ENVIRONMENTAL IMPACT STATEMENT

FOR THE INTENSIFICATION OF

DERRYCLURE LANDFILL

CO. OFFALY

Volume 2 of 3 – Main Report

ORIGINAL

Prepared for:

Offaly County Council
Charleville Road
Tullamore
Co. Offaly

Prepared by:

Fehily Timoney & Company
Core House
Pouladuff Road
Cork

October 2008

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User is Responsible for Checking the Revision Status of this Document

Rev. Nr.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date
A	Initial Draft	SM			02.09.08
B	Second Draft	DOS			10.10.08
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Client: Offaly County Council

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Abstract This document comprises part of the EIS for the proposed intensification of Offaly County Council's landfill at Derryclure, Co. Offaly. The site operates under a waste licence from the Environmental Protection Agency (W0029-02). This document forms Volume 2 of the EIS – Main Report

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PREAMBLE

Offaly County Council proposes to intensify activities at Derryclure Landfill. The Landfill straddles the two townlands of Derryclure and Killeigh, Co Offaly. Offaly County Council (OCC) intends to increase its waste intake from 40,000 tonnes to 100,000 tonnes per annum.

The development is subject to the requirements of the Planning and Development Acts 2000 – 2006. An environmental impact assessment (EIA) is required in support of the application in accordance with Part 13 of Schedule 5 of the Planning and Development Regulations 2001 - 2006 where it is stated that;

'*any changes or extension of development which would:- (ii) result in an increase in size greater that 25 per cent, or an amount equal to 50 per cent of the appropriate threshold, whichever is greater*'

Clearly, an increase from 40,000 to 100,000 tonnes per annum exceeds the threshold and an EIA is required. This environmental impact statement (EIS) summarises OCC's findings as part of the EIA.

Because the proposed development is being carried out by a local authority and is the subject of EIA (Section 175 (1) of the Planning and development Act 2000) it is deemed 'strategic' and OCC is required to submit its proposals to An Bórd Pleanala for approval.

A review of the existing Waste Licence (Ref W0029-02) by the Environmental Protection Agency (EPA) is also required as part of the intensification of landfilling activities.

OCC has appointed Fehily Timoney and Company (FTC) as their consultant for this project. FTC is responsible for the preparation of the required EIS for submission to An Bord Pleanála on behalf of OCC in support of its application for planning approval for the proposed development.

1. INTRODUCTION

1.1 Project Overview

This EIS has been prepared for the proposed intensification of the existing landfill located in the townland of Derryclure, approximately 5 km south of Tullamore, County Offaly. This EIS, which will also accompany the waste licence review application, provides an assessment of all possible environmental impacts of the proposal.

The site comprises an area of approximately 29.5 ha. The study area extends outside the site to its immediate environs. Derryclure lies adjacent to the N80 national secondary route, and is accessed directly from the N80. The facility is bounded to the west by pasture land and to the north, east and south by raised peat bogland under the ownership of Bord na Mona. Its location is shown in Figure 1.1.

The proposed intensification comprises increasing the tonnage of waste currently accepted at the site from 40,000 tonnes per annum to 100,000 tonnes per annum. Consequently, this will shorten the life of the landfill. It is currently estimated that there remains approximately 954,000 tonnes of landfill capacity if the landfill is developed to the full extent allowable under the current waste licence. Intensification would reduce the remaining lifespan of the facility from 24 years to 9.5 years.

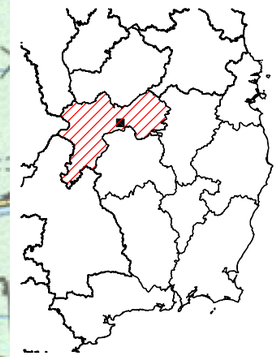
The proposed intensification will occur within the existing site boundary. No additional physical infrastructure is proposed under this application. Intensification will result only in earlier development of future landfill cells and associated infrastructure. The extent of the facility boundary is shown in Figure 1.2.

1.2 The Applicant

The Applicant is Offaly County Council, Aras an Chontae, Charleville Road, Tullamore, Co Offaly.

1.3 Difficulties Encountered During the Project

No significant difficulties were encountered during the preparation of the EIS



KEYMAP

SITE PLAN
Scale 1:25000

Rev.	Drawn	Chkd	Appd		
A	MM	SM	DOS	Cork 21.10.08	ISSUE FOR APPROVAL
Revision History				Rev Origin / Date	Description
A					

Name of Client

OFFALY COUNTY COUNCIL

Name of Job

DERRYCLURE LANDFILL WASTE LICENCE REVIEW

Title of Drawing

SITE LOCATION PLAN

Scales Used 1:25000

Dwg. No. CE07-286-01_FIG 1.1 — **Rev.** A

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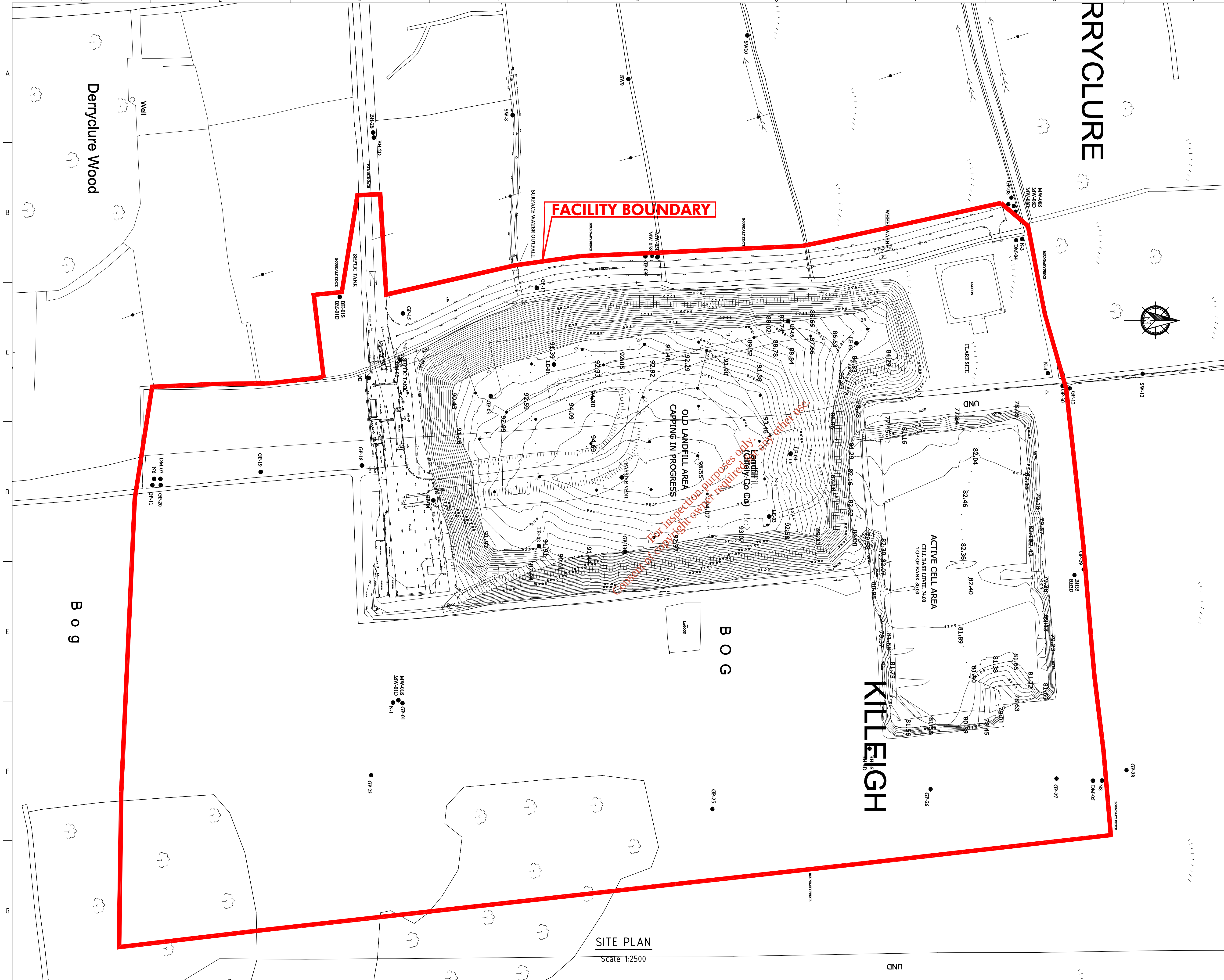

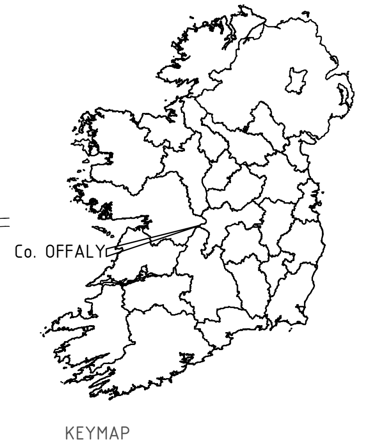

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Do not scale. Use figured dimensions only. If in doubt - Ask!

Rev.	Drawn	Chk'd	App'd	Rev Origin / Date	Description
A	MM	SM	DO'S	Cork 21.10.08	ISSUE FOR APPROVAL

Revision History A

Name of Client

OFFALY COUNTY COUNCIL

Name of Job

DERRYCLURE LANDFILL WASTE LICENCE REVIEW

Title of Drawing

FACILITY BOUNDARY

Scales Used 1:2500

Dwg. No. CE07-286-01_FIG 1.2 **Rev.** A

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ORIGINAL DRAWING SIZE A1 - (841 x 594)

1.4 National and Regional Waste Management Policy

This section of the EIS outlines the National and Regional policy documents which set out specific policy statements in relation to the development and operation of landfills.

1.4.1 National Policy

Changing Our Ways 1998

Government policy in relation to waste management is set out in the policy statement entitled Waste Management: Changing Our Ways published by the Department of Environment and Local Government (DoELG) in September 1998. The policy document outlines ambitious targets for waste management which includes:

- the diversion of 50% of overall household waste away from landfill
- a minimum 65% reduction in biodegradable wastes consigned to landfill
- the development of waste recovery facilities employing environmentally beneficial technologies, as an alternative to landfill
- recycling of 35% of municipal waste,
- recycling at least 50% of C&D waste within a five year period, with a progressive increase to at least 85% over fifteen years,
- rationalisation of municipal waste landfills

'Changing Our Ways' focuses on Ireland's need to reduce dependence on landfilling. At the same time, this document recognises that landfill has a role to play in waste management in Ireland. Section 3.9 states:

'The nature of that role must change so that landfill becomes a subsidiary element of an integrated waste infrastructure catering for the disposal of residual waste which cannot be prevented or otherwise treated….'.

'Changing Our Ways' acknowledges that there may be some short-term deficits with respect to landfill capacity. It states that expansion of existing facilities should be prioritised over the construction of new facilities. Section 5.2 states:

'Where immediate landfill capacity problems exist, action to extend the life of existing landfill facilities, rather than to provide new landfill sites, should be a priority.'

"Waste Management: Taking Stock and Moving Forward – 2004

On 5th April 2004, a further national waste management policy document – 'Waste Management: Taking Stock and Moving Forward' – was launched. 'Taking Stock' assesses progress on the implementation of a variety of aspects of the Waste Management Act 1996 over the preceding five years. It sets down new challenges in light of the findings of this assessment.

Chapter 3.5.3 of this policy document addresses the issue of landfill and notes that in the absence of timely delivery on recycling and thermal treatment objectives there will be increased pressure for an extension of landfill capacity which will require local authorities to provide further short-term solutions without prejudicing the achievement of the longer term goal of achieving maximum diversion from landfill.

The document summarises the estimated remaining landfill capacity for each of the 10 waste management regions in 2004.

Chapter 4.3 of the policy document states that:

"There is not an automatic implication of waste management plans that waste facilities provided in the region have to be used exclusively for the region/county concerned… clearly facilities provided in the region must serve primarily the waste management needs of that region. That is entirely consistent with the concept of regional waste management planning where each region has to take lead responsibility for its own waste, …however careful consideration needs to be given to whether the imposition of blanket prohibitions on all cross-regional movements of waste is inappropriate and measured interpretation of the philosophy underlying regional waste management planning… it is noteworthy that the EPA in its most recent National Waste Database Report for 2001 has recommended that the inter-regional movement and treatment of wastes should be provided for… in appropriate circumstances."

Chapter 4.3 concludes with key point 3 namely that "*an examination of the issues arising in terms of the inter-relationship between regional boundaries and waste facilities will be completed with a view to providing guidance to the relevant authorities…"*

The above guidance referred to in Chapter 4.3 was provided in circular WIR:04/05 published by the DoEHLG in May 2005. It stated that:

"One of the fundamental components of policy in regard to the regulation of the movement of waste is the application of the proximity principle… the application of the proximity principle does not entail interpreting administrative waste management planning boundaries in such a manner as to inhibit the development of waste infrastructure which will support the attainment of national waste management policy objectives through the rational development and use of such infrastructure."

Chapter 4.5.7 of 'Taking Stock' states that any update of waste management plans will need to provide for an appropriate balance between "*having sufficient landfill capacity available in the short to medium term pending the delivery of alternative 'higher-in-hierarchy' infrastructure, and guarding against the overprovision of landfill*…"

National Biodegradable Waste Strategy (2006)

The National Biodegradable Waste strategy outlines government policy for the diversion of biodegradable material from landfill. It builds upon the key objectives established in previous policy documents, 'Changing Our Ways', Delivering Change' and 'Taking Stock and Moving Forward' mentioned above. The strategy focuses on Biodegradable Municipal Waste (BMW) with the principal biodegradable components being paper, cardboard, food, and garden wastes. This document sets limits for maximum quantities of BMW to be landfilled in 2010, 2013 and 2016, in line with the mandatory targets laid down in the Landfill Directive.

1.4.2 Regional Policy

Midlands Waste Management Plan 2005 -2010

The Waste Management Plan for the Midland Region (WMPMR) applies to the administrative areas of five local authorities, which have a combined population of 317,687 based on the 2006 Census. These five authorities are Offaly County Council, Longford County Council, Laois County Council, North Tipperary County Council and Westmeath County Council. It sets a recycling target of 46%, thermal treatment 37% and landfill disposal 17% for the region.

The Plan acknowledges that the establishment of a thermal treatment facility within the region "*could take a period in excess of 5 – 7 years. In the interim, residual waste will be primarily landfilled*".

This plan places strong emphasis on waste prevention and minimisation. It states that future policy shall take cognisance of all relevant and pending regulations, shall recognise priority waste streams and shall promote sustainable waste management practices at local, business and industrial level.

A summary of the policies of the WMPMR 2005-2010 relevant to this proposed development is provided below:

15.7.5 Waste Disposal

Waste Disposal Policy shall consider the medium to long-term options for rationalisation of landfills in the Region, taking account of residual capacities and timetables for alternative treatment options.

16.5 Biological Treatment

The Local Authorities shall reduce the quantity of biodegradable waste disposed of to landfill in accordance with the mandatory requirements of the EU Landfill Directive (1999) and the targets set out in the Draft National Biodegradable Waste Strategy (2004).

16.8 Landfill Disposal

In relation to landfilling, the plan states *"In the short to medium term until such systems* (MBT, Thermal Treatment) *are developed there will be a need for significant landfill capacity in the Region. It must however be recognised that the long-term viability and need for four landfills in the Region will be impacted by the EU Landfill Directive Targets, by the development of a Waste to Energy facility and by the recycling targets set out in the Plan. The four existing facilities can remain provided the mandatory BMW landfill targets are adhered to as set down in the Draft National Biodegradable Waste Strategy".*

Policy:

The Local Authorities will continue to pursue a policy of regional landfill rationalisation in the long term whilst continuing to operate and maintain landfill facilities to satisfy regional demand, to the highest international standards in accordance with Waste Licences issued by the EPA.

Target to 2010:

Local Authorities will provide adequate landfill disposal capacity in the Region respecting the mandatory BMW targets and until alternative thermal capacity is available to the Region.

16.12 Inter-Regional Movement of Waste

Policy:

The proximity principle should be taken into account however it is recognised that there should be flexibility with respect to the movement of waste across regional boundaries and within the Region. The capacity of waste facilities in the Region should, as far as possible, satisfy the needs of the Region whilst allowing some element of flexibility of movement of waste into and out of the Region in line with the policy direction issued by the Minister in May 2005 under section 60 of the Waste Management Act, 1996 (as amended).

1.4.3 Offaly County Development Plan

The Offaly County Development Plan 2003 – 2009 sets out an overall strategy for the proper planning and sustainable development of the county through the objectives of the plan. The development plan makes due reference to the policies and objectives set down in the regional waste management plan.

The existing county development plan will be superseded by the Offaly County Council Development Plan 2009 – 2015, a draft of which is currently in circulation. The 2009 – 2015 plan makes due reference to the WMPMR 2005 – 2010, and makes provision for the development of waste treatment infrastructure such as waste to energy and mechanical biological treatment facilities.

1.4.4 Compliance of Proposed Development with Policy

The Midlands Waste Management Plan and County Development Plan do not prohibit the intensification of Derryclure landfill. The Midlands Waste Management Plan specifically mentions Derryclure as a regional facility. The Plan states that local authorities will provide adequate landfill capacity until alternative thermal capacity is available to the Region. At time of writing, there are no plans underway for development of a thermal treatment plant in the region. The Plan also makes allowance for inter-regional movement of waste, while acknowledging that the capacity of waste management facilities in the Region should as far as possible satisfy the needs of the Region.

The proposed development complies with national policy with respect to landfill development. 'Changing Our Ways' recommends that where additional landfill capacity is required, existing facilities should be extended where possible rather than developing new facilities. 'Waste Management – Taking Stock and Moving Forward' (2004) states that inter-regional movement of waste should be facilitated in appropriate circumstances.

1.5 Need for the Development

Derryclure landfill services the Midlands region in line with the Midlands Waste Management Plan, and also caters for waste from the Greater Dublin Area (GDA). In the short term, from 2009 – 2011, there will be a shortfall in landfill capacity in the GDA due to the pending closure of Arthurstown Landfill in mid to late 2009. Arthurstown has been running on a reduced capacity since 2006, reducing waste intake from 600,000 tonnes per annum (tpa) to c. 250,000 tpa. Thus there has been a significant up-take of landfill capacity at other landfills on the periphery of the GDA, Derryclure being one of these.

The Dublin Waste Region has identified a 'preferred site' for the Region at Nevitt in north County Dublin (Fingal) as a replacement facility for the regional landfill at Arthurstown. The replacement Dublin Waste Management Plan has set a target of 2010 for the opening of Fingal Landfill. The landfill once operational will accept 500,000 tpa. However, this facility has not received planning or a waste licence to-date. Planning approval has yet to be granted, the ABP oral hearing is to be re-convened shortly.

In parallel with this application, the Dublin Region has secured thermal treatment capacity of 600,000 tpa at Ringsend. Planning permission has been granted for this facility while the proposed decision for the waste licence is currently under appeal. In addition, Indaver Ireland has received statutory consent for the construction of a 200,000 tpa waste to energy facility at Carranstown, Co. Meath. It is likely that this demand for landfill capacity outside the GDA will continue until Fingal landfill, Poolbeg and Carranstown thermal treatment facilities come on-stream. Carranstown is expected to be the first of these, and is anticipated to commence processing waste in early 2012.

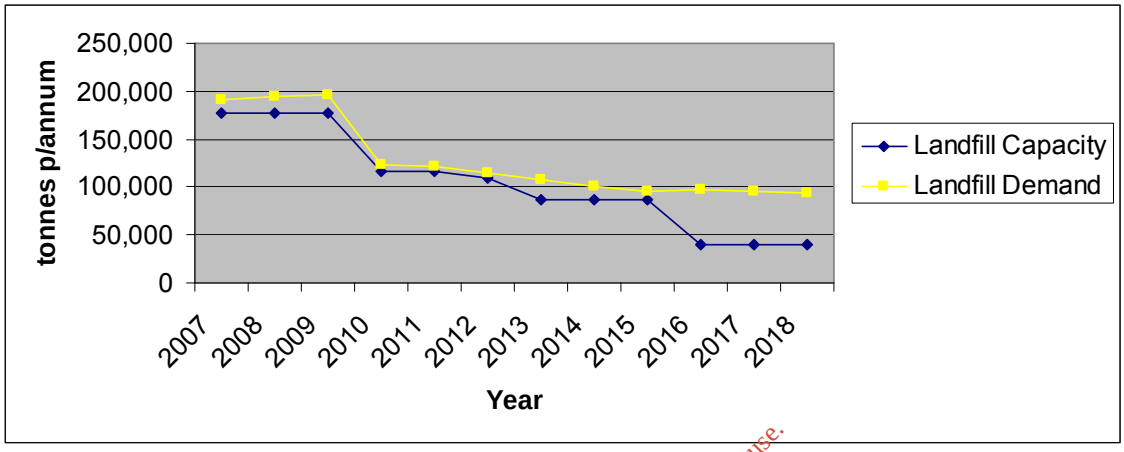
However, as neither Fingal landfill nor the waste-to-energy facility at Ringsend have yet successfully completed the statutory processes, any delay in the establishment of either of these facilities will result in a deficit in waste management capacity in the Dublin Region for an extended period.

In the short-medium term, there will be a shortfall of landfill capacity in the Midlands Region. Westmeath County Council's landfill at Ballydonagh is planned to close in late 2009, reducing available capacity in the region by 60,000 tpa. Ballaghveny Landfill in North Tipperary is licensed to import 49,000 tonnes of waste per annum. Ballaghveny currently imports circa 30,000 tonnes per annum and at this rate of intake is expected to reach capacity in 2012, with the loss of an actual 30,000 tpa to regional capacity. Thus from 2012 onwards the only operational landfills in the Midlands Region will be Derryclure and Kyletalesha (near Portlaoise). This shortfall in landfill capacity is illustrated in Figure 1.3 below, which simply compares landfill demand to available landfill capacity.

Geographically, Derryclure is better-positioned than Kyletalesha to make up the shortfall that will arise when Ballydonagh closes. In fact, in the national spatial strategy, Tullamore, Athlone and Mullingar comprise a 'linked gateway/hub'. There have been instances in the recent past where Kyletalesha has been directed to close (by the EPA) pending environmental improvements. . In that instance, Derryclure is the most proximate alternative. In any case there is a need for redundant capacity to manage upset events in the region.

Section 3.7 of the National Spatial Strategy states *"Waste management is a particular current priority. Efficient, effective and cost competitive waste management facilities are essential if industrial and enterprise activity is to thrive and develop in a balanced way across Ireland".*

Figure 1.3 Landfill Demand v Available Landfill Capacity



1.5.1 Assessment of Landfill Capacity within the Midlands Region & Surrounding Area

The remaining lifetime of the landfill at the current rate of waste intake is approximately 24 years. Intensification of intake to 100,000 tonnes per annum would reduce this lifetime to 9.5 years. Landfill capacity and demand is therefore projected up to 2018.

There are currently four operational landfills in the Midlands Region at various stages of development and capacity. A fifth landfill, Annaskinnan, has been granted a waste licence by the EPA but planning permission was refused by ABP. It has therefore been excluded from the projection of available landfill capacity.

The status of each of these four landfills is summarised in Table 1.1 below.

Table 1.1: Status of Landfills in Midlands Region

County	Landfill	Annual Intake (tonnes)	Remaining Capacity (tonnes)*	Expected Closure
Laois	Kyletalesha Landfill	47,100	377,379	2015
Westmeath	Ballydonagh Landfill	60,000	120,000	2009
Offaly	Derryclure Landfill	40,000	953,000	2032
North Tipperary	Ballaghveny Landfill	30,000	113,813	2012

*Estimated 2008 figures

1.5.2 Landfill Capacity Demand – Midlands Region

To determine the landfill capacity demand for the Midlands Region, the following factors were considered:

- Projected population growth
- Projected waste generation per head of population
- Target recycling rates
- Target diversion rates of BMW away from landfill
- Portion of residual waste returned to landfill following treatment (MBT or thermal)

1.5.3 Population Growth

Population growth was estimated using figures from the Central Statistics Office - Population and Labour Force Predictions 2006-2036. This report predicts various growth rates for the periods 2006-2011, 2011-2016 and 2016 – 2021 and beyond. Using the average of these growth rates, and applying to population figures from the 2006 Census, populations for each of the years 2006 – 2018 were calculated.

1.5.4 Projected Waste Generation

Total waste generation quantities for the region for the period 2006 – 2016 were estimated using waste projections per head of population from the latest ESRI Mid-Term Review. These are summarised in Table 1.2 below.

Table 1.2: National Waste Generation Projections

	2006	2007-2010	2011-2015	2016-2021	2021-2025
MSW (million tonnes)	3.56	3.97	4.71	5.7	6.82
Per person (tonnes)	0.84	0.9	1.01	1.15	1.31

1.5.5 Projected Quantities of Waste Recycled

The Waste Management Plan for the Midlands Region 2005-2010 maintains ambitious targets for recycling. These are summarised as follows;

Table 1.3: Target Recycling Rates to 2013

Source	Target Rate
Household	40%
Commercial & Industrial	26%

The recently-revised EU Waste Framework Directive (17 June 2008) lays down targets of 50% of total municipal solid waste (MSW) to be recycled by 2020.

Projected quantities of recycled waste up to 2013 have been calculated using the target rates set down in the WMPMR. After 2013, projections have been made assuming a gradual increase in recycling rates to the 2020 target rate.

Total quantities of MSW produced have been calculated as previously described. This total quantity has been separated into quantities for Domestic and C&I (Commercial and Industrial) in the ratio of 59.9%:40.1% in accordance with data contained in the EPA's National Waste Report 2006.

