of the site boundary aligning with the private access road to Kerdiffstown House is positioned within the 0.1% AEP (annual exceedance probability) and 1% AEP fluvial flood events which represents areas at risk of 1 in 1000 and 1 in 100 year flood events respectively.

A suitably competent contractor(s) will be appointed to undertake remedial works at the site, with surface water management a particular aspect to be closely monitored and controlled. The contractor will be required to construct temporary perimeter bunds and silt fences to enable separation of working areas from remediated areas. However, it is anticipated that until initial vegetation coverage, comprising grass, fully germinates silty runoff from capping soils may still be prevalent and require control. The appointed contractor(s) responsible for the remediation works will be required for ensuring a break between working (exposed waste) areas and remediated areas (restored) is maintained to prevent cross contamination. The appointed contractor(s) may also utilise temporary on site lagoons to retain surface water runoff, with silt buster tanks (or similar) used to limit the amount of silt being disposed to the ponds/ lagoons. Water collected in these lagoons will be used for dust suppression across the open working areas and, if not contaminated, over restored areas with any contaminated waters removed from the site by road tanker. The appointed contractor will be required to prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC, for the contractor to then implement through the Remediation Phase, with water contamination testing requirements and limits to be agreed by the EPA.

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Oil interceptors will be required during the Remediation Phase to serve temporary working areas (e.g. potential laydown area, fuelling station, temporary car park and wheel wash area). These interceptors will be removed on completion of the remediation works.

Surface water management ponds in Zone 1A and Zone 4 are to be developed as part of the remediation works, only discharging once remediation works have been completed. An impermeable cap will isolate the waste body from interacting with rainfall on the site and nearly all rainfall will result in runoff which will have to be managed to avoid flooding or ponding of water on the site. This rainwater/surface water will not have interacted with waste or leachate in any way and will be equivalent in quality to runoff from parkland or agricultural fields with a degree of suspended solids which will need to be reduced before discharge, with the pond in Zone 1A discharging to groundwater via a soakaway and the ponds in Zone 4 discharging to surface water. The location of these ponds is shown in Table 4.10 below.

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Table 4.10: Surface Water Ponds Proposals

Surface Water Ponds Proposals		
	**Pond 1 (Zone 1A)**	The surface water management design incorporates a surface water pond and soakaway at the north western corner of the site. This soakaway may be used following settlement for discharge during the Remediation Phase with monitoring to confirm that there will be no impacts to groundwater.
	Ponds 2 & 3 (Zone 4)	Two further surface water ponds are to be located at the south eastern area of the site. Pond 2 will discharge to Pond 3, for discharge to the Morell River. Discharge from these ponds will be controlled via SCADA system and penstock, controlling discharge to the Morell River.

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Further details can be found in the Surface Water Management Plan (Appendix A4.6).

Due to topographical constraints runoff from the north flank of Zone 1 cannot be returned into the site for discharge. An infiltration swale will be constructed in these locations to allow collected surface water to infiltrate to ground. As this area is adjacent to the flood plain the level of swale bund will be required to be above the maximum flood level.

Drainage design for internal site roads will incorporate road gullies, silt traps and oil interceptors, prior to passing forward flows to the surface water ponds in Zone 4. The offsite runoff from the proposed new roundabout, realigned road and footpath and cycleway will be connected to the existing drainage system near the existing roundabout on the L2005 Kerdiffstown Road.

Surface water from the new Landfill Infrastructure Compound will be collected by a system of road gullies and underground pipework which will be supplied with silt and oil interceptor(s). Flows from the Compound will be discharged to the main site road drainage. However due to the risk of runoff from the Compound containing contaminants due to leachate spillages the drainage system from the Compound will also be provided with an isolation point before discharge into the main site road drainage. An isolation penstock will be installed within a manhole and the surface water runoff will be retained within the storage manhole until mitigation works have been carried out. Contaminated surface water may need to be transported off-site for disposal during this period until the normal operation has been restored. Contingency plans to address leaks from valves and tankers used in the management of leachate in the Landfill Infrastructure Compound are outlined in the Leachate Management Plan (Appendix A4.4).

The sampling and monitoring of surface water discharges will be required post remediation works to confirm that the runoff quality complies with the discharge parameters. A real time monitoring and control system will be provided at the outlet from Pond 3 in the south-eastern area, discharging to the Morell River. Sampling of the infiltration swale at the northern perimeter of the site will also be undertaken. Sampling of the Morell River upstream and downstream of the surface water outfall from Pond 3 will continue (as a minimum). The frequency of monitoring at all locations is to be monthly unless otherwise stipulated in the IEAL, with the real time monitoring and control system recording data via a supervisory control and data acquisition (SCADA) system more frequently. The frequency of the monitoring of the Morell River may be reduced following sufficient data to support ongoing assessment.

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A Surface Water Management Plan has been prepared and is provided in Appendix A4.6. Having an appropriate plan in place is a requirement of the IEAL process and the Surface Water Management Plan will be maintained and updated as required through the Remediation and Operational Phases.

4.2.10 Environmental Management During the Remediation Phase

Prior to commencement of the Remediation Phase, the appointed contractor responsible for the remediation works shall prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC. The CEMP shall contain the mitigation measures and plans identified (as a minimum), the wider EIAR and shall implement the conditions set out in the planning approval and the requirements of the site's Industrial Emissions Activities Licence (IEAL).

The CEMP shall set out all the intended methods to manage potential environmental impacts from remediation of the proposed Project, and shall include the following plans as a minimum:

- Groundwater Management Plan;
- Odour Management Plan (to be developed using the existing draft Odour Control Plan (SKM 2013);
- Dust Management Plan;
- Noise and Vibration Management Plan;
- Invasive Species Management Plan;
- Site Biodiversity Management Plan;
- Erosion and Sediment Control Plan;
- Contaminant Spill Emergency Plan;
- Construction Traffic Management Plan;
- Mobility Management Plan; and
- Waste and Materials Management Plan.

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The CEMP shall also incorporate the requirements of the existing plans developed for the proposed Project, including but not limited to:

- Landfill Gas Management Plan;
- Leachate Management Plan;
- Surface Water Management Plan;
- Landscape Masterplan Statement;
- KLRP Management Plan Accident and Emergency Response; and
- Monitoring and Control Management Plan.

These Plans and the CEMP are live documents and will be reviewed on a regular basis and updated accordingly by the appointed contractor, in particular the document shall be reviewed on receipt of planning approval and grand of the IEAL.

The key elements of the CEMP shall include:

- Appointment of an Environmental Officer by the appointed contractor for the duration of the Remediation Phase;
- Incorporation of environmental commitments and requirements;
- Incorporation of procedures to record any environmental incidents on site and procedures for implementing appropriate corrective and preventative measures;
- Outlining the methods by which the remediation works will be managed to meet these commitments and requirements;

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- Outlining the relevant guidance (with those outlined in the EIAR as a minimum) that have informed the Plan development;
- Incorporation of procedures for communicating with KCC, the public and stakeholders;
- Incorporation of procedures for staff environmental awareness training;
- Incorporation of environmental monitoring procedures; and
- Incorporation of a system of audit and review with regard to the effectiveness of the Plan.

4.3 Proposed Works and Methods

Further to the description of the main features given in Section 4.2, the following Sections set out details with respect to the proposed works and outline phasing programme, working methods and controls, and materials.

4.3.1 Outline Remediation Phasing

For the purposes of the EIAR, the remediation works are grouped into eight phases of works, assumed to take place over an approximate four year period. It is appreciated that the construction phases are of varying lengths but the overall duration of the intensive works is estimated to be 4 years, and for the purposes of the assessment we have assumed an average phase length of 6 months. It is acknowledged that there may be overlap between phases and activities based on identified constraints. The assumed phases are dependent on a number of factors, including the period at which a planning decision is granted, legal agreements for land purchase, availability of suitable materials for importation, procurement approach for the works, programme and ecological constraints. Depending on the outcome of these factors a lead-in time for the commencement of remediation works may also be required. The durations are also likely to be subject to weather conditions, which can restrict works where impacts and nuisance may be prevalent including inclement weather giving rise to surface water runoff, and dust and odour generation through waste excavation works. The outline phasing is broadly described below. Figure 4.8 shows the Outline Remediation Phasing for Phases 1 to 4 and Figure 4.9 shows similar for Phases 5 to 8.

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Phase 1

- Demolition of existing residential properties (REC010, REC011 and REC016).
- Construction of new site entrance;
- Realignment of L2005 Kerdiffstown Road;
- Provision of new footpath and cycleway adjacent to realigned road extents;
- Installation of new perimeter fencing to site boundary;
- Installation of new foul and leachate pipeline connections to Johnstown Pumping Station;
- Construction of a new Landfill Infrastructure Compound;
- Demolition of concrete structures in Zone 2A, Zone 2B and Zone 4, including demolition of the retaining wall to form a future link to the Morell River;
- Removal of existing site connection to Canal Feeder Stream;
- Establishment of crushing and screening area in Zone 2B for processing of site generated concrete from demolition activities;
- Removal of stockpiles of materials in Zone 4;
- Re-profiling of current over-steep slopes in Zone 4, including removal of wastes where identified;
- Processing of materials from Zone 4 where identified as an opportunity for recovery of soils and re-use on site;
- Re-profiling of Zone 1/ 1A to accommodate surplus material derived from Zone 4;
- Stockpiling of imported fill material in Zone 2A; and

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- Filling of Zone 3 with wastes from Zone 4.

Phase 2

- Continued re-profiling of slopes in Zone 4;
- Installation of a capping system in Zone 1A;
- Temporary stockpiling of Zone 4 material in Zone 2B for processing;
- Continued filling of Zone 3 with wastes from Zone 4;
- Continued re-profiling of waste in Zone 1 including filling with surplus material from Zone 4;
- Installation of a new or supplementary gas wells in Zone 1A; and
- Placement of imported low permeable soils to Zone 4.

Phase 3

- Removal of subsoil stockpile located adjacent to the new site entrance;
- Construction of temporary surface water retention pond in Zone 4;
- Installation of a capping system in Zone 1;
- Installation of a capping system in Zone 3;
- Installation of a new or supplementary gas wells in Zones 1 and 3; and
- Placement of imported low permeable soils to Zone 4.

Phase 4

- Construction of surface water retention pond in Zone 1A;
- Continued re-profiling and installation of a capping system in Zone 1;
- Continued progressive installation of new or supplementary gas wells in Zone 1; and
- Removal of the processed material stockpile from Zone 2B.

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Phase 5

- Removal of the existing flare stack in Zone 1, commencing use of new flare stack in the new Landfill Infrastructure Compound;
- Continued re-profiling and installation of a capping system in Zone 1;
- Re-profiling and installation of a capping system in Zones 2A and 2B;
- Inspection and repair of concrete hardstandings in Zone 2B;
- Installation of gas venting measures in Zone 2B;
- Continued progressive installation of new or supplementary gas wells in Zone 1; and
- Removal of existing perimeter screening bund in Zone 1.

Phase 6

- Construction of surface water soakaway in Zone 1A;
- Continued progressive installation of new or supplementary gas wells in Zone 1;
- Continued re-profiling and installation of a capping system in Zone 1;
- Reduction in material stockpiled in Zone 2A;
- Re-profiling and installation of a capping system in Zones 2A and 2B;
- Inspection and repair of concrete hardstandings in Zone 2A; and

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- Installation of gas venting measures in Zone 2A.

Phase 7

- Cleaning of surface water management pond in Zone 1A and commissioning of soakaway;
- Continued progressive installation of new or supplementary gas wells in Zone 1;
- Removal of stockpiled materials from Zone 2A;
- Removal of concrete stockpiles from Zone 2B;
- Cleaning of surface water management ponds in Zone 4, installation of ecological enhancements and final commissioning of the ponds; and
- Remediation works complete.

Phase 8

- Installation of multi-use sports pitches;
- Construction of building with changing rooms, public toilets and stores;
- Creation of a children's playground; and
- Construction of car parking, informal trails and defined viewpoints.

Design Mitigation

The Remediation Phase works will be subject to conditions identified with in the planning approval and IEAL licence issued by the EPA. The durations of construction phasing will also be subject to conditions, to restrict works where impacts and nuisance may be prevalent including inclement weather giving rise to surface water runoff, and dust and odour generation through waste excavation works. Prior to commencing any such works the appointed contractor(s) will prepare an Erosion and Sediment Control Plan (ESCP), setting out the procedures to minimise impacts, which could include use of temporary lagoons, silt busters and/or silt fences, as necessary.

A series of management plans will be required under the IEAL process which will also input and affect the approach to the phasing works.

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4.3.2 Material Processing

Waste materials present at the site typically contain a high proportion of C&D wastes, including large blocks of concrete and demolition rubble. Re-profiling of the site will require the selected removal of oversize materials at the point of excavation. The oversize material will be crushed and screened to an acceptable grading to facilitate its re-use as bulk fill, or used to fill large voids. Crushing and screening and temporary stockpiling prior to re-use will be undertaken in the Zone 2B site won materials processing and stockpiling area.

4.3.3 Material Import and Export

The application of key material and waste management principles, such as the waste management hierarchy (Diagram 4.6), will reduce the effects on natural resources. In particular, this will be achieved by re-using existing soils at the site, with appropriate processing, assessment and testing.

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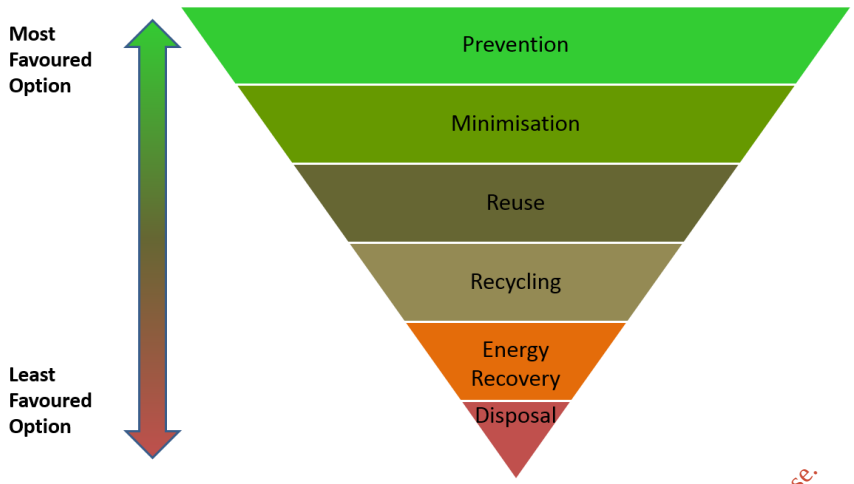


Diagram 4.6: Waste Management Hierarchy

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In considering material resources use and waste management, it is important to define when, under current legislation and understanding, a material is considered to be a waste. The Waste Framework Directive (European Directive 2006/12/EC, as amended by Directive 2008/98/EC) defines waste as any substance or object that the holder discards or is required to discharge. The Waste Framework Directive is implemented by European Communities (Waste Directive) Regulation (S.I. No. 126/2011). Once a material has become waste, it remains waste until it has been fully recovered and no longer poses a potential threat to the environment or to human health, at which point it is no longer subject to the controls and other measures required by the Directive. These principles are applied by the EPA to waste used as aggregate/construction material in civil engineering applications, which ceases to be waste once it is incorporated in the construction. It is these principles that apply to works at Kerdiffstown. No wastes other than inert wastes for use as engineering materials, such as aggregate, subsoil and top soil will be imported to the site. Further detail is provided in Section 4.5.

Proposals for material management will be set out in a CEMP, required as part of the EIAR and planning process. The CEMP will be prepared by the appointed contractor responsible for the remediation works. Material management is discussed further in Chapter 12 Soils, Geology, Contaminated Land and Groundwater, Chapter 15 Waste and Chapter 17 Material Assets.

Export volumes

Significant export of materials from the site is not expected to be required during the site remediation works. Waste materials would be inspected at the point of excavation and where deemed to be suspected as non-compliant, would be subject to the relevant waste acceptance criteria process in accordance with Article 16 and Annex II of the Landfill Directive. The Landfill Directive is implemented by Article 50 of Waste Management (Licensing) Regulations 2004 (S.I. No. 395/2004). Waste would be classified as being hazardous when it displays one or more of the hazardous properties listed in the Second Schedule of the Waste Management Act as amended (European Communities (Waste Directive) Regulations 2011 S.I. 126 of 2011). On completion of the classification, the correct European Waste Catalogue (EWC) code referenced from the List of Waste (LoW) would be assigned. LoWs are listed in the EPA document “Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous”, valid from 1 June 2015.

Materials that may require removal from site are therefore expected to be restricted to:

- materials with a re-sale value generated from the residual demolition works (e.g. reinforcing steel);

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- tyres currently used on site for an engineering purpose being the restraint of the temporary cap on the lined cell (Zone 3); and
- hazardous waste, if encountered during the site re-profiling works, which requires disposal to a suitably licensed off-site facility as determined through the above process.

Other materials may be generated, for instance from off-cuts of geosynthetic liner or fencing. The removal of such materials does not represent export of existing waste materials, but as generated through the remediation works. Appropriate records of waste transfer will be maintained and held in the site file.

Import volumes

The site will not be operated as a landfill site. No waste materials will be imported to the site as part of the remediation works, except where that material is defined as waste as outlined above.

With the exception of a limited stockpile of sub-soil material located adjacent to the existing site entrance, no other materials suitable for capping construction are available on site. Capping of the site will therefore require a substantial import of soil materials with an associated high number of vehicle movements, albeit this has been significantly reduced through determination of capping options.

The total volume of soil materials required to construct the capping has been calculated by applying the construction thicknesses to the required capping areas. The approximate material import volumes are summarised in the Table 4.11.

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Table 4.11: Approximate Volumes of Material to be Imported

Material		Approximate Import volumes (m^3)
Capping System	Top soil / Soil Forming Material	29,300
	Sub-soil	68,300
	Regulation layer (fine grained material, e.g. sand)	16,500
Engineered bunds (to support Surface Water Ponds 2 & 3)		13,300
Total volume		**127,400**

It is envisaged that further material import may be necessary to offer mitigation to landscape and visual impacts as well as in the construction of the end-use proposals. However, the volumes are unlikely to be significant above that indicated in Table 4.11 as required to facilitate the remediation works, where these figures are considered to be conservative with opportunities to reduce import volumes through re-processing of on-site materials.

4.3.4 Temporary Stockpiling

Prior to commencing any phase of remediation works a suitable volume of soils will be required on site. Completion of the remediation works will require the temporary stockpiling of site won and imported materials at various phases during the works. Proposals for stockpile management will be set out in a CEMP, required as part of the EIAR and planning process.

To prevent possible contamination of clean materials by site wastes separate stockpiling areas for imported materials and site won materials will be established. Stockpiling arrangements are summarised in the following table with stockpile locations shown indicatively on Figure 4.8 and Figure 4.9.

Stockpile locations are retained on existing concrete hardstanding areas as far as practicable, to offer a separation to and protection of the underlying materials.

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Table 4.12: Stockpiling Arrangements

Stockpile	Location	Identified Potential Uses
Existing sub-soil	Retained adjacent to existing site entrance.	Zones 1 and 4 capping
Imported 'clean' soils	Zone 2A Greenfield north of Zone 2A	Zone 3 toe bund Zone 4 ponds bunds Zones 1 to 4 capping (subject to testing and specification compliance)
Crushed / screened concrete (aggregate)	Zone 2B	Gas wells, access tracks, drainage aggregate. (subject to testing and specification compliance)
Site wastes (including fines from crushing of concrete)	Zone 2B	Infill to Zones 1 and 3 (where shown to be compliant with Industrial Emission Licence acceptance criteria)

Other areas will require to be designated on site, such as holding areas, quarantine areas and storage of unprocessed waste. Storage of processed waste is unlikely to be necessary as it would be transported to the infill area (typically Zones 1 and 3) immediately to reduce the need for double handling.

The general segregation of imported clean materials and site material stockpiles between Zones 2A and 2B respectively will also limit the risk of cross contamination of clean materials by avoiding the need for road going vehicles to directly traffic on or though areas containing exposed waste materials.

Surface water management proposals indicate that there will be no discharge from the site permitted during the remediation works. The ponds will be adopted as retention ponds during the remediation works, and the appointed contractor shall be required to utilise silt-buster traps as is typical on earthworks/ construction projects.

To further mitigate the risk of off-site contamination, all road going vehicles which access stockpile areas will be required to pass through a wheel washing facility prior to exiting the site. Further, site access roads including Kerdiffstown Road will be subject to regular road sweeping.

Sizing of stockpiles cannot be determined at this stage as it is dependent on the availability of suitable material for import, the programming of the works, subject to planning approval being granted, and the procurement approach adopted.

It is envisaged that stockpiling of materials will be undertaken in accordance with *'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites'* published by the UK Department for Environment Food and Rural Affairs or equivalent Irish guidelines.

As a minimum stockpile management will include:

- Visual screening for potential contaminated materials;
- Segregation of material suspected to be contaminated from clean materials;
- Stockpiling of materials at appropriate heights / batters to prevent potential instability;
- Protection of stockpiled materials from scour / erosion;
- The provision of adequate drainage to limit and control potential contaminated surface water runoff, including silt mitigation;
- The avoidance of un-necessary trafficking / handling of stockpiled materials; and
- Measures to prevent the spread of invasive plant species.

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The following additional measures shall be applied to topsoil stockpiles:

- A limitation on stockpile height to prevent degradation of the topsoil structure; and
- Adequate control of weed growth.

With the exception of top soil (or soil forming materials), stockpile heights will be restricted to a maximum of 4m to facilitate adequate management during the works.

A reduced stockpile height of 2m will apply to any top soil / soil forming materials to prevent possible degradation of soil structure.

4.3.5 Construction Quality Assurance (CQA)

To enable overall quality management, the remediation works will be governed by a comprehensive CQA Plan, prepared for submission to and review by the EPA. CQA is defined as a planned system of activities that provide assurance that the facility was constructed in accordance with the contract and technical specifications. The CQA Plan will set out:

- Construction Quality Control (CQC) procedures to ensure materials and workmanship meet design specifications;
- Procedures for implementing quality control;
- Technical specification and the conditions of contract drawn up by the designer; and
- Set out roles and responsibilities for the remediation works. The CEMP may also inform and be informed by the CQA Plan.

On completion of the remediation works a CQA Report will be prepared, to demonstrate that the capping system(s) and associated components comply with the specification as set out in the CQA Plan.

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4.3.6 Park Construction

The final stage of works for the proposed Project will be the construction of a public park including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints as shown on the indicative Landscape Masterplan (Figure 4.20). Refer to Section 4.7 for more detail.

4.3.7 Significant Effects

Assessments of significant effects are discussed in Chapters 7 to 17 of this EIAR.

4.3.8 Environmental Protection Measures

The remediation works proposals have been developed to include environmental protection measures to manage issues including odour, leachate, landfill gas, noise and dust. A series of management plans have been developed and will be supported as necessary by a CEMP. The CEMP will be prepared by the appointed contractor responsible for the remediation works for agreement with KCC, embracing all mitigation detailed in this EIAR, conditions set out in the planning approval and the requirements of the site's IEAL.

4.4 Commissioning

As part of the proposed Project there are a number of activities which will require to be commissioned prior to the Operational Phase. These are summarised below:

- The sewage pipeline from the leachate collection system and sewage pipeline from the changing rooms and site office will be connected to the sewerage system, subject to Irish Water approval;
- Once the gas flares are installed within the Landfill Infrastructure Compound, they will be connected to the gas pipework and once commissioned will emit in a controlled manner to atmosphere;

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- Surface water ponds will be connected to the Morell River, following cleaning to remove sedimentation build up. The connection will be subject to EPA approval; and
- Northern surface water pond will be connected to soakaway, subject to EPA approval.

Commissioning of the leachate management system, specifically the leachate treatment plant and transfer pipeline to Johnstown Pumping Station, will be undertaken immediately following construction in the early phase of the remediation works, in agreement with the EPA and Irish Water.

Records of all commissioning work will be held on site file.

4.5 Raw Material Requirement and Sourcing

The remediation strategy is based on the optimisation of the capping guidance and end-use in order to minimise the requirement for import of materials from off-site sources. However, it is recognised that there will be a need to import materials to meet the requirements for provision of a suitably engineered site and to meet the proposed end-use condition.

The proposed Project will not operate as a landfill and will not accept waste for disposal but will require importation of inert wastes for use as engineering materials, such as aggregate, subsoil and top soil. In such instances, waste acceptance procedures shall be followed. The procedures will be supported by a summary note of Waste Acceptance Procedures (for issue to Contractors when seeking appropriate materials) and an extract from Part VIII of the Waste Management (Licensing) Regulations 2004, to confirm the wastes that are prohibited from the proposed Project. For all soils proposed for the remediation of the site a source specific determination of their suitability shall be required. Source materials which have the potential to be contaminated shall be tested to determine the suitability of the soils for use in the remediation works. The testing protocols and the frequency of testing shall be determined from an assessment of the source site. This methodology shall be carried out for both greenfield and brownfield sites. Once the source information is available then a site specific risk assessment shall be undertaken to identify the actual risks posed by the contaminants in their proposed use at the site and the suitability of the soils for remediation purposes confirmed. This suitability assessment will include Waste Acceptance Procedures comprising:

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- Basic characterisation;
- Compliance testing; and
- On-site verification.

There is also an opportunity to process and re-use materials on site, subject to appropriate testing and specification compliance.

The primary requirement for raw materials will be in the provision of capping material. During site re-profiling, excavated material will be physically sorted to separate out suitable capping material. Where required, additional capping material will be specified and sourced from the local area where possible.

Table 4.11 sets out the assumptions with respect to materials volumes for importation. An Earthworks Summary Technical Note has been prepared to support the calculations of materials balance, importation and phasing (refer to Appendix A4.7).

4.6 Waste Recovery and Disposal

It is anticipated that only limited new sources of waste material will be introduced to the site during the remediation works. Where wastes are generated from, for example, the demolition of existing site infrastructure the majority of the material produced will be re-used as part of the site re-profiling and landscaping works. Any material that cannot be reused on site will be appropriately segregated and stored prior to collection for off-site recycling, recovery or disposal as appropriate at a suitably licensed facility.

During the Remediation and Operational Phases landfill gas and leachate will continue to be produced from the degradation of landfill wastes. The remediation works will enable the collection and appropriate disposal of these

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materials. As the landfill wastes are assumed to be in a partially degraded state, the collection of landfill gas for the purposes of energy recovery is not considered feasible given the low quantities produced, however this will be reassessed once capping has been completed and further pumping trials have been conducted. The remediation proposals will also limit the production of leachate requiring treatment and disposal. Collected leachate will be pre-treated on site, prior to being pumped to Osberstown Wastewater Treatment Plant for further treatment.

It is estimated that there may be the potential to recycle rebar, to be recovered from the walls of former buildings and structures at the site as part of the remediation works. The level of recovery will depend on a number of factors including market value at the time of the proposed works and the grade of the rebar. Materials arising from the demolition of the existing residential properties will also be recovered as far as reasonably practicable.

It is not anticipated that other existing waste materials at Kerdiffstown will require off-site recovery or disposal. However, in the event that the construction works uncover a waste type which is non-compliant with a non-hazardous waste licence thus requiring off-site disposal, then measures to remove and dispose/recover such materials will be undertaken in accordance with the CEMP.

It is anticipated that soils that have been used for covering wastes may be reprocessed on site for the purposes of providing an engineering use, such as regulation layer (below cap) or as a subsoil (above cap) where appropriate testing and classification has been undertaken. The reuse of such materials will reduce the quantities of materials required to be imported and therefore the traffic impact on the surrounding community. The Traffic and Transport Assessment (refer to Chapter 14 Traffic and Transport) has assumed a 'worst case' scenario, which assesses the importation of all materials by road and no reuse of other site won materials in the remediation works.

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4.7 End-Use, Aftercare and Maintenance

4.7.1 Industrial Emissions Activities Licence Compliance

Although the end-use proposal for the site is a multi-use public park the site will still be 'operated' under an IEAL granted by the EPA. However, unlike other landfill facilities in which waste licences set conditions for the operation of an active landfill for the acceptance and disposal of waste, it is anticipated that the IEAL for the site will set conditions and emission limits for the ongoing aftercare of the end-use at the site. KCC, as the licence holder, will be required to adhere to these specific conditions to minimise potential environmental impacts from the site, and provide data and reports to the EPA to confirm compliance. As a result, there will be an ongoing requirement for access to gas, leachate and groundwater monitoring wells on and off site and for the recovery of surface water samples from the within and outwith the site. The IEAL will also set out conditions in which the site may be determined as no longer requiring monitoring and aftercare, with the licence holder seeking EPA agreement with justification to satisfy that condition(s).

4.7.2 End-Use

Proposals

The end-use of the site, representing the Operational Phase of the proposed Project, will be a multi-use public park including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints as shown on the indicative Landscape Masterplan (Figure 4.20). The proposals provide landscape improvements and present an opportunity for further ecological enhancements.

An overview of the main components of the park is outlined below:

- Vehicular and pedestrian/cycle main entrance, with double gates;
- Semi-ornamental planting to roundabout;
- North-west pedestrian entrance, with security gate;
- Vehicular 6m wide, tarmac access road within the park, with a minimum 2m wide footway;

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- Public walkways and informal tracks within the site of varying widths (typically 1.2m-1.8m), constructed of unbound stone. These paths would vary in gradient, with some steps required in steeper sections, requiring confirmation on review of the final achieved site profiles;
- Maintenance tracks, 4m in width, constructed of unbound, imported stone, or combined with reinforced grass to reduce visual impact (north flank; Zone 1).
- One main car park for approximately 100 spaces, with opportunity for additional mobility impaired and coach/mini-bus parking. This would be constructed in tarmac, with the bays formed in Grasscrete or similar approved.
- One overspill car park for approximately 100 spaces, with close access to informal footpaths/cycle paths. This would be constructed in unbound stone, with the bays formed in Grasscrete or similar approved.
- Changing rooms (4 No.) and public toilet facilities;
- Store room for materials required in use of sports pitches;
- Playground area adjacent to the main changing room building;
- Bicycle parking provision;
- Three synthetic (or similar approved surface) pitches, two sized 90m by 145m suitable for multiple codes including GAA, rugby and soccer, which can be sub-divided, each lit by 6 No. x 18m high, hinged masts; the third pitch offering flexibility as a training pitch or as 3 No. five-a-side pitches, lit by 6 No. x 8m high, hinged masts;
- Ball-retention fencing (12m high x 30m wide) installed to one end of each pitch, to prevent balls going onto Kerdiffstown Road or into the attenuation ponds;
- Enhancement of the three attenuation ponds, with use of marginal aquatic species planting and grouped trees;
- Surface water ditches and swales, enhanced by filling with stone or seeded with wet grassland species;
- Surface water reed bed area, filled with gravel and soil substrate and planted with native reed and marginal aquatic species;
- Native mix woodland, trees, scrub, shrub and hedgerow planting;
- Native or naturalised parkland trees;
- Semi-ornamental amenity tree and shrub planting to the main entrance and roundabout;
- Two designated wildlife areas, fenced off from public access;
- Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles;
- Defined viewpoint areas with a trigonometric plinth at the top of the site; and
- Outlet to the Morell River, with a stone clad headwall to integrate visually into the bank.

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Further details of end-use proposals are included in the Landscape Masterplan Statement (refer to Appendix A4.8).

At the detailed design stage, the provision of trails would also be considered, which would mark out set trail lengths within the park of 1,000m and 2,000m with colour coded waymarkers. Future provision of outdoor fitness equipment could be implemented along these trails, along with occasional seating, cycle racks and bin provision.

Drainage of foul and grey waters from the changing rooms building will be directed to the sewer installed during the Remediation Phase. Further detail is provided in the Surface Water Management Plan (refer to Appendix A4.6).

Details of the changing room building and the sewage drainage arrangements from the building are shown on Figures 4.21 and 4.22. There will also be infrastructure required for the continued control of emissions from the landfill, namely the gas flare and a leachate management system discussed earlier.

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Management of the Public Park

The park will be open to the public for use as an amenity area. The proposed hours of use of the multi-use public park are set out in Table 4.13 below.

Table 4.13: Proposed Public Park Opening Hours

Period	Sports Pitches	Park
Monday to Friday	08:00 – 21:00	09:00 – 20:00
Saturdays / Public Holidays	08:00 – 21:00	09:00 – 20:00
Sunday	09:00 – 18:00	10:00 – 17:00

Note: Park Opening will be subject to hours of daylight and dictated by park operations with the times specified above the latest closing time permitted to be used.

KCC will retain ownership of the park and will have overall responsibility for managing and maintaining the site. A KCC Site Manager will be based on site to maintain and oversee the monitoring and control mechanisms for the landfill infrastructure at the site, including gas wells and leachate. It is anticipated that park rangers and / or maintenance teams will also attend site when necessary.

Wastes generated during the operation of the park and the operation of the landfill infrastructure are likely to be litter (to be collected and removed from the site), some municipal and paper waste from the site office and foul waters from the changing room building and site office (to be disposed of to sewer).

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Health & Safety of Visitors

The end-use for the site has considered the health and safety of visitors by incorporating the following elements into the outline design:

- Presence of council staff including the KCC Site Manager on site during normal working hours and park opening hours as outlined above.
- The public park facility, comprising paths across Zone 1, Zone 3 and around the ponds in Zone 4 will be open during daylight hours only. At all other times, these sections of the site will be closed off by locking gates.
- Areas around key plant and equipment, such as the Landfill Infrastructure Compound, will be designated as out of bounds, with no access to the public.
- A footpath and cycleway will be provided to allow pedestrians and cyclists to safely gain access to the site from the footbridge over the N7 from Johnstown, linking also to existing footpaths leading to Junction 8 over the N7 and to an underpass at Goff's, leading to Kill.
- Suitable signage will be placed around the site, warning visitors of the potential for deep water and the presence of key landfill infrastructure. A number of life buoys will be provided around the perimeter of the ponds, and the ponds will be fenced off to prevent access and to promote biodiversity in these areas.
- All monitoring wells at the site will be fitted with lockable covers.

During detailed design of the remediation and end-use, risks from landfill gas will be considered through the implementation of the requirements of Part 8 of the Safety Health and Welfare (General Application) Regulations 2007 (Statutory Instrument No. 299 of 2007) as amended. These Regulations require that where an explosive atmosphere is, or is likely to be, present at or may, from time to time, arise in a workplace the employer is required to make a suitable and appropriate assessment of the risk arising from such explosive atmosphere to the employees concerned having regard to all the circumstances. In this case users of the 'workplace' would be extended to public users of the parkland and recreational facilities. It cannot be ruled out that public users will not use ignition sources, therefore the site and infrastructure would need to be appropriately assessed, zoned and access restrictions put in place. The Regulations require the employer to prepare an explosion protection document to confirm the risk assessment undertaken and set out the applicable zoning of the site. This document

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will be informed by the remediation works, most notably the findings of the landfill gas pumping trials and as-built details of the gas management system, for adoption in the management of the public park. Further information is provided in Section 12.3.20.

Health and Safety considerations and procedures will be regularly reviewed and developed, most notably during the detailed design phase and on completion of the remediation works.

Resource Requirements

Electricity will be required to power lighting in the Landfill Infrastructure Compound, car parking areas, multi-use sports pitches and changing room building. Water will be required for the changing room building and Landfill Infrastructure Compound.

Renewable technologies for lighting and re-use of grey waters will be explored at the detailed design stage, if feasible. Opportunities for energy efficiency will also be explored during detailed design, including the requirements for new buildings to be Nearly Zero Energy Buildings (NZEB). Existing utilities, such as electricity, water and telecommunications are discussed in detail in Chapter 17 Material Assets.

4.7.3 Post Remediation Settlement

Due to the nature of material deposited during the landfilling activities at the site, degradation of the waste over time will result in settlement – a process by which the volume of material decreases. As part of the remediation design a "post-settlement profile" of the planned final profile of the landfill after all settlement has taken place has been estimated for the Project using numerical predictive waste settlement modelling. This is shown on Figure 4.5.

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Consideration of this potential settlement has been taken into account to ensure that the remediation profiles remain acceptable over the long term. This includes:

- The maintenance of acceptable surface gradients and avoidance of low spots to prevent possible surface water ponding; and
- Excessive deformation of the capping which could result in a loss of capping integrity.

To confirm acceptable post-settlement profiles will be maintained, a preliminary settlement assessment was undertaken for the site. Post remediation settlement predictions were made by the application of Jacobs' numerical predictive waste settlement model[1] which is related to the anticipated composition and age of the waste materials present at the site. Post remediation settlement due to waste degradation in Zones 1 and 3 is predicted to be in the order of 14% with settlement expected to be substantially complete by 2150 (refer to Appendix A4.2). Through an iterative process, the proposed remediation profiles were adjusted until no post-settlement low spots occurred and a minimum gradient of 1v:30h was achieved for all areas of capping, providing suitable profiles for surface water management and complying with relevant EPA guidance. This excluded the retained hardstanding areas which are assumed to be drained separately as part of end-use proposals.

Emplacement of wastes from other areas on the site will be specified in any future contractual agreement to meet performance specifications and density targets, or by method specification as agreed through trials. Should substantial loading of the capping system be required, supplementary settlement calculations will be required to confirm resulting deformation of the capping system remains within acceptable tolerances.

Following the remediation works regular inspections of the site will be required to check for signs of settlement, such that maintenance can be undertaken without delay.

[1] In 2002 Enviros, a predecessor company of Jacobs, developed a reliable in-house, numerical method to accurately predict post-capping waste settlement, based on the modelling of waste degradation processes which act on the actual waste types and tonnages deposited over time at a subject landfill. This settlement prediction method utilises the mathematical representations of waste processes developed by Dr Alan Young in association with Enviros – Young (1992). The numerical, predictive waste settlement model considers waste processes and determines postcapping settlement with time, based on the mathematical prediction of mass loss due to waste degradation over time, from the commencement of the placement of waste. Post-capping waste settlement is directly related to mass loss due to waste degradation. The model is described in detail in Thomas and Cooke (2007), which includes illustrative data taken from previous practical applications of the model.

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4.7.4 Aftercare

Aftercare arrangements include the collection, monitoring and flaring (as required) of landfill gas, the collection, monitoring and disposal of leachate and ongoing monitoring of groundwater and surface water. The Landfill Infrastructure Compound will also be maintained during the aftercare period.

The period of aftercare is likely to be detailed in the site's IEAL, together with criteria to be assessed in order to affect cessation of the aftercare period.

4.7.5 Maintenance

The following maintenance activities will be required to continue on a regular basis during aftercare, albeit mostly for short periods and for most activities on an infrequent basis:

- inspections and servicing of pumps, treatment plant, flare unit, collection pipes, etc.;
- measurement of leachate and gas concentrations in on-site and perimeter boreholes to check for off-site migration (more infrastructure will be required within the scope of remedial works);
- observation and assessment of settlement, slope stability and any ground movements;
- surveys of odour and other nuisances, e.g. noise;
- safety and security inspections;
- inspections of drainage and investigation and rectification of any ponding, flooding or pollution; and
- investigation and rectification of any operational damage from the selected end-use.

A series of management plans will be prepared to account for the continued operations at the site including maintenance requirements, to be regulated by the EPA under the sites' IEAL.

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4.8 Vulnerability of the Project to Risks of Major Accidents and/or Disasters

Article 2 of Directive 2014/52/EU provides that Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with the Directive by 16 May 2017. Therefore, in line with this Directive Table 4.14 considers the expected effects deriving from vulnerability of the project to risks of major accidents and/or disasters, where relevant to the project.

The below key outlines the approach to assessing the risk.

Key

Likelihood x Severity =	Risk

Likelihood	Severity: Negligible	Severity: Moderate	Severity: Severe
Likely	Medium	High	High
Unlikely	Low	Medium	High
Highly Unlikely	Low	Low	Medium

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Table 4.14: Consideration of Vulnerability to Major Accidents or Disasters

Scenario	Hazard	Degree of Risk (uncontrolled)			Control Measures	Residual Risk			Reference in the EIAR
		Likelihood	Severity	Risk		Likelihood	Severity	Risk	
Flooding	• Increased risk of siltation within runoff • Risk of damage to site management infrastructure and amenity infrastructure. • Inaccessibility of areas of the park. • Health and safety risks				The landform design of the proposed Project has been designed to avoid the potential for surface ponding, waterlogging and flooding. At all stages the aim of the surface water management infrastructure for the proposed Project is to not increase the future flood risk to land or properties outside the site boundary. Surface water management measures for the Remediation and Operational Phases have been designed to mitigate the risk of environmental pollution and flooding from the site. The proposed drainage system for the site will include a network of open ditches, channels, swales and wetlands to intercept and control surface water runoff generated within the licensed extents of the site and direct it towards storage ponds. A Flood Risk Assessment (FRA) has been carried out. This indicates that the site is located just outside the fluvial flood risk zone. The FRA has initially concluded that all across the study area, comparison of the existing and the proposed Project demonstrates that the proposed works do not increase the flood risk.				Surface Water Drainage System – Section 4.2.9 Flood Risk Assessment – Appendix A13.1 Chapter 12 Soils, Geology, Contaminated Land and Groundwater Chapter 13 Water Quality – Hydrology
Fire	• Damage to site infrastructure and buildings. • Smoke impact on air quality and health of local residents. • Release of pollutants to air including particulate matter. • Odours associated with the fire. • Risk of contamination to groundwater and surface waters due to firefighting activities. • Health and safety risks. • Waste generated from firefighting activities and clean-up operations.				Capping of wastes and installation of landfill gas management system to control and burn off gases generated by the waste, preventing gas build-up.				Chapter 4 Description of the Proposed Project Section 4.2.8 Leachate and Landfill Gas Management Systems Appendix A4.5 – Landfill Gas Management Plan
Slope failure	• Risk to any underground infrastructure (piping, gas wells, groundwater wells, etc.). • Exposure of waste. • Damage to trees and other habitats. • Safety risk to people on or below slopes. • Impact to watercourses and groundwater.				The proposed Project includes re-profiling the site to address current over-steep slopes to permit installation of an engineered capping and/or soil cover system, to allow for surface water drainage, and provide mitigation of long-term settlement of the waste mass. Observation and assessment of settlement, slope stability and any ground movements have been identified as key maintenance activities required to continue on a regular basis during the Operational Phase.				Chapter 4 Description of the Proposed Project Slope stability assessment Requirement for the appointed contractor to provide a CEMP:
Explosion of gases, migration of gas off-site, lateral flow of gas once capping is in place	• Damage to landfill gas management infrastructure. • Damage to leachate management infrastructure. • Damage to sewer lines. • Risk of causing a fire. • Health and safety risks.				Installation of landfill gas management system to control and burn off gases in a controlled manner. Installation of methane stripping plant to remove methane from leachate prior to discharge into the sewer. An Accident Prevention and Emergency Response Plan has been developed which includes measures to minimise the risk of fires. The Plan is a live document and will be reviewed on a regular basis and upgraded accordingly.				Chapter 4 Description of the Proposed Project Section 4.2.8 Leachate and Landfill Gas Management Systems Appendix A4.5 – Landfill Gas Management Plan Chapter 12 Soils, Geology, Contaminated Land and Groundwater
Uneven settlement	• Localised dips in the surface • Possible damage to infrastructure such as the landfill gas management system, the leachate management system and surface water management system, the multi-use sports pitches, underground pipelines, pathways, etc.				Due to the nature of the site and risks to the environment should any such facilities fail, the new Landfill Infrastructure Compound is proposed to be positioned off-waste such that ground conditions are not liable to settlement due to waste degradation or loading. Observation and assessment of settlement, slope stability and any ground movements have been identified as key maintenance activities required to continue on a regular basis during the Operational Phase. To confirm acceptable post-settlement profiles will be maintained, a preliminary settlement assessment was undertaken for the site.				Chapter 4 Description of the Proposed Project Section 4.7.3 Post Remediation Settlement Section 4.7.5 Maintenance
Failure of Leachate Management System-Leachate release	• Contamination of surface water drainage system • Odours • Contamination of groundwater				Security measures for the leachate management system are proposed in the Leachate Management Plan, to include provision for an underground storage tank which will be used in the event of spillage from the valves connecting to road tankers or the tankers. The operation of this system will be controlled and alarms set using a supervisory control and data acquisition (SCADA) system or similar, with proposals developed during detailed design. A Leachate Management Plan has been prepared, which provides further detail on the leachate management system. Leachate management system and management plan in place, regular maintenance of tanks to be carried out, emergency response plan in place.				Chapter 4 Description of the Proposed Project Section 4.2.8 Leachate and Landfill Gas Management Systems Appendix A4.4 – Leachate Management Plan

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Scenario	Hazard	Degree of Risk (uncontrolled)			Control Measures	Residual Risk			Reference in the EIAR
		Likelihood	Severity	Risk		Likelihood	Severity	Risk	
Spillage	• Variable depending on substance spilled, the scale of the spill and the location of the spill. • Contamination of surface water drainage system • Odours • Contamination of groundwater				An Accident Prevention and Emergency Response Plan has been developed which includes measures to minimise the risk of spillages. The Plan is a live document and will be reviewed on a regular basis and updated accordingly. The proposed Project includes for water quality monitoring to be undertaken as indicated in the Industrial Emissions Activities Licence (IEAL) as agreed by the EPA supported by a Monitoring and Control Management Plan. In the event of an exceedance of the agreed emission level values, the discharge from the pond will be automatically shut off.				Appendix A4.4 Leachate Management Plan Chapter 13 Water Quality – Hydrology
Failure of gas management system	• Odours due to lack of flaring of gases				A back up flare will be available during both the Remediation and Operational Phases in the event of the main flare going offline. Regular maintenance to be carried out on the system. Measurements of gas concentrations in on-site and perimeter boreholes has been identified as a key maintenance activity required to continue on a regular basis during the Operational Phase. An Accident Prevention and Emergency Response Plan has been developed which includes measures to minimise the risk of migration of landfill gas and explosions. The Plan is a live document and will be reviewed on a regular basis and updated accordingly.				Chapter 4 Description of the Proposed Project
Penstock failure	• Loss of control on surface water release in the event of contamination to the site drainage				An Accident Prevention and Emergency Response Plan has been developed which includes measures to minimise the risk of spillages and leakages. The Plan is a live document and will be reviewed on a regular basis and updated accordingly. Regular maintenance to be carried out on the penstock. Surface water ponds act to attenuate surface waters being discharged to the Morell River surface water outfall.				Chapter4 Description of the Proposed Project Appendix A4.6 Surface Water Management Plan
Extreme weather (high winds and/or rainfall)	• Increase in pressure on the surface water drainage network. • Damage to buildings and infrastructure from high winds. • Impact on gas flaring. • Damage to trees and fencing • Health and safety risk from windblown debris. • Scour of capping system.				Surface water system design takes cognisance of climate change. Construction works to be undertaken by competent contractor. Specification for the works to embrace all relevant building regulations, standards and approvals. A Maintenance Management Plan will be required as part of the IEAL. Site will be regulated under conditions of IEAL by EPA.				Appendix A4.6 Surface Water Management Plan Surface Water drawings
Contamination being found in imported fill material	• Contamination of surface waters and groundwater • Cross contamination of materials				The proposed Project includes measures for the management of imported material, including strict environmental and geotechnical specifications and acceptance criteria. It is envisaged that stockpiling of materials will be undertaken in accordance with 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites' published by the UK Department for Environment Food and Rural Affairs or equivalent Irish guidelines. As a minimum stockpile management of imported material will include: • Visual screening for potential contaminated materials; • Segregation of material suspected to be contaminated from clean materials; • Stockpiling of materials at appropriate heights / batters to prevent potential instability; • Protection of stockpiled materials from scour / erosion; • The provision of adequate drainage to limit and control potential contaminated surface water runoff, including silt mitigation; • The avoidance of un-necessary trafficking / handling of stockpiled materials; • Measures to prevent the spread of invasive plant species; • The following additional measures shall be applied to topsoil stockpiles: • A limitation on stockpile height to prevent degradation of the topsoil structure; and • Adequate control of weed growth.				Chapter 4 Description of the Proposed Project Section 4.3 Proposed Works and Methods Requirement for the appointed contractor to provide a CEMP:

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Scenario	Hazard	Degree of Risk (uncontrolled)			Control Measures	Residual Risk			Reference in the EIAR
		Likelihood	Severity	Risk		Likelihood	Severity	Risk	
Non-compliant material being found in imported fill material	• Contamination of surface waters and groundwater • Cross contamination of materials	🟠	🟠	🟠	The proposed Project includes measures for the management of imported material, including strict environmental and geotechnical specifications and acceptance criteria. It is envisaged that stockpiling of materials will be undertaken in accordance with 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites' published by the UK Department for Environment Food and Rural Affairs or equivalent Irish guidelines. As a minimum stockpile management of imported material will include: • Visual screening for potential contaminated materials; • Segregation of material suspected to be contaminated from clean materials; • Stockpiling of materials at appropriate heights / batters to prevent potential instability; • Protection of stockpiled materials from scour / erosion; • The provision of adequate drainage to limit and control potential contaminated surface water runoff, including silt mitigation; • The avoidance of un-necessary trafficking / handling of stockpiled materials; • Measures to prevent the spread of invasive plant species; • The following additional measures shall be applied to topsoil stockpiles: • A limitation on stockpile height to prevent degradation of the topsoil structure; and • Adequate control of weed growth.	🟠	🟢	🟢	Chapter 4 Description of the Proposed Project Requirement for the appointed contractor to provide a CEMP:
Discovery of non-compliant materials within the existing waste mass during earthworks	• Release of contaminants to air, water, ground. • Human health	🟠	🟠	🟠	It is not anticipated that other existing waste materials at Kerdiffstown will require off-site recovery or disposal. However, in the event that the construction works uncover a waste type which is non-compliant with a non-hazardous waste licence thus requiring off-site disposal, then measures to remove and dispose/recover such materials will be undertaken in accordance with the Construction Environmental Management Plan.	🟠	🟢	🟢	Requirement for the appointed contractor to provide a CEMP:
Earthquake	• Risk to any underground infrastructure (piping, gas wells, groundwater wells, etc.). • Risk to any over ground infrastructure (Landfill Infrastructure Compound buildings, changing rooms, lighting, etc.) • Exposure of waste. • Damage to trees and other habitats. • Health and safety risks.	🟢	🔴	🟠	In the event of an earthquake impacting the proposed Project, the project would require an assessment of damage cause by the earthquake, the implementation of interim control measures where appropriate and development of a strategy to address any damage. Observation and assessment of settlement, slope stability and any ground movements have been identified as key maintenance activities required to continue on a regular basis during the Operational Phase.	🟢	🔴	🟠	
Power failure	• Failure of power supply to the landfill infrastructure • Failure of power supply to the park infrastructure, floodlighting, changing rooms, etc. • Health and safety risks.	🟠	🟠	🟠	The appointed contractor(s) responsible for the remediation works will be responsible for ensuring a suitable power supply and possible back-up generators to continue the remediation works. In the event of a power failure during the Operational Phase, KCC will be responsible for reviewing the opening hours to ensure the public's safety. KCC will also review the situation to determine if a back-up power generator is required to continue the operation of the landfill infrastructure. Detailed design of leachate, surface water and landfill gas management systems will be subject to a Hazard and Operability Study (HAZOP) to determine appropriate security provisions for these systems in order to prevent accidents.	🟠	🟢	🟠	Leachate Management Plan
Irish Water unable to accept leachate at Johnstown Pumping Station for a prolonged period of time	• The proposed leachate management system would be unable to pump leachate to Johnstown Pumping Station	🟢	🟢	🟢	The utilisation of various storage capacities within the site allow for a period for tankers to be mobilised to site to remove leachate directly from the leachate system. This use of capacities is necessary as a fail-safe as the prevention of discharge to sewer network via sewer may also apply for direct disposal to a treatment plant, which requires the assignation and agreement of Irish Water. Allowing for the tankering of leachate for removal to a suitably licenced treatment facility.	🟢	🟢	🟢	Chapter 4 Description of the Proposed Project Section 4.2.8 Leachate and Landfill Gas Management Systems Appendix A4.4 – Leachate Management Plan

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4.9 Guidance

Below is a non-exhaustive list of guidance used in the determination of design for the purposes of this Chapter of the EIAR.

- Abacus. 2017. Gaelic Sports Lighting. [ONLINE] Available at: http://www.abacuslighting.com/gaelic-sports-lighting.asp. [Accessed 14 June 2017].
- CIRIA (2007). The SuDS Manual (C753).
- CIRIA (2010). Environmental Good Practice on site (third edition).
- Cumann Luthchleas Gael (2005). Club Manual. Chapter Eight – Providing Facilities.
- Department of Transport, Tourism and Sport (2013). Design Manual for Urban Roads and Streets.
- Directive 94/9/EC of the European Parliament and the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.
- Directive 1999/92/EC of the European Parliament and of the Council of 16 December 1999 on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres (15th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC)
- Environmental Protection Agency (1995). Landfill Manuals. Investigations for Landfills.
- Environmental Protection Agency (1997). Landfill Manuals. Landfill Operational Practices.
- Environmental Protection Agency (1999). Landfill Manuals. Landfill Restoration and Aftercare.
- Environmental Protection Agency (2000). Landfill Manuals. Landfill Site Design.
- Environmental Protection Agency (2003). Landfill Manuals. Landfill Monitoring (2nd Edition).
- Environmental Protection Agency (2011). Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities.
- HR Wallingford. 2017. Online Tools for Sustainable Drainage Systems (SuDS). [ONLINE] Available at: http://www.uksuds.com/. [Accessed 14 June 2017].
- Irish Water (2016). Code of Practice for Wastewater Infrastructure. A design and construction guide for developers.
- National Transport Authority (2011). National Cycle Manual.
- National Standards Authority of Ireland (2000) IS EN 12056-2 Gravity drainage systems inside buildings.
- National Standards Authority of Ireland (2008) IS EN 752:2008 Drain and sewer systems outside buildings.
- S.I. 10 of 2005. Safety, Health and Welfare at Work Act (2005)
- S.I. 291 of 2013. Safety, Health and Welfare at Work (Construction) Regulations (2013).
- Scottish Water (2015). Sewers for Scotland (3rd Edition).
- Transport Infrastructure Ireland (2011). Design Manual for Roads and Bridges.
- UK Department for Environment Food and Rural Affairs (DEFRA) (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.
- UK Environment Agency (2014). Technical Guidance Note (Monitoring) M18. Monitoring of discharges to water and sewer.
- UK Water Industry Research Limited (2011). Civil Engineering Specification for the Water Industry (7th edition).
- WRc (2013). Sewers for Adoption. A Design and Construction Guide for Developers. 7th Edition.

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5. Consideration of Alternatives

5.1 Introduction

This Chapter of the EIAR describes the reasonable alternatives which were considered for remediation and end-use of Kerdiffstown Landfill site. This Chapter also provides an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects. In developing design options a key aspiration was to embrace a balance between the avoidance of adverse environmental effects and achievement of the project objectives. As outlined in Chapter 1 Introduction, the objectives of the proposed Project are:

- Remove risks to public health and safety;
- Reduce environmental risk profile to an acceptable level;
- Deliver a remediation solution that is accepted by the community;
- Complete remediation works within 8 years; and
- Embed sustainability in both remediation and post closure stages.

Kerdiffstown Landfill comprises a former quarry, landfill and waste processing facility, occupying an area of approximately 30 hectares. The site has been progressively backfilled with wastes since around 1950 until 2010, with an estimated waste volume of around 3.1Mm^3. Further details of the site history are outlined in Chapter 3 The Need for the Proposed Project. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment whilst developing the site to provide an amenity to the local community, comprising a public park with multi-use sports pitches, changing rooms, car parking and a children's playground.

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From the "*Revised Guidelines on the Information to be contained in Environmental Impact Statements (Draft)*" Environmental Protection Agency (2015) it is recognised that there are aspects for which alternatives may not be applicable to a particular project. When considering the nature of this proposed Project there are a number of alternatives that are therefore not relevant. Therefore, no consideration has been given to options that would potentially leave the site in breach of relevant environmental legislation. Typical alternatives considered for this proposed Project are outlined below referencing to the appropriate Section in this Chapter where these are discussed further.

- Alternative Locations refer to Section 5.2;
- Alternative Layouts refer to Section 5.3;
- Alternative Designs refer to Section 5.4; and
- Alternative Processes refer to Section 5.5.

5.2 Alternative Locations

5.2.1 Remediation

A remediation options assessment carried out for the site (Kerdiffstown Landfill Remediation Project Remedial Options Report, SKM Enviros 2013) examined the potential technical options for addressing the risks posed by the site and used a qualitative scoring mechanism to assess each viable option against a number of performance criteria.

The option to excavate and remove all of the wastes for off-site disposal was dismissed early in the options assessment process. If considering groundwater protection only the option of "dig and dump" would be appealing; however, the environmental consequences of excavating 3.1Mm^3 of waste would be significant, involving the uncontrolled release of landfill gas resulting in very significant odour impacts over a period of years, as well as thousands of tonnes of Greenhouse Gases (GHGs). The implications for traffic would also be enormous with over 300,000 traffic movements; at least 7,000,000 kilometres travelled (based on known, existing landfill location) and greater than 10,000 tonnes of GHGs released.

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It is also recognised that there is a significant pressure on landfill capacities for operational sites at a national level, with set annual limits regularly being reached within a period of less than 12 months. The additional disposal of waste from Kerdiffstown Landfill would therefore require planning and regulatory approvals to be in place at a national level. It is considered unlikely that a single and or local disposal site would be available for the entire volume requiring excavation from Kerdiffstown Landfill.

The 'void' that would then be created at the site, by the excavation of waste, would require importation of inert material to at least partially restore the site to an acceptable profile. This poses risks of sourcing suitable material (clean, local source) and traffic impacts to import the material to site.

As a result, complete removal of wastes to another location was not considered to be a sustainable option and was not considered further.

Assessment of remedial options is further discussed in Section 5.3.1, which includes reference to the transfer of waste from this site to another location.

5.2.2 End-Use

The key aspect of the proposed Project is the remediation of the former landfill site and to then offer an amenity use to the local community who have been negatively affected by works at the site for a number of years. In this regard, the exploration of an alternative location for the end-use proposals is not considered relevant for this proposed Project.

5.3 Alternative Layouts

5.3.1 Remediation

As outlined in Chapter 4 Description of the Proposed Project waste deposits have been observed to the extents of the site. Alternative layouts of the remediation design were considered as part of the remediation strategy review, discussed further in Section 5.4.1.

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5.3.2 End-Use

Technical Constraints

Options for the end-use for the proposed Project are limited due to the technical constraints posed by the long term management requirements associated with the legacy landfill site, many of which will be addressed through the installation of infrastructure at the site. These constraints are outlined in Table 5.1:

Table 5.1: Technical Constraints on End-Use Alternatives

Constraint	Description	Effect
Settlement of wastes	The volume of the waste mass will reduce as the biodegradable components in waste degrade and decompose over time.	This reduction in the volume of waste will result in the lowering of the waste profile. Access to waste areas will be required to facilitate inspection and maintenance.
Protection of the Surrounding Environment and Identified Receptors	The remediation design will include measures to provide protection to the surrounding environment, for example capping to reduce generation of leachate and limit gas and odour emissions.	A capping system will be required above wastes which limits the nature of the development which can be undertaken on such areas. Special design features may be necessary, with supporting risk assessments.

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Constraint	Description	Effect
Leachate Management	The site will continue to generate leachate from the waste mass for a significant period of time. Within the lined cell leachate will be collected for extraction, representing a long-term site management requirement.	Infrastructure is required at the site to enable monitoring, extraction and transfer of leachate from the site. Access will be required to facilitate inspection, monitoring and maintenance.
Surface Water Drainage	A network of ditches, swales or drains will be required to convey the rainwater collected over the site area to a suitable low point for settlement to remove suspended solids and for discharge to an off-site watercourse/ body.	The presence of drainage features should not constrain the end-use. Drainage for any areas on which traffic movements or parking occur, would be diverted through a silt trap and oil interceptor, before discharge. Access will be required to facilitate inspection, monitoring and maintenance.
Landfill Gas Management	The site will continue to generate landfill gas from the waste mass for a significant period of time. The need to manage landfill gas remains a long-term site management requirement.	Monitoring of gas wells, manifolds and boreholes will be required on a regular basis, as determined by the site's Industrial Emissions Activities Licence (IEAL). Flare operation and maintenance will be required over the remaining gassing lifespan of the site. Access will be required to facilitate inspection, monitoring and maintenance.
Landform	A number of walls remain from former buildings and structures which would require removal as they pose a risk to site users. Over-steep slopes require to be re-profiled to provide a stable landform. The profile of the remediated areas of the site requires to be such that surface water runoff is facilitated and ponding does not occur. Above wastes, where settlement is predicted, the pre-settlement landform has to be sufficient to accommodate the predicted settlement.	Re-profiling of slopes and removal of stockpiles present on site will generate a significant volume of material to be accommodated within the extents of the site, without the need for exporting from the site, thus restricting areas for development on the site. Access will be required to facilitate inspection, monitoring and maintenance.
Capping Integrity	The capping of predominant areas of waste with a fully engineered low permeability capping system is a fundamental element of the remediation solution. It will provide a barrier to prevent the infiltration of rainfall into the waste and the uncontrolled escape of gas from the waste mass.	The integrity of the capping system(s) must be maintained and cannot be impacted by any end-use or development overlying the capped surface.

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Constraint	Description	Effect
Monitoring and Maintenance	The operation of the end-use option will require the following activities on a regular basis: • Inspections and servicing of pumps, treatment plant, flare unit, collection pipes, etc.; • Monitoring of groundwater quality and gas concentrations in on-site and perimeter boreholes to check for offsite migration; • Observation and assessment of settlement, slope stability and any ground movements; • Surveys of odour and other nuisances, e.g. air quality; • Safety and security inspections; • Inspections of drainage and investigation and rectification of any ponding, flooding or pollution; and • Investigation and repair of any operational damage from the selected end-use.	Access to the various infrastructure (monitoring boreholes, wells, pipes, drains) and surface will be required for a significant period of time, until the period when cessation of activities can be agreed by the Environmental Protection Agency.

In the determination of end-use design options the above constraints were considered in order to select the option(s) with least environmental impact, balanced against technical imperative for the long-term management of the site.

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End-Use Options

There is precedent for closed landfills to be remediated to allow various end-uses that are compatible with the constraints imposed by the need to continue to 'manage' the performance of the landfill. These range from relatively passive uses for capped landfills, generally pasture, parkland or wildlife reserves, through to more active uses such as sports facilities and suitably engineered structures. Ultimately it is possible to conceive of a large range of end-uses for the Kerdiffstown site, but as a general rule the costs of implementation will increase with complexity.

A Remedial Options Report (Kerdiffstown Landfill Remediation Project Remedial Options Report, SKM Enviros 2013) presented an outline of three potential end-use options, namely:

1. Site completion in accordance with previous planning approval – domed cap (i.e. layering of waste and/or cover material above original ground contours) with final remediation level of 108mOD (Poolbeg), providing an agricultural end-use.
2. Medium to high density mixed-use redevelopment – utilising existing concrete slab areas for industrial/ commercial end-use, possible educational centres and activity parks. Employment and cultural projects could be included.
3. Passive amenity function, i.e. informal recreation – landscape entire site with retention of raised area in north-west area of site (Zone 1), retention of hardstand in central portion and provision of a landscaped area in south-east (Zone 4). Other sub-options were considered with respect to providing wider access to the site following completion of the remediation works.

The Remedial Options Report concluded that Option 3 was the preferred option for a number of reasons including improved landscape and visual impacts and provision of an amenity site for the local community.

In 2016 Jacobs undertook a further End Use Assessment on behalf of Kildare County Council (Kerdiffstown Landfill End Use Assessment, Jacobs 2016), taking cognisance of the following design objectives:

- Environmental Protection;
- Public Health Protection;
- Bringing the Land Back into Productive Use; and

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- Sustainability.

This report considered a range of constraints including technical, economic and local community opinion. This report detailed a number of potential end-uses for Kerdiffstown Landfill, all of which have precedence elsewhere in Ireland and the UK. A summary of alternative end-use options is presented in Table 5.2.

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Table 5.2: Alternative End-Use Options

Selected Option	Description		Main reason for selecting chosen option
Public open space, parkland Sports and recreation	Series of pathways, a car park, cafe and children's play area. Potential for dog park, visitor centre and an outdoor events venue. Sports pitches and changing rooms. Possibility to extend to include outdoor gym equipment, cycling paths, or BMX track.		Provides an amenity to local community. Improved landscape and visual impact.
Alternatives	**Description**	**Environmental and Planning Considerations/Constraints**	**Main reason for rejecting alternative**
Pasture/grazing	Pasture for grazing animals	Human perception (assumption that there would be contamination of the food chain) may have precluded livestock production for food – reducing farmer's potential income.	Infrastructure required for drainage and gas management can be buried at shallow depth possibly at risk from animals. 80% of the land available for agricultural leases for grazing, leaving 20% of site to be otherwise managed.
Arable	Arable farmland for crops	Slope gradients limit access for machinery. The depth and quality of the soil cover would need to be greater to protect integrity of capping layer. Human perception (assumption that there would be contamination of the food chain) may have precluded crop production for food – reducing farmer's potential income.	Infrastructure required for drainage and gas management can be buried at shallow depth possibly at risk from farming activities. 70% of the land available for agricultural leases for crop growing, leaving 30% of site to be otherwise managed. Improved landscape and visual impact offered by multi-use park.
Renewable energy	Landfill gas transformed to electricity. Heat energy potential from the ground for use in district heating. Solar farm or wind turbines.	Limited volumes of landfill gas being generated. Heat energy - provision of heat beyond on-site uses, unlikely to be a viable option. (Exploration of Heat Recovery Potential from Landfill Waste [Reilly 2016]) Solar - site would need to be extensively re-profiled to render it suitable for this type of development (south-facing). Wind turbines require complex foundations. Landscape and visual impacts from solar farm or wind turbines.	Gas may provide only limited energy source, unlikely to produce sufficient energy to warrant export to the grid or to power nearby property. The nature of the waste may affect the ability to predict how the heat source may vary over time and therefore the viability. Provision of infrastructure would require long-term investment return period, and incentives are politically motivated and hence subject to market turbulence.

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5.3.3 Consultation on Alternative End-Use

As part of the 2016 end-use assessment (Kerdiffstown Landfill End Use Assessment, Jacobs 2016) three options were selected by KCC for further consideration and external consultation, being:

1. Agriculture (pasture for grazing);
2. Country Park; and
3. Multi-use Recreational.

A simple screening matrix was developed to assess the identified technical constraints against the potential end-uses. For completeness the option of developing the site for industrial or commercial purposes was also included in the assessment as there is precedent for such developments elsewhere on closed landfill sites.

Table 5.3: End-Use Screening Matrix

End Uses:	Technical Constraints								
	Waste settlement	Site profile and topography	Leachate Management	Surface Water Drains	Gas management	Capping integrity	Boundary issues	Environmental Monitoring Boreholes	Traffic / site Location
Pasture/grazing									
Arable									
Parkland – basic public open space									
Parkland – country park									
Sports									
Renewable Energy									
Commercial / Industrial									

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Key

	Green – end-use has minimal impact on remediation design.
	Yellow – end-use requires remediation design to be modified to some extent.
	Red – end-use cannot be accommodated without fundamental change to remediation design.

Consideration was also given to potential environmental benefits associated with each of the selected end-use options, as set out in Table 5.4.

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Table 5.4: Potential Environmental Benefits of End-Use Options

Benefit	Option 1 Agricultural end-use	Option 2 Country Park	Option 3 Multi-Use Recreational
Food production	Minimal	×	×
Non-food production	Possible	×	×
Recreation	×	Limited – could be expanded through design	✓
Potential to provide local economic gains	×	Limited – could be expanded through design	✓
Biodiversity value	×	✓ Values could be maximised through targeted design and management	Limited
Education	×	×	✓
Visual amenity	×	✓	✓
Potential to provide climate resilience benefits	×	✓ Values could be maximised through targeted design and management	✓
Renewable energy possibilities	Considered to be technically not feasible		

KCC undertook a period of consultation, discussed further in Chapter 6 The Consultation Process. This consultation process and the feedback supported the selection of a multi-use public park as the end-use. Further input and feedback from individuals, community groups and sports partnerships have informed the design of the park, shown on Figure 4.20.

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5.4 Alternative Designs

5.4.1 Remedial Options Studies

In 2010 SKM Enviros (now Jacobs) were commissioned by the Environmental Protection Agency (EPA) to conduct an evaluation of potential environmental liabilities associated with various closure scenarios for Kerdiffstown Landfill. In 2013 SKM Enviros carried out a high level independent review of the environmental baseline at the site, including identifying potential outline remediation and end-use options. As part of this work, the scenarios as proposed in the Evaluation of Environmental Liabilities (SKM Enviros 2010) report were further explored and refined in the Kerdiffstown Landfill Remediation Project Remedial Options Report (SKM Enviros 2013). The outline details of remediation options considered along with the main environmental and technical advantages and disadvantages were assessed to determine the most appropriate solution for the proposed Project, as presented in Table 5.5.

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Table 5.5: Remedial Options Assessment

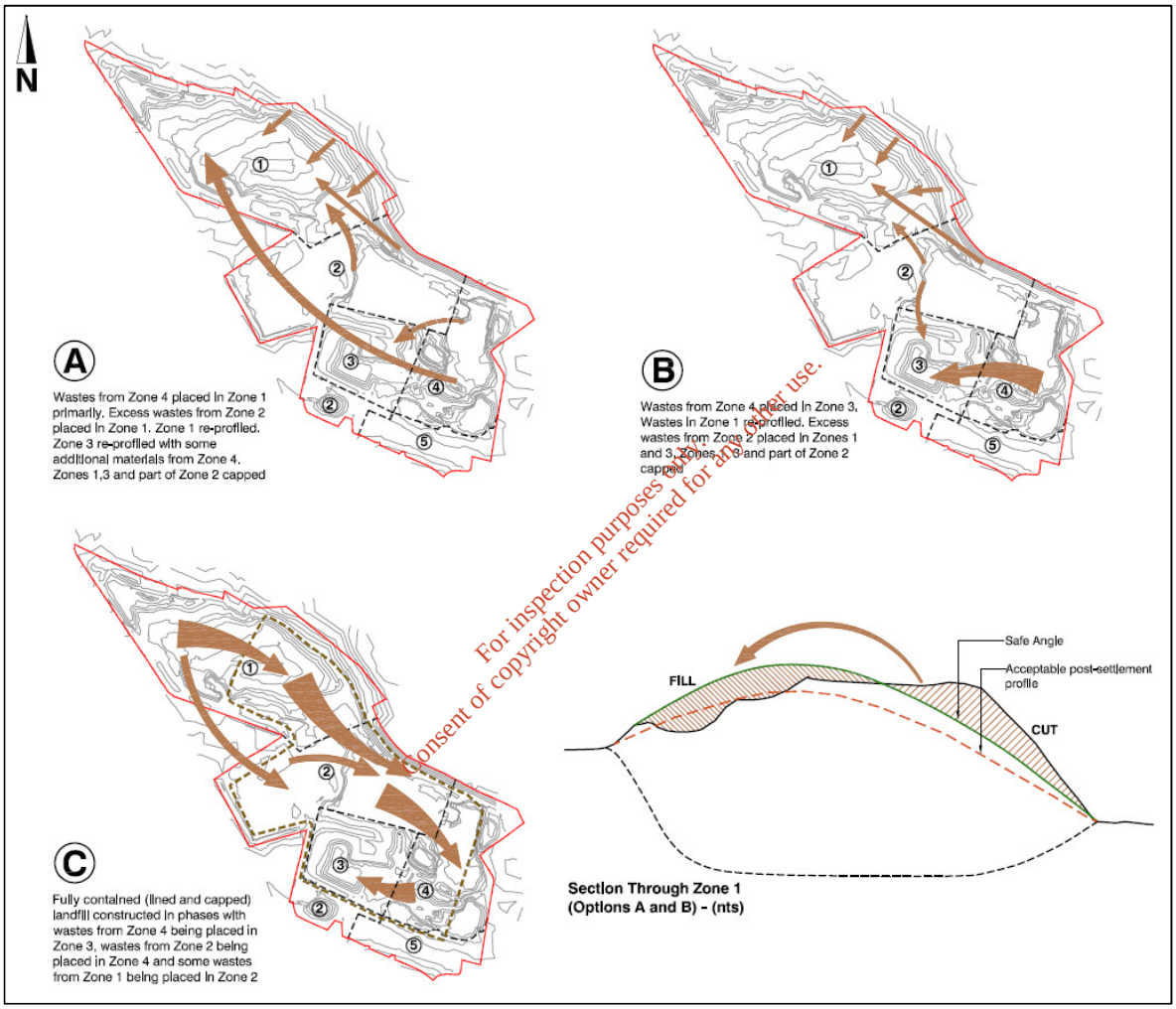
Item	Option	Broad Description	Environmental Advantages	Environmental Disadvantages	Comment
1	**Do Nothing**	Leave site in its current state and discontinue ongoing environmental monitoring.	None	Risks to human health via direct and indirect pathways remains. Would leave the site in breach of environmental legislation.	Does not meet the project objectives. **Not considered further.**
2	**Do Minimum**	Environmental monitoring regime continues, with reactionary action undertaken in the event of an environmental hazard occurring.	None	Risks to human health via direct and indirect pathways remains. Would leave the site in breach of environmental legislation.	Does not meet the project objectives. **Not considered further.**
3A	**Do Something** Minimal reconfiguration and capping	Minimal movements of wastes to provide a safe landform. Installation of cap; collection and management of landfill gas, leachate and surface water.	Limited excavation minimising potential environmental impacts during works (noise, traffic, odour etc.). Post remediation gas and odour control. Post remediation surface water control.	Ongoing groundwater impact post remediation but leachate generation should be restricted by capping of wastes to reduce infiltration. Potential off site leachate migration from Zone 1 posing risk to Morell River.	Meets project objectives. Potentially viable option.
3B	**Do Something** High quality cap across whole site, groundwater interception and treatment	Minimal movements of wastes to provide a safe landform. Installation of cap; collection and management of landfill gas, leachate, surface water and groundwater.	Limited excavation minimising potential for environmental impacts (noise, traffic, odour etc.). Post remediation gas and odour control. Post remediation surface water control. Off-site leachate migration controlled by barrier system to prevent groundwater / surface water impact, mitigating risk to Morell River.	Ongoing groundwater impact post remediation but leachate generation should be limited by capping of wastes to reduce infiltration.	Meets project objectives. Potentially viable option.
3C	**Do Something** Development of fully lined containment site for all wastes	Construction of new lined cells to form a new lined landfill. Installation of cap; collection and management of landfill gas, leachate and surface water.	Groundwater and surface water impacts controlled by total containment solution. Post remediation gas and odour control. Post remediation surface water control.	Extended construction period, longer duration of temporary construction related impacts. Extensive excavation works required increasing potential for environmental impacts and nuisance.	Meets project objectives. Not viable from a financial perspective.
3D	**Off-Site Disposal** Excavation and off-site disposal of all wastes	Remove all processing plant, waste and other materials from the site and transfer all wastes off-site for deposition into another appropriately licensed landfill site.	Removes predominant risks from the site.	Lack of suitable alternative licensed disposal sites in vicinity. Significant volumes of haulage traffic associated with this option. Significant odour, dust and noise impacts. Potential requirement to import significant quantities of materials to fill in void, post-waste excavation. Health and safety risks for workers. Transference of risk to another site.	Not viable both from a sustainability and financial perspective. **Not considered further.**

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5.4.2 Short-listed Remedial Options

From the assessment in Table 5.5 three options were considered to be potentially viable, being 3A, 3B and 3C. These scenarios were further refined (as Scenarios A, B and C) using a high level optioneering process (Kerdiffstown Landfill Remediation Project Remedial Options Report, SKM Enviros 2013), as shown on Diagram 5.1.



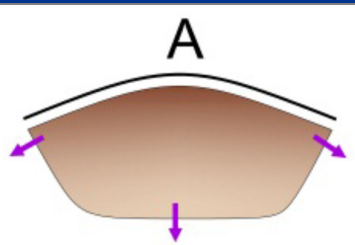
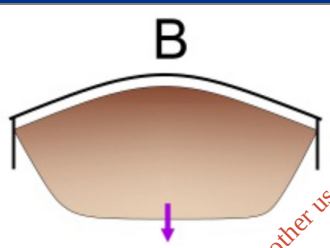
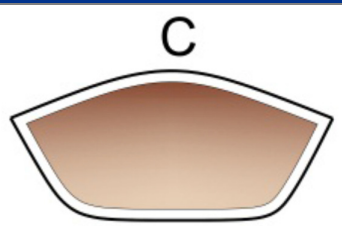
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Diagram 5.1: High Level Remediation Scenario Schematics (SKM Enviros 2013)

Each of the options were broadly similar, all representing a practical way of capping wastes in-situ. Scenario A achieved this objective as a 'do minimum' approach; rationalising all wastes with the minimum of excavation by creating both a lined and unlined capped landfill with provision for perimeter collection and treatment of any significant leachate migration formed Scenario B; and, the creation of a new lined landfill in the south-eastern area of the site was the basis of Scenario C. A summary of each scenario is presented below and are illustrated in simple conceptual terms by schematics.

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Table 5.6: Remediation Scenario Summary

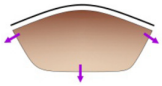
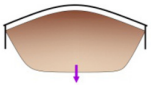
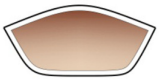
Scenario A	Scenario B	Scenario C
		
Majority of wastes left in-situ; Peripheral wastes to the north-western area of Zone 1 moved within Zone 1; Waste from Zone 2 not covered by concrete to Zone 1; Existing liner in Zone 3 to be repaired; Waste from Zone 4 moved into the lined cell in Zone 3 (any excess to be moved to Zone 1); Re-profile the waste in Zone 1 and completion of lined cell in Zone 3 to an acceptable, safe landform; Install a capping layer over Zones 1 along with completion/capping of the lined cell in Zone 3; Installation of a gas management system in conjunction with capping; Acceptance of reduced leakage through the base of unlined zones (and to a lesser extent Zone 3) into the underlying groundwater system; Allow potential lateral leachate migration from Zones 1 and 2 (on the basis of much reduce leachate generation potential as a result of the cap); Collection and management of surface water runoff; Continue to collect and manage leachate from Zone 3.	As with Scenario A, leave the majority of the waste in-situ with limited movement of waste in Zone 1; Repair and expand the lined cell in Zone 3 to allow receipt of all waste from Zone 4 along with uncovered waste from Zone 2; Re-profile the waste in Zone 1 and completion of lined cell in Zone 3 to an acceptable, safe landform; Install a capping layer over Zones 1 along with completion/ capping of the lined cell in Zone 3; Installation of a gas management system in conjunction with capping; Acceptance of reduced leakage through the base of unlined zones (and to a lesser extent Zone 3) into the underlying groundwater system but in addition to Scenario A, installation of a hydraulic control/cut-off along the north eastern area of the site between the wastes and the Morell River; Provide for treatment of collected contaminated groundwater via perimeter cut-off wall/ barrier system; Collection and management of surface water runoff; Continue to collect and manage leachate from Zone 3.	Completion of the existing lined cell in Zone 3; Construction of new lined cells to form a new lined landfill in areas currently occupied by redundant waste processing plant; Cells filled/ completed sequentially; Placement of remaining wastes, including all wastes currently deposited in north-western area into lined cells; Installation of leachate and gas collection infrastructure; Restoration with a low permeability capping layer and creating a safe landform after the existing wastes have been excavated. Collection and management of surface water runoff; Collect and manage leachate from all cells.

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A series of key criteria were determined in order to qualitatively consider the relative merits of each of the three scenarios in terms of order of preference. The findings of this assessment are summarised in Table 5.7.

Table 5.7: Qualitative Assessment of Technical Merits for Remediation Scenarios

Issue	Scenario A	Scenario B	Scenario C
	A 	B 	C 
Groundwater protection			
Surface water protection			
Landfill gas control			
Odour and nuisance impacts			
Traffic, noise and vibration impacts			
Visual impact / intrusion during works			
Timescale to remediate the site			
Sustainability / greenhouse gas emissions			
Cost			

Key:

Most preferred option | Intermediate option | Least preferred option

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Scenario C was determined to be the least preferred option for odour and noise impacts, traffic, noise and vibration impacts, visual impact during works, timescale of works and greenhouse gas emissions.

Scenario B was therefore selected as the preferred option, on the basis of landfill gas control, odour and nuisance impacts, traffic, noise and vibration impacts, visual impacts/ intrusion during works, timescale and greenhouse gas emissions.

5.4.3 Developed Remedial Option

Subsequent to the optioneering assessments, during 2016 and the development of the engineering design for the remediation of the site it was observed that previously predicted plumes of contamination migrating from the site had not been realised. Monitoring data, recorded on at least a monthly basis, had shown no impact on the Morell River. This is further discussed in Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Options for limiting migration of leachate in groundwater from the site are varied, and can include the construction of a cut-off wall, installation of a series of abstraction boreholes or a combination of both. The impacts of such a system were therefore assessed as an early design consideration, with findings outlined below:

- Water quality monitoring and ecological assessments have not shown any direct impacts from leachate on the Morell River;
- Geophysical surveys undertaken annually along the eastern boundary of the site have not identified a contaminant plume emanating from the site and discharging to the river;

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- The adoption of engineered capping systems across the site will reduce infiltration and therefore the potential for leachate generation, thereby reducing the environmental risk profile to a likely acceptable level;
- There is a risk of destabilising the current groundwater system through the installation of a cut-off wall;
- There is the potential to impact on river flow rates as water is prevented from discharging to the river. This could have potential knock-on effects on river ecology. Pumping could similarly impact river flows as the pumping may also draw in water from the river;
- There would be increased impacts during works and a need for additional resources such as cement and water;
- The requirement for dewatering to install the cut-off wall would likely impact the river, ecology and the public sewer;
- Installation of the cut-off wall would not be a sustainable solution with associated environmental impacts (carbon footprint, dust, noise emissions, etc.), which would not be in alignment with the project objectives; and
- Should future monitoring highlight the need for such remediation measures the system could be installed relatively quickly and is not reliant on other remediation works.

Many of the above observations align with the broader project objectives, set out in Section 5.1. The remediation design was therefore progressed without a cut-off wall, on the basis that monitoring works would continue at the site with regular reviews and reporting to verify data and to assess the effect (if any) of the site on groundwater and the Morell River. It is also envisaged that with the Industrial Emissions Activities Licence (IEAL) application, trigger levels will require to be set for groundwater monitoring locations, which will allow ongoing review and assessment of data to determine any future requirement for remediation measures between the site boundary and the Morell River.

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Similarly, the IEAL will require a Groundwater Management Plan to be prepared for the site to include monitoring and actions to be undertaken where assessment of data suggests effects on the river are being realised. This management plan will be submitted as part of the licence application and used to regulate the site in the future by the EPA.

5.4.4 Consultation on Alternatives for Remediation Design

In parallel with the planning application a waste licence will be required for the operations to be undertaken in the remediation of the site, comprising movement of wastes and management of landfill gas, leachate and nuisance impacts. An application for an IEAL will therefore be undertaken where the technical merits of the remediation solution will require to be justified to the EPA.

5.5 Alternative Processes

This Section reviews the alternative options that were considered for the main design elements, processes or activities of the proposed Project. The design of the proposed Project is outlined in Chapter 4 Description of the Proposed Project.

5.5.1 Site Access

The site access will be reconfigured with a new roundabout being constructed along with realignment of a section of the existing road (L2005 Kerdiffstown Road) and provision of a new footpath and cycleway. Refer to Chapter 4 Description of the Proposed Project for a full description. Other options considered for the design of the site access are shown in Table 5.8. Mitigation of impacts to the site access was also considered through the reduction in soil importation volumes, as described in Section 5.5.5.

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Table 5.8: Alternative Considerations for Site Access Arrangements

Selected Option Description		Main reason for selecting chosen option
New roundabout to facilitate continued safe usage of Kerdiffstown Road during Remediation Phase (& Operational Phase). Improvement works to include provision of new a footpath and cycleways on Kerdiffstown Road.		Significant number of HGVs will require access to the site during the Remediation Phase, with current road layout compromising safe access.
Description of Alternatives	**Environmental and Planning Considerations/Constraints**	**Main reason for rejecting alternative**
Do nothing	Traffic numbers. Carriageway width and design speed. Visibility. Congestion.	Health and safety concerns. Increasing congestion. Crossing of road by HGVs affecting road users from west (Sallins) coming off bend with restricted visibility.
Do minimal – increase visibility	Impact on landowners to improve sightlines.	Health and safety concerns. Increasing congestion. Crossing of road by HGVs affecting road users from west (Sallins). Impact on landowners.
Revised T junction arrangement	Traffic numbers. Carriageway width and design speed. Visibility. Impact on landowners to improve sightlines. Congestion.	Health and safety concerns. Increasing congestion. Crossing of road by HGVs affecting road users from west (Sallins). Impact on landowners.

The design of the site access and roundabout was further reviewed and mitigation embedded following completion of a Stage 1 Road Safety Audit.

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5.5.2 Demolition Works

There are a series of concrete walls and drainage features remaining following the demolition of buildings and structures in 2011 and during 2016-2017. To enable the remediation and end-use development at the site these walls will be required to be removed. There will also an opportunity to re-use the materials in the remediation works, subject to appropriate screening and testing. There are also three residential properties (REC010, REC011 and REC016) which will be required to be demolished in order to remediate the site, provide safe access to the site, allow construction of key landfill infrastructure off-waste and construct the end-use option of a multi-use public park. Alternatives considered are outlined in Table 5.9.

Table 5.9: Alternative Considerations for Demolition Works

Selected Option Description	Main reason for selecting chosen option
Removal of remaining concrete walls and three residential properties.	Provides areas for storage/ stockpiling of imported and processed materials. Provides an opportunity to re-use crushed and screened materials in remediation. Provides areas supporting end-use development.

Description of Alternatives	Environmental and Planning Considerations/Constraints	Main reason for rejecting alternative
Do nothing (retention of properties)	Removes three properties from local housing market. Drainage infrastructure would require upgrading to remove linkage to the site.	Prevents safe access to site and provision of footpath and cycleway. Severely restricts siting options for key landfill infrastructure.
Do nothing (Retention of walls)	Potentially unsafe in longer term.	No amenity value. Impacts end-use options.
Demolition and removal from site	Traffic impacts. Noise and nuisance.	Not sustainable option in terms of vehicles movements, air, dust and noise impacts. Option to re-use materials reduces volumes and impacts of imported / quarried aggregate.

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5.5.3 Landfill Infrastructure Compound

A new Landfill Infrastructure Compound is required to maintain requisite landfill management plant and equipment in a single, secure location. Due to the nature of the site and risks to the environment should any such facilities fail, the new compound is proposed to be positioned off-waste such that ground conditions are not liable to settlement due to waste degradation or loading. A description of the option for the Landfill Infrastructure Compound is included in Chapter 4 Description of the Proposed Project. Alternatives considered for the position of the Landfill Infrastructure Compound are outlined in Table 5.10.

Table 5.10: Alternative Considerations for Landfill Infrastructure Compound

Selected Option Description	Main reason for selecting chosen option
Construction of new landfill gas and leachate management facilities in a single, secure location off-waste.	Allows construction and operation in parallel with site remediation works. Improved security of key infrastructure. Minimised risk of settlement. Control of site at entrance. Optimises areas on site for end-use development.

Description of Alternatives	Environmental and Planning Considerations/Constraints	Main reason for rejecting alternative
On top of the waste	Settlement. Pollution incidents. Restriction on end-use development opportunities.	Failure of infrastructure poses environmental risks hence settlement of ground should be avoided. Earthworks required to improve ground conditions would be extensive and not representative of a sustainable option. Buildings and service intrusions would require to be protected from underlying wastes.
On existing hardstanding	Potential settlement. Restriction on end-use development opportunities.	Failure of infrastructure poses environmental risks hence settlement of ground should be avoided. Buildings and service intrusions would require to be protected from underlying wastes. Restriction for maintenance access. Restriction on end-use development. Increase vehicle (including tanker) movements on site / park roads.
Other, non-waste area	Potential settlement. Pollution incidents. Restriction on end-use development opportunities.	Limited non-waste areas on site. Restriction on end-use development. Increase vehicle (including tanker) movements on site / park roads.

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5.5.4 Site Re-profiling

Site re-profiling options were broadly considered as part of the remedial options assessment undertaken in 2013 (refer to Section 5.4.1). The EPA Landfill Manuals regarding Site Design and Restoration and Aftercare have stipulations with respect to landforms on landfill sites, to include:

- minimum slope of 1 in 30 to prevent surface water ponding and to promote surface water runoff; and
- slopes to be no greater than 1 in 3.

Zone 1 comprises the largest volume of waste at the site and is largely domed. However, this zone has a number of voids in places and several flat lying areas. Without intervention these slopes would encourage ponding of surface water and could cause leakage into the landfill due to failure of the landfill cap generating leachate, as well as releasing landfill gas to the atmosphere. Similarly, there are a number of waste stockpiles around the site and over-steep slopes that pose a significant risk of failure without intervention.

The re-profiling of other areas would alleviate these issues on Zone 1 using site won material as opposed to imported materials, in parallel to addressing slope stability risks in the other zones, providing profiles that will permit installation of an engineered capping system where required.

For this EIAR further design work was undertaken to determine suitable re-profiled contours to comply with the EPA guidance whilst maintaining a balance in the volumes of materials required to be retained within the footprint of the site. The profile was also identified as being able to support the potential end-use options.

Alternatives considered in the design review are outlined in Table 5.11.

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Table 5.11: Alternative Considerations for Site Re-profiling

Selected Option Description	Main reason for selecting chosen option
Re-profiling the site to address current over-steep slopes to permit installation of an engineered capping and/or soil cover system, to allow for surface water drainage, and provide mitigation of long-term settlement of the waste mass.	Minimises volumes associated with the excavation, movement and deposition of materials within the site. Material export from the site is not required, reducing the impact of the works on the local community and environment. Gradients required to manage surface water and maintain capping integrity following settlement.

Description of Alternatives	Environmental and Planning Considerations/Constraints	Main reason for rejecting alternative
Do nothing	Over steep slopes present potential stability risk. Profile does not accord with EPA Landfill Manuals for restoration profiles. Would not permit placement of wastes and reduction of risk/ footprint from other zones.	Current profiles would require additional soils to provide abutment to create suitable final profile. Retention of existing profile would present long term issues for surface water ponding. Capping system installation would require re-profiling to ensure long-term stability and integrity. Does not comply with environmental guidance and legislation. Poses risks to receptors. Does not align with risk profile and objectives of the project.
Reduce height of site / reduce slope gradients.	Excavation volumes. Nuisance: odour, dust. Environmental controls: leachate, landfill gas. Industrial Emissions Activities Licence compliance. Incompatible with EPA guidance on landfill restoration.	To reduce profile to previously permitted height (ref KCC: 03/2355; ABP: PL.09.206726); maximum height 110.7mOD Malin Head) would require excavation of c.19,000m^3 of highly odorous wastes, causing significant environmental impacts. Significant increase in volumes from slopes, requiring increased height on site or removal from site. Material likely to be removed from site, or other areas identified for deposition on site. Vehicle movements to / from site and associated impacts. Limits end-use options.

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As a result of the likely environmental impacts that would be realised by reducing the elevation of the waste mass, primarily in Zone 1, to accord with the previous planning permission, Kildare County Council exercised its powers under Section 56 of the Waste Management Act 1996 (as amended) and took the measure of issuing a Chief Executives Order CE10770 instructing that:

> "*All practicable measures… to be taken in the design and implementation of the Kerdiffstown Landfill Remediation Project to minimise the movement of odorous materials to prevent and limit environmental pollution in accordance with the aims of remedial Option B for the site.*"
>
> "*…the maximum elevation at the Kerdiffstown Landfill of 113.5mOD Malin is not required to be reduced as part of the remediation, given the significant environmental pollution that could result from any such action to reduce the height significantly below this level.*"

5.5.5 Engineered Capping and Soil Cover Systems

The primary role of the landfill capping system for the site is to control leachate production by preventing or significantly limiting the infiltration of rainfall into the waste mass. The capping system is therefore required to include a barrier layer of very low permeability to intercept rainwater and an overlying drainage layer to convey the water away efficiently. This system reduces the amount of leachate produced, restricts vertical migration of landfill gas and reduces risks to human health and the environment. Proposals for the engineered capping and

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cover systems to be installed for the proposed Project are discussed in Chapter 4 Description of the Proposed Project.

The proposed capping and soil cover systems vary according to the waste quantities, types and associated risks that are present in each zone at the site, taking cognisance of EPA Landfill Manuals Landfill Site Design (EPA 2000). Alternatives for each zone are considered below.

Zone 1 and Zone 3

The capping design for Zones 1 and 3 compared to alternatives is discussed in Table 5.12 below:

Table 5.12: Alternative Capping System and Materials (Zones 1 and 3)

Selected Option Description		**Main reason for selecting chosen option**
Top soil / soil forming material cover (150mm depth); Subsoil (350mm depth); Geocomposite drainage layer (GDL); Flexible membrane liner; Regulation layer (fine grained material, e.g. sand).		Reduced volume of imported fill. Reduced traffic and associated impacts. Provides requisite stability of capping system. Low maintenance requirements. Complies with project objectives.
Description of Alternatives	**Environmental and Planning Considerations/Constraints**	**Main reason for rejecting alternative**
Topsoil (strict specification, e.g. to BS 3882:2015) Subsoil (up to 850mm depth)	Traffic impacts. Available sources. Market conditions.	No site won material available for works. Precludes use of other, suitable growing media materials. Use of recycled soils seen as preferable over external borrow pit arrangement (subject to appropriate testing and specification compliance).
Drainage Layer		
Sand or granular drainage layer (up to 500mm depth)	Traffic impacts. Available sources. Market conditions. Material resources.	GDL reduces vehicles movements to site. GDL provides adequate transmissivity of water above the barrier layer. Not sustainable in terms of use of virgin, quarried materials, vehicles movements. Impact on roads and traffic.
Barrier Layer		
Clay (up to 600mm depth)	Traffic impacts. Available sources. Market conditions. Material resources.	The Flexible Membrane Liner (FML) complies with Landfill Directive. Cost effectiveness. Reduces importation of clay. Removes use of natural resources. Ease of construction compared to clay. Onerous CQA for clay. Long-term settlement. Not sustainable in terms of use of virgin, quarried materials, vehicles movements. .
Geosynthetic Clay Layer	Settlement and cap integrity.	Reduced stability for side slopes. Use of single product for ease of capping integration across zone.

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Selected Option Description		Main reason for selecting chosen option
Top soil / soil forming material cover (150mm depth); Subsoil (350mm depth); Geocomposite drainage layer (GDL); Flexible membrane liner; Regulation layer (fine grained material, e.g. sand).		Reduced volume of imported fill. Reduced traffic and associated impacts. Provides requisite stability of capping system. Low maintenance requirements. Complies with project objectives.
Description of Alternatives	**Environmental and Planning Considerations/Constraints**	**Main reason for rejecting alternative**
Bentonite Enriched Soils (up to 600mm depth)	Traffic impacts. Available sources. Market conditions. Material resources.	Reduces importation of bentonite and host material. Use of natural resources (water). Consistency of material batching. Potential future issues due to settlement of the waste mass. Not sustainable.
Gas Drainage Layer		
Geosynthetic drainage layer	Traffic impacts. Capping integrity.	Ease of construction. Requirement to protect FML from underlying wastes. Gas extraction wells installed across zones will allow management of landfill gas. Gas wells will be sufficiently spaced based on pump tests to ensure zones of influence capture gas appropriately.

The EPA Landfill Manuals Landfill Site Design confirms that design of a capping system should be determined on a site by site basis. Depths of layers were considered taking cognisance of the absence of site-won material, impacts on traffic and sustainable options for the remediation of the site. The end-use proposals were also based around these key areas, such that Zones 1 and 3 will only have paths and tracks for public use. Six options were considered as shown in Table 5.13.

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Table 5.13: Capping Options for Zone 1 & 3 (Approximate Import Volumes)

Option	Topsoil (m)	Sub-soil (m)	Drainage Blanket (m)	Clay Barrier (m)	Granular Gas Blanket (m)	Regulation Layer (m)	Drainage Geocomposite	GCL or FML Barrier	Gas Geocomposite	Total Cap Thickness (m)	Required Capping Material Import Volume (m^3)	Reduction Compared to Option 1	
												(m^3)	(%)
1	0.15	0.85	0.5	0.6	0.3	0.15				2.55	274,000	n/a	n/a
2	0.15	0.35	0.5	0.6	0.3	0.15				2.05	256,000	18,000	7%
3	0.15	0.85	0.5		0.3	0.15		✓		1.95	245,000	29,000	11%
4	0.15	0.35	0.5		0.3	0.15		✓		1.45	190,000	84,000	31%
5	0.15	0.85				0.15	✓	✓		1.15	120,500	153,500	56%
6	0.15	0.35				0.15	✓	✓	✓	0.65	**66,000**	**208,000**	76%

As shown in Table 5.13 the proposed capping system for Zones 1 and 3 provides a 1.75m reduction in the total thickness of the capping system (excluding the regulation layer) and, as a result, a 76% reduction in required imported soil volumes and associated vehicle movements when considered with a typical 0.6m depth of a clay barrier layer. This reduced capping system thickness still complies with environmental guidance and legislation as demonstrated in Chapter 4 Description of the Proposed Project, whilst satisfying project objectives.

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Zones 1A, 2A & 2B

In Zones 2A and 2B the majority of the capping is being provided by the existing concrete hardstanding pads which overlie waste deposits, with remedial works to seal joints and cracks. In areas where separation to waste will not be provided by the hardstanding areas a low permeability capping solution is proposed consisting of a 350mm thick layer of compacted clay under a layer of topsoil. This system, described further in Chapter 4 Description of the Proposed Project, poses a lower risk to groundwater from surface water infiltration due to a combination of reduced waste thicknesses and predominant construction and demolition (C&D) waste composition with a reduced proportion of Municipal Solid Wastes (MSW) compared to Zones 1 and 3. Alternatives are shown in Table 5.14.

Table 5.14: Alternative Capping System and Materials (Zones 1A, 2A and 2B)

Selected Option Description		**Main reason for selecting chosen option**
Top soil / soil forming material cover (min 150mm depth); Low permeability clay (min. 350mm depth).		Low maintenance requirements. Complies with project objectives.
Description of Alternatives	**Environmental and Planning Considerations/Constraints**	**Main reason for rejecting alternative**
Topsoil (according to strict specification e.g. BS 3882:2015)	Traffic impacts. Available sources. Market conditions.	No site-won material available for works. Precludes use of other, suitable growing media materials. Use of recycled soils seen as preferable over external borrow pit(s) arrangement (subject to appropriate testing and specification compliance).
Subsoils to greater depth (e.g. 850mm)		
Mineral Layer		
Flexible Membrane Liner	Settlement and cap integrity.	Would require earthworks to create suitable profile to facilitate collection of runoff.
Geosynthetic Clay Layer	Settlement and cap integrity.	Would require earthworks to create suitable profile to facilitate collection of runoff.
Bentonite Enriched Soils (up to 600mm depth)	Traffic impacts. Available sources. Market conditions. Material resources.	Reduces importation of bentonite and host material. Use of natural resources (water). Consistency of material batching. Potential future issues due to settlement of the waste mass. Not sustainable.

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Zone 4

Zone 4 poses a lower risk to groundwater from surface water infiltration due to a reduced waste thickness, predominant C&D waste composition with minimal MSW and re-profiling works removing a significant proportion of the existing waste mass. The remediation profile will also reduce the risk in this zone due to the slope gradients and installation of (lined) surface water ponds. This system, described further in Chapter 4 Description of the Proposed Project, poses a lower risk to groundwater from surface water infiltration due to a combination of reduced waste thicknesses and footprint. Alternatives are shown in Table 5.15.

Table 5.15: Alternative Soil Cover System (Zone 4)

Selected Option Description		**Main reason for selecting chosen option**
Top soil / soil forming material cover (min 0.15m depth); Soil cover (min. 0.35m depth). Predominantly regraded 1:3 side slope gradients to enable surface water runoff, with grassed surface.		Low maintenance requirements. Complies with project objectives.
Description of Alternatives	**Environmental and Planning Considerations/Constraints**	**Main reason for rejecting alternative**
Topsoil (according to strict specification e.g. BS 3882:2015)	Traffic impacts Available sources Market conditions	No site-won material available for works. Precludes use of other, suitable growing media materials. Use of recycled soils seen as preferable over external borrow pit(s) arrangement (subject to appropriate testing and specification compliance).
Subsoils to greater depth (e.g. 850mm)		

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The soil cover system proposed is reflective of the reduced risk, comprising placement of 350mm depth of low permeable subsoils overlain by 150mm of top soil/ soil forming material.

This zone also has two large surface water ponds located at the toe of the slopes, with the ponds lined with a geomembrane liner, to separate the clean surface water runoff from the underlying wastes.

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5.5.6 Leachate and Landfill Gas Management Systems

Leachate Management System

The need to manage leachate remains a long-term maintenance liability for the site. Further details on the selected option are provided in Chapter 4 Description of the Proposed Project. Alternatives considered for leachate management are outlined in Table 5.16.

Table 5.16: Alternative Considerations for Leachate Management

Selected Option Description		**Main reason for selecting chosen option**
Improved leachate management systems to remove and transfer leachate to a wastewater treatment plant via the public sewer network.		Significantly reduces traffic impacts from road tankers (tankering only to be used as a back-up), and potential for pollution events through accidents. Reduces risks of pollution events on site. Subject to agreement with Irish Water.
Description of Alternatives	**Environmental and Planning Considerations/Constraints**	**Main reason for rejecting alternative**
Do nothing	Leachate from Zone 3 (lined cell) will overtop lining system polluting the environment. Odour emissions. Impacts on end-use.	Does not comply with environmental guidance and legislation. Poses risks to receptors. Does not align with risk profile and objectives of the project.
Continuation of existing arrangements through collection of raw leachate by road tanker for haulage to off-site treatment works.	Traffic. Environmental pollution. Ability to manage leachate volumes. Sustainability (road use). Acceptance limits at treatment works.	Not considered as a sustainable option. Impacts on the local community through vehicle movements (due to high volumes of traffic). Environmental risks with carriage of leachate on public roads should an accident occur. Not sustainable when considering transportation and disposal activities. Disposal to Ringsend WWTP requires 100km round-trip.
Pumping raw leachate through a dedicated rising main pipeline directly to an off-site treatment works.	Onerous discharge conditions. Landowner's agreements for dedicated main.	Treatment of raw leachate subject to commercial agreement between KCC and Irish Water. Price likely to fluctuate according to variations in leachate concentrations and flow rates. Not sustainable. When considering impacts for installation of dedicated main to a treatment works would be significant. Sustainability choices with respect to sizing of pumps.
Partial on-site treatment/ discharge to foul sewer for final treatment at an off-site treatment works.	Land area required to install treatment system. Environmental impacts due to pollution event. Onerous discharge conditions.	On-site treatment not in KCC interest for risk exposure should failure scenarios be realised. On-site treatment likely to affect siting of plant and hence influence use and perception of end-use.
On-site treatment in a bespoke treatment plant/ tertiary treatment in a wetland/ discharge to a nearby watercourse.	Land area required to install treatment system. Environmental impacts due to pollution event. Potential impacts to local watercourses.	On-site treatment not in KCC interest for risk exposure should failure scenarios be realised. On-site treatment likely to affect siting of plant and hence influence use and perception of end-use.

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A Leachate Management Plan has been prepared and is provided in Appendix A4.4, which provides further detail on the leachate management system. Having an appropriate plan in place is a requirement of the Industrial Emissions Activities Licensing process and the Leachate Management Plan will be maintained and updated as required through the Remediation and Operational Phases.

Any discharge to the public sewer network or disposal to a treatment works requires agreement with Irish Water. Discussions in this regard are ongoing with agreement in principle having been reached with respect to the selected option and discharge to Johnstown Pumping Station.

Landfill Gas Management System

The primary function of the proposed landfill gas management system at the site is to break the pathway to surrounding environmental receptors by prevention of uncontrolled release of gas and odours from the site. Due to the risks posed by landfill gas and the location of sensitive receptors in proximity to the site the need to manage landfill gas remains a long-term maintenance liability for the site.

The design of the site's landfill gas system comprises extraction from Zones 1 and 3 for combustion in a high temperature flare and venting in Zones 2A and 2B where the gas quality is considered too low for flaring. Gas management in Zone 4 is not required due to a lack of degradable wastes and due to the re-profiling works proposed. The effectiveness of the gas management system is directly linked with the capping system design. Further details on the selected option for the landfill gas management system are provided in Chapter 4 Description of the Proposed Project. Alternatives considered for landfill gas management are outlined in Table 5.17.

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Table 5.17: Alternative Considerations for Landfill Gas Management

Selected Option Description		Main reason for selecting chosen option
Gas management to be improved across the site following capping works, with extraction being undertaken from predominant gas generating wastes and venting in other areas where landfill gas has been detected.		Reduces the risk of gas migration from the site. Reduces Greenhouse Gas (GHG) emissions from the site. Addresses potential odour issues (with capping design). Complies with appropriate environmental guidance and legislation.
Description of Alternatives	**Environmental and Planning Considerations/Constraints**	**Main reason for rejecting alternative**
Do nothing	Risk of landfill gas migration. GHG emissions. Odour emissions. Impacts on local receptors. Impacts on end-use.	Does not comply with environmental guidance and legislation. Poses risks to receptors. Does not align with risk profile and objectives of the project.
Continuation of existing arrangements through collection of gas in discrete fields for flaring.	Risk of landfill gas migration. GHG emissions. Odour emissions. Impacts on local receptors. Impacts on end-use.	Reactionary. Does not comply with environmental guidance and legislation. Poses risks to receptors. Does not align with risk profile and objectives of the project.
Physical gas barrier	Land requirements (beyond waste). Sustainability, requiring importation of low permeable materials.	Not sustainable given reducing life-span of gas potential at the site. Technically not feasible.
Utilisation of landfill gas	Proximity to energy grid. Landowner's agreements for connections. Visual impacts of plant.	Gas quality and yield too low for utilisation. Not sustainable option. Would require flaring back-up system.

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A Landfill Gas Management Plan has been prepared and is provided in Appendix A4.5, which provides further detail on the proposals for landfill gas management. Having an appropriate plan in place is a requirement of the Industrial Emissions Activities Licensing process.

5.5.7 Surface Water Management

Remediation of the site will require installation of a surface water management system. The system must collect and transport runoff from the site to drains. Design proposals include a network of open ditches, channels, swales and wetlands to intercept and control surface water runoff and direct it towards storage ponds. Further details on the selected option for surface water management at the site are provided in Chapter 4 Description of the Proposed Project. Alternatives considered for surface water management are outlined in Table 5.18.

Table 5.18: Alternative Considerations for Surface Water Management

Selected Option Description		**Main reason for selecting chosen option**
Surface water drainage to manage runoff post-remediation works, to treat and control discharges from the site.		Sustainable option, capturing clean water for retention in surface water catchment.
Description of Alternatives	**Environmental and Planning Considerations/Constraints**	**Main reason for rejecting alternative**
Do nothing	Uncontrolled runoff would affect local properties/ receptors.	Does not comply with environmental guidance and legislation. Poses risks to receptors. Does not align with risk profile and objectives of the project.
Discharge all runoff from the site to the Morell River	Volume to be discharged to the Morell River. Effects on river. Flood risks. Land requirements to achieve capture.	Topography limits ability to achieve gravity drainage from the north flank (Zone 1) and north-west corner (Zone 1A). Maintenance challenges for piped systems. Pumping from these locations is not a sustainable option.
Utilise existing discharge to the Canal Feeder Stream.	Quality of receiving water. Integrity of existing pipeline and connection.	Topography prevents capture from all of site discharging by gravity. Pumping is not a sustainable option. Would require additional emission and hence monitoring and compliance location. Would require new, larger diameter pipe to facilitate discharge.
Discharge to sewer.	Effect on removal of site catchment from surface water resources.	Removes 'clean water' from catchment. Not considered as a sustainable option.
Remove waters via road tanker.	Traffic. Ability to manage volumes. Sustainability (road use).	Removes 'clean water' from catchment. Not considered as a sustainable option.

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5.6 References

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6. The Consultation Process

6.1 Introduction

This Chapter describes the consultation process of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project").

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950's until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation and operation can be found in Chapter 4 Description of the Proposed Project.

The Kerdiffstown Project Team has engaged with local residents, interested groups and other local commercial interests since 2011. In 2011, a Community Liaison Group (CLG) was set up and meetings held on a quarterly basis. Updates on the latest developments at the site were provided and feedback welcomed from the group participants.

Early involvement of the public and other stakeholders ensured that the views of groups and individuals were taken into consideration throughout the preparation of the Environmental Impact Assessment Report (EIAR) and during the development of the proposed Project design. It was recognised at an early stage of the project that public and stakeholder engagement is a critical component to the process of developing a sustainable, long-term end-use for the Kerdiffstown Landfill Site.

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6.1.1 Consultation Process

The objective of the stakeholder and public consultation process undertaken for the proposed Project was to:

- Meet the regulatory requirements for consultation under the EIA Regulations;
- Raise public and stakeholder awareness, and develop their knowledge of the project;
- Promote and provide active engagement with the public and all stakeholders on the Kerdiffstown Landfill Remediation Project;
- Seek input from the public and from relevant stakeholders with respect to the proposed end-use for Kerdiffstown Landfill and the measures to reduce impacts during the Remediation Phase;
- Give opportunities for the public and stakeholders to provide baseline and other information with respect to the potential impacts that could arise as a result of implementing the proposed Project; and
- Keep the public informed of the proposed Project as it progresses.

The consultation process to date has involved two key consultation phases;

- Public and stakeholder consultation on the proposed end-use, which included letters, consultation events and a defined consultation period; and
- EIA Scoping consultation.

These two key elements of consultation are discussed in detail in Section 6.2 and Section 6.3 respectively.

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6.1.2 Communication Channels

There were a number of communication channels for each of the consultation phases, as outlined in Section 6.2 and Section 6.3. However, to support the ongoing consultation and engagement, a standalone webpage was set up, www.kerdiffstowncleanup.ie. This website enables the public to access (at any time) up-to-date information on the consultation process, the proposed Project and the overall project programme. An extract showing the home page of the website is provided in Diagram 6.1 below.



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Diagram 6.1: Extract from www.kerdiffstowncleanup.ie

Additionally, a dedicated email address kerdiffstown@kildarecoco.ie, postal address (Environment Section, Áras Chill Dara, Devoy Park, Naas, Co. Kildare), phone line (045 980240) and text line (0879607899) were established, to allow any interested parties the opportunity to provide feedback or ask questions through a variety of means.

6.2 Public and Stakeholder Consultation on Proposed End-Use

6.2.1 Stakeholder Mapping

In order to establish a stakeholder list, key members of the public and organisations (both statutory and non-statutory) with a potential interest in the Kerdiffstown Landfill Remediation Project were identified. These included:

- People living and working in the area;
- Local community groups;
- Local business groups;
- Local environmental groups;
- Local public representatives;

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- Locals who expressed an interest in the project previously (e.g. CLG, Kerdiffstown Residents Association, Clean Air Naas, North Kildare Chamber of Commerce, Saint Vincent de Paul (SVP) Kerdiffstown House); and
- Statutory Stakeholders (i.e. prescribed bodies under EIA Regulations).

6.2.2 Consultation Initiatives

In addition to the established communication channels outlined in Section 6.1.2 a number of initiatives were also undertaken for this consultation phase, such as follows:

- **Social media** Kildare County Council's Twitter and Facebook accounts posted tweets and updates about the Project;
- **Press Release** in local media and online;
- **Advertisement Posters** on the public consultation day posters were put up in local shops, council office, public houses and library;
- **Community Briefings** were organised for key organisations with an interest in Kerdiffstown Landfill; and
- **Council Briefings** were organised for Kildare County Council members to provide project updates and information.

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In February 2016 a consultation letter was distributed to the following stakeholders;

- An Taisce
- BirdWatch Ireland
- Department of Agriculture, Food and Marine
- Department of Arts Heritage and the Gaeltacht (National Parks and Wildlife Services (NPWS))
- Department of Communications Energy and Natural Resources
- Electric Supply Board
- Fáilte Ireland
- Geological Survey of Ireland (GSI)
- Health and Safety Authority
- Heritage Council
- Inland Fisheries Ireland
- Inland Waterways Association – Kildare
- Kildare County Council Heritage Department
- Teagasc
- Transport Infrastructure Ireland (TII)
- Tourism Ireland
- Waterways Ireland

The letter outlined the project, provided information on upcoming consultation events and provided details on how to keep up-to-date with project progress.

6.2.3 Proposed end-use consultation events

A public consultation day was held to launch the public consultation period regarding the future use of the Kerdiffstown Landfill on Wednesday 13 April 2016. The main aim of this event was to update the public on the project and to elicit feedback on the potential end-use for the Kerdiffstown Landfill. This event provided an open and transparent process for members of the public and stakeholders to participate and discuss the key issues they deemed relevant to their community, property or organisation.

Prior to the launch of the consultation on the proposed end-use (13 April 2016) Kildare County Council met with the CLG, to brief them on project progress and about the potential end-use options, and they were encouraged to make a formal submission on the project.

The public consultation day was held by the Kerdiffstown Project Team in the Kildare County Council Offices, Áras Chill Dara, Devoy Park, Naas, on 13 April 2016 from 14:00 to 19:00. A number of presentations, posters and display material was presented on the day and included the following:

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- The Site History;
- The Site Now – detailing the interim measures taken to stabilise the site;
- Site Remediation – detailing the outline programme of works and the aims and objectives of the remediation;
- The two potential end-use options of the Landfill Site (Agricultural or Public Park); and
- Have your say – a poster encouraging feedback and providing contact details.

All attendees were provided with a summary leaflet before being taken through the display material by a member of the team. Consultation forms were also provided to obtain feedback. See Photo 6.1, for pictures from the consultation event.



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Photo 6.1: Kerdiffstown Landfill Remediation Project, Public Consultation Day, 13 April 2016

6.2.4 Results of the Public Consultation

The public consultation day was attended by 17 individuals. Attendees included representatives of community groups, sporting organisations, interested individuals and Kildare County Council members. The main submission and comments identified the preferred end-use for Kerdiffstown Landfill as a multi-use public park and submissions were made regarding the elements to be included in the multi-use public park.

In addition, the subsequent consultation period from 13 April to 25 May 2016 resulted in the public and stakeholders showing a strong preference for a multi-use public park design over the agriculture option. There were 39 submissions in total made during the consultation period, summarised as follows:

- 36 of the submissions received were in favour of a multi-use public park option and the remaining three submissions expressed no preference.
- Suggested the following shall be considered for inclusion within the remediated site:
  - Good quality children's playground;
  - Picnic seating area close to the playground;
  - Buggy friendly walkway;
  - Adult fitness equipment;
  - Wildflower / wildlife area;
  - Car park that includes bike racks;
  - Play pitches (Gaelic football / Rugby / Soccer);
  - Park run facility / running track;
  - Running track;

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- Dog friendly park;
- Camping facilities;
- Café / indoor play area;
- Toilet facility;
- 'Fairy Woodland' area;
- Car park for visitors;
- Bicycle trail around the site;
- An area (up to 5 acres) for a Men's Shed group; and
- 4 acres to be used to extend local sporting facility.

- A number of submissions highlighted the need for additional playing pitches as County Kildare has seen a high population increase in recent years, and is projected to continue to grow, particularly in the areas surrounding Kerdiffstown. This has resulted in increased pressure on the amenities in Kildare and Kerdiffstown is seen as an ideal opportunity to help alleviate this problem;
- Suggestion for a combination of agricultural land and public park, with allotments;
- Vermin and ragwort control to be considered during remediation activities;
- 24-hour security and litter control during and post remediation shall be implemented; and
- Design stage shall incorporate suitable sustainable drainage system (SUDS) design and take account for the need for wastewater treatment.

6.3 EIA Scoping Consultation

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As part of the EIA Scoping process a number of stakeholders were consulted through written correspondence or discussions. The stakeholders included prescribed bodies for the purposes of the Planning and Development Act 2000-2010, the Waste Management Act 1996 (as amended) and other key organisations that would have an interest in the proposed Project.

A consultation letter, inviting comment on the Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report (Jacobs, September 2016), was issued in October 2016 to the following stakeholders:

- An Taisce;
- Birdwatch Ireland;
- Commission for Electricity Regulation;
- Córas Iompair Éireann;
- Department of Agriculture, Food and the Marine;
- Department of Communications, Climate Action & Environment;
- Department of Housing, Planning, Community & Local Government;
- Department of Jobs, Enterprise, and Innovation;
- Department of Justice and Equality;
- Development Applications Unit - The Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs;
- Environmental Protection Agency;
- Electric Supply Board (ESB);
- Fáilte Ireland;
- Geological Survey of Ireland (GSI);
- Health and Safety Authority (HSA);
- Health Service Executive (HSE);
- Inland Fisheries Ireland (IFI);
- Inland Waterways Association – Kildare;
- Kildare County Council;
- National Transport Authority (NTA);
- Office of Public Works (OPW);
- South Dublin County Council;
- Teagasc;
- The Heritage Council;
- Tourism Ireland;
- Transport Infrastructure Ireland (TII):
- Waterways Ireland; and
- Wicklow County Council

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The aim of the EIS Scoping Report was to inform the Stakeholders of the progressing planning stage of the proposed Project. In addition, to invite submissions on the project proposal in relation to potential environmental issues which Stakeholders foresee may result from Remediation Phase and/or Operational Phase and that should be considered when developing the EIAR. The letter template issued is included in Appendix A6.1: EIA Scoping Letter Template.

6.4 Result of EIAR Scoping Consultation

Details of the feedback received through this approach is summarised in Table 6.1.

Table 6.1: Key Issues Raised Through EIAR Scoping Process

Stakeholder name	Acknowledgement from Stakeholder	Summary of Stakeholder Submission	Relevant Chapter/Section of this EIAR
An Taisce	Yes – see next column	Concerns raised over the landfill gas, the hydrology of the site and biodiversity. An Taisce are in favour of the option to use the site in a passive amenity function..*	A description of the proposed Landfill Gas Management System is provided in Section 4.2.8. A Landfill Gas Management Plan has been prepared and is provided in Appendix A4.5, which provides further detail on the proposals for landfill gas management. An assessment of potential hydrology impacts is provided in Chapter 13 Water – Hydrology. An assessment of potential impacts on biodiversity is provided in Chapter 11 Biodiversity. The proposed Project will remediate the site and includes the development of a multi-use public park.
CIE	Yes – see next column	CIE stated the proposed Project should not have any impact on the operations of Irish Rail.	Not applicable.
Commission for Energy Regulation (CER)	EIS Scoping Report received and acknowledged by the CER.	None	Not applicable.
Department of Communications, Climate Action & Environment	EIS Scoping Report received and acknowledged on behalf of Minster Denis Naughten.	None	Not applicable.
Department of Housing, Planning, Community and Local Government	EIS Scoping Report received and acknowledged on behalf of Minister Simon Coveney. It was then agreed that this matter is more appropriate for the Department of Communications, Climate Action and Environment.	None	Not applicable.
Department of Jobs, Enterprise and Innovation	EIS Scoping Report received and acknowledged on behalf of Ms. Mary Mitchell O'Connor.	None	Not applicable.

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Stakeholder name	Acknowledgement from Stakeholder	Summary of Stakeholder Submission	Relevant Chapter/Section of this EIAR
Development Applications Unit	EIS Scoping Report was received and acknowledged by the DAU, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.	None	Not applicable.
Environmental Health Service (EHS)	EIS Scoping Report was received and acknowledged by EHS.	The Environmental Health Officer is satisfied that the EIS Scoping Report outlines and identifies environmental issues to be examined which are of concern to this department.	Not applicable.
Environmental Protection Agency (EPA)	Yes – see next column	The following comments were submitted regarding the remediation option for Kerdiffstown: - Clearly demonstrate why the remediation methods where selected and why alternatives were dismissed;	Chapter 3 The Need for the Proposed Development and Chapter 4 Description of the Proposed Development provides the background, history and need for the Kerdiffstown Landfill Remediation Project, which is under consideration for this EIAR. Chapter 5 Consideration of Alternatives describes the reasonable alternatives which were considered for the remediation and end-use of the Kerdiffstown Landfill site.
		- Planning history should be clearly mapped including current planning status;	The planning history is described separately in the Planning Report to be submitted to An Bord Pleanála. This EIAR will support that planning application.
		- Full history of site investigations should be presented;	A summary of the historical site investigations is provided in Chapter 12 Soils, Geology, Contaminated Land and Groundwater (specifically Section 12.3.1).
		- Description of current emissions using models refine models clearly showing pathway and receptors; - Describe how and why particular parameters were selected and what they show in terms of emissions from landfill; - Forecasting methods used to assess effects on the environment need to be clearly described;	Descriptions of the baseline conditions, the assessment methodology and predicted impacts are provided in Chapters 7 to 17.
		- Odour prevention and management presented clearly;	Odour mitigation measures are discussed Section 7.5. The draft Odour Control Plan (OCP) for the proposed Project will be finalised as part of the overall Construction Environmental Management Plan (CEMP) and formed into an Odour Management Plan as part of the CEMP. A Draft OCP was formulated to inform the design process for this proposed Project and is attached in Appendix A7.7.
		- Noise / vibration sensitive locations and why selected;	The identification of Noise Sensitive Receptor (NSR) locations is described in Section 8.3 and NSRs were chosen as being representative of all receptors in the vicinity of the proposed Project that may be impacts by noise emissions arising from the proposed Project.
		- Construction of pipeline to carry leachate to main sewer shall be included and environmental aspect of the pipeline considered;	The construction of the pipelines to carry leachate and foul water to Johnstown Pumping Station have been included within this EIAR and where potential impacts associated with this construction have been identified they are discussed within Chapters 7 to 17.

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Stakeholder name	Acknowledgement from Stakeholder	Summary of Stakeholder Submission	Relevant Chapter/Section of this EIAR
		- Invasive species locations identified and methods of eradication discussed; - Risk of importing soil to the site, and potential for invasive species spread; and - Invasive species management plan shall be considered.	Invasive species are discussed within Chapter 11 Biodiversity. The requirement to prepare an Invasive Species Management Plan is identified as part of the mitigation measures to control and prevent the spread of invasive species.
		Cumulative impacts of emissions from the facility and proposed works and the inter-relationship of all considered*.	Chapter 18 Environmental Interactions.
Fáilte Ireland	Yes – see next column	Recommend Fáilte Ireland's Guidelines for the treatment of tourism in an EIAR is taken into account in preparing the EIAR. *	Guidelines were considered within the assessment.
Geological Survey Ireland	EIS Scoping Report received and acknowledged by GSI, however, due to lack of resources GSI were unable to comment.	None	Not applicable.
Health Services Executive (HSE)	Yes – see next column	HSE are satisfied that the EIS Scoping report identifies and outlines the environmental issues to be examined which are of concern to the HSE. *	Not applicable.
Inland Fisheries Ireland (IFI)	Yes – see next column	Concerned regarding leachate and surface water management measures. IFI have suggested using their recent guidelines: "Guidelines on protection of fisheries during construction works in and adjacent to waters" (2016). *	A description of the proposed Leachate Management System is provided in Section 4.2.8. A Leachate Management Plan has been prepared and is provided in Appendix A4.4, which provides further detail on the proposals for leachate management. An assessment of potential hydrology impacts is provided in Chapter 13 Water – Hydrology. The IFI guidelines were considered within the assessment.
Inland Waterways Association of Ireland (IWAI) Kildare	Yes – see next column	Concerned about leachate management, Air Quality Impacts during construction phase, contingency planning should Air Quality risk increase during Operational Phase, Noise and Vibration. However, content is substantial and that risk mitigation has been detailed comprehensively. *	A description of the proposed Leachate Management System is provided in Section 4.2.8. A Leachate Management Plan has been prepared and is provided in Appendix A4.4, which provides further detail on the proposals for leachate management. An assessment of potential air quality impacts in both the Remediation Phase and the Operational Phase is provided in Chapter 7 Air Quality, Odour and Climate. An assessment of potential noise and vibration impacts in both the Remediation Phase and the Operational Phase is provided in Chapter 8 Noise and Vibration.
National Transport Authority (NTA)	EIS Scoping Report was received and acknowledged by the NTA.	None	Not applicable.
Office of Public Works (OPW)	EIS Scoping Report was received and acknowledged by the OPW.	None	Not applicable.

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Stakeholder name	Acknowledgement from Stakeholder	Summary of Stakeholder Submission	Relevant Chapter/Section of this EIAR
The Heritage Council	EIS Scoping Report received and acknowledged by The Heritage Council, however, due to lack of funding were unable to comment.	None	Not applicable.
Transport Infrastructure Ireland	Yes – see next column	The Authority advised they are not in a position to engage directly with the process but uphold official policy and guidelines in the Spatial Planning and national roads Guidelines for Planning Authorities and to the relevant TII guidance available. *	

* The full submission from these stakeholders can be found in Appendix A6.2.

6.5 Consultation Feedback

In addition to the above EIA Scoping stakeholder consultation letter, there was an Environmental Impact Assessment public consultation day held on Tuesday 7 March 2017 from 18:00 to 21:30 in Lawlor's Hotel, Poplar Square, Naas, Co. Kildare. A formal presentation was given between 18:30 and 19:30 covering all aspects of the Environmental Impact Assessment process, with informal interaction and Questions and Answers before and after the presentation. The event was advertised on the Kerdiffstown website and local residents and individuals were issued with invites. The aim of this event was to elicit views from the public and local residents and/or groups on the environmental Impact Assessment process being undertaken as part of the Kerdiffstown Landfill and how it fits into the preparation of a planning application.

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The event was well attended by local residents and elected officials, with over 20 individuals attending the presentation and/or the evening. The general feedback was positive and there were discussions with the Project Team regarding capping, permeability and impact on local roads.

Consultation in its various forms has been undertaken throughout the EIA process as outlined in this Chapter. Feedback, information and queries arising in the course of these consultations were regularly disseminated to the project team. This has ensured that the concerns of the public, stakeholders and prescribed bodies have continually fed into the project development. Where possible and appropriate, the preliminary outline design and proposed mitigation measures have been refined with public and stakeholder concerns taken into consideration. The early engagement with the public and key stakeholders has allowed sufficient time for concerns to be addressed in the EIA process.

6.6 Ongoing Consultation

The Kerdiffstown Project Team will continue to engagement with key stakeholders and the public. In addition, the project website (http://www.kerdiffstowncleanup.ie/) will be kept up to date with project news, community updates and Press Releases.

Outside of formal consultation events, the Kerdiffstown Project Team has met with key stakeholders, to inform them of project progress. These meeting were as follows:

- Kerdiffstown Landfill CLG, 19 October 2016; and
- Elected members of the Naas Municipal District Council, 15 November 2016.

The feedback from these events has generally been very positive in relation to the progress of the project and the development of the outline design for the remediation of the site and development of the multi-use public park.

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Press Releases are posted on the website to further encourage stakeholders and the public to engage with the Kerdiffstown Project Team. Examples of the Press Releases are as follows:

- 30 May 2016 – Future use public consultation ends
- 21 October 2016 – Kerdiffstown clean-up project progressing
- 15 November 2016 – Community update 20 – A park for Kerdiffstown
- 1 March 2017 – Community Update 21 – Public Consultation on Environmental Impact Assessment

This ongoing engagement has encouraged further submissions from stakeholders. Submissions received as part of this ongoing and continued consultation process have reaffirmed support for the multi-use public park and associated amenity, in particular for the playing pitches and a submission acknowledging that Kildare County Council have taken suggestions on board while refining the outline design of the multi-use public park.

Kildare County Council are committed to continuing engagement with key stakeholders and the public after the planning application for the proposed Project has been submitted, and will continue to address any issues or concerns raised by the public through to the proposed Remediation Phase for the project. The project website will continue to be kept updated and function as an information point through the various stages of the statutory approvals process (e.g. statutory consultation and oral hearing).

During the Remediation Phase Kildare County Council will appoint a KCC Site Manager. The KCC Site Manager will be the first point of contact for public enquiries and be responsible for monitoring complaints, providing project up-dates and addressing any issues or queries as they arise.

In addition, the key stakeholder's groups will continue to be updated on the project progress and the Kerdiffstown Project Team will offer site visits to interested individuals.

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7. Air Quality, Odour and Climate

This Chapter assesses the potential air quality, odour and climate impacts which may be generated during the Remediation and Operational Phases of the proposed Project. The principal Remediation Phase air quality and odour impacts will be primarily associated with dust emissions due to re-profiling and demolition works, landfill gases and odour emissions associated with re-profiling and earth moving activities and transport emissions. Transport associated with the import of material will also contribute to air emissions through the generation of dust and vehicle emissions and there will also be emissions associated with operation of landfill gas flares. The potential air quality impacts associated with the Operational Phase of the proposed Project arise primarily as a result of the landfill gas management system that will manage the landfill gas from the former landfill.

An air dispersion modelling assessment was carried out to determine the potential for impacts on air quality as a result of the proposed Project, particularly from the flare and the back-up flare which will be present on site. The impact assessment found that the highest potential for impact to air quality and odour was related to the disturbance of waste during demolition and site re-profiling works during remediation. However, all impacts were assessed as being short-term. With the implementation of appropriate dust and odour control measures and the appropriate phasing of the remediation works, the Remediation Phase of the proposed Project is not predicted to cause any significant impacts.

The air dispersion modelling carried out to predict the Operational Phase impacts of the proposed Project concluded that there would be no exceedances of the air quality standards caused by the operation of the on-site flare. During the Operational Phase of the proposed Project odour will be reduced by the extensive network of landfill gas extraction and venting systems and the proposed new landfill gas flare (and back-up flare if required) which will convert landfill gas into harmless substances. The results of the modelling undertaken for this impact assessment have shown that no odours shall be detectable as a result of emissions from the flare during the Operational Phase.

The completion of the proposed Project will result in considerable environmental improvements arising from the improved control of landfill gases and odours generated from the waste.

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7.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as “the proposed Project”) on air quality, odour and climate which are anticipated to occur during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950’s until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children’s playground, etc. and management of the site as a remediated landfill. Table 7.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed

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Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

Table 7.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of the surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation can be found in Chapter 4 Description of the Proposed Project.

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The assessment focuses on the key pollutants emitted to air from the landfill site as these are the emissions of concern in relation to the proposed Project. The pollutants potentially emitted from the proposed Project include methane, carbon dioxide, nitrogen oxides and trace gases; the trace gases are typically linked with the odours that are characteristic of landfill gas emissions.

7.1.1 Fundamentals of Air Quality and Odour

Good air quality is essential in order to protect human health, vegetation and ecosystems. In general air quality in Ireland is of a high standard across the country and is among the best in Europe. This is largely due to the prevailing clean Atlantic air and a lack of large cities and heavy industry. Air quality is usually judged in terms of the levels of various pollutants present in the air. The EPA manages the Irish national ambient air quality monitoring network, measuring the levels of a number of atmospheric pollutants including:

- Ozone – A natural component of the atmosphere. Exposure to high concentrations of ozone in the troposphere (the layer of atmosphere next to the earth) can cause detrimental health impacts;
- Carbon monoxide – The principal source of carbon monoxide in Ireland is from traffic sources and if absorbed into the bloodstream carbon monoxide can have harmful effects;
- Nitrogen dioxide and nitrogen oxides – The main source of nitrogen oxides in Ireland is emissions from traffic along with industry and electricity generating stations. Nitrogen dioxide can cause cellular damage.
- Sulfur dioxide – The main source of sulfur dioxide in Ireland is from fuel burning including oil and coal and it can cause damage to the throat and lungs.

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- Particulate matter – these are small particles including dust from sources including combustion both in vehicles and industry as well as emissions from soil and road surfaces and these particles can be inhaled causing damage.

The results of the monitoring programme demonstrate that air quality in Ireland is generally excellent throughout the country.

Odour is another indicator of air quality that is of interest in terms of the proposed Project. Odour is the property of a substance that activates the human sense of smell. The human olfactory system is highly sensitive and as such is capable of detecting extremely low concentrations (fractions of a part per billion) of a wide range of odorous chemicals.

Offensive odours can have impacts on the health and well-being of humans, especially if one is subjected to the odour for extended periods of time. At sufficiently high concentrations odorous compounds may have a direct effect on human health. Also, an individual's health may suffer indirectly due to stress associated with odour impact. The gases that are typically linked with the odours that are characteristic of landfill gas emissions and include VOCs, hydrogen sulfide and sulfur dioxide.

As a result of natural biodegradation of waste which was deposited in the landfill during operation, gases are formed which have the potential to impact on air quality, odour and climate. The current control measures currently in place to manage the gases and odours are described in Section 3.7 of this EIAR where it is noted that the control measures are maintaining a stable environmental condition but are insufficient to fully mitigate the risks posed by Kerdiffstown Landfill to the environment, as well as public health and safety into the future. There is therefore a need to remediate the site and the impact of the proposed remediation project on air quality and climate is assessed in this Section of the EIAR.

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The substances that are potentially emitted from the landfill arise as a result of the decomposition of waste and the management of the gases that are produced by the decomposition. The principal sources of gases and their potential release mechanisms are summarised as follows:

- Fugitive emissions of gases and odours from the surface of the landfill, mainly the uncapped areas; and
- Emissions of gases from the landfill gas flares and management infrastructure.

The management of landfill gas at the site is discussed in Chapter 12 Soils, Geology, Contaminated Land and Groundwater. Landfill gas is currently managed by an active gas extraction system through a network of extraction wells in two areas of the site, the lined cell (Zone 3) which cover the majority of the waste in this zone, and the north-western section (Zone 1) where only approximately a quarter of the waste has gas well coverage. The extracted gas is burned in a high temperature gas flare. There are two flares currently on site, one with capacity 250m^3/hr and the second with capacity 500m^3/hr. Currently all extracted gas is being directed to the "250 flare" located in Zone 1, with the "500 flare" acting as standby. Landfill gas is directed to the flare for combustion of the flammable constituents, particularly methane and to control odour nuisance and adverse environmental impacts.

Due to the risks posed by landfill gas and the location of sensitive receptors in proximity to the site (as shown on Figure 12.32) a Landfill Gas Management Plan (Appendix A4.5) has been developed to ensure that the landfill gas is appropriately controlled and managed according to the specific features and risks associated with each Zone. The Landfill Gas Management Plan as summarised in Figure 4.18 describes a system of in-waste gas extraction wells which are actively extracted with the gas burned in a new flare and perimeter gas venting trenches (adaptable to active extraction system if required) in areas where low levels of gas generation have been identified. The existing 250 flare and the back-up 500 flare will continue to operate throughout much of the Remediation Phase and the flares will be moved around the site to reduce emissions and odour if observed during the works. A new 600m^3/hr ("600 flare") will be installed in the Landfill Infrastructure Compound during the Remediation Phase as shown in Figure 4.13.and is anticipated to commence operation in Phase 5 with a 250m^3/hr backup flare.

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7.2 Methodology

7.2.1 Study Area

The site of the proposed Project, is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The land uses in the immediate vicinity of the proposed Project are land associated with Kerdiffstown House to the north-east, golf courses to the north and north-east, and a mixture of land uses including residential, agricultural and worked out quarries to the south-east, south-west and west. Potential air quality impacts associated with the proposed Project are predicted to be at their most significant close to the site, but some impacts could be experienced up to 2 – 3km from the proposed Project. The study area is dependent on the nature of the site, the proposed Project and the potential air quality impacts which could arise and is determined by dispersion modelling. Air quality and climate impacts of the proposed Project on receptors which could potentially be affected by the proposed Project are considered in this Section of the report. The receptors located closest to the site and potentially impacted by the emissions are shown in Figure 7.1.

7.2.2 Air Quality and Odour Impact Assessment Methodology

General Impact Assessment Approach

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The general approach to the impact assessment involves the identification and characterisation of the air quality and odour impacts that may be associated with the proposed Project, characterisation of the receiving environment to benchmark the existing situation, quantitative prediction of air quality impacts and assessment of the impacts against recognised Air Quality Standards and Guidelines. From this assessment comes a definition of the Management Plans and mitigation measures that are required to ensure that all aspects of the impacts of the proposed Project through the Remediation and Operational Phases are managed and controlled to protect human health, the environment and amenity.

The approach to the assessment of air quality impacts is described in the following Sections:

(i) The receiving environment is characterised in terms of baseline air quality and meteorological conditions which have the potential to influence the dispersion of pollutants and therefore the air quality impact of the proposed Project. The baseline air quality has been established by means of up-to-date surveys of existing air quality at the proposed Project and considers all of the available baseline data in describing the baseline air quality. Meteorological conditions at the proposed Project are described by reference to the comprehensive data available for Casement Aerodrome located approximately 14.7km from the centre of the proposed Project.

(ii) The likely and possible air quality impacts of the Remediation and Operational Phases of the proposed Project are identified.

(iii) A quantitative assessment of the potential air quality impacts of the proposed Project has been carried out and the results of the assessment are benchmarked against Air Quality Standards and Guidelines formulated for the protection of human health, amenity and the environment. The magnitude of potential air emissions is determined using a variety of techniques which include the data from previously completed and newly completed monitoring surveys, the Institute of Air Quality Management *"Guidance on the assessment of dust from demolition and construction" (IAQM 2014),* and the Institute of Air Quality Management *"Guidance on the assessment of odour for planning" (IAQM 2014).* A dispersion modelling assessment has been carried out using the US EPA AERMOD modelling suite to assess the impact of emissions to atmosphere from the flares and to confirm the optimum location of the flares on site and optimum stack height to promote effective dispersion of the emissions.

(iv) The overall air quality impact of the proposed Project is evaluated with particular emphasis on assessing the duration and extent of potential impacts as well as the longer term benefits associated with the completed

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remediation programme. Particular attention is paid to the identification of sensitive receptors in the area and an evaluation of potential impacts on these receptors.