1.5.6 Target Rates for BMW Diversion from Landfill

The 2006 National Strategy on Biodegradable Waste outlines the maximum quantities of residual BMW to be landfilled in accordance with the Landfill Directive. Ireland's target maximum quantities of residual waste to be landfilled are illustrated in Table 1.4 below.

Table 1.4: Maximum Quantities of BMW to Landfill 2010 - 2016

Year	Maximum Quantity of BMW to Landfill (Tonnes)
2010	967,433
2013	644,956
2016	451,469

No figures yet exist beyond 2018, and it is therefore assumed that the 2016 figure will carry forward through 2017 and 2018.

The figures in Table 1.4 above are national figures. We have apportioned the total national quantity to the regions by population ratio. In 2018, the population of the Midlands Region is expected to be 7.47% of the national total. Thus the maximum quantity of treated BMW for landfill in the region in 2018 will be 33,724 tonnes.

The EPA's National Waste Report 2006 states;

'Approximately 74% of the household and commercial waste managed in Ireland in 2006 was biodegradable.'

Thus, if 74% of treated municipal solid waste (MSW) in 2018 is equal to 33,724 tonnes, the quantity of MSW that can be landfilled in 2018 is calculated as follows:

$$\text{Total MSW} = \frac{33{,}724}{74\%} = 45{,}573 \text{ tonnes}$$

1.5.7 Total Landfill Demand

Total landfill demand for the period 2006 – 2018 will comprise:

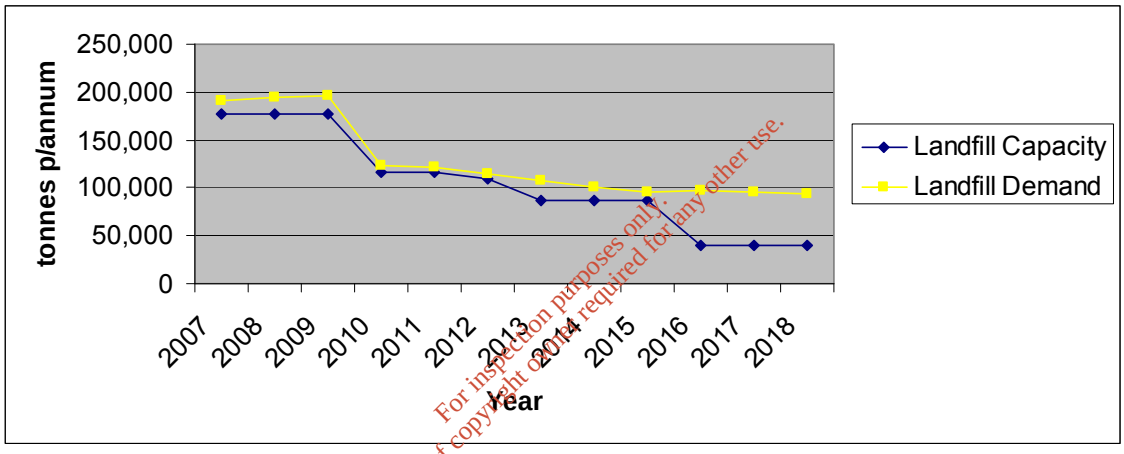
- Total allowable MSW to landfill

- Total remaining MSW following treatment (thermal or MBT) which will require to be landfilled (fly ash, contaminated materials etc). This has been estimated at 25% of treated MSW.

1.5.8 Comparison of Total Landfill Demand to Available Landfill Capacity

Figure 1.4 below illustrates a graphic comparison of total landfill demand versus available landfill capacity for the Midlands Region. This graph shows that while there is forecast to be a convergence of landfill capacity and landfill demand in 2010 due to the introduction of residual BMW diversion targets, there is generally a shortfall of landfill capacity in relation to landfill demand. This shortfall increases significantly in 2015 following the anticipated closure of Kyletalesha Landfill.

Figure 1.4 Landfill Demand v Available Landfill Capacity



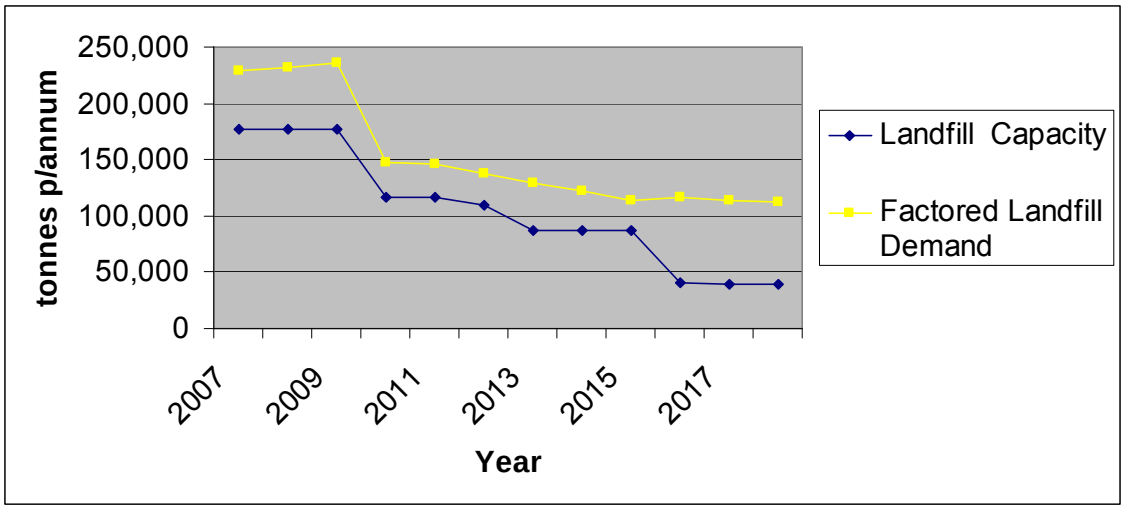
1.5.9 Comparison of Factored Landfill Demand to Available Landfill Capacity

It is good planning practice to apply a 'factor of safety' when planning infrastructure. In the case of waste management infrastructure, (in this case landfill capacity) it is logical to allow for fluctuations in landfill demand, and also in landfill capacity. Any system should be designed with flexibility to adapt to variable or unforeseen circumstances. For example, Kyletalesha Landfill was closed for a period of 2 ½ months in 2007 due to technical difficulties. During that period, Derryclure Landfill had to cater for Kyletalesha's normal intake.

For this analysis the region's annual landfill capacity estimates are based on maximum quantities allowable under each facility's waste licence. These take no account of potential delays in the construction of future cells such as unforeseen ground conditions, weather or other contractual problems. There is no hard and fast rule regarding the amount of redundancy that should be built-in to strategic planning. Some will argue that no redundancy will force alternative practices; however in practice the system's robustness will be measured by its capacity to absorb upset conditions and for the purposes of this analysis 20% redundancy has been built into the foregoing.

Figure 1.5 below illustrates a graphic comparison of factored total landfill demand versus available landfill capacity for the Midlands Region.

Figure 1.5 Factored Landfill Demand v Available Landfill Capacity



1.5.10 Inter-Regional Movement of Waste – Greater Dublin Area

The Waste Management Plan for the Midlands Region 2005-2010 acknowledges that the proximity principle should be taken account of with respect to waste movement. Part 4 Section 16.12 states:

'The capacity of waste facilities in the Region should, as far as possible, satisfy the needs of the Region whilst allowing some element of flexibility of movement of waste into and out of the Region….'

This policy makes reference to the policy direction, Circular WIR: 04/05, issued by the DoEH&LG on 03 May 2005, which states:

'…relevant authorities, in preparing waste management plans……should recognise that the application of the proximity principle does not entail interpreting administrative waste management planning boundaries in such a manner as to inhibit the development of waste infrastructure which will support the attainment of national waste management policy objectives…..'

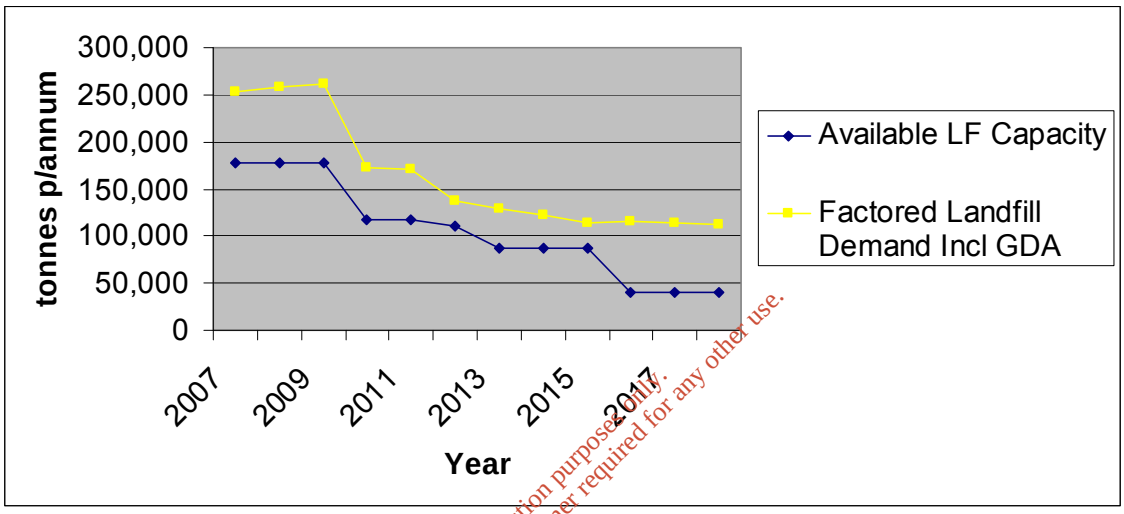
There is currently a shortfall in waste disposal/treatment capacity in the Greater Dublin Area. This will be accentuated between the years 2009 – 2011 after Arthurstown Landfill closes, and pending construction and commissioning of proposed thermal treatment facilities at Carranstown and Poolbeg and construction of the proposed landfill at Nevitt (Fingal County Council).

Derryclure Landfill is well placed to accept waste from the Greater Dublin Area, being easily accessible from Dublin vis the N7/N80 or N4/N52/N80 routes. Derryclure accepted waste from the Greater Dublin Area in 2007 and 2008 (approximately 25,000 tonnes per annum). OCC received a letter from RPS consulting engineers on behalf of Fingal County Council on 21 May 2008 seeking landfill capacity on behalf of the four Dublin authorities in the short and medium term.

While having the physical capacity to assist the Dublin region, given its limited availability due to the 40,000 tonnes per annum restriction, OCC is currently unable to facilitate the Dublin region.

Figure 1.6 below illustrates a graphic comparison of factored total landfill demand including 25,000 tpa intake from the Greater Dublin Area for the years 2007 – 2011 versus available landfill capacity for the Midlands Region.

Figure 1.6 Factored Landfill Demand including 25,000 tpa from GDA v Available Landfill Capacity

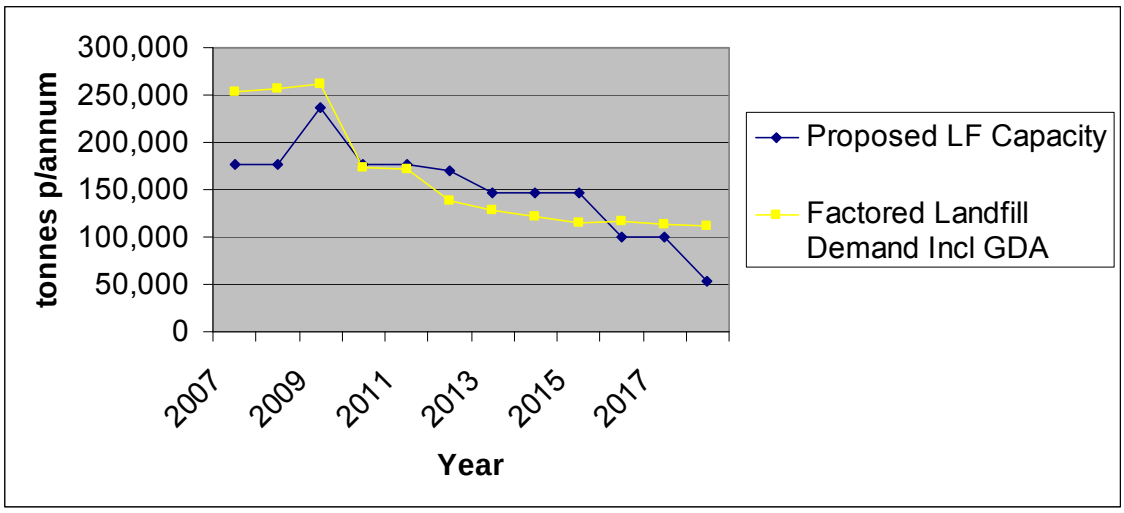


1.5.11 Effect of Proposed Intensification

Figures 1.4-1.6 above illustrate a general shortfall in the available landfill capacity in the region from 2007 – 2018 and beyond.

Figure 1.7 below illustrates a graphic comparison of the effect of the proposed intensification at Derryclure on the available landfill capacity in the region. This figure compares the proposed landfill capacity (assuming intensification to 100,000 tonnes per annum) to the factored landfill demand including 25,000 tpa intake from the Greater Dublin Area from 2007 - 2012. It can be seen that the result is variable, with demand periodically outstripping capacity (2007-2010, 2016-2018) and capacity periodically outstripping demand (2011 - 2016). The trend of the graph suggests that demand will continue to outstrip capacity beyond 2018.

Figure 1.7 Factored Landfill Demand including 25,000tpa from GDA v Proposed Landfill Capacity



1.6 Concluding Note on Need

The Region continues to pursue a rationalisation policy with the imminent closure of Ballydonagh landfill in 2009 and Ballaghveny landfill in 2012.

Given the lack of private sector interest and central government support for waste to energy facilities, it is now prudent that enhanced landfill capacity will be required to meet the Region's waste disposal needs in the medium term.

The provision of pre-treatment and the residuals management of municipal solid waste at these facilities in accordance with Article 6 of the Landfill Directive will in turn allow the Region meet its obligations under the Directive.

Intensification, as sought in this application will allow Offaly County Council to continue to invest in the necessary infrastructure to maintain Derryclure as a viable facility. There is adequate physical space within the current permitted landfill footprint.

1.7 EIS Requirements

OCC is submitting this EIS in accordance with the following legislation:

- Planning and Development Acts 2000 – 2006 (as amended by the Planning and Development Strategic Infrastructure Act 2006)
- Planning and Development Regulations 2006 (S.I 685 of 2006)

This EIS is prepared with regard to the following guidelines issued by the EPA.

- 'Guidelines on the information to be contained in Environmental Impact Statements', (EPA, 2002)
- Advice notes on Current Practice (in the preparation of Environmental Impact Statements) (EPA, 2003)

This document has been structured according to the grouped format structure, and comprises three volumes:

Volume 1: Non Technical Summary
Volume 2: Main Report
Volume 3: Appendices

1.8 Scoping

The EIA process is initiated by a scoping process which determines the key environmental aspects relating to a development. S.I. 600 of 2001 (Planning and Development Regulations 2001) prescribes the content of an EIS. In particular, with respect to the environmental effect, the Regulations prescribe that significant effects must be described and addressed in the EIS:

The scoping process for this EIS was based on:

- Consultation with An Bord Pleanála
- Consultation with the EPA
- Examination of environmental impact statements for developments in similar circumstances, which were deemed to be of an acceptable standard by the relevant authorities
- Knowledge of the site by the developer's consultants and, in particular the issues that have arisen in the past.

Descriptions of potential impacts as well as relevant and appropriate mitigation measures are presented in the following individual sections. A summary of impacts, both positive and negative, is presented in Chapter 9.

1.8.1 Impact Description

This EIS provides for an assessment of a range of potential impacts from the proposed development. These include:

- Direct impacts
- Indirect impacts
- Secondary impacts
- Cumulative impacts
- Short-term impacts
- Medium-term impacts
- Long-term impacts
- Permanent impacts
- Temporary impacts
- Positive impacts
- Negative impacts

For the purposes of this EIS the following concepts are applied:

- An *imperceptible impact* is one that is capable of measurement but without noticeable consequences
- A *slight impact* is an impact which cause noticeable changes in the character of the environment in a manner that is consistent with existing and emerging trends

- A *moderate impact* alters the character of the environment in a manner that is consistent with existing and emerging trends
- A *significant impact* is one which by character, magnitude, duration or intensity alters a sensitive aspect of the environment
- A *profound impact* obliterates sensitive characteristics.

Descriptions of potential impacts as well as relevant and appropriate mitigation measures are presented within the individual sections of this document.

1.8.2 Pre-Submission Consultations

In addition to the above consultees, consultation letters were sent to a number of statutory bodies and non-Governmental organisations on the 22 July 2008. Copies of this letter are included in Appendix 1, with replies received included in Appendix 2. The consultees are listed in Table 1.5

Table 1.5: List of Consultees

Contact	Organisation
Mr. Ian Lumley	An Taisce
Mr. Paddy Matthews	The National Heritage Council
Mr Michael McCarthy	Department of Environment, Heritage and Local Government
The Secretary	Tullamore Town Council
Mr. Conor McDermott	Office of Public Works
Dr. Stephen Newton	BirdWatch Ireland
Ms. Sarah Fields	Irish Wildlife Trust
Mr Paddy Matthews	Failte Ireland
The Secretary	Health and Safety Authority
The Secretary	Health Service Executive
Dr. Ronnie Creighton	Geological Survey of Ireland
Ms. Patricia Kelly	Department of Agriculture and Food
Ms. Ciara Maxwell	Environmental Protection Agency
Mr. David McInerney	Southern Regional Fisheries Board
The Secretary	Bus Eireann
The Secretary	Department of Enterprise Trade and Employment
Tara Spain	National Roads Authority

1.9 Alternatives Considered

The main reasons for choosing the Derryclure site for intensification are set out within this section of the EIS. OCC considered the following alternatives to the proposed development:

- Development of a new landfill
- Do nothing

1.9.1 Development of a Second Landfill

This option would involve a lengthy lead-in time given that a site selection and public consultation process would need to be undertaken, followed by preliminary design, preparation of an EIS and waste licence application and construction of a new facility including lined cells, administration, roads, gas and leachate management systems, drainage and weighbridges. All such infrastructure is currently in place at Derryclure.

More importantly, this option conflicts with government policy (Changing Our Ways 1998) which states that where local authorities need to provide additional landfill capacity, consideration should be given to the extension of existing landfill facilities rather than developing new facilities.

This option was rejected on the grounds of conflict with national policy, delivery time and economics.

1.9.2 Do-Nothing

To do nothing would result in a shortfall of landfill capacity in the Midlands Region in the short and medium term. Waste would need to be exported from the Midlands Region to neighbouring regions.

This option was rejected on the basis of conflict with regional policy. The Waste Management Plan for the Midlands Region 2005-2010 states:

'The capacity of waste facilities in the Region should, as far as possible, satisfy the needs of the Region…'

As stated in 1.5 above, Derryclure may be the only viable landfill in the region in the medium term.

2. SITE DESCRIPTION

2.1 Introduction

Derryclure Landfill has been in operation since 1977 and consists of an unlined cell which is based on the 'dilute and disperse' principle and more recently fully engineered landfill cells. At the current permissible annual intake (40,000 tpa), the remaining lifetime of the landfill is approximately 24 years. The site was licensed by the EPA in November 1999.

2.2 Existing Facility

The layout of existing infrastructure at the facility is shown in Figure 2.1 and consists of the following:

- Lined landfill cells 1A and 1B (currently operational)
- Fully capped unlined landfill cell
- Landfill gas flare and associated collection infrastructure
- Leachate containment lagoon and associated collection infrastructure
- Reception area including administration offices, weighbridges and quarantine/inspection area, car parking etc.
- Civic amenity
- Wheelwash
- Perimeter fencing
- Surface water management system

Permission was granted in 2003 by the Environmental Protection Agency to develop nine additional cells to the north, east and south of the site (refer to Figure 2.3 below). If this application for intensification is successful, the construction of the cells will be accelerated to accommodate the additional waste intake.

2.2.1 Hours of Operation

Hours of operation at the facility are regulated as follows under the Condition 1.6 of waste licence W0029-02:

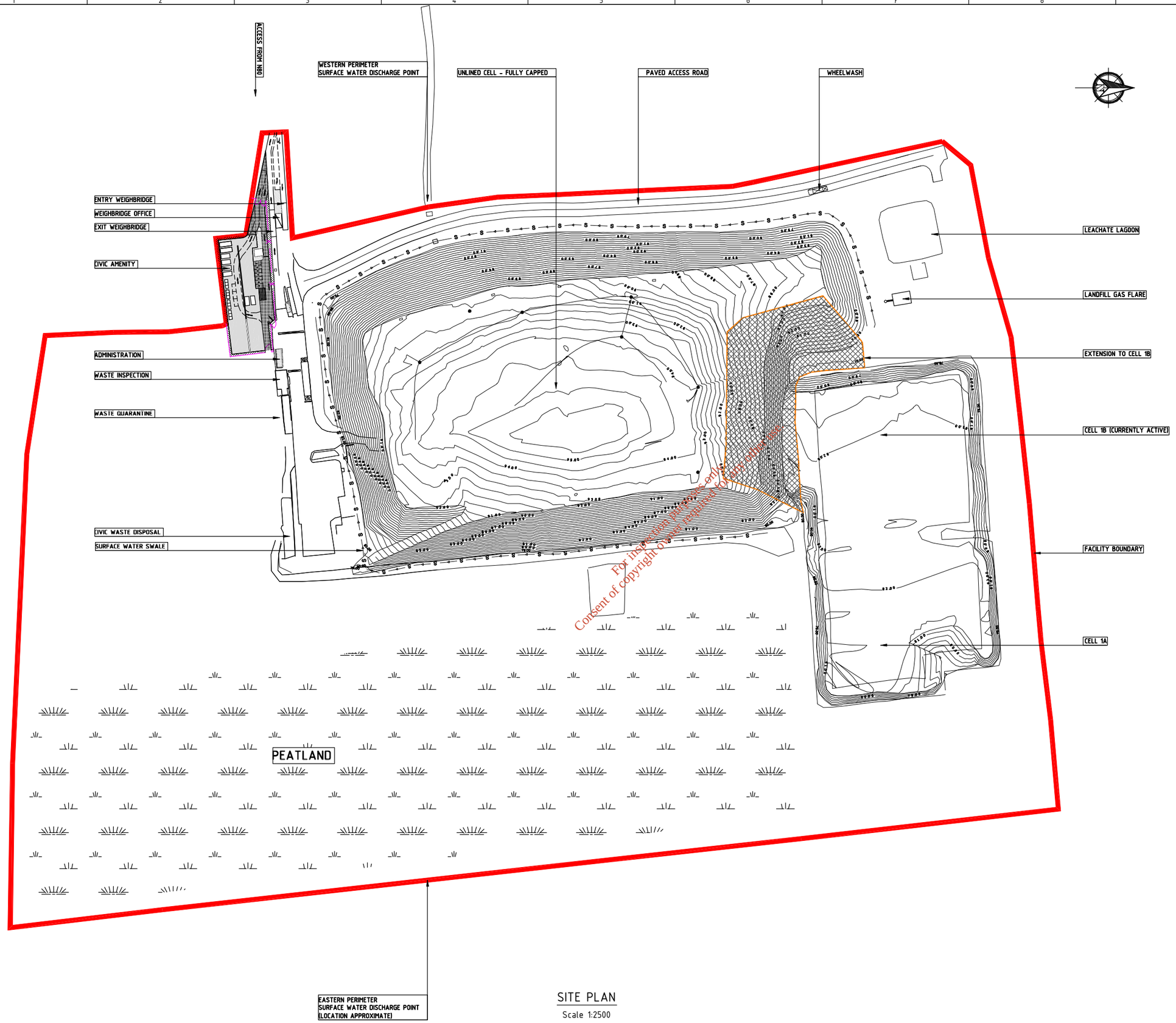
1.6.1. Landfill

1.6.1.1. Waste may only be accepted at the facility for disposal at the landfill between the hours of 8.00 a.m. to 4.30 p.m. Monday to Friday inclusive and 8.00 a.m. to 3.00 p.m. on Saturdays.

1.6.1.2. The landfill at the facility may only be operated during the hours of 8.00 a.m. to 5.30 p.m. Monday to Friday inclusive and 8.00 a.m. to 4.00 p.m. on Saturdays.

1.6.1.3. Waste shall not be accepted at the landfill on Sundays or Bank Holidays.

1.6.2. Civic Waste Facility



SITE PLAN

Scale 1:2500

Rev.	Drawn	Chk'd	App'd		
A	MM	SM	DOS	Cork 21.10.08	ISSUE FOR APPROVAL
Revision History				Rev Origin / Date	Description
A					

Name of Client

OFFALY COUNTY COUNCIL

Name of Job

DERRYCLURE LANDFILL WASTE LICENCE REVIEW

Title of Drawing

EXISTING FACILITY INFRASTRUCTURE

Scales Used
1:2500

Dwg. No.
CE07-286-01_FIG 2.1

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Rev.
A

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1.6.2.1. *Waste shall only be accepted at the Civic Waste Facility between the hours of 8.00 a.m. to 4.30 p.m. Monday to Friday inclusive and 8.00 a.m. to 3.00 p.m. on Saturdays.*

2.2.2 Existing Waste Acceptance Activities

In accordance with the Third and Fourth Schedule of the Waste Management Act 1996, the facility is licensed to carry out the following waste disposal and recovery activities:

Waste Disposal – Third Schedule

- *Class 1 Deposit on, in or under land (including landfill)* - This activity is limited to the deposition of waste in areas where waste has previously been deposited pending the completion of lined cells at the facility.
- *Class 4 Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons* - This activity is limited to the storage of leachate in lagoons or tanks.
- *Class 5 Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.* This activity is limited to the placement of waste into lined cells and the flaring/utilisation of landfill gas.
- *Class 7 Physico-chemical treatment not referred to elsewhere in this Schedule (including evaporation, drying and calcination) which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this Schedule (including evaporation, drying and calcination)* - This activity is limited to the stripping of methane from leachate stored at the facility.
- *Class 11 Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule* - This activity is limited to the mixing of waste types to be used in the restoration of the facility.
- *Class 13 Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced* - This activity is limited to the temporary storage of waste at the facility prior to its disposal at the landfill or at an alternative appropriate disposal facility.

Waste Recovery – Fourth Schedule

- *Class 2 Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)* - This activity is limited to the composting of biodegradable waste.
- *Class 3 Recycling or reclamation of metals and metal compounds* - This activity is limited to the collection and storage of metals at the Civic Waste Facility
- *Class 4 Recycling or reclamation of other inorganic materials* - This activity is limited to the collection of waste at the Civic Waste Facility and for the storage/use of inert waste for the restoration of the facility.
- *Class 13 Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced* - This activity is limited to the collection and storage of recyclable and reusable wastes at the facility prior to their use on-site or their removal off-site for recycling/recovery.

Table 2.1 outlines the type and quantities of each waste type currently landfilled at the site.

Table 2.1: Waste Categories and Quantities to be Accepted for Disposal (Current Licence)

Waste Type	Maximum (TONNES PER ANNUM) Note 1
Household	15,500
Commercial	9,500
Industrial Non-Hazardous Solids	7,500
Treated Sewage Sludge	5,500
Construction and Demolition Waste	2,000
Total	**40,000**

Existing Resources (Plant and Personnel)

Details of on-site personnel are presented in Table 2.2 below. All named personnel are direct employees of Offaly County Council. All other personnel are employed by private contractors, and are not named as they are subject to change.

Table 2.2: Site Staff Details

Name	Title	Responsibility	Full time /Part time	Plant Item (if applicable)
Brendan King	Facility Manager	Overall responsibility for management of the site and waste licence compliance	Full time	N/A
P J Cleary	Foreman	General operations	Full time	Lorry/JCB/Tractor
Gerry Condron	General Operative	GO Duties	Full Time	Lorry/JCB/Tractor
David Mc Cabe	General Operative	Weigh Bridge Operator	Full Time	N/A
Brendan Monaghan	General Operative	GO Duties	Full Time	Lorry/JCB/Tractor
Eddie Kaye	General Operative	Part time weighbridge operator and G O duties	Full Time	Lorry/JCB/Tractor
AN Other	Driver	Machine Operator	Full Time	Compactor
AN Other	Driver	Machine Operator	Full Time	Excavator
AN Other	Driver	Machine Operator	Part Time	Dump Truck

The following plant is used on-site for daily operations:

- Zetor Tractor
- DAF 85 Lorry
- Small Van
- JCB 3cx
- Ford 6600 Tractor
- DAF 91 Lorry
- Daewoo 130V Excavator
- Bomag Compactor
- Stand by compactor
- Volvo BM 25 tonne Dumper

2.2.3 Waste Acceptance and Handling

Waste acceptance procedures are summarised as follows:

- All waste disposal vehicles pass over the weighbridge where they are weighed and vehicle and driver details are recorded
- Each load is inspected by a member of facility staff prior to tipping to ensure compliance with Waste Licence W0029-02. If a load is suspected of not complying, it is diverted to the inspection/quarantine area.
- Waste disposal vehicles are directed to the active tipping face or public disposal area as appropriate
- The active tipping face is maintained to maximum dimensions of 2.5 m high and 25 m long in accordance with Waste Licence W0029-02.
- Waste is deposited at the active face directly from the waste disposal vehicle.
- Waste is compacted using a steel-wheeled compactor.
- The working face is covered before the end of each working day using hessian or cover soil
- Waste disposal vehicles pass through the automatic wheelwash after leaving the active area.
- Waste disposal vehicles exit via the weighbridge where their exit weight and vehicle and driver details are recorded.

2.2.4 Design Principles of the Landfill

Derryclure landfill is designed and operated in accordance with the EU Directive on the Landfilling of Waste and EPA manuals on landfill design and operation. The design principles facilitate the control and management of potentially adverse environmental impacts from activities at the site.

Unlined Landfill Cell

Landfilling commenced at Derryclure Landfill in 1977. This was in advance of the advent of engineered landfill cells and waste management facility licensing. Thus landfilling was initially carried out in a single unlined cell, which continued until the lined cells 1A and 1B were ready for waste acceptance in late 2006.

Capping of this unlined cell commenced in July 2007 and was completed in May 2008. A fully engineered cap was placed in accordance with the conditions of the waste licence and the EPA Landfill Design Manual. The cap consists of:

- 1 mm thick LLDPE barrier layer laid to falls
- Gas geo-composite layer
- Passive gas venting system
- Drainage geo-composite layer
- Sub-surface drainage pipework system
- Side-slope geo-grid reinforcement
- 850 mm subsoil layer
- 150 mm topsoil layer
- Wildflower meadow/grass mix

Lined Landfill Cells

Two discrete lined landfill cells (1A and 1B) were constructed in 2005/2006 and were opened for landfilling in the last quarter of 2006. The makeup of the cell floor construction is as follows:

- 500 mm thick stone drainage blanket on
- protection geotextile on
- 2 mm high density polyethylene (HDPE) layer on
- 1 m layer of engineered clay, hydraulic conductivity of less than or equal to 1 x 10^{-9} m/s on
- sub-surface stone drainage layer on
- virgin soil

Following completion of construction, a construction quality assurance (CQA) report was prepared and submitted to the EPA for approval. This CQA report was approved by the EPA prior to commencement of landfilling activities in these cells.

In April 2008, there remained approximately 135,000 tonnes of void space between Cells 1A and 1B.

Gas Management

Biodegradation of the organic faction of waste generates landfill gas. The composition of landfill gas produced varies over time depending on the nature of the waste. Typical major components of landfill gas are methane and carbon dioxide. Other components, such as organic-sulphur compounds (for example hydrogen sulphide), organic acids (for example proponic acid), ketones and aldehydes give the landfill gas its characteristic odour.

A landfill gas model, Landgem Version 3.02., was run to estimate landfill gas production at the facility each year for the current allowable intake of 40,000 tonnes per annum. The model determined that peak annual landfill gas production will occur in 2033, with a peak average output of 744 m^3/hour. The total landfill gas produced over the study period is estimated at 332.4 million m^3. A summary of the landfill gas model is included in Appendix 4.

An enclosed landfill gas flare was installed at the facility in March 2007, replacing the existing elevated gas flare. The enclosed flare has a capacity of 1,000 m^3/hour with the facility to upgrade to 1,500 m^3/hour should landfill gas yields warrant it, although from current model predictions this seems unlikely

Thirty three landfill gas extraction wells have been installed in the unlined cells and are connected to the enclosed gas flare. This system has been designed for future expansion as necessary.

Installation of vertical gas extraction wells and odour management infrastructure in Cells 1A and 1B is imminent. OCC has submitted a specified engineering works proposal to the EPA for approval prior to proceeding with this work. The layout of this infrastructure is illustrated in Figure 2.2 below.

Leachate Management

Rainwater or any other water coming in contact with waste becomes contaminated by the waste. This contaminated water is known as leachate.

The primary contributing factor to leachate generation is rainwater while other factors which influence leachate generation are:

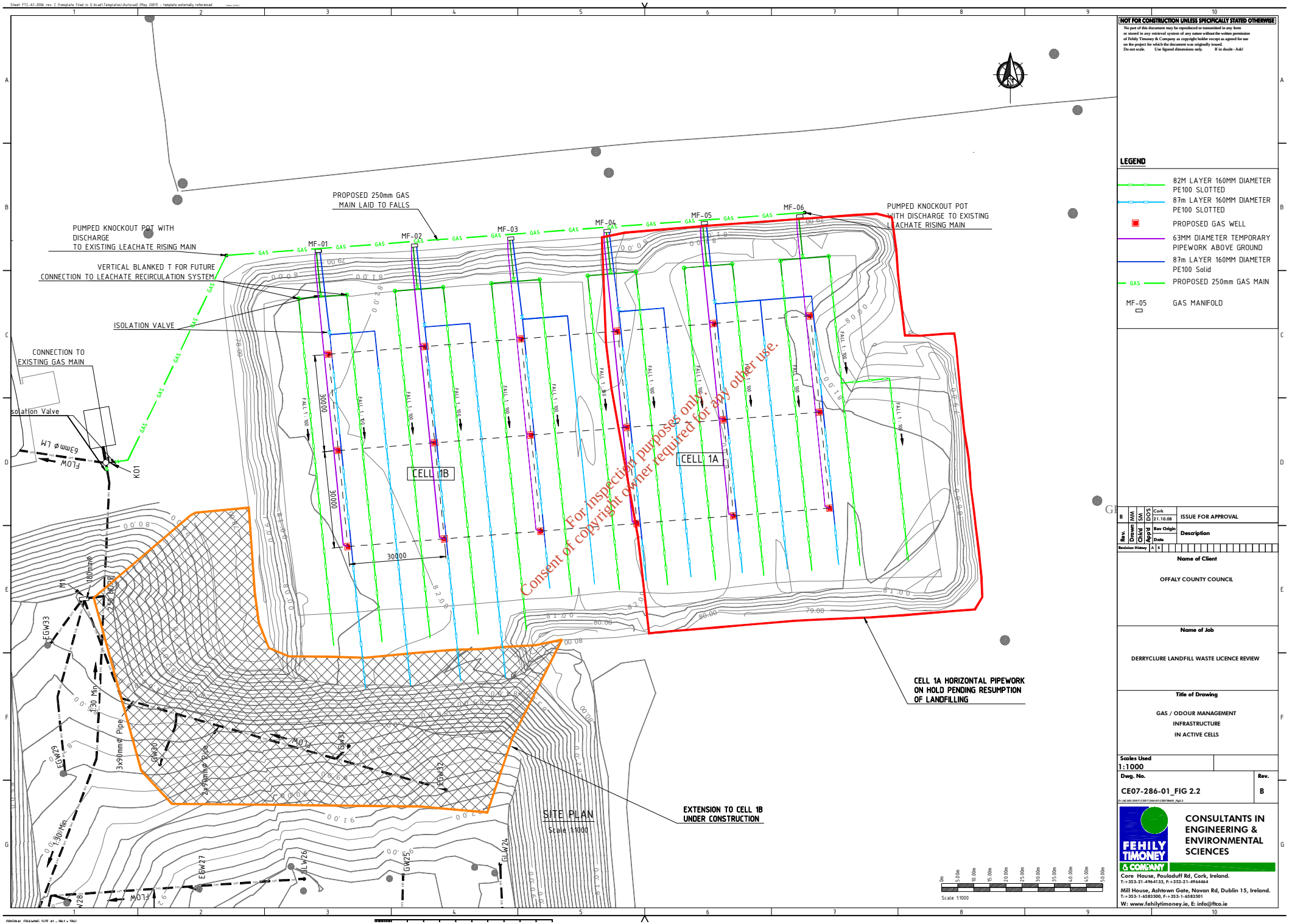
- Areas of open landfill cells
- Areas of permanently capped cells and infiltration rates
- Absorptive capacity of waste
- Waste input
- Evapotranspiration

Leachate water-balances for the site estimate that based on an annual waste intake of 40,000 tonnes per annum, the total volume of leachate generated for the period 2009 – 2032 will be 198,842m^3.

Leachate management infrastructure at the facility comprises of the following:

- Fully engineered lined leachate containment lagoon
- Leachate pump sumps within lined Cells 1A and 1B, discharging via pressure main to the leachate lagoon
- Pumped leachate abstraction wells within the unlined cell discharging via pressure main to the leachate lagoon
- Leachate toe-drain around the perimeter of the unlined cell, draining to a pump chamber whence it is pumped to the leachate lagoon
- SCADA system for data acquisition and control of the leachate management system

Leachate is removed from the lagoon by vacuum tanker and disposed of to Tullamore Wastewater Treatment Plant (WWTP). In 2007 approximately 22,000 m^3 of leachate was tankered off-site.



NOT FOR CONSTRUCTION UNLESS SPECIFICALLY STATED OTHERWISE

LEGEND

- 82M LAYER 160MM DIAMETER PE100 SLOTTED
- 87m LAYER 160MM DIAMETER PE100 SLOTTED
- PROPOSED GAS WELL
- 63MM DIAMETER TEMPORARY PIPEWORK ABOVE GROUND
- 87m LAYER 160MM DIAMETER PE100 Solid
- GAS — PROPOSED 250mm GAS MAIN
- MF-05 — GAS MANIFOLD

Rev.	Drawn	Chkd	Appd	Date	Description
B	MM	SM	DOS	21.10.08	ISSUE FOR APPROVAL

Revision History: A, B

Name of Client

OFFALY COUNTY COUNCIL

Name of Job

DERRYCLURE LANDFILL WASTE LICENCE REVIEW

Title of Drawing

GAS / ODOUR MANAGEMENT INFRASTRUCTURE IN ACTIVE CELLS

Scales Used 1:1000

Dwg. No. CE07-286-01_FIG 2.2

Rev. B

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Reception Area

The facility reception area comprises of the following:

- Administration area
- Weighbridges (entry and exit)
- Weighbridge office
- Waste quarantine and inspection areas

The administration area consists of prefabricated units containing an office, toilets and canteen. The weighbridge office is a permanent structure, which facilitates the weighbridge attendant and facility manager. The weighbridges record all materials imported to or exported from (e.g. recycled materials) site via the SCADA system and all records are maintained on site. The waste quarantine and inspection area are maintained in accordance with waste licence conditions for inspection of suspect loads of waste, and for quarantine if necessary.

Civic Amenity

Construction of the new civic amenity was completed in the second quarter of 2008. This facility is now fully operational and being operated by Greyhound Recycling and Recovery.

This replaces the old civic amenity area, providing greater functionality and convenience for patrons by eliminating the need to pass through the weighbridges and up into the facility proper for disposal of recyclables. The civic amenity provides for collection of the following:

- Paper and cardboard
- Plastics
- Tin and aluminium cans
- Glass
- Household hazardous waste (e.g. batteries, paint, oil)
- Waste electronic and electrical equipment (WEEE)
- Residual Waste
- Timber
- Green Waste
- Tyres

In 2007, a total of 1,200 tonnes of recyclable materials was accepted at the civic amenity.

Wheelwash

An automatic wheel-wash provides for cleaning of waste vehicles travelling from the active landfill face, so that soil/dirt is not brought out to the public road. The wheel-wash it triggered by an automatic sensor and is located in the exit lane such that all traffic exiting the active face must pass through it.

All water is recycled to reduce the environmental impact of the unit. The wheelwash unit is drained down periodically and cleaned as necessary.

Perimeter Fencing

The facility is fenced around the entire perimeter. The western boundary is fenced with 2.4 m high palisade security fencing. The northern, southern and eastern boundaries are fenced with low-level post and wire fencing. The risk of security breach is not considered very high along these boundaries given that they border open bog-lands.

The civic amenity is separated from the rest of the facility with 2.4 m high palisade fencing.

Surface Water Drainage

Formal surface water drainage systems exist at the facility to drain paved areas and capped areas. All paved surface water run-off drains via petrol interceptors prior to discharging from site at the western perimeter discharge point as indicated in Figure 2.1. Surface and sub-surface run-off from capped areas is collected in a swale running around the perimeter of the capped cell. This swale discharges to both the eastern and western perimeter discharge points as indicated in Figure 2.1. Approximately 58,000 m^2 of the capped area drains to the western perimeter discharge point, with the remaining c 15,000m^2 draining to the eastern perimeter discharge point.

2.2.5 Future Infrastructure

Permission was granted in 2003 by the Environmental Protection Agency to develop nine additional cells to the north, east and south of the site. This created an additional 1.1 million tonnes approximately of void space. Two of these cells (1A and 1B) have been constructed, as described above. The remaining seven cells will be constructed in the future. If this application for intensification is successful, construction of these future cells will be accelerated. The extent of fully developed cells is shown in Figure 2.3 below.

2.3 Proposed Development

2.3.1 Proposed Hours of Operation

It is proposed to extend the operating hours of the facility to:

- Hours of operation of the landfill – 07:00 to 19:30 Monday to Friday inclusive and 8.00 to 18.00 on Saturday.
- Hours of waste acceptance at the facility – 07:30 to 19.00 Monday to Friday inclusive, and 8.30 to 17.30 on Saturday
- Hours of waste acceptance of the civic amenity – 08:00 to 18:00 Monday to Friday inclusive and 08:30 to 17.30 on Saturdays.

2.3.2 Proposed Waste Acceptance Activities

It is proposed to increase the waste intake to 100,000 tpa which will reduce the lifespan of the landfill by 14.5 years. Table 2.3 gives a breakdown of the total quantity.

Table 2.3: Proposed Waste Categories and Quantities

Waste Type	Maximum (Tonnes Per Annum)
Household	45,500
Commercial	39,500
Industrial non-hazardous solids	11,000
Treated municipal sludge	2,000
Construction and demolition waste	2,000
Total	**100,000**

Proposed Resources (Plant and Personnel)

OCC does not anticipate that any additional plant will be required for this development, except that the dump truck and operator will be required on a full-time basis rather than the current part-time arrangement. Current site resources have additional capacity to sufficiently manage the additional waste intake.

2.3.3 Leachate and Landfill Gas Generation Under Proposed Development

Leachate

The total volume of leachate generated for the period 2009 – 2032 at annual intake of 100,000 tonnes per annum is estimated at 129,855 m^3. When compared to the estimated total of leachate generated during the same period for annual intake of 40,000 tonnes per annum (198,842 m^3), it can be seen that the intensification of the site will result in a decrease in leachate generation by approximately 35%. This reduction is a result of:

- Each landfill cell will be filled at a faster rate and subsequently capped, thus minimising the timeframe the cell is open to rainfall.
- The absorptive capacity of waste will be exploited because over a given period, a greater volume of waste will be placed per volume of rainfall.

The full water balance calculation for the proposed development is included in Appendix 3.

Landfill Gas

A landfill prediction gas model was run to assess the increase intake of 100,000 tonnes per annum using LandGEM v302. The model determined that peak annual landfill gas production at the increase intake of 100,000 tonnes per annum will occur in 2019, with a peak average output of 1,036 m^3/hour in 2019. The total landfill gas produced over the study period is estimated at 333.6 million m^3.

When compared to the gas model prepared for a continued 40,000 tonnes per annum intake, it can be seen that the overall gas quantities will increase by approximately 0.3%, which is negligible. Annual landfill gas quantities will peak earlier (in 2019 versus 2033) which means earlier stabilisation of the waste mass (by 14 years). Peak gas yields will increase under the proposed development (1,036 m^3/hour versus 744 m^3/hour) which will make generation of electricity from landfill gas more feasible. The existing gas management infrastructure has the capacity for any increase in peak gas quantities. A summary of the landfill gas model is included in Appendix 4.

SITE PLAN

Scale 1:2500

Rev.	Drawn	Chk'd	App'd	Date	Description
A	MM	SM	DOS	Cork 21.10.08	ISSUE FOR APPROVAL

Revision History: A

Name of Client

OFFALY COUNTY COUNCIL

Name of Job

DERRYCLURE LANDFILL WASTE LICENCE REVIEW

Title of Drawing

FUTURE FACILITY INFRASTRUCTURE

Scales Used
1:2500

Dwg. No. CE07-286-01_FIG 2.3 — **Rev.** A

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2.4 Phasing Plan

Condition 4.2 of Waste Licence W0029-02 limits the final restoration height of the facility post capping to 94.0 m OD (Malin). Permission was sought from the EPA, and granted, to exceed this height to facilitate profiling of the unlined cell with inert subsoil to achieve required falls for the final cap construction.
The maximum height at the facility is now approximately 95.8 m OD. Also, a minor extension to Cell 1A was constructed in the second quarter of 2008. The final profile of the facility needs to be amended to take account of these alterations. A plan of the proposed restoration contours is shown in Figure 7.1.The phasing plan for construction, filling and capping of the landfill is illustrated in Table 2.4 below, assuming intensification to 100,000 tonnes of annual waste intake.

Table 2.4: Phasing Plan

Cell	Capacity	Construct	Fill to Capacity (year ending)	Final Capping (year commencing)
Cell 1A/1B	135,053	n/a	2009	2010
Cell 3	178,848	2009	2011	2012
Cell 4	178,848	2009	2013	2014
Cell 5	136,469	2013	2014	2015
Cell 6	118,404	2013	2015	2016
Cell 7	69,696	2015	2016	2017
Cell 8	95,040	2015	2017	2018
Cell 9	41,400	2015	2018	2019

The phasing plan is illustrated in Figures 2.4 and 2.5 below.

2.5 Facility Health and Safety

The site is operated in accordance with the Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (General Application) Regulations 2007. OCC maintains a safety manual on site for the safe operation of the facility. This is a live document which is maintained and updated by the on-site Health and Safety Manager.

All facility personnel receive training in health and safety on a regular basis. All personnel are made aware of the facility safety manual and are kept abreast of facility health and safety procedures. All site personnel have attained FAS 'Safe Pass' training. All site personnel receive appropriate personal protection equipment (PPE), for which they must sign, and a log is maintained of all PPE issued. Site personnel have recently been trained in such areas as:

- Basic fire training course
- Bird scaring pistol proficiency training
- Gas detection services
- Work station analysis

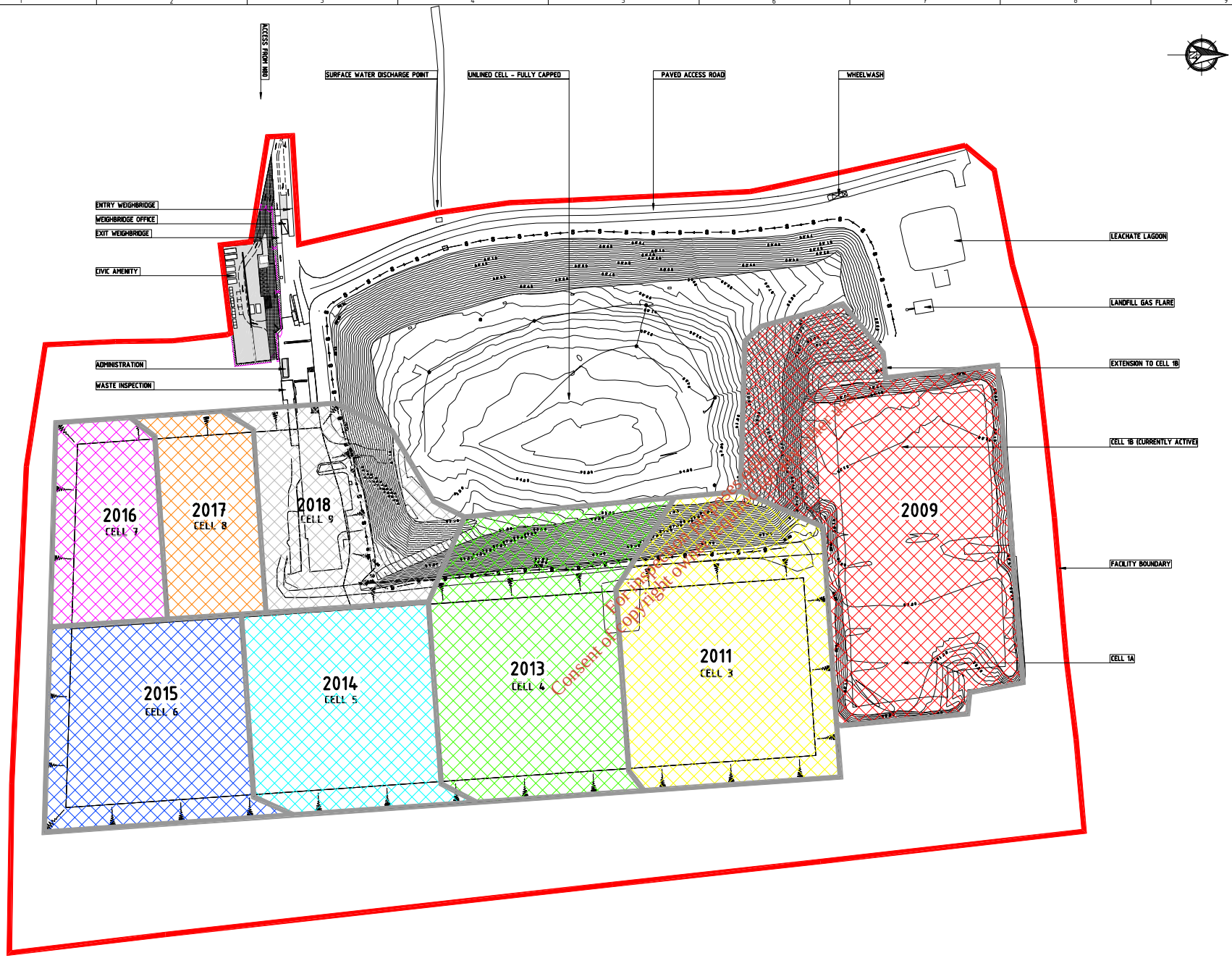
All visitors to the facility (except the civic amenity) must sign in and out. All contractors (e.g. waste disposal, leachate collection) are made aware of facility health and safety procedures and are issued with a 'Safe Systems of Work' document.