The assessment of air quality and odour has been carried out in accordance with the following guidance and has been tailored to this site and the proposed Project based on professional judgement and local circumstance:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- The Institute of Air Quality Management "Guidance on the assessment of dust from demolition and construction" (Institute of Air Quality Management January 2014); and
- The Institute of Air Quality Management "Guidance on the assessment of odour for planning" (Institute of Air Quality Management May 2014).

The effects of the proposed Project are described by considering the possible impacts that could occur as a result of the proposed Project, the probability of their occurrence and the nature and significance of such impacts. The EPA *Revised Guidelines on the Information to be Contained in Environmental Impact Statements* (2015) are draft Guidelines which take account of the revised EIA Directive (2014/52/EU) and which have been considered in this assessment. Impacts are described in the draft Guidance under various headings which are summarised as follows:

- Probability – likely, possible, unlikely;
- Quality – positive, neutral, negative;
- Significance - imperceptible, not significant, slight, moderate, significant, very significant, profound; and
- Magnitude – extent, duration, frequency, context.

A description of the significance of effects is presented in Table 7.2 which shows the approach taken to quantify the significance and magnitude of potential air quality and odour impacts.

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Table 7.2: Describing the Significance and Magnitude of Environmental Effects

Aspect	Description
Significance of Effects	
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics.
Magnitude of effects	
Extent	This is described by the size of the area, the number of sites and the proportion of the population affected by the effect.
Duration	**Momentary effects** last seconds to minutes.
	Brief effects last less than a day.
	Temporary effects lasting less than a year.
	Short-term effects last from one to seven years.

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Aspect	Description
	Medium-term effects last from seven to fifteen years.
	Long-term effects last from fifteen to sixty years.
	Permanent effects last over sixty years.
Frequency	How often the effect will occur.
Context	The contextual relationship between the effect and the existing baseline.

Remediation Phase Impact Assessment Methodology

There are emissions to atmosphere of gases and odours from the landfill in its current condition, and these substances and others will continue to be emitted during the Remediation Phase. In order to ensure that the impact of these emissions is managed, the magnitude of the potential impact is assessed and a Management Plan is formulated from the findings of the assessment. The principal air quality impacts that may arise during the Remediation Phase of the proposed Project arise as a result of emissions to atmosphere of dust, particulate matter, VOCs, landfill gases and odours. The Remediation Phase impact assessment methodology is summarised here.

'Guidance on the assessment of dust from demolition and construction activities' was published in 2014 by the Institute of Air Quality Management. This Guidance describes a five-step approach to the assessment which is summarised as follows.

(i) Screen the proposed Project to determine if there is a requirement for a more detailed assessment.
(ii) Assess the risk of dust impacts for each of the four activities (demolition, earthworks, construction and construction traffic) and take account of the scale and nature of the works, and the sensitivity of the area.
(iii) Determine the site-specific mitigation for each potential activity.
(iv) Examine the residual effects and determine whether or not these are significant.
(v) Prepare the dust assessment report.

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This approach has been applied in this assessment. A detailed assessment is required when there are human receptors within 350m of the boundary of the proposed Project and since the closest human receptors to the proposed Project boundary are within this distance, a detailed assessment is required. There are no European sites or designated sites within 50m of the site boundary which is the threshold distance for ecological sensitivity, so there are no significant Remediation Phase air quality and odour impacts predicted for ecological sites associated with the proposed Project. The Guidance advises that most projects will require a detailed assessment to ensure that the approach adopted is conservative, and therefore a detailed assessment has been carried out in this study.

The potential impact of emissions of landfill gases and VOCs from the landfill gas flares during the Remediation Phase was assessed using a computerised Dispersion Model to evaluate the impact of emissions to atmosphere on ambient air quality. The results of the assessment were compared with benchmarks, discussed in Section 7.2.5. The assessment of impact significance is based on a comparison of predicted impacts with air quality standards and guidelines, and consideration of the magnitude and duration of the potential impact. A more detailed description of the methodology for the dispersion modelling is presented in Section 7.2.4.

Odour impacts are also possible during some elements of work in the Remediation Phase. The Institute of Air Quality Management *"Guidance on the assessment of odour for planning"* was published in 2014 and offers some guidance on the assessment of odour for projects such as that proposed here. This Guidance is especially suitable for the assessment of the temporary impacts which could arise during the Remediation Phase which is of limited duration. The Guidance recommends a number of key stages in the odour impact assessment process as follows, and this methodology was adopted for the odour impact assessment study reported here:

a) The magnitude of the potential odour emissions from all sources is identified;
b) Sensitive receptors are identified and classified according to their relative sensitivity;
c) The magnitude of the odour impact on receptors is identified; and

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d) The significance of the effect is assessed as either 'significant' or 'not significant'.

Operational Phase Impact Assessment Methodology

The completion of the proposed remediation of the landfill will result in considerable environmental improvements arising from the improved control of gases and odours generated from the decomposing waste. These improvements include better containment and capture of the gases and odours and therefore reduced levels of emissions. After completion of the Remediation Phase, emissions to atmosphere of gases and odours will still occur but at reduced levels and in a controlled manner thereby minimising odours and air quality impacts. The proposed Project will involve engineering works as described in Section 4.2 and Section 4.3 that lead to better containment and capture of gases and odours. The gases will be collected in the landfill gas management infrastructure and emissions to atmosphere will no longer be uncontrolled fugitive losses from the landfill surface. Instead, the gas will be contained, collected and burned in the new landfill gas flare. There will be some controlled emissions from passive vent systems where the gas concentrations are low and where such emissions will not lead to detectable odours.

The principal air quality and odour impacts that may arise during the Operational Phase of the proposed Project arise as a result of emissions to atmosphere of VOCs, landfill gases and odours from the landfill gas flares. The assessment methodology adopted for the assessment of the impact of these emissions is summarised here.

The potential Operational Phase impacts have been evaluated by means of a dispersion modelling study to evaluate the potential impact of emissions to atmosphere from the landfill gas flares. This type of study involves use of a computerised Dispersion Model to evaluate the impact of emissions to atmosphere during the Operational Phase on ambient air quality. The results of the assessment have been compared with benchmarks, discussed in Section 7.2.4. The assessment of impact significance is based on a comparison of predicted impacts with air quality standards and guidelines, and consideration of the magnitude and duration of the potential impact.

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7.2.3 Climate Impact Assessment Methodology

This Section of the EIAR assesses the potential climate impact of the proposed Project by comparing the total emissions of Greenhouse Gases (GHG) with those that would occur if the site was left as it is. The Climate Action and Low-Carbon Development Act 2015, which provides for new arrangements aimed at achieving transition to a low-carbon, climate-resilient and environmentally sustainable economy by 2050, requires that Kildare County Council consider and reduce their carbon footprint in all aspects of the activities they undertake. This assessment provides information on how the proposed Project considers this objective in the selection of the preferred remediation option for the landfill site.

The principal GHG emissions associated with the landfill and the proposed Project are methane and carbon dioxide (CO_2). The main sources of these emissions for the current site and proposed Project are summarised as follows:

- Emissions resulting from the energy use of existing and new site buildings;
- Emissions resulting from the energy use of on-site plant and equipment;
- Fugitive emissions of methane within landfill gas (CO_2 fugitive emissions, or CO_2 from flared methane are considered to be short-cycle carbon)
- Embodied emissions resulting from the use of materials for construction of additional infrastructure;
- Emissions resulting from transport of materials to and off-site; and,
- Carbon savings resulting from sequestration from reinstated land cover.

For the purposes of this assessment the proposed remediation of the site is compared with an essentially un-remediated site baseline i.e. a *Do Nothing* scenario. Therefore, two scenarios have been assessed as follows:

Scenario 1 – Do Nothing

In this scenario, the landfill site will not be remediated, and all the gas generated in the waste body is released as fugitive emissions.

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Scenario 2 – *In-situ* remediation of the proposed Project

In this scenario the proposed Project is assessed. Wherein this scenario, the waste remains in place, with waste re-profiling or waste excavation / movement minimised. The site will be capped thereby reducing diffuse landfill gas emissions. Gas extraction will occur from the areas of the site where this is required.

The assessment estimates the total GHG emissions from direct and indirect activities associated with the proposed Project. Annual emissions as well as overall emissions over the lifetime of the project (set at 32 years in line with the 2013 SKM Enviros Phase 1 Preliminary Life Cycle Assessment (LCA)) are determined. The assessment is presented in terms of tonnes of CO_{2e} i.e. the equivalent tonnage of carbon dioxide from all the various sources. While there are some uncertainties, the assessment allows a reliable comparison of the Climate Impact of the proposed Project relative to the Do Nothing scenario.

The Phase 1 Preliminary Life Cycle Assessment (LCA) of the remediation and potential end-use scenarios at the site, "*Kerdiffstown Landfill Outline Life Cycle Assessment, 2013*", is included in Appendix A7.8. The assessment looked at the overall impact of the various possible remediation scenarios which were under consideration at that time, including different quantities and types of GHG that could be emitted over the lifetime of the landfill against a Do Nothing scenario.

Since the detailed remediation design proposals were not available at that time, the 2013 assessment made various assumptions about work plans and timescales for remedial works as well as the overall GHG emissions estimates associated with various remedial options. The 2013 LCA Report presented a model of the site, with variables that can be adjusted to model different scenarios, using standard emission factors applicable for Ireland or the UK. The model was used initially to produce a relative ranking of the options that were being considered for the site, and the same Model is used here to refine the assessment based on the current design of the proposed Project.

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A range of potential end-use options were considered during the initial assessment, including (a) medium to high density mixed use development; (b) completion of the site in accordance with previous planning permissions and restoration proposals, and; (c) some form of passive amenity function/open space end-use. The emissions from the remediated site would be essentially the same regardless of the final end-use design details since no high intensity or industrial uses are envisaged.

The assessment is based on the site conditions and considers the existing landfill gas generation and flaring rates, current leachate removal volumes etc. and modelled projections for the future requirements of the proposed Remediation Project. A Landfill Gas Management Plan (Appendix A4.5) has been completed for the site using GasSim for the 'Source Term' module to determine the quantity of landfill gas generation over time based on the mass of waste deposited and the composition of the waste, and outputs from this Model were incorporated into this assessment. In addition, details of the proposed Project relating to the likely import and export of materials and associated traffic movements were also considered.

7.2.4 Dispersion Modelling Methodology

A detailed dispersion modelling assessment was undertaken using the US EPA Model AERMOD and the current regulatory version of this Model (Version 16216r). The model computes average ground-level concentrations of pollutants emitted from emission sources at the facility which allows the impact of the emissions to be evaluated. A summary of the steps involved in the assessment is presented as follows:

(i) Characterise the receiving environment through detailed analysis of background air quality data that is representative of the area; this is described in Section 7.3.

(ii) Determine appropriate criteria for evaluating the significance of air quality impacts through reference to Air Quality Standards and Guidelines; this is described in Section 7.2.5.

(iii) Describe the emissions in quantitative terms and describe the Operating Conditions that will affect the emissions; this is described in Section 7.4.1 for the Remediation Phase and Section 7.4.3 for the Operational Phase.

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(iv) Predict the potential air quality impacts using a dispersion model; this has been executed as described here and the results are presented in Section 7.4.1 for the Remediation Phase and Section 7.4.3 for the Operational Phase.

(v) Assess the impact by comparing the calculated levels against the adopted assessment criteria.

Information on a number of input variables is required for the dispersion model as follows:

- Emissions characteristics;
- Site layout and topography;
- Receptor locations;
- Meteorological data; and
- Baseline air quality.

The Environmental Protection Agency *"Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)"* (EPA 2010a) gives guidance on the use of Dispersion Models which was followed in the execution of this study. A more detailed description of the methodology and the various input data sets are presented in Appendix A7.1.

7.2.5 Impact Assessment Criteria

Air Quality Standards in Ireland have been defined to ensure compliance with EC Directives; they are developed at different levels for different purposes. European legislation on air quality has been framed in terms of two categories, limit values and guide values. Limit values are concentrations that cannot be exceeded and are based on World Health Organisation (WHO) guidelines for the protection of human health. Guide values are set as long-term precautionary measures for the protection of human health and the environment. The WHO guidelines differ from EU air quality standards in that they are primarily set to protect public health from the effects of air pollution, whereas Air Quality Standards are recommended by governments, and other factors such as socio-economic factors, may be considered in setting the standards.

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The air quality standards and guidelines referenced in this report are summarised in Table 7.3 to Table 7.5. These criteria were chosen to ensure that the potential impacts of the proposed Project during both Remediation and Operational Phases may be benchmarked against appropriate standards. There are no national or European Union air quality standards with which dust deposition can be compared. However, a figure of 350 mg/m^2-day based on the German Standard TA Luft Regulations is commonly applied by Local Authorities and the EPA to ensure that no nuisance effects will result from specified industrial activities.

The EPA Guidance Note "*Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)"* (E Porter & E Collins, 2010; http://www.epa.ie/pubs/advice/air/emissions) which includes guidance on appropriate odour Standards against which odour emissions may be evaluated is the most widely used Guidance in Ireland for assessments of this type. This Guidance recognises that the exposure of the population to odour is assessed based on the odour concentration as well as the length of time that the population may perceive the odour. By definition, 1 odour unit per cubic metre (OU_E/m^3) is the detection threshold of 50% of a qualified panel of observers working in an odour-free laboratory using odour-free air as the zero reference, and standards are defined relative to this benchmark.

The EPA has issued guidance specific to intensive agriculture which sets target values for odour for pig-production units of 1.5 to 6.0 OU_E/m^3 as a 98 percentile of 1-hour averaging periods. Guidance from the UK Environment Agency *"H4 Odour Management"* (Environment Agency 2011) recommends that odour standards should vary from 1.5 – 6.0 OU_E/m^3 as a 98 percentile of 1-hour averaging periods at the worst-case sensitive receptor based on the offensiveness of the odour and with adjustments for local factors such as population density. Specifically, for wastewater treatment plants, the UK Guidance specifies a benchmark of 1.5 OU_E/m^3 as a 98 percentile of 1-hour averaging periods. Guidance from New Zealand is based on consideration of the sensitivity of the receiving environment rather than the offensiveness of the odour and specifies odour criteria of 1.0 – 10.0 OU_E/m^3 for the 99.9 to 99.5 percentile of 1-hour average ground level odour concentration, with target specifications of 1.0 to 2.0 OU_E/m^3 for high sensitivity receiving environments. Similar guidance from Europe, especially the Netherlands, sets comparable performance criteria.

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The target specification is to ensure that there is no odour nuisance beyond the site boundary. Targets for odour nuisance vary as outlined above but there is a general consensus that the target performance specification for the 98 percentile of 1-hour average concentration should be 1.0 OU_E/m^3. Due to the location of residential properties in the vicinity of the proposed Project, it is considered appropriate to specify a stringent Performance Standard of 1.0 OU_E/m^3 for the 98 percentile of 1-hour average concentration in order to assess the potential for odour nuisance at site boundaries.

Table 7.3: Air Quality Impact Assessment Criteria

Pollutant	EU Regulation	Limit Type	Value
Dust deposition	None	Limit over 28 – 30 days	350 mg/m^2-day
Odour	None	Hourly limit for prevention of nuisance – not to be exceeded more than 176 hours per year (98 percentile)	1 OU_E/m^3

There are no formal Air Quality Standards defined for the emissions of VOCs from landfills. Guidance from the EPA defines Trigger Values which represent thresholds that require certain actions to be taken if achieved or exceeded. Trigger values for VOC emissions from landfill are specified in the "*EPA Air Guidance Note 6 (AG6) Surface VOC Emissions Monitoring on Landfill Facilities"*, 2010. This states that in relation to surface emissions from the waste body and identified features, the following shall constitute a trigger level:

- VOC greater than or equal to 50 parts per million by volume (ppmv) average over capped area; or,
- VOC greater than or equal to 100 ppmv instantaneous reading on open surfaces within the landfill footprint; or,
- VOC greater than or equal to 500 ppmv around all identified features.

These Trigger Values are a useful benchmark for evaluating the significance of diffuse emissions from the surface of the landfill.

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The Clean Air for Europe (CAFE) Directive (Council Directive 2008/50/EC) sets out limit and target values for named air quality parameters and it was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). The 4th Daughter Directive, which also defines limit values for pollutants, was transposed by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009). This Directive and the Irish Regulations set out the main standards against which the potential impact of aspects of the proposed Project on air quality are assessed. These standards are summarised in Table 7.4.

In addition to the Air Quality Standards Regulations and the Directive Standards, it is also appropriate to consider the WHO Guidelines. These guidelines were developed by the WHO to provide appropriate air quality targets worldwide, based on the latest health information available. The air quality guidelines for particulate matter (PM_{10}), nitrogen dioxide and sulfur dioxide, and $PM_{2.5}$ are considered in this report (WHO, 2005; updated in 2008). While the WHO Guidelines are not mandatory, they represent current informed opinion on the levels to which we should be aspiring in order to minimise the adverse health impacts of air pollution. The WHO air quality standards and guidelines referenced in this report are summarised in Table 7.5.

Table 7.4: Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011; based on EU Clean Air for Europe [CAFE] Directive 2008/50/EC)

Pollutant	EU Regulation	Limit Type	Margin of Tolerance	Value
Nitrogen dioxide	2008/50/EC	Hourly limit for protection of human–health - not to be exceeded more than 18 times/year	None	200 $\mu g/m^3$ NO_2
		Annual limit for protection of human health	None	40 $\mu g/m^3$ NO_2
		Annual limit for protection of vegetation	None	30 $\mu g/m^3$ $NO + NO_2$

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Pollutant	EU Regulation	Limit Type	Margin of Tolerance	Value
Sulfur dioxide	2008/50/EC	Hourly limit for protection of human–health - not to be exceeded more than 24 times/year	150 µg/m^3	350 µg/m^3
		Daily limit for protection of human–health - not to be exceeded more than 3 times/year	None	125 µg/m^3
		Annual & Winter limit for the protection of human health and ecosystems	None	20 µg/m^3
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human–health - not to be exceeded more than 35 times/year	50%	50 µg/m^3
		Annual limit for protection of human health	20%	40 µg/m^3
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health (Stage 1)	20% from June 2008. Decreasing linearly to 0% by 2015	25 µg/m^3
		Annual limit for protection of human health (Stage 2)	None To be achieved by 2020	20 µg/m^3
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m^3 (8.6 ppm)
Benzene	2008/50/EC	Annual limit for protection of human health	0% by 2010	5 µg/m^3

Table 7.5: WHO Air Quality Guidelines

Pollutant	Limit Type	Value
Nitrogen dioxide	Hourly limit for protection of human health	200 µg/m^3 NO_2
	Annual limit for protection of human health	40 µg/m^3 NO_2
Sulfur dioxide	Daily limit for protection of human health	20 µg/m^3
	10-minute limit for protection of human health	500 µg/m^3
Particulate Matter (as PM_{10})	24-hour limit for protection of human health	50 µg/m^3
	Annual limit for protection of human health	20 µg/m^3
Particulate Matter (as $PM_{2.5}$)	24-hour mean for protection of human health	25 µg/m^3
	Annual mean for protection of human health	10 µg/m^3

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7.3 Baseline Conditions

7.3.1 Meteorological Conditions

The magnitude of potential impacts of the proposed Project on air and climate will largely be influenced by the local meteorological conditions, in particular by wind speed and direction and by precipitation rates. An evaluation of the climatic conditions at the site is therefore useful for an assessment of the type required for the proposed Project.

Met Éireann operate a Synoptic Network of weather stations at Belmullet, Malin Head, Rosslare (closed since 2008), Johnstown Castle, Birr, Clones, Kilkenny and Mullingar while the Aviation Division of Met Éireann maintains observing stations at Shannon Airport, Knock Airport, Casement Aerodrome, Dublin Airport and Cork Airport. There is no long-term continuous meteorological monitoring at the proposed Project site but the general guidance on selection of meteorological data for air quality impact assessments is to choose representative data, recently acquired, which best represents conditions at the site. At least three years of recently acquired data is preferred. Comprehensive monitoring data is available for Casement Aerodrome (located approximately 14.7km from the centre of the proposed Project) which would be indicative of the meteorological conditions that are experienced at the proposed Project. Therefore, for the purpose of obtaining reliable information about the

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climatological conditions at the site of the proposed Project, a full set of 3 years' meteorological data for the period 2013 – 2015 recorded at Casement Aerodrome was analysed. This is considered an appropriate data set for the study because of the close proximity of the station to the site and the similarity in topography in the immediate area of both Casement Aerodrome and the site of the proposed Project.

Wind speed and direction in particular are important in determining how emissions associated with the activity are dispersed. The prevailing wind direction determines which areas are most significantly affected by the emissions from the activity and wind speed determines in part the effectiveness of the dispersion of the emissions. The windroses for Casement Aerodrome are presented in Diagram 7.1 for each of the years 2013 – 2015. The dominant wind direction is from the south-west quadrant. The wind speed is below 5.14 metres per second (m/s) for just under 50% of the time. The average long-term wind speed over the period 1985 – 2010 is 5.5m/s.

Meteorological conditions at the site of the proposed Project were monitored during 2016 and a summary of the data for the period January to 6 October 2016 is presented in Table 7.6. The average wind speed recorded at the on-site station was 3.3m/s with wind speeds less than 5.14m/s for 77% of the time. The dominant wind direction was from the south-west quadrant with the wind blowing from this direction 55.6% of the time. The site-specific data compares well with the data from Casement Aerodrome which lends confidence to the selection of data from Casement Aerodrome for this assessment. The base elevation for the anemometer at Casement Aerodrome is 118mOD Malin Head with the anemometer recording at 10m above ground level, whereas the on-site station is located at an elevation of approximately 112mOD Malin Head, with the anemometers recording at 4.5m above ground level. Some differences in wind speed but not direction would be expected for this difference in anemometer height.

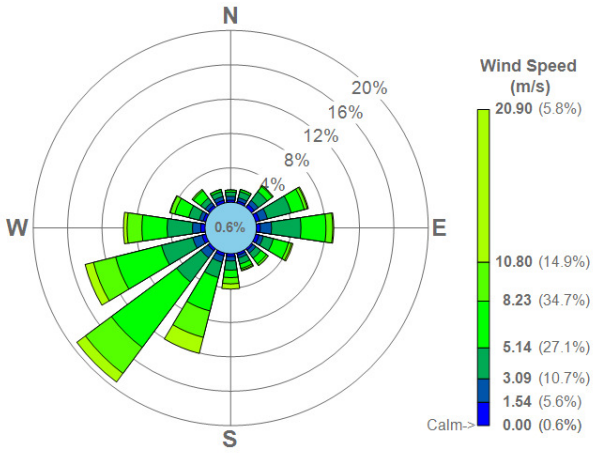
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Table 7.6: On-Site Meteorological Data

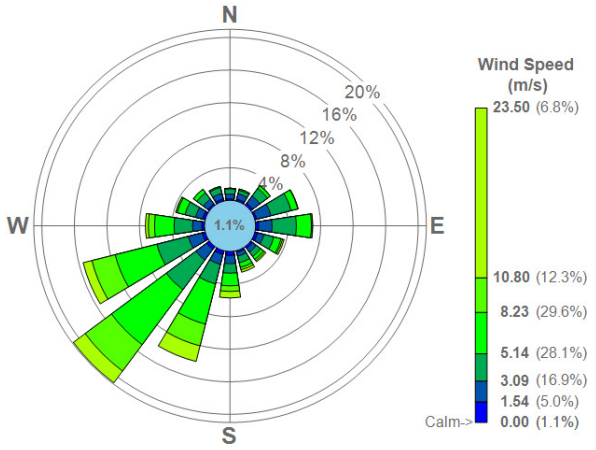
Month	Average wind speed, m/s	Wind Direction SW Quadrant %
January 2016	3.9	77.3
February 2016	Not recorded	Not recorded
March 2016	Not recorded	Not recorded
April 2016	Not recorded	Not recorded
May 2016	3.2	20.6
June 2016	2.2	29
July 2016	3.3	54.9
August 2016	3.8	70.8
September 2016	3.3	81.1
October – December 2016	Not recorded	Not recorded
Average	3.3	55.6

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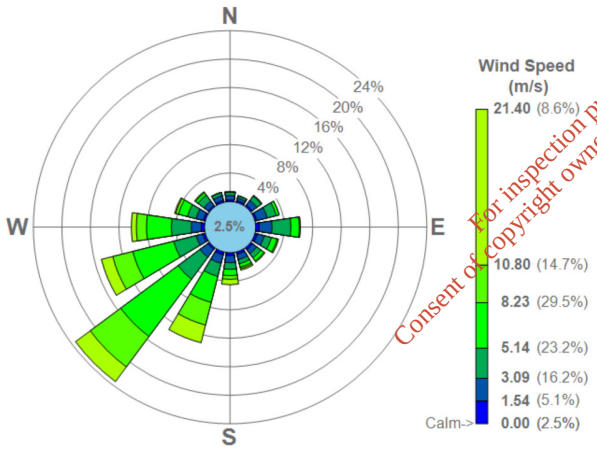
Casement Aerodrome 2013



Casement Aerodrome 2014



Casement Aerodrome 2015



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Annual Average data for Casement Aerodrome 1981 - 2010	
Temperature, °C	9.7
Rainfall, mm	754
Mean num. of days with >= 0.2mm	183
Average wind speed, m/s	5.5

tms environment ltd

TMS Environment Ltd, 53 Broomhill Drive, Tallaght, Dublin 24
Tel: +353-1-4626710

Diagram 7.1

Windroses for Casement Aerodrome 2013 - 2015

Diagram 7.1: Windroses for Casement Aerodrome 2013 - 2015

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7.3.2 Influences on Ambient Air Quality

The existing activities at and in the vicinity of the proposed Project have the potential to exert an influence on ambient air quality by the release of emissions to atmosphere as follows:

- emissions of fine particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO) and carbon dioxide (CO_2) from domestic, commercial and industrial heating;
- emissions of fine particulate matter (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO and benzene from traffic on adjoining roads;
- emissions of fine particulate matter (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO, CO_2 and benzene from air traffic approaching / departing Casement Aerodrome;
- emissions of fine particulate matter (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO and CO_2 from the existing flare;
- Emission of VOCs from the existing flare and/or from the landfill mass; and
- Emissions of trace gases and odour from the existing flare and/or from the landfill mass.

There are a number of facilities located in the Monread Industrial Estate which have been linked in the past with odorous emissions and odour complaints. These facilities are considered to be located too far away from the proposed Project to exert a significant influence on ambient air quality.

The main potential air quality impacts arise as a result of dust and diffuse landfill gas emissions from the current uncapped surface of the landfill site, while secondary potential emission sources include the lined cell (Zone 3) and landfill management infrastructure such as the two existing landfill gas flares and the leachate management infrastructure. While landfill gas contains a complex mixture of substances, the primary constituents are methane, carbon dioxide, nitrogen and trace gases. The trace gases are typically linked with the odours that are characteristic of landfill gas emissions and include VOCs such as fatty acids, hydrogen sulfide and various organo-sulfur compounds such as mercaptans, thiols, and organo-sulfides. VOCs are grouped into methane and other non-methane VOCs (NMVOCs).

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Landfill gas at the proposed Project is currently managed actively by directing extracted gases to the landfill gas flare and passive gas management is achieved through venting. The combustion of landfill gas in a flare converts methane to carbon dioxide and water vapour. Typical emissions from landfill gas flares include carbon dioxide, nitrogen oxides, sulfur dioxide, fine particulate matter, as well as potentially hydrogen chloride and hydrogen fluoride if chlorinated or fluorinated organic trace compounds are present in the gas. Typical emissions from the passive vents include trace gases and odours as noted above.

Overall, the contribution of traffic to air quality is considered to be the most significant influence on air quality in the immediate vicinity of the proposed Project, but all other sources also exert significant influences on air quality and are considered in this assessment.

The main substances which are of interest in terms of existing air quality are sulfur dioxide, nitrogen oxides, particulate dusts including PM_{10} and $PM_{2.5}$ which could originate from combustion sources and traffic. A description of existing levels of the various substances in ambient air is required to allow completion of the evaluation of air quality impacts associated with the proposed Project and is presented in Section 7.3.3.

7.3.3 Existing Ambient Air Quality

Dust and Fine Particulate Matter, PM_{10}

A considerable amount of baseline information has been collected during the period when the landfill site was operating and also in the period 2008 – 2017. The comprehensive database of environmental information provides a detailed statement of the air quality in the vicinity of the proposed Project. The data that is most representative of current baseline conditions at the proposed Project is the most recent environmental monitoring data recorded at the site; this includes two dust deposition rate surveys undertaken in 2016 as well as a survey of fine particulate matter (PM_{10}). When the landfill site was operating and receiving waste, there

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were no controls in place and no landfill gas flares which is significant. The 2016 dust surveys involved measurements carried out over periods of 24 hours for the PM_{10} and 28 days for the dust deposition surveys.

Two dust deposition monitoring surveys were completed during the period 19 August 2016 to 14 October 2016 by Kildare County Council and the results are presented in Table 7.7. The laboratory analysis Certificates for the analysis of the deposited dust are presented in Appendix A7.2. Measurements were carried out at 10 locations shown in Figure 7.2 and as described below in Table 7.8. The survey results are all well within the benchmark standard of 350 mg/m^2-day to ensure that no nuisance effects occur as a result of deposition of dust from emissions. The deposition rate at D1 (located adjacent to Nass Golf Club and L2005 Kerdiffstown Road) is higher than the level recorded at the other monitoring locations but is still well within the levels expected for this type of environment. The average of the measurement data at all of the monitoring locations over the survey intervals was 64.7 mg/m^2-day. These levels are consistent with expectations for the area and indicate that air quality as represented by dust deposition rates is not significantly affected currently by the landfill site. These levels are also broadly similar to the levels found in the surveys carried out in previous years at the site.

Table 7.7: Dust Deposition Survey Results 2016

Monitoring Location	D1	D2	D3	D4	D5	D6	D7	D8	D9
19 Aug - 16 Sept 2016 (mg/m^2-day)	141	89	39	74	53	75	36	86	72
16 Sept – 14 Oct 2016 (mg/m^2-day)	140	46	59	12	33	46	85	36	35

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Table 7.8: Monitoring Locations

Monitoring Location	Description
D1	North-western corner boundary adjacent golf course
D2	Eastern site boundary
D3	Elevated location along southern boundary
D4	Western site boundary
D5	On green area 25m from Kerdiffstown House
D6	Adjacent to Johnstown Garden Centre
D7	Near private residence adjacent site entrance
D8	Western site boundary
D9	South-eastern site boundary
D10	Western site boundary beside site offices

The PM_{10} monitoring data was acquired during the period 8 September 2016 to 20 September 2016 and the results are presented in Table 7.9. Measurements were carried out at 9 locations as shown in Figure 7.2. Measurements were carried out at one location close to the offices (D10) over 8 days, while measurements were also carried out at 8 locations around the boundaries of the proposed Project over 24-hour intervals. Air quality as represented by the measured PM_{10} levels is representative of an unpolluted rural environment, and all of the measurement results are within the prescribed Air Quality Standard of 50 µg/m^3, for the 24-hour average.

Table 7.9: PM_{10} Monitoring Results 2016

Monitoring Location	Measurement Dates		PM10 µg/m3
D1	19/09/16o	20/09/16	4
D2	09/09/16	10/09/16	< 1
D3	13/09/16	14/09/16	2
D4	08/09/16	09/09/16	1
D5	14/09/16	15/09/16	34

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Monitoring Location	Measurement Dates		PM10 µg/m3
D6	15/09/16	16/09/16	12
D7	16/09/16	17/09/16	10
D8	12/09/16	13/09/16	< 1
D10	08/09/16	09/09/16	1.6
D10	09/09/16	10/09/16	0.5
D10	10/09/16	11/09/16	0.5
D10	11/09/16	12/09/16	0.7
D10	12/09/16	13/09/16	1.3
D10	13/09/16	14/09/16	1.1
D10	14/09/16	15/09/16	0.5
D10	15/09/16	16/09/16	0.9

The PM_{10} result obtained at D5 (Kerdiffstown House) was higher than all the other measurement results but within the Air Quality Standard. This monitoring location is located downwind of the landfill site and is in a very sheltered location which might explain the results. A further survey was conducted at D5 from 2 February 2017 to 9 February 2017 and the results are presented in Table 7.10. The results during the second survey are in the range 9 – 35 µg/m^3 and are higher than the levels recorded at the other locations. The survey results, except for two of the measurements at D5, also lie below the Air Quality Standard for $PM_{2.5}$ of 25 µg/m^3 (this limit will reduce to 20 µg/m^3 in 2020) for the annual average. The measurement results are for PM_{10} over 24-hour periods and the $PM_{2.5}$ Air Quality Standard is for the annual average but the comparison is useful for benchmarking and is included for information.

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Table 7.10: PM_{10} Monitoring Results 2017

Monitoring Location	Measurement Dates		PM10 µg/m3
D5	02/02/17	03/02/17	9
D5	03/02/17	04/02/17	14
D5	04/02/17	05/02/17	10
D5	05/02/17	06/02/17	25
D5	06/02/17	07/02/17	14
D5	07/02/17	08/02/17	16
D5	08/02/17	09/02/17	35

Landfill Gases and Volatile Organic Compounds (VOCs)

Landfill gas constituents include VOCs and hydrogen sulfide, organic sulfides and mercaptans generated by the decomposing waste, as well as carbon dioxide, carbon monoxide, nitrogen dioxide and sulfur dioxide potentially present from the existing flare. Levels of many of these substances in ambient air in the vicinity of the facility were determined over a number of monitoring intervals to benchmark existing air quality in the area. The results of the surveys are presented in Table 7.11 and Table 7.12 and the laboratory analysis Certificates are presented in Appendix A7.3.

Table 7.11: NO_2, SO_2 and H_2S Monitoring Results 2016

Monitoring Location	Measurement Dates		NO_2 µg/m^3	SO_2 µg/m^3	H_2S µg/m^3
D1	08/09/16	22/09/16	9.66	< 2.1	< 0.05
	22/09/16	07/10/16	8.34	< 2.3	< 0.03
D2	08/09/16	22/09/16	9.45	< 2.1	0.10
	22/09/16	07/10/16	9.22	< 2.3	< 0.03

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Monitoring Location	Measurement Dates		NO_2 µg/m³	SO_2 µg/m³	H_2S µg/m³
D3	08/09/16	22/09/16	10.20	< 2.1	0.21
	22/09/16	07/10/16	<0.65	< 2.3	0.03
D4	08/09/16	22/09/16	10.26	< 2.1	< 0.05
	22/09/16	07/10/16	Not measured	< 2.3	0.04
D5	08/09/16	22/09/16	10.39	< 2.1	< 0.05
	22/09/16	07/10/16	12.40	< 2.3	< 0.03
D6	08/09/16	22/09/16	26.95	< 2.1	< 0.05
	22/09/16	07/10/16	27.10	< 2.3	0.14
D7	08/09/16	22/09/16	11.53	< 2.1	< 0.05
	22/09/16	07/10/16	Not measured	< 2.3	< 0.03
D8	08/09/16	22/09/16	9.80	< 2.1	< 0.05
	22/09/16	07/10/16	<0.65	< 3.3	0.05
Average			12.9	< 2.2	0.05

Nitrogen dioxide and sulfur dioxide levels are unremarkable and are typical of the levels found in unpolluted rural environments. The survey presents a snapshot of measurement results over a relatively short time period but is a useful additional data set to benchmark existing baseline conditions. Hydrogen sulfide was detected at five of the eight locations but at levels significantly lower than the level which would be detectable as odour. The odour threshold for hydrogen sulfide is 0.47 parts per billion (ppb) (0.7µg/m³) and the level of hydrogen sulfide detected around the proposed Project is significantly lower than this threshold and therefore below the level at which it would result in a detectable odour.

VOCs as represented by benzene, toluene, ethyl benzene and xylenes (BTEX) were also monitored and the results are summarised in Table 7.12. The concentration of each substance was either below the limit of detection for the technique or at low levels typical of similar unpolluted environments.

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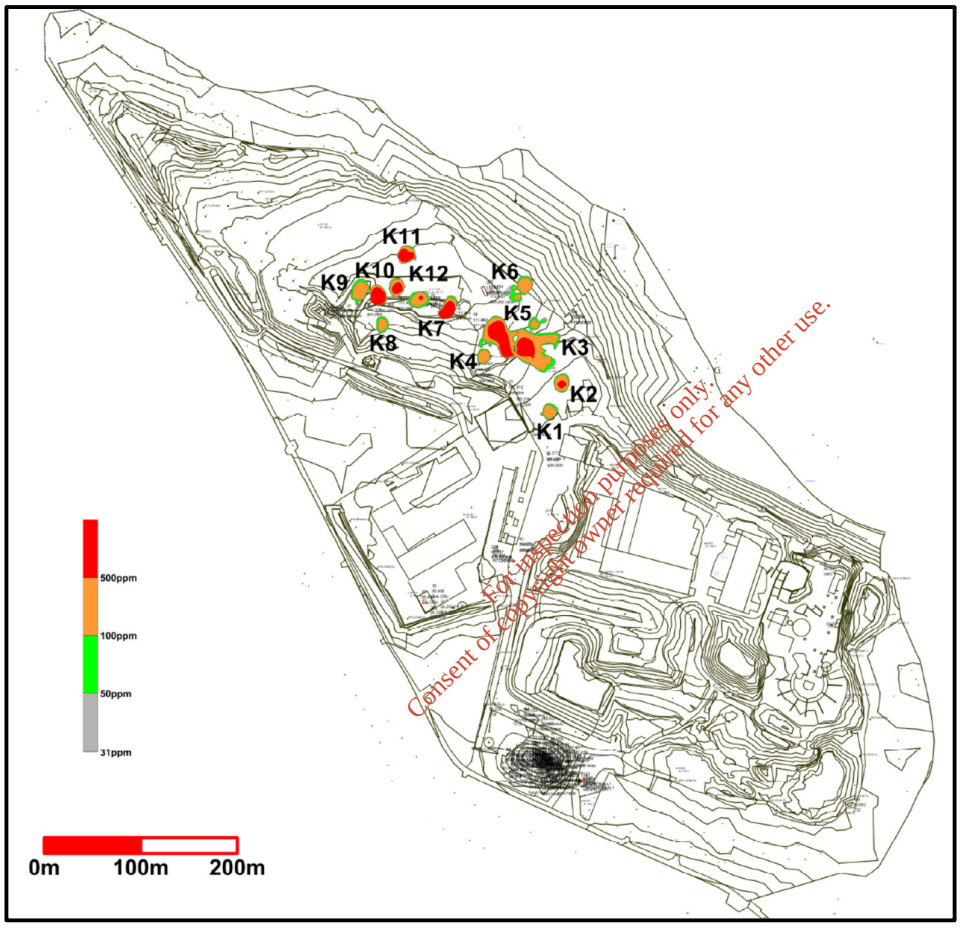
Table 7.12: Volatile Organic Compounds (VOC) Monitoring Results 2016

Monitoring Location	Measurement Dates		Concentration µg/m³				
			Benzene	Toluene	Ethylbenzene	m/p-Xylene	o-Xylene
D1	08/09/16	22/09/16	1.11	3.18	3.92	4.09	1.60
	22/09/16	07/10/16	0.90	<0.70	<0.66	<0.66	<0.66
D2	08/09/16	22/09/16	0.88	0.89	<0.71	0.71	<0.71
	22/09/16	07/10/16	<0.73	0.77	<0.66	0.91	<0.66
D3	08/09/16	22/09/16	Not measured	Not measured	Not measured	Not measured	Not measured
	22/09/16	07/10/16	1.08	<0.70	<0.66	0.81	<0.66
D4	08/09/16	22/09/16	1.02	2.44	<0.71	0.95	<0.71
	22/09/16	07/10/16	0.94	<0.70	<0.66	0.68	<0.66
D5	08/09/16	22/09/16	1.00	6.53	<0.71	1.17	<0.71
	22/09/16	07/10/16	<0.73	<0.70	<0.66	<0.66	<0.66
D6	08/09/16	22/09/16	<0.79	1.57	<0.71	0.73	<0.71
	22/09/16	07/10/16	<0.73	0.71	<0.66	0.70	<0.66
D7	08/09/16	22/09/16	<0.79	1.96	<0.71	0.95	<0.71
	22/09/16	07/10/16	<0.73	0.71	<0.66	1.18	<0.66
D8	08/09/16	22/09/16	1.01	4.20	<0.71	1.27	<0.71
	22/09/16	07/10/16	<0.73	<0.70	<0.66	<0.66	<0.66

Surveys of diffuse emissions of VOCs and odours from the landfill gas area have been carried out annually since 2008 by Odour Monitoring Ireland Ltd in accordance with the EPA Guidance AG6 *"Surface VOC Emissions Monitoring on Landfills, 2010"*. The most recent survey report completed in August 2016 identified a

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number of areas in the north-western area of the site (Zone 1) where diffuse emissions of VOCs and landfill gases from the surface were occurring as shown in Diagram 7.2. This area has been identified in various studies undertaken at the site as the area where the most odorous wastes are located and the area with the most significant potential for release of odours. There were no diffuse VOC emissions detected in the south-east lined cell area of Zone 3. The recorded emissions exceeded the recommended trigger levels in several areas as outlined in the EPA Guidance Note AG6 and discussed in Section 7.2.5 which led to actions being taken to limit the emissions. The measurement results indicate the potential level of emissions from this area and are an indicator of the level of emissions during the Remediation Phase.

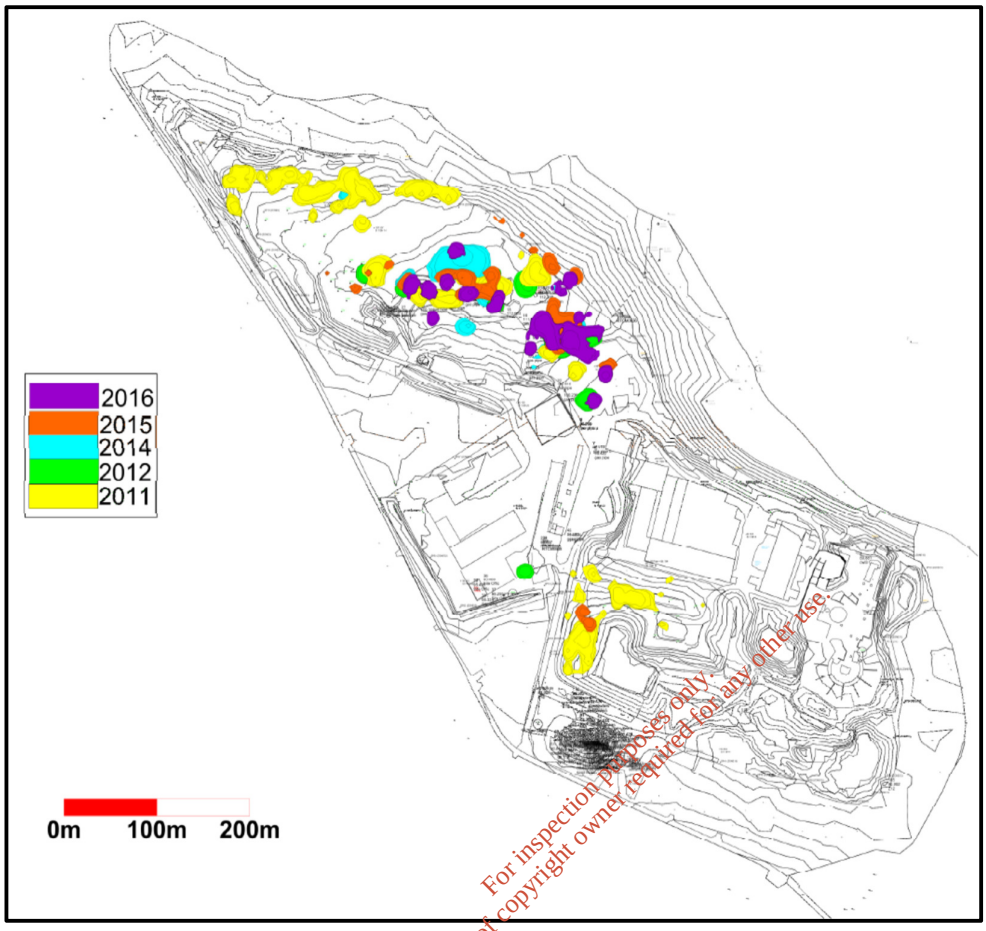


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Diagram 7.2: VOC Surface Emission Mapping at Kerdiffstown 2016

The KLRP VOC / Surface Emissions / 2016/1 Surface Emissions Survey at Kerdiffstown, Naas, Co. Kildare report, 2016 also summarises results of previous surveys, and shows the effectiveness of the mitigation measures taken to manage areas where surface emissions had been identified in the previous years' surveys. The changes in the locations of diffuse emissions from the landfill surface over the period 2011 – 2016 are shown in Diagram 7.3 with the coloured areas representing a variation in VOC levels. Diagram 7.3 shows that the extent of VOC surface emissions has decreased at the site, most significantly in the south-east due to the temporary capping of this site area, thereby preventing diffuse emission releases. The report provides a valuable benchmark of the existing diffuse emissions and shows the areas with the greatest potential for release of such emissions, the complete report is attached in Appendix A7.4.

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Diagram 7.3: VOC Surface Emission Location Mapping at Kerdiffstown, 2011 – 2016

Influence of Materials On-Site on Odour Emissions

A comprehensive characterisation of the site, the materials deposited and the classification of wastes in each area was undertaken on behalf of the EPA from 2010 to 2013. The findings of the investigations were presented in the "*Kerdiffstown Landfill Remediation Project Remediation Options Report, SKM Enviros, 2013*". This report describes the different areas of the landfill site in terms of the types of materials deposited and the odour generating potential of each area.

There are four principal areas classified according to the types of waste present and the odour emissions potential. The four principal waste zones on the site are shown in Figure 3.2 and are outlined below in Table 7.13.

Table 7.13: Description of Wastes Deposited on the Site

Area	Description of the Area
Zone 1 	Wastes deposited in the north-west area of the site, Zone 1 (and 1A) account for approximately 66% of the entire estimated volume of waste on site. As outlined in Table 3.1, the majority of waste in this zone is reported to comprise Municipal Solid Waste (MSW), although some logs do show Construction & Demolition (C&D) waste to also be present. The area is unlined and uncapped with a series of landfill gas wells extracting gas to a flare. Zone 1A to the north-west extents of the site does not contain MSW and hence is unlikely to generate odour.

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Area	Description of the Area
Zones 2A and 2B 	Zones 2A and 2B comprise largely flat areas with concrete hardstandings and remnants of buildings from the waste processing facility. As a result, this area was assessed as one zone. However, review of ground investigations and subsequent monitoring data confirms that wastes in Zone 2A comprise more MSW than that in Zone 2B. The wastes are generally described as being dry, although damp or wet wastes are identified closer to the groundwater table with saturated wastes shown in the boreholes where waste is at the lowest elevation in Zone 2B. No saturated wastes have been identified in Zone 2A. MSW may be odorous, but the extensive hardstanding areas effectively prevent escape of odours.
Zone 3 	Zone 3 comprises a cell with engineered basal and side slopes lining system. Zone 3 has a temporary cap applied over the existing waste mass. Landfill gas wells extract gas to a flare. The wastes are likely to be similar to the wastes elsewhere on site and thought to comprise processed non-hazardous C&D materials with domestic waste mixed through.
Zone 4 	Zone 4 contains predominantly C&D waste with a high proportion of inert material (dominantly reported as gravelly clay) with varying amounts of plastic, timber, textiles, steel, concrete, brick and PVC pipes.

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From this characterisation, it is clear that the most odorous wastes are located in Zone 1 which is where the surface VOC emission surveys also identify areas with the greatest potential for release of emissions to atmosphere including odours. Other areas not currently linked with odorous emissions e.g. the lined cell may release odorous gases once the waste is disturbed during the Remediation Phase. This is also the finding reported in the "Kerdiffstown Landfill Odour Control Plan, 2013" which is attached in Appendix A7.7.

Odours

Odour emissions at the existing Kerdiffstown Landfill are primarily linked with diffuse landfill gas emissions, while other potential secondary odour sources include gas flare emissions. While the site was operational and receiving waste, the odour emissions from Kerdiffstown Landfill gave rise to sustained complaints from people living in, and visiting, the area at that time. At that time there were no environmental controls in place. The EPA intervened under Section 56 of the Waste Management Act 1996 after a fire occurred at the site in 2011 and implemented a series of emergency measures to contain and limit the environmental impact of the site. Since the fire was brought under control and extinguished in 2011, the EPA and later KCC have implemented works to deal with the most immediate risks presented at the site. A landfill gas management system was implemented as a priority to reduce the risk of further fires which consisted of the installation of an active landfill gas collection system. There are currently two flares on site, one with capacity 250m^3/hr, the second with capacity 500m^3/hr. Currently, all gas extracted from wellfields in the north-west and the lined cell is being burned at the 250m^3/hr flare, with the second flare as standby. This flare will continue to operate during the Remediation Phase of the proposed Project.

The installation of the landfill gas management system was very effective in managing the gases and odours associated with the most odorous wastes in the north-western area (Zone 1) of the site and in the south-eastern lined cell area (Zone 3). Odour complaints are now rare occurrences on site, with only six complaints logged between February 2011 and March 2013, seven in 2014, four in 2015 and three in 2016. Some complaints related directly to intrusive site investigations that were taking place in 2012 when boreholes were drilled

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through the waste body to prove depth to natural ground and provide information of waste. For others, no specific cause for the complaint was identified.

Subjective olfactometric assessments were carried out at the same locations as those for the 2016 VOC measurement events. The methodology conformed to the general guidance issued by the EPA in the Guidance Note *"Air Guidance Note 5 (AG5): Odour Impact Assessment Guidance for EPA Licensed Sites"*. This Guidance offers a systematic and consistent approach to the assessment of odours on and in the local area of facilities and installations that are licensed by the EPA. While the study was aimed at establishing baseline ambient air quality as opposed to examining the air quality impact of a licenced facility, the use of this best-practice Guidance demonstrates the robust assessment procedures adopted for the study. No detectable odours were recorded during these surveys at the measurement locations. Odours were detected on site near the security high hut in Zone 1 approaching the D2 monitoring location, but the odour was not experienced at the boundary or at the D2 location.

Priority Construction Ltd. were undertaking works at the proposed Project during October 2016 and arranged for a survey of odour levels at four monitoring locations to be carried out by BHP Laboratories Ltd. and a summary of the results is presented in Table 7.14 with the full report presented in Appendix A7.5. No odorous compounds were detected during that survey.

Table 7.14: Odour Monitoring Results 2016

Monitoring Location	Measurement Date	Mercaptans mg/m^3	H_2S mg/m^3	Odour
D4	21/10/2016	< 1.25	< 0.3	None detected
D2	21/10/2016	< 1.25	< 0.3	None detected
D3	21/10/2016	< 1.25	< 0.3	None detected
D9	21/10/2016	< 1.25	< 0.3	None detected

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Long Term Air Quality Monitoring Data

The main substances which are of interest in terms of existing air quality in all areas potentially affected by the proposed Project are sulfur dioxide, nitrogen oxides (nitric oxide, NO and nitrogen dioxide NO_2, collectively referred to as NO_x), fine particulate matter including PM_{10} and $PM_{2.5}$ which could originate from combustion sources, traffic and the existing commercial and industrial activities in the study areas. Carbon monoxide is also potentially of interest, and benzene may also be of interest from traffic sources.

Particulate matter is made up of tiny particles in the atmosphere that can be solid or liquid (except for water or ice) and is produced by a wide variety of natural and manmade sources. Particulate matter includes dust, dirt, soot, smoke and tiny particles of pollutants. Particulate matter of 10 micrometres (µm) in aerodynamic diameter or less are also referred to as **PM_{10}** or more strictly, particles which pass through a size selective inlet with a 50% efficiency cut-off at 10µm aerodynamic diameter. Similarly, **$PM_{2.5}$** refers to particulate matter of 2.5 µm or less in aerodynamic diameter. In the past domestic coal burning was a major source of particulate matter in Irish cities during winter months. Levels of particles have decreased significantly following the introduction of abatement strategies including Special Control Areas and other Regulations regarding the use, marketing, sale and distribution of certain fuels. The significance of particulate matter in relation to air quality is predominantly related to human health and respiratory effects.

Nitrogen oxides (NO_x, which is the sum of NO and NO_2), are generated primarily by combustion processes. The main anthropogenic sources (man-made sources) are mobile combustion sources (road and air traffic) and stationary combustion sources (including industrial combustion and domestic heating). The main source of nitrogen oxides in the vicinity of the study area is traffic. The significance of nitrogen oxides is health-related for nitrogen dioxide (NO_2) and ecological for nitrogen oxides (NO_x).

Sulfur dioxide (SO_2) also originates from combustion but predominantly from heating sources and not traffic. The trend in ambient SO_2 concentrations is clearly downward and this pollutant is not a matter for concern in

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Ireland. The reduction in ambient sulfur dioxide concentrations in recent years can be attributed to fuel switching from high-sulfur fuels, such as coal and oil, to natural gas and to decreases in the sulfur content of oil.

Carbon monoxide (CO) is a colourless and odourless gas, formed when carbon in fuel is not burned completely. It is a component of motor-vehicle exhaust, which accounts for most of the CO emissions nationwide. Consequently, CO concentrations are generally higher in areas with heavy traffic congestion. CO is also a significant emission from air traffic.

Carbon dioxide (CO_2) may be emitted from any combustion sources which include road and air traffic and commercial and domestic heating.

Odour emissions are commonly associated with landfills of this type and are quantified and studied in this report. The principal odorous gases potentially present in emissions from the proposed Project will include trace gases emitted from the landfill surface and the combustion products CO, NO, NO_2 and SO_2 and fine particulate matter which may be emitted as a result of combustion of gases in the flare. Where available, data for existing levels of these substances in ambient air have been discussed in this Section of the report.

The available data from the National Ambient Air Quality Network is a reliable data set for consideration in this study. The EPA and local authorities maintain and operate a number of ambient air quality monitoring stations throughout Ireland in order to implement EU Directives and to assess the country's compliance with national air quality standards. Ireland's small population and generally good air quality means that a relatively small number of monitoring stations are sufficient across the country for the purposes of implementing the EU Air Directives. For ambient air quality management and monitoring in Ireland, four zones, A, B, C and D are defined in the Air Quality Standards (AQS) Regulations (S.I. No. 180 of 2011) and are defined as follows:

Zone A: Dublin Conurbation.

Zone B: Cork Conurbation.

Zone C: 24 cities and large towns. Includes Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Newbridge, Mullingar, Letterkenny, Celbridge and Balbriggan, Portlaoise, Greystones and Leixlip.

Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B & C.

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The proposed Project is located close to Naas which is in Zone C, but the air quality in the area is best described under the Zone D (Rural Ireland) heading. Air Quality Data from representative air monitoring stations in Zone D is therefore considered representative of air quality at the proposed Project. The EPA publishes Ambient Air Quality Reports every year which details the air quality in each of the four zones. The most recent report, published by the EPA is the *Air Quality Monitoring Annual Report 2015*, (EPA 2016), which presents monitoring data collected during 2015. Best practice requires that an average of at least three years of recent monitoring data is used for assessments of this type so data for 2013 – 2015 has been reviewed from the *EPA Ireland Archive of Nitrogen Oxides Monitoring Data datasets* available from Environmental Research Data managed by EPA.

Data from the Air Quality Monitoring Annual Report 2013 (EPA 2014), the Air Quality Monitoring Annual Report 2014 (EPA 2015) and the Air Quality Monitoring Annual Report 2015 (EPA 2016) produced by the EPA were reviewed and a summary of the data for representative stations for the three most recent years is presented for each parameter of interest in Table 7.15. The approach taken is to take the average of the three most recent years (2013 – 2015) for Zone D wherever data is available. Where no data exists for Zone D, data for Zone C is provided.

It is noted from the data that existing ambient air quality in Ireland is good for all health-related pollutants. The short-term data acquired during the baseline surveys undertaken at the proposed Project in 2016 and 2017 is consistent with the longer term data reported in summary in Table 7.15.

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Table 7.15: Background Air Quality Data for Zone D

Pollutant	Averaging Interval	2013	2014	2015	Average (2013 – 2015)
Nitrogen dioxide, NO_2	Annual Mean, µg/m^3	4	3	2	3
Nitrogen oxides, NO_x	Annual Mean, µg/m^3	5	3	2	3
Sulfur dioxide, SO_2	Annual Mean, µg/m^3	3	2	2	2
Particulate Matter PM_{10}	Annual Mean, µg/m^3	11	9	10	10
Particulate Matter $PM_{2.5}$	Annual Mean, µg/m^3	8	5	6	6
Carbon Monoxide	Annual Mean, µg/m^3	300	400	500	400
Benzene	Annual Mean, µg/m^3	0.5	0.09	0.13	0.24
Toluene	Annual Mean, µg/m^3	Not measured	Not measured	0.15	0.15
Ethylbenzene	Annual Mean, µg/m^3	Not measured	Not measured	< 0.01	< 0.01
Xylenes	Annual Mean, µg/m^3	Not measured	Not measured	0.03	0.03

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7.4 Predicted Impacts

7.4.1 Remediation Phase Air Quality Impacts

Impact Identification

The potential air quality impacts during the Remediation Phase are summarised in this Section of the report.

a) Dust emissions associated with re-profiling and demolition works

One of the most significant potential air quality impacts associated with the Remediation Phase of the proposed Project is dust. Dust can be generated as a result of disturbance of materials, as a result of wind blowing across exposed surfaces and as a result of construction vehicle movements across exposed surfaces.

There are three potential impacts on air quality of the dust / particulate matter emissions:

- Dust deposition on surfaces is the main potential impact associated with the larger particles;
- Nuisance effects such as reduced visibility could be associated with excessively high levels of suspended particulate matter, and
- Respiratory effects could occur as a result of excessive levels of fine particles such as PM_{10} and $PM_{2.5}$.

Dust emissions associated with the Remediation Phase of the proposed development are anticipated to be predominantly in the 10 – 75µm particle size range so these particles, because of their size, will generally be deposited within 100m of the emission source. Only under exceptional meteorological conditions would the dusts be carried further downwind. The majority of the dust associated with construction activity is in the 10 – 75µm particle size range.

Suspended particulate matter (SPM) may also be released and this matter may remain suspended in the air. The main effect would be on visibility but this type of material could also be a respiratory nuisance if present at excessive levels. Emissions of dust in the form of fine particulate matter, PM_{10} and $PM_{2.5}$, may

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also occur, primarily as a result of materials handling and storage since the dominant particle size is in the lower size ranges. There may also be some emissions of particles in these size ranges from the general site activities including the demolition of on-site concrete structures, re-profiling works, the installation of the engineered capping system and landfill management infrastructure and the installation of park infrastructure such as paths and pitches.

b) *Aspergillus* emissions from re-profiling and earthmoving activity

There is concern about a fungal disease, "invasive Aspergillosis" which may be contracted as result of disturbance of materials that release fungal spores into the atmosphere. Fungal spores (the *Aspergillus* moulds) are found everywhere but are of particular concern when large scale demolition, excavation and earth-moving activity take place. There is some concern about such emissions from large construction projects and this will be particularly important due to the re-profiling of waste during the proposed Project.

c) Landfill gases and Volatile Organic Compounds (VOCs)

Landfill gases and VOCs arise as a result of diffuse emissions from the landfill surface. These emissions are well controlled at present but when the re-profiling of waste during the Remediation Phase commences some diffuse emissions are expected.

d) Odour emissions associated with re-profiling and earth moving activity

A significant potential impact is odour which is anticipated to arise as a result of the proposed works. In particular works involving the re-profiling of waste and any re-profiling into the waste body are anticipated to result in odour emissions.

e) Remediation Phase transport emissions

Emissions of dust raised by vehicle movement on the roads near the proposed Project and also on-site has already been examined as part of the dust and particulate matter impacts. Emissions from the construction vehicles as a result of fuel combustion are considered here. The emissions include PM_{10} and $PM_{2.5}$, NO_2 and NO_x and CO and benzene.

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Dust and Particulate Matter Impacts

The Remediation Phase will involve eight different Phases of significant construction works during which the site will be remediated and the final landforms will be constructed to facilitate the development of the multi-use public park. Some of the works will require the use of heavy earth-moving machinery and equipment that will be used for re-profiling, importation of materials to the proposed Project and construction and installation of landfill management infrastructure and the multi-use public park infrastructure.

The risk of dust being emitted in sufficient quantities to cause a nuisance or health impacts is evaluated by considering the scale of the works programme. The Institute of Air Quality Management Guidance Note gives advice on classifying the magnitude of the potential dust impacts and using the advice and information derived from the outline remediation phasing, as described in Section 4.3.1, for the proposed Project, the magnitude of the dust emissions has been estimated as shown in Table 7.16. The list of activities is representative of the types of activity that will occur and includes the main activities planned for the Remediation Phase. Chapter 4 Description of the Proposed Project presents a description of the works involved in each phase of works, and a summary of the principal activities is given in Table 7.1.

The potential air quality impact arises from emissions of particulate matter and may result in deposition of dust around the proposed Project, and being tracked-out onto the roads in the vicinity of the proposed Project. The overall magnitude of the potential emissions associated with the Remediation Phase is assessed as medium using these criteria.

The significance of the dust emissions and impacts is evaluated in terms of the sensitivity of the receptors in the area that could be affected by the emissions. In general, receptors located close to the site boundary are considered to have a high sensitivity with sensitivity decreasing with increasing distance from the source reflecting the exponential decrease in dust levels as distance increases. The receptor sensitivity in the

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immediate vicinity of the proposed Project is High because of the proximity of a significant number of residential receptors. A summary of the assessment of sensitivity for each activity is presented in Table 7.16.

Table 7.16: Assessment of Magnitude of Dust Emission and Receptor Sensitivity for Remediation Phase for Closest Receptors

Activity	Magnitude of Dust Emission	Sensitivity of receptors and surrounding areas		
		Dust soiling	Human Health	Ecological
Minor works e.g. plant movement	Low	Low	High	Low
Demolition	Medium	Medium	High	Low
Crushing and screening of demolition arisings	Low	Low	High	Low
Demolition material stockpiling	Low	Low	Low	Low
Soil Stripping	Low	High	High	Low
Temporary surface water management measures	Low	Low	Low	Low
Clean stockpile use	Low	Low	Low	Low
Fill import / stockpiling	Low	Low	Medium	Low
Leachate Infrastructure installation & commissioning	Low	High	High	Low
Gas infrastructure installation & commissioning	Low	High	High	Low
Waste filling	Low	Medium	Medium	Low
Slope Remediation and Capping	Medium	High	High	Low
Temporary stockpiling of Zone 4 wastes	Low	Medium	Medium	Low
Final re-profiling / capping (backfilling of ponds)	Medium	Medium	Medium	Low
Construction of Surface Water Management Pond	Low	Low	Low	Low
Removal of SW screening bund	Medium	Medium	Medium	Low
Final re-profiling / capping	Medium	Medium	Medium	Low
Cleaning of ponds & commissioning.	Low	Low	Low	Low
Construction Traffic	Low	Low	Low	Low

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Using the alternative assessment approach outlined in the EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017) as outlined in Section 7.2, the significance of potential dust emissions during the Remediation Phase is summarised in Table 7.17.

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Table 7.17: Assessment of Significance of Dust Emissions for Remediation Phase

Activity	Magnitude & significance of Dust Emissions at site boundary	Duration of Dust Emission
Minor works e.g. plant movement	Imperceptible	Momentary
Demolition	Not significant	Brief
Crushing and screening of demolition arisings	Not significant	Brief
Demolition material stockpiling	Not significant	Brief
Soil Stripping	Moderate	Short term
Temporary surface water management measures	Not significant	Short term
Clean stockpile use	Slight	Brief
Fill import / stockpiling	Moderate	Short term
Leachate Infrastructure installation & commissioning	Slight	Temporary
Gas infrastructure installation & commissioning	Slight	Temporary
Waste filling	Moderate	Temporary
Slope Remediation and Capping	Moderate	Temporary
Temporary stockpiling of Zone 4 wastes	Moderate	Brief
Final re-profiling / capping (backfilling of ponds)	Slight	Temporary
Construction of Surface Water Management Pond	Slight	Temporary
Removal of SW screening bund	Significant	Temporary
Final re-profiling / capping	Significant	Short-term
Cleaning of ponds & commissioning.	Slight	Temporary
Construction Traffic	Slight	Short-term

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This assessment shows that the most significant potential impacts are those associated with the site re-profiling. The assessment also shows that the potential dust emissions associated with the removal of the screening bund in Zone 1 is significant, but temporary. There is predicted to be a temporary slight adverse impact on the closest receptors during the Remediation Phase with potential short-term impacts from traffic on the surrounding roads within about 50m of the proposed Project. There will be no lasting impact and the short-term impacts will be managed by means of an effective Dust Management Plan incorporating the mitigation measures outlined in Section 7.5. The Construction Environmental Management Plan (CEMP) developed by the appointed contractor will include a specific Dust Management Plan which will ensure that dust impacts are prevented or minimised during the Remediation Phase of the proposed Project.

Using the alternative assessment approach outlined in the EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017) as outlined in Section 7.2, the significance of potential dust emissions during the Remediation Phase is summarised in Table 7.18. This table presents an assessment of significance of dust emissions for the indicative phases of remediation. The assessment of significance of potential dust emissions for the complete Remediation Phase is Moderate and the duration is short-term (i.e. lasting from one to seven years).

Table 7.18: Assessment of Significance of Dust Emissions for Indicative Phases of Remediation

Remediation Phase	Magnitude & Significance of Dust Emission at Site Boundary	Duration of Dust Emission
Phase 1	Moderate	Temporary
Phase 2	Moderate	Temporary
Phase 3	Moderate	Temporary
Phase 4	Moderate	Temporary
Phase 5	Moderate	Temporary
Phase 6	Moderate	Temporary
Phase 7	Moderate	Temporary
Phase 8	Moderate	Temporary

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Aspergillosis and Fungal Spore Impacts

As noted above, there is concern about a fungal disease, "invasive Aspergillosis" which may be contracted as a result of disturbance of materials that release fungal spores into the atmosphere. This is a disease which is detrimental to persons with suppressed immune systems, such as hospital patients. The "*National Guidelines for the prevention of Nosocomial Invasive Aspergillosis during construction/renovation activities*" (developed by a sub-committee of the Scientific Advisory Committee of the National Disease Surveillance Centre, 2002) deals specifically with construction works occurring within or adjacent to hospitals. The report states that the fungal spores responsible for invasive Aspergillosis can originate from a number of sources such as construction, demolition, renovation, disturbance of soil, removal of fibrous insulation material, removal of suspended ceiling tiles and from poorly maintained air ventilation systems. The potential sources of the fungal spores associated with invasive Aspergillosis, as detailed above, are related to the occurrence of these operations either within or in very close proximity to hospital buildings.

Fungal spores (the *Aspergillus* moulds) are found everywhere but are of particular concern when large scale demolition, excavation and earth-moving activity takes place and especially in close proximity to areas where vulnerable individuals are located. The dispersion of spores (or indeed dust or any other substance) which are released at a particular location depends on a significant number of factors which include:

- rate and temperature of the release;
- release height;
- wind speed;
- rainfall;
- wind direction;
- topography;
- local meteorological conditions;
- nature of the substances released;
- potential for physical or chemical interactions; and
- concentrations of the substances released.

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The dispersion of fungal spores will depend on all of the above factors and this dispersion is evaluated by considering the factors noted above and the distances from the source at which the predicted impacts are to be assessed. In the first instance, the key factors are the concentration of the spores released and the distance to sensitive receptors. Dispersion of fungal spores released as a result of any activity is a function of time and distance and spores would be completely dispersed i.e. no measurable concentration at c. 250m from the source of the release.

The National Guidelines report referred to above notes that the fundamental requirement in respect of eliminating *Aspergillus* infection from construction works is first to minimise the dust generated during construction. All Remediation Phase works will be carried out in a way that minimises dust generation and will be carried out in conformance with the National Guidelines referenced here.

The most sensitive receptor in the immediate vicinity of the proposed Project is Kerdiffstown House (REC001, refer to Figure 7.1) since it is located predominantly downwind of the landfill. Although this receptor is located within 250m of the site boundary, conformance with the best practice guidelines and in particular the phasing of works to be undertaken at the proposed Project will ensure that no significant adverse impacts occur as a result of the proposed Project. Larchfield Nursing Home (REC0038, refer to Figure 3.4) is located far enough from the boundary of the proposed Project (> 250m) to ensure that no adverse impacts will be observed.

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Landfill Gas Flare Impact Assessment Inputs

Current management controls for landfill gas (and odours) at the site consists of two gas flares (one of which is currently operational) with gas extracted at a rate of approximately 150m^3/hr from Zones 1 and 3. Landfill gas is also managed by means of passive venting from areas where lower levels of gas production and less odorous gases are present, and some uncontrolled emissions are released from uncapped areas of the landfill. The 250m^3 flare, and the standby 500m^3 flare, will continue to be operated throughout the Remediation Phase of the proposed Project until a new 600m^3 flare, and a standby flare, are installed the new Landfill Infrastructure Compound. Only one flare operates at a time, and the impact of the emissions from the flare on air quality is assessed by carrying out a dispersion modelling assessment. Information on a number of input variables required for the dispersion model is described here. A representative location for the flare was chosen for the modelling exercise but the flare may be moved during the Remediation Phase to optimise the location. Although the flare may move during the remediation Phase, the modelled location is representative of the potential future flare locations and the selected location is suitable for the assessment. Any future movement of the flare would be to topographically suitable locations and does not affect the robustness of the assessment approach.

(i) Emissions characteristics

The principal assumption is that the flare runs continuously and that the emissions are at the maximum level at all times. In practice this will not occur as the emissions will decrease over time. A summary of the emission data is presented in Table 7.19. This data was derived from consideration of the most recently available monitoring data for the existing 250m^3 flare which was acquired in 2016. The Air Scientific *"Air Emissions Compliance Monitoring Emissions Report"* (Air Scientific 2016) is attached in Appendix A7.6. Data for PM_{10} was not recorded so a conservative assumption that the concentration of PM_{10} in the flare emissions is 10mg/m^3 was made based on data from similar facilities; this is likely to overestimate the PM_{10} emissions.

Hydrogen sulfide was not measured in the flare emissions during the monitoring event. It is however known that some of the sulfur present in landfill gas is released from the flare as hydrogen sulfide, with Literature estimates suggesting that at least 0.1% of the sulfur present could be emitted as hydrogen sulfide. For this assessment it is assumed that 1% of the sulfur present is emitted as hydrogen sulfide. The sensitivity of the assessment to this assumption is discussed in the sensitivity analysis presented below.

In this assessment, the assumption made is that all of the nitrogen oxides are present as NOx in line with current guidance on the use of dispersion modelling for air quality impact assessment. While this may overestimate the 1-hour ground level concentration (GLC), the conservative approach does not affect the outcome of the assessment.

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Table 7.19: Input Data for AERMOD Dispersion Model: KLRP 250m^3 Flare

Parameter	Existing 250 Flare*
Stack height, m**	8
Flow rate, m^3/sec (based on extracted volume of 250m^3/hour)	0.0694
Temperature, K	1288
SO_2, g/sec	0.041198
CO, g/sec	0.000922
Particulates as PM_{10}, g/sec	0.000417
Particulates as $PM_{2.5}$, g/sec	0.000417
Nitrogen dioxide, NO_2, g/sec	0.000839
Hydrogen sulfide, H_2S, g/sec	0.000412

Notes
*Emission rates are derived from the most recent environmental monitoring at the existing flare on site, taking measurement uncertainty into account
**Stack height refers to height in metres above ground level

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(ii) Site layout and topography

Site layout and topographical information was obtained from an aerial site survey carried out in February 2016 and from maps, orthographic photographs and digital Ordnance Survey data.

(iii) Averaging intervals

Averaging intervals were chosen to allow direct comparison of predicted ground level concentrations with the relevant assessment criteria as outlined in Section 7.2.5.

(iv) Receptor locations

Since the impact of the emissions can be observed at considerable distances from the emission sources, a fine grid, 2km x 2km centred on the main emission sources was constructed with receptors located at 50m intervals; a second grid of 6km x 6km with receptors at 50m intervals was also constructed. In addition to the receptor grids, a number of receptors were selected at sensitive locations in the area represented by the closest residential receptors. A summary of the representative receptors for which data was acquired is given in Table 7.20 and their locations are presented in Figure 7.1.

Table 7.20: Sensitive Receptor Locations for Dispersion Modelling Assessment

Receptor	Grid Co-ordinates
REC001	657954, 5902286
REC016	657891, 5901835
REC012	657935, 5901566
REC007	658228, 5901318
REC039	658273, 5901433

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(v) Meteorological data

As noted in Section 7.3.1, meteorological conditions at the proposed Project are best described by data from the nearby Casement Aerodrome. For this assessment three years of meteorological data from 2013 to 2015 for Casement Aerodrome have been used.

(vi) Baseline air quality

Baseline air quality has been described in Section 7.3.3 from the very comprehensive database of information available for the site as well as longer term data acquired for similar locations in Ireland.

Landfill Gas Flare Air Quality Impact Assessment Predictions

The impact assessment involves execution of modelling runs to represent different potential scenarios associated with the emissions. The following Scenarios were considered in the modelling runs.

(i) **Meteorological data** – Model runs were executed to consider the effect of meteorological data set selection on the impact predictions;

(ii) **Pollutant concentrations** – Model runs were executed to evaluate the effect of varying pollutant emission rates on the impact predictions.

(iii) Model runs were conducted as part of a **sensitivity analysis** to investigate the effect of a number of variables in the input data and operating conditions on the modelling predictions.

The impact assessment predictions for PM_{10} and $PM_{2.5}$, CO, SO_2, NO_2, and NO_x are presented in this Section. In each case, the worst-case meteorological data set predictions are quoted. The results demonstrate that for those pollutants and emission scenarios studied, the Air Quality Standards are not breached as a result of the emissions under normal operating conditions as modelled in this report. The individual results for each

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parameter of interest are discussed here, and the complete data set for the modelling predictions is presented in Appendix A7.9.

The background ambient air quality is considered in Section 7.3 of this report. In accordance with the guidance presented in the EPA Guidance AG4*, Air Dispersion Modelling from Industrial Installations Guidance Note (AG4), 2010,* the background concentrations are treated as follows:

- For the assessment of 24-hour and annual mean concentrations, the predicted contribution from the site is added to the average annual background concentration.
- For the assessment of 1-hour mean concentrations, the predicted contribution from the site is added to twice the average annual background concentration.

Particulate Matter / PM_{10} and $PM_{2.5}$

Particulate emissions from the landfill gas flare are very low and contribute primarily to airborne particulate concentrations due to the anticipated particle size. Since this consists primarily of PM_{10}, the impact assessment is based primarily on the assessment criteria for this parameter. The predicted ground level concentrations as a result of the emissions from the proposed Project combined with the background concentrations are as shown in Table 7.21 alongside the relevant Air Quality Standards.

Table 7.21: Predicted Remediation Phase Ground Level Concentration of PM_{10} Resulting from the Existing 250m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
24-hour limit not to be exceeded more than 35 times/year (90.4 percentile)	50 µg/m³	10	0.35	10.4
Annual limit	40 µg/m³	10	0.12	10.1

Note
The worst case meteorological year for the 90.4 percentile of the 24-hour average is 2013 and the worst case meteorological year for the annual average is 2014.

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The data demonstrates that the emissions from the operation of the existing landfill gas flare during the Remediation Phase will not cause the air quality standards to be exceeded.

An isopleth showing the predicted 90.4 percentile of 24-hour ground level concentration of PM_{10} as a result of the emissions from the existing 250m³ flare during the Remediation Phase is presented in Figure 7.3. An isopleth is a line on a map connecting points having equal values, in this case showing the concentration of PM_{10}.

Data for $PM_{2.5}$ is presented in Table 7.22 using the very conservative assumption that all of the particulates are present as $PM_{2.5}$. This conservative approach will overestimate the significance of the $PM_{2.5}$ emissions. Even so, the data presented in Table 7.22 demonstrates that the emissions will not cause the air quality standards to be exceeded.

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Table 7.22: Predicted Remediation Phase Ground Level Concentration of $PM_{2.5}$ Resulting from the Existing 250m³/hr Flare Emissions

Air Quality Standard Note		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
Annual limit	25 µg/m³	6	0.12	6.1

Note
A limit of 20 µg/m³ will apply from 2020 and this limit is also complied with.
The worst case meteorological year is 2014.

An isopleth showing the predicted mean ground level concentration of PM_{10} as a result of the emissions from the existing 250m³ flare during the Remediation Phase are presented Figure 7.4 for PM_{10}. An isopleth showing the predicted annual mean ground level concentration of $PM_{2.5}$ as a result of the emissions from the existing 250m³ flare during the Remediation Phase is presented in Figure 7.5.

Carbon monoxide, CO

The modelling results for CO are presented in Table 7.23. In accordance with Guidance, for the assessment of the 8-hour mean concentrations, the predicted contribution from the site is added to two times the average annual background concentration.

Table 7.23: Predicted Remediation Phase Ground Level Concentration of CO Resulting from the Existing 250m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
8-hour rolling average	10,000 µg/m³	800	<1	800

Note
The worst case meteorological year is 2014.

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The data presented in Table 7.23 demonstrates that the emissions from the flare do not cause the air quality standards to be exceeded. The isopleth was not plotted as the predicted concentrations are below the threshold that allows for plotting.

Sulfur dioxide, SO_2

The modelling results for SO_2 are presented in Table 7.24 for the maximum potential emission rates from the existing flare.

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Table 7.24: Predicted Remediation Phase Ground Level Concentration of SO_2 Resulting from the Existing 250m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
Hourly limit - not to be exceeded more than 24 times/year (99.7 percentile)	350 µg/m³	4	129	133
Daily limit - not to be exceeded more than 3 times/year (99.2 percentile)	125 µg/m³	2	55	57
Annual and winter limit for protection of human health and ecosystems	20 µg/m³	2	7	9

Note
The worst case meteorological year is 2014.

The data presented demonstrate that the emissions from the flare do not cause the air quality standards to be exceeded. An isopleth showing the predicted 99.7 percentile of 1-hour ground level concentrations of SO_2 as a result of the emissions from the existing 250m³ flare during the Remediation Phase are presented in Figure 7.6. An isopleth showing the predicted 99.2 percentile of 24-hour ground level concentrations of SO_2 as a result of the emissions from the existing 250m³ flare during the Remediation Phase are presented in Figure 7.7. An isopleth showing the predicted annual mean ground level concentrations of SO_2 as a result of the emissions from the existing 250m³ flare during the Remediation Phase are presented in Figure 7.8.

The predicted annual mean ground level concentration approaches but does not exceed the limit for the protection of human health and ecosystems. There is some uncertainty about the concentration of SO_2 that may be present in the flare emissions and this is discussed in the sensitivity analysis at the end of this Section of the EIAR.

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Nitrogen dioxide, NO_2, and nitrogen oxides, NO_x

The modelling results for nitrogen dioxide and nitrogen oxides are presented in Table 7.25 and Table 7.26.

Table 7.25: Predicted Remediation Phase Ground Level Concentration of NO_2 Resulting from the Existing 250m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
Hourly limit - not to be exceeded more than 18 times/year (99.8 percentile)	200 µg/m³	6	2.8	8.8
Annual limit for protection of human health	40 µg/m³	3	0.35	3.4

Note
The worst case meteorological year for the 99.8 percentile of 1-hour average is 2013 and the worst case meteorological year for the annual average is 2014.

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Table 7.26: Predicted Remediation Phase Ground Level Concentration of NO_x Resulting from the Existing 250m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
Annual limit for protection of vegetation	30 µg/m³	3	0.35	3.4

Note
The worst case meteorological year is 2014.

The data presented in Table 7.25 and Table 7.26 demonstrates that the emissions from the flare do not cause the air quality standards to be exceeded. It is also noted that a conservative modelling approach was adopted with assumptions that all of the nitrogen oxides are present as NO_2 so the assessment is based on a worst-case impact assessment scenario.

An isopleth showing the predicted 99.8 percentile of 1-hour ground level concentrations of NO_2 as a result of the emissions from the existing 250m³ flare during the Remediation Phase is presented in Figure 7.9 and an isopleth showing the predicted annual mean ground level concentrations of NO_2 as a result of the emissions from the existing 250m³ flare during the Remediation Phase is presented in Figure 7.10.

An isopleth showing the predicted annual mean ground level concentration of NOx as a result of emissions from the existing 250m³ flare during the Remediation Phase is presented in Figure 7.11.

Odour

Odour is of particular significance in this assessment and is considered separately in this Section of the report. The other modelling predictions have focused on the comparison of impact predictions with Air Quality Standards which are designed for the protection of human health and ecosystems. A further issue to be considered is the potential for odour nuisance as a result of the emissions from the landfill gas flare. This potential is considered by examining the 1-hour ground level concentration of sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) as a result of the emissions from the flare. These substances are chosen because of their significance in terms of potential odour impact. Other sulfur containing substances are not present at significant concentrations in the flare emissions due to the high combustion temperature so the assessment focuses on the predicted ground level concentration of SO_2 and H_2S which are the principal sulfur-containing species that may be present in flare emissions.

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The 98 percentile of 1-hour ground level concentration of hydrogen sulfide and sulfur dioxide was also modelled and is shown in Table 7.27. An isopleth showing the predicted 98 Percentile of 1-hour ground level concentration of SO_2 as a result of emissions from the existing 250m³ flare during the Remediation Phase is presented in Figure 7.12.

Table 7.27: Predicted Remediation Phase Ground Level Concentration of SO_2 and H_2S Resulting from the Existing 250m³/hr Flare Emissions

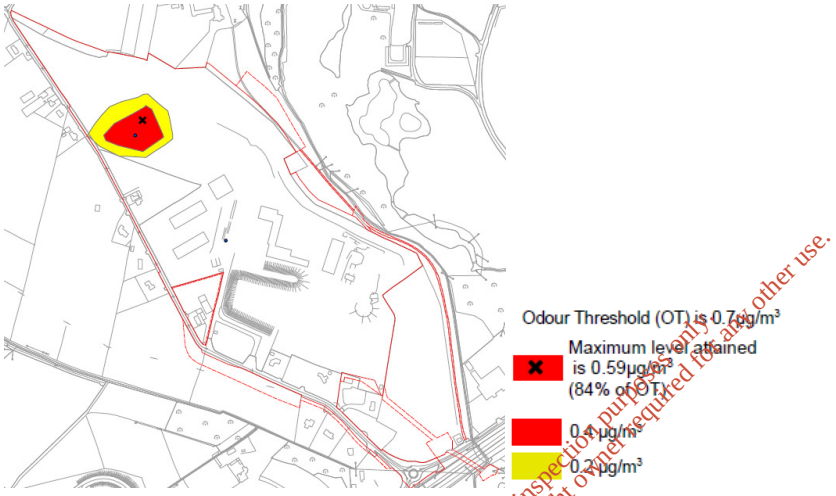
Air Quality Indicator	Odour Threshold Note, µg/m³	Predicted GLC, µg/m³
SO_2 98 percentile of 1-hour ground level concentration	1,200	58.6
H_2S 98 percentile of 1-hour ground level concentration	0.7	0.59

Note
The Odour threshold is the benchmark against which the impact is assessed

The 98 percentile is the maximum concentration level for 98 percent of the time, or 8,584 hours in a year; so this level is reached or exceeded for just 2 percent of the time or for 176 hours per year. The data is evaluated

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by comparing the 98 percentile of the 1-hour GLC to the odour threshold for SO_2 which is 1,200 µg/m³ and 0.7 µg/m³ for H_2S (*Odor Threshold Determinations of 53 Odorant Chemicals, Journal of the Air Pollution Control Association, 19:2, 91-95, 1969*). The assessment has shown that odour attributable to the emissions from the landfill gas flare is not detectable for the scenarios modelled. An isopleth showing the predicted 98 percentile of 1-hour ground level concentration of SO_2 as a result of emissions from the existing 250m³ flare during the Remediation Phase and an isopleth showing the predicted 98 percentile of 1-hour ground level concentration of H_2S as a result of emissions from the existing 250m³ flare during the Remediation Phase are presented in Figure 7.12 and Figure 7.13 respectively, and an extract of these figures is provided in Diagram 7.4 and Diagram 7.5 below.



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Diagram 7.4: Isopleth showing the predicted 98 percentile of 1-hour ground level concentration of SO_2 as a result of emissions from the existing 250m³ flare during the Remediation Phase

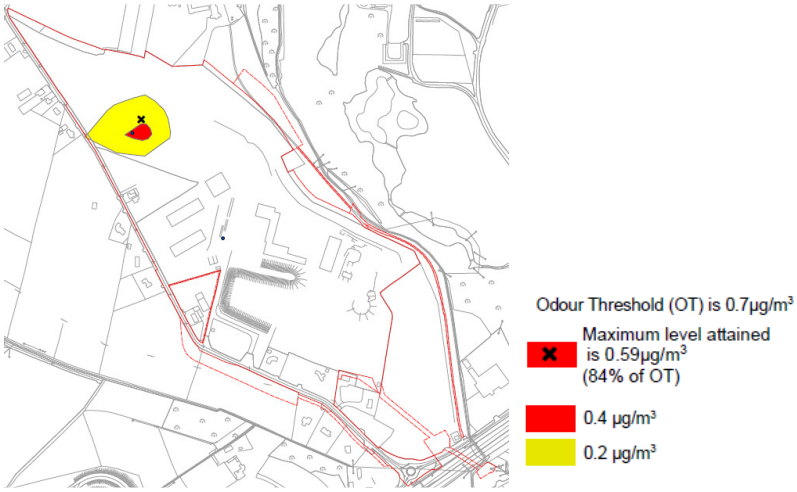


Diagram 7.5: Isopleth showing the predicted 98 percentile of 1-hour ground level concentration of H_2S as a result of emissions from the existing 250m³ flare during the Remediation Phase

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Odour Impacts

The Remediation Phase will involve a number of different phases of works during which the proposed Project will be remediated with the final landforms suitable for the proposed end-use. The Remediation Phase will extend to approximately four years of intensive works with each of the eight Phases lasting approximately 6 months. The duration of impact at any given receptor will depend on the rate of progress of the works. The faster the rate of progress, the shorter the duration of impact that may be experienced at any receptor in the vicinity of the works. Some of the works will involve disturbance and re-profiling of waste in order to achieve the final landforms of the proposed Project. This is a significant potential impact the magnitude of which will vary depending on the activity and the area in which the works are being undertaken. It is therefore appropriate to consider the individual areas of the site and the specific activities which could lead to the generation of odours.

As outlined in Chapter 4 Description of the Proposed Project, the site is sub-divided into a number of discrete areas characterised mainly by the types and arrangement of deposited material in each area:

- Zone 1 is the largest zone, it is unlined and uncapped, with active landfill gas management. A significant proportion of the waste comprises Municipal Solid Wastes (MSW) and is therefore anticipated to be odorous. Zone 1A to the north-west extents of the site does not contain MSW and hence is unlikely to generate odour;
- Zone 2A and Zone 2B will be used as temporary stockpile areas for imported fill materials (Zone 2A contains more MSW than Zone 2B). MSW may be odorous, but the extensive hardstanding areas effectively prevent the escape of odours;
- Zone 3 comprises a lined cell with active landfill gas management and a temporary cap which currently prevents significant losses of odour;
- Zone 4 contains predominantly inert wastes and extensive covering with concrete hardstanding. Wastes in this area are anticipated to be non-odorous.

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The remediation of the site in this proposed Project will involve re-profiling of materials in each zone but primarily in Zone 1, completion of the lined cell in Zone 3 with a permanent engineered capping system and the installation of new landfill infrastructure to manage the leachate and landfill gas generated at the site.

The risk of odours being released during the works is evaluated by considering the type of works being undertaken and the types and pattern of material deposition in each Zone. The Institute of Air Quality Management *"Guidance on the assessment of odour for planning"* (Institute of Air Quality Management 2014) was followed for the assessment of odours in this study together with information derived from the Outline Remediation Phasing Plans for the proposed Project. The outline description of the works is representative of the types of activity that will occur and includes the main activities planned for the Remediation Phase and is provided in Section 4.3.1 and in Figure 4.8 and Figure 4.9.

The significance of the odour emissions and impacts was evaluated in terms of the sensitivity of the receptors in the area that could be affected by the emissions. In general, receptors located close to the site boundary are considered high sensitivity with sensitivity decreasing with increasing distance from the source reflecting the dilution of any odour as distance increases. The overall receptor sensitivity in the immediate vicinity of the proposed Project is High. A summary of the assessment of sensitivity for each activity in each Zone is presented in Table 7.28.

Using the alternative assessment approach outlined in the EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017) as outlined in Section 7.2, the significance of potential odour emissions during the Remediation Phase is summarised in Table 7.29.

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Table 7.28: Assessment of Magnitude & Significance of Odour Emissions for Remediation Phase

Activity and Zone	Magnitude of Odour Impact at Site Boundary	Significance of Odour Impact
Site Entrance Area, Infrastructure & Off-site Works		
Site boundary fence, entrance & site compound	Negligible	Not significant
Permanent leachate infrastructure installation & commissioning	Negligible	Not significant
Leachate discharge pipeline construction	Negligible	Not significant
Permanent gas infrastructure installation & commissioning	Moderate Adverse	Significant
Construction of surface water discharge to the Morell River	Negligible	Not significant
Temporary surface water management measures (progressive)	Negligible	Not significant
Clean stockpile use	Negligible	Not significant
Zone 1		
Waste filling (surplus materials from other zones)	Slight Adverse	Not significant
Capping of NW zone	Negligible	Not significant
Construction of surface water management pond	Negligible	Not significant
NE slope boundary drainage	Negligible	Not significant
Remediation of NE slopes including capping	Moderate Adverse	Significant
Removal of existing flare stack	Slight Adverse	Not significant
Remediation / capping of remaining outer slopes	Moderate Adverse	Significant
Removal of SW screening bund	Negligible	Not significant
Final remediation / capping of central area.	Moderate Adverse	Significant
Gas wells installed	Moderate Adverse	Significant
Construction of soakaway	Negligible	Not significant
Cleaning of ponds & commissioning	Negligible	Not significant
Zone 2A (Import area)		
Demolition of concrete structures	Negligible	Not significant
Fill import / stockpiling	Negligible	Not significant
Stockpiled material use (incl. existing clean stockpile)	Negligible	Not significant
Re-profiling & capping	Slight adverse	Not significant
Vent trenches / gas management measures	Slight Adverse	Not significant
Zone 2B (Processing area)		
Demolition of structures	Negligible	Not significant
Crushing and screening of materials	Negligible	Not significant
Demolition material stockpiling	Negligible	Not significant
Temporary stockpiling of Zone 4 materials	Negligible	Not significant
Re-profiling & capping	Negligible	Not significant
Vent trenches / gas management measures	Slight Adverse	Not significant
Zone 3		
Toe bund construction	Slight Adverse	Not significant
Waste filling	Moderate	Significant
Capping	Moderate	Significant
Installation of gas wells	Slight Adverse	Not significant
Zone 4		
Demolition of structures / retaining wall	Negligible	Not significant

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Activity and Zone	Magnitude of Odour Impact at Site Boundary	Significance of Odour Impact
Slope remediation & materials screening	Negligible	Not significant
Construction of surface water management ponds (for Remediation Phase)	Negligible	Not significant
Final remediation / capping (backfilling of ponds)	Negligible	Not significant
Cleaning of ponds; installation of ecological enhancements to ponds	Negligible	Not significant
Construction Traffic	Negligible	Not significant

Table 7.29: Assessment of Significance of Odour Emissions for Indicative Phases of Remediation Phase

Remediation Phase	Odour exposure	Magnitude of impact	Significance
Phase 1	Small	Slight adverse	Not significant
Phase 2	Medium	Moderate adverse	Significant
Phase 3	Medium	Moderate adverse	Significant
Phase 4	Medium	Moderate adverse	Significant
Phase 5	Medium	Moderate adverse	Significant
Phase 6	Medium	Moderate adverse	Significant
Phase 7	Medium	Moderate adverse	Significant
Phase 8	Negligible	Negligible	Not significant

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Using the Institute of Air Quality Management Guidance, the potential odour impact is considered significant for much of the work in Zone 1 where the most odorous wastes are deposited. The works will be carefully phased to manage the impact and in particular those activities with the greatest potential for odour generation will not be progressed simultaneously. Therefore, while the impact is considered significant, it will be significant at different receptor locations throughout this Phase of works for limited periods of time. Other zones do not contain such significant amounts of odorous wastes and the works are anticipated to progress without significant adverse impact.

The dominant wind direction is from the south-west quadrant and therefore the receptor which may experience the most significant impact is Kerdiffstown House (REC001 refer to Figure 7.1), located predominantly downwind of the works in Zone 1.

Sensitivity Analysis

The sensitivity of the modelling predictions to varying input data was tested to evaluate the robustness of the modelling assumptions. A discussion of the principal findings of this sensitivity analyses is presented here.

(i) Meteorological Data

Data from Casement Aerodrome was used as the primary data set in this assessment. Given the close proximity of the Airport to the proposed Project, it is considered that the data is a reliable indicator of meteorological conditions at the site. The robustness of the assessment was strengthened by using 3 years of recent data (2013 – 2015) for the assessment. Details are presented in this report of the worst-case year and the additional modelling results acquired for all of the other years of data is presented in Appendix A7.9. There was very little variation noted between the data sets used in the study but a conservative approach was adopted with the worst-case data set, as evidenced by the highest predictions, reported in this report.

A further sensitivity check was performed by running the Model using meteorological data from Dublin Airport. There was no significant difference between the predictions for the two alternative data sets, and the complete results of the analysis are summarised in Appendix A7.9.

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(ii) Stack Height

Stack height is a particularly important variable in this assessment. The effect of varying stack height was investigated and the assessment showed that for the scenario modelled, the existing stack height is adequate to ensure effective dispersion of the emissions. Further details are included in Appendix A7.9.

(iii) Modelling Uncertainty

The inherent uncertainty in dispersion modelling is approximately 50 to 100%. As a general rule it is recommended that the predicted contribution to ground level concentrations from the activity shall not exceed approximately 67% of the air quality standard. This approach was considered in the assessments undertaken here and where appropriate higher stack heights were recommended to allow this criterion to be satisfied.

(iv) Sulfur Concentration in the Landfill Gas

Sulfur from landfill gas comes from organic sulfur (sulfides and mercaptans mainly) and hydrogen sulfide. When the gas is burned, the sulfur is emitted primarily as SO_2 but there is also some H_2S and organic sulfur emitted. How much of each depends on a lot of factors – the nature of the decomposing waste, the age of the waste, efficiency of the flare, etc. There is some uncertainty about the relative distribution of sulfur in different forms in the emissions from flares.

The available information on sulfur in the flare emission comes from measurements carried out at the site and from Literature. H_2S levels in the flare inlet have been measured since January 2017. The average concentration from weekly measurements is 1,350ppm (2,025 mg/m^3) and the range is 520 – 1,862 ppm (780 – 2,793 mg/m^3).

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The Dispersion Model presented in this EIAR uses the flare emission data from 2016 to derive the sulfur content in the emissions. For H_2S as noted above, it was assumed (based on Literature estimates) that 1% of the total sulfur was present as H_2S. In order to test the sensitivity of the assessment to the sulfur input data, separate model runs were executed to evaluate the potential impact of the emissions from the flare if higher sulfur levels than those reported above are present in the extracted gas that is burned in the flare.

From the data presented in Table 7.27 for the impact assessment predictions for SO_2, it is clear that even doubling the emission rate of SO_2 in the emissions from the flare would not have a short term adverse impact on air quality in the area as evidenced by the predictions for the 99.7 percentile of 1-hour ground level concentration and the 99.2 percentile of 24-hour ground level concentration. For the annual mean however, the predicted ground level concentration as shown in Table 7.27 is approaching the air quality standard and any further increase in the sulfur dioxide concentration in the flare emissions would cause a breach of this air quality standard. Higher SO_2 levels are considered possible but unlikely during the Remediation Phase based on available information about gas quality throughout the Kerdiffstown Landfill. It is however prudent to consider what actions are required if sulfur levels in the flare inlet gas are higher than those modelled. Further modelling runs were therefore executed which show that a stack height increase to 11m for the existing 250m^3 flare would allow for effective dispersion of the emissions without breach of the air quality standard if the sulfur levels are 50% higher than those modelled for Table 7.27. The results of this additional sensitivity analysis are presented in Appendix A7.9.

A stack height increase is not immediately achievable for a retrofitting solution to an existing flare, so other options are also considered. In particular, using a chemically treated activated carbon filter on the inlet gas to the flare would reduce the sulfur levels by up to 90% and this would ensure that the predicted ground level concentrations are well within the air quality standards.

For the assessment of odour as a result of flare emissions, the 98 percentile 1-hour ground level concentration of SO_2 and H_2S was assessed as discussed in Table 7.27. Odour attributable to SO_2 emitted from the flare is not detectable even if the emissions are much higher. However, at a very low level of H_2S in the emissions as shown in Table 7.27, the 98 percentile reaches 85% of the odour threshold. Kildare County Council are monitoring the level of hydrogen sulfide in the landfill gas weekly and will continue to do so as part of the active management of landfill gas at the site throughout the Remediation Phase of the proposed Project. If higher sulfur, and H_2S, levels are detected in the landfill gas flare inlet during the Remediation Phase, then a suitable

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abatement system, likely to be an activated carbon filter, will be fitted to reduce the levels of sulfur reaching the flare. This is considered an unlikely scenario but there is a management solution available to deal with this if it arises.

(v) Landfill Gas Flare Breakdown

There is a stand-by flare available for the Remediation Phase which the gas can be diverted to if the 250m^3 operating flare breaks down or is taken out of service for maintenance. There are therefore no adverse air quality impacts predicted due to the landfill gas flare breakdown.

The general findings of the sensitivity analyses are that where necessary, the gas treatment and dispersion arrangements can be optimised so that the effect of further variations on input data were insignificant. For all other elements investigated there was very little difference between the predictions using the different data sets.

Remediation Phase Transport Impacts

The principal substances that are emitted from the vehicles are fine particulate matter, nitrogen oxides and carbon monoxide. Dust and particulate matter impacts associated with the passage of vehicles on roads has already been assessed as part of the dust and particulate matter impacts. The level of traffic movements has been reviewed in the context of potential contributions to air quality in the area. Potential emissions from traffic using the L2005 Kerdiffstown Road and roads linking onto the M7 were taken into consideration in this assessment. Using the guidance from the National Roads Authority (NRA) *"Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*, NRA 2011" it was concluded that the additional transport will not generate significant emissions in terms of local air quality and no measurable change in air quality relative to the existing situation is predicted. UK Government guidance "*Review and Assessment: Technical Guidance, LAQM TG (03)"*, Department of Environment, Food and Rural Affairs, 2003 indicates that roads with less than 10,000 vehicles per day are unlikely to have a significant impact on air quality and do not require specific assessment. The only road with a traffic throughput of greater than 10,000 vehicles per day in the vicinity of the site is the M7 motorway.

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7.4.2 Lifecycle Climate Impacts of the Proposed Project

A simplified boundary of the site and the emissions was drawn up for each of the scenarios assessed. Although there are some minor differences between the boundaries for each of the scenarios, the indicative boundary used is shown on Diagram 7.6 below. The red line boundary shows the assessment boundary, which includes reasonably anticipated on and off-site activities to the extent that they are currently known. The blue dotted line boundary shows the site boundary, which includes the materials in the landfill as well as materials stored on-site.

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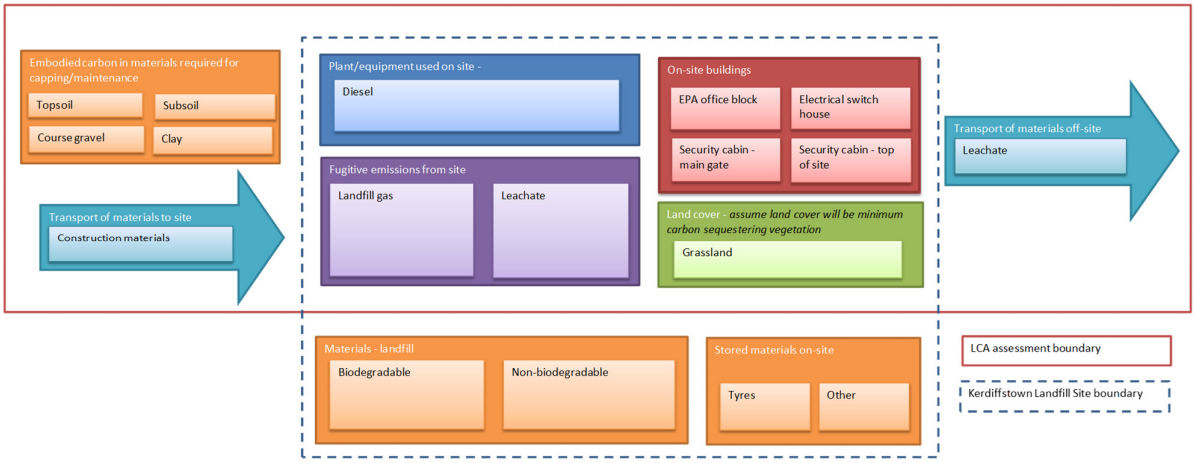


Diagram 7.6: Indicative Boundary for Lifecycle Greenhouse Gas Assessment (Source: Outline Life Cycle Assessment, SKM Enviros 2013, refer to Appendix A7.8)

The results of the LCA assessment for the two scenarios are shown in Table 7.30 below.

Table 7.30: Greenhouse Gas Emissions over the Proposed Project Lifetime

Activity	Total lifetime emissions, tonnes CO_{2e}	
	Scenario A: Do Nothing	Scenario B: Remediation
On-site buildings	1,055	728
On-site plant and equipment		2,428
Fugitive emissions	826,554	459,764
Capping materials		18,134
Transport of materials to / off site	2,994	1,729
Land cover		-12,858
Total	**830,603**	**469,915**

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Scenario A (*Do Nothing*) has the highest overall net emissions and Scenario B, the proposed Project is the lowest at 43% less than that of Scenario A. The most significant source of emissions for both scenarios is from the methane in fugitive landfill gas. Since Scenario B involves capping the landfill, capturing landfill gas and flaring it, the fugitive emissions are lower than for Scenario A (uncapped with no significant flaring). Once landfill gas has been captured and flared, it is converted to CO_2 and is no longer within the boundary of the assessment as this CO_2 is considered to come from a biogenic short-cycle carbon source. However, capping the landfill comes at a cost of embodied carbon for materials and transport of those materials to site. The relative contribution of these activities is minor in the overall scheme which indicates that, based on current information, the best way to reduce the overall LCA emissions from the site would be to maximise the efficiency of the landfill gas capture and flaring, but aim to use the least amount of capping material possible to achieve this outcome. This has been considered in formulating the overall remediation strategy for the site.

It is noted that the 2013 Lifecycle Assessment (refer to Appendix A7.8) assessed a number of possible options for the landfill. Scenario B as reported in that assessment considered a version of the *in-situ* remediation which was slightly different from that proposed now. The 2013 assessment showed that the total emissions over the lifetime of Scenario B was 516,527 tonnes CO_{2e} which is 10% higher than the emissions estimate in Table 7.30 for the proposed Project.

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7.4.3 Operational Phase Air Quality Impacts

Introduction

Following remediation, the site will continue to generate landfill gases which will be managed to minimise emissions of gases and odours. The design of the landfill gas management system has been described in Section 4.2.8 and the Landfill Gas Management Plan is presented in Appendix A4.5. The principal objective of the Landfill Gas Management Plan is to provide effective and efficient collection of gas to ensure that the landfill gas is appropriately controlled and managed throughout the life of the proposed Project.

Control measures have been developed to take account of the different potential of each zone for generating gas from the decomposing waste and their final end-use following remediation works. The landfill gas management system, as outlined on Figure 4.18 and described in Section 4.2.8 consists of a system of gas collection wells which are actively extracted with the gas being flared at high temperature in the landfill gas flare, as well as perimeter gas venting trenches in zones where low levels of gas generation occur. The system design considered the gas output from the GasSim Landfill gas model as outlined in Chapter 12 Soils, Geology, Contaminated Land and Groundwater. The model estimate is 550m^3/hour and a flare capacity of 600m^3/hour provides a slight over-estimation for risk assessment and specification of gas management infrastructure.

The potential air quality impacts associated with the Operational Phase of the proposed Project arise primarily as a result of the gas management system that will manage the landfill gas from the former landfill. The landfill gas will be managed by a system of passive vents and active management techniques. Passive venting techniques will be used in areas where the gas generation rate is low and allows use of this technique. Landfill gas will be extracted from the landfill areas where needed via a system of gas wells installed in Zone 1 and Zone 3 and will be burned in the flare that will be located in the Landfill Infrastructure Compound. It is proposed to remove the existing 250m^3 and standby 500m^3 flares. A new 600m^3/hr flare will be installed with a smaller 250m^3 back-up flare located in the Landfill Infrastructure Compound. Gas models which assess the gas potential from the site have demonstrated that approximately 600m^3/hr should be produced in 2017. Only one flare will operate at a time. The assessment of potential impacts is completed by carrying out a dispersion modelling assessment to predict the impact of the emissions from the 600m^3/hr flare on air quality and this Section of the report describes the study methodology and the findings of the assessment.

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Dispersion Model Input Data for Landfill Gas Flare

Evaluation of the impact of the emissions on air quality using dispersion modelling requires information on a number of input variables which are described here.

(i) Emissions characteristics

The principal assumption is that the flare will run continuously and that the emissions are at the maximum level at all times. In practice this will not occur as the emissions will decrease over time. A summary of the emission data is presented in Table 7.31. This data was derived from consideration of the most recently available monitoring data for the existing flare which was acquired in 2016; the full measurement report is attached in Appendix A7.6. Data for PM_{10} was not recorded so a conservative assumption that the concentration of PM_{10} in the flare emissions is 10mg/m^3 was made based on data from similar facilities. This is likely to overestimate the PM_{10} emissions.

Hydrogen sulfide was not measured in the flare emissions during the monitoring event. It is however known that some of the sulfur present in landfill gas is released from the flare as hydrogen sulphide, with Literature estimates suggesting that at least 0.1% of the sulfur present could be emitted as hydrogen sulfide. For this assessment it is assumed that 1% of the sulfur present is emitted as hydrogen sulfide. The sensitivity of the assessment to this input parameter is discussed in the Sensitivity Analysis at the end of this Section of the EIAR.

In this assessment, the assumption made is that all of the nitrogen oxides are present as NO_x in line with current Guidance on the use of dispersion modelling for air quality impact assessment. While this may overestimate the

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1-hour ground level concentration (GLC), the conservative approach does not affect the outcome of the assessment.

Table 7.31: Input Data for AERMOD Dispersion Model: KLRP 600m³ Flare, Operational Phase

Parameter	Proposed 600 flare*
Stack height, m**	11
Flow rate, m^3/sec (based on extracted volume of 600m^3/hour)	0.0531
Temperature, K	1288
SO_2, g/sec	0.16479
CO, g/sec	0.003687
Particulates as PM_{10}, g/sec	0.001667
Particulates as $PM_{2.5}$, g/sec	0.001667
Nitrogen dioxide, NO_2, g/sec	0.003355
Hydrogen Sulfide, H_2S, g/sec	0.001339

Note
*Emission rates are derived from the most recent environmental monitoring at the existing flare on site, taking measurement uncertainty into account
**Stack height refers to height in metres above ground level

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(ii) Site layout and topography

Layout and topographical information was obtained as outlined in Appendix A7.1.

(iii) Averaging intervals

Averaging intervals were chosen to allow direct comparison of predicted ground level concentrations with the relevant assessment criteria as outlined in Section 7.2.5.

(iv) Receptor locations

Since the impact of the emissions can be observed at considerable distances from the emission sources, a fine grid, 2km x 2km centred on the main emission sources was constructed with receptors located at 50m intervals; and a second grid of 6km x 6km with receptors at 50m intervals was also constructed. In addition to the receptor grids, a number of receptors were selected at sensitive locations in the area represented by the closest residential receptors. A summary of the representative receptors for which data was acquired is given in Table 7.20 and their locations are shown in Figure 7.1.

(v) Meteorological data

As noted in Section 7.3.1, meteorological conditions at the proposed Project are best described by data from the nearby Casement Aerodrome. For this assessment three years of meteorological data from 2013 to 2015 for Casement Aerodrome have been used.

(vi) Baseline air quality

Baseline air quality is described in Section 7.3.3 from the very comprehensive database of information available for the site as well as longer term data acquired for similar locations in Ireland.

Operational Phase Air Quality Impact Assessment Predictions

The impact assessment involves execution of modelling runs to represent different potential scenarios associated with the emissions. The following Scenarios were considered in the runs.

(i) **Meteorological data** – Model runs were executed to consider the effect of meteorological data set selection on the impact predictions;

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(ii) **Pollutant concentrations** – Model runs were executed to evaluate the effect of varying pollutant emission rates on the impact predictions.

(iii) Model runs were conducted as part of a **sensitivity analysis** to investigate the effect of a number of variables in the input data and operating conditions on the modelling predictions.

The results demonstrate that for those pollutants and emission scenarios studied, the Air Quality Standards are not breached as a result of the emissions under normal operating conditions as modelled in this report. The individual results for each parameter of interest are discussed here, and the full dispersion modelling data set is presented in Appendix A7.9.

The background ambient air quality has been considered in Section 7.3.3 of this report. In accordance with the guidance presented in the EPA Guidance AG4, the background concentrations are treated as follows:

- For the assessment of 24-hour and annual mean concentrations, the predicted contribution from the site is added to the average annual background concentration.
- For the assessment of 1-hour mean concentrations, the predicted contribution from the site is added to twice the average annual background concentration.

Particulate matter / PM_{10} and $PM_{2.5}$

Particulate matter and PM_{10} emissions from the landfill gas flare are low and will contribute primarily to airborne particulate concentrations due to the anticipated particle size; since this consists primarily of PM_{10}, the impact assessment is based primarily on the assessment criteria for this parameter. The predicted ground level concentrations as a result of the emissions from the proposed Project combined with the background concentrations are as shown in Table 7.32 alongside the relevant Air Quality Standards.

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Table 7.32: Predicted Operational Phase Ground Level Concentration of PM_{10} Resulting from the proposed 600m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
24-hour limit not to be exceeded more than 35 times/year (90.4 percentile)	50 µg/m³	10	0.38	10.4
Annual limit	40 µg/m³	10	0.12	10.1

Note
The worst case meteorological year for the 90.4 percentile of 24-hour average is 2013 and the worst case year for the annual average is 2014.

The data demonstrate that the emissions from the proposed Project will not cause the air quality standards to be exceeded.

An isopleth showing the predicted 90.4 percentile of 24-hour ground level concentration of PM_{10} as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.14. An isopleth showing the predicted annual mean ground level concentration of PM_{10} as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.15.

Data for $PM_{2.5}$ is also presented using the very conservative assumption that all of the particulates are present as $PM_{2.5}$. This conservative approach will overestimate the significance of the $PM_{2.5}$ emissions. Even so, the data presented in Table 7.33 demonstrate that the emissions from the flare during the operation of the multi-use public park will not cause the air quality standards to be exceeded.

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Table 7.33: Predicted Operational Phase Ground Level Concentration of $PM_{2.5}$ Resulting from the proposed 600m³/hr Flare Emissions

Air Quality Standard [Note]		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
Annual limit	25 µg/m³	6	0.12	6.1

Note
A limit of 20 µg/m³ will apply from 2020 and this limit is also complied with.
The worst case meteorological year is 2014.

An isopleth showing the predicted annual mean ground level concentration of $PM_{2.5}$ as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.16.

Carbon monoxide, CO

The modelling results for CO are presented in Table 7.34. For the assessment of the 8-hour mean concentrations, the predicted contribution from the site is added to two times the average annual background concentration.

Table 7.34: Predicted Operational Phase Ground Level Concentration of CO Resulting from the proposed 600m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
8-hour limit	10,000 µg/m³	800	<1	800

Note
The worst case meteorological year is 2014.

The data presented in Table 7.34 demonstrates that the emissions from the proposed Project will not cause the air quality standards to be exceeded.

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Sulfur dioxide, SO_2

The modelling results for SO_2 are presented in Table 7.35 for maximum potential emission rates from the proposed Project.

Table 7.35: Predicted Operational Phase Ground Level Concentration of SO_2 Resulting from the proposed 600m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
Hourly limit - not to be exceeded more than 24 times/year (99.7 percentile)	350 µg/m³	4	75	79
Daily limit - not to be exceeded more than 3 times/year (99.2 percentile)	125 µg/m³	2	27.3	29.3
Annual limit	20 µg/m³	2	7	9

Note
The worst case meteorological year is 2014.

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The data presented demonstrates that the emissions from the proposed Project will not cause the air quality standards to be exceeded.

An isopleth showing the predicted 99.7 percentile of 1-hour ground level concentration of SO_2 as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.17. An isopleth showing the predicted 99.2 percentile of 24-hour ground level concentration of SO_2 as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.18. An isopleth showing the predicted annual mean ground level concentration of SO_2 as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.19.

The predicted annual mean ground level concentration approaches but does not exceed the limit for the protection of human health and ecosystems. There is some uncertainty about the concentration of SO_2 that may be present in the flare emissions and this is discussed in the sensitivity analysis Section at the end of this Section of the EIAR.

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Nitrogen dioxide, NO_2, and nitrogen oxides, NO_x

The modelling results for nitrogen dioxide and nitrogen oxides are presented in Table 7.36 and Table 7.37.

Table 7.36: Predicted Operational Phase Ground Level Concentration of NO_2 Resulting from the proposed 600m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
Hourly limit - not to be exceeded more than 18 times/year (99.8 percentile)	200 µg/m³	6	1.4	7.6
Annual limit for protection of human health	40 µg/m³	3	0.1	3.1

Note
The worst case meteorological year for the 99.8 percentile of 1-hour average is 2013 and the worst case year for the annual average is 2014.

Table 7.37: Predicted Operational Phase Ground Level Concentration of NOx Resulting from the proposed 600m³/hr Flare Emissions

Air Quality Standard		Background concentration, µg/m³	Predicted incremental contribution, µg/m³	Predicted GLC including background, µg/m³
Annual limit for protection of vegetation	30 µg/m³	3	0.1	3.1

Note
The worst case meteorological year is 2014.

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The data demonstrates that the emissions from the flare during the Operational Phase will not cause the air quality standards to be exceeded. It is also noted that a conservative modelling approach was adopted with assumptions that all of the nitrogen oxides are present as NO_2 so the assessment is based on a worst-case impact assessment scenario.

An isopleth showing the predicted 99.8 percentile of 1-hour ground level concentration of NO_2 as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.20. An isopleth showing the predicted annual mean ground level concentration of NO_2 as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.21.

An isopleth showing the predicted annual mean ground level concentration of NOx as a result of emissions from the proposed 600m³ flare during the Remediation Phase is presented in Figure 7.22.

Odour

Odour is of particular significance in this assessment and is considered in this Section of the report. The other modelling predictions have focused on the comparison of impact predictions with Air Quality Standards which are designed for protection of human health and ecosystems. A further issue to be considered is the potential for odour nuisance as a result of the emissions from the landfill gas flares. This potential is considered by examining the maximum 1-hour ground level concentration of sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) as a result of the emissions. These substances are chosen because of their significance in terms of potential odour impact. Other sulfur containing substances are not present at significant concentrations in the flare emissions due to the high combustion temperature so the assessment focuses on the predicted ground level

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concentration of SO_2 and H_2S which are the principal sulfur-containing species that may be present in flare emissions.

The 98 percentile of 1-hour ground level concentration of hydrogen sulfide and sulfur dioxide was also modelled and the results are shown in Table 7.38.

Table 7.38: Predicted Operational Phase Ground Level Concentration of SO_2 and H_2S Resulting from the proposed 600m³/hr Flare Emissions

Air Quality Standard	Odour threshold, µg/m³	Predicted GLC, µg/m³
SO_2 98 percentile of 1-hour ground level concentration	1,200	51.5
H_2S 98 percentile of 1-hour ground level concentration	0.7	0.68

Note
The odour threshold is the benchmark against which the impact is assessed

The 98 percentile is the maximum concentration level for 98 percent of the time, or 8,584 hours in a year; so this level is reached or exceeded for just 176 hours per year.

An isopleth showing the predicted 98 percentile of 1-hour ground level concentration of SO_2 as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.23 and an isopleth showing the predicted 98 percentile of 1-hour ground level concentration of H_2S as a result of emissions from the proposed 600m³ flare during the Operational Phase is presented in Figure 7.24. Extracts of these are shown in Diagram 7.7 and Diagram 7.8 respectively. The data is evaluated by comparing the 98 percentile of the 1-hour GLC to the odour threshold for SO_2 which is 1,200µg/m³ and 0.7 µg/m³ for H_2S. The assessment has shown that odour attributable to the emissions from the landfill gas flare is not detectable for the scenarios modelled.

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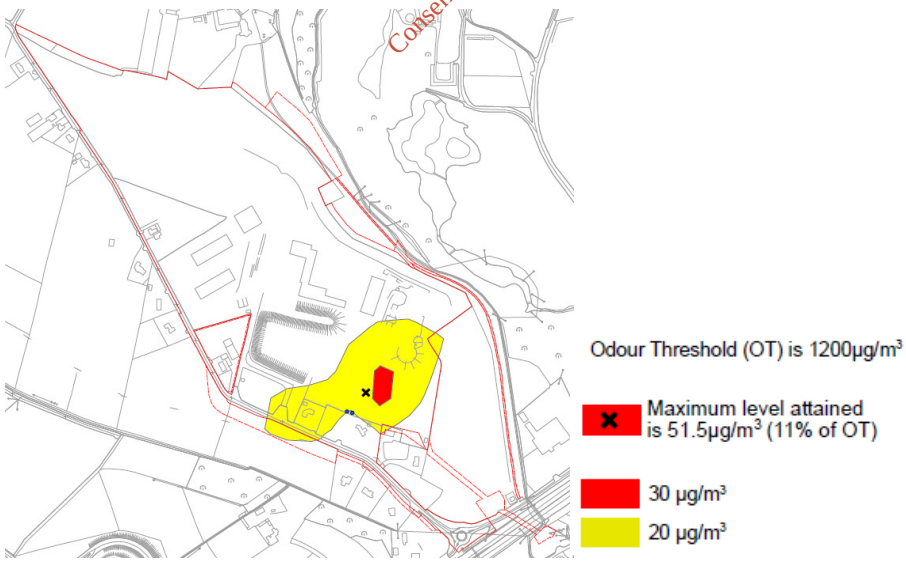


Diagram 7.7: Isopleth Showing the Predicted 98 percentile of 1-hour Ground Level Concentration of SO_2 as a Result of Emissions from the Proposed 600m³ Flare During the Operational Phase

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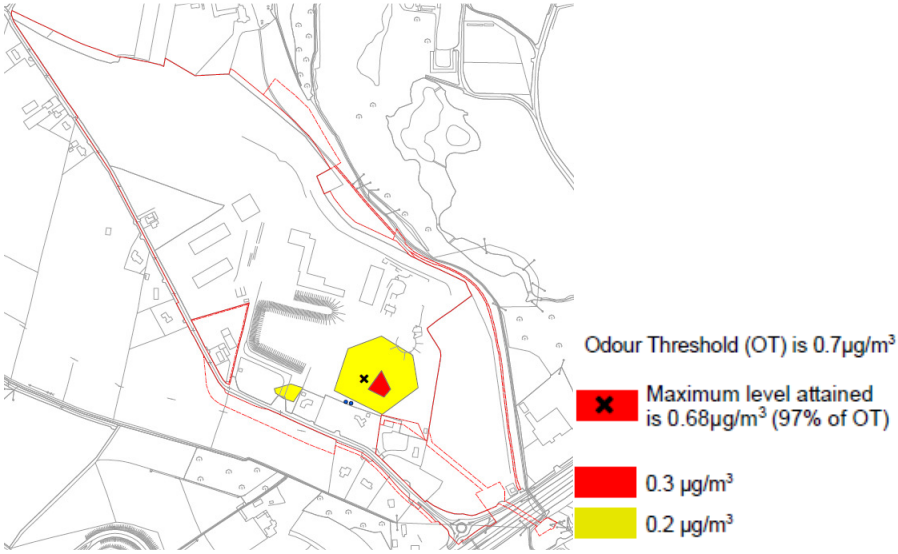


Diagram 7.8: Isopleth showing the predicted 98 percentile of 1-hour ground level concentration of H_2S as a result of emissions from the proposed 600m³ flare during the Operational Phase

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Sensitivity Analysis

The sensitivity of the Operational Phase modelling predictions to varying input data was tested to evaluate the robustness of the modelling assumptions. A discussion of the principal findings of this sensitivity analyses is presented here.

(i) Meteorological Data

Data from Casement Aerodrome was used as the primary data set in this assessment. Given the close proximity of the Airport to the Kerdiffstown site, it is considered that the data is a reliable indicator of meteorological conditions at the site. The robustness of the assessment was strengthened by using 3 years of recent data (2013 – 2015) for the assessment. Details are presented in this report of the worst-case year (2013 or 2015) and the additional modelling results acquired for all of the other years of data is presented in Appendix A7.9. There was very little variation noted between the data sets used in the study but a conservative approach was adopted with the worst-case data set, as evidenced by the highest predictions, reported in this report.

(ii) Stack Height

Stack height is a particularly important variable in this assessment. The effect of varying stack height was investigated and the assessment showed that for the scenario modelled, the proposed 11m stack height is adequate to ensure effective dispersion of the emissions. Further details are included in Appendix A7.9.

(iii) Modelling Uncertainty

The inherent uncertainty in dispersion modelling is approximately 100%. As a general rule it is recommended that the predicted contribution to ground level concentrations from the activity shall not exceed approximately 67% of the air quality standard. This approach was considered in the assessments undertaken here and where appropriate higher stack heights were recommended to allow this criterion to be satisfied.

(iv) Sulfur Concentration in the Landfill Gas

As noted in Section 7.4.1 there is some uncertainty about the sulfur content of the landfill gas that will arise when the proposed Project is completed. Kildare County Council are monitoring the level of hydrogen sulfide in the landfill gas weekly and will continue to do measurements as part of the active management of landfill gas at the site throughout the gas-generating life of the landfill. If higher sulfur, and H_2S, levels are detected in the landfill gas flare inlet during the Remediation and Operational Phase, then a suitable abatement system, likely

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to be an activated carbon filter, will be fitted to reduce the levels of sulfur reaching the flare. This is considered an unlikely scenario but there is a management solution available to deal with this if it arises.

(v) Landfill gas flare breakdown

There is a stand-by flare available for the Operational Phase which the gas can be diverted to if the 600m^3 operating flare breaks down or is taken out of service for maintenance. There are therefore no adverse air quality impacts predicted from flare breakdown.

The general findings of the sensitivity analysis are that where necessary, the gas treatment and dispersion arrangements can be optimised so that the effect of further variations on input data were insignificant. For all other elements investigated there was very little difference between the predictions using the different data sets.

7.5 Mitigation Measures

7.5.1 Remediation Phase

The Remediation Phase of the proposed Project represents the most significant potential for air quality and odour impacts. As identified and quantified in this report, the principal impacts relate to dust and particulate matter and odour emissions. Compliance with the EPA Guidance on the Operation of Landfills, "*Landfill Manuals - Landfill Operational Practices*" 1997 will ensure that the highest standards of environmental protection are achieved.

Prior to commencement of the Remediation Phase, the appointed contractor will prepare a Construction Environmental Management Plan (CEMP). The CEMP will contain the mitigation measures and plans identified in the following Sections and ensure that they are fully implemented during the construction phase, to prevent or reduce the impacts identified in the impact assessment.

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The CEMP will contain a Dust Management Plan which will be formulated for the Remediation Phase of the proposed Project, as the planned activities are likely to generate some dust emissions. The principal objective of the Dust Management Plan will be to ensure that dust emissions do not cause significant nuisance at receptors in the vicinity of the proposed Project. The Dust Management Plan shall address the following:

- The appointed contractor for the remediation works will be assigned with overall responsibility for Dust Management reporting back to the KCC Site Manager;
- The design, and in particular the phasing of the Remediation Phase work will consider dust impact management and choose design approaches to minimise dust emissions;
- The Remediation Phase will be carried out in Phases so that all of the works with significant potential for generating dust emission will not all occur simultaneously;
- An effective training programme in dust management for site personnel will be implemented for the duration of the Remediation Phase;
- A strategy for ensuring effective communication with the local community will be developed and implemented;
- A programme of dust minimisation and control measures will be implemented and regularly reviewed; and
- A monitoring programme will be implemented.

The following is a summary of the main mitigation features of the proposed Project and the specific mitigation measures which will be employed in order to minimise dust emissions from the activity and the associated impacts of such emissions:

- The areas on site which vehicles will be travelling on will be hard-surfaced where practicable thus significantly reducing the potential for dust emissions from the vehicles;

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- A wheel washing facility with water collection and filtering before any discharge to the surface water management system will be set up. Gate security staff will be briefed on inspection of vehicles for cleanliness ahead of leaving site. During the initial stages of site set-up, a mobile wheel washing vehicle will be available at short notice, if necessary. The use of a wheel wash facility at the entrance to the proposed Project will minimise the transfer of any dust onto the roads in the vicinity of the site; this will also minimise the potential for dust build-up on surfaces which could be blown across the site.
- In order to minimise the potential for wind-generated emissions from storage of materials, the storage areas will be oriented in a favourable manner with respect to the prevailing wind to minimise the effects of wind blow on release of dust and particulate.
- The relatively coarse particle size (10 – 75µm) associated with the proposed Project means that the particles will generally be deposited close to the emission source and will not travel significant distances away from the site.
- Fixed and mobile water sprays will be used to control dust emissions from material stockpiles and road and hardstanding surfaces as necessary in dry and/or windy weather.
- A daily inspection programme will be formulated and implemented in order to ensure that dust control measures are inspected to verify effective operation and management.
- A dust deposition monitoring programme will be implemented at the site boundaries for the duration of the Remediation Phase in order to verify the continued compliance with relevant standards and limits.

During the Remediation Phase the risk of odour impacts will increase significantly, when waste containing materials will become exposed during re-profiling and other works. The prevailing wind at the site is south-westerly, so the sensitive receptors to the north and north-east of the site are therefore at risk of receiving odour and air quality impacts. Weather conditions have a significant effect on dispersion and propagation of odours with the strongest odours generally experienced on sites like this during low wind conditions, when there is little dilution of air. Further, a sudden drop in barometric pressure tends to result in an increase in gas diffusing from the waste body, and high atmospheric temperatures also result in more odours being released in warm weather. Careful attention to these factors will ensure that odours related to weather effects are minimised during the Remediation Phase of the proposed Project.

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During the Remediation Phase the appointed contractor will work in accordance with the guidance provided in the National Guidelines for the prevention of Nosocomial Invasive Aspergillosis during construction/renovation activities (developed by a sub-committee of the Scientific Advisory Committee of the National Disease Surveillance Centre, 2002).

Odour mitigation measures are discussed in the draft Odour Control Plan (OCP) for the proposed Project which will be finalised as part of the overall CEMP. A Draft OCP was formulated to inform the design process for this proposed Project and is attached in Appendix A7.7. Odour incidents are being minimised at the site through best practice and regular monitoring. Odour minimisation and prevention measures which are currently implemented and which will continue to be updated during the Remediation Phase will include:

- Carrying out subjective odour assessments (sniff tests) and logging details of odorous emissions during daily and weekly site assessments in accordance with EPA guidance;
- Noting wind direction, temperature and barometric pressure on a daily basis;
- Ensuring that landfill gas flaring is balanced and optimised to maximise gas collection from installed gas wells and flaring according to operational recommendations;
- Investigating any odour that appears stronger than the normal emission;
- Logging any odour complaints, and investigating circumstances on the day the complaint was made. This includes correlating wind direction and speed, barometric pressure, and whether any site works were being carried out; and,
- Notifying nearby sensitive receptors prior to any works being carried out, that may disturb the waste body and cause odours to be released.

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Disturbing the waste is unavoidable during the Remediation Phase of the proposed Project and therefore odour emissions are unavoidable. The magnitude and impact of any such odours will be minimised by implementing a phased approach to the Remediation Phase, and by ensuring that effective mitigation measures are in place. The proposed approaches are summarised here.

Minimisation of evaporation of odours will be promoted through adoption of the following measures:

- Maintain an adequate supply of temporary cover material prior to any works commencing (e.g. clean topsoil, clay or liner membrane);
- Any disturbance and exposure of odorous waste will be kept to the minimum practical duration;
- The surface area of exposed waste will be kept to a minimum size at all times;
- Temporary cover will be applied to all work areas as quickly as practicable;
- The carrying out of major waste movements during hot weather when odours volatise most readily will be avoided;
- Leaving open waste exposed in direct sunlight, which increases evaporation, will be avoided;
- Water spray to lower the temperature of exposed waste, and inhibit evaporation will be used;
- Screening of materials containing waste, unless adequately contained, will be avoided; and
- Any waste containing material that has to be transported from one side of the site to another will be covered and contained during transport.

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- Planning of works to take place under suitable weather conditions for minimising odours will be actively implemented during the Remediation Phase. If unacceptable odours are generated from a particular activity it may be necessary to cover the exposed waste, and cease the activity until additional odour control measures can be put in place. This may include the provision of additional water bowsers, or waiting for cooler weather conditions. The appointed contractor will agree such measures with the KCC Site Manager.
- Nearby sensitive receptors and local Community Liaison Group will be kept informed of the progress and plans regarding the Remediation Phase. Nearby sensitive receptors will be informed prior to any remediation works being carried out. They will be informed of the works phasing plan, and the locations of works planned for the duration of remediation works will be regularly updated and communicated. Where adverse metrological conditions coincide with works phasing that cannot be averted, residents will be informed of the heightened risk of short-term odour nuisances.
- During remediation works there will be a requirement for monitoring of odour emissions from the site to be undertaken which shall include the following:
  - Frequent sniff sampling and logging of odour characteristics at the working face;
  - Frequent sniff tests at the site perimeter downwind from the working face;
  - Frequent sampling of specified compounds with colour indicator tubes specified at
  - Appropriately low detection ranges.
  - Frequent measurement of Total VOC concentrations using a FID (flame ionization detector) handheld field detector; and,
  - Regular sniff tests off-site near sensitive receptor locations.

If monitoring indicates higher than expected odour emissions, or impacts at sensitive receptors, additional mitigation measures will need to be implemented. If necessary, and in adverse conditions, the works may have to be stopped and the workface contained with a temporary cover, until adequate mitigation can be assured. The appointed contractor will agree such measures with the KCC Site Manager.

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Kildare County Council are monitoring the level of hydrogen sulfide in the landfill gas weekly and will continue to do so as part of the active management of landfill gas at the site throughout the Remediation Phase of the proposed Project. If higher sulfur, and H_2S, levels are detected in the landfill gas flare inlet during the Remediation Phase, then a suitable abatement system, likely to be an activated carbon filter, will be fitted to reduce the levels of sulfur reaching the flare. This is considered an unlikely scenario but there is a management solution available to deal with this if it arises.

7.5.2 Operational Phase

The principal mitigation measures proposed for the Operational Phase of the proposed Project are the comprehensive proposals for the management of landfill gas at the proposed multi-use public park. Landfill gas will be actively and passively managed by means of an extensive network of extraction wells and perimeter gas venting trenches. Actively extracted gas will be diverted to the new flare located within the purpose-built Landfill Gas Infrastructure compound which will convert the landfill gas into harmless substances. There will be two landfill gas flares, one operating in duty and one in back-up mode. The location of the Landfill Infrastructure Compound and the height of the landfill gas flare stacks has been chosen to optimise the management of the landfill gas at the proposed Project. The assessment has shown that the proposed management plans will ensure that no odours are detectable as a result of the emissions from the proposed Project during the Operational Phase. Over time, the gas concentrations will decrease so that eventually the landfill gas flares would no longer be required. It is not anticipated that any diffuse odour impacts will occur during the Operational Phase, as the capping and ongoing landfill gas management of the site will be effective in managing and preventing diffuse emissions.

The design of the pipeline to transfer leachate off site will require installation of air valves and manholes. These manholes will include sealant to prevent release of odours. The connection point to Johnstown Pumping Station will be fitted with a carbon filter to further mitigate an odour release.

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7.6 Residual Impacts

The proposed mitigation measures have been shown to be effective in the management of air quality and odour impacts associated with the proposed Project. The Remediation Phase will be managed so that there are no significant residual air quality impacts after completion. The comprehensive mitigation and management proposals will ensure that there are no significant residual impacts during the Operational Phase.

7.7 Difficulties Encountered in Compiling Information

There were no specific difficulties encountered when carrying out this assessment.

7.8 Cumulative Impacts

The cumulative impact of the proposed Project and other permitted developments in the area can be assessed by taking account of the existing baseline environment and the predicted impacts associated with the operation of the proposed Project in combination with predicted impacts of any other proposed developments in the area.

There are a number of additional development projects proposed in the vicinity of the proposed Project that are considered in terms of a cumulative impact on air quality that may be experienced at receptors and/or at the site boundaries. These projects are discussed in the following paragraphs.

7.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of

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inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. The Waste Facility Permit restricts the truck movements onto the quarry site to a maximum of 35 per day and restricts the working hours to 08:00 to 17:00 Mondays to Fridays and 08:00 to 13:00 on Saturdays. This approximates to four loads of inert materials coming to the site per hour at maximum capacity. The project is anticipated to be completed over a three-year period which would significantly reduce the number of truck movements to approximately one per hour on average over the duration of the project.

The quarry infilling will use only inert materials and therefore any potential impact on air quality will be related to dust and particulate emissions; inert materials are not odorous and therefore odour impacts will not occur as a result of the quarry infilling. The Waste Facility Permit requires the quarry works to meet a limit for dust deposition at the site boundaries of 350mg/m^2-day. The only receptor that has significant potential to be impacted by works at both sites is REC018. Since dust deposition at both the quarry site boundary and the proposed Project site boundaries will be limited to 350mg/m^2-day, there is therefore no potential for a significant adverse cumulative impact since both proposed Projects will operate within levels that will ensure that adverse air quality impacts do not occur. The use of different approach roads to serve the two sites is also beneficial since this will minimise the traffic movements on each road thereby minimising the impact on nearby receptors. There will be no adverse air quality impact from the Operational Phase of the infilled quarry.

7.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass M7 Naas to Newbridge By-Pass Upgrade Schemes involves the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell, and a new re-configured interchange at Newhall and a grade separated junction, M7 Osberstown Interchange, located between the existing M7 Maudlins and Newhall Interchanges. The potential air quality impact is related to dust and particulate matter, and no odour impacts are predicted. The nearest receptors to the proposed Project are too far removed to be significantly impacted by the road construction works and the overall cumulative impact is considered to be neutral.

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7.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. The cumulative impacts from this project (if it were to proceed at a point in the future) and the proposed Project is anticipated to be neutral given the considerable distance between the site and the proposed Project.

7.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed the cumulative impact from the housing development project and the proposed Project is anticipated to be neutral.

7.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed upgrade works as part of the proposed Project. It is

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anticipated that the construction of the new pumped sewer will be scheduled at the same time as the upgrade works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic.

If construction works proceed for both schemes at the same time, the plant and machinery required will have to operate at different sections along the Kerdiffstown Road due to the nature of the work and the size and type of machinery required. In effect, the construction work for one project would be followed by the other project but they would never directly overlap. Assuming that the works for both schemes are managed as described above to minimise air quality impacts, the cumulative impact is anticipated to be not significant. In the event that either the proposed Project or the new pumped sewer construction is delayed there will be no cumulative impact.

The assessment has shown that cumulative impacts at the boundaries of the proposed Project and at sensitive receptors in the area are predicted to be imperceptible. It is therefore not considered that any additional mitigation measures above those already provided, are required to account for cumulative impacts.

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8. Noise and Vibration

This Chapter assesses the potential noise and vibration impacts which may be generated during the Remediation and Operational Phases of the proposed Project. The principal Remediation Phase noise and vibration impacts will be associated with machinery use, excavation, demolition of walls and construction of landfill management infrastructure, while Operational Phase noise and vibration impacts are anticipated to be insignificant following completion of the remediation programme.

Noise levels will vary throughout the Remediation Phase with a range of noise generating activities involved in the remediation works phase. Noise modelling has been completed for a set of conservative scenarios to account for all significant noise generating activities and has shown that the noise criteria can be met. The entire remediation programme has been assessed as being short-term in duration with a moderate significance in terms of over-all impact. Traffic noise impacts have been assessed as moderate and within the adopted noise criteria.

The results of the Operational Phase noise assessment indicate that the operation of the proposed Project will make no measurable change to the prevailing daytime, evening time and night time ambient noise environment. The predicted increase in operational traffic noise at the Noise Sensitive Receptors is anticipated to be barely perceptible and the associated noise impact is classified as negligible.

A range of best practice noise management measures will be employed to mitigate any potential noise disturbance during the Remediation Phase. As the noise impact assessment has shown there are no adverse noise impacts associated with the Operational Phase of the proposed Project and mitigation measures are not required during the operation of the multi-use public park.

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8.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") due to noise and vibration anticipated to occur during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950's until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 8.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 8.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound supported by a back-up flare • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and management of surface water management infrastructure • Operation and maintenance of the leachate management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation can be found in Chapter 4 Description of the Proposed Project.

The assessment focuses on the potential noise and vibration impacts associated with the deployment of equipment and machinery during remediation and vehicles accessing the proposed Project during the Remediation and Operational Phases, as these are the main sources of noise and vibration associated with the proposed Project.

8.1.1 Fundamentals of Acoustics

Noise is usually defined as an annoying or unwanted sound. Sound can be defined as any pressure variation (in air, water or other medium) that the human ear can detect. In order to account for the large range of pressure levels that can be detected by the human ear, sound is measured in terms of a logarithmic ratio of sound pressures. These measurements are described as Sound Pressure Levels (SPL) and are measured in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). As a rule of thumb, a doubling in the loudness of the sound occurs with every increase of 10dB in sound pressure. Similarly, for each 10dB decrease in sound pressure, the loudness is cut in half.