All construction and development works at the facility are carried out in accordance with current health and safety legislation. For example for the recent Derryclure Landfill Capping Phase 1 project, Fehily Timoney and Company was appointed Project Supervisor Design, with Priority Construction Ltd undertaking the role of Project Supervisor for the Construction Stage

Priority Construction Ltd is responsible for the compilation of the Safety File which will be maintained on site in the facility manager's office, and which will facilitate the safe operation of the newly constructed elements of the facility.

2.6 Environmental Monitoring

OCC personnel and/or external consultancies carry out the sampling and monitoring programme in accordance with the existing waste licence. The Site Manager is responsible for the implementation of the monitoring programme. Samples are collected and transported under chain-of-custody to a laboratory. Locations of existing monitoring points (EMP) are indicated on Figure 2.6. Locations of proposed EMPs are illustrated in Figure 2.7.



SITE PLAN

Scale 1:2500

Rev.	Drawn	Chkd	Appd	Rev Origin	Date	Description
A	MM	SM	DOS	Cork	21.10.08	ISSUE FOR APPROVAL

Revision History: A

Name of Client

OFFALY COUNTY COUNCIL

Name of Job

DERRYCLURE LANDFILL WASTE LICENCE REVIEW

Title of Drawing

PROPOSED PHASING PLAN:
LANDFILLING

Scales Used: 1:2500

Dwg. No.: CE07-286-01_FIG 2.4

Rev.: A

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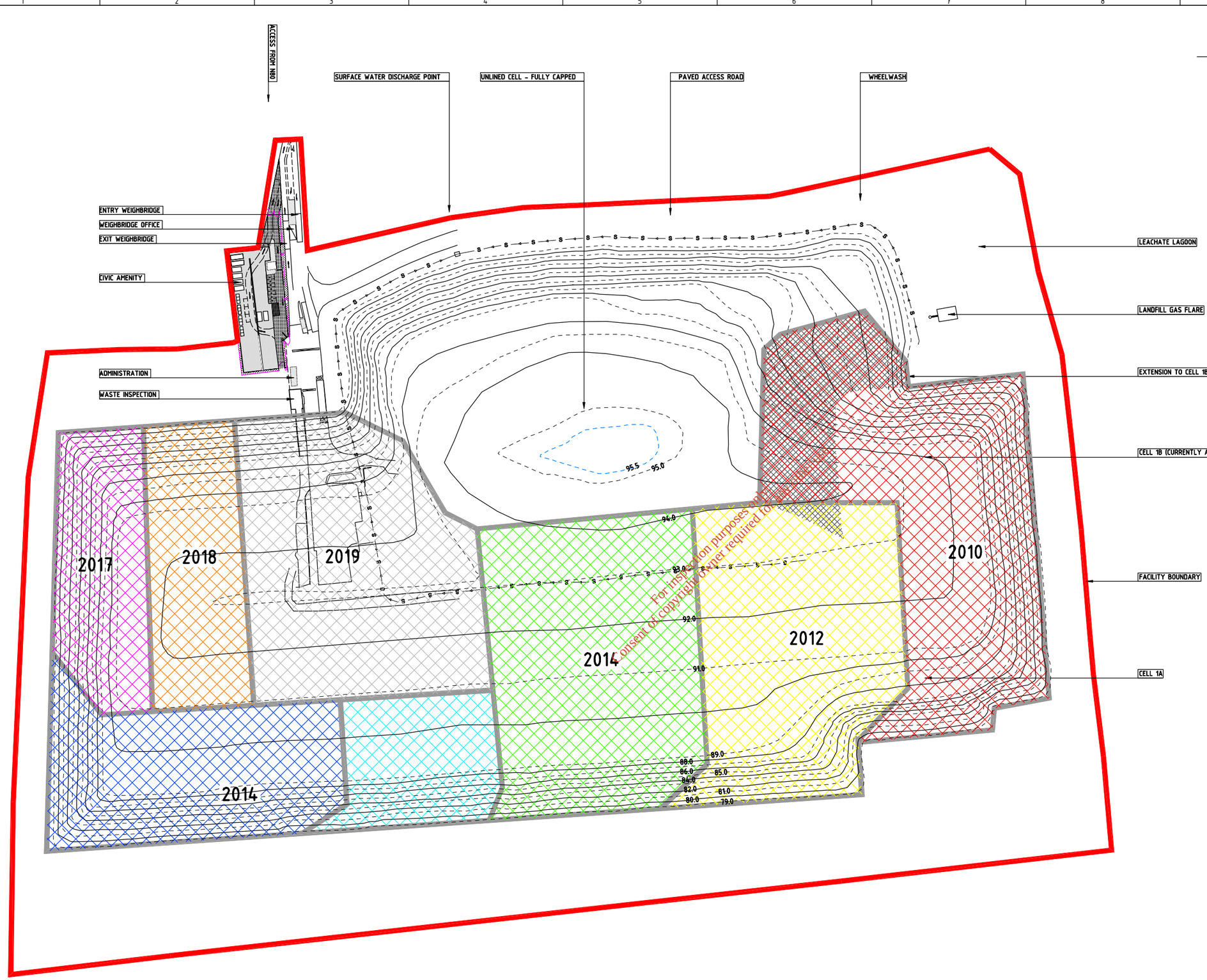

SITE PLAN
Scale 1:2500

Rev.	Drawn	Chk'd	App'd		
A	MM			Cork	ISSUE FOR APPROVAL
				Rev Origin	Description
Revision History				Date	
A					

Name of Client
OFFALY COUNTY COUNCIL

Name of Job
DERRYCLURE LANDFILL WASTE LICENCE REVIEW

Title of Drawing
PROPOSED PHASING PLAN:
CAPPING

Scales Used
1:2500

Dwg. No.
CE07-286-01_FIG 2.5

Rev.
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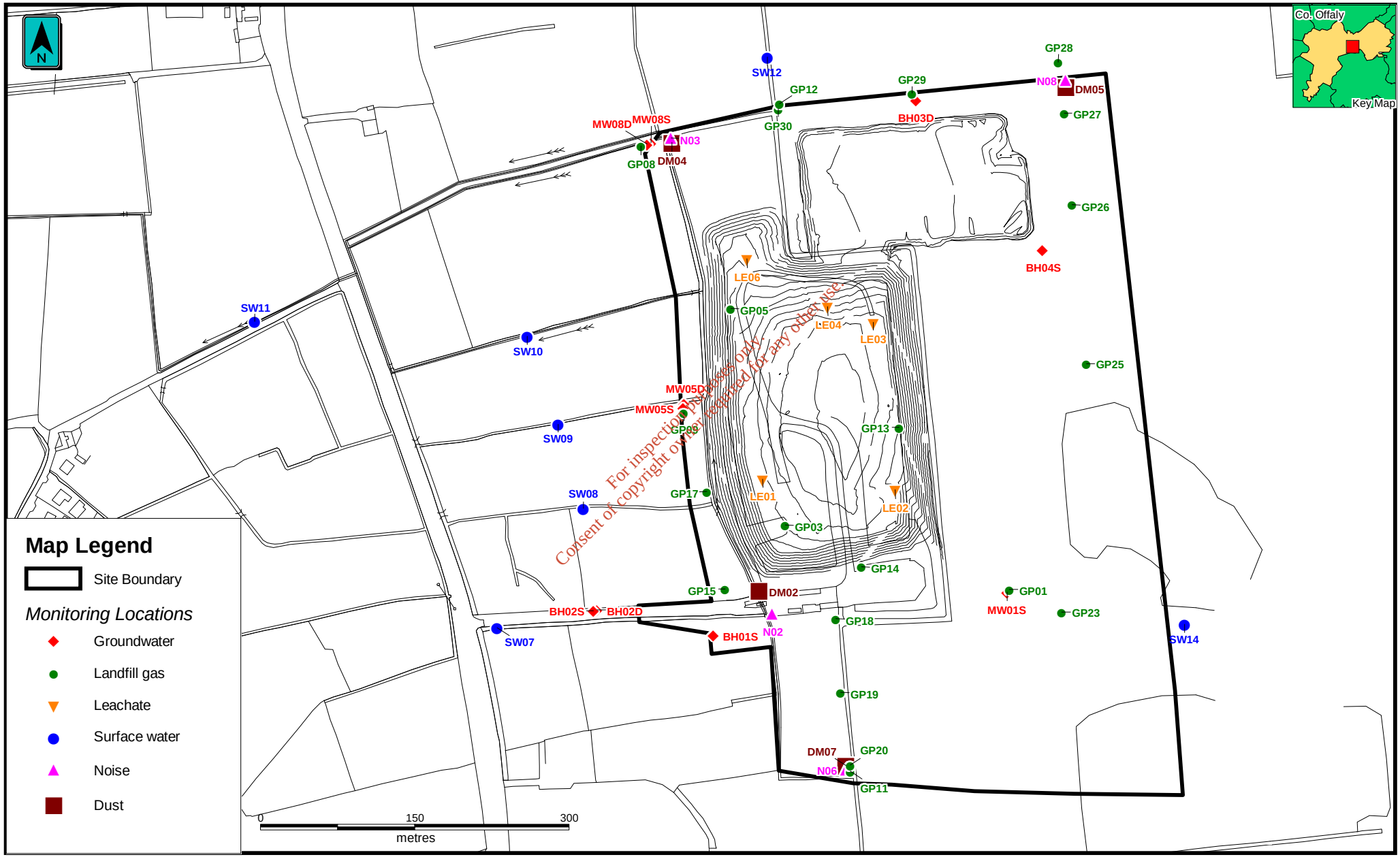
ORIGINAL DRAWING SIZE A1 - 841 x 594

Date 09/09/08 SW/SM R:\Map Production\2008\CE07\286\01\Workspace\
CE07-286-01_Figure 2.6_Existing Environmental Monitoring Location Map_Rev A



Existing Environmental Monitoring Location Map

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Figure 2.6

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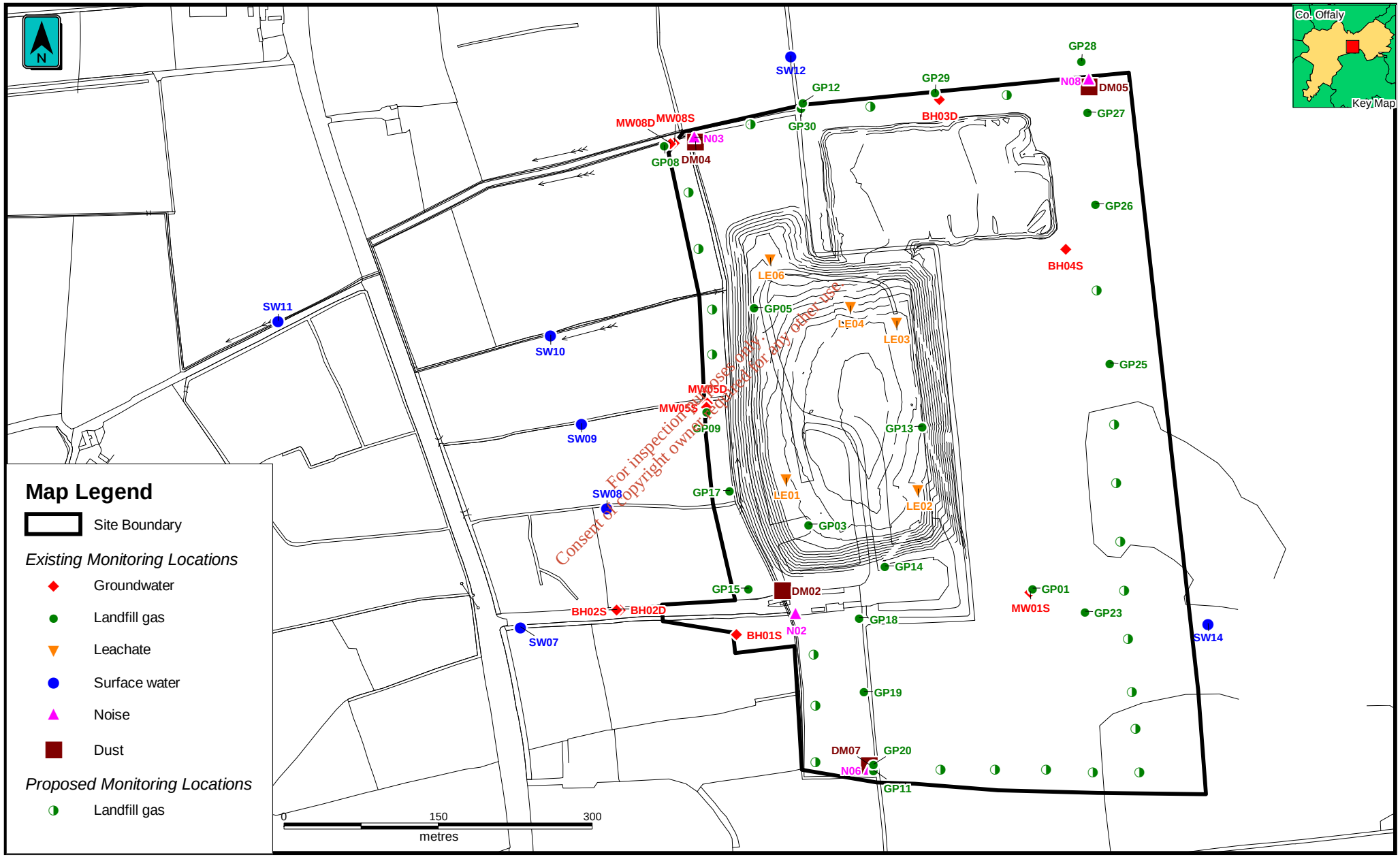
CE07-286-01_Figure 2.7_Proposed Environmental Monitoring Location Map_Rev A



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Proposed Environmental Monitoring Location Map

Figure 2.7

3. HUMAN ENVIRONMENT

This chapter describes the existing human environment in the area of the proposed development. It examines the potential effects of the proposed intensification of waste intake on that environment and outlines the measures proposed to mitigate any potential impacts. The main areas examined with respect to the potential effects of the proposed development on human environment are:

- Socio-economic factors
- Noise
- Traffic
- Health and safety
- Environmental nuisances
- Air quality
- Visual impacts

Socio-economic factors, noise, traffic, human health and environmental nuisance and air are discussed in this chapter. Health and safety impacts are discussed in Chapter 2 and visual impacts are discussed in Chapter 7.

3.1 Socio Economic Factors

3.1.1 Existing Socio Economic Environment

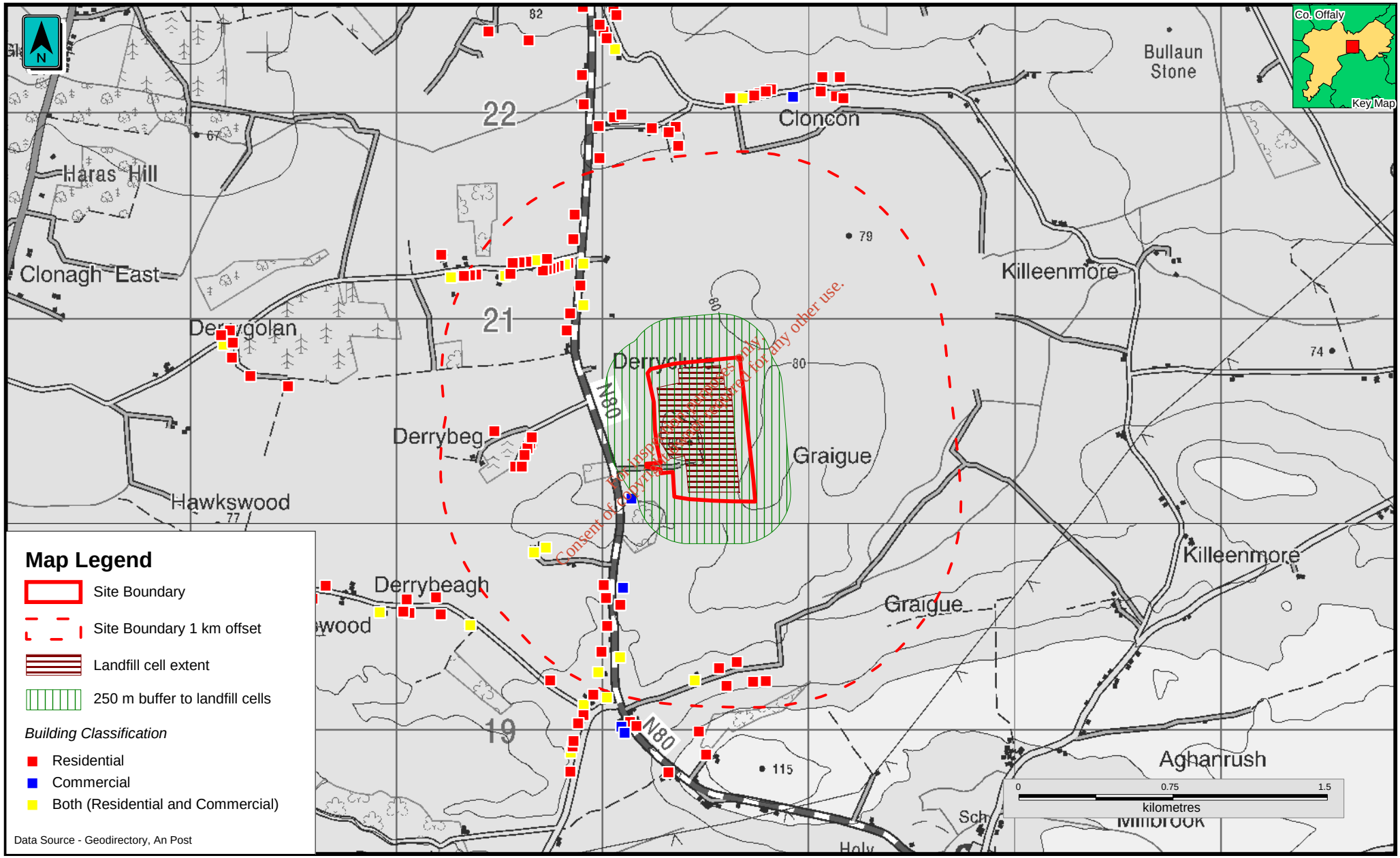
Nearby Residents

Derryclure Landfill is located approximately 5 km south of Tullamore town on the N80 Tullamore-Killeigh road. The current landfill footprint is located on an area of cut away peatland and the landfill is surrounded to the north, east and south by raised peatlands.

The landfill is located in a rural area with local housing comprising a mixture of farm houses and detached residential single-family dwellings. Figure 3.1 overleaf indicates the location of dwellings within 500 m of the site. Housing is mainly located to the west of the landfill around Derrybryan Wood to the north west along the N80 to Tullamore as well as along the third class road connecting the N80 to the R421 via Derrygolan.

Other population centres in the area include Killeigh village located 4 km south and Killurin 6 km to the south west of the site. There are no schools, shops or other public buildings located within 1 km of the landfill footprint.

Date 14/10/08 SW/SM R:\Map Production\2008\CE07\286\01\Workspace\
CE07-286-01_Figure 3.1_House Location Map_Rev B



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House Location Map

Figure 3.1

Land Use

The Offaly County Development Plan 2003-2009 and the Tullamore & Environs Development Plan does not specify a land use zone for the area of the Derryclure Landfill.

Local Employment and Economic Benefit

Due to Tullamore's central location and close proximity to road and rail infrastructure, there has been an increase in employment in Tullamore, especially in the services and industrial sectors. There are a number of industrial estates within the Tullamore Town Council with Clonminch Industrial and Business Park (36 hectares) located 2 km north of the landfill. More recently, as a possible consequence of the global economic downturn, there have been significant job-loss announcements with the closure of Boston Scientific and Flextronics (totalling 320 job losses).

Tullamore is an administrative centre for the county and it has been identified in the Offaly County Development Plan as a 'development district' hence trends of increasing employment in Tullamore are likely to continue.

Derryclure landfill currently employs eight staff which contributes to employment in the locality and the economy of the area. Indirect economic benefits are also experienced in the local area.

Amenity/Tourism

Tullamore town is a designated heritage town and the town's distilling and canal heritage generates tourism in the area. Tullamore however, has not maximised its potential as a tourism centre and the Tullamore and Environs Development Plan aims to enhance and protect the tourist attractions in the town to benefit the economy and the environment of the town.

In the Derryclure area there are a number of designated National Heritage Areas (NHAs). Charleville Demesne is located approximately 3 km north west of the facility; this is the grounds of Charleville Castle. These are discussed in greater detail in Chapters 6 and 7 of this EIS.

There are no marked trails in close proximity to the landfill. The Grand Canal Way is 130 km walk along the Grand Canal from Ringsend in Dublin to Shannon Harbour. This walk is approximately 5 km north of the landfill footprint. The Offaly Way runs south-west of the landfill at a distance of approximately 14 km.

The Clodiagh River and Tullamore River (approximately 4 km north of the landfill) have fair to good stocks of wild brown trout (Shannon Fishery Board Game Angling Website). These rivers therefore provide good fishing amenities.

Utilities

Drinking water is supplied to the landfill facility through Killeigh group supply scheme. The facility also has a foul sewer system to cater for office/canteen/toilet foul waste. There is no waste water treatment system on site. All foul sewerage is discharged to a holding tank and then transported to Tullamore Waste Water Treatment plant for treatment.
Electricity supply to the facility is via the national gird. Telecommunications supply to the facility is via the telecom lines.

Transport Network

The landfill is located adjacent to the N80 national secondary route, and is accessed directly from the N80. The N80 connects Tullamore to Mountmellick via Killeigh. There are a number of third class roads and other roads in the vicinity of the development.

Environmental Nuisances

A number of best practices have been implemented at the site to minimise nuisances on the surrounding community. These are discussed below.

Contamination of surface water or groundwater

As previously described in Chapter 2 of the EIS, landfilling only occurs within newly constructed engineered cells. The leachate management system installed at the facility provides for the abstraction and collection of leachate generated. Leachate is pumped from these wells to a leachate storage lagoon and from here the leachate is tankered off site for treatment at Tullamore Waste Water Treatment Plant.

Surface water management infrastructure such as a silt trap and oil interceptors have been installed at the facility to prevent contamination from surface water run-off arising from all impermeable surfaces entering the surface water drains.

Groundwater management infrastructure has also been installed to ensure that groundwater levels are maintained below the base level of the lining system.

Groundwater and surface water and quality is discussed in greater detail in Chapters 4 and 5 respectively.

Odour, dust, litter, bird & vermin

During normal landfilling operations, there is potential for odour, dust and litter nuisance from a number of sources. The potential for dust and litter nuisance is highest during dry windy conditions and arises from the waste material itself and from the cover material.

To limit dust and litter nuisance, only one working face is operational at the landfill and this is covered as soon as is practicable and prior to the end of each day. This also helps to control odour emissions.

A wheel wash has been installed at the facility and in dry weather, site roads and other areas used by vehicles is sprayed with water to minimise dust and mud deposits from transport vehicles.

Litter fencing has been installed around the active landfilling area and all waste transport vehicles are required to be appropriately covered in order to minimse the generation of windblown litter. Litter inspections are also carried out on a daily basis.

Odour can arise from fresh waste in the active cells and from waste in various stages of decay in other cells. Odour mitigation measures (effective daily cover and odour masking) are employed where fresh waste is being landfilled to prevent off-site odours. All sewage sludge accepted onsite is also covered immediately. Odour is discussed in greater detail later in this chapter.

Landfills also have the potential to attract vermin such as rats and flies and if not correctly managed can lead to an increase in local populations in the vicinity of the landfill. In general, vermin infestations tend to be seasonal and levels of control are tailored to reflect these changes. Existing measures have been successful in ensuring that vermin numbers are controlled. Birds gathering and feeding on the landfill are controlled by the use of a stress caller during the daily operation of the facility. Bird Control Ireland visit site twice weekly, and a flare gun is used if/when deemed necessary.

3.1.2 Impacts on the Socio-Economic Environment

Nearby Residents

Potential impacts on residential amenity in the immediate environs of the facility due to the intensification of waste acceptance will principally arise from a combination of increased traffic, noise and air emissions, which are addressed in detail later in this chapter.

A positive (from a public perception point of view) impact arising from the proposed development is that the lifespan of the landfill will be reduced from 24 years to 9.5 years which will have a positive impact on the amenity of local residents. The visual impact of the landfill will also be significantly reduced due to an acceleration of the capping programme for the site.

Industry and Commerce

The proposed intensification of waste acceptance will result in the creation of 2 to 3 additional jobs at the facility. This will directly benefit the economy of the area and also contribute indirectly to the economy of the area. In addition, as all IPPC-licensed industries have to demonstrate disposal of waste at a licensed facility, the existence of appropriate infrastructure is a positive factor in siting of industry.

Land Use

The proposed intensification will be conducted within the existing site boundary and no additional physical infrastructure is proposed.

Therefore, there will be no negative impacts on land use. A positive impact will be that the site will be fully capped in approximately 10 -12 years and available for beneficial after-use.

Tourism and Recreation

The proposed development will not impact on the tourism and amenity of Tullamore town as the facility is located approximately 5 km south of the town. Also due to the distance between the facility and the nearest NHAs (Charleville Demesne, Clonad Wood and Screggan Bog) the proposed develop will not impact on these areas.

Continued successful operation of the surface water, groundwater and leachate infrastructure onsite will ensure that surface water, groundwater and the Clodiagh and Tullamore Rivers will not be impacted on by the proposed intensification of waste acceptance.

Utilities

Existing utility supplies to the current facility will not require upgrading due to the intensification of waste acceptance and therefore will not be impacted on by the proposed development.

Transport Network

The intensification of waste acceptance at the facility will result in the generation of 25 additional truck movements per day during peak activity. It is proposed to widen the N80 in the vicinity of the landfill in order to provide a right-turn lane due to this increase in traffic flows. This will reduce traffic flow disruption on the N80. Traffic is discussed in greater detail later is this chapter.