The frequency of sound is the rate at which a sound wave oscillates, and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. To account for this, a weighting mechanism known as the 'A-weighting' system is used to provide an accurate correlation with perceived loudness for the human ear. SPL's measured using 'A weighting' are expressed in terms of dB(A).

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An indication of the level of some common sounds on the dB(A) scale is presented in Table 8.2 and a glossary of noise terms is provided in Table 8.3 .

Table 8.2: The Level of Typical Common Sounds on the dB(A) Scale

dB(A)	Sound Description
0	Threshold of Hearing
30	Quiet Bedroom
50	Public Library
60	Busy General Office
70	7m from Car Passing at 60kph
85	Very Busy Pub (raise voice to be heard)
100	Disco
110	Very Loud Rock Concert
120	Threshold of Pain

8.1.2 Noise Glossary

Table 8.3: Noise Glossary of Terms

Term	Definition
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).
L_{AN}	The A-weighted noise level exceeded for N% of the sampling interval.
L_{A90}	Refers to the A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It is commonly used to describe the background noise level.
L_{A10}	Refers to the A-weighted noise levels in the top 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period.
L_{Amax}	The maximum Root Mean Square (RMS) A-weighted sound pressure level occurring within a specified time period.
L_{pA} (dB)	An 'A-weighted decibel' - a measure of the overall level of sound across the audible frequency range (20Hz – 20kHz) with A-frequency weighting, known as 'A–weighting', to compensate for the varying sensitivity of the human ear to sound at different frequencies.
RMS	The RMS value of a set of numbers is the square root of the average of their squares.
Noise Sensitive Location (Receptor)	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
Sound Pressure Level	Sound pressure refers to the fluctuations in air pressure caused by the passage of a sound wave. It may be expressed in terms of sound pressure level at a point.
Hertz	The unit of sound frequency in cycles per second.
dB	Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micropascals (20 µPa).
Sound Power Level	The logarithmic measure of sound power in comparison to a referenced sound intensity level of one picowatt (1pW) per m^2

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8.2 Methodology

8.2.1 Study Area

The site of the proposed Project, is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The land uses in the immediate vicinity of the site are land associated with

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Kerdiffstown House to the north-east, golf courses to the north and north-east and a mixture of land uses including residential, agricultural and worked out quarries to the south-east, south-west and west. Potential noise and vibration impacts associated with the proposed Project are predicted to be at their most significant close to the site boundary but potential impacts may be observed at further removed locations. The general area surrounding the proposed Project was assessed in order to identify the noise sensitive receptors (NSRs) that have the potential to be impacted by noise emissions associated with the proposed Project and this informed the study area for the impact assessment. Noise and vibration impacts associated with the proposed Project works on NSRs are considered in this Section of the report.

8.2.2 Impact Assessment Methodology

This Section of the EIAR evaluates the potential noise and vibration impacts which may be generated during the Remediation and Operational Phases of the proposed Project. The assessment considers all potential impacts, before and after mitigation and control measures, and evaluates the significance of potential impacts on NSRs in the vicinity of the proposed Project. The methodologies adopted in the assessment are summarised as follows:

(i) A review of the existing baseline noise data for the proposed Project site was completed. This included the noise monitoring completed by Fitz Scientific in October 2012 and also the noise monitoring completed by BHP in October 2016.

(ii) A project specific baseline noise and vibration survey was carried out to provide up-to-date information on existing background and specific site noise levels at the proposed Project boundaries, particularly those closest to residential and other NSRs such as Kerdiffstown House, the golf courses and Johnstown Garden Centre. This baseline noise survey captured current noise data representative of all noise sensitive receptors in the vicinity of the proposed Project that could be impacted by the noise generating activities associated with the proposed Project. The survey was executed in accordance with the requirements of *ISO 1996 (2007): Acoustics - Description and Measurement of Environmental Noise Part 2 Determination of Environmental Noise Levels* and in addition, with reference to the EPA publication; *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), 2016.* Noise and vibration monitoring was carried out in September and November 2016 at eight noise monitoring locations and two vibration monitoring locations in the vicinity of the proposed Project. The monitoring locations are shown in Figure 8.1.

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(iii) Identification of appropriate criteria against which to assess the noise and vibration impacts associated with the proposed Project. Criteria for noise assessment are discussed in Section 8.2.3 and the criteria for vibration assessment are discussed in Section 8.2.4.

(iv) Noise and vibration impacts associated with the Remediation Phase have been calculated in accordance with ISO 9613: *Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996* using input data sourced from British Standard *5228-1:2009+A1:2014 –Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise* (BS 5228-1) and British Standard BS 5228-2:2009+A1:2014 *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 2: Vibration (BS 5228-2).*

(v) Noise impacts associated with the Operational Phase have been calculated in accordance with ISO 9613: *Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation, 1996* and with the use of noise modelling software. Details on the noise modelling are provided in Section 8.4.

(vi) The results generated by the impact assessments have been compared against the relevant criteria for both the Remediation and Operational Phases.

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(vii) Mitigation and avoidance measures are proposed where required to ensure that impacts are managed and controlled to minimise the impact on receptors.

The scope of the assessment includes an assessment of Remediation and Operational Phase impacts. The assessment was carried out in accordance with the following guidance and tailored to the proposed Project based on professional judgement and local circumstance:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017); and
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015).

The effects of the proposed Project are described by considering the possible impacts that could occur as a result of the proposed Project, the probability of their occurrence and the nature and significance of such impacts. The EPA draft revised *Guidelines on the Information to be Contained in Environmental Impact Statements* (2015) are draft Guidelines which take account of the revised EIA Directive (2014/52/EU) and which have been considered in this assessment. Impacts are described in the draft Guidance under various headings which are summarised as follows:

- Probability – likely, possible, unlikely;
- Quality – positive, neutral, negative;
- Significance – imperceptible, moderate, profound; and
- Magnitude – duration, frequency, extent, context.

A description of the significance of effects is presented in Table 8.4 which shows the approach taken to quantifying the significance and magnitude of potential noise impacts.

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Table 8.4: Significance and Magnitude of Environmental Effects

Aspect	Description
Significance of Effects	
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics.
Magnitude of effects	
Extent	This is described by the size of the area, the number of sites and the proportion of the population affected by the effect.
Duration	**Momentary effects** last seconds to minutes.
	Brief effects last less than a day.
	Temporary effects lasting less than one year.
	Short-term effects last from one to seven years.
	Medium-term effects last from seven to fifteen years.
	Long-term effects last from fifteen to sixty years.

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Aspect	Description
	Permanent effects last over sixty years.
Frequency	How often the effect will occur.
Context	The contextual relationship between the effect and the existing baseline.

8.2.3 Noise Assessment Criteria

There is no specific Irish legislation which sets out environmental noise limits that must be achieved and therefore the assessment criteria that are presented in this report are based on the guidelines set out by regulatory bodies such as the Environmental Protection Agency (EPA), the World Health Organisation (WHO), the Department of Communications, Climate Action and Environment whose guidance and standards are based on international best practice.

Remediation Noise Criteria

The Remediation Phase construction noise will be temporary in nature and is usually experienced over a short to medium-term period and this characteristic requires it to be considered differently to other longer-term noises. Construction activities on larger-scale construction projects such as this one will inevitably result in noise being generated.

Chapter 4 Description of the Proposed Project describes the works associated with each Phase and remediation works for the proposed Project will be carried out both on-site and off-site. The on-site works include all remediation activities that will be carried out inside the site boundary while the off-site works include all Remediation Phase works that will be completed outside the site boundary such as the realignment of the L2005 Kerdiffstown Road. Consequently, the source of the noise being assessed (on-site or off-site) is required to be considered to ensure that the correct noise criteria are applied.

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The on-site activities associated with the Remediation Phase of the proposed Project will, in this instance, be carried out under the conditions and requirements of an Industrial Emissions Activities Licence (IEAL) as granted by the EPA and as such the on-site Remediation Phase activities will have to meet the same Operational Phase noise limits that are normally applied in IEALs. This is further discussed below.

The offsite noise generating activities do not fall under the conditions of the IEAL and as such can be considered and assessed against the typical construction noise criteria as discussed below.

Off-Site Remediation Phase Noise Criteria

There is no Irish Guidance specifically published for the off-site construction work such as that proposed for the proposed Project but International best practice dictates that noise limits in the range 65 to 75dB are generally acceptable in the community during daytime construction activities. Such off-site works include the realignment works on the L2005 Kerdiffstown Road, drilling works under the N7 Road and the installation of the leachate and foul water sewer pipelines.

Transport Infrastructure Ireland (TII) (formerly the National Roads Authority) is the only government body in Ireland to publish construction noise limits which are presented in their document *'Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA 2004)'*.

The guidelines are not mandatory but are recommended to achieve appropriate consistency with respect to the treatment of noise and vibration. The TII Guidelines point out that there is no published Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. However, they say that Local Authorities, where appropriate, shall control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. The TII Guidelines present

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indicative noise levels that are typically deemed acceptable during the construction phase of road developments. These are presented below in Table 8.5.

Table 8.5: NRA Maximum Permissible Construction Phase Noise Levels at the Façade of Dwellings during Road Developments

Days & Times	$L_{Aeq, (1hr)}$ dB	$L_{pA(max) slow}$ dB
Monday to Friday - 07:00 to 19:00	70	80
Monday to Friday - 19:00 to 22:00	60[1]	65[1]
Saturday - 08:00 to 16:30	65	75
Sundays and Bank Holidays - 08:00 to 16:30	60[1]	65[1*]

Note 1: Construction activity at these times, other than that required in respect of emergency works, will normally require the explicit permission of the relevant local authority.

For the off-site Remediation Phase works it is considered appropriate to adopt the construction noise criteria presented in Table 8.5 above for all NSRs. The construction noise limit of 70dB $L_{Aeq,1hr}$ will be adopted for week-day works for all off-site construction activities. Any works required to be carried out outside of these hours will be required to comply with the appropriate limit presented in Table 8.5.

In order to assist with the interpretation of construction traffic noise, Table 8.6 offers guidance as to the likely impact associated with changes in traffic noise level. For construction traffic, due to the short-term time-period over which this impact occurs, the magnitude of impacts can be assessed against the 'short-term' period as described in the Design Manual for Roads and Bridges Volume 11, Section 3, Part 7 as revised in November 2011.

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Table 8.6: Classification of Magnitude of Traffic Noise Impacts in the Short Term (Construction Phase)

Change in Sound Level (dB L_{A10})	Magnitude of Impact (Short-Term)
0	No change
0.1 to 0.9	Negligible
1.0 to 2.9	Minor
3.0 to 4.9	Moderate
5+	Major

For the off-site HGV movements, it is considered appropriate to adopt the construction noise criteria presented in Table 8.5 for all NSRs and the associated impacts will be assessed against the criteria presented in Table 8.5.

On-Site Remediation and Operational Phase Noise Criteria

The on-site Remediation works and Operational Phase of the proposed Project will require an Industrial Emissions Activities Licence (IEAL) from the EPA. The EPA administers a wide range of licensing, enforcement, assessment and monitoring activities and their guidance is based on WHO standards and best international practice. The EPA Noise Guidance Note NG4, sets out noise criteria to be met at the nearest NSRs for noise emissions falling within the scope of their licensing regime. The on-site Remediation Phase works and the Operational Phase of the proposed Project will be managed under the conditions and requirements of the IEAL granted by the EPA. Therefore, the relevant noise criteria set out in NG4 will be required to be met for this element of the proposed Project. The applicable table from the Guidance Note NG4 is presented in Table 8.7 below and these are considered the appropriate noise criteria for this project.

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Table 8.7: Recommended Noise Limit Criteria for the On-Site Remediation and Operational Phases

Scenario	Daytime Noise Criterion dB $L_{Ar,T}$ (07:00 to 19:00 hrs)	Evening Noise Criterion dB $L_{Ar,T}$ (19:00 to 23:00 hrs)	Night-time Noise Criterion dB $L_{Ar,T}$ (23:00 to 07:00 hrs)
Quiet Area	Noise from the licensed site to be at least 10dB below the average daytime background noise level measured during the baseline noise survey	Noise from the licensed site to be at least 10dB below the average evening background noise level measured during the baseline noise survey	Noise from the licensed site to be at least 10dB below the average night-time background noise level measured during the baseline noise survey
Areas of Low Background Noise	45dB	40dB	35dB
All other Areas	55dB	50dB	45dB

The existing proposed Project area is not in a "Quiet Area" as defined in Section 4.4.2 of NG4. The screening criteria that the proposed Project does not meet for a Quiet Area includes the following:

- At least 3km from urban areas with a population >1,000 people;
- At least 10km from any urban areas with a population >5,000 people;
- At least 15km from any urban areas with a population >10,000 people;
- At least 3km from any local industry;
- At least 10km from any major industry centre;
- At least 5km from any National Primary Route; and
- At least 7.5km from any Motorway or Dual Carriageway.

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In order to establish whether the noise sensitive locations in the vicinity of proposed Project would be considered 'low background noise' areas, the noise levels measured during the environmental noise survey need to satisfy the following three criteria:

- Average Daytime Background Noise Level ≤40dB L_{AF90} and
- Average Evening Background Noise Level ≤35dB L_{AF90} and
- Average Night-time Background Noise Level ≤30dB L_{AF90}.

The proposed Project was assessed and found not to be located in a Quiet Area and the baseline noise survey does not meet the requirements of a low background noise area, in which case the appropriate noise criteria for the nearest NSRs to the proposed Project are:

- $L_{Ar,T}$, Day (07:00 to 19:00 hrs) 55dB;
- $L_{Ar,T}$, Evening (19:00 to 23:00 hrs) 50dB; and
- $L_{Ar,T}$, and Night (23:00 to 07:00 hrs) 45dB.

The above noise criteria will be adopted for the duration of the on-site Remediation Phase works and also for the Operational Phase of the proposed Project.

The Design Manual for Roads and Bridges Volume 11, Section 3 also offers guidance on 'long-term' noise impacts associated with changes in traffic noise level. For the Operational Phase, traffic impacts are assessed against the 'long-term' impact classification, presented in Table 8.8.

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Table 8.8: Classification of Magnitude of Traffic Noise Impacts in the Long Term (Operational Phase)

Change in Sound Level ($dB L_{A10}$)	Magnitude of Impact (Long-Term)
0	No change
0.1 to 2.9	Negligible
3.0 to 4.9	Minor
5.0 to 9.9	Moderate
10+	Major

8.2.4 Vibration Assessment Criteria

Some activities during the Remediation Phase of the proposed Project have the potential to generate ground vibrations at sensitive receptor locations. Activities such as demolition of concrete walls and houses, movement of loaded HGVs and other construction traffic can all cause vibration to occur. The levels of vibration associated with these activities would not normally be expected to cause structural damage to buildings but may have the potential to impact negatively on humans depending on environmental factors such as distance from source and mitigation measures employed. The Operational Phase of the proposed Project will not generate any significant vibration emissions and the only activity with the potential to generate low-level ground vibration will be the movement of the HGVs into and out of the site along the road network.

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Construction Vibration Criteria

Vibration standards are defined for dealing with human comfort, and for dealing with structural or cosmetic damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV). PPV is the simplest indicator of both perceptibility and the risk of damage to structures. PPV is measured in millimetres per second (mm/sec) and can be defined as the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.

Humans are particularly sensitive to vibration with the threshold of perception typically being in the range of 0.14 to 0.3 mm/sec PPV and levels above this may cause annoyance. However, significantly higher levels than this can be tolerated for single short-term events and do not cause annoyance or disturbance to humans. BS 5228-2 provides guidance on vibration and its control and management on various site types. The standard also presents details on the human response to vibration and Table 8.9 outlines these effects.

Table 8.9: Guidance on Effects of Vibration Levels

Vibration level	Effect
0.14 mm/sec	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/sec	Vibration might be just perceptible in residential environments.
1.0 mm/sec	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/sec	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

The response of a building to ground borne vibration is affected by numerous factors including the type of foundation, underlying ground conditions, the building construction and the state of repair of the building.

British Standard 7385-2 *Evaluation and Measurement for Vibration in Buildings. Guide to Damage Levels Arising from Groundborne Vibration* (BS 7385-2) provides guidance on vibration measurement, data analysis and reporting as well as building classification and guide values for building damage and is referenced in BS 5228-2. The damage threshold criteria presented in BS 7385-2 are based upon systematic studies using a

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carefully controlled vibration source in the vicinity of buildings. This Standard states that there should be no cosmetic damage to buildings if transient vibration levels do not exceed 15mm/sec in the low frequency range and this rises to 20mm/sec at frequencies of 15Hz and to 50mm/sec at 40Hz and above. These guidelines should be reduced by up to 50% for listed structures or similar. It is also noted that the probability of damage for transient vibrations tends towards zero at 12.5mm/sec at component PPV. For continuous vibrations, the threshold is considerably less at around half this value.

Table 8.10 presents the vibration levels below which there is no risk of damage to buildings. These limits apply to vibration frequencies below 15Hz where the most conservative limits are required and are presented for both transient and continuous vibrations. For protected or potentially vulnerable buildings, the recommended construction vibration limit is reduced by half.

Table 8.10: Maximum Permissible Construction Phase Vibration Levels

Building Type	Vibration Limit - Peak Particle Velocity for Transient Vibrations for Frequencies <15Hz	Vibration Limit - Peak Particle Velocity for Continuous Vibrations for Frequencies < 15Hz
Structurally sound and not protected structures	12.5 mm/s	6.25 mm/s
Protected and/or vulnerable structures	6 mm/s	3 mm/s

8.2.5 Sources of Noise and Vibration

Remediation Phase Noise and Vibration

The principal Remediation Phase noise and vibration impacts will be associated with machinery used for the excavation, movement and compaction of waste and materials, demolition of concrete walls and buildings, construction of the landfill management infrastructure and other features of the proposed Project, re-profiling of waste, road and pipeline construction works and other associated activities. The type of machinery that is expected to be used includes excavators, backhoes, compactors, crushing and screening plant, mounted breakers, dump trucks, HGVs, road rollers and similar machinery. In addition, there will be some percussive noise generated as a result of any demolition works or breaking down of concrete slabs.

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Operational Phase Noise and Vibration

The potential noise and vibration impacts are anticipated to be insignificant following completion of the remediation programme. During the Operational Phase, it is anticipated that noise and vibration impacts would be those associated with the landfill management infrastructure such as pumps and flares and with traffic accessing and exiting the multi-use public park and the Landfill Infrastructure Compound. The multi-use public park users, including walkers, teams using the sports pitches, etc. will result in a noise impact similar to that of any town park or sport pitch and is not considered to be significant in an overall context.

8.3 Baseline Conditions

8.3.1 Introduction

The project specific baseline noise monitoring survey consisted of carrying out noise measurements at eight noise monitoring locations in the vicinity of the proposed Project, these locations are shown on Figure 8.1. Noise monitoring locations were selected in accordance with Section 6.1 of the EPA Guidance Note NG4 by taking account of the site location, site layout and the nearest noise sensitive receptors to the boundary perimeter.

Baseline noise monitoring was carried out to determine the existing noise levels at NSR locations surrounding the proposed Project location. The detailed noise monitoring survey report has been completed in accordance with the requirements of NG4 and is presented in Appendix A8.1 of this EIAR.

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8.3.2 Existing Noise Climate

Noise measurements were carried out at each monitoring location during the daytime period (07:00 to 19:00) and the evening time period (19:00 to 23:00) between 8 September 2016 and 14 September 2016. Night-time measurements (23:00 to 07:00) were recorded during the night of 15 March 2017. Monitoring periods for the noise survey were 30 minute intervals for the daytime measurements and 15-minute intervals for the evening time and night-time measurements. Precise noise measurement details are presented in Appendix A8.1. It is not anticipated that normal Remediation Phase construction works would be carried out during night-time hours, however it may be necessary on occasion to carry out emergency works and activities to ensure the continued operation of the landfill infrastructure control systems (e.g. leachate management system, gas flare, etc.).

The Noise Glossary in Section 8.1.2 includes definitions for the noise survey measurement parameters and other acoustic terminology used in this Chapter. A summary of the results are summarised in Table 8.11 below with the detailed measurement report presented in Appendix A8.1. These results are a reliable representation of the existing baseline noise climate in the vicinity of the proposed Project.

The noise monitoring locations N1 to N8 are described in Table 1 of Appendix A8.1 and are shown graphically on Figure 8.1.

Table 8.11: Baseline Noise Monitoring Results (averaged) at Noise Monitoring Locations

Monitoring Location	Measurement Interval	$L_{Aeq, T}$ dB(A)	$L_{A90, T}$ dB(A)	$L_{A10, T}$ dB(A)	LA_{Amax} dB(A)
N1	Daytime	55	48	56	90
	Evening time	52	48	54	78
	Night-time	42	40	44	57
N2	Daytime	51	44	52	86
	Evening time	56	54	57	65
	Night-time	55	52	57	65
N3	Daytime	54	51	55	85
	Evening time	57	55	59	67
	Night-time	50	46	53	61
N4	Daytime	50	47	51	82
	Evening time	50	49	51	72
	Night-time	45	43	46	71
N5	Daytime	53	51	54	70
	Evening time	53	52	55	73
	Night-time	45	41	47	56
N6	Daytime	53	51	54	79
	Evening time	53	51	54	69
	Night-time	46	43	47	71
N7	Daytime	58	56	60	82
	Evening time	63	61	65	67
	Night-time	58	51	61	68
N8	Daytime	58	57	60	73
	Evening time	52	50	53	66
	Night-time	47	43	49	64

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On-site observations were made during the monitoring survey to support the baseline noise measurement results. It was generally observed that the main source of noise at all noise monitoring locations was anthropogenic in nature and by far the most dominant noise source was the passing traffic using the nearby M7 Motorway and the N7 dual carriageway. Non-anthropogenic noise sources such as dogs barking and the wind blowing through trees etc. had a minor impact on the noise environment at the noise monitoring locations. These observations were generally consistent throughout the daytime, evening time and night-time periods.

8.3.3 Existing Vibration Climate

There are no significant sources of vibration in the vicinity of the proposed Project. The main vibrations experienced at the nearest sensitive receptor locations relate to the passing traffic along the surrounding road network. Low-level, short-term vibrations may be experienced when fully loaded HGVs travelling at speeds in excess of 50km/hr pass in close proximity to private residences. There are no residential areas close enough to any of the main remediation activities to be of concern in terms of vibration activity.

To give an indication of existing vibration levels that can be expected in the vicinity of the proposed Project site, baseline vibration monitoring was carried out at two monitoring locations broadly in line with the noise monitoring locations N2 (on the footpath outside the residential receptor REC012) and N4 (on the footpath outside residential receptor REC001). Vibration monitoring was carried out in accordance with the requirements of BS 7385-2.

Continuous vibration monitoring was conducted using a Vibrock V901 tri-axial vibration recorder at each monitoring location. The measurement parameter recorded was resultant Peak Particle Velocity (PPV, mm/sec) and the instrument measures vibration levels in excess of 0.2 mm/sec. The measurement results are presented in Table 8.12.

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Table 8.12: Baseline Vibration Monitoring Summary Results

Monitoring Location	Measurement Interval	Maximum Resultant PPV (mm/sec)	Time of Maximum PPV
N2 (REC012)	17-11-2016 at 12:00 to 18-11-2016 at 14:00	0.70	17-11-2016 at 17:53
N4 (REC001)	08-11-2016 at 16:00 to 11-11-2016 at 14:00	1.15	08-11-2016 at 16:12

The vibration measurement results are within the expected range for the monitoring locations and the maximum vibration levels recorded are consistent with moving vehicles in close proximity to the measurement location. It should be noted that Priority Construction Ltd were under-taking works on site during the vibration monitoring period and the vibration measurement results are within the expected measurement range for any typical sensitive receptor.

8.4 Predicted Impacts

8.4.1 Remediation Phase

Introduction

The noise levels associated with the Remediation Phase of the proposed Project have been calculated using the Bruel and Kjaer 7810 Predictor software package. The noise-modelling package uses a computer based noise propagation model, in accordance with the ISO 9613-2 standard, "*Acoustics - Attenuation of sound during propagation outdoors*", which is an international standard used to undertake noise prediction modelling. The noise model accounts for the impacts on noise propagation associated with the magnitude of the noise source,

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the distance from the source to the receptor, the intervening ground type and topography, the presence of screens or buildings, meteorological impacts and the time that a noise source would be operating.

The noise model was constructed based on the ISO 9613-2 standard method using the named NSR locations. Noise data for plant and machinery associated with the various construction activities of the Remediation Phase was sourced from BS 5228-1 which provides sound pressure level data for a wide range of plant and equipment used for different construction activities.

The noise model calculates noise levels for a set of specified receptor locations that can be shown on a noise map that presents calculated sound pressure levels for various scenarios. Receptor locations were chosen for the closest NSRs in the vicinity of the proposed Project to account for the complete perimeter boundary covering north, south, east and west. These receptor locations are used to assess the potential Remediation Phase noise impacts at the nearest NSRs. There are six named NSRs in the impact assessment and all receptors within the study area are represented by these as the other receptors will experience the same or lower noise levels than the named receptors. The named receptors and the receptors they also represent are summarised in Table 8.13.

Table 8.13: Noise Sensitive Receptor Locations used in the Impact Assessment

Noise Sensitive Receptor ID	Description of Location
REC001	Kerdiffstown House
REC012	Private Residence on Kerdiffstown Road south of Zone 2A
REC014	Private Residence on Kerdiffstown Road west of Zone 2A. Represents REC013, REC015.
REC017	Private Residence on Kerdiffstown Road west of Zone 1. Represents REC040, REC041.
REC018	Private Residence on Kerdiffstown Road west of Zone 1A
REC039	Private Residence adjacent to the south-western corner of the site. Represents REC006, REC007, REC008, COM007

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This report presents the predicted sound pressure levels associated with the various phases of the remediation works at the named noise sensitive locations in the vicinity of the proposed Project.

On-Site Remediation Phase Works Noise

On-site Remediation works will be carried out over a number of different phases as described in Chapter 4 Description of the proposed Project. Each of the Remediation Phase works have been reviewed and considered from a noise perspective and the key phases associated with the remediation works where there is potential for significant noise emissions to arise on the proposed Project have been considered to occur during Phase 1, Phase 2, Phase 3, Phase 4, Phase 5 and Phase 6. Noise modelling has been completed for each of these Phases individually as well as Phases 7 and 8.

The actual noise level produced by Remediation Phase works will vary at the nearest sensitive receptor boundary at any time depending upon a number of factors including the type of plant in use, plant location, duration of operation, hours of operation and intervening topography. Given that the remediation works involves a number of phases which will encompass a range of different activities on a week to week basis, it is therefore difficult to precisely determine the likely noise levels at this stage, however, the impact assessment carried out for the proposed Project presents a set of conservative scenarios which represent the plausible worst-case scenario for each phase considered.

Therefore, the noise model that has been run for each Phase of works considered, is representative of a conservative scenario or the plausible worst-case for that particular phase of works. The plausible worst-case scenario provides for multiple items of plant (typically four or more) all operating simultaneously and continuously for two thirds of the day working in close proximity to the nearest NSRs that will be impacted by

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that particular phase of works. Short-term activities such as the demolition of the houses, the installation of the perimeter fencing etc. have been assessed but due to their intensity and duration were not required to be considered in the plausible worst-case scenario. The longer-term works using heavy plant items such as excavators, compactors, dozers and dump trucks are considered to generate the greatest overall noise emissions and consequently represent the plausible worst-case scenario.

The assessment has been carried out this way in order to demonstrate whether or not the proposed noise criteria can be met for a likely or plausible worst case in terms of the noise generated by on-site activities. The predicted noise levels are indicative only and are intended for comparison with the adopted noise criteria. Depending on the specific activities occurring at the site the measured noise levels will vary accordingly.

For the purposes of a plausible worst-case assessment, Table 8.14 presents the plant items and their estimated on-time which have been assumed in the model for each of the key remediation activities associated with each Phase assessed. An on-time or operating time of 66% for plant items is presented in the assessment which assumes that plant will operate for a full eight hours over a twelve-hour daytime working period (07:00 to 19:00) or for forty minutes every hour. This is considered a conservative approach for construction activities such as those on this project considering the dynamic nature of construction works and construction sites.

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Table 8.14: On-Site Remediation Activity Assumed for Each Phase of the Remediation Programme

Plant Details	Number of Plant Items								Sound Power Level Lw, dB(A)	Operating Time %
	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8		
Tracked Excavator [note 1]	5	5	5	5	3	3	2	0	110 & 102	66
Mounted Breaker	2	0	0	0	0	0	0	0	121	66
Mobile Crusher	1	1	1	1	0	0	0	0	112	66
Mobile Screen	1	1	1	1	0	0	0	0	109	66
Artic Dump Truck	4	8	8	4	5	4	2	1	108	66
Bulldozer	3	3	3	2	2	2	2	0	102	66
Waste Compactor	3	3	3	2	2	0	0	0	100	66
Dumper (6t)	1	1	1	1	1	1	1	0	91	66
Road Sweeper	1	1	1	1	1	1	1	0	109	66
Tractor & Bowser	1	1	1	1	1	1	1	0	108	66
Wheeled Loader	0	0	0	0	0	0	0	1	104	66
Mobile Crane	0	0	0	0	0	0	0	1	95	66
Generator	0	0	0	0	0	0	0	1	88	100
Angle Grinder	0	0	0	0	0	0	0	1	109	66
Cutting & Grinding	0	0	0	0	0	0	0	1	107	66
Total daily HGV movements into and out of the proposed Project	140	140	140	140	140	140	18	8	106	

Note 1: Two of the tracked excavators used in Phase 1 have been assigned a higher sound power level due to their involvement in demolition works (Ref. Table C.1.12 of BS5882) while the sound power level from Table C7.12 of BS5228 has been used for the excavators for all other works at the proposed Project.
Note 2: The maximum number of HGV movements associated with the on-site remediation works will be 140 per day and this is only likely to occur during Phase 2 and Phase 3, however the worst-case of 140 movements per day has been modelled for Phases 1 to 6.

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Table 8.14 presents the key noise generating activities associated with each phase of the remediation works assessed and their associated sound power levels. It is not anticipated that normal Remediation Phase construction works would be carried out outside daytime hours, however it may be necessary on occasion to carry out emergency works and activities to ensure the continued operation of the landfill infrastructure control systems (e.g. leachate management system, gas flare).

Predicted noise levels have been calculated for the nearest NSR locations and Table 8.15 presents the predicted noise level for each of the Remediation Phase works assessed.

It is important to note that Table 8.15 presents two scenarios for the Phase 1 works. Noise modelling was completed for the Phase 1 works for the site in its current state which yielded calculated noise results at a number of NSR locations that exceeded the assessment criteria of 55dB LAeq,1hr. It was therefore clear that the existing screening banks along the western and southern boundary of the site would not sufficiently mitigate the plausible worst-case noise emissions to allow compliance with the noise criteria at the nearest NSR locations.

The reinforcement of the existing screens and provision of acoustic screens in key locations along certain sections of the site boundary were then considered in order to significantly improve the existing situation. These acoustic screens will be erected at the beginning of Phase 1 and prior to any noise generating on-site activities occurring. They will remain in place until the end of the Remediation Phase works.

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An acoustic screen of 5m height and with low reflection properties, typically constructed of straw or equivalent, will be erected along the northern, southern and western boundaries of Zone 2A. An acoustic screen of 2.4m height will be erected along the south-western corner boundary of Zone 4 immediately west and north of the receptor located along here (REC039). The screen shall be designed so that there is no line of sight between the noise source and the receptor. Similarly, an acoustic screen of 2.4m height will be erected along the haul route in to the site adjacent to receptor REC012. This is to protect the receptor from elevated noise levels associated with HGVs passing into and out of the proposed Project and will particularly be required during Phase 2 through to Phase 5. The existing screening banks adjacent the L2005 Kerdiffstown Road in the north-western section of the site will be reinforced with straw bales or equivalent in any areas where the screening banks have deteriorated or fallen away. The locations of the acoustic screens are shown on Figure 8.2. These acoustic screens are designed to be temporary in nature and can easily be removed or added to if required.

The calculated results presented in Table 8.15 has assumed the reinforcement of the existing situation with the temporary acoustic barriers in place for all Phases assessed.

The results presented in Table 8.15 show the maximum noise levels predicted for each NSR and represent the noise levels for the plausible worst-case scenario. However, considering the progressive nature of the proposed Project works during on-site remediation and the size of the site, all of the plant will not be operating simultaneously and will not be operating in the same boundary location all at the same time. Therefore, the model results represent a conservative estimation of the predicted noise levels at the nearest noise sensitive receptor locations.

The noise contour results of the modelled on-site remediation works are presented in Figure 8.3 to Figure 8.11 and the specific on-site remediation works noise levels at the assessed NSR locations are presented in Table 8.15.

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Table 8.15: Predicted Noise Levels at NSR Locations for the Remediation Phase Works

NSR ID	Predicted Noise Level dB $L_{Aeq,1hr}$								
	No Acoustic Reinforcement in Place	Acoustic Reinforcement in Place							
	Phase 1	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
REC001	39	40	38	40	51	37	34	32	26
REC012	58	51	51	49	45	42	43	42	36
REC014	61	54	46	46	43	43	49	45	52
REC017	53	46	54	55	41	51	46	40	39
REC018	41	40	43	46	39	40	37	35	31
REC039	58	52	50	50	39	37	37	35	31

On-Site Phase 1

The noise environment during the Phase 1 works will be dominated by the demolition works involving the use of the mounted breakers required to demolish the existing concrete walls at the proposed Project. There will also be significant activity in Zone 3 and Zone 4 due to the earthworks activities and there will be crushing and screening of the demolished concrete in Zone 2B. There will only be very small quantities of materials imported to the proposed Project to be stockpiled during Phase 1.

During the Phase 1 on-site works noise levels are calculated to be highest at receptor REC014 which is the closest receptor to the demolition works in Zone 2A. The results indicate that the predicted noise levels associated with the Phase 1 remediation works will not exceed the assessment criteria of 55dB $L_{Aeq,1hr}$ at any of the named receptor locations after the existing screening banks have been reinforced and upgraded with acoustic barriers as described above and shown in Figure 8.4. The noise contour results of the modelled on-site remediation works for Phase 1 are presented in Figure 8.4 and outlined in Diagram 8.1 below.

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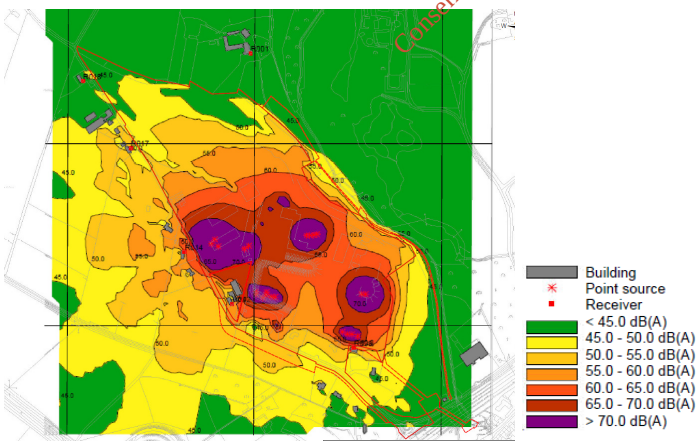


Diagram 8.1: Noise Contours Phase 1 On-site Remediation Works

There is potential for the limit to be exceeded at receptors REC012, REC013, REC014 and REC015 due to the increased noise levels associated with the concrete wall breaking works in Zone 2A. To ensure that the noise limits are met here, mounted breakers shall be positioned well apart from each other when operating simultaneously in Zone 2A. Scheduling of works for Zone 2A will ensure that the mounted breakers are correctly positioned to ensure that the relevant criteria are not exceeded at the nearest NSRs. This information shall be included in the Noise and Vibration Management Plan as discussed in Section 8.5.

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The significance of the noise impacts at the named NSRs can be assessed in accordance with Table 8.4 using professional judgement and experience. The significance of the impact for the on-site Phase 1 works will vary from imperceptible to moderate at the nearest NSRs and will be temporary in duration.

On-Site Phase 2

Activities associated with Phase 2 include the importation of materials to the proposed Project for stockpiling, the removal of waste from Zone 4 into Zone 3, stockpiling of waste in Zone 2B and the re-profiling of Zone 1 including filling with surplus Zone 4 material. The noise contour results of the modelled on-site remediation works for Phase 2 are presented in Figure 8.5 and outlined in Diagram 8.2 below.

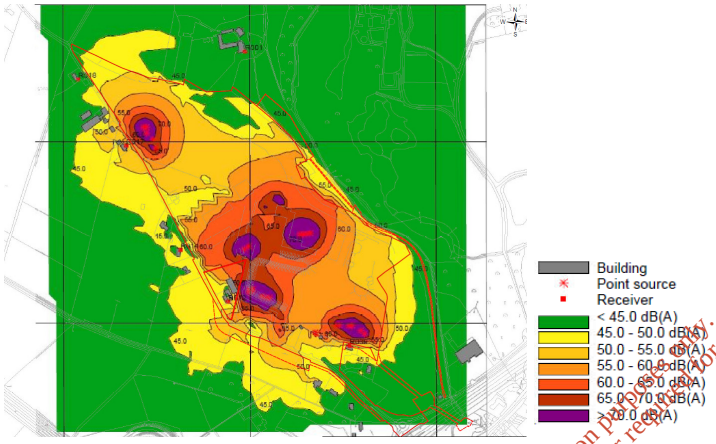


Diagram 8.2: Noise Contours Phase 2 On-site Remediation Works

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During the Phase 2 works, noise levels were calculated to be highest at receptor REC017 which is amongst the closest receptors to the earthworks that will occur in Zone 1. The results indicate that the predicted noise levels associated with the Phase 2 remediation works will not exceed the assessment criteria of to 55dB $L_{Aeq,1hr}$ at any of the named receptor locations.

Phase 2 works will also involve the stockpiling of significant quantities of imported fill material in Zone 2A. Best Practice shall ensure that the stockpiling will be carried out in a sequence where the stockpile is built up from the boundary nearest to the receptors and added to so that the stockpile can act as a barrier between the noise source and the nearest receptors as the works develop. This information shall be included in the Noise and Vibration Management Plan as discussed in Section 8.5.The significance of the impact for the on-site Phase 2 works will vary from imperceptible to moderate at the nearest NSRs and will be temporary in duration.

On-Site Phase 3

The Phase 3 works are very similar in nature to the Phase 2 works but with an increased concentration of works in Zone 1 where increased volumes of materials will be deposited from Zone 4. The Zone 3 works will be much reduced and the works involving the pond construction in Zone 4 will be completed. The stockpiling of imported fill material will continue in Zone 2A. The noise contour results of the modelled on-site remediation works for Phase 3 are presented in Figure 8.6 and outlined in Diagram 8.3 below.

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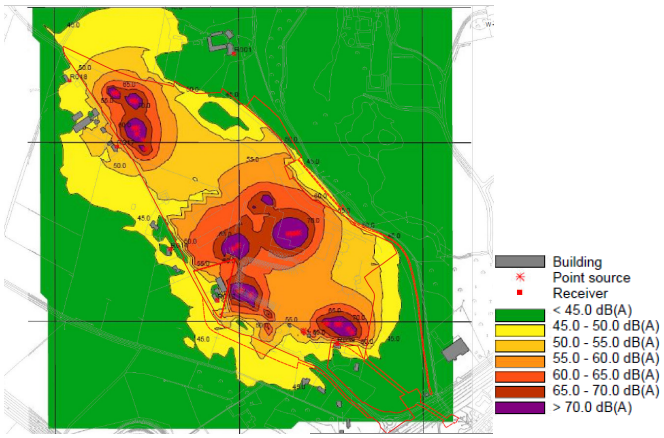


Diagram 8.3: Noise Contours Phase 3 On-site Remediation Works

During the Phase 3 works noise levels were calculated to be highest at receptor REC017 which is the closest receptor to the Zone 1 earthworks. The results indicate that the predicted noise levels associated with the Phase 3 remediation works will not exceed the assessment criteria of to 55dB $L_{Aeq,1hr}$ at any of the named NSR locations. Best Practice will ensure that the number of plant items in operation simultaneously when Zone 1 works are close to the NSRs along the L2005 Kerdiffstown Road are managed accordingly to ensure the noise criteria are met. This information shall be included in the Noise and Vibration Management Plan as discussed in Section 8.5.

It is also planned to remove the sub-soil stockpile adjacent to the proposed Project entrance during the Phase 3 works. This will require careful management of the work-load and strict control of the number of vehicles allowed in this area at any one time. Receptor REC012 is located in close proximity to the west end of the stockpile. Works shall commence by removing the stockpile from the eastern end first and working in a direction towards the receptor REC012 so that the stockpile itself can act as an acoustic barrier between the source and receptor for this element of the works. This information shall be included in the Noise and Vibration Management Plan as discussed in Section 8.5.

The significance of the impact for the on-site Phase 3 works will vary from imperceptible to moderate at the nearest receptors and will be temporary in duration.

On-Site Phase 4

The intensity of the noise generating works will be reduced for the on-site Phase 4 works with the daily imports of capping materials for storage in Zone 2A being reduced. The Zone 3 and Zone 4 earthworks will be complete and the main areas of activity will be the north-eastern slope of the proposed Project located in Zone 1 and the ponds in Zone 4. Both of these locations are further removed from the nearest receptors which will result in reduced noise impacts experienced at the nearest receptor locations. The noise contour results of the modelled on-site remediation works for Phase 4 are presented in Figure 8.7 and outlined in Diagram 8.4 below.

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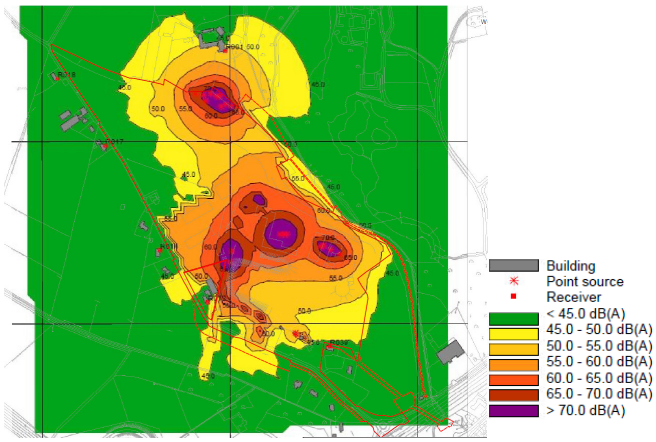


Diagram 8.4: Noise Contours Phase 4 On-site Remediation Works

During the on-site Phase 4 works noise levels are calculated to be highest at Receptor REC001 which is the closest receptor to the re-profiling works on the north-eastern slope of Zone 1. The results indicate that the predicted noise levels associated with the Phase 4 on-site remediation works will not exceed the assessment criteria of to 55dB $L_{Aeq,1hr}$ at any of the named receptor locations.

The significance of the impact for the Phase 4 works will vary from imperceptible to moderate at the nearest receptors and will be temporary in duration.

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On-Site Phase 5

The intensity of the noise generating works for Phase 5 will be very similar to that of Phase 4 but with a further reduction in the daily imports of capping materials for storage in Zone 2A. The main remediation activities for Phase 5 will occur in the southern section of Zone 1 and the northern slopes of Zone 2B. The works in Zone 2B will be well removed from the nearest receptors and will not have significant impacts on any receptors. During the Phase 5 works noise levels are calculated to be highest at Receptor REC017 which is amongst the closest receptors to the Zone 1 works. The results indicate that the predicted noise levels associated with the Phase 5 remediation works will not exceed the assessment criteria of to 55dB L_{Aeq} at any of the named receptor locations. The noise contour results of the modelled on-site remediation works for Phase 5 are presented in Figure 8.8 and outlined in Diagram 8.5 below.

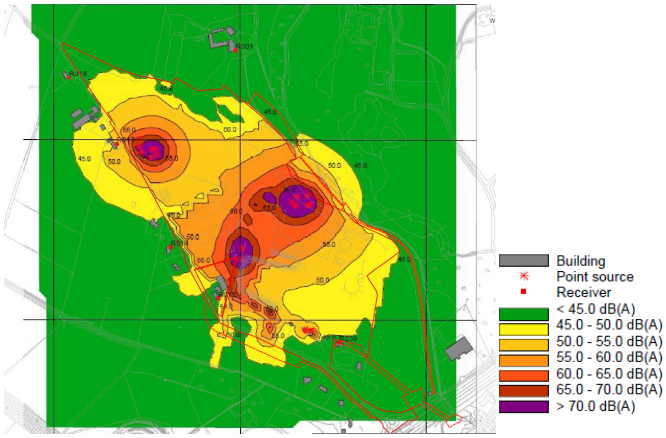


Diagram 8.5: Noise Contours Phase 5 On-site Remediation Works

Part of the Phase 5 works involves removing the existing screening bund in Zone 1 and this will be completed last, after the re-profiling and capping works of the south-eastern slopes of Zone 1 have been completed. This is

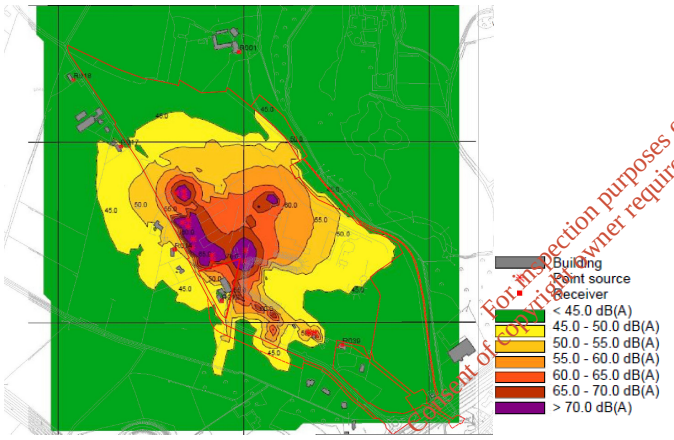
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to ensure that the screening bank can act as an acoustic barrier between the noise sources and the nearest receptors for the duration of the capping works in this Zone and minimise noise impacts experienced at the receptor locations. This information shall be included in the Noise and Vibration Management Plan as discussed in Section 8.5.

The significance of the impact for the on-site Phase 5 works will vary from imperceptible to slight at the nearest NSRs and will be temporary in duration.

On-Site Phase 6

Noise generating works will be significantly reduced for Phase 6. It is generally expected that there would be no further significant traffic movement associated with material import. The remainder of the re-profiling and capping of Zone 1 will be completed and the crushed concrete stockpiles in Zone 2B will be used to form access tracks. The most noise sensitive works during Phase 6 will be completed in Zone 2A when the stockpiled material will be fully used and there will be minor capping and re-profiling of the Zone 2A boundaries to the edge of the hardstanding. The noise contour results of the modelled on-site remediation works for Phase 6 are presented in Figure 8.9 and outlined in Diagram 8.6 below.



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Diagram 8.6: Noise Contours Phase 6 On-site Remediation Works

During the on-site Phase 6 works noise levels are calculated to be highest at Receptor REC014 which is the closest receptor to the Zone 2A boundaries. The results indicate that the predicted noise levels associated with the Phase 6 remediation works will not exceed the assessment criteria of 55dB L_{Aeq} at any of the named receptor locations.

The significance of the impact for the on-site Phase 6 works will vary from imperceptible to slight at the nearest NSRs and will be temporary in duration.

On-Site Phase 7

Noise generating works will be significantly reduced for Phase 7 and the works will include the cleaning of the surface water management ponds, installation of gas wells and the final removal of any remaining stockpiles in Zones 2A and 2B. During the on-site Phase 7 works noise levels are calculated to be highest at Receptor REC014 which is the closest receptor to the Zone 2A boundary. The results indicate that the predicted noise levels associated with the Phase 7 remediation works will not exceed the assessment criteria of 55dB L_{Aeq} at any of the named receptor locations. The noise contour results of the modelled on-site remediation works for Phase 7 are presented in Figure 8.10 and outlined in Diagram 8.7 below.

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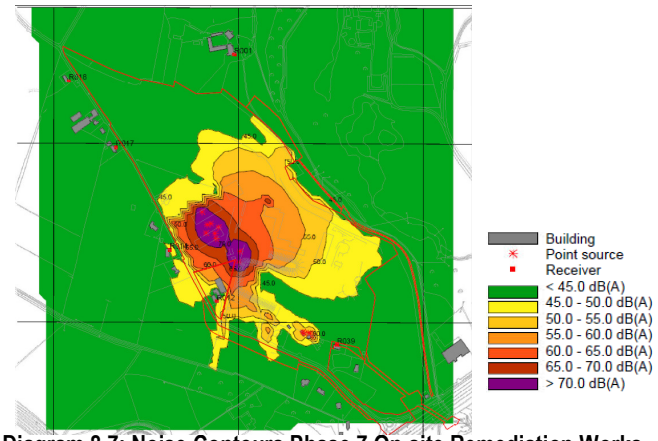


Diagram 8.7: Noise Contours Phase 7 On-site Remediation Works

The significance of the impact for the on-site Phase 7 works will vary from imperceptible to not significant at the nearest NSRs and will be temporary in duration.

On-site Phase 8

The Phase 8 works will include the construction of the multi-use public park including multi-use sports pitches, a building with changing rooms, public toilets and stores, a car park, children's playground and informal trails. During the on-site Phase 8 works noise levels are calculated to be highest at Receptor REC014 which is the closest to the construction of the sports pitches. The results indicate that the predicted noise levels associated with the Phase 8 remediation works will not exceed the assessment criteria of 55dB L_{Aeq} at any of the named receptor locations. The noise contour results of the modelled on-site remediation works for Phase 8 are presented in Figure 8.11 and outlined in Diagram 8.8 below.

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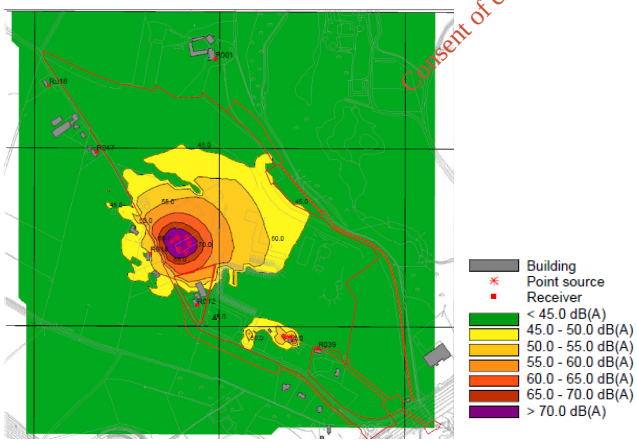


Diagram 8.8: Noise Contours Phase 8 On-site Remediation Works

The significance of the impact for the on-site Phase 8 works will vary from imperceptible to slight at the nearest NSRs and will be temporary in duration.

Off-site Construction Noise Impacts

The proposed Project includes some off-site works including the upgrade works on the L2005 Kerdiffstown Road, drilling works under the N7 dual carriageway and the installation of the leachate and foul water sewer pipelines. Works involved in upgrading the section of L2005 Kerdiffstown Road are considered to be the noisiest of the proposed off-site works and are likely to result in elevated noise levels during the works programme. The

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road works are scheduled to be carried out at the beginning of Phase 1 before any significant increase of HGV movements into and out of the proposed Project. The road upgrade works will require the use of a variety of plant items including excavators, dump trucks, road surfacing and levelling plant and equipment. There will be very limited ground breaking required and the main elements of works will include earthworks, surfacing works and landscaping.

TII guidance refers to BS 5228-1 for calculation of noise levels associated with road construction works. Sound pressure levels for plant items commonly used on road construction works as set out in the Standard were used for the prediction of noise levels at selected locations.

The calculations use the methodology provided within BS 5228-1. For this method the sound pressure level of the noise source at a known distance is defined and the attenuation is calculated between its location and the selected receiver, taking account of distance, screening due to barriers, ground attenuation and the time that a noise source would be operating.

Table 8.16 and Table 8.17 set out assumed plant items during the key stages of the road upgrade works with the associated noise source reference from BS5228-1. The closest property to the proposed road works is REC006 and is located 22m from the closest point of the proposed path and 24.5m from the closest point of the proposed road. Other properties are further removed and will experience a lesser noise impact and consequently construction noise calculations have been completed for distances of 22m from the works to present a worst-case scenario.

The calculations assume that plant items are operating continuously for two thirds of the time and that all plant items are operating simultaneously and at the same distance for any one scenario. This scenario is considered a conservative estimate due to the dynamic nature of road construction works and all plant items will not be located at the closest point to the receptor. The use of a standard construction site hoarding along the boundary of the construction works has been included in the noise calculations.

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Table 8.16: Calculated Construction Noise Levels for Road Realignment Preparation Works

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB $L_{Aeq,T}$ at 22m distance from works
Mini excavator with hydraulic breaker	C5.2	59
Wheeled excavator	C5.11	52
Dozer	C5.12	55
Articulated dump truck	C5.17	61
Combined L_{Aeq}		64

Table 8.17: Calculated Construction Noise Levels for Road Realignment Construction Works

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB LAeq,T at 22m distance from works
Dozer	C5.12	52
Road roller	C5.19	59
Vibratory compactor (asphalt)	C5.29	60
Asphalt paver (+ tipper lorry)	C5.30	54
Combined L_{Aeq}		63

During the L2005 Kerdiffstown Road realignment works noise levels are calculated to reach a maximum of 64dB $L_{Aeq,1hr}$ for the worst-case scenario at the nearest NSR (REC006) to the road realignment works. This scenario has all named plant items operating simultaneously at 22m from the dwelling for two thirds of the

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working day. This is a highly conservative scenario and actual noise levels are anticipated to be much lower than those calculated.

The calculated noise levels for the worst-case scenario are below the adopted daytime construction noise criterion of 70dB $L_{Aeq,1hr}$ as per Table 8.5 for the road realignment works. The road realignment works will only occur between Mondays and Fridays and it is anticipated that there will be no road works undertaken on Saturdays or Sundays. If it becomes necessary to carry out road works on a Saturday, the works will still meet the Saturday limit of 65 dB $L_{Aeq,1hr}$.

The significance of off-site construction works noise impacts will vary from imperceptible to significant at the nearest receptors and will be temporary in duration.

Directional drilling will be required to complete the leachate pipeline connection from the site to the Johnstown Pumping Station which is situated across the N7 Dual Carriageway. While it is not possible at this stage to calculate the actual magnitude of construction phase noise emissions to the local environment, it is possible to predict typical noise levels using guidance set out in *BS 5228-1: 2009+A1 2014* using assumed activities.

Table 8.18 presents the noise levels associated with typical construction noise sources assessed in this instance along with typical sound pressure levels at a location 20m from the works. The calculations assume that plant items are operating continuously and simultaneously. The use of a standard construction site hoarding along the boundary of the construction works has been included in the noise calculations.

Table 8.18: Calculated Construction Noise Levels for Directional Drilling Works

Plant Details	BS5228-1 Reference	Calculated Noise Level, dB $L_{Aeq,T}$ at 20m distance from works
Directional Drilling	C2.44	61
Tracked excavator	C4.65	55
Dumper	C4.5	47
Combined $L_{Aeq,T}$		63

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The predicted noise level for the scenario presented in Table 8.18 is well within the adopted limit value of 70dB $L_{Aeq,T}$, at distances of 20m or greater from the works. The nearest NSRs to the drilling works are further removed than the 20m assessed and therefore the noise criteria for the drilling works will be met at all the NSRs that may be impacted by the works.

Remediation Phase Traffic Noise

The Remediation Phase will result in increased traffic movements which will make use of the local road network to access and egress the proposed Project. Chapter 14 Traffic and Transport of this EIAR presents the detailed traffic details for the proposed Project.

The number of HGVs using the public roadway importing materials to the proposed Project will vary according to the different phases of the remediation works. All materials imported to the proposed Project to enable remediation works shall be required to access the site from the N7 via the L2005 Kerdiffstown Road. Average daily HGV movements will peak during Phase 1 to Phase 6 when up to a maximum of 140 movements per day will be experienced.

In order to assess the potential traffic noise level during the different phase works, the specific noise levels associated with passing construction traffic added to the existing baseline has been assessed. This can be done by assessing the noise levels associated with a passing construction vehicle movement by using the method outlined in BS 5228-1, F.2.5 *Method for mobile plant using a well defined route (e.g. haul roads)*. The general expression for predicting the L_{Aeq} alongside a haul road used by single-engined items of mobile plant is:

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$L_{Aeq} = L_{WA} - 33 + 10*\log_{10}(Q) - 10*\log_{10}(V) - 10*\log_{10}(d)$ where

L_{WA} = the sound power level of the plant in dB

Q = the number of vehicles per hour

V = the average vehicle speed (km/hr)

d = distance between centre of haul road and nearest receptor

The closest noise sensitive receptors along the route are greater than 20m away from the centreline of the haul route. The calculation assumes the HGVs travelling at a speed of 45km/hr, with a Sound Power Level of 104dB L_{WA} for the trucks and the minimum distance of 20m between the haul roads and the nearest noise sensitive receptors.

The worst-case will arise during Phase 1 to Phase 6 remediation works when it is estimated that there will be up to 140 vehicle movements per day. Using the formula above, and accounting for the worst-case traffic movements, noise levels experienced at residential dwellings along the haul routes, including REC005, REC006, REC007, REC008, REC039, REC012, as a result of HGV movements are calculated to be up to 53dB $L_{Aeq,1hr}$. The impact assessment for the Remediation Phase traffic noise is presented in Table 8.19.

Table 8.19: Calculated Remediation Phase Traffic Impacts along the Haul Routes

Haul Route	Measured Baseline dB L_{Aeq}	Remediation Traffic Noise dB L_{Aeq}	Cumulative Noise Level dB L_{Aeq}	Cumulative L_{Aeq} Minus Baseline L_{Aeq} dB(A)	Impact Rating	Compliance with Assessment Criteria 70dB $L_{Aeq,T}$
Kerdiffstown Road, south of KLRP access	54 to 58	53	57 to 59	3 to 1	Moderate / Minor	Yes

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The Remediation Phase traffic impact assessment has determined that during Phase 1 to Phase 6, traffic noise levels are calculated to increase at some residential properties that are 20m from the haul routes. The highest potential impact is calculated to be an increase in noise levels of 3dB(A). The impact rating for the NSRs on this haul route for the worst-case scenario is classified to be Moderate as per Table 8.6 criteria. It should be noted that the increase of 3dB(A) is on the bottom end of the impact scale for Moderate. All other impacts are classified as Minor or Negligible and all predicted Remediation Phase traffic noise levels are well within the assessment criteria of 70dB(A).

Cumulative Remediation Phase Noise Impacts

The Kerdiffstown Road realignment works will be completed over a short period of time during the early stages of the Phase 1 remediation works and there may be a short overlap between on-site remediation works and the off-site road realignment works. The on-site Phase 1 remediation works have been shown to comply with the 55dB $L_{Aeq,1hr}$ noise limit and the off-site road realignment have been shown to comply with the 70dB $L_{Aeq,1hr}$ limit.

The noise limit applicable at the NSR location is defined by the activity being assessed and the NSRs REC006, REC007, COM007, REC008, REC012 and REC039 which will be impacted by the road upgrade works will consequently have two different noise limits applying simultaneously to them, namely the 55dB $L_{Aeq,1hr}$ noise limit for on-site works and the 70dB $L_{Aeq,1hr}$ limit for off-site works. In this instance both activities will be required to meet the individual limits and cumulatively the noise will have to meet the 70dB $L_{Aeq,1hr}$ limit.

A commonly used simple method for the addition of decibels shows that when the difference between two decibels to be added together is greater than 12 the total contribution to the highest decibel is 0. Consequently,

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when the decibel values of 70 and 55 are added together, the total figure is still 70 decibels. Therefore, the limit of 70dB $L_{Aeq,1hr}$ will still be achieved at the NSRs REC006, REC007, COM007, REC008, REC012 and REC039 even if on-site activities are overlapping with the off-site works.

Remediation Phase Vibration Impacts

There are no works proposed during the Remediation Phase with potential to cause damage to any of the buildings in the vicinity of the proposed Project. The demolition works in Zone 2B and Zone 4 and the road realignment works have potential the generate ground-borne vibrations. Empirical data for these activities is not provided in BS:5228-2, however, based on experience from other sites and the distances between the nearest receptors and the works the likely levels of vibration are considered to be orders of magnitude below the relevant criteria for cosmetic damage to buildings.

The only works with potential to cause vibration nuisance to humans will occur during the Phase 1 works when the concrete walls are being demolished at the proposed Project and the use of the waste compactor. All demolition works in Zone 2B and Zone 4 are too far removed from the nearest receptors to cause any vibrational impact. The demolition works in Zone 2A may cause very low vibration levels to be experienced at the nearest receptors to these works. However, considering that all the demolition is above ground and the type of intervening ground between the works and the nearest receptors all ground vibrations experienced at the nearest receptors will be less than 0.3 mm/sec. The waste compactor will be located on soft ground well removed from the nearest receptors which will ensure that no adverse vibration impacts are experienced at the nearest receptors. This information shall be included in the Noise and Vibration Management Plan as discussed in Section 8.5.

The worst-case scenario vibration impacts will be just perceptible in the most sensitive situations for most vibration frequencies as per Table 8.9.

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8.4.2 Operational Phase

Multi-Use Public Park

The multi-use public park will have three sports pitches open to public use and will also have walkways and a playground. The facility will be accessible by members of the public during daylight hours and noise emissions associated with amenity users will be similar to any town park and will be imperceptible in terms of significance. There will be some additional traffic into the multi-use public park as a result of the proposed Project and this impact is discussed separately below.

There will be some limited overlap between the Remediation Phase works and the Operational Phase of the proposed Project in that the Landfill Infrastructure Compound will have been built and operating during the remediation works and this has been included in the impact assessment for the Remediation Phase. The Landfill Infrastructure Compound will generate very low levels of noise as the noise generating pumps will all be housed internally in the plant building and the only external noise will be associated with the operation of the gas flare.

The noise levels associated with the operation of the Landfill Infrastructure Compound have been calculated using the Bruel and Kjaer 7810 Predictor Software package as described in Section 8.4.1. The input noise data used for the plant associated with the Landfill Infrastructure Compound is presented in Table 8.20. The sound power levels were sourced from a combination of existing data from other similar facilities and from plant and equipment manufacturers. The noise levels for the gas flare were taken from on-site measurements recorded at the existing gas flare on the site.

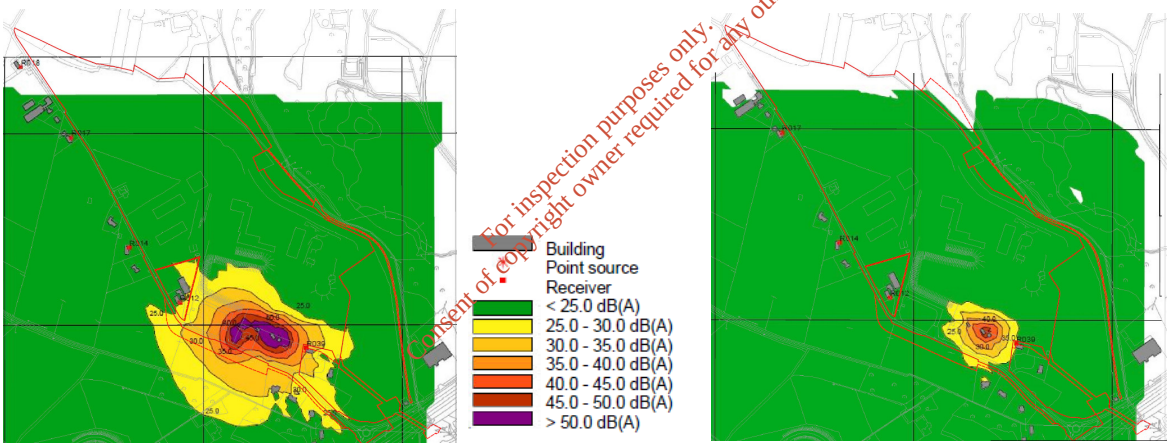
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Table 8.20: Input Data for Operational Phase Noise Model

Equipment Item	Number of Items	Operating Hours	Operating time %	Sound Power Level Lw, dB(A)
Pump	1	00:00-24:00	100	87
Air Blowers	2	00:00-24:00	100	83
Gas Flare	2	00:00-24:00	100	70

In order to assess the noise levels that will be generated for the Operational Phase of the proposed Project a noise model was generated to account for two air blowers and one duty pump operating 24-hours per day, housed internally in the plant building and two gas flares also operating 24-hours per day. Both the duty and stand-by gas flares were modelled to account for a worst-case scenario. The noise model also accounts for HGV traffic entering the Landfill Infrastructure Compound and accounts for 4 HGVs entering and departing the site during daytime hours.

The predicted operational noise levels for the daytime, evening time and night time and the over-all increase in noise level at the nearest receptors are presented in Table 8.21 to Table 8.23 and the associated noise contour results are presented in Figure 8.12 and 8.13 and outlined in Diagram 8.9. The impacts are assessed against the assessment criterion of 55dB $L_{Aeq,T}$ for daytime, 50dB $L_{Aeq,T}$ for evening time and 45dB $L_{Aeq,T}$ for night time.



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Diagram 8.9: Noise Contours Operational Phase (Left Daytime, Right Evening and Night-time)

Table 8.21: Predicted Noise Levels at the named NSR Locations for the Operational Phase (Daytime)

Noise Sensitive Receptor	Measured Baseline dB L_{Aeq}	Predicted Operational Noise dB L_{Aeq}	Cumulative Noise Level dB L_{Aeq}	Increase in Noise Level dB(A)	Compliance with Assessment Criteria 55dB $L_{Aeq,T}$
REC001	50	5	50	0	Yes
REC012	51	29	51	0	Yes
REC014	51	17	51	0	Yes
REC017	53	11	53	0	Yes
REC018	55	7	55	0	Yes
REC039	54	36	54	0	Yes

The results of the assessment indicate that day-time operational noise levels predicted at the nearest receptor (REC039) is 36dB L_{Aeq} and operational noise levels are all significantly below the day time criterion of 55dB L_{Aeq} at all receptor locations. The results of the assessment indicate that the operation of the proposed Project is

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calculated to make no measurable change to the prevailing daytime ambient noise environment. There will be no increase in noise levels experienced at the nearest receptors and consequently the significance of the impact is classified as imperceptible and long-term in duration.

Table 8.22: Predicted Noise Levels at the named NSR Locations for the Operational Phase (Evening time)

Noise Sensitive Receptor	Measured Baseline dB L_{Aeq}	Predicted Operational Noise dB L_{Aeq}	Cumulative Noise Level dB L_{Aeq}	Increase in Noise Level dB(A)	Compliance with Assessment Criteria 50dB $L_{Aeq,T}$
REC001	50	0	50	0	Yes
REC012	56	15	56	0	Yes
REC014	56	10	56	0	Yes
REC017	53	4	53	0	Yes
REC018	52	3	52	0	Yes
REC039	57	26	57	0	Yes

The results of the assessment indicate that evening-time operational noise levels predicted at the nearest receptor (REC039) is 26dB L_{Aeq} and operational noise levels are all significantly below the evening time criterion of 50dB L_{Aeq} at all receptor locations. The results of the assessment indicate that the operation of the proposed Project is calculated to make no measurable change to the prevailing evening time ambient noise environment. There will be no increase in noise levels experienced at the nearest receptors and consequently the significance of the impact is classified as imperceptible and long-term in duration.

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Table 8.23: Predicted Noise Levels at the named NSR Locations for the Operational Phase (Night time)

Noise Sensitive Receptor	Measured Baseline dB L_{Aeq}	Predicted Operational Noise dB L_{Aeq}	Cumulative Noise Level dB L_{Aeq}	Increase in Noise Level dB(A)	Compliance with Assessment Criteria 45dB $L_{Aeq,T}$
REC001	45	0	45	0	Yes
REC012	55	15	55	0	Yes
REC014	55	10	55	0	Yes
REC017	45	4	45	0	Yes
REC018	42	3	42	0	Yes
REC039	50	26	50	0	Yes

The results of the assessment indicate that night time operational noise levels predicted at the nearest receptor (REC039) is 26dB L_{Aeq} and operational noise levels are all significantly below the night time criterion of 45dB L_{Aeq} at all receptor locations. The results of the assessment indicate that the operation of the proposed Project is calculated to make no measurable change to the prevailing night-time ambient noise environment. There will be no increase in noise levels experienced at the nearest receptors and consequently the significance of the impact is classified as imperceptible and long-term in duration.

Traffic Impacts

A detailed Traffic and Transport Assessment has been prepared and is presented in Appendix A14.1 of this EIAR. Information from the traffic report has been used to determine the predicted change in noise levels in the vicinity of the roads and junctions that pass the entrance route to the proposed Project.

For the purposes of assessing potential noise impact, the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the proposed Project are considered. The Annual Average Daily Traffic (AADT) figures used in the assessment are taken from the Traffic and Transport

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Assessment. Operational traffic accessing the proposed Project will approach along the L2005 Kerdiffstown Road and turn into the proposed Project from south of the KLRP access or alternatively will approach along the Kerdiffstown Road and turn into the proposed Project from north of the KLRP access. The NSRs situated along the Kerdiffstown Road require to be assessed for traffic noise impacts by looking at the calculated change in noise level associated with the increase in overall traffic movements along these routes. Calculations were completed to determine the noise levels associated with the traffic numbers for the "with" and "without" scenarios to determine the change in noise level. In order to assess the worst case impact, robust assumptions have been made in the Traffic and Transport assessment regarding the proportion of Operational Phase traffic accessing the site, assuming that 100% of traffic will access the site from the north and 100% will access from the south. This is an extremely robust approach as the volumes of traffic traveling to the public park will, in reality, be significantly lower and therefore the assessment of Operational Phase traffic can very much be considered as worst case.

Table 8.24: presents the traffic volume figures and the associated change in noise level that will be experienced by the NSRs situated along the Kerdiffstown Road.

Table 8.24: Change in Noise Level due to Traffic

Road	2022 Projected AADT (Without proposed Project)	Daily Increase in Traffic With proposed Project	Change in Noise Level dB(A)
Kerdiffstown Road, south of KLRP access	1864	151	0.3
Kerdiffstown Road, north of KLRP access	1800	151	0.3

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The predicted increase in noise levels at the NSRs along the Kerdiffstown Road due to the worst-case additional vehicular traffic associated with the proposed Project is 0.3dB(A). Table 8.8 offers guidance as to the likely impact associated with a change in traffic noise level. The predicted increase in traffic noise at the NSRs along these routes is 0.3dB(A), which is barely perceptible and the associated noise impact is classified as negligible.

8.5 Mitigation Measures

8.5.1 Remediation Phase Mitigation Measures

The impact assessment for the Remediation Phase works across the proposed Project has shown that remediation activities can be undertaken within the proposed noise criteria at the nearest sensitive receptors. It is possible that there may be some short-term instances where elevated noise levels may be experienced due to proximity of works to noise sensitive receptors and the type of works being undertaken. However, with good noise management practices and the appropriate noise mitigation measures the number and duration of these incidents will be minimised.

Prior to the commencement of any on-site works, the appointed contractor will be required to prepare a Construction Environmental Management Plan (CEMP) in agreement with Kildare County Council. The CEMP shall contain a stand-alone Noise and Vibration Management Plan (NVMP) which will detail how the appointed contractor will comply with the noise criteria set out in this EIAR and will deal specifically with on-site activities in a strategic manner to remove or reduce significant noise and vibration impacts associated with the remediation works. The NVMP will detail the provision and installation of the acoustic barriers, the best practice noise measures that the appointed contractor will adhere to on-site and the noise and vibration monitoring programme that the appointed contractor will undertake during the remediation works.

The appointed contractor shall be required to carry noise monitoring at NSR locations on a weekly basis and this shall be increased to continuous monitoring in agreement with the EPA and the conditions of the IEAL, once

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the remediation works begin to approach the NSR locations. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works., The results the noise monitoring will be available in real time to the KCC Site Manager. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works to ensure that the noise emissions from the various works are kept within the prescribed noise limits. The appointed contractor shall also be required to carry out vibration monitoring at the nearest NSR locations during sensitive phases of the remediation works and this data shall be reviewed daily to ensure the limits are being complied with.

The NVMP will detail the best practice measures to be adhered to at the site including but not limited to the following:

- the correct positioning of the mounted breakers in Zone 2A during Phase 1 on-site works to minimise their combined impact - To ensure that the noise limits are met, mounted breakers shall be positioned well apart from each other when operating simultaneously in Zone 2A. Scheduling of works for Zone 2A will ensure that the mounted breakers are correctly positioned to ensure that the relevant criteria are not exceeded at the nearest NSRs;
- the correct sequencing of the building up or taking down of stockpiles on-site - Best Practice shall ensure that the stockpiling will be carried out in a sequence where the stockpile is built up from the boundary nearest to the receptors and added to so that the stockpile can act as a barrier between the noise source and the nearest receptors as the works develop;
- the careful management of the number of plant items in simultaneous operation when the works are close to the NSRs along L2005 Kerdiffstown Road and other key locations; and
- the careful positioning of heavy plant items, such as the waste compactor, to minimise the potential for ground borne vibrations to be generated.

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The real time noise monitoring that will be carried out by the appointed contractor will be used to feed information back to the KCC Site Manager to assist with the above measures and to ensure that noise criteria are met for the Remediation Phase works.

As described above the remediation works will be managed through the use of construction noise limits which the appointed contractor will be required to work within. Best practice control measures including choice of plant, scheduling of works on site, provision of temporary acoustic screening, on-site noise monitoring and other measures will be employed in order to ensure noise limits are not exceeded.

Best practice noise management procedures for the control of noise and vibration from demolition and construction activities as presented in BS5228 will be followed. Such measures to be adhered will include the following:

On-site Work Practices

- Avoid unnecessary revving of engines and switch off equipment when not required;
- Keep internal haul routes well maintained and avoid steep gradients;
- Use rubber linings in chutes and dumpers to reduce impact noise;
- Minimise drop height of materials;
- Start-up plant and vehicles sequentially rather than all together;
- Equipment shall be located away from noise sensitive areas, as much as is feasible;
- Regular and effective maintenance by trained personnel shall be carried out to reduce noise and/or vibration from plant and machinery;
- Limit noisy construction works to 07:00 to 19:00 weekdays with Saturday working from 08:00 to 16:30 unless otherwise agreed with the relevant authority.

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In addition to the above BS5228 recommendations, Section 10.3 of NG4 discusses the management of Waste Related Operations and includes the following mitigation measures which will also be adhered to at the proposed Project:

- Employ noise reducing technologies, such as attenuators or enclosures, where practicable;
- Ensure that noise control measures are maintained as per the manufacturers requirements;
- Minimise the number of vehicles/heavy plant on the proposed Project at any one time;
- Maintain vehicles in good order, employ the principles of preventive maintenance and undertake reference vehicle noise measurements at defined intervals;
- Ensure that noisy vehicles are parked as far as possible from noise sensitive areas;
- Ensure that drivers are aware of the potential for noise to cause annoyance/disturbance to local residents – they shall show due regard to this, particularly when entering and leaving the proposed Project (e.g. no unnecessary horn blowing); and
- Consider the use of alternative varieties of reversing alarm with reduced noise output, such as ambient noise sensing alarms with variable volume or directional modulated alarms – these must be evaluated on a case-by-case basis and regard must be had to any health and safety issues that may arise.

Selection of Quiet Plant

- In accordance with best practicable means, plant and activities to be employed on the proposed Project will be reviewed to ensure that they are the quietest available for the required purpose.

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Acoustic Screens and Barriers

- Acoustic screens are required to be erected in certain locations for the duration of the Remediation Phase works (refer to Figure 8.2 and Section 8.4.1 for more details). These screens shall be carefully positioned to be as effective as possible. In general, the barrier shall have no gaps or openings in the joins of the barrier material and the barrier material shall have a minimum mass per unit area of 7 kg/m^2. The minimum height of the barrier shall typically be such that no part of the noise source will be visible from the receiving point. This will not always be possible and therefore the minimum recommended height is prescribed at 2.4m. The existing screening banks along the western boundary of the proposed Project will be supplemented to give additional noise protection to the private residences along the L2005 Kerdiffstown Road. This shall be done with the use of straw bales (or equivalent) as that is the most readily accessible and highly mobile screen type with very effective mitigation properties. The low-reflection acoustic screens required around the boundary of Zone 2A shall be solidly constructed of straw bales (or equivalent) and shall be of minimum 5m height. The locations for the erection of the acoustic screens are shown on Figure 8.2.

Noise Control

- Improved sound reduction methods, such as equipment enclosures shall be used (this is also addressed in NG4 guidance above).

Communications

- Maintain ongoing contact with local residents to ensure any complaints relating to Remediation Phase noise for the project from local residents can be addressed. Also, prior to any particularly noisy activities, local residents shall be contacted and notified of upcoming works in order to minimise the perceived noise impact. Any liaison with local residents will be undertaken in agreement with the KCC Site Manager.

Monitoring

- On-site noise monitoring during the actual works will be a key part in the mitigation programme for the proposed works. As discussed above, monitoring of the noise levels at NSR locations for comparison with the noise limits during the different Remediation Phases will be critical and the live measurement results

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will be passed onto the KCC Site Manager and will be used to assist the scheduling of works to ensure that the noise emissions from the various works are kept within the limits.

Additionally, the appointed contractor shall continue the current engagement with local residents and stakeholders and will notify them before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. Throughout the Remediation Phase there shall be distribution of information circulars by the contractor informing people of the progress of works and any likely periods of significant noise and vibration. A nominated contact for any communications in relation to noise and vibration for the duration of the project remediation works and any queries, complaints or other formal correspondence regarding noise and vibration shall be appointed by the contractor.

8.5.2 Operational Phase Mitigation Measures

There are no adverse noise impacts associated with the Operational Phase of the proposed Project and the noise impact assessment has shown that mitigation measures are not required.

8.6 Residual Impacts

8.6.1 Remediation Phase

The impact assessment has shown that with correct implementation of appropriate noise and vibration mitigation measures, the resultant noise and vibration impacts will be sufficiently controlled to within the relevant criteria. The overall noise and vibration impact from the Remediation Phase of the proposed Project is anticipated to be short term and moderate considering the existing noise environment and the predicted impacts of the proposed Project.

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8.6.2 Operational Phase

The impact assessment has shown that the proposed Project can operate within the adopted day, evening and night-time noise limits for the site. The overall noise and vibration impact from the operation of the proposed Project is anticipated to be long term and imperceptible considering the existing noise environment and the predicted impacts of the proposed Project.

8.7 Difficulties Encountered in Compiling Information

There were no specific difficulties encountered when carrying out this assessment.

8.8 Cumulative Impacts

The cumulative impact for the proposed Project can be assessed by taking account of the existing baseline noise environment and the addition of the predicted noise levels associated with the operation of the proposed Project. Assuming there is no change (positive or negative) to the existing noise environment as a result of other developments in the area, the cumulative impacts at the named receptor locations are estimated to be imperceptible as shown in Section 8.4.1.

In addition to the operation of the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on overall noise levels that may be experienced at receptors. These projects are discussed in the following paragraphs.

8.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall

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ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. The Waste Facility Permit restricts the truck movements onto the quarry site to a maximum of 35 per day and restricts the working hours to 08:00 to 17:00 Mondays to Fridays and 08:00 to 13:00 on Saturdays. This approximates to four loads of inert materials coming to the site per hour at maximum capacity. The project is anticipated to be completed over a three-year period which would significantly reduce the number of truck movements to approximately one per hour on average over the duration of the project.

The access route to the quarry site is from the south using the L2012 Monread Road and crossing over the M7 motorway. This will result in keeping all the quarry infilling traffic well removed from the proposed Project works in the event of the quarry back-filling works occurring at the same time as the Remediation Phase works. The Waste Facility Permit requires the quarry works to meet noise limits of 55dB $L_{AEq,T}$ at the nearest receptor locations. The only receptor that has the potential to be impacted by works at both sites is REC018. The maximum predicted noise levels for the Remediation Phase works at REC018 is 45dB $L_{AEq,1hr}$ during Phase 3 works and consequently the cumulative impact from this development is anticipated to be neutral. There will be no impact from the Operational Phase of the infilling quarry.

8.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell, a new re-configured interchange at Newhall and a grade separated junction, M7 Osberstown Interchange, located between the existing M7 Maudlins and Newhall Interchanges. Review of the M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes Environmental Impact Statements and the Oral Hearing Briefs of Evidence, note that with the inclusion of the proposed mitigation measures the residual impact to noise as a result of the proposed road schemes is positive. Consequently, the cumulative impact from this development and the proposed Project is anticipated to be neutral. Environmental Impact Statements and the Oral Hearing Briefs of Evidence, note that with the inclusion of the proposed mitigation measures the residual impact to noise as a result of the proposed road schemes is positive. Consequently, the cumulative impact from this development and the proposed Project is anticipated to be neutral.

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Construction works for the road scheme were shown to be able to be carried out within the proposed noise limits at the nearest receptors to the road works. The nearest receptors to the proposed Project are too far removed to be impacted by the road construction works and again the overall cumulative impact is considered to be neutral.

8.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. The Operational Phase of the proposed Service Station is anticipated to be not significant at the nearest noise sensitive receptors and therefore the cumulative impacts from this project (if it were to proceed at a point in the future) and the proposed Project is anticipated to be neutral.

8.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed the cumulative impacts from the housing development project and the proposed Project is anticipated to be neutral.

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The predicted noise impacts associated with the proposed Project are significantly below those associated with the existing noise environment and also those associated with the other planned projects as discussed above. Therefore, the Operational Phase of the proposed Project is anticipated to be imperceptible in terms of noise contributed to the surrounding environment. It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

8.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic.

If construction works proceed for both schemes at the same time, the plant and machinery required will have to operate at different sections along the Kerdiffstown Road due to the nature of the work and the size and type of machinery required. In effect, the construction work for one project would be followed by the other project but they would never directly overlap. The precise detail of how the works would be completed if they were to proceed at the same time is not available at this time however the active plant and machinery for both schemes would need to be kept at a sufficiently removed distance from each other to ensure that the proposed noise limits are maintained. Assuming that the works for both schemes are managed as described above to minimise noise impacts, the cumulative impact is anticipated to be not significant. In the event that either the proposed Project or the new pumped sewer construction is delayed there will be no cumulative impact.

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8.9 References

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9. Landscape and Visual

This Chapter assesses the landscape and visual impacts of the proposed Project. It is envisaged that overall the landscape and visual aspects of the proposed Project at Operational Phase will be a positive improvement on the current un-remediated baseline scenario.

The baseline conditions assessed encompass a variety of aspects including landform and drainage, vegetation and land use, and transport routes. These baseline conditions have been used in determining the landscape sensitivity of the site with the landscape to the north and east of the site being deemed as medium while the landscapes to the south and west of the site being more consistent with low sensitivity ratings.

Remediation Phase landscape effects are deemed to be medium impact within the site itself and low impact within the surrounding environs. Remediation Phase visual impacts range between moderate and imperceptible, largely depending on viewing distance and these tend to relate to construction related activity and vegetation stripping. All Remediation Phase impacts will be temporary.

The use of the site as a public recreational facility has positive connotations for the Green Infrastructure Network of the environs of Naas and Johnstown and will influence public perceptions of the site in a positive manner. The Operational Phase landscape impact of the site is generally deemed to be positive in comparison to baseline conditions. There are a number of key mitigation measures that will be undertaken in order to minimise the overall visual impact of the proposed Project however in most instances it is considered that the residual visual impact of the Operational Phase will be a 'positive' improvement on the current un-remediated baseline scenario or will have no material effect on visual amenity.

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9.1 Introduction

This Landscape and Visual Impact Assessment (LVIA) considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as the proposed Project). The appraisal takes account of not only the end-use of the proposed Project, but also the complex construction period that will take place sequentially. Remediation of the site will result in changes to the existing landform and land cover and will require the movement of heavy plant and machinery within the site, as well as access to and from the site by construction traffic.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950's until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 9.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 9.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound supported by a back-up flare • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of the surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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In contrast to most landscape and visual appraisals the proposed outcome of the remediation works will represent an improvement to the baseline and historical conditions of the site. Thus, the focus of the assessment process in this instance is to maximise the positive impacts, whilst critically identifying potential impacts due to construction activities to be undertaken in the Remediation Phase and reducing the magnitude of those temporary negative impacts.

The landscape and visual assessment will integrate a number of elements into the assessment, namely:

Landscape Impact Assessment (LIA) which relates to the assessment of effects on the landscape as a resource in its own right and is concerned with how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character.

Visual Impact Assessment (VIA) which relates to the assessment of effects on specific views and on the general visual amenity experienced by people. This deals with how the surroundings of individuals, or groups of people, may be specifically affected by changes in the content and character of views as a result of the change or loss of existing elements of the landscape and/or introduction of new elements. Visual impacts may occur from; Visual Obstruction (blocking of a view, be it full, partial or intermittent) or; Visual Intrusion (interruption of a view without blocking).

Cumulative landscape and visual impact assessment is concerned with additional changes to the landscape or visual amenity caused by the proposed Project in conjunction with other developments (associated or separate to the proposed Project), or actions that occurred in the past, present or are likely to occur in the foreseeable future.

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9.2 Methodology

9.2.1 Relevant Guidance Documents

This landscape and visual impact assessment is based on:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015); and
- Landscape Institute and the Institute of Environmental Management and Assessment publication entitled Guidelines for Landscape and Visual Impact Assessment (GLVIA-2013).

The assessment includes three main aspects and these are outlined below in Section 9.2.2, Section 9.2.3 and Section 9.2.4.

9.2.2 Data Collection, Research and Baseline Establishment

The potential impacts to landscape and visual assets as a result of the proposed Project were assessed through a desk-based study of available information, including: Review of the Kildare County Development Plan (2017-2023), particularly in relation to the county Landscape Character Assessment and designated scenic routes and views. This informed the selection of an appropriate study area, within which, to examine the landscape and visual effects of the proposed Project. It also identified sensitive receptor locations within the study area from which to prepare photomontages for the later appraisal of visual impacts.

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Extent of Study Area

Kerdiffstown Landfill is not a particularly prominent feature within its wider landscape setting, however, the Kildare County Development Plan (2017-2023) identifies a number of designated hilltop views, from which, vast areas of the landscape are visible. In the interests of a comprehensive appraisal, a 3km radius study area is used in this instance. However, there is a particular focus on receptors contained within 1km, except where iconic or designated scenic viewpoints exist at greater distances out to 3km.

9.2.3 Fieldwork, Viewshed Reference Point Selection and Photo Capture

This site-work stage involves the verification of potential viewpoint locations from the initial desk-based study and the capture of high-resolution photography for the preparation of the photomontages that form the basis of the visual impact assessment. Photomontages accurately represent the way in which a future development will appear within a particular view by superimposing a photo-realistic model of it into an existing photograph that represents the view in question. Field notes are recorded in relation to the likes of topography, land use, significant landscape features and overall landscape character. This process is used to inform the proposed Project specific landscape character assessment that is the basis of landscape impact appraisal. The project specific landscape character assessment is not intended to override the County Kildare Landscape Character Assessment. Instead, it allows for a comparison with the broader scale document to identify points of commonality and also where the county based assessment may not have identified salient landscape features or finer scale aspects of landscape character that are pertinent to the proposed Project. This is particularly relevant to complex hinterland areas as county-based landscape character assessments tend to focus on the core aspects of countryside (non-urban) character.

9.2.4 Appraisal of Landscape and Visual Impacts

Landscape Impact Assessment Criteria

When assessing the potential impacts on the landscape resulting from a proposed Project, the following criteria are considered:

- Landscape character, value and sensitivity;

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- Magnitude of likely impacts; and
- Significance of landscape effects.

The sensitivity of the landscape to change is the degree to which a particular landscape receptor (Landscape Character Area (LCA) or feature) can accommodate changes or new elements without unacceptable detrimental effects to its essential characteristics. Landscape Value and Sensitivity is classified using the following criteria set out in Table 9.2, which have been derived from a combination of the Guidelines for Landscape and Visual Impact Assessment 2nd Edition 2002 (Institute of Environmental Management & Assessment 3rd Edition updated 2013) and professional judgement.

Table 9.2: Landscape Value and Sensitivity

Sensitivity	Description
Very High	Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are high value landscapes, protected at an international or national level (World Heritage Site/National Park), where the principal management objectives are likely to be protection of the existing character.
High	Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national or regional level (Area of Outstanding Natural Beauty), where the principal management objectives are likely to be considered conservation of the existing character.
Medium	Areas where the landscape character exhibits some capacity and scope for development. Examples of which are landscapes, which have a designation of protection at a county level or at non-designated local level where there is evidence of local value and use.
Low	Areas where the landscape character exhibits a higher capacity for change from development. Typically, this would include lower value, non-designated landscapes that may also have some elements or features of recognisable quality, where landscape management objectives include, enhancement, repair and restoration.
Negligible	Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value.

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The magnitude of a predicted landscape impact is a product of the scale, extent or degree of change that is likely to be experienced as a result of the proposed Project. The magnitude takes into account whether there is a direct physical impact resulting from the loss of landscape components and/or a change that extends beyond the boundary of the proposed Project that may have an effect on the landscape character of the area. See Table 9.3.

Table 9.3: Magnitude of Landscape Impacts

Magnitude of Impact	Description
Very High	Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
High	Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
Medium	Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality.
Low	Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements.

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Magnitude of Impact	Description
Negligible	Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable.
Neutral	Changes that do not involve the loss of any landscape characteristics or elements and will not result in noticeable changes to the prevailing landscape character.
Positive	Changes that restore a degraded landscape or reinforce characteristic landscape elements

The significance of a landscape impact is based on a balance between the sensitivity of the landscape receptor and the magnitude of the impact. The significance of landscape impacts is arrived at using the following matrix set out in Table 9.4.

Table 9.4: Impact Significance Matrix

	Sensitivity of Receptor				
Scale/Magnitude	***Very High***	***High***	***Medium***	***Low***	***Negligible***
Very High	Profound	Profound-substantial	Substantial	Moderate	Minor
High	Profound-substantial	Substantial	Substantial-moderate	Moderate-slight	Slight-imperceptible
Medium	Substantial	Substantial-moderate	Moderate	Slight	Imperceptible
Low	Moderate	Moderate-slight	Slight	Slight-imperceptible	Imperceptible
Negligible	Slight	Slight-imperceptible	Imperceptible	Imperceptible	Imperceptible
Neutral	Imperceptible	Imperceptible	Imperceptible	Imperceptible	Imperceptible
Positive	Positive	Positive	Positive	Positive	Positive
Note: The significance matrix provides an indicative framework from which the significance of impact is derived. The significance judgement is ultimately determined by the assessor using professional judgement. Due to nuances within the constituent sensitivity and magnitude judgements, this may be up to one category higher or lower than indicated by the matrix. Judgements indicated in orange are considered to be 'significant impacts' in EIA terms.					

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Visual Impact Assessment Criteria

As with the landscape impact, the visual impact of the proposed Project will be assessed as a function of sensitivity versus magnitude. In this instance the sensitivity of the visual receptor, weighed against the magnitude of the visual effect.

Sensitivity of Visual Receptors

Unlike landscape sensitivity, the sensitivity of visual receptors has an anthropocentric (or human-centric) basis. It considers factors such as the perceived quality and values associated with the view, the landscape context of the viewer, the likely activity they are engaged in and whether this heightens their awareness of the surrounding landscape. Table 9.5 outlines the location and direction of view for the viewpoints considered in this assessment. Refer to Figure 9.3 for the location of these assessment viewpoints.

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Table 9.5: Viewpoint Descriptions

Viewpoint (VP)	Magnitude of Landscape Impacts	Direction of View
VP1	Access road to Kerdiffstown House	W
VP2	Walled Garden at Kerdiffstown House	SW
VP3	2nd Hole of Palmerstown House Golf Course	W
VP4	3rd Hole of Palmerstown House Golf Course	NW
VP5	L2005 Kerdiffstown Road	NE
VP6	Clubhouse of Naas Golf Course	S
VP7	7th Green of Naas Golf Course	SW
VP8	N7 Pedestrian Overpass to Johnstown	N
VP9	Maudlins Interchange Overbridge	NW

A list of the factors considered by the assessor in estimating the level of sensitivity for a particular visual receptor is outlined below and used in Table 9.5 to establish visual receptor sensitivity at each Viewshed Reference Point (VRP):

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Susceptibility of Receptors - In accordance with the Institute of Environmental Management and Assessment ("IEMA") Guidelines for Landscape and Visual Assessment (3rd edition 2013) visual receptors most susceptible to changes in views and visual amenity are;

- "Residents at home;
- People, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focussed on the landscape and on particular views;
- Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience;
- Communities where views contribute to the landscape setting enjoyed by residents in the area; and
- Travellers on road, rail or other transport routes where such travel involves recognised scenic routes and awareness of views is likely to be heightened".

Visual receptors that are less susceptible to changes in views and visual amenity include;

- "People engaged in outdoor sport or recreation, which does not involve or depend upon appreciation of views of the landscape; and
- People at their place of work whose attention may be focussed on their work or activity, not their surroundings and where the setting is not important to the quality of working life".

Recognised scenic value of the view (County Development Plan designations, guidebooks, touring maps, postcards etc.). These represent a consensus in terms of which scenic views and routes within an area are strongly valued by the population because in the case of County Developments Plans, for example, a public consultation process is required;

Views from within highly sensitive landscape areas. Again, highly sensitive landscape designations are usually part of a county's Landscape Character Assessment, which is then incorporated within the County Development Plan and is therefore subject to the public consultation process. Viewers within such areas are likely to be highly attuned to the landscape around them;

Primary views from dwellings. A proposed Project might be seen from anywhere within a particular residential property with varying degrees of sensitivity. Therefore, this category is reserved for those instances in which the design of dwellings or housing estates, has been influenced by the desire to take in a particular view. This might

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involve the use of a slope or the specific orientation of a house and/or its internal social rooms and exterior spaces;

Intensity of use, popularity. This relates to the number of viewers likely to experience a view on a regular basis and whether this is significant at county or regional scale;

Connection with the landscape. This considers whether or not receptors are likely to be highly attuned to views of the landscape i.e. commuters hurriedly driving on a busy national route versus hill walkers directly engaged with the landscape enjoying changing sequential views over it;

Provision of elevated panoramic views. This relates to the extent of the view on offer and the tendency for receptors to become more attuned to the surrounding landscape at locations that afford broad vistas;

Sense of remoteness and/or tranquillity. Receptors taking in a remote and tranquil scene, which is likely to be fairly static, are likely to be more receptive to changes in the view than those taking in the view of a busy street scene, for example;

Degree of perceived naturalness. Where a view is valued for the sense of naturalness of the surrounding landscape it is likely to be highly sensitive to visual intrusion by distinctly manmade features;

Presence of striking or noteworthy features. A view might be strongly valued because it contains a distinctive and memorable landscape feature such as a promontory headland, lough or castle;

Historical, cultural and / or spiritual significance. Such attributes may be evident or sensed by receptors at certain viewing locations, which may attract visitors for the purposes of contemplation or reflection heightening the sense of their surroundings;

Rarity or uniqueness of the view. This might include the noteworthy representativeness of a certain landscape type and considers whether the receptor could take in similar views anywhere in the broader region or the country;

Integrity of the landscape character. This looks at the condition and intactness of the landscape in view and whether the landscape pattern is a regular one of few strongly related components or an irregular one containing a variety of disparate components;

Sense of place. This considers whether there is special sense of wholeness and harmony at the viewing location; and

Sense of awe. This considers whether the view inspires an overwhelming sense of scale or the power of nature.

Those locations which are deemed to satisfy many of the above criteria are likely to be of higher sensitivity. No relative importance is inferred by the order of listing. Overall sensitivity may be a result of a number of these factors or, alternatively, a strong association with one or two in particular.

Visual Impact Magnitude

The magnitude of visual effects is determined on the basis of two factors; the visual presence (relative visual dominance) of the proposed Project and its effect on visual amenity.

Given that the landfill maintenance infrastructure and multi-use public park ancillary structures do not represent significant bulk, visual impacts will result almost entirely from visual 'intrusion' rather than visual 'obstruction' (the blocking of a view). The magnitude of visual impacts is classified in Table 9.6.

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Table 9.6: Magnitude of Visual Impact

Criteria	Description
Very High	The proposal intrudes into a large proportion or critical part of the available vista and is without question the most noticeable element. A high degree of visual clutter or disharmony is also generated, strongly reducing the visual amenity of the scene.
High	The proposal intrudes into a significant proportion or important part of the available vista and is one of the most noticeable elements. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene.
Medium	The proposal represents a moderate intrusion into the available vista, is a readily noticeable element and/or it may generate a degree of visual clutter or disharmony, thereby reducing the visual amenity of the scene. Alternatively, it may represent a balance of higher and lower order estimates in relation to visual presence and visual amenity.
Low	The proposal intrudes to a minor extent into the available vista and may not be noticed by a casual observer and/or the proposal would not have a marked effect on the visual amenity of the scene.
Negligible	The proposal would be barely discernible within the available vista and/or it would not detract from, and may even enhance, the visual amenity of the scene.
Neutral	Changes that are not discernible within the available vista and have no bearing the visual amenity of the scene.
Positive	Changes that enhance the available vista by reducing visual clutter or restoring degraded features.

Visual Impact Significance

As stated above, the significance of visual impacts is a function of visual receptor sensitivity and visual impact magnitude. This relationship is expressed in the same significance matrix and applies the same EPA definitions of significance as used earlier in respect of landscape impacts (See Table 9.4).

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9.3 Baseline Conditions

9.3.1 Study Area

Given that this is a remediation project rather than a development project involving the construction of significant structures or large-scale excavation it is not considered that significant landscape and visual effects could result beyond the immediate environs of the site. Nonetheless, this is a locally elevated landform element and it is important to consider views of the site that might be afforded from locations in the wider landscape context. By way of balance, therefore, a 3km radius study area is considered appropriate in this instance.

9.3.2 Landform and Drainage

The landform of the study area is generally flat to mildly undulating. The initial folds of the Wicklow Mountain foothills begin to emerge throughout the eastern quarters of the study area, whilst the land to the west is more planar in nature as it declines gently towards the River Liffey. The River Liffey meanders in a northerly direction through the western extents of the study area, whilst the smaller tributaries of the Morell River feed towards it from the higher ground in the east of the study area passing adjacent to the north-east of the site. Several ponds have been formed within the low-lying ground immediately to the north-east of the site (WB001 and WB002, refer to Figure 13.2 for the location of watercourses and waterbodies). These appear to utilise water from the Rathmore Stream for the benefit of Palmerstown demesne and golf course.

9.3.3 Vegetation and Land Use

The land cover and land use of the study area is richly varied, typifying the crossover of urban hinterlands between both the major metropolitan centre of Dublin City and that of the significant satellite centre of Naas. The land use matrix consists of urban (residential and industrial) land use at Naas to the south of the site and Sallins to the west. The complex land use matrix of the study area can be seen in Figure 9.1.

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The N7 national road transitions into the M7 motorway a short distance to the south-west of the site and there are several complex orbital junctions onto this major road corridor to the south and east of the site. These broad transport corridors and associated infrastructure contribute significantly to the overall land cover of the study area. Whilst agricultural farmland is the predominant land use outside of the urban areas it is interspersed with several golf courses including Palmerstown House Estate and Golf Course immediately to the east of the landfill and Naas Golf Course to the north. These are often associated with former demesne landscapes of which there are a number in the immediate vicinity of the landfill as well as within the wider study area. Kerdiffstown House and demesne is located adjacent to the east of the landfill site and consist of parkland landscape and a walled garden that is contiguous with the House. There is also evidence of equestrian centres and horse training facilities within the rural landscape with the most notable of these being Goffs Equine Holdings a short distance to the east of the site. A former quarry site to the north-west of the landfill site has received planning permission and a waste facility permit for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste.

9.3.4 Centres of Population and Houses

The most significant settlement in the context of the study area is Naas. The site is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The neighbouring and almost contiguous settlement of Sallins lies on the opposite side of the motorway to Naas and is approximately 1km to the north-west of the landfill site. The smaller settlements of Johnstown and Kill lie on the opposite side of the N7 road corridor to the south-east and east of the site respectively. Though the area to the north-east of the site is relatively sparsely populated in the context of the remainder of the study area the local roads that skirt this area are consistently lined with rural dwellings.

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9.3.5 Transport Routes

The most significant transport route within the study area is the M7 / N7 road corridor, which skirts around the eastern, southern and western sides of the proposed Project, refer to Figure 3.1. There are also elevated junctions and flyovers associated with this road corridor that occur within 500m of the site and provide potential views towards the site. A section of the Dublin – Cork national railway line also passes through the study area between Naas and Sallins and is approximately 850m to the north-west of the site at its nearest point.

9.3.6 Amenity, Tourist and Heritage Facilities

The main recreational amenity features are the various golf courses within the less populated northern half of the study area. These include; Palmerstown House Golf Club (adjacent to the north-east); Naas Golf Club (to the north); Killeen Golf Club (approximately 1.5km north) and Sherlockstown Golf Club (approximately 2.2km north-west). In addition to the golf course, Palmerstown House Estate is also utilised as a wedding and conference venue. Kerdiffstown House, which lies only a short distance to the north-east of the proposed Project, has been operated as a respite centre by the Society of St Vincent de Paul for several years.

The other notable amenity feature within the study area is the Grand Canal, which runs through the northern and western extents. This waterway and its associated tow paths are utilised by canal boaters and walkers.

The complex land use matrix of the study area can be seen in Figure 9.1.

9.3.7 Landscape Policy Context

Kildare County Development Plan 2017-2023

A Landscape Character Assessment was produced in 2004 for County Kildare and this is incorporated into the Kildare County Development Plan 2017-2023. The Landscape Character Assessment identifies four Landscape Character Types (LCTs) within the county and the proposed Project is shown to be contained within the 'Lowland Plains and Boglands' LCT. The county is then divided into a further 15 No. geographically distinct Landscape Character Areas (LCA) with Kerdiffstown Landfill situated within the 'Northern lowlands LCA (Diagram 9.1). This LCA is characterised by *'generally flat terrain and open lands with regular (medium sized)*

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field patterns. Hedgerows are generally well maintained and low, with scattered trees along the field boundaries that partially screen the lowest lying areas. Nevertheless, the generally low-lying vegetation of the area allows long-distance and extensive visibility'.

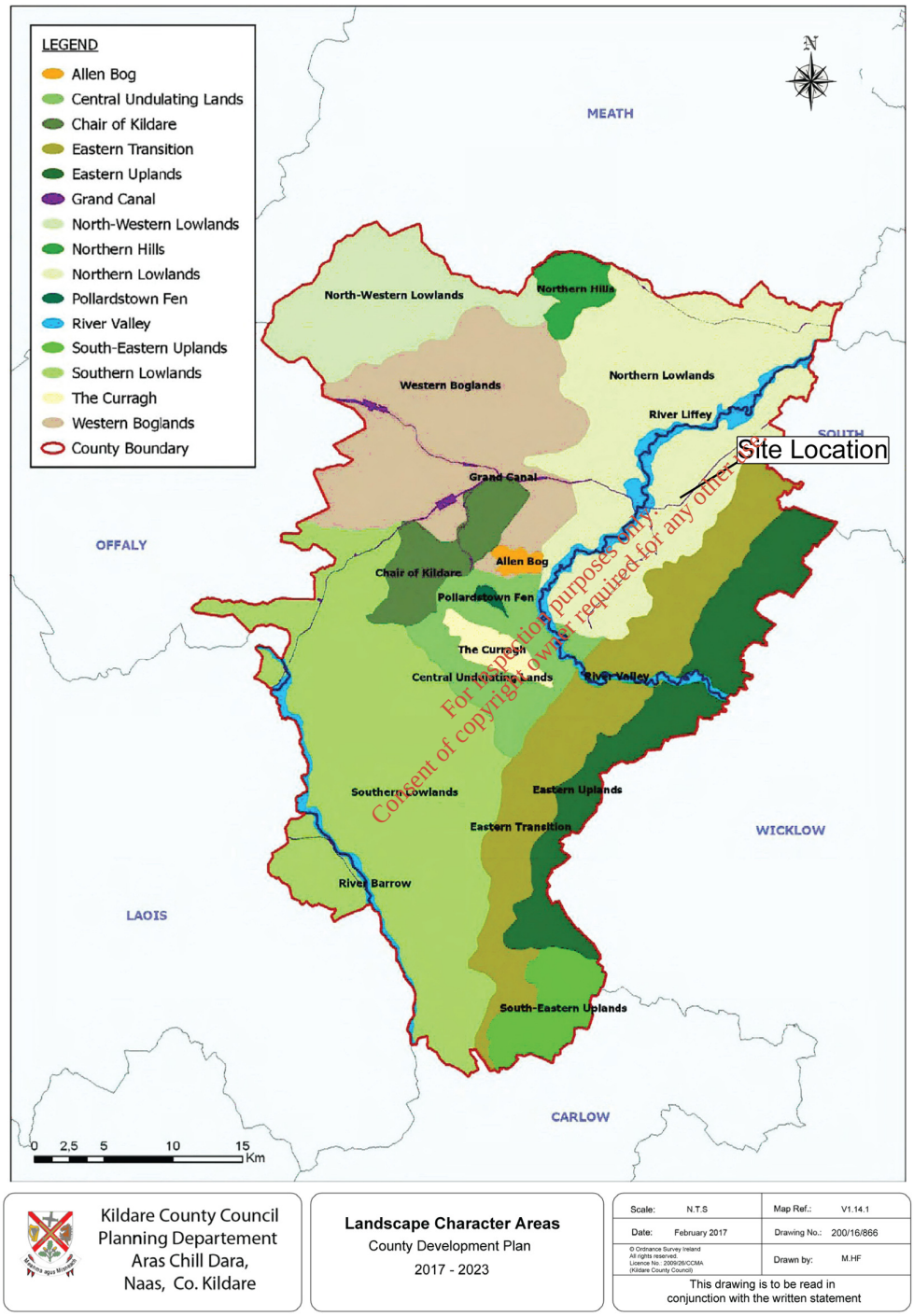
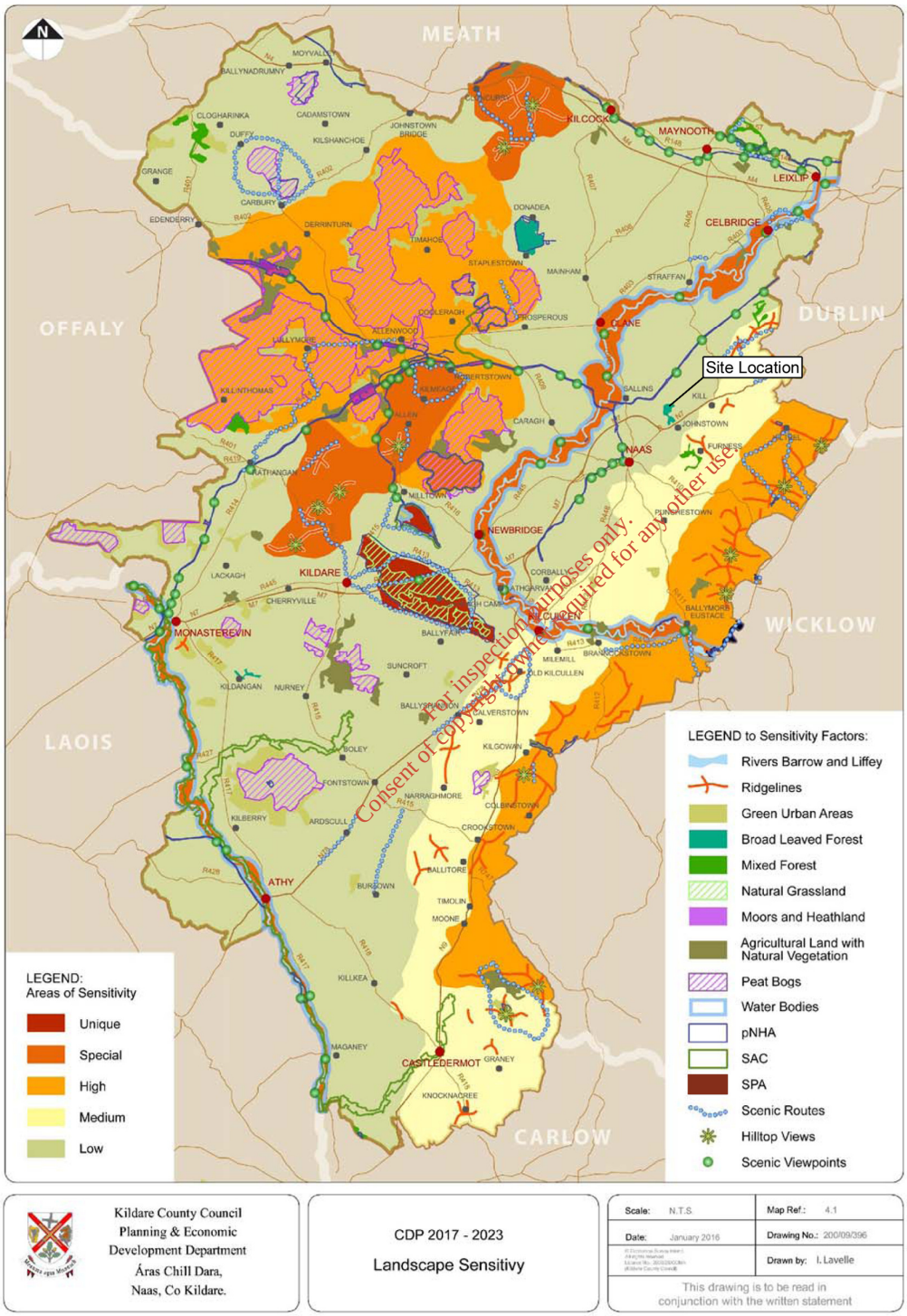


Diagram 9.1: Excerpt from Kildare County Development Plan (2017-2023), Landscape Character Areas Map

The landscape character assessment also attributes each LCA with a sensitivity rating relating to the ability to accommodate change. The 'Northern Lowlands LCA has been designated as a 'Low' sensitivity landscape and

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is described as *'robust landscapes which are tolerant to change, and which have the ability to accommodate development pressure'*. (refer to Diagram 9.2)



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Diagram 9.2: Excerpt from Kildare County Development Plan (2017-2023), Map 4.1 Landscape Sensitivity

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The Kildare County Development Plan (CDP) includes a number of policies regarding the 'Lowland Plains and Boglands' landscape type, some of which are relevant to the proposed Project. These include;

LL1 *- Recognise that the lowlands are made up of a variety of working landscapes, which are critical resources for sustaining the economic and social well-being of the county.*

LL2 *- Continue to permit development that can utilise existing structures, settlement areas and infrastructure, whilst taking account of the visual absorption opportunities provided by existing topography and vegetation.*

LL3 *- Recognise that this lowland landscape character area includes areas of significant landscape and ecological value, which are worthy of protection.*

The CDP also lists a number of general landscape policies, in Section 14.8 of the CDP, many of which have relevance to the proposed Project;

LA1 *- Ensure that consideration of landscape sensitivity is an important factor in determining development uses. In areas of high landscape sensitivity, the design, type and the choice of location of proposed development in the landscape will also be critical considerations.*

LA2 *- Protect and enhance the county's landscape, by ensuring that development retains, protects and, where necessary, enhances the appearance and character of the existing local landscape.*

LA3 *- Require a Landscape/Visual Impact Assessment to accompany significant proposals that are likely to significantly affect:*
- Landscape Sensitivity Factors
- A Class 4 or 5 Sensitivity Landscape (i.e. within 500m of the boundary)
- A route or view identified in maps 14.2 and 14.3 (i.e. within 500m of the boundary)

LA4 *- Seek to ensure that local landscape features, including historic features and buildings, hedgerows, shelter belts and stone walls are retained, protected and enhanced where appropriate, so as to preserve the local landscape and character of an area, whilst providing for future development.*

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Also included at the end of Chapter 14 of the CDP are a number of general landscape objectives. Those that are considered to be relevant to the proposed remediation project are included below;

LO1 *- Have regard to the Landscape Sensitivity Classification of sites in the consideration of any significant development proposals.*

LO2 *- Ensure landscape assessment will be an important factor in all land-use proposals.*

LO3 *- Investigate the feasibility of preparing a Landscape Conservation Area Assessment within the county to identify any area(s) or place(s) within the county as a Landscape Conservation Area in accordance with the Planning and Development Acts.*

LO4 *- Protect the visual and scenic amenities of County Kildare's built and natural environment.*

LO5 *- Preserve the character of all important views and prospects, particularly upland, river, canal views, views across the Curragh, views of historical or cultural significance (including buildings and townscapes) and views of natural beauty.*

LO6 *- Preserve and protect the character of those views and prospects obtainable from scenic routes identified in this Plan, listed in Table 14.2 and identified on Map 14.3.*

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LO7 *- Encourage appropriate landscaping and screen planting of developments along scenic routes. Where scenic routes run through settlements, street trees and ornamental landscaping may also be required.*

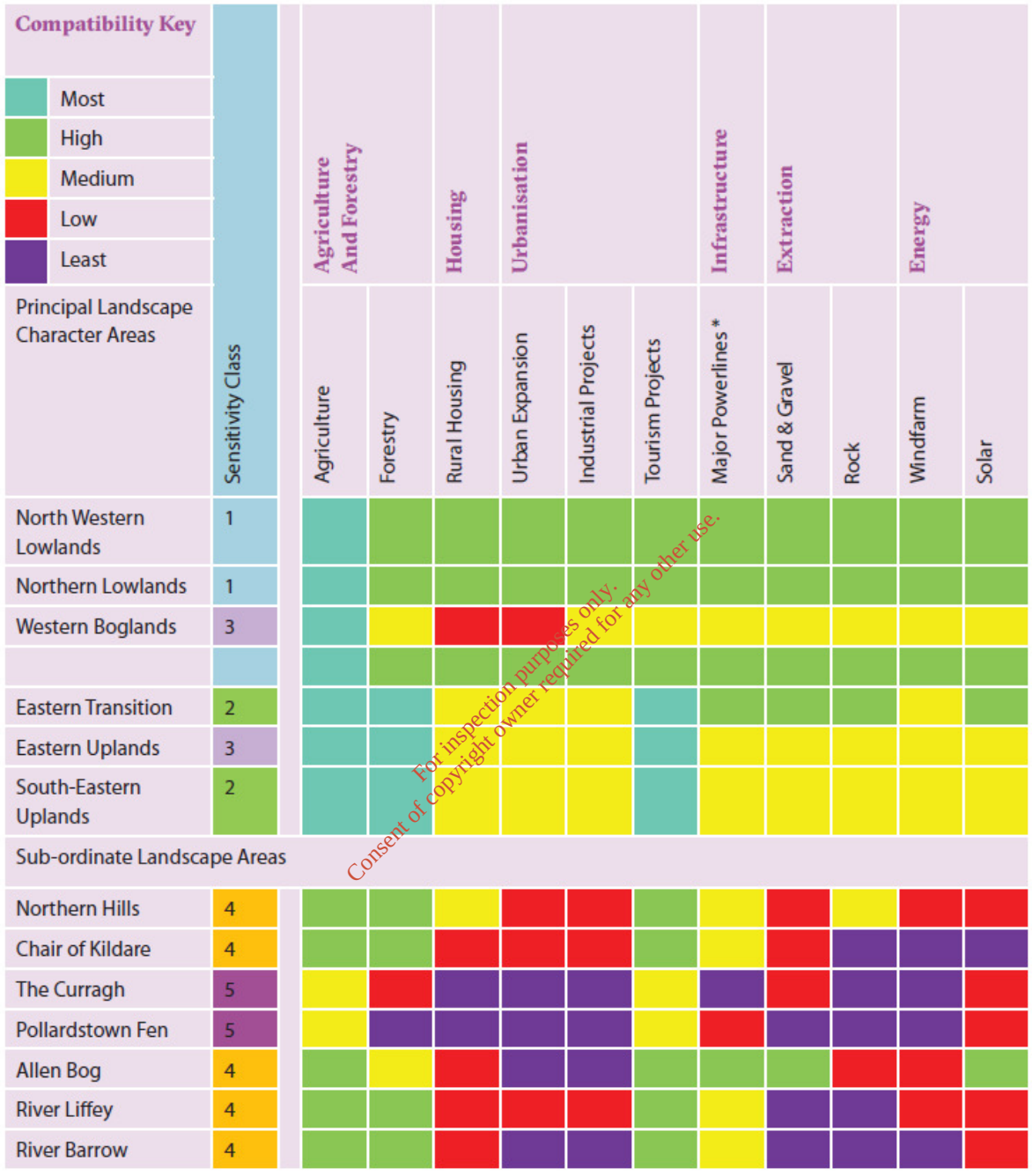
LO8 *- Prepare further detailed guidance in relation to views and prospects available along scenic routes occurring within the boundaries of Local Area Plans.*

L10 *- Review and update the County Landscape Character Assessment in accordance with all relevant legislation and guidance documents.*

In respect of the Kerdiffstown Landfill Remediation Project, the landscape classifications and sensitivity designations are shown in Diagram 9.2. A number of matrices have been introduced relating to the compatibility of various land uses within each LCA (Diagram 9.3), and also in relation to principal landscape sensitivity factors (Diagram 9.4). These matrices do not include a specific reference to remediation projects such as that proposed. Nonetheless, it should be noted that the 'Northern Lowlands LCA is either 'most compatible' or 'highly compatible' with all of the other land use categories identified.

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Compatibility Key	Sensitivity Class	Agriculture And Forestry		Housing	Urbanisation			Infrastructure	Extraction		Energy	
Most / High / Medium / Low / Least												
Principal Landscape Character Areas		Agriculture	Forestry	Rural Housing	Urban Expansion	Industrial Projects	Tourism Projects	Major Powerlines *	Sand & Gravel	Rock	Windfarm	Solar
North Western Lowlands	1											
Northern Lowlands	1											
Western Boglands	3											
Eastern Transition	2											
Eastern Uplands	3											
South-Eastern Uplands	2											
Sub-ordinate Landscape Areas												
Northern Hills	4											
Chair of Kildare	4											
The Curragh	5											
Pollardstown Fen	5											
Allen Bog	4											
River Liffey	4											
River Barrow	4											

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Diagram 9.3: Excerpt from Kildare County Development Plan (2017-2023), Table 14.3 Showing Likely Compatibility Between a Range of Land-Uses and Principal Landscape Areas

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5 - Likely to be very compatible in most circumstances. 4 - Likely to be compatible with reasonable care. 3 - Likely to be compatible with great care. 2 - Compatible only in certain circumstances. 1 - Compatible only in exceptional circumstances. 0 - Very unlikely to be compatible.	Agriculture and Forestry		Housing	Urbanisation			infrastructure	Extraction		Energy	
Proximity within 300m of Principal Landscape Sensitivity Factors.	Agriculture	Forestry	Rural Housing	Urban Expansion	Industrial Projects	Tourism Projects	Major Powerlines	Sand and Gravel	Rock	Windfarm	Solar
Major Rivers and Water bodies	5	5	2	2	2	3	2	1	0	1	0
Canals	5	5	2	2	2	3	2	1	0	1	1
Ridgelines	5	5	1	1	1	1	1	0	0	2	0
Green Urban Areas	4	5	2	0	0	4	3	3	3	2	2
Broad-Leaved Forestry	3	5	2	2	2	4	3	2	3	1	2
Mixed Forestry	3	5	2	2	2	4	3	2	3	1	2
Natural Grasslands	5	2	2	1	1	4	2	1	1	2	2
Moors and Heathlands	2	2	1	0	0	1	2	1	0	2	1
Agricultural Land with Natural Vegetation	5	5	2	2	2	3	3	3	3	4	2
Peat Bogs	0	0	0	0	0	0	2	0	0	3	1
Scenic View	5	5	2	1	1	5	1	3	0	0	2
Scenic Route	5	5	2	1	1	5	1	3	0	0	2

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Diagram 9.4: Excerpt from Kildare County Development Plan (2017-2023), Table 14.4 Showing Likely Compatibility Between a Range of Land-Uses and Proximity to Principal Landscape Sensitivity Factors

Kildare County Development Plan 2017-2023 - Green Infrastructure

Green infrastructure can be described as *'a strategically planned and managed network featuring areas with high quality biodiversity (uplands, wetlands, peatlands, rivers and coast), farmed and wooded lands and other green spaces that conserve ecosystem values which provide essential services to society'* (Comhar 2010, p.12, Chapter 13).

The enhancement of green infrastructure can have a range of landscape related benefits including;

- Provides green buffers /green wedges between built up areas;
- Supports unique habitats for wildlife, biodiversity, and fragile ecosystems;
- Has important recreational, tourism and cultural roles; and

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- Provides corridors for walking and cycling;

Within the development plan (2017-2023) the council lists a number of key policies relating to green infrastructure in County Kildare, some of which have relevance to the proposed development;

> ***GI 1*** *- Ensure the protection, enhancement and maintenance of Green Infrastructure and recognise the health benefits as well as the economic, social, environmental and physical value of green spaces through the integration of Green Infrastructure (GI) planning and development in the planning process.*
>
> ***GI 2*** *- Develop and support the implementation of a Green Infrastructure Strategy for County Kildare.*
>
> ***GI 3*** *- Identify Green Infrastructure resources within and on the edge of the settlement boundaries by expanding the existing programme of Green Infrastructure mapping and to include, during the review process of Local Area Plans, Green Infrastructure policies and objectives.*
>
> ***GI 4*** *- Require that all Local Area Plans protect and manage the Green Infrastructure network in an integrated and coherent manner and add additional Green Infrastructure where possible.*
>
> ***GI 5*** *- Encourage, pursuant to Article 10 of the Habitats Directive, the management of features of the landscape, such as traditional field boundaries, important for the ecological coherence of the Natura 2000 network and essential for the migration, dispersal and genetic exchange of wild species.*
>
> ***GI 6*** *- Provide for the incorporation of underpasses and/or Green Bridges at ecologically sensitive locations on the county's road and rail corridors that will facilitate the free movement of people and species through the urban and rural environment.*
>
> ***GI 7*** *- Promote a network of paths and cycle tracks to enhance accessibility to the Green Infrastructure network, while ensuring that the design and operation of the routes responds to the ecological needs of each site.*

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Following the policies listed in the development plan, the council has also produced a number of objectives relating to green infrastructure in County Kildare;

> ***GIO 1*** *- Prepare a Green Infrastructure Strategy for County Kildare in accordance with international best practice.*
>
> ***GIO 2*** *- Complete the mapping of Green Infrastructure for each town, village and settlement in County Kildare and to develop specific policies and objectives for each area.*
>
> ***GIO 3*** *- Prepare an inventory of locally important Biodiversity sites in the County to support the nationally designated sites and seek to ensure that they are protected through local authority planning processes.*

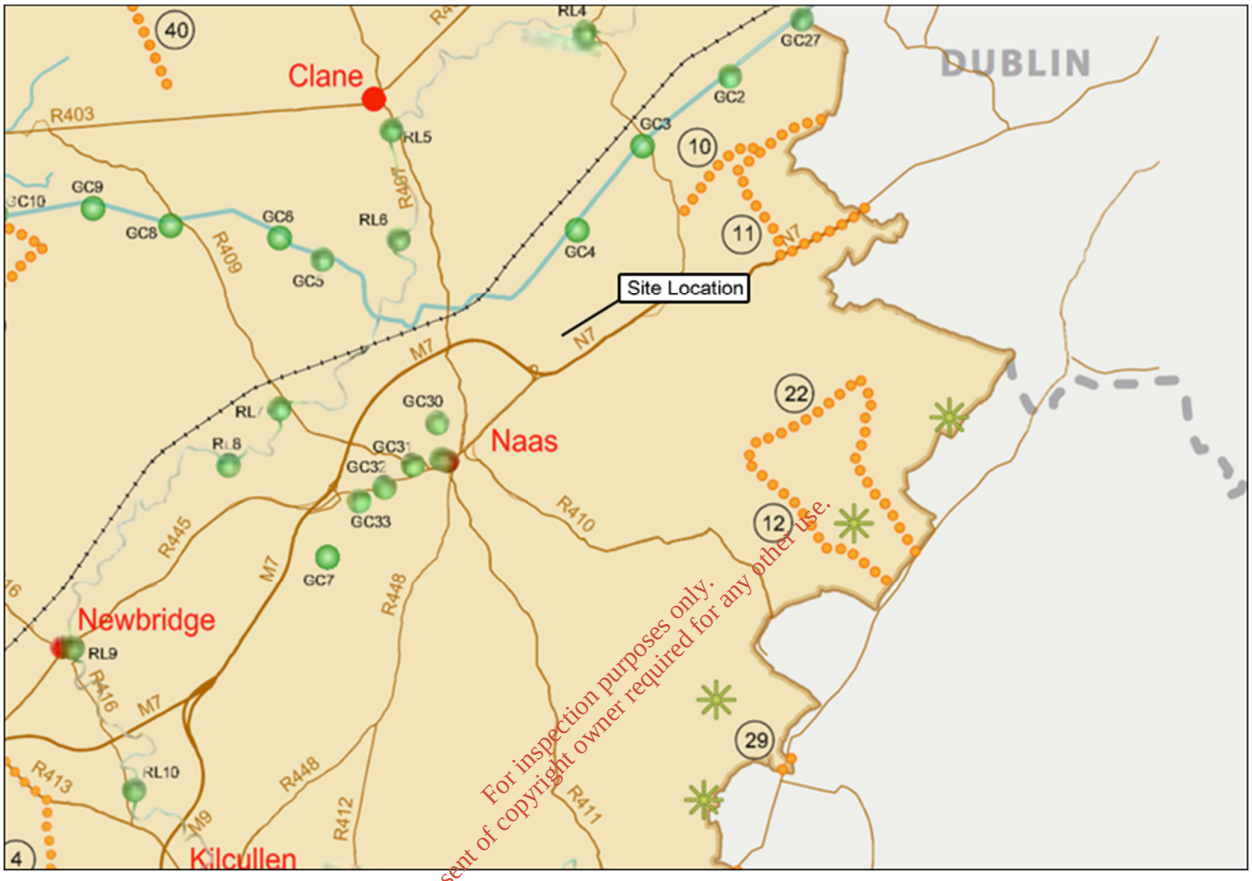
Views of Recognised Scenic Value

Views of recognised scenic value are primarily indicated within County Development Plans in the context of scenic views/routes designations, but they might also be indicated on touring maps, guide books, road side rest stops or on post cards that represent the area.

The County Development Plan includes a map of designated scenic views, routes and hill top views. There are no scenic views or routes located within the immediate vicinity of the proposed Project. Many of the designated views that are located in the surrounding area are canal bridge views that tend to be enclosed by canal-side vegetation. The only designated view that has the potential be influenced by the proposed Project is GC4 –

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Devonshire Bridge, Sherlockstown Common, as the canal is closely aligned with the landfill. However, following fieldwork inspection it is not considered that there will be any visual impact from GC4. Refer to Diagram 9.5.



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Diagram 9.5: Excerpt from Kildare County Development Plan (2017-2023), Map 14.3 Showing Approximate Location of Site in Relation to Designated Scenic Views, Routes and Hill Top Views

9.4 Predicted Impacts

9.4.1 Landscape Value and Sensitivity

The first aspect of the landscape appraisal, regardless of which stage is being assessed, is to determine the landscape sensitivity of the receiving landscape based on baseline conditions. For this project there is a clear distinction between the site itself, which is a former landfill in an uncapped and degraded condition that is in urgent need of remediation to protect the surrounding environs. Using any form of classification system, the site itself can only be considered to have 'Negligible' landscape sensitivity. Indeed, the definition used herein (Section 9.2.4) to describe a landscape of Negligible sensitivity fits closely;

> *"Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value."*

The wider landscape of the study area is more complex in terms of sensitivity. To the north and east of the site is a series of designed landscapes including that of Kerdiffstown House, Palmerstown House Estate and Naas Golf Club (at least some of which appears to have once been a part of the grounds of Kerdiffstown House). With the exception of the current Kerdiffstown House estate, the other sites are currently used as golf courses. This is a common occurrence throughout the country that allows much of the parkland character and in particular,

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mature tree groups, to remain in-situ. These lands along with 'Goffs' equine holdings further to the east are immaculately kept, have little built development and a relatively high degree of tranquillity given the intensity of the land uses that surround them to the south and west. These attributes are not specifically reflected in the County Landscape Character Assessment, which considers each Landscape Character Area (LCA) at a broader scale and attributes the subject LCA (Northern Lowlands) a 'Low' sensitivity rating. This need not be the default sensitivity judgement when considering the receiving landscape at the finer project level.

The landscape to the south and west of the site is much more utilitarian than the lands to the north and east. Beyond a brief apron of agricultural farmland is a bend in the M7 motorway that effectively wraps around these aspects of the site and incorporates a series of major junctions that serve Johnstown, Naas and Sallins. The north-eastern industrial quarter of Naas occupies a substantial portion of land immediately beyond the motorway before giving way to residential estates. The settlements of Johnstown and Sallins are located to the south-east and north-west of the site respectively. The busy Johnstown Garden Centre is a notable commercial operation immediately to the south-east of the site.

For the reasons outlined above, the sensitivity of the designed landscape to the north and east of the site is deemed to be in the order of Medium, whereas the utilitarian landscapes to the south and west are deemed to be more consistent with the Low sensitivity rating of the Northern Lowlands LCA in the Kildare Landscape Character Assessment.

Table 9.7: Landscape Sensitivity Judgements

Landscape Area	Sensitivity (in accordance with criteria contained in Table 9.2)
Kerdiffstown Landfill	Negligible
Naas environs - Utilitarian peri-urban landscape south and west of site including former quarry / landfill	Low
Former demesne landscapes / golf courses north and east of site	Medium

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9.4.2 Magnitude of Landscape Impacts

Remediation Phase Landscape Impacts

There will be physical impacts on the landform and land cover of the site during the Remediation Phase and although this will involve considerable movement of material, the site is an end-of-life landfill. As such the landform is largely modified and most vegetative land cover is recently established. There will be a loss of small sections of the existing tree line near the Zone 1 northern perimeter of the site adjacent to the private access road leading to Kerdiffstown House in order to accommodate the remediation works and the installation of a surface water management system and provision of an access/maintenance track. Otherwise, it is intended that all perimeter trees will be retained as far as practicable. Local areas of steep slopes are present where trees may be lost during remediation works to stabilise those slopes. However, most trees to be removed are relatively small and are not significant in terms of amenity value or screening.

Re-profiling works are intended to minimise volumes associated with the excavation, movement and deposition of materials within the site. Design of the remediation profiles has achieved an approximate balance such that materials will not require to be removed from the site, reducing the impact of the works on the local community and environment. Significant export of materials from the site is not anticipated to be required during the site remediation works. Imported material will be required as part of the capping system and the quantities of material required are detailed in Chapter 4 Description of the Proposed Project. Material will not be exported unless it is observed to be non-compliant. The site profile will be altered, but the overall massing of the landfill will remain very similar and in many areas will reduce.

The highest section (Zone 1) is currently at a maximum height of 113.5mOD Malin. Following re-profiling works the maximum pre-settlement waste profile will be approximately 114.5mOD Malin; this height located in Zone 1. The multilayer engineered capping system for Zone 1 will have a total thickness of around 650mm bringing the maximum height of the site/ Zone 1 to 115.15mOD Malin. This increase will be barely discernible in the context of the existing site profile and there will be some settling of the waste mass in Zone 1 over a long period of time

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(estimated to settle to around 110.5mOD Malin), which will more than balance any minor increases in height observed during the Remediation Phase. In order to understand the magnitude of difference between landfill heights, a scoping exercise was undertaken to examine the variation in height between the current maximum landfill height of 113.5mOD Malin and the originally permitted landfill height of 110.7mOD Malin. This used two comparative photomontages prepared from within and outside of the site and these showed a barely discernible difference in visual impact terms in the context of the overall mound in Zone 1 (refer to Volume 3A Photomontages). In terms of effects on landscape character, the Remediation Phase will present as similar to a construction site. There will be movement of large earthmoving plant and equipment and HGVs transporting materials and equipment around the site as well as to and from the site. A perimeter palisade security fence will be erected which will remain in perpetuity. There will also be a higher quantum of traffic generated on roads in the immediate vicinity of the site by appointed contractors working on the Remediation Phase, though it should be noted that there will be no increase in HGV traffic along the Sallins road to the north-west of the site. The current baseline scenario (un-remediated landfill) is relatively tranquil compared to the site activity that will occur during the Remediation Phase. Compared to the scrubby land cover on much of the site at present, the Remediation Phase will have a much higher proportion of exposed earth. However, the Remediation Phase comprises a series of relatively short phases as outlined in Chapter 4 Description of the Proposed Project where progressive exposing and re-covering of the waste mass would be undertaken on a daily basis, with new soils placed above to be progressively seeded with a suitable grass mix. In the short-term, the remediation works will tend to highlight the proposed Project to a greater degree within its immediate 'green' surrounds and impart something of an industrial character as well as the perception that this is a landscape undergoing substantial change. This perception will begin to alter as the proposed multi-use public park is constructed towards the end of the remediation stage. Whilst there will be continued construction works required to build the sports pitches, change facilities and children's playground, this aspect of the Remediation Phase also sees planting and landscaping works taking place simultaneously.

The proposed widening and realignment of the local access road to the south of the site will also result in short term construction related landscape impacts due to the loss of roadside vegetation and boundary treatments to the front of dwellings REC006, REC007 and REC008. These are relatively minor physical landscape impacts and the short term nature of these road works is also minor in terms of effects on landscape character (visual impacts at these properties addressed in Section 9.4.3 below).

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Although the works associated with the Remediation Phase are of a substantial magnitude they relate to the re-profiling of an existing, highly modified landfill site and the effects on landscape character from the remediation activities will be short-term. Thus, Remediation Phase landscape effects are deemed to be Medium within the site itself and Low within the surrounding environs.

Table 9.8: Summary of Remediation Phase Landscape Impacts

Landscape Area	Sensitivity	Magnitude of Landscape Impacts	Significance of Landscape Impacts
Kerdiffstown Landfill	Negligible	Medium	**Imperceptible**
Utilitarian peri-urban landscape south and west of site including former quarry / landfill	Low	Low	**Slight-imperceptible**
Former designed landscapes / golf courses north and east of site	Medium	Low	**Slight**

9.4.3 Remediation Phase Visual Impacts

See Appendix A9.1 for individual Viewpoint appraisals.

Remediation Phase visual impacts have been assessed at nine representative viewpoint locations (see Table 9.5 and individual viewpoint (VP) appraisals contained in Appendix A9.1). It should be noted at the outset that the proposed Project area is not readily visible from within the surrounding landscape due to screening by a combination of terrain, vegetation and buildings. Only from immediately adjacent to the site and from elevated locations in the near vicinity is it even partially visible and in such instances it is generally the higher mound of Zone 1 that is contained within views.

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Visual impacts for the residential properties adjacent to the proposed L2005 Kerdiffstown Road realignment to the south of the site are also considered. In these cases, the elevated VP8 provides a contextual understanding of the nature of visual change to the front boundaries of these properties.

Visual Receptor Sensitivity

Visual receptor (people and groups of people) sensitivity is considered to range between 'Medium' and 'Low' in the context of this visual appraisal. Recreational landscape users within the more tranquil parkland settings of the Naas and Palmerstown House Estate Golf courses are deemed to be at the higher end of this sensitivity spectrum. Viewers from the surrounding local road network and N7 overpasses are considered to be at the lower end of this sensitivity spectrum. Whilst viewers at VP1 (access road to Kerdiffstown House) are in a relatively tranquil parkland setting near the wooded Morell River corridor, the adjacent landfill slopes also contribute to the baseline setting and thus, the sensitivity at this location is deemed to be Medium-low on balance. (Receptor sensitivity judgments are contained in Appendix A9.1).

Remediation Phase Visual Impact Magnitude

It is during the Remediation Phase that the highest magnitude of visual impact is considered to occur, as the proposed Project will appear as a major construction project from surrounding receptors. Some of the main visual elements that will detract from baseline visual amenity include increased levels of HGV traffic on local roads and road works to construct a new site entrance that incorporates an offset roundabout. There will also be significant construction activity on the site using earth-moving plant and machinery. The existing scrub and rough grassland cover will be stripped from most areas of the site and although this is by no means attractive vegetation, it currently helps to assimilate and camouflage the visible slopes of the site within the existing parkland and semi-rural landscape setting. With this vegetation stripped, the site will present as a large mound of bare-earth from the nearest receptor locations though it should be noted that this represents a periodic worst-case-scenario as there will be periods between phases of capping works where bare earth will be reseeded. Views of the site during the Remediation Phase will generally improve as the proposed multi-use public park and its associated facilities are constructed towards the end of this Phase as these works also involve final seeding, planting and landscaping. However the introduction of sports pitch floodlights and ball-stop netting poles will contribute slightly to visual clutter of vertical structures above the skyline from some locations, especially those to the south and east where these structures are not screened by the main landfill mound. The highest order Remediation Phase visual impacts are deemed to be High-medium at the nearest viewpoint locations where the Zone 1 landfill mound is clearly visible (VP1 and VP5). The visual impact magnitude reduces to Low and Negligible where the landfill is substantially screened by intervening vegetation and/or it is seen at greater distances in the context of a complex and busy landscape setting (VP6, VP7 and VP9).

For residential properties REC006, REC007 and REC008 there will be a loss of roadside vegetation and front boundary treatments (and a sliver of property) as part of the realignment works proposed for the local access road to the south of the site. This will reduce the sense of privacy and residential visual amenity during the construction period for the road and in relation to construction traffic utilising this road for the landfill remediation works. Although these impacts are considered to be in the order of High-medium during the road construction period, they will be temporary in terms of duration.

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Remediation Phase Visual Impact Significance

Table 9.9: Remediation Phase Visual Impact Significance at the Individual Viewpoints

Viewpoint (VP)	Visual Receptor Sensitivity	Visual Impact Magnitude	Significance of Visual Impact
VP1	Medium-low	High-medium	**Moderate**
VP2	Medium	Low-negligible	**Slight-imperceptible**
VP3	Medium	Medium-low	**Moderate-slight**
VP4	Medium	Medium-low	**Moderate-slight**
VP5	Low	High medium	**Moderate slight**
VP6	Medium	Low	**Slight**
VP7	Medium	Low	**Slight**
VP8	Low	Medium	**Slight**
VP9	Low	Low-negligible	**Imperceptible**

When visual receptor sensitivity judgements are combined with visual impact magnitude judgements, the highest level of significance is considered to occur at VP1 from the grounds of Kerdiffstown House immediately adjacent to the Zone 1 mound of the site. The level of visual impact significance in this instance is deemed to be Moderate on balance of a Medium-Low sensitivity judgement and a High-medium visual impact magnitude. With a similar, but slightly further removed and more substantially screened view of the landfills' Zone 1 mound, VP3 and VP4 (Palmerstown House Estate and Golf Course) are considered to incur a 'Moderate slight' significance of impact. This is on the basis of 'Medium' sensitivity and 'Medium-low' impact magnitude judgements. On the opposite side of the landfill at VP5, the significance of visual impact is predicated to be 'Moderate slight' on the basis of the same level of magnitude as for VP1, but lower degree of sensitivity (low). At all of the other viewpoint locations, the significance of Remediation Phase visual impacts is deemed to be 'Slight' or 'Imperceptible'.

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Despite the fact that Remediation Phase visual impacts of up to 'High-medium' will occur, such impacts will be largely temporary in terms of duration with operations being controlled on a daily basis to clear the surface, for remediation and covering with new soils/cover in progressive phases. The temporary nature of the works is not incorporated into the initial magnitude assessments in the interests of presenting worst-case-scenario. Nonetheless, the temporary duration of such impacts is an important factor in determining the overall significance of the proposed Project in EIA terms and on this basis the Remediation Phase visual impacts from the individual viewpoints and including the residential properties along the proposed realigned access road are not considered to be significant.

9.4.4 Operational Phase Landscape Impacts

Given that the main Remediation Phase landscape impacts relate to the proposed Project site appearing as a substantial construction site with associated activity and vehicle movements, there will be a marked reduction in landscape impacts once remediation work has ceased. Indeed, the multi-use public park end-use scenario will have a number of beneficial consequences for the landscape character of the area. The parkland character of the remediated site will blend with the similar character of golf course and Kerdiffstown demesne that lie adjacent to the north and east of the site. There will also be a much stronger sense that this is a managed and manicured landscape rather than a degraded, and at the very least fallow, landscape.

Whilst it would be optimal to establish native broadleaf trees in clusters throughout the site, this is not possible due to the need to maintain the integrity of the engineered capping system. However, peripheral areas beyond the capped extents will be planted with native trees insofar as possible and capped areas will incorporate some areas of shrub planting. The mottled effect of this shrub planting will help to further assimilate the remediated site with its parkland surrounding and deemphasise the utilitarian former use of the site. Areas of ecological habitat within and around the borders of the site will add to the utility of this landscape as well as its aesthetics.

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There will be little sense of the former land use other than for several small areas of controlled access and residual components. These include, surface laid manhole covers, preventing access to below ground gas wells on the northern (Zone 1) area of the site and in the Zone 3 area adjacent to the site and the Landfill Infrastructure Compound housing a site office, building, leachate management infrastructure and landfill gas flares within a fenced and screened area adjacent to the public park entrance.

During evening hours in the winter time floodlights will illuminate the playing pitches. This will highlight the central portion of the multi-use public park within the wider landscape, particularly from the east and north where comparatively lower levels of night time lighting occur than to the west and south around Naas and Johnstown as well as the M7/N7 corridor (see Volume 3a of this EIAR for nightime photomontages from VP8). During these periods there is likely to be a noticeable increase in the intensity of non-rural development compared to baseline levels. However, within the context of this peri-urban landscape, these brief periods of minor additional illumination will have little influence on landscape character and the rural amenity of 'dark skies'.

The use of the site as a public recreational facility has positive connotations for the Green Infrastructure Network of the environs of Naas and Johnstown and will influence public perceptions of the site in a positive manner. For the reasons outlined above, the Operational Phase landscape impact of the site is deemed to be Positive in comparison to baseline conditions.

9.4.5 Operational Phase Visual Impacts

See Appendix A9.1 for individual Viewpoint appraisals.

Table 9.10: Operational Phase - Year 1 Visual Impact Significance at the Individual Viewpoints (Prior to Mitigation Establishment)

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Viewpoint (VP)	Visual Receptor Sensitivity	Visual Impact Magnitude	Significance of Visual Impact
VP1	Medium-low	Neutral	**Imperceptible**
VP2	Medium	Neutral	**No Effect**
VP3	Medium	Negligible	**Imperceptible**
VP4	Medium	Negligible	**Imperceptible**
VP5	Low	Low	**Slight Imperceptible**
VP6	Medium	Positive	**Enhanced**
VP7	Medium	Positive	**Enhanced**
VP8	Low	Low	**Slight Imperceptible**
VP9	Low	Low negligible	**Imperceptible**

The assessment of Operational Phase visual impacts is divided between those that will occur immediately post remediation works (Year 1 Operational Phase) and those that will occur once mitigation planting measures have become substantially established (Year 7 – Operational Phase). The Year 1 scenario is addressed now and the Year 7 scenario is addressed later in Section 9.6 – Residual Impacts. Note that the Year 1 Operational Phase scenario assumes remediation activity been completed and grass has been established on bare slopes but not tree or shrub planting.

The key aspect of the Year 1 Operational Phase impact is that the construction related activity of earth moving plant and machinery and HGV movements to the site will have ceased. All structures associated with the management of the site (within the Landfill Infrastructure Compound) and multi-use public park (changing rooms building) will be in place. The most visible aspect of the proposed Project, the capped mound at the Zone 1 northern end of the site will be grassed. In terms of visual impact, the site will no longer appear as a landfill or a construction site, but rather, a managed visual extension of the parkland landscapes to the north and east or even farmed slopes. There will be some sense of this being a manmade rather than natural landform feature,

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but this will have little effect on visual amenity. At this stage there will be something of a balance between the fact that the remediated landfill site is likely to be more noticeable within views than the camouflaged baseline scenario of scrub covered slopes, but there it will also represent an improved aesthetic. The required perimeter palisade security fence will detract slightly from the parkland aesthetic prior to its consolidation and screening by proposed perimeter planting (see VP1 and VP5), but this is not a readily visible feature from receptors that are not immediately adjacent to the site.

On the southern extent of the site where the newly formed site entrance roundabout is to be constructed and the Landfill Infrastructure Compound is most visible, there will be a noticeable increase in the intensity of the development on the site. There will also be a slight increase in visual clutter of vertical structures above the skyline in some of the southern and eastern views due to the sports pitch floodlights and ballstop netting poles. The local access road from the south will also be widened and realigned to include a two-way cycle lane on its eastern side and more formalised boundary treatments on its western side. This will result in the loss of some roadside vegetation and a more substantial corridor that will appear more urban and less rural than it does at present. For the three residential properties that will lose a section of the front boundary and associated roadside vegetation (REC006, REC007 and REC008), KCC will engage with the residents regarding appropriate new stonewall, fencing and/or replacement semi-mature planting screening along the realigned road at these properties. These measures will substantially restore the sense of privacy and residential visual amenity for these residents, though there will be a very minor foreshortening of views due to the permanent loss of a sliver of land along the front boundaries of these properties.

Overall, it will feel less like a rural hinterland landscape and more like a peri-urban landscape - this is the nature of wider area due to its proximity to the M7/N7 motorway, Naas, Sallins and Johnstown. The proposed multi-use public park end-use will also provide an appropriate transition from the peri-urban landscape into the parkland landscapes currently to the north and east of the site.

Overall the Year 1 Operational Phase visual impacts are deemed to range between Slight Imperceptible and Positive in comparison to the baseline scenario.

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9.5 Mitigation Measures

There are a number of key mitigation measures that will be undertaken in order to minimize the overall visual impact of the proposed Project. Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP). The CEMP shall contain these mitigation measures and plans identified in the following sections and ensure that they are fully implemented during the Remediation Phase, to prevent or reduce the impacts identified in the impact assessment. The landscaping and planting proposals for the proposed Project will be subject to confirmation during the detailed design stage.

Mitigation measures in this instance are considered to be those singular interventions designed to ameliorate and consolidate the end-use multi-use public park in terms of its landscape and visual impacts rather than the transformation of the former landfill and waste processing facility into a public park, which is an enhancement measure and the overall objective of the project beyond the safe management of leachate and landfill gas. Landscape mitigation measures are indicated on Figure 4.20 – Landscape Masterplan and outlined in greater detail in the Landscape Masterplan Statement contained in Appendix A4.8. Related ecological mitigation measures are also shown on Figure 11.6 - Ecological Mitigation and Enhancements.

The main landscape and visual mitigation measures relate to tree and shrub planting within and around the site. There are limitations as to where tree planting can take place so as not to compromise the integrity of the engineering capping system. This leaves peripheral areas and site boundaries available for such planting and this will occur wherever practicable (Refer to Figure 4.20).

The most visible aspect of the site from surrounding areas is the Zone 1 mound, which is to be subject to ground clearance, re-profiling of slopes, placement of an engineered capping system with new soils and grass seed mix applied. At the north-west end of the mound is a proposed pond to manage surface water runoff from this area of the site and this occurs adjacent to a patch of woodland contained within the neighbouring property

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of Kerdiffstown House. The area surrounding this pond will remain fenced off from the public providing an opportunity for ecological enhancement.

Another area where something of an ecological aesthetic and improved screening can be achieved is along the eastern slopes of the Zone 1. An existing line of small trees will be lost from this boundary of the site as part of the remediation works. However, a drainage swale will be constructed at the base of this slope and the existing site is to be extended slightly into the Kerdiffstown House lands to facilitate this. This swale will be outside of the capped area and will be planted with semi-mature parkland trees. Once established this band of trees will serve as a stronger physical and visual divide between the realigned private access road to Kerdiffstown House and the site slopes (which will have also been made less severe during remediation). The trees will eventually serve as something of a scale transition that will deemphasise the height and severity of the landfill slopes when viewed from Kerdiffstown House and from Palmerstown House Estate and Golf Course (see VP1 and VP3). In both an ecological and an aesthetic sense, the swale tree planting will connect the patch of woodland at the northern end of the site with that which wraps around the eastern boundary of the site and contains the Church ruins adjacent to the private access road to Kerdiffstown House.

Perimeter tree and hedge planting will also be incorporated into the boundary treatment on the western side of the site. This will include amenity planting around the site entrance as well as native hedgerow screen planting to fill a short gap in the roadside vegetation adjacent to an existing residential dwelling on the eastern side of the Kerdiffstown road (see VP5). Two patches of woodland planting in the form of whips and feathered trees will be provided at the south-eastern end of the site to expand and consolidate existing woodland areas that occur immediately adjacent to the site (Intervention A14 on Figure 4.20). The Landfill Infrastructure Compound located to the east of the public park entrance will be planted with trees and shrubs to screen the compound insofar as possible. Though the building and landfill gas flare stacks are still likely to remain visible and it may still be obvious that landfill related infrastructure exists beyond the screening, there will be a reduced sense of visual clutter and the Landfill Infrastructure Compound will blend more readily with the surrounding parkland context. It should be noted that all proposed woodland and hedgerow amenity and mitigation planting will comprise of native and naturalised species.

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Wetland ponds are proposed for Zone 1A and central portion of Zone 4 and these will be planted up with a variety of wetland plants to benefit biodiversity. This lower portion of the site is not readily visible from surrounding visual receptors, but nonetheless, this planting will help to assimilate the multi-use public park end-use with the surrounding context in both a landscape and visual sense.

For the three residential properties (REC006, REC007 and REC008) that will lose front boundary vegetation as part of the widening and realignment works, the local access road to the south of the site, new stonewall/ fencing is proposed. Semi-mature tree and shrub planting will also be provided to the inside of the wall for additional screening and amenity purposes. These mitigation measures are subject to consultation with the property owners in question.

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9.6 Residual Impacts

Table 9.11: Operational Phase - Year 7 Visual Impact Significance at the Individual Viewpoints (following mitigation)

Viewpoint (VP)	Visual Receptor Sensitivity	Visual Impact Magnitude	Significance of Visual Impact
VP1	Medium-low	Positive	**Enhanced**
VP2	Medium	Neutral	**No Effect**
VP3	Medium	Positive	**Enhanced**
VP4	Medium	Positive	**Enhanced**
VP5	Low	Neutral	**No effect**
VP6	Medium	Positive	**Enhanced**
VP7	Medium	Positive	**Enhanced**
VP8	Low	Neutral	**No effect**
VP9	Low	Neutral	**No effect**

Residual visual impacts are assessed at each of the representative viewpoints using a period of approximately seven years for the substantial establishment of mitigation planting. In every instance it is considered that the residual visual impact of the Operational Phase will be either a 'Positive' improvement on the current un-remediated baseline scenario or have 'No effect' on visual amenity. This is universally on the basis that the multi-use public park end-use will present a more manicured and managed appearance to that of the existing scrub covered site that exists at present. This tends to assimilate the proposed Project with the parkland aesthetic of, in particular, the surrounding golf courses and demesne landscape at Kerdiffstown House. That is, it presents as a visual extension of these landscapes.

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The maturing boundary trees will deemphasise the severity of remediated site slopes and the overall height of the site within the surrounding landscape context. Rather than the appearance of a freshly constructed public park, the maturing trees will give a stronger sense of assimilation with the designed heritage landscapes (now golf courses) to the north and east. In two instances (VP8 and VP9), the view of sports pitch flood lights and ball-stop netting poles above the skyline will remain a slightly negative aspect of view, but overall this is balanced by the improved parkland aesthetic of the site resulting in no material reduction in visual amenity.

9.6.1 Night-time Visual Effects from Lighting

The potential visual effects from lighting proposals in this instance do not relate so much to effects on views and visual amenity, but the effects on rural amenity and in particular the concept of 'dark skies', which has become a recognised amenity of living in remote or rural areas. Nightime visual effects from lighting proposals, particularly relating to the sports pitch flood lights and the roadside lighting poles for the widened and realigned access road were examined using a representative nightime photomontage from VP8 – 'N7 pedestrian overpass to Johnstown' (see Volume 3A of the EIAR for photomontages). This photomontage indicates that there will be a noticeable, but not substantial, increase in lighting levels within the northern aspect of the view compared to baseline levels. This occurs directly from the light source as well as more diffused ground level illumination. The slightly increased level of illumination also highlights the change in the nature and intensity of use for the site from an end-of-life landfill to a multi-use public park.

In terms of mitigation and ameliorating factors, the flood lights are directed inwards towards the pitches and not into the surrounding landscape and focussed on the ground in order to maximise pitch illumination and reduce lightspill. The sports pitch lighting will also only be utilised during evening hours and predominantly during winter months, when it is most needed.

Roadside lighting is also baffled towards the ground, but it does not benefit from existing and proposed vegetative screening to the same degree as the internal sports pitch lighting (from this particular location at

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least). It is also worth noting that it is a common perception that increased street lighting aids the sense of security in addition to the obvious road safety benefits.

For the reasons outlined above and within this peri-urban setting, the minor increase in the level of illumination proposed within and around the site is not considered to be significant issue.

9.7 Difficulties Encountered in Compiling Information

No difficulties were encountered in compiling information.

9.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on the landscape and visual environment. These projects are discussed in the following paragraphs.

9.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018.A Waste Facility Permit has been granted for the proposed quarry infilling. The access route to the quarry site is from the south using the L2012 Monread Road and crossing over the M7 motorway. This will result in keeping all the quarry infilling traffic well removed from the proposed Project works in the event of the quarry back-filling works occurring at the same time as the Remediation Phase works. No cumulative impacts from this project and the proposed Project are anticipated.

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9.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

9.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future) are anticipated.

9.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from the housing development project and the proposed Project are anticipated.

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9.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. This will add to the intensity and extent of construction works and will be a temporary additional visual impact for local residents and road users on the L2005 Kerdiffstown road in combination with the proposed Remediation Phase works at the Kerdiffstown Landfill. The timing of these works to coincide with the remediation project is considered preferable, in terms of the nature and duration of landscape and visual impacts, to scheduling them separately. Nonetheless, the cumulative effect of these temporary works within the road corridor will be minimal even if circumstances do not allow them to be undertaken together with the landfill remediation works. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

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9.9 References

- Comhar (2010). An Introduction to Landscape Character Assessment (LCA)
- Environmental Protection Agency (2002). Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2003). Advice notes on current practice in the preparation of Environmental Impact Statements
- Environmental Protection Agency (2015). Revised Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2015). Advice notes for preparing Environmental Impact Statements (Draft)
- Kildare County Council (2017). Kildare County Development Plan 2017-2023
- Landscape Institute and the Institute of Environmental Management and Assessment (2013). Guidelines for Landscape and Visual Impact Assessment (GLVIA) 2nd Edition 2002 (3rd Edition updated 2013)

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10. Archaeology, Cultural Heritage and Architectural Heritage

The purpose of this assessment is to identify and assess the significance of, and impacts, to any known or proposed archaeological, architectural and cultural heritage resources associated with the proposed Project.

There are six recorded monuments in the vicinity of the proposed Project site, one of which (a mound) is within the proposed Project area. This mound, which may have represented an early medieval settlement, is recorded as having been disturbed by quarrying activity in the 1950s although the plotted location is outside of the area infilled as part of the Kerdiffstown Landfill. No structures of architectural heritage significance are located within the existing site. There are no Protected Structures located within the area of the proposed Project, although nine structures are situated within a 500m radius.

During the Remediation Phase ground disturbances in the west of the site may have an impact on the site of the recorded mound, however the mound location is currently uncertain and may have been removed by quarrying activity. No features of archaeological potential were noted in this area during a geophysical survey. Ground disturbances within the Kerdiffstown Demesne may impact on a recorded church and graveyard site and associated remains that may survive beneath the existing ground level with no surface expression. A series of mitigation measures are proposed to reduce impacts to the archaeological features. No direct or indirect impacts are predicted upon the remaining recorded archaeological sites located within the receiving environment surrounding the proposed Project. No potential impacts are predicted upon the built architectural resource as part of the proposed remediation works.

During the Operational Phase it is envisaged that there will be a significant positive impact on both the archaeological and architectural resources surrounding the proposed Project through the reduction and stabilisation of slopes as well as the visual improvement of the landscape.

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10.1 Introduction

10.1.1 General

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as “the proposed Project”) on Archaeology, Cultural Heritage and Architectural Heritage, anticipated to occur during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950’s until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children’s playground, etc. and management of the site as a remediated landfill. Table 10.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 10.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound supported by a back-up flare • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of the surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation and operation can be found in Chapter 4 Description of the Proposed Project.

This study determines, as far as reasonably possible from existing records, the nature of the cultural heritage resource within the area of proposed Project using appropriate methods of study. Desk based research is defined as an assessment of the known or potential archaeological resource within a specified area consisting of a collation of existing written and graphic information. The assessment takes place in order to identify the likely character, extent, quality and worth of the known or potential archaeological resource in order to make an assessment of its merit in context, leading to one or more of the following:

- The formulation of a strategy to ensure the recording, preservation or management of the cultural heritage resource;
- The formulation of a strategy for further investigation, whether or not intrusive, where the character and value of the resource is not sufficiently defined to permit a mitigation strategy or other response; or
- The formulation of a proposal for further archaeological investigation within a programme of research. (Institute of Field Archaeologists 2014a, p.4).

The study involved detailed interrogation of the archaeological, historical and architectural background of the proposed Project. This included information from the Record of Monuments and Places of County Kildare, the County Development Plan, the topographical files of the National Museum of Ireland and cartographic and documentary records. Aerial photographs of the study area were also consulted. A field inspection was carried out on 10 November 2016 in an attempt to identify any known cultural heritage sites and previously unrecorded features, structures and portable finds within the proposed Project area. An impact assessment and a mitigation strategy have been prepared. The impact assessment is undertaken to outline potential adverse impacts that the proposed Project may have on the cultural heritage resource, while the mitigation strategy is designed to avoid, reduce or offset such adverse impacts. How impacts can occur upon the potential archaeological or architectural resource are described in Appendix A10.1.

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10.1.2 Consultations

As part of the EIAR scoping process a consultation letter including the Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report (Jacobs, September 2016) was issued to the Development Applications Unit – The Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, the Kildare County Council Heritage section and to the Heritage Council inviting comment on the proposed scope of the environmental assessment.

Following the initial research, a number of statutory and voluntary bodies were consulted to gain further insight into the cultural background of the background environment, receiving environment and study area, as follows.

- Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs – the Heritage Service, National Monuments and Historic Properties Section: Record of Monuments and Places; Sites and Monuments Record; Monuments in State Care Database; Preservation Orders and the Register of Historic Monuments;
- National Museum of Ireland, Irish Antiquities Division: topographical files of Ireland;
- National Inventory of Architectural Heritage: County Kildare;
- Kildare County Council: Planning Section; and
- Trinity College Dublin, Map Library: Historical and Ordnance Survey Maps.

10.2 Methodology

10.2.1 Guidance and Legislation

The following legislation, standards and guidelines were also consulted as part of the assessment.

- National Monuments Acts, 1930-2014;
- The Planning and Development (Strategic Infrastructure) Act, 2006
- Heritage Act, 1995;
- EPA 'Advice Notes for preparing Environmental Impact Statements' (Draft 2015);
- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, (formerly) Department of Arts, Heritage, Gaeltacht and Islands;
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 2000 and the Local Government (Planning and Development) Act 2000; and
- Architectural Heritage Protection: Guidelines for Planning Authorities, 2011), (formerly) Department of Arts, Heritage and the Gaeltacht.

Research for the assessment has been undertaken in three phases. The first phase comprised a paper survey of all available archaeological, architectural, historical and cartographic sources covering a receiving environment of 500m from the edge of the proposed Project. The second phase involved a field inspection of the proposed Project area. The third phase consisted of a geophysical survey of a small part of the site that remains undisturbed and contained a recorded monument. An assessment of the outline design for the proposed Project was undertaken with potential impacts identified and mitigation measures determined.

10.2.2 Paper Survey

This is a document search. The following sources were examined and a list of areas of archaeological, architectural and cultural heritage potential was compiled:

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Record of Monuments and Places (RMP) is a list of archaeological sites known to the National Monuments Section, which are afforded legal protection under Section 12 of the 1994 National Monuments Act and are published as a record.

Sites and Monuments Record (SMR) holds documentary evidence and field inspections of all known archaeological sites and monuments. Inclusion within the SMR does not necessarily result in statutory protection. Some information is also held about archaeological sites and monuments whose precise location is not known e.g. only a site type and townland are recorded. These are known to the National Monuments Section as 'un-located sites' and cannot be afforded legal protection due to lack of locational information. As a result, these are omitted from the RMP.

SMR/ RMP sites are also listed on a website maintained by the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DoAHRRGA): archaeology.ie.

National Monuments in State Care Database is a list of all the National Monuments in State guardianship or ownership. Each is assigned a National Monument number whether in guardianship or ownership and has a brief description of the remains of each Monument.

The Minister for the DoAHRRGA may acquire national monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister. There are no National Monuments in the vicinity of the proposed Project.

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Preservation Orders List contains information on Preservation Orders and/or Temporary Preservation Orders, which have been assigned to a site or sites. Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 National Monuments Act, which also makes any interference with such a site an offence. Temporary Preservation Orders can be attached under the 1954 National Monuments Act, with these performing the same function as Preservation Orders under the 1934 National Monuments Act; however, these are limited to a time limit of six months, after which time the basis for the Temporary Preservation Order must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders/Temporary Preservation Orders with the written consent, and at the discretion, of the Minister. There are no sites under preservation order within the vicinity of the proposed Project.

Register of Historic Monuments was established under Section 5 of the 1987 National Monuments Act, which requires the Minister to establish and maintain such a record. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places.

Topographical files of the National Museum of Ireland is the national archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information on the discovery of sites of archaeological significance.

Cartographic sources are important in tracing land use development within the proposed Project area as well as providing important topographical information on areas of archaeological potential and the development of buildings. Cartographic analysis of all relevant maps has been made to identify any topographical anomalies or structures that no longer remain within the landscape. These include:

- Sir William Petty, Down Survey Map, Barony of Naas and Salt, (c. 1655);
- Noble and Keenan's Map of County of Kildare (1752);
- Alexander Taylor's Map of the County of Kildare (1783); and
- Ordnance Survey maps of County Kildare (1839, 1871 and 1910).

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Documentary sources were consulted to gain background information on the archaeological, architectural and cultural heritage landscape of the proposed Project area. These include a range of academic texts and texts that relate specifically to County Kildare.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its likely potential for archaeology. A number of sources were consulted including aerial photographs held by the Ordnance Survey and Google Earth and the results of an aerial survey of the proposed Project area undertaken in February 2016.

Place Names are an important part in understanding both the archaeology and history of an area. Place names can be used for generations and in some cases can be used to give an insight to history and heritage of an area.

Development Plans contain a catalogue of all the Protected Structures and archaeological sites within the county. Protected Structures are afforded statutory protection under the Planning and Development Act (2000). The Kildare County Development Plan (2017-2023) was consulted to obtain information on cultural heritage sites in and within the immediate vicinity of the proposed Project.

The **National Inventory of Architectural Heritage (NIAH)** is a state initiative established under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999 tasked with making a nationwide record of significant local, regional, national and international structures, which in turn provides county councils with a guide as to what structures to list within the Record of Protected Structures. The architectural survey for County Kildare was completed during 2003. The NIAH have also carried out a nationwide desk-based survey of historic gardens, including demesnes that surround large houses. This has also been completed for County Kildare and was examined in relation to the surviving demesnes within the surrounding area of the proposed Project.

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Excavations Bulletin is a summary publication that has been produced every year since 1970. This summarises every archaeological excavation that has taken place in Ireland during that year up until 2010 and since 1987 has been edited by Isabel Bennett. This information is vital when examining the archaeological content of any area, which may not have been recorded under the SMR and RMP files. This information is also available online from 1970–2015.

10.2.3 Field Inspection

Field inspection is necessary to determine the extent and nature of archaeological and architectural remains, and can also lead to the identification of previously unrecorded or suspected sites and portable finds through topographical observation and local information.

The archaeological and architectural field walking inspection entailed:

- walking the proposed Project area and its immediate environs;
- noting and recording the terrain type and land usage;
- noting and recording the presence of features of archaeological, architectural or cultural heritage significance;
- verifying the extent and condition of recorded sites; and
- visually investigating any suspect landscape anomalies to determine the possibility of these being anthropogenic in origin.

10.2.4 Geophysical Survey

Geophysical survey is used to create ‘maps’ of subsurface archaeological features. Features are the non-portable part of the archaeological record, whether standing structures or traces of human activities left in the soil. Geophysical instruments can detect buried features when their electrical or magnetic properties contrast measurably with their surroundings. In some cases, individual artefacts, especially metal, may be detected as well. Readings taken in a systematic pattern become a dataset that can be rendered as image maps. Survey

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results can be used to guide excavation and to give archaeologists insight into the patterning of non-excavated parts of the site. Unlike other archaeological methods, geophysical survey is not invasive or destructive.

A geophysical survey of a small area of greenfield within the western part of the proposed Project was carried out by Joanna Leigh in March 2017 under licence 17R0027, due to the presence of a recorded mound site (KD019-018). The survey showed a large amount of magnetic disturbance across the area. A faint curving trend was noted and whilst an archaeological interpretation may be possible the feature was barely discernible in the data. The report is included as Appendix A10.2.

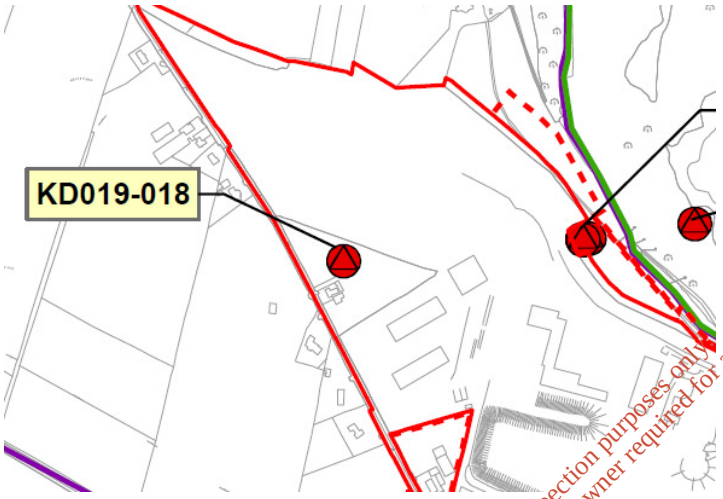


Diagram 10.1: Location of the Recorded Mound Site (KD019-018)

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Definitions

In order to assess, distil and present the findings of this study, the following definitions apply.

'Cultural Heritage' where used generically, is an over-arching term applied to describe any combination of archaeological, architectural and cultural heritage features, where –

- the term 'archaeological heritage' is applied to objects, monuments, buildings or landscapes of an (assumed) age typically older than AD 1700 (and recorded as archaeological sites within the Record of Monuments and Places);
- the term 'architectural heritage' is applied to structures, buildings, their contents and settings of an (assumed) age typically younger than AD 1700; and
- the term 'cultural heritage', where used specifically, is applied to other (often less tangible) aspects of the landscape such as historical events, folklore memories and cultural associations. This designation can also accompany an archaeological or architectural designation.

For the purposes of this report the terms 'architectural heritage' and 'built heritage' have the same intended meaning and are used interchangeably.

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Table 10.2: Impact Definitions (as defined by the EPA 2017 Guidelines, p.50)

Effects	Description
Imperceptible Effects	An effect capable of measurement but without significant consequences.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment.
Profound Effects	An effect which obliterates sensitive characteristics.

10.3 Baseline Conditions

10.3.1 Archaeology

Archaeological and Historical Background

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The site of the proposed Project, is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. A large majority of the site comprises a former sand and gravel quarry, which has been backfilled from the 1950s onwards. It is bordered to the west by the L2005 Kerdiffstown Road from Sallins to Johnstown and to the north and east by demesne landscapes associated with Kerdiffstown House and Palmerstown House.

There is one recorded monument within the proposed Project area. This consists of the site of a mound that was recorded as being disturbed by quarrying activity in the 1950s, which may have represented an early medieval settlement area (KD019-018). The files within the National Museum suggest that the site was located within the existing landfilled area; however, the record is not located within an area which has been infilled as part of the Kerdiffstown Landfill. There are a further five sites or groups of sites located within a 500m radius of the proposed Project. The nearest of these comprise the church, graveyard and two grave slabs (KD019-006001–4) located to the immediate east of site (refer to Figure 10.1 and Appendix A10.3 and Appendix A10.4).



Diagram 10.2: Location of the Church, Graveyard and Two Grave slabs (KD019-006001–4)

Prehistoric Period

The earliest recorded activity in proximity to the proposed Project can be dated to The Bronze Age (c. 2500–800BC). As with the earlier transition from Mesolithic to Neolithic, significant social change is associated with the early Bronze Age. This is reflected in the material culture of the time, but also in the excavated evidence for settlement and ritual. Large communal tombs were replaced in favour of individual, subterranean cist or pit burials that were either in isolation or in small cemeteries.

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Evidence for funerary activity has been identified through excavation in advance of the N7 Naas Road Widening Scheme in the townland of Killhill (KD020-021 and KD020-022002), approximately 2.4km east of the proposed Project. Records in the Topographical Files of the National Museum of Ireland (NMI) note the discovery of cremated bone from a 'sandy hill' in Sherlockstown townland in 1983. It is likely that these remains represent a Neolithic or Bronze Age burial site.

The Bronze Age landscape is often defined by these burial monuments but also by other monuments such as standing stones, stone rows and stone circles. A single example of a standing stone (KD019-059, RPS B19-15) is located within proximity to the proposed Project, 360m to the south-east in Maudlings townland. It is believed locally to be a scratching post but may date to the Bronze Age period.

Bronze Age activity is commonly identified in the landscape by the presence of *fulachta fiadh* or burnt mounds. Over 4,500 of these sites have been recorded in the country with the majority comprising of a mound of burnt stone, commonly in horseshoe shape, in low lying marshy areas or in proximity to streams. These sites are generally uncovered in or near riverine and waterlogged environments which provide the ideal circumstances for the construction, use and ultimate preservation of the sites. While there are none of these sites identified to date within the vicinity of site, riversides are attractive locations for such activity.

Early Medieval Period (AD 400–1100)

The territory of the *Uí Faeláin* was the tribal grouping who ruled the northern part of County Kildare up until the coming of the Normans. Naas, located approximately 3km south-west of the proposed Project, is regarded as the residence of the Kings of Leinster. According to Bradley et al (1986 vol. 4, 343–383), Naas was the site of an early Christian monastery known as 'Cill Corbain' or 'Cill Náis' (RMP KD019-030046), the former's name being preserved in the present day Corban's Lane, whose curving course may preserve the line of a pre-Norman monastic enclosure. However, the precise location of the monastery is uncertain. The town is also known as 'Nás na Rí' or 'The assembly place of the Kings', because between the 8th and 10th century it was a seat of the Kings of Leinster. The fort ('dún') of Naas is first referred to in 705 AD, and may subsequently have been incorporated into the Anglo-Norman motte that is located within the town (RMP KD019-030009). A second motte (RMP KD019-030023) may have stood at the southern end of the town.

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During this period Ireland was not a united country but rather a patchwork of minor monarchies all scrambling for dominance. Borders were ever changing as alliances were formed and battles fought. Kingdoms were a conglomerate of clannish principalities with the basic territorial unit known as a *túath*. Byrne (1973) estimates that there were probably at least 150 kings in Ireland at any given time during this period, each ruling over his own *túath.* The landscape surrounding the proposed Project area is characterised by the remains of early medieval activity in the form of secular settlement and ecclesiastical activity.

The most common indicator of settlement during the early medieval period is the ringfort. Ringforts (raths and cashels) are also the most common monument type encountered within the surrounding region. Ringforts, (also known as rath, *lios, caiseal, cathair* and *dún*) are a type of defended homestead comprising of a central site enclosed by a number of circular banks and ditches. The number of ditches can vary from one (univallate) to two or three (bivallate or multi-vallate) and is thought to reflect the status and affluence of the inhabitants. Another morphological variation consists of the platform or raised rath – the former resulting from the construction of the rath on a naturally raised area. Ringforts are most commonly located at sites with commanding views of the surrounding environs which provided an element of security. While raths, for the most part, avoid the extreme low and uplands, they also show a preference for the most productive soils (Stout 1997, p.107). The most recent study of the ringfort (Stout 1997) has suggested that there is a total of 45,119 potential ringforts or enclosure sites throughout Ireland. While rath and *lios* seem to refer to earthen ringforts, *caiseal* (cashel) and *cathair* refer to their stone-walled equivalents. Cashels are more frequent in the west of the country. No ringforts are recorded within the immediate vicinity of the proposed Project but examples are known in Turnings Upper townland (KD014-024 and KD014-037) further to the north. It is possible that the recorded mound (KD019-018) within the western section of the proposed Project area may relate to early medieval habitation activity, as during the 1950s several artefacts were recovered during quarrying that may be contemporary with the period. However, the exact location of the site is unknown and whilst it is marked within a greenfield, it may have been located within what is the land filled area.

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From early medieval historical texts, it is clear that the idea of a great road system existed within the country and this was formalised in the tradition that five great roadways radiated from Tara. The *Slighe Dhála Meic Umhóir*, one such road way, made its way south from the Hill of Tara in County Meath, to County Kildare before turning west and passing through Naas and the Curragh. O'Lochlainn (1940) describes part of the western section of the *Slighe Dhála Meic Umhóir*, meaning 'The Road of *Dála*, son of *Umhóir*', (or *Belach Muighe Dála*) as running along the northern boundary of Munster.

Medieval Period (AD 1100–1600)

Upon the arrival of the Anglo-Normans in Kildare, the cantred of *Uí Faeláin* was granted to Adam de Hereford prior to 1176. It is likely that there was an influx of an immigrant farming population and by the end of the 12th century Norman settlement was effective over the whole county. This marked the beginning of the rule of the Fitzgerald family as Earls of Kildare. Naas was granted by John, Earl of Morton, to William Fitzmaurice. This included adjacent territory and a variety of important privileges, including a market (Lewis 1837). It was at this time that Naas, fortified with an enclosing wall and several castles, rapidly rose into importance within the Pale. In 1569 Queen Elizabeth granted a charter declaring that Naas be a free and undoubted borough.

A medieval church and graveyard (KD019-014001, 2) are located approximately 425m east-south-east of the proposed Project area in the Palmerstown townland. The church may have been built originally by the Knights Hospitallers of St John of Jerusalem, from whom Johnstown village took its name (National Monuments Service, 2016). The church was dedicated to St. John the Baptist. The church is partially restored and the interior contains the 15th century 'Flatesbury Monument' (KD019-014003), a medieval font (KD019-014002) and a 19th century high cross marking the burials of the Bourke (Mayo) family. The Flatesbury Monument, comprising a limestone slab carrying an eight-pointed cross of mixed floriated and pointed terminals on a stepped-base and two heraldic shields, possibly commemorates the marriage of Eleanor Wogan and James Flatesbury in 1564.

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Buckley (2008, p.29) noted that the word 'palmer' indicates a pilgrim during the medieval period who had been to the Holy Land (and brought back a palm leaf in token of the fact). She states that these pilgrims were frequently lepers and thus leper hospitals are associated with places named Palmerstown, Palmerston or Palmershill (*ibid.*). In addition, some saints' names are associated with leper hospitals including St Stephen, St James, St Nicholas and St Mary Magdelene to name a few. Leper hospitals were frequently known as Maudlin houses; Maudlin being a corruption of Magdelene or Madeline. The site and grounds of a hospital or its endowed lands were often called 'The Maudlins' (Lee 1996, p.19). The townland of Maudlings adjacent to Palmerstown may indicate the presence of a medieval leper hospital in the area. Lee suggests that the Palmerstown Demesne lands may have been part of the endowment of the hospital of Naas. In 1606 the townland of Maudlings was recorded as belonging to the chantry priests of St. David's church (*ibid.*) associated with a 12th century priory and hospital at Stephenstown nearby (*ibid.*).

Summary of Previous Archaeological Fieldwork

A review of the Excavations Bulletin (1970–2016) has revealed that several archaeological investigations have been carried out within the immediate vicinity of the proposed Project. One programme of archaeological monitoring was carried out within the proposed Project area during 2003 (O'Carroll; Licence Ref.: 03E1527). Ground disturbances associated with the southern extension of the landfill facility were monitored. Two modern features, along with one feature of negligible archaeological potential were identified during the course of the works.

In the wider area archaeological testing was undertaken in advance of the improvements to Naas Dual Carriageway in the Naas, Johnstown and Kill area (O' Donnchadha 2003b; Licence Ref.: 03E1257). A number of sites were identified and excavated under separate licence.

Testing of a possible dwelling site in Kerdiffstown approximately 500m north-west of the Project Area identified late 19th and 20th century remains (O' Donnchadha 2003b; Licence Ref.: 03E1261 and O' Donnchadha 2003c; Licence Ref.: 03E1262).

Monitoring of the Bord Gáis Éireann pipeline through Johnstown Main Street revealed nothing of archaeological significance (O' Riordáin 1998; Licence Ref.: 98E0113). A small number of other programmes of work have

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been undertaken within or near the village of Johnstown; however, nothing of archaeological significance was identified (McCabe 2002, Licence Ref.: 02E1820; O' Donovan 2002, Licence Ref.: 02E1838 and Larsson 2003, Licence Ref.: 03E0917).

During the 1950s the site of the recorded mound (KD019-018) was visited by the UCD Archaeological Society which is recorded within the topographical files held by the National Museum. Upon visiting the site, they found that it had been completely removed. The driver of the bulldozer or mechanical excavator said that there had been a mound in the area, which was removed. Archaeological investigation was not deemed possible owing to the condition of the area. Two bone comb fragments and a section of bronze wire were recovered from the site and it was agreed that the site likely represented an early medieval settlement.

Geophysical Survey

A geophysical survey of a small area of greenfield (1.3ha) within the western part of the proposed Project was carried out by Joanna Leigh in March 2017 under licence 17R0027, due to the presence of a recorded mound site (KD019-018). A large magnetic shadow from the adjacent spoil of the landfill site obscures a large section of the data. The location of the recorded mound (KD019-018) lies partially within the magnetic shadow. No responses indicative of an archaeological mound were recorded. In the south of the application area (Area B) a faint curving trend has been identified. Although this is barely discernible in the data, this may represent the remains of a circular archaeological feature, although this is speculative. The report is included as Appendix A10.2.

Cartographic Analysis

Down Survey Map of the Barony of Naas and Salt c. 1655

The Down Survey Map shows the parishes and townlands known within the baronies at this time. Naas town is shown as a fortified walled town with several castles and large houses within the settlement. There is no detail included for the proposed Project area.

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Noble and Keenan's Map of County Kildare, 1752

This map provides a more detailed depiction of the surrounding landscape. The main infrastructural routes and topographical features are shown including many of the main houses. A large house is shown at 'Cardiffs tonn' sited between two watercourses. Palmerstown House, to the east, is one of the most substantial residences in the area with large gardens and an avenue shown to the south. Johnstown village comprises of six houses and a church (RMP KD019-014001, NIAH Ref.: 11812009) bordered to the east and west by rivers. A water wheel is shown on the river to the immediate west of Johnstown and the fields to the north, in the vicinity of the proposed Project area, are annotated as 'Bleachy'. To the south Naas has grown in size.

Taylor's Map of County Kildare, 1783

This map shows a slightly more accurate depiction of the network of roads, rivers and topographical features of the area. The demesne lands of Palmerstown and 'Kerdiffstown' to the north of Naas appear heavily wooded. Milestones are depicted along the Dublin to Naas road with numbers 13 and 14 located to the north and west of Johnstown. A mill race runs to the south of Johnstown and a watercourse to the west of the village is annotated as 'A run for the bleachfield'. The proposed Project area is located in undeveloped fields to the east of this mill race and west of the road leading to Kerdiffstown House (RPS B19-23).

First Edition six inch Ordnance Survey Map, 1839, scale 1:10560

The first edition Ordnance Survey (OS) mapping is the first accurate representation of the landscape in question. The proposed Project area is shown as being located within a rural landscape, to the north-west of Johnstown Village and west of a demesne landscape associated with Kerdiffstown House. The site itself is shown as being partially located within a demesne landscape associated with Kerdiffstown House (RPS B19-23). The house is marked approximately 150m north of the proposed Project with a large walled garden shown between the site and the house. A belt of trees shown within the south-western part of the demesne is located

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within the proposed Project area. The demesne, which is relatively narrow and modest landscape, is traversed by a drive way that runs through part of the eastern part of the Project area.

No previously unrecorded sites of archaeological or architectural heritage potential were noted within the mapping. The recorded church and graveyard (KD019-029001-4) is indicated to the immediate east of the site. No features are marked within the vicinity of the recorded mound (KD019-018).

Second Edition six inch Ordnance Survey Map, 1871, scale 1:10560

There are no major changes to note within the second edition OS map. Several houses have been built to the south-east of Johnstown along the Dublin-Naas road.

Ordnance Survey Map, 1910, scale 1:2500

By the time of this map the demesne associated with Kerdiffstown House has been extended significantly and now contains the proposed Project area (refer to Diagram 10.3). Additional demesne planting has been added, including scattered trees and clumps. One semi-circular clump is shown in the south-western part of the demesne and a proposed leachate and foul sewer pipelines will run through the southern tip of this feature. Johnstown village has grown slightly with the construction of a terrace of houses to the south of the road at the location of a flour mill (RPS B19-38 and B19-039, NIAH 11812012 and 11812029). A lodge house and entranceway are shown within the current footprint of the M7 for Kerdiffstown House (NIAH 11812022) and Roseborough House (NIAH 11812028).

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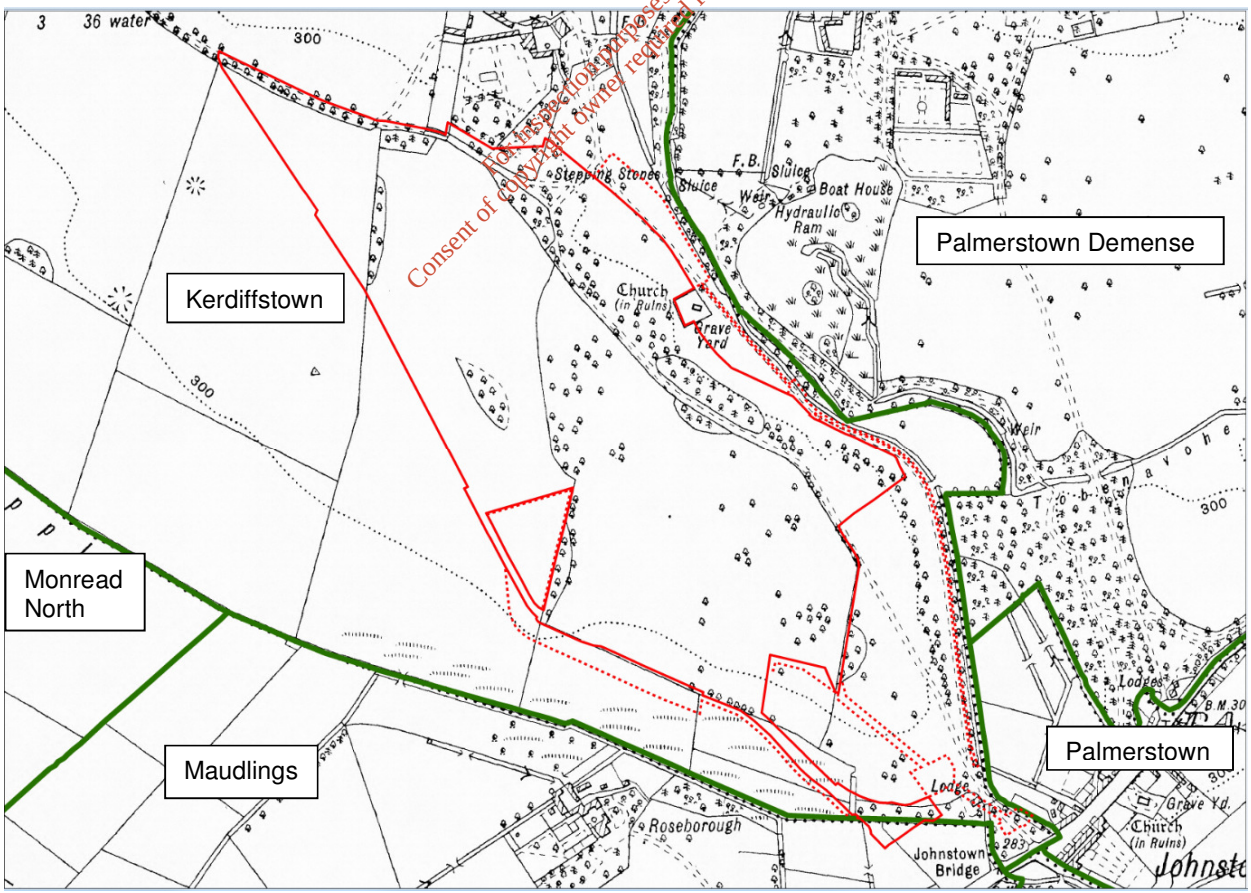


Diagram 10.3: Extract from the 1910 OS Map Showing the proposed Project Area and Townland Boundaries

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County Development Plan

The Kildare County Development Plan 2017–2023 recognises the statutory protection afforded to all RMP sites under the National Monuments Legislation (1930–2004). The development plan lists a number of aims and objectives in relation to archaeological heritage (refer to Appendix A10.5). Table 10.3 provides details on recorded archaeological sites within 500m of the proposed Project, full records from the National Monuments Service are provided in Appendix A10.3 and marked on Figure 10.1.

Table 10.3: Recorded Archaeological Sites within 500m of proposed Project

Site ID	Statutory Status	Townland	Classification	Distance to Site boundary
KD019-018	RMP	Kerdiffstown	Mound	0m
KD019-006001-4	RMP	Kerdiffstown	Church, graveyard & two grave slabs	To the immediate east
KD019-067	RMP	Palmerstown Demesne	Architectural fragment	145m north-east
KD019-059	RMP (and RPS)	Mauldings	Standing stone	360m south-east
KD0190014001-4	RMP	Palmerstown Demesne	Church, graveyard, font, graveslab	425m east-south-east
KD019-064	RMP	Palmerstown Demesne	Mill	460m north-east

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Aerial Photographic Analysis

A review of the aerial photographic coverage of the proposed Project area (OSI, Google Earth and Digital Globe and a high resolution aerial survey flown in 2016) has shown that the development area has been subject to continuing modern disturbance. No previously unrecorded sites of archaeological potential were noted within the surrounding landscape.

Field Inspection

The field inspection sought to assess the site, its previous and current land use, the topography and whether any areas or sites of archaeological potential were present. During the course of the field investigation the proposed Project area and its surrounding environs were inspected for known or previously unknown archaeological sites.

A majority of the proposed Project area was formerly in use as a quarry before being used as a landfill site. As such the entire site has been subject to significant quarrying and disturbance (Photo 10.1-Photo 10.3). No areas of archaeological potential were noted within the proposed Project area.

The western part of the proposed Project area is formed by a small triangular field which contains the recorded site of a mound (KD019-018) The location of the site is visible from the proposed Project, between bunds that form the western boundary. The area is characterised by a field of rough pasture and does not possess any surface expression of a mound.

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Photo 10.1: Proposed Project area, facing west



Photo 10.2: Proposed Project area, facing south-east

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Photo 10.3: Northern-end of proposed Project area, facing south-east

To the immediate east of the proposed Project area is a recorded church and graveyard, along with two grave slabs (KD019-006001-4). This was previously incorporated in the demesne associated with Kerdiffstown House, as a landscape feature. However, today the site is located at the foot of a man-made slope associated with the former landfill site. It is surrounded with trees and the graveyard is very overgrown. The western gable of the church is clearly visible from the access drive to Kerdiffstown House (Photo 10.4) and the surrounding vegetation has enabled the preservation of its current landscape context to a degree.

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Photo 10.4: Church and Graveyard (KD019-006001-4), facing west

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To the north of the recorded church site it is intended to realign the existing drive that provides access to Kerdiffstown House, Here the drive is characterised by a tarmac road way running through level pasture, with the Morell River to the east. The river is flanked by mature trees.

At the southern end of the proposed Project area, the proposed leachate and foul sewer pipelines will run from the existing landfill site in a south-easterly direction before passing beneath the existing N7. The pipeline wayleave will cross a section of surviving demesne landscape associated with Kerdiffstown House. This includes a semi-circular clump of trees apparent on the early 20th century OS map. Here the existing pasture falls away to the south. The original southern boundary of the demesne has been removed and replaced with modern boundary treatments, due to the construction of the N7.

With the exception of the recorded archaeological sites, no specific features of archaeological potential were noted. However, works within the vicinity of the Morell River will be located within a landscape that possesses a general archaeological potential, due to the activity that water courses have attracted since the prehistoric periods.

10.3.2 Architecture

Built heritage refers to all built features in the environment including buildings and other structures such as harbours, bridges, and wells. These sites have been identified through consultation with the County Development Plan 2017–2023, National Inventory of Architectural Heritage (NIAH) and through cartographic analysis and field inspection.

Background

The built heritage within the landscape surrounding the proposed Project area is typified by large country manors and associated demesne landscapes. The 18th century, a relatively peaceful period, saw the large-scale development of demesnes and country houses in Ireland. Demesnes were dominant features of the rural landscape throughout the 18th and 19th centuries. The large country house was only a small part of the overall estate of a large landowner and provided a base to manage often large areas of land that could be located nationwide. Lands associated with the large houses were generally turned over to formal gardens, which were much the style of continental Europe. Gradually this style of formal avenues and geometric garden designs was replaced during the mid-18th century by the adoption of parkland landscapes – to be able to view a large house

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within a natural setting. Although the creation of a parkland landscape involved working with nature, rather than against it, considerable constructional effort went into their creation. Earth was moved, field boundaries disappeared, streams were diverted to form lakes and quite often roads were completely diverted to avoid travelling anywhere near the main house or across the estate.

In 1837 Lewis described Johnstown as a neat village consisting of c. 13 houses and 101 inhabitants. At this time the village contained a constabulary police station, an inn and two flour-mills, which were the property of the Earl of Mayo. Palmerston Demesne borders the village to the north. Palmerstown House, a large mansion, was built by the Earl of Mayo in 1872 to the design of James Wyatt. The house is located approximately 690m north-east of the proposed Project. This replaced an earlier house, which was marked on the first edition OS map approximately 390m north-east of the proposed Project. The 1872 house, now restored, was burnt during the 1920s. The main entrance to Palmerstown Demesne, consisting of high stone estate walls and recessed gates (RPS B19-10, NIAH 11812027) were relocated during the construction of the N7 Naas Road in the mid 1960's. Both the house and the entrance are listed as protected structures.

Kerdiffstown House, in the demesne adjacent to the proposed Project area, is an impressive early 19th century three-storey, stone-built house with rusticated brick surrounds to the windows (Bence-Jones 1978). The house is located approximately 150m north of the site and is a protected structure (B19-023). A Kerdiff family has been recorded within the Naas area since the 16th century, although the house dates to the first half of the 19th century. However, an earlier house is marked within the 18th century mapping of the landscape, suggesting an earlier house once occupied the site of the current house. In 1883 the Kerdiffstown estate consisted of 3,088 acres. In the 1901 Census Hans Hendrick Aylmer is recorded as inhabiting the house. The Aylmers had a governess for their three children, Muriel (11), Violet (9) and Gerald (3). During this time the house was recorded as having six rooms and 29 windows in the front, 12 stables, three coach-houses, a harness room, three cow houses, six calf houses, two piggeries, a dairy, a barn and two sheds. The mansion, along with 600 acres of land was sold by Lt. Colonel Richard M. Aylmer, in March 1938, to the Dominican Order of Nuns. It subsequently became a convent and a Chapter Room and Sacristies were also added. Since the late 1960s the house has been under the ownership of the Society of Saint Vincent de Paul.

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Vernacular architecture is defined in James Steven Curl's Encyclopaedia of Architectural Terms as '*a term used to describe the local regional traditional building forms and types using indigenous materials, and without grand architectural pretensions*', i.e. the homes and workplaces of the ordinary people built by local people using local materials. This is in contrast to formal architecture, such as the grand estate houses of the gentry, churches and public buildings, which were often designed by architects or engineers. The majority of vernacular buildings are domestic dwellings. Examples of other structures that may fall into this category include shops, outbuildings, mills, lime kilns, farmsteads, forges, gates and gate piers. No obvious structures of this type are shown in the OS maps of the proposed Project area.

Industrial development and rapid social and political change during the 19th century initiated a new phase of building throughout rural and urban areas. This included advances in infrastructure, with the construction of the Royal and Grand Canals and the railway network and associated bridges and railway stations, the erection of mills, distilleries and other industrial buildings. The commencement of the Grand Canal in 1756 and the Royal Canal in 1789 helped sustain urban and industrial growth in 18th century Kildare. The canal provided conveyance for corn, coal and turf for the supply of the surrounding neighbourhood. A branch of the Grand Canal, completed in 1789, commencing to the south of Sallins, passed through Naas. The canal passes approximately 550m to the north of the proposed Project at its closest point as it approaches Sallins.

The route of the N7 functioned as a turnpike road in the 18th and 19th century. Taylor and Skinner's Maps of the Roads of Ireland shows the turnpike road between Dublin and Naas in the late 18th century, with 16 milestones marked and numbered. The 13th milestone, located at the south-east corner of Palmerstown Demesne on the north side of the road was recently discovered during an earlier phase of work on the N7 widening. Although the Ordnance Survey six-inch maps mark the location of the stones from the late 19th century onwards, many of the milestones pre-date these later edition OS maps. The majority of the Irish milestones were laid out in the 18th and 19th centuries, during which period roads were the responsibility of the Grand Juries; the Turnpike Trusts, and later, the Post Office.

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Cartographic Analysis

See the text on Cartographic Analysis under Section 10.3.1Archaeology.

County Development Plan

The Kildare County Development Plan 2017-2023 was reviewed as part of this assessment. The development plan lists a number of aims and objectives in relation to architectural heritage (Appendix A10.6). County Kildare has a wealth of structures of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. Such features are contained in the Record of Protected Structures (RPS). County Kildare boasts a large number of country houses and demesnes where the grounds and settings constitute an intrinsic element of their character.

There are no Protected Structures located within the area of the proposed Project although nine structures are situated within a 500m radius. The nearest of these comprises of Kerdiffstown House, located approximately 150m north of the proposed Project. With the exception of one site, standing stone (RPS B19-15) all of the Recorded Protected Structures are also included in the NIAH survey (Table 10.4). The structures are described in detail in Appendix A10.7 and marked on Figure 10.1.

Table 10.4: Recorded Protected Structures (RPSs)

RPS No. NIAH No.	Statutory Status	Townland	Classification	Distance to Site
RPS - B19-23 NIAH - 11812025	RPS	Kerdiffstown	Kerdiffstown House	150m north
RPS – B19-23 NIAH - 11812022	RPS	Kerdiffstown	Kerdiffstown House entrance	210m south-east
RPS – B19-22 NIAH - 11812020	RPS	Maudlings	Johnstown House	340m south-east
RPS – B19-15	RPS (and RMP)	Mauldlings	Standing stone	360m south-east
RPS – B19-37 NIAH 11812004	RPS	Palmerstown Demesne	Former houses within Johnstown Village	360m south-east
RPS – B19-39 NIAH 11812029	RPS	Palmerstown Demesne	House within Johnstown Village	370m south-east
RPS B19-38 NIAH 11812012	RPS	Palmerstown Demesne	House within Johnstown Village	375m south-east
RPS – B19-21 NIAH - 11812011	RPS	Palmerstown Demesne	Former RIC Barracks	385m east-south-east
RPS – B19-20 NIAH - 11812007	RPS	Palmerstown Demesne	House within Johnstown Village	425m east-south-east

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National Inventory of Architectural Heritage (NIAH)

A review of both the architectural survey and garden survey was undertaken as part of this assessment. An area up to 500m that surrounds the proposed Project was examined in order to identify any buildings or areas of architectural significance. The results of this survey are summarised below.

There are 20 structures located within the vicinity of the site that are recorded in the NIAH survey. Of these eight structures are also protected structures. Whilst the remainder are not subject to statutory protection, they may be added to the RPS by the Local Authority and as such should be considered as cultural heritage constraints. The nearest NIAH structure is Kerdiffstown House, located approximately 150m north of the proposed Project (refer to Figure 10.1).

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Table 10.5: National Inventory of Architectural Heritage (NIAH)

Site ID	Statutory Status	Townland	Classification	Distance to Site
NIAH 11812025	RPS	Kerdiffstown	Kerdiffstown House	150m north
NIAH 11812022	RPS	Kerdiffstown	Kerdiffstown House entrance	210m south-east
NIAH 11812028	No	Maudlings	Entrance gates to Roseborough House	300m south
NIAH 11812018	No	Johnstown, Mauldings & Kerdiffstown	Bridge	315m south-east
NIAH 11812017	No	Palmerstown Demesne	House within Johnstown Village	335m south-east
NIAH 11812020	RPS	Maudlings	Johnstown House	340m south-east
NIAH 11812015	No	Palmerstown Demesne	House within Johnstown Village	350m south-east
NIAH 11812010	No	Palmerstown Demesne	Outbuilding within Johnstown Village	350m south-east
NIAH 11812008	No	Palmerstown Demesne	Former stables within Johnstown Village	360m south-east
NIAH 11812004	RPS	Palmerstown Demesne	Former houses within Johnstown Village	360m south-east
NIAH 11812013	No	Palmerstown Demesne	Water pump within Johnstown Village	365m south-east
NIAH 11812029	No	Palmerstown Demesne	House within Johnstown Village	370m south-east
NIAH 11812005	No	Palmerstown Demesne	Former Coaching Inn within Johnstown Village	370m south-east
NIAH 11812012	RPS	Palmerstown Demesne	House within Johnstown Village	375m south-east
NIAH 11812011	RPS	Palmerstown Demesne	Former RIC Barracks	385m east-south-east
NIAH 11812002	No	Palmerstown Demesne	School within Johnstown Village	400m east-south-east
NIAH 11812001	No	Palmerstown Demesne	House within Johnstown Village	400m east-south-east
NIAH 11812006	No	Palmerstown Demesne	Cobbling within Johnstown Village	410m east-south-east
NIAH 11812009	(RMP)	Palmerstown Demesne	Church	425m east-south-east
NIAH 11812007	RPS	Palmerstown Demesne	House within Johnstown Village	425m east-south-east

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Three demesne landscapes are located within 500m of the proposed Project. These are also recorded in the NIAH Garden Survey.

Kerdiffstown House demesne (NIAH garden Ref.: KD-49-N-914226) is recorded as '*Main features unrecognisable - peripheral features visible*' within the survey. Whilst the house and entrance drive is still present, the demesne has been impacted upon by quarrying activity that formerly took place within the proposed Project area.

Palmerstown House demesne (NIAH garden Ref.: KD-49-N-916226) is recorded as '*Main features substantially present - peripheral features unrecognisable*' and is located directly east of Kerdiffstown House demesne. Today, whilst the principal structure and outbuildings are still present, the southern part of the demesne has been impacted upon by the widening of the N7 and the demesne now contains a golf course.

Roseborough House (NIAH garden Ref.: KD-49-N-914215) is located approximately 130m south of the proposed Project area. It is recorded within the survey as '*Main features substantially present - peripheral features unrecognisable*'. The principal structure is present but the southern side of the demesne has been impacted upon by the widening of the N7.

Field Inspection

The field inspection sought to assess the proposed Project area and whether any structures of architectural merit survive in or within the immediate vicinity of it.

The proposed Project area was formerly in use as a quarry before being used as a landfill site. As such the entire site has been subject to significant quarrying and disturbance (Photo 10.1-Photo 10.3). No structures are

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marked on the historical mapping within the site and those structures that are present today relate to the use of the site as a landfill and are of no architectural heritage merit.

The proposed Project area is located within part of the demesne formerly associated with Kerdiffstown House, but no features relating to that landscape survive within the site. Remains of the demesne do survive to the east, including the driveway (Photo 10.5) and relocated entrance (moved after N7 expansion). This entrance, despite it not being in-situ is also a protected structure (RPS B19-23) (Photo 10.6). The adjacent lodge is a modern structure.

At the southern end of the proposed Project area, the proposed leachate and foul sewer pipelines will run from the existing landfilled site in a south-easterly direction before passing beneath the existing N7. The pipeline wayleave will cross a section of surviving demesne landscape associated with Kerdiffstown House. This includes a semi-circular clump of trees apparent on the early 20th century OS map. Here the existing pasture falls away to the south. The original southern boundary of the demesne has been removed and replaced with modern boundary treatments, due to the construction of the N7.


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Photo 10.5: Kerdiffstown House demesne, facing south with the proposed Project area visible as an artificial hill in the background

Kerdiffstown House (RPS B19-23) is situated approximately 150m north of the proposed Project. It survives in good condition and is currently owned by the charity Society of Saint Vincent de Paul. The main elevation of the house faces north-east and there is a convent chapel to the south, with outbuildings to the west and the remains of walled gardens to the west and south-west. These abut the north-eastern boundary of the proposed Project (Photo 10.7 and Photo 10.8). Generally, the house and grounds are overlooked by the man-made mound that dominates the proposed Project area.

Within the wider landscape, Johnstown House (RPS B19-22) is screened from the proposed Project area by a mature demesne landscape. This is also the case for Roseborough House. The house, which is not a protected structure, but still of merit, is located within a mature demesne approximately 225m south of the proposed Project area. The remaining protected structures within Johnstown Village are not discernible from the proposed Project area. This is mostly due to the present of the M7, which travels between the village and the proposed Project.

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Photo 10.6: Entrance to Kerdiffstown House (RPS B19-23), facing north-north-west

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Photo 10.7: Kerdiffstown House, facing north-west

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Photo 10.8: Kerdiffstown House, convent chapel and outbuildings, facing north-north-west

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10.3.3 Cultural Heritage

The proposed Project is located within the townland and parish of Kerdiffstown. A very small section of the scheme extent is located in Maudlings. The surrounding townlands consist of Palmerstown, Palmerstown Demesne, Maudlings, Sallins and Sherlockstown located within the parishes of Naas, Johnstown, Sherlockstown and Bodenstown in the Barony of North Naas and South Salt, County Kildare. The boundaries are marked on Diagram 10.3.

Placename Analysis

Townland and topographic names are an invaluable source of information on topography, land ownership and land use within the landscape. They also provide information on history; archaeological monuments and folklore of an area. A place name may refer to a long forgotten site, and may indicate the possibility that the remains of certain sites may still survive below the ground surface. The Ordnance Survey surveyors wrote down townland names in the 1830's and 1840's, when the entire country was mapped for the first time. Some of the townland names in the study area are of Irish origin and through time have been anglicised. The main reference used for the place name analysis is Irish Local Names Explained by P.W Joyce (1870).

As discussed previously placenames such as Palmerstown, Palmerston or Palmershill and Maudlings are often associated with leper hospitals (Lee, 1996). It is likely that the name Kerdiffstown directly relates to the Kerdiff family that formerly inhabited the Naas area. This may be the case for Sherlockstown too. The name Sallins possibly derives from the word *Sailín*, meaning 'a little heel, or projection'.

Townlands

The townland is an Irish land unit of considerable longevity as many of the units are likely to represent much earlier land divisions. However, the term townland was not used to denote a unit of land until the Civil Survey of 1654. It bears no relation to the modern word 'town' but like the Irish word *baile* refers to a place. It is possible that the word is derived from the Old English *tun land* and meant '*the land forming an estate or manor*' (Culleton 1999, p.174).

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Gaelic land ownership required a clear definition of the territories held by each sept and a need for strong, permanent fences around their territories. It is possible that boundaries following ridge tops, streams or bog are more likely to be older in date than those composed of straight lines (*ibid.* p.179).

The vast majority of townlands are referred to in the 17th century, when land documentation records begin. Many of the townlands are mapped within the Down Survey of the 1650s, so called as all measurements were carefully 'laid downe' on paper at a scale of forty perches to one inch. Therefore, most are in the context of pre-17th century landscape organisation (McErlean 1983, p.315).

In the 19th century, some demesnes, deer parks or large farms were given townland status during the Ordnance Survey and some imprecise townland boundaries in areas such as bogs or lakes, were given more precise definition (*ibid.*). Larger tracks of land were divided into a number of townlands, and named Upper, Middle or Lower, as well as Beg and More (small and large) and north, east, south and west (Culleton 1999, p.179). By the time the first Ordnance Survey had been completed a total of 62,000 townlands were recorded in Ireland.

There are no townland boundaries crossing the proposed Project area. The boundaries between the adjacent townlands of Maudlings and Palmerstown Demesne are formed by existing watercourses.

10.4 Predicted Impacts

10.4.1 Remediation Phase

Archaeological Heritage

It is possible that ground disturbances associated with the proposed remediation works, such as the construction of a playing pitch, may have a significant or profound negative impact on the site of a recorded mound (KD019-018) located in the western part of the proposed Project area. However, the location of this site is uncertain, as it may have been removed by quarrying activity in the 1950s. No definite archaeological anomalies were identified within this area during the geophysical survey.

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It is possible that ground disturbances associated with the realignment of the driveway and insertion of drainage swales to the immediate north and south of the boundary that surrounds the recorded church site (KD019-006001-4) may have a significant or profound negative impact on associated remains that may survive beneath the existing ground level with no surface expression. The driveway realignment is located c. 25m north of the church, whereas the drainage swales are located c. 26m south-west of the church. Such buried remains may include burials or the foundations of additional structures. In addition, the movement of plant within this area has the potential to have a direct and negative impact on the upstanding remains of the church and associated graveyard.

It is possible that the insertion of a surface water outfall pipeline into the Morell River may have a significant or profound negative impact on any archaeological features, deposits or artefacts that have the potential to survive within this area due to the presence of the water course.

It is possible that ground disturbances associated with the insertion of the pipeline routes through the southern part of the Kerdiffstown demesne, may have a significant or profound negative impact on any archaeological remains that may survive beneath the existing ground level with no surface expression.

No direct or indirect impacts are predicted upon the remaining four recorded archaeological sites located within the receiving environment surrounding the proposed Project.

Architectural Heritage

No potential impacts are predicted upon the built architectural resource as part of the proposed remediation works. No structures of architectural heritage significance are located within the existing site. The closest protected structures and NIAH structures are Kerdiffstown House (located approximately 150m to the north) and the relocated entrance to Kerdiffstown House (located approximately 210m to the south-east).

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As part of the proposed works, the driveway through Kerdiffstown Demesne will be subject to realignment. It will be moved a maximum of 15m to the north-east of its current position and will run parallel with the former drive way. This modification is minor and does not affect the character of the demesne as it exists today and is deemed to be neutral. Views of Kerdiffstown House from the approach will not be affected.

Cultural Heritage

No potential impacts are predicted upon the cultural heritage resource as part of the proposed remediation works (other than those outlined above).

10.4.2 Operational Phase

Archaeological Heritage

It is predicted that the Operational Phase will have a significant positive impact on the archaeological resource surrounding the proposed Project area, including the church and graveyard (KD019-006001-4). This would be due to the reduction and stabilisation of slopes surrounding the structure and visual improvement of the landscape from a former quarry/ waste facility to recreational grounds.

Architectural Heritage

It is predicted that the Operational Phase will have a significant positive impact on the architectural resource surrounding the proposed Project area, including Kerdiffstown House and entrance (RPS B19-23). This would be due to the visual improvement of the landscape from a former quarry/ waste facility to recreational grounds.

It is predicted that the Operational Phase will also have a significant positive impact on the cultural heritage resource surrounding the proposed Project area, including Kerdiffstown House demesne and the other surrounding demesne landscapes. This would be due to the visual improvement of the landscape from a former quarry/ waste facility to recreational grounds.

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Cultural Heritage

No potential impacts are predicted upon the cultural heritage resource as part of the operation of the proposed Project (other than those outlined above).

10.5 Mitigation Measures

Archaeological Heritage

A programme of archaeological testing shall be carried out within the small area of greenfield in the western section of the proposed Project area, which contains the recorded mound (KD019-018). This shall be undertaken under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).

A limited programme of archaeological testing shall be carried out to the immediate north and south of the recorded church site, within the footprint of the proposed works due to the proximity of the church and the potential for these areas to contain buried archaeological remains. This investigation will be carried out under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA). The standing remains of the church and graveyard shall be fenced off with non-intrusive fencing during the course of remediation works in this area, in order to prevent inadvertent impacts with plant and equipment.

An archaeological wade survey shall be carried out at the proposed location of the surface water outfall point into the Morell River. This investigation will be carried out under licence to the DoAHRRGA. Full provision shall

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be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).

All topsoil stripping associated with the proposed remediation works, including the surface water outfall pipeline and pipelines through the southern part of Kerdiffstown demesne, shall be monitored by a suitably qualified archaeologist. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).

10.6 Residual Impacts

Once all of the above mitigation measures are carried out, there will be no residual impacts upon the archaeological, architectural and cultural heritage resource.

10.7 Difficulties Encountered in Compiling Information

No difficulties were encountered during the compilation of this EIAR.

10.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on archaeology, cultural heritage and architectural heritage.

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10.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

10.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

10.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future) are anticipated.

10.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development

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proposed the cumulative impacts from the housing development project and the proposed Project no cumulative impacts are anticipated.

10.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact. It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

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- National Monuments Act (1930-2014)
- Planning and Development Act, 2000

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11. Biodiversity

This Chapter assesses any potential effects the proposed Project may have on biodiversity and the ecological environment in and around the proposed Project location. The proposed Project is not situated within or next to any European sites and there are no Qualifying Interest (QI) habitats or species of any SAC or SPA within the Zone of Influence (ZoI) of the proposed Project.

There are a number of potential impacts to biodiversity associated with the Remediation Phase of the proposed Project. These include habitat loss, severance, mortality, disturbance and contamination, with the majority of these impacts being generally short-term in nature and often significant in the absence of mitigation. As a result, a number of appropriate mitigation measures are proposed in order to reduce impacts to biodiversity as far as is reasonably practicable, including appropriate scheduling of works; protection of certain trees; translocation of certain species; and the halting of any site discharge to surface waters throughout the remediation works. A number of the mitigation measures identified will need supervision by, or liaison with, a suitably qualified ecologist.

Predicted Operational Phase impacts include impacts to water quality and aquatic fauna associated with the new surface water outfall into the Morell River, as well as impacts to fauna from the new public park lighting. A series of mitigation measures and opportunities for future enhancement have been proposed in order to improve the biodiversity of the proposed multi-use public park. Such mitigation and enhancement includes but is not limited to water quality monitoring; replacement of habitats lost during remediation through planting of new flora; installation of nest boxes and reptile hibernacula; and avoidance of lighting in particularly sensitive areas. The proposed Project has the potential to benefit and contribute to the overall biodiversity of the area. In particular habitats will be created and/or enhanced, particularly wetland habitats to the benefit of species associated with such habitats.

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11.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") on the ecological environment anticipated to occur during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950's until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 11.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 11.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1, commencing use of new flare stack in the new Landfill Infrastructure Compound • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping including wetland habitat creation • Ecological mitigation such as timing of works, working under license from the NPWS and translocation of species • Ecological enhancements including installation of reptile hibernacula and nesting boxes
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of the surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation and operation can be found in Chapter 4 Description of the Proposed Project.

11.1.1 Consideration of European Sites

Regarding European sites, which comprise Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), all potentially significant impacts are assessed in this Chapter. "European site" replaced the term "Natura 2000 site" under the EU Environmental Impact Assessment and Habitats Regulations 2011 (S.I. No. 473 of 2011). There are currently no SACs in Ireland. All remain 'candidate' (cSAC) until the European Commission approves and ratifies the final list of cSACs. cSACs are afforded the same protection as SACs. The process of making cSACs SACs by means of Statutory Instrument has begun. While this process is ongoing the term SAC will be used, in conformance with nomenclature used in National Parks and Wildlife Service (NPWS) databases.

A Screening for Appropriate Assessment was completed in March 2017. The screening concluded that an Appropriate Assessment is not required as it can be excluded, on the basis of objective scientific information, and in light of the conservation objectives of relevant sites, that the proposed Project, either individually or in combination with other plans or projects, could have likely significant effects on any European site.

11.1.2 Location of Proposed Project

The site is located in County Kildare, approximately 3km north-east of central Naas and approximately 400m north-west of Johnstown village as shown on Figure 3.1. To the north-east are lands associated with Kerdiffstown House and to the north is a golf course. The western boundary of the proposed Project comprises of the L2005 Kerdiffstown Road, from Sallins to Johnstown, which includes some residential properties that are

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adjacent to the southern end of the proposed Project. To the west of Zone 1 of the proposed Project is a worked out quarry.

Land use around the remainder of the site principally comprises agricultural and pasture fields grazed by horses. There are a number of waterbodies in the vicinity of the proposed Project. The Morell River (WB005) is located approximately 15m to the east of proposed Project at its nearest point, contained in a woodland corridor. South-east of the site, the Rathmore Stream also known as the Hartwell River (WB006) joins the Morell, while further north the Mill Race watercourse (WB007) departs from the Morell River. There are also a number of lakes/ponds associated with the Palmerstown House Estate & Golf Course (WB001 and WB002), which lie approximately 100m to the east of the proposed Project. The Canal Feeder Stream (WB004) is an engineered feature that collects surface water runoff from lands generally to the south and south-west of the site. The Canal Feeder Stream flows generally westward to the Grand Canal proposed Natural Heritage Area (pNHA) which is located approximately 2km west of the site. Waterbodies in the vicinity of the proposed Project are shown in Figure 13.2. There are no European sites within or abutting the proposed Project.

Habitats within the site in particular dominant habitats including scrub and grassland are growing directly on uncapped waste with very shallow ground and soil cover, interspersed with protruding rebar and processed plastics.

11.1.3 The Proposed Project Description

The proposed Project is described in detail in Chapter 4 Description of the Proposed Project. In summary, the proposed Project involves the remediation of a former landfill and waste processing facility. The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site, see Section 4.3.1 for details on the outline phasing of the works. The end-use proposal for the site is a multi-use public park with multi-use sports pitches, changing rooms, a children's playground, etc. (the Operational Phase). To facilitate remediation and the end-use and for the purposes of this assessment the entire site has been deemed to be at risk of development, including the removal of all surface cover/vegetation, which may include the removal of some mature boundary trees (dependant on slope stability). Outline Remediation Phasing is shown on Figure 4.8 and Figure 4.9.

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11.1.4 Scope of the Assessment

Impacts Assessed in Full

Various elements of the proposed Project could give rise to potentially significant impacts on ecological receptors, and have informed the delineation of the Zone of Influence (ZoI). Different potential impacts will arise during Remediation and Operational Phases, and both types of potential impacts are described in Section 11.4.

The following key impacts were assessed:

- Direct and indirect impacts during Remediation Phase including direct habitat loss, severance, mortality (including protected species), disturbance (noise and lighting) and pollution (discharge of surface water); and
- Direct and indirect impacts during Operational Phase including disturbance (from increased visitor pressure and lighting) and pollution (discharge of surface water).

11.2 Methodology

11.2.1 Guidance

The surveys undertaken to inform this Chapter followed guidance on ecological survey techniques produced by the Transport Infrastructure Ireland [formerly National Roads Authority (NRA)] (NRA, 2009a, 2009b). Whilst NRA guidelines were originally written for the assessment of ecological impacts of road schemes, the survey techniques employed and potential impacts on protected species do not vary greatly between road and non-

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road projects and therefore can be applied across various project types. A list of guidance used in the assessment is provided in Appendix A11.1 and summarised below;

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- Chartered Institute of Ecology and Environmental Management (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland -–Terrestrial, Freshwater, and Coastal;
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust: London (Collins, J. (ed.) (2016));
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016); and
- Good Practice Guidelines for Developers. Biodiversity and Development in County Kildare. Kildare Heritage Series 2. An Action of the County Kildare Heritage Plan.

11.2.2 Relevant Legislation, Policy and Guidelines

The assessment detailed in this Chapter was carried out in accordance with the relevant legislation, policy and guidelines as set out in Appendix A11.1.

11.2.3 Consultation

In undertaking the assessment, consideration has been given to the scoping responses and other consultation as undertaken and detailed in Table 11.2 below.

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Table 11.2: Consultation Responses

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
National Parks and Wildlife Service (NPWS)	Inter-agency group meeting held on 31 March 2016	Damien Clarke (NPWS District Conservation Officer for Kildare, Laois and Offaly) noted that no Special Area of Conservation (SAC) is in close proximity to the site	Separate AA screening was undertaken to assess any potential for Likely Significant Effects (LSE) arising from the proposed Project.
Development Application Unit (DAU)	Scoping report acknowledged. Further letter sent to the DAU on 23 February 2016 to request feedback.	-	-
Inland Fisheries Ireland (IFI)	Scoping response received on the 18 November 2016	- Highlighted the importance of the Morell River and its tributaries for spawning Atlantic salmon and brown trout, lamprey and white-clawed crayfish. - Reiterated the need for implementation of comprehensive leachate and surface water management measures to avoid ecological impacts on receiving waters.	All issues raised are addressed in the EIAR and appropriate mitigation put in place to avoid any impacts on ecological interests within the Morell River and the Grand Canal.

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Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
An Taisce	Scoping response received on the 18 November 2016	- Any wetland habitat created will be beneficial to wildlife, use of plants of local provenance. - Where unavoidable damage to the habitats and protected species, ensure strong mitigation measures are implemented.	All issues raised are addressed in the EIAR and appropriate mitigation put in place to avoid any impacts on protected species and overall biodiversity of the site.
EPA	Scoping response received on the 18 November 2016	- In relation to Biodiversity the EPA raised concerns about the spread of invasive species (listed on Part 1 or Part 3 of the Third Schedule of the European Communities Regulations, 2011) and/or the risk of invasive species being brought on site in vector material (imported soils).	All issues raised are addressed in the EIAR and appropriate mitigation put in place to avoid the spread of invasive species or the importation of invasive species into the site via vector materials (see Chapter 4 Description of the Proposed Project).

11.2.4 Zone of Influence

Guidance on Zone of Influence

The Zone of Influence (ZoI) is the likely area over which the proposed Project could have potential impacts on a given receptor. The ZoI over which significant impacts may occur will differ for different Key Ecological Receptors, depending on the pathway. Significant impacts are deemed to be those impacts resulting in a likely change in conservation status of a Key Ecological Receptor. According to NRA Guidelines (2009a), Key Ecological Receptors (KER's) will be features of sufficient value to be material in the decision-making process for which potential impacts are likely. According to the NRA Guidelines, KER's are therefore defined as features of Local (Higher Value), County, National or International Importance.

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In their *Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland* the Chartered Institute of Ecology and Environmental Management (CIEEM) recognise that the ZoI will vary for different ecological features, depending on their sensitivity (CIEEM, 2016). The need to identify receptor-specific ZoI is also supported by guidance from the Department of Environment, Heritage and Local Government (DoEHLG) for assessing impacts in the context of Appropriate Assessment (DoEHLG, 2010; p.23, para 1).

Method to Determine Zones of Influence

The starting point for determining Zones of Influence (ZoI) is to analyse the characteristics of the proposed Project (Chapter 4 Description of the Proposed Project) and identify the range of ZoI using the source-pathway-receptor conceptual model. For instance, in the case of borehole installation affecting protected mammals during construction;

- Source(s) – e.g. Drilling.
- Pathway(s) – e.g. Vibration.
- Receptor(s) – e.g. Underground mammal resting site at risk of collapse.

As recommended by CIEEM (2016), professionally accredited or published studies have been used to determine ZoI (see Appendix A11.2). In the example above, the ZoI is 150m, based on guidance from the NRA (2006a) regarding the distance to underground otter (*Lutra lutra*) sites, within which disturbing works are likely to require licensing (NRA, 2006a). Once identified, a receptor-specific ZoI is used to determine the field survey areas (i.e. in the case above, the field survey area for underground mammal sites is 150m from piling works).

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For designated sites, a slightly different approach may be employed. Initially, a single worst-case ZoI encompassing all pathways for significant impacts generates a list of preliminary sites potentially impacted. Next, the list of sites and features is revised by scoping out features based upon the receptor-specific ZoI for which the sites are designated. A ZoI is identified based on professional judgement and published studies (see Appendix A11.2 for full details).

The number of different Zones of Influence can be reduced by grouping features based on shared ecological dependencies and sensitivities. For instance, the potential risk of piling resulting in the collapse of underground resting sites in similar habitats for otter and badger (*Meles meles*), is presumed to be similar.

11.2.5 Desk Study

Extent

The desk study areas were defined differently for different ecological features, by applying the ZoI identified in Appendix A11.2. For instance, the ZoI of effects to breeding birds from the proposed Project boundary was determined to be up to 100m. However, in line with NRA guidelines (NRA 2009a), records of known bat roosts should be obtained for areas up to 1km from the boundary of the proposed Project.

Some records from the National Parks & Wildlife Service (NPWS) research branch are considered accurate only to 10km. Therefore, the desk study area for obtaining existing ecological records was set at 10km from the centre of the proposed Project (grid reference: N 91400 22051) to account for the potential spatial error associated with these ecological records.

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Desktop Data Sources

Records for rare / protected species within 10km of the proposed Project site were obtained from the NPWS Research Branch on the 18 September 2015. Records were also obtained from the online database of the National Biodiversity Data Centre (NBDC). Bat roost records were obtained from Bat Conservation Ireland (BCI) for the centre of the proposed Project site to a distance of 10km on the 25 June 2016.

Key desktop sources were:

- Mapping of European site boundaries from NPWS available online at www.npws.ie;
- Mapping and aerial photography available online from Ordnance Survey Ireland (www.osi.ie) and Google Maps (http://maps.google.com/);
- Land zonings and land use plans available from the Department of the Environment, Community and Local Government available online (www.myplan.ie);
- Botanical Society of Britain and Ireland website – Species Distribution Maps available online (www.bsbi.org.uk/; accessed on various dates in 2015);
- National Biodiversity Data Centre – Species Distribution Maps available online (www.biodiversityireland.ie/; accessed on various dates in 2015);
- Data on the conservation status of species, and the distribution and ecology of such species in the full suite of all Ireland 'Red Lists';
- Habitat mapping and plant species recorded at the Kerdiffstown site in September 2011 as per the unpublished 2011 report produced by Roger Goodwillie & Associates on behalf of SKM Enviros entitled: *Remediation of Landfill at Kerdiffstown, Naas, Co Kildare. Ecological assessment*;
- Ecological walkover undertaken as part of the baseline report. SKM Enviros (2013). Kerdiffstown Landfill Environmental Baseline Report; and
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to Kerdiffstown Facility In Co. Kildare (Aquens Ltd. 2012, 2015, 2016).

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11.2.6 Field Survey

A suite of ecological surveys was undertaken between September 2015 and September 2016 as summarised in Table 11.3. Surveys spanned all four seasons and covered the optimal survey periods for all flora and fauna. Surveys had due consideration for best practice guidelines published by e.g. the NRA (NRA 2009b) and the Bat Conservation Trust (BCT) (Collins 2016; Hundt 2012).

Study Area Description

For the purposes of the assessment, the 'study area' referred to throughout this Chapter extends to a series of buffers within which impacts have been assessed. The study area extends beyond the extents of the site as detailed in Table 11.3 below. Detailed habitat and faunal surveys were undertaken to include a range of buffers from the study area based on best practice guidance. The study area for the assessment ranges from the site boundary only (habitats), to buffers of 150m for species groups, given best practice guidance, species and their specific sensitivities, the ZoI of the likely sources of impact and the nature of the proposed Project. These buffers were extended based on professional judgement when and if required.

Surveys Scoped Out

As outlined in the Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report (Jacobs 2016) the requirement to assess the following ecological features has been scoped out:

- **Winter bird surveys.** Habitats found within the study area are not considered suitable to support any significant wintering bird populations due to their distance from any designated, coastal, or wetland bird habitats, and the absence of potential winter roosting habitats (e.g. reed beds, moorland).
- **Invertebrate (aquatic) / fish surveys.** The majority of aquatic habitats within the study area are artificial in nature and considered unlikely to support any aquatic invertebrates of conservation interest. However, the Morell River is likely to support a good macroinvertebrate assemblage. Water quality monitoring reports produced by Aquens were reviewed to identify the potential for any incidental records of notable aquatic invertebrate species such as white–clawed crayfish (*Austropotamobius pallipes*). The Morell River and surrounding tributaries are known to support good populations of Salmonids including Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) as well as lamprey (*Lampetra sp.*) spawning habitat. Given the nature of the proposed works (e.g. minor instream works to accommodate a new surface water outfall) additional aquatic surveys were not considered necessary, instead these species were presumed to be present and works will be undertaken to avoid impacts on these species.
- **Invertebrate surveys (terrestrial).** Terrestrial habitats within the study area are considered unlikely to support any protected invertebrate species, as the study area does not support the food plants of the protected small blue (*Cupido minimus*) and marsh fritillary (*Euphydryas aurinia*) butterflies or suitable habitat for the protected whorl snail species *Vertigo spp.*
- **Reptile surveys.** Areas of the study area provide suitable basking and refuge habitat for protected viviparous lizard (*Zootoca vivipara)*, in particular south-facing slopes and log-piles in the north-west of the site. However, as shown on historical aerial mapping much of the site was devoid of vegetation between 2003 and 2010 when the site was an operational landfill. The site has since re-vegetated and there is potential for small numbers of reptile to have recolonised from surroundings areas. However, the numbers of reptile if present are likely to be low and unlikely to be picked up in a survey. Consequently, common lizard is presumed to be present in low numbers. A precautionary mitigation plan will be prepared to potentially include targeted hand clearance of surface vegetation in areas likely to have highest lizard densities, as well as compensatory habitat creation where required.

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Table 11.3: Ecology Surveys Informing the EIAR

Species / Habitat	Study Area (meters beyond site boundary)	Survey Date(s)
Habitat Survey (incl. invasive species and rare or notable flora)	0m (field to south of site, outside site boundary also surveyed)	24 September 2015
Daytime Assessment of Bat Roost Potential (trees and buildings)	50m	26 November 2015 and 10 March 2016
Bat Roost Surveys (trees and buildings with bat roost potential)	0m	Various between June – September 2016
Bat Activity Surveys using static detector recording devices (unmanned)	0m	September 2015; various between June – September 2016
Breeding Bird Survey (territory mapping)	50m (150m for kingfisher [*Alcedo atthis*])	31 March and 30 June 2016
Protected Mammal Surveys	150m	26 November 2015 and 10 March 2016
Amphibian Surveys	0m	10 March 2016
Water Quality Monitoring (Aquens Ltd.)	Monitoring points approximately 1km upstream and downstream of the proposed Project	11 December 2012, 11 October 2015 and 23 June 2016.

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Habitats and Flora Survey

The field survey area for terrestrial habitats was within the proposed Project boundary. The field south of the site (outside the site boundary) was also surveyed to account for a potential increase in the footprint of the proposed Project to accommodate ancillary works such as temporary storage and/or access routes.

Habitats and flora were classified using the Heritage Council's *Guide to Habitats in Ireland* (Fossitt 2000). Within each habitat, dominant and abundant plant species and indicator species were recorded. Searches in suitable habitat were made for any species listed on the Red Data Book for vascular plants (Jackson *et al.* 2016), the Red List for bryophytes (Lockhart et al. 2012), any species protected on the Flora Protection Order 2015, and any invasive species listed on Schedule 3 to the Bird and Habitat Regulations 2011-2015. Vascular plant nomenclature follows that of the Checklist of the Flora of Britain & Ireland (BSBI 2007) and as such any name changes since 2007 (including Stace 2010) are not included. Bryophyte nomenclature follows the British Bryological Society (Atherton et al. 2010).

Protected Fauna (other than bats)

Field survey areas varied for different fauna and extended up to a maximum of 150m from the proposed Project boundary for mammals. These buffers were extended based on professional judgement when and if required. The suitability of the study area to support notable or protected fauna including birds, amphibians and mammals was assessed using field surveys to recognised standards such as those published by the NRA, British Trust for Ornithology (BTO) and the BCT. Habitats on-site were assessed for signs of usage by protected fauna and/or those of conservation concern or on national red lists. Fauna were recorded by direct observation and indirectly using field signs including tracks, feeding signs, droppings, and breeding and resting sites. Observations on potentially suitable habitat were also made.

Badger and Otter

The field survey area for badger and otter resting sites extended up to a 150m from the proposed Project boundary. This was based on *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes* (NRA 2006b), which state that intrusive earthworks (e.g. piling) within 150m of a protected badger or otter breeding or resting site is likely to require licencing from the NPWS due to the risk for disturbance potentially including entombment of animals from hole collapse. The status of any badger setts, otter holts (both

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underground breeding or resting sites), or otter couches (temporary above-ground resting places) were recorded along with any evidence of activity, including paths, paw-prints, feeding signs, latrines and spraints.

Pygmy Shrew, Hedgehog, and Stoat

No formal surveys were undertaken for other protected mammal species for which field signs are less frequent and/or reliable than other larger mammals. Care was taken to search for activity signs such as searching soft muds for tracks, and to look for droppings. Potential presence of these species in suitable habitat was recorded based on the habitat preferences described in Hayden & Harrington 2001. Road mammal fatalities in the locality were also recorded (if observed) as these are sometimes the only reliable indication of hedgehog *(Erinaceus europaeus*) or Irish stoat (*Mustela erminea hibernica*) presence in an area, beyond live sightings.

Breeding Birds

The field survey area for breeding birds was 50m beyond the proposed Project boundary (with the exception of kingfisher) to record all birds within the potential ZoI during Remediation and Operational Phases. The breeding bird surveys involved walking along a route and recording birds within the study area. Birds were recorded when signs of breeding were observed such as singing to hold a territory, feeding young, family groups and nest sites. Field surveys were complemented by a desktop search of potentially suitable breeding habitat for highly sensitive breeding species, for which the ZoI of disturbance could extend up to 1km. This desktop search, including analysis of aerial photography, concluded there was no potential for highly sensitive breeding bird species. No suitable Kingfisher habitat was noted within the ZoI.

Breeding birds were surveyed on two visits on 31 March 2016 and the 30 June 2016, in calm conditions, between sunrise and 11:00, having regard for the Common Birds Census territory mapping method (Gilbert *et al*. 1998). Both visits in spring and summer 2016 recorded breeding activity of resident and migratory birds. The visit in June recorded evidence of breeding including juvenile birds, nests, parents feeding young and roaming families. The categories of breeding evidence developed by the BTO (available at http://www.bto.org/volunteer-surveys/birdatlas/methods/breeding-evidence) were applied to all birds recorded. All birds were assessed for their conservation importance in accordance with the traffic light system of Green (Low), Amber (Medium) and Red (High) conservation concern for the island of Ireland (Colhoun & Cummins 2013)

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Amphibians and Reptiles

Amphibian surveys were cognisant of the NRA guidelines (NRA 2009b). The main waterbody identified within the site was artificial in nature and comprised a surface water lagoon (WB003) which receives water runoff from temporary capping surface of the lined cell (Zone 3, refer to Figure 3.2). Water quality within the lagoon appeared to be poor given the presence of algae growing in the water column. This waterbody was also lacking any significant aquatic vegetation and as such was deemed unsuitable to support protected smooth newt (*Triturus vulgaris*). However, it was deemed suitable to support protected common frog (*Rana temporaria*). Furthermore, terrestrial habitats and other temporary waterbodies including a water filled wheel rut, and drainage ditch were also deemed suitable to support common frog. A site walkover and survey of all waterbodies (where accessible) was conducted in March 2016 to look for frog spawn.

As noted above no formal surveys were undertaken for reptiles. However, care was taken to look for common lizards at exposed basking sites in suitable habitat during the course of other ecological survey work.

Invertebrates (aquatic)

Biological water quality monitoring was undertaken by Aquens Ltd in 2012, 2015 and 2016. Monitoring in 2016 was undertaken at eight sampling localities on the Morell River and two on the Rathmore Stream to assess the upstream and downstream water quality as indicated by the benthic macroinvertebrate community. The Rathmore Stream (also known as the Hartwell River) joins the Morell River adjacent to the site and therefore the water quality had to be assessed to determine its influence on the Morell River. The sampling method adopted was that applied by the EPA in the national river monitoring programme (McGarrigle et. al. 2002 cited in Aquens Ltd. 2016). Using a Freshwater Biological Association (FBA) pond net (1mm mesh), a 2-minute, multi-habitat kick-sample was taken at each site. In addition, one-minute stone-washing was also undertaken. The samples were preserved in 70% Industrial Methylated Spirit (IMS) and processed in the laboratory. Samples were sorted

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in an illuminated tray and all the macroinvertebrates identified to the appropriate taxonomic resolution using FBA taxonomic keys. The detailed water quality monitoring report(s) are provided in Appendix A13.3.

Protected Fauna (Bats)

The field survey area for foraging and roosting bats was determined to be approximately 50m beyond the footprint of the proposed Project boundary. This was based on professional judgement and considered sufficient to address potential impacts from light spill and the potential for increases in the footprint of the proposed Project to accommodate any new access routes. Bat surveys had due consideration for best practice guidelines NRA (NRA 2009b) and BCT (Collins 2016; Hundt 2012).

Assessment of Bat Roost Potential (Initial Daytime Assessment)

A daytime assessment of buildings and trees with potential to be removed as part of the proposed Project and treelines / woodland edges potentially affected by the proposed Project was undertaken in November 2015. A further assessment was undertaken in March 2016. Subsequent to these surveys all but one of the buildings were confirmed to have negligible potential to support a bat roost. The buildings with negligible potential were removed as part of a demolition contract undertaken in 2016 due to the unsafe nature of the buildings and structures at the site. One building was therefore subject to further dusk and dawn emergence/re-entry surveys. A further three properties (REC010, REC011 and REC016) will be demolished during the Remediation of the site. These private properties and surrounding gardens were not surveyed during the initial bat assessment and surveys. Daytime assessments and potential further roost surveys of these buildings will be required prior to them being demolished. Surveys will be undertaken by a suitably qualified ecologist. If a bat roosts is identified in any of these buildings, they will have to be demolished under licence from the NPWS and appropriate mitigation put in place.

These assessments comprised an external inspection of trees and buildings within the site boundary to identify potential roost features (PRFs). Close focusing binoculars were used to look for features which may support bat roosts, and evidence of bat activity. Bats may utilise several different roosts throughout the year and may only occasionally make use of any given feature, particularly cracks, crevices and fissures. The criteria used to categorise the PRFs or suitability of buildings and trees as a roost are summarised in Table 11.4 below (based on Collins 2016). Figure 11.1 shows trees and buildings that were assessed as having PRFs.

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Table 11.4: Bat Roost Potential Categories

Category	Description	Recommended No. of Survey Visits*	Recommended Survey Timings**
High Trees / buildings that are suitable for use by large numbers of bats on a regular basis	Features include holes, cracks or crevices that extend or appear to extend back to cavities suitable for bats. In buildings, examples include eaves, barge boards, gable ends and corners of adjoining beams, ridge and hanging tiles, behind roofing felt or within cavity walls. In trees, examples include rot holes, woodpecker holes, splits and flaking or raised bark which could provide roosting opportunities. Any ivy cover is sufficiently well-established and matted so as to create potential crevices beneath. **Further survey is required to determine whether or not bats are present and if so, the bat species present. Appropriate mitigation and potentially licensing requirements may then be determined. Seasonal constraints may apply.**	**Buildings / trees –** Three separate visits. One dusk emergence and a separate dawn re-entry survey. The third survey visit can be dusk or a dawn survey. **NB.** Multiple survey visits should be spread out as much as possible, with surveys at least two weeks apart, preferably more.	**Buildings / trees –** May to September (with at least two of the surveys between May and August)

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Category	Description	Recommended No. of Survey Visits*	Recommended Survey Timings**
Moderate Moderate potential is assigned to trees / structures with potential to support bat roosts but supports fewer features than a high potential building / tree and is unlikely to support a roost of high conservation value.	From the ground, building / tree appears to have features (e.g. holes, cavities or cracks) that may extend back into a cavity. However, owing to the characteristics of the feature, they are deemed to be sub-optimal for roosting bats. **Further survey is required to determine whether or not bats are present and if so, the bat species present. Appropriate mitigation and potentially licensing requirements may then be determined. Seasonal constraints may apply.**	**Buildings / trees –** Two separate visits. One dusk emergence and a separate dawn re-entry survey. **NB.** Multiple survey visits should be spread out as much as possible, with surveys at least two weeks apart, preferably more.	**Buildings / trees –** May to September (with at least one of the surveys between May and August)
Low Low potential is assigned to structures and trees with features that could support individual bats opportunistically.	If no features are visible but owing to the size and age and structure, hidden features, sub-optimal for roosting bats, may occur that only an elevated inspection may reveal. In respect of ivy cover, this is not dense (i.e. providing PRF in itself) but may mask presence of PRF features. **Further survey may be required <u>for buildings only</u> or works may proceed using reasonable precautions (e.g. controlled working methods, under licence or supervision of a bat worker. Seasonal constraints may apply).**	**Buildings –** One survey visit. One dusk emergence or dawn re-entry survey. **Trees** – No further Surveys Required	**Buildings –** May to August **Trees** – No further Surveys Required

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<u>Notes</u>
Bat Roost Potential Categories as per latest guidance Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust: London.
* Recommended minimum number of survey visits to give confidence in a negative result for structures (also recommended for trees but unlikely to give confidence in a negative result).
** Recommended timing for presence/absence surveys to give confidence in a negative result for structures (also recommended for trees but unlikely to give confidence in a negative result).

Dusk Emergence and Dawn Re-entry Surveys

Dusk emergence and dawn re-entry surveys of trees and buildings identified as having PRFs were undertaken to determine the presence / probable absence of bat roosts. The location of trees and buildings surveyed are shown in Figure 11.2. Surveys were undertaken on the following dates:

- 14, 15 and 16 June 2016
- 18, 19, 26 and 27 July 2016

Surveyors were positioned at potential roost access / egress points. Surveyors recorded bat activity using heterodyne Elekon Batscanner detectors and / or the frequency division Anabat SD2. Dusk emergence surveys commenced approximately 15 minutes before, and continued for at least 90 minutes after sunset. Dawn re-entry surveys commenced at least 90 minutes prior to, and continued until, sunrise. Surveys were undertaken during suitably warm and dry weather conditions.

Static Monitoring (Activity Surveys)

To provide additional data concerning the use of the proposed Project site by bats, static detector surveys were carried out between June and September 2016. The static detector records bat activity to a memory card and this information was analysed to confirm the species present as well as air temperature, times and dates of bat activity. Static monitoring locations are shown in Figure 11.2. Static monitoring locations were chosen to incorporate the different habitat features of the study area which may be used by bats for commuting and

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foraging (i.e. rough grassland, woodland, treelines and water bodies). Separate transect / walked activity surveys were not undertaken as a number of the dusk emergence and dawn re-entry surveys were undertaken in the immediate vicinity of potential commuting and foraging habitat within the proposed Project boundary. Bat activity and use of these potential foraging and commuting habitats were sufficiently recorded during the dusk/dawn surveys.

Bat Call Analysis

Bat call analysis was undertaken using Analook software. Analook software was used to analyse bat calls recorded on the Anabat during static monitoring and dusk emergence and dawn re-entry surveys.

Bat species identification was interpreted using known call parameters (British Bat Calls: A Guide to Species Identification, Jon Russ 2012) and existing literature on the ecology of Irish and UK bat species, including distribution, range, habitat associations and behavioural characteristics, in addition to professional judgement. Every attempt was made to identify bats to species level. However, in some instances it was only possible to take the analysis to genus level (distinguishing between certain bat species echolocation calls can be very difficult due to the overlap in call parameters e.g. those species within the *Myotis* genus).

11.2.7 Ecological Valuation and Impact Assessment Methodology

The ecological assessment was undertaken in accordance with guidelines produced by the NRA (NRA 2009a).

In line with the NRA guidelines (NRA 2009a), the impact assessment was only undertaken of Key Ecological Receptors (KERs). These are features within the ZoI of an effect from the proposed Project (ZoI is defined in Section 11.2.4) which are *'both of sufficient value to be material in decision making and likely to be affected significantly'*. Features qualifying as KERs must be similar in ecological value to examples of "Local Importance (Higher Value)" or higher as per the NRA examples in Table 11.5. Features similar in ecological value to the NRA's examples of Local Importance (Lower value) are excluded from impact assessment. All potential impacts were assigned a significance level at a particular geographic scale corresponding to the examples in the NRA guidance. The assessment also had due consideration for the following guidelines;

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017); and
- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2016).

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Table 11.5: Ecological Evaluation Criteria from NRA Guidelines (NRA 2009a)

Examples of Ecological Valuation

International Importance:
• 'European site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.
• Site that fulfils the criteria for designation as a 'European site' (see Annex III of the Habitats Directive, as amended).
• Features essential to maintaining the coherence of the Natura 2000 Network [Note 1].
• Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.
• Resident or regularly occurring populations (assessed to be important at the national level) [Note 2] of the following:
  ○ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and / or International Importance:
  ○ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
• Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
• World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage 1972).
• Biosphere Reserve (UNESCO Man & The Biosphere Programme).
• Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
• Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
• Biogenetic Reserve under the Council of Europe.
• European Diploma Site under the Council of Europe.
• Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988). [Note 3]

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Examples of Ecological Valuation

National Importance:
• Site designated or proposed as a Natural Heritage Area (NHA).
• Statutory Nature Reserve.
• Refuge for Fauna and Flora protected under the Wildlife Acts.
• National Park.
• Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
• Resident or regularly occurring populations (assessed to be important at the national level) [Note 4] of the following:
  ○ Species protected under the Wildlife Acts; and/or
  ○ Species listed on the relevant Red Data list.
• Site containing 'viable areas' [Note 5] of the habitat types listed in Annex I of the Habitats Directive.

County Importance:
• Area of Special Amenity. [Note 6]
• Area subject to a Tree Preservation Order.
• Area of High Amenity, or equivalent, designated under the County Development Plan.
• Resident or regularly occurring populations (assessed to be important at the County level) [Note 7] of the following:
  ○ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  ○ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  ○ Species protected under the Wildlife Acts; and/or
  ○ Species listed on the relevant Red Data list.
• Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.
• County important populations of species, viable areas of semi-natural habitats or natural heritage features identified in the National or Local Biodiversity Action Plan (BAP) if this has been prepared.
• Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.
• Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

Local Importance (Higher value):
• Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared.
• Resident or regularly occurring populations (assessed to be important at the Local level) of the following:
  ○ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  ○ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  ○ Species protected under the Wildlife Acts; and/or
  ○ Species listed on the relevant Red Data list.
• Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality.
• Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (Lower value): • Sites containing small areas of semi-natural habitat that are of some local importance for wildlife. • Sites or features containing non-native species that are of some importance in maintaining habitat links.

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Notes

1 See Articles 3 and 10 of the Habitats Directive.

2 It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

3 Note that such waters are designated based on these waters' capabilities of supporting Atlantic salmon, trout, char (Salvelinus) and whitefish (Coregonus).

4 Note that such waters are designated based on these waters' capabilities of supporting salmon, trout, char and whitefish.

5 A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

6 It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

7 It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County importance where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

All potential impacts are assessed against parameters as set out within the NRA guidance and take cognisance of guidance produced by the EPA (EPA 2002) and CIEEM (CIEEM 2016). Via this approach, a scientific and repeatable method is applied whereby all aspects of a potential impact are considered. Unless otherwise stated, impacts identified in the assessment are considered to be adverse.

Impacts are considered with reference to the following parameters;

- Magnitude.

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- Extent.
- Duration.
- Reversibility.
- Timing and Frequency.
- Integration of impact characteristics.

A degree of confidence is assigned to assess the likelihood of an impact occurring (integration of impact characteristics). The following scale (as defined within the NRA guidelines) is referred to;

- Near-certain: >95% chance of occurring as predicted.
- Probable: 50-95% chance of occurring as predicted.
- Unlikely: 5-50% chance of occurring as predicted.
- Extremely unlikely: <5% chance of occurring as predicted.

Based on these parameters, an impact is then considered to be either significant or not significant and likely to be either beneficial or adverse. An impact is considered to be significant if it has the potential to affect the integrity of a habitat or the conservation status of a species.

With respect to ecology, best practice guidance advises that significance should not be defined as 'high', 'moderate' or 'low' due to the complexities of ecological processes. Therefore, all impacts defined as 'significant' are considered to be significant in the context of the EIA Regulations.

Furthermore, the EPA guidance (EPA 2002) further defines duration of impacts as follows:

- Short-term Impact – *Impact lasting one to seven years.*
- Medium-term Impact – *Impact lasting seven to fifteen years.*
- Long-term Impact – *Impact lasting fifteen to sixty years.*

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11.3 Baseline Conditions

11.3.1 Site Overview

The site is located in County Kildare, approximately 3km north-east of central Naas and approximately 400m north-west of Johnstown village as shown on Figure 3.1. The study area supports a variety of habitats. Scrub and grassland were dominant, while treelines and hedges were common along the site boundary. Other habitats included recolonising bare ground, buildings and artificial waterbodies. Scrub and grassland habitats dominated in the north while the majority of buildings and areas of hardstanding were associated with the southern end of the site. The site also supported steep sandy banks along the north-east and south-eastern boundaries. As noted in Section 11.2.6 (Assessment of Bat Roost Potential - Initial Daytime Assessment) some buildings were demolished in 2016 due to their unsafe nature.

11.3.2 Desk Study Results

Designated Sites

The proposed Project is not situated within or next to any European sites and there are no Qualifying Interest (QI) habitats or species of any SAC or SPA within the ZoI of the proposed Project. The two closest European sites are the 'Red Bog, Kildare' SAC, located approximately 7.5km south-east of the site and the Ballynafagh Lake SAC, located approximately 10km away. The two closest SPAs are Poulaphouca Reservoir located 10km from the site and Wicklow mountains located over 16.5km from the site boundary. There is no hydrological link to these features from the site, refer to Chapter 13 Water – Hydrology for details on the hydrology assessment. The nearest nationally designated site is the Grand Canal proposed National Heritage Area (pNHA) which is located approximately 550m north of the proposed Project boundary at its closest point. The Morell River lies approximately 15m to the east of proposed Project at its closest point. The Morell River flows north to its confluence with the River Liffey at Straffan, approximately 3km north of the proposed Project boundary. There is

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a second pNHA Liffey at Osberstown 4km west of the proposed Project boundary. All nationally and internationally designated sites potentially within the ZoI of the proposed Project are shown in Figure 11.3.

All waterbodies in the vicinity of the proposed Project are shown in Figure 13.2. The Canal Feeder Stream flows generally westward to the Grand Canal pNHA which is located approximately 550m north of the proposed Project at its closed point. This provides indirect hydrological connectivity with the proposed Project. The protected aquatic plant species opposite-leaved pondweed (*Groenlandia densa*) is one of the most important species in the Grand Canal according to the NPWS site synopsis for the pNHA.

The River Liffey is not designated for nature conservation at its confluence with the Morell River, or downstream of the confluence. The River Rye, which flows into the River Liffey downstream of the proposed Project at Leixlip is designated as the Rye Water Valley/Carton SAC, but is upstream of any hydrological effect pathway with the proposed Project. A preliminary list of all SACs potentially within the ZoI of the proposed Project is shown in Table 11.6 and all SPAs are shown in Table 11.7.

Table 11.6: Preliminary List of SACs potentially within the ZoI of the proposed Project

Site and Code	Distance from Proposed Project Boundary (km)	Qualifying Interests (cSACs/SPAs) or Reason for Designation (pNHAs) (* = Priority Habitat)
Red Bog, Kildare SAC (000397)	7.5	Transition mires and quaking bogs [7140]
Ballynafagh Bog SAC (000391)	10	Active raised bogs [7110]
		Depressions on peat substrates of the Rhynchosporion [7150]
		Degraded raised bogs still capable of natural regeneration [7120]

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Table 11.7: Preliminary List of SPAs potentially within the ZoI of the proposed Project

Site and Code	Distance from Proposed Project Boundary (km)	Qualifying Interests (cSACs/SPAs) or Reason for Designation (pNHAs)
Poulaphouca Reservoir SPA (004063)	10	Greylag Goose (*Anser anser*) Lesser Black-backed Gull (*Larus fuscus*)
Wicklow mountains SPA (004040)	16.5	Merlin (*Falco columbarius*) Peregrine (*Falco peregrinus*)

Records of Protected/Rare Flora and Fauna Species

Records of rare or protected flora within 10km of the proposed Project obtained from the NPWS are shown in Table 11.8 and records of rare of protected fauna (also obtained from the NPWS) are shown in Table 11.9.

Table 11.8: Records of Protected and Red Data Book Flora (data from NPWS)

Common Name	Scientific Name	Protection*	Status**	Habitat Preference	Flowering Time
Musk thistle	*Carduus nutans*	None	Indeterminate	Pastures, waysides, arable fields and waste places.	May-September
Narrow-leaved helleborine	*Cephalanthera longifolia*	FPO	Endangered	White-flowered orchid of damp woods and scrub.	May-June
Basil thyme	*Clinopodium acinos*	None	Endangered	Exposed esker ridges, in arable fields, on gravel, and on sandy soils. It has a preference for calcareous soils.	May-September

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Common Name	Scientific Name	Protection*	Status**	Habitat Preference	Flowering Time
Blue fleabane	*Erigeron acer*	None	Endangered	It occurs on eskers, in dry grassland, sandy pastures and on walls - especially on calcium-rich substrates.	June-August
Darnel	*Lolium temulentum*	None	Endangered	Annual grass of cultivated fields and waste ground.	Unknown
Greater broomrape	*Orobanche rapum-genistae*	None	Vulnerable	This parasite on the roots of shrubby Leguminosae (chiefly gorse or broom) is restricted to south-east Ireland.	July-September
Green figwort	*Scrophularia umbrosa*	None	Endangered	This erect perennial of river banks and lake shores.	June-September
Green-winged orchid	*Anacamptis morio*	None	Endangered	Occurs in meadows, pastures and sandhills.	April to June
Hairy violet	*Viola hirta*	Flora Protection Order (FPO)	Endangered	Occurs on dry banks, rocky ground and scrub on limestone soils in the southern half of Ireland. It has been recorded in Kildare in the past (one site).	March to May
Heath cudweed	*Gnaphalium sylvaticum*	FPO	Vulnerable	This woolly, perennial herb of upland pastures and damp sandy places.	July-August
Henbane	*Hyoscyamus niger*	None	Vulnerable	Grows in sandhills, sandy open areas and waste ground. Prefers disturbed ground, including rabbit warrens and building sites. Lowland.	May-August
Meadow saxifrage	*Saxifraga granulata*	FPO	Critically Endangered	Pastures and sandhills near the coast, has been recorded from 21 sites in nine counties. In 13 sites in the vicinity of counties Kildare, Meath, Dublin and Wicklow.	April to June
Opposite-leaved pondweed	*Groenlandia densa*	FPO	Endangered	Grows in running or still freshwater habitats, including canals. It colonises fine mud sediments.	June- July
Red hemp-nettle	*Galeopsis angustifolia*	FPO	Endangered	Found in eskers, arable fields and waste places.	July-September
Small-white orchid	*Pseudorchis albida*	FPO	Endangered	Orchid of upland pastures and heaths.	May-July
Yellow archangel	*Lamiastrum galeobdolon subsp. montanum*	None	Vulnerable	Found in hedges and woods. Only in the south-east of Ireland, with an outlying site in Westmeath.	April-July
Corncockle	*Agrostemma githago*	None	Extinct	An annual weed of cereal and other arable crops, tolerant of various soil types.	N/A
Corn chamomile	*Anthemis arvensis*	None	Extinct	An aromatic annual of light calcareous or sandy soils, growing in arable fields, especially cereals; also in leys, field-borders and waste places, and on roadsides and disturbed ground near the sea. I	N/A

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Common Name	Scientific Name	Protection*	Status**	Habitat Preference	Flowering Time
Bog orchid	*Hammarbya paludosa*	FPO	Rare	A pseudobulbous herb of boggy areas where the water is usually acidic but subject to some lateral movement. Typically, it grows amongst saturated Sphagnum, but also on peaty mud and among grasses on the edges of runnels and flushes.	July - September
Shepherd's-needle	*Scandix pecten-veneris*	None	Extinct	An annual of arable fields, particularly on calcareous clay soils; occasionally on paths and banks beside current or former arable sites, and rarely on waste ground, coastal cliffs, and in gardens.	N/A

Notes
* HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora Protection Order; WA = Wildlife Acts; BD I = Birds Directive Annex I.
** Mammal Red-list from Marnell *et al*. 2009. Birds from Birds of Conservation Concern in Ireland (Colhoun & Cummins 2013); vascular flora from the Irish Red Data Book 1 Vascular Plants (Curtis & McGough 2005); Fish and Amphibians from King *et al*. 2011; Non-Marine Molluscs from Byrne et.al. 2009.

In addition to data obtained from the NPWS the BCI provided records of bat roosts within 10km of the proposed Project, with a total of 22 known roosts recorded. According to BCI records the nearest known roost is located approximately 1km from the proposed Project boundary. This comprised a roost of three species including brown long-eared bat, soprano pipistrelle and common pipistrelle. The full list of records provided by BCI is included in Appendix A11.3.

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Table 11.9: Records of Protected, Rare and other Notable Fauna (data from NPWS and BCI)

Common Name	Scientific Name	Protection*	Conservation Status**, ***
White-clawed crayfish	*Austropotamobius pallipes*	WA, HD II	Endangered
Red deer	*Cervus elaphus*	WA	Least Concern
Sika deer	*Cervus nippon*	WA	Not assessed (introduced post 1500)
Hedgehog	*Erinaceus europaeus*	WA	Least Concern
Badger	*Meles meles*	WA	Least Concern
Brook lamprey	*Lampetra planeri*	HD II	Least Concern
Brown long-eared bat	*Plecotus auritus*	WA, HD IV,	Least Concern
Desmoulin's Whorl Snail	*Vertigo moulinsiana*	HD II	Endangered
Common Frog	*Rana temporaria*	WA	Least Concern
Pygmy shrew	*Sorex minutus*	WA	Least Concern
Red squirrel	*Sciurus vulgaris*	WA	Near Threatened
Otter	*Lutra lutra*	HD II/IV, WA	Near Threatened
Irish Hare	*Lepus timidus subsp. hibernicus*	WA	Least Concern
Stoat	*Mustela erminea subsp. hibernica*	WA	Least Concern
Narrow-mouthed whorl snail	*Vertigo angustior*	WA	Vulnerable
Pine marten	*Martes martes*	WA	Least Concern
Smooth newt	*Lissotriton vulgaris*	WA	Least Concern
Common pipistrelle	*Pipistrellus pipistrellus*	WA, HD IV,	Least Concern

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Common Name	Scientific Name	Protection*	Conservation Status**, ***
Soprano pipistrelle	*Pipistrellus pygmaeus*	WA, HD IV,	Least Concern
Leisler	*Nyctalus leisleri*	WA, HD IV,	Near Threatened
Brown long-eared	*Plecotus auritus*	WA, HD IV,	Least Concern
Daubenton's	*Myotis daubentonii*	WA, HD IV,	Least Concern
Black rat	*Rattus rattus*	None	Vulnerable

Notes
* HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora Protection Order; WA = Wildlife Acts; BD I = Birds Directive Annex I.
** Mammal red-list from Marnell *et al*. 2009; bird red-list from *Birds of Conservation Concern in Ireland* (Colhoun and Cummins 2013); red-listed fish and amphibians from King *et al*. 2011; red-listed non-marine molluscs from Byrne et.al. 2009; red-listed dragonflies and damselflies from Nelson *et al*. 2011; red-listed water beetles from Foster *et al*. 2009.
*** IUCN red list http://www.iucnredlist.org/ - accessed December 2016

Likelihood of Occurrence of Protected, Rare and Notable Species

Flora

The majority of flora species listed in Table 11.8 occur in habitats not found within the study area, as determined following habitat surveys. Many of these species are found in upland habitats. All suitable habitats were surveyed for their floristic interest and none of the flora species listed was recorded. Habitat Preferences and distribution data from Parnell & Curtis (2012), Curtis & McGough, Doogue *et al*., 1998, and the online atlas of the British and Irish Flora.

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Fauna (other than Fish)

Based on the habitats present, determined following habitat survey, there was potential for a small number of mammal species from Table 11.9 to occur within the ZoI of the proposed Project. The study area has the potential to support foraging and breeding habitat for badger, stoat, hedgehog, pygmy shrew and bats. Protected amphibians including common frog are likely to occur within the proposed Project boundary and surrounding habitats given suitable waterbodies are present on-site. The potential occurrence of all species is elaborated upon in the field survey results section, and potential impacts and mitigation subsequently addressed as relevant. There was no suitable habitat for red squirrel, smooth newt, marsh fritillary present within the study area.

Rare Flora

A population of rare spiked sedge (*Carex spicata)* was recorded by Roger Goodwillie & Associates within the site (northern end of the site) in September 2011 but its precise location was not provided in the report. The species, which flowers from May to July, was not located in subsequent surveys undertaken by Jacobs in 2016. It is likely that the small population recorded in 2011 is no longer present within the site.

Fish and Water Quality

Water Quality

Full details of the baseline water quality relevant to the proposed Project are provided in Chapter 13 Water – Hydrology and summarised below.

Water Quality -Aquens Report

Benthic macroinvertebrates are used as they exhibit differential responses to physical and chemical changes in their environment. Some macroinvertebrates are sensitive to pollution while others are tolerant. They can provide a realistic record of the baseline water quality conditions. The 2012 biological Q-rating assessment found that the water quality was good along the Morell River's length with sites achieving scores of Q4 and most achieving Q4-5. In 2015 and 2016 the assessment found that both the Morell River and Rathmore Stream were impacted. The water quality of the Morell River was moderately polluted (Q3) upstream of the landfill and

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improves to slightly polluted (Q3-4) downstream as it flows past Kerdiffstown Landfill which is consistent with the WFD status. However, these assessment shows that there is still no evidence of ecological deterioration or impact from the landfill. These three reports are contained in Appendix A13.3.

Water Quality -EPA Classification

The EPA assesses the water quality of rivers and streams across Ireland using a biological assessment method. The EPA assigns biological river quality (biotic index) ratings from Q5-Q1 to watercourse sections. Q5 denotes a watercourse with high water quality and high community diversity, whereas Q1 denotes very low community diversity and a bad water quality. Table 13.7 provides details of the Q water quality status of the Morell River and the Rathmore Stream for the period 2004-2015 as shown in the EPA Envision Mapper (EPA 2017). Information pertaining to the EPA monitoring station locations and current status can be found in Table 13.8 in Chapter 13 Water – Hydrology.

Fish

The Morell River provides spawning habitat for lamprey and a key population of Atlantic salmon in addition to supporting significant populations of brown trout. The River Liffey and several of its tributaries (including the Morell River) are exceptional in the area in supporting Atlantic salmon and sea trout, in addition to resident brown trout populations (IFI scoping response, 2016). River habitat in the vicinity of a new surface water outfall to be constructed to permit surface water discharge from the proposed Project (constructed in Remediation Phase; commissioned in Operational Phase) was described by Aquens Ltd. as mainly gravel and sand with some cobbles. Such habitat may have the potential to support spawning lamprey and/or Atlantic salmon. Immediately upstream of the proposed surface water outfall location (loosely corresponds to survey locations M2 and M3 in Aquens Ltd. report) the river bank has been heavily modified and has existing rock armour. A site walkover by Jacobs was undertaken in December 2016 at the location of the proposed surface water outfall (see Photo 11.5 and 11.6 in Appendix A11.4) found that there was little silty substrate in the vicinity of the proposed works and therefore low potential for juvenile lamprey to be present. Furthermore, the river bed in the vicinity of the proposed works is considered sub-optimal spawning habitat for fish due to the dominance of sandy substrates.

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Invertebrates (Aquatic)

No formal surveys were undertaken for white-clawed crayfish (*Austropotamobius pallipes*) within the Morell River. However, incidental records of this species have been recorded during surveys undertaken by Aquens Ltd. In 2016 this species was recorded at sampling location M5 and M6 (see Aquens Ltd. Report, Appendix A13.3) downstream of the study area, in 2015 they were recorded at location M4 again downstream of the study area and in 2012 they were recorded at locations M1 and H1 upstream of the study area. M1 and H1 are in close proximity to the proposed surface water outfall location. For the purposes of the assessment this species is presumed to be present upstream and downstream of the study area and potentially within the footprint of the proposed surface water outfall location. Therefore, appropriate mitigation will be put in place to avoid impacts on this species.

11.3.3 Field Survey Results

Habitat descriptions below are in the past tense, to reflect their accuracy at a point in the recent past (i.e. September 2015).

Habitats and Flora

Habitats within the study generally comprised the following: dry meadows and grassy verges (GS2) and scrub (WS1). The proposed Project boundary was dominated by treelines (WL2), scrub and occasional hedgerow (WL1). Mixed broadleaved woodland (WD1) was limited in extent. Other habitats comprised earth banks (BL2), buildings (the majority now demolished) and artificial surfaces (BL3) and wetland habitats, including artificial lakes and ponds (FL8) and drainage ditches (FW4), were also recorded. A habitat map is presented in Figure 11.4. A full flora species list by habitat is provided in Appendix A11.5.

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Other Artificial Lakes and Ponds (FL8)

There is one artificial waterbody on-site, comprising a surface water lagoon in Zone 4 and several temporary water features. At the time of survey, the lined cell was partially infilled with leachate present on the open gravel area. Subsequently, infilling to the cell has taken place using waste that had been located within the buildings that have now been demolished and new temporary capping system applied hence the open gravel area (and presence of leachate) is no longer visible. The surface lagoon and cell were both predominately devoid of vegetation. A third much smaller temporary feature which appeared to be fed by a pipe was also recorded within the south-west of the site at the base of a scrubbed over earth mound. This temporary pond supported denser vegetation including bulrush (*Typha latifolia*), water-starwort (*Callitriche sp.*) and marsh foxtail (*Alopecurus geniculatus*). Finally, a small number of temporary features were noted throughout the season while conducting various surveys. This included a drainage ditch between the lined cell and the surface water lagoon and a wheel rut that was filled with water at the time of conducting surveys for frog spawn.

Drainage Ditches (FW4)

A single gravel bedded swale was recorded running approximately east to west along the base of the lined cell just west of the surface water lagoon. This swale appeared to link up the surface water lagoon and the lined cell, taking runoff from the temporary capped area of the cell to the lagoon. The swale was dry at the time of survey and was devoid of vegetation save for a small patch of filamentous algae.

Rivers (FW2)

The Morell River channel has an artificially straightened planform throughout its length, with likely modifications to account for surrounding land uses and drainage requirements. Within the study area, there are lengths of bank reinforcement with a modified channel cross-section. The bed consists primarily of cobbles and gravels. Immediately adjacent to the site the river is rather narrow (3.9-4.9m) with a relatively shallow bed and fast flowing water. In-stream vegetation was limited at this point and the river bed comprised mainly gravel. There is evidence that the river bank has been modified where rock armour has replaced the natural bank over a length of approximately 45m, presumably to protect the foundations of the adjacent private access road to Kerdiffstown House. The new proposed surface water outfall from the site to the Morell River will be located immediately downstream of this rock armour protection zone.

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Improved Agricultural Grassland (GA1)

This habitat type was recorded to the south-east of the study area just outside of the site boundary. Dominant species included those indicative of heavily improved grasslands such as perennial rye-grass (*Lolium perenne*), clover (*Trifolium sp.*) and Yorkshire-fog (*Holcus lanatus*).

Dry Meadows and Grassy Verges (GS2)

This habitat type dominated the north of the study area and was mainly associated with a large raised vegetated area, termed Zone 1 (refer to Figure 3.2). It formed a mosaic with areas of scrub and tall ruderal vegetation. Two smaller areas were recorded along a relatively steep bank bordering the north-eastern site boundary. A range of species were recorded within the sward (an expanse of short grass) including grasses such as cock's-foot (*Dactylis glomerata*), common bent (*Agrostis capillaris)*, false oat-grass (*Arrhenatherum elatius)*, perennial rye-grass and timothy (*Phleum pratense*). Herbs within the sward comprised creeping buttercup (*Ranunculus repens*), creeping cinquefoil (*Potentilla reptans*), creeping thistle (*Cirsium arvense*) and dove's-foot crane's-bill (*Geranium molle*). This grassland typed for the most part supported a relatively rank overgrow sward with a shorter sward in areas that were heavily grazed by rabbit. A single stand of the invasive species Japanese knotweed (*Fallopia japonica*) was recorded within this habitat type in the north-east of the study area bordering the access track. This stand has subsequently been treated.

Wet Grassland (GS4)

Small stands of wetter / inundated areas of grassland which were too small to map were occasionally noted within the GS2 habitat above, here species such as hard rush (*Juncus inflexus*) and pendulous sedge (*Carex pendula*) were abundant. A small area of wet grassland was recorded in the north-west corner of the study area at the base of a relatively steep scrubby bank. Hard rush dominated here. Frequent species included broad-

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leaved willowherb (*Epilobium montanum*), creeping bent (*Agrostis stolonifera*), cut-leaved crane's-bill (*Geranium dissectum*), red fescue (*Festuca rubra*), silverweed, Yorkshire-fog and the moss *Pseudoscleropodium purum*.

Scrub (WS1)

This was the most frequently recorded semi-natural habitat within the study area, dominating in both the north and south extents. The dominant species comprised butterfly-bush (*Buddleja davidii*) and bramble (*Rubus fruticosus agg*). Frequent species included dogwood (*Cornus sanguinea*) and wild raspberry (*Rubus idaeus*). A relatively diverse assemblage of rose species was also recorded in the north of the study area including field rose (*Rosa arvensis*), Japanese rose (*Rosa rugosa*), Sherard's downy-rose (*Rosa sherardii*) and dog-rose (*Rosa canina*). Boundary scrub was dominated by blackthorn (*Prunus spinosa*), elder (*Sambucus nigra)* and hawthorn (*Crataegus monogyna)*,

Hedgerow (WL1) and Treelines (WL2)

These habitat types occurred where scrub habitats graded into hedgerows and treelines around the periphery of the site. Treelines were dominated by ash (*Fraxinus excelsior)* and beech (*Fagus sylvatica*). Hedgerows were limited on site mainly providing screening for adjacent properties and were generally species poor, dominated by beech and Leyland (cypress *x Cupressocyparis lylandii*).

Mixed Broadleaved Woodland (WD1)

This habitat type was rare within the study area. A small copse was recorded in the south-east corner. The woodland canopy was relatively closed, to 20m high, and was dominated by beech and oak. The understory was open with occasional stands of hawthorn and elder while the field layer was dominated by common nettle (*Urtica dioica*) with frequent dock (*Rumex sanguineus*), hogweed (*Heracleum sphondylium*), garlic mustard (*Alliaria petiolate)* and occasional wood avens (*Geum urbanum*).

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Scattered Trees and Parkland (WD5)

Two mature oak trees were recorded within the improved grassland field to the east of the study area just outside of the site boundary.

Spoil and Bare Ground (ED3) and Recolonising Bare Ground (ED2)

The habitats were predominantly associated with access tracks, hardstanding and / or areas of recently cleared vegetation. Species were those usually associated with disturbed ground, comprising chickweed (*Stellaria media*), common poppy (*Papaver rhoeas*), fat-hen (*Chenopodium album*), giant viper's-bugloss (*Echium pininana*) and nipplewort (*Lapsana communis*). A number of non-native, garden escapees were also recorded including garden dahlia (*Dahlia pinnata*), apple-of-Peru (*Nicandra physalodes*), caper spurge *(Euphorbia lathyris*) and Bilbao fleabane (*Conyza floribunda*).

Earth Banks (BL2)

This habitat type was recorded in the north-west corner of the study area at the base of a relatively steep scrubby bank. A large mammal hole was recorded within this steep sandy bank.

Buildings and Artificial Surfaces (BL3)

Buildings and associated hardstanding were mainly concentrated in the centre of the study area. The majority of the structures and buildings on-site were no longer in use, in a poor state of disrepair and were demolished by the end of 2016.

Invasive Species

The invasive species Japanese knotweed was previously recorded within the site. This was successfully treated by Greentown Environmental Ltd working on behalf of KCC. The company issued a letter to KCC on the 5 June 2016 which stated:

"Kerdiffstown Landfill was treated in 2013 – 2014 and we monitored the re-growth in 2015 and again on Monday the 25/05/16 and can confirm that we have witnessed two consecutive years with no re-growth and

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therefore can confirm that all the identified sites have been eradicated and study area is currently free from Japanese Knotweed".

It should be noted that Japanese knotweed was also recorded within Kerdiffstown House lands, to the north and outwith the site boundary (refer to Figure 11.4).

Protected Fauna (other than bats)

Table 11.9 lists the fauna recorded within 10km of the proposed Project boundary as provided by the NPWS research branch. This includes details on the protection afforded to these species. Figure 11.1 includes signs of fauna recorded within the study area.

Otter and Badger

No evidence of otter was recorded within the study area. The section of the Morell River which falls within the study area surveyed did not provide suitable habitat for otter resting or breeding sites.

Badger were recorded during the surveys. Due to the high level of persecution of badger and legal protection afforded to this species, information pertaining to the location of setts is treated as confidential. For this reason, detailed information on the location of badger setts including figures identifying sett locations are not provided in this Chapter. This information is contained within a separate confidential report which has been provided to NPWS. NPWS have confirmed this approach in writing. The assessment of impacts of the proposed Project on Badger is presented in this Chapter.

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Pygmy shrew, Hedgehog and Stoat

All three species have been recorded within 10km of the study area based on desktop data provided by the NPWS research branch. No visual sightings were recorded of pygmy shrew, hedgehog or stoat during surveys; this is not unusual however as sightings of these species are rare. The site supports suitable habitat for pygmy shrew which is often found in long grass in dense vegetation (including damp conditions), under rocks or logs, wherever adequate insect food supplies exist (habitat preference from Haydyn & Harrington 2001). There is also suitable nesting habitat for hedgehog (typically hedges or scrub in particular where these habitats border woodland) within the site. Such habitats were mainly recorded along the boundary of the site or immediately adjacent to it. Stoat dens are predominantly associated with woodland habitats which are limited in extent within the site.

Protected Fauna (Bats)

Buildings and trees with potential roost features (PRFs) are shown in Figure 11.1 and bat survey locations shown in Figure 11.2. Full survey results are provided in Appendix A11.6. The study area supports optimal habitat for roosting bats (within trees and buildings) and foraging and commuting bats (particularly associated with treelines along the proposed Project boundary, and woodland (immediately adjacent to the site). At least four species of bat have been recorded on-site:

- Common pipistrelle;
- Soprano pipistrelle;
- Leisler; and
- *Myotis spp.* (likely to be Natter's *Myotis nattereri* or Daubenton's *Myotis daubentonii*)

Assessment of Bat Roost Potential

Features assessed for their PRFs are shown in Figure 11.1. The assessment of PRFs for buildings and trees is summarised in Table 11.10 below. Assessments were based on external surveys undertaken from the ground using binoculars. No internal inspections of buildings or climbing of trees was undertaken. At the time of the surveys buildings were not structurally sound and therefore could not be accessed to be surveyed internally, while a climbing assessment was not deemed necessary to inform the assessment, hence dusk and dawn

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emergence surveys were conducted. Photos of suitable features are included in Appendix A11.4 (see Photos 11.1 -11.4).

Table 11.10: Assessment of Buildings and Trees with PRF

Feature reference (refer to Figures 11.1 and 11.2)	Type	PRF Classification	Detailed Inspection findings
Point A	Building	High	Numerous crevices in brick work on south-east face of building above door and under metal clad roof. North-east face of building with dense ivy cover.
Point B	Tree (mature ash) on high steep bank	High	Large wound on main trunk (SW facing, approx. 8m up) which appeared to extend back into large cavity.
Point C	Trees along north / north-western boundary	Moderate	Number of semi-mature / mature trees along boundary with dense ivy cover.
Point D	Tree (mature ash)	High	Large wound on main trunk (S facing, approx. 5m up) which appeared to extend back into large cavity. Only one dusk emergence survey was completed at this location.
Point E	Mature oak in field SE of the proposed Project (site boundary)	High	Numerous suitable features including wounds (which appear to extend back into a cavity. Split and lose bark. No dusk/dawn emergence surveys undertaken (not considered necessary given proposals, tree to be retained, no new lighting in this area).
Point F	Mature beech trees in Kerdiffstown House woodland.	High	A number of large mature beech trees within woodland at Kerdiffstown House.

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Roost Surveys

The location of roost surveys, static monitoring points and confirmed roosts are shown on Figure 11.2. A summary of the surveys undertaken at each PRF is provided in Table 11.11.

Table 11.11: Bat Roost Survey Methods by Feature

Feature (map reference)	Roost Survey		Anabat Static Monitoring	Confirmed Roost
	Dusk Emergence	Dawn Re-entry		
Point A	Yes	Yes	No	No
Point B	Yes	Yes	No	Yes
Point C	Yes	Yes	No	No
Point D	Yes (1 survey, no predicted impacts)	No	No	No
Point E	No (no impacts predicted)	No (no impacts predicted)	No	No
Point F	No	No	Yes	Potential roost within woodland
Point G	No	No	Yes	No

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Anabat Static Monitoring Summary – Indicative Relative Abundance

Static monitoring locations are provided in Figure 11.2. Static monitoring was undertaken within the woodland south of Kerdiffstown House (Point F, Figure 11.2) and in the south of the site next to the building scheduled for removal (Point G, Figure 11.2). As shown in Table 11.12 below, the mean number of 'sound files' or 'passes' recorded for each bat species at each location in July (one week) has been used to provide a comparable measure of 'relative' abundance between species and locations. Detailed findings are provided in Appendix A11.6.

Table 11.12: Summary of Bat Activity by Location

Anabat Location	Mean number of sound files per species					Total Number of Species
	Common Pip (Pip 45)	Soprano Pipi (Pip 55)	Leisler	Pip Social Call (PipSoc.)	Myotis Sp.	
Point F	27	15	89	2	125	4
Point G	21	23	103	1	1	4

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Confirmed Bat Roost

No roosts were identified in the building (Point A, Figure 11.2) this building has subsequently been demolished. A single bat roost was identified within a mature ash tree in the north of the study area (Point B, Figure 11.2). Leisler bats were recorded emerging on the third survey undertaken of this tree. A further dawn survey (fourth survey) was undertaken the following morning to confirm the number of bats present (bats are easier to count when swarming). Bats were recorded emerging on the 18 July, the first bat emerging at 21:56 (14 minutes after sunset) with the final bat emerging at 22:18. In total 10 bats were recorded emerging from the roost. The following morning, the 19 July, bats were observed swarming around the tree at 04:48 (32 minutes before sunrise) and the last bat entered the tree roost at 05:08 (16 minutes before sunrise). Given the time of year and number of bats recorded this is likely to be a maternity roost. Plate 11.1 below shows the sonogram (call) of the Leisler's bat at 22kHz recorded at the confirmed roost.