A positive impact on traffic on Tullamore town is the construction of the N52 Tullamore by-pass, which began in February 2008 and aims to be completed in 2010, which will provide access from Derryclure landfill to the National Roads network without entering Tullamore town centre. Traffic impacts are discussed in more detail later in this chapter.

Environmental Nuisances

Environmental controls will continue to be implemented at the site. The intensification of the facility will result in the early closure and restoration of the site which will have positive impact on the surrounding community.

Once the landfill is capped and restored dust, litter, birds and vermin will be eliminated. The potential for odour generation will also be significantly reduced. Mitigation measures for odour emissions are discussed in greater detail in the air section of this chapter.

3.1.3 Mitigation Measures on Socio-Economic Issues

Having regard to the potential impacts outlined above, no further mitigation measures are required for the proposed development, over and above those presented within applicable chapters of this EIS. Individual assessments of the impact of predicted noise, air and traffic have been conducted and are outlined later in this Chapter. All assessments have indicated that following the implementation of a number of mitigation measures, emissions from the proposed development will not have a significant residual impact.

3.2 Air

This chapter describes the air quality in the existing environment. It examines the potential effects of the proposed intensification of waste intake on that environment and outlines the measures proposed to mitigate any potential impacts. The main parameters examined with respect to air quality in the area of a landfill are:

- Dust
- Odour
- Landfill gas

3.2.1 Air Quality in the Existing Environment

Dust

Dust includes any solid matter between 1 to 75 µm that is borne in the wind. Primarily, dust is generated at a landfill through the movement of heavy vehicles on road surfaces and hardstanding areas. Onsite dust control measures currently implemented at the site include:

- the spraying of site roads and other areas used by vehicles with water, especially during drier weather
- the operation of a wheel wash
- the operation of only one working face at the landfill. This is covered as soon as is practicable and prior to the end of each day.

Dust deposition monitoring is carried out at the landfill in accordance with the waste licence for the facility. In 2007 and 2008, dust monitoring was undertaken at four locations using the Standard method VDI2119 -Measurement of Dustfall, Determination of Dustfall using Bergerhoff Instrument (German Engineering Institute). Dust deposition levels were analysed in the relevant laboratories and results were reported as mg/m^2/day. Monitoring is undertaken at least twice during the period May to September in accordance with the waste licence. Dust monitoring locations are shown on Figure 2.6 in Section 2 and dust monitoring results for 2007 and 2008 are shown in Table 3.1 below.

Table 3.1: Dust Monitoring Results 2007 & 2008

Monitoring Locations	Sampling Period Units: mg/m2 /day				Waste Licence Limit Value
	16th May- 18th June 2007	18th June- 13th Aug 2007	13th Aug- 27th Sept 2007	7th May – 5th June 2008	
DM-02	56.1	311.4	204.7	*143.3*	350
DM-04	129.1	305.5	142.8	*224.6*	350
DM-05	67.3	**417.1**	303.8	*252.1*	350
DM-07	50.5	123.4	190	***515.1***	350

Exceedances of the limit occurred at two locations, DM-05 DM-07 during 2007/2008. DM05 is located to the north eastern boundary of the landfill and is located in close proximity to a peat milling plant operated by Bord Na Mona.

Therefore, this operation may have contributed to elevated levels in this area. Dust deposition has decreased at this location during the following sampling period.

In 2008, elevated dust deposition levels were recorded at DM07. DM07 is located at the south-western end of the site and is not in close proximity to an active landfill face. It is located close to where milled peat is stored while awaiting removal off site. Future dust monitoring will analyse for the organic and inorganic faction of the dust in order to help identify if off-site operations are affecting the dust deposition levels at the landfill.

Landfill Gas

Methane is the primary constituent of landfill gas making up 60% v/v and is flammable at concentrations between 5 - 15% volume in air. Carbon dioxide makes up 40% v/v and is also asphyxiating in enclosed areas (at concentrations greater than 1.5% volume). Over time, the concentrations of both gases change, depending on the type and age of waste, method of fill and moisture content. If not properly managed, these gases can pose a risk through migration off site or build-up in enclosed spaces leading to a potentially explosive atmosphere or an asphyxiation hazard in confined areas.

Current design and control practice in the active cells for landfill gas control is that all new cells are fully lined with impermeable HDPE liner and a low permeability compacted clay lining system. Vertical wells are also planned for installation within the waste at approximate 40 m grid spacing to minimise the gas pressures within the waste body during waste placement. This procedure removes the potential for lateral gas migration.

Currently, landfill gas from the capped unlined cell is collected via a system of vertical wells and collection pipework, and is conveyed to the enclosed landfill gas flare. The landfill gas flare burns off the methane producing heat and carbon dioxide, which is approximately 21 times less damaging as a greenhouse gas than methane. The enclosed flare also operates at high temperature having the effect of burning off any odorous compounds.

The unlined portion of the landfill has been capped to prevent landfill gas emission from the surface of the waste and infrastructure for the active collection and flaring of this landfill gas has been installed. This system has been fully operational since mid 2008.

Landfill Gas Monitoring

Landfill gas monitoring is carried out at the landfill in accordance with the waste licence for the facility. In 2007 and 2008, landfill gas monitoring was undertaken using infrared gas analysis. Methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) are analyzed and results were reported in % V/V.

Landfill gas monitoring is undertaken at 19 locations monthly at the facility. Landfill gas monitoring locations are shown on Figure 2.6 (Section 2) and monitoring results for 2007 and 2008 are shown in Table 3.2 and Table 3.3 respectively. Monitoring results are compared to emission limit values set out in Schedule C of the waste licence: 1% v/v Methane (CH_4) and 1.5% v/v carbon dioxide (CO_2). Levels elevated over these limit values are highlighted in bold.

As can be seen from the results, levels of methane and carbon dioxide in the landfill gas are elevated in some of the monitoring wells. A summary of overall trends is discussed below:

- Monitoring wells GP03, GP05 and GP13 and GP14 are located within the waste body and therefore high levels of methane and carbon dioxide should occur at these locations
- GP01, GP18 and GP29 have consistently high methane and carbon dioxide results. GP05 and GP14 are located in close proximity to the waste area which would explain elevated results at these locations. GP01 and GP18 are located to the south east outside the old unlined landfill cell and GP29 is located to the north of the currently active lined landfill cells.
- GP15, GP26, GP27, GP28 and GP30 produced high CO_2 results while CH_4 levels are low. GP15 is located west of the old landfilled area while all the other wells are located around the new landfill cell.
- GP09, GP16, GP19, GP20, GP23, GP25, GP26 show variable CH_4 and or CO_2 over the 2007 and 2008 periods. These wells are located at greater distances from the landfill waste body.
- Two wells are below the limited values and these are GP08 and GP17. These wells are on the west boundary of the facility with GP 17 being closer the old waste body.

Table 3.2: Methane Levels in 2007

Month	GP 01	GP 03	GP 05	GP 08	GP 13	GP 14	GP 16	GP 19	GP 20	GP 25	GP 26	GP 27	GP 28	GP 30	GP 29	GP 18	GP 15	GP 09	GP 23
Jan-07	**17.3**	**62.4**	**14.6**	0	**64.3**	**20.6**	0	**2.9**	**3.2**	0.2	**2.3**	0.1	0.1	0	**1.7**	0	0	0	**4.3**
Feb-07	**1.3**	**66.3**	**7.9**	0	**57.5**	**31.2**	0.2	**2.6**	**2.3**	0	0.8	0	0.1	0	**20.4**	**18.1**	0	0	**1.3**
Mar-07	**27.4**	**65**	**3.2**	0	**48.8**	**20.5**	0	0	1	0	**1.3**	0.1	0.1	0	0	**1.8**	0	0	0.4
Apr-07	**10.2**	**63.7**	**6.8**	0	**65.3**	**28.6**	0.2	0	0	0	0	0	0	0	**15.6**	**2.7**	0	0	1
May-07	**51.3**	**55.3**	**9.6**	0.1	**67.1**	**73.2**	**1.3**	0	0	0	0.4	0	0	0	**7.3**	**4.2**	0	0	0.6
Jun-07	**46.6**	**59.9**	**51.1**	0	**64.8**	**73.4**	0.4	0	0	0	**1.6**	0	0	0	**35.4**	**13.5**	0	0	**5.1**
Jul-07	**27.6**	**60.1**	**17.1**	0	**62.8**	**43.7**	0	0	0	0	0.7	0	0	0	**28.7**	**19.8**	0	0	**4.3**
Aug-07	**1.9**	**61.6**	**12.2**	0		**37.2**	**3.1**	0	0	0	0.2	0	0	0	**10.2**		0	0	**23.3**
Sep-07	**42.7**	**47.8**	**1.4**	0	**25.6**	**35.4**	0	**1.3**	0	0	0.8	0	0	0	**39.6**	0	**20.2**	0	0.3
Oct-07		**60.9**	0	0	**52.6**	**34.5**	**1.7**	0	0	0	**1.5**	0	0	0	**37.2**		0	0	**1.5**
Nov-07	**5.1**			0		**11.5**	0	0	0	0	**2.7**	0	0	0	**10.1**		0	0	**3.5**
Dec-07	**61.3**			0		**20.1**	0	0	0	0			0	0	**27.3**	**11**	0	0	**5.7**

Table 3.3: Methane Levels in 2008

Month	GP 01	GP 03	GP 05	GP 08	GP 13	GP 14	GP 16	GP 19	GP 20	GP 25	GP 26	GP 27	GP 28	GP 30	GP 29	GP 18	GP 15	GP 09	GP 23
Jan-08		**65**		0		**32.2**		**1.7**	0	0.2	**4.5**	0	0	0	0	0	0	0	
Feb-08		**65.4**		0		**22.6**		0	0	0	0.6	0	0	0	0	0	0	0	
Mar-08				0		**44.9**	0	0.8	0	0	**3.3**	0		0	**23**	**36.2**	0	0	
Apr-08				0		**69.2**		0	0	0	0	0		0	**24.6**	**23.9**	0	0	
May-08		**62.1**	**44.5**	0	**61.5**	**67.9**		0	0	0	0	0	0	0	**10.7**	**27.4**	0	0	
Jun-08	**10.8**		0.3	0.2		**67.2**		**1.9**	0		0	0	0	0	**7.8**	**22.2**	0.1	0.1	

Table 3.4: Carbon Dioxide Levels in 2007

Month	GP 01	GP 03	GP 05	GP 08	GP 13	GP 14	GP 16	GP 19	GP 20	GP 25	GP 26	GP 27	GP 28	GP 30	GP 29	GP 18	GP 15	GP 09	GP 23
Jan-07	**11.1**	**37.2**	**23.1**	0.8	**38**	**9**	0	**9.4**	**7.1**	1.5	**7.3**	1.3	**1.6**	0	**3.7**	0.1	1.5	0.8	**5**
Feb-07	1.5	**40.7**	**14.5**	0.6	**38.2**	**13.1**	0	**17**	**6.4**	0	**7.7**	**3.9**	**3.7**	0.1	**8.3**	**3.2**	**1.8**	0.9	**1.6**
Mar-07	**10.9**	**38.3**	**14.6**	0.5	**32.6**	**10.8**	0	**15**	**6.3**	**1.8**	**7**	**1.8**	**2.1**	0	0	**2**	**2.3**	1.2	**1.7**
Apr-07	**4.2**	**40.1**	**25.8**	0.8	**41.6**	**9.7**	1.1	0.1	0	1.4	**7**	1.1	1.1	0.1	**8.5**	**10.3**	**3.8**	**1.9**	**2**
May-07	**30.8**	**38.8**	**20.4**	1	**32.1**	**25.8**	**3.1**	**1.8**	**3**	**2.3**	**8.4**	**1.7**	**2.3**	0.1	**10.6**	**15.5**	**5.9**	1.1	1.1
Jun-07	**30.2**	**42.6**	**35.5**	1.2	**41.7**	**31.3**	**4.9**	**4.3**	**1.9**	**2.7**	**9.3**	**2.2**	**1.8**	0	**13.9**	**18.9**	**5.4**	**2**	**7.1**
Jul-07	**15.2**	**36.7**	**16.5**	**1.6**	**37.6**	**15.5**	0	0	**1.8**	**3.2**	**8.2**	**1.7**	1.1	0	**12.2**	**2.8**	**8.5**	1.3	**4.9**
Aug-07	**4**	**37.2**	**15**	**1.8**		**15**	**0.1**	0	**2.9**	**1.9**	**2.8**	**2.5**	**2.4**	0.9	**5.6**		**8.1**	**2.6**	**12**
Sep-07	**29.4**	**33.5**	**13.4**	1.1	**20.6**	**13.7**	4.3	0.5	**3.3**	**3.1**	**4.6**	**2.2**	**1.9**	**5.3**	**14.2**	**18.3**	0.7	0.9	**1.8**
Oct-07		**36.7**	0	1.4	**32.6**	**13.4**	0.2	0.1	**2.7**	**2.3**	**8.3**	**2**	**1.8**	**2.7**	**14.3**		**5.6**	1	**4.4**
Nov-07	**2.9**			1		**7.4**	**4.4**	0.1	1.3	**2.5**	**2.3**	**2.3**	**1.6**	**2.4**	**3.9**		0	1	**2.8**
Dec-07	**61.3**	**32.3**		0.8		**10.5**	**5**	**7.8**	0.2	**3.2**	**4.1**	**2.7**	**2.8**	1.4	**10.1**	**13.5**	0	1	**3**

Table 3.5: Carbon Dioxide Levels in 2008

Month	GP 01	GP 03	GP 05	GP 08	GP 13	GP 14	GP 16	GP 19	GP 20	GP 25	GP 26	GP 27	GP 28	GP 30	GP 29	GP 18	GP 15	GP 09	GP 23	GP 17
Jan-08		**36.1**		0.2		**14.1**		**3.4**	**5.6**	**1.7**	**5**	1.4	**1.6**	**3.2**	0.2	0.2	**2.5**	0.4		0
Feb-08		**33.6**		0.5		**13**		0	0.7	0.2	1	0.8	0	0.5	0.1	0	**2.1**	0.3		0
Mar-08				0.5		**17.6**	0.1	**13.4**	**3.6**	**1.7**	**5.4**	0		**2.5**	**7.2**	**7.9**	**1.9**	0.8		
Apr-08				1.2		**30.3**		0.4	**3.1**	1.4	**6**	**1.8**		**3.3**	**7.9**	**9.5**	**2.7**	0.9		0.5
May-08		**34.2**	**27**	1	**33.5**	**29.5**		**11.2**	**2**	**2.2**	**6.7**	1.3	0.4	**2.6**	**8.4**	**13.5**	**4.5**	0.9		0
Jun-08	**19.9**		0	0.5		**29.4**		**2.6**	0.8		**6.9**	1.2	1.2	**2.4**	**15.2**	**21.5**	**4.3**	0.8		0

Permanent gas monitors are installed in the administration, staff services, leachate plant and maintenance buildings. To date, observed levels of methane and carbon dioxide recorded in these buildings indicate levels of methane and carbon dioxide that are significantly less than 1.0% v/v and 1.5% v/v respectively.

It is considered that the migration of gases from the older landfilling area is the main contributor to elevated levels of methane and carbon dioxide in the perimeter wells. Migration of landfill gas is very likely from this area as it is unlined. Therefore, gases generated in the waste will follow lines of least resistance through the waste and sub-soils to the perimeter of the facility.

Indeed, in the 'dilute and disperse' scenario the absence of gas in migration monitoring wells would lead to suspicion that the monitoring infrastructure is inadequate. For that reason, in 1994, the Department of the Environment published guidelines 'Protection of New Buildings and Occupants from Landfill Gas'. In essence the document recommends that no new buildings be constructed within 250 m of a landfill. The '250 m' dimension has subsequently been used as a new landfill site-selection criterion. The only building within the 250 m zone is the office and that has been given enhanced protection and monitoring equipment. This is further reinforced in the current draft county development plan

The capping of the old cell has both reduced the quantity of leachate being generated and increased the efficiency of landfill gas collection. Without a basal liner, sub-surface gas migration cannot be eliminated but the enhanced control and establishment of negative pressure in the waste mass will reduce the risk of significant migration. The only significant receptor is the office that remains unaffected. Monitoring will continue both to establish trends and to provide warning of the build-up of hazardous concentrations of gas.

Odour

Odour can arise from fresh waste in the active cells and from waste in various stages of decay in other cells. Landfill gas also comprises trace odorous components such as mercaptans and ketones.

Odour issues have been an intermittent problem at the facility and a number of odour complaints have been received at the facility.

In April 2008, Odour Monitoring Ireland (OMI) was commissioned by the Office of Environmental Enforcement in the EPA to carry out an assessment of landfill gas management in Derryclure Landfill. An 'odour hog' VOC analyser was used to measure organic and inorganic vapours using a photo ionisation detector (PID) principal. A flame ionisation detector (FID) was also used to detect the methane fraction of landfill gas leakage. The capped area of the landfill was surveyed using these meters for potential landfill gas leakage areas. During the monitoring, 11 surface emission zones were identified. Four localised surface emissions zones were located on the older, capped area of the landfill. Emissions were reported to be due to insufficient gas abstraction at wellheads and failure of the capping system.

The remaining seven surface emissions were diffuse sources and were located on the flanked areas of the active landfill cells.

OMI recommended maintaining a slight negative vacuum pressure to mitigate the sources on the older capped area and ensure all wellheads are tapped into the gas abstraction system. In the active cell area, OMI recommends abstraction of landfill gas in the active cell to reduce emissions. Design of flanked areas should be reconsidered and techniques such as GCL membrane or benching should be considered to contain landfill gas within the cell. Horizontal gas abstraction system could also facilitate greater containment of landfill gas.

It is noted that at the time of the survey by OMI, the permanent gas flare and collection system had not been commissioned and that the permanent capping of the old landfill was not complete. This system has now been commissioned and the issues which were highlighted in the report have been addressed.

3.2.2 Potential Impacts of the Development on Air

Dust emissions

The intensification of waste acceptance at the landfill has the potential to increase dust emissions if good housekeeping practices are not implemented. Control measures currently in place will continue to be applied to these areas. The main source of potential dust emissions are:

- Vehicles travelling along internal roads
- On-site construction works e.g. capping, cells construction
- Uncovered stockpiles
- Deposition of waste

Landfill Gas Emissions

The intensification could, if not properly managed, increase the quantity of landfill gas that escapes untreated to the environment. However, the intensification will accelerate the provision of capping and the expansion of landfill gas collection infrastructure thus increasing the overall efficiency of the landfill gas management system.

Although there will be a faster production rate of landfill gas and the peak generation will occur sooner for an intensified waste intake (refer to Chapter 2), it will be actively abstracted and directed for flaring and/or utilisation. The overall quantity will not be altered by the accelerated filling but the efficiency of extraction and the economics of utilisation will be increased. A detailed feasibility study on potential electricity utilisation at the facility will be carried out if intensification proceeds.

In the active cells, landfill gas is currently allowed to passively vent to the air. Landfill gas can migrate freely through air and its concentration is generally negligible owing to low emission rate from the relatively fresh waste and the massive dilution effect of ambient air and airflow over the landfill that disperses the gases. Plans are underway to install a combined system of horizontal pipework and vertical wells in the active cells. Installation of this system is expected to be complete by end of 2008. This infrastructure is expected to result in the reduction of offensive odour emissions at the site because more of the waste mass will be under 'negative' pressure.

Current design and control practices for landfill gas in the active and future cells will included the installation of both vertical and horizontal gas extraction wells. Strict control on the design of future cells will ensure landfill gas from the proposed development will not have a significant impact on the surrounding area. Intensification of the waste filling activities will only occur within the engineered cells.

Fugitive gas emissions of landfill gas can occur from the active cells as they are being filled and while landfill gas is not being actively abstracted. These emissions can be minimised by the use of daily cover materials.

Odour Emissions

The controlling and management of odours is difficult because their impacts depend on different sensitivities in different people and because odour levels vary significantly with weather conditions. Impacts from odorous air contaminants are often nuisance-related rather than health-related. This is because trace levels of particularly odorous components, for example mercaptans and ketones, in a landfill are significantly diluted on venting to atmosphere, which reduces levels to below the respective health and safety guideline values for the compounds of interest. However, even at very low concentrations, odorous compounds can be detected in the part per billion (or below) range.

The emission of odour cannot be prevented from some activities and 'no odour' is not always a realistic goal. However, effective management of a facility, for example a landfill site, can reduce the occurrence of odour incidences so as to not cause a nuisance.

A number of complaints have been received at the facility in relation to odours and following an odour survey carried out by OMI a number of localised and diffuse surface emission points were identified. On the older landfilling area sources were reported to be due to insufficient gas abstraction and failure of the capping system in specific areas. It should be noted that this survey was carried out prior to final completion of the landfill capping and gas system installation contracts. These have since been completed and OMI's concerns addressed as necessary.

Sources on the new active landfill cells are diffuse and were located on the flanked areas of the active cell area. The passive venting of landfill gas is currently facilitating the release of odorous compounds from the active cells.

If this was to continue into the future the intensification of waste acceptance in the proposed development would increase the fugitive landfill gas and odour emissions from the facility in the short-term. However, OCC submitted a specified engineering works proposal to the EPA in June 2008 for installation of a landfill gas and odour management system in the active cells. The layout of this system is shown in Figure 2.2 in Section 2 of this document. Key aspects of this proposal include:

- Temporary Capping of Cell 1B using a plastic membrane and soil layer until Cell 1A is filled to final level
- Installation of vertical gas extraction wells at c. 30 m spacings throughout Cells 1A and 1B

- Installation of horizontal slotted pipework in the active cell in advance of the developing waste front
- Extension of the landfill facility gas main
- Connection of slotted pipework and extraction wells to the gas main via control manifolds
- Conveyance of all gases to the enclosed flare for thermal treatment

It is intended that this system will be utilised in the existing and all future active cells. This system is expected to be fully operational within the existing cells by the end of 2008. Once operational, this system will capture the majority of landfill gas being generated in the waste mass, and will greatly reduce the fugitive emissions at the active face

It should be noted that the proposed development will hasten the final capping and restoration of the landfill which will reduce any potential landfill gas and odorous emissions in the long term.

3.2.3 Mitigation Measures

Dust Emissions

A number of mitigation measures are currently in place which successfully control dust on site. These measures will be continued across the site and will include the following:

- Surface dressing of roads to the landfill area to reduce the amount of dust generated
- The use of a water spray to keep dust close to ground level thus containing the impact within the site
- All refuse and construction trucks leaving the site will be required to pass through the wheel-wash to prevent dust and mud debris on the public roads
- Careful compaction of waste and use of daily cover
- Vegetation of capped areas to prevent windblown erosion.

OCC will also ensure that all stock piles during the construction phase of the additional landfill cells will be sprayed during periods of dry weather in order to suppress dust migration from the site.

Landfill Gas Emissions

A number of mitigation measures have been identified to control landfill gas from both the old unlined landfill area and the new active landfill areas.

As the old landfill area is unlined, lateral landfill gas migration is difficult to control. OCC proposes to increase the management and control of the gas field extraction system.

Management of this is complex due to:

- Gas production levels constantly changing
- Atmospheric conditions changing
- Balancing of complex flows and pressures under the cap.

At the active cells 1A and 1B, OCC will fill Cell 1A to final level before returning to complete filling Cell1B. In the interim, OCC will install a temporary cap consisting of a plastic cover and soil layer in Cell 1B until landfilling recommences in this area. Installation of a system of vertical gas wells at c. 30 m spacings throughout Cells 1A and 1B will enable extraction of landfill gas generated by the waste mass. In future cells, vertical wells will be constructed immediately following commencement of waste placement in new cells to enable early extraction of landfill gas to the enclosed flare. Horizontal slotted pipework will be placed at intervals in advance of the developing waste front for odour control. In the medium term, these pipes will also be used for landfill gas extraction providing increased coverage of the landfill gas extraction system.

Landfill gas monitoring will continue and will also be extended as landfilling progresses. The number of boreholes to be installed and the borehole locations will be agreed in advance with the EPA.

Odour Emissions

Mitigation measures to contain landfill gas discussed above will directly improve control of odour emissions from the facility.

The odour control system which is expected to be operational in the active landfilling area by end of 2008 will have a significant impact on odour management at the facility. This odour control system will comprise the installation of slotted horizontal pipework in advance of the developing waste front. When connected to the facility gas extraction system, a slight negative pressure will be applied by the landfill gas flare. The magnitude of this pressure will be controlled by valves at connection manifolds.

This negative pressure will have the effect of drawing potentially odoriferous emissions into the gas extraction system rather than emitting to air. This is new technology which is in its infancy in Ireland, but is a system which has been approved for installation by the EPA at several landfills to date. The effectiveness of this system will be monitored frequently, and can be improved if necessary by installing horizontal pipes at closer horizontal and vertical spacings, and by application of filter media as daily cover to attenuate any fugitive emissions.

3.3 Climate

The nearest synoptic station to the landfill facility is Birr weather station which is located approximately 40 km to the south-west of the landfill facility. Birr synoptic weather station is located 73 m OD, i.e. at approximately the same elevation as the Derryclure site. The station is also situated in the low-lying midlands area and should also closely represent climatic conditions at the landfill facility.

The long term weather patterns at the site reflect regional conditions in the low-lying mid-land areas, with high summer temperatures and low winter temperatures. The average monthly weather data recorded at Birr synoptic station over the period 1961 to 1990 is set out in Table 3.6.

Table 3.6: Summary of Average Monthly and Annual Weather Data at Birr Synoptic Station 1961-1990.