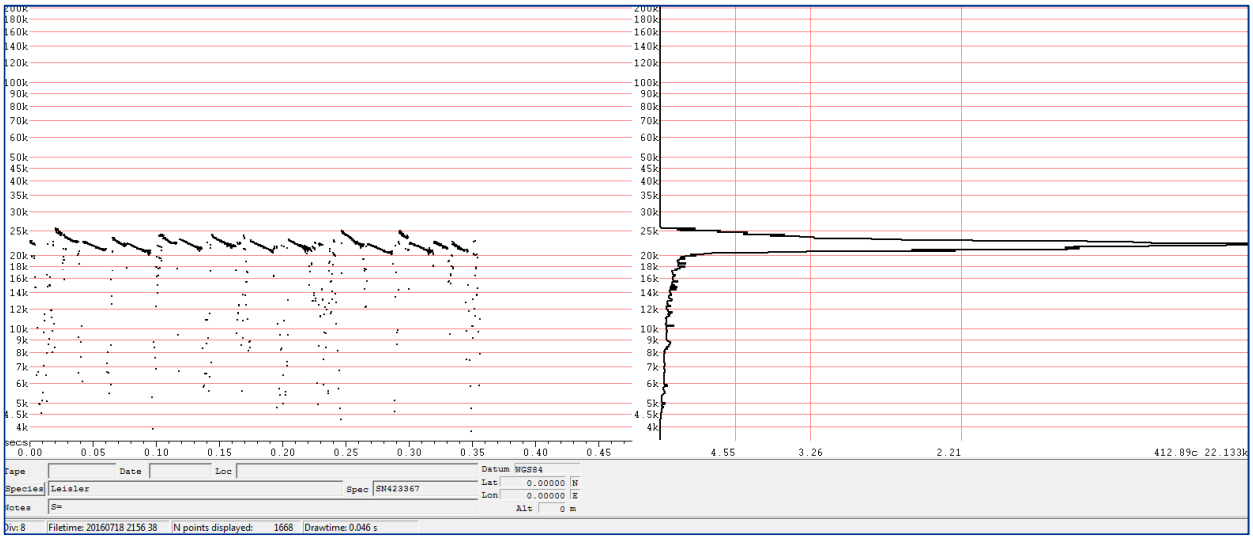


Plate 11.1: **Sonogram of Lesiler's bat emerging from tree roost at 21:56 on 18 July**

While conducting additional surveys of trees in this area it was noted that Leisler were recorded soon after sunset on a number of the surveys indicating another potential roost nearby. An additional tree (Point D, Figure

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11.2) had PRFs, however, no bats were observed emerging from this tree during a single dusk emergence survey. Leisler bats are known to move frequently between roosts as highlighted by the BCT publication on Leisler's Bat www.bats.org.uk/publications_download.php/218/leislers.pdf (accessed September 2016). It is likely that both trees (Point B and Point D) are utilised by this species.

Bat Activity (Roost Surveys)

Bat activity was relatively constant throughout the dusk and dawn emergence / re-entry surveys. Leisler's, common pipistrelle and soprano pipistrelle were the most frequently recorded species, with a few *Myotis spp.* passes recorded during these surveys. Bat activity was more frequent throughout the surveys undertaken in July in comparison to June, with almost constant activity recorded throughout the roost surveys in July. Furthermore, activity was recorded during roost surveys undertaken of the trees in the north of the study area in comparison to surveys in the south. This is likely a reflection of better foraging habitat in the north, where there are more mature trees, scrub and where habitats are not lit. There was some limited light spill on the existing building from lighting associated with the main entrance. The south of the site has existing lighting associated with security huts. The first and last bat passes in the vicinity of the building occurred 30 minutes after sunset or over 30 minutes before sunrise indicating that there are no roosts within or in the vicinity of the building. In contrast the first bat passes in the north of the site were recorded between 10-15 minutes after sunset indicating potential for further roosts nearby.

Bat Activity (Static Monitoring Surveys)

In July static recorders were left in place for up to one week within the woodland of Kerdiffstown House (Point F, Figure 11.2) and next to the building in the south of the site (Point G, Figure 11.2). Bat activity was recorded every night at both locations.

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Within the woodland of Kerdiffstown House only two species were recorded, including a small number of soprano pipistrelle passes and frequent *Myotis spp.* (likely Daubenton's and / or Natterer's). On all nights *Myotis spp.* were not recorded until approximately 40 minutes after sunset and the last pass for this species was generally up to an hour before sunrise indicating that this / these species are unlikely to be roosting within the woodland or very close by, instead likely to be using the woodland only to forage. On two nights soprano pipistrelle was first recorded 18 minutes after sunset and the last pass for this species was recorded at sunrise, indicating a potential roost (likely transitional) for this species within the woodland.

In contrast no *Myotis spp.* were recorded around the building (Point G, Figure 11.2). Frequently recorded species included Leisler's and pipistrelle bats (common and soprano pipistrelle). Leisler bats were generally recorded quite soon after sunset at this location. However, they are known to roost nearby elsewhere on the site and are not considered to be roosting in the building. Bat activity generally ceased in this area up to one hour before sunrise again indicating no roost in the immediate vicinity.

Myotis spp. were infrequently recorded within the proposed Project boundary (recorded during dusk/dawn surveys in the north of the site) but were more active within Kerdiffstown House woodland adjacent to the site. *Myotis spp*. such as Daubenton's and Natterers are less likely to forage in lit areas, while Natterers tend to forage within woodland habitats rather than more open areas (such as those provided within the site boundary). Plate 11.2 below shows the sonogram (call) of *Myotis spp*. recorded from within the woodland of Kerdiffstown House. The higher number of *Myotis spp.* passes within the woodland is likely to be a result of the darker more sheltered conditions provided within the woodland. Conversely Leisler's and pipistrelle bats are less sensitive to light and will forage in lit areas, which reflects the assemblage of species recorded around the building.

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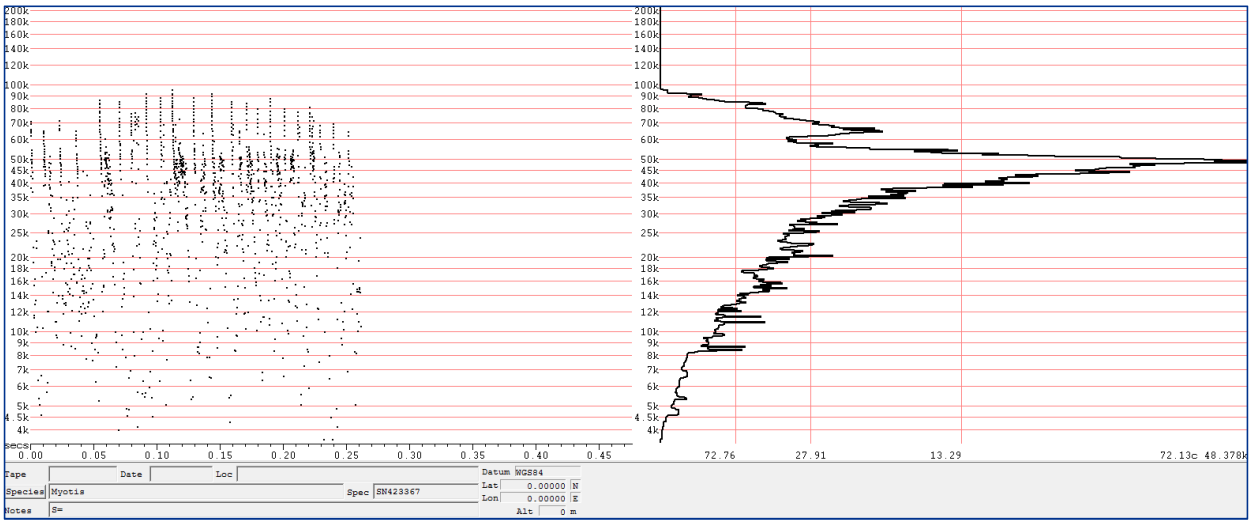


Plate 11.2: Sonogram of a Myotis spp. recorded in woodland to the south of Kerdiffstown House

Breeding Birds

A total of 38 species were recorded during the breeding bird surveys. The full list of species recorded within the study area during the surveys is provided in Appendix A11.7. All species were considered to be confirmed or probable breeders. Breeding territories were typically associated with hedgerow, grassland, woodland or scrub habitats within the study area.

A meadow pipit (*Anthus pratensis*) adult, a red-listed species, was observed carrying food and flying with young indicating a nest nearby. Grey wagtails (*Motacilla cinerea*) were observed, including juveniles, indicating breeding pairs of this red-listed species. Yellowhammers (*Emberiza citronella)* were recorded singing on the second visit, though no evidence of breeding was found, however it is probable this species is breeding within or adjacent to the site, this species is known to nest on the ground below hedgerows or shrubs.

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Various amber listed species were also recorded including swallows (*Hirundo rustica)* with numerous juveniles, these are likely nesting nearby; and robin (*Erithacus rubecula*) feeding young. Long-eared owl (*Asio otus*) was noted foraging on-site by one of the surveyors while they were undertaking a bat survey. This species is highly unlikely to breed on-site given the lack of suitable habitat (usually breeds in stands of conifer). However, the site does provide a suitable foraging habitat for this species.

Sand martins (*Riparia riparia)* were previously observed nesting in a large sand bank in the south-east of the site (SKM Enviros 2013). Sand martins were not recorded on-site during either of the breeding bird surveys undertaken in 2016. The sand banks around the site are unstable and have collapsed in parts, and in particular where the sand martins were previously recorded in 2013. It is likely that the sand banks currently offer limited suitable nesting opportunities for this species.

The territories of probable / confirmed breeding birds of Medium (Green/Amber) or High (Red) Conservation within 50m of the proposed Project are illustrated in Figure 11.5 and summarised in Table 11.13.

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Table 11.13: Probable/Confirmed Breeders of Medium or High Conservation Concern

Common Name	Scientific Name	Status	Conservation Status
Goldcrest	*Regulus regulus*	Probable	Amber
Greenfinch	*Carduelis chloris*	Probable	Amber
Grey wagtail	*Motacilla cinerea*	Confirmed	Red
Kestrel	*Falco tinnunculus*	Probable	Amber
Linnet	*Carduelis cannabina*	Probable	Amber
Meadow pipit	*Anthus pratensis*	Confirmed	Red
Robin	*Erithacus rubecula*	Probable	Amber
Skylark	*Alauda arvensis*	Probable	Amber
Sparrowhawk	*Accipiter nisus*	Probable	Amber
Starling	*Sturnus vulgaris*	Probable	Amber
Swallow	*Hirundo rustica*	Probable	Amber
Yellowhammer	*Emberiza citrinella*	Probable	Red

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Amphibians and Reptiles

There was no suitable habitat for protected smooth newt within the study area. Although the site provides suitable foraging and basking habitat for common lizard there are no records of this species within 10km of the proposed Project. However, this species is likely to be under recorded. No surveys were undertaken for this species, instead it is presumed to be present in low numbers. Frog spawn was recorded in two locations within the study area (refer to Figure 11.1). Three clumps were recorded within the lagoon to the south and an additional clump recorded in a water filled wheel rut in the north of the study area. An incidental record of an adult frog was recorded by Jacobs's staff working at the project offices on-site in February 2016.

Invertebrates (Aquatic)

As noted in Section 11.3.2 white-clawed crayfish were recorded as present within the Morell River by Aquens Ltd. in 2012, 2015 and 2016. The section of the Morell River in the vicinity of the site supports suitable habitat for this species. Although the river bed around the proposed surface water outfall from the site is mainly gravel and sand, which provides sub-optimal habitat for this species, potential refuges are provided in the form of river substrate cobbles and crevices within rocky banks.

11.3.4 Ecological Valuation and Identification of Key Ecological Receptors

Table 11.14 summarises the ecological evaluation, taking into consideration legal protection, conservation status and local abundance. KER's are identified in grey in Table 11.14. European sites are also listed in Table 11.14 below and were also assessed separately in the Appropriate Assessment Screening Statement (Jacobs, 2017) provided in Appendix A11.10.

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Table 11.14: Summary of Valuation of Key Ecological Receptors

Ecological Feature Type	European protection	Ecological Importance as per NRA, 2009	Key Ecological Receptor (s)? *
Designated Sites			
Red Bog, Kildare cSAC (000397)	Yes	International	Yes
Ballynafagh Bog cSAC (000391)	Yes	International	Yes
Poulaphouca Reservoir SPA (004063)	Yes	International	Yes
Wicklow mountains SPA (004040)	Yes	International	Yes
Other Designated Sites	No	National	Yes
Habitats			
GS2 Dry meadows and grassy verges	No	Local (Higher value)	Yes
GS4 Wet grassland	No	Local (Higher value)	Yes
GA1 Improved agricultural grassland	No	Local (Lower value)	No
WD1 Mixed broadleaved woodland	No	Local (Higher value)	No - because remediation of the site will not result in the loss of this habitat type.
WS1 Scrub	No	Local (Higher value)	Yes
WL2 Treeline	No	Local (Higher value)	Yes
WL1 Hedgerow	No	Local (Lower value)	No – because this habitat type is limited on site and where present is species poor. Although this habitat may provide some limited nesting opportunities for birds there is an abundance of other suitable nesting habitat on site, considered to be of higher value (Scrub/Treelines). Hedgerows on site are sparse and gappy providing sub-optimal commuting habitat for bats. Furthermore, the majority of existing hedgerows will be retained.
ED3 Recolonising bare ground	No	Local (Lower value)	No
ED2 Spoil and bare ground	No	Local (Lower value)	No
FW4 Drainage ditches	No	Local (Lower value)	No
FW2 Rivers	No	County Value	Yes
FL8 Other artificial lakes and ponds	No	Local (Lower value)	No
BL2 Earth banks	No	Local (Lower value)	No
BL3 Buildings and artificial surfaces	No	Local (Lower value)	No
Rare/Notable Flora Species			
Spiked sedge	No	County	No – no longer present on site (confirmed by habitat surveys)

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Ecological Feature Type	European protection	Ecological Importance as per NRA, 2009	Key Ecological Receptor (s)? *
Species			
Badger (setts)	No	Local (Higher value)	Yes
Badger (foraging habitat)	No	Local (Higher value)	Yes
Other mammals presumed present (hedgehog, pygmy shrew)	No	Local (Higher value)	Yes
Bats (roosting)	Yes	Local (County value)	Yes
Bats (foraging/commuting)	Yes	Local (Higher value)	Yes
Breeding Birds of Conservation Concern	No	Local (Higher value)	Yes
Common lizard (presumed present)	No	Local (Higher value)	Yes
Common Frog	No	Local (Higher value)	Yes
White-clawed crayfish	Not outside SAC	Local (County value)	Yes
Fish (lamprey and salmonids)	Not outside SAC	Local (County value)	Yes
Smooth newt	No	Local (Higher value)	No – not within ZoI
Invertebrates (terrestrial)	Not outside SAC	Local (Lower value)	No
Otter	Yes	Local (Higher value)	No – not within ZoI
Invasive species	N/A	N/A	Treatment completed in 2014 (Refer to Section 11.3.3 Field Survey Results)

* Note: KERs highlighted in grey

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11.3.5 Ecological Features Scoped out from the Assessment

In accordance with best practice guidance (NRA 2009 and CIEEM 2016): recolonised bare ground; spoil and bare ground; drainage ditches; buildings; other artificial lakes; ponds; hedgerows and earth banks were scoped out from the impact assessment, as they were assessed as being of Local (Lower value). Receptors are generally valued at Local (Lower value) because they are considered widespread, unthreatened, resilient or of little ecological importance. Spiked sedge which was previously recorded on-site in 2011 could not be located during surveys undertaken in 2015 / 2016 and is presumed to no longer be present on-site; it has therefore been scoped out from further assessment. Invasive Japanese knotweed present within the site boundary was successfully treated and is also scoped out from the impact assessment. However, this species is still present in neighbouring land where appointed contractors may be required to access therefore measures to avoid the spread of invasive species are discussed further in Section 11.5.

Smooth newt and otter were scoped out from the impact assessment as habitats within the study area are not considered suitable to support these species or surveys indicated that they were not present. These species are not considered to be within the ZoI and have therefore been scoped out. Finally, the study area is not considered to support significant number of or notable terrestrial invertebrates, therefore these have also been scoped out of the assessment.

11.4 Predicted Impacts of the Proposed Project

The remediation of the site and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately 4 years of intensive construction works to remediate the site. Potential impacts associated with remediation include but are not limited to:

- **Direct habitat loss** - vegetation removal associated with land-take particularly areas of grassland and scrub.

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- **Severance** - i.e. fragmentation of habitat, prevention of animal and seed dispersal and discontinuity of habitat or loss of foraging habitat.
- **Mortality** – of protected species associated with vegetation removal and construction activities.
- **Disturbance** – associated with works in the vicinity of retained habitats, for example impacting tree roots or hydrology or which provide shelter for protected species.
- **Contamination** –such as hydrological impacts associated with accidental pollution events, spillages.

The predicted impacts on KERs during the Remediation Phase in the absence of mitigation are provided below.

11.4.1 Remediation Phase

Potential Impacts to European and National Designated Sites

Having identified a preliminary list of sites in Section 11.3.2, the source-pathway-receptor conceptual model was applied, given the characteristics of the proposed Project, to identify which sites, and specific features within sites, should be scoped into the impact assessment. These are identified in Table 11.15 below.

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Table 11.15: Identification of Designated Site Potentially Affected

Site and Code	Distance from Proposed Project (km)	Qualifying Interests (cSACs/SPAs) or Reason for Designation (pNHAs) (* = Priority Habitat)	Potential Source-~Pathway-Receptor Link?	Scoped into Assessment? *
Red Bog, Kildare SAC (000397)	7.5	Transition mires and quaking bogs [7140]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
Ballynafagh Bog SAC (000391)	10	Active raised bogs [7110]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
		Depressions on peat substrates of the *Rhynchosporion* [7150]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
		Degraded raised bogs still capable of natural regeneration [7120]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
Poulaphouca Reservoir SPA (004063)	10	Greylag Goose Lesser black-backed gull	No - desktop and field survey indicates no populations within ZoI of disturbance or other potential impacts. Furthermore, likely to be well outside core foraging range for greylag goose which is up to 12km from designated roosts/feeding sites**. Gulls have a large foraging range up to 40km. However, this species was not recorded within the study area.	No
Wicklow mountains SPA (004040)	16.5	Merlin Peregrine	No - desktop and field survey indicates no populations within ZoI of disturbance or other potential impacts. Nests within 500m of effect could be subject to disturbance***.	No
Grand Canal pNHA	2	Various flora and fauna of conservation interest. The Grand Canal feeder also represents an important ecological resource. The canal supports significant populations of coarse fish a range of other freshwater aquatic species, plus all associated floral and faunal components in adjacent habitats.	**Yes – pollution.** There is a direct hydrological link from the proposed Project to the Grand Canal pNHA. The Canal Feeder Stream (WB004) is an engineered feature that collects surface water runoff from lands generally to the south and south-west of the site. The Canal Feeder Stream flows generally westward to the Grand Canal pNHA which is located approximately 2km west of the site providing a direct hydrological link with the proposed Project.	**Yes**
Liffey at Osberstown pNHA	4	The site was surveyed in 1976 and comprised a scrubby steep 10m bank. The main plant of interest was black willow (*Salix nigricans)*. By 1983 the site had been cleared of woodland and no black willow was found.	**No.** No potential source-pathway-receptor links identified.	No

Notes
* Sites potentially impacted are highlighted in grey
** See reference list, Bell (1988).
*** . Nests are not mobile, but birds can perceive disturbance at significant distances to pose a threat. Distance is likely critical reaction distance based on Whitfield et al. (2008).

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European Designated Sites

As outlined in Table 11.15 above there are no potential source-pathway-receptor links between the proposed Project and any European designated sites. There is no potential for the proposed Project to impact on QI species or habitats. There will be no impacts on European designated sites.

National Designated Sites

The Grand Canal pNHA (2104) is located approximately 550m north of the proposed Project. Given the distance of the pNHA from the study area there is no potential for habitat loss within the designated site associated with the proposed Project. However, as discussed in Table 11.15 above there is a direct hydrological link between the proposed Project and the Grand Canal. Therefore, potential pollution impacts during remediation associated with an accidental pollution event cannot be ruled out, however unlikely. In the absence of mitigation, a pollution event during the Remediation Phase has the potential to impact on aquatic species within the canal. However, given the distance of the pNHA from the proposed Project footprint impacts are likely to be localised, temporary and significant at the Local geographic scale only.

Potential Impacts to Habitats and Flora

Habitats

To facilitate remediation including capping of the entire site (area defined by the waste profile), excluding a small number of mature boundary trees in the north-east of the site and a section of hedgerow along the site entrance approach it is certain that the existing habitats within the study area will be removed. The habitats identified as KERs that will be directly impacted are listed in Table 11.16. Remediation works are planned to be undertaken in eight phases, subject to a number of aspects such as procurement approach, availability of suitable materials and programme constraints (ecology and weather). Although the majority of habitats on-site will be lost eventually, removal of habitats will be undertaken on a phased basis. The following areas of habitats valued as being of Local Importance (higher value) will be lost during construction: approximately 3.3ha of dry meadow grassland (GS2); approximately 10.3ha of scrub (WS1), approximately 300m of treelines (WL2) and 0.13ha of wet grassland (GS4). The loss of habitats identified as KERs is considered a temporary significant reversible impact at the Local geographic scale.

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The area of instream habitat loss will be minimal where construction of the new surface water outfall from the site is required. A small area of the river bed (approx. 0.0004ha) will be dewatered to facilitate works during remediation. The river bed present in the location of the proposed works footprint (surface water outfall location) has the potential to provide suitable lamprey or salmonid spawning habitat. There is potential for white-clawed crayfish habitat (cobbles / rocky crevices in the bank) at this location. Although rivers have been evaluated at County geographic scale given the abundant ecological resources it supports (e.g. significant fish populations, spawning habitat and notable invertebrates) the loss of habitat will be temporary and covering a very small area therefore habitat loss in the Morell River will constitute a temporary, short-term significant impact at a Local geographic scale.

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Table 11.16: Predicted Habitat Loss from the Proposed Project

Habitat Type	Approximate extent of habitat within footprint (ha)[2]	Approximate loss of habitat during remediation (%)	Ecological Importance of receptor within field survey area	Potential Impact Significance
GS2 Dry meadows and grassy verges	3.28	100	Local (higher value)	Local
GS4 Wet grassland	0.13	100	Local (higher value)	Local
WS1 Scrub	10.32	100	Local (higher value)	Local
WL2 Treeline	0.14	20	Local (higher value)	Local
FW2 Rivers	0.0004	N/A	County	Local

Potential Impacts to Water Quality (Morell River)

Due to the historical use of the site, the exact nature of the existing waste material cannot be fully determined. During the Remediation Phase, there will be some movement of waste to allow for re-profiling of slopes to provide stability pre and post-settlement. There will also be a requirement for the temporary stockpiling of materials, such as crushed concrete and imported fill materials. During incidents of heavy rainfall there is potential for newly uncovered waste to generate leachate which could penetrate ground water sources within the site which are hydrologically linked to the Morell River. Such impacts would likely be intermittent, short-term and significant at the Local geographic scale.

An accidental pollution event during remediation, although unlikely, would result in a near-certain, short-term significant impact at Local to County geographic scale in relation to water quality in receiving waters.

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Potential Impacts to Fauna

In the absence of mitigation there is potential for impacts to a number of KERs including badger, bats, breeding birds, hedgehog (and other small mammals), amphibians, reptiles, white-clawed crayfish and fish during remediation of the site. All other receptors were scoped out (see Section 11.3.5).

Badger

Badger activity was mainly concentrated around the site periphery associated with woodland, grassland and scrub habitats. Woodland habitat, located on the perimeter and outwith the site, will be unaffected during the Remediation Phase. However, remediation works will result in the permanent loss of some scrub and grassland habitats which will reduce the availability of existing foraging resource for badger. However, despite the study area being of Local Importance (higher value) for badger there is an abundance of optimal badger habitat within the immediate wider landscape outside the proposed Project boundary. Impacts on badger foraging resource are considered non-significant.

The study area supports two badger setts. The two potentially affected badger setts are considered to be that of the same group (single territory) given their proximity to each other (within 250m). A national study of badgers and their habitats across Ireland indicated that one badger social group will be found per 2km^2 (Smal 1995).

One main sett will be subject to direct, temporary disturbance as a result of noise and vibration associated with the remediation works. One subsidiary sett will be removed to facilitate remediation of the site. In the absence of mitigation remediation works in close proximity to the setts has the potential to result in sett collapse, badger mortality and/or disturbance. Remediation works will result in the permanent loss of one sett and temporary disturbance to another. The works, although phased, will also result in a short-term, temporary loss of available setting habitat. Impacts on this badger group will be temporary and significant at the Local geographic scale.

[2] Habitat areas based on habitat map provided in Figure 11.4

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Other Mammals (Pygmy shrew, Hedgehog and Stoat)

There are three other mammal species, protected under the *Wildlife Acts*, which are likely to occur within the proposed Project boundary and surrounding habitats, based on the habitat types present and include Irish stoat, hedgehog and pygmy shrew. Site clearance during remediation of the site is unlikely to result in any significant mortality to the larger and more mobile species such as stoat (if present). However, it is probable that vegetation clearance may result in some accidental mortality to the smaller pygmy shrew if present. The potential impact would be anticipated to be greater during the breeding season when juveniles would be present in burrows (April-October), or in the case of hedgehog impacts may be greater during their hibernation period which is November – March (inclusive). Remediation of the site will also result in the permanent loss of available foraging habitat for these species during construction. Impacts on these mammal species will be short-term and significant at the Local geographic scale.

Bats

Bat Roosts

There will be no loss of any known bat roosts during remediation of the site. A single tree roost of high conservation value (Leisler maternity roost) was recorded in a mature ash tree in the north-east of the site, refer to Figure 11.2. There is potential for disturbance to this roost during Remediation Phase from lighting associated with plant or mobile lighting. Lighting has been shown to affect emergence at roost sites and could result in the permanent abandonment of a roost. Lighting impacts would result in a permanent significant impact at the County geographic scale, the level at which this receptor has been valued.

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Bat Foraging and Commuting Habitat

Remediation of the site will predominantly result in temporary loss of grassland and scrub habitats. However, bats tend to commute and forage along linear features such as hedgerows, treelines and woodland edges. The majority of existing mature treelines to the north-east of the site will be retained. Woodland associated with Kerdiffstown House in the wider field survey area will continue to be an available foraging resource. A small number of semi-mature trees will be lost along the north-eastern flank to accommodate a new surface water drainage system. The tree line along this flank has existing gaps and tree loss will be minimal, hence this is unlikely to have a significant impact on bat commuting habitat. However, clearance of grassland and scrub habitats will near certain result in a reduction of available invertebrate prey resource in the short-term. Impacts on bat commuting habitat are considered non-significant while impacts on bat foraging are considered a short-term significant impact at the Local geographic scale.

Light spill over retained habitats including suitable commuting and foraging habitats could result in disturbance to bats. Lighting can alter bats use of a site, the feeding behaviour of bats (either displacing bats or attracting insects away from unlit feeding areas), and can result in a barrier effect to commuting routes to and from feeding / roosting sites (Stone 2013). In relation to noise impacts, a recent study (Luo et al. 2015) has shown that anthropogenic noise, in this case traffic, reduced foraging activity and prey capture in Daubenton's bat. If lighting and noise impacts occur during the Remediation Phase, associated with construction traffic and mobile lighting they would result in a short-term significant impact at the Local geographic scale.

Breeding Birds

Remediation of the site will result in the clearance of an extensive area of suitable bird nesting habitat mainly associated with scrub and grassland habitats. This will result in a reduction in the availability of suitable nesting habitat for several species resulting in a decrease in the number of nesting territories.

Breeding Birds - Birds of Conservation Concern in Ireland (BoCCI) Red List Species

A total of three Red-listed species were recorded within the field survey area, with grey wagtail and meadow pipet confirmed to be breeding on-site. Yellowhammer were recorded to the west of the proposed Project boundary and are likely to be utilising the site for nesting as well as neighbouring agricultural land. Meadow pipet and yellowhammer are known to nest on the ground under dense vegetation. All three species will be negatively impacted by habitat loss and disturbance during remediation of the site. However, these red-listed species are likely to be relatively abundant in the local area in which further additional suitable habitat to support these species is present.

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Clearance of suitable bird nesting habitat in the absence of mitigation would result in the mortality of a potentially large number of birds, particularly those species associated with grassland and scrub habitats. Mortality, disturbance and loss of potential breeding habitat would result in a short-term significant impact on red list species at the Local geographic scale.

BoCCI Amber and Green List Species

All of the amber and green-listed bird species present will be negatively impacted by habitat loss, to both potential and existing nesting habitat and foraging habitat. The majority of species recorded are all common species in agricultural and urban / suburban habitats. Species such as kestrel and sparrowhawk are unlikely to be nesting in the habitats to be cleared as part of the site remediation. However, foraging resources for these species will be reduced.

Clearance of suitable bird nesting habitat in the absence of mitigation would near-certain result in the mortality of green and amber listed birds, particularly those species associated with grassland and scrub habitats. Mortality, disturbance and loss of potential breeding habitat would result in a near-certain short-term significant impact on green list species at the Local geographic scale.

Amphibians and Reptiles

Common frog was the only amphibian species recorded within the site. Frog spawn was recorded in one permanent water body (surface water lagoon) in the south-east of the site. Additional frog spawn was recorded in a temporary water body (wheel rut) in the north-west of the site. Furthermore, an incidental record of an adult frog was recorded within the site. There is potential for this species to be present in suitable habitat across the site at the time of remediation; in particular, any waterbodies or suitable damp habitats (grassland). Remediation will result in the temporary loss of all waterbodies. Clearance of the site including draw down of the ponds will be phased. If this occurs during a period that coincides with the frog breeding season (February to April inclusive) frogs and / or frog spawn could be present resulting in the mortality of this species. Such an impact would be permanent and significant at the Local geographic scale.

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Common lizard has not been recorded on-site. However, parts of the site provide suitable basking and refuge habitat for this species. If present, this species is presumed to be present in low numbers. The clearance of grassland, scrub, rock and log piles during remediation has the potential to disturb or result in mortality of a small number of individuals. The risk of mortality would be reduced in summer months (warmer conditions) when this species is much more mobile. Impacts may be greater in winter months when this species is in hibernation. Clearance of the site associated with remediation works would result in a near-certain, short-term, significant impact at the Local geographic scale.

White-Clawed Crayfish

White-clawed crayfish are known to be present in the Morell River and Rathmore Stream. There is potential for this species to be present within the vicinity of the proposed new surface water outfall location. Construction of the surface water outfall could result in mortality, disturbance or injury of a small number of individuals.

An accidental spillage or pollution event into a surface water feature is likely to have a negative impact on this species. The impact is likely to be temporary and localised but would be dependent on the nature and scale of the pollution event.

This species has been valued at County value, however, impacts on this species if they occurred would likely be localised to the area of the surface water outfall location. Potential impacts on this species during the Remediation Phase including mortality, injury, and disturbance would result in a short-term, significant impact at the Local geographic scale.

Fish (Salmonids and Lamprey)

There is currently no direct hydrological link between the study area and the Morell River. However, the Morell River lies approximately 15m to the east of proposed Project at its closest point. This is a highly sensitive watercourse which supports important lamprey, salmon and brown trout populations. Contaminated surface water runoff and sediments could be washed overland and enter the Morell River during the Remediation Phase. Depending on the volumes and contaminants concerned, potential impacts could be significant at Local to County geographic scales of significance (i.e. the maximum ecological value of Salmonids and Lamprey).

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Construction of the new surface water outfall to the Morell River and the leachate and foul sewer pipelines to be installed via directional drilling techniques under the Morell River in Johnstown could cause disturbance to fish from vibration and drilling. However, this impact would be localised, short-term, and temporary at the Local geographic scale. There is potential suitable spawning habitat for lamprey and salmonids in the vicinity of the proposed surface water outfall location. Construction of the new surface water outfall could result in mortality of a small number of fish or disturbance to spawning habitat through dewatering of the works area. There is no potential for barriers to fish mitigation as a result of construction of the surface water outfall as a continuous flow of water around the working area will be maintained.

Impacts on lamprey and salmonids during the Remediation Phase associated with disturbance, mortality and pollution would result in a short-term significant impact at Local geographic scale. Impacts associated with disturbance to spawning habitat would be temporary, short-term and significant at the Local geographic scale only.

11.4.2 Operational Phase

There are no predicted Operational Phase impacts for European sites, habitats, pygmy shrew, stoat, hedgehog, breeding birds, amphibians and reptiles. For some of these KERs the Operational Phase will have a significant beneficial impact. This is discussed further in Section 11.6 Residual Impacts.

National Designated Sites

There is currently a direct hydrological link between the proposed Project and the Grand Canal pNHA associated with the Canal Feeder Stream that discharges a local surface water catchment area off the site. The connection to the Canal Feeder Stream will be removed during the Remediation Phase and hence will no longer be in use during the Operational Phase. There will be no Operational Phase impacts.

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Potential Impacts to Water Quality (Morell River)

The Operational Phase of the proposed Project will result in a new hydrological link between the proposed Project and the Morell associated with the new surface water outfall. The surface water outfall will discharge from the site into the Morell River. In the absence of mitigation, a pollution event during operation has the potential to impact on water quality. An accidental pollution event during Operational Phase, although unlikely, would near-certain result in a short-term significant impact at Local to County geographic in receiving waters.

Potential Impacts to Fauna

Badger

During the Operational Phase the integrity of the engineered capping system could be undermined if badger were to try and dig a new sett. It is proposed that mammal proof fencing will be installed on the perimeter of the site along the edge of the woodland behind Kerdiffstown House, but within the site boundary. This will be installed throughout the Remediation Phase once the capping is in place and will be maintained during the Operational Phase. This will reduce the total foraging area available to badger. Loss of foraging habitat during Operational Phase will be permanent at the Local geographic scale. However, given that there is an extensive area of suitable foraging habitat available immediately adjacent to the site and the wider landscape impacts associated with loss of foraging habitat are considered non-significant.

Bat Roosts

Potential impacts on the tree roost (Leisler's maternity roost) during Operational Phase would be associated with any new lighting where installed, such as for the multi-use sports pitches, site office and access roundabout. However, impacts are highly unlikely as the new infrastructure is to be constructed in the south of the site away from the confirmed roost. If the tree roost was subject to new lighting impacts this could result in the permanent abandonment of the roost. This would near-certain result in a permanent, significant impact at the County geographic scale, the level at which this receptor has been valued.

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Bat Foraging and Commuting Habitat

Operational Phase impacts on bat foraging and commuting bats would be associated with lighting of retained habitats. The majority of existing mature treelines to the north-east of the site will be retained. Woodland associated with Kerdiffstown House in the wider field survey area will continue to be an available foraging resource. Lighting of retained habitats including suitable commuting and foraging habitat corridors is probable to result in disturbance to bats altering their use of the site. However, impacts are highly unlikely as the new infrastructure is to be constructed in the south of the site away from the retained habitats. If lighting impacts were to occur, it is possible that areas of currently suitable foraging and commuting habitat could be rendered permanently unsuitable for use by some species. For example, species such as common pipistrelle, soprano pipistrelle, and Leisler's bat are less sensitive to light displacement impacts in foraging areas than many other bat species; e.g. *Myotis spp*. (Stone 2013). *Myotis spp.* are known to forage within the woodland immediately adjacent to the site. This area is currently dark and lighting impacts during Operational Phase could render this area unsuitable for these species. In the absence of mitigation impacts on foraging and commuting bats are likely to result in a permanent significant impact at the Local geographic scale.

Fish (Salmonids and Lamprey)

During the Operational Phase there will be a direct hydrological link between the proposed Project and the Morell River through a single new surface water outfall. The new surface water outfall will discharge from the site into the Morell River. In the absence of mitigation, a pollution event during operation has the potential to impact on fish including salmonids and lamprey the impact of which is near-certain to result in a short-term, temporary impact significant at the Local to County geographic scale.

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White-Clawed Crayfish

White-clawed crayfish are known to be present in the Morell River and Rathmore Stream. The Operational Phase of the proposed Project will result in a new hydrological link between the proposed Project and the Morell associated with the surface water new surface water outfall. The surface water outfall will discharge from the site into the Morell River. In the absence of mitigation, a pollution event during operation has the potential to impact on this aquatic species.

This species has been valued at County value, however, a pollution impact if it occurred would likely be localised. Pollution impacts on this species during the Operational Phase would result in a short-term, significant impact at the Local geographic scale.

11.5 Mitigation Measures

There are a number of key mitigation measures that will be undertaken in order to minimise the overall impact of the proposed Project. Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP). The CEMP shall contain these mitigation measures and plans identified in the following sections and ensure that they are fully implemented during the construction phase, to prevent or reduce the impacts identified in the impact assessment.

The CEMP will include a Site Biodiversity Management Plan which will address the following as a minimum:

- Badgers;
- Bat (including the retained Leisler's maternity roost); and
- Habitat including retention of habitats during Remediation Phase and the development of new habitats during the Operational Phase.

All proposed ecological mitigation measures and enhancements for biodiversity are outlined below and detailed in Figure 11.6. A number of the mitigation measures outlined below will need supervision or liaison with a suitably qualified ecologist.

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11.5.1 Remediation Phase

National Designated Sites

The first phase of remediation works will involve the disconnection of the existing hydrological link between the site and the Grand Canal pNHA, via the Canal Feeder Stream. Surface water drainage from the adjacent property REC012 will be realigned and reconnected to the existing outfall to the Canal Feeder Stream outside of the site boundary and the site connection to the Canal Feeder Stream will be removed. This outlet will not be reconnected during the Operational Phase. Surface water will be retained on site during the Remediation Phase. Therefore, there is no potential for contaminated surface water to enter the pNHA via this pathway during the Remediation Phase.

Habitats

Measures to Reduce the Potential for Impacts on Retained Habitats (Trees, Scrub and Hedgerows)

Any trees, scrub or hedgerows adjacent to, or within, the site boundary which are intended to be retained will be afforded adequate protection prior to remediation works commencing. Mitigation measures will be in accordance with the *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes* (National Roads Authority, 2006b), as follows:

- All trees along the site boundary that are intended to be retained, both within and adjacent to the site boundary (where the root protection area of the tree extends into the site boundary), will be fenced off at the outset of works in the adjacent working area and for the duration of the remediation works in that area to avoid structural damage to the trunk, branches or root systems of the trees. Temporary fencing (post and rail) will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. In general, the RPA covers an area equivalent to a circle with a radius 12 times the stem diameter (measured at 1.5m above ground level for single stemmed trees, or above the root flare for multi-stemmed trees);
- Where fencing is not feasible due to insufficient space, protection for the trees will be afforded by wrapping hessian sacking (or equivalent) around the trunk of the tree and strapping stout buffer timbers around it;
- The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). The storage of hazardous materials (e.g. hydrocarbons) will not be undertaken within 10m of any retained trees, hedgerows and treelines; and
- If construction activities are required within the RPA, e.g. excavation work, then a qualified arborist will advise on the best methods for protecting the tree. For example, any excavation works carried out within the RPA will need to avoid damage to the protective bark covering larger roots. This may involve excavation by mini-digger and/or hand as deemed appropriate. Exposed roots will be wrapped in a hessian sacking to avoid desiccation and roots less than 2.5cm in diameter can be pruned back to a side root. The advice of a qualified arborist will be sought if larger roots that influence anchorage need to be severed. Any remedial works required to trees will be carried out by a qualified arborist.
- Where tree removal may be required (due to health and safety considerations) in areas not previously identified liaison with a suitably qualified ecologist will be required.

Mitigation Measures to Reduce the Potential for Impacts to Aquatic Habitats and Water Quality

Mitigation and monitoring measures in relation to water quality are detailed in Chapter 13 Water – Hydrology.

Mitigation Measures to Control and Prevent the Spread of Invasive Species

Japanese knotweed has been eradicated from within the site boundary. It was, however, found to be present within the land of Kerdiffstown House immediately adjacent to the site (refer to Figure 11.4). If the appointed contractor is required to work within 7m of the infested area an invasive species specialist will be appointed. The invasive species specialist will identify the extents of Japanese knotweed and provide recommendations to the appointed contractor on what measures may be required to remove or avoid spreading this invasive species. This would need to be detailed in the invasive species management plan which will be developed as

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part of the CEMP. Any mitigation strategy in relation to invasive plant species will be based on the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (National Roads Authority, 2010a).

The following non-exhaustive measures shall be included in the Invasive Species Management Plan:

- Works including access will need to avoid disturbing the Japanese knotweed or potentially contaminated soil within at least 7m of the infested area.
- If works cannot be avoided within the exclusion zone the Japanese knotweed and contaminated soil will need to be treated and/or excavated and potentially removed off site or buried on site under licence from the NPWS, this would be detailed in the invasive species management plan.

Measures to Mitigate Potential Impacts to Fauna

Badger

Pre-construction surveys for badger will be undertaken prior to commencement of remediation works to assess the status of the existing setts and any potential newly established setts as specified in the Wildlife Act Licence (DER/BADGER 2017-92) as granted by NPWS – licence has been provided to NPWS as part of the confidential badger report. The findings of these surveys will inform any updates to the derogation licence. The mitigation measures described below follow the recommendations set out in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006c).

The location containing the main sett will be retained and as such, the permanent removal of the sett as a result of remediation activities will not occur. The subsidiary sett will be removed prior to remediation works to facilitate remediation and installation of the engineered capping system. The mitigation measures that apply in relation to each badger sett within the ZoI are discussed below.

Prior to remediation works commencing within the vicinity of the main sett all site personnel will be given a Toolbox talk where they will be briefed on the presence of the sett and the legal protection that badgers, and their setts, are afforded.

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Badger - Closure of Subsidiary Sett

Prior to commencement of remediation works in this area and the closure of the sett, the log pile immediately adjacent to the sett will be removed under licence and supervision by a suitably qualified ecologist. Any additional sett entrances identified will be gated as part of the exclusion.

Prior to closure, the sett will be assessed to determine the use of each hole. Any holes that appear to be disused will be soft-blocked (backfilled with earth and vegetation) and then hard-blocked and proofed to prevent badgers digging back into the sett.

Badger gates will then be fitted to all of the used holes on the sett. Sett exclusion will be carried out over a minimum period of 21 days, with the setts being monitored every three days. This will provide information on whether the badgers are still active at the sett. Camera traps will be placed facing the most well used entrance hole, in order to establish that the badger gates are working correctly and are preventing the badgers from re-entering the sett. In order to monitor all other holes where cameras have not been placed, small sticks will be leant in front of the gate to enable an assessment of badger activity. Monitoring will also confirm that the gates are functioning properly. Once there is certainty that all badgers have been excluded from the sett the gates will be locked permanently stopping any access into or out of the sett.

Standard guidance (NRA 2006) states that a sett should be destroyed as soon as the exclusion has been completed. However, the standard methods usually employed for safe destruction of a sett will not be feasible in this instance. The sett is located within a steep sandy bank, located on the northern perimeter of the site and is considered to extend in a northerly direction into lands beyond the site. Assessment has shown that the bank could become destabilised and collapse if the sett tunnels and chambers were to be excavated. Furthermore, there is very high risk of the bank including mature trees (one of which contains a bat roost) collapsing using standard methods for destruction of the sett.

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The remediation works required at this area of the site will comprise backfilling and raising up to be almost level with the existing bank; as such the sett will be buried as part of the remediation works. Rather than destroying the sett it is proposed to leave the gates on for the duration of the works until this area is infilled. The gates would be left in place and the bank covered with wire mesh to prevent badger digging back in. The area immediately surrounding the sett will also be fenced off with mammal proof fencing and vegetation in the vicinity removed to make it less favourable to badger. The area would be monitored once a month to ensure that the gates/mesh and fencing are all in proper working order.

Badger- Measures to Minimise Disturbance to Main Sett

The following lists of mitigation measures are to be undertaken during remediation works in the vicinity of the main sett to minimise disturbance within retained habitat areas immediately adjacent to the site. These measures will be incorporated into the relevant contract documents:

- Any works within 30m of the sett will be supervised by a suitably qualified ecologist (extended to 50m during the breeding season). A 30m buffer will be demarcated around the sett, using barrier tape. Where any works are planned in the vicinity of these exclusion zones (and where they could encroach into same the ecologist will be contacted prior to any such works. The ecologist will ensure that the appointed contractor is complying with the mitigation measures outlined below.
- Night-time working will be restricted as far as possible within 100m of the sett. As badgers are nocturnal, disturbance will be reduced by restricting the amount of night-time working within the vicinity of sett. Night-time, in terms of badger nocturnal activity, is defined as beginning one hour before sunset and lasting to one hour after sunrise;
- The use of noisy plant and machinery in the vicinity of badger setts will cease before sunset; If the works involve excavations they will either be covered (with plywood), fenced or have an escape ramp installed overnight to prevent badgers, or other wildlife, from falling into them and becoming trapped;
- Any borrow pits or spoil heaps will be sited at a minimum distance of 30m from setts;
- Chemicals shall not be used within 20m of a badger sett;
- Mammal proof fencing to be installed in the vicinity of the sett will be hand dug under supervision.

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A licence has been granted by NPWS to enable the Remediation Phase works. The licence allows for the monitoring of the setts prior to commencement of remediation works, for exclusion of the subsidiary sett, for the installation of the fence line and to permit works within the distance bands described above. Works within the distance bands described above will only be carried out during daylight hours so as not to disturb foraging badgers.

Bats

Three properties (REC010, REC011 and REC016) will be demolished during the Remediation Phase of the site. These private properties and surrounding gardens were not accessed during the initial bat assessment and surveys. Daytime bat assessments and potential further roost surveys of these properties and trees will be required to be undertaken by a suitably qualified ecologist prior to them being demolished. If a bat roost is identified the roost will be removed under licence from the NPWS and appropriate mitigation implemented per the licence requirements.

Other Mammals (Pygmy shrew and Hedgehog)

There is no known method for excluding pygmy shrew or hedgehog from nest / hibernation sites and therefore the seasonal clearance of vegetation for breeding birds (as described below) will be implemented. This means vegetation clearance works will avoid the period 1 March – 31 August as far as practicable; a significant portion of the main breeding season for both species. This mitigation will simultaneously avoid the majority of the main breeding season for most small mammal species (Hayden & Harrington 2001).

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Bats

The lighting design principles will be avoidance of lighting within particularly sensitive areas. Measures to mitigate the impact of lighting disturbance on bats during The Remediation Phase will include:

- Avoid lighting of retained habitats, particularly in the vicinity of woodland, boundary treelines and the confirmed roost. This will ensure that important roosting, foraging and commuting corridors are maintained;
- Lighting if required shall be of a low height (as low as possible without compromising safe working standards) to ensure minimal light spill and where feasible timers or motion sensors shall be used to ensure areas are retained in darkness as much as possible. Lighting shall be directed to where it is required only and this can be achieved by fitting louvres to the lighting; and
- White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact in comparison to other lighting types as it is less attractive to insects and as such insects will not be diverted away from darker areas where more sensitive bat species will be foraging.

Breeding Birds

Vegetation (e.g. hedgerows, trees, scrub and grassland) will not be removed between the 1 March and 31 August, to avoid impacts on nesting birds. Although the Wildlife Acts provide an exemption from this seasonal restriction to vegetation removal for some construction activities, there is no exemption provided for the destruction of nest sites. It is recognised that the remediation works are to be phased, hence vegetation clearance will not be undertaken across the entire site in one operation but will be targeted based on appropriate working areas that can be controlled and managed. Where the remediation programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist for the presence of breeding birds prior to clearance. Where nests are present, an ecologist will make a decision as to whether a licence is required for vegetation removal. Alternatively, the ecologist can demarcate a suitable buffer around an active nest and clearance within this area will be postponed until the chicks have fledged. A suitable exclusion zone will be established dependant on the species identified. Areas found not to contain nests must be cleared within three days of the inspection; otherwise repeat inspections will be required. If vegetation is to be cleared in the breeding season (under supervision of an ecologist) it will be chipped, removed or covered (ideally) on the same day to prevent birds from nesting.

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Amphibians and Reptiles

Areas of suitable reptile habitat such as grassland will initially be cut to 10cm high in order to avoid harm to any reptiles should they be present. This will be carried out by hand using hand tools, or if machinery is used, this will be set to a height of 10cm as advised by the suitably qualified ecologist. Refugia such as log piles will be cleared in warmer months (typically April – September) when reptiles are active. Newly created habitat can be enhanced for reptiles, which will entail provision of artificial hibernacula (see Appendix A11.4, Photo 11.7). Newly created hibernacula will be south-facing and free-draining.

If works to clear the existing waterbodies are to be undertaken during the season where frogspawn / tadpoles may be present (February – July) a pre-construction survey will be undertaken to determine whether breeding amphibians are present. If found to be present, the species will be removed by hand net and translocated to the nearest available habitat that is suitable, under licence from the NPWS. There is an abundance of suitable receptor habitat in the immediate locality including ponds located within Kerdiffstown House adjacent to the site.

A licence has been granted by the NPWS (Refer to Appendix A11.8) to enable the removal of frog spawn prior to remediation works should it be required.

White-Clawed Crayfish

Mitigation measures to protect water quality during the Remediation Phase are detailed in Section 11.1.4. The mitigation approach to protect the white-clawed crayfish during the proposed work is to undertake capture and relocation of individuals immediately prior to undertaking the construction of the surface water outfall, following pre-construction surveys to confirm the presence of white-clawed crayfish in the vicinity of the outfall and associated works. As the mitigation approach will require the capture of crayfish and the potential disturbance of refuges, it will require a licence from the NPWS. As these works are proposed for year three of the Remediation Phase a licence has not yet been sought. This will be applied for by the KCC (or a nominated representative)

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prior to the works being undertaken. Capture and translocation if required will be undertaken between July – September (to avoid the sensitive period for fish). All works will be undertaken in line with the following documents:

- *Guidance on works affecting white-clawed crayfish* (Peay 2000);
- *Guidance on Habitat for White-clawed crayfish and its restoration* (Peay 2002); and
- *Conservation management of the white-clawed crayfish,* (*Austropotamobius pallipes*) (Reynolds 2010).

Fish (Salmonids and Lamprey)

All works will be carried out in accordance with the requirements of IFI as set out in *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI 2016). If instream work outside July-September period is required these shall be agreed in writing with IFI. The following measures will be implemented to mitigate the potential impacts to fish species:

- Maintaining water quality in the surface water network
- Maintaining fish passage while the surface water outfall is being constructed. Only a small section of the river may require to be de-watered using sandbags or similar, hence a continuous flow will be maintained around the de-watered area;
- Prior to dewatering the area will be electrofished and fish will be placed upstream of works; and
- Instream works will only be carried out during the period July - September (inclusive).

11.5.2 Operational Phase

Mitigation Measures to Reduce the Potential for Impacts to Aquatic Habitats and Water Quality

Mitigation and monitoring measures in relation to water quality are detailed in Chapter 13 Water – Hydrology.

Habitats

Measures to Mitigate for Habitat Loss

The landscaping design is outlined in Chapter 4 Description of the Proposed Project (Refer to Figure 4.20). Wherever possible, mature trees and tree lines will be retained. The main mitigation measures relate to tree and shrub planting within and around the site. There are limitations as to where tree planting can take place so as not to compromise the integrity of the engineered capping system. This leaves peripheral areas and site boundaries available for such planting and this will occur wherever practicable. As outlined in the All-Ireland Pollinator Plan 2015-2020 all planting will, where practicable, comprise native species of local provenance. In summary, the following landscape planting and measures will be implemented:

- Perimeter tree planting and hedgerow planting to include amenity planting around the site entrance as well as native hedgerow screen planting along the boundary;
- Wetland ponds are proposed for the north and south central portion of the site, and these will be planted up with a variety of wetland plants to benefit biodiversity;
- Wetland ponds have been designed with gradual sloping edges to create a variety of niche habitats to benefit biodiversity;
- Dry meadows and grassy verges (GS2) and wet Grassland (GS4) will all be lost as a result of the proposed Project, therefore species-rich native seed mixes will be incorporated into the final design with localised areas of wildflower planting; and
- Drainage ditches and wetland swales across the site will be planted up with wetland herbs and grasses at appropriate locations.

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Fauna

Badger

No specific Operational Phase mitigation measures are proposed. There is an abundance of optimal badger habitat within the immediate wider landscape outside the proposed Project boundary. Impacts on badger foraging resource are considered non-significant.

Other Mammals (Pygmy shrew and Hedgehog)

To mitigate for loss of small mammal habitat and nesting opportunities four hedgehog nest boxes will be installed in retained woodland and scrub areas. Boxes will be placed in deep scrub or wooded areas away from obvious paths of disturbance by humans or dogs within the wildlife area fenced off from the public (Refer to Figure 4.20). Furthermore, newly created habitats outlined will provide suitable foraging and resting habitat for these species.

Bats

The lighting design principal will be avoidance of lighting within particularly sensitive areas. The end-use proposal for the site will include three new multi-use sports pitches, changing rooms, a children's playground, etc. These will be located in the centre and south of the site away from sensitive areas which include the woodland in the lands of Kerdiffstown House and existing unlit areas in the north of the site where the confirmed roost is located. The new access route to the north of the site will be for pedestrians only and will not be lit at night. Measures to mitigate the impact of lighting disturbance on bats during the Operational Phase will include:

- Avoidance of lighting, particularly in the vicinity of retained woodland, boundary treelines and the confirmed roost. This will ensure that important foraging and commuting corridors are maintained;
- Reduced light spill through the use of baffles / hoods to ensure that light is directed to the sports pitches as required and not wider;
- White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact in comparison to other lighting types as it is less attractive to insects and as such insects will not be diverted away from darker areas where more sensitive bat species will be foraging; and
- Where lighting is required within sensitive areas (i.e. in the vicinity of retained woodland habitats / tree lines) light levels will be that of full moon light levels, typically between 0.1-0.3 lux.

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Breeding Birds

To mitigate for loss of nesting habitat trees, hedgerows, scrub and grassland habitats will be provided, refer to Figure 4.20. Whilst no significant impacts are anticipated during the Operational Phase, this will provide compensatory habitat for some bird species. Nest boxes will also be provided to compensate for passerine habitat loss. Ten nest boxes to accommodate different species will be provided and these will be erected under supervision of a suitably qualified ecologist at appropriate locations in secluded/unlit treelines proposed for retention.

Amphibians and Reptiles

Whilst no significant impacts are anticipated during the Operational Phase, to account for any loss of potential reptile habitat newly created habitat can be enhanced for reptiles through the provision of artificial hibernacula (see Appendix A11.4, Photo 11.7). Newly created hibernacula will be south-facing and free-draining.

A wetland soakaway pond is proposed for Zone 1A and the surface water management ponds in Zone 4, will be planted up with a variety of wetland plants providing optimal breeding habitat for common frog.

11.5.3 Opportunities for Future Enhancement

Ecological mitigation and enhancement measures are outlined in Figure 11.6. Habitat mitigation measures identified above will enhance the habitats within the proposed Project footprint. Key features to enhance the site's biodiversity have been targeted to benefit local biodiversity. Enhancement measures are driven by local planning policy and guidance and national plans relating to the protection and enhancement of biodiversity:

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- Installation of bat boxes on retained trees
- Planting of wildflowers to benefit pollinators.
- Creation of new and diverse wetland habitats, including reed beds and wet grassland swales;
- Although no residual impacts have been predicted for breeding birds there is an opportunity to enhance the site for these species and in particular for sand martin given the materials available on-site. There is an opportunity to create artificial sand martin banks with reject sand from the site (Refer to Appendix A11.4, Photo 11.8). This shall be built according to key sand martin specifications including a vertical face (2.5 meters high) to limit predation impacts from predators such as stoat and foxes. Further details are provided in Appendix A11.9. This would further enhance the site for promoting wildlife to public visitors.

This opportunity is dependent on the presence of waste and the suitability and stability of slopes; to be confirmed during detailed design and Remediation Phase.

11.6 Residual Impacts

Residual significance is defined as the level of significance of a potential impact following the implementation of mitigation. A summary of impacts before and after proposed mitigation measures is provided in Table 11.17. Impacts on the various ecological features ranged from those considered to be significant at the County to Local geographic scale.

Through the implementation of well-established approaches to mitigation, which will be implemented in accordance with best practice guidance, it will be possible to reduce the impacts to not significant for all ecological features.

As a result of the proposed mitigation and enhancement measures, no residual significant adverse impacts are predicted for the ecological receptors in the long-term following implementation of mitigation measures. Indeed, as a result of the proposed Project and habitats features to be created, significant beneficial impacts are predicted for the Operational Phase of the proposed Project for the following ecological receptors: wetland habitats, amphibians and reptiles.

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Table 11.17: Summary of Impacts

Key Ecological Receptor	Ecological Valuation (as per NRA, 2009b)	Impact Type	Significance	Mitigation Measures	Residual Significance
Remediation					
Designated Sites and Habitats					
Designated Sites (Grand Canal pNHA)	National	• Contamination	Significant Adverse (Local)	• Link between the site and the Grand Canal pNHA, via the Canal Feeder Stream will no longer exist as the current outfall will be permanently disconnected during remediation. • There will be no direct hydrological connection from the site to the Morell River during the Remediation Phase	Not Significant
Habitats (retained)	Local (Higher value)	• Contamination • Disturbance	Significant Adverse (Local)	• All trees along the site boundary that are to be retained, both within and adjacent to the site boundary (where the root protection area of the tree extends into the site boundary), will be fenced off at the outset of works • Temporary fencing (post and rail) will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. • Where fencing is not feasible due to insufficient space, protection for the trees will be afforded by wrapping hessian sacking (or equivalent) around the trunk of the tree and strapping stout buffer timbers around it; • The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). • The storage of hazardous materials (e.g. hydrocarbons) or concrete washout areas will not be undertaken within 10m of any retained trees, hedgerows and treelines; and • If construction activities are required within the RPA, the advice of a qualified arborist will be sought	Not Significant
Habitats (Aquatic) and Water Quality	County	• Contamination • Direct Habitat loss	Significant Adverse (Local to County)	• Monitoring and mitigation measures in relation to water quality are outlined in Chapter 13 Water - Hydrology.	Not Significant

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Key Ecological Receptor	Ecological Valuation (as per NRA, 2009b)	Impact Type	Significance	Mitigation Measures	Residual Significance
Fauna					
Badger	Local (Higher value)	• Mortality • Disturbance • Habitat loss (foraging and resting sites)	Significant Adverse (Local)	• Pre-construction surveys • Toolbox Talk • Exclusion and removal of subsidiary sett will be undertaken under licence from the NPWS. • Clearance of log piles next to subsidiary sett will be undertaken using by hand and/or light machinery to identify any potential sett entrances below. • Potentially disturbing works in the vicinity of main sett will be undertaken under licence and supervised by a suitably qualified ecologist • The suitably qualified ecologist will be notified of any potentially disturbing works to be undertaken within 50m of the sett before they commence. • Any borrow pits or spoil heaps will be sited at a minimum distance of 30m from setts; • Chemicals shall not be used within 20m of a badger sett; • Mammal proof fencing to be installed in the vicinity of the sett will be hand dug under supervision	Not Significant
Bats (Roosting)	Local (County Value)	• Mortality • Abandonment of roosting sites • Disturbance	Significant Adverse (County)	• Retention of tree roost (Point B on Figure 11.2). • Avoidance of lighting, particularly in the vicinity of retained woodland, boundary treelines and the confirmed roost (refer to Figure 11.6). • Pre-construction surveys of properties (REC010, REC011 and REC016) will be required prior to them being demolished. If a bat roost is identified it will have to be removed under licence from the NPWS and appropriate mitigation put in place.	Not Significant
Bats (Foraging)	Local (Higher value)	• Disturbance • Habitat loss (foraging)	Significant Adverse (Local)	• Where security lighting and lighting for remediation works is required in the vicinity of retained woodland habitats it will be of a low (as low as possible without compromising safe working standards) height to ensure minimal light spill and where possible timers or motion sensors may be used • Fitting louvres to the lighting to ensure that light is directed only as required • White LED or amber coloured LED lighting will be used	Not Significant
Breeding Birds	Local (Higher value)	• Mortality • Habitat loss (nesting sites) • Disturbance	Significant Adverse (Local)	• Vegetation clearance will be phased and not be removed between the 1 March and 31 August. • Where the remediation programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist. • The suitably qualified ecologist will make a decision as to whether a licence is required for vegetation removal/ demarcate a suitable buffer around an active nest and clearance within this area will be postponed until the chicks have fledged.	Not Significant

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Key Ecological Receptor	Ecological Valuation (as per NRA, 2009b)	Impact Type	Significance	Mitigation Measures	Residual Significance
Other Mammals (Pygmy Shrew, Hedgehog and Stoat)	Local (Higher value)	• Mortality • Habitat loss (nesting / hibernation sites) • Disturbance	Significant Adverse (Local)	• No known method for excluding pygmy shrew or hedgehog from nest / hibernation sites and therefore the seasonal works mitigation for breeding birds will be implemented.	Not Significant
Common Lizard	Local (Higher value)	• Mortality • Habitat loss (basking / hibernation sites) • Disturbance	Significant Adverse (Local)	• Areas of suitable reptile habitat such as grassland will initially be cut to 10cm high in order to avoid harm to any reptiles. • Refugia such as log piles will be cleared in warmer months (May – September).	Not Significant
Common Frog	Local (Higher value)	• Mortality • Habitat loss • Disturbance	Significant Adverse (Local)	• Pre-construction survey for all works where it is necessary to clear ponds or other waterbodies. • If found, frogs will be removed by hand net and translocated to the nearest available habitat that is suitable, under licence from the NPWS.	Not Significant
White-clawed Crayfish	Local (County value)	• Mortality • Disturbance	Significant Adverse (County)	• Capture and relocation of individuals immediately prior to undertaking the proposed works (surface water outfall construction) under licence from the NPWS.	Not Significant
Fish (lamprey and salmonids)	Local (Higher Value) to County	• Mortality • Disturbance	Significant Adverse (Local to County)	• Maintaining fish passage while the surface water outfall is being constructed. • Instream works will only be carried out during the period July to September (inclusive). • Removal of fish from dewatered area and placed upstream of works.	Not Significant
Operation					
Designated sites and Habitats					
Designated Sites (Grand Canal pNHA)	National	• Contamination	No impact	• The connection to the Canal Feeder Stream will be removed during the Remediation Phase and hence, will no longer be in use during the Operational Phase.	Not Significant
Habitats	Local (Higher value) -Dry meadows and grassy verges (GS2) -Wet grassland (GS4) -Scrub (WS1) -Treeline (WL2)	• Habitat loss	Significant Adverse (Local)	• Detailed landscaping is included in Figure 4.20 and will include: • Post-construction remediation and enhancement of grassland habitats including meadow creation • Wetland habitat creation. • Native hedgerow planting. • Tree planting • Marsh and wet grassland • Species rich grassland	Not Significant Wetland habitats (Significant beneficial)

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Key Ecological Receptor	Ecological Valuation (as per NRA, 2009b)	Impact Type	Significance	Mitigation Measures	Residual Significance
Water Quality	Local to County (based on receptors within the Morell)	• Contamination	Significant Adverse (Local to County)	• During operation measures to attenuate and treat the surface water runoff in order to avoid significant impacts have been incorporated into the drainage design of the proposed Project including the provision of a Surface Water Management Pond (SWMP). • The SWMP will be fitted with a penstock / shut-off valve when constructed to deal with any event of accidental spillage. • During operation water quality monitoring will continue as indicated in the IEAL. • Mitigation and monitoring measures in relation to water quality are detailed in Chapter 13 Water – Hydrology.	Not Significant
Fauna					
Badger	Local (Higher value)	• Loss of foraging areas	Not significant	• None.	Not Significant
Bats (Foraging and Roosting)	Local (Higher value – County)	• Disturbance	Significant Adverse (Local to County)	• Reduced light spill through the use of baffles/hoods to ensure that light is directed to the sports pitches as required. • White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact. • No lighting of retained woodland habitat/treelines.	Not Significant
Breeding Birds	Local (Higher Value)	• Loss of nesting habitat	Not significant	• Compensatory habitat for some bird species provided through the planting of trees, hedgerows, scrub and grassland habitats as well as the extension of the existing woodland (Refer to Figure 4. 20) • Ten nest boxes will be provided to compensate for habitat loss (Refer to Figure 11.6)	Not Significant
Other Mammals (Pygmy Shrew and Hedgehog)	Local (Higher value)	• Habitat loss (nesting / hibernation sites)	Not significant	• Four hedgehog nest boxes will be installed in retained woodland and scrub areas (Refer to Figure 11.6) • Habitat creation as outlined above (Refer to Figure 4.20)	Not Significant
Common Lizard	Local (Higher value)	• Habitat loss (basking / hibernation sites)	Not significant	• Newly created habitat can be enhanced for reptiles with the use of artificial hibernacula (Refer to Figure 11.6)	Not Significant
Common Frog	Local (Higher value)	• Habitat loss	Not significant	• Habitat creation as outlined above in particular wetland habitat creation (Refer to Figure 4.20)	Not Significant

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11.7 Difficulties Encountered in Compiling Information

No significant difficulties were encountered.

11.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on Key Ecological Receptors. These projects are discussed in the following paragraphs.

11.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018.A Waste Facility Permit has been granted for the proposed quarry infilling.

There will be a cumulative loss of locally valuable habitats in this area associated with the development of both sites should these be undertaken within similar timescales. However, such impacts will be short-term in nature, during the Remediation Phase of the proposed Project. New tree and scrub planting, and newly created wetlands will be provided within the lands of the proposed Project as part of the remediation which will negate for any habitat loss in the short-term.

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Clearance of vegetation in the adjacent quarry will result in a cumulative loss of local foraging and nesting habitat for birds and bats. This will limit the available foraging and nesting habitat for these species in the short-term. New tree and scrub planting, and newly created wetlands will be provided within the proposed Project boundary and the provision of nest and bat boxes will also be provided within the end design to account for the loss of nesting and foraging habitat in the short-term.

11.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. Clearance of vegetation to allow for widening of the M7 carriage way could also result in a cumulative loss of foraging habitat and resting sites for badger and bats if vegetation clearance was undertaken on both projects within similar timeframes, this would likely result in a short-term temporary impact given that new tree and scrub planting proposed.

11.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future) are anticipated.

11.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the

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proposed Project site. Due to the distance between the two sites and the type of development proposed, no cumulative impact from the housing development project and the proposed Project on biodiversity is anticipated.

11.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. Mitigation has been proposed in relation to the potential impact from the Remediation Phase of the proposed development. It is assumed that the contractors responsible for the construction of the sewerage Scheme will implement best practice measures to protect ecological receptors during the construction phase. Therefore, potential cumulative impacts are not anticipated for ecological receptors during construction. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

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12. Soils, Geology, Contaminated Land and Groundwater

This Chapter assesses what effects the proposed Project may have on the soils, geology, contaminated land and groundwater in and within close proximity to the proposed site.

There are a number of adverse impacts predicted during the Remediation Phase, the magnitudes of which range from negligible to moderate. Impacts include changes to landfill gas migration routes; encountering perched leachate and increase in contamination through disturbance of wastes particularly near the water table. In order to mitigate against these predicted impacts, a number of measures are proposed primarily involving a regime of gas and groundwater monitoring at regular intervals throughout the remediation works. The monitoring regime will be formulated based on risk, and will evolve as remediation works progress.

The Operational Phase impacts will be largely beneficial to the environment. Once the site has been capped, infiltration to the landfill will be reduced and therefore less leachate will be produced. Re-profiling of the site will remove low points and therefore prevent pooling and increase landfill stability. The reduction in infiltration may also result in the reduction of the local water table, thereby reducing the amount of waste lying beneath the water table. The increased landfill gas control measures will also reduce the potential for gas migration off the site. As with the Remediation Phase, groundwater and gas monitoring will be carried out on the site at regular intervals once it is operational as a multi-use public park.

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12.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") on the on soils, geology and groundwater anticipated to occur during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950's until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the site and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. Table 12.1 summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 12.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound supported by a back-up flare • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of the surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation and operation can be found in Chapter 4 Description of the Proposed Project.

Reference has been made to the extensive geological and hydrogeological data collected in relation to the Kerdiffstown Landfill and the immediate surrounding area over the last six years (2011 to present) by organisations on behalf of the Environmental Protection Agency (EPA) and more recently Kildare County Council (KCC). The most recent information includes the ground investigation and environmental monitoring and risk assessments undertaken in the autumn/winter of 2016/2017.

12.1.1 Study Area

The soils, geology, contaminated land and groundwater study area (hereafter referred to as "the hydrogeology study area" comprises the existing site itself and an area covering a 3km radius from the centre of the existing site (Figure 12.1). This study area has been determined in accordance with the Institute of Geologists of Ireland (IGI) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI 2013) which recommends a minimum distance of 2km from the site boundary and by using professional judgement. Whilst the proposed Project is unlikely to impact on the geology or soils outside of the proposed Project boundary, it does have the potential to impact on other receptors, particularly those associated with migration of contamination including the movement of contaminated groundwater. The 3km radius incorporates all of the proposed Project area and captures the groundwater and surface water features considered to have the highest potential of being affected by the proposed Project. This includes the Morell River closest to the existing site and aquifers down hydraulic gradient from the existing site.

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12.1.2 Legislation

Water and Waste

Groundwater in Ireland is protected under European Community and national legislation, and local authorities and the EPA are responsible for enforcing this legislation. Efforts to protect groundwater resources in Europe began in the 1970s resulting in the adoption of the first Groundwater Directive (80/68/EEC). However, the European Community identified that there was a need for further action to avoid long-term deterioration of quality and quantity of all freshwater resources, including groundwater and this led to a framework for an Integrated European water policy; the Water Framework Directive (WFD, 2000/60/EC). The WFD includes groundwater in its river basin management planning, and sets clear milestones for groundwater bodies in terms of delineation, economic analysis, characterisation (analysis of pressures and impacts), monitoring, and the design of programmes of measures to ensure that there is a sufficient quantity of groundwater of "good" chemical status.

The WFD was later complemented by the adoption in 2006 of a daughter directive (Directive 2006/118/EC, the so called "Groundwater Daughter Directive" [GWDD]) laying down additional technical specifications on the protection of groundwater against pollution and deterioration and led to the repeal of the original 1980 Groundwater Directive in 2013.

The requirements of the WFD and GWDD have been enacted into Irish law through S.I. No. 9 of 2010 — European Communities Environmental Objectives (Groundwater) Regulations 2010. The regulations require measures to be implemented to prevent the input of hazardous substances to groundwater bodies. "Hazardous substances" means substances or groups of substances that are toxic, persistent and liable to bio-accumulate and other substances or groups of substances that give rise to an equivalent level of concern

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S.I. No. 9 of 2010 also limits the input of non-hazardous substances to groundwater. The input of non-hazardous substances shall be limited so as to ensure that such inputs do not cause deterioration in groundwater status or cause significant and sustained upward trends in the concentration of pollutants in groundwater.

Under the regulations, the EPA may issue exemptions to the "prevent and limit" requirements of the regulations if, for example:

- Inputs are considered to be of a quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of the receiving groundwater;
- Inputs are considered incapable, for technical reasons, of being prevented or limited without using:
  i. measures that would increase risks to human health or to the quality of the environment as a whole, or
  ii. disproportionately costly measures to remove quantities of pollutants from or otherwise control their percolation in, contaminated ground or subsoil.

An example of where such an exemption could apply is given in Guidance on the Authorisation of Discharges to Groundwater (EPA December 2011) as an old, unlined landfill where full remediation may do more environmental harm than good.

It is also relevant to make reference to the Waste Management Act 1996 (as amended) which implements EU Council Directive 99/31/EC (referred to as the Landfill Directive) on the landfill of waste. The overarching purpose of the Directive is to reduce the amount of waste being landfilled and to increase the standard of operation of those sites which continued to operate.

The Waste Management Act 1996 (as amended) list the control and monitoring procedures which the operator must ensure are carried out from the start of the Operational Phase of a waste facility such as a landfill until closure. They also provide for closure and after care procedures for landfills which may relate to the whole or part of the landfill in order to protect the underlying groundwater and wider environment.

The Environmental Liability Directive (2004/35/EC) has been partially transposed into Irish law through the European Communities (Environmental Liability) Regulations (2008). The principal aims of the European Communities (Environmental Liability) Regulations 2008 are to prevent and remedy water damage, land

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damage and damage to natural habitats and protected species. Furthermore, these Regulations require operators to initiate preventive measures where there is an imminent threat of environmental damage occurring (as defined under the Directive). The European Communities (Environmental Liability) Regulations 2008 do not apply to damage that took place before 1 April 2009 or damage caused by an emission, event or incident which took place after the 1 April 2009, when it is derived from a specific activity that took place and finished before this date.

With respect to groundwater, environmental damage under the European Communities (Environmental Liability) Regulations 2008 means damage to the groundwater body such that it has a significant adverse effect on the groundwater body chemical status under the Water Framework Directive. It is noted in the EPA's recently issued document 'Determining Groundwater Pollution: A Proposed Approach for the Development and Application of Guideline Values for Groundwater' (EPA 2017a) setting out proposed guideline values for groundwater quality that where groundwater monitoring indicates that where a groundwater Threshold Value is exceeded over a significant extent of the groundwater body or if there is a contaminant plume, where concentrations exceed the Threshold Value over an area > 2km^2, the groundwater body may be classified as being at poor chemical status.

Contaminated Land

Currently there is no specific legislation addressing contaminated land in Ireland and to date numerous approaches to managing contaminated land have been adopted including the ad hoc application of standards and methodologies from other countries. However, under existing EPA licenses, new releases of contaminants to land and groundwater are controlled.

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There is no specific statutory guidance in how to deal with a remediation project for a formerly licensed site which was operated in a non-compliant manner. The risk-based approach taken in the assessment of the site and outline design of the remediation of the site has been cognisant of the principles set out in guidance published by the EPA including:

- The "Code of Practice Environmental Risk Assessment for Unregulated Waste Disposal Sites (EPA 2007)" which was drafted to provide "*guidance on how to deal with illegal landfills that have come into being since the introduction of the waste licensing regime.*"; and
- The "Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (EPA 2013)" which was drafted to cope with contaminated land and groundwater issues at all EPA licensed facilities (i.e. industrial, waste etc., but excluding illegal landfills).

The use of key principles such as: a tiered approach, detailed site investigation, use of source-pathway-target(receptor) methodology, detailed quantitative risk assessment and design of remedial measures are clearly applied in the approach taken to assessing the proposed Project, with the approach taken tailored to cope with the unique challenges of the Kerdiffstown Landfill site.

Soils and Geology

Whilst at the European level there were proposals for a Soil Framework Directive tabled in 2006 the directive was never adopted and there is no specific soil protection legislation in place in Ireland.

Section 6 of the Heritage Act (1995) defines national heritage to include, amongst other things, landscapes and geology. The Heritage Act established The Heritage Council which is an independent body which has a statutory responsibility to "*propose policies and priorities for the identification, protection, preservation and enhancement of the national heritage*".

Landfill Gas

Section 4 of Annex 1 of the 1999 EU Landfill Directive outlines the gas control requirements for all classes of landfills. The specific requirements with regards to treatment and use of landfill gas are:

- *4.2 Landfill gas shall be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and used. If the gas collected cannot be used to produce energy, it must be flared.*

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- *4.3 The collection, treatment and use of landfill gas under paragraph 4.2 shall be carried on in a manner which minimises damage to or deterioration of the environment and risk to human health.*

This Directive was transposed into Irish law by the Waste Management Licensing Regulations 2004 (SI 395 of 2004) and the Waste Management Act 1996 (as amended).

12.2 Methodology

The methodology used to assess and mitigate potential impacts to soils, geology and groundwater is based on established best practice. Risk assessments and conceptual site models (CSMs) for land contamination have been prepared and the findings of these assessments have been used to inform the outline design of the proposed Project. The assessments and development of appropriate mitigation measures have followed best practice advice including:

- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, Institute of Geologists of Ireland, 2013;
- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009);
- The EPA Landfill Manual guidance notes (EPA 1995, 1997, 1999, 2000 and 2003b):
  - Environmental Protection Agency (1995). Landfill Manual - Guidance Note on Investigations for Landfills;
  - Environmental Protection Agency (1997). Landfill Manual - Guidance note of Landfill Operational Practices;
  - Environmental Protection Agency (1999). Landfill Manual - Guidance note of Landfill Restoration;
  - Environmental Protection Agency (2000). Landfill Manual - Landfill Site Design;
  - Environmental Protection Agency (2003b). Landfill Manual - Guidance note of Landfill Monitoring.
- EPA document Management of Low Levels of Landfill Gas (EPA 2011b);
- England's Environment Agency's Model Procedures for the Management of Land Contamination (EA 2004);
- The Building Research Establishment's guidance Concrete in Aggressive Ground. Special Digest 1 (BRE 2005) and UK Water Industry Research Limited's Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (WIR 2010).

There are no permitted or proposed mineral extraction activities within the site boundary.

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Groundwater

The assessment has considered the sensitivity of the groundwater environment (and surface water where these are in continuity with the groundwater) in the context of prevailing hydrogeological conditions. The baseline characteristics in the vicinity of the proposed Project have been determined using the following information:

- Publicly available geological data from the Geological Survey of Ireland (GSI) and EPA (e.g. geological maps, hydrogeological maps and borehole records);
- Publicly available information (e.g. GSI aquifer classification, WFD classifications and assessments, soil designation maps);
- Information regarding groundwater and surface water abstractions including recorded information on private supplies obtained from the GSI website (GSI 2016);

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- Reports and data interpretation from ground investigations which provide local geological and groundwater level and quality information;
- Water quality data obtained from monitoring of surface waters and groundwater;
- Observations from site walkovers.

Landfill Gas

The controls required for landfill gas will be based on the conceptual model and Landfill Gas Management Plan (Appendix A4.5) for the site (Jacobs, 2017). The controls which will be employed through the remediation of the site will be based on the Best Available Techniques (BAT) principle and ensure that the long-term environmental risk is minimised through effective containment, monitoring, and control.

A Landfill Gas Risk Assessment has been completed for the site using GasSim for the 'Source Term' module to determine the quantity of landfill gas generation over time based on the mass of waste deposited and the composition of the waste. Further details of GasSim2.5 can be found at www.GasSim.co.uk.

The GasSim2.5 Source Term module, which calculates the bulk gas generation from the site, relies on estimated inputs of waste tonnages, definition of waste types to determine the biodegradable portion of the wastes and other landfill characteristics. A Landfill Gas Management Plan has been developed based on the risk assessment. This includes an assessment of the temporary works required for the site remediation, as well as proposals for landfill gas management infrastructure for the final end-use. The Landfill Gas Management Plan has been developed with consideration of the requirements of the Landfill Directive, and the EPA Landfill Guidance manuals where possible with due regard of the scope of the remediation.

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The GasSim 'Global Impact' module has also been used to assess the global warming potential and ozone depletion potential of the emissions calculated by the source term model and through associated combustion processes (e.g. flaring or utilisation of the landfill gas). Due to the limitation in the GasSim 'Lateral Migration' module the sub-surface migration risk has been undertaken using a risk assessment matrix based on the conceptual model. Air dispersion assessments have been completed using US AERMOD software (refer to Chapter 7 Air Quality, Odour and Climate).

Waste

To assess the biodegradability of the wastes descriptions within the available site borehole logs were interrogated. A representative sample of borehole logs was selected based on:

- spatial representation for the Zones;
- quality of the recorded descriptions of the wastes and strata; and
- boreholes which did not hit early obstructions and terminate early.

Assessment criteria

Consideration has been given to the assessment criteria presented in contaminated land and environmental risk assessment guidance to make them applicable to the assessment. Impacts are compared to a 'Do Nothing' approach i.e. compared to the current (baseline) conditions.

The assessment identifies the likely impacts during the Remediation and Operational Phases of the proposed Project. This has involved assessing the significance of any potential effects by determining the sensitivity of the receptor and the magnitude of the potential effect. Recognising that EIA is a predictive process and that a degree of uncertainty is attached to the assessments being made, the assessment indicates the degree of confidence or certainty attached to the assessment.

A generic list of standard definitions in relation to assessing the impacts of a proposed Project has been produced by the EPA entitled Guidelines on the Information to be Contained in Environmental Impact Statements (EPA 2002) (and revised guidelines, due to be finalised in 2017). Each term has been defined to

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describe the "quality", "significance", "duration" and "type" of a potential impact. With respect to geology and hydrogeology, further definitions of the terms are presented in Appendix C of the IGI "*Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013)*" document, which in turn are based on the guidance provided by the NRA; Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009). This approach has been adopted for this assessment and the process takes three stages:

Stage 1: Estimate the importance of a geological or hydrogeological feature (Table 12.2).

It should be noted that the NRA guidance does not provide an estimate of importance or magnitude of impact for human health or property impacts. Therefore, terms associated with these aspects have been added to Table 12.2 and Table 12.3 and have been marked with an asterisk.

Table 12.2: Estimation of Importance of Geological and Hydrogeological Attributes

Importance	Criteria for Geology/Soils and Contaminated Land	Typical Examples for Geology/Soils and Contaminated Land		Criteria for Hydrogeology	Typical Examples for Hydrogeology
Extremely High	None identified	Human receptors i.e. construction workers, future site users, maintenance workers, adjacent land users and future construction workers*		Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
Very High	Attribute has a high quality, significance or value on a regional or national scale Degree or extent of soil contamination is significant on a national or regional scale Volume of peat and/or soft organic soil underlying the site is significant on a national or regional scale	Geological feature rare on a regional or national scale (NHA) Large existing quarry or pit Proven economically extractable mineral resource		Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - NHA status Regionally important potable water source supplying >2,500 homes Inner source protection area for regionally important water source
High	Attribute has a high quality, significance or value on a local scale Degree or extent of soil contamination is significant on a local scale Volume of peat and/or soft organic soil underlying route is significant on a local scale	Contaminated soil on site with previous heavy industrial usage Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site) Well drained and/or highly fertility soils Moderately sized existing quarry or pit Marginally economic extractable mineral resource		Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers Locally important potable water source supplying >1,000 homes Outer source protection area for regionally important water source Inner source protection area for locally important water source

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Importance	Criteria for Geology/Soils and Contaminated Land	Typical Examples for Geology/Soils and Contaminated Land		Criteria for Hydrogeology	Typical Examples for Hydrogeology
Medium	Attribute has a medium quality, significance or value on a local scale Degree or extent of soil contamination is moderate on a local scale Volume of peat and/or soft organic soil underlying the site is moderate on a local scale	Contaminated soil on site with previous light industrial usage Small recent landfill site for mixed wastes Moderately drained and/or moderate fertility soils Small existing quarry or pit Sub-economic extractable mineral resource Property, including below ground services, building foundations and domestic animals*		Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes Outer source protection area for locally important water source
Low	Attribute has a low quality, significance or value on a local scale Degree or extent of soil contamination is minor on a local scale Volume of peat and/or soft organic soil underlying the site is small on a local scale	Large historical and/or recent site for construction and demolition wastes Small historical and/or recent landfill site for construction and demolition wastes Poorly drained and/or low fertility soils Uneconomically extractable mineral resource		Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes

* These terms are not included in the NRA guidance and have been added so that the impacts on human health and property from contaminated land can be determined

Stage 2: Estimate the scale of the impact on the geological or hydrogeological feature from the proposed Project (Table 12.3).

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Table 12.3: Estimation of Magnitude of Impact on Soil/Geology and Hydrogeology Attribute

Magnitude of Impact	Criteria for Geology/Soils and Contaminated Land	Typical Examples for Geology/Soils and Contaminated Land		Criteria for Hydrogeology	Typical Examples for Hydrogeology
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves Irreversible loss of high proportion of local high fertility soils Removal of entirety of geological heritage feature Requirement to excavate / remediate entire waste site Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath the site Soil contamination is considered to pose a high risk to potential receptors with one or more pollutant linkages certain to be present*		Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems Potential high risk of pollution to groundwater from routine runoff Calculated risk of serious pollution incident >2% annually

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Magnitude of Impact	Criteria for Geology/Soils and Contaminated Land	Typical Examples for Geology/Soils and Contaminated Land		Criteria for Hydrogeology	Typical Examples for Hydrogeology
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves Removal of part of geological heritage feature Irreversible loss of moderate proportion of local high fertility soils Requirement to excavate / remediate significant proportion of waste site Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath the site Soil contamination is considered to pose a moderate risk to potential receptors with one or more pollutant linkages present*		Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems Potential medium risk of pollution to groundwater from routine runoff Calculated risk of serious pollution incident >1% annually
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves Removal of small part of geological heritage feature Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils Requirement to excavate / remediate small proportion of waste site Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath the site Soil contamination is considered to pose a low risk to potential receptors with one or more pollutant linkages possibly present*		Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems Potential low risk of pollution to groundwater from routine runoff Calculated risk of serious pollution incident >0.5% annually
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes Soil contamination is considered to pose a very low risk to potential receptors with one or more pollutant linkages unlikely to be present*		Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature		-	-
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature		-	-
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature		-	-

* These terms are not included in the NRA guidance and have been added so that the impacts on human health and property from contaminated land can be determined

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Stage 3: Estimate the significance of the impact on the geological or hydrogeological feature from a matrix based on the importance of the feature and the scale of the impact (Table 12.4).

Table 12.4: Matrix for Rating of Significant Environmental Impacts at EIA Stage

		Magnitude of Impact			
		Negligible	**Small**	**Moderate**	**Large**
Importance of Attribute	**Extremely High**	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/Moderate	Profound/Significant	Profound
	High	Imperceptible	Moderate/Slight	Significant/Moderate	Severe/Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

The definitions used for the significance of the impacts are shown in Table 12.5.

Table 12.5: Definitions for the Significance of Environmental Impacts

Magnitude of Impact	Definition
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound	An impact which obliterates all previous sensitive characteristics

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Further Descriptors

The above terms have been used and applied to soils, geology, contaminated land and groundwater assessment and the terms used are summarised below. Each of these criteria will have further descriptors associated with them as summarised below.

- The duration of an impact is described in terms of whether it is “temporary”, “short-term”, “medium-term”, “long-term” or “permanent” as follows:
  - Temporary (construction-related and lasting less than one year).
  - Short-term (lasting one to 7 years).
  - Medium-term (lasting between 7 to 15 years).
  - Long-term (lasting 15 to 60 years).
  - Permanent (lasting over 60 years).
- The impact assessment considers the type of the impact. This will be described as “cumulative”, “indeterminable”, “irreversible”, “residual”, “synergistic” or “worst case”.
- To show the uncertainty that is inherent in any hydrogeological and contaminated land, landfill gas and soils assessment, the impact assessment considers the certainty that the impact will occur using the terms “certain”, “likely”, “possible” or “unlikely” as set out below:
  - Certain: >95% chance of occurring as predicted.
  - Likely: 50-95% chance of occurring as predicted.
  - Possible: 5-50% chance of occurring as predicted.
  - Unlikely: <5% chance of occurring as predicted.

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- . If the assessment considers an impact is unlikely this will not be considered in the assessment.

The embedded mitigation measures which have been designed and incorporated into the proposed Project have then been considered in the initial assessment. If following this initial assessment additional mitigation is required, the additional mitigation measures will be described and the significance and magnitude of the residual impacts described again, using the above terms, identifying a reduction of impact where possible.

The following disciplines may interact with soils, geology, hydrogeology and landfill gas to a greater or lesser extent and the following Chapters should be considered alongside this Chapter;

- Air Quality, Odour and Climate (Chapter 7): consideration of soil gas generated by waste and contaminated land;
- Biodiversity (Chapter 11): the inter-relationship of groundwater and any ecological features to be protected needs to be considered for example surface water ecosystems dependent on groundwater baseflows;
- Water Quality (Chapter 13): consideration of groundwater and surface water interactions; and
- Waste (Chapter 15): contaminated land and volumes of waste to be excavated based on ground conditions need to be considered.

12.3 Baseline Conditions

12.3.1 Historical Site Investigations

The baseline data provided in this Chapter was largely obtained from site investigations that the EPA and KCC commissioned to establish geological and groundwater conditions as summarised in Table 12.6. The locations of investigation points are shown in Figure 12.2.

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Table 12.6: Summary of Groundwater Site Investigations

Investigation Name	Dates of Site Investigation	No. of Boreholes Drilled	No. of Monitoring Wells Installed	On / off site	Monitoring Well No.s
EPA SI	10/05/10 to 12/05/10	10	9	Off-site	EMW01* to EMW10
EPA SI	06/06/11 to 19/06/11	7	7	On-site	EMW11 to EMW17
Phase 1 SI	09/01/12 to 06/02/12	24	4	On-site	BH2, BH6, BH7, BH24
Phase 2 SI	14/08/12 to 21/09/12	61	21 (17 groundwater, 1 leachate (now dry) 2 Inclinometer, 1 Gas)	On and off-site	BH26, BH36B, BH39B, BH40B, BH42, BH48, EMW18 to EMW24, BHEMW27 to EMW33.
Phase 3	November 2016 to February, 2017	69	44	On-site and off-site	RM01 to RM06 BB01 to BB04 BH60 to BH70 DB01 to DB15 (excluding DB13)
Former abstraction wells	Not relevant	2	2	On-site	GW1D, GW2S

* EMW01 was backfilled due to health and safety concerns by the landowner regarding the location of the well on a pathway.

Investigations involved installation of approximately 40 groundwater monitoring wells (not all wells were completed) on and off the existing site (Table 12.6). Wells were established to collect data to define the geological and hydrogeological site setting and provide groundwater monitoring points. Subsequent rounds of

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groundwater monitoring have been undertaken monthly to establish the chemical quality of the groundwater with the most recent round prior to this report being undertaken in December 2016.

In addition to the intrusive ground investigations summarised above, there have also been non-intrusive geophysical investigations to aid the assessment of the geology and to detect the presence of or any changes in contaminant plumes flowing from the existing site. As noted in Chapter 3 The Need for the Proposed Project, these surveys have been undertaken annually with the most recent survey undertaken in February 2016. Each survey has comprised electrical resistivity tomography profiles (repeating lines undertaken in previous surveys) and conductivity mapping. These surveys have concentrated on the land to the east of the landfill where contaminant plumes may move from the site to the Morell River.

Due to the potential for groundwater to discharge to the local surface waters, a series of surface water samples are collected along the Morell River and the Canal Feeder Stream at the locations shown in Figure 13.2 (refer to Chapter 13 Water - Hydrology for a description of surface water quality).

In addition to the groundwater and surface water investigations and monitoring, works have been undertaken to investigate and control landfill gas (which principally comprises methane and carbon dioxide, as well as odorous trace compounds). This included installation of boreholes into the waste to allow for the abstraction and flaring of landfill gas (refer to Chapter 7 Air Quality, Odour and Climate for the assessment air quality and odour impacts).

12.3.2 Land Use

The Coordination of Information on the Environment (CORINE) database shows the land use at the site to be defined as “dump” (EPA 2016), refer to Figure 9.1. However, within the hydrogeology study area, the majority of the land use is agricultural, with the soil to the west of the site described in the CORINE database as “pastures”. A sport and leisure land use is shown to the east of the existing site and urban and industrial areas associated with Naas and Sallins are present in the west and south of the hydrogeology study area.

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The GSI online mapping portal shows that historically the site was a quarry with a historical quarry present to the west of the site (GSI 2016). The maps also show that land surrounding the site has high potential for granular aggregate extraction and the limestone bedrock underlying the overburden deposits has a low or moderate potential to be used for crushed stone aggregate. No historical mine sites are identified within the hydrogeology study area (EPA 2016).

12.3.3 Soils

The natural soils beneath the existing site have almost entirely been removed due to the historical site development, particularly the use of the site for mineral extraction. The main area of natural soils that haven’t been disturbed by historical quarrying and landfilling operations within the site boundary are identified as being along the site’s southern boundary to the south of Zones 3 and 4. Investigation logs show that topsoil in this area is thin (0.05 to 0.2m). Adjacent to the existing site, where remediation works will extend outside of the former waste licence boundary to the east, borehole logs have identified that “top soil” is in the region of 0.3m thick, however further details of the soil structure are not provided in these logs. These soils form part of the Palmerstown House Estate grounds and the CORINE database (EPA), refer to Figure 9.1, shows land use in this area is for sport and leisure facilities and is therefore not used for agricultural purposes (EPA 2016).

The ground in the triangle of land known as Tunney’s Field to the south-west of Zone 1 also has not been used for quarrying or landfilling purposes, therefore the historical site investigations have not included significant investigation in this area although some trial pits and a borehole have been completed close to the boundary with Zone 1. It is thought that Tunney’s Field has natural soils at the surface. The vegetation in this area is seen to be relatively scrubby grassland.

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Diagram 12.1: Location of Tunney's Field

In the wider area around the proposed Project area, the soils are designated on the Teagasc soil map (Teagasc 2016) as follows:

- River alluvium associated with the Morell River;
- Fine loamy drift with limestone;
- To the north of the existing site, soils associated with an urban environment.

Sub-soils beneath the site are shown to be Carboniferous limestone sands and gravels with undifferentiated gravelly alluvium sub-soils associated with the Morell River (EPA 2016).

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12.3.4 Geology Overview

A summary of the geology, including the made ground deposits identified at the existing site, is shown in Table 12.7. Geological cross sections through the site are shown in Figure 12.3 and the base of waste elevation and waste thickness are shown in Figures 12.4 and 12.5. The natural geological sequence in the vicinity of the site comprises overburden deposits of glacial origin (sands and gravels, silt and clays), with alluvial (river) deposits close to the major rivers (including along the Morell River). These overburden deposits overlie limestone bedrock. On the existing site, the natural geology has been altered by the quarrying of the sand and gravel deposits and subsequent deposition of waste materials

Table 12.7: Summary of Geology

Geological strata	Occurrence	Thickness (m)	Further Comments
Made ground	Present in Zone 1, Zone 2, Zone 3 and Zone 4 (see Figure 12.5 for extent of the waste). Potentially present in other in-filled quarries to the north-west of the existing site	0 to 36m	The greatest thickness is observed in Zone 1 of the existing site. Made ground likely to be absent in Tunney's Field.
Glacial overburden deposits	Beneath the entire existing site and adjacent area.	5 to 25m	The glacial deposits are dominantly sand and gravel in nature and it is this material that would have been quarried at the site. However, deposits of a more clayey or silty nature are present, particularly to the south of the existing site in Zone 4.
Alluvium (overburden)	Deposits laid down by the major rivers in the region including the Morell River	Approximately 5m to 7m	Identified as a silty, clayey material, although sandy in places.
Limestone bedrock	Present beneath the whole region	Over 100m	

No recorded landslides within the hydrogeology study area are shown on the GSI landslide map (GSI 2016).

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12.3.5 Occurrence of Waste Materials and Made Ground

Made ground (principally in the form of waste deposits) is present over most of the proposed Project area, with the greatest thickness and lowest elevation of made ground being in the centre of Zone 1 where approximately 36m of made ground has been observed (see Figures 12.4 and 12.5 for the areas where waste has been encountered). The made ground is principally waste material comprising a mixture of municipal solid wastes (MSW and also known as "household waste") and construction and demolition (C&D) waste. In general, the MSW is identified in greater proportions beneath Zone 1 and Zone 2A. Beneath Zone 2B and beneath Zone 4, C&D wastes predominate with much of the waste within Zone 4 appearing to consist of the residuals from waste that has previously been processed on site (Table 12.8). No hazardous wastes have been noted in the ground to date.

Table 12.8: Occurrence of Waste by Zone

Zone	Waste type	Thickness (m)	Further Comments
Zone 1	Principally MSW described as containing varying quantities of timber, paper, textiles, soft plastic, rubber, metal, brick and concrete.	Maximum thickness over 36m	The greatest thickness of waste on the existing site is observed in Zone 1.
Zone 2A	MSW and C&D waste described as containing varying quantities of timber, paper, cardboard, textiles, soft plastic, rubber, metal, brick and concrete. Measurements of methane during the ground investigations showed high concentrations indicating a high proportion of putrescible waste.	Up to 16m	Waste is present directly beneath concrete hardstanding in this area. Also, the bund which bounds the south of this zone also contains waste. The presence of waste in the bund to the west is uncertain.
Zone 2B	Principally C&D waste described as containing varying quantities of hardcore, plastic, timber, concrete and brick. Measurements of methane during the ground investigations showed low concentrations indicating a low proportion of putrescible waste.	3m to 12m	The thickest waste deposits in this zone are present along the zone's north-eastern boundary where a "bund" of waste material is present. Beneath a concrete pad associated with this zone, around 6m of waste is present.
Zone 3	This zone contains C&D wastes with varying amounts of clay, gravel, concrete, brick, wood, textile, plastic, rubber and metal. Non-hazardous waste excavated from the location of the fire at the site in 2011 was also deposited in the lined cell; volume approximately 35,000m^3. Following demolition of the site buildings in 2016, non-hazardous wastes that had been stockpiled in and around the buildings was removed and deposited to the lined cell; approximate volume 14,000m^3.	Up to 13m	Wastes in this zone are in an engineered lined cell.
Zone 4	Principally C&D waste described as containing varying quantities of hardcore, plastic, timber, concrete and brick.	Up to 20m in mounds and bunds. Away from the mounds, the waste thickness is up to 5m	Wastes in this zone are largely present in mounds or bunds the latter of which border the north-eastern and eastern boundary of the zone.

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12.3.6 Overburden Geology

On a regional scale, the existing site is indicated to be in an area of glacio-fluvial sands and gravels which extend over an area of 2km^2 (Figure 12.6). Due to the nature of the historical development of the site, originally as a sand and gravel quarry, the overburden deposits beneath much of the existing site have been removed at least in part. However, it should be noted that boreholes which have fully penetrated the waste have all

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identified overburden deposits beneath the waste with no waste having been indented as sitting directly on the bedrock.

Boreholes installed immediately at the edge of the landfilled areas (shown by the extent of waste in Figure 12.5) and off-site are completed in the natural overburden deposits where little or no made ground is identified.

In general, this glacial overburden is characterised by an initial, more silty, clayey sand and gravel horizon approximately 3m thick underlain by gravelly sands approximately 10m thick and then sandy gravels around 7m thick. To the east and south-east of the existing site the glacial deposits tend to become more silty and clayey. However, within these clayey deposits, sand and sand and gravel horizons are present. In several boreholes installed along the Morell River and the site's eastern boundary, a hard conglomeritic horizon (a coarse-grained sedimentary rock that comprises a substantial amount of rounded to subangular gravel to cobble sized rock fragments) was encountered and this horizon appears to be observed in the river's bed.

Based on the information gained in the site investigations, a greater thickness of overburden deposits are found running through the centre of the site in a broadly north-south direction with a thickness in the region of 25m for example in borehole BH68, BB02 and DB02 (see Figure 12.2 for the location of these boreholes). The thinnest overburden deposit that has been proven by fully penetrating the deposits is in BB04 in the east of the site (on the northern boundary) where 6.7m of natural overburden deposits were proven.

Along the northern and eastern boundaries of the landfill, a number of monitoring wells were advanced to define the full thickness of the overburden deposits. The boreholes show that the thickness of overburden deposits increases in a northerly direction along the eastern boundary with the thickest deposits being encountered in borehole BB2 at 25m. The data suggests there is a buried channel running through the site in a generally south to north direction. Within the site itself, even thicker overburden deposits were encountered in borehole BH68 with the deposits being 26.8m thick. It should be noted, that this feature was speculatively identified in the resistivity survey as being present in the first geophysical investigation undertaken in 2010 (Apex Geoservices 2010).

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In the Morell River valley, clayey alluvium associated with the river predominates. However, the borehole logs for the north-east of the existing site show that sandy lenses (isolated pockets of overburden deposits) are present in the clay-dominated alluvium (for example in boreholes EMW02 and EMW05).

12.3.7 Bedrock Geology

The majority of the existing site is mapped by the GSI as being underlain by bedrock of the Ballysteen Formation (Figure 12.7). This formation is described as dark muddy limestone/shale and not susceptible to processes which would cause an increase in permeability such as karstification. The far north-west corner of the existing site is underlain by the Waulsortian Limestone, which is described as a pale grey muddy limestone

Ground investigations in 2012 and 2016/2017 reached the bedrock in 12 boreholes although the 2012 borehole logs do not provide a description of the bedrock strata. The 2016/2017 investigation included coring of the bedrock in a number of boreholes to provide a detailed description of the bedrock. Based on the 2016/2017 investigation, the bedrock is generally described as a strong to medium strong, thickly to thinly bedded, grey/dark grey, fine-grained, limestone. Based on these descriptions and appearance of the limestone, the rock encountered would appear to be the limestones of the Ballysteen Formation which is shown on the geological maps as underlying the majority of the site.

Fracture logging in the Factual Report of Ground Investigation (IGSL 2017) shows the upper sections of the bedrock to be highly fractured, with the number of fractures reducing with depth. The logs show the rock quality designation (RQD) which is an indication of the degree of fracturing within the rock mass, measured as a percentage of the drill core recovered in lengths of 0.1m or more. High quality, competent rock has a RQD of more than 75% and low quality, fractured rock has a RQD of less than 50%. The log for borehole BB4 shows that there is less fracturing at depths with RQDs of over 95% being recorded from a depth of 15m onwards (this

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being approximately 8m from rockhead) and in borehole BB1, a RQD of 90% is recorded at around 5m below rockhead.

The borehole logs also show that within many of the fractures clay is recorded as being present.

The depth to bedrock was recorded in the borehole logs as being between 7.1m and 26.8m bgl (metres below ground level) with the bedrock elevation varying from 62mOD (metres Ordnance Datum) in borehole BB02 to 79.5mOD in BH60. The plan showing the contours of the bedrock (Figure 12.8) would indicate that there is a buried channel running through the site in a south to north direction, with the lowest point being identified on the north-eastern boundary in borehole BB02. The estimated depth to bedrock is shown in Figure 12.9.

The GSI website (GSI 2016) shows that there are no mapped karst features (cavities and cave systems created by weathering of limestone) present in the limestones within the hydrogeology study area.

12.3.8 Geological Features of Interest

The Geological Survey of Ireland (GSI) publishes a list of “Sites of Geological Interest”. The audit of County Geological Sites in County Kildare was completed in 2005 and there are no sites within the hydrogeology study area (GSI 2005; GSI 2016).

12.3.9 Hydrogeology Overview

Beneath the existing site, the overburden deposits form one aquifer and the limestone bedrock forms a second aquifer although the GSI overburden aquifer designation map (GSI 2016) does not show the glacial sand and gravel deposit to be a recognised aquifer in the vicinity of the site. The map does show the bedrock (both the Ballysteen Formation and Waulsortian Limestone) to be classified by the GSI as being a Locally Important aquifer which is moderately productive only in local zones (Figure 12.10). The GSI’s vulnerability classification for the bedrock aquifer in the vicinity of the existing site is ‘high’ (Figure 12.11).

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Within the overburden deposits, groundwater flow will be within the pore spaces between the sand and gravel deposits. Whilst the clay and silt deposits may have a relatively high percentage of pore space, there will be very limited groundwater movement in these deposits with the clays forming a barrier to groundwater flow.

In the bedrock aquifer, flow will be dominantly in fractures rather than within the rock matrix itself. A review of available data indicates that groundwater flow in these deposits is likely to occur in the upper few metres of the deposits according to Poorly Productive Aquifers – Monitoring Installations and Conceptual Understanding (EPA 2010d). Whilst there are no relevant published data for the bedrock in the immediate vicinity of the existing site, similar rocks in the region (which are classed as both “Locally Important” aquifers and “Poorly Productive” aquifers), show that the top metre or so of the bedrock is classed as a “transition zone” where the rock is often highly fractured and has a “rubbly” appearance (EPA 2010d). This transition zone is likely to be less than a metre thick and is underlain by a “shallow bedrock” zone where fractures are present which may or may not be clogged with residual clays. This shallow bedrock zone is unlikely to reach a depth from rockhead of greater than 10 to 20 metres and in turn is underlain by the “deep bedrock” zone. This deep bedrock zone is a zone in which fractures become fewer with depth and in which there is reduced groundwater flow compared to the two overlying zones. However, it is important to note that all these zones may not be present or apparent at any given location (EPA 2010d).

Based on the borehole logs from the 2016/2017 investigation, it is apparent that there is this transition zone and fractured “shallow bedrock” zone beneath the Kerdiffstown site. Although the thickness of the transition zone is not easily determined, it is apparent that the upper five to ten metres of the bedrock is fractured and will provide the dominant pathway for groundwater movement in the bedrock.

The site is located in the Eastern River Basin as defined under the Water Framework Directive and within the Kildare River Basin District. The basin’s management plan was produced in 2010 (the Eastern River Basin District River Basin Management Plan. 2009 – 2015, Department of Environment, Heritage and Local

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Government 2010). The site is shown on the GSI mapping portal to lie on the south-western edge of the Dublin Groundwater Body which covers an area of 824km^2 (GSI 2016). In 2004 the groundwater body in the vicinity of the site was “not at risk” and is shown to be of good chemical and quantitative status. The second cycle of the River Basin Management Plans (RBMPs) is currently underway and the draft second cycle RBMPs setting out the status of waters, the proposed environmental objectives and the draft programme of measures to achieve those objectives by 2021 will be issued early in 2017.

12.3.10 Groundwater Levels and Flow

Groundwater strikes within the overburden deposits observed during the time of site investigations did not generally record large water inflows following the strike (see the borehole logs in IGSL 2017). Many of the boreholes did not record water strikes, even though subsequently the completed boreholes were found to contain groundwater. However, when drilling the bedrock boreholes, it was noted that large inflows occurred when the fractured transition zone at the top of the bedrock was encountered. This would indicate that this zone is potentially an important flowpath for groundwater and any contamination within the groundwater, although where the fractures are clay-filled the importance of this zone for groundwater flow will be reduced.

The borehole logs (IGSL 2017) also show that following water strikes in the overburden deposits, the water levels rose slightly and this, together with the presence of “blowing sand” in some boreholes would indicate that there is a degree of confinement in the overburden deposits with the more clayey horizons (sometimes associated with alluvial deposits along the Morell River) providing the confining layer. The conglomeratic horizon encountered close the Morell River also has the potential to provide a confining layer or a barrier to the downward flow of groundwater.

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Groundwater levels in all available monitoring wells (Figure 12.12) are measured monthly. Groundwater contour plans for the overburden deposits and the underlying bedrock recorded in February 2017 are shown in Figures 12.13 and 12.14 (levels at this time were, in most boreholes, close to the yearly low levels although water level data from other dates show a similar pattern for the two geological strata). Over the existing site, the groundwater contours for the overburden deposits indicate a general fall in groundwater levels from south to north indicating a broadly north-easterly groundwater flow direction. Groundwater levels to the south of the existing site are in the order of 81mOD with levels to the north-east of the existing site being in the order of 78mOD. However, the data also show an easterly flow component with flow from the site to the Morell River.

There are a number of wells in Zone 4 which appear to be perched levels (where local groundwater levels are higher than the regional level) with, for example, BH2 (water levels around 84mAOD), DB09 (88mAOD) and DB10 (88.3mAOD) all having water levels much higher than measured at the other wells in this part of the site. There are also a number of high groundwater levels recorded at a number of wells completed in the waste in Zones 2 and 3, and these too are likely to be perched water levels.

A weir on the Morell River adjacent to the existing site has an elevation of 79.79mOD. The well RM05, is closest in proximity to the Morell River and in February and March 2017 it had a groundwater level of 79.31 mOD and 79.37 mOD respectively suggesting the river and groundwater are in hydraulic connection. To the south of the weir, the river levels would be greater than 79.79mOD, whilst to the north the river levels would generally be less than 79.79mOD. It is noted that groundwater levels on the site to the north of the weir in Zone 4 do fall below the weir elevation at times of low groundwater levels, indicating that on occasions there is the potential for water to flow from the river to groundwater.

The Morell River flows generally northwards to flow into the River Liffey. The River Liffey itself lies approximately 3km north-west of the existing site at its closest point, also flowing generally northwards, before following a more eastward flow direction some 5km to 6km north of the site. There is a major public water supply abstraction from the River Liffey at Leixlip, which serves Fingal, Kildare and north Dublin.

Spot measurement of the water level in the Canal Feeder Stream to the west of the existing site has shown this feature to be at an elevation of approximately 80.6mOD adjacent to the existing site (at monitoring point SW10).

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This suggests that the Canal Feeder Stream may be hydraulically connected with groundwater, although the observed groundwater flow direction (i.e. south to north) indicates that there is likely to be little groundwater input to this stream from groundwater in the vicinity of the site.

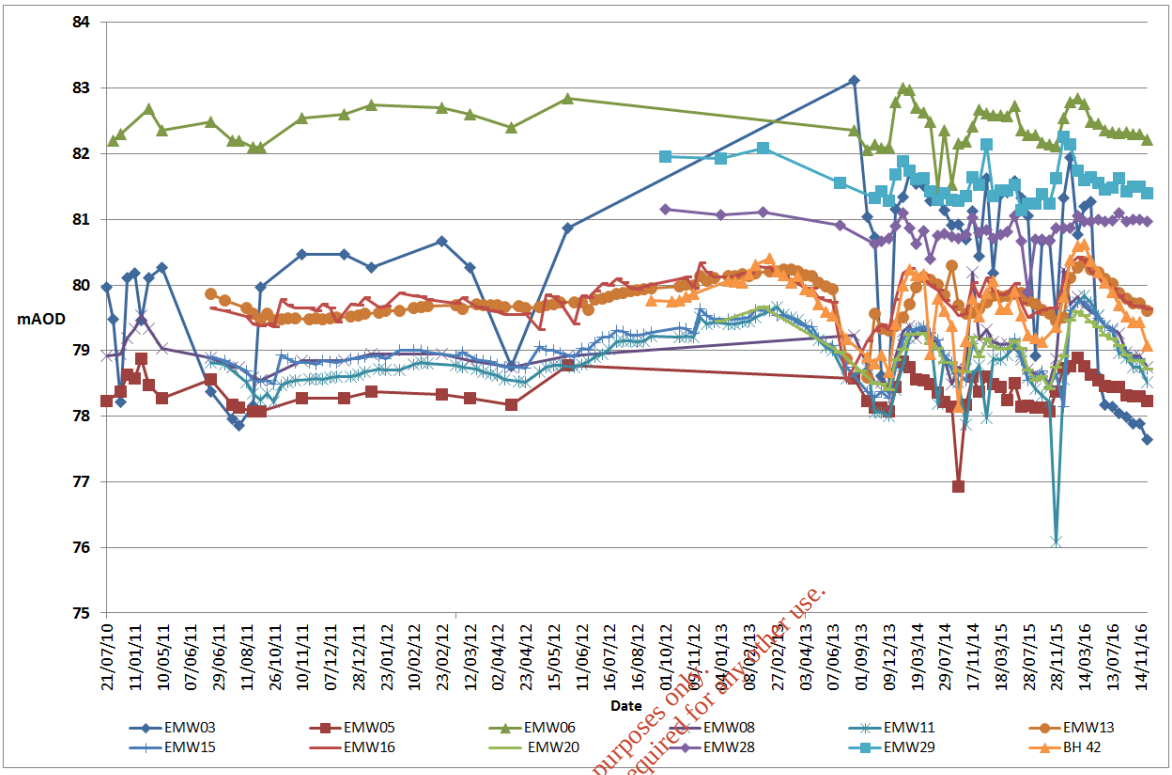
There are now 11 monitoring wells in the bedrock aquifer from which water levels are obtained. The pattern of inferred contours for the bedrock is shown in Figure 12.14 which shows a generally south to north flow with water levels being around 79mOD in the south and 76mOD in the north. The groundwater levels recorded in the bedrock boreholes are typically in the order of 10m to 15m higher than the bedrock surface elevation.

Comparison of measured water levels between the overburden and bedrock aquifers indicates higher water levels within the overburden deposits across the existing site (typically in the order of 2m to 3m). This difference in groundwater level provides a mechanism for potential downward flow of groundwater (and potential contamination from the wastes in the landfill) into the bedrock aquifer. However, in borehole BB04 which is completed near to the Morell River in the south-east of the site, the groundwater elevation in the bedrock is close to the elevation recorded in the overburden deposits and the Morell River elevation. This would indicate that in this part of the site there is potential that groundwater in the bedrock is in connection with the Morell River. Furthermore, as often occurs in groundwater systems, it is possible that beneath the length of the river the bedrock groundwater level is higher and groundwater from the bedrock could discharge to the river as the river would act as a discharge point.

Since groundwater level monitoring commenced in 2010 for off-site boreholes and 2011 for on-site boreholes, the groundwater level data show that there has been a gradual increase in overall water levels up to January 2013 by between approximately 0.5m and 2m (refer to Diagram 12.2 below). This is likely to be the result of increased rainfall during 2012 which was a wet year relative to 2011, with 861mm of rainfall recorded at Casement weather station in 2012 compared to 429mm of rainfall recorded in 2011. Following this rise in groundwater levels, the levels have been exhibiting a seasonal fluctuation in the region of 0.5m to 1m with the high groundwater levels being recorded in the late winter/early spring and the low water levels recorded in late summer. This seasonal variation is typical of groundwater levels in Ireland where high winter rainfall and low evapotranspiration rates lead to groundwater recharge over the winter. In the spring and summer, little or no rainfall will reach the groundwater table due to evapotranspiration and rainfall reducing soil moisture deficits. As a result, groundwater levels fall during the spring and summer and start rising again in the autumn, although due to a relatively dry autumn and early winter in 2016 water levels in 2016 were not observed to have risen by December.

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Diagram 12.2: Groundwater Levels Recorded Over Time for Selected Overburden Boreholes

Data produced by the GSI (GSI 2016) shows that in the vicinity of the site the effective rainfall (that is the rainfall which will either recharge ground or runoff as shallow flow to streams) is 391mm/year with the groundwater recharge to the limestone bedrock being 200mm/year. Recharge to the shallow sand and gravel deposits and the wastes within the Kerdiffstown Landfill site boundary is likely to be higher than the recharge to the limestone and closer to the effective rainfall value (in assessments undertaken where groundwater infiltration is a required parameter, an infiltration rate to waste of 350mm/year has been assumed).

With respect to groundwater levels and the base of the waste, in most areas, the waste is above the groundwater table. However, in the south and east of Zone 1 and the north-east of Zone 2B, the data show that the waste is below the groundwater table such that the waste is saturated in this area (Figure 12.15). Up to 5m of waste may be saturated in parts of Zone 1. Within Zone 4, the data also show that wastes are locally present below the water table in areas where there are mounds of waste. Zone 3, the lined landfill cell, was constructed above the water table, although there is local perching of groundwater to the south and west of the zone where the perched groundwater table is locally above the base of the liner.

12.3.11 Groundwater Abstractions

Whilst the GSI website (GSI 2016) shows 74 wells and springs to be present within the hydrogeology study area, most of these wells appear to relate to boreholes installed for ground investigation, other investigation purposes or relate to historical wells. However, based on the “well use” description, wells shown in Table 12.9 have been identified as potentially being in use. The location of these abstractions is shown on Figure 12.1:

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Table 12.9: Potential Groundwater Abstractions within the Hydrogeology Study Area

Well Type	Location		Locational Accuracy (m)	Depth (m)	Use
	Easting	Northing			
Dug well	690311	724559	50	14.1	Agricultural and domestic use
Borehole	690961	720979	10	15	Industrial use
Dug well	691401	724788	50	2	Agricultural and domestic use
Borehole	690531	721229	10	11.9	Industrial use
Unknown	689971	724059	50	NR	Agricultural and domestic use
Dug well	690891	724798	50	4.4	Agricultural and domestic use
Dug well	691191	724598	50	1.5	Agricultural and domestic use
Dug well	691241	724688	50	2	Agricultural and domestic use
Dug well	690301	724479	50	4.2	Agricultural and domestic use
Dug well	690911	724948	50	6.8	Agricultural and domestic use
Dug well	690880	724998	50	NR	Agricultural and domestic use

NR – Not recorded

Two groundwater abstractions were situated on the Kerdiffstown Landfill site but these are effectively no longer operational other than for a minor abstraction used very occasionally for site operations (details are also not fully known in terms of depth or how much water they historically abstracted). In addition to these former abstractions, the data presented in the Kerdiffstown Remediation Project Groundwater Management Plan (SKM Enviros 2013a) identified a further abstraction associated with Palmerstown House Golf Course, situated approximately 500m to the north-east of the existing site. As this is situated to the east of the Morell River it is unlikely to be a receptor for groundwater from the Kerdiffstown Landfill and its use is understood to be for watering the golf course rather than being for the more sensitive end-use of a drinking water supply.

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With respect to the Waulsortian Limestone, due to the variable nature of the limestone, it is known that wells regularly fail in this horizon and that poor yielding wells can occur very close to more successful wells. This indicates the unpredictability of this rock unit in terms of providing a water source. The Ballysteen Limestone also shows variable productivity and a small number of wells are described as having excellent productivity in the County Kildare Groundwater Protection Scheme Volume 1: Main Report (GSI 2002).

12.3.12 Permeability and Groundwater Flux

In-situ permeability (hydraulic conductivity) tests have been completed in a number of boreholes on two occasions as follows, with the results shown in Table 12.10.

- In 2012, permeability tests were completed in groundwater monitoring wells installed in the 2011 and 2012 ground investigations. These tests were principally in wells completed in the overburden deposits although one test was also undertaken in one of the completed bedrock boreholes (EMW12D).
- During the 2016/2017 ground investigation further permeability tests were undertaken in boreholes at the time of drilling. Four of the tests were undertaken in the bedrock.

The results from the 2016/2017 tests undertaken in boreholes at the time of drilling show results which are generally orders of magnitude below those in the competed wells with the highest value being 1.9m/d (only two results in the tests undertaken in completed boreholes were below this value).

For the test undertaken in the completed borehole in bedrock (EMW12D) the result was similar to the tests undertaken in the over burden deposits. EMW12D is completed in the shallow bedrock deposits (the top 7.5m of bedrock) and as such is likely to be completed in the zone where fracturing of the bedrock is enhanced. As with permeability tests in the overburden deposits, the results from permeability tests undertaken during the 2016/2017 site investigation shows values to be orders of magnitude lower than the test in the completed EMW12D borehole.

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Table 12.10: Permeability Measurements

Borehole	Geological Horizon	Permeability (m/day)	Permeability (m/s)
Overburden Deposits – tests undertaken in completed wells			
EMW11	Gravelly SAND	2.0	2.31E-05
EMW13	Silty, sandy coarse GRAVEL	5.7	6.60E-05
EMW14	Silty, gravelly CLAY	0.01	1.16E-07
EMW15	Silty, sandy coarse GRAVEL	13.5	1.56E-04
EMW16	Sandy, silty gravelly CLAY	0.1	1.16E-06
EMW17	SAND and GRAVEL	24.5	2.84E-04
EMW18	SAND and GRAVEL	32.5	3.76E-04
EMW20	GRAVEL, occasional cobbles	147.5	1.71E-03
EMW21	GRAVEL, occasional cobbles	119.5	1.38E-03
EMW23	Sandy GRAVEL	9.06	1.05E-04
EMW28	Sandy GRAVEL	11.4	1.32E-04
EMW30	Gravelly SAND	18.3	2.12E-04
Overburden Deposits – tests undertaken in boreholes during drilling			
DB01	Firm brown very sandy silty CLAY with some fine gravel bands. Sand is fine to coarse. Gravel is fine.	0.038	4.35E-07
DB01	Stiff to very stiff brown slightly sandy gravelly CLAY with some cobbles	0.012	1.36E-07
DB03	Medium dense to dense grey slightly silty gravelly fine to coarse SAND. CLAY at base	0.181	2.09E-06
DB03	Gravelly SAND (driller's description)	1.875	2.17E-05
DB12	Medium dense to dense, brown, slightly gravelly silty SAND with gravel/sand conglomerate from 8.5m.	0.055	6.31E-07
BB02	Sandy gravelly clay with occasional cobbles	0.023	2.71E-07
BH60	Gravelly CLAY with occasional cobbles overlying rock (driller's description)	0.009	1.05E-07
RM01	Medium dense brown/grey silty sandy fine to coarse GRAVEL	0.027	3.15E-07
RM01	Dense brown/grey fine to coarse GRAVEL with some lenses of blowing gravelly sand and some small cobbles overlying stiff, brown, slightly sandy very gravelly CLAY with many cobbles	0.346	4.00E-06
RM02	Dense grey slightly sandy fine to coarse GRAVEL with occasional silty sand pockets	0.005	6.19E-08
RM02	Dense grey slightly sandy fine to coarse GRAVEL with occasional silty sand pockets	0.005	6.10E-08
RM03	Dense grey slightly sandy silty fine to coarse GRAVEL	0.005	5.22E-08
RM03	Dense grey fine to coarse GRAVEL	0.632	7.32E-06
RM04	Medium dense brown/grey silty sandy fine to coarse GRAVEL	0.005	5.58E-08
RM04	Dense grey sandy fine to coarse GRAVEL with many fine to coarse cobbles	0.022	2.55E-07
RM05	Medium dense to dense grey very silty sandy fine to coarse GRAVEL	0.005	5.46E-08
RM05	Dense grey slightly sandy fine to coarse GRAVEL	0.056	6.49E-07
RM06	Dense grey slightly sandy fine to coarse GRAVEL	0.175	2.03E-06
RM06	Dense grey coarse GRAVEL with many cobbles	0.164	1.90E-06

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Borehole	Geological Horizon	Permeability (m/day)	Permeability (m/s)
Bedrock – tests undertaken in completed well			
EMW12D	Bedrock (no further description provided in borehole log)	5.4	6.25E-05
Bedrock – tests undertaken in boreholes during drilling			
BB01	Strong to medium strong, thickly to thinly bedded, grey/dark grey, fine-grained, LIMESTONE	0.032	3.76E-07
BB03	Strong to medium strong, thickly to thinly bedded, grey/dark grey, fine-grained, LIMESTONE	0.003	3.25E-08
BB04	Medium strong, thickly to thinly bedded, grey to brownish grey, fine-grained, LIMESTONE	0.083	9.62E-07
BH68	Strong, thickly to thinly bedded, grey/dark grey, fine-grained, LIMESTONE	0.004	4.61E-08

It should be noted that the method of testing only provides an indication of the hydraulic conductivity in the immediate vicinity of the borehole and not on an aquifer-wide scale which will be more important for contaminant flow from the existing site. In relatively complex geological settings as observed in the overburden deposits at Kerdiffstown, whilst local hydraulic conductivities may be high in the sand horizons, the bulk movement of water in the aquifer may be controlled more by the lower permeability values present in the clays and silts which can provide a barrier to flow (both vertically and horizontally) if there is no continuous sand horizon.

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Boreholes installed into the bedrock are at a relatively shallow depth and likely to be monitoring the "transition zone" or "shallow bedrock" zone (as defined in EPA 2010d). Insufficient details are provided on the boreholes logs to confirm if these zones are present or their depths due to the drilling method employed. However, the GSI has indicated that the transmissivity of both the Ballysteen and Waulsortian in this area is less than 10m^2/day with a bulk permeability for the two formations of 0.1 to 0.2m/day. Yields from the boreholes installed in the Ballysteen and Waulsortian bedrock are usually less than 30m^3/day (EPA 2010d). The measured bedrock permeability value for the one borehole measured at Kerdiffstown (EMW12D) of 5.4m/day would therefore suggest that this borehole is monitoring a transition / fractured zone.

Based on the measured hydraulic gradient and the permeability values, the groundwater flux (the volume of water which flows through a volume of rock over a given time), has been calculated for flow from Zone 1 in the overburden deposits to the east towards the Morell River as 160m^3/day to 640m^3/day, as per the report on Groundwater and Surface Water Monitoring at Kerdiffstown Landfill February 2013 (Geosyntec 2013). Further assessment of the impacts of groundwater contamination on river water concentrations for Zone 1 and other zones adjacent to the river based on the groundwater DQRA is provided in Section 12.3.17.

12.3.13 Baseline Leachate and Groundwater Quality

Leachate quality

Landfill leachate is a liquid which forms when water passes through degrading waste which dissolves environmentally harmful substances which may then enter the environment. The main components of concern with respect to water contamination are ammonia (directly toxic to fish and other aquatic life), dissolved organic material (mainly organic acids) which give rise to high demands for oxygen (chemical oxygen demand [COD] and biochemical oxygen demand [BOD]) which can deoxygenate waters (leading to fish kills) and chloride which increases salinity of water and changes the ecological make-up. Leachate also contains other components such as dissolved metals and trace organic compounds, and the extent of these depends principally on the origin of the wastes.

The EPA's web-based Envision mapping system (EPA 2016) does not show any groundwater quality monitoring points within the hydrogeology study area.

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Boreholes have been drilled into the wastes in Zone 1 and elsewhere. However, the majority of these boreholes were installed to investigate waste depth and composition. Due to difficult drilling conditions including impenetrable objects in the waste such as large concrete blocks and boulders, determination of waste thickness was not achieved. Further, as the majority of the site is unlined leachate is unlikely to have been collected in a discrete layer to enable detection and thus boreholes have not been completed as monitoring points to collect leachate. The 2016/2017 investigation did install monitoring points within Zone 1 although again difficulties completing the holes meant that the base of the waste was not always reached although casing to allow monitoring was installed. As such, leachate composition for each individual zone is not always available. Measurements of leachate levels in the boreholes completed in the waste in Zone 1 in early 2017 did not identify leachate to be present in these boreholes (see Appendix A12.1).

Samples of leachate are routinely collected from the lined cell in Zone 3 and these are analysed for a small range of parameters to allow the leachate to be disposed of off-site. Leachate is collected for temporary storage in tanks. Road tankers then extract the leachate from the tanks on a daily basis for off-site disposal at Ringsend Wastewater Treatment Plant. In addition, sampling of groundwater from boreholes completed below or adjacent to waste deposits provides an indication of the contaminants which are leaching from the waste.

The likely leachate composition based on the data from Zone 3 and groundwater quality data from below and around Zone 1 was assessed in the Kerdiffstown Landfill Remediation Project Groundwater DQRA Report for the Environmental Protection Agency (SKM Enviros 2014). The Zone 3 leachate results (Table 12.11) show that the leachate being produced at the site is typical of a landfill that has accepted MSW and C&D waste in that it has elevated chloride and ammoniacal nitrogen concentrations. Assessment of the groundwater data also shows elevated concentrations compared to background groundwater quality and environmental quality standards for certain metals (including nickel and zinc) and trace organic compounds including mecoprop (a pesticide used in “feed and weed” formulas so frequently found in landfills which have accepted domestic and construction and demolition waste) and phenol which shows that leachate is being produced in Zone 1.

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Table 12.11: Leachate Monitoring Results from Zone 3

Determinand*	No. of samples	IGV	Minimum	Average	Maximum
Ammoniacal nitrogen	231	0.15	**87.7**	**350**	**833**
Arsenic	9	0.01	<0.001	**0.057**	**0.224**
Benzene	4	0.001	<0.0005	**0.0046**	**0.0059**
Chloride	233	30	**171**	**434**	**1142**
Mercury	121	0.0001	<0.00005	0.0018	0.005
Nickel	158	0.02	<0.001	**0.098**	**0.605**
Phenol	1	0.0005	<0.05	<0.05	<0.05
Zinc	157	0.1	0.013	**0.302**	**3.7**

All values mg/l
* Results from samples taken from 2010 to 2016
Average calculated using the detection limit value where the result is reported as less than the detection limit
Results in bold show exceedance of the IGV

Groundwater Quality

To assess the impact on groundwater quality from the leachate, regular (monthly and six monthly) groundwater and surface water monitoring is undertaken. Monthly monitoring has been undertaken from selected boreholes for a reduced analytical suite. Six monthly sampling has been undertaken from all serviceable monitoring boreholes with analysis for an expanded analytical suite which includes organic parameters. Monthly monitoring commenced in October 2013 and results and findings of groundwater monitoring are included in monthly monitoring reports. The most recent six-monthly groundwater monitoring report is included as Appendix A12.2. Groundwater sampling of the wells installed in the 2016/2017 ground investigation was undertaken in early 2017. Results from this monitoring are reported in Appendix A12.1. Monitoring includes the collection and analysis of groundwater samples for a range of potential contaminants associated with landfill leachate. These

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have been collected from both on-site and off-site monitoring wells installed within overburden deposits and the underlying bedrock.

Groundwater chemical analysis results indicate elevated concentrations of parameters present in the leachate including ammoniacal nitrogen, chloride and trace organic compounds. Concentrations of certain substances are recorded as exceeding interim environmental quality objectives and standards set for protecting groundwater quality in the EPA interim report Towards Setting Guideline Values for the Protection of Groundwater in Ireland (EPA 2003c). Table 12.12 sets out exceedances for certain key determinands which are identified in the groundwater. It should be noted that the EPA recently issued for consultation proposed revised guideline values for groundwater (EPA 2017a). These proposed values are also shown on Table 12.12 with the key differences being for chloride (30mg/l as the IGV and increasing to 125mg/l) and for mecoprop (decreasing from 0.01mg/l as the IGV to 0.00005mg/l). Potassium has not been included in the proposed revised guideline values.

Table 12.12: Exceedances of Interim Guideline Values for Key Leachate Parameters Measured Around the Whole Site

Determinand	IGV*	Proposed Guideline Value for Groundwater**	Maximum Concentration measured in groundwater^	Location of Maximum
Ammoniacal nitrogen	0.15	0.15	**273**	EMW14
Chloride	30	125	**475**	BH26
Mecoprop	0.01	0.00005	**0.084**	EMW14
Phenols	0.0005		**0.230**	BH26

All values mg/l
* Interim Guideline Value (EPA 2003c)
** Proposed Guideline Value for Groundwater (EPA 2017a).
^ Measured up to December 2016
Values in bold show exceedances for the IGV

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Figures 12.16 to 12.19 show the distribution of chloride, ammoniacal nitrogen, phenol and mecoprop (an organic herbicide) across the existing site and off-site in December 2016 whilst Figures 12.20 to 12.23 show the same parameters for the samples taken in February 2017 (these latter figures include samples taken from the boreholes installed in the 2016/2017 investigation). These key contaminants occur in elevated concentrations in leachate for landfills that accepted household wastes and wastes that are likely to degrade. Ammoniacal nitrogen is linked to ammonia which is highly toxic to aquatic species. Whilst chloride provides a good “tracer” for landfill leachate as it is very mobile and discharges to surface water can alter the ecology of the receiving water. Phenol is an organic compound with relatively high mobility and is frequently found in leachates and groundwater, as has been the case at Kerdiffstown. Mecoprop is an active ingredient in many broadleaf weed killers and is commonly detected in landfill leachate and has been detected in the groundwater at Kerdiffstown. Both phenol and mecoprop have relatively low guideline values in groundwater.

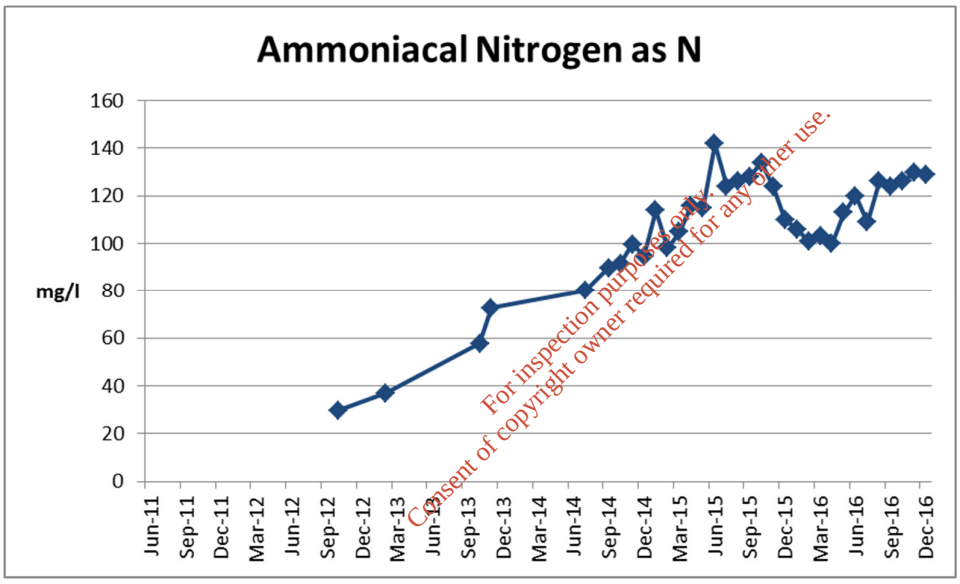
Figures 12.15 to 12.22 do not show a clear contaminant plume emanating from the site, although figures show that substances are present in on-site monitoring wells completed in the overburden deposits and in groundwater off-site. These occur principally in monitoring wells located along the north-eastern boundary of the existing site near to the unlined and uncapped area of the landfill (Zone 1 and Zone 2B) and along the site’s northern boundary (wells DB2 and DB3). However, wells situated closest to the Morell River do not show greatly elevated concentrations of the key substances although there is evidence that increases in concentrations of determinands associated with landfill leachate are observed such as EMW05 during times of lower water levels during the summer.

Monitoring of the river does not show a discernible impact from these substances with the probable exception of slight changes in chloride concentrations (typically in the range of 1 to 2mg/l) as the river flows past the site. In the winter, the monitoring shows a slight increase in the chloride concentration observed downstream whilst during the last two summers the concentrations downstream are slightly lower than upstream.

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Groundwater monitoring has shown seasonal variation in quality in certain boreholes, with the highest concentrations being detected in late summer. This likely occurs due to dilution of leachate in the winter from increased groundwater recharge. Elevated concentrations of determinands associated with landfill leachate are observed in the well closest to the Morell River (EMW05) during times of lower water levels during the summer. However, the measured concentrations are significantly lower than measured in boreholes on the site boundary such as EMW13 and EMW03.

The most recent groundwater monitoring reports (Appendices A12.1 and A12.2) includes plots of groundwater quality data over time. In the majority of boreholes, there is no indication of substance concentrations increasing or decreasing over time. However, in borehole BH26, completed in the overburden deposits at the base of the waste in Zone 1, the ammoniacal nitrogen concentration has increased since the borehole was installed (Diagram 12.3). Furthermore, in 2016 concentrations of certain substances, including ammoniacal nitrogen (Diagram 12.4) and chloride, increased in EMW20 on the existing site's north-eastern boundary. The increase in concentrations in borehole EMW20 is likely to reflect seasonal increases observed since monitoring began in certain other boreholes on the north-eastern boundary such as in EMW03 (Diagram 12.5).



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Diagram 12.3: Ammoniacal Nitrogen Concentration in BH26 over Time

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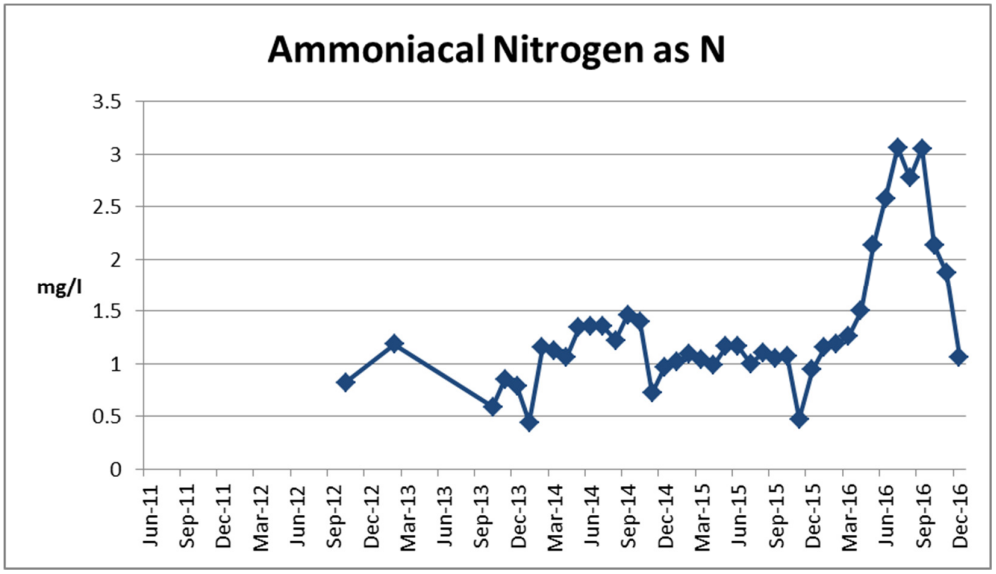


Diagram 12.4: Ammoniacal Nitrogen Concentration in EMW20 over Time

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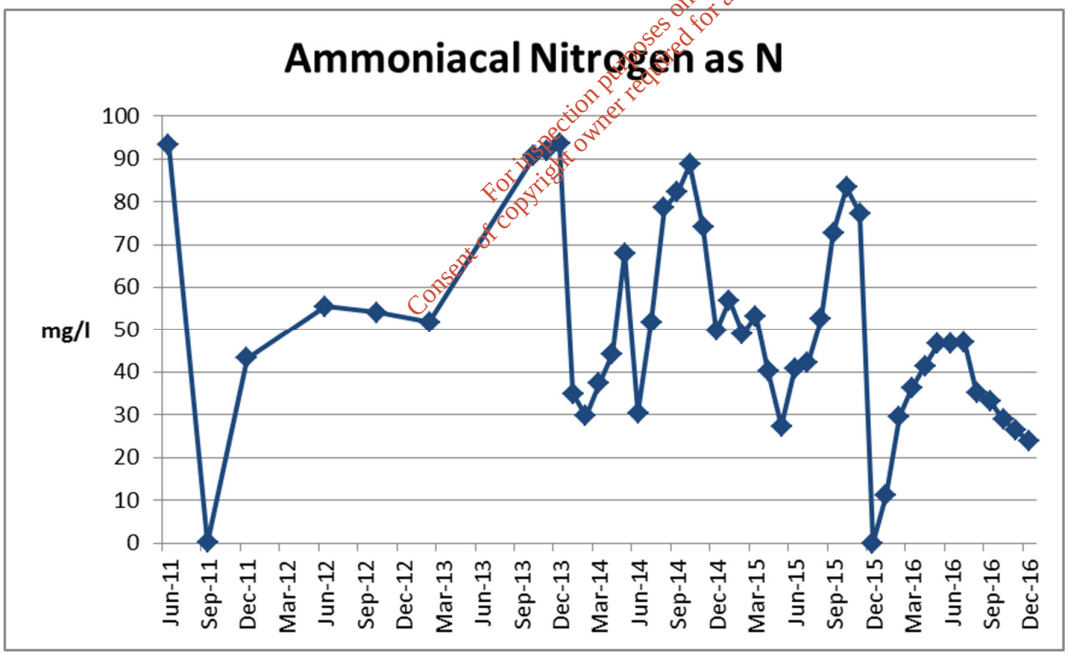


Diagram 12.5: Ammoniacal Nitrogen Concentration in EMW03 over Time

An assessment of the seasonal variation in contaminant concentrations with respect to rainfall is presented in Appendix A12.1 for selected boreholes. No clear correlation between rainfall and contaminant concentration is apparent throughout the site, although following a wet month in December 2015 (205mm) concentrations of ammoniacal nitrogen were noted to significantly decrease in borehole EMW03 and EMW05, but it did not appear to affect the concentration in EMW19. Furthermore, in spite of the dry weather in the autumn of 2016, concentrations of ammoniacal nitrogen in the boreholes continued to show the seasonal trend of reducing in the autumn, suggesting that seasonal recharge periods are more important than individual rainfall events.

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In certain circumstances the ratio of potassium to sodium can be used to determine groundwater contaminated by organic material and in Irish groundwaters the potassium:sodium ratio is usually less than 0.4 as noted in the County Kildare Groundwater Protection Scheme Volume II: Source Protection Zones (KCC and GSI 2004). A potassium:sodium ratio greater than 0.4 can be used to indicate contamination by plant organic matter, usually from farmyard 'dirty water', but occasionally from landfill sites from the breakdown of paper. Groundwater quality data collected in June 2016, December 2016 and sampling of the new wells (installed in the 2016/2017 ground investigation) in February 2017 shows that in most cases the potassium:sodium ratio of 0.4 is not exceeded. Even in boreholes where contamination from landfill leachate is evident and including boreholes situated between the waste boundary and the Morell River. However, as shown in Table 12.13 the ratio does exceed 0.4 in 10 boreholes on each occasion the wells were sampled in 2016 (out of 34 boreholes sampled) and seven samples (out of 23 wells sampled) in February 2017. The three cases where the ratio is elevated for the off-site locations (boreholes EMW23, EMW32, BB03 and possibly EMW24) are likely to be elevated due to a source other than landfill leachate with an agricultural input the most likely source. For the other elevated ratios landfill leachate is the most likely source.

Table 12.13: Locations where the Potassium:Sodium Ratio Exceeds 0.4

Area of site	Borehole	K:Na ratio, June 2016*	K:Na ratio, December 2016*	K:Na ratio, February 2017*
Northern and eastern boundary of Zone 1	EMW03	<0.4	0.48	NS
	EMW06	0.58	0.90	NS
	EMW13	0.41	0.40	NS
	EMW24	0.40	<0.4	NS
Zone 2A	EMW11	0.90	0.59	NS
	BH68	NS	NS	0.95
	BH77	NS	NS	1.76
Zone 2B	EMW15	0.62	0.55	NS
Zone 3	BH78	NS	NS	0.82
Zone 4	BH6	0.58	0.73	NS
	BH7	0.96	0.68	NS
	BH42	0.47	0.56	NS
	BH70	NS	NS	0.70
	BH71	NS	NS	0.65
	BH69	NS	NS	0.81
Off-site to the north	EMW23	1.58	1.50	NS
	EMW32	0.67	0.69	NS
Off-site to the west	BB03	NS	NS	0.55

NS – Well not sampled or not tested for potassium
* 34 wells were sampled in June and December 2016 and 23 wells were sampled in February 2017

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With respect to groundwater quality in the bedrock, low concentrations of substances associated with landfill leachate (including ammoniacal nitrogen and potassium) are measured in boreholes EMW12, EMW19 and BB01. However, concentrations are significantly lower than measured in the overburden deposits in the vicinity of Zone 1.

In the 2016/2017 ground investigation, chemical testing was undertaken on selected soil samples in the form of leaching tests, to assess how much contamination could leach from the soils and reach groundwater. Full results of the leaching tests are provided in the IGSL Factual Report of Ground Investigation (IGSL 2017) and summarised in Table 12.14.

The results show that in Zone 1, high leaching rates can occur with the average ammoniacal nitrogen and chloride concentrations exceeding the IGV for these substances. Zone 1 was also the only zone where phenol

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was detected, although mecoprop was not measured in any sample. Relatively high concentrations of ammoniacal nitrogen were also measured in the leachate from samples taken at the top of Zone 3 (the lined cell) although the concentrations were not as high as the values recorded in the leachate collected from the zone and removed for off-site treatment. For Zone 4, the maximum ammoniacal concentration detected was 21.8mg/l although chloride was not greatly elevated. For the samples from the other zones, relatively low concentrations of ammoniacal nitrogen and chloride were measured, and in the case of phenol and mecoprop these substances were not detected.

Table 12.14: Leaching Test Results from 2016/172016/2017 Ground Investigation (all results mg/l)

Zone	No. of tests	Determinand	IGV	Minimum leachate concentration	Average leachate concentration*	Maximum leachate concentration
Zone 1	14	Ammoniacal nitrogen	0.15	<0.03	**42.3**	**171.98**
		Chloride	30	0.5	**45.3**	**187.9**
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	**0.0043**	**0.01**
Zone 2A	4	Ammoniacal nitrogen	0.15	<0.03	0.0625	0.1
		Chloride	30	0.3	0.875	1.6
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	<0.0005	<0.0005
Zone 2B	5	Ammoniacal nitrogen	0.15	0.07	**0.778**	**2.47**
		Chloride	30	0.5	5.92	21.4
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	<0.0005	<0.0005
Zone 3	4	Ammoniacal nitrogen	0.15	1.83	**37.0**	**57.76**
		Chloride	30	1.2	20	**31.7**
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	<0.0005	<0.0005
Zone 4	5	Ammoniacal nitrogen	0.15	0.03	**7.18**	**21.8**
		Chloride	30	0.8	9.5	25.3
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	<0.0005	<0.0005

* Average value calculated using the detection limit where a result is reported to be below the detection limit. Results in **bold** show exceedance of the IGV

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12.3.14 Baseline Landfill Gas

Currently active gas extraction occurs in two areas of the site; the lined cell (Zone 3) where the majority of the currently in-place waste has gas extraction well coverage, and the north-western section (Zone 1) where only approximately a quarter of the in-place waste has gas well coverage.

The aims of the existing measures are to control off-site migration along the north-western boundary of the site where wastes are deep and close to the edge of the original sand quarry wall, and houses and outbuildings are present within 10m of the site boundary. Also to reduce emissions to the atmosphere and to control odours (these two areas of the site were identified in the Kerdiffstown Odour Control Plan (SKM Enviros 2013b) as being significant for gas emissions to the atmosphere and hence odour.

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Within the lined cell, wastes have been covered with a temporary heavy duty membrane to assist with odour management and to reduce air from being drawn in during gas extraction operations.

Gas extraction is accomplished via a network of gas extraction wells and pipework. Gas is removed and burnt in specially manufactured stainless steel high temperature gas flares. There are two flares on site, one with capacity 250m^3/hr and the second with capacity 500m^3/hr. Valves are incorporated within pipework which enables gas from both fields to go to a single flare, or to separate flares, depending on gas yields and quality. Currently, all gas extracted is being directed to the '250' flare, with the '500' flare acting as standby.

The overall quality of gas entering the 250 flare has declined gradually over time with current flows of approximately 100m^3/hr and gas concentrations noted at 23% methane, 23% carbon dioxide and 0.3% oxygen. This represents a decrease of more than a half for the gas flows compared to initial gas yields during July/August 2011. The decline in gas yields has been seen to be relatively steady since April 2012 despite weekly monitoring and adjustment of gas flow rates to ensure the landfill gas reaching the flare is suitable quality for flaring.

12.3.15 Hydrogeological Conceptual Site Models

Hydrogeological Conceptual Site Models (CSMs) for the different zones of the existing site have been developed based on the following guidance:

- Code of Practice: Environmental Risk Assessment for Unregulated Disposal Sites 2007 (EPA 2007);
- Framework Approach for the Management of Contaminated Land and Groundwater at EPA Licensed Facilities 2012a (EPA 2012a); and
- Model Procedures for the Management of Land Contamination (EA 2004).

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The conceptual models are based on the long-established "source-pathway-receptor" approach that without all three components being in place there can be no risk to the receiving environment. The CSMs for the zones are presented graphically in Figures 12.24 to 12.27 with further explanation provided in Table 12.15. Within each figure and the table, the CSMs show how the identified source-pathway-receptor linkage will be addressed within the remediation works. The available information (historical aerial photos and the logs from DB09 and DB10) for the area of land to the south of Zones 3 and 4 would indicate that there is no waste in this area, and as such there is no source present and a pollution linkage does not exist for this land.

Whilst there has been no investigation of the area of land known as Tunney's Field, the historical aerial photos would suggest that waste is absent in this area and as such there is no source present and a pollution linkage does not exist for this area of land.

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Table 12.15: Hydrogeological Conceptual Site Models by Zone for Current Conditions and how the Pollutant Linkage is being Addressed by Remediation

Zone	Source	Pathway	Potential Receptor	Approach to addressing the pollutant linkage
Zone 1*	Principally MSW wastes above the groundwater table	Rainfall infiltration and leaching of contaminants from the wastes with vertical and lateral groundwater migration	Groundwater in the overburden deposits	This zone will be capped with an engineered landfill cap. Capping of the zone will reduce rainfall infiltration and leaching from the unsaturated wastes leading to a lower input of contaminants to the groundwater in the overburden deposits.
			Groundwater in the limestone bedrock, principally within the transition zone	Capping of the zone will reduce rainfall infiltration and leaching from the unsaturated wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent vertical migration to the bedrock aquifer. Capping the zone has the potential to reduce the groundwater level in the overburden deposits beneath the zone and reduce the driving head (the pressure moving the groundwater vertically from one rock unit to another) in to the limestone caused by the groundwater in the overburden deposits being higher than the groundwater levels in the bedrock.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Capping of the zone will reduce rainfall infiltration and leaching from the unsaturated wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent migration to the surface water receptors. Capping the zone has the potential to reduce the groundwater level in the overburden deposits beneath the zone and reduce the hydraulic gradient between the zone and the Morell River, therefore reducing the contaminant flux.
	Principally MSW wastes below the groundwater table in the centre and east of the zone	Groundwater flowing through the wastes, leaching of contaminants and vertical and lateral groundwater migration	Groundwater in the overburden deposits	Capping the zone may reduce the groundwater level beneath the zone and thus the thickness of saturated waste may reduce. However, even after capping it is very likely that wastes at the base of Zone 1 will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits.
			Groundwater in the limestone bedrock, principally within the transition zone	As with the wastes situated above the water table, capping the zone may reduce the driving head into the bedrock aquifer. However, even after capping the zone, the saturated waste will continue to provide an ongoing source of contaminants to groundwater with the potential for downward migration into the limestone bedrock.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Even after capping the zone, the saturated waste will continue to provide an ongoing source of contaminants to the overburden groundwater with the potential for migration to the surface waters. However, reduction in the groundwater hydraulic gradient may reduce the groundwater flux.
Zone 2A	MSW and C&D wastes above the groundwater table	Rainfall infiltration and leaching of contaminants from the wastes with vertical and lateral groundwater migration	Groundwater in the overburden deposits	This zone will be remediated by installation of a low permeability layer at the surface to reduce rainfall infiltration. Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits.
			Groundwater in the limestone bedrock, principally within the transition zone	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent vertical migration to the bedrock aquifer.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent migration to the surface water receptors.
Zone 2B	MSW and C&D wastes above the groundwater table	Rainfall infiltration and leaching of contaminants from	Groundwater in the overburden deposits	This zone will be remediated by installation of a low permeability layer at the surface to reduce rainfall infiltration. Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits.

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Zone	Source	Pathway	Potential Receptor	Approach to addressing the pollutant linkage
		the wastes with vertical and lateral groundwater migration	Groundwater in the limestone bedrock, principally within the transition zone	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent vertical migration to the bedrock aquifer.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent migration to the surface water receptors.
	MSW and C&D wastes below the groundwater table	Groundwater flowing through the wastes, leaching of contaminants and vertical and lateral groundwater migration	Groundwater in the overburden deposits, principally within the transition zone	Even after placement of the low permeability materials it is likely that wastes at the base of Zone 2B will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits.
			Groundwater in the limestone bedrock	Even after placement of the low permeability materials, it is likely that wastes at the base of Zone 2B will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits with the potential for downward migration into the limestone bedrock.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Even after placement of the low permeability materials, it is likely that wastes at the base of Zone 2B will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits with the potential for migration to the surface water receptors.
Zone 3	Wastes within the lined cell (the origin of the wastes is uncertain but is likely to reflect wastes elsewhere on the existing site comprising processed MSW and C&D wastes)	Rainfall infiltration through the geomembrane, leaching of contaminants from the wastes and leakage through the basal liner (engineered liner at the base of the landfill) with vertical and lateral groundwater migration	Groundwater in the overburden deposits, principally within the transition zone	Following infilling of this zone, the zone will be capped with an engineered landfill cap with leachate abstraction from the lined cell. Control of leachate levels will minimise the leakage of contaminants through the basal liner into the overburden groundwater flowing beneath the zone.
			Groundwater in the limestone bedrock, principally within the transition zone	Minimising the input of contaminants to the overburden deposits would also minimise the subsequent vertical migration of contaminants to the bedrock aquifer.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Minimising the input of contaminants to the overburden deposits would also minimise the subsequent migration of contaminants to the surface water receptors.
Zone 4	Wastes above the groundwater table	Rainfall infiltration and leaching of contaminants from the wastes with vertical and lateral groundwater migration	Groundwater in the overburden deposits	This zone will be remediated by installation of a low permeability layer at the surface to reduce rainfall infiltration. Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits.
			Groundwater in the limestone bedrock, principally within the transition zone	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent vertical migration to the bedrock aquifer.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent migration to the surface water receptors.
	Wastes below the groundwater table locally present at	Groundwater flowing through the wastes and	Groundwater in the overburden deposits	Even after placement of the low permeability materials it is possible that wastes at the base of Zone 4 will locally remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits.

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Zone	Source	Pathway	Potential Receptor	Approach to addressing the pollutant linkage
	the base of the mounds of waste	vertical and lateral groundwater migration	Groundwater in the limestone bedrock, principally within the transition zone	Even after placement of the low permeability materials, it is possible that wastes at the base of Zone 4 will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits with the potential for downward migration into the limestone bedrock.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Even after placement of the low permeability materials, it is possible that wastes at the base of Zone 4 will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits with the potential for migration to the surface water receptors.

* For Zone 1A as there are no significant putrescible waste deposits present in this area (and hence no source-pathway-receptor linkages), a conceptual model has not been defined for the zone.

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12.3.16 Potential Changes to Baseline Due to Climate Change

Over the medium and long term, groundwater resources in the Study Area may be affected by climate change. Future precipitation changes in Ireland are subject to uncertainty. However, modelling has shown that winter rainfall in Ireland by the 2050s is projected to increase by approximately 10% while reductions in summer rainfall of 12 to 17% are projected by the same time. By the 2080s, winter rainfall will have increased by 11 to 17% and summer rainfall will have reduced by 14 to 25% (EPA, 2008). Changes in the frequency of extreme events will accompany these climate changes. Lengthier heatwaves, a substantial reduction in the number of frost days, lengthier rainfall events in winter and more intense downpours in summer are projected. At the same time an increased summer drought propensity is indicated, especially for eastern and southern parts of Ireland.

The direct effect of climate change on groundwater resources depends primarily upon the change in the volume and distribution of groundwater recharge. If drier, warmer summers lead to the seasonal deficits in the moisture content of soils extending into the autumn, the winter groundwater recharge season may be shortened. This could be compensated, at least to some extent, by an increase in winter rainfall. However, aquifers are recharged more effectively by prolonged steady rain, which continues into the spring, rather than short periods of intense rainfall where surface water runoff usually predominates.

The effects of climate change on groundwater therefore may include:

- a long term decline in groundwater storage;
- increased frequency and severity of groundwater droughts;
- increased frequency and severity of groundwater-related floods; and
- mobilisation of pollutants due to seasonally high water tables.

These effects could mean locally significant impacts on water supplies (public and private), and on streams and groundwater dependent terrestrial ecosystems that are sustained by groundwater flows.

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12.3.17 Hydrogeology Risk Assessment

In order to put potential impacts into context for Zone 1, a detailed quantitative risk assessment (DQRA) was undertaken for Zone 1 in 2014 (SKM Enviros 2014) to assess the potential impacts to the overburden groundwater and Morell River receptors and the benefits of capping the landfill in this zone. The DQRA utilised the LandSim modelling package (EA 2001) which estimates leachate leakage through the base of a landfill with subsequent mixing (dilution) of leachate in the underlying groundwater and migration away from the landfill. Through the various pathways, “attenuation” processes are applied including retardation and degradation of organic substances. The retardation process means that the speed at which a substance travels through an aquifer is less than the speed at which the groundwater itself moves such that the substance will take a longer time to reach a receptor. Degradation will remove organic substances from the groundwater system by the breakdown of the substance, usually by bacteriological processes and usually to less harmful components (for example, hydrocarbon fuels will ultimately breakdown to water and carbon dioxide). These processes can occur in both the unsaturated and saturated zones.

The DQRA predicted that based on the current layout of Zone 1, substances present in leachate would be present in the groundwater beneath and adjacent to Zone 1. Furthermore, the assessment predicted that significant impacts on groundwater adjacent to the Morell River would be seen. The groundwater monitoring identified that these substances are present in groundwater beneath and adjacent to the existing site at similar concentrations as predicted by the model. However, substances are not seen at the predicted concentrations in groundwater monitoring undertaken in boreholes between the existing site and the Morell River.

Following the DQRA in 2014, further DQRA was undertaken during the 2016/2017 ground investigation (Jacobs 2017) and reproduced as Appendix A12.3). This DQRA was undertaken for all zones, using updated ground investigation and monitoring information, and so that the impacts of wastes present beneath the water table could be assessed.

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For Zones 1, 2A, 2B and 4, the DQRA used the ESI RAM modelling software (ESI 2008) as this allowed, where required, each zone to be modelled as having two distinct sources of contaminant input to the groundwater system:

- Contaminants leaching from the waste as rainwater percolates through the waste with contaminants migrating through the unsaturated zone and mixing with groundwater as it flows beneath the zone; and
- A direct input of contaminants to the groundwater from wastes which are present below the water table. This input is not allowed for in LandSim which assumes that all wastes are present above the groundwater table.

For Zone 3, the 2017 DQRA utilised the LandSim modelling package as described above for Zone 1. Zone 3 attributes, in terms of landfill construction, closely match the assumptions of LandSim, including with wastes only being present above the groundwater table.

A DQRA has not been undertaken for Zone 1A as no significant putrescible waste deposits were identified in this zone and as such there is no source-pathway-receptor linkage.

For each zone, the DQRA assessed a capped zone and an uncapped zone to understand the effects of capping the zone. A summary of the DQRA results and effects of undertaking the remediation works is provided below with full results in Appendix A12.3.

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Zone 1 DQRA Results

For Zone 1, the uncapped and capped models do not clearly show an improvement in groundwater quality following installation of the cap, although this is thought to be due to limitations of the RAM model (Refer to Appendix A12.3 for further details). The model shows that the source term is dominated by the saturated waste component, and this is likely to remain the case for this zone such that even after capping, the saturated wastes would continue to have the major input of contaminants to groundwater. However, in reality the cap would reduce rainfall infiltration (that is migrating through the waste), reduce leachate generation and leachate build up within the cell and potentially reduce the water levels beneath the landfill (any potential reduction in groundwater level is not included in the RAM model). A reduction in groundwater level beneath the waste, even if this reduction is small, would have benefits to the groundwater environment by:

- Reducing the amount of waste that is saturated and hence reducing the source term;
- Reducing the hydraulic gradient between the site and the Morell River such that the migration of contaminants would be slowed (allowing more time for degradation of organic compounds) and the volume of groundwater discharging to the river would be reduced; and
- Reducing the difference in groundwater levels between the overburden and bedrock water bodies and therefore reducing the flow of groundwater from the overburden deposits to the bedrock transition zone.

Zone 2A DQRA Results

For Zone 2A, the uncapped and capped models show that there would be an improvement in groundwater quality following installation of the low permeability materials in this zone. This occurs due to lower infiltration into the wastes and subsequent higher dilution of leachate in the groundwater for the capped scenario. As this zone is modelled as having negligible saturated waste, there is no input of leachate from this source which plays a significant role in other zones.

Zone 2B DQRA Results

For Zone 2B, the uncapped and capped models show that there would be an improvement in groundwater quality following installation of the low permeability materials in this zone. This occurs due to lower infiltration into the wastes and subsequent higher dilution of leachate in the groundwater for the capped scenario. However, as the saturated waste provides the dominant input component for this zone and the wastes are likely to remain saturated after the zone is capped. The predicted improvement in groundwater quality is marginal.

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Zone 3 DQRA Results

The capped model has a larger area than the uncapped model due to the addition of waste materials from other zones as part of the remediation. Despite these conditions, the capped scenario results in concentrations of the same order of magnitude than the uncapped scenario, with concentrations below the IGVs in both cases. Furthermore, it should be considered that by transferring waste materials from other zones to Zone 3, the risks in those other areas is reduced. Placing waste materials in a fully engineered landfill cell would provide overall betterment for the site.

Zone 4 DQRA Results

For Zone 4, the uncapped and capped models show that there would be an improvement in groundwater quality following installation of the low permeability materials in this zone. This occurs due to lower infiltration into the wastes and subsequent higher dilution of leachate in the groundwater for the capped scenario. However, as the saturated waste provides the major input component for this zone, and the wastes are likely to remain saturated after the zone is capped. The predicted improvement in groundwater quality is limited.

Surface water impacts DQRA results

The RAM modelling package has also been used to assess the potential impacts on water quality in the Morell River for the three zones adjacent to the river (Zones 1, 2B and 4). Within the RAM model, the receptor in the river was set to the Q95 flow (0.322m^3/s) calculated from the 2008 to 2016 daily flow data for the Morell River at Kerdiffstown as provided on the EPA's HydroNet website (EPA 2017b).

To assess a worst case scenario, the 95 percentile concentration in the river has been considered to assess the predicted impact of the remediation works on the river quality by comparing the maximum predicted concentration under the current situation with that for the remediated site. The results of the DQRA for ammoniacal nitrogen for the river impacts are shown in Table 12.16 and show that for the remediated site the impacts are reduced from the current situation, indicating that the remediation works are likely to reduce impacts on river quality. For Zone 1, the model predicts that the remediation works would result in the ammoniacal nitrogen concentration falling below the IGV whereas without the works it is above the IGV.

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Table 12.16: Model Predictions from the RAM Models on Water Quality in the Morell River for Ammoniacal Nitrogen

Zone	Peak Morell River concentration (mg/l)	
	Pre-remediation	Following remediation
1	**0.291**	0.100
2B	0.017	0.007
4	0.005	0.001

Result in **bold** shows exceedance of the ammoniacal nitrogen IGV of 0.15mg/l.

12.3.18 Contaminated Land and Human Health Risks

Human health risks are currently managed by preventing public access to the site and having appropriate health and safety measures in place for staff working on the site. As there is no impact of leachate on surface water bodies outside of the existing site or nearby groundwater abstractions, there is no human contact with contaminated water. Even though a source (contaminants within the waste) and a receptor (site workers) have been identified, based on the source-pathway-receptor model described for the hydrogeology CSM, there is no pollution linkage as there is no pathway from the source to the receptor due to the safe working methods of site workers including the use of PPE as appropriate. It should be noted that this could change following site remediation when members of the public are allowed on to the site and this is considered in the impact assessment. The assessment of human health risks from landfill gas is considered later in this Chapter.

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12.3.19 Contaminated Land and Property Risks

Below ground services and structures have the potential to be attacked by contaminants in contaminated land. These include concrete structures which can be attacked by water with high sulphate or chloride concentrations or acid conditions (low pH). Plastic pipes can be attacked by organic compounds (including phenol) can permeate plastic water supply pipes such that drinking water is tainted. The potential for chemical attack depends on the presence of water as a carrier of the substance, the concentration of the substance and the degree of contact between the substance and the below ground infrastructure.

At Kerdiffstown, the majority of the existing site surface is significantly above the groundwater table (only the low points of Zone 4 are relatively close to the water table). As such, the below ground infrastructure, which will be at shallow depth beneath the ground surface, is unlikely to be in contact with contaminated groundwater, although there is the potential that contaminated water in the unsaturated zone, produced as rainwater infiltrates through the waste, does come into contact with the below ground services.

12.3.20 Landfill Gas Risks

Off-site boreholes show variable sequences of silt, sand, gravel and clay around the site. Gas migration risk is highest along bands of sand and gravel deposits which have lower permeability silts and clays above and below them, thus concentrating gas movement along the sand and gravel layer. The boreholes from the site investigation indicate that much of the natural geology is conducive to gas movement. The variability of the strata and the presence of sand and gravel layers cannot be defined to the level required to consider the risk of migration through specific routes. It must be assumed that without suitable gas controls there is a high risk of off-site gas migration.

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Although the surrounding strata are considered suitable for potential gas migration, only receptors on or within 250m of the site are considered to be at risk from lateral sub-surface landfill gas migration. Other receptors at risk from emissions to air and emissions from combustion are considered within Chapter 7 Air Quality, Odour and Climate.

There are a number of buildings and structures (enclosed spaces) on site (site offices, ESB switch gear room, security huts) and houses and outbuildings close to the north-western, western and southern boundaries of the site which could be vulnerable to landfill gas entry. Gas present in soils can enter buildings through cracks or holes in the floor slab, or via services which enter buildings below ground if no protection measures have been incorporated into building design. The following provides a list of the sensitive receptors for the proposed Project:

- Domestic properties and occupants along the L2005 (REC005 to REC018), some of which are within 20m of the landfill;
- Kerdiffstown House (REC001) and occupants, the nearest building being approximately 110m from the landfill;
- Naas Golf Course (COM017) to the north of the site;
- Naas Driving Range (COM018) and residential properties to the north-west of the site, within 200m of the north-west site boundary;
- Palmerstown House Estate and Golf course (COM001), approximately 500m to the northern boundary;
- Johnstown Garden Centre (COM002) and domestic properties to the south of the site, within 200m of the southern site boundary

Landfill gas receptors are shown on Figure 4.21.

An explosion protection document has been prepared for the proposed Project, detailing a risk assessment for the current conditions of the site including zoning around infrastructure and setting out working procedures. The explosion protection document will require to be updated following remediation works in advance of operation of the public park (as a minimum). This is discussed further in Section 12.6.2.

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12.4 Predicted Impacts

12.4.1 Impact Assessment Criteria

Following the Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009) and Guidance for the preparation of Soil Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI 2013) EIA assessment methodology, the sensitivity and importance of the environmental soil, geology, hydrogeology and by extension, human health, environment are classified in Table 12.177.

Table 12.17: Importance of Relevant Soil, Geology and Hydrogeology Features

Environmental Attribute	Importance	Comments
Groundwater in overburden deposits	Low	The overburden deposits in the vicinity of Kerdiffstown Landfill are not recognised on the GSI aquifer map as an aquifer.
Groundwater in the bedrock aquifer.	Medium	The limestone bedrock aquifer is designated by the GSI as a Locally Important Aquifer.
Groundwater abstractions for non-potable use (golf course).	Medium	These abstractions have an economic value.
Human Health through exposure to contaminated materials or effects of landfill gas (asphyxiation or explosion).	Extremely High	Human health has a very high sensitivity.
Property – below ground services and building foundations.	Medium	This could include water and sewer pipes and below ground concrete structures.
Property – On-site buildings.	Medium	
Property – Off-site buildings.	Medium	
Vegetation – economical crops and grassland on adjacent golf course. Also, the public park and recreational land following site remediation.	Medium	These vegetation types have economic value.
Vegetation – rough grassland within the landfill boundary.	Low	Vegetation within the landfill site boundary has no economic value.
Soils (off-site) and Tunney's Field.	Low	The assessment of the soils has identified that the soils around the boundary are of low economic value in terms of being used for arable crops.
Mineral resources (sand and gravels) beneath Tunney's Field	Low	Given the relatively small area of the field and presence of the bounding road and the landfill site, the mineral reserves beneath Tunney's Field are likely to be an uneconomically extractable mineral resource.

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The geology of the surrounding area will not be significantly affected by the proposed works. The landfill has minimal impact upon the geology and so this is not characterised as a receptor. Also, as no potable groundwater abstractions have been identified in the vicinity of the site, the effects of contaminated groundwater on human health are not considered. It should also be noted that the potential impacts on surface water receptors such as the Morell River and surface water abstractions which may be impacted by contaminants that migrate in groundwater are considered in Chapter 13 Water - Hydrology.

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12.4.2 Do-Nothing Scenario

Under a “Do-nothing” scenario, the site would remain in its current condition with leachate production and contaminant concentrations in the groundwater and surrounding environment remaining generally stable with the current baseline condition. However, over time there is the potential for increased leachate production as rainfall infiltration continues. Leachate would continue to be abstracted from Zone 3 and tankered off site for treatment and disposal.

Under this scenario, environmental monitoring would continue (albeit potentially at a reduced frequency due to a better understanding gained over time) as would the extraction and flaring of landfill gas. The site would remain fenced off with 24-hour security such that members of the public would not have access. The magnitude of impacts under the “do nothing” scenario is shown in with the significance of the impact shown in Table 12.18.

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Table 12.18: Magnitude of Impacts – Do Nothing Scenario

Potential Impact	Importance of attribute	Magnitude of Impact	Significance of Impact	Comments
Contaminated land and groundwater				
Impacts to groundwater quality in the overburden deposits due to leaching of contaminants from waste deposits.	Low	Moderate adverse	Slight Permanent Residual Certain	Contamination is currently identified in the groundwater, including outside of the landfill boundary. However, the overburden deposits are not classified as an aquifer by the GSI. As such the groundwater is considered more as pathway to other receptors such as the Morell River or groundwater abstractions.
Impacts to water quality in the limestone aquifer due to leaching of contaminants from waste deposits.	Medium	Moderate adverse	Moderate Permanent Residual Likely	Potential medium risk of pollution to groundwater in the Locally Important bedrock aquifer although only limited impact is identified in the limestone aquifer.
Impacts to groundwater abstractions (non-potable).	Medium	Negligible	Imperceptible	Given the distance of the abstractions from the site and groundwater flow directions, the impacts on the abstractions is likely to be negligible and no impacts have been observed to date.
Impacts to human health through direct contact with exposed waste.	Extremely High	Negligible	Imperceptible	As public access to the site is restricted, those coming onto contact with contaminated material would be site workers (including security staff). However, these workers are aware of the risks and working practices prevent contact with the wastes.
Degradation of on-site below ground services and building foundations due to contact with contaminated ground or groundwater.	Medium	Small adverse	Slight Permanent Residual Possible	No adverse impacts have been observed to date on below ground services or building foundations. Currently the occupied buildings on site do not have deep foundations.
Landfill gas				

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Potential Impact	Importance of attribute	Magnitude of Impact	Significance of Impact	Comments
Impacts to human health though migration of landfill gas into on-site properties leading to asphyxiation explosion or toxicological effects.	Extremely High	Small adverse	Significant Long term Residual Possible	There is limited monitoring of landfill gas. Landfill gas control operates in Zone 1 and Zone 3 to minimise the risks of landfill gas migration into on-site properties. However, there are potential impacts from landfill gas generation, particularly in Zone 2A although buildings at this location are situated on hardstanding and of the raised, modular type with no below ground structures. With the current gas control measures in place, although the likelihood of any impacts is small, the sensitivity of the receptor is extremely high which results in a significant significance.
Impacts to human health though migration of landfill gas in to off-site properties leading to asphyxiation explosion or toxicological effects.	Extremely High	Small adverse	Significant Long term Residual Possible	Landfill gas G control operates in Zone 1 and Zone 3 to minimise the risks of landfill gas migration in to off-site properties in these zones. However, there are potential impacts from landfill gas generation, particularly in Zone 2A. There is limited monitoring of landfill gas in this area. With the current gas control measures in place, although the likelihood of any impacts is small, the sensitivity of the receptor is extremely high which results in a significant significance.
Impacts to on-site buildings though migration of landfill gas and subsequent explosion.	Medium	Small adverse	Sight Long term Residual Possible	There is limited monitoring of landfill gas. Landfill gas control operates in Zone 1 and Zone 3 to minimise the risks of landfill gas migration in to on-site properties in these zones. However, there are potential impacts from landfill gas generation, particularly in Zone 2A although buildings at this location are situated on hardstanding and of the raised, modular type with no below ground structures. With the current gas control measures in place, the likelihood of any impact is small.
Impacts to off-site buildings though migration of landfill gas and subsequent explosion.	Medium	Small adverse	Slight Long term Residual Possible	There is limited monitoring of landfill gas. Landfill gas control operates in Zone 1 and Zone 3 to minimise the risks of landfill gas migration in to off-site properties. However, there are potential impacts from landfill gas generation, particularly in Zone 2A. With the current gas control measures in place, the likelihood of any impact is small.
Landfill gas causing die back of vegetation outside of the landfill boundary, including on nearby golf course.	Medium	Negligible	Imperceptible	No impacts on vegetation outside of the landfill site has been identified to date and with the current gas control measures in place, the likelihood of any impacts is negligible. As landfill gas generation rates decrease over time, future impacts are considered unlikely.

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Potential Impact	Importance of attribute	Magnitude of Impact	Significance of Impact	Comments
Landfill gas causing die back of vegetation within the landfill boundary.	Low	Small adverse	Imperceptible	Impacts of landfill gas on the site vegetation are not readily apparent. However, there may be areas where vegetation growth is being affected. Local die back within the site boundary would have no economic effects, although secondary effects such as reduction of evapotranspiration causing increased infiltration may occur. As landfill gas generation rates decrease over time, future impacts are considered unlikely.

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12.4.3 Remediation Phase

Chapter 4 Description of the Proposed Project outlines the proposed remedial solution and the construction techniques that will be employed to achieve the remediation. The relevant aspects of the Remediation Phase in relation to the soil, geology, hydrogeology and contaminated land environment are: -

- Human health risks – As works are undertaken, contaminated material in the waste has the potential to come into contact with construction workers undertaking the work and affect human health. This could be by direct contact, ingestion, or inhalation.
- Waste Relocation – Within Zone 4, the base of inert waste materials in the mounds and bunds is relatively close to the water table (or below it in some areas). Removal of overlying inert waste has the potential to disturb the ground close to the water table which has the potential to increase impacts from leachate. For example, if waste is compacted by machinery squeezing out leachate or by creating a more level profile to the waste may allow greater rainfall infiltration. The removal of the current top layer of materials in Zone 1 to re-profile the site would need to be undertaken so that the waste can be moved to form more stable shapes. This top layer is likely to reduce recharge to the wastes to some degree. As a result of the works there will be a period of time where the waste is uncovered allowing increased rainfall infiltration and the potential for increased leachate production.
- Landfill gas risks – Changes to the landfill gas migration routes may occur as the works progress. This could occur due to the exposure of waste releasing landfill gas or the placement of low permeability material on to the zones (as construction works progress), forcing gas to take a lateral rather than a vertical migration route. During works, the current landfill gas abstraction system has the potential to be disrupted. Receptors for landfill gas would include on-site and off-site properties, people and vegetation.
- As works are undertaken within Zone 1 to re-profile the site, there is potential that perched leachate horizons are encountered which lead to the release of leachate. If released in sufficient quantities, this leachate then has the potential to migrate to receptors such as the Morell River or soak into the ground outside of the landfill site leading to local contamination.

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The magnitude and significance of impacts under the Remediation Phase is shown in Table 12.19. Table 12.19 considers, in isolation from the baseline, the potential impact from each activity during the remediation works. Where an impact could increase an existing impact (as identified in the “do-nothing” assessment in Table 12.18), it is noted in the comments section of Table 12.19. However, for imperceptible significance outcomes during the Remediation Phase, it is assumed that these impacts would not affect the significance as shown in the “do-nothing” table.

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Table 12.19: Magnitude of Impacts – Remediation Phase

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contaminated land and groundwater				
Changes to infiltration to the overburden deposits due to disturbance of the existing ground surface and exposure of waste materials to infiltration.	Low	Small adverse	Imperceptible	Disturbance of the existing ground surface (including removal of the existing vegetation) to re-profile the site is likely to allow greater rainfall infiltration to the waste. This would allow for greater leachate production or reduction in the waste's adsorptive capacity and potential increase in contaminant concentrations in the overburden and bedrock aquifers. Exposure of waste to rainfall would allow leachate to be produced. Compaction of soils from plant has the potential to reduce infiltration although this is likely to be a more local effect where soils are heavily trafficked.
Changes to infiltration to the bedrock aquifer due to disturbance of the existing ground surface and exposure of waste materials to infiltration.	Medium	Small adverse	Slight Temporary Residual Possible	
Removal of inert waste mounds in Zone 4 leading to disturbance of wastes near to the water table and increase in contaminant concentrations in groundwater in the overburden deposits.	Low	Small adverse	Imperceptible	Whilst the remediation works would not move any waste from below the water table, locally the waste removed may be close to the water table leading to disturbance of waste below the water table from plant undertaking the remediation works and increasing leaching of contaminants.
Removal of existing structures and hardstanding leading to increased infiltration to groundwater in the overburden deposits	Low	Small adverse	Imperceptible	Whilst the majority of the site building would have been removed by the time the remediation works start, some will remain until the works are completed. Hardstanding in Zone 4 would be removed as part of the works to construct the drainage pond, although it considered that there are limited quantities of waste below this section of hardstanding. Other hardstanding would remain in place and there is a small likelihood that work could lead to increased cracking of the hardstanding and therefore a very minor increase in infiltration. However, cracks within it would be repaired as part of the works thus reducing infiltration as works progress.
Construction of landfill gas venting trenches leading to changes in groundwater infiltration to the overburden deposits.	low	Small adverse	Imperceptible	While trenches would be a positive during the Operational Phase the initial construction of gas venting trenches has the potential to lead to increased rainfall infiltration during their construction due to the removal of lower permeability surface materials. This would lead to an increase in recharge and potentially leachate production.

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Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contamination of groundwater in the overburden deposits from fuels and oils stored and used for site plant.	Low	Small adverse	Imperceptible	Groundwater contamination has the potential to occur due to spills and leaks of stored fuels and oils (used for re-fuelling site plant) or leaks from site plant during operation. However, handling procedures for fuels and emergency procedures for spills or leaks of fuels and oils would be covered in the CEMP.
Effects on human health for construction workers from contact with waste materials.	Extremely high	Negligible	Imperceptible	Although construction workers would come into contact with waste material, there would be working procedures including risk assessments in place to minimise these risks. These would include procedures for actions to be taken if unexpected hazardous materials were encountered.
Effects on human health for construction workers through direct exposure to any contaminated materials within soils being brought on to site for capping works.	Extremely high	Negligible	Imperceptible	Although materials brought on to site have the potential to be a contaminant source, testing of the materials will be undertaken as part of the remediation works. Working procedures including risk assessments would be in place to minimise these risks.
Encounter perched leachate	Low	Moderate adverse	Slight Temporary Residual Possible	The potential exists that during excavation of the waste body in Zone 1 or bunds around the site boundary, perched leachate could be encountered and released to locally contaminate groundwater in the overburden deposits. Whilst this is unlikely, the serious nature of this impact results in the magnitude being classed as Moderate.
Landfill gas				
Changes to landfill gas migration routes and impacts to off-site human health receptors.	Extremely High	Small adverse	Significant Temporary Residual Possible	Disturbance of the current ground surface has the potential to allow greater landfill gas to vent to air rather than migrate laterally. However, during remediation works the landfill gas extraction system has the potential to be interrupted such that less landfill gas is collected with potential for greater migration rates off-site. As the zones are capped there is then greater potential for gas to migrate laterally rather than vertically to off-site receptors. The extremely high sensitivity of the receptors results in a significant impact.

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Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Changes to landfill gas migration routes and impacts to off-site property receptors (including vegetation).	Medium	Small adverse	Slight Temporary Residual Possible	Disturbance of the current ground surface has the potential to allow greater landfill gas to vent to air rather than migrate laterally. However, during remediation works the landfill gas extraction system has the potential to be interrupted such that less landfill gas is collected with potential for greater migration rates off-site. As the zones are capped there is then greater potential for gas to migrate laterally rather than vertically to off-site receptors. While the sensitivity of landfill gas reaching the public would be high, the likelihood of such an occurrence is low. As a result, the significance of the impact has been classified as slight.
Changes to landfill gas migration routes and impacts to on-site human health receptors.	Extremely High	Negligible	Imperceptible	For the on-site landfill gas receptors, including human health, these would be controlled by safe working procedures including risk assessments in place to minimise these risks. These would include procedures for actions to be taken if unexpected events occurred.
Changes to landfill gas migration routes and impacts to on-site property receptors.	Medium	Negligible	Imperceptible	
Soils and geology				
Loss of soils	Low	Small adverse	Imperceptible	Only a small area of soils will be affected and areas where soil is present which are used for stockpiling of materials such as Tunney's Field will be stripped of soils so the soils can be used elsewhere on site or as cover.

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12.4.4 Operational Phase

Potential impacts after the construction of the remedial solution would generally be positive for the environment:

- Human health risks – the site will become available for public amenity use as the pathways between contaminated material in the waste (source) and human health (receptors) by direct contact, ingestion, and inhalation (pathways) will have been removed through provision of a barrier between the waste and site end users.
- Addition of a cap to reduce infiltration to the landfill and so decrease leachate generation.
- Completion of the lined cell in Zone 3 with a fully engineered cap.
- Removal of low points within Zone 1 to prevent pooling and increase landfill stability;
- Addition of perimeter drainage system to collect surface water runoff from the capped landfill including use of a soakaway in the north of the site and a swale to collect surface water runoff from the east of Zone 1 (see Chapter 4 Description of the Proposed Project for further details).
- Potential for reduction in the local water table beneath capped areas, decreasing the amount of waste that lies beneath the water table.
- Increase in vegetation at the surface leading to an increase in evapotranspiration further reducing infiltration.
- Increased landfill gas control measures reducing the potential for gas migration off site.

Only one potential adverse impact has been identified for the Operational Phase of the proposed Project. This relates to the potential for the pipe leading from the leachate treatment plant to the local sewer to leak and lead to local groundwater contamination.

The magnitude and significance of impacts under the Operational Phase is shown in Table 12.20

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Table 12.20: Magnitude of Impacts – Operational Phase

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contaminated land and groundwater				
Presence of a low permeability cap to reduce infiltration to wastes and reduce the production of leachate for migration to groundwater in the overburden deposits	Low	Minor beneficial	Imperceptible	The capping of the wastes would reduce leachate production and vertical migration of contaminants into the underlying groundwater. However, wastes below the groundwater table would continue to leach contaminants and the DQRA does not clearly show that there would be a significant improvement to groundwater quality in all zones.
Presence of a low permeability cap to reduce infiltration to wastes and reduce the production of leachate for migration to groundwater in the bedrock aquifer.	Medium	Minor beneficial	Slight beneficial Permanent Residual Possible	
Presence of a low permeability cap leading to reduction in the local water table decreasing the amount of waste that lies beneath the water table and reducing the impact on groundwater in the overburden deposits.	Low	Minor Beneficial	Imperceptible	Reducing the amount of waste in contact with the water table would decrease the generation of leachate in the groundwater and when combined with the decreased infiltration a greater decrease in leachate production would occur. However, the significance of this on the water table are likely to be slight as the change in water level is unlikely to be great and some wastes are likely to remain saturated.
Presence of a low permeability cap leading to reduction in the local water table decreasing the amount of waste that lies beneath the water table and reducing the impact on groundwater in the bedrock aquifer.	Medium	Minor beneficial	Slight beneficial Permanent Residual Possible	
Increased leakage from the lined cell in Zone 3 with impacts on the quality of groundwater in the overburden deposits.	Low	Negligible	imperceptible	The amount of waste that is in Zone 3 and the waste footprint will increase as a result of the remediation works, as such for this zone, impacts are likely to increase, although the overall benefit is likely to increase due to the removal of wastes from areas which aren't currently in an engineered landfill.
Increased leakage from the lined cell in Zone 3 with impacts on the quality of groundwater in the bedrock aquifer.	Medium	Small adverse	Slight Permanent Residual Possible	

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Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Increase in vegetation at the surface leading to an increase in evapotranspiration, further reducing infiltration to the wastes and leachate production in the overburden deposits.	Low	Minor Beneficial	Imperceptible	The reduction in infiltration would help to reduce infiltration and leachate production. The vegetation will also increase stability of the ground, particularly on the steeper slopes.
Change to groundwater recharge points to the overburden deposits due to the use of a soakaway and swale for the discharge of surface water.	Low	Negligible	Imperceptible	These drainage features would locally alter groundwater recharge points and potentially flow routes to other receptors such as the Morell River. However, the effects of the change to recharge points would not significantly change the overall recharge rate. Recharge via soakaway and lagoons would be in areas where waste is not present so that additional leachate would not be produced.
On-site below ground services such as water pipes and drainage and building foundations being in contact with contaminated land or groundwater leading to degradation of the infrastructure (property damage) or permeation into water supplies.	Medium	Negligible	Imperceptible	Whilst substances are present in the wastes and groundwater at the existing site that have the potential to attack below ground infrastructure or permeate drinking water pipes, installation of new below ground structures would take the nature of the ground into account and follow the appropriate guidance.
Landfill gas				
Enhanced landfill gas control measures leading to improved monitoring and control of landfill gas (on-site and off-site human health receptors).	Extremely high	Major beneficial	Profound beneficial Permanent Residual Certain	The remediation works allow for greater control of landfill gas through the installation of capping to reduce fugitive emissions through the ground surface and additional gas extraction wells in Zone 1 and gas venting trenches in other zones. Enhanced gas monitoring will be undertaken with additional gas monitoring boreholes on the site's periphery. Remediation works would therefore provide enhanced landfill gas control measures compared with the "do nothing" scenario.
Enhanced landfill gas control measures leading to improved monitoring and control of landfill gas (on-site and off-site property receptors).	Medium	Major beneficial	Significant beneficial Permanent Residual Certain	

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Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Presence of a cap over all waste deposits reduces the likelihood of people coming into contact with waste, reducing the human health risk.	Extremely high	Minor beneficial	Significant beneficial Permanent Residual Certain	Waste is currently exposed at the ground surface and the remediation would ensure that this waste is covered. However, the use of the site for recreational purposes would mean that more people are on site than in the "do nothing" scenario.
Use of fertilizers and pesticides for the recreation ground or to establish site vegetation leading to contamination of groundwater in the overburden deposits.	Low	Small adverse	Imperceptible	The application of fertilizers and pesticides have the potential to increase the nitrate concentration in the groundwater underlying the site if applied at too high a concentration. However, providing pesticides and fertilizers are applied in accordance with manufacturer's recommended application rates, impacts would be imperceptible.
Soils and geology				
Loss of mineral reserves beneath Tunney's Field	Low	Small adverse	Imperceptible	Use of the field for a sports pitch would permanently prevent the mineral deposits beneath the field from being extracted. However, the area which would be lost is relatively small and the presence of the local road and housing means that the mineral reserve in the field is unlikely to be an economically viable deposit.

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12.4.5 Modelling Limitations

The groundwater beneath the site is contaminated and monitoring data shows clear evidence of contamination on the eastern fringes of the site. However, no sustained upward trend in the level of contaminants such as ammoniacal nitrogen and chloride is observed between the site and the Morell River. Across the entire site area monitoring data gathered over a 7-year period (since 2010), comprising groundwater samples and geophysical monitoring, illustrate there is no evidence of a sustained upward trend in contamination or evidence of any significant changes in the geophysical characteristics of the area that would indicate the movement of a plume of leachate. While a leachate plume would represent a significant risk to the groundwater and surface water quality in the area it does not appear, at present, that contaminants are very mobile indicating either a level of lower permeability in strata that has been supposed or detected to date; or that the contaminants are migrating in a manner that does not result in a detectable impact.

In spite of extensive efforts undertaken to date to characterise the site a full understanding of how the groundwater system functions may never be achieved due to the heterogeneity observed. The efforts to understand the groundwater have also included groundwater modelling, detailed below, which have predicted more pessimistic outcomes than have been observed by real-world monitoring to date. It is recoded that while groundwater modelling is a useful tool results cannot be considered in isolation when taking decisions regarding mitigation of predicted impacts. The EPA cautions against an approach where an over-reliance on modelling can lead to poor decision making in their *Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites EPA; 2013)*:

> "For some sites, a combination of modelling and on- and off-site data gathering and monitoring may be required. It should be noted that in some cases, modelling may not be appropriate at all. Such decision-making should ensure that risks are assessed in a consistent and meaningful way and that the environment is protected."

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One of the key limitations of any kind of groundwater modelling is the complexity of the system to be represented by the model. If the natural ground conditions are highly variable, as is the case in the proposed Project area, the ability of the model to represent this in a meaningful way is compromised. The models used are also highly conservative and assume a worst-case to ensure that the decisions taken would protect the environment in the vast majority of circumstances even though there is a low likelihood that such circumstances would arise. An overly optimistic model outcome could lead to decisions not to intervene or remediate a site; conversely an overly pessimistic model could lead to the view that despite intervention there will be no benefit to the environment, while real-world experience has demonstrated that such interventions do result in benefits. Such is the case with the capping of landfills. With the limitation of the generation of new leachate and the control of hydraulic gradients a key benefit is achieved by capping. This is observed by many landfill operators installing interim capping at the earliest opportunity before final, permanent capping is required.

The models which have been undertaken as part of this EIAR in a genuine effort to understand the site in as much detail as possible have predicted very limited benefit to capping the waste, principally due to the presence of some waste beneath the water table. However, the benefits of capping waste to in terms of groundwater protection and landfill gas control are key pillars of landfill management and the model results should be viewed in context and not used as the key decision-making tool.

The waste beneath the water table will continue to contaminate groundwater into the future. Much of this waste has been beneath the water table for a period greater than 20 years and has been contributing to the impact on groundwater quality at the site (albeit with limited impact off-site). Considering the issue in isolation the option to dig this waste out should of course be considered. However, given the depth at which this waste is located and the volume of waste present above it means that the environmental consequences of moving millions of tonnes of waste to protect the groundwater where limited impacts have been observed would be highly significant and, over such a sustained period, would be unacceptable.

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12.5 Mitigation Measures

For any negative impacts identified as being adverse moderate or greater, additional mitigation measures would need to be proposed. This assessment identified the significance of the majority of impacts during the Remediation and Operational Phase would be slight or lower, and in many cases the works would have a positive impact. However, during the Remediation Phase, the impacts of landfill gas to off-site human health receptors were identified as being significant, largely due to the extremely high importance of the receptor.

12.5.1 Remediation Phase

As noted above, the potential impact from landfill gas to off-site human health receptors is significant and mitigation measures are required. These mitigation measures are provided in the Landfill Gas Management Plan (Appendix A4.5) which sets out the likely requirements for gas mitigation measures and monitoring to be undertaken by the appointed contractor during the remediation works (subject to agreement with the regulatory authorities and specified in the IEAL). During the works additional or replacement interim gas controls may need to be installed to ensure the risk of lateral off-site migration is not increased.

The proposals for gas monitoring will need to be bespoke for the remediation works in order to assess the changing nature of the site and associated impacts from gas migration. However, throughout the period of remediation works monitoring of all off-site boreholes shall be conducted at least monthly. During active remedial works, or where materials are moved to uncapped areas of wastes for temporary storage, more frequent monitoring of off-site boreholes adjacent to affected areas is likely to be required. Frequency will be determined by the risk assessment produced by the appointed contractor for each phase of works and incorporated within their method statement for working.

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The installation of gas extraction wells within the site as works progress will be in a phased manner, moving from zone to zone as the active remediation works move around the site. Details of the gas control measures and monitoring that will be in place for the Remediation Phase are provided in the Landfill Gas Management Plan (Appendix A4.5).

Whilst the significance of impacts to groundwater are determined as being no greater than slight, due to the uncertainty which is inherent in any groundwater impact assessment, groundwater quality monitoring will be undertaken during the Remediation Phase to ensure that potential negative impacts are not occurring in the groundwater.

Groundwater quality monitoring will be undertaken during the Remediation Phase to ensure that potential negative impacts are not occuring in the groundwater. The boreholes and analytical suite to be used will be agreed with the regulatory authorities and will be specified in the Industrial Emissions Activities Licence (IEAL) for the site. The monitoring will be based on results of ongoing baseline monitoring. The need for installation of new boreholes (which may be required if existing boreholes are to be lost as part of the remediation works) will be considered and if required new boreholes will be installed prior to the remediation works starting. The results of this monitoring will be reported to the EPA to comply with the conditions of the IEAL.

12.5.2 Operational Phase

As with the Remediation Phase, groundwater and soil gas monitoring will be agreed with the EPA and will be specified in the site's IEAL. For groundwater monitoring frequency following remediation may reduce over time as the level of impact and associated risk becomes better understood.

As noted in Chapter 5 Consideration of Alternatives, the installation of a cut-off wall or other perimeter remedial measure to be located between the landfill and the Morell River has been considered as an alternative to (or in addition to) capping the site. As the remediation scheme design has been developed, most notably through 2016, the protection of groundwater in all zones has remained a key consideration. The scheme design will utilise capping systems to reduce infiltration to the waste mass across the site; for Zones 1 and 3 this will comprise a geosynthetic liner system; Zones 2 and 4 will utilise low permeable soils (depth and performance specification to be determined).

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Review of monitoring data and assessment of the remediation design proposals has identified that the need for remediation measures (e.g. cut-off wall or series of groundwater abstraction boreholes, or combination thereof) has been determined to not be required at this time. This conclusion is founded on the following rationale:

- Water quality monitoring and ecological assessments have not shown any direct impacts from leachate on the Morell River.
- Geophysical surveys undertaken annually for the past five years along the site's eastern boundary have not identified a contaminant plume emanating from the site and discharging to the river.
- One of the remediation objectives of the work at Kerdiffstown is to "reduce the environmental risk profile to an acceptable level". The adoption of capping systems across the site will reduce infiltration and hence the potential for leachate generation and migration to groundwater, giving a reduction to the environmental risk profile of the site to a likely acceptable level.
- Regulation 4 of the Groundwater Regulations places a duty on public authorities to take all reasonable steps to prevent the input of hazardous substances and limit the input of non-hazardous substances to groundwater and reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater. As the proposed remediation design for the site involves reducing infiltration to the waste by installing capping systems, leaching of contaminants from historical wastes which will remain on site will be reduced.
- The discharge of contaminants to the river cannot be fully eliminated as wastes would remain saturated in parts of the site and recharge from groundwater cannot be avoided. The installation of remedial measures between the boundary of the site and the river, such as a barrier, would not change the input of contaminants to groundwater; only control the discharge.
- An option for a typical remedial measure for the site boundary being installation of a cut-off wall is not without risk of destabilising the current groundwater system. Installing a cut-off wall would alter the existing groundwater flow regime and potentially cause problems as contaminated groundwater backs up behind a wall or groundwater flows to a greater depth beneath the wall (if the wall could not be keyed in to a low permeability horizon) or flows around the edge of the wall. Modelling cannot fully predict this behaviour and there are many examples of cut-off wall/ barrier systems that are not performing as required.
- High dilution in the river from groundwater discharges will make it difficult to record changes in river quality and concentrations of contaminants in groundwater significantly higher than have been measured in boreholes adjacent to the river to date would be required in order for impacts in the river to be recorded. However, consideration of dilution in the river does imply that dilution is an acceptable form of contaminant attenuation.
- The general principle of preventing water from discharging to the river could have an impact on the river flow rates and potential knock-on effects on river ecology. Similarly use of a pumping solution as part of a remedial measures option to control groundwater could also have a negative impact on the river flows and ecology as pumping may also draw in water from the river to the pumping wells.
- As there is no evidence to support the installation of remediation measures another of the key project objectives of having "embedded sustainability in both remediation and post closure" is also realised, as installing a cut-off wall/ barrier system now would require resources (e.g. cement, water) and lead to increased impacts during the works, such as through traffic movements, dust and noise.
- The installation of a cut-off wall/ barrier is likely to require dewatering. As there is no evidence to support any requirement for such a system at this time, the need to remove and treat groundwater would be unnecessary and hence lead to impacts on the river, ecology and public sewer network (as a likely outlet for disposal of any treated waters).
- Should future monitoring highlight that remediation measures are required it is considered that such a system could be installed relatively quickly. Installation of such a system is not reliant on other remediation works, e.g. capping systems on the site, and could be undertaken as "stand alone" works (although removal of any groundwater from the cut-off wall/ barrier system may require additional infrastructure on and off site to facilitate treatment and disposal).
- The DQRA assessment has shown that capping of the site is likely to improve the current situation overall.

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- It is noted that due to the potential effects that a cut-off wall could have and the presence of the transition zone in the bedrock providing a preferential pathway for contaminant migration which could not be sealed, the option of installing a cut-off wall is not considered practicable or sustainable.

In terms of the gas monitoring, the Landfill Gas Management Plan (Appendix A4.5) accompanying the IEAL application identifies that gas management proposals for the Operational Phase are likely to follow those that identified for the Remediation Phase, augmented by the addition of the new gas management system and requirements of specific guidance on flares and surface emissions.

12.6 Residual Impacts

12.6.1 Remediation Phase

Following implementation of the mitigation measures for landfill gas, the magnitude and significance of the residual impact during the Remediation Phase is presented in Table 12.21.

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Table 12.21: Magnitude of Impacts Following Implementation of Additional Mitigation– Remediation Phase

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contaminated land and groundwater				
Changes to infiltration to the overburden deposits due to disturbance of the existing ground surface and exposure of waste materials to infiltration.	Low	Small adverse	Imperceptible	Disturbance of the existing ground surface (including removal of the existing vegetation) to re-profile the site is likely to allow greater rainfall infiltration to the waste. This would allow for greater leachate production or reduction in the waste's adsorptive capacity and potential increase in contaminant concentrations in the overburden and bedrock aquifers. Exposure of waste to rainfall would allow leachate to be produced. Compaction of soils from plant has the potential to reduce infiltration although this is likely to be a more local effect where soils are heavily trafficked.
Changes to infiltration to the bedrock aquifer due to disturbance of the existing ground surface and exposure of waste materials to infiltration.	Medium	Small adverse	Slight Temporary Residual Possible	
Removal of inert waste mounds in Zone 4 leading to disturbance of wastes near to the water table and increase in contaminant concentrations in groundwater in the overburden deposits.	Low	Small adverse	Imperceptible	Whilst the remediation works would not move any waste from below the water table, locally the waste removed may be close to the water table leading to disturbance of waste below the water table from plant undertaking the remediation works and increasing leaching of contaminants.
Removal of existing structures and hardstanding leading to increased infiltration to groundwater in the overburden deposits	Low	Small adverse	Imperceptible	Whilst the majority of the site building would have been removed by the time the remediation works start, some will remain until the works are completed. Hardstanding in Zone 4 would be removed as part of the works to construct the drainage pond, although it considered that there are limited quantities of waste below this section of hardstanding. Other hardstanding would remain in place and there is a small likelihood that work could lead to increased cracking of the hardstanding and therefore a very minor increase in infiltration. However, cracks within it would be repaired as part of the works thus reducing infiltration as works progress.
Construction of landfill gas venting trenches leading to changes in groundwater infiltration to the overburden deposits.	low	Small adverse	Imperceptible	While trenches would be a positive during the Operational Phase the initial construction of gas venting trenches has the potential to lead to increased rainfall infiltration during their construction due to the removal of lower permeability surface materials. This would lead to an increase in recharge and potentially leachate production.

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Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contamination of groundwater in the overburden deposits from fuels and oils stored and used for site plant.	Low	Small adverse	Imperceptible	Groundwater contamination has the potential to occur due to spills and leaks of stored fuels and oils (used for re-fuelling site plant) or leaks from site plant during operation. However, handling procedures for fuels and emergency procedures for spills or leaks of fuels and oils would be covered in the CEMP.
Effects on human health for construction workers from contact with waste materials.	Extremely high	Negligible	Imperceptible	Although construction workers would come into contact with waste material, there would be working procedures including risk assessments in place to minimise these risks. These would include procedures for actions to be taken if unexpected hazardous materials were encountered.
Effects on human health for construction workers through direct exposure to any contaminated materials within soils being brought on to site for capping works.	Extremely high	Negligible	Imperceptible	Although materials brought on to site have the potential to be a contaminant source, testing of the materials will be undertaken as part of the remediation works. Working procedures including risk assessments would be in place to minimise these risks.
Encounter perched leachate	Low	Moderate adverse	Slight Temporary Residual Possible	The potential exists that during excavation of the waste body in Zone 1 or bunds around the site boundary, perched leachate could be encountered and released to locally contaminate groundwater in the overburden deposits. Whilst this is unlikely, the serious nature of this impact results in the magnitude being classed as Moderate.
Landfill gas				
Changes to landfill gas migration routes and impacts to off-site human health receptors.	Extremely High	Negligible	Imperceptible	Disturbance of the current ground surface has the potential to allow greater landfill gas to vent to air rather than migrate laterally. However, during remediation works the landfill gas extraction system has the potential to be interrupted such that less landfill gas is collected with potential for greater migration rates off-site. As the zones are capped there is then greater potential for gas to migrate laterally rather than vertically to off-site receptors. However, additional mitigation would be in place and during the works the appointed contractor would produce a bespoke landfill gas monitoring plan and risk assessment to control the risk of off-site migration.

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Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Changes to landfill gas migration routes and impacts to off-site property receptors (including vegetation).	Medium	Small adverse	Slight Temporary Residual Possible	Disturbance of the current ground surface has the potential to allow greater landfill gas to vent to air rather than migrate laterally. However, during remediation works the landfill gas extraction system has the potential to be interrupted such that less landfill gas is collected with potential for greater migration rates off-site. As the zones are capped there is then greater potential for gas to migrate laterally rather than vertically to off-site receptors. While the sensitivity of landfill gas reaching the public would be high, the likelihood of such an occurrence is low. As a result, the significance of the impact has been classified as slight.
Changes to landfill gas migration routes and impacts to on-site human health receptors.	Extremely High	Negligible	Imperceptible	For the on-site landfill gas receptors, including human health, these would be controlled by safe working procedures including risk assessments in place to minimise these risks. These would include procedures for actions to be taken if unexpected events occurred.
Changes to landfill gas migration routes and impacts to on-site property receptors.	Medium	Negligible	Imperceptible	
Soils and geology				
Loss of soils	Low	Small adverse	Imperceptible	Only a small area of soils will be affected and areas where soil is present which are used for stockpiling of materials such as Tunney's Field will be stripped of soils so the soils can be used elsewhere on site or as cover.

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12.6.2 Operational Phase

Due to no known effects greater than small adverse identified for the Operational Phase of the development, no additional mitigation measures are proposed for the Operational Phase. However, groundwater and landfill gas monitoring will continue to be undertaken and this will be specified in the site's IEAL. As there would be no change to effects as identified in Table 12.20, the effects as shown in the table remain for the Operational Phase.

The site engineering (including an engineered capping design and gas management proposals for the final end-use) will limit vertical migration of the landfill gas to the site surface. However, there is a risk that landfill gas may accumulate in voids, or structures associated with the proposed Project, which may intentionally or unintentionally vent landfill gases.

During detailed design of the remediation and end-use, risks from landfill gas will be considered through the implementation of the requirements of the ATEX Directives. In Ireland, the ATEX Directives and the Work (Explosive Atmospheres) Regulations 2003, have since been revoked and replaced by Part 8 of the Safety Health and Welfare (General Application) Regulations 2007 (Statutory Instrument No. 299 of 2007) as amended.

Where explosive atmospheres might occur in a workplace (or in this case the landfill), the Regulations require employers to:

- assess the potential risks of any work activities involving flammable substances or work activities in potentially explosive atmospheres;
- determine measures to eliminate, reduce or control the risks as far as reasonably practicable;
- provide equipment and procedures to deal with accidents and emergencies;
- provide information and training to all employees; and
- classify places where explosive atmospheres may occur into zones and mark those zones as necessary.

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Where an explosive atmosphere is, or is likely to be, present at or may, from time to time, arise in a workplace, the employer is required to make a suitable and appropriate assessment of the risk arising from such explosive atmosphere to the employees concerned having regard to all the circumstances. In this case users of the 'workplace' would be extended to public users of the parkland and recreational facilities. It cannot be ruled out that public users will not use ignition sources, therefore the site and infrastructure would need to be appropriately assessed, zoned and access restrictions put in place. The Regulations require the employer to prepare an explosion protection document to confirm the risk assessment undertaken and set out the applicable zoning of the site. An explosion protection document has been prepared for the current conditions of the site. This will require to be updated following remediation works, most notably to embrace the findings of the pumping trials and as-built gas management system, for adoption in the management of the public park.

Key infrastructure to be assessed for the explosion protection document includes:

Underground services - Underground services on-site and off-site are potentially at risk from landfill gas entry and accumulation, unless the services have been designed to prevent gas ingress. The risk to underground services from landfill gas ingress is associated with the flammability and potential explosion risk of methane. Locations of existing surface water drainage on site are known and sections of drainage around the site offices and access road have been subject to drainage surveys. In addition, services can act as pathways for gas to migrate into buildings via service entries. These risks would be considered and assessed during the detailed design stage.

Utility workers - The risks to utility workers from landfill gas are associated with flammability and potential explosion risk of methane, and asphyxiation arising from accumulation of carbon dioxide and/or reductions in

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oxygen. It is likely that practices for working below ground and within buildings will take account of potential risks arising from accumulation of potentially asphyxiant and explosive atmospheres before work commences, although this may not be recognised by individuals working on their own premises.

Vegetation/agricultural land and golf courses - Landfill gas which migrates into soils will tend to displace oxygen from the root zone and in extreme cases can lead to anaerobic conditions in the soil. This can result in vegetation stress or perish. Deep rooted vegetation is generally more prone to effects of landfill gas presence in soils than shallow rooted vegetation.

The landfill gas CSMs are shown diagrammatically in Figures 12.28 to 12.31. The potential gas migration pathways would be addressed by the cap installed on Zones 1 and 3 and the extraction of landfill gas from these zones. For Zones 2A and 2B the gas would be controlled to prevent migration into off-site and on-site receptors by the use of gas venting trenches on the edge of the zones.

12.7 Difficulties Encountered in Compiling Information

No difficulties were encountered during the assessment.

12.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on soils, geology and groundwater. These projects are discussed in the following paragraphs.

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12.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. Given that the materials to be used for infilling the quarry are to be inert, they would not lead to additional groundwater or soil gas quality effects. As such, there would be no cumulative effect on groundwater or soil gas quality.

12.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

12.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

12.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the

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proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

12.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic.

The works are unlikely to introduce new sources of groundwater contamination or interrupt groundwater flows as groundwater levels are relatively deep to the west of the proposed Project site along the L2005. However, below ground works do have the potential to increase impacts to off-site workers as there would be additional workers working in excavations. However, providing the workers are made aware of the risks and take appropriate measures then the cumulative impacts would be neutral. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

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13. Water – Hydrology

This Chapter assesses the likely impacts to the surface water environment of the proposed Project site and the surrounding areas.

The Remediation Phase impacts associated with the construction of the surface water outfall and pipelines will be negative and temporary. There have been a number of mitigation measures proposed for the Remediation Phase. The preparation of an Erosion and Sediment Control Plan (ESCP) prior to commencement of works shall be required which will include provisions to prevent the release of sediment into the Morell River (e.g. cofferdams, sediment fences and silt curtains). Surface water runoff from the site will not be permitted during remediation works, with all runoff to be retained within the site for reuse and/or disposal offsite, there will be no discharge to the Morell River during the Remediation Phase.

Operational Phase impacts will range from negative to positive and will all be long term in nature. The presence of a new surface water outfall structure within the Morell River will have a slight negative impact through the altering of the flows and removal of bank and vegetation. Accidental spillages into the site surface waters also have the potential to have a negative impact on the Morell River. Provision of real time monitoring and a penstock at the outlet from the surface water pond will hold back the water in the case of any contamination. Emergency response procedures will also be in place to manage in the event of a spillage. Only clean surface water will be allowed to discharge through the surface water outfall into the Morell River.

The remediation of the site will have a positive long-term impact on the hydrology of the area through the reduction in generation of leachate from the site following the placement of the low permeability cap across the waste bodies.

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13.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") on the surface water environment anticipated to occur during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950's until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 13.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 13.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Decommissioning of the surface water connection to the Canal Feeder Stream • Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound supported by a back-up flare • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of the surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation and operation can be found in Chapter 4 Description of the Proposed Project.

The potential impacts on various hydrological aspects such as water quality, flooding, hydromorphology and amenity value, likely to be caused by the proposed Project, have been identified as a result of:

- Works in or adjacent to watercourses;
- Water quality impact on receiving rivers and streams due to potential discharges both during the Remediation Phase and the Operational Phase including from groundwater influences; and
- Potential increased flood risk.

13.2 Legislative Context

The EU Water Framework Directive (2000/60/EC) (WFD) established a framework for the protection of both surface and groundwater. Transposing legislation (S.I. 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended) outlines the water protection and water management measures required in Ireland to maintain high status of waters where it exists, prevent any deterioration in existing water status and achieve at least good status for all waters. A number of River Basin Management Plans (RBMPs) were developed to address the requirements of the WFD. The RBMP of relevance to this assessment (the Eastern RBMP 2009-2015) was adopted in 2009 and includes a programme of measures required to facilitate the achievement of the WFD objectives. This programme of measures included full implementation of existing legislation including the Water Pollution Acts, Water Services Act, Bathing Water Quality Regulations, Integrated Pollution Prevention and Control (IPPC) Regulations, Urban Wastewater Treatment Regulations, the Foreshore Acts and the Birds and Habitats Directives (particularly the Appropriate

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Assessment process). The second cycle of the river basin management planning is currently underway (this was delayed due to significant reform in the water sector in recent years) and the second consolidated draft RBMP which will include the merging of the Eastern, South Eastern, South Western, Western and Shannon River Basin Districts to form one national River Basin District is currently open for consultation, with the final RBMP due to be published by the end of 2017.

Other important EU and national legislation pertaining to the hydrological environment include:

- The EU Floods Directive 2007/60/EC;
- S.I. 722 of 2003, European Communities (Water Policy) Regulations, as amended;
- S.I. 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended;
- S.I. 350 of 2014, European Union (Water Policy) Regulations 2014;
- S.I. 122 of 2010, European Communities (Assessment and Management of Flood Risks) Regulations; and
- S.I. 81 of 1988, European Community Environmental (Quality of Surface Water Intended for Human Consumption) Regulations 1984 as amended.

13.3 Methodology

The assessment was carried out in accordance with the following guidance and tailored accordingly based on professional judgement:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- National Road Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009); and
- Office of Public Works (OPW) Guidelines for Planning Authorities (GPA) 20: The Planning System and Flood Risk Management (OPW and Department of Environment, Heritage and Local Government 2009).

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In line with the above guidance this assessment covered the potential impacts to water quality and described the existing hydrological and hydromorphological environment and any potentially significant impacts associated with the Remediation and Operational Phases of the proposed Project. The impact assessment process involved:

- Assigning the receptor/attribute sensitivity and importance;
- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts; and
- Assessing the significance of any residual effects after mitigation.

The assessment also considered the potential impact to local abstractions potentially affected by the proposed Project.

A Flood Risk Assessment (FRA) Stage 1 was carried out in accordance with the Office of Public Works Guidelines for Planning Authorities (GPA) 20: The Planning System and Flood Risk Management. Refer to Appendix A13.1.

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13.3.1 Appraisal Method used for Assessment of Impacts

The following impact assessment methodology was adapted from the NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009), specifically Section 5.6 (impact quality, type, magnitude/ significance and duration are considered relative to the importance of the hydrological attribute), see Table 13.2 to Table 13.4. The assessment also took account of the guidance set out in the EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017).

Table 13.2: Criteria for Rating Site Attributes - Estimation of Importance of Hydrology Attributes

Importance	Criteria	Typical example
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European communities (Quality of Salmonid Waters) Regulations, 1988. River has sediment regime which provides a diverse mosaic of habitat types, with highly varied morphological features (e.g. pools, riffles, bars) and no sign of channel modification. River displays natural fluvial process and natural flow regime, which would be highly vulnerable to change.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation (NHA status). Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities River has sediment regime which provides highly varied habitat types with varied morphological features and very limited signs of modification.
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Regionally important amenity site for wide range of leisure activities River has sediment regime which provides varied habitat types and appears largely in natural equilibrium. River exhibiting natural range of morphological features with limited signs of artificial modification or morphological pressures.
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding River has sediment regime which provides some habitat and has some natural processes occurring. Rivers exhibit some morphological features; however, the channel cross-section is partially modified with obvious signs of modification.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure Activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people River has sediment regime which provides limited physical habitat and has been extensively modified. River has uniform flow and banks and absence of morphological features.

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Table 13.3: Criteria for Rating Impact Significance - Estimation of Magnitude of Impact on Hydrology Attribute

Magnitude of Impact	Criteria
Large Adverse	Results in loss of attribute and/ or quality and integrity of attribute.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.
Minor Beneficial	Results in minor improvement of attribute quality.
Moderate Beneficial	Results in moderate improvement of attribute quality.
Major Beneficial	Results in major improvement of attribute quality.

Table 13.4: Rating of Significant Environmental Impacts

		Magnitude of impact			
		Negligible	Small	Moderate	Large
Importance of Attribute	Extremely High	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
	High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Profound/ Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/ Moderate

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13.4 Baseline Conditions

13.4.1 Desktop Study

A desk study was carried out to collate the available information on the hydrology water quality of the study area (1km beyond the land-take boundary of the proposed Project). The following data sources were referred to during the assessment:

- Ordnance Survey of Ireland - current and historic mapping;
- Aerial photographs;
- EPA - water quality monitoring database and reports;
- Met Éireann (http://www.met.ie);
- EPA - flow and water level measurements (EPA Hydronet System);
- EPA Hydrotool Report for the Morell River Catchment 2016;
- Water Framework Directive Ireland Database (http://www.wfdireland.ie);
- The Eastern RBMP 2009-2015 and the Liffey WMU Action Plan 2009-2015;
- National Parks and Wildlife Service (NPWS) - designated sites;
- Kildare County Development Plan 2011-2017;
- Kildare County Development Plan 2017-2023;
- Inland Fisheries Ireland - fishery resources;
- Office of Public Works - flood records and the Eastern Catchment Flood Risk Assessment and Management Study (ongoing);
- Kerdiffstown Remediation Project Surface Water Management Plan (SKM Enviros, September 2013);
- Kerdiffstown Environmental Baseline Report (SKM Enviros 2013);

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- Monthly and Bi-annual Surface Water Monitoring Data (Jacobs, October 2013 to December 2016);
- Groundwater and Surface Water Monitoring at Kerdiffstown Landfill (Geosyntec Consultants Ltd, May 2013);
- Preliminary Environmental Site Assessment – Kerdiffstown Landfill (Ford Consulting Group Ltd, April 2012);
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare (Aquens Ltd, December 2012);
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare (Aquens Ltd, October 2015);
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare (Aquens Ltd, September 2016);
- N7 Naas Road Interchange Scheme: Hydraulic Model & Flood Alleviation Measures Report (J B Barry & Partners Limited, January 2002);
- Kerdiffstown Landfill Facility; Briefing Note: Water Management Plan Surface water quality monitoring data (SKM Enviros, March 2012);
- Kildare County Council, National Roads Design Office, N7 Naas Road Widening & Interchanges Scheme, Kill & Johnstown Flood Alleviation Measures Report (June 2002);
- Kildare County Council, National Roads Design Office, N7 Naas Road Widening Interchange Scheme, Hydraulic Model & Flood Alleviation Measures Report (January 2002);
- Kildare County Council Memo, Report Re: Flooding in County Kildare, 5-7 November 2000; and
- OPW Flood Event Report, Flooding at Killeenmore, Co. Kildare, 26 November 2012.

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13.4.2 Field Survey and Monitoring

Hydrological Field Surveys

Site walkovers were undertaken in September and December 2016 to gain an understanding of the hydrological environment in the vicinity of the proposed Project. Visual inspections have been made of the Morell River (WB005), Canal Feeder Stream (WB004) and the other minor watercourses or features in the study area.

Baseline Water Quality Monitoring

Baseline water quality monitoring is currently undertaken monthly at seven locations including the Morell River and the Canal Feeder Stream. An extended suite of sampling is undertaken on a bi-annual basis for an increased number of locations (sixteen) and parameters, see Table 13.5 and Figure 13.2.

Table 13.5: Water Quality Sampling Locations

Water Body	Sampling Location	Orientation from site	Monthly Sampling	Bi annual Sampling
Morell River (WB005)	SW01	Upstream SE	✓	✓
	SW02	Upstream E	✓	✓
	SW03	Adjacent E	✓	✓
	SW04	Adjacent E		✓
	SW05	Downstream NE	✓	✓
Mill Race (off Morell River) (WB007)	SW17	Upstream SE		✓

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Water Body	Sampling Location	Orientation from site	Monthly Sampling	Bi annual Sampling
Canal Feeder Stream (WB004)	SW13	Upstream S	✓	✓
	Site Discharge	Adjacent to S	✓	✓
	SW10	Downstream S		✓
	SW11	Downstream SW	✓	✓
	SW12	Downstream SW		✓
Watercourse on Palmerstown House Estate & Golf Course (WB001)	SW16	Upstream SE		✓
	SW08	Upstream SE		✓
	SW06	Adjacent E		✓
	SW15	Adjacent E		✓
Watercourse on Palmerstown House Estate & Golf Course (WB002)	SW14	Downstream NE		✓

Surface water runoff samples are also collected on-site from a manhole chamber located directly downgradient from an oil interceptor located adjacent to the existing site entrance road in the southern part of the site (Zone 2A), with ultimate discharge to the Canal Feeder Stream.

Surface water samples are analysed for a suite of inorganic parameters including major ions and metals/metalloids as well as a broad suite of organic compounds including volatile organic compounds (VOC's), semi volatile organic compounds (SVOC's) and pesticides. Existing sampling locations are shown on Figure 13.2 and parameters are listed in Appendix A13.2.

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A biological Q-rating assessment of the Morell River using benthic macroinvertebrates as bio-indicators was also carried out in 2012, 2015 and 2016 (Aquens Ltd, 2012, 2015, 2016). This involved macroinvertebrate sampling at seven locations: six in the Morell River and one in its tributary, the Rathmore Stream (also known as the Hartwell River) for the 2012 and 2015 assessment. In 2016 three additional sites were added, two on the Morell River and one on the Rathmore Stream, to represent upstream water quality. The macroinvertebrate data was used to derive a Q-value for each monitoring location based on the proportions of different macroinvertebrate groups, refer to Appendix A13.3 for the Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare 2012, 2015 and 2016 reports.

13.4.3 Consultation

Consultation on the surface water impact assessment was undertaken with the following organisations:

- EPA;
- Water Policy Advisory Committee (Department of Housing, Planning, Community & Local Government);
- The National Parks and Wildlife Service (NPWS);
- The Office of Public Works (OPW);
- Water Service Department of Kildare County Council and Irish Water (IW);
- Inland Fisheries Ireland (IFI); and
- Waterways Ireland.

Consultation responses available are summarised in Chapter 6 The Consultation Process and are included in Appendix A6.2.

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13.4.4 Description of the Existing Environment

Study Area

The study area lies within the Eastern River Basin District (ERBD), Hydrometric Area (HA) 9 (Liffey and Dublin Bay) within the Liffey Water Management Unit (WMU). The catchment of this HA is drained by the River Liffey with all associated watercourses entering tidal water in the Liffey Estuary, north-east of the study area. The assessment has primarily focused within 1km of the proposed Project land-take boundary, including both upstream and downstream extents of surface waters receptors in the vicinity of the site; this was extended as required dependent upon professional judgement. There is one EPA delineated catchment (Liffey and Dublin Bay) and two sub-catchments (Liffey_SC_060 and Liffey_SC_070) within the study area as shown in Figure 13.1.

Major Surface Waterbodies

The key waterbodies (WB) within the study area are shown in Figure 13.2 and an in Diagram 13.1 below.

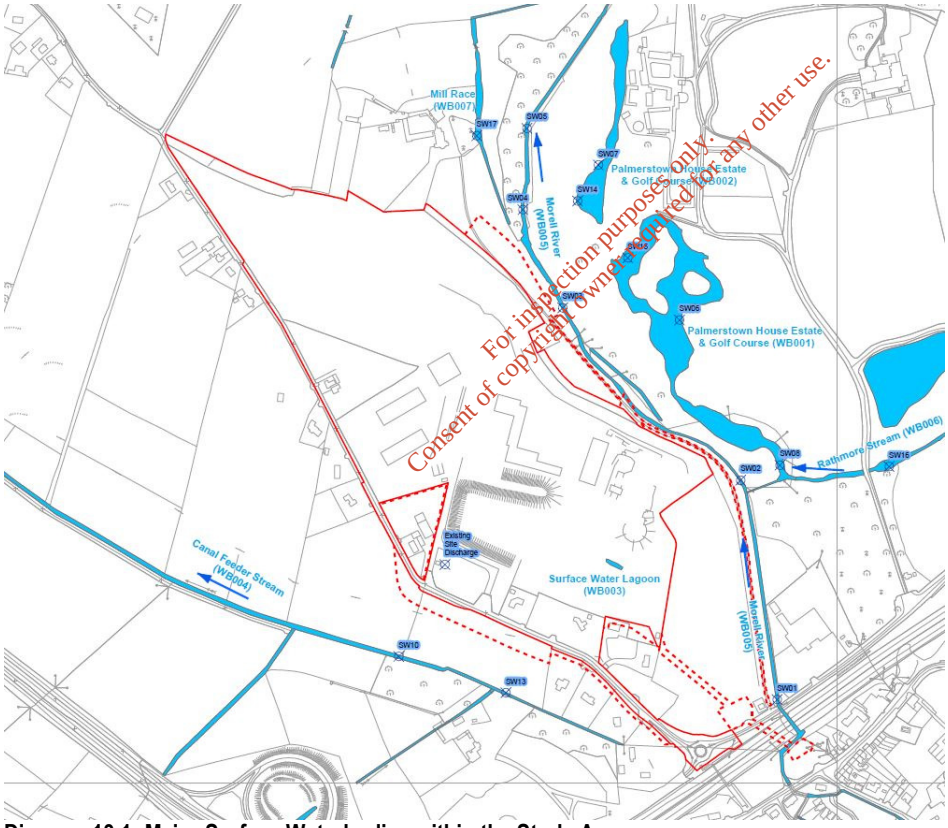


Diagram 13.1: Major Surface Waterbodies within the Study Area

The closest surface water body to the site is the Morell River (WB005) which lies to the east of the proposed Project. The Morell River flows generally northwards joining the River Liffey approximately 5-6km from the site boundary. The Morell River itself is located approximately 15m east of the site boundary. The river channel has an artificially straightened planform throughout its length, with likely modifications to account for surrounding land uses and drainage requirements. Within the study area, there are lengths of bank reinforcement with a modified channel cross-section. The bed consists primarily of cobbles and gravels. A pool-riffle sequence was also noted, providing variation in low flow and some morphological diversity.

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The Rathmore Stream (WB006) has its source approximately 8.5km south-east of the proposed Project between the town of Rathmore and Kilteen and joins the Morell River east of the proposed Project. The connection from the Rathmore Steam to the Morell River is not shown on any published maps but has been confirmed via field surveys carried out for the project, refer to Figure 13.2.

The watercourse has a predominantly sinuous planform which flows through pastoral agricultural fields. The channel appears to be laterally adjusting with several lengths of erosion and large deposits visible along the entire course. The watercourse has a limited vegetated riparian buffer, with an intermittent tree lining that shades some lengths of the channel and acts to stabilise the banks (i.e. through the root network).

The Canal Feeder Stream (WB004) is an engineered feature that collects surface water runoff from lands generally to the south and south-west of the site. The Canal Feeder Stream flows generally westward to the Grand Canal, which is located approximately 2km west of the site. The Canal Feeder Stream has a modified channel cross-section with uniform flow and limited morphological features.

Minor Surface Water Features

Other surface water features in the study area include the lakes/ponds associated with the Palmerstown House Estate & Golf Course (WB001 and WB002), which lie approximately 100m to the east of the proposed Project; as shown in Figure 13.2. There is also an existing surface water lagoon (WB003) located within the boundary of the proposed Project.

Overview of Surface Water Quality

Water Quality and the Water Framework Directive Classification

The status of the Morell River and the Rathmore Stream adjacent to the site is moderate, see Table 13.6. To note as shown in the recent EPA WFD data from the EPA Catchments online portal (EPA 2017) the status of the Morell River and the Rathmore Stream upstream of the site is poor and downstream of the site the status of the Morell River is recorded as good.

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Table 13.6: WFD Waterbodies and Current Status in or adjacent to the Study Area

Water Body	Heavily Modified Water Body	Waterbody Code (former code 2009 RBMP)	Type	Status 2010-2015	Element causing less than good	Achieve Good Status by (under the 2009 RBMP)
Morell River	No	IE_EA_09M010100 (IE_EA_09_1480)	River	Moderate	Macroinvertebrates	2021
Rathmore Stream	No	IE_EA_09R020300 (IE_EA_09_1602)	River	Moderate	Macroinvertebrates	2021

Water Quality and EPA Classification

The EPA assesses the water quality of rivers and streams across Ireland using a biological assessment method. The EPA assigns biological river quality (biotic index) ratings from Q5-Q1 to watercourse sections (refer to Table 13.7). Q5 denotes a watercourse with high water quality and high community diversity, whereas Q1 denotes very low community diversity and a bad water quality. Table 13.8 provides details of the Q water quality status of the Morell River and the Rathmore Stream for the period 2004-2015 as shown in the EPA Envision Mapper (EPA 2017).

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Table 13.7: EPA Biotic Indices ("Q Values")

Q Value*	WFD Status	Pollution Status	Condition**
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously Polluted	Unsatisfactory

Notes
* These Values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily also snails, worms, shrimps etc.) resident at a river site.
** "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses.

Table 13.8: EPA Monitoring Station Locations and Current Status

EPA River Reference	Location	Q Value	Status 2004-2015
RS09M010100	Morell River	Q 2-3, Q3	Poor
RS09R020300	Rathmore Stream	Q 3-4	Moderate

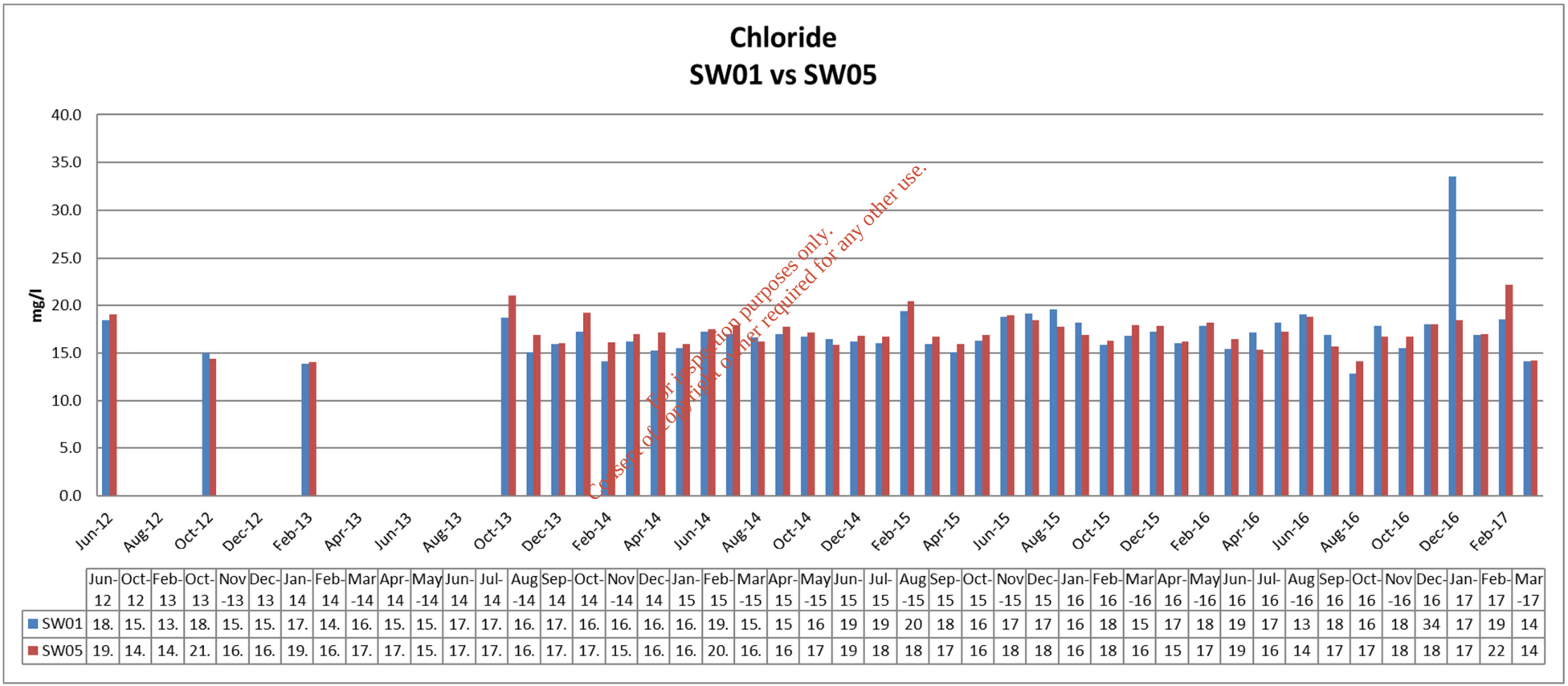
Baseline Water Quality Monitoring Results

Monthly baseline water quality monitoring is currently undertaken at seven key strategic locations on the Morell River and Canal Feeder Stream, to assess whether the landfill is having an adverse impact upon water quality within these water bodies as detailed in Section 13.4.2. Bi-annual surface water monitoring involves the collection and analysis of sixteen samples from the Morell River and Canal Feeder Stream and water bodies located on Palmerstown House Estate & Golf Course, see Table 13.5 and Figure 13.2.

Sampling and monitoring of surface water upstream and downstream of the landfill indicates that the quality of water within the Morell River is good, with no evidence of an increase in key landfill leachate indicators such as ammoniacal nitrogen, alkalinity and Chemical Oxygen Demand (COD). Historically, the chloride concentration at sampling location SW05 has been higher than the concentration recorded at the upstream sampling location SW01 which could be attributed to the landfill. However, as seen in Diagram 13.2 below, chloride concentrations in the Morell River for the four months (April-July 2016) have had a slight decrease downstream from SW01 (16.9mg/l) to SW05 (15.7mg/l). This trend was similarly seen in the summer to autumn of 2015, where three consecutive months (July, August and September) recorded a lower concentration at SW05 than SW01.

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	Jun-12	Oct-12	Feb-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17
SW01	18.	15.	13.	18.	15.	15.	17.	14.	16.	15.	15.	17.	17.	16.	17.	16.	16.	16.	16.	19.	15.	15	16	19	19	20	18	16	17	17	16	18	15	17	18	19	17	13	18	16	18	34	17	19	14
SW05	19.	14.	14.	21.	16.	16.	19.	16.	17.	17.	15.	17.	17.	16.	17.	17.	15.	16.	16.	20.	16.	16	17	19	18	18	17	16	18	18	16	18	16	15	17	19	16	14	17	17	18	18	17	22	14

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Diagram 13.2: Chloride in Morell River – Upstream (SW01) versus Downstream (SW05)

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Previous monitoring indicated that the Canal Feeder Stream was of good quality however, some recent results were higher downstream of the site than upstream e.g. calcium, potassium, sodium, alkalinity, sulphate and chloride. The data collected could indicate that runoff from roads in the vicinity of the proposed Project is impacting the Canal Feeder Stream with elevated chloride concentrations seen during the winter months from road salt but decreasing through the summer.

Where available, these results are compared to the standards in the European Communities Environmental Objective (Surface Water) Regulations, S.I. 272 of 2009. The following metal and metalloids are measured against the Surface Water Regulations: Arsenic, Cadmium, Chromium, Copper, Lead, Nickel and Zinc. The results between October 2013 and July 2016 show that almost all of the analytes are testing below the surface water regulation standards, refer to Appendix A13.2.

Benthic macroinvertebrates are used as bio-indicators as they exhibit differential responses to physical and chemical changes in their environment. Some macroinvertebrates are sensitive to pollution while others are tolerant. They can provide a realistic record of the baseline water quality conditions. The 2012 biological Q-rating assessment found that the water quality was good along the Morell River's length with sites achieving scores of Q4 and most achieving Q4-5. In 2015 and 2016 the assessment found that both the Morell River and Rathmore Stream were impacted. The water quality of the Morell River was moderately polluted (Q3) upstream of the landfill and improves to slightly polluted (Q3-4) downstream as it flows past Kerdiffstown Landfill which is consistent with the WFD status. However, these assessments show that there is still no evidence of ecological deterioration or impact from the landfill. These three reports are contained in Appendix A13.3.

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Flow Measurement

Flow measurements within rivers are taken throughout the Republic of Ireland by the OPW and the EPA. Within the study area the OPW measure water level and flow on the Morell River at station No. 09036 (water level only) and Kildare County Council / EPA at gauging station No. 09044 (Water Level and Flow) at Kerdiffstown House, refer to Figure 13.1.

The summary flow statistics downloaded from the EPA for the existing hydrometric station near the weir adjacent to Kerdiffstown House (gauging station No. 09044) indicates an annual minimum dry weather flow of 0.059m^3/s and Q95 (95 percentile flow) of 0.119m^3/s (a statistical measure of flow rate based on long-term flow records).

Water Supply Sources

A review of EPA abstraction data and previous reports, such as the Kerdiffstown Landfill Facility; Briefing Note: Water Management Plan (SKM Enviros, March 2012) surface water quality monitoring data did not identify any known drinking water abstraction points or designated surface water drinking sources downstream of the proposed Project. The closest major public water supply abstraction from the River Liffey at Leixlip, which serves Fingal, Kildare and north Dublin, is located approximately 15km north-east of the landfill site. There is also a known industrial abstraction downstream on the Liffey near Leixlip.

Discharges, IPC/Industrial Emissions Activities Licenced Facilities and Urban Wastewater Treatment Plant (UWWTP)

There are approximately six licensed IPC facilities and two licensed waste facilities within 7km of the proposed Project, see Table 13.9. The Osberstown (UWWTP) which serves the Upper Liffey Valley Regional Sewerage Scheme agglomeration (D0002-01) lies within 5km of the proposed Project.

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Table 13.9: Licensed Facilities and Facility Type

Facility Name	Facility Type	Licence No.	Orientation from site	Approx. distance from the centre of the of the site (km)
Boran Plastic Packaging Limited	IPC Facility	P0819-01	West	2.4
Greenisle Foods Limited (Naas)	IPC Facility	P0805-01	West	1.5
Trimite Truecoat Limited	IPC Facility	P0239-01	South-West	1
Dennison Trailers Limited	IPC Facility	P0782-01	South-West	1
Arrow Group	IPC Facility	P0812-01	South-West	1.2
Saint Gobain Building Distribution (ROI) Limited T/a PDM	IPC Facility	P0325-01	East	6.2
Arthurstown Landfill	Waste Facility	W0004-04	South-East	4
Rehab Glassco Limited	Waste Facility	W0279-02	South-East	5
Osberstown Upper Liffey Valley UWWTP	UWWTP	D0002-01	South-West	4

Ecological Designations

The site is not situated within or next to any European sites. The nearest European site to the proposed Project is Red Bog, Kildare SAC approximately 7.5km south-east of the proposed Project. There is no hydrological or source-pathway-receptor connectivity between the Kerdiffstown site and this SAC (refer to Chapter 11 Biodiversity). Surveys to date have recorded no species or habitats associated with designated European sites within the site. The nearest European site hydrologically connected to the site is at least 20km downstream (Dublin Bay), measured by connecting watercourses, including the Morell River which lies within 15m of the north-east site boundary at its closest point. However, designated sites in Dublin Bay do not support any aquatic Qualifying Interest (QI) species such as Atlantic salmon or lamprey. The Canal Feeder Stream discharges into the Grand Canal, which is designated as a proposed Natural Heritage Area (pNHA) 2km north of the site boundary. The ecological value of the canal lies in the diversity of species it supports along its linear habitats than in the presence of rare species (refer to Chapter 11 Biodiversity).

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Amenity Areas

The site is in close proximity to a number of commercial and leisure receptors along the access road to Kerdiffstown Landfill. The site neighbours a number of recreational land uses, specifically Palmerstown House Estate & Golf Course and Naas Golf Course to the north-east and north-west respectively. In addition to this is the Grand Canal (pNHA), located approximately 550m north of the propose Project at the nearest point. The Grand Canal provides the area with an amenity site suitable for walking, running and cycling.

History of Flooding and Flood Risk Assessment

With reference to the OPW National Flood Hazard Mapping (www.floodmaps.ie) which contains flood information, a number of historical flood events were identified within the areas around the proposed Project, namely the Kill, Johnstown and Sallins areas, refer to Appendix A13.1.

13.4.5 Receptor Importance

Table 13.10 summarises the importance of the surface water receptors within the study area using the criteria from NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, professional judgement and consultation feedback The surface water lagoon (WB003) is part of the existing site drainage and is not consider a receptor for the purpose of the assessment. The Mill Race (WB007) is considered under the Morell River (WB005) assessment.

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Table 13.10: Receptor Importance within the Study Area

Receptor	Water Body	Receptor Importance	Rationale
Morell River	WB005	High	The Morell River provide spawning habitat for a key population of Atlantic salmon in addition to supporting significant populations of Brown trout
Canal Feeder Stream	WB004	Medium	Downstream connection 2km to the Grand Canal pNHA
Rathmore Stream (also known as the Hartwell River)	WB006	High	Quality Class B (Biotic Index Q3-4) and connection to the Morell River see above
Watercourse on Palmerstown House Estate & Golf Course	WB001 & WB002	Low	Limited ecological potential but some local/regional amenity value

13.4.6 Current Site Conditions and Drainage

Current Site Conditions and Drainage – Pre-Remediation

The site has been divided into zones as shown Figure 3.2. Table 13.11 summarises those elements within each zone of relevance to this surface water assessment. The existence of uncapped wastes means that surface water currently infiltrates the landfill to generate leachate, most notably in Zones 1 and 3.

It is noted that there is only one existing discharge point from the site into the Canal Feeder Stream in the form of the overflow from the settlement tank (including an oil interceptor) adjacent to the site entrance. There is currently no direct discharge from the site to the Morell River.

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Table 13.11: Zonation of Kerdiffstown Site

No.	Zone Characteristics (relating to Surface/Ground Water refer to Section 3.4 for more details and Figure 3.2 for the location of each Zone)
1/1A	Wastes in this area of the Site are uncapped although large areas are covered in vegetation. This zone is unlined and localised areas of free leachate are present within the wastes. Currently there is no surface water control within Zone 1 and rainfall largely infiltrates into the ground, runs-off to the surrounding ground or evaporates.
2A/2B	Much of these zones is covered by thick, reinforced concrete pads, which form an impermeable layer over the wastes and prevent direct rainwater ingress. The smaller area of wastes not covered by concrete allows rainwater to infiltrate in a similar manner to Zone 1 above. Leachate production in this area is already significantly reduced by presence of the concrete slabs. Currently, hard-standing surface water runoff from Zone 2A (from around the site office, former buildings and the site access road) drains into road gullies and flows through a settling tank and subsequently through an oil interceptor via piped network to the Canal Feeder Stream. Foul drainage from the site offices currently drains to a septic tank which is cleaned out on a regular basis.
3	This zone comprises a lined cell, which has been partially infilled with wastes, and this infilled area has been capped (temporarily) with a geosynthetic liner. Leachate is collected by pumps transferring the leachate to two tanks above the cell area for removal by road tanker, where the leachate is treated at Ringsend Wastewater Treatment Plant (WWTP). The lined cell has not been completely infilled to date. Waste was removed from within the former buildings that were demolished in 2016 and disposed to the lined cell, with new temporary capping installed over this waste mass. Around this temporary cap, a ditch shape has been formed to collect surface water runoff from the temporary capped area, which transfers surface water to a surface water channel and to a surface water lagoon (WB003) located in Zone 4, refer to Figure 13.2. This lagoon has no outlet hence waters dissipate to groundwater. Due to a permeable horizon lying above a clay layer on the south slope of the cell, groundwater has been noted to build up behind the liner. This water is extracted via pin wells and drains into the surface water channel feeding the surface water lagoon.

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No.	Zone Characteristics (relating to Surface/Ground Water refer to Section 3.4 for more details and Figure 3.2 for the location of each Zone)
4	Zone 4 contains the surface water lagoon, which is cut into the surface which is considered to include some waste deposits. Any leachate generated in this area is considered to be weak and discharges directly to groundwater.

An area located to the south extents of the proposed Project, within the land ownership boundary, comprises houses, access roads, a stockpile of fill material and drainage features. Refer to Figure 3.2 for the location of the zones.

To facilitate the remediation works a compulsory purchase process will be undertaken for adjacent lands. There are a number of properties that will then be affected within the Compulsory Purchase Order (CPO) boundary. Reference should be made to Figure 3.4 for the location of the properties discussed below.

Foul water from REC010 is discharged to a septic tank within the bounds of the property. This property will be demolished as part of the works to construct the new Landfill Infrastructure Compound. Foul water from REC011 discharges to a septic tank within the bounds of the property. This property will be demolished as part of the works to construct the new site access.

Surface water drainage from a property (REC012) currently flows into drains, transferring into road gullies to a settlement tank and oil interceptor, then discharging via a piped network to the Canal Feeder Stream. This connection will be realigned as part of the remediation works to remove pipes from within the licensed boundary. Foul water for REC012 is assumed to discharge to a septic tank within the bounds of the property.

Foul water for REC016 is discharged to a septic tank within the bounds of the property. This property will be demolished as part of the enabling works to permit stockpiling of clean imported materials.

A septic tank, of soakaway design, extends from property REC039 and discharges within the site boundary. This discharge will be removed and a sewer connection provided for this property.

Foul and grey waters drainage from the existing site offices are collected in a septic tank and are removed from site on a regular basis.

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13.5 Predicted Impacts

This Section considers and assesses the impact of the proposed Project with regards to surface water receptors. Flooding impacts are addressed in detail in the FRA specialist report contained in Appendix A13.1 and are summarised in Section 13.5.5.

13.5.1 Site Drainage Conditions – During Remediation

A suitably competent contractor(s) will be appointed to undertake remedial works at the site, with surface water management a particular aspect to be closely monitored and controlled. The contractor will be required to construct temporary perimeter bunds and silt fences to enable separation of working areas from remediated areas. However, it is anticipated that until initial vegetation coverage is established silty runoff from capping soils requires control. As a result, the surface water management design proposals do not permit surface water discharge to the Morell River during the Remediation Phase.

The appointed contractor(s) responsible for the remediation works will be required for ensuring a break between working (exposed waste) areas and remediated areas (restored) is maintained to prevent cross contamination. The appointed contractor(s) may also utilise temporary on site lagoons to retain surface water runoff, with silt buster tanks (or similar) used to limit the amount of silt being disposed to the ponds/ lagoons. Water collected in these lagoons will be used for dust suppression across the open working areas and, if not contaminated, over restored areas with any contaminated waters removed from the site by road tanker. The appointed contractor will be required to prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC,

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for the contractor to then implement through the Remediation Phase, with water contamination testing requirements and limits to be agreed with the EPA.

13.5.2 Future Site Drainage Conditions – Post Remediation

Details of the future site drainage conditions are provided in the Surface Water Management Plan (Appendix A4.6). Details of leachate management are included in the Leachate Management Plan (Appendix A4.4).

Foul water: Foul water from the proposed amenity facilities (changing room and the site management offices) will be directed via a new sewer pipeline, crossing under the N7 and Morell River, connecting to Johnstown Pumping Station for discharge into the public sewer network and then transferred onto Osberstown WWTP, refer to Figure 4.17.

Leachate: Leachate will be collected from Zone 3 and may also be extracted from Zone 1 when required. Leachate will be pumped to the Landfill Infrastructure Compound (refer to Figure 4.13), where it will be treated (by methane stripping) and then pumped via a new leachate pipeline, crossing under the N7 and Morell River, to Johnstown Pumping Station, for discharge into the public sewer network and then transferred on to Osberstown WWTP. This will be a separate pipeline from the foul water connection. If required leachate can be collected from the Landfill Infrastructure Compound and tankered off-site for disposal, as discussed in Chapter 4 Description of the Proposed Project. A Leachate Management Plan has been prepared and is provided in Appendix A4.4.

Clean surface runoff: Following capping and remediation works clean surface water runoff, collected within the proposed development area via a series of open channels, will be directed to lined surface water ponds located within Zone 4 where it will ultimately be discharged at the proposed new surface water outfall to the Morell River, refer to Figure 4.19.

A local area over the north flank of the Site in Zone 1 cannot be collected and transferred to the pond due to topographical constraints, hence this will be collected in a swale located at the toe of the slope and will infiltrate to ground. Due to the site topography a limited area to the north-west of the site (delineated as Zone 1A) cannot connect to the Zone 4 ponds, hence will collect surface water in a lined storage pond (Pond 1) and attenuated before overflowing to a soakaway, refer to Figure 4.19.

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Potentially contaminated runoff: Surface water runoff from the car parks and internal road network will be directed via a kerb and gully system to a petrol interceptor and then on to the surface water pond in Zone 4 (Pond 2 & 3) where it will be ultimately discharged to the Morell River.

Surface water from the new Landfill Infrastructure Compound will be collected by system of road gullies and underground pipework which will be supplied with silt and oil interceptor(s). Flows from the Compound will be discharged to the main site road drainage and onto Zone 4 (Pond 2 & 3). However due to the risk of runoff from the Compound containing contaminants due to leachate spillages the drainage system from the Compound will also be provided with an isolation point before discharge into the main site road drainage.

As part of the remediation works a new site access and realignment of the L2005 Kerdiffstown Road will be constructed, to include provision of a new footpath and cycleway. This realigned road will tie into the existing road drainage system.

Properties REC010, REC011 and REC16 will be demolished. Where these areas are within the licensed boundary the surface water drainage will tie into surface water system of the proposed Project. Any foul water systems associated with these properties will be decommissioned.

Surface water drainage for property REC012 will be realigned as part of the remediation works to remove pipes from within the licensed boundary to continue current discharge via the piped network to the Canal Feeder Stream. Foul water will continue to discharge to a septic tank as per currently understood arrangements.

Foul water for property REC039 will be connected to a new sewer pipeline which will discharge to the public sewer network via Johnstown Pumping Station.

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Details of the future site drainage conditions are provided in the Surface Water Management Plan (Appendix A4.6).

13.5.3 Remediation Phase

During the Remediation Phase there is the potential for pollution of surface water features due to sediment loading and associated anthropogenic polluting substances entering watercourses as a result of surface water runoff that could potentially be contaminated by waste material and/or spills on-site and/or groundwater influx. Potential sources of pollution which may occur during the Remediation Phase of the proposed Project include:

- Construction works within and adjacent to the Morell River associated with the provision of the surface water pond (Pond 3) outfall;
- Pipeline crossing of the Morell River for the provision of the leachate pipeline and separate foul pipeline;
- Site clearance works;
- Crushing of construction/concrete works;
- Realignment of the L2005 Kerdiffstown Road;
- Excavations including those associated with the provision of drainage works;
- Re-profiling of the waste material to create the necessary safe slopes and topographic landform for the proposed capping solution which has the potential to generate dust and encounter perched leachate;
- Infiltration of surface water into the waste body following rainfall and during dry weather water spraying to supress dust generation on the site;
- Stockpiling of materials (imported and processed on site);
- Traffic accessing and egressing the site (carrying mud onto surrounding roads);
- Accidental spillage of anthropogenic polluting substances in or adjacent to watercourses; and
- Construction plant and vehicle washing.

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Outline details of the Remediation Phase works are provided in Section 4.3.1 in Chapter 4 Description of the Proposed Project and in Figure 4.8 and Figure 4.9.

The remediation of the proposed Project which includes the development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site, see Section 4.3.1 for details on the outline phasing of the works.

More specifically, during remediation, construction works in and around the water environment will be as follows:

- In-channel working for the provision of the surface water pond outfall on the Morell River (WB005)
- Below river works (directional drilling) to facilitate the connection of the leachate and foul water pipelines to the Johnstown Pumping Station refer to Figure 4.17;
- Remediation/construction works within Zone 4 and Zone 1 will be within approximately 50m and 100m of the Morell River (WB005) respectively;
- Remediation/construction works within Zone 3 will be within approximately 120m of the Canal Feeder Stream (WB004); and
- Remediation/construction works within Zone 4 will be within approximately 250m of the Rathmore Stream (WB006).

Due to the historical use of the site, the exact nature of the existing waste material cannot be fully determined; refer to Chapter 12 Soils, Geology, Contaminated Land and Groundwater for a complete review of the ground investigation results. During remediation, there will be some movement of waste in Zones 1, 1A, 2A, 2B, 3 and 4, to allow for safe re-profiling of these zones. The waste from Zone 4 will be moved to Zones 1, 1A and 3 for re-profiling and infilling of these zones. There will also be a requirement for the temporary stockpiling of waste,

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crushed concrete and clean materials as outlined in Chapter 4 Description of the Proposed Project. In the event that the remediation works uncover a waste type that requires off-site disposal, then measures to remove and dispose/recover such materials will be undertaken. During incidents of heavy rainfall there is potential for newly uncovered waste to generate leachate which could penetrate ground water sources within the site which are hydrologically linked to the Morell River.

In terms of the physico-chemical parameters relating to water quality, one of the main potential contaminants during the Remediation Phase is considered to be suspended solids. Increased suspended solid concentrations could cause aquatic ecological problems which include clogging fish gills, smothering spawning grounds, reducing light penetration for flora growth, and adding bacteria and algae to the water. Nutrients and contaminants can often be associated with the solids (inorganic nutrients such as phosphorus and organic pollutants such as hydrocarbons) and in turn can cause the deterioration of water quality and damage to aquatic life due to eutrophication of the water environment and eventual fish-kills due to lowering of oxygen supply.

During the Remediation Phase there potentially would be direct and indirect impacts on water quality and direct impacts on the Morell River (from works to construct the surface water outfall and the leachate/foul water pipeline and their associated protection). All other potential impacts are considered to be indirect, temporary, negative and slight and as a result of surface water runoff. Potential impacts from the remediation works in the absence of mitigation measures on the various sensitive receptors (watercourses) are described below.

Morell River (WB005)

The Morell River (WB005) is considered to be a receptor of High importance. Any potential impacts associated with increased sediment release or anthropogenic pollution during the Remediation Phase, including the construction of the 2 No. pipeline connections to Johnstown Pumping Station and 1 No. surface water outfall directly to the river could have an impact on this watercourse.

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The construction of the surface water outfall is likely to require the removal of some riparian vegetation and potential replacement of natural bank and bed material with artificial material associated with the surface water outfall components. The proposed location of the surface water outfall is beside an existing length of rock armour. As a result, the impacts are unlikely to be significant; however, the new surface water outfall would lead to additional artificial material being introduced to the channel.

The provision of the pipelines crossing below the Morell River could cause localised disturbance to the bed of the river. It is intended that the 2 No. pipelines would be constructed using directional drilling techniques, with the pipelines having to cross underneath the watercourse and the N7 carriageway. The 2 No. pipelines will be the same size, anticipated to be fully welded 150mm (internal diameter) barrier Medium Density Polyethylene Pipe (MDPE) pipe and will be laid approximately 1m apart. The minimum distance between the crown of the 2 No. pipelines and the river bed is expected to be at least 400mm. Given the preliminary pipeline design proposed and based on discussions with Inland Fisheries Ireland, it is not proposed to install additional stream bed armour in order to minimise disturbance of the natural stream bed, but the detailed design of the pipeline will be agreed with Inland Fisheries Ireland. Should Inland Fisheries Ireland require stream bed armour to be installed additional works (potentially in stream) may be required to provide a protective cover to these pipes. Worst case it is assumed that the proposed method would require in stream works to lay concrete under the river bed, with the natural bed then replaced like-for-like. This work would require complete removal of the natural bed and banks with potential for fine sediment mobilisation. The concrete would alter the potential for natural processes such as incision, although the channel bed appeared stable at the time of survey. The reinstatement of the bed could lead to channel instability and adjustment depending on the remediation design and tie in with the existing channel cross section.

Runoff would be generated during the Remediation Phase and there is potential for waste material (that could contain non-compliant waste) and stockpiled material to become exposed to rainfall during the remediation works. This could subsequently generate leachate and/or surface water runoff which could contain

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contaminants related to this material and this runoff/leachate could make its way to the Morell River. See also Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Impacts on the Morell River from the remediation works are considered to be direct during construction (provision of the new pipelines to facilitate connection to Johnstown Pumping Station, and the surface water outfall direct to the river) and indirect (spills or runoff which could potentially be contaminated) temporary, negative and significant. Potential ecological and hydrogeological impacts on the Morell River and surrounding environs are considered in Chapter 11 Biodiversity and Chapter 12 Soils, Geology, Contaminated Land and Groundwater respectively.

Canal Feeder Stream (WB004)

The Canal Feeder Stream (WB004) is considered to be a receptor of Medium importance due to its downstream connection with the Grand Canal pNHA. There are no anticipated direct impacts on the Canal Feeder Stream during remediation as the existing site connection will be removed in the first phase of remediation works. Any potential impacts associated with increased sediment release or anthropogenic pollution during the Remediation Phase (i.e. from site vehicles dispositioning material on the road during the ingress/egress) could have an impact on this watercourse. However, this is considered unlikely due to the distance of the Canal Feeder Stream to the site and it associated access. Therefore, it is not anticipated that there would be direct or indirect impacts on the Canal Feeder Stream during remediation.

Rathmore Stream (WB006)

The Rathmore Stream (WB006) is considered to be a receptor of High importance due to its connectivity with the Morell River. It is not anticipated that there would be direct or indirect impacts on the Rathmore Stream during remediation, due to its location (upstream) and the distance from the proposed Project.

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Other Watercourses

Other watercourses in the study area are the lakes/ponds associated with the Palmerstown House Estate & Golf Course (WB001 and WB002). These are considered to be receptors of Low importance. It is not anticipated that they will be directly or indirectly impacted by remediation work due to their distance from the proposed Project.

13.5.4 Operational Phase

The proposed future site conditions and drainage is detailed on Section 13.5.2 and these have been considered as inherent to the design. Additional mitigation measures as required for the Operational Phase are outlined in Section 13.6.2.

Morell River (WB005)

The Morell River is considered to be a receptor of High importance. There will be a new surface water outfall proposed and pipelines crossing for the Morell River installed during the remediation works as outlined in Section 13.5.2. Commissioning of the new surface water outfall to the Morell River will occur during the final site works once all remediation works have been completed. The site surface water drainage system will carry runoff from Zones 1, 2A, 2B, 3 and 4 to the surface water pond located in Zone 4, where the water will be discharged via the surface water outfall to the Morell River. Potential long term hydromorphological impacts from the surface water outfall include but are not limited to:

- Changes to flow and sediment processes due to surface water outfall discharges and potential changes to the channel cross-section as a consequence of adjustment to modifications;
- Replacement of natural banks with concrete headwalls and reducing the vegetated riparian zone; and
- Increases in suspended sediment input into the Morell River potentially disturbing and/or smothering existing geomorphological features (including riffles and pools).

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It is noted that the location of the proposed surface water outfall will be adjacent to existing rock armour which was constructed recently on the Morell River and therefore the bank is already modified.

If there was a breach in the capping liner integrity and subsequently leachate entering the on-site surface water system this could potentially reach the Morell River. However, this scenario is considered highly unlikely to occur given proposals for construction methodology, supervision and quality control which will be undertaken during the remediation works as detailed in Section 4.3. This is further mitigated post-remediation and through the Operational Phase by the requirement to monitor the surface water system in compliance with the Industrial Emissions Activities Licence (IEAL) as agreed by the EPA. A penstock will also be constructed during the Remediation Phase to permit closure of the current outfall to the Morell River should contamination of the surface water system be detected.

Surface water runoff from the north-west of the Site (Zone 1A) will be collected in a lined storage pond, attenuated and will drain to groundwater via a soakaway. Surface water from the north flank of the Site will be collected in a swale located at the toe of the slope and will infiltrate to ground. Potential impacts on hydrogeological receptors as a result of these features are addressed in Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Surface water from the Landfill Infrastructure Compound will be collected by system of road gullies and underground pipework which will be supplied with silt and oil interceptor(s). Flows from the Compound will be discharged to the main site road drainage.

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Pollutants, for example oils and hydrocarbons from the internal road network could be deposited on the road surface and transported in surface water runoff via a kerb and gully system however, as described in Section 13.5.2 a petrol interceptor will be used prior to the surface water pond and the ultimate discharge to the Morell River.

There is a potential for accidental spillage of material on the internal road system or similar that could make its way to the surface water pond and ultimately the Morell River.

Pollutants, for example oils and hydrocarbons from the realigned L2005 Kerdiffstown Road could be deposited on the road surface and transported in surface water runoff to the Morell River. Full details of the traffic levels are provided in Chapter 14 Traffic and Transport but in summary the baseline traffic levels for the L2005 Kerdiffstown Road, south of access to the proposed Project, are 1,749 Annual Average Daily Traffic (AADT)) and the projected AADT for 2022 is 2,015. This increase of 266 vehicles a day is not considered significant in terms of increased pollutant load on this local road network.

Overall potential impacts on the Morell River during routine operation are as follows:

- There is a potential for a direct (discharge), long term, negative and slight for routine operation;
- There is a potential for a direct, long term, significant/profound impact in the event of an accidental spillage of contaminant such as leachate on the internal road system or as a result of linear integrity failure; and
- The reduced generation of contamination (leachate) from the site following the placement of the engineered capping system will have a positive (beneficial) impact on the quality of the receiving water, the Morell River due to the reduction in leachate entering the Morell River via groundwater, see Chapter 12 Soils, Geology, Contaminated Land and Groundwater. Therefore, there is a potential for an indirect, long term, Slight positive impact on the Morell River during routine operation, more details of this are provide in Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Canal Feeder Stream (WB004)

The Canal Feeder Stream is considered to be a receptor of Medium importance. It is anticipated that there would be no direct/indirect impacts to the Canal Feeder Stream during operation, as the current outfall will be permanently disconnected during the Remediation Phase.

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Rathmore Stream (WB006)

The Rathmore Stream is considered to be a receptor of High importance, with no anticipated impacts on the Rathmore Stream during the operation of the proposed Project, due to its location upstream and distance from the proposed Project.

Other Watercourses

Similarly, the other waterbodies in the study area associated with the Palmerstown House Estate & Golf Course are not anticipated to have any predicted impacts associated with the operation of the proposed Project, due to their location from the proposed Project.

Table 13.12 summarises the impacts on water quality and morphology for each receptor during Remediation and Operational Phases (based on NRA, 2009).

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Table 13.12: Summary of Environmental Impacts

Receptor	Importance	Source of Effect	Effect Summary Description	Potential Effect Unmitigated		
				Magnitude	Significance	Impact Type
Morell River	High	Remediation Direct impact on watercourse from construction of the discharge pipe, surface water outfall and pipeline crossing to Johnstown pumping station and indirect impact from accidental spillage/runoff entering the watercourse.	Remediation Potential release of suspended solids, and spillage of contaminants in general area during construction works which could impact on the watercourse. In-channel working and removal of natural bed and banks as well as riparian vegetation.	Moderate	Significant	Direct and indirect negative temporary
		Operation Surface runoff and accidental spillage during operation. Presence of a permanent surface water outfall structure.	Operation Structure removing natural vegetation and bank and altering flow processes	Small	Slight	Direct negative long term
			Operation Potential for pollutants to be transported in surface water runoff and enter the watercourse via the drainage system in the event of an accidental spillage event.	Moderate	Significant/ Profound	Direct negative long term
			Operation Reduced generation of contamination (leachate) from the site following the placement of the low permeability cap.	Small	Slight	Indirect positive long term
Canal Feeder Stream	Medium	No predicted impacts associated with remediation.	Remediation None anticipated.	N/A	N/A	N/A
		No predicted impacts associated with operation.	Operation None anticipated.	N/A	N/A	N/A
Rathmore Stream	High	No predicted impacts associated with remediation.	Remediation None anticipated.	N/A	N/A	N/A
		No predicted impacts associated with operation.	Operation None anticipated.	N/A	N/A	N/A
Watercourse on Palmerstown House Estate & Golf Course	Low	No predicted impacts associated with remediation No predicted impacts associated with operation.	Remediation None anticipated.	N/A	N/A	N/A
			Operation None anticipated.	N/A	N/A	N/A

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13.5.5 Flood Risk

A flood risk assessment (FRA) in line with the Office of Public Works (OPW) Guidelines for Planning Authorities (GPA) 20: The Planning System and Flood Risk Management (OPW, 2009), has been undertaken. The full report is contained in Appendix A13.1. The primary objective of the FRA was to assess the flood risk in the existing situation and with the proposed Project in operation.

The initial surface water design for the proposed Project indicates there will be a surface water outfall with a discharge rate of 51.07 l/s to the Morell River from the pond located to the south extents of the site. An assessment was carried out using the existing Catchment Flood Risk Assessment and Management (CFRAM) fluvial (related to a river or stream) flood data for the area. Based on the initial surface water design, a discharge rate of 51.07 l/s would cause a less than 1% increase in flow in the 10% annual exceedance probability (AEP) and the 0.1% AEP CFRAM Flood Events (1 in 10 year event and 1 in 100 year event respectively). The increase in flow equates to a maximum increase in water level of approx. 5mm, which is considered negligible. Therefore, the impact on fluvial flood risk to the Morell River as a result of the proposed Project is anticipated to be negligible.

The FRA has initially concluded that all across the study area, comparison of the existing and the proposed Project demonstrate that the proposed works does not increase the flood risk. Table 13.13 below provides a summary of the potential flood risk impacts on surrounding areas as a result of the proposed Project.

Table 13.13: Flood Risk Assessment Summary

Flood Risk	Summary of Impact	Notes
Coastal	N/A	-
Fluvial	Negligible Impact	Any increase in flood risk from fluvial sources to the surrounding area is considered negligible.
Estuarial	N/A	-
Pluvial	No Impact	Flood risk from pluvial sources to the surrounding area will not be increased.
Artificial Drainage Systems	No Impact	Flood risk from artificial drainage systems sources to the surrounding area will not be increased.
Groundwater	No Impact	Flood risk from groundwater sources to the surrounding area will not be increased.
Climate Change	N/A	The impact from the proposed Project on Climate Change is considered non-applicable.

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13.6 Mitigation Measures

This Section considers and assesses the mitigation measures of the proposed Project with regards to surface water.

13.6.1 Remediation Phase Mitigation

Prior to commencement of the Remediation Phase, the appointed contractor responsible for the remediation works shall prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC. The CEMP shall contain the mitigation measures and plans identified in the following Sections (as a minimum), the wider EIAR and shall implement the conditions set out in the planning approval and the requirements of the site's Industrial Emissions Activities Licence (IEAL). The appointed contractor shall also ensure that the CEMP is fully implemented during the Remediation Phase in agreement with KCC, to prevent or reduce the impacts identified in the impact assessment.

All construction works shall be completed in line with reference to the guidelines outlined below where applicable, and specified in the CEMP:

- 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (NRA, 2005);
- CIRIA C648 'Control of Water Pollution from Linear Construction Projects: Technical Guide' (Murnane *et al.*, 2006);

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- CIRIA C649 'Control of Water Pollution from Linear Construction Projects: Site Guide' (Murnane *et al.*, 2006);
- CIRIA C692 Environmental Good Practice on Site 3rd Edition (2010);
- 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA, 2001);
- 'IFI Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters' (IFI, 2016); and
- UK Environment Agency:
  - PPG3 Use and design of oil separators in surface water drainage systems;
  - PPG5 Pollution Prevention Guidelines Works and Maintenance in/ or near Water;
  - PPG21 Incident Response Planning;
  - PPG22 Dealing with Spills; and
  - PPG26 Drums and Intermediate Bulk Containers.

The first phase of the remediation works will include the removal of the site connection to the Canal Feeder Stream. Therefore, there will be no direct hydrological connection from the site to the Canal Feeder Stream during the Remediation Phase.

Temporary construction surface drainage and sediment control measures will be in place before earthworks commence.

There will be no direct hydrological connection from the site to the Morell River during the Remediation Phase.

The surface water pond areas (to be utilised in the Operational Phase) will be used temporarily for the storage of runoff during the remediation works. These ponds will be lined. Further temporary ponds may be constructed at locations adjacent to working areas to assist with management of runoff if the phasing and timing works require additional storage volumes. These temporary ponds will also be lined. Therefore, any potentially contaminated runoff will be captured and contained and will not be discharged from the site. Water may be required for on-site purposes. Re-use on site will include dust suppression and irrigation where necessary (during periods of dry weather) and where the water has been appropriately tested for the intended use. Any waters confirmed to be contaminated and considered as unsuitable for treatment or reuse on site will require to be removed from the site via a road tanker or to sewer in agreement with Irish Water. The appointed contractor will be required to ensure that water is disposed of to a licensed treatment facility. Discharge to ground may be utilised via the soakaway in the north-west extents of the site (Zone 1A).

The appointed contractor will be required to prepare an Erosion and Sediment Control Plan (ESCP) prior to commencing the remediation works. The ESCP shall be included in the CEMP. To prevent or reduce the amount of sediment or other polluting substances being released into watercourses, the ESCP will include the following measures to be implemented by the appointed contractor:

- Provision of measures to prevent the release of sediment to the Morell River during the construction works (surface water outfall construction to the Morell River, pipeline crossings beneath the Morell River, and road realignment works to include footpath and cycleway with drainage connecting to existing road drainage outfall). Measures will include but not be limited to a cofferdam, sediment fences, and silt curtain; and
- Provision of exclusion zones and barriers (sediment fences) between earthworks (re-profiling of slopes), stockpiles and temporary surfaces and watercourses to prevent sediment washing into the watercourse.

No waste material, including wastewater, will be permitted to discharge into any watercourse during the works.

During the Remediation Phase there will be a requirement to expose existing waste, which may allow the infiltration of rainfall to the waste and result in contaminated runoff. To minimise this effect, works will be managed by the appointed contractor through a number of on-site operations, including:

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- Working in discrete areas to minimise the area of exposed waste;
- Interception of any leachate outbreaks identified during waste excavation and re-profiling activities;
- Provision of daily cover to exposed wastes, occurring as part of the remediation works; and
- Progressively remediate the site with a landfill cap.

These measures will be detailed by the appointed contractor in the ESCP.

Cleaning of roads to reduce mud and dust deposits will be carried out away from watercourses.

Any pouring of cement for the provision of the surface water outfall and or pipeline crossings for the works will be carried out in the dry and allowed to cure for 48 hours before re-flooding. Pumped concrete will be monitored to ensure no accidental discharge. Mixer washings and excess concrete will not be discharged to surface water.

No storage of hydrocarbons or any toxic chemicals will occur within 50m of a watercourse. Fuel storage tanks will be bunded to a capacity of at least 110% of the volume of the storage tank. Re-fuelling of machinery will not occur within 50m of any watercourse and only in bunded refuelling areas. Emergency procedures will be put in place and construction staff will be familiar with emergency procedures.

The appointed contractor shall consult with IFI in relation to the ESCP and shall include their requirements in this regard.

The detailed design of works within and adjacent to watercourses (e.g. directional drilling beneath the Morell River for the new pipeline crossings; construction of the new surface water outfall to the Morell River from the surface water ponds) would be undertaken with input from a hydromorphologist. Such works will only be conducted during forecast low flow periods and shall be done in July to September. Following in-channel working (i.e. for the surface water outfall and pipeline crossing) the channel cross-section would be reinstated as per pre-work conditions and tied into the structures.

The appointed contractor will detail emergency measures to be implemented in the event of a spillage or accidental discharge. This Emergency Plan will form part of the overall ESCP incorporated as part of the CEMP to be prepared by the appointed contractor and agreed with KCC.

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(i) Monitoring During Remediation

Water quality monitoring will be undertaken as indicated in the IEAL as agreed by the EPA and this will be supported by a Monitoring and Control Management Plan.

The IEAL will require the licence holder (KCC) to undertake a monitoring regime to include the Morell River, with key pollution indicators analysed on a regular basis from locations up and downstream of the site. The results of this monitoring will be reported to the EPA to comply with the conditions of the licence.

In addition, daily visual inspections of the surface drainage and sediment control measures and the watercourses will be undertaken by the KCC Site Manager or nominated representative. Indicators that water pollution may have occurred include the following:

- Change in water colour;
- Change in water transparency;
- Increases in the level of silt in the water;
- Oily sheen to water surface;
- Floating detritus; or
- Scums and foams.

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These inspections shall be recorded. In the event that such indicators are observed, a review of site works will be undertaken to determine potential linkage. Where a potential linkage is determined an investigation of the potential cause will be undertaken by the appointed contractor.

The above monitoring will allow KCC to be assured that the mitigation measures employed by the appointed contractor are successfully operating.

13.6.2 Operational Phase Mitigation

Measures to attenuate and treat the surface water runoff have been incorporated into the outline drainage design of the proposed Project including the provision of surface water ponds.

Any discharge from Ponds 2 and 3 must be fully compliant with EPA Emission Level Values for Emissions to Surface Water in the Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities (EPA 2011). The likelihood of a serious surface water pollution incident is considered low. However, a penstock/shut-off valve will be provided on Pond 3 to prevent the release of a discharge to the Morell River in the event of accidental spillage.

Surface water from the Landfill Infrastructure Compound will be collected by system of road gullies and underground pipework which will be supplied with silt and oil interceptor(s). Flows from the Compound will be discharged to the main site road drainage. However due to the risk of runoff from the Compound containing contaminants due to leachate spillages the drainage system from this Compound will also be provided with an isolation point before discharge into the main site road drainage.

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In order to avoid adverse watercourse impacts due to spills or accidental leakages i.e. leachate spill, a Contaminant Spill Emergency Plan will be put in place to contain, remove or remediate spillages before they reach a surface water receptor. Emergency equipment/spill kits to facilitate the implementation of such a plan will be made available in secured locations within the Landfill Infrastructure Compound area.

Detailed design for the new site access, realignment of the L2005 Kerdiffstown Road and provision of a footpath and cycleway will be required to include appropriate mitigation measures such as petrol interceptors for the revised road drainage system prior to release to the Morell River.

For the pipeline crossing of the Morell River the following measures will be implemented:

- The minimum distance between crown of the pipes and the river bed will be 400mm to ensure that that the river bed will not be disturbed.
- A cover would be provided over the top of pipe (assumed to be concrete) to protect the pipe from any potential future downward erosion. The cover would be placed beneath the natural bed and the bed reinstated as per existing conditions and tied in with the existing bed and banks.

For the surface water outfall to the Morell River, the inclusion of the surface water ponds (Pond 2 and 3, located within Zone 4) and the provision of the petrol interceptor will reduce potential impacts of fine sediment input into the channel and excessive flows discharging from the surface water outfall. The design of the surface water outfall will aim to avoid disturbance of the natural bank and tie in with the existing rock armour. Specific mitigation measures include but are not limited to:

- Constructing the surface water pond to encourage deposition of suspended sediments and minimising sediment input to the river;
- Directing the surface water outfall downstream and away from the banks to minimise the impact to flow patterns and minimising any potential risk of erosion (particularly on the opposite bank); and
- Minimising the size and extent of headwalls where possible, reducing the potential impact on the banks.

Following completion of remediation works surface water runoff will not come into contact with waste materials. However, water may still contain some suspended solids and possibly oil, fuel and silt washed off roads. Silt

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fences installed around the site as part of the remediation works will remain in place until the vegetation within the site is well established and perimeter ditches and swales grassed. Once it has been established that sediment retention techniques are no longer required, silt fences may be removed.

There will be no direct / indirect impacts from the proposed Project to the Canal Feeder Stream during operation, as the current outfall will be permanently disconnected during the Remediation Phase. Therefore, no mitigation is proposed.

(i) Monitoring During Operation

Water quality monitoring will be undertaken as indicated in the IEAL as agreed by the EPA supported by a Monitoring and Control Management Plan developed and implemented by KCCs site personnel. During the Operational Phase real time water quality monitoring (and control) in the pond is proposed to be used to measure key pollution indicator parameters to be agreed by the EPA, for inclusion in the IEAL and the site's Management Plan. The concentrations recorded in the pond shall be in accordance with the EPA Emission Level Values for Emissions to Surface Water in the Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities (EPA 2011). In the event of an exceedance of the agreed emission level values, the discharge from the pond will be automatically shut off.

Sampling of the infiltration swale at the northern perimeter of the site will also be undertaken. Sampling of the Morell River upstream and downstream of the surface water outfall from Pond 3 will continue (as a minimum). The frequency of monitoring at all locations is to be monthly unless otherwise stipulated in the IEAL, with the real time monitoring and control system recording data via a supervisory control and data acquisition (SCADA) system more frequently. The frequency of the monitoring of the Morell River may be reduced following sufficient data to support ongoing assessment.

The design of the surface water system will permit isolation of runoff from various parts of the site in the unlikely event that elevated concentrations of indicator parameters are detected, facilitating investigation to determine the source and remediate where necessary.

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13.7 Residual Impacts

The residual impacts associated with the proposed Project after implementation of the mitigation measures during the Remediation Phase are detailed in Table 13.14.

Table 13.14: Residual Impact after Mitigation Measures for Construction

Attribute	Importance	Significance Pre Mitigation	Significance Post Mitigation
Morell River	High	Significant	Imperceptible
Canal Feeder Stream	Medium	Moderate	Imperceptible
Rathmore Stream	High	NA	NA
Watercourse on Palmerstown House Estate & Golf Course	Low	NA	NA

The drainage design for the proposed Project has been considered during the operational impact assessment and as required further mitigation has been proposed. Therefore, no significant residual impacts as a result of the proposed Project in terms of surface water receptors are anticipated.

In addition, the reduced generation of contamination (leachate) from the site following the emplacement of the low permeability cap will have a positive (beneficial) impact on the quality of the receiving water, the Morell River in the long term. This watercourse will be monitored in accordance with the IEAL.

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13.8 Difficulties Encountered in Compiling Information

No difficulties were encountered during the assessment. However, at the time of assessment the exact drainage network of Palmerstown House Estate & Golf Course and the existing road drainage system on the L2005 was unknown. However, this does not alter the robustness of the assessment.

13.9 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on the hydrological environment. These projects are discussed in the following paragraphs.

13.9.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

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13.9.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

13.9.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

13.9.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

13.9.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic.

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Mitigation has been proposed in relation to the potential impact from the Remediation Phase of the proposed development. It is assumed that the contractors responsible for the construction of the sewerage Scheme will implement best practice measures to protect water receptors during the construction phase. Therefore, the potential magnitude of cumulative impacts is considered to be negligible and the significance of impacts would be imperceptible on surface water receptors during construction. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact. No Operational Phase cumulative impacts are predicted.

It is therefore not considered that any additional mitigation measures above those already provided, are required to account for cumulative impacts.

13.9.6 Water Framework Directive Compliance

The EU Water Framework Directive (WFD) and transposed legislation has introduced environmental targets with specific objectives for surface water bodies including:

- Prevention of deterioration in the status of surface water bodies; and
- Protection, enhancement and restoration of all surface water bodies with the aim of achieving good ecological and chemical status by 2015.

The assessment of potential surface water impacts for the proposed Project, including mitigation, has concluded that there would not be any significant impacts on surface water quality or geomorphology. With respect to the WFD water body, the proposed Project would not cause deterioration in the WFD quality elements (biological, physico-chemical and hydromorphological) for the WFD surface water bodies adjacent to the proposed development. A more detailed assessment of the biological quality elements is provided in Chapter 11 Biodiversity.

It can therefore be concluded that the proposed Project will not compromise the ability of the Morell River WFD designated water body to achieve good status or cause deterioration, and the proposed Project is therefore then in compliance with the provisions of the WFD in relation to surface water bodies.

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14. Traffic and Transport

This Chapter assesses the potential effects of the proposed Project on the local traffic and transport network during the Remediation and Operational Phases

Site access will be improved via a new junction arrangement including realignment of the L2005 Kerdiffstown Road to facilitate safe access to the site by, primarily, heavy goods vehicles (HGVs) during the Remediation Phase. These works will also comprise provision of a new footpath and cycleway. The footpath and cycleway will link to Johnstown via the footbridge over the N7 to the south-east of the site and offer linkage to Kill further to the east and Naas to the south. This improvement will provide safe passage to passers-by during remediation works and access by vehicles, cycles and pedestrians to the multi-use public park during the Operational Phase.

Potential sensitive receptors were identified in a desktop assessment. Site access arrangements and the significance of impacts in relation to traffic flow increases were assessed in terms of the quality of effects, the significance of the effects and the duration of how long the effect would last.

The additional traffic generated as a result of the anticipated Remediation Phase programme will result in increases of traffic flows on the primary and secondary roads leading to the proposed Project. An assessment has been undertaken, both in relation to the estimates of Remediation Phase traffic and the distribution of Remediation Phase traffic within the assessed road network. When considering actual volumes of traffic, the predicted increase in flows are minimal and will have a negligible impact on the practical operating capacity of these roads. Notwithstanding this, mitigation measures have been identified, including the provision of a Construction Traffic Management Plan (CTMP) and Mobility Management Plan (MMP), which will ensure that any potential traffic impacts are managed. As such, the overall environmental impact is therefore considered to be not significant, with the effective implementation of appropriate mitigation measures.

The increases in the levels of traffic anticipated during the Operational Phase of the proposed Project are not significant and therefore no mitigation is proposed.

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14.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as “the proposed Project”) on the local traffic and transport network anticipated to occur during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950’s until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children’s playground, etc. and management of the site as a remediated landfill. Table 14.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 14.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound supported by a back-up flare • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of the surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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To facilitate safe access to the site during the Remediation and Operational Phases a new site access is to be constructed, comprising a roundabout, in close proximity to the existing site access. This revised site access will also require realignment and widening of the L2005 Kerdiffstown Road. Construction of the new site access and road realignment is proposed to be undertaken as part of the first phase of works. The realignment works will extend to the immediate west of the existing site access and to the east, adjoining to an existing roundabout on the L2005 Kerdiffstown Road located to the south-east of the site. This section then links to Junction 8 of the N7, part of the strategic road network. Heavy goods vehicles (HGVs) traffic accessing to and from the site during the Remediation Phase of the proposed Project will route via Junction 8 of the N7 and will not be permitted to route via Sallins.

While providing a safe access arrangement for all road users during the Remediation and Operational Phases the proposed access design also includes provision of pedestrian and cycle infrastructure. This will be of particular benefit during the Operational Phase, offering linkage to nearby residential areas including Johnstown and Kill.

Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation and operation can be found in Chapter 4 Description of the Proposed Project.