TEMPERATURE (o C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
mean daily max.	7.5	7.9	9.8	12.2	14.9	17.7	19.2	18.8	16.6	13.6	9.7	8.2	**13.0**
mean daily min.	1.8	1.8	2.5	3.5	5.9	8.7	10.7	10.3	8.5	6.7	3.1	2.5	**5.5**
mean	4.6	4.8	6.1	7.9	10.4	13.2	14.9	14.6	12.6	10.1	6.4	5.4	**9.3**
RELATIVE HUMIDITY (%)													
mean at 0900UTC	90	89	87	82	77	78	80	84	86	89	90	90	**85**
mean at 1500UTC	83	76	71	65	64	66	67	68	71	76	80	84	**73**
SUNSHINE (hours)													
mean daily duration	1.60	2.31	3.18	4.64	5.32	4.80	4.24	4.16	3.58	2.67	2.03	1.41	**3.33**
greatest daily duration	7.2	9.2	11.7	13.6	15.2	15.6	15.2	13.8	11.3	9.7	8.1	6.7	**15.6**
mean no. of days with no sun	11	7	5	3	2	2	3	2	4	6	9	12	**66**
RAINFALL (mm)													
mean monthly total	75.9	54.0	61.3	52.5	61.7	55.2	59.1	77.6	70.6	83.5	74.1	78.6	**804.2**
greatest daily total	28.6	35.3	25.9	30.9	26.2	27.5	39.5	42.2	25.6	40.3	25.9	47.1	**47.1**
WIND (knots)													
mean monthly speed	8.0	8.1	8.1	7.0	6.7	6.1	5.8	6.0	6.6	7.2	7.1	7.9	**7.0**
max. gust	85	77	62	58	55	49	49	58	81	65	60	69	**85**

The total monthly and annual rainfall data for 2007 (in millimetres) recorded at the Birr synoptic station is set out in Table 3.7.

Table 3.7: Total Monthly and Annual Rainfall recorded at Birr Station for 2007 and 2008

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2007(mm)	95.6	60.3	57.7	21.8	53.1	91.2	99.5	145.2	44.9	34.6	49.6	109.4	862.9
2008 (mm)	135	31	96	30	19	86	92	180	84				

The prevailing wind direction recorded at Birr is from the southwest and the mean annual wind-speed recorded at this meteorological station is 6.8 knots (3.5 m/s).

3.3.1 Potential Impacts on Climate

There are no expected negative impacts from the development on the local climate in the area. Landfill facilities generate landfill gas as the waste decomposes over time mainly comprising methane and carbon dioxide.

Although there will be a faster production rate of landfill gas and the peak generation will occur sooner for an intensified waste intake (refer to Chapter 2), it will be actively abstracted and directed for flaring and/or utilisation. The overall quantity will not be significantly (less than 1%) altered by the accelerated filling but the effectiveness of extraction, the efficiency of destruction of methane and the economics of utilisation will be increased. Thus the increased intake will reduce the proportion of more harmful greenhouse gasses being emitted to the atmosphere.

Landfill gas comprises of methane, CO_2, O_2 and other trace compounds. Its combustion eliminates methane which is approximately 23 times more harmful to the environment (contribution to global warming) than CO_2.

In addition, the intensification of the site will make the utilisation of landfill gas more feasible and may have the benefit of generating power from a renewable source, thus reducing the need to further create emissions to atmosphere by the burning of fossil fuels for power generation.

3.3.2 Mitigation Measures

Waste pre-treatment to reduce the organic waste deposited to landfill and gas flaring/utilisation for electricity generation will result in reduced greenhouse gas emissions from the landfill. No additional mitigation measures are required.

3.4 Noise and Vibration Impact Assessment

This section of the EIS determines the impact of noise emissions from the proposed development on noise sensitive locations within the area surrounding the site. Where significant impacts are identified, mitigation measures are outlined to avoid, reduce or remedy these impacts.

To assist in the understanding of the acoustic terms, measurement methods, and assessment criteria used in this report, the following is a brief introduction to the fundamental terms of noise. Noise is defined as unwanted sound. The impacts of noise are subjective and can vary from person to person.
Noise factors such as the frequency, tonal aspects, patterns, existing background noise levels, and the activities being carried out when the person experiences the noise all influence the impacts of the noise levels experienced by people.

Noise is measured as sound pressure levels; the unit of sound pressure level is the decibel (dB). This is calculated as a logarithm of sound. A change of 10 dB corresponds approximately to halving or doubling the loudness of sound. The use of decibels (A-weighted), dB (A), as the basic unit for general environmental and traffic noise is widely accepted. Decibels measured on sound level meters incorporating this frequency weighting differentiate between sounds of different frequency in a manner similar to the human ear. That is, measurements in dB (A) broadly agree with human beings' assessment of loudness.

Sound pressure levels are not directly added to one another, that is, if a sound level of 30 dB is added to another sound level of 30 dB the combined sound level is not a doubling to 60 dB. Rather, as a result of the logarithmic scale used, the combined sound level would be 33 dB. Thus every increase of 3 dB represents a doubling of sound levels. Related to this is the fact that the smallest noise change detectable by the human ear is three decibels.

Another property of the sound decibel scale is that if a sound is 10 dB less than another sound, then the total noise level is simply the louder of the two noises. For example, the combined noise level from a source at 30 dB added to another source at 40 dB is 40 dB. As a result, noise assessments are limited to the loudest sources on a site, which determine the sound levels experienced at the noise sensitive locations.

To assist in the understanding of the noise measurement scales, Table 3.8 is presented here. This gives the decibel scale (dB (A)) and some common place activities which would typically give rise to environmental noise at these decibel levels.

Table 3.8: Approximate Representative Noise Levels

Situation/Noise Source	Approximate Noise Level dB(A)	Sound Pressure µPa	Subjective Description
30 metres from a military jet aircraft take-off	140	200,000,000	Painful, intolerable
Rock/pop concert	105	3,500,000	
Nightclub	100	2,000,000	
Pop/concert at mixer desk	98	1,600,000	
Passing heavy Goods vehicle at 7 m	90	630,000	Very noisy
Ringing alarm clock at 1 m	80	200,000	
Domestic vacuum cleaner at 3 m	70	63,000	Noisy
Busy office	60	20,000	
Normal conversation at 1 m	55	11,000	
Reading rooms	35	1,100	
Bedroom in a quiet area with the windows shut	30	360	Very quiet
Remote location without any identifiable sound	20	200	
Theoretical threshold of hearing	0	20	Near Silence

Noise level and frequency varies constantly with time. It cannot be described with a single number. As a result, statistical metrics are commonly used to describe the noise levels.

To understand the terms used in this report, definitions of the terms used are outlined below.

- **L_{A10}** Refers to those noise levels in the top 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period. It is used to determine the intermittent high noise level features of locally generated noise and usually gives an indicator of the level of traffic.
- **L_{A90}** Refers to those 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 will therefore exclude the intermittent features of traffic and is used to estimate a background level.
- **L_{Aeq}** The average level recorded over the sampling period. The closer the L_{Aeq} value is to either the L_{A10} or L_{A90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.

Impulsive noise: a noise of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.

Tonal noise: A noise source that is concentrated in a narrow band of the frequency spectrum.

A-weighted sound levels emphasise the middle frequencies of the noise spectrum, while putting less emphasis on the higher and lower frequencies. This emulates the way that the human ear responds to sound. A-weighted sound pressures are designated by 'dB (A)'.

3.4.1 Existing Noise Environment

The site is located in a rural area adjacent to a peat bog. The baseline noise in the region is made up of the existing operations at the site, road traffic noise from the N80 National Primary Road, agricultural activities and turbury activities.

The waste licence for the site sets a maximum permissible noise limits for day-time noise of 55 dB 30-minute L_{Aeq}, when measured at noise sensitive locations. Noise monitoring is carried out annually at the facility. Measurements are taken at four boundary locations; no measurements are taken at noise sensitive locations. The noise monitoring locations are shown in Figure 2.6 in Section 2 and the results of noise monitoring for 2007 are presented in Table 3.9 over.

Table 3.9: Results of Existing Noise Levels (2007)

Monitoring Locations	L_{Aeq} 30-min	L_{A10} 30-min	L_{A90} 30-min
	dB	dB	dB
N2	71.0	68.1	49.9
N3	59.2	61.8	58.6
N6	42.0	43.8	37.7
N8	51.6	57.4	43.2

The results show that the L_{Aeq} levels were above 55 dB at N3 and N2. N2 is located next to the facility entrance and is influenced by the movement of traffic to and from the site and this is indicated by the L_{AF10} result (68.1 dB). Noise levels at N3 were influenced by a pump running adjacent to the monitoring locations during the monitoring period.

Background noise levels recorded at the site boundary during the 2007 monitoring event range from 42 to 58 dB. However, the 58 dB result relates again to the monitoring carried out in close proximity to a water pump on the site.

The nearest noise sensitive locations are dwellings developed along the N80 to the west, southwest and northwest of the site. There are 18 dwellings within 500 m of the site boundary. Noise emissions from the site are not considered to be having a significant impact on these dwellings as the dominant noise source at these locations is most likely traffic travelling along the N80.

This is further supported by the separation distance from the boundary of the site to the noise sensitive locations and the fact that no noise complaints have been registered at the site since records began.

3.4.2 Description of the Likely Significant Noise Impacts

The operation of machinery in the open has the greatest potential for noise impacts at the site. The operation of each cell of the landfill has three main phases; cell construction, filling of the cell with waste and finally the installation of the capping. Potential noise sources at the site include;

- Vehicle movements to and from the site as well as within the site itself
- Equipment and plant operating within the site particularly on the active face
- Environmental protection infrastructure including pumps, landfill gas flares.
- Other plant and machinery

The intensification of the site will mean that the life span of the landfill will be reduced by 14.5 years, but operation levels will increase on the site. The noise impacts from each of these sources are examined in detail below;

Noise Impacts of off-site development generated Traffic

New operations at the site will result in an increase in traffic levels along the N80, as detailed in the traffic impact section. The operations at the site are predicted to result in the generation of an additional 50 truck movements per day along the route. The existing traffic flow in the peak hour is predicted (using CRTN method) to have a L_{den} noise level at a reference distance of 10 m of 70 dB. When the predicted operational traffic peak hour flow is added to the peak hour flow of the existing baseline traffic the basic noise level at a reference distance of 10 m shows no increase in predicted traffic noise levels from 70 dB. An increase in traffic levels, as predicted in the traffic impact assessment, will have an imperceptible impact on the noise emissions from the local road network.

Noise Impacts from Operations On-site

Each phase will entail the use of different machinery and plant, across various locations on the site. Many of the noise sources are mobile plant.

The waste filling phase will include the waste delivery vehicles on the site, the waste placement equipment (e.g. excavator, loaders or bulldozer) and the compactors to tightly compact the waste into the landfill cell.

The final capping phase will again involve earthmoving equipment to move and place the capping material and the environment protection infrastructure. Earthmoving plant such as excavators, bulldozers and trucks will be used to move and place the cap material.

All of these actives will occur on the site anyway, but the proposed extension of the annual intake of waste and operating hours at the facility will require some activities to be intensified. That is, activities may occur for longer periods in the short term.
This intensification of activities will result in some marginal increases in noise levels due to greater levels of activity at the site. However, the development will not result in any change in the nature of noise from the site.

Considering the previous record of the site, the existing noise levels at the site and the proposed future scale of intensification, the noise levels from the site as experienced at existing noise sensitive locations site will not significantly change. It is further noted that intensification of waste intake will result in the projected closure date of the facility being brought forward from 2032 to 2018. Thus the long term risk of noise nuisance will be greatly reduced. The site will operate within the EPA imposed waste licence limit of 55 dB(A) daytime and 45 dB(A) night-time limits. Consequently the development will have an imperceptible impact on noise emissions from the site, but a moderate positive impact through shortening the noise emissions of the site from long-term to medium-term.

3.4.3 Noise Mitigation Measures

Noise emissions on adjacent receptors do not currently cause a significant impact on noise sensitive locations. OCC will continue to implement good housekeeping practices to minimise noise impacts on the surrounding environment by:

- Ensuring that management practices at the site will include best practice methods for noise control at open sites (e.g. BS 5228:1997 Noise and Vibration Control on Construction and Open Sites).
- Continue to control noise from heavy plant, equipment and activities at source by ensuring that they are routinely serviced. All plant and equipment used during the operational phase complies with noise regulations on outdoor plant and machinery.
- Assess any planned particularly noisy activities and carefully plan implementation, scheduling and operating times to avoid significant impacts.
- Carry out noise monitoring in accordance with the revised waste licence for the site to ensure the site is operating without undue noise impact.

3.5 Traffic

This section assesses the existing conditions associated with the roads environment in the vicinity of the landfill which is located along the N80 National Secondary Road to the south of Tullamore. In this section existing and forecast traffic levels for the landfill are estimated and the potential impact of the development is assessed with regard to likely impacts or influences on the operation of the receiving roads network. Where necessary, mitigation measures are proposed to address identified negative impacts or to improve shortcomings identified in the existing roads environment.

3.5.1 Existing Conditions

General Location in relation to Roads Network

The site is located in the townland of Derryclure to the south of Tullamore town. The closest junction to the north of the site will be the Clonminch Roundabout on the Tullamore Bypass which is currently under construction.
The town of Tullamore is located in the centre of Offaly at the intersection of the N52 National Secondary Route and the N80 National Secondary Route. The N52 route runs in a southerly direction from the N6 National Primary Route in Kilbeggan to Tullamore and then in a south-westerly direction through Kilcormac, Birr and Borrisokane before connecting to the N7 National Primary Route in Nenagh.

The N80 road runs in a south-easterly direction from the N6 at Moate through Clara, Tullamore, Mountmellick and Portlaoise and connects to the M7 motorway to the southeast of Portlaoise. Tullamore is also served by the R420 Regional Road; this road runs in a south-easterly direction from Tullamore and provides access to Portarlington via the village of Clonygowan.

Road Access from Existing Site

The site has direct vehicular access to the N80 via a single entrance located on the south-western corner of the site boundary. The N80 is a single carriageway national secondary road which is subject to a posted speed limit of 100 kph, the carriageway width is approximately 6.3 m and hard shoulders of approximately 1.6 m width are present on both sides (there dimensions vary e.g. the carriageway width at the site entrance is 7.35 m wide with two 1.2 m shoulders giving approximately the same overall paved width). Following the completion of the Tullamore Bypass in 2010 the site will have excellent access to the national roads network and as such will not contribute any additional traffic within Tullamore town centre.

Significant Developments near the Site

There is limited development in the vicinity of the landfill, with the majority of the surrounding lands made up of agricultural lands.

3.5.2 Future Road Improvements in the vicinity of Tullamore

N52 Tullamore By Pass

Construction began in February 2008 on the N52 Tullamore Bypass which involves the construction of approximately 11.5 kms of standard single carriageway and 2.4 km of wide single carriageway. The proposed bypass will depart from the existing line of the N52 in the townland of Heath, approximately 6 km southwest of Tullamore town, and will rejoin the existing N52 in the townland of Gormagh, approximately 3 km north of Tullamore town. The proposed development also involves the construction of 6 underbridges and 1 overbridge. When construction is completed in 2010 the N52 Tullamore Bypass will provide access from the site to the National roads network without entering Tullamore town centre.

N52 National Secondary Road

The N52 road is a National Secondary road; this 218 km long route links the N7 National Primary Route from just south of Nenagh, County Tipperary to the N1 National Primary Route north of Dundalk in County Louth.

The N52 between Kilbeggan and Tullamore has been identified as being in need of improvement in order to provide for future traffic growth, a route selection has being completed for this section of the N52 route and a preliminary design is currently being developed by the NRA and Offaly County Council.

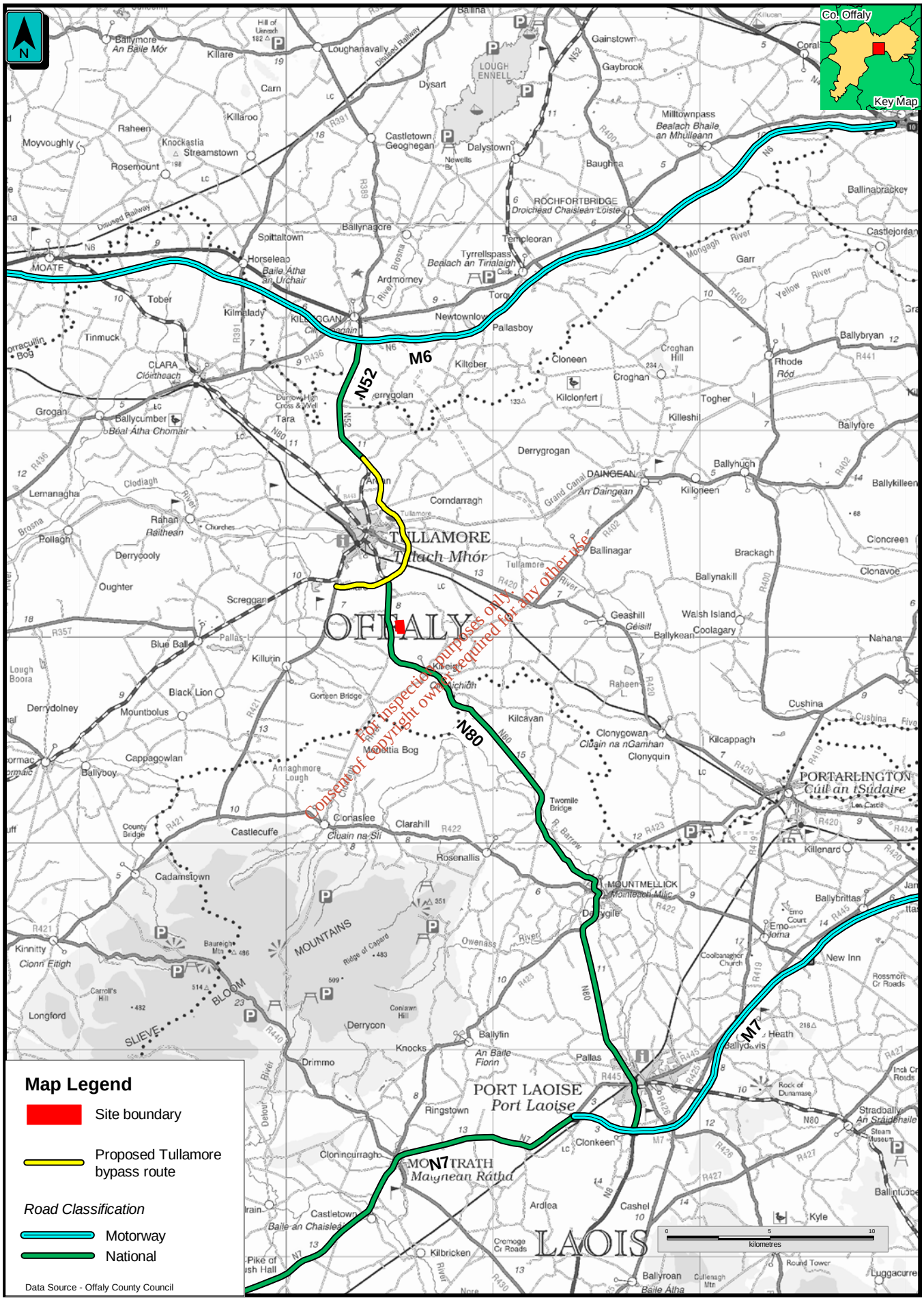
N6 National Primary Route

The M6/N6 road is the National Primary Route connecting Dublin to Galway (by connecting to the M4 motorway at Kinnegad) across the midlands of Ireland. The route starts at Junction 11 on the M4 at Kinnegad. From there the road bypasses Rochfordbridge and Tyrrellspass and passes through Kilbeggan and Moate.

The route follows a bypass around the town of Athlone, crossing the River Shannon, before passing through Ballinasloe and Loughrea. A section of dual carriageway brings the route into Galway, providing a link also for the N18 road from Limerick, which joins it near Oranmore.

Note this route has recently been upgraded to motorway standard between Dublin and Athlone. Works are currently in progress to construct a Motorway between Athlone and Galway.

Following completion of these schemes the Derryclure landfill will have improved access to the national roads network and vehicles travelling to and from the landfill site will be able to travel towards Dublin and the south west without entering any towns.



Proximity of Tullamore Bypass

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Figure 3.2

3.5.3 Quantification of Current Traffic Flows

Data Collection – Available NRA Count Data

National Roads and Traffic Survey Reports for the period 2003 and 2004 have been used as a source of traffic data for this assessment. The annual average daily traffic (AADT) estimates for 2003 and 2004 are based on Local Authority short-term traffic counts.

The closest traffic counter on the N52 in the vicinity of the proposed development is at the T-junction with the R420 just south of the Grand Canal in Tullamore town centre. Two other traffic counters in the vicinity of the proposed development are located at the cross roads with N80/R420 to Clara and at the roundabout with N80 to Mountmellick.

The closest traffic counert on the N80 in the vicinity of the proposed development is 1.5 km south of Tullamore, another counter is located on the N80 just north of Mountmellick some 15 Kilometres from the site.

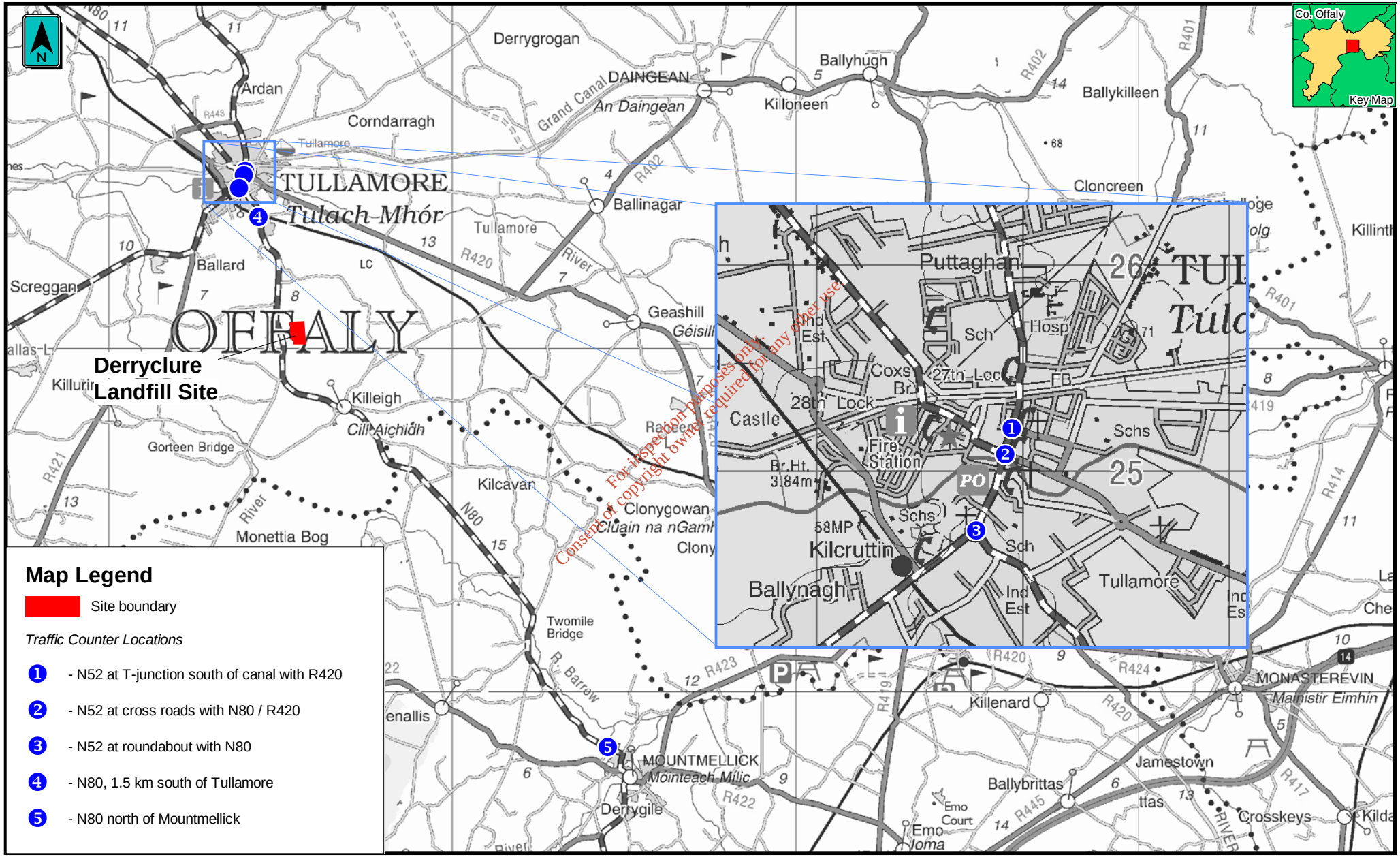
Table 3.10 below shows the AADT estimate and the percentage of HGVs recorded at each of these sites for 2003 and 2004, while their location is indicated on Figure 3.3.

Table 3.10: N52 and N80 – 2003 and 2004 AADT estimate and the % of HGVs

Location	2003		2004	
	AADT	%HGV	AADT	%HGV
N52 at roundabout with N80	10,830	7.0	11,421	5.3
N52 at cross roads with N80/ R420	12,009	5.3	10,552	17.1
N52 at T-junction south of canal with R420	11,786	8.3	12,446	8.3
N80, 1.5 km south of Tullamore	10,719	7.5	11,308	7.5
N80 north of Mountmellick	5,159	11.3	5,572	12

In August 2003 the National Roads Authority published a document entitled 'Future Traffic Forecasts 2002-2040'. This document provides growth indices for national primary, national secondary and non-national roads.

The growth index for factoring 2004 recorded flows to 2008 forecast levels on national secondary roads is given as *1.11 x (2004 Flow);* the current estimated flows on the N52 and N80 are shown in Table 3.11.



Map Legend

Site boundary

Traffic Counter Locations

1. - N52 at T-junction south of canal with R420
2. - N52 at cross roads with N80 / R420
3. - N52 at roundabout with N80
4. - N80, 1.5 km south of Tullamore
5. - N80 north of Mountmellick

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Location of Traffic Counters

Figure 3.3

Table 3.11: N52 and N80 – 2008 estimated AADT

N52 at roundabout with N80	12,600
N52 at cross roads with N80/ R420	11,650
N52 at T-junction south of canal with R420	13,700
N80, 1.5km south of Tullamore	12,450
N80 north of Mountmellick	6,150

Data Collection – Tullamore Bypass – Peak-hour Flows

The 2001 peak-hour flows and turning counts for the Clonminch Roundabout are shown in **Table 3.12.**

Table 3.12: 2001 peak-hour flows at the Clonminch Roundabout (No. of vehicles)

Road	Nearside Flow	Offside Flow	Two-Way Flow
N80 Portlaoise Road (West of the Clonminch Roundabout)	232 (eastbound)	164 (westbound)	396
N80 Portlaoise Road (East of the Clonminch Roundabout)	375 (eastbound)	289 (westbound)	664
N52 Road (North of the Clonminch Roundabout)	294 (northbound)	459 (southbound)	753
N52 Road (South of the Clonminch Roundabout)	87 (northbound)	234 (southbound)	321

A factor of 12.78 from RT201 – Expansion Factors for Short Period Traffic Counts can be used to convert the 2001 peak-hour flows into 2001 AADT flows. The scheduled opening year for the Tullamore Bypass is 2010 and a growth factor of 1.373 (based on NRA Future Traffic Forecasts 2002-2040) can be used to convert 2001 AADT to 2010 AADT flows. These 2010 AADT flows for the N80 at the Clonminch roundabout are shown in Table 3.13.

Table 3.13: 2010 AADT flows at the Clonminch Roundabout (No. of vehicles)

Road	2001 peak-hour Two-Way Flow	2001 AADT	2010 AADT
N80 Portlaoise Road (West of the Clonminch Roundabout)	396	5,061	6,949
N80 Portlaoise Road (East of the Clonminch Roundabout)	664	8,486	11,651
N52 Road (North of the Clonminch Roundabout)	753	9,623	13,213
N52 Road (South of the Clonminch Roundabout)	321	4,102	5,633

3.5.4 Traffic Generation from the Existing Development

The estimation of current levels of daily traffic generation at the site is based on the site's weighbridge data. The weighbridge data provides information relating to weight and type of each vehicle logged entering the site.

The following information has been used to estimate current daily traffic generation at the existing waste disposal facility:

- Current hours of operation for the landfill are 08:00 to 16:30hrs Monday to Friday and 08:00 to 15:00hrs on a Saturday. As such the facility operates on a 6-day working week. Accounting for public holidays this equates to the facility operating for a total of 300 days annually.

- The applicant has generated a report from the weighbridge database system at the site. The base data includes all vehicles crossing the weighbridge for the period 12th May 2008 to 24th May 2008. Allowing for a 6-day working week, the data provided by the applicant includes for a total of 10 weekday days and two Saturdays.

Table 3.14 below, summarises the weighbridge data and shows the vehicle type and amount of waste processed at the site during the specified period. This information has been used to estimate current traffic generation associated with the transport of waste at the facility.

Table 3.14: Existing Daily Traffic Generation

	Week 1	Week 2	Average
Imported Tonnage	879.81 t	1,209.58 t	1,045 t
Incoming Vehicles			
HGV - waste	99	125	112
HGV - other	42	49	46
Cars/LGV	**938**	780	859
Total	**1,079**	**954**	**1017**
Busiest Day - Saturday			
HGVs	9	6	8
Cars/LGV	345	295	320
Total	**354**	**301**	**328**

Over the period 12th May 2008 to 24th May 2008 a weekly average of 1045 tonnes of waste was delivered to the facility and the corresponding number of HGV trips generated by the facility was 158. A trip incorporates two separate vehicle movements (in and out of the site). As the facility operates a 6 day working week the average number of HGV trips generated over the same period in any one day was 27 and the corresponding amount of average amount of waste delivered was approximately 175 tonnes. The existing waste licence for Derryclure Landfill permits 40,000 tonnes of waste to be processed each year and the facility operates approximately 300 days per year, which amounts to an average of 130 tonnes of waste per day, however in order to provide a conservative assessment 175 tonnes corresponding to 27 HGV trips will be adopted to represent the traffic generated by the existing facility in a typical day.

Table 3.15 below categorises the total average daily traffic generated at the existing facility into HGVs and private vehicles, however due to the presence of a civic amenity at the same location the average number of cars/LGV on a Saturday of 313 is well above the weekly average of 143.

Table 3.15: Estimated Existing Daily Traffic Generation

Vehicle Type	Existing Trips
HGVs	27
Cars/private vehicles	143
Total	170

Traffic Distribution

The majority of waste delivered to site is household and commercial which would generally originate from Tullamore town and its environs.

It is reasonable to assume that the vast majority of traffic using the facility travels north towards Tullamore. Considering this the following will be assumed:

- 80% mostly used the N80 north to Tullamore
- 20% mostly used the N80 south to Portlaoise

3.5.5 Traffic Generation from the Proposed Development

Brief description of Proposed Facility

It is intended that the proposed facility will accept 100,000 tonnes of waste materials per annum; in theory this represents a 150% increase in the amount of waste currently being accepted. However as Derryclure actually accepted approximately 67,000 tonnes of waste in 2007, the real increase in waste intake will be approximately 50%.

Methodology for Estimating Traffic Generation of Proposed Facility

The following provides an estimate of the number of vehicles which could potentially be generated by the landfill if activities are increased at the site. The methodology used to achieve this takes into account the average incoming and outgoing payload data as determined from the weighbridge data. In these estimates, the weighbridge-derived figures are applied to the proposed quantity of waste (100,000 tonnes).

Adopting the above methodology it is possible to estimate likely traffic generation and patterns at the proposed development over the course of a typical working day. Derivation of traffic generation by this methodology is endorsed in the Institution of Highways and Transportation 'Guidelines for Traffic Impact Assessment (Sept 1994).

To estimate the number of trips associated with the proposed volumes of waste the highest number of trips recorded during the two week period will be multiplied by a factor of 1.9 (100,000 ÷ (175 x 300)). The maximum number of daily HGV trips determined from the weighbridge data is 27, multiplying this by the factor of 1.9 provides the estimated HGV trips for the proposed facility of 52 trips.

It is not intended to expand operations at the civic amenity so it will be assumed that car/LGV traffic will remain the same as the figures calculated in Section 1.1.5.

Table 3.16 below categorises the total daily traffic generation of the proposed facility into HGVs and private vehicles.

Table 3.16: Estimated Proposed Daily Traffic Generation

Vehicle Type	Total Trips		% Increase
	Existing	Proposed	
HGVs	27	52	92%
Cars/private vehicles	143	143	0%
Total	**170**	**195**	**15%**

From the above, it is estimated that an increase in waste intake will have the potential to generate approximately 195 vehicle trips or 390 vehicular movements per day. Considering that the existing facility generates approximately 170 vehicle trips or 340 vehicular movements per day, it follows that it is likely that the proposed development would represent an increase in traffic of some 25 vehicular trips per day, comprised entirely of HGV trips. In the context of the greater roads network this forecast increase is not considered to be significant.

On the basis of a very conservative peak hour factor of 20%, the proposed development could reasonably be expected to generate typical peak hour volumes of about 39 vehicle trips, consisting of 11 HGV trips and 28 light vehicle trips.

3.5.6 Threshold for Traffic and Transport Assessment

In Ireland, a **Traffic and Transport Statement (TTS)** must accompany all planning applications for developments that could potentially act as traffic generators. A traffic and transport statement is a brief outline of the transport requirements for the development and is used as a first step to identifying the likely impact of any development. The traffic and transport statement is also used to determine if more detailed traffic analysis is required. An in-depth analysis of the impact of a development in terms of traffic is carried out through a **Traffic and Transport Assessment (TTA**).

The NRA Traffic and Transport Assessment Guidelines recommend the following thresholds for undertaking a TTA:

> *"Applications that exceed **any** of the following thresholds will be required to produce full TTAs, in addition to completing a TTS. The TTS should summarise the findings of the TTA and briefly outline the mitigating measures proposed by the developer or agent:*
>
> - ***Industry Gross Floor Area (GFA) in excess of 5,000 sq.m***
> - *Distribution and Warehousing GFA in excess of 10,000 sq.m*
> - ***100 trips (in/out combined) in the peak hour***
> - ***Development traffic exceeds 10% of two-way traffic flow on adjoining road***
> - *Development traffic exceeds 5% of two-way traffic flow on adjoining road if congestive or sensitive*
> - *100 on-site parking spaces"*
>
> *(Reference-NRA Traffic and Transport Assessment Guidelines: Table 2.2; page 4)*

The thresholds considered as most pertinent in relation to whether the proposed development requires a TTA are highlighted and include: 'Industry GFA in excess of 5,000 square metres', 'developments generating 100 trips in/out combined in the peak hour' and 'development traffic exceeds 10 percent of two-way flow on adjoining road'.

The TTA threshold for increase in gross floor area is not relevant to a landfill development.

In relation to the peak hour flow, the preceding calculations indicate that the proposed development is estimated to generate a maximum trip rate of approximately 39 trips in the peak hour. If the existing traffic generated by the facility is taken into consideration, the forecast 'incremental' impact of the proposed development would be less than 25 trips. Therefore the development proposal falls short of this specific threshold.

The final relevant threshold for the preparation of a TTA requires the development traffic to exceed 10 percent of the two way traffic flow on the adjoining road. It has been estimated that the AADT for the N80 National Secondary Road in 2010 is 11,651 vehicles. In the analysis above, it has been calculated that an additional 39 trips or 78 vehicle movements per day are likely to be generated by the proposed developlment. By reference to the predicted AADT of 11,651 vehicles, it is estimated that the 78 vehicular movements associated with the new development represent less than 1% of existing traffic on the road.

Considering the above, as none of the stated thresholds are attained a TTA in accordance with the NRA requirements is not warranted in this case.

3.5.7 Safety Issues

Right Turn Capacity Assessment using NRA: Design Manual for Roads and Bridges

The NRA: Design Manual for Roads and Bridges TD42 paragraph 2.16 advises the following, with respect to the provision of a ghost island right turn lane:

> "At existing rural and at urban junctions the cost of upgrading a simple junction to provide a right turning facility will vary from site to site. However, upgrading should always be considered where the minor road flow exceeds 500 vehicles 2-way AADT, a right turning accident problem is evident, or where vehicles waiting on the major road to turn right inhibit the through flow and create a hazard."

The calculated average daily traffic for the entrance at the Derryclure Landfill is 195, however considering that approximately 26% of this traffic is HGVs a right turn lane in accordance with the DMRB should be considered.

Visibility to N80 from Entrance

The visibility standards for access on to national roads are described in TD41/95 of the NRA DMRB. In TD41/95 the visibility splay (known as the y distance) required from the access to the carriageway edge of a national road with a design speed of 100kph is 215 m.

The setback distance (known as the x distance) is measured form a point at the back of the hard shoulder on the main road to its intersection with the centre line of the access. The recommended minimum x distance for an access with an AADT flow of up to 500 vehicles is 4.5 m however a relaxation to 2.4 m can be provided in difficult circumstances. The 2.4 m setback relates to normally only one vehicle wishing to join the main road at one time, the 4.5 m covers the situation where two vehicles may want to accept the same gap in the main road traffic. An assessment of a survey of the existing landfill entrance has shown that a visibility splay form the access of 215 m is achieved with a 2.4 m setback; however a visibility splay from 215 m with a 4.5 m setback will be obstructed by the existing fence and hedge located along the N80.

Some consideration should be given to improving the visibility in the vicinity of the entrance by trimming back the hedge and moving the fence line back from the N80 carriageway.

Visibility along the N80

The stopping sight distance (SSD) required on a national road are described in TD9/07 of the NRA DMRB. In TD9/07 the desirable minimum SSD required on a national road with a design speed of 100 kph is 215 m. A one–step relaxation to 160 m or a two–step relaxation to 120 m can be provided in difficult circumstances. An assessment of a survey of the southern approach to the landfill entrance has shown that the SSD is approximately 120 m which is a two–step relaxation in accordance with TD9/07.

It is required in TD41/95 that full visibility of 215 m is provided from the national road to an access. A visual assessment of the southern approach to the landfill entrance has shown that full SSD of 215 m can be provided at a setback of 4.5m if a section of existing palisade fence is relocated.

It is proposed that a verge as described above be provided on the southern approach. A right turn lane will also be provided so that the westbound carriageway of the N80 is not blocked by stationary vehicles turning into the landfill.

Visibility to the Right from Entrance

Visibility to the left from Entrance

Derryclure Landfill Entrance

N80 Road in the Vicinity of the Entrance

The N80 road in the vicinity of the proposed entrance has a carriageway width of 7.35 m with a 1.2 m hard shoulder on either side. The road is marked as a non-overtaking section of road with a continuous white line centreline and edge lines on both sides and the pavement quality is reasonably good.

3.5.8 Traffic Mitigation Measures

The following measures are proposed to enhance safety at the landfill and on the adjacent roads.

- All HGV traffic will be instructed primarily to use the Tullamore Bypass when construction is complete where possible.
- A right-turn lane and widened verge on the southern approach in accordance with NRA standards will be provided. At time of writing, Offaly County Council had commenced enabling works to facilitate road widening works. The layout of the proposed right-turning lane is illustrated in Figure 3.4 below.
- Visibility in the vicinity of the entrance will be improved by trimming back the hedge and moving the fence line back.

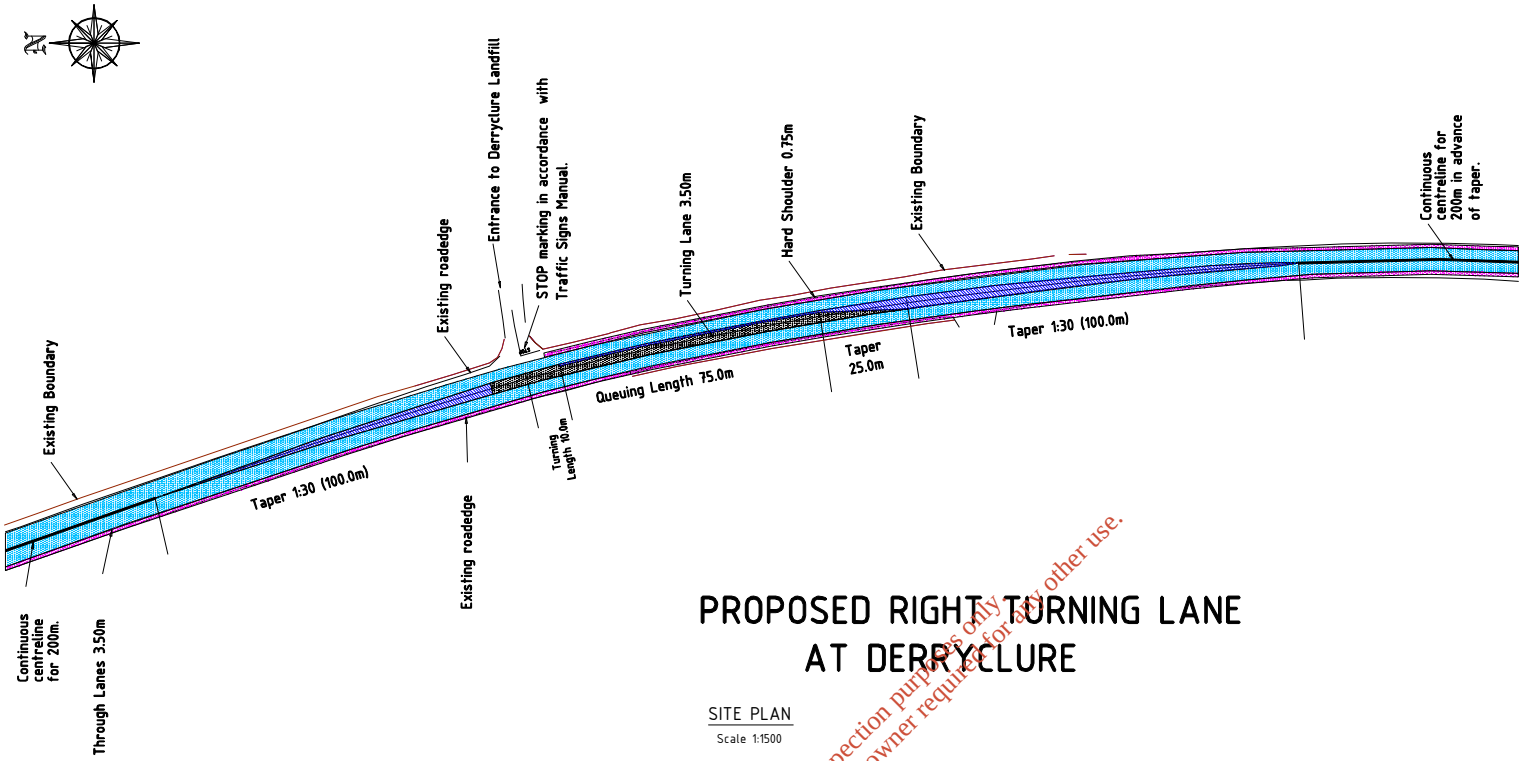
- Advance signing for the entrance on all major approach roads to the facility to avoid traffic inadvertently entering Tullamore will be provided. The location and detail of same will be agreed with the OCC roads department prior to installation.
- Road markings will be in accordance with the DoE Traffic Signs Manual.

3.5.9 Conclusions of Traffic Assessment

The traffic generation figures used in the assessment of the development are considered robust. The results of the analyses carried out show that the likely increase in traffic and the likely impact of such traffic on the capacity and operation of the receiving roads network will not be significant. The only significant mitigation measure required is the provision of a right-turn lane on the N80 at the site entrance.

Accordingly the traffic generation associated with the current proposal will not compromise the existing level of service on the N80 road. The Tullamore bypass is scheduled to open in 2010 at which time access to the landfill from the north will not require traffic to enter Tullamore.

From the calculations and assessments carried out, it is considered that the development-related traffic will not have an adverse impact on the operation of the local roads network in the vicinity of the landfill.



PROPOSED RIGHT TURNING LANE AT DERRYCLURE

SITE PLAN

Scale 1:1500

KEY

- Through Lanes
- Queuing Length
- Hatching
- Hard Shoulder
- Existing Road Edge
- Existing Boundary

All road markings to be in accordance with the Traffic Signs Manual.

Rev.	Drawn	Chkd	Appd	Date	Description
A	MM	SM	DOS	Cork 21.10.08	ISSUE FOR APPROVAL

Revision History: A

Name of Client: OFFALY COUNTY COUNCIL

Name of Job: DERRYCLURE LANDFILL WASTE LICENCE REVIEW

Title of Drawing: PROPOSED N80 WIDENING WORKS

Scales Used: 1:1500

Dwg. No.: CE07-286-01_FIG 3.4

Rev.: A

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4. GEOLOGY & HYDROGEOLOGY

Notwithstanding the fact that this proposal for increased waste intake, not entailing any increased footprint, will not affect the hydro-geological regime of the site, the foregoing is a detailed assessment of groundwater management at the site.

This assessment is included to give the reader an opportunity to appreciate how groundwater is managed in the context of the overall operation of the site.

This section of the EIS addresses geology and hydrogeology in the existing environment, identifies potential impacts of the proposed development and outlines measures to avoid, reduce and mitigate potential impacts.

It was prepared having regard to '*Geology in Environmental Impact Statements – A Guide*', Institute of Geologists of Ireland, September 2002. It was also prepared using available published literature for the site area. The literature reviewed included:

1. Groundwater Protection Scheme for County Offaly (on GSI website).
2. Geology of Galway - Offaly - Sheet 15 (GSI).
3. A Geological description of Galway-Offaly and adjacent parts of Westmeath, Tipperary, Laois, Clare and Roscommon to accompany the Bedrock Geology 1:100,000 Scale map Series, Sheet 15 Galway-Offaly.
4. General Soil Map of Ireland - Second Edition 1980.
5. The Development of a Waste Disposal facility at Derryclure, Co. Offaly. - An Environmental Impact Statement 30th November 2001. Bord na Móna Environmental.

Following the compilation of data and information on the existing environment, the details of the proposed development were reviewed with the project engineers to identify potential impacts on geology and hydrogeology.

4.1 Existing Soils and Geology

The General Soil Map of Ireland, 1:575,000 scale shows that the soils to the south of Tullamore belong to the 'Flat to Undulating Lowlands' broad physiographic division characterised by mainly wet mineral and organic soils. The site area is classified as 'Basin Peat'.

Figure 4.1 shows a summary of the quaternary geology for the site and surrounds. The GSI Quaternary Geology website shows that the site area lies within an area of peat overlying limestone derived glacial till.

The unconsolidated deposits of the quaternary period were deposited during the last 1.6 million years and conceal much of the bedrock throughout Ireland. Large volumes of detritus were deposited as till (boulder clay), below or at the margins of the ice sheet.

Till is generally a poorly sorted deposit of boulders and stones in a matrix of sand, silt and clay. Limestone till, which is dominated by fragments of lower carboniferous limestones, is widely distributed throughout the Offaly region where thicknesses of 10 to 20 m are common, being thickest within glacial valleys and other former depressions in the landscape.

After the ice had melted and large ice-marginal lakes had drained, extensive depressions surrounded by glacial deposits remained into which clay and silt were deposited. In some of the lakes, hard groundwater caused precipitation of calcium carbonate, producing a creamy-white sticky marl layer, prior to and during the onset of peat deposition. Generally less than one metre thick, it contains minor amounts of clay minerals and organic matter.

With the warmer and wetter conditions around 9,000 years ago, fen peat (also known as basin peat) formation commenced in the low-lying, poorly drained shallow lakes, as vegetation encroached from the margins. This slightly alkaline peat composed of accumulated reeds and grasses is generally around 2-3 m thick.

Figure 4.2 shows a summary of the bedrock geology of the site and surrounding area. The GSI 1:100,000 scale bedrock geology map (Sheet 15, Galway - Offaly) '"*Bedrock Geological Map of The Carboniferous of Central Ireland*" (Geological Survey of Ireland (GSI), 1992) is the reference source for the description of the bedrock geology of the region.

The map shows that the entire site is underlain by middle carboniferous age (undifferentiated visean) basinal limestones. These rocks are predominantly dark grey, laminated, argillaceous limestones, calcareous shales and some limestone turbidities which are locally sandy.

Due to the argillaceous 'impure' nature of the limestones, karst features are not commonly associated with these limestones, however the GSI website shows some karst features do exist within limestones in the Tullamore area including springs and swallow holes although none are observed within 1 km of the site area.

A site investigation was undertaken in January 2004 at the site by Glover Site Investigations as part of a proposed landfill extension. The eight boreholes were undertaken within the north-eastern part of the existing landfill area and encountered a sequence of peat, calcareous marl, sand, silt and glacial till overlying (presumed) limestone bedrock at a depth of between 9.2 and 10.2 m below natural ground level. A summary of the geology is presented in Table 4.1.

Table 4.1: Summary of Site Investigation Results

Strata	Depth to Top of Strata (m bgl)	Thickness (m)
Peat	0.0	1.4 - 2.4
Calcareous Marl	1.4 - 2.4	0.7 - 1.7
Sand	2.1 - 4.1	2.1 - 3.2
Silt	5.0 - 7.0	1.0 - 2.8
Glacial Till	7.5 - 8.2	1.4 - 2.2
Bedrock	9.2 - 10.2	Not proven

4.1.1 Structural Geology and Topography

The topography of the area is one of rolling hills and wide river valleys. The hills have been formed as a result of the Variscan Orogeny which took place towards the end of the carboniferous. The deformation in this area formed a number of northeast-southwest trending anticlines and synclines.

Structurally, apart from the folding of the strata, the area is cut by several faults which either follow the stratigraphic boundaries or more commonly run perpendicular to the boundaries in a northwest-southeast direction. No faults are shown crossing the site, however a northeast-southwest trending boundary (the Knockshigowna Fault) lies approximately 500 m west of the site and divides the impure limestones of the Tullamore Basin in the south from the pure limestones of the Borrisokane-Birr Shelf to the north.