This Chapter is also supported by a Traffic and Transport Assessment, as contained in Appendix A14.1, with the approach and findings of this assessment included in Section 14.2.2 and Section 14.4.3 respectively. A Stage 1 Road Safety Audit has also been undertaken based on the preliminary design of the new site access, L2005 Kerdiffstown Road realignment and footpath and cycleway provision, as presented in Appendix A14.3.

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14.2 Methodology

14.2.1 Policy, Legislation and Guidance

The majority of the roads considered within this study are strategic national primary roads and secondary roads and by their nature have a greater traffic capacity and better general safety record when compared with more rural roads. Only a short section of secondary road, the L2005 Kerdiffstown Road between the proposed site access and the roundabout west of N7 Junction 8, is used for access to the site. However, the assessment undertaken for the EIAR addressed the continuation of the L2005 Kerdiffstown Road toward Sallins.

In undertaking the assessment of the potential traffic and transport impacts on the local road network, the following guidance documents have been taken into account:

- Guidelines for the Environmental Assessment of Road Traffic, by the Institute of Environmental Management and Assessment (the IEMA Guidelines);
- Guidelines for Traffic Impact Assessment, The Institution of Highways and Transportation, September 1994;
- Design Manual for Roads and Bridges, Traffic Infrastructure Ireland;
- Traffic and Transport Assessment Guidelines, (Traffic Infrastructure Ireland, 2014) (TII Guidelines);
- Design Manual for Urban Roads and Streets (DMURS), Department of Environment, Community and Local Government, 2013;
- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017); and
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015).

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A summary of the relevant traffic and transport related policy context in relation to the proposed Project is outlined below.

Kildare County Development Plan 2017 – 2023

The Kildare County Development Plan 2017 – 2023 (KCDP) is set out to provide an encompassing strategy for planning and sustainable development in the area. In relation to Movement and Transport (Chapter 6), Kildare County Council aims to:

> *"promote ease of movement within and access to County Kildare, by integrating sustainable land use planning with a high quality, integrated transport system; to support improvements to the road, rail and public transport network, together with cycleway and pedestrian facilities and to provide for the sustainable development of aviation travel within the county in a manner which is consistent with the proper planning and sustainable development of the county."*

The proposed Project is located in close proximity to the M7/N7 and the strategic road network, providing a good base-level of accessibility for both Remediation and Operational Phase traffic. HGV traffic, associated with the Remediation Phase, will not be permitted to route to the site via Sallins thus avoiding traffic through areas of housing and employment, and utilising instead the strategic road network for such traffic. In contrast, route options for cyclists and in particular for pedestrians from Naas to the site are restricted by the M7/N7 road which is routed directly between the site and settlements. The Operational Phase for the proposed Project comprises a multi-use public park to be used for recreational and exercising activities and as such is likely to increase the demand for active travel infrastructure. The site would therefore be a good catalyst for developing cycleway and pedestrian facilities in Kildare, as well as the overall sustainable development of the local area, in particular the Naas Neighbourhood Greenways initiative as mentioned below.

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Aims in the KCDP include modal shift and sustainable travel which feature prominently throughout the Chapter. Key policies relating to the proposed Project include:

> *"*MT1: *Promote the sustainable development of the county through the creation of an appropriately phased integrated transport network that services the needs of communities and businesses."*
>
> "MT11: *Focus on improvements to the local road and street network that better utilise existing road space and encourage a transition toward more sustainable modes of transport, while ensuring sufficient road capacity exists for trips which will continue to be taken by private vehicle."*
>
> "WC1: *Prioritise sustainable modes of travel by the development of high quality walking and cycling facilities within a safe street environment."*
>
> "WC3: *Ensure that connectivity for pedestrians and cyclists is maximised in new communities and improved within the existing areas in order to maximise access to town centres, local shops, schools, public transport services and other amenities."*
>
> "LR1: *Ensure that the safety and capacity of the local road network is maintained and improved where funding allows and to ensure that local streets and roads within the county are designed to a suitable standard to accommodate the future needs of the county. The design of these roads and streets should balance the needs of place and movement with providing a safe street environment for all road users."*

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These policies focus largely on sustainability within the community and encouraging sustainable travel choices to be made. Sustainable travel will be integrated into both the Remediation and Operational Phases of the proposed Project.

Furthermore, use of the remediated site as a multi-use public park would encourage active travel choices to be made, given the improved footpath and cycleway provision. This includes the village settlements of Johnstown and Kill. These factors would have a positive influence on the local community and its businesses, through the economic benefits of developing the site and infrastructure; social and health benefits of a new recreational space which encourages active lifestyles (e.g. walking and cycling); and the environmental benefit of remediating the former landfill site and developing it into a multi-use public park which would ideally be accessed through means of active travel.

Grand Canal Way

The Grand Canal Way provides a network of paths which provide a pedestrian and cycle link between Dublin and Shannon Harbour. From the proposed Project, access can be gained to the Grand Canal Way in Sallins from the L2005 Kerdiffstown Road or via a forest track through Palmerston House Estate. Any potential future improvements to connect the Grand Canal Way and the proposed Project would require agreement with third party landowners and is not included as part of the proposed Project.

In summary, reference to local policy and guidance indicates that the proposed Project comprising a multi-use public park would augment the development of this greenways network and could act as a key destination on the route of greenways. There is also the opportunity to use existing active travel infrastructure, such as the Johnstown footbridge, and create new active travel infrastructure between the site and residential areas such as Johnstown to the south and in Naas further south. This aligns with the previously mentioned policy documents which focus heavily on the need for sustainable development and infrastructure.

14.2.2 Approach

The approach to assessing the traffic and transport impacts of the proposed Project is based on an industry recognised methodology that has been successfully applied to assessments across Ireland, enhanced with

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professional judgement where required. The assessment approach is undertaken with consideration for the policy documents detailed within Section 14.2.1.

The traffic impact of the proposed Project has been assessed utilising the following approach:

- Relevant transport policies were reviewed;
- The road sections likely to be affected by the traffic associated with the proposed Project have been identified;
- The existing character of the road network has been determined;
- Existing traffic levels on the road network have been measured;
- A review of accident data on the surrounding network has been undertaken;
- The additional traffic generated by all stages of the proposed Project has been estimated;
- The impact of the additional traffic has been assessed; and
- Appropriate mitigation measures have been identified to ensure that any potential traffic impacts are kept to a minimum.

The National Cycle Manual (NTA 2011) also provided guidance in relation to assessment of cycle provision for the proposed Project.

Initial assessment of predicted traffic volumes suggested that a standalone Traffic and Transport Assessment (TTA) may not be required. However, in order to ensure a robust assessment of impacts on the road network for both the Remediation Phase and Operational Phase a TTA has been undertaken for the proposed Project. Refer to Appendix A14.1 for the TTA which should be read in conjunction with this Chapter, and includes the following:

- An assessment of the proposed Project in relation to current and emerging local, regional and national transport policy and guidance;
- A review of sustainable and active travel opportunities to the proposed Project, prioritising the most sustainable modes of travel;
- People trip generation and distribution estimates for all relevant modes of travel;
- Junction capacity assessments at key junctions on the local road network; and
- A review of parking requirements for the proposed Project.

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While the TTA should be read in conjunction with this Chapter, a brief summary of the findings is presented in Section 14.4.4 below.

14.2.3 Study Area

To define conditions for the proposed Project in terms of access and transportation, a baseline study comprising a strategic route review and local access assessment was undertaken.

The site is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The neighbouring and almost contiguous settlement of Sallins lies on the opposite side of the motorway to Naas and is approximately 1km to the north-west of the proposed Project. The smaller settlements of Johnstown and Kill lie on the opposite side of the N7 road corridor to the south-east and east of the site respectively. Though the area to the north-east of the site is relatively sparely populated in the context of the remainder of the study area the local roads that skirt this area are consistently lined with rural dwellings.

The traffic impact study area was defined as comprising the following sections of the road network:

- N7 in the vicinity of Junction 8;
- Access road south of N7 Junction 8, between N7 and Johnstown; and

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- L2005 Kerdiffstown Road between N7 Junction 8 and the proposed Project access; and
- L2005 Kerdiffstown Road from the proposed Project access to Sallins via Church Avenue.

14.2.4 Sensitive Receptors

A desktop assessment was undertaken to identify potential sensitive receptors (e.g. settlements, schools etc.) along potential vehicle access routes to the site, which may be impacted by traffic associated with the proposed Project during either the Remediation or Operational Phases.

Professional judgement was applied to assign a level of sensitivity to receptors (low; medium; or high) and to determine the nature of the foreseen impact (beneficial, negligible or adverse), while also taking into consideration the EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017)

Receptors considered to be of 'high' sensitivity would typically include hospitals, schools, day-care facilities or nursing homes, where disruption would result in a significant inconvenience to the residents and/or the functionality of the receptor. Receptors of 'medium' sensitivity would typically be those that would be resilient enough to overcome the challenges posed by the proposed Project, for example commercial businesses. Receptors considered to be of 'low' sensitivity would include, for example, disused recreational space and unoccupied buildings.

Refer to Figure 3.4 for the location of local residential and commercial receptors in close proximity to the proposed Project.

The means by which the impacts of the proposed Project on any such sensitive receptors, are to be mitigated are considered in Section 14.5.

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Settlements

Sallins

In terms of traffic assessments, the town of Sallins is located in relatively close proximity to the proposed Project and as such is considered a sensitive receptor. It will be a stated requirement in procurement documentation for the Remediation Phase of the works that HGVs will not be permitted to pass through Sallins, hence all Remediation Phase HGV traffic will route via the N7 Junction 8. Notwithstanding this, there is a posted 3 tonne weight limit on the railway bridge on the L2005 Kerdiffstown Road to the west of Sallins. However, Sallins has still been considered as a sensitive receptor for the purposes of robustness in approach.

Sallins National School, located in close proximity to Church Avenue which would accommodate any traffic travelling to the site via Sallins during the Operational Phase, is considered to be a sensitive receptor given that there is potential interaction between staff, pupils and parents on their way to / from school and traffic leading towards the proposed Project. While this receptor would ordinarily be deemed highly sensitive given the location of the school, the fact that no HGV traffic will route via Sallins during the Remediation Phase ensures that a low sensitivity rating can be assigned as only a small proportion of proposed Project related traffic is predicted to route via Sallins.

It is observed that queueing is currently experienced at the junctions assessed in Sallins (see Appendix A14.1 for further details). This is reflective of the existing road network and the resolution of this is not within the scope of the proposed Project. However, any further impacts and the significance of these is discussed herein.

Properties on Kerdiffstown Road (L2005)

There are a number of residential and commercial properties along both sides of L2005 Kerdiffstown Road located on the route to the proposed Project from the N7 which are considered as sensitive receptors, given their proximity to passing Remediation Phase HGV traffic heading to the site in particular. Furthermore, given the proposals to realign and upgrade the southern section of the L2005 Kerdiffstown Road, these residential

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properties are considered as key sensitive receptors during the Remediation Phase and during the Operational Phase. These receptors are shown in Figure 3.4 and in Table 14.2 below.

Table 14.2: Receptor on Kerdiffstown Road (L2005)

Receptor Ref	Description
COM002	Commercial: Johnstown Garden Centre
COM007	Commercial: Mike Brown's Caravans
REC005	Residential
REC006	Residential
REC007	Residential
REC008	Residential
REC010	Residential
REC011	Residential
REC039	Residential

Given the likelihood that a significant proportion of Remediation Phase traffic, including all HGVs, will pass these properties these receptors are considered to be high sensitivity receptors.

During construction of the new site access and realignment of the L2005 Kerdiffstown Road traffic management measures will be employed. This will impact on the sensitive receptors along this section of road as listed in Table 14.2. However, access to all properties will be maintained during the works thus impacts are considered to be not significant.

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Properties on Kerdiffstown Road (L2005) / Church Avenue

There are a number of residential and commercial properties along both sides of L2005 Kerdiffstown Road leading onto Church Avenue, north of the existing site entrance, which are considered as sensitive receptors. Whilst Remediation Phase HGV traffic will not be permitted to access the site from the Sallins direction and passing these properties, these properties are considered as key sensitive receptors for the purposes of this assessment to give a robust approach due to some Operational Phase traffic accessing the proposed Project using this route. Notwithstanding this, a low sensitivity rating has been applied to these sensitive receptors given that only a small proportion of proposed Project related traffic is predicted to route via Sallins. These receptors are shown in Figure 3.4.

Naas

The town of Naas is located in relatively close proximity to the proposed Project and as such is considered as a sensitive receptor. There are a number of schools within the town, all of which are considered as sensitive receptors. Furthermore, Naas General Hospital, located in the south of the town, along with a number of doctors' surgeries within the town are also considered as key sensitive receptors.

While these receptors would ordinarily be deemed highly sensitive given the location of the school, hospital and doctors surgeries, the fact that it is unlikely that HGV traffic will route via Naas allows a low sensitivity rating to be assigned as only a small proportion of proposed Project related traffic is predicted to route via Naas.

Naas Golf Club

Naas Golf Club, the access to which is located approximately 1km north-west of the existing access to the site, is considered to be a sensitive receptor given that it is a local trip generator.

No HGV traffic accessing the site for the remediation works will interact with Naas Golf Club and as such, given that only a small proportion of proposed Project related traffic is predicted to route via Church Avenue and the northern section of the L2005 Kerdiffstown Road, a low sensitivity rating has been attributed to this receptor.

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Johnstown Garden Centre

Johnstown Garden Centre is a busy and notable commercial operation immediately to the south-east of the site, the access to which is located approximately 750m south-west of N7 Junction 8, and is enroute to the site. As a result, this is considered a sensitive receptor given that it generates a high level of trips and the majority of Remediation Phase (HGV) traffic will pass its access.

Given the possibility that all Remediation Phase traffic, including HGVs, will pass this location this receptor has been considered a high sensitivity receptor.

Palmerstown House Estate

Palmerstown House Estate, the access to which is located approximately 600m south-west of N7 Junction 8 on the route to the site from N7 Junction 8, is considered a sensitive receptor given that it is a local trip generator and the majority of Remediation Phase (HGV) traffic will pass its access.

Given the possibility that all Remediation Phase traffic, including HGVs, will pass this location this receptor has been considered a high sensitivity receptor.

Kerdiffstown House

Kerdiffstown House, the access to which is located approximately 900m south-west of N7 Junction 8 on the route to the site from the N7, is considered a sensitive receptor given that the majority of proposed Project Remediation Phase (HGV) traffic will pass its access.

Given the possibility that all Remediation Phase traffic, including HGVs, will pass this location this receptor has been considered a high sensitivity receptor.

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14.2.5 Assessment of Environmental Impacts

While the EPA Guidelines provide a qualitative approach to understanding impacts relating to traffic and transport, the IEMA Guidelines provide thresholds upon which impacts associated with increases in traffic can be assessed and in turn ensures that a robust assessment of impacts is undertaken. Consequently, the traffic and transport related impacts of the proposed Project have been assessed based on the IEMA Guidelines, with any qualitative assessment of impacts based on EPA Guidelines as this is a more robust approach.

14.2.6 Significance of Effects

The IEMA Guidelines identify that the following environmental effects may be considered when assessing the traffic related to developments:

- accidents and safety;
- air pollution;
- driver delay;
- dust and dirt:
- hazardous loads;
- noise;
- pedestrian amenity;
- pedestrian delay;
- severance (of communities);
- heritage and conservation;
- visual effects;

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- ecological effects; and
- vibration.

Of the above effects, the following have been considered within other Chapters of this EIAR, if the effects are considered to be potentially significant:

- Air pollution, dust and dirt – these are considered within Chapter 7 Air Quality, Odour and Climate;
- Noise and vibration – these are considered within Chapter 8 Noise and Vibration;
- Visual impacts – these are considered within Chapter 9 Landscape and Visual;
- Heritage and conservation - these are considered within Chapter 10 Archaeology, Architectural Heritage and Cultural Heritage; and
- Ecological impacts – these are considered within Chapter 11 Biodiversity.

14.2.7 Significance Criteria

The TII and IEMA Guidelines suggest that two broad principles are used as a screening process to focus the scale and extent of the assessment. These are:

- *Traffic to and from the development exceeds 10% of the traffic flow on the adjoining road; and*
- *Traffic to and from the development exceeds 5% of the traffic flow on the adjoining road where congestion exists or the location is sensitive.*

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Moreover, criteria for assessing the significance of the increases in traffic volumes as a result of the proposed Project have been derived on this basis as shown in Table 14.3.

Table 14.3: Significance of Impacts in Relation to Traffic Flow Increases

Significance Criteria	Increase in Traffic Flow
Major	Above 90%
Moderate	Between 60% and 90%
Minor	Between 30% and 60%
Negligible	Under 30%

While in the first instance, impacts are assessed against these criteria, an element of professional judgement has been applied with respect to the carrying capacity of the roads being considered. Where existing traffic levels are exceptionally low (e.g. on some unclassified roads), any increase in traffic flow is likely to exceed these thresholds. Where this situation is identified it is important to consider any increase both in terms of its relative increase in respect of existing traffic flows, as well as the overall total flow in respect of the available capacity of the section of road being considered.

For example, a 100% increase in traffic flow on a road which currently only carries 90 vehicles Annual Average Daily Traffic (AADT) flow, will potentially indicate an impact of major significance if considered simply in terms of the significance criteria presented in Table 14.3. However, a typical 6m wide road is capable of accommodating approximately 5,000 two-way vehicles per day, in accordance with thresholds contained in TII TD 9/12 (DN-GEO-03031). Therefore, such an increase will be unlikely to create major impacts given the road's overall capacity. Table 14.4 refers to the link capacity of varying rural road types.

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Table 14.4: Link Speed and Link Capacity (TII Design Manual for Roads and Bridges, Volume 6, TD 9 Road Link Design; DN-GEO-03031)

Description	Capacity (two way per day)
6.0m wide Single Carriageway	5,000
7.0m wide Single Carriageway	8,600
7.3m wide Single Carriageway	11,600
Standard Motorway	52,000

The existing carriageway width of the L2005 Kerdiffstown Road is approximately 5.5m. As outlined in Section 14.2.5, while the IEMA Guidelines provide a robust threshold approach in which to assess effects and the EPA Guidelines are also considered. The characteristics of the impact assessment in line with the Guidelines on the Information to be contained in an Environmental Impact Statement (revised 2015) are defined below, as per the EPA Guidelines (EPA 2002, EPA 2015).

- **Quality of Effects**
  - **Positive Effects:** A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities);
  - **Neutral Effects:** No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error; and
  - **Negative/Adverse Effects:** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance).
- **Significance of Effects**
  - **Imperceptible:** An effect capable of measurement but without significant consequences;
  - **Not significant:** An effect which causes noticeable changes in the character of the environment but without noticeable consequences;
  - **Slight Effects:** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities;
  - **Moderate Effects:** An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends;
  - **Significant Effects:** An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment;
  - **Very Significant Effects:** An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment; and
  - **Profound Effects:** An effect which obliterates sensitive characteristics.
- **Duration of Effects**
  - **Momentary Effects:** Effects lasting from seconds to minutes;
  - **Brief Effects:** Effects lasting less than a day;
  - **Temporary Effects:** Effects lasting less than a year;
  - **Short-term Effects:** Effects lasting one to seven years;
  - **Medium-term Effects:** Effects lasting seven to fifteen years;
  - **Long-term Effects:** Effects lasting fifteen to sixty years; and
  - **Permanent Effects:** Effects lasting over sixty years.

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- The significance of any environmental impact is assessed on the basis of the magnitude of the impact and the likelihood of the impact occurring. Any potential environmental impacts including accidents and safety, driver delay, pedestrian amenity, pedestrian delay and severance are considered on a case by case basis using professional judgement and reasoned argument.

There are no general thresholds for determining the significance of increased traffic on road safety. Professional judgement is therefore required in order to determine any potential detrimental impacts associated with the traffic generated by the proposed Project.

Appropriate mitigation measures have been identified to ensure that any potential traffic impacts are kept to a minimum. The means by which the impacts of the proposed Project, on any such sensitive receptors, are to be mitigated are considered in Section 14.5.

14.2.8 Site Access Arrangements

As part of the proposed Project, an assessment of the existing access arrangements for the site was undertaken. This confirmed that the existing access would not be fit for purpose in terms of accommodating HGV traffic associated with the Remediation Phase of the proposed Project, given poor levels of visibility on egress from the site. An assessment of alternatives was therefore undertaken, embracing the following activities:

- A high level desk study of potential site access options;
- A comprehensive site visit to assess the strengths and weaknesses of all potential site access options and to consider additional options not identified from the desk study activity. The site visit eliminated non feasible access options and identified options to be taken forward to feasibility design stage;
- Preparation of feasibility design drawings of potential access options determined from the site visit; and
- Design of the preferred access option.

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The assessment identified that a new site access would comprise a roundabout, in close proximity to the existing site access. The location and make-up of the proposed access represents the most appropriate option to enable safe access to the site for both the Remediation Phase and Operational Phase. The roundabout has been designed in accordance with the National Road Authority Design Manual for Roads and Bridges (NRA DMRB) (DN-GEO-TD16 Geometric Design of Roundabouts). To accommodate the revised site access realignment and widening of the L2005 Kerdiffstown Road is required. This comprises works to the immediate west of the existing site access and to the east, adjoining to an existing roundabout on the L2005 Kerdiffstown Road located to the south-east of the site. The geometric design parameters for this road realignment are set out in the Design Manual for Urban Roads and Streets (DMURS) (Section 4.4.6 Alignment and Curvature) (refer to Appendix A4.1).

Furthermore, while providing a safe access arrangement for all road users during the Remediation and Operational Phases the proposed access design includes provision of pedestrian and cycle infrastructure. This will be of particular benefit during the Operational Phase. This provision of a new shared use pathway alongside the L2005 Kerdiffstown Road comprises:

- Linkage of the site via the existing footbridge to Johnstown to the south (and onward to Naas);
- Linkage of the site via the N7 Junction 8 to the east, towards Kill;
- Several uncontrolled crossings;
- A section of shared use pathway linking to L2005 Kerdiffstown Road to the north-west of the new site access; and
- A ramp providing cyclists access to the shared use trail south of the proposed site access roundabout.

Details of the new access, road realignment and pedestrian/ cycleway provision are shown on Figures 4.10 to 4.12 of the EIAR.

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The design has been subject to a Stage 1 Road Safety Audit (RSA). The RSA was approved by Kildare County Council project team, and the design revised accordingly. The RSA and associated feedback is provided in Appendix A14.3.

14.3 Baseline Conditions

14.3.1 Description of Existing Conditions

The sections of the road network included within this assessment have been determined on the basis of the potential impact of increased traffic associated with the Remediation Phase and Operational Phase of the proposed Project.

14.3.2 Local Road Network

The N7 / M7 Motorway is a route of national significance which travels between Dublin in the north-east and Limerick in the south-west. In the vicinity of N7 Junction 8, which gives access to the proposed Project, the N7 / M7 takes the form of a 3 lane motorway in each direction, with a hard shoulder. Access to the proposed Project is via the grade separated Junction 8.

L2005 Kerdiffstown Road, between N7 Junction 8 and Sallins, which passes the existing site access, is a single carriageway road which accommodates two-way traffic. While the carriageway is of good quality between the N7 Junction 8 and the roundabout south-west of Johnstown Garden Centre, the road narrows from this point north towards Sallins to an approximate 5.6m carriageway width, which creates issues for the continuation of two-way operation of the road at points. Furthermore, there is a posted 3 tonne weight limit on the railway bridge on the L2005 Kerdiffstown Road to the west of Sallins.

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Segregated shared use paths exist both north and south of the N7 directly south of the site and eastward. A pedestrian bridge provides access over the N7 to Johnstown, though cyclists must walk bicycles across due to low parapet height of the bridge. Many roads in the vicinity do not have segregated facilities or marked cycle lanes; cyclists share the carriageways with vehicular traffic.

The proposed Project includes construction of a new site access and realignment of the south section of the L2005 Kerdiffstown Road, from the site access to an existing roundabout. Impacts are likely during these construction works as traffic management measures would be employed.

14.3.3 Baseline Traffic Data

Traffic flow data for the primary road network within the study area has been obtained from the Transport Infrastructure Ireland (TII) Traffic Data Website. Classified junction traffic count and queue length surveys were undertaken by Nationwide Data Collection on 26 January 2017 between 07:00 and 19:00 at the following junctions:

1. R407 / Church Avenue, Sallins;
2. R407 / Church Avenue (E), Sallins;
3. Church Avenue (W) / Church Avenue (S), Sallins;
4. L2005 Kerdiffstown Road Roundabout;
5. N7 Junction 8 North Roundabout; and
6. N7 Junction 8 South Roundabout.

Automatic Traffic Counters (ATCs) were installed at the following locations on the local road network:

7. Church Avenue Railway Bridge, Sallins (January 2017);

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8. L2005 Kerdiffstown Road, North of Existing Landfill Access (September 2016); and

9. L2005 Kerdiffstown Road, South of Existing Landfill Access (September 2016).

Further details on these counts and a location plan of surveys and ATCs are provided in the TTA (refer to Appendix A14.1).

The data has been processed, using the Design Manual for Roads and Bridges, Volume 13, Economic Assessment of Road Schemes, Section 1, The COBA Manual to estimate 5-day Annual Average Daily Traffic (AADT) flows for two way (return journeys) traffic. AADT relates to the 5-day week (Monday to Friday) over a 12-month time period. The AADT is established as an average of this whole time period in order to account for any holiday and seasonal variations over the 12-month period. In terms of traffic flow information for the road network surrounding the proposed Project, sufficient information has been obtained to calculate the estimated AADT and to allow a suitable, robust assessment to be made of the potential traffic impacts as a result of the proposed Project.

14.3.4 Traffic Growth

Traffic growth for the surrounding road network is based on the medium growth rates for East Ireland obtained from NRA Project Appraisal Guidelines, Unit 5.5 Link-Based Traffic Growth Forecasting.

The commencement of the Remediation Phase is subject to the determination of the planning process, the period for which is not defined. As a result, a start date of remediation works for the purposes of this traffic and transport assessment has been assumed as 2018. This ensures a robust assessment of the Remediation Phase impacts.

By assuming that the peak traffic volumes relating to the remediation works occur in the first year of the Remediation Phase, i.e. 2018, baseline traffic is projected to an earlier year and thus utilises a lower projected baseline. The addition of the associated percentage increase to this baseline, taking cognisance of the estimated total daily construction traffic volumes, would be higher than use of a later start date (this would see a higher projected baseline but lower percentage increase). It is therefore considered that this assumed start date of 2018 represents a more robust approach.

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Furthermore, with the intensive construction period of the proposed Remediation Phase estimated to last a minimum of four years, therefore the Operational Phase of the proposed Project is anticipated to commence (at the earliest) in 2022. As a result, and in a similar approach to that above, baseline traffic has been updated to this year for the purposes of the Operational Phase assessment. As such, this represents a robust approach to determining the impacts of Operational Phase traffic.

The following medium growth rates, from the TII Project Appraisal Guidelines, have been applied to the base flows for the following scenarios:

- Medium growth rate of 1.022 (All Traffic) and 1.016 (HGVs) for peak Remediation Phase year of 2018; and
- Medium growth rate of 1.066 (All Traffic) and 1.048 (HGVs) for Operational Phase year of 2022.

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Table 14.5: Baseline and Projected AADT

Location	Northbound baseline AADT (2016)	Southbound baseline AADT (2016)	Combined AADT (2016)	Combined HGVs (2016)	% HGVs (2016)	Combined projected AADT (2018)	Combined projected HGV (2018)	Combined projected AADT (2022)	Combined Projected HGV 2022)
N7 west of Junction 8	29,582	31,217	60,798	4,384	7.2%	62,137	4,454	64,812	4,594
Access road north of N7 Junction 8	1,542	1,476	3,018	47	1.6%	3,084	48	3,217	49
Access road south of N7 Junction 8	2,812	1,945	4,757	91	1.9%	4,862	92	5,071	95
Kerdiffstown Road, south of access to proposed Project	866	883	1,749	14	0.8%	1,787	14	1,864	15
Kerdiffstown Road, north of access to proposed Project	855	834	1,689	44	2.6%	1,726	45	1,800	46

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14.3.5 Road Condition

Whilst this Chapter will demonstrate that impacts of the proposed Project on the local road network will be limited, it is observed that the importation of materials to the site using HGVs during the Remediation Phase may have an impact on the condition of the road surface, between the N7 junction and L2005 Kerdiffstown Road (where the road after the existing roundabout is realigned). As a result, the appointed contractor responsible for the remediation works will be required to undertake a pre-condition survey of the existing road from the N7 to the site with the scope and method of assessment to be agreed with KCC Transportation Department. Following completion of the importation works, a further survey will be undertaken to determine any deterioration and the requirement for any remedial works, for agreement with the KCC Transportation Department.

14.4 Predicted Impacts

Reference should be made to the TTA contained in Appendix A14.1.

14.4.1 Remediation Phase

Assessment of Remediation Phase Traffic Generation

The traffic impact of the additional vehicles associated with the Remediation Phase of the proposed Project can be categorised as:

- Additional traffic volumes associated with the Remediation Phase activities, primarily HGV's for the proposed Project travelling on the existing road network; and
- Delays to non-Project related journeys as a result of slow moving vehicles i.e. HGVs.

The remediation of the site and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. Further details on the outline phasing of the works are provided in Section 4.3.1. The traffic movements associated with

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all eight phases of the Remediation Phase have been estimated based on approximate volumes of materials to be imported to support the capping and remediation of the site (refer to Appendix A4.7). This assessment focuses on the traffic impacts of the busiest phase of Remediation Phase (anticipated to be around Phase 2 and Phase 3).

A total of 180 two-way vehicle trips per day are predicted during the worst case Remediation Phase, comprising 140 two-way HGV movements and 40 two-way car / Light Goods Vehicles (LGV) movements. The trip generation has been added to the projected 2018 AADT, detailed in Table 14.6, in order to confirm the percentage increase in traffic associated with the proposed Project Remediation Phase. In order to assess the worst case impact, assumptions have been made regarding the proportion of Remediation Phase related traffic passing any particular traffic counter, notably that 100% of traffic will pass all traffic counter locations. This is a robust approach as the volumes of traffic passing certain ATC locations will in reality be significantly lower and therefore the assessment of Remediation Phase related traffic is considered a worst case scenario. Table 14.6 details the percentage increases in total traffic. Table 14.7 details the percentage increases in HGV traffic. The following paragraphs discuss the impacts on key sections of the road network (based on strategic ATC locations) and sensitive receptors as a result of the increase in traffic associated with the Remediation Phase of the proposed Project.

Table 14.6: Worst Case Remediation Phase Percentage Increase in Total Traffic

ATC Location	% Split at each ATC	Projected Base AADT (2018)	Worst Case Daily Remediation Total Vehicles (Two Way)	% Increase in Total Vehicles
N7 west of Junction 8	100%	62,137	180	0.3%
Access road north of N7 Junction 8	100%	3,084	180	5.8%
Access road south of N7 Junction 8	100%	4,862	180	3.7%
Kerdiffstown Road, south of access to proposed Project	100%	1,787	180	10.1%
Kerdiffstown Road, north of access to proposed Project	100%	1,726	180	10.4%

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Table 14.7: Worst Case Remediation Percentage Increase in HGV Traffic

ATC Location	% Split at each ATC	Projected Base HGV (2018)	Worst Case Daily Remediation Phase HGVs (Two Way)	% Increase in HGVs
N7 west of Junction 8	100%	4,454	140	3.1%
Access road north of N7 Junction 8	100%	48	140	293.2%
Access road south of N7 Junction 8	100%	92	140	151.4%
Kerdiffstown Road, south of access to proposed Project	100%	14	140	984.3%
Kerdiffstown Road, north of access to proposed Project	100%	45	140	N/A*

* HGVs will not be permitted to access the site via Sallins.

Summary of Remediation Phase Traffic Generation Impacts

During construction of the new site access and realignment of the L2005 Kerdiffstown Road traffic management measures will be employed. This will impact on the sensitive receptors along this section of road as listed in Table 14.2. However, access to all properties will be maintained during the works thus impacts are not considered to be significant.

In terms of the percentage increase of total vehicles shown in Table 14.6, the proposed Project will have a negligible impact on all assessed road sections based on the criteria outlined in Table 14.1, where a negligible impact is predicted on percentage increases of less than 30%.

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While the increase in total Remediation Phase related traffic on Kerdiffstown Road marginally exceeds both the TII and IEMA thresholds detailed within Section 14.2.7, it is important to consider the increases in traffic in relation to actual vehicles. As detailed above, an increase of 180 two-way movements per day (total vehicles) are predicted during the worst case phase in terms of traffic increases which equates an average of 18 two-way movements per hour (9 arrivals and 9 departures).

It is important to consider the increase on Kerdiffstown Road in the context of the existing low levels of baseline traffic and the carrying capacity of the road. It is noted that this road is currently operating significantly below its capacity. Table 14.4 provides typical capacities for a variety of road types and it is estimated that the capacity of a road such as the L2005 Kerdiffstown Road is a 5,000 two-way flow per day. During the busiest month of the Remediation Phase, the total vehicles per day on this road (including baseline traffic) will be 1,967 per day (1,787 projected 2018 AADT + 180 Remediation Phase traffic). As such, it is considered that Kerdiffstown Road is currently operating below its capacity and will continue to do so with the addition of the Remediation Phase traffic flows. Despite undertaking an assessment of Remediation Phase impacts within the EIAR, the actual increases in traffic numbers will be minimal.

With regards to HGV movements, the percentage increases for the L2005 Kerdiffstown Road section outlined in Table 14.7 suggests an impact of major significance on the road network in accordance with the IEMA criteria as detailed in Table 14.3. However, this high percentage is a result of the low levels of baseline HGV traffic at this location. It has been determined that during the worst case phase of the remediation works, the total two-way HGV movements per hour will be on average only 14 (7 arrivals and 7 departures). Therefore, despite the high percentage increases, the numerical increase in HGVs is low. Moreover, the impacts of worst case Remediation Phase traffic will occur over a relatively short period and the existing road infrastructure is currently operating well below capacity, therefore reducing the overall impact.

Consequently, taking the existing low baseline and overall carrying capacity of the L2005 Kerdiffstown Road and the short term period of the works, no significant impacts are predicted to arise from Remediation Phase related traffic generated by the proposed Project.

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14.4.2 Operational Phase

In order to determine trip generations associated with the Operational Phase of the proposed Project, reference has been made to the Trics 2016 database (managed by Trics Consortium Limited) in which daily vehicle trip rates were established. Trip rates for the following leisure land use (term as defined in the Trics 2016 database) have been considered:

- Country Park

Given that the Country Park land use in Trics can include facilities such as a nine-hole golf course, café and visitor centre, it is assumed that the trip rates provided are robust in relation to the end-use of the proposed Project. As such, it is assumed that the robustness of the trip rates will offset any trip generation associated with the multi-use public park including playing pitches. Trics outputs files are contained in Appendix A14.2 for reference.

The vehicle trip rates have been applied to the area of the proposed Project in order to ascertain a daily trip generation profile associated with the Operational Phase of the proposed Project. Country Park trip rates are only available for a Saturday, which would be considered as a peak usage period for such land use hence in order to provide a robust assessment, these trip rates have been assumed to also apply to the weekday scenario. As with Remediation Phase related traffic, the trip generation has been added to the projected 2022 AADT in order to confirm the percentage increase in traffic associated with the Operational Phase of the proposed Project. In order to assess the worst case impact, robust assumptions have been made regarding the proportion of Operational Phase traffic passing any particular traffic counter, notably that 100% of traffic will pass all traffic counter locations. This is an extremely robust approach as the volumes of traffic passing each ATC location will, in reality, be significantly lower and therefore the assessment of Operational Phase traffic can very much be considered as worst case.

Table 14.8 details the predicted Operational Phase traffic levels; and Table 14.9 details the percentage increase to baseline traffic flows on the road network as a result of the Operational Phase of the proposed Project.

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Table 14.8: Total Weekday Operational Phase Trip Generation

Land Use	Two-Way Daily Trip Generation
Country Park	151

Table 14.9: Worst Case Operational Phase Percentage Increase in Traffic

ATC Location	% Split at each ATC	Projected Base AADT (2022)	Worst Case Daily Operational Phase Total Vehicles (Two Way)	Projected Base + Worst Case Operational Phase	% Increase in Total Vehicles
N7 west of Junction 8	100%	64,812	151	64,963	0.23%
Access road north of N7 Junction 8	100%	3,217	151	3,368	4.69%
Access road south of N7 Junction 8	100%	5,071	151	5,222	2.97%
Kerdiffstown Road south of public park access	100%	1,864	151	2,015	16.02%
Kerdiffstown Road north of public park access	100%	1,800	151	1,951	8.38%

The impacts of this level of traffic during the Operational Phase fall substantially below the guidance thresholds detailed in Section 14.2.7 and consequently the significance of the impacts is considered negligible.

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14.4.3 Environmental Impacts

Assessment of Environmental Impacts (Remediation and Operational Phases)

Environmental Impacts have been assessed for both the Remediation and Operational Phases for the proposed Project in relation to the EPA Guidelines on the Information to be contained in an Environmental Impact Statement (revised 2015) (as detailed in Section 14.2.7). Works to realign the L2005 Kerdiffstown Road, including construction of the new site access and provision of a footpath and cycleway, have been considered with the Remediation Phase assessment as these will be undertaken during the first phase of works. Review text is provided below including summaries detailed in Table 14.10 and Table 14.11 below.

Accidents and Safety

A review of Road Safety Authority Collision Statistics (RSA 2014) was undertaken, which provided details of all collisions on the roads in the immediate vicinity of the proposed Project, between 2009 and 2013. The following accidents were identified:

- Minor accident on Kerdiffstown Road, north of proposed site access, in the vicinity of the railway bridge; and
- Minor accident on N7 Eastbound, at Junction 8 off-slip.

While no data is available from 2013, it is clear from the observed data that only a small number of minor accidents have occurred in the vicinity of the proposed Project, none of which are linked to operations at the site and as such it is clear that there are no existing accident or safety issues based on these statistics. However, given the identified need for significant volumes of material import via HGV during the Remediation Phase there is a perceived increase in risk of accidents due to the current site access arrangements. This forms the basis of the proposed new access arrangements and realignment of the L2005 Kerdiffstown Road. With these improvements it is anticipated that the safety of vulnerable road users (VRU) would be improved for both the Remediation and Operational Phases. This is therefore a permanent positive significant impact.

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Driver Delay

Traffic delays as a result of Remediation Phase traffic could occur along the chosen site access and egress routes. The IEMA Guidelines note that *"these delays are only likely to be significant when the traffic on the network surrounding the development is already at, or close to, the capacity of the system"*.

The road network surrounding the proposed Project is currently operating comfortably within capacity, which is confirmed by comparing the baseline and projected AADT flows in Table 14.5 with the anticipated capacity outlined within Table 14.4. Projections show that the road will continue to operate below its capacity with the addition of Remediation Phase related traffic flows, taken as the worst case scenario. The increases in flow are therefore anticipated to have a negligible impact on driver delay. Notwithstanding this, mitigation will be provided as described in Section 14.5.

The impacts from the Operational Phase are then neutral and therefore not significant following adoption of mitigation as identified for the Remediation Phase.

Fear, Intimidation and Pedestrian Amenity / Delay

Traffic volume, composition and speeds, in combination with pedestrian footways and crossings, contribute to the level of general unpleasantness, fear, intimidation and delay experienced by pedestrians and other vulnerable road users.

There are no footways on L2005 Kerdiffstown Road to the immediate north and south of the site access, however a footway exists on the east side of Kerdiffstown Road, approximately 350m south of the existing site access. This footway connects to Johnstown Garden Centre (Receptor ID COM002) to the east of the proposed Project; and to the settlement of Johnstown via a crossing at the roundabout, approximately 415m to the south of the site and a footbridge over the N7, located approximately 460m to the south of the site access. This bridge is suitable for use by pedestrians and also allows cyclists access to the new cycleway linking to the proposed Project. It is noted that the parapet height on this bridge is insufficient to permit cycling hence signage will be required to direct cyclists to dismount. As part of the proposed Project, a shared use cycleway / footway will be developed on the eastern side of the L2005 Kerdiffstown Road, which will provide a segregated and direct link between the proposed Project site access roundabout and the existing pedestrian bridge connecting over the N7 to Johnstown.

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During the worst case Remediation Phase traffic, it is predicted that 180 two-way movements per day will access the proposed Project, which equates to an average of 18 two-way movements per hour. Consequently, the impact of the potential for HGVs moving to and from the site in platoons has been assessed. It is clear when comparing the worst case traffic impact during the Remediation Phase, with the theoretical operating capacity of a road such as the L2005 Kerdiffstown Road (Table 14.4), that there is ample available capacity in order to accommodate the increases in traffic associated with all parts of the Remediation Phase of the proposed Project. Furthermore, with the provision of segregated footpath and cycleway, protection will be afforded to VRU's during the Remediation Phase. As such, the impact of the Remediation Phase of the proposed Project is neutral and therefore not significant regarding impact on fear, intimidation and delay. Notwithstanding this, mitigation measures outlined in Section 14.5 will ensure that any impacts are kept at a minimum.

With the opening of the public park and the provision of segregated footpaths and cycleways the access is considered to provide a significant, positive effect on fear, intimidation and pedestrian amenity/ delay. The increases in traffic are reduced from that assessed in the Remediation Phase hence the effect would be neutral and not significant.

Severance

The IEMA Guidelines note that "*Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery*".

Whilst the proposed Project does not comprise the construction of a new major traffic artery the increase in HGV traffic may be perceived to increase severance. During the worst case of the Remediation Phase works, it

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is predicted that 180 two-way movements per day, the majority of which are HGVs, will access the proposed Project, which equates to an average of 18 two-way movements per hour. Consequently, the impact of the potential for HGVs moving to and from the site in platoons has been assessed. This is not likely to lead to any severance issues.

Furthermore, HGVs travelling to the site will not be permitted to route via Sallins and will therefore predominantly travel on the strategic road network. Whilst the low levels of additional traffic generated by the proposed Project coupled by the strategic routing of HGVs is not significant, the issue of severance due to this traffic has been conservatively considered as adverse and significant. Mitigation measures outlined within Section 14.5 will ensure that any impacts are kept at a minimum. The Operational Phase will provide improved connectivity from Johnstown to the proposed Project hence is considered to be a slight permanent positive effect.

Summary of Environmental Impacts (Remediation Phase)

In terms of the above outlined environmental impacts the performance of the Remediation Phase for the proposed Project in relation to the EPA Guidelines (as detailed in 14.2.7) is summarised in Table 14.10 below.

Table 14.10: Summary of Environmental Impacts (Remediation Phase)

Environmental Impact	Environmental Impact description	Quality of Effects	Significance	Duration	Comments
Accidents and Safety	Improvements to the proposed site access junction and associated realignment of L2005 Kerdiffstown Road	Positive	Significant	Permanent	The proposed mitigation measures will assist in managing and reducing these effects.
	Increases in traffic, most notably HGVs.	Adverse	Slight	Short-term	
Driver Delay	Increases in traffic on the road network as a result of Remediation Phase activities, most notably slow moving HGVs.	Adverse	Not significant	Short-term	The proposed mitigation measures, most notably the timing and routing of Remediation Phase traffic, will assist in minimising these effects.
Fear, Intimidation and Pedestrian Amenity / Delay	Increases in traffic on the road network as a result of Remediation Phase activities, most notably HGVs.	Adverse	Not significant	Short-term	The proposed mitigation measures, most notably the timing and routing of Remediation Phase traffic, will assist in minimising these effects.
	The potential for HGVs moving to / from the site in platoons.	Adverse	Significant	Short-term	
Severance	Increases in traffic on the road network as a result of Remediation Phase activities, most notably HGVs.	Adverse	Significant	Short-term	The proposed mitigation measures, most notably the timing and routing of Remediation Phase traffic, will assist in minimising

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Environmental Impact	Environmental Impact description	Quality of Effects	Significance	Duration	Comments
	The potential for HGVs moving to / from the site in platoons.	Adverse	Significant	Short-term	these effects.

Summary of Environmental Impacts (Operational Phase)

In terms of the above outlined environmental impacts the performance of the Operational Phase for the proposed Project in relation to the EPA Guidelines (as detailed in 14.2.7) the scenarios described above in the discussions of assessment of environmental impacts (Remediation Phase) remain largely valid and are presented as a summary in Table 14.11.

Table 14.11: Summary of Environmental Impacts (Operational Phase)

Environmental Impact	Environmental Impact description	Quality of Effects	Significance	Duration
Accidents and Safety	Improvements to the proposed site access junction and associated realignment of L2005 Kerdiffstown Road	Positive	Significant	Permanent
	Increases in traffic are negligible.	Neutral	Not significant	Permanent
Driver Delay	Increases in traffic on the road network as a result of the Operational Phase are negligible.	Neutral	Not significant	Not applicable.
Fear, Intimidation and Pedestrian Amenity / Delay	Increases in traffic on the road network as a result of the Operational Phase are negligible.	Neutral	Not significant	Not applicable.
	Improved pedestrian and cycle access to the public park as part of the L2005 Kerdiffstown Road realignment works.	Positive	Significant	Permanent
Severance	Increases in traffic on the road network as a result of the Operational Phase are negligible.	Positive	Slight	Permanent

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14.4.4 Traffic and Transport Assessment

The initial assessment of predicted traffic volumes suggested that a standalone TTA may not be required. However, in order to ensure a robust assessment of impacts on the road network for both the Remediation Phase and Operational Phase a TTA was undertaken for the proposed Project. While the TTA should be read in conjunction with this Chapter, a brief summary of the findings relating to the operation of the local road network are presented below. Refer to Appendix A14.1 for the TTA.

A key consideration of the TTA relates to the impact on the local road network with the addition of traffic related to the proposed Project, during both the AM and PM peak periods. A microsimulation model was developed in February 2017, with the approach, methodology and extents of the assessment agreed with the KCC Transportation Department following the submission of a scoping report. The model extends from Junction 8 of the N7, to the south-east of the site, to the R407 / Church Avenue junction in Sallins, to the north-west of the site.

The scenarios considered within the TTA for the AM and PM peak periods are:

- 2017 Base;
- 2018 Projected Do Minimum (assumed Remediation Phase start);

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- 2022 Projected Do Minimum (assumed Operational Phase start);
- 2027 Projected Do Minimum (5 years after assumed Operational Phase start);
- 2037 Projected Do Minimum (15 years after assumed Operational Phase start);
- 2018 Projected + Remediation Phase Traffic (assuming 30% (based on professional judgement) of daily Remediation Phase traffic arrives / departs during the AM / PM peak hours);
- 2018 Projected + Remediation Phase Traffic (Sensitivity Test) (assuming 100% of daily Remediation Phase traffic arrives / departs during both AM and PM peak hours);
- 2022 Projected + Operational Phase Traffic;
- 2027 Projected + Operational Phase Traffic; and
- 2037 Projected + Operational Phase Traffic.

While this report assesses the worst case impacts of both the Remediation and Operational Phases of the proposed Project, the assessment has shown that it is extremely unlikely that either of the Remediation Phase scenarios outlined above will occur in reality given that the appointed contractor will be bound by a Construction Traffic Management Plan (CTMP). The CTMP, details of which are provided in Section 14.5, will include details of the routes that Remediation Phase traffic must take when travelling to the site, along with details of delivery windows confirming when traffic is predicted to arrive on-site, which is likely to be outside of the AM and PM peak periods.

A summary of the model results for each assessed scenario is provided below. Reference should be made to Diagram 14.1 and Diagram 14.2 for identification of the study area.

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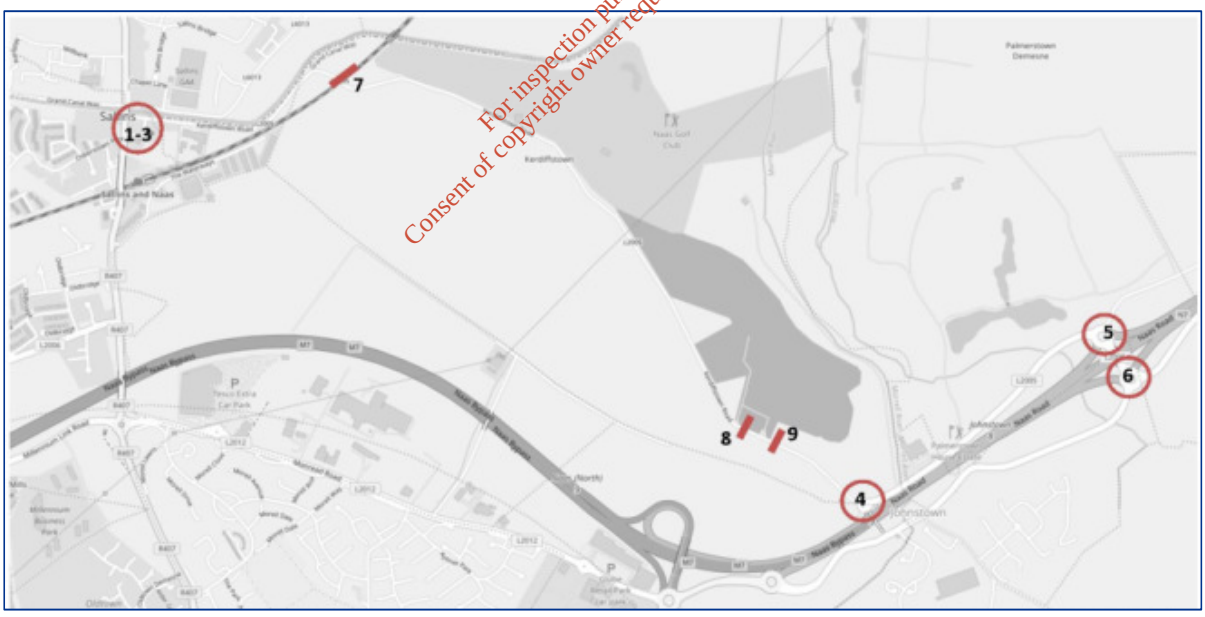


Diagram 14.1: Location of all Traffic Surveys

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Diagram 14.2: Focus on Traffic Survey Locations 1-3

2017 Base Network

During both the AM and PM peak periods, Junctions 1 – 3 in Sallins experience varying levels of queuing and delay, with existing queues of up to 30 vehicles reported in the AM peak period on the R407 (S) arm of the R407 / Church Avenue junction. It is important to note, however, that despite this level of queuing, vehicles are only reported to experience a delay of up to 9 seconds when negotiating the junction.

Similar levels of performance are noted in the PM peak, albeit to a lesser extent, with existing queues of up to 26 vehicles noted on the R407 (S) arm of the R407 / Church Avenue junction. As with the AM peak the levels of delay are manageable, with vehicles only reported to experience a delay of up to 8 seconds when negotiating the junction.

Notwithstanding this, it is clear that there are existing capacity issues within Sallins, however levels of queueing and associated vehicle delay are manageable.

There are no predicted queuing issues at any other assessed location on the network.

Reference should be made to the TTA (Appendix A14.1) for a more detailed narrative of the existing road network performance.

2018 / 2022 / 2027 / 2037 Projected Network

While it is natural that any increases in traffic will exacerbate existing issues on the network for the 2018 / 2022 / 2027 / 2037 future year projections, only minor increases are anticipated in relation to maximum queuing and delay at a number of locations on the network, but overall delay and maximum queuing remain manageable.

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2018 Projected + Remediation Phase Traffic

With the addition of Remediation Phase traffic to the 2018 projected traffic, as expected there would be increased levels of queuing and delay on the L2005 Kerdiffstown Road at the proposed Project roundabout, although again this equates to a small increase in vehicles and a small increase in delay.

Very little change would be anticipated at other junctions on the network, when Remediation Phase trips are added to projected traffic.

The impacts on the local road network during the Remediation Phase are anticipated to be negligible. Furthermore, the mitigation measures detailed below will ensure that impacts associated with Remediation Phase traffic in the AM and PM peaks are minimal. It is recorded that HGV traffic (which comprises the majority of Remediation Phase traffic) will not be permitted to route via Sallins, hence no impacts to future traffic flows from Remediation Phase traffic is anticipated for junctions in Sallins.

2018 Projected + Remediation Phase Traffic (Sensitivity Test)

Despite the sensitivity assessment, assuming that 100% of daily Remediation Phase traffic movements will occur during the AM and PM peak period, a situation which is not predicted to occur, the increases in maximum queuing and delay are anticipated to be minor. During the AM peak, it is predicted that queuing on the L2005 Kerdiffstown Road will increase by 4 vehicles, with a minimal increase in delay. Furthermore, minor increases in queuing and delay are predicted at other locations on the network.

Despite a robust assessment of Remediation Phase activities, the impacts on the local road network are anticipated to be negligible. Furthermore, the mitigation measures detailed below will ensure that impacts associated with Remediation Phase traffic in the AM and PM peaks are minimal. It is recorded that HGV traffic (which comprises the majority of Remediation Phase traffic) will not be permitted to route via Sallins, hence no impacts to future traffic flows from Remediation Phase traffic is anticipated for junctions in Sallins.

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2022 / 2027 / 2037 Projected + Operational Phase Traffic

As outlined above, there are existing capacity issues at the junctions assessed in Sallins, however these issues are manageable given the levels of queueing and, more importantly, the maximum delay for vehicles. Given that predicted increases in traffic associated with the Operational Phase of the proposed Project are anticipated to be low (as demonstrated within this assessment), the additional traffic is predicted to have a minor effect on the operation of the road network within Sallins across all future year scenarios, with very slight increases in queueing and delay anticipated. Importantly, overall levels of queueing and delay will remain manageable.

The additional traffic associated with the proposed Project Operational Phase can be accommodated on all other assessed junctions on the network with no detrimental impact.

14.5 Mitigation Measures

14.5.1 Remediation Phase

Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Traffic Management Plan (CTMP). The purpose of the CTMP is to set out management and mitigation measures to prevent or minimise the transport impacts during the Remediation Phase of the proposed Project.

The CTMP shall include details of the following:

- Identify to all staff and contractors the appropriate and safe routes to and from the proposed Project;
- Confirmation that routing of HGV traffic is not permitted via Sallins, all Remediation Phase HGV traffic will route via the N7 Junction 8;
- Timing of HGV movements to take place outside of peak flow hours, where practicable, in order to minimise disruption to general traffic flows on the road network, including details of delivery windows confirming when traffic is predicted to arrive on-site;

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- Consideration of location of weighbridge within the site in order to minimise queueing of site traffic on the L2005 Kerdiffstown Road;
- Measures to ensure access to all private properties along the L2005 Kerdiffstown Road is maintained throughout the Remediation Phase works; and
- Appropriate warning signs to be erected to warn other road users of the presence of HGV's and general Remediation Phase related traffic.

Through the CTMP, regular engagement with the existing Community Liaison Group shall be undertaken in order to engage with the local residents on when remediation works will commence, including;

a) The schedule of works;

b) Disseminate details of signage;

c) The direction from where HGV loads will be travelling from;

d) A dedicated telephone number which the residents can contact to report any issues;

e) Provide details of the dates of the community liaison group meetings; and

f) Obtain local resident's feedback on other issues that need to be addressed including details of any forthcoming public events etc. that need to be considered.

The CTMP shall provide for regular inspections to be carried out to ensure that agreed mitigation measures, as outlined above, are being undertaken.

The appointed contractor responsible for the remediation works will be required to undertake a pre-condition survey of the existing road from the N7 to the site with the scope and method of assessment to be agreed with KCC Transportation Department. Following completion of the importation works, a further survey will be undertaken to determine any deterioration and the requirement for any remedial works, for agreement with the KCC Transportation Department.

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A Mobility Management Plan (MMP) shall be prepared by the appointed contractor prior to initiation of the Remediation Phase, the purpose of which is to provide the mechanism to support and promote sustainable travel for staff, contractors and visitors travelling to the proposed Project.

The MMP shall seek to eliminate where feasible the barriers preventing users of the site from accessing via sustainable travel modes, improving travel choices and managing single occupancy car use.

14.5.2 Operational Phase

As identified within this assessment, the traffic generated during the Operational Phase for the proposed Project is anticipated to be minimal and will not have a significant impact on the existing road network. As such no specific mitigation relating to this phase is required, however the MMP shall continue through the Operational Phase and seek ways in which to promote active and sustainable travel to all staff and visitors to the public park.

Notwithstanding this, the proposals to provide a shared footway / cycleway, segregated from the carriageway on the L2005 Kerdiffstown Road, will present a safe and desirable opportunity for walking and cycle trips to the public park. There will also be provision of adequate car parking facilities to accommodate members of the public arriving by road.

14.6 Residual Impacts

14.6.1 Remediation Phase

While the nature of traffic increases will be short-term and the impacts negligible, the mitigation measures outlined will minimise any residual impacts. A summary justification is as follows:

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- A CTMP will minimise, as far as practicable, traffic impacts during the Remediation Phase;
- Large sections of the proposed delivery routes are on national roads, which are established HGV routes;
- The maximum traffic increases as a result of Remediation Phase related traffic will be temporary;
- Safety of all road users will be improved with the construction of a new site access, realignment of the L2005 Kerdiffstown Road and provision of a footpath and cycleway during the first phase of remediation works; and
- Environmental impacts identified will be managed through the mitigation measures outlined above, thus ensuring the impacts are not significant.

14.6.2 Operational Phase

The traffic generated during Operational Phase of the proposed Project will not have a significant impact on the existing road network. Suitable signage will be erected advising of the appropriate access to the proposed Project.

Furthermore, staff and visitors to the proposed Project, once operational, will benefit from the pedestrian and cycle infrastructure that will provide a safe and desirable opportunity for walking and cycling to the public park.

14.7 Difficulties Encountered in Compiling Information

There were no specific difficulties encountered when carrying out this assessment.

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14.8 Cumulative Impacts

The cumulative impact of the proposed Project and other permitted developments in the area has been assessed by taking account of the existing baseline environment and the predicted impacts associated with the operation of the proposed Project in combination with predicted impacts of any other proposed developments in the area.

The key permitted developments proposed in the vicinity of the proposed Project that are considered in terms of a cumulative impact on traffic and transport within the study area are discussed in the following paragraphs.

14.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018.

The Waste Facility Permit restricts the truck movements onto the quarry site to a maximum of 35 per day and restricts the working hours to 08:00 to 17:00 Mondays to Fridays and 08:00 to 13:00 on Saturdays. The access route to the quarry site is from the south using the L2012 Monread Road and crossing over the M7 motorway. This will result in keeping all the quarry infilling traffic well removed from the proposed Project works in the event of the quarry infilling works occurring at the same time as the Remediation Phase works. The use of different approach roads to serve the two sites is also beneficial since this will minimise the traffic movements on each road thereby minimising the impact on nearby receptors.

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14.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The proposed M7 Osberstown Interchange and R407 Sallins Bypass Scheme comprises an interchange on the M7 between the M7 Maudlins and Newhall Interchanges, north and south of Naas respectively and a bypass of Sallins town. Following review of the scheme Environmental Impact Statement (EIS), there are likely to be cumulative impacts associated with the construction of this project and the remediation of the proposed Project.

The M7 Osberstown Interchange and R407 Sallins Bypass Scheme EIS has undertaken a worst case assessment whereby construction of the M7 Osberstown Interchange and Sallins Bypass occur at the same time over an 18-month construction period. In order to ensure that a robust cumulative assessment is undertaken, the assessment has considered the worst case construction months of both schemes and the proposed Project remediation occurring concurrently in order to robustly assess cumulative impacts.

From Table 4.11 of the M7 Osberstown Interchange and Sallins Bypass EIS, it is predicted that 193,500 construction traffic movements will be generated across all phases of the project over the 18-month construction period, which generates an average of 10,750 vehicles per month and 384 per day (assuming 28 working days per month). During the busiest phase of Kerdiffstown remediation a total of 180 vehicles per day are anticipated.

On reviewing the local road network, relevant to the proposed Project, only the counter on the N7 West of Junction 8 is predicted to accommodate vehicle movements from both developments. Table 14.12 details the cumulative percentage impact based on the worst case months for both developments.

Table 14.12 ATC Counters Experiencing Cumulative Impacts

ATC Location	Cumulative Daily Traffic	Two Way Projected AADT 2018	% Increase in Total Vehicles
N7 West of Junction 8	564	62,137	0.91%

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It is demonstrated in Table 14.12 that following the cumulative assessment, all locations on the road network, will experience a percentage increase of less than 30% which is of negligible significance in terms of the criteria within Table 4.3

14.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

14.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

14.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment of this section of road as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment of the L2005 Kerdiffstown Road to minimise potential impacts on local residents and

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traffic. It is likely that to facilitate installation of the new sewer traffic management will be required on L2005 Kerdiffstown Road and hence impacts may be experienced. On confirmation of works programme for the new sewer and the proposed Project, a strategy for managing cumulative impacts will be developed. This requirement for collaboration will be embraced within the appointed contractor's Construction Traffic Management Plan. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

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14.9 References

- Department of Environment, Community and Local Government (2013) / Traffic Infrastructure Ireland. Design Manual for Roads and Bridges.
- Design Manual for Urban Roads and Streets (DMURS), Department of Environment, Community and Local Government, 2013 (DMURS).
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15. Waste

This Chapter assesses the potential impacts of waste on the environment as a result of the proposed Project. It is envisaged that none of the in-situ waste will be removed from the site for disposal, except where the waste material has a resale value (e.g. rebar), or materials are encountered which are deemed to be non-compliant. This impact assessment therefore did not assess the impact of the in-situ waste which is to stay on-site, and focussed on the likely wastes which will be generated by the proposed Project needing off-site disposal, both during Remediation and Operation.

During remediation works the majority of waste is likely to arise through the demolition of the remaining concrete structures, demolition of the residential properties which will be acquired through Compulsory Purchase Orders (CPOs), and general and hazardous wastes which will arise from the remediation works as is typical of any construction project. The main waste types which will be generated by the proposed Project are rebar from demolished concrete structures, hazardous wastes such as oily wastes from plant and vehicle maintenance and chemical drums, general wastes from site personnel and activities, and the continued generation of effluent (leachate and wastewater from site facilities).

Waste-related impacts will be managed through the Construction Environmental Management Plan (CEMP) which will detail how waste generated by the remediation works will be managed by the appointed contractor(s) in accordance with best practice and applicable legislation.

Once operational the waste generated from the multi-use public park will be minimal, composed predominantly of landscaping waste, general waste from park visitors and the infrastructure compound, maintenance wastes, and leachate and wastewater. The management of effluent will have improved when compared to the baseline with leachate and wastewater leaving the site via a sewer connection to Johnstown Pumping Station for treatment at Osberstown WWTP.

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15.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") and the waste that may occur during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950's until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 15.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 15.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound supported by a back-up flare • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation can be found in Chapter 4 Description of the Proposed Project.

15.2 Methodology

The methodology sets out the approach for assessing the potential waste impacts as a result of activities associated with the Remediation and Operational Phases of the proposed Project. An analysis of the available information was undertaken, consisting of the following:

- A desktop study of the available information and publicly available datasets for the establishment of the baseline conditions at the site of the proposed remediation project and in the wider area;
- A review of relevant plans and strategic documents;
- An assessment of all likely impacts to the environment arising from waste generated in the Remediation and Operational Phases based on the information gathered from the desktop study, using the EPA criteria; and
- Identification of mitigation measures to reduce or remove the impacts identified in the impact assessment.

The methodology is consistent with relevant guidance including, but not limited to:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- National Roads Authority Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008);

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- National Roads Authority Guidelines for the Management of Waste from National Road Construction Projects (NRA, 2008); and
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects (2006).

The characteristics of an impact relates to the quality, significance and duration of the impact. The definition of these impact characteristics as per the draft EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017) is provided below:

Quality of Effects

- **Positive Effects**: A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities);
- **Neutral Effects:** No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error; and
- **Negative/Adverse Effects:** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance).

Significance of Effects

- **Imperceptible:** An effect capable of measurement but without significant consequences;
- **Not significant:** An effect which causes noticeable changes in the character of the environment but without noticeable consequences;
- **Slight Effects:** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities;
- **Moderate Effects:** An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends;
- **Significant Effects:** An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment;
- **Very Significant Effects:** An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment; and
- **Profound Effects:** An effect which obliterates sensitive characteristics.

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Duration of Effects

- **Momentary Effects:** Effects lasting from seconds to minutes;
- **Brief Effects:** Effects lasting less than a day;
- **Temporary Effects:** Effects lasting less than a year;
- **Short-term Effects:** Effects lasting one to seven years;
- **Medium-term Effects:** Effects lasting seven to fifteen years;
- **Long-term Effects:** Effects lasting fifteen to sixty years; and
- **Permanent Effects:** Effects lasting over sixty years.

The impact assessment and identification of mitigation measures aims to manage the generation of waste and resources more efficiently in order to reduce the amount of waste requiring final disposal during the Remediation and Operational Phases. Any waste which is generated will be dealt with in adherence to the waste hierarchy (Refer to Diagram 15.1), with the main priority being to prevent waste from being generated in the first place.

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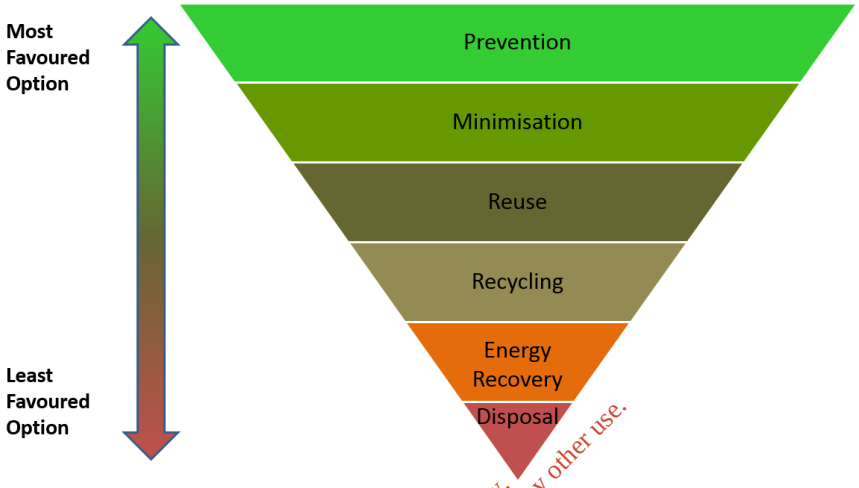


Diagram 15.1: Waste Hierarchy

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15.3 Baseline Conditions

15.3.1 Study Area

The study area of the proposed Project, is located in County Kildare. The site is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The site is located in close proximity to a number of residential and commercial receptors as well as being a short distance away from the larger settlements of Johnstown, Sallins and Naas. The materials brought to site for the purposes of remediation will include heavy plant and machinery, construction materials, inert fill material and landscaping supplies. All materials on-site will be reused and recycled where possible to reduce the necessity to utilise alternative disposal routes for waste materials.

15.3.2 Plans and Policies

As part of the compilation of this EIAR Chapter the following local and national policy documents were reviewed with respect to waste management policies:

- Eastern – Midlands Region Waste Management Plan 2015-2021;
- Kildare County Development Plan 2017-2023;
- Naas Town Development Plan 2011-2017;
- Sallins Local Area Plan 2016-2022; and
- National Hazardous Waste Management Plan 2014-2020.

The Eastern – Midlands Region Waste Management Plan 2015 – 2021 (DCC 2015), compiled by Dublin City Council on behalf of all local authorities in the Eastern and Midlands Region, commits to a large and varied number of waste management policies for the region. The plan contains several policies about generally improving waste management; for example, Policy A3 sets out an objective to '*Contribute to the improvement of*

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management performance across all waste streams through the implementation of policy actions and monitor progress towards national targets' (DCC 2015, p.25).

The Eastern – Midlands Region Waste Management Plan also contains policies specific to landfill remediation. For example, Policy E11 states that '*The plan supports the consideration of appropriate alternative future land uses at authorised inactive landfills…*' with the list of potential activities including '*Development of public and recreational amenities*' (DCC 2015, p.168), while Policy G2 makes a commitment to '*Roll-out the plan for remediating historic closed landfills prioritising actions to those sites which are the highest risk to the environment and human health*' (DCC 2015, p.131).

The Kildare County Council Development Plan 2017-2023 (KCC 2017) outlines eighteen waste management policies for the county, for example Policy WM3 states that it is the policy of the Council to '*Support the implementation of the Eastern-Midlands Region Waste Management Plan 2015-2021 by adhering to overarching performance targets, policies and policy* action'. WM10 states that the County Council will *'Encourage waste prevention, minimisation, reuse, recycling and recovery as methods of managing waste…*' (KCC 2017, Section 7.6.5). The County Development Plan also contains a policy specific to the Kerdiffstown Landfill Remediation Project, namely WM16 which states that the County Council are '*To work in conjunction with the Department of the Environment and all other relevant stakeholders to remediate the Kerdiffstown Landfill in a socially, economically and environmentally sustainable manner to deliver an appropriate scheme to manage and reduce environmental risk*' (KCC 2017, Section 7.6.5).

While the Naas Town Development Plan 2011-2017 (Naas Town Council 2011) and the Sallins Local Area Plan 2016-2022 (KCC 2016) do not contain any objectives specific to the Kerdiffstown Landfill site, they both contain objectives to reduce waste. The Sallins LAP contains a Strategic Environmental Objective number S4 to '*Minimise the amount of waste to landfill*', while the Naas Town Development Plan includes a policy (WM3) '*To encourage waste prevention, minimisation, reuse, recycling and recovery as methods of managing waste*'.

The National Hazardous Waste Management Plan 2014-2020 (EPA 2014) includes a section (Section 7.1) on the legacy issues of closed landfills in the context of hazardous waste. The Plan states that '*While most of these old landfills would not be expected to contain significant quantities of hazardous waste, an identification, assessment and action-planning exercise is required to deal with them*'.

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15.3.3 Baseline

The Eastern – Midlands Region Waste Management Plan 2015 – 2021 (DCC 2015) includes some waste statistics for the region between 2010 and 2012. Overall there was an increase in the total amount of waste generated in the region during this period, with these volumes projected to increase further in the coming years. Whilst it has ceased operating and is listed as closed, Kerdiffstown Landfill is one of sixteen EPA authorised facilities within County Kildare (detailed within Appendix E of the Eastern – Midlands Region Waste Management Plan), only six of which are currently active. The Waste Management Plan lists 28 legacy and historic landfills within County Kildare (DCC 2015, Appendix F).

The Remedial Options Report (SKM Enviros 2013) estimates that Kerdiffstown Landfill contains a volume of approximately 3.1 million cubic metres of waste. The landfill ceased operating in 2010, at which point waste was no longer accepted at the site. The remedial options outlined in the report (SKM Enviros 2013) for the site identified the proposed option, to retain wastes on site and apply an engineered capping system, to be the most environmentally and economically viable. Discussion regarding the existing waste deposits is therefore limited in this Chapter, with reference made in Chapter 4 Description of the Proposed Project and Chapter 5 Consideration of Alternatives. Waste gas emissions as a result of the degradation of the existing waste will be controlled through the landfill gas management infrastructure. Further detail on this is addressed in Chapter 7 Air Quality, Odour and Climate.

The site was previously licensed to accept non-hazardous and inert wastes (EPA Licence W0047-02); however, the lack of available detailed waste records from the former operations means that the existence of other, non-compliant waste materials cannot be ruled out completely. There have also been a number of ground investigations carried out which have not detected any hazardous waste or any other non-compliant wastes, as well as no evidence within the groundwater monitoring results. An exception to this may be asbestos. During the

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demolition of the site buildings there were trace amounts of asbestos encountered. Also given the fact that the landfill accepted C&D waste there is a risk of asbestos being found within the existing waste bodies. There is also a risk of asbestos existing in the pre-1980s residential properties due to be demolished.

The waste types currently contained within the site are summarised in Chapter 3 The Need for the Proposed Project. Please refer to Figure 3.2 for the location of the zones.

2016 / 2017 Demolition Works

A number of buildings remained on site in an unsafe condition following cessation of works at the site in 2010. Subsequently, partial demolition of these buildings, leaving only the concrete walls, was undertaken in 2016 and 2017, with materials re-used or recycled as outlined below:

- Steel frames and metal cladding – removed off-site by demolition contractors for segregation and reuse or recycling;
- Timber poles – creosote treated timber poles were removed off-site for re-use at other sites and/or sent to PDM in Kill, Co. Kildare for refurbishment and reuse;
- Rubber tyres – reused on the site where possible (to hold down temporary capping liner). Any surplus tyres were removed off-site for recycling by Crumb Rubber in Co. Louth; and
- Containers, elevated platforms, storage tanks, sorting machines and conveyors – removed off-site to the segregation facility where different material components were segregated and sent to appropriate facilities for reuse / recycling.

Remaining materials, including processed waste which had been stored within these buildings, was removed to the lined cell (Zone 3) of the site for disposal.

As part of the demolition works a waste quarantine area was identified for use on-site during the works, located beside former Building 2 near the current site office. This bunded quarantine area was utilised for the storage of suspected non-compliant wastes, until the waste can be tested and appropriate disposal route identified.

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Waste Tyres

Whole tyres have been used on site to provide an engineering function, being the weighting and anchorage to the temporary (geosynthetic) capping system in the lined cell (Zone 3). These tyres will require to be removed as part of the remediation works as they cannot be disposed to landfill under the Landfill Directive (1999/31/EC). The List of Wastes Code (LoW) (also often referred to as the EWC code) and the estimated quantity of tyres (based on aerial photography) is outlined in Table 15.2 below.

Table 15.2: Tyres Currently Existing on Site to be Removed During the Remediation Phase

LoW Code	Description	Quantity Estimate
16 01 03	End of Life Tyres	5,000 @ 10kg = 50 tonnes

Site Management Waste

The types of waste currently generated on-site due to ongoing management, maintenance and security activities are:

- General waste and mixed recyclables from the site office and security huts;
- Minimal amounts of hazardous waste such as fluorescent lightbulbs, lab reagents, batteries and fuel containers from the site office and security huts;
- Wastewater from on-site sinks and toilets;
- Leachate, collected from the lined cell (Zone 3), tankered off-site for disposal; and
- Occasional interceptor waste from the on-site surface water drainage network.

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The lined cell located in Zone 3 of the site includes leachate collection facilities. Leachate collects within the lined cell and is tankered off-site to a licenced facility, currently Ringsend WWTP (licence D0034-01) for disposal. Since 2011 there has been an average of 12,142 cubic metres of leachate disposed of in this manner per year, or 1,012 cubic metres per month. The amount of leachate needing to be removed during any time period has been dependent on the amount of rainfall during that period.

The waste types currently generated by the site are summarised in Table 15.3 below. Information on waste quantities were taken from the 2014 and 2015 Annual Environmental Reports as applicable.

Table 15.3: Waste Types Currently Generated On-Site

Waste Type	Approx. Annual Quantity	Disposal Route
General Waste (LoW: 20 03 01)	0.506 tonnes (2015)	Disposed of through Thornton's Recycling (NWCPO-09-01190-01) or AES (NWCPO-08-10601-05)
Mixed Dry Recyclables (LoW: 20 03 01)	0.095 tonnes (2015)	Disposed of through Thornton's Recycling (NWCPO-09-01190-01) or AES (NWCPO-08-10601-05)
Hazardous Waste (LoW: Various)	Minimal	Disposed of on an as required basis through appropriate fully licensed hazardous waste contractor.
Wastewater (from sinks and toilets)	Relatively small quantities which are stored in an on-site tank.	Storage tank periodically emptied by Elsatrans Ltd. (NWCPO-12-11124-01) to Ringsend Wastewater Treatment Plant (EPA Licence D0034).
Leachate (LoW: 19 07 03)	12,142m^3 (annual average since 2011)	Collected by Elsatrans Ltd. (NWCPO-12-11124-01) to Ringsend Wastewater Treatment Plant (EPA Licence D0034-01).
Interceptor Wastewater (LoW: 13 05 07*)	Occasional as required - none in 2015, 32,940kg in 2014	Transported by Enva (NWCPO-08/01116-02) to Enva Facility (EPA Licence W0196-01).

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15.4 Predicted Impacts

A description of the proposed Project is included in Chapter 4 Description of the Proposed Project, but key elements will include re-profiling of the site, installation of an engineered capping system across the waste, and construction of infrastructure to manage gas and leachate.

15.4.1 Remediation Phase

An application for an Industrial Emissions Activities Licence (IEAL) is to be submitted to the EPA in parallel with the planning application. Acceptance of imported materials will be controlled under specifications and acceptance criteria, to comply with the IEAL. Operations on site will also be regulated by the EPA during the Remediation and Operational Phases.

Excavated Materials / Demolished Structures

The proposed Project will involve re-profiling of the site to address the current over-steep slope angles and to accommodate infrastructure for long-term maintenance of the site. This will involve the re-profiling and movement of waste material within the site. It is anticipated that this material would not be removed from the site as it would all be used to re-profile the site except in the unlikely event that hazardous material is found within the excavated waste. If there is hazardous waste within the waste bodies, the excavation and disturbance of the waste bodies would have the potential to mobilise contaminants. See the Section on Hazardous Waste below for further detail on hazardous waste.

The remaining existing concrete structures located within the site will be demolished. There will be waste rebar arising as a result of this demolition, which will be removed from the site for reuse or recycling. Concrete will be crushed and screened on site for re-use in the remediation works. Three properties, located to the west and south of the site, will be demolished to facilitate construction of a new access roundabout and provide additional

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area for temporary storage of materials (during the Remediation Phase) and a third multi-use sports pitch (during the Operational Phase). The current site office prefab structure will also need to be removed once the new site compound has been constructed.

Due to the generation of waste such as rebar from the demolition works, the impact of excavated materials and demolished structures is assessed as negative with a slight significance and a short-term duration.

Surplus Material

Surplus material and waste may occur where material supply exceeds material demand. While some surplus materials may have reuse potential, other materials may be considered as waste and fall under relevant regulatory controls. Materials brought to site but not fully utilised for their original purpose can result in waste such as damages, off-cuts and surplus products. There is unlikely to be any surplus materials arising from re-profiling works as it is envisaged that all such material will be reused in the remediation of the site.

The potential environmental effects of surplus materials would primarily be associated with the production, movement and transport, processing and, if required, the disposal of the materials at licensed / permitted facilities. It is therefore assessed to have a negative impact of slight significance and a short-term duration.

Waste Management

Poor practice when it comes to the storage, handling, transportation and/or disposal of waste materials during the Remediation Phase could have the potential to cause pollution to the air, soil, groundwater and/or surface waters. Such poor practices could include locating unmanaged stockpiles of wastes near sensitive receptors, improper storage of chemicals, or improper segregation of wastes on-site.

Without proper implementation of waste management plans on-site, the impact is assessed as negative, with a moderate significance and a short-term duration.

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Hazardous Waste

Due to the need to re-profile the site there is the possibility that hazardous wastes may be encountered. The disturbance of this ground during the remediation works may lead to the release of contaminants into the air, ground or water. To date there has been no hazardous waste discovered mixed within the waste bodies at the site as per the Remedial Options Report (SKM Enviros 2013), however the impact and management of such waste needs to be considered in the event that any is encountered during the remediation works.

Aside from the possibility of discovering unknown hazardous wastes within the existing on-site waste during re-profiling works, there is likely to be some hazardous waste generated during the Remediation Phase through maintenance of plant and machinery, such as waste chemical containers and waste oils, and the demolition of some pre-1980s houses which may contain asbestos. There will also continue to be minimal amounts of hazardous waste produced by the site offices such as fluorescent tubes, lab reagents and batteries.

Due to the slight potential of disturbing unknown hazardous waste during re-profiling works and remobilisation of contaminants into the environment, the impact is assessed as negative, with a moderate significance and short-term duration.

Leachate and Effluent

Leachate and effluent will continue to be produced during the Remediation Phase of the proposed Project, with management of both to continue as per the baseline until planned sewer connections have been installed and commissioned. Surface water runoff will also continue to be generated during the remediation of the site. During the Remediation Phase of the proposed Project the leachate management system and sewer connection to Johnstown Pumping Station will be constructed allowing for leachate to leave the site for treatment at Osberstown WWTP.

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Any interruption to leachate management processes, or uncontrolled discharge of leachate, effluent or surface water runoff from the site during remediation works could have the potential to cause pollution to the soil, groundwater and surface waters during the Remediation Phase of the proposed Project. Without proper implementation of good leachate, effluent and surface water management practices on-site, the impact is assessed as negative, with a moderate significance and a short-term duration.

15.4.2 Operational Phase

The likely waste types which will arise during the Operational Phase of the proposed Project will be generated through general multi-use public park use and maintenance activities. The nature of the proposed Project being a multi-use public park, there is likely to be small amounts of general waste and littering associated with the use of the public park by the general public. Operation, maintenance and upkeep of the public park is likely to generate some general waste, hazardous waste (fluorescent tubes and batteries), green waste through landscaping activities, wastes from surface water drainage maintenance (i.e. drainage and interceptor cleaning), and effluent and leachate through a wastewater drainage connection to Johnstown Pumping Station and on to Osberstown Wastewater Treatment Plant for treatment.

As there are only small amounts of waste likely to be generated on the site during the Operational Phase, foul sewage from changing rooms and the site office will be discharge to Johnstown Pumping Station via a buried pipeline and, other than in emergency situations, the tankering of leachate off-site for disposal will have ceased with the introduction of a further buried connection to Johnstown Pumping Station, the impact is assessed as positive, with slight significance and a long-term duration.

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15.5 Mitigation Measures

15.5.1 Remediation Phase

Excavated Materials / Demolished Structures

It is estimated that all of the material removed during re-profiling works will be reused on-site as part of the remediation of the site. Inspections will be undertaken of the material to ensure suitability for reuse and any opportunity for processing to achieve other uses on site. Should any waste material be suspected to be non-compliant, the appointed contractor will be required to quarantine that waste by constructing a perimeter bund and placement of a tarpaulin or other suitable cover over the waste until such time as testing is undertaken and waste classification confirmed. In the event that any of the excavated material is deemed to be hazardous, it will be removed for disposal by a licensed waste contractor to a suitably licensed facility.

With respect to the demolition of the on-site concrete structures, the rebar will be removed from the site for reuse or recycling. The appointed contractor will be responsible for the compliant management of the waste rebar. The concrete which arises from the demolition of the concrete structures will be crushed and reused on-site. Waste arising from the demolition of the three properties which fall under CPOs will be managed by the appointed contractor in accordance with the Construction Environmental Management Plan (CEMP).

Surplus Material

All waste materials excavated as part of the remediation works will remain on-site, with no surplus materials envisaged to be generated. An exception to this is the rebar from the concrete structures and waste tyres currently used to anchor the temporary geosynthetic capping in Zone 3, which will be removed off-site for reuse or recycling. In the event that any materials are generated during excavation, which cannot be used on the site, it will be inspected, handled and disposed of in accordance with the CEMP or as stated in the Section on hazardous waste below.

Materials which will require to be imported to the site to facilitate the remediation works will be appropriately sourced and managed to ensure that the material is of suitable engineering grade for the proposed Project. In so far as is possible, materials will be ordered within a reasonable timeframe of when they will be required on-site. This should prevent waste being generated through over-ordering, or through materials degrading due to long periods of storage on-site prior to use.

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Where material needs to be stockpiled within the site the appointed contractor will be responsible for management of the stockpiles in accordance with the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA 2009) to ensure that surface water and groundwater are protected from contamination and these provisions will be detailed in the CEMP. Please refer to Chapter 4 Description of the Proposed Project for further information and requirements on stockpile management.

As a minimum stockpile management will include:

- Visual screening for potential contaminated materials;
- Segregation of material suspected to be contaminated from clean materials;
- Stockpiling of materials at appropriate heights / batters to prevent potential instability;
- Protection of stockpiled materials from scour / erosion;
- The provision of adequate drainage to limit and control potential contaminated surface water runoff, including silt mitigation; and
- The avoidance of un-necessary trafficking / handling of stockpiled materials;

With the exception of top soil (or soil forming materials), stockpile heights will be restricted to a maximum of 4m to facilitate adequate management during the works.

A reduced stockpile height of 2m will apply to any top soil / soil forming materials to prevent possible degradation of soil structure.

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Waste Management

The appointed contractor(s) responsible for the remediation works will ensure that any facility to which waste is brought is licensed / permitted in compliance with waste management legislation and will obtain the appropriate certification of disposal / destruction of waste.

Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a CEMP. The CEMP shall contain the mitigation measures and plans identified in the following Sections and ensure that they are fully implemented during the Remediation Phase, to prevent or reduce the impacts identified in the impact assessment.

The CEMP will outline measures and provisions for the management of waste during the Remediation Phase, and will take the following guidance documents into consideration:

- Best Practice Guidelines on the preparation of Waste Management Plans of Construction and Demolition Projects, Department of the Environment, Heritage and Local Government, July 2006;
- CIRIA document C692 – Environmental Good Practice on site;
- CIRIA document 133 Waste Minimisation in Construction;
- National Hazardous Waste Management Plan 2014-2020; and
- Guidelines for the Management of Waste from National Road Construction Projects, NRA 2008.

Hazardous Waste

As well as hazardous wastes generated by the remediation works, there is a slight possibility of encountering some unknown hazardous waste during the remediation works. If such waste types are uncovered, further investigation, testing and risk assessment will be undertaken to determine the appropriate actions to be taken with regards to compliant removal and disposal of such waste.

Materials identified as hazardous will be required to be suitably disposed of in a licensed hazardous waste disposal facility. Where practicable, the closest suitable facilities to the proposed Project will be selected to reduce impacts associated with vehicle movements such as air emissions and noise. There are no facilities within County Kildare which accept hazardous wastes. There are a number of facilities located in Dublin, the

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closest of which is Rilta which is approximately 17km from the proposed Project. There is also an Enva facility in Dublin which is approximately 25km from the proposed Project. Enva also have a facility in Portlaoise for the treatment of contaminated soils, which is approximately 60km from the site of the proposed Project.

Any such material will be managed in accordance with waste management legislation and the following requirements:

- Excavation will be targeted and stockpiling will be managed in order to prevent potential contaminants from being released into the surrounding environment;
- All hazardous waste will be segregated from non-hazardous waste, with different types of hazardous waste being segregated from each other if safe to do so. Each hazardous waste storage location will be clearly signposted stating the type of waste and that it is hazardous; and
- A Waste Transfer Form (WTF) will be used to record the transportation of hazardous waste within the State and will be required of any movements of hazardous waste arising during construction of the proposed Project. Should the need arise for the Transfrontier Shipment (TFS) of waste, the movement between countries is subject to control procedures under the EU and national legislation and guidance, such as the Waste Management (Transfrontier Shipment of Waste) Regulations, 2007.

The appointed contractor, as the waste producer, will be responsible for ensuring the compliant disposal of all wastes during the Remediation Phase of the proposed Project, and as such will be required to retain records of all hazardous wastes. Kildare County Council will monitor that all waste arising as part of the Remediation Phase is handled and disposed of compliantly by the appointed contractor as per these requirements. Copies of all testing will be retained by the KCC Site Manager.

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Leachate and Effluent

During the Remediation Phase of the proposed Project, the management of leachate and effluent will need to be maintained at the baseline levels at a minimum. A Leachate Management Plan (Appendix A4.4) has been developed and shall be implemented to ensure continued collection and compliant disposal of leachate being generated from the site.

The Leachate Management Plan outlines leachate management proposals throughout a number of different stages of the remediation works. These include:

- Operation in discrete areas to minimise the area of exposed waste;
- Interception of any leachate outbreaks during waste excavation or re-profiling activities;
- Provision of daily cover to exposed wastes; and
- Progressively remediate the site with a landfill cap.

Discharge of runoff during remediation works will not be permitted as per the Surface Water Management Plan (Appendix A4.6), with ponds lined with geomembrane liner to offer additional protection to groundwater during this period. Should a situation arise where runoff levels are becoming higher than can be adequately collected and maintained within the site, the collected water will be tankered off-site by a suitably licensed contractor for disposal at a suitably licensed facility.

The leachate pipeline and Landfill Infrastructure Compound shall be built during the early Phases of the remediation works, allowing for the leachate collected in Zone 3 to be discharged from the site through the new system to the Johnstown Pumping Station. The appointed contractor will be responsible for ensuring the compliant management and disposal of leachate during the Remediation Phase of the proposed Project.

15.5.2 Operational Phase

Management of wastes arising during the Operational Phase of the proposed Project will be the responsibility of Kildare County Council as the licensee. The Council may appoint contractor(s) to provide waste management and landscaping services on their behalf. Management plans for the operation and maintenance of the multi-use public park shall be produced and adhered to by all landscaping and maintenance personnel.

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Waste silts and hydrocarbons / oily waters collected in the on-site drainage interceptors will be handled and disposed of through appropriately licensed contractors as and when required. The specialist contractors will clean out the interceptors and the waste material will be sent to a suitable licensed facility for treatment and/or disposal.

Leachate and effluent from the site compound and changing room facilities will be disposed of to Johnstown Pumping Station for treatment at Osberstown WWTP via a sewer connection to the local sewer network under agreement with Irish Water. There may be occasions where leachate will need to be tankered off-site for disposal. This will only arise at times when there are any abnormal occurrences with the treatment process or restrictions on discharge to sewer. It is anticipated that there will be a call-off agreement in place with a licensed contractor such that when tankers are needed they can be mobilised prior to full utilisation of leachate storage capacity at the site. Refer to Appendix A4.4 Leachate Management Plan for further detail on leachate management and disposal.

15.6 Residual Impacts

The residual impacts associated with the proposed Project after adherence to the implementation of mitigation measures are summarised in Table 15.4.

Table 15.4: Residual Impact after Mitigation Measures

Impact	Significance Pre Mitigation	Significance Post Mitigation
Remediation Phase		
Excavated Material / Demolished Structures	Slight Negative	Imperceptible Negative
Surplus Material	Slight Negative	Imperceptible Negative
Waste Management	Moderate Negative	Imperceptible Negative
Hazardous Waste	Moderate Negative	Slight Negative
Leachate Management	Moderate Negative	Imperceptible Negative
Operational Phase		
Operation of the multi-use public park	Slight Positive	Moderate Positive

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15.7 Difficulties Encountered in Compiling Information

There is some degree of uncertainty with regards to the types of waste contained within the site. To date, no hazardous waste has been encountered within the waste body at the site; however, the scale of the waste body and the need to excavate some materials in order to re-profile the landscape may result in the disturbance of some hazardous materials heretofore unknown about. The outline design of the remediation works has taken into consideration a cut-fill balance, reducing as far as practicable the need for excavation to existing materials to reduce impacts and disturbance.

15.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact of waste. These projects are discussed in the following paragraphs.

15.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western

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boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

15.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

15.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

15.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

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15.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. It is not anticipated that there would be any significant cumulative impact with respect to waste as a result of this project.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

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15.9 References

- CIRIA (1997). CIRIA Special Publication 133: Waste Minimisation in Construction – Site Guide
- CIRIA (2010). CIRIA Report C692 – Environmental Good Practice on site
- Department of Food, Environment and Rural Affairs UK (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites
- Department of Environment, Heritage and Local Government (2006). Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects
- Dublin City Council (2015) (*on behalf of the Eastern-Midlands Waste Region*). Eastern-Midlands Region Waste Management Plan 2015-2021
- Environmental Protection Agency (2002). Guidelines on the Information to be contained in Environmental Impact Statements
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- Jacobs (2014) (*on behalf of the Environmental Protection Agency*). Kerdiffstown Landfill Annual Environmental Report 2014
- Jacobs (2015) (*on behalf of Kildare County Council*). Kerdiffstown Landfill Annual Environmental Report 2015
- Kildare County Council (2017). Kildare County Development Plan 2017-2023.
- Kildare County Council (2016). Sallins Local Area Plan 2016-2022
- Naas Town Council (2011). Naas Town Development Plan 2011-2017
- National Roads Authority (2008). Environmental Impact Assessment of National Road Schemes – A Practical Guide
- National Roads Authority (2008). Guidelines for the Management of Waste from National Road Construction Projects
- National Roads Authority (2008). Guidelines for the Management of Waste from National Road Construction Projects
- SKM Enviros (2013) (*on behalf of the Environmental Protection Agency*). Kerdiffstown Landfill Remediation Project – Remedial Options Report

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16. Population and Human Health

This Chapter assesses the potential effects of the proposed Project on the people in the surrounding community. The assessment of the impact to receptors within a 1km radius was considered in line with best practice given the fixed nature of the site boundary.

Generally, the proposed Project will have moderate beneficial effects on the surrounding community. Only the Remediation Phase works are anticipated to have some short-term slight negative impacts related to increases in noise, odour and the visual intrusion of the works. A series of mitigation measures have been proposed to reduce these impacts on nearby receptors, including regular communication with local residents and the Community Liaison Group to ensure that they are kept up to date on progress and allowing a forum through which concerns or complaints can be made.

The proposed Project as a whole will benefit the local community. Improvements in site access for vehicles, cyclists and pedestrians will have a permanent positive impact on the community who use the L2005 Kerdiffstown Road. There will be employment created by the remediation works which will in turn benefit the local economy. The remediation of the site from a brownfield site into a multi-use public park will positively contribute to the health of the local community due to the improvement of the environment in and around the site as well as the provision of an amenity for the community to use for recreational activities.

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16.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") on the surrounding community during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950's until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 16.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 16.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound supported by a back-up flare • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of the surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation and operation can be found in Chapter 4 Description of the Proposed Project.

Socio-economics can be defined as the interaction between social and economic factors that have potential to affect people and communities. These factors may include changes in employment levels and economic opportunities, community demographics, demand for public services and the amenity value of the local area. These factors will be assessed along the basis of anticipated consequences arising from a change in site conditions at Kerdiffstown Landfill once the Remediation process is complete and the final end-use of the site is operational.

The term 'community' can be defined in many ways, and at different geographic scales. For example, the catchment area for those who use services such as schools and other educational institutions, GP surgeries, libraries, town halls, local shops, recreation facilities, green spaces and any other communal facilities may be defined as the local community. The wellbeing of a community may also be influenced by economic factors such as the state of the economy and the availability of employment opportunities.

This assessment covers effects at a local level which may affect people that live in the Kerdiffstown and Johnstown communities and wider effects upon the urban centre of Naas, which comprises of a population of approximately 21,393 (CSO, 2016).

16.1.1 Policy and Plan Context

A brief outline of some of the key national, regional and local plans and policies is provided below, which provide context as to the importance of taking appropriate action to protect the local environment and population with regard to existing and legacy waste management facilities.

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The National Hazardous Waste Management Plan was published by the EPA in 2014. The 'National Hazardous Waste Management Plan' sets out measures aimed at improving the management of hazardous waste, reducing the possibility of environmental and health impacts of unregulated waste disposal and preventing and reducing the generation of hazardous waste in general. Following review of the plan, it was determined that the Kerdiffstown Landfill site is a non-hazardous waste site.

The Eastern-Midlands Region Waste Management Plan 2015 - 2021 is the Waste Management Plan for the Eastern-Midlands Region which is made up of the local authorities of Louth, Offaly, Meath, Wicklow, Westmeath, South Dublin, Dublin City, Fingal, Dún Laoghaire, Kildare, Laois and Longford. In its policy document it states as one of its strategic objectives that "*Protecting the environment and health of citizens in the region from potential adverse impacts resulting from waste management activities is a key responsibility of the local authorities. The location of waste facilities can help to address many of their potential impacts, and local authorities will aim to improve guidance in this area*. The known environmental hazards at Kerdiffstown and the possible future consequences of these hazards are directly related to the proposed objective to remediate the site which is being led by Kildare County Council.

The Kildare County Development Plan 2017 - 2023 sets out the overall strategy for the proper planning and sustainable development of County Kildare over the period of the plan, in this case 2017-2023. The Kildare County Development Plan 2017-2023 has been published and includes policy WM 16 *"To work in conjunction with the Department of the Environment and all other relevant stakeholders to remediate the Kerdiffstown Landfill in a socially, economically and environmentally sustainable manner to deliver an appropriate scheme to manage and reduce environmental risk".*

While the site is outside the zone of influence that is under the remit of the Naas Development Plan 2011-2017, the town's development plan was consulted as Naas possesses the majority of sensitive and community receptors that may be adversely impacted as a result of any negative event at the site.

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16.1.2 Study Area

The site of the proposed Project, is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The site is located in close proximity to a number of residential and commercial receptors as well as being a short distance away from the larger settlements of Johnstown and Naas. In addition to the above, the site neighbours a number of recreational land uses, specifically Palmerstown House Estate and Naas Golf Course to the north-east and north-west respectively.

The proposed Project is to remediate the existing site to reduce risk to the environment and allow for a suitable and practical site end-use thereafter. The end-use option being proposed is for a multi-use public park with facilities such as sports pitches, changing rooms, a children's playground and running/walking tracks. This end-use option has the potential to bring socio-economic/community benefits to the surrounding area.

16.2 Methodology

An initial desktop scoping exercise (Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report, Jacobs 2016) was completed in October 2016, whereby available information on the receptors within the study area was identified (1km beyond the land-take boundary of the proposed Project) (refer to Figure 3.4, and outlined in Diagram 16.1). Professional judgement was applied to assign a level of sensitivity to receptors (low, medium, or high), and to determine the nature of the foreseen impact (beneficial, negligible or adverse).

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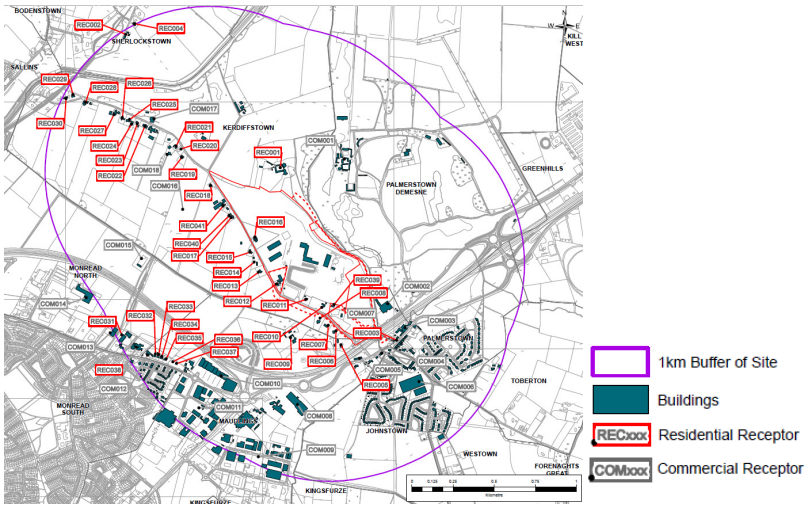


Diagram 16.1: Key Residential and Commercial Receptors within 1km of the Site

Receptors considered to be of 'high' sensitivity would typically include hospitals, schools, day-care facilities or nursing homes, where disruption would result in a significant inconvenience to the residents and/or the functionality of the receptor. Receptors of 'medium' sensitivity would typically be those that would be resilient enough to overcome the challenges posed by the Project, for example commercial businesses. Receptors considered to be of 'low' sensitivity would include, for example, disused recreational space and unoccupied buildings.

Following the approach adopted for the EIS Scoping Report, the assessment themes for the purpose of this report, together with the identified receptors and their level of sensitivity, are set out in Table 16.2. Refer to Figure 3.4 for the location of residential and commercial receptors within 1km of the site.

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Table 16.2: Identified Receptors within the Study Area

Assessment Theme	Receptors Identified Within the Study Area	Level of Sensitivity (Low; Medium; or High)
A. Amenities & Recreation	Kerdiffstown House, St. Vincent de Paul (REC001) Palmerstown House Estate (COM001) Naas Golf Club (COM017) and Naas Driving Range (COM018) Grand Canal Morell River	High Medium Medium Medium Medium
B. Community Severance & Accessibility	Access – non motorised users Access – motorised users Receptors on the L2005 Kerdiffstown Road North Leinster Ambulance Service Depot (Monread Road in Naas)	High High High High
C. Employment	Johnstown Garden Centre (COM002) Johnstown Inn (COM003) Discount Designer Tiles and Bathrooms (COM005) Londis Distribution Centre (Vacant at Present – May 2017) (COM006) Mike Brown Caravans (COM007) Naas Industrial Estate (COM009) Globe Retail Park (COM010) The Maudlins Industrial Estate (COM011) Centra, Monread Road (COM012) Centra, Johnstown (COM004) Green Isle Foods (COM014)	Medium Medium Medium Medium Medium Medium Medium Medium Medium Medium Medium
D. Land-use	Landfill Site Surrounding Lands	Low Medium
E. Economy & Tourism	Grand Canal Naas Town Centre Monread North Centre (Tesco Extra) Sallins Village Johnstown Village	High High Medium High High
F. Human Health	Naas Town Centre Johnstown Village Sallins Village Refer to Chapter 7 Air Quality, Odour and Climate specific receptors Refer to Chapter 8 Noise and Vibration specific receptors Refer to Chapter 12 Soils, Geology, Contaminated Land and Groundwater specific receptors Refer to Chapter 14 Traffic and Transport specific receptors	High High High High High High High

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A comprehensive literature review of existing data sets and reports was completed, including the following:

- Kerdiffstown Environmental Baseline Report (SKM Enviros, 2013);
- Kerdiffstown Landfill Facility; Site Profile Material Use and Capping (SKM Enviros, 2013);
- Sallins Local Area Plan: 2016 - 2022;
- Naas Town Development Plan 2011 – 2017;
- Kildare County Development Plan 2011 – 2017;

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- Kildare County Development Plan 2017 – 2023;
- National Hazardous Waste Management Plan; and
- A Framework for Health and Wellbeing 2013 – 2025.

A site visit was carried out in Summer 2016 of the surrounding area around the site to a distance of 1km radius approximately, consistent with a similar initial assessment carried out as part of the Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report (Jacobs, September 2016). This distance was extended where required to include the relevant potential receptors. Visual inspections were also made of the surrounding residential/commercial properties and community amenities within the study area. The assessment of 1km radius was considered in line with best practice given the fixed nature of the site boundary.

Regular consultation has been held by the project team with the Community Liaison Group, consisting of the following parties:

- Kerdiffstown Residents Association;
- St. Vincent de Paul;
- Naas Chamber of Commerce;
- Clean Air Naas (up to November 2016); and
- Local landowners.

Consultation on the EIAR has also been undertaken with the following bodies and institutions:

- An Taisce;
- Birdwatch Ireland;
- Commission for Electricity Regulation;
- Coras Iompair Éireann (CIE);
- Department of Agriculture, Food, and the Marine;
- The Department of Arts, Heritage and the Gaeltacht (including the Development Application Unit);
- Department of Communications, Climate Action & Environment;
- Department of the Defence;
- Department of Jobs, Enterprise, and Innovation;
- Department of Justice and Equality;
- Department of Housing, Planning, Community & Local Government;
- National Transport Authority;
- Environmental Protection Agency;
- Electricity Supply Board;
- Fáilte Ireland;
- Geological Survey of Ireland;
- Health and Safety Authority;
- Health Service Executive (HSE);
- Inland Fisheries Ireland;
- Inland Waterways Association – Kildare;
- Kildare County Council;

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- Transport Infrastructure Ireland;
- Office of Public Works;
- South Dublin County Council;
- Teagasc;
- The Heritage Council;
- Tourism Ireland;
- Waterways Ireland; and
- Wicklow County Council

This assessment is a study of the potential indirect and direct socio-economic impacts of remediating the site as well as the designated end-use option that will be employed thereafter. The study was undertaken and aided by the undertaking of an extended study of the environmental baseline, site visit, public consultation and further assessment where deemed appropriate.

This assessment has had regard for and was carried out in accordance with relevant national and EU legislation and guidance, including but not limited to the following documents:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised guidelines, due to be finalised in 2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- Department of Public Expenditure and Reform's - The Public Spending Code;
- Additionality Guide (Homes and Communities Agency) (2014); and
- Fáilte Ireland guidelines on the treatment of Tourism in an Environmental Impact Assessment (2007).

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Receptors were assessed for sensitivity, magnitude and significance to provide an appropriate and adequate assessment of how they could be impacted by the Remediation and Operation of the proposed Project. The characteristics of this impact assessment are defined below, as per the EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, March 2002 and draft guidelines for consultation, EPA, 2015):

- **Quality of Effects**
  - **Positive Effects:** A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities);
  - **Neutral Effects:** No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error; and
  - **Negative/Adverse Effects:** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance).
- **Significance of Effects**
  - **Imperceptible:** An effect capable of measurement but without significant consequences;
  - **Not significant:** An effect which causes noticeable changes in the character of the environment but without noticeable consequences;
  - **Slight Effects:** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities;
  - **Moderate Effects:** An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends;

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- **Significant Effects:** An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment;
- **Very Significant Effects:** An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment; and
- **Profound Effects:** An effect which obliterates sensitive characteristics.

- **Duration of Effects**
  - **Momentary Effects:** Effects lasting from seconds to minutes;
  - **Brief Effects:** Effects lasting less than a day;
  - **Temporary Effects:** Effects lasting less than a year;
  - **Short-term Effects:** Effects lasting one to seven years;
  - **Medium-term Effects:** Effects lasting seven to fifteen years;
  - **Long-term Effects:** Effects lasting fifteen to sixty years; and
  - **Permanent Effects:** Effects lasting over sixty years.

GIS mapping was used to visually record information relevant to the assessment.

The assessment considers receptors under the following main study themes: Amenities & Recreation, Community Severance & Accessibility, Employment, Land-Use, Economy & Tourism and Human Health. Note that 'Amenities' has been extended here to include 'Recreation'. This allows for further differentiation to be made between effects on recreation versus effects on tourism.

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The approach to assessing each of these Assessment Themes is described as follows:

A. Amenities & Recreation

The assessment considers the potential impacts on amenities of a recreational nature in the immediate locality of the proposed Project, including the ability of the local population to enjoy the general character and surrounding quality of the area. Leisure activities (e.g. walking, running, golf) in the areas located in close proximity (1km approximately) to the site were considered, including local green spaces, wooded areas, and waterbody amenities.

B. Community Severance & Accessibility

The assessment focuses on the degree to which the general public is able to access community services and facilities, and whether this is enabled or hindered by the proposed Project, as well as whether or not the proposed Project enhances or is detrimental to the visual amenity of the area. Also included in the assessment is the proximity of the site to educational receptors. Given that the anticipated construction workforce would not exceed 50 No. at any given time on site, the cultural integration of the workforce within the locality during remediation is not anticipated to be a factor.

C. Employment

The assessment of employment was based on the anticipated size of the workforce, the practiced norms within the construction industry, and the duration of the proposed works with respect to the Remediation Phase and the impact of these factors on direct and indirect employment opportunities locally close to the proposed Project. An analysis of impacts on employment during the Operational Phase was not undertaken as direct employment opportunities during this Phase are anticipated to be minimal and not anticipated to promote indirect employment opportunities.

D. Land Use

The assessment considered the existing and future use of land at the site of the proposed Project, and assessed the impact on the land use economic function.

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E. Economy & Tourism

This assessment considers the potential for impacts on the local and regional economy and the general economic stimulation that could result from the proposed Project's remediation and end-use operation. The local economy is defined as the town of Naas and its immediate environs. The regional economy is defined as the Greater Dublin Area (GDA) - the area encompassing the Dublin and Mid-East Regions, respectively, comprising of Dublin City and counties Dun Laoghaire-Rathdown, Fingal and South Dublin in the Dublin Region, together with the counties of Kildare, Meath and Wicklow in the Mid-East Region.

Tourism is often considered an important sector for the local and regional economy and as such, the assessment also considers potential impacts on the tourism industry.

F. Human Health

According to the Institute of Public Health in Ireland (IPH), Public Health is the science and art of promoting and protecting health and well-being, preventing ill-health and prolonging life. According to IPH, public health is population based, emphasising a collective responsibility for the health, its protection and prevention of disease. They also link public health to the underlying socio-economic and wider determinants of health within the subject society.

Health impacts are assessed via biophysical factors such as air, noise and water, as relevant. The human health aspect will primarily be addressed under other Chapters of the EIAR, mainly Air Quality, Odour and Climate, and Soils, Geology, Contaminated Land and Groundwater and Traffic and Transport as outlined and indicated within the EPA's revised (draft) Guidelines on the Information to be Contained in Environmental Impact Statements (EPA 2015). The Air Quality, Odour and Climate assessment includes a quantitative assessment of the potential air quality impacts of the proposed Project and benchmarking the results against Air Quality Standards and Guidelines formulated for the protection of human health. The Soils, Geology, Contaminated Land and Groundwater assessment includes a human health risk assessment via comparison with appropriate assessment criteria. The Traffic and Transport assessment will include an assessment of accidents and safety, pedestrian amenity and severance of the community.

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16.3 Baseline Conditions

16.3.1 Amenities and Recreation

The site is located approximately 3km north-east of Naas town centre within an extensive green belt, consisting of linear residential and commercial properties, undeveloped agricultural land as well as recreational/leisure amenity areas in the form of golf courses. This green belt possesses considerable tree coverage and shrubbery along site boundaries and within the lands of the recreational/leisure amenities, creating an extensive open landscape. The urban footprint of Naas and suburban village of Johnstown are located within 1km of the site, existing as a highly developed and concentrated area of residential, commercial, community and leisure receptors.

Information on the utilisation of golf courses close to the site is presented in Table 16.3.

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Table 16.3: Utilisation of Amenity Lands (Golf Courses) Close to the Site

Golf Courses in Close Proximity to Site. / Baseline Conditions	Palmerstown House Estate (Golf Course)	Naas Golf Club	Killeen Golf Club
Location (At closest point from site boundary)	Approx. 50m west	<50m north	Approx. 1.5km north-east
No. of Annual Users (2016)	37,000 per annum (720 users on average per week)	20,000 per annum (385 users on average per week)	20,800 per annum (400 users on average per week)
Under or Oversubscribed Membership	Under-subscribed	Under-subscribed	Under-subscribed
Exclusiveness*	Medium	Low	Low

*Exclusiveness has been determined based on the quality standard of the facility/amenity as well as the cost and obligations attached to player/club membership.

The Grand Canal, considered as a cultural asset to the local community, is located approximately 550m north-west of the site and provides the local community with an amenity site suitable for walking, running and cycling.

The Morell River (located in close proximity to the eastern boundary of the site) is a tributary of the River Liffey which is the water source for the Greater Dublin Area. This river is narrow in nature with a considerable volume and velocity of water running south to north. While in the vicinity of the site, the river is not currently suitable for recreational purposes and is not easily accessible.

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The Kerdiffstown site has been seen in a negative light for a considerable amount of time due to the historical activities at the site along with the fire event in 2011. The public knowledge of the landfill's negative history has contributed to additional negativity regarding the area that surrounds the site. The visual amenity/impact of the site is currently considered to be poor with most of the site's make up consisting of overgrown grassland, concrete dilapidated infrastructure and associated steel structures as well as a lined waste cell. Having said this, residential and commercial properties situated next to the site are sufficiently protected, sheltered or screened from the visual impact of the site by existing fencing and somewhat overgrown vegetation.

16.3.2 Community Severance and Accessibility

A significant community receptor or vital primary public service in proximity of the proposed Project is the North Leinster Ambulance Service Depot on the Monread Road in Naas. The location of this depot is on the northern fringes of Naas, 815m south-west of the site.

Further to this, there are no educational or community facilities within 1km of the site.

The receptors closest to the site are one-off residential dwellings or commercial premises that surround the site boundary.

There are currently no footways, cycleways or bridleways providing non-motorised access to the site. Access to the surrounding areas, including the golf courses and Kerdiffstown site itself, is provided by the L2005 Kerdiffstown Road, which forms the western boundary of the site. The L2005 Kerdiffstown Road links to the M7/N7 which forms the main motorway artery from Dublin across the East & Midlands region to Limerick in the south-west of Ireland. The strategic nature of this route and its proximity to Naas, Johnstown and Sallins has meant that a comprehensive network of routes has been developed around the site.

The site neither hinders nor promotes community accessibility. The main M7/N7 route acts to sever north from south, irrespective of the position of the site. It is likely that in its current state, the site acts as a disincentive for further development of land in the immediate proximity, thereby limiting community/commercial interest to this

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undeveloped land. The likelihood of further development, including the provision of new community amenities, is significantly diminished by the presence of this former landfill.

16.3.3 Employment

The preliminary findings of the 2016 Census, undertaken on the 24 April 2016, indicated that there was a growth in population of 5.6% in County Kildare between the previous census in 2011 and 2016. Similarly, to this, the electoral division of 'Naas Town, Co. Kildare' experienced a growth in population of 3.3%.

Table 16.4: Population in County Kildare, Naas & Johnstown (2016-2006)

Population for County Kildare, Naas & Johnstown			
	2016	**2011**	**2006**
County Kildare	222,504	210,312	186,335
Naas	21,597	20,713	20,044
Johnstown	173* (provisional)	179	167

*Lack of residential house building in Johnstown likely justification for no increase in population during this period.

According to the national census in 2011, County Kildare had an average unemployment rate of 17.9%, while Naas had an average unemployment rate of 15% which was below the national average of 19% at the time. This census also showed that over a quarter (26%) of those in employment worked within the 'Commerce and Trade' industry, while just 3% worked in 'Building and Construction'.

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Table 16.5: Employment in County Kildare (By Industry – 2011)

Employment by Industry in County Kildare (2011)	Daytime Working Population in County Kildare (2011)
Agriculture, Forestry and Fishing	2,828
Building and Construction	1,860
Manufacturing	10,644
Commerce and Trade	14,494
Transport and Communications	2,795
Public Administration	3,536
Professional Services	13,521
Other	6,240
Total:	55,918

The main employment centres in the area are within the urban centres of Naas and Johnstown. Commercial receptors located along the L2005 Kerdiffstown Road connecting the N7 dual-carriageway to Sallins Village also act as small scale employment centres.

16.3.4 Land-Use

At present, the land proposed for the proposed Project consists of a closed landfill, and therefore is not economically active. However, ownership of the land for the proposed Project is fragmented with a considerable number of parties being the registered owners or leaseholders.

Kildare County Council will assume ownership of relevant land folios necessary for the proposed Project's requirements through the compulsory purchase order (CPO) process (permanent). There is also a requirement for KCC to assume ownership temporarily (via temporary CPO or wayleave) in a number of areas to ensure suitable working areas, to facilitate access in order to complete the remediation works and to allow for the realignment of the L2005 Kerdiffstown Road.

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The surrounding land predominantly consists of agricultural land (open farmland and pastures) as well as local recreational amenities, specifically golf courses and local commercial enterprises such as Johnstown Garden Centre and Mike Brown Caravans. There are no land designations located near the proposed Project with the exception of the Grand Canal proposed Natural Heritage Area (pNHA) approximately 550m to the north of the proposed Project at the nearest point.

16.3.5 Economy and Tourism

County Kildare is included in Fáilte Ireland's new promotional campaign 'Ireland's Ancient East' that commenced in 2016 and which promotes tourism in the eastern region based on the ancient, viking, and medieval history of the region. Naas is uniquely placed within this context, as its Gaelic name translates to 'Nás na Ríogh' or 'Meeting Place of the Kings'. This tourism campaign is the most recent initiative for the region and is anticipated to boost the tourism industry considerably during its lifetime.

The top three attractions in County Kildare throughout the period (2009-2015) are as follows:

- Newbridge Silverware Museum of Style Icons (no fee) 350,000 visitors in 2015 (no change from data reported for 2014)
- Castletown House & Parklands (fee charging) 297,691 visitors in 2015 (18% increase in numbers since 2014)
- Irish National Stud & Japanese Gardens (fee charging) 120,138 visitors in 2015 (5% increase in numbers since 2014)

Palmerstown House Estate & Golf Course and Naas Golf Club as well as the Grand Canal were highlighted as the significant tourist attractions within the locality of Naas in the Naas Town Development Plan 2011 - 2017.

In 2015, County Kildare has approximately 214,000 overseas visitors while approximately 250,000 domestic visitors (i.e. residents in Ireland) visited the county resulting in a total visitor number of nearly half a million (domestic figure is number of visitors to counties Kildare and Carlow combined).

The key economic areas would include Naas Town Centre, Monread North Centre and Johnstown and Sallins Villages.

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16.3.6 Human Health

The primary residential and commercial receptors have been outlined in the Sections above. In addition the baseline conditions associated with Air Quality, Odour and Climate are outlined in Section 7.3, the baseline conditions associated with Noise and Vibration are outlined in Section 8.3, the baseline conditions associated with Soils, Geology, Contaminated Land and Groundwater are outlined in Section 12.3 and the baseline conditions associated with Traffic and Transport are outlined in Section 15.3 of this EIAR.

16.3.7 Summary of Prominent Receptors According to Assessment Theme

The most prominent receptors within the study area (1km radius) according to Assessment Theme are presented in Table 16.6. Refer to Figure 3.4 for the location of local residential and commercial receptors in close proximity to the proposed Project.

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Table 16.6: Summary of Sensitivity of Receptors Identified Within the Study Area According to Assessment Theme

Assessment Theme	Receptors Identified within the Study Area	Level of Sensitivity (Low; Medium; or High)
A. Amenities & Recreation	Kerdiffstown House, St. Vincent de Paul (REC001) Palmerstown House Estate (COM001) Naas Golf Club (COM017)	High Medium Medium
B. Community Severance & Accessibility	Access – non motorised users Access – motorised users Receptors on the L2005 Kerdiffstown Road North Leinster Ambulance Service Depot (Monread Road in Naas)	High High High
C. Employment	Johnstown Garden Centre (COM002) Johnstown Inn (COM003) Discount Designer Tiles and Bathrooms (COM005) Londis Distribution Centre (Vacant at Present – September 2016) (COM006) Mike Brown Caravans (COM007) Naas Industrial Estate (COM009) Globe Retail Park (COM010) The Maudlins Industrial Estate (COM011) Centra, Monread Road (COM012) Centra, Johnstown (COM004) Green Isle Foods (COM014)	Medium Medium Medium Medium Medium Medium Medium Medium Medium Medium Medium
D. Land-use	Landfill Site Surrounding Land	Low Medium
E. Economy & Tourism	Grand Canal Naas Town Centre Monread North Centre (Tesco Extra) Sallins Village Johnstown Village	High High Medium High High
F. Human Health	Naas Town Centre Johnstown Village Sallins Village Refer to Chapter 7 Air Quality, Odour and Climate Refer to Chapter 8 Noise and Vibration Refer to Chapter 12 Soils, Geology, Contaminated Land and Groundwater Refer to Chapter 14 Traffic and Transport	High High High High High High High

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16.4 Predicted Impacts

16.4.1 Remediation Phase

A. Amenities & Recreation

An increase in baseline noise levels resulting from remediation-related activities could cause disruption to users of nearby recreation and amenity areas such as Kerdiffstown House, and users of the local golf courses in close proximity to the site. Disruption could also be experienced from possible odour releases/air and dust emissions from the movement of materials on-site. There could also be impacts associated with visual amenity on receptors in the vicinity as a result of remediation works required at the site i.e. site clearance works, excavation works and, re-profiling. These impacts are addressed in detail within the specific Chapters (Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration and Chapter 9 Landscape and Visual).

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There is not anticipated to be any direct socio-economic impacts on the Grand Canal or Morell River during the Remediation Phase.

As a result of the impacts described above, the potential effects were assessed as adverse, of slight significance and are anticipated to be of short-term duration, therefore the potential effect is considered to be not significant.

B. Community Severance & Accessibility

As previously mentioned (refer to Section 16.3.2), the urban footprints of Naas and Johnstown are located within the study area (1km radius of the site boundary), forming a concentrated area of residential, commercial, leisure and community receptors. A significant community receptor (primary public service) is the North Leinster Ambulance Service Depot on the Monread Road in Naas. The location of this depot is on the northern fringes of Naas, 815m south-west of the site. Despite this concentration of economic activity and location of a primary public service, it is not anticipated that this area will be impacted during the Remediation Phase as construction-related traffic will be instructed to access the site using N7 Junction 8 (junction before Junction 9 Naas North leading directly to this area in which the North Leinster Ambulance Service Depot is located) and the L2005 Kerdiffstown Road. Construction-related traffic will be instructed to avoid entering Naas.

In addition, it is not anticipated that this area (northern fringes of Naas) will be affected by noise or visually-intrusive effects from the site during the Remediation Phase as the area has a degree of severance from the site by way of the M7/N7 dual-carriageway.

New access to the site, to include improvements to the L2005 Kerdiffstown Road to the south-east of the site, will provide safe passage for heavy goods and other vehicles accessing the site during the Remediation Phase, as well as offering protection to non-motorised users including pedestrians and cyclists through the provision of a shared footway and cycleway. The footpath and cycleway will be provided as part of the proposed Project and will link to the footbridge over the N7. The realignment of the L2005 Kerdiffstown Road is considered to be positive and of moderate significance due to the improvements around access for both motorised and non-motorised users.

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During remediation, the workforce is anticipated to be made up of skilled labourers. Given the anticipated size of the workforce during the Remediation Phase, it is anticipated that in general, workers are likely to commute to the site from their existing home addresses using public and private modes of transport, presenting no challenge to local services and no cultural integration issues.

These workers would possibly contribute to an increase in construction-related traffic in the area, although this is anticipated to be minimal given the anticipated size of the workforce on-site during the Remediation Phase.

It is noted that the Compulsory Purchase Order (CPO) requirements for the realignment of the L2005 Kerdiffstown Road during the Remediation Phase of the proposed Project have the potential to give rise to some adverse effects in terms of access to local residential (REC006, REC007, REC008 and REC012), commercial (COM007) and community (REC001) receptors. However, the appointed contractor will be required to maintain access to these properties throughout the Remediation Phase regardless of construction processes on-site, and therefore ensuring that community severance is avoided. On this basis, the impacts are considered to be of slight significance and short-term in duration.

C. Employment

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site, see Section 4.3.1 for details on the outline phasing of the works. Remediation of the site will generate new jobs, (i.e. appointed contractors directly employing workers to undertake the necessary works on-site) along with the potential for indirect/induced employment opportunities within the local areas of Johnstown, Sallins and Naas.

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Due to the nature of the works during the Remediation Phase, it is anticipated that the number of workers at the site would be kept as low as possible. It was therefore assumed that there would be a maximum of 50 full time equivalent (FTE) construction workers at the site at any one time. The 50 FTE construction jobs are anticipated to be procured by an appointed contractor who would be awarded the remediation works contract through the appropriate tendering process, which is yet to be undertaken. The construction workforce for the proposed Project is largely anticipated to commute into the area with the expectation that there will be an increased demand for services for such items as construction materials, convenience shopping, food and drink business and accommodation locally.

In addition, given the proximity of the site to the urban settlements of Johnstown, Sallins and Naas, and the strong likelihood that the construction workforce is anticipated to consume goods and services from convenience stores, local retailers and avail of some recreational amenities, the consumer demand from the construction workforce is anticipated to facilitate some indirect and induced employment opportunities within these areas.

As a result of the impacts described above and the potential employment opportunities that the proposed Project would bring to the local area, the potential effects are assessed as positive, of moderate significance and are anticipated to be of short-term duration. Therefore, the potential effect overall is considered to be a positive significant effect.

The employment (commercial) receptors in the immediate proximity of the site face the potential of some temporary disruption from noise, air (dust and odour), visual intrusion and traffic-related issues during the Remediation Phase from the anticipated activities on-site (i.e. earth-moving and removal of vegetation/shrubbery) and off-site in relation to construction related traffic and improvements to the L2005 Kerdiffstown Road as well as the new site access. Such potential effects are assessed as negative, of slight significance and anticipated to be of short-term duration.

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D. Land Use

Currently the site is not economically active, as it is a former landfill site and therefore generates no revenue. There would therefore be no loss of economically active land use during remediation. The land is considered to have limited development potential due to the ongoing future need for environmental controls (i.e. leachate and landfill gas management and future settlement of the waste materials).

Remediation would impact upon the land use of various areas of land adjoining the present site boundary. It is anticipated that sections of land will be subject to a temporary CPO process in order to ensure the ability to undertake appropriate remediation works, namely, construction of the surface water drainage swale and surface water outfall connection to the Morell River. This land will be returned to its prior state following the completion of necessary works.

In addition to this, further land is anticipated to be subject to a permanent CPO process. This includes three residential dwellings REC010, REC011 and REC016, which would be demolished and become part of the site that is subject to the proposed Project. This additional land is required as a result of the planned final end-use of the site, including the Landfill Infrastructure Compound as well as the new junction and improvements to the L2005 Kerdiffstown Road to better serve the site during the Remediation and Operational Phases.

For the properties (REC006, REC007 and REC008) along the L2005 Kerdiffstown Road, there will be some loss of land and loss of front boundary vegetation to accommodate the realignment of the road (through a temporary CPO process). As part of the CPO process KCC will engage with the residents regarding appropriate fencing and screening along the realigned road at these properties to ensure the privacy of the residences during the Remediation Phase. It is anticipated that this may be undertaken by the erection of some form of additional wall or fencing and vegetative screening that would be agreed with the landowners in advance of the remediation works commencing.

As a result of the impacts described above it is considered that the overall potential impacts are assessed as negative, of slight significance and are anticipated to be of short-term duration (land subject to temporary CPO

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process) and permanent duration (land permanently acquired under the CPO process). The potential effect overall is considered to be not significant.

E. Economy & Tourism

As outlined in 'C. Employment', the Remediation Phase of the proposed Project is expected to create a maximum of 50 full-time equivalent (FTE) construction jobs. Increased local and regional economic activity is expected to occur when the number of employed people increases in an economy. Such an increase in economic activity is likely to be realised more locally as money is likely to be spent in greater quantities closer to sources of new employment rather than elsewhere. On-site activity is anticipated to stimulate these economies by creating, not only direct employment opportunities, but also indirect employment opportunities as well from the increased economic spending and consumption within the locality during the Remediation Phase. In addition, the remediated site will help to promote a positive image of the local area, further encouraging economic activity and development in the area.

As a result of the impacts described that the proposed Project would bring to the local area, the overall potential effects are assessed as positive, of moderate significance and are anticipated to be of short-term duration.

F. Human Health

In a broad sense, public health within the local community, and to some degree the regional community, is expected to benefit considerably from the proposed Project, which is in effect, replacing a disused, brownfield, landfill with a recreational amenity in the form of a multi-use public park fit for recreational use by those communities in a variety of ways.

During the remediation of the site however it is expected that some construction activities and processes will hold some negative effects to wider public health concerns, primarily in regard to air quality and odour; soils, geology, contaminated land, and groundwater; traffic and transport; surface water and noise and vibration.

In terms of air quality and odour, the primary concerns in respect to potential impacts on public health are dust/particulate matter emissions and odour. Further details on these potential impacts are made account of in Section 7.4.1 of Chapter 7 Air Quality, Odour and Climate.

Noise and vibration, while not necessarily an obvious concern in terms of public health, excessive levels can result deficiencies in hearing and sleeping patterns. It can also contribute to hypertension, heart disease, and generally annoyance. All of these effects can assist in the deterioration of an individual's personal health and well-being. Potential impacts in regard to noise and vibration effects of the Remediation Phase of the proposed Project are detailed in Section 8.4.1 of Chapter 8 Noise and Vibration.

The potential impacts on public health from environmental effects associated with the soils, geology, groundwater as well as any potential contaminated land located at the site is a primary concern. Details of the potential impact in respect to this area are detailed in Section 12.4.3 of Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Likely to be the most "visible" potential impact of the Remediation Phase, as well as the one which may give a higher perception of disruption, is the potential impacts brought by the traffic and transportation requirements of the Remediation Phase for the proposed Project. Potential effects from traffic and transport include concerns relating to accidents and safety; driver delays; fear, intimidation, and pedestrian amenity/delay; and severance. Further details of such potential impacts are made in Section 14.4.1, Chapter 14 Traffic and Transport.

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16.4.2 Significance of Effects during Remediation

A summary of the effects during the Remediation Phase of the development is presented in Table 16.7.

Table 16.7: Significance of Effects During the Remediation Phase

Receptor	Receptor Description	Quality of Effects	Significance	Duration
A. Amenities & Recreation	Amenities include local golf courses and the Kerdiffstown House	Adverse effects (noise, odour and visual impacts)	Slight	Short-term
B. Community Severance & Accessibility	Community facilities and services – including North Leinster Ambulance Service Depot (Monread Road in Naas)	No effect	Neutral	Neutral
	Receptors on the L2005 Kerdiffstown Road	Access to properties during the realignment of the L2005 Kerdiffstown Road	Slight	Short-term
	Access – non-motorised users	Beneficial effects - Improvement works to site access from the L2005 will be completed early stages of the Remediation Phase	Moderate	Permanent
	Access – motorised users	Beneficial effects - Improvement works to site access from the L2005 will be completed early stages of the Remediation Phase	Moderate	Permanent
C. Employment	Local employment in the urban centre of Naas and the neighbouring villages of Sallins and Johnstown	Positive effects resulting from the 50 direct employment opportunities during the Remediation Phase and the impact they would have on the local economy.	Moderate	Short-term
	Local employment centres in direct proximity to the proposed Project	Adverse effects - potential for disruption from the likes of dust, odour, noise and traffic resulting from the remediation works	Slight	Short-term
D. Land-use	Landfill site	Overall neutral effect– No loss of economically active land during remediation.	Neutral	Neutral
	Surrounding lands	Slight Adverse– CPO in respect to some of the surrounding land in order to accommodate appropriate works.	Slight	Short-term & Permanent
E. Economy & Tourism	Grand Canal; Naas Town Centre; Monread North Centre (Tesco Extra); Sallins Village; Johnstown Village;	Overall positive effects - direct impacts on amenity areas neighbouring the site (noise, odour and visual impacts). However, there is greater potential for economic stimulation for the area given the economic activity brought by the construction workers and indirect employment.	Moderate	Short-term
F. **Human Health**	The remediation of the site is expected to bring with it some wider public health concerns to the local community in regard to the necessary construction activities. These concerns are primarily in respect to air quality, odour and climate; noise and vibration; soils, geology, contaminated land, and groundwater; and traffic and transport; potential impacts which are presented in further detail in Chapter 7 Air Quality, Odour and Climate; Chapter 8 Noise and Vibration; Chapter 12 Soils, Geology, Contaminated Land and Groundwater; and Chapter 14 Traffic and Transport.			

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16.4.3 Operational Phase

A. Amenities & Recreation

The final end-use of the site, once the Remediation Phase is completed, will be a multi-use public park with a variety of facilities. The amenity will include operational infrastructure such as access routes and car parking, and a Landfill Infrastructure Compound which will house landfill management infrastructure. Refer to Figure 4.20.

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The purpose of this final end-use is to ensure that the land will be proactively utilised by the local community and sports clubs for recreational and leisure purposes, rather than leaving the site as vacant grassland. The multi-use public park would also have the capacity to act as a safe and visually appealing amenity for recreational walkers and joggers as well as young families through the incorporation of various provisions and amenities throughout the site. The diverse and multi-use nature of the final end-use will ensure the longevity and usability of the site over time.

During the consultation period, the Kildare Sports Partnership highlighted their concerns over the 'lack of capacity in sporting and recreational facilities within the Greater Naas Area'. In addition to this, a Ministerial Direction (Simon Coveney T.D., Minister for Housing, Planning and Local Government) subject to the 'Sallins Local Area Plan 2016-2022' raised concerns of 'the deficiency of local community and recreational facilities relative to the needs of the town'. Sallins is situated approximately 1.25km north-west of the site, indicating the necessity for such a facility and the potential widespread use of the proposed multi-use public park once constructed.

The potential effects are assessed as positive for the wider amenity and recreational receptors of moderate significance, and are anticipated to be of medium to long-term duration. It is therefore determined that the overall potential effect, as described above, is considered significant.

B. Community Severance & Accessibility

This amenity is anticipated to help address the lack of capacity in sporting and recreational facilities in the area while also the complementing the surrounding land uses, which are predominantly green space and recreational in nature. The multi-use public park would reduce the historical stigma attached to the site while also representing the opportunity to improve access and reduce severance issues in the area through the installation of the improved motorised and non-motorised access as outlined previously in Section 16.4.1 'B – Community Severance & Accessibility'. The proposed end-use design proposes will include the provision of an on-line pedestrian and cyclist access path from the L2005 Kerdiffstown Road, between the site and the pedestrian bridge over the M7/N7 dual-carriageway, bringing ease of access to the site from the communities of Johnstown, Kill and Naas.

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The potential effects are assessed as positive, of moderate significance and are anticipated to have a medium to long-term duration. Such potential effects are considered to be significant.

The potential effects for the North Leinster Ambulance Service Depot (Monread Road in Naas) are considered to be neutral for the Operational Phase.

C. Employment

Employment during Operational Phase is anticipated to be limited to a KCC Site Manager role responsible for the ongoing management of the landfill infrastructure and park maintenance workers to manage refuse and landscaping. Overall, there are not expected to be significant levels of employment directly generated by the proposed Project during the Operational Phase.

Having said this, some level of induced employment is anticipated to be created in local convenience and commercial businesses by the economic activity anticipated by from the users of the multi-use public park during the Operational Phase.

As a result of the impacts described above, the potential effects are assessed as positive, of slight significance and are anticipated to be of medium to long-term duration. In this context, the potential effect overall is considered to be not significant.

D. Land Use

In its current state, the land use of the site generates no revenue and thus provides no economic benefit. Converting this land to a recreational facility therefore delivers a clear improvement in the economic performance of the land.

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Based on the population data provided in Table 16.4 and the written submissions from Kildare Sports Partnership, using both as a best estimation for a baseline, it is reasonable to consider that a considerable number of individuals would visit the multi-use public park for recreational purposes considering that the main attractions in terms of visitor numbers would be the sporting facilities and separate area for young families.

For the properties (REC006, REC007 and REC008) along the L2005 Kerdiffstown Road, there will have been some loss of land and loss of front boundary vegetation to accommodate the realignment of the road (via a temporary CPO process). It is proposed that a new stonewall or fencing of 2m in height shall be erected along these properties. Semi-mature tree and shrub planting will also be provided to the inside of the wall for additional screening and amenity purposes. These mitigation measures would be implemented in consultation with the property owners in question.

Operational Management Plans and regular maintenance schedules will be put in place to manage and maintain the site and approaches to the proposed Project on an ongoing basis during the Operational Phase, therefore minimising any potential negative impacts of the proposed multi-use public park.

In terms of land use, it is generally considered that the potential effects are positive, of moderate significance and are anticipated to have a medium to long-term duration. The potential effect overall is determined to be significant.

E. Economy & Tourism

The successful remediation and establishment of a multi-use public park would present an investment in the local community and available services/facilities as part thereof. It is likely to encourage additional community activity in the area which may translate to additional economic activity in the local economy. Given the strategic location of the site in relation to the M7/N7 dual-carriageway corridor, the proposed Project is well positioned to deliver benefits to local economic and tourism interests. Although the site itself may not be an attraction that would increase local visitor numbers directly, it will add to the local tourism offering (connectivity to local greenways and walk/cycle routes), thereby supporting the regional tourism strategy, 'Ireland's Ancient East'.

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It would be anticipated that the creation of additional greenspace would result in indirect economic benefits for the region, such as improving the image of the local area, new business start-ups and private investment.

However, the economic development of the area surrounding the former landfill is reliant on other external factors and cannot be directly attributed to the successful remediation and creation of the proposed Project. As a result, the impacts are assessed as positive, of slight significance and are anticipated to have a medium to long-term duration. Within this context, the overall potential effects of the Operational Phase on Economy and Tourism are determined to be not significant.

F. Human Health

As stated above under 'E - Economy and Tourism', the establishment of a multi-use public park would present an investment in the local community and services/facilities. Such provision is likely to provide considerable beneficial effects to public health in terms of positive physical and mental well-being from additional visual amenity, community facilities and greenspace that will be created as a result of the multi-use public park. Aside from its visual presentation as amenity parkland, the site will have operational obligations in terms of the continuous management processes which will continue during the Operational Phase. The site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase). Potential impacts of this Operational Phase on public health are possible and summarised below.

Potential air quality and odour impacts associated with the Operational Phase of the proposed Project will primarily be associated with the landfill gas management system however these are not expected to be significant. Details of the potential impacts associated with this management system are presented in Chapter 7 Air Quality, Odour and Climate.

Noise and vibration are anticipated to be minimal during the Operational Phase of the proposed Project. Noise emissions associated with the amenity users will be similar to any town park and are not considered significant.

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Details of such noise and vibration emissions are assessed within Section 8.4.2 of Chapter 8 Noise and Vibration.

As stated previously, during the Operational Phase, areas of the site will become available for public amenity use as the pathways between contaminated material in the waste (source) and public health (receptors) will have been removed through the provision of a barrier between the waste and site end users. Further details on this subject are provided within Section 12.4.4 of Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Traffic levels will reduce significantly during the Operational Phase once vehicle movements associated with the remediation works cease. Improved route access for motor vehicles, pedestrians and cyclists as a result of the realignment and new access junction to the site from the L2005 Kerdiffstown Road will provide greater safety for all users, and by extension contributing to a beneficial effect in terms of human or public health. Further details of such potential impacts are provided in Chapter 14 Traffic and Transport.

16.4.4 Significance of Effects during Operation

Table 16.8 below presents a summary of the effects during the Operational Phase of the proposed Project.

Table 16.8: Significance of Effects during Operation

Receptor	Receptor Description	Quality of Effects	Significance	Duration
A. Amenities & Recreation	Amenities include local golf courses and Kerdiffstown House	Positive effect - Amenities neighbouring the site will experience an improvement as a result of the roll-out of the Operational Phase of the project (multi-use public park) as these amenities will no longer be located next to a dis-used, brownfield site as is currently the case.	Moderate	Medium to Long-term
B. Community Severance & Accessibility	Community facilities and services – including North Leinster Ambulance Service Depot (Monread Road in Naas	No effect	Neutral	N/A
	Receptors on the L2005 Kerdiffstown Road	Positive – Improved motorised and non-motorised access in the vicinity of these properties	Moderate	Permanent
	Access – non-motorised users	Positive effect – Access for non-motorised users would be greatly improved with the creation of an off-line pedestrian access from Kerdiffstown House (REC001) and the M7/N7 pedestrian overbridge. There will also be the continuation of the pedestrian services (path and cycleway) associated with the L2005 Kerdiffstown Road from its present point up to the proposed realigned junction entrance to the site.	Moderate	Permanent
	Access – motorised users	Positive effect – Motorised access to the site would be improved as a result of the proposed redesigned and realigned junction entrance to the site and L2005 Kerdiffstown Road as well as the new provision of vehicle parking for use during the Operational Phase.	Moderate	Permanent
C. Employment	Local employment in the urban centre of Naas and the neighbouring communities of Sallins and Johnstown and including employment receptors in the vicinity of the proposed Project	Positive effect - Employment during operation is anticipated to be limited to a low number of site management roles, including the management of any ongoing maintenance operations (a maximum of 2-3 persons). Induced employment for some of the employment centres is anticipated to be created by the economic activity associated with the users of the multi-use public park during the Operational Phase.	Slight	Medium to Long-term

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Receptor	Receptor Description	Quality of Effects	Significance	Duration
D. Land-use	Landfill site	Positive effect - Land-use of the site will be improved as it will be transformed from a brownfield, disused landfill to a multi-use public park and could encourage further future development of the surrounding area.	Moderate	Medium to Long-term
	Surrounding lands			
E. Economy & Tourism	Grand Canal; Naas Town Centre; Monread North Centre (Tesco Extra); Sallins Village; Johnstown Village;	The Operational Phase has the potential to encourage economic development in the area surrounding the site, which would provide new businesses and enterprises, resulting in a boost for the local economy while the operation of the site would improve the diversity of the local tourism offer	Slight	Medium to Long-term
F. Human Health	The Operational Phase of the proposed Project is not expected to result in any significant human health concerns but to be in itself a positive contribution to the human health of the local community as the site fulfils its new purpose as an area of recreation and amenity for public use. Details on the potential impacts to human health of the Operational Phase are made account of in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration; Chapter 9 Landscape and Visual; Chapter 13 Water - Hydrology; and Chapter 14 of this EIAR.			

16.4.5 Summary of Human Health Impacts

A summary of potential human health effects expected during the Remediation and Operational Phases of the proposed Project are outlined in Table 16.9.

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Table 16.9: Summary of Human Health Impacts

Human Health Topic	Remediation Phase Impacts	Operational Phase Impacts	Mitigation Proposed	Conclusion for Human Health	Traffic Light Indication
Air Quality and Odour **Chapter 7** **Baseline - Section 7.3** **Potential Impacts – Section 7.4** **Mitigation Measures - Section 7.5**	Air Quality and Odour impacts on Human Health during the Remediation Phase are as follows: • Dust emissions as a result of required construction-related activities; • Release of odour and pollutant gases such as PM_{10}, $PM_{2.5}$, CO, SO_2, NO_2, and NO_X as a result of construction-related activities and movement of existing landfill waste as well as the operation of the Landfill Gas Flare (LFG) flare located on site throughout the Remediation Phase; and,	Air Quality and Odour impacts on Human Health during the Operational Phase are as follows: • Release of odour and pollutant gases such as PM_{10}, $PM_{2.5}$, CO, SO_2, NO_2, and NO_X as a result of the operation of the site as part of the final end-use design.	Air Quality and Odour mitigation measures are proposed including: Remediation Phase: • A Construction Environmental Management Plan (CEMP) developed before the commencement of the Remediation Phase will contain a Dust Management Plan to ensure that dust emissions do not cause significant nuisance for receptors in the vicinity of the site. In addition, the appointed contractor for the remediation works will be assigned with overall responsibility for Dust Management reporting back to the KCC Site Manager. • The design and in particular the phasing of the Remediation Phase considers dust impact management and chooses design approaches that will minimise dust emissions resulting in the potential for significant simultaneous dust generation to be reduced. • A dust monitoring programme will be implemented on site. • The CEMP will also include an Odour Management Plan which outlines the minimisation of odour at the site through best practice and regular monitoring. Odour derived from existing landfill waste located on site will also be minimised through the implementation of a phased approach to earthworks involving waste. • The release of pollutant gases is already mitigation through the existing LFG flare located on site. The flare will be monitored to ensure it is balanced and optimised to maximise gas collection from installed gas wells and flaring according to operational recommendations. Operational Phase: • The principle mitigation measures proposed for the Operational Phase of the proposed Project are the comprehensive proposals for the management of LFG at the proposed multi-use public park. LFG will be actively and passively managed by a means of an extensive network of extraction wells which will be diverted to a new purpose-built Landfill Infrastructure Compound and by perimeter gas venting trenches. This flare will convert the LFG into harmless substances.	Potential Air Quality and Odour effects of the Construction and Operational phase of the KLRP as assessed and reported in this EIAR have been modelled within an automatic Dispersion Model that is in accordance with US EPA AERMOD modelling suite and benchmarked against national Air Quality Standards and Guidelines for the protection of human health, amenity and the environment. Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from air quality and odour.	
Noise and Vibration **Chapter 8** **Baseline - Section 8.3** **Potential Impacts – Section 8.4** **Mitigation Measures - Section 8.5**	Noise and Vibration impacts on Human Health during the Remediation Phase are as follows: • Potential for noise emissions and vibration as a result of required construction-related activities and traffic on and off site. • Potential for noise emissions and vibration as a result of the construction and operation of the landfill management infrastructure.	Noise and Vibration impacts on Human Health during the Operational Phase are as follows: • Potential for noise emissions associated with amenity users. • Potential for noise emissions as a result of the operation of the landfill management infrastructure	Noise and Vibration mitigation measures are proposed including: Remediation Phase: • A CEMP developed before the commencement of the Remediation Phase will contain a Noise and Vibration Management Plan to ensure that noise emissions and vibration do not cause significant nuisance for receptors in the vicinity of the site. In addition, on–site work practices will be implemented to ensure that noise and vibration are minimised further. • The Remediation Phase will be undertaken in phases to assist in the minimisation of noise and vibration effects. • Acoustic screens and barriers shall also be used in certain locations where noise sensitive receptors are situated. • On-site noise monitoring during the Remediation Phase will also be undertaken. Operational Phase: • Not applicable.	Potential Noise and Vibration effects of the Remediation and Operational Phases of the KLRP as reported in this EIAR have been assessed in accordance with *ISO 1996 (2007): Acoustics – Description and Measurement of Environmental Noise Part 2 Determination of Environmental Noise Levels* and with reference to the EPA's publication *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).* Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from noise and vibration.	

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Human Health Topic	Remediation Phase Impacts	Operational Phase Impacts	Mitigation Proposed	Conclusion for Human Health	Traffic Light Indication
Soils, Geology, Contaminated Land, & Groundwater **Baseline - Section 12.3** **Potential Impacts – Section 12.4** **Mitigation Measures - Section 12.5**	Soils, Geology, Contaminated Land and Groundwater impacts on Human Health during the Remediation Phase are as follows: • As works are undertaken, contaminated material in waste has the potential to come into contact with construction workers undertaking the work and affect human health. This could be from direct contact, ingestion, or inhalation. • During the re-profiling of the site, specifically in Zone 1, there is the potential that perched leachate horizons are encountered which may lead to the release of leachate. If released in sufficient quantities, this leachate then has the potential to migrate to receptors such as the Morell River or soak into the ground outside of the landfill leading to local contamination and therefore posing potential risk to human health.	Soils, Geology, Contaminated Land and Groundwater impacts on Human Health during the Operational Phase are as follows: • As the site will become available for public amenity use as the pathways between contaminated material in the waste (source) and human health (receptors) by direct contact, ingestion, and inhalation (pathways) will have been removed through provision of a barrier between the waste and site end users.	Mitigation measures regarding Soils, Geology, Contaminated Land and Groundwater are proposed including: Remediation Phase: • A CEMP developed before the commencement of the Remediation Phase will contain a Landfill Gas Management Plan to ensure that LFG emissions and gas do not raise to critical levels nor cause significant nuisance for receptors in the vicinity of the site. In addition, perimeter boreholes would be installed before remediation activities commence to ensure appropriate gas, soil, and groundwater monitoring can take place. Operational Phase: • Groundwater and gas monitoring will be agreed with the EPA and will be specified in the Industrial Emissions Activities Licence (IEAL) for the site.	As public access to the site is restricted during the Remediation Phase, those coming onto contact with contaminated material would be site workers (including security staff). However, these workers are aware of the risks and working practices to prevent contact with the wastes. In addition, additional mitigation would be put in place to remove any potential impact on human health from LFG. The Operational Phase will result in the removal of potential impacts from LFG and waste as engineered measures (i.e. waste capping, flares, etc.) will be implemented to remove potential risks. Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from soils, geology, contaminated land and groundwater.	
Traffic and Transport **Baseline - Section 14.3** **Potential Impacts – Section 14.4** **Mitigation Measures - Section 14.5**	Traffic and Transport impacts on Human Health during the Remediation Phase are as follows: • Additional traffic volumes (and associated air quality emissions/ issues) associated with the remediation activities, primarily HGV's, for the proposed Project travelling on the existing road network. • Traffic volume, composition and speeds, in combination with pedestrian footways and crossing would contribute to unpleasantness, fear, intimidation and delay experienced by pedestrians and other vulnerable road users.	Traffic and Transport impacts on Human Health during the Operational Phase are as follows: • Traffic volumes (and associated air quality emissions/ issues) associated with the Operational Phase of the site are expected to be minimal and so do not pose any significant impacts.	Mitigation measures regarding Traffic and Transport are proposed as follows: Remediation Phase: • Prior to the commencement of the Remediation Phase, a Construction Traffic Management Plan (CTMP) will be implemented. The CTMP will be used as a consultation document for regular engagement and consultation with the Community Liaison Group throughout the Remediation Phase. Operational Phase: • Not applicable.	The Remediation Phase of the proposed Project is not expected to have potential significant effects on Human Health in respect to traffic and transport. This is due to the implementation of appropriate mitigation measures as well as the proposed improvements to the site access road and site access junction with the L2005 Kerdiffstown Road. The Operational Phase is also not anticipated to bring potential significant effects on Human Health given that the site will be a functioning recreational/leisure amenity that will not require excessive vehicular (including HGV) traffic flows. This Phase will also bring about benefits in terms of improved pedestrian access in the area around the site. Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from Traffic and Transport.	
Surface Water – Hydrology **Baseline Section 13.4** **Potential Impacts Section 13.5** **Mitigation Measures Section 13.6**	Hydrological impacts on Human Health during the Remediation Phase are as follows: • Potential for pollution of surface water features due to sediment loading and associated anthropogenic polluting substances entering watercourses as a result of surface water run-off that could be contaminated by waste material and/or spills on-site and/or groundwater influx. Human health could be impacted if individuals interact with such waterbodies.	Hydrological impacts on Human Health during the Operational Phase are as follows: • Potential pollution of surface water will be removed as appropriate engineered measures are considered part of the capping design that will remove the potential for contamination.	Mitigation measures regarding Hydrology are proposed as follows: Remediation Phase: • Provision of measures to prevent the release of sediment concentrations to surface water features during the construction works. • Provision of exclusion zones and barriers (sediment fences) between earthwork stockpiles and temporary surfaces and watercourses to prevent sediment washing into watercourses. • The Remediation Phase may allow the infiltration of rainfall to the waste and encourage contaminated runoff. This will be control through the use of appropriate site and waste management measures.	Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from hydrological effects of the proposed Project.	
Recreational Amenity **Figure 4.20**	Not applicable – the site, in its existing state, is not suitable for recreational use and nor will it be available to the local community for recreational use during the Remediation Phase due to remediation activities.	Recreational amenity will be significantly improved as a result of the Operational Phase of the proposed Project as the final end-use of the site will be a multi-use public park. This amenity will incorporate the following facilities: • Changing Rooms/WC • Sports Pitches; • Playground Area; • Walking tracks; and • Green Space and appropriate landscaping	Mitigation measures for recreation amenity are not applicable as the Operational Phase of the proposed Project is in itself mitigation for the site as a whole.	With the nature and function of the site during the Operational Phase, it is anticipated that there will be significant positive human health impacts in terms of recreational amenity.	
Promoting Active Travel/ Healthy Lifestyle	The Remediation Phase will include improvements to realign the L2005 Kerdiffstown Road and the provision of new cycleways and footways along this route to provide a safer passageway for VRU during the Remediation Phase.	The improvements to the L2005 Kerdiffstown Road and the provision of new cycleways and footways during the Remediation Phase will already exist and will improve access and usability of the site during the Operational Phase.	Mitigation measures for Active Travel are not applicable as the facilitation of improved motorised and VRU access of the proposed Project is in itself mitigation for the Project as a whole.	With the nature and function of the site during the Operational Phase, it is anticipated that there will be significant positive human health impacts in terms of promoting Active Travel.	

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16.5 Mitigation Measures

16.5.1 Remediation Phase

The proposed mitigation measures during the Remediation Phase for each assessment theme is summarised below. Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP). The CEMP shall contain the mitigation measures identified in the following sections and ensure that they are fully implemented during the Remediation Phase, to prevent or reduce the impacts identified in the impact assessment:

A. Amenities & Recreation

- During the Remediation Phase of the proposed Project, mitigation as detailed in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration and Chapter 9 Landscape and Visual will be implemented. This shall include the development of a CEMP by the appointed contractor. Full details of Remediation Phase mitigation measures are detailed in Chapter 19 Schedule of Environmental Commitments.
- The Kildare County Council Project Team with the appointed contractor will continue to communicate with the local residents, including the Community Liaison Group, as well as local recreation providers/local community. These communication channels will allow local groups to keep future visitors up to date on the proposed Project as well as providing an avenue to raise concerns or issues during this Phase of the project.

B. Community Severance & Accessibility

- The appointed contractor will be required to maintain access to residential and commercial properties throughout the Remediation Phase.

C. Employment

- The potential employment opportunities associated with the Remediation Phase are positive impacts, albeit in the short-term. These impacts require no mitigation.
- In relation to employment centres in direct proximity of the site, a CEMP shall be developed by the appointed contractor which shall implement appropriate measures to minimise impacts from Remediation Phase works (directly on site and in the realignment of the L2005 Kerdiffstown Road).

D. Land-Use

- Access to areas subject to the temporary CPO process will be maintained throughout the Remediation Phase to ensure severance and community access issues are not a factor. Areas subject to the temporary CPO process will also be returned to their approximate previous state after necessary works are completed.
- For the properties (REC006, REC007 and REC008), KCC will engage with the residents regarding appropriate fencing and screening along the realigned road at these properties to ensure the privacy of the residences during the Remediation Phase. This shall be undertaken by the erection of some form of additional wall or fencing and vegetative screening that would be agreed with the landowners in advance of the remediation works commencing.

E. Economy & Tourism

- During the Remediation Phase the proposed Project shall look to procure material and services from local providers, where reasonably practicable, and within the requirements of the procurement process. This would encourage additional economic activity in the local economy which may subsequently result in indirect employment opportunities being created.

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16.5.2 Operational Phase

During the Operational Phase the creation of a multi-use public park will bring the site from its currently inactive economic state into productive land use and will provide a recreational/leisure area for the local and regional population. It has therefore been considered that the provision of a multi-use public park is satisfactory mitigation for the proposed Project in its entirety in regard to the population and human health (socio-economics) assessment.

In relation to Land Use, for the properties (REC006, REC007 and REC008) along the L2005 Kerdiffstown Road, a new wall or fencing shall be erected along these properties. Semi-mature tree and shrub planting may also be provided to the inside of the wall for additional screening and amenity purposes. These mitigation measures shall be implemented in consultation with the property owners in question.

Operational Management Plans and regular maintenance schedules will be put in place to manage and maintain the site and approaches to the proposed Project on an ongoing basis during the Operational Phase, minimising any potential negative impacts of the proposed multi-use public park.

16.5.3 Opportunities for Future Enhancement

Details on the proposed Project outline design and the features currently proposed are provided in Chapter 4 Description of the Proposed Project. Detailed below is an outline of potential future enhancements which could be considered, at a later date, for the multi-use public park in the future, to further enhance the proposed Project and provide the site with the greatest sense of utility so far as practicable.

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A. Amenities & Recreation

- The provision of a park centre or community centre could enhance the social experience of the public park by providing a space for community, educational or leisure activities.
- Annual Council-sponsored community activities/event days for families with young children would encourage active participation, knowledge and utility of the site over the long-term.
- Provision of designated areas for alternative recreational activities (Dog area, BMX/Skateboard Park, Outdoor Cinema, etc.) would further extend the services/facilities offered on-site.

B. Community Severance & Accessibility

- The proposed Project could be designated as a centre for recreation or sporting activities with links to other areas in the locality to promote more sustainable transport and lifestyle in the area. Locally there is the Dublin-Sallins-Naas Greenway along the Grand Canal and the Dublin Road Greenway within the urban centre of Naas that could link in with the proposed Project to promote and encourage sustainable living in the Naas area.

C. Employment

- Leisure related commercial businesses (i.e. group fitness classes) could be encouraged and promoted as a result of appropriate facilities located on-site.

D. Land Use

- None required (the conversation of a former landfill to a recreation facility or amenity provides an overall improvement in the land use).

E. Economy & Tourism

- None required (the establishment of a multi-use public park would present an investment in the local community and available services/facilities as part thereof. It is likely to encourage additional community activity in the area which may translate to additional economic activity in the local economy).

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16.6 Residual Impacts

The residual impacts (impacts of the proposed Project that will remain despite the implementation of mitigation measures) of the Remediation Phase are set out in Table 16.10:

Table 16.10: Residual Effects during Remediation

Assessment Theme	Receptor Description	Nature of Effect(s)	Proposed Mitigation	Residual Effects
A. Amenities & Recreation	Amenities include local golf courses, Kerdiffstown House, Grand Canal, and the Morell River	Adverse effects (noise, odour, visual impacts and communication).	Mitigation as detailed in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration and Chapter 9 Landscape and Visual. This shall include the development of a CEMP by the appointed contractor. Full details of Remediation Phase mitigation measures are detailed in Chapter 19 Schedule of Environmental Commitments Continued communication between Kildare County Council Project Team and Community Liaison Group.	Not significant (Temporary)
B. Community Severance & Accessibility	Community facilities and services	No effect.	No mitigation required - Neutral	Neutral
	Receptors on the L2005 Kerdiffstown Road	Access to properties	The appointed contractor will be required to maintain access to residential and commercial properties throughout the Remediation Phase regardless of construction processes on-site.	Not significant (Temporary)
	Access – non-motorised users	No effect - (currently no access to site for non-motorised users).	No mitigation required – Improvement works to the L2005 Kerdiffstown Road to be completed in the early stages of remediation.	Moderate Beneficial (Permanent)
	Access – motorised users	No effect – (current site access is anticipated to be maintained as main access point to site during the remediation).	No mitigation required – Improvement works to the L2005 Kerdiffstown Road to be completed in the early stages of remediation	Moderate Beneficial (Permanent)
C. Employment	Local employment in the urban centre of Naas and the neighbouring villages of Sallins and Johnstown	Beneficial effects resulting from 50 potential employment opportunities during the Remediation Phase.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance– Positive impact in relation to local employment opportunities in the local economy.
	Local employment centres in direct proximity to the proposed Project	Disruption from the likes of dust, odour, noise and traffic	A CEMP shall be developed by the appointed contractor.	Not significant (Temporary)
D. Land-use	Landfill site	No change	No mitigation required.	Neutral
	Surrounding lands	Temporary and permanent land-take required.	Access maintained during Remediation Phase and returned to previous state upon completion. Provision of fencing/screening to maintain screening for properties specified along the L2005 Kerdiffstown Road.	Not significant (Temporary)

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Assessment Theme	Receptor Description	Nature of Effect(s)	Proposed Mitigation	Residual Effects
E. Economy & Tourism	Grand Canal; Naas Town Centre; Monread North Centre (Tesco Extra); Sallins Village; Johnstown Village;	Overall positive effects - direct impacts on amenity areas neighbouring the site (noise, odour and visual impacts). However, there is greater potential for economic stimulation for the area given the economic activity brought by the construction workers and indirect employment.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance – Positive impact in relation to local economic activity in the local economy. Potential for some noise and odour impacts on recreational amenity areas are anticipated to remain.
F. Human Health	The remediation of the site is expected to bring with it some wider public health concerns to the local community in regard to the necessary construction activities. These concerns are primarily in respect to air quality and odour; noise and vibration; soils, geology, contaminated land, and groundwater; and traffic and transport; potential impacts which are presented in further detail in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration, Chapter 12 Soils, Geology, Contaminated Land and Groundwater and Chapter 14 Traffic and Transport. Mitigation measures outlined for each environmental topic are considered to be appropriate mitigation against any potential negative effects of the proposed Project on Human Health. It is within this context that the residual effect of the Remediation Phase on Human Health is assessment as having no effect.			

The residual impacts of the Operational Phase of the proposed Project are presented in Table 16.11.

Table 16.11: Residual Effects during Operation

Assessment Theme	Receptor Description	Nature of Effect(s)	Proposed Mitigation	Residual Effects
A. Amenities & Recreation	Amenities include local golf courses, Kerdiffstown House, Grand Canal, and the Morell River	Beneficial effect – Amenities neighbouring the site will experience an improvement as a result of the roll-out of the Operational Phase of the project (multi-use public park) as these amenities will no longer be located next to a dis-used, brownfield site.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance
B. Community Severance & Accessibility	Community facilities and services	No effect (currently no community facilities or services in the study area).	N/A	No effect.
	Receptors on the L2005 Kerdiffstown Road	Beneficial effect – Non-motorised and motorised access will be greatly improved.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance
	Access – non-motorised users	Beneficial effect – Non-motorised access will be greatly improved.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance
	Access – motorised users	Beneficial effect – Motorised access will be greatly improved.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance

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Assessment Theme	Receptor Description	Nature of Effect(s)	Proposed Mitigation	Residual Effects
C. Employment	Local employment in the urban centre of Naas and the neighbouring villages of Sallins and Johnstown and including employment receptors in the vicinity of the proposed Project	Beneficial effect - Employment during operation is anticipated to be limited to a low number of site management roles, including the management of ongoing remediation operations, a maximum of 2-3 persons. There is the potential from some of the employment centres to benefit from induced employment opportunities. (There is the potential for other employment opportunities in regard to the facilities that could be located on-site as part of future enhancements).	No mitigation required as effect is of a positive nature.	Positive effect of slight significance
D. Land-use	Landfill site	Beneficial effect – Site transformed from former landfill site to recreational/leisure land use.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance
	Surrounding lands	Beneficial effect - Land-use of the surrounding area will be improved as the area will have a recreational amenity which could encourage investment and development.	Generally, no mitigation required as effect is of a positive nature. However, note the provision of a stonewall and planting at the properties specified along the L2005 Kerdiffstown Road	Overall Positive effect of moderate significance
E. Economy & Tourism	Grand Canal; Naas Town Centre; Monread North Centre (Tesco Extra); Sallins Village; Johnstown Village;	Beneficial effect - The Operational Phase has the potential to encourage additional community activity in the area surrounding the site, resulting in a boost for the local economy. Beneficial effect – The Operational Phase of the proposed Project has the potential to increase the utility of the Grand Canal and neighbouring recreational amenities (i.e. golf courses).	No mitigation required as effect is of a positive nature.	Positive effect of slight significance Moderate, beneficial (significant)
F. Human Health	The Operational Phase of the proposed Project is not expected to result in any significant human health concerns but to be in itself a positive contribution to the human health of the local community as the site fulfils its new purpose as an area of recreation and amenity for public use. Details on the potential impacts to human health of the Operational Phase are made account of in Chapter 7 Air Quality and Odour, Chapter 8 Noise and Vibration, Chapter 12 Soils, Geology, Contaminated Land and Groundwater and Chapter 14 Traffic and Transport of this EIAR. It is within this context that the residual effect of the Remediation Phase on Human Health is assessment as positive and of major significance.			

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16.7 Difficulties Encountered in Compiling Information

There were no significant difficulties encountered in compiling the information contained in this Population and Human Health Chapter; however, census data (2016) is in provisional condition and is in need of revision once the appropriate data is released by the Central Statistics Office. It is not anticipated that any future revision of figures/data would result in a significant impact upon the findings of this assessment as detailed here.

16.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on the surrounding communities. These projects are discussed in the following paragraphs.

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16.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

16.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

16.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

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16.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

16.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. The impacts in respect to Population and Human Health would be additional disruption for neighbouring residential and commercial receptors in terms of dust, noise and vibration, visual amenity and traffic however appropriate and proportional mitigation measures would reduce any potential impact to be not significant. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

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16.9 References

- Central Statistics Office (2011). Census 2011 Report
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17. Material Assets

This Chapter assesses and presents the potential impacts of the proposed Project on material assets. The material assets considered as part of this assessment are residential property, major utilities and imported material.

Impacts to material assets from the proposed Project will mainly occur during remediation works, with the loss of three residential properties being the largest potential impact as it is permanent. This will be mitigated through the implementation of the Compulsory Purchase Order process and consultation with the residents. The impact to major utilities will also potentially occur during remediation works, with mitigation to be put in place to limit impacts to neighbouring properties caused by temporary losses of services such as electricity. Impacts to services will be temporary in nature during remediation, with no disruption to occur during operation. Similarly, the need to import materials for use as capping (topsoils, sub-soils, sands, clays) will have short-term negative impacts, mainly through the increased HGV movements on the local roads.

The new sewer connection to Johnstown Pumping Station from the site for the purposes of leachate and wastewater disposal, will be the only real change to the major utilities in the area caused by the proposed Project. This additional input into the public sewer system can be accommodated by the local sewer system and will be completed under agreement with Irish Water. The impact will therefore be imperceptible.

Overall, the proposed Project will greatly improve the local landscape, making the site itself into a material asset for the local community and nearby larger settlements of Naas, Sallins and Johnstown once fully operational as a multi-use public park.

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17.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") on the material assets, including existing major utilities within and around the site during the Remediation and Operational Phases.

Kerdiffstown Landfill is located in County Kildare and comprises a former quarry, landfill and waste processing facility. The site has been progressively backfilled with wastes since the 1950's until 2010. The site poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures, over-steep slopes and absence of appropriate capping to the lined cell. The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment, whilst developing the site to provide an amenity to the local community, comprising a multi-use public park (the Remediation Phase). Following the Remediation Phase, the site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase).

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 17.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

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Table 17.1: Summary of Key Activities during the Remediation and Operational Phases

Indicative Phase		Summary of Key Activities
Remediation Phase Phase 1 – Phase 8	Works to re-profile the site and construction of landfill infrastructure	• Construction of new site entrance and realignment of the L2005 Kerdiffstown Road • Demolition of 3 properties (REC010, REC011 and REC016) and concrete structures in Zone 2A, Zone 2B and Zone 4 • Installation of new foul and leachate pipeline connections to Johnstown Pumping Station • Construction of a new Landfill Infrastructure Compound • Removal of stockpiles of materials • Temporary stockpiling • Re-profiling and filling • Installation of capping systems • Installation of new or supplementary gas wells and gas venting measures • Construction, cleaning and commissioning of surface water management infrastructure • Removal of the existing flare stack in Zone 1 and the second back-up flare, commencing use of new flare stack in the new Landfill Infrastructure Compound supported by a back-up flare • Inspection and repair of concrete hardstandings in Zone 2A and Zone 2B • Removal of existing perimeter screening bund in Zone 1
	Construction of Multi-Use Public Park	• Construction of park infrastructure, including multi-use sports pitches, a building with changing rooms, public toilets and stores, car parking, a children's playground, informal trails and defined viewpoints. • Planting and landscaping • Ecological enhancement and mitigation features such as hibernacula, nesting boxes and log piles
Operational Phase	Operation of Multi-Use Public Park	• Operation of the multi-use public park • Operation and maintenance of the landfill gas management infrastructure • Operation and maintenance of the leachate management infrastructure • Operation and maintenance of the surface water management infrastructure • Environmental control and monitoring as agreed by the Environmental Protection Agency

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Details on the project background and site history can be found in Chapter 3 The Need for the Proposed Project and descriptions of the remediation and operation can be found in Chapter 4 Description of the Proposed Project.

Material assets are resources that are valued and intrinsic to the site of the proposed Project and the surrounding area.

The material assets to be considered as part of this assessment include:

- Residential property;
- Major utilities; and
- Imported material.

Other material assets which have the potential to be impacted by the proposed Project, but which are assessed in other EIAR Chapters include:

- Cultural heritage assets (Chapter 10 Archaeology, Cultural Heritage and Architectural Heritage);
- Groundwater (Chapter 12 Soils, Geology, Contaminated Land and Groundwater).
- Transport infrastructure (Chapter 14 Traffic and Transport);
- Land use (Chapter 16 Population and Human Health); and
- Social amenities (Chapter 16 Population and Human Health);

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17.2 Methodology

The potential impacts to material assets as a result of the proposed Project were assessed through a desk-based study of available information, and consultation with major utility providers as required. The methodology is consistent with relevant guidance including:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised guidelines, due to be finalised in 2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015); and
- NRA Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008).

Following a review of the EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA 2002, EPA 2015) and the revised draft Advice Notes (EPA 2003, EPA 2015) it is considered that the proposed Project falls most closely within the Project Type 32. Project Type 32 refers to '*Waste disposal installations for the incineration, chemical treatment or landfill of hazardous and non-hazardous waste*', where the former Kerdiffstown Landfill was licensed to receive non-hazardous and inert waste. The Advice Notes suggest that the primary considerations under the heading of Material Assets for this type of project are:

- Power supply;
- Road network;
- Potential for such projects affecting groundwater development in the area in the future, especially down gradient of the site; and
- Attraction of feeding birds and impact on aircraft operations.

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The impact to power supply has been assessed in this Chapter. As described above the possible impact on the road network and groundwater are addressed in Chapter 14 Traffic and Transport and Chapter 12 Soils, Geology, Contaminated Land and Groundwater respectively. With regards to attracting feeding birds, the site in its current state does not offer a food source for birds and the re-profiling works are unlikely to attract birds; however, the end-use of a multi-use public park should enhance the environment for birds once completed. The likely impact of the proposed Project on birds is included in Chapter 11 Biodiversity.

The characteristic of an impact relates to the quality, significance and duration of the impact. The definition of these impact characteristics as per the EPA Guidelines on the Information to be Contained in Environmental Impact Statements and the revised draft Guidelines (EPA 2002, EPA 2015) is provided below:

- **Quality of Impacts**
  - **Positive Impact:** A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities);
  - **Neutral Impact:** No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error; and
  - **Negative Impact:** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance).
- **Significance of Impacts**
  - **Imperceptible Impact:** An impact capable of measurement but without noticeable consequences;
  - **Slight Impact:** An impact which causes noticeable changes in the character of the environment without affecting its sensitivities;
  - **Moderate Impact:** An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends;
  - **Significant Impact:** An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment; and
  - **Profound Impact:** An impact which obliterates sensitive characteristics.

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- **Duration of Impacts**
  - **Temporary Impact:** Impact lasting for one year or less;
  - **Short-term Impact:** Impact lasting one to seven years;
  - **Medium-term Impact:** Impact lasting seven to fifteen years;
  - **Long-term Impact:** Impact lasting fifteen to sixty years; and
  - **Permanent Impact:** Impact lasting over sixty years.

17.3 Baseline Conditions

17.3.1 Study Area

The study area, the site of the proposed Project, is located in County Kildare. The site is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The site is located in close proximity to a number of residential and commercial receptors as well as being a short distance away from the larger settlements of Johnstown, Sallins and Naas. There are a number of social amenities in close proximity to the site of the proposed Project, including Kerdiffstown House owned by St. Vincent de Paul, and a number of golf courses. Access to the site is via road only, with the site entrance located on the L2005 Kerdiffstown Road, part of which has a posted vehicular weight restriction of 3 tonnes for the bridge over the main Dublin to the south-west railway line. There are no footpaths to the site. There are no European designated sites in the vicinity of the proposed Project, with the nearest being Red Bog, Kildare approximately 7.5km from the proposed Project boundary. The site sits on top of a locally important aquifer, which is moderately productive in local zones (Ll).

There is one recorded monument within the proposed Project area, namely a mound (KD019-018) that was disturbed by quarrying activity in the 1950s. This mound may have represented an early medieval settlement area. Please refer to Chapter 10 Archaeology, Cultural Heritage and Architectural Heritage for further details.

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17.3.2 Residential Properties

There are five residential properties bordering the site, three to the south (Receptors REC010, REC011 and REC039) and two to the west (Receptors REC012 and REC016). The exact locations of these properties are shown in Figure 3.4. These are all accessed via the L2005 Kerdiffstown Road.

17.3.3 Major Utilities

A number of utility providers have assets within and around the existing site including electricity, water, sewerage and telecommunications. Please refer to Figure 17.1 for an overview of the location of all current site services as laid out below.

Electricity

There are a number of overhead ESB Networks high voltage and low voltage electricity lines running adjacent to the site along the L2005 Kerdiffstown Road, as well as crossing the north of the site (Refer to Figure 17.1).

There is an existing electricity supply which supplies power to the current site infrastructure such as the site office, the existing landfill gas flares, security huts, leachate pumps and lighting. The electricity lines within the site run through above ground ducting.

There is also an ESB transformer located near the current site entrance (Refer to Figure 17.1).

Telecommunications

There is a telecommunications line which runs along the L2005 Kerdiffstown Road adjacent to the site as shown in Figure 17.1. The site office is connected into the telecommunications line.

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Water Supply

Potable water is currently supplied into the site from the existing Irish Water network. The existing potable water main into which the site is connected runs along the L2005 Kerdiffstown Road as shown in Figure 17.1.

Wastewater Services

Wastewater from the site office facilities is currently discharged to a sealed concrete tank on-site. There is currently no sewer connection from the existing site. This wastewater tank is cleaned out periodically and tankered off site to Ringsend Wastewater Treatment Plant (WWTP).

As well as the site office wastewater, the lined cell located in Zone 3 of the site includes leachate collection facilities. Leachate collects in a controlled area within the lined cell and is tankered off-site to a licenced facility, currently Ringsend WWTP (licence D0034-01) for disposal daily. Since 2011 there has been an average of 12,142 cubic metres of leachate disposed of in this manner per year, or 1,012 cubic metres per month. The amount of leachate needing to be removed during any time period is dependent on the amount of rainfall during that period.

Surface Water Drainage

The management of surface water originating from within the site is detailed in Chapter 13 Water - Hydrology. Aside from the surface water originating on the site, there is a connection from an adjacent property (REC012) into the site's surface water drainage. This connection is located near the south-west corner of the lined cell. It crosses the site boundary here and connects into the site drainage, where it joins the site generated surface water and eventually discharges into the Canal Feeder Stream.

Gas Supply

There is currently no connection to the gas network at the site.

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17.3.4 Imported Material

The site is a disused sand and gravel quarry which has been progressively back filled with waste material since the 1950s. The facility at Kerdiffstown was operated under a local authority waste permit followed by a waste licence, W0047-01, issued by the EPA in 2003, with a revised licence W0047-02 issued in 2006. The material imported largely consisted of C&D wastes and mixed municipal wastes over the years. As the site has been inactive since 2010, there has been no further importation of waste materials to the site on any meaningful scale.

17.4 Predicted Impacts

17.4.1 Remediation Phase

Residential Property

There are a number of constraints associated with the layout and siting of the proposed site entrance and the proposed Landfill Infrastructure Compound and which impact the overall land-take requirements for the proposed Project (refer to Chapter 5 Consideration of Alternatives for additional detail). Due to health and safety concerns caused by the number of bends on the L2005 Kerdiffstown Road along the extents of the site boundary, there are limitations on the options for the layout and siting of the proposed site access in order to maintain a safe line of sight for vehicles accessing and exiting the proposed Project. A roundabout has been proposed rather than a smaller footprint priority junction in order to minimise congestion at the site entrance and negate the need for HGVs to cross the road when entering or exiting the site. The proposed site entrance location minimises the impacts of the bend to the west and achieves the best possible forward visibility on all approaches to the junction.

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For the location of the Landfill Infrastructure Compound, there are a number of considerations constraining the proposed location. Firstly, due to the sensitive equipment to be housed within (leachate piping and tanks) it must be constructed in an area with suitable, stable ground conditions. This necessitates construction in an area which is not on top of any waste body. Secondly, there is the requirement for vehicles, including HGVs, to be able to access the compound over the lifecycle of the site. Situating it near the site entrance and on a separate road from the rest of the internal road network keeps this additional traffic separate from public areas during the Operational Phase.

As a result of the above constraints, the land-take for the proposed Project will involve the demolition of two of the properties located at the southern boundary of the proposed Project. Property KE41129F (Receptor REC011) is located within the area required for the new site entrance roundabout. Similarly, property KE9594N (Receptor REC010) will need to be demolished in order to allow for the implementation of security and screening measures for the Landfill Infrastructure Compound.

In addition to the above two properties, there is also the need to acquire and demolish property KE9592N (Receptor REC016) in order to allow for the installation of a third multi-use sports pitch. The need for this third sports pitch was identified by Kildare County Council (KCC) based on submissions from numerous parties, with these lands being the only space available to do this. As waste also extends to and over the boundary of the property, this land is also required to facilitate the remediation and to provide access for maintenance of the pond in the north-west corner of the site.

As well as the demolition of the properties, there will also be some lands required in order to allow for the realignment of the L2005 Kerdiffstown Road and other project features. This includes strips of land from a series of properties located along the road, as well some parts of the grounds of Kerdiffstown House. There will also be the need to decommission the septic tank in the grounds of REC039 in order to allow for the Landfill Infrastructure Compound to be constructed.

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The properties are shown in Figure 3.4. As the three residential properties will be demolished entirely, the impact will be negative, profound and permanent.

Major Utilities

There is the potential for temporary impacts to utility supplies during the remediation works. This would occur where there is a need to relocate existing utility lines or to shut off services during works. In the absence of mitigation, impacts on services would be profound as services would no longer be functioning.

Electricity

It is envisaged that during remediation works electricity will continue to be supplied from the existing site connection, with the current site offices location continuing to be used as a site compound during the remediation works. In the event that a connection to the existing electricity network is not possible at any point during remediation works, diesel generators will be utilised to provide electricity.

The realignment of the L2005 Kerdiffstown Road will likely result in the need to move the electricity poles which follow the road. Movement of these will result in temporary disruption of electricity supply to neighbouring properties.

It may be necessary to upgrade the transformer located near the site entrance as part of the remediation works. The need for this will be based on the loading required by the infrastructure within the completed end-use, namely the site compound, pumps, blowers, lighting and changing facility. Should an upgrade be required, there may be temporary disruptions to electricity supply at the proposed Project and potentially some temporary disruption to neighbouring properties.

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Telecommunications

Similar to electricity supply, it is envisaged that during remediation works telecommunications will continue to be supplied from the existing above ground site connection, with the current site office location continuing to be used as a site compound during the remediation works.

As is the case with the electricity supply, the realignment of the existing L2005 Kerdiffstown Road will likely result in the need to move the telecommunication poles which follow the road. Movement of these will result in temporary disruption of service to neighbouring properties.

Water Supply

A water supply would be required on-site during the Remediation Phase of the proposed Project. The existing underground connection into the Irish Water network would be utilised to supply potable water to the site compound during remediation works.

In addition to the supply required by the proposed Project, there will also likely be the need to divert and reposition the watermain which follows the L2005 Kerdiffstown Road in order to allow for the construction of the new road layout and site entrance. There is also a watermain which crosses the field to the south-east of the site (KE6338F). This watermain is in close proximity to the planned new sewer lines to be constructed for leachate and effluent disposal from the proposed Project. This will require a diversion of the watermain at the time of the works. Watermain diversions will result in temporary disruptions to the water supply to the properties in the area.

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Wastewater Services

A new sewer connection will be installed in the Remediation Phase to facilitate off-site disposal of leachate to Johnstown Pumping Station. From there it will discharge to the local public sewer network for subsequent treatment at Osberstown WWTP. Another sewer connection will also be installed to Johnstown Pumping Station for future connection to the new site office (in the Landfill Infrastructure Compound) and the changing rooms (for use in the Operational Phase).

Where additional site cabins and welfare facilities are required that cannot be connected to the existing infrastructure modular septic tanks will be utilised, with regular cleaning and removal from site as necessary.

Surface Water Drainage

As part of the remediation works the current surface water connection from the adjacent property (REC012) into the site will be redirected so as to stop external surface water entering the proposed Project drainage network. Realignment of this surface water connection around the boundary of the proposed Project will need to be undertaken, allowing it to be reconnected to the existing discharge via a new drainage pipe.

Gas Supply

There would be no gas supply required as part of the remediation works.

Imported Material

A description of the materials likely to be used during the remediation works is provided in Chapter 4 Description of the Proposed Project. As part of the remediation works material will be required to act as fill for re-profiling, and as capping material. It is anticipated that approximately 130,000m^3 of imported material will be required in total. This material will be mainly composed of topsoils, sub-soils and sands in order to construct the capping layer (Refer to Section 4.3.3 for more detail on material import to the site).

Further materials may be imported to mitigate against landscape and visual impacts as well as in the construction of the end-use for the site. Such materials would include but are not limited to materials required for construction of site buildings (Landfill Infrastructure Compound and changing rooms), materials for road

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construction (gravels, bitumen, etc.), geosynthetic materials to be used as part of the capping, materials for the multi-use sports pitches, and palisade fencing to surround the site. However, these volumes are unlikely to be significant in comparison to the required import volumes of soils and subsoils.

Importation of material to the site will be carried out on a phased basis, with material being imported throughout much of the remediation works, with differing quantities to be imported from Remediation Phases 1 to 5. The highest volumes of material are anticipated to be imported during Phase 2 and 3, with slightly smaller quantities to be imported during Phases 4 and 5. Stockpiling of this imported material will be required on the site throughout remediation works.

There will be impacts associated with the importation of this material during the Remediation Phase, namely increased heavy goods vehicle movements on the local roads in the area when transporting this material to site. An estimated 70 daily HGV movements will occur within the vicinity of the proposed Project during the busiest period of the remediation works (Phases 2 and 3). This is covered in more detail in Chapter 8 Noise and Vibration and Chapter 14 Traffic and Transport. The impact is assessed as negative, with a slight significance and short-term duration.

17.4.2 Operational Phase

Residential Property

There are no predicted impacts associated with the Operational Phase of the proposed Project as the acquiring of the lands and removal of the properties will be completed prior to operation of the multi-use public park.

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Major Utilities

Electricity

An electricity supply will be required for the operation of the multi-use public park. This will be required for the changing rooms, the Landfill Infrastructure Compound and sports pitch lighting. It is anticipated that the demand for electricity to operate the public park will be higher during the Operational Phase of the public park compared to the current electricity consumption to operate the site office and site infrastructure. As there is already electricity utilised by the site in its current state, it is not anticipated that there will be any significant additional impacts to electricity supply during the operation of the multi-use public park.

Telecommunications

The Landfill Infrastructure Compound will require a telecommunications connection during the Operational Phase. There is already a telecommunications connection at the existing site. There will be no anticipated additional impacts to telecommunications during operation of the multi-use public park.

Water Supply

Water will be required during operation of the public park for welfare facilities such as showers, sinks and toilets within the changing rooms and the Landfill Infrastructure Compound. This water will continue to be supplied to the site from the existing Irish Water network. It is not anticipated that there will be any additional impacts to water supply during the operation of the multi-use public park.

Wastewater Services

Leachate will be discharged to the Irish Water sewer network via a pipeline which is to be constructed as part of the Remediation Phase. This new pipeline shown in Figure 4.17 will exit the site near the south-east corner of Zone 4, cross the adjacent field and run under the N7 and the Morell River to the Irish Water Johnstown Pumping Station.

The leachate discharged to Johnstown Pumping Station will be treated at the Osberstown WWTP in County Kildare. Osberstown WWTP is undergoing an upgrade to increase treatment capacity and improve the level of treatment achieved. This upgrade is due to be completed by the end of 2017.

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Aside from the leachate, there will be smaller quantities of wastewater generated during the Operational Phase, namely from showers, sinks and toilets within the changing rooms and site office. This will be discharged via the foul sewer connected into the Johnstown Pumping Station as part of the Remediation Phase. The changing room building and the Landfill Infrastructure Compound sewerage waste will be directed to a single sewerage main which will run parallel to the leachate main. Refer to Chapter 4 Description of the Proposed Project for more details.

As there is currently no sewer connection from the site, the additional input into the existing sewer network from the leachate main and sewerage main will result in an imperceptible negative impact which is permanent in nature. These proposed connections to the Irish Water sewer network have been subject to liaison and agreement with Irish Water, refer to Chapter 4 Description of the Proposed Project for more details on the connection.

Surface Water Drainage

As the realignment of the existing surface water drainage connection into the site from the adjacent property (REC012) will still result in discharge via the existing outfall (separate to the site), there will be no additional impacts. Other surface water impacts are assessed in Chapter 13 Water - Hydrology.

Gas Supply

It is not anticipated that there will be a gas supply required for the operation of the multi-use public park, therefore there will be no impact to gas supply.

Imported Material

As the impacts associated with the import of material will occur only during the Remediation Phase of the proposed Project, there is no anticipated impact during the Operational Phase.

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17.5 Mitigation Measures

The following mitigation measures shall be implemented for the proposed Project.

17.5.1 Residential Property

All reasonable locations for the site access, Landfill Infrastructure Compound and third multi-use sports pitch have been explored in order to minimise impact to residential property. The three properties to be demolished as well as the areas of land required shall be the subject to Compulsory Purchase Orders (CPOs), with the landowners to be compensated accordingly for the loss of the asset. A septic tank, of soakaway design, extends from property REC039 and discharges within the site boundary. This discharge will be removed and a sewer connection provided for this property.

The implementation of the CPO process will reduce the impact to neutral.

17.5.2 Major Utilities

All possible precautions shall be taken to avoid unplanned disruptions to any services during the Remediation Phase of the proposed Project. This shall include thorough investigation to identify the location of all utility infrastructure within the working areas, and the implementation of robust procedures when undertaking works in and around known utility infrastructure such as overhead lines.

Service disruptions impacting the surrounding residential, social and commercial properties shall be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions shall be given to all impacted properties. This shall include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties shall be undertaken prior to any proposed disruptions.

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Specific mitigation measures are as follows:

- Avoidance of interaction with overhead utility lines in and around the site;
- Protection in place of all underground services for which diversion is not required;
- Use of existing electricity, telecommunications and water connections where possible;
- The surface water drain from the adjacent property shall be reconnected to the existing outfall to the Canal Feeder Stream outside of the site boundary, with the site connection removed;
- Consultation and agreement in place with Irish Water on allowable quantities and acceptance criteria for the leachate and other wastewater to be discharged to the public sewer network; and
- Pre-treatment of leachate (methane stripping) prior to disposal to the sewer to remove explosion risk within mains.

When the mitigation is implemented, the severity of the impact is reduced to slight as the services will have been satisfactorily diverted or amended, and will therefore continue to operate in their current form as required.

17.5.3 Imported Material

Where additional material is required for re-profiling and capping of the site, this material shall be imported. Only materials which meet suitable engineering grade shall be sourced as required. A number of key issues shall be considered as part of the selection process. These include source; material specification; production and transport costs; and the availability of material. Proposals for material management are to be set out in the Construction Environmental Management Plan (CEMP) for the proposed Project. Any material being imported to the site must be accompanied by a source report completed by the provider of the material, which will give the history of the material and the land from which it has been taken. Material shall only be accepted based on the information contained in the source report. No material shall be accepted to site without a suitable source report.

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The imported material shall be sourced locally as far as reasonably practicable in order to reduce the need for long distance transportation of the material. Possible future sources for this material may include nearby development sites. Upcoming construction projects in County Kildare and County Dublin include:

- The M7 Naas Newbridge Bypass Upgrade + M7 Osberstown Interchange & R407 Sallins Bypass Scheme which will include the addition of a third lane each way to the main carriageway (stretching from Naas to the M7/M9 interchange) and the construction of a new interchange;
- The large service station planned for Naas located less than 1km from the site of the proposed Project (Planning Application 15500 - Withdrawn);
- A 284-unit housing development in Craddockstown, Naas within 5km of the site of the proposed Project which has been granted planning permission (Planning Application 246340);
- A 385-unit housing development in Newbridge, within 15km of the proposed Project, for which planning is being sought (Planning Application 16/975);
- A planned extension to the Kildare Village retail development (planning application not yet lodged) less than 30km from the site of the proposed Project; and
- The development of the Cherrywood area of South County Dublin approximately 40km from the site. Construction of this development is planned to run in stages until 2030 and includes construction of approximately 3,000 residential units as well as retail and other business and leisure units.

These are some possible local examples of projects where suitable topsoil and subsoil material may be available for importation. As well as those specific developments, the Kildare County Development Plan 2017-2023 (KCC 2017) has a new housing target of over 32,000 units for the county by 2023, including 4,842 dwellings in Naas alone (Kildare County Development Plan, KCC, 2017, Table 3.3). There is also a great deal of land zoned for future housing in the plan. Should development of these lands proceed, material may also become available from these projects.

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17.5.4 Opportunities for Future Enhancement

Details of the proposed Project outline design and the features currently proposed are provided in Chapter 4 Description of the Proposed Project. There may be other opportunities for enhancement of the public park's value as a material asset which may be explored as part of the detailed design process. One such enhancement for which the feasibility may be explored is the use of solar power to augment the public park's energy consumption. The use of grey water to supplement the potable water requirements of the toilet facilities could also be explored as part of detailed design.

17.6 Residual Impacts

Residual impacts on both the major utilities and the imported material are considered to be imperceptible.

17.7 Difficulties Encountered in Compiling Information

The utility information compiled has been gathered through requests from utility service providers. The gathering of this information from a number of different sources may result in some gaps in information. There is a risk that there could be more utilities located in and around the site which are unknown at the time of compiling the data for this Chapter. All possible precautions shall be taken to avoid unplanned disruptions to any services during the Remediation Phase of the proposed Project and this shall include thorough investigation to identify the location of all utility infrastructure within the all working areas, and the implementation of robust procedures when undertaking works in and around known utility infrastructure such as overhead lines.

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17.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on material assets. These projects are discussed in the following paragraphs.

17.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonnes. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

17.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

17.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

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17.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

17.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

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17.9 References

- Environmental Protection Agency (2002). Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2003). Advice notes on current practice in the preparation of Environmental Impact Statements
- Environmental Protection Agency (2015). Revised Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2015). Advice notes for preparing Environmental Impact Statements (Draft)
- Kildare County Council (2017). Kildare County Development Plan 2017-2023.
- National Roads Authority (2008). Environmental Impact Assessment of National Road Schemes – A Practical Guide

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18. Environmental Interactions

18.1 Introduction

The interaction of environmental aspects was clearly identified at an early stage in the project to be an important factor to be considered in the full evaluation of the environmental impacts associated with the proposed Project.

While all environmental factors are inter-related to some extent, the significant interactions and interdependencies were taken into consideration by the specialist environmental and ecological consultants when preparing their assessments. Consequently, these interactions were integrated into the individual sub-Sections from Chapters 7 to 17 of this EIAR. In addition, a summary of the general interactions is presented in Table 18.1 and the detail of the interactions in Table 18.2.

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Table 18.1: Relationships between the Environmental Factors

Inter-relationship Matrix- Environmental Elements	Air Quality, Odour and Climate	Noise and Vibration	Landscape and Visual	Archaeology, Cultural Heritage and Architectural Heritage	Biodiversity	Soils, Geology, Contaminated Land and Groundwater	Water – Hydrology	Traffic	Waste	Population and Human Health	Material Assets
Air Quality, Odour and Climate											
Noise and Vibration											
Landscape and Visual											
Archaeology, Cultural Heritage and Architectural Heritage		✓	✓								
Biodiversity	✓	✓	✓								
Soils, Geology, Contaminated Land and Groundwater					✓						
Water – Hydrology			✓		✓	✓					
Traffic and Transport	✓	✓					✓				
Waste	✓		✓	✓		✓	✓	✓			
Population and Human Health	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Material Assets	✓				✓	✓		✓		✓	

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Table 18.2: Explanatory Notes on the Relationships between the Environmental Aspects

Inter-relationship Matrix-Environmental Elements	Air Quality, Odour and Climate	Noise and Vibration	Landscape and Visual	Archaeology, Cultural Heritage and Architectural Heritage	Biodiversity	Soils, Geology, Contaminated Land and Groundwater	Water – Hydrology	Traffic and Transport	Waste	Population and Human Health	Material Assets
Air Quality, Odour and Climate											
Noise and Vibration											
Landscape and Visual											
Archaeology, Cultural Heritage and Architectural Heritage		Vibration generated from site activities impacting on cultural heritage assets	Landscape and Visual impacts on cultural heritage assets, including indirect impact on the setting of a cultural heritage feature								
Biodiversity	Air quality changes on flora and fauna – dust, odour, landfill gas	Disturbance to fauna from noise and vibration generated from site activities	Landscaping proposals and impacts on flora and fauna – retaining habitats, creating new habitats and the impact of the loss of habitats on landscape and visual amenity								
Soils, Geology, Contaminated Land and Groundwater					Leachate generation and management – impacts for flora and fauna						
Water – Hydrology			Visual impacts on surface water receptors		Surface water quality impacts on flora and fauna – surface water outfall Creation of new habitats	Leachate generation and management – impacts for nearby surface water receptors					
Traffic and Transport	Increase in air emissions associated with increased traffic generation	Increase in noise and vibration emissions associated with increased traffic generation					Increase runoff associated with traffic generation (oil, fuel and silt can be washed off) – impacts on surface water quality				
Waste	Storage, stockpiling, handling and transport material on site – dust and odour impacts		Storage, movement and stockpiling of material on site during the Remediation Phase – impact on landscape and visual receptors	Storage, movement and stockpiling of material on site during the Remediation Phase – impact on cultural heritage assets		Storage, stockpiling, handling and transport of material generated from the Remediation Phase such as excavated material.	Water unsuitable for reuse for dust suppression during the Remediation Phase is treated as a waste and will be removed to a licenced facility.	Transportation of waste generated during the Remediation Phase (typical construction type wastes) and during the Operational Phase (wastes generated within the Site Office and as part of the maintenance of the multi-use public park).			
Population and Human Health	Air quality changes on local community – dust, odour, landfill gas and emissions from increased traffic	Increase in noise levels and impacts on the local community – generated from site activities	Landscape and visual impacts associated with Remediation Phase works and the presence of a multi-use public park in the surrounding environment	Potential impacts on cultural heritage assets – amenity value from a local community perspective	The amenity value of future ecological habitat areas for the local community	Leachate generation and management – impacts for local communities	Impacts on surrounding surface water quality and impacts on local community	Increase in traffic levels and resultant travel time delays impacting on the local community – generated from remediation and operational activities	Storage, movement and stockpiling of material on site – impacts on local community		
Material Assets	Import of fill material to support Remediation Phase works – dust impacts				Import of fill material to support Remediation Phase works – dust impacts to flora and fauna	Import of fill material to support Remediation Phase works		Import of fill material resulting in increased traffic levels during Remediation Phase		Impacts on utilities during the Remediation Phase and the potential impact on local communities	

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19. Schedule of Environmental Commitments

19.1 Introduction

The purpose of this Chapter is to collate the mitigation measures identified in the Environmental Impact Assessment Report (EIAR) that are considered necessary to protect the environment prior to the commencement and during the Remediation Phase and/or during the Operational Phase of the proposed Project.

As described throughout this EIAR, the outline design of the proposed Project has been progressed taking account of environmental constraints and considerations that have been identified, enabling avoidance of potential environmental impacts.

19.2 Mitigation Schedules

Mitigation and environmental commitments have been identified as general requirements which shall help to avoid, reduce or offset potential impacts and are relevant to a number of the environmental aspects addressed in the EIAR. These are provided in Section 19.3.

Specific mitigation measures specified within the EIAR technical assessments are provided in Section 19.4 to Section 19.15.

The timing of the implementation of the mitigation measure is indicated in within the tables as:

- Remediation Phase: The undertaking of the physical works to remediate the former landfill and construct the multi-use public park.
- Operational Phase: When the proposed multi-use public park has opened as well as the ongoing operation and maintenance of the landfill management infrastructure.

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19.3 General Requirements

Table 19.1: General Requirement Mitigation

Mitigation No.	Description	Timing of the Measures	Technical Areas to which mitigation item is applicable											
			Proposed Works and Methods as described in Chapter 4 Description of the Proposed Project	Air Quality, Odour and Climate	Noise and Vibration	Landscape and Visual	Archaeology, Cultural Heritage and Architectural Heritage	Biodiversity	Soils, Geology, Contaminated Land and Groundwater	Water – Hydrology	Traffic and Transport	Waste	Population and Human Health	Material Assets
GR1	Prior to commencement of the Remediation Phase, the appointed contractor responsible for the remediation works shall prepare a Construction Environmental Management Plan (CEMP) for agreement with Kildare County Council (KCC). The CEMP shall contain the mitigation measures and plans identified in the following Sections (as a minimum), the wider EIAR and shall implement the conditions set out in the planning approval and the requirements of the site's Industrial Emissions Activities Licence (IEAL). The CEMP shall set out all the intended methods to manage potential environmental impacts from remediation of the proposed Project, and shall include the following as a minimum: • Groundwater Management Plan • Odour Management Plan (to be developed using the existing draft Odour Control Plan, SKM 2013) • Dust Management Plan • Noise and Vibration Management Plan • Invasive Species Management Plan • Site Biodiversity Management Plan • Erosion and Sediment Control Plan • Contaminant Spill Emergency Plan • Construction Traffic Management Plan • Mobility Management Plan • Waste and Materials Management Plan	Remediation Phase	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
GR2	The CEMP shall also incorporate the requirements of the existing plans developed for the proposed Project, including but not limited to: • Landfill Gas Management Plan (including risk assessment) • Leachate Management Plan • Surface Water Management Plan • Landscape Masterplan Statement • KLRP Management Plan Accident and Emergency Response • Monitoring and Control Management Plan These Plans and the CEMP are live documents and will be reviewed on a regular basis and updated accordingly by the appointed contractor, in particular the document shall be reviewed on receipt of planning approval and grant of the IEAL.	Remediation Phase		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GR3	The key elements of the CEMP shall include: • Appointment of an Environmental Officer by the appointed contractor for the duration of the Remediation Phase • Incorporation of environmental commitments and requirements • Incorporation of procedures to record any environmental incidents on site and procedures for implementing appropriate corrective and preventative measures • Outlining the methods by which the remediation works will be managed to meet these commitments and requirements • Outlining the relevant guidance (with those outlined in the EIAR as a minimum) that have informed the Plan development • Incorporation of procedures for communicating with KCC, the public and stakeholders • Incorporation of procedures for staff environmental awareness training • Incorporation of environmental monitoring procedures • Incorporation of a system of audit and review with regard to the effectiveness of the Plan	Remediation Phase		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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Mitigation No.	Description	Timing of the Measures	Technical Areas to which mitigation item is applicable											
			Proposed Works and Methods as described in Chapter 4 Description of the Proposed Project	Air Quality, Odour and Climate	Noise and Vibration	Landscape and Visual	Archaeology, Cultural Heritage and Architectural Heritage	Biodiversity	Soils, Geology, Contaminated Land and Groundwater	Water – Hydrology	Traffic and Transport	Waste	Population and Human Health	Material Assets
GR4	The appointed contractor shall ensure that the CEMP is fully implemented during the Remediation Phase in agreement with KCC, to prevent or reduce the impacts identified in the impact assessment.	Remediation Phase	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GR5	Maintenance and active management of the landfill infrastructure is integral to the Operational Phase of the proposed Project. As described in this EIAR the continued monitoring and management of the site will provide assurance that the landfill management systems are operating effectively. KCC will appoint a Site Manager for the Operational Phase who shall be responsible for the control, operation and maintenance of the site and emissions shall take place as set out in the IEAL. The KCC Site Manager will be responsible for managing the sampling, analyses, measurements, examinations, maintenance and calibrations as set out in the IEAL and for reporting to the EPA, in the format specified in the IEAL. The KCC Site Manager will establish procedures to ensure that corrective action is taken should the specified limits of the IEAL not be fulfilled. These procedures will include the actions for initiating further investigation and implementing corrective action where appropriate. In the development of the outline design of the proposed Project consideration has been given to the nature of the works and where appropriate potential future management solutions have been identified. These solutions are available for KCC to implement in the future should they be required.	Remediation Phase	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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19.4 Proposed Works and Methods

Table 19.2: Proposed Works and Methods Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
WM1	4.2.4	On-site concrete structures are envisaged to be demolished by pneumatic breakers fitted to excavators. Where noise limits are likely to be exceeded noise barriers will be provided between the works and identified receptors in proximity to the working area in accordance with the mitigation measures specified in Chapter 8 Noise and Vibration. The broken out material will be processed using mobile crushing and screening plant to be located in Zone 2B, due to its reduced exposure to surrounding environs compared to Zone 2A. Dust suppression techniques will be employed, by spraying water from a site bowser or similar, in accordance with the Dust Management Plan developed as part of the Construction Environmental Management Plan (CEMP).	Remediation Phase
WM2	4.2.7	In order to prevent damage to the capping system only selected waste, to exclude large and bulky or sharp items such as concrete blocks and rebar, will be used to form the final lift of waste across Zones 1 and 3 immediately below the regulation layer. Selection and placement of the final layer of waste will be carried out under the supervision of a suitably trained and qualified person. Each waste layer placed will be covered at least by the end of the working day with the application of daily cover to assist with control of odours as well. This may comprise soils or geosynthetics, widely used for such purposes in the waste management industry as a temporary cover. The objective of the daily cover is to ensure windblown litter and debris are minimised, vermin is prevented from entering the waste mass and scavenging is prevented as far as practicable and the depth of cover is sufficient to avoid future problems of perched leachate. A stockpile of cover materials will be maintained, as necessary, in the vicinity of the operational area in order to ensure that exposed waste can be covered at the end of each working day. The use of alternative cover methods (e.g. proprietary geosynthetic sheeting) will be agreed with the EPA prior to use.	Remediation Phase
WM3	4.2.8	During the Remediation Phase the generation of leachate will be managed through a number of on-site management operations, including: • Working in discrete areas to minimise the area of exposed waste; • Interception of any leachate outbreaks identified during waste excavation and re-profiling activities; • Provision of daily cover to exposed wastes, occurring as part of the remediation works; and • Progressively remediate the site with a landfill cap.	Remediation Phase
WM4	4.2.9	During remediation works the flare will be moved around the site to support key extraction areas, to reduce emissions and odour if observed during the works.	Remediation Phase
WM5	4.2.9	A suitably competent contractor(s) will be appointed to undertake remedial works at the site, with surface water management a particular aspect to be closely monitored and controlled. The contractor will be required to construct temporary perimeter bunds and silt fences to enable separation of working areas from remediated areas. However, it is anticipated that until initial vegetation coverage comprising grass, fully germinates silty runoff from capping soils may still be prevalent and require control. The appointed contractor(s) responsible for the remediation works will be required for ensuring a break between working (exposed waste) areas and remediated areas (restored) is maintained to prevent cross contamination. The appointed contractor(s) may also utilise temporary on site lagoons to retain surface water runoff, with silt buster tanks (or similar) used to limit the amount of silt being discharged to the ponds/ lagoons. Water collected in these lagoons will be used for dust suppression across the open working areas and, if not contaminated, over restored areas with any contaminated waters removed from the site by road tanker. The appointed contractor will be required to prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC, for the contractor to then implement through the Remediation Phase, with water contamination testing requirements and limits to be agreed by the EPA.	Remediation Phase
WM6	4.2.9	Oil interceptors will be required during the Remediation Phase to serve temporary working areas (e.g. potential laydown area, fuelling station, temporary car park and wheel wash area). These interceptors will be removed on completion of the remediation works.	Remediation Phase
WM7	4.2.9	Surface water management ponds in Zone 1A and Zone 4 are to be developed as part of the remediation works, only discharging once remediation works have been completed. An impermeable cap will isolate the waste body from interacting with rainfall on the site and nearly all rainfall will result in runoff which will have to be managed to avoid flooding or ponding of water on the site. This rainwater/surface water will not have interacted with waste or leachate in any way and will be equivalent in quality to runoff from parkland or agricultural fields with a degree of suspended solids which will need to be reduced before discharge, with the pond in Zone 1A discharging to groundwater via a soakaway and the ponds in Zone 4 discharging to surface water.	Remediation Phase

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<table>
<tr><th>Mitigation No.</th><th>EIAR Section Reference</th><th>Description of Mitigation Measure / Environmental Commitments</th><th>Stage of Impact i.e. Remediation Phase / Operational Phase</th></tr>
<tr><td>WM8</td><td>4.3.4</td><td>To prevent possible contamination of clean materials by site wastes separate stockpiling areas for imported materials and site won materials will be established. Stockpiling arrangements are summarised in the following table with stockpile locations shown indicatively on Figures 4.8 and 4.9.
Stockpile locations are retained on existing concrete hardstanding areas as far as practicable, to offer a separation to and protection of the underlying materials.
Stockpiling Arrangements
<table>
<tr><th>Stockpile</th><th>Location</th><th>Uses</th></tr>
<tr><td>Existing sub-soil</td><td>Retained adjacent to existing site entrance.</td><td>Zones 1 and 4 capping</td></tr>
<tr><td>Imported ‘clean’ soils</td><td>Zone 2A</td><td>Zone 3 toe bund
Zone 4 ponds bunds
Zones 1 to 4 capping.</td></tr>
<tr><td>Crushed / screened concrete (aggregate)</td><td>Zone 2B</td><td>Gas wells, access tracks.</td></tr>
<tr><td>Site wastes (including fines from crushing of concrete)</td><td>Zone 2B</td><td>Infill to Zones 1 and 3
Export from site if classified as hazardous during waste classification</td></tr>
</table>
Other areas will require to be designated on site, such as holding areas, quarantine areas and storage of unprocessed waste. Storage of processed waste is unlikely to be necessary as it would be transported to the infill area (typically Zones 1 and 3) immediately to reduce the need for double handling.
The general segregation imported clean materials and site material stockpiles between Zones 2A and 2B respectively will also limit the risk of cross contamination of clean materials by avoiding the need for road going vehicles to directly traffic on or though areas containing exposed waste materials.
Surface water management proposals indicate that there will be no discharge from the site permitted during the remediation works. The ponds will be adopted as retention ponds during the remediation works, and the appointed contractor shall be required to utilise silt-buster traps as is typical on earthworks/ construction projects.
To further mitigate the risk of off-site contamination, all road going vehicles which access stockpile areas will be required to pass through a wheel washing facility prior to exiting the site. Further, site access roads including Kerdiffstown Road will be subject to regular road sweeping.
Sizing of stockpiles cannot be determined at this stage as it is dependent on the availability of suitable material for import, the programming of the works, subject to planning approval being granted, and the procurement approach adopted.
Stockpiling of materials will be undertaken in accordance with ‘Construction Code of Practice for the Sustainable Use of Soils on Construction Sites’ published by the UK Department for Environment Food and Rural Affairs or equivalent Irish guidelines.
As a minimum stockpile management will include:
• Visual screening for potential contaminated materials;
• Segregation of material suspected to be contaminated from clean materials;
• Stockpiling of materials at appropriate heights / batters to prevent potential instability;
• Protection of stockpiled materials from scour / erosion;
• The provision of adequate drainage to limit and control potential contaminated surface water runoff, including silt mitigation;
• The avoidance of un-necessary trafficking / handling of stockpiled materials;
• The following additional measures shall be applied to topsoil stockpiles:
• A limitation on stockpile height to prevent degradation of the topsoil structure; and
• Adequate control of weed growth.
With the exception of top soil (or soil forming materials), stockpile heights will be restricted to a maximum of 4m to facilitate adequate management during the works.
A reduced stockpile height of 2m will apply to any top soil / soil forming materials to prevent possible degradation of soil structure.</td><td>Remediation Phase</td></tr>
<tr><td>WM9</td><td>4.5</td><td>The proposed Project will not operate as a landfill and will not accept waste for disposal but will require importation of inert wastes for use as engineering materials, such as aggregate, subsoil and top soil. In such instances, waste acceptance procedures shall be followed. The procedures will be supported by a summary note of Waste Acceptance Procedures (for issue to Contractors when seeking appropriate materials) and an extract from Part VIII of the Waste Management (Licensing) Regulations 2004, to confirm the wastes that are prohibited from the proposed Project. For all soils proposed for the remediation of the site a source specific determination of their suitability shall be required. Source materials which have the potential to be contaminated shall be tested to determine the suitability of the soils for use in the remediation works. The testing protocols and the frequency of testing shall be determined from an assessment of the source site. This methodology shall be carried out for both greenfield and brownfield sites. Once the source information is available then a site specific risk assessment shall be undertaken to identify the actual risks posed by the contaminants in their proposed use at the site and the suitability of the soils for remediation purposes confirmed. This suitability assessment will include Waste Acceptance Procedures comprising:
• Basic characterisation;
• Compliance testing; and
• On-site verification.</td><td>Remediation Phase</td></tr>
<tr><td>WM9</td><td>4.5</td><td>The proposed Project will not operate as a landfill and will not accept waste for disposal but will require importation of inert wastes for use as engineering materials, such as aggregate, subsoil and top soil. In such instances, waste acceptance procedures shall be followed. The procedures will be supported by a summary note of Waste Acceptance Procedures (for issue to Contractors when seeking appropriate materials) and an extract from Part VIII of the Waste Management (Licensing) Regulations 2004, to confirm the wastes that are prohibited from the proposed Project. For all soils proposed for the remediation of the site a source specific determination of their suitability shall be required. Source materials which have the potential to be contaminated shall be tested to determine the suitability of the soils for use in the remediation works. The testing protocols and the frequency of testing shall be determined from an assessment of the source site. This methodology shall be carried out for both greenfield and brownfield sites. Once the source information is available then a site specific risk assessment shall be undertaken to identify the actual risks posed by the contaminants in their proposed use at the site and the suitability of the soils for remediation purposes confirmed. This suitability assessment will include Waste Acceptance Procedures comprising:
• Basic characterisation;
• Compliance testing; and
• On-site verification.</td><td>Remediation Phase</td></tr>
</table>

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19.5 Air Quality, Odour and Climate

Table 19.3: Air Quality, Odour and Climate Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
A1	7.5.1	The CEMP will contain a Dust Management Plan which will be formulated for the Remediation Phase of the proposed Project, as the planned activities are likely to generate some dust emissions. The principal objective of the Dust Management Plan will be to ensure that dust emissions do not cause significant nuisance at receptors in the vicinity of the proposed Project. The Dust Management Plan shall address the following: • The appointed contractor for the remediation works will be assigned with overall responsibility for Dust Management reporting back to the KCC Site Manager; • The design, and in particular the phasing of the Remediation Phase work will consider dust impact management and choose design approaches to minimise dust emissions; • The Remediation Phase will be carried out in Phases so that all of the works with significant potential for generating dust emission will not all occur simultaneously; • An effective training programme in dust management for site personnel will be implemented for the duration of the Remediation Phase; • A strategy for ensuring effective communication with the local community will be developed and implemented; • A programme of dust minimisation and control measures will be implemented and regularly reviewed; and • A monitoring programme will be implemented.	Remediation Phase
A2	7.5.1	The areas on site which vehicles will be travelling on will be hard-surfaced where practicable thus significantly reducing the potential for dust emissions from the vehicles.	Remediation Phase
A3	7.5.1	A wheel washing facility with water collection and filtering before any discharge to the surface water management system will be set up. Gate security staff will be briefed on inspection of vehicles for cleanliness ahead of leaving site. During the initial stages of site set-up, a mobile wheel washing vehicle will be available at short notice, if necessary. The use of a wheel wash facility at the entrance to the proposed Project will minimise the transfer of any dust onto the roads in the vicinity of the site; this will also minimise the potential for dust build-up on surfaces which could be blown across the site.	Remediation Phase
A4	7.5.1	In order to minimise the potential for wind-generated emissions from storage of materials, the storage areas will be oriented in a favourable manner with respect to the prevailing wind to minimise the effects of wind blow on release of dust and particulate.	Remediation Phase
A5	7.5.1	Fixed and mobile water sprays will be used to control dust emissions from material stockpiles and road and hardstanding surfaces as necessary in dry and/or windy weather.	Remediation Phase
A6	7.5.1	A daily inspection programme will be formulated and implemented in order to ensure that dust control measures are inspected to verify effective operation and management.	Remediation Phase
A7	7.5.1	A dust deposition monitoring programme will be implemented at the site boundaries for the duration of the Remediation Phase in order to verify the continued compliance with relevant standards and limits.	Remediation Phase
A8	7.5.1	During the Remediation Phase the appointed contractor will work in accordance with the guidance provided in the National Guidelines for the prevention of Nosocomial Invasive Aspergillosis during construction/renovation activities (developed by a sub-committee of the Scientific Advisory Committee of the National Disease Surveillance Centre, 2002). Odour mitigation measures are discussed in the draft Odour Control Plan (OCP) for the proposed Project which will be finalised as part of the overall CEMP. A Draft OCP was formulated to inform the design process for this proposed Project and is attached in Appendix A7.7. Odour incidents are being minimised at the site through best practice and regular monitoring. Odour minimisation and prevention measures which are currently implemented and which will continue to be updated during the Remediation Phase will include: • Carrying out subjective odour assessments (sniff tests) and logging details of odorous emissions during daily and weekly site assessments, in accordance with EPA guidance; • Noting wind direction, temperature and barometric pressure on a daily basis; • Ensuring that landfill gas flaring is balanced and optimised to maximise gas collection from installed gas wells and flaring according to operational recommendations; • Investigating any odour that appears stronger than the normal emission; • Logging any odour complaints, and investigating circumstances on the day the complaint was made. This includes correlating wind direction and speed, barometric pressure, and whether any site works were being carried out; and • Notifying nearby sensitive receptors prior to any works being carried out, that may disturb the waste body and cause odours to be released.	Remediation Phase
A9	7.5.1	Minimisation of evaporation of odours will be promoted through adoption of the following measures: • Maintain an adequate supply of temporary cover material prior to any works commencing (e.g. clean topsoil, clay or liner membrane); • Any disturbance and exposure of odorous waste will be kept to the minimum practical duration; • The surface area of exposed waste will be kept to a minimum size at all times; • Temporary cover will be applied to all work areas as quickly as practicable; • The carrying out of major waste movements during hot weather when odours volatise most readily will be avoided; • Leaving open waste exposed in direct sunlight, which increases evaporation, will be avoided; • Water spray to lower the temperature of exposed waste, and inhibit evaporation will be used; • Screening of materials containing waste, unless adequately contained, will be avoided; and • Any waste containing material that has to be transported from one side of the site to another will be covered and contained during transport.	Remediation Phase
A10	7.5.1	Planning of works to take place under suitable weather conditions for minimising odours will be actively implemented during the Remediation Phase. If unacceptable odours are generated from a particular activity it may be necessary to cover the exposed waste, and cease the activity until additional odour control measures can be put in place. This may include the provision of additional water bowsers, or waiting for cooler weather conditions. The appointed contractor will agree such measures with the KCC Site Manager.	Remediation Phase
A11	7.5.1	Nearby sensitive receptors and local Community Liaison Group will be kept informed of the progress and plans regarding the Remediation Phase. Nearby sensitive receptors will be informed prior to any remediation works being carried out. They will be informed of the works phasing plan, and the locations of works planned for the duration of remediation works will be regularly updated and communicated. Where adverse metrological conditions coincide with works phasing that cannot be averted, residents will be informed of the heightened risk of short-term odour nuisances.	Remediation Phase

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Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
A12	7.5.1	During remediation works there will be a requirement for monitoring of odour emissions from the site to be undertaken which shall to include the following: • Frequent sniff sampling and logging of odour characteristics at the working face; • Frequent sniff tests at the site perimeter downwind from the working face; • Frequent sampling of specified compounds with colour indicator tubes specified at appropriately low detection ranges; • Frequent measurement of Total VOC concentrations using a FID (Flame Ionization Detector) handheld field detector; and • Regular sniff tests off-site near sensitive receptor locations.	Remediation Phase
A13	7.5.1	If monitoring indicates higher than expected odour emissions, or impacts at sensitive receptors, additional mitigation measures will need to be implemented. If necessary, and in adverse conditions, the works may have to be stopped and the workface contained with a temporary cover, until adequate mitigation can be assured. The appointed contractor will agree such measures with the KCC Site Manager.	Remediation Phase
A14	7.5.1	Kildare County Council will continue to monitor the level of hydrogen sulphide in the landfill gas on a weekly basis as part of the active management of landfill gas at the site throughout the Remediation Phase of the proposed Project. If higher sulfur, and H_2S, levels are detected in the landfill gas flare inlet during the Remediation Phase, then a suitable abatement system, likely to be an activated carbon filter, will be fitted to reduce the levels of sulfur reaching the flare	Remediation Phase
A15	7.5.2	Landfill gas will be actively and passively managed by means of an extensive network of extraction wells and perimeter gas venting trenches. Actively extracted gas will be diverted to the new flare located within the purpose-built Landfill Gas Infrastructure Compound which will convert the landfill gas into harmless substances. There will be two landfill gas flares, one operating in duty and one in back-up mode. The location of the Landfill Gas Infrastructure Compound and the height of the landfill gas flare stacks have been chosen to optimise the management of the landfill gas at the proposed Project.	Operational Phase
A16	7.5.2	The design of the pipeline to transfer leachate off site will require installation of air valves and manholes. These manholes will include be sealed with a gas-resistant sealant to prevent release of odours. The connection point to Johnstown Pumping Station will include be fitted with a carbon filter to further mitigate an odour release.	Operational Phase

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19.6 Noise and Vibration

Table 19.4 Noise and Vibration Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
N1	8.5.1	Prior to the commencement of any on-site works, the appointed contractor will be required to prepare a Construction Environmental Management Plan (CEMP) in agreement with Kildare County Council. The CEMP shall contain a stand-alone Noise and Vibration Management Plan (NVMP) which will detail how the appointed contractor will comply with the noise criteria set out in this EIAR and will deal specifically with on-site activities in a strategic manner to remove or reduce significant noise and vibration impacts associated with the remediation works. The NVMP will detail the provision and installation of the acoustic barriers, the best practice noise measures that the appointed contractor will adhere to on-site and the noise and vibration monitoring programme that the appointed contractor will undertake during the remediation works.	Remediation Phase
N2	8.5.1	The appointed contractor shall be required to carry noise monitoring at NSR locations on a weekly basis and this shall be increased to continuous monitoring in agreement with the EPA and the conditions of the IEAL, once the remediation works begin to approach the NSR locations. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works., The results the noise monitoring will be available in real time to the KCC Site Manager. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works to ensure that the noise emissions from the various works are kept within the prescribed noise limits. The appointed contractor shall also be required to carry out vibration monitoring at the nearest NSR locations during sensitive phases of the remediation works and this data shall be reviewed daily to ensure the limits are being complied with.	Remediation Phase
N3	8.5.1	The NVMP will detail the best practice measures to be adhered to at the site including but not limited to the following: • the correct positioning of the mounted breakers in Zone 2A during Phase 1 on-site works to minimise their combined impact - To ensure that the noise limits are met, mounted breakers shall be positioned well apart from each other when operating simultaneously in Zone 2A. Scheduling of works for Zone 2A will ensure that the mounted breakers are correctly positioned to ensure that the relevant criteria are not exceeded at the nearest NSRs; • the correct sequencing of the building up or taking down of stockpiles on-site - Best Practice shall ensure that the stockpiling will be carried out in a sequence where the stockpile is built up from the boundary nearest to the receptors and added to so that the stockpile can act as a barrier between the noise source and the nearest receptors as the works develop; • the careful management of the number of plant items in simultaneous operation when the works are close to the NSRs along L2005 Kerdiffstown Road and other key locations; • the careful positioning of heavy plant items, such as the waste compactor, to minimise the potential for ground borne vibrations to be generated.	Remediation Phase
N4	8.5.1	The remediation works will be managed through the use of construction noise limits which the appointed contractor will be required to work within. Best practice control measures including choice of plant, scheduling of works on site, provision of temporary acoustic screening, on-site noise monitoring and other measures will be employed in order to ensure noise limits are not exceeded.	Remediation Phase
N5	8.5.1	Best practice noise management procedures for the control of noise and vibration from demolition and construction activities as presented in BS5228 will be followed. Such measures to be adhered will include the following: On-site Work Practices • Avoid unnecessary revving of engines and switch off equipment when not required; • Keep internal haul routes well maintained and avoid steep gradients; • Use rubber linings in chutes and dumpers to reduce impact noise; • Minimise drop height of materials; • Start-up plant and vehicles sequentially rather than all together; • Equipment shall be located away from noise sensitive areas, as much as is feasible; • Regular and effective maintenance by trained personnel shall be carried out to reduce noise and/or vibration from plant and machinery; and • Limit noisy construction works to 07:00 to 19:00 weekdays with Saturday working from 08:00 to 16:30 unless otherwise agreed with the relevant authority. In addition to the above BS5228 recommendations, Section 10.3 of NG4 discusses the management of Waste Related Operations and includes the following mitigation measures which will also be adhered to at the proposed Project: • Employ noise reducing technologies, such as attenuators or enclosures, where practicable; • Ensure that noise control measures are maintained as per the manufacturers requirements; • Minimise the number of vehicles/heavy plant on the proposed Project at any one time; • Maintain vehicles in good order, employ the principles of preventive maintenance and undertake reference vehicle noise measurements at defined intervals; • Ensure that noisy vehicles are parked as far as possible from noise sensitive areas; • Ensure that drivers are aware of the potential for noise to cause annoyance/disturbance to local residents – they shall show due regard to this, particularly when entering and leaving the proposed Project (e.g. no unnecessary horn blowing), and • Consider the use of alternative varieties of reversing alarm with reduced noise output, such as ambient noise sensing alarms with variable volume or directional modulated alarms – these must be evaluated on a case-by-case basis and regard must be had to any health and safety issues that may arise.	Remediation Phase
N6	8.5.1	Selection of Quiet Plant • In accordance with best practicable means, plant and activities to be employed on the proposed Project will be reviewed to ensure that they are the quietest available for the required purpose.	Remediation Phase
N7	8.5.1	Acoustic Screens and Barriers Acoustic screens are required to be erected in certain locations for the duration of the Remediation Phase works (refer to Figure 8.2 and Section 8.4.1 for more details). These screens shall be carefully positioned to be as effective as possible. In general, the barrier shall have no gaps or openings in the joins of the barrier material and the barrier material shall have a minimum mass per unit area of 7 kg/m^2. The minimum height of the barrier shall typically be such that no part of the noise source will be visible from the receiving point. This will not always be possible and therefore the minimum recommended height is prescribed at 2.4m. The existing screening banks along the western boundary of the proposed Project will be supplemented to give additional noise protection to the private residences along the L2005 Kerdiffstown Road. This shall be done with the use of straw bales (or equivalent) as that is the most readily accessible and highly mobile screen type with very effective mitigation properties. The low-reflection acoustic screens required around the boundary of Zone 2A shall be solidly constructed of straw bales (or equivalent) and shall be of minimum 5m height. The locations for the erection of the acoustic screens are shown on Figure 8.2.	Remediation Phase
N8	8.5.1	Noise Control • Improved sound reduction methods, such as equipment enclosures shall be used (this is also addressed in Environmental Protection Agency (2016). Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA,2016))	Remediation Phase

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Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
N9	8.5.1	Communications The appointed contractor shall continue the current engagement with local residents and stakeholders and will notify them before the commencement of any works forecasted to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. Throughout the Remediation Phase there shall be distribution of information circulars by the appointed contractor informing people of the progress of works and any likely periods of significant noise and vibration. A nominated contact for any communications in relation to noise and vibration for the duration of the project remediation works and any queries, complaints or other formal correspondence regarding noise and vibration shall be appointed by the contractor. Any liaison with local residents will be undertaken in agreement with the KCC Site Manager.	Remediation Phase
N10	8.5.1	Monitoring The appointed contractor shall be required to carry noise monitoring at NSR locations on a weekly basis and this shall be increased to continuous monitoring in agreement with the EPA and the conditions of the IEAL, once the remediation works begin to approach the NSR locations. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works., The results the noise monitoring will be available in real time to the KCC Site Manager. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works to ensure that the noise emissions from the various works are kept within the prescribed noise limits. The appointed contractor shall also be required to carry out vibration monitoring at the nearest NSR locations during sensitive phases of the remediation works and this data shall be reviewed daily to ensure the limits are being complied with.	Remediation Phase

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19.7 Landscape and Visual

Table 19.5 Landscape and Visual Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
LV1	9.5	Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP). The CEMP shall contain these mitigation measures and plans identified in this EIAR and ensure that they are fully implemented during the Remediation Phase, to prevent or reduce the impacts identified in the impact assessment. The landscaping and planting proposals for the proposed Project will be subject to confirmation during the detailed design stage.	Remediation Phase
LV2	9.5	Landscape mitigation measures are indicated on Figure 4.20 – Landscape Masterplan and outlined in greater detail in the Landscape Masterplan Statement contained in Appendix A4.8. Related ecological mitigation measures are also shown on Figure 11.6 – Ecological Mitigation and Enhancements.	Remediation Phase
LV3	9.5	Tree and shrub planting will occur wherever practicable (Refer to Figure 4.20). This will mainly occur in peripheral areas and site boundaries due to limitations as to where tree planting can take place so as not to compromise the integrity of the engineering capping system.	Remediation Phase
LV4	9.5	At the north-west end of the mound is a proposed pond to manage surface water runoff from this area of the site and this occurs adjacent to a patch of woodland contained within the neighbouring property of Kerdiffstown House. The area surrounding this pond will remain fenced off from the public providing an opportunity for ecological enhancement.	Remediation Phase
LV5	9.5	The swale proposed at the base of the eastern slope of Zone 1 will be outside of the capped area and will be planted with semi-mature parkland trees.	Remediation Phase
LV6	9.5	Perimeter tree and hedge planting will also be incorporated into the boundary treatment on the western side of the site. This will include amenity planting around the site entrance as well as native hedgerow screen planting to fill a short gap in the roadside vegetation adjacent to an existing residential dwelling on the eastern side of the Kerdiffstown road (see VP5). Two patches of woodland planting in the form of whips and feathered trees will be provided at the south-eastern end of the site to expand and consolidate existing woodland areas that occur immediately adjacent to the site (Intervention A14 on Figure 4.20). The Landfill Infrastructure Compound located to the east of the public park entrance will be planted with trees and shrubs to screen the compound insofar as possible. It should be noted that all proposed woodland and hedgerow amenity and mitigation planting will comprise of native and naturalised species.	Remediation Phase
LV7	9.5	Wetland ponds proposed for Zone 1A and central portion of Zone 4 will be planted up with a variety of wetland plants to benefit biodiversity.	Remediation Phase
LV8	9.5	For the three residential properties (REC006, REC007 and REC008) that will lose front boundary vegetation as part of the widening and realignment works, the local access road to the south of the site, new stonewall/fencing will be provided. Semi-mature tree and shrub planting will also be provided to the inside of the wall for additional screening and amenity purposes. These mitigation measures are subject to consultation with the property owners in question.	Remediation Phase

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19.8 Archaeology, Cultural Heritage and Architectural Heritage

Table 19.6 Archaeology, Cultural Heritage and Architectural Heritage Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
ARC1	10.5	A programme of archaeological testing shall be carried out within the small area of greenfield in the western section of the proposed Project area, which contains the recorded mound (KD019-018). This shall be undertaken under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).	Remediation Phase
ARC2	10.5	A limited programme of archaeological testing shall be carried out to the immediate north and south of the recorded church site, within the footprint of the proposed works due to the proximity of the church and the potential for these areas to contain buried archaeological remains. This investigation will be carried out under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA). The standing remains of the church and graveyard shall be fenced off with non-intrusive fencing during the course of remediation works in this area, in order to prevent inadvertent impacts with plant and equipment.	Remediation Phase
ARC3	10.5	An archaeological wade survey shall be carried out at the proposed location of the outfall point into the Morell River. This investigation will be carried out under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).	Remediation Phase
ARC4	10.5	All topsoil stripping associated with the proposed remediation works, including the surface water outfall pipeline and pipelines through the southern part of Kerdiffstown demesne, shall be monitored by a suitably qualified archaeologist. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).	Remediation Phase

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19.9 Biodiversity

Table 19.7 Biodiversity Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
B1	11.5.1	There are a number of key mitigation measures that will be undertaken in order to minimise the overall impact of the proposed Project. Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP). The CEMP shall contain these mitigation measures and plans identified in the following sections and ensure that they are fully implemented during the construction phase, to prevent or reduce the impacts identified in the impact assessment. The CEMP will include a Site Biodiversity Management Plan which will address the following as a minimum: • Badgers; • Bat (including the retained Leisler's maternity roost); and • Habitat including retention of habitats during Remediation Phase and the development of new habitats during the Operational Phase.	Remediation Phase
B2	11.5.1	Any trees, scrub or hedgerows adjacent to, or within, the site boundary which are intended to be retained will be afforded adequate protection prior to remediation works commencing. Mitigation measure will be in accordance with the *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes* (National Roads Authority, 2006b), as follows: • All trees along the site boundary that are intended to be retained, both within and adjacent to the site boundary (where the root protection area of the tree extends into the site boundary), will be fenced off at the outset of works in the adjacent working area and for the duration of the remediation works in that area to avoid structural damage to the trunk, branches or root systems of the trees. Temporary fencing (post and rail) will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. In general, the RPA covers an area equivalent to a circle with a radius 12 times the stem diameter (measured at 1.5m above ground level for single stemmed trees, or above the root flare for multi-stemmed trees); • Where fencing is not feasible due to insufficient space, protection for the trees will be afforded by wrapping hessian sacking (or equivalent) around the trunk of the tree and strapping stout buffer timbers around it; • The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). The storage of hazardous materials (e.g. hydrocarbons) will not be undertaken within 10m of any retained trees, hedgerows and treelines; • If construction activities are required within the RPA, e.g. excavation work, then a qualified arborist will advise on the best methods for protecting the tree. For example, any excavation works carried out within the RPA will need to avoid damage to the protective bark covering larger roots. This may involve excavation by mini-digger and/or hand as deemed appropriate. Exposed roots will be wrapped in a hessian sacking to avoid desiccation and roots less than 2.5cm in diameter can be pruned back to a side root. The advice of a qualified arborist will be sought if larger roots that influence anchorage need to be severed. Any remedial works required to trees will be carried out by a qualified arborist; and Where tree removal may be required (due to health and safety considerations) in areas not previously identified liaison with a suitably qualified ecologist will be required.	Remediation Phase
B3	11.5.1	Japanese knotweed has been eradicated from within the site boundary. It was, however, found to be present within the land of Kerdiffstown House immediately adjacent to the site (refer to Figure 11.4). If the appointed contractor is required to work within 7m of the infested area an invasive species specialist will be appointed. The invasive species specialist will identify the extents of Japanese knotweed and provide recommendations to the appointed contractor on what measures may be required to remove or avoid spreading this invasive species. This would need to be detailed in the Invasive Species Management Plan which will be developed as part of the CEMP. Any mitigation strategy in relation to invasive plant species will be based on the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (National Roads Authority, 2010a). The following non-exhaustive measures shall be included in the Invasive Species Management Plan: • Works including access will need to avoid disturbing the Japanese knotweed or potentially contaminated soil within at least 7m of the infested area. • If works cannot be avoided within the exclusion zone the Japanese knotweed and contaminated soil will need to be treated and/or excavated and potentially removed off site or buried on site under licence from the NPWS, this would be detailed in the Invasive Species Management Plan.	Remediation Phase
B4	11.5.1	*Badger* Pre-construction surveys for badger will be undertaken prior to commencement of remediation works to assess the status of the existing setts and any potential newly established setts as specified in the Wildlife Act Licence (DER/BADGER 2017-92) as granted by NPWS – licence has been provided to NPWS as part of the confidential badger report. The findings of these surveys will inform any updates to the derogation licence. The mitigation measures described below follow the recommendations set out in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006c). The location containing the main sett will be retained and as such, the permanent removal of the sett as a result of remediation activities will not occur. The subsidiary sett will be removed prior to remediation works to facilitate remediation and installation of the engineered capping system. The mitigation measures that apply in relation to each badger sett within the ZoI are discussed below.	Remediation Phase
B5	11.5.1	*Badger* Prior to remediation works commencing within the vicinity of the main sett all site personnel will be given a Toolbox talk where they will be briefed on the presence of the sett and the legal protection that badgers, and their setts, are afforded.	Remediation Phase
B6	11.5.1	*Badger - Closure of Subsidiary Sett* Prior to commencement of remediation works in this area and the closure of the sett, the log pile immediately adjacent to the sett will be removed under licence and supervision by a suitably qualified ecologist. Any additional sett entrances identified will be gated as part of the exclusion. Prior to closure the sett will be assessed to determine the use of each hole. Any holes that appear to be disused will be soft-blocked (backfilled with earth and vegetation) and then hard-blocked and proofed to prevent badgers digging back into the sett. Badger gates will then be fitted to all of the used holes on the sett. Sett exclusion will be carried out over a minimum period of 21 days, with the setts being monitored every three days. This will provide information on whether the badgers are still active at the sett. Camera traps will be placed facing the most well used entrance hole, in order to establish that the badger gates are working correctly and are preventing the badgers from re-entering the sett. In order to monitor all other holes where cameras have not been placed, small sticks will be leant in front of the gate to enable an assessment of badger activity. Monitoring will also confirm that the gates are functioning properly. Once there is certainty that all badgers have been excluded from the sett the gates will be locked permanently stopping any access into or out of the sett. Standard guidance (NRA 2006) states that a sett should be destroyed as soon as the exclusion has been completed. However, the standard methods usually employed for safe destruction of a sett will not be feasible in this instance. The sett is located within a steep sandy bank, located on the northern perimeter of the site and is considered to extend in a northerly direction into lands beyond the site. Assessment has shown that the bank could become destabilised and collapse if the sett tunnels and chambers were to be excavated. Furthermore, there is very high risk of the bank including mature trees (one of which contains a bat roost) collapsing using standard methods for destruction of the sett. The remediation works required at this area of the site will comprise backfilling and raising up to be almost level with the existing bank; as such the sett will be buried as part of the remediation works. Rather than destroying the sett it is proposed to leave the gates on for the duration of the works until this area is infilled. The gates would be left in place and the bank covered with wire mesh to prevent badger digging back in. The area immediately surrounding the sett will also be fenced off with mammal proof fencing and vegetation in the vicinity removed to make it less favourable to badger. The area would be monitored once a month to ensure that the gates/mesh and fencing are all in proper working order.	Remediation Phase

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Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
B7	11.5.1	*Badger- Measures to Minimise Disturbance to Main Sett* The following lists of mitigation measures are to be undertaken during remediation works in the vicinity of the main sett to minimise disturbance within retained habitat areas immediately adjacent to the site. These measures will be incorporated into the relevant contract documents: • Any works within 30m of the sett will be supervised by a suitably qualified ecologist (extended to 50m during the breeding season). A 30m buffer will be demarcated around the sett, using barrier tape. Where any works are planned in the vicinity of these exclusion zones (and where they could encroach into same the ecologist will be contacted prior to any such works. The ecologist will ensure that the appointed contractor is complying with the mitigation measures outlined below. • Night-time working will be restricted as far as possible within 100m of the sett. As badgers are nocturnal, disturbance will be reduced by restricting the amount of night-time working within the vicinity of sett. Night-time, in terms of badger nocturnal activity, is defined as beginning one hour before sunset and lasting to one hour after sunrise; • The use of noisy plant and machinery in the vicinity of badger setts will cease before sunset; If the works involve excavations they will either be covered (with plywood), fenced or have an escape ramp installed overnight to prevent badgers, or other wildlife, from falling into them and becoming trapped; • Any borrow pits or spoil heaps will be sited at a minimum distance of 30m from setts; • Chemicals shall not be used within 20m of a badger sett; and • Mammal proof fencing to be installed in the vicinity of the sett will be hand dug under supervision. A licence has been granted by the NPWS to enable the Remediation Phase works. The licence allows for the monitoring of the setts prior to commencement of remediation works, for exclusion of the subsidiary sett, for the installation of the fence line and to permit works within the distance bands described above. Works within the distance bands described above will only be carried out during daylight hours so as not to disturb foraging badgers.	Remediation Phase
B8	11.5.1	*Other Mammals (Pygmy shrew and Hedgehog)* There is no known method for excluding pygmy shrew or hedgehog from nest / hibernation sites and therefore the seasonal clearance of vegetation for breeding birds (as described below) will be implemented. This means vegetation clearance works will avoid the period 1 March – 31 August as far as practicable; a significant portion of the main breeding season for both species. This mitigation will simultaneously avoid the majority of the main breeding season for most small mammal species (Hayden & Harrington 2001).	Remediation Phase
B9	11.5.1	*Bats* Three properties (REC010, REC011 and REC016) will be demolished during the Remediation Phase of the site. These private properties and surrounding gardens were not accessed during the initial bat assessment and surveys, . Daytime bat assessments and potential further roost surveys of these properties and trees will be required to be undertaken by a suitably qualified ecologist prior to them being demolished. If a bat roost is identified the roost will be removed under licence from the NPWS and appropriate mitigation implemented per the licence requirements. The lighting design principles will be avoidance of lighting within particularly sensitive areas. Measures to mitigate the impact of lighting disturbance on bats during the Remediation Phase will include: • Avoid lighting of retained habitats, particularly in the vicinity of woodland, boundary treelines and the confirmed roost. This will ensure that important roosting, foraging and commuting corridors are maintained; • Lighting if required shall be of a low height (as low as possible without compromising safe working standards) to ensure minimal light spill and where feasible timers or motion sensors shall be used to ensure areas are retained in darkness as much as possible. Lighting shall be directed to where it is required only and this can be achieved by fitting louvres to the lighting; and • White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact in comparison to other lighting types as it is less attractive to insects and as such insects will not be diverted away from darker areas where more sensitive bat species will be foraging.	Remediation Phase
B10	11.5.1	*Breeding Birds* Vegetation (e.g. hedgerows, trees, scrub and grassland) will not be removed between the 1 March and 31 August, to avoid impacts on nesting birds. Although the Wildlife Acts provide an exemption from this seasonal restriction to vegetation removal for some construction activities, there is no exemption provided for the destruction of nest sites. It is recognised that the remediation works are to be phased, hence vegetation clearance will not be undertaken across the entire site in one operation but will be targeted based on appropriate working areas that can be controlled and managed. Where the remediation programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist for the presence of breeding birds prior to clearance. Where nests are present, an ecologist will make a decision as to whether a licence is required for vegetation removal. Alternatively, the ecologist can demarcate a suitable buffer around an active nest and clearance within this area will be postponed until the chicks have fledged. A suitable exclusion zone will be established dependent on the species identified. Areas found not to contain nests must be cleared within three days of the inspection; otherwise repeat inspections will be required. If vegetation is to be cleared in the breeding season (under supervision of an ecologist) it will be chipped, removed or covered (ideally) on the same day to prevent birds from nesting.	Remediation Phase
B11	11.5.1	*Amphibians and Reptiles* Areas of suitable reptile habitat such as grassland will initially be cut to 10cm high in order to avoid harm to any reptiles should they be present. This will be carried out by hand using hand tools, or if machinery is used, this will be set to a height of 10cm as advised by a suitably qualified ecologist. Refugia such as log piles will be cleared in warmer months (typically April – September) when reptiles are active. Newly created habitat can be enhanced for reptiles, which will entail provision of artificial hibernacula (see Appendix A11.4, Photo 11.7). Newly created hibernacula will be south-facing and free-draining. If works to clear the existing waterbodies are to be undertaken during the season where frogspawn / tadpoles may be present (February – July) a pre-construction survey will be undertaken to determine whether breeding amphibians are present. If found to be present, the species will be removed by hand net and translocated to the nearest available habitat that is suitable, under licence from the NPWS. There is an abundance of suitable receptor habitat in the immediate locality including ponds located within Kerdiffstown House adjacent to the site. A licence has been granted by the NPWS (Refer to Appendix A11.8) to enable the removal of frog spawn prior to remediation works should it be required.	Remediation Phase
B12	11.5.1	*White-Clawed Crayfish* Mitigation measures to protect water quality during the Remediation Phase are detailed in Section 13.6.1. The mitigation approach to protect the white-clawed crayfish during the proposed work is to undertake capture and relocation of individuals immediately prior to undertaking the construction of the outfall, following pre-construction surveys to confirm the presence of white-clawed crayfish in the vicinity of the outfall and associated works. As the mitigation approach will require the capture of crayfish and the potential disturbance of refuges, it will require a licence from the NPWS. As these works are proposed for year three of the Remediation Phase a licence has not yet been sought. This will be applied for by KCC (or a nominated representative) prior to the works being undertaken. Capture and translocation if required will be undertaken between July – September (to avoid the sensitive period for fish). All works will be undertaken in line with the following documents: • *Guidance on works affecting white-clawed crayfish* (Peay 2000); • *Guidance on Habitat for White-clawed crayfish and its restoration* (Peay 2002); and • *Conservation management of the white-clawed crayfish,* (*Austropotamobius pallipes*) (Reynolds 2010).	Remediation Phase

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Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
B13	11.5.1	*Fish (Salmonids and Lamprey)* All works will be carried out in accordance with the requirements of IFI as set out in *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI 2016). If instream work outside July-September period is required these shall be agreed in writing with IFI. The following measures will be implemented to mitigate the potential impacts to fish species: • Maintaining water quality in the surface water network • Maintaining fish passage while the outfall is being constructed. Only a small section of the river may require to be de-watered using sandbags or similar, hence a continuous flow will be maintained around the de-watered area; • Prior to dewatering the area will be electrofished and fish will be placed upstream of works; and • Instream works will only be carried out during the period July - September (inclusive).	Remediation Phase
B14	11.5.2	*Measures to Mitigate for Habitat Loss* The landscaping design is outlined in Chapter 4 Description of the Proposed Project (Refer to Figure 4.20). Wherever possible, mature trees and tree lines will be retained. The main mitigation measures relate to tree and shrub planting within and around the site. There are limitations as to where tree planting can take place so as not to compromise the integrity of the engineered capping system. This leaves peripheral areas and site boundaries available for such planting and this will occur wherever practicable. As outlined in the All-Ireland Pollinator Plan 2015-2020 all planting will, where practicable, comprise native species of local provenance. In summary, the following landscape planting and measures will be implemented: • Perimeter tree planting and hedgerow planting to include amenity planting around the site entrance as well as native hedgerow screen planting along the boundary; • Wetland ponds are proposed for the north and south central portion of the site, and these will be planted up with a variety of wetland plants to benefit biodiversity; • Wetland ponds have been designed with gradual sloping edges to create a variety of niche habitats to benefit biodiversity; • Dry meadows and grassy verges (GS2) and wet Grassland (GS4) will all be lost as a result of the proposed Project, therefore species-rich native seed mixes will be incorporated into the final design with localised areas of wildflower planting • Drainage ditches and wetland swales across the site will be planted up with wetland herbs and grasses at appropriate locations.	Operational Phase
B15	11.5.2	*Badger* No specific Operational Phase mitigation measures are proposed. There is an abundance of optimal badger habitat within the immediate wider landscape outside the proposed Project boundary. Impacts on badger foraging resource are considered non-significant.	Operational Phase
B16	11.5.2	*Other Mammals (Pygmy shrew and Hedgehog)* To mitigate for loss of small mammal habitat and nesting opportunities four hedgehog nest boxes will be installed in retained woodland and scrub areas. Boxes will be placed in deep scrub or wooded areas away from obvious paths of disturbance by humans or dogs within the wildlife area fenced off from the public (Refer to Figure 4.20). Furthermore, newly created habitats outlined will provide suitable foraging and resting habitat for these species.	Operational Phase
B17	11.5.2	*Bats* The lighting design principal will be avoidance of lighting within particularly sensitive areas. The end-use proposal for the site will include three new multi-use sports pitches, changing rooms, a children's playground, etc. These will be located in the centre and south of the site away from sensitive areas which include the woodland in the lands of Kerdiffstown House and existing unlit areas in the north of the site where the confirmed roost is located. The new access route to the north of the site will be for pedestrians only and will not be lit at night. Measures to mitigate the impact of lighting disturbance on bats during the Operational Phase will include: • Avoidance of lighting, particularly in the vicinity of retained woodland, boundary treelines and the confirmed roost. This will ensure that important foraging and commuting corridors are maintained; • Reduced light spill through the use of baffles / hoods to ensure that light is directed to the sports pitches as required and not wider; • White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact in comparison to other lighting types as it is less attractive to insects and as such insects will not be diverted away from darker areas where more sensitive bat species will be foraging; and • Where lighting is required within sensitive areas (i.e. in the vicinity of retained woodland habitats / tree lines) light levels will be that of full moon light levels, typically between 0.1-0.3 lux.	Operational Phase
B18	11.5.2	*Breeding Birds* To mitigate for loss of nesting habitat trees, hedgerows, scrub and grassland habitats will be provided, refer to Figure 4.20. Whilst no significant impacts are anticipated during the Operational Phase, this will provide compensatory habitat for some bird species. Nest boxes will also be provided to compensate for passerine habitat loss. Ten nest boxes to accommodate different species will be provided and these will be erected under supervision of a suitably qualified ecologist at appropriate locations in secluded/unlit treelines proposed for retention.	Operational Phase
B19	11.5.2	*Amphibians and Reptiles* Whilst no significant impacts are anticipated during the Operational Phase, to account for any loss of potential reptile habitat newly created habitat can be enhanced for reptiles through the provision of artificial hibernacula (see Appendix A11.4, Photo 11.7). Newly created hibernacula will be south-facing and free-draining. A wetland soakaway pond is proposed for Zone 1A and the surface water management ponds in Zone 4, will be planted up with a variety of wetland plants providing optimal breeding habitat for common frog.	Operational Phase

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19.10 Soils, Geology, Contaminated Land and Groundwater

Table 19.8 Soils, Geology, Contaminated Land and Groundwater Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
GW1	12.5.1	The potential impact from landfill gas to off-site human health receptors is significant and mitigation measures are required. These mitigation measures are provided in the Landfill Gas Management Plan (Appendix A4.5) which sets out the likely requirements for gas mitigation measures and monitoring to be undertaken by the appointed contractor during the remediation works (subject to agreement with the regulatory authorities and specified in the IEAL). During the works additional or replacement interim gas controls may need to be installed in agreement with KCC to ensure the risk of lateral off-site migration is not increased.	Remediation Phase
GW 2	12.5.1	The proposals for gas monitoring will need to be bespoke for the remediation works in order to assess the changing nature of the site and associated impacts from gas migration. Throughout the period of remediation works monitoring of all off-site boreholes shall be conducted at least monthly. During active remedial works, or where materials are moved to uncapped areas of wastes for temporary storage, more frequent monitoring of off-site boreholes adjacent to affected areas is likely to be required. Frequency will be determined by the risk assessment produced by the appointed contractor for each phase of works and incorporated within their method statement for working.	Remediation Phase
GW 3	12.5.1	The installation of gas extraction wells within the site as works progress will be in a phased manner, moving from zone to zone as the active remediation works move around the site. Details of the gas control measures and monitoring that will be in place for the Remediation Phase are provided in the Landfill Gas Management Plan (Appendix A4.5).	Remediation Phase
GW 4	12.5.1	Groundwater quality monitoring will be undertaken during the Remediation Phase to ensure that potential negative impacts are not occurring in the groundwater. The boreholes and analytical suite to be used will be agreed with the regulatory authorities and will be specified in the Industrial Emissions Activities Licence (IEAL) for the site. The monitoring will be based on results of ongoing baseline monitoring. The need for installation of new boreholes (which may be required if existing boreholes are to be lost as part of the remediation works) will be considered and if required new boreholes will be installed prior to the remediation works starting. The results of this monitoring will be reported to the EPA to comply with the conditions of the IEAL.	Remediation Phase
GW 5	12.5.2	The scheme design will utilise capping systems to reduce infiltration to the waste mass across the site; for Zones 1 and 3 this will comprise a geosynthetic liner system; Zones 2 and 4 will utilise low permeable soils (depth and performance specification to be determined).	Operational Phase
GW 6	12.5.2	In terms of the gas monitoring, the Landfill Gas Management Plan (Appendix A4.5) accompanying the IEAL application identifies that gas management proposals for the Operational Phase are likely to follow those identified for the Remediation Phase, augmented by the addition of the new gas management system and requirements of specific guidance on flares and surface emissions.	Operational Phase

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19.11 Water – Hydrology

Table 19.9 Water - Hydrology Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
H1	13.6.1	Prior to commencement of the Remediation Phase, the appointed contractor responsible for the remediation works shall prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC. The CEMP shall contain the mitigation measures and plans identified in the EIAR (as a minimum) and shall implement the conditions set out in the planning approval and the requirements of the site's Industrial Emissions Activities Licence (IEAL). The appointed contractor shall also ensure that the CEMP is fully implemented during the Remediation Phase in agreement with KCC, to prevent or reduce the impacts identified in the impact assessment. All construction works shall be completed in line with reference to the guidelines outlined below where applicable, and specified in the CEMP: • 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (NRA, 2005); • CIRIA C648 'Control of Water Pollution from Linear Construction Projects: Technical Guide' (Murnane *et al.*, 2006); • CIRIA C649 'Control of Water Pollution from Linear Construction Projects: Site Guide' (Murnane *et al.*, 2006); • CIRIA C692 Environmental Good Practice on Site 3rd Edition (2010); • 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA, 2001); • 'IFI Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters' (IFI, 2016); and • UK Environment Agency: - PPG3 Use and design of oil separators in surface water drainage systems; - PPG5 Pollution Prevention Guidelines Works and Maintenance in/ or near Water; - PPG21 Incident Response Planning; - PPG22 Dealing with Spills; and - PPG26 Drums and Intermediate Bulk Containers.	Remediation Phase
H2	13.6.1	The first phase of the remediation works will include the removal of the site connection to the Canal Feeder Stream. Therefore there will be no direct hydrological connection from the site to the Canal Feeder Stream during the Remediation Phase. Temporary construction surface drainage and sediment control measures will be in place before earthworks commence.	Remediation Phase
H3	13.6.1	There will be no direct hydrological connection from the site to the Morell River during the Remediation Phase. The surface water pond areas (to be utilised in the Operational Phase) will be used temporarily for the storage of run-off during the remediation works. These ponds will be lined. Further temporary ponds may be constructed at locations adjacent to working areas to assist with management of run-off if the phasing and timing works require additional storage volumes. These temporary ponds will also be lined. Therefore, any potentially contaminated run-off will be captured and contained and will not be discharged from the site. Water may be required for on-site purposes. Re-use on site will include dust suppression and irrigation where necessary (during periods of dry weather) and where the water has been appropriately tested for the intended use. Any waters confirmed to be contaminated and considered as unsuitable for treatment or reuse on site will require to be removed from the site via a road tanker or to sewer in agreement with Irish Water. The appointed contractor will be required to ensure that water is disposed of to a licensed treatment facility. Discharge to ground may be utilised via the soakaway in the north-west extents of the site (Zone 1A).	Remediation Phase
H4	13.6.1	The appointed contractor will be required to prepare an Erosion and Sediment Control Plan (ESCP) prior to commencing the remediation works. The ESCP shall be included in the CEMP. To prevent or reduce the amount of sediment or other polluting substances being released into watercourses, the ESCP will include the following measures to be implemented by the appointed contractor: • Provision of measures to prevent the release of sediment to the Morell River during the construction works (outfall construction to the Morell River, pipeline crossings beneath the Morell River, and road realignment works to include footpath and cycleway with drainage connecting to existing road drainage outfall). Measures will include but not be limited to a cofferdam, sediment fences, and silt curtain; and • Provision of exclusion zones and barriers (sediment fences) between earthworks (re-profiling of slopes), stockpiles and temporary surfaces and watercourses to prevent sediment washing into the watercourse. No waste material including wastewater, will be permitted to discharge into any watercourse during the works.	Remediation Phase
H5	13.6.1	During the Remediation Phase there will be a requirement to expose existing waste, which may allow the infiltration of rainfall to the waste and result in contaminated run-off. To minimise this effect, works will be managed by the appointed contractor through a number of on-site operations, including: • Working in discrete areas to minimise the area of exposed waste; • Interception of any leachate outbreaks identified during waste excavation and re-profiling activities; • Provision of daily cover to exposed wastes, occurring as part of the remediation works; and • Progressively remediate the site with a landfill cap. These measures will be detailed by the appointed contractor in the ESCP.	Remediation Phase
H6	13.6.1	Cleaning of roads to reduce mud and dust deposits will be carried out away from watercourses.	Remediation Phase
H7	13.6.1	Any pouring of cement for the provision of the outfall and/or pipeline crossings for the works will be carried out in the dry and allowed to cure for 48 hours before re-flooding. Pumped concrete will be monitored to ensure no accidental discharge. Mixer washings and excess concrete will not be discharged to surface water.	Remediation Phase
H8	13.6.1	No storage of hydrocarbons or any toxic chemicals will occur within 50m of a watercourse. Fuel storage tanks will be bunded to a capacity of at least 110% of the volume of the storage tank. Re-fuelling of machinery will not occur within 50m of any watercourse and only in bunded refuelling areas. Emergency procedures will be put in place and construction staff will be familiar with emergency procedures.	Remediation Phase
H9	13.6.1	The appointed contractor shall consult with IFI in relation to the ESCP and shall include their requirements in this regard.	Remediation Phase
H10	13.6.1	The detailed design of works within and adjacent to watercourses (e.g. directional drilling beneath the Morell River for the new pipeline crossings; construction of the new outfall to the Morell River from the surface water ponds) will be undertaken with input from a hydromorphologist. Such works will only be conducted during forecast low flow periods and shall be done in July to September. Following in-channel working (i.e. for the outfall and pipeline crossing) the channel cross-section will be reinstated as per pre-work conditions and tied into the structures.	Remediation Phase

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Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
H11	13.6.1	The appointed contractor will detail emergency measures to be implemented in the event of a spillage or accidental discharge. This Emergency Plan will form part of the overall ESCP incorporated as part of the CEMP to be prepared by the appointed contractor and agreed with KCC.	Remediation Phase
H12	13.6.1	Water quality monitoring will be undertaken as indicated in the Industrial Emissions Activities Licence (IEAL) as agreed by the EPA and this will be supported by a Monitoring and Control Management Plan. The IEAL will require the licence holder (KCC) to undertake a monitoring regime to include the Morell River, with key pollution indicators analysed on a regular basis from locations up and downstream of the site. The results of this monitoring will be reported to the EPA to comply with the conditions of the licence. In addition, daily visual inspections of the surface drainage and sediment control measures and the watercourses will be undertaken by the KCC Site Manager or nominated representative. Indicators that water pollution may have occurred include the following: • Change in water colour; • Change in water transparency; • Increases in the level of silt in the water; • Oily sheen to water surface; • Floating detritus; or • Scums and foams. These inspections shall be recorded. In the event that such indicators are observed, review of site works will be undertaken to determine potential linkage. Where a potential linkage is determined an investigation of the potential cause will be undertaken by the appointed contractor. The above monitoring will allow KCC to be assured that the mitigation measures employed by the appointed contractor are successfully operating.	Remediation Phase
H13	13.6.2	Any discharge from the Ponds 2 and 3 must be fully compliant with EPA Emission Level Values for Emissions to Surface Water in the Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities (EPA 2011). The likelihood of a serious surface water pollution incident is considered low. However, a penstock/shut-off valve will be provided on Pond 3 to prevent the release of a discharge to the Morell River in the event of accidental spillage.	Operational Phase
H14	13.6.2	Surface water from the Landfill Infrastructure Compound will be collected by system of road gullies and underground pipework which will be supplied with silt and oil interceptor(s). Flows from the Compound will be discharged to the main site road drainage. The Landfill Infrastructure Compound will also be provided with an isolation point before discharge into the main site road drainage. In order to avoid adverse watercourse impacts due to spills or accidental leakages i.e. leachate spill, a Contaminant Spill Emergency Plan will be put in place to contain, remove or remediate spillages before they reach a surface water receptor. Emergency equipment/spill kits to facilitate the implementation of such a plan will be made available in secured locations within the Landfill Infrastructure Compound area.	Operational Phase
H15	13.6.2	Detailed design for the new site access, realignment of the L2005 Kerdiffstown Road and provision of a footpath and cycleway will be required to include appropriate mitigation measures such as petrol interceptors for the revised road drainage system prior to release to the Morell River.	Operational Phase
H16	13.6.2	For the pipeline crossing of the Morell River the following measures will be implemented: • The minimum distance between crown of the pipes and the river bed will be 400mm to ensure that that the river bed will not be disturbed. • A cover will be provided over the top of pipe (assumed to be concrete) to protect the pipe from any potential future downward erosion. The cover will be placed beneath the natural bed and the bed reinstated as per existing conditions and tied in with the existing bed and banks.	Operational Phase
H17	13.6.2	For the outfall to the Morell River, the inclusion of the surface water ponds (Pond 2 and 3, located within Zone 4) and the provision of the petrol interceptor would reduce potential impacts of fine sediment input into the channel and excessive flows discharging from the outfall. The design of the outfall would aim to avoid disturbance of the natural bank and tie in with the existing rock armour. Specific mitigation measures include but are not limited to: • Constructing the surface water pond to encourage deposition of suspended sediments and minimising sediment input to the river; • Directing the outfall downstream and away from the banks to minimise the impact to flow patterns and minimising any potential risk of erosion (particularly on the opposite bank); and • Minimising the size and extent of headwalls where possible, reducing the potential impact on the banks.	Operational Phase
H18	13.6.2	Following completion of remediation works surface water run-off will not come into contact with waste materials. However, water may still contain some suspended solids and possibly oil, fuel and silt washed off roads. Silt fences installed around the site as part of the remediation works will remain in place until the vegetation within the site is well established and perimeter ditches and swales grassed. Once it has been established that sediment retention techniques are no longer required, silt fences may be removed. There will be no direct / indirect impacts from the proposed Project to the Canal Feeder Stream during operation, as the current outfall will be permanently disconnected during the Remediation Phase. Therefore, no mitigation is proposed.	Operational Phase
H19	13.6.2	Water quality monitoring will be undertaken as indicated in the IEAL as agreed by the EPA supported by a Monitoring and Control Management Plan developed and implemented by KCCs site personnel. During the Operational Phase real time water quality monitoring in the pond is proposed to be used to measure key pollution indicator parameters to be agreed by the EPA, for inclusion in the IEAL and the site's Management Plan. The concentrations recorded in the pond shall be in accordance with the EPA Emission Level Values for Emissions to Surface Water in the Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities (EPA 2011). In the event of an exceedance of the agreed emission level values, the discharge from the pond will be automatically shut off. The design of the surface water system will permit isolation of runoff from various parts of the site in the unlikely event that elevated concentrations of indicator parameters are detected, facilitating investigation to determine the source and remediate where necessary.	Operational Phase

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19.12 Traffic and Transport

Table 19.10 Traffic and Transport Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
TT1	14.5.1	Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Traffic Management Plan (CTMP). The purpose of the CTMP is to set out management and mitigation measures to prevent or minimise the transport impacts during the Remediation Phase of the proposed Project. The CTMP shall include details of the following: • Identify to all staff and contractors the appropriate and safe routes to and from the proposed Project; • Confirmation that routing of HGV traffic is not permitted via Sallins, all Remediation Phase HGV traffic will route via the N7 Junction 8; • Timing of HGV movements to take place outside of peak flow hours, where practicable, in order to minimise disruption to general traffic flows on the road network, including details of delivery windows confirming when traffic is predicted to arrive on-site; • Consideration of location of weighbridge within the site in order to minimise queueing of site traffic on the L2005 Kerdiffstown Road; • Measures to ensure access to all private properties along the L2005 Kerdiffstown Road is maintained throughout the Remediation Phase works; and • Appropriate warning signs to be erected to warn other road users of the presence of HGV's and general Remediation Phase related traffic. Through the CTMP, regular engagement with the existing Community Liaison Group shall be undertaken in order to engage with the local residents on when remediation works will commence, including; • The schedule of works; • Disseminate details of signage • The direction from where HGV loads will be travelling from; • A dedicated telephone number which the residents can contact to report any issues; • Provide details of the dates of the community liaison group meetings; and • Obtain local resident's feedback on other issues that need to be addressed including details of any forthcoming public events etc. that need to be considered. The CTMP shall provide for regular inspections to be carried out to ensure that agreed mitigation measures, as outlined above, are being undertaken.	Remediation Phase
TT2	14.5.1	The appointed contractor responsible for the remediation works will be required to undertake a pre-condition survey of the existing road from the N7 to the site with the scope and method of assessment to be agreed with KCC Transportation Department. Following completion of the importation works, a further survey will be undertaken to determine any deterioration and the requirement for any remedial works, for agreement with the KCC Transportation Department.	Remediation Phase
TT3	14.5.1	A Mobility Management Plan (MMP) shall be prepared by the appointed contractor prior to initiation of the Remediation Phase, the purpose of which is to provide the mechanism to support and promote sustainable travel for staff, contractors and visitors travelling to the proposed Project. The MMP shall seek to eliminate where feasible the barriers preventing users of the site from accessing via sustainable travel modes, improving travel choices and managing single occupancy car use.	Remediation Phase
TT4	14.5.2	As identified within this assessment, the traffic generated during the Operational Phase for the proposed Project is anticipated to be minimal and will not have a significant impact on the existing road network. As such no specific mitigation relating to this phase is required, however the MMP should continue through the Operational Phase and seek ways in which to promote active and sustainable travel to all staff and visitors to the public park.	Operational Phase

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19.13 Waste

Table 19.11 Waste Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
W1	15.5.1	It is estimated that all of the material excavated during re-profiling works will be reused on-site as part of the remediation of the site. Inspections will be undertaken of the material to ensure suitability for reuse and any opportunity for processing to achieve other uses on site. Should any waste material be suspected to be non-compliant, the appointed contractor will be required to quarantine that waste by constructing a perimeter bund and placement of a tarpaulin or other suitable cover over the waste until such time as testing is undertaken and waste classification confirmed. In the event that any of the excavated material is deemed to be hazardous, it will be removed for disposal by a licensed waste contractor to a suitably licensed facility.	Remediation Phase
W2	15.5.1	With respect to the demolition of the on-site concrete structures, the rebar will be removed from the site for reuse or recycling. The appointed contractor will be responsible for the compliant management of the waste rebar. The concrete which arises from the demolition of the concrete structures will be crushed and reused on-site. Waste arising from the demolition of the three properties which fall under CPOs will be managed by the appointed contractor in accordance with the Construction Environmental Management Plan (CEMP).	Remediation Phase
W3	15.5.1	Waste tyres currently used to anchor the temporary geosynthetic capping in Zone 3, will be removed off-site for reuse or recycling. These will be managed by the appointed contractor in accordance with the CEMP.	Remediation Phase
W4	15.5.1	Materials which will require to be imported to the site to facilitate the remediation works will be appropriately sourced and managed to ensure that the material is of suitable engineering grade for the proposed Project. In so far as is possible, materials will be ordered within a reasonable timeframe of when they will be required on-site. This should prevent waste being generated through over-ordering, or through materials degrading due to long periods of storage on-site prior to use.	Remediation Phase
W5	15.5.1	Where material needs to be stockpiled within the site the appointed contractor will be responsible for management of the stockpiles in accordance with the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA 2009) to ensure that surface water and groundwater are protected from contamination and these provisions will be detailed in the CEMP. Please refer to Chapter 4 Description of the Proposed Project for further information and requirements on stockpile management. As a minimum stockpile management will include: • Visual screening for potential contaminated materials; • Segregation of material suspected to be contaminated from clean materials; • Stockpiling of materials at appropriate heights / batters to prevent potential instability; • Protection of stockpiled materials from scour / erosion; • The provision of adequate drainage to limit and control potential contaminated surface water runoff, including silt mitigation and • The avoidance of un-necessary trafficking / handling of stockpiled materials. With the exception of top soil (or soil forming materials), stockpile heights will be restricted to a maximum of 4m to facilitate adequate management during the works. A reduced stockpile height of 2m will apply to any top soil / soil forming materials to prevent possible degradation of soil structure.	Remediation Phase
W6	15.5.1	The appointed contractor(s) responsible for the remediation works will ensure that any facility to which waste is brought is licensed / permitted in compliance with waste management legislation and will obtain the appropriate certification of disposal / destruction of waste. Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a CEMP. The CEMP shall contain the mitigation measures and plans identified in the EIAR and ensure that they are fully implemented during the Remediation Phase, to prevent or reduce the impacts identified in the impact assessment. The CEMP will outline measures and provisions for the management of waste during the Remediation Phase, and will take the following guidance documents into consideration: • Best Practice Guidelines on the preparation of Waste Management Plans of Construction and Demolition Projects, Department of the Environment, Heritage and Local Government, July 2006; • CIRIA document C692 – Environmental Good Practice on site; • CIRIA document 133 Waste Minimisation in Construction; • National Hazardous Waste Management Plan 2014-2020; and • Guidelines for the Management of Waste from National Road Construction Projects, NRA 2008.	Remediation Phase
W7	15.5.1	As well as hazardous wastes generated by the remediation works, there is a slight possibility of encountering some unknown hazardous waste during the remediation works. If such waste types are uncovered, further investigation, testing and risk assessment will be undertaken to determine the appropriate actions to be taken with regards to compliant removal and disposal of such waste. Materials identified as hazardous will be required to be suitably disposed of in a licensed hazardous waste disposal facility. Where practicable, the closest suitable facilities to the proposed Project will be selected to reduce impacts associated with vehicle movements such as air emissions and noise. There are no facilities within County Kildare which accept hazardous wastes. There are a number of facilities located in Dublin, the closest of which is Rilta which is approximately 17km from the proposed Project. There is also an Enva facility in Dublin which is approximately 25km from the proposed Project. Enva also have a facility in Portlaoise for the treatment of contaminated soils, which is approximately 60km from the site of the proposed Project. Any such material will be managed in accordance with waste management legislation and the following requirements: • Excavation will be targeted and stockpiling will be managed in order to prevent potential contaminants from being released into the surrounding environment; • All hazardous waste will be segregated from non-hazardous waste, with different types of hazardous waste being segregated from each other if safe to do so. Each hazardous waste storage location will be clearly signposted stating the type of waste and that it is hazardous; and • A Waste Transfer Form (WTF) will be used to record the transportation of hazardous waste within the State and will be required of any movements of hazardous waste arising during construction of the proposed Project. Should the need arise for the Transfrontier Shipment (TFS) of waste, the movement between countries is subject to control procedures under the EU and national legislation and guidance, such as the Waste Management (Transfrontier Shipment of Waste) Regulations, 2007. The appointed contractor, as the waste producer, will be responsible for ensuring the compliant disposal of all wastes during the Remediation Phase of the proposed Project, and as such will be required to retain records of all hazardous wastes. Kildare County Council will monitor that all waste arising as part of the Remediation Phase is handled and disposed of compliantly by the appointed contractor as per these requirements. Copies of all testing will be retained by the KCC Site Manager.	Remediation Phase

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Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
W8	15.5.1	During the Remediation Phase of the proposed Project, the management of leachate and effluent will need to be maintained at the baseline levels at a minimum. The Leachate Management Plan (Appendix A4.4) will be implemented to ensure continued collection and compliant disposal of leachate being generated from the site. The Leachate Management Plan outlines leachate management proposals throughout a number of different stages of the remediation works. These include: • Operation in discrete areas to minimise the area of exposed waste; • Interception of any leachate outbreaks during waste excavation or re-profiling activities; • Provision of daily cover to exposed wastes; and • Progressively remediate the site with a landfill cap. Discharge of run-off during remediation works will not be permitted as per the Surface Water Management Plan (Appendix A4.6), with ponds lined with geomembrane liner to offer additional protection to groundwater during this period. Should a situation arise where run-off levels are becoming higher than can be adequately collected and maintained within the site, the collected water will be tankered off-site by a suitably licensed contractor for disposal at a suitably licensed facility. The leachate pipeline and Landfill Infrastructure Compound shall be built during the early Phases of the remediation works, allowing for the leachate collected in Zone 3 to be discharged from the site through the new system to the Johnstown Pumping Station. The appointed contractor will be responsible for ensuring the compliant management and disposal of leachate during the Remediation Phase of the proposed Project.	Remediation Phase
W9	15.5.2	Management of wastes arising during the Operational Phase of the proposed Project will be the responsibility of Kildare County Council as the licensee. The Council may appoint contractor(s) to provide waste management and landscaping services on their behalf. Management plans for the operation and maintenance of the multi-use public park shall be produced and adhered to by all landscaping and maintenance personnel.	Operational Phase
W10	15.5.2	Waste silts and hydrocarbons / oily waters collected in the on-site drainage interceptors will be handled and disposed of through appropriately licensed contractors as and when required. The specialist contractors will clean out the interceptors and the waste material will be sent to a suitable licensed facility for treatment and/or disposal.	Operational Phase
W11	15.5.2	Leachate and effluent from the site compound and changing room facilities will be disposed of to Johnstown Pumping Station for treatment at Osberstown WWTP via a sewer connection to the local sewer network under agreement with Irish Water. There may be occasions where leachate will need to be tankered off-site for disposal. This will only arise at times when there are any abnormal occurrences with the treatment process or restrictions on discharge to sewer. It is anticipated that there will be a call-off agreement in place with a licensed contractor such that when tankers are needed they can be mobilised prior to full utilisation of leachate storage capacity at the site. Refer to Appendix A4.4 Leachate Management Plan for further detail on leachate management and disposal.	Operational Phase

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19.14 Population and Human Health

Table 19.12 Population and Human Health Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
P1	16.5.1	Amenities & Recreation • During the Remediation Phase of the proposed Project, mitigation as detailed in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration and Chapter 9 Landscape and Visual will be implemented. This shall include the development of a CEMP by the appointed contractor. • The Kildare County Council Project Team with the appointed contractor will continue to communicate with the local residents, including the Community Liaison Group, as well as local recreation providers/local community. These communication channels will allow local groups to keep future visitors up to date on the proposed Project as well as providing an avenue to raise concerns or issues during this Phase of the project.	Remediation Phase
P2	16.5.1	Community Severance & Accessibility • The appointed contractor will be required to maintain access to residential and commercial properties throughout the Remediation Phase.	Remediation Phase
P3	16.5.1	Employment • The potential employment opportunities associated with the Remediation Phase are positive impacts, albeit in the short-term, however such impacts require no mitigation. • In relation to employment centres in direct proximity of the site, a CEMP shall be developed by the appointed contractor which shall implement appropriate measures to minimise impacts from Remediation Phase works (directly on site and in the realignment of the L2005 Kerdiffstown Road).	Remediation Phase
P4	16.5.1	Land-Use • Access to areas subject to the temporary CPO process will be maintained throughout the Remediation Phase to ensure severance and community access issues are not a factor. Areas subject to the temporary CPO process will also be returned to their approximate previous state after necessary works are completed. • For the properties (REC006, REC007 and REC008), KCC will engage with the residents regarding appropriate fencing and screening along the realigned road at these properties to ensure the privacy of the residences during the Remediation Phase. This shall be undertaken by the erection of some form of additional wall or fencing and vegetative screening that would be agreed with the landowners in advance of the remediation works commencing.	Remediation Phase
P5	16.5.1	Economy & Tourism • During the Remediation Phase the proposed Project shall look to procure material and services from local providers, where reasonably practicable, and within the requirements of the procurement process. This would encourage additional economic activity in the local economy which may subsequently result in indirect employment opportunities being created.	Remediation Phase
P6	16.5.2	In relation to Land Use, for the properties (REC006, REC007 and REC008) along the L2005 Kerdiffstown Road, a new wall or fencing shall be erected along these properties. Semi-mature tree and shrub planting may also be provided to the inside of the wall for additional screening and amenity purposes. These mitigation measures shall be implemented in consultation with the property owners in question. Operational Management Plans and regular maintenance schedules will be put in place to manage and maintain the site and approaches to the proposed Project on an ongoing basis during the Operational Phase, minimising any potential negative impacts of the proposed multi-use public park.	Operational Phase

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19.15 Material Assets

Table 19.13 Material Assets Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
MA1	17.5.1	The three properties to be demolished, as well as the areas of land required, shall be the subject to Compulsory Purchase Orders (CPOs), with the landowners to be compensated accordingly for the loss of the asset. A septic tank, of soakaway design, extends from property REC039 and discharges within the site boundary. This discharge will be removed and a sewer connection provided for this property.	Remediation Phase
MA2	17.5.2	All possible precautions shall be taken to avoid unplanned disruptions to any services during the Remediation Phase of the proposed Project. This shall include thorough investigation to identify the location of all utility infrastructure within the working area, and the implementation of robust procedures when undertaking works in and around known utility infrastructure such as overhead lines. Service disruptions impacting the surrounding residential, social and commercial properties shall be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions shall be given to all impacted properties. This shall include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties shall be undertaken prior to any proposed disruptions. Specific mitigation measures are as follows: • Avoidance of interaction with overhead utility lines in and around the site; • Protection in place of all underground services for which diversion is not required; • Use of existing electricity, telecommunications and water connections where possible; • The surface water drain from the adjacent property shall be reconnected to the existing outfall to the Canal Feeder Stream outside of the site boundary, with the site connection removed; • Consultation and agreement in place with Irish Water on allowable quantities and acceptance criteria for the leachate and other wastewater to be discharged to the public sewer network; and • Pre-treatment of leachate (methane stripping) prior to disposal to the sewer to remove explosion risk within mains.	Remediation Phase
MA3	17.5.3	Where additional material is required for re-profiling and capping of the site, this material shall be imported. Only materials which meet suitable engineering grade shall be sourced as required. A number of key issues shall be considered as part of the selection process. These include source; material specification; production and transport costs; and the availability of material. Proposals for material management are to be set out in the Construction Environmental Management Plan (CEMP) for the proposed Project. Any material being imported to the site must be accompanied by a source report completed by the provider of the material, which will give the history of the material and the land from which it has been taken. Material shall only be accepted based on the information contained in the source report. No material shall be accepted to site without a suitable source report. The imported material shall be sourced locally as far as reasonably practicable in order to reduce the need for long distance transportation of the material. Possible future sources for this material may include nearby development sites.	Remediation Phase

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20. Summary of Residual Impacts

The residual impacts associated with the proposed Project after adherence to the implementation of mitigation measures, are summarised in Table 20.1.

Table 20.1: Residual Impact after Mitigation Measures

Chapter No.	Environmental Aspect	Summary of Residual Impact
7	Air Quality, Odour and Climate	**Remediation Phase** The Remediation Phase will be managed so that there are no significant residual air quality impacts after completion.
		Operational Phase The comprehensive mitigation and management proposals will ensure that there are no significant residual impacts during the Operational Phase.
8	Noise and Vibration	**Remediation Phase** The overall noise and vibration impact from the Remediation Phase of the proposed Project is anticipated to be short term and moderate considering the existing noise environment and the predicted impact of the proposed Project.
		Operational Phase The impact assessment has shown that the facility can operate within the adopted day, evening and night-time noise limits for the site. The overall noise and vibration impact from the operation of the proposed Project is anticipated to be long term and imperceptible (not significant) considering the existing noise environment and the predicted impact of the proposed Project.
9	Landscape and Visual	**Remediation Phase** The Remediation Phase will be managed so that there are no significant residual impacts to landscape and visual amenity after completion.
		Operational Phase Residual visual impacts area assessed at each of the representative viewpoints using a period of approximately seven years for the substantial establishment of mitigation planting. In every instance it is considered that the residual visual impact of the Operational Phase will be either a positive improvement on the current un-remediated baseline scenario or have no effect on visual amenity. Minor increase in the level of illumination proposed within and around the site is not considered to be significant.
10	Archaeology, Cultural Heritage and Architectural Heritage	**Remediation and Operational Phase** With all of the specified mitigation measures are carried out, there will be no residual impacts upon the archaeological, architectural and cultural heritage resource.
11	Biodiversity	**Remediation Phase** Through the implementation of well-established approaches to mitigation, which will be implemented in accordance with best practice guidance, it will be possible to reduce the impacts to not significant for all ecological features. **Operational Phase** As a result of the proposed mitigation and enhancement measures, no residual significant adverse impacts are predicted for the ecological receptors in the long-term following implementation of mitigation measures. In addition, as a result of the proposed Project and habitats features to be created, significant beneficial impacts are predicted for the Operational Phase of the proposed Project for the following ecological receptors: wetland habitats, amphibians and reptiles.
12	Soils, Geology, Contaminated Land and Groundwater	**Remediation and Operational Phase** The comprehensive mitigation and management proposals will ensure that there will be no significant residual impacts on soils, geology, contaminated land or groundwater.

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Chapter No.	Environmental Aspect	Summary of Residual Impact
13	Water – Hydrology	**Remediation and Operational Phase** The comprehensive mitigation and management proposals will ensure that there will be an imperceptible residual impact the Morell River, and the Canal Feeder Stream, and no residual impact on Rathmore Stream and the watercourse on the Watercourse on Palmerstown House Estate & Golf Course.
14	Traffic and Transport	**Remediation Phase** While the nature of traffic increases will be short-term and the impacts negligible, the mitigation measures outlined will minimise any residual impacts. **Operational Phase** The traffic generated during Operational Phase of the proposed Project will not have a significant residual impact on the existing road network. Suitable signage will be erected advising of the appropriate access to the proposed Project. Furthermore, staff and visitors to the proposed Project, once operational, will benefit from the pedestrian and cycle infrastructure provided from the realignment of the L2005 Kerdiffstown Road which will provide a safe and desirable opportunity for walking and cycling to the public park.
15	Waste	**Remediation Phase** With mitigation and management proposals in place, there will be no significant residual impacts. **Operational Phase** As a result of the management of leachate and effluent from to site, and the connection to the wastewater treatment plant, and the implementation of operational management plans, there will be a positive residual impact.
16	Population and Human Health	**Remediation Phase** With mitigation and management proposals in place, there will be no significant adverse residual impacts. Furthermore, there will be positive residual impacts in relation to local employment opportunities, economic activity as a result of this employment, and an improvement to the L2005 Kerdiffstown Road. **Operational Phase** There will be positive residual effects in relation to local employment opportunities, and an improvement to the L2005 Kerdiffstown Road, recreational amenity and an improvement in the surrounding area, a positive contribution to the human health of the local population due through use of the recreational and amenity areas, and potential to increase the utility of the Grand Canal and neighbouring recreational amenities.
17	Material Assets	**Remediation and Operational Phase** Residual impacts on both the major utilities and the imported material are considered to be imperceptible.

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