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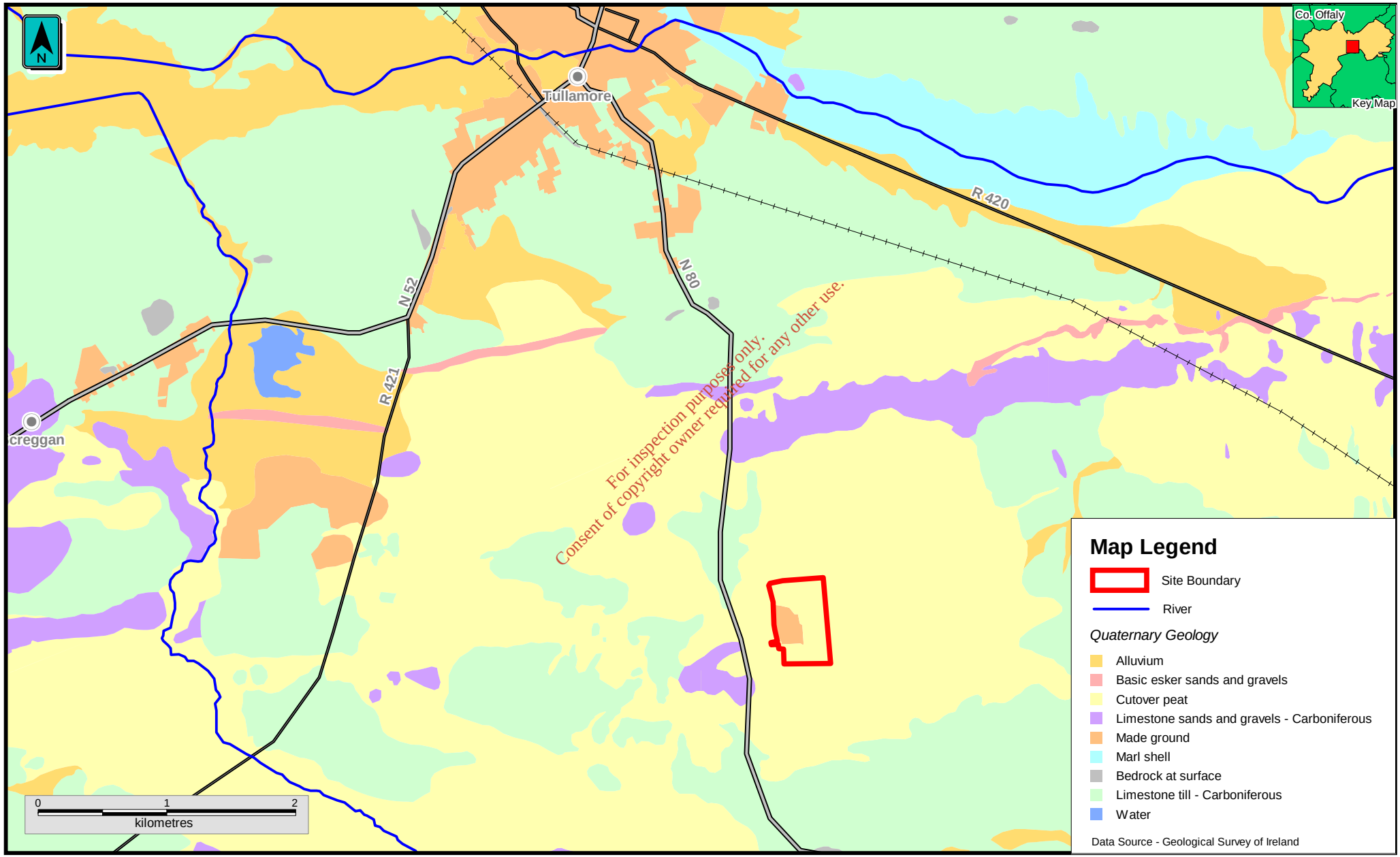
CE07-286-01_Figure 4.1_Quaternary Geology_Rev A



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Quaternary Geology

Figure 4.1

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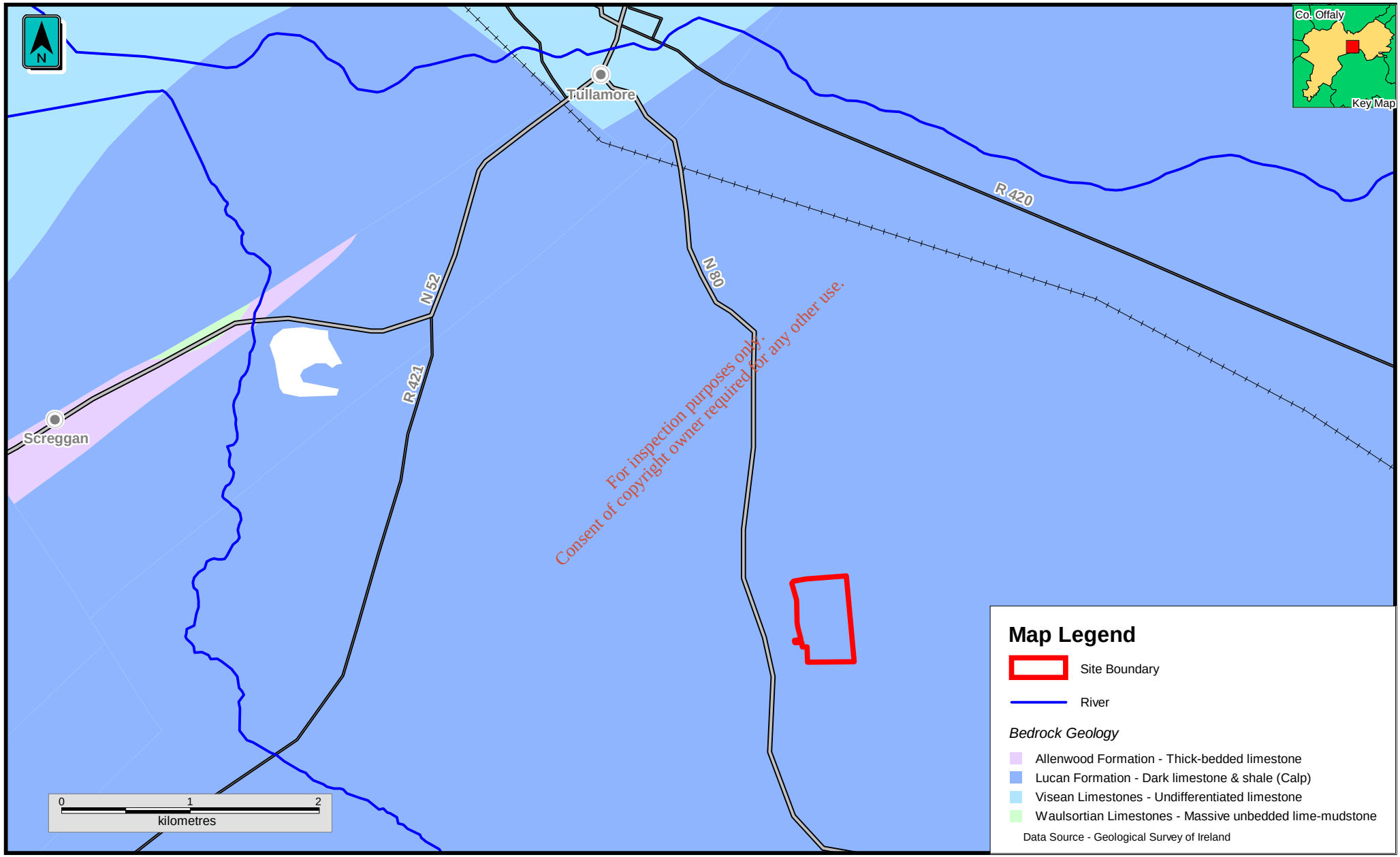
CE07-286-01_Figure 4.2_Bedrock Geology_Rev A



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Bedrock Geology

Figure 4.2

4.2 Hydrogeology in the Existing Environment

The hydrogeological characteristics of the region are strongly influenced by the Variscan fold system along approximate northeast-southwest trends. The principal aquifers ('Regionally Important Aquifers') of the region are formed within the pure shallow marine lower carboniferous (Lower Dinantian) limestones which occupy the synclinal valleys of the region. The permeability of the aquifers depends almost entirely on their fracturing. Within the limestones, the permeability has been further enhanced by enlargement of the fractures by karstification and dolomitisation.

The site area however is underlain by the Upper Dinantian impure limestone which is classified as a 'Locally Important Aquifer (LI)' which is "moderately productive in local zones only". A 'Regionally Important Aquifer' is located some 500 m west of the site within the pure limestones of the Lower Dinantian.

Groundwater monitoring on the site has shown that groundwater exists within the glacial deposits which suggests that a perched aquifer may exist within the overburden deposits. Although not classified as an aquifer on the GSI website, it is possible that this groundwater may be abstracted locally and may therefore be considered to be a minor aquifer which has the potential to be locally important. It is also possible that this groundwater may be connected to the locally important aquifer within the underlying limestone.

Water in limestone aquifers is always hard (usually over 250 mg/l and often over 300 mg/l).

Most well-yields within the Lower Dinantian limestones are low (less than 100 m^3/day) and occasional failed wells are probable. Specific capacities are often low. High yields (more than 400 m^3/day) are possible, but these are associated with fault zones. According to the GSI website, there are approximately six groundwater wells located within 2 km of the site, four of which are located within Killenmore, approximately 2 km east of the site, Derrygolan, approximately 2 km west of the site and Killeigh, approximately 2 km southeast of the site. All six wells are assumed to be within the same locally important aquifer as the site. These wells were drilled or dug for both domestic and public water supplies (group schemes) to depths of between 3.7 m and 27.3 m. The wells encountered rock at depths of between 6.7 m and 12.2 m. The yield of the public supplies is:

- Killurin 655 m^3/day
- Toberfinn 9,000 m^3/day
- Gangan Beg 180 m^3/day

while the domestic wells have poor yields of between 16 and 27 m^3/day. The EIS undertaken submitted by Bord na Mona Environmental during 2001 confirmed that there are no groundwater abstraction wells within 500 m of the site. It is understood that the site and all households within the vicinity of the site are connected to a group water scheme.

The approximate locations of the nearest wells as given on the GSI well database are shown in Figure 4.4.

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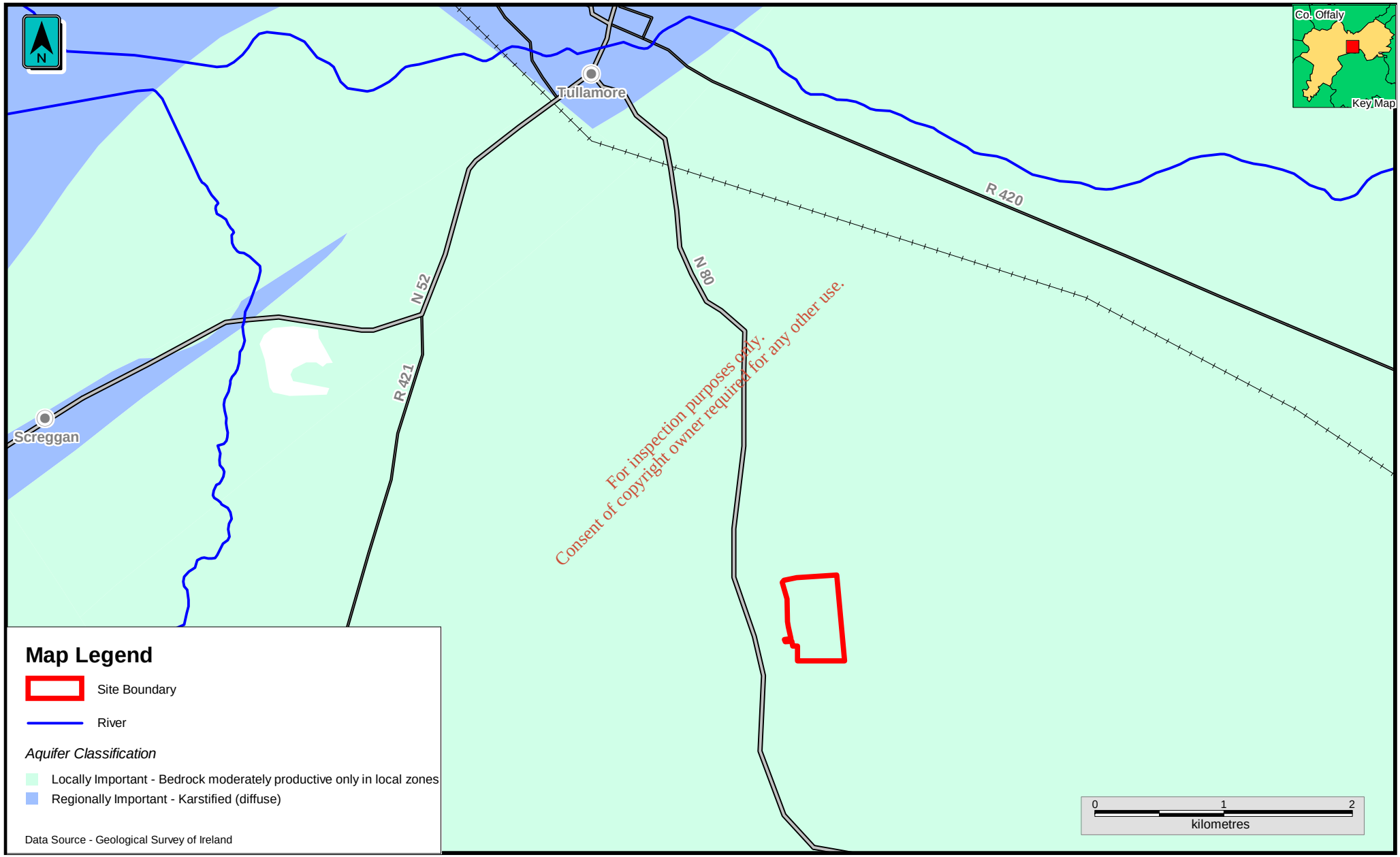
CE07-286-01_Figure 4.3_Aquifer Classification_Rev A



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Aquifer Classification

Figure 4.3

4.2.1 Groundwater Vulnerability

Groundwater vulnerability, as defined by the GSI, is the term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The factors used in assessing groundwater vulnerability include subsoil type and thickness and recharge type. The GSI procedure whereby groundwater protection is assessed is outlined in the EPA-GSI publication 'Groundwater Protection Schemes'. The procedure proposes a matrix, which relates vulnerability, source and resource such that a particular site is given a Response ('R') to specific activities.

The GSI online Groundwater Vulnerability Mapping for the area rates the bedrock aquifer in the site area as 'Moderate Vulnerability'. The aquifer vulnerability of the site and surrounding area are shown in Figure 4.4. The perched aquifer observed within the overburden is not mapped as an aquifer on the GSI website, however due to its shallow depth, this perched aquifer may be considered as being of very high vulnerability.

The deposits of glacial till, silt and marl beneath the landfill have a generally low permeability and act as confining aquitards to the underlying aquifer within the bedrock. The presence of this aquitard results in the formation of a perched water table at shallow depth within the overlying peat. Within the site investigation boreholes, two distinct water strikes were observed, beneath the peat at about 2 m and overlying the bedrock at about 8 m. Groundwater flow is understood to be towards the northeast.

Table 4.2 details the aquifer vulnerability of the site assessed from the geological profile given in Table 4.1. The assessed vulnerability of the aquifer is moderate which is in agreement with the GSI website rating.

Table 4.2: GSI Guidelines – Aquifer Vulnerability Mapping

Vulnerability rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand/gravel)	Moderate Permeability (e.g. Sandy soil)	Low Permeability (e.g. Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	>3.0 m	3.0 -10.0 m	3.0 - 5.0 m
Moderate (M)	N/A	>10.0 m	5.0 - 10.0 m
Low (L)	N/A	N/A	>10 m

Notes:
N/A = Not Applicable
Precise permeability values cannot be given at present.
Release point of contaminants is assumed to be 1-2m below ground surface.

The GSI's Response Matrix for Landfills combines the aquifer vulnerability, and the classification of the aquifer (Pu), to give a response for site suitability for landfills. Table 4.3 details the response matrix for landfills under the GSI guidelines.

Table 4.3: GSI Guidelines – Response Matrix for Landfills

Vulnerability Rating	RESOURCE PROTECTION Aquifer Category					
	Regionally Important (R)		Locally Important (L)		Poor Aquifers (P)	
	Rk	**Rf/Rg**	**Lm/Lg**	**Ll**	**Pl**	**Pu**
Extreme (E)	R4	R4	R3[2]	R2[2]	R2[2]	R2[1]
High (H)	R4	R4	R3[1]	R2[1]	R2[1]	R1
Moderate (M)	R4	R3[1]	R2[2]	R2[1]	R2[1]	R1
Low (L)	R3[1]	R3[1]	R1	R1	R1	R1

Thus, a resource protection response of R2[1] is adopted. That is, the landfill development is acceptable subject to guidance in the EPA Landfill Design Manual or to the conditions of the waste licence.

The GIS protection response also states that "*Special attention should be given to checking for the presence of high permeability zones. If such zones are present then the landfill should only be allowed if it can be proven that the risk of leachate movement to these zones is insignificant. Special attention must be given to existing wells down-gradient of the site and to the projected future development of the aquifer.* "

One high permeability zones was identified from the ground investigation which will require ongoing monitoring. The existing wells are monitored on a regular basis according to the waste licence. The low productivity of the bedrock aquifer excludes it from significant future development.

In addition, the groundwater head is maintained below the formation level of the cells as required under the waste licence, and the leachate head is maintained at 1 m or less above the level of the HDPE liner.

4.2.2 Source Protection Areas

The GSI website shows that the site area lies approximately 2 km west of the Killeigh / Meelaghans Source Protection Area as shown in Figure 4.4. Due to the hydrology and hydrogeology of the area, the increased waste intake will not have any influence on the source protection area.

4.2.3 Groundwater Monitoring

Six groundwater wells were installed on the site as part of previous site investigations with groundwater samples being obtained for analysis from both deep and shallow monitoring wells (well names suffixed D and S respectively). On-going groundwater monitoring results were reported as part of the previous EIS undertaken in 2001. The groundwater sampling was undertaken from wells situated both up-gradient (to the southeast) and down-gradient (to the northwest) of the then existing (unlined) landfill. The currently active landfill cells to the northeast of the old landfill are within a lined contained system.

Table 4.4 Comparison of Groundwater Monitoring Results for 2001 and 2007

UPGRADIENT WELLS	2001	2007				2001	2007			
	1st Qrtr.	1st Qrtr.	2nd Qrtr.	3rd Qrtr.	4rd Qrtr.	1st Qrtr.	1st Qrtr.	2nd Qrtr.	3rd Qrtr.	4rd Qrtr.
	MW01D					MW01S				
Ammonical Nitrogen NH_3-N (mg/l)	49	7.65	7.04	7.27	6.8		5.46	1.33	Dry	Dry
Total Organic Carbon TOC (mg/l)	21	5	71	14.8	20.6		17.1	54	Dry	Dry
Dissolved Oxygen (% Sat. 0_2)	1.61	25.4	32.4	22.3	57.8		4.5	6.1	Dry	Dry
Electrical Conductivity ($uScm^{-1}$)	2352	708	682	837	764		1159	971	Dry	Dry
pH (pH Units)	7.2	7.21	7.2	7.03	7.2		6.97	6.82	Dry	Dry
Temperature (^oC)	n/a	8.7	10.6	13.5	10		9.3	10.7	Dry	Dry
Chloride (mg/l)	212.9	14.97	14.6	15.1	27.1		12.29	11.7	Dry	Dry
	BH01D					BH01S				
Ammonical Nitrogen NH_3-N (mg/l)		8.13	0.46	8.97	8.71		8.98	6.07	7.63	<0.01
Total Organic Carbon TOC (mg/l)		4.1	32	9.6	18.6		6.2	29	14.6	19.8
Dissolved Oxygen (% Sat. 0_2)		1.9	44.8	11.7	76.6		42.3	40.1	68.2	64.8
Electrical Conductivity ($uScm^{-1}$)		568	621	545	636		799	718	806	635
pH (pH Units)		6.99	7.42	7.11	7.31		7.29	7.36	6.98	7.41
Temperature (^oC)		10	10.4	10.9	10.6		9	10.3	12.1	10.9
Chloride (mg/l)		9	13.4	7.6	15		9.61	12	8.3	16.9
	BH02D					BH02S				
Ammonical Nitrogen NH_3-N (mg/l)		4.25	4.91	5.31	4.69		0.02	0.02	<0.01	<0.01
Total Organic Carbon TOC (mg/l)		0.1	16	11.3	19.3		1.6	60	14.9	12.5
Dissolved Oxygen (% Sat. 0_2)		24.7	47.8	35.7	84.9		33.2	52.8	39.8	94.9
Electrical Conductivity ($uScm^{-1}$)		656	610	605	575		923	928	716	1002
pH (pH Units)		7.06	7.30	7.01	7.29		6.63	6.95	6.86	7.18
Temperature (^oC)		10	10.3	11	10.6		9.1	9.7	12.7	11.6
Chloride (mg/l)		12.71	14.9	42.7	50.3		13.49	14.9	5.7	23.8
	BH04D					BH04S				
Ammonical Nitrogen NH_3-N (mg/l)		6.56	6.07	7.14	6.149		2.91	3.04	3.25	2.89
Total Organic Carbon TOC (mg/l)		<0.1	56	25	6.19		19.6	49.5	18.5	20.3
Dissolved Oxygen (% Sat. 0_2)		50.4	25.8	21.3	39.5		60	63	45.8	38.5
Electrical Conductivity ($uScm^{-1}$)		733	737	747	646		685	682	695	977
pH (pH Units)		6.56	7.10	6.92	7.10		7.08	7.21	7.02	7.03
Temperature (^oC)		9.6	10.2	10.5	10.2		8.7	11	14.1	10.3
Chloride (mg/l)		12.57	14.2	11.2	27.7		9.87	12.1	10	18.3

DOWNGRADIENT WELLS	2001	2007				2001	2007			
	1st Qrtr.	1st Qrtr.	2nd Qrtr.	3rd Qrtr.	4rd Qrtr.	1st Qrtr.	1st Qrtr.	2nd Qrtr.	3rd Qrtr.	4rd Qrtr.
	BH03D					BH03S				
Ammonical Nitrogen NH_3-N (mg/l)		4.13	1.58	4.84	3.01		2.19	n/a	n/a	n/a
Total Organic Carbon TOC (mg/l)		9.4	2	13.8	18.8		8.4	n/a	n/a	n/a
Dissolved Oxygen (% Sat. 0_2)		50.3	20.4	31.7	58.5		87.7	n/a	n/a	n/a
Electrical Conductivity ($uScm^{-1}$)		710	663	666	668		743	n/a	n/a	n/a
pH (pH Units)		7.17	7.16	6.95	7.19		7.34	n/a	n/a	n/a
Temperature (^oC)		10	10.4	14.4	10.3		7.5	n/a	n/a	n/a
Chloride (mg/l)		11.82	14.4	11.4	26.6		12.71	n/a	n/a	n/a
	MW05D					MW05S				
Ammonical Nitrogen NH_3-N (mg/l)	5.2	6.44	5.71	6.18	5.66		6.44	8.3	1.93	1.07
Total Organic Carbon TOC (mg/l)	13	0.1	25	14.2	18		10.2	29	12.9	10.9
Dissolved Oxygen (% Sat. 0_2)	2.41	55.4	59.9	34.1	66.6		57.6	62.6	51.8	62.6
Electrical Conductivity ($uScm^{-1}$)	690	694	670	674	770		937	766	609	682
pH (pH Units)	7.5	7.17	7.08	6.96	7.21		7.13	7.46	6.87	7.24
Temperature (^oC)	n/a	10.9	11.5	12.2	11.2		10	11.9	17	11.6
Chloride (mg/l)	12.6	15.96	18.9	14.4	32.7		93.95	59.7	25.6	34.7
	MW08D					MW08S				
Ammonical Nitrogen NH_3-N (mg/l)	3.7	3.76	2.55	3.49	3.36	3.1	0.94	0.49	n/a	n/a
Total Organic Carbon TOC (mg/l)	7	1.7	2	15.2	15.8	<5	46	102	n/a	n/a
Dissolved Oxygen (% Sat. 0_2)	1.91	44.5	38.7	28.8	85.5	1.60	68.5	77.8	n/a	n/a
Electrical Conductivity ($uScm^{-1}$)	708	695	678	689	806	640	1178	1247	n/a	n/a
pH (pH Units)	7.3	7.13	7.04	6.99	7.21	7.8	7.1	7.43	n/a	n/a
Temperature (^oC)	n/a	10.1	10.7	10.7	10.6	n/a	8.2	12.4	n/a	n/a
Chloride (mg/l)	12.6	26.92	24.5	22.2	28.1	13.8	80.34	72	n/a	n/a

The groundwater quality monitoring from the 2001 EIS showed significantly elevated concentrations of ammoniacal nitrogen and manganese (compared with European Directive 98/83/EC, Water Quality intended for Human Consumption) with slightly elevated levels of iron, magnesium, potassium and total coliforms, however it is notable that there is no significant difference between up-gradient and down-gradient wells.

In accordance with the licence for the facility, groundwater monitoring has been undertaken during 2007 from a total of fourteen groundwater wells (eight up-gradient and six down-gradient) for a number of key indicator parameters with the results being compared to the previous EIS results (where applicable) along with the European Directive. The results presented in Table 4.4 show that there appears to be some changes in the groundwater chemistry within comparable wells between 2001 and 2007. The general trend observed from the key indicator parameters shows that for the down-gradient wells, there is a general increase within MW05D, MW08D and MW08S in dissolved oxygen and chloride concentrations with a consistent decrease in pH levels. In comparison, the concentrations measured within well MW01D, up-gradient of the landfill, shows a decrease in ammoniacal nitrogen, conductivity and chloride between 1991 and 2007, with an increase in dissolved oxygen. It is notable that none of the key indicator parameters tested (chloride, conductivity, pH) exceed the guideline values given in the European Directive 98/83/EC).

As a whole, the site comprises an un-lined 'dilute and disperse' zone and a fully lined and contained zone. By its very definition, the unlined area has impacted groundwater locally. The unlined area has recently been capped (mid 2008). The capping contract incorporated increased pumping of leachate from under the unlined area. This will greatly reduce the hydraulic gradient that forces water through the waste mass, thus forming leachate that reaches the groundwater. It is emphasised that the existing active cells and all future cells will be fully lined in accordance with the requirements of the licence, the Waste Management Act and the EU Directive on the Landfilling of Waste.

The increased waste intake will have no negative impact whatsoever on groundwater. A positive effect of the development is that the quantities of leachate generated will decrease.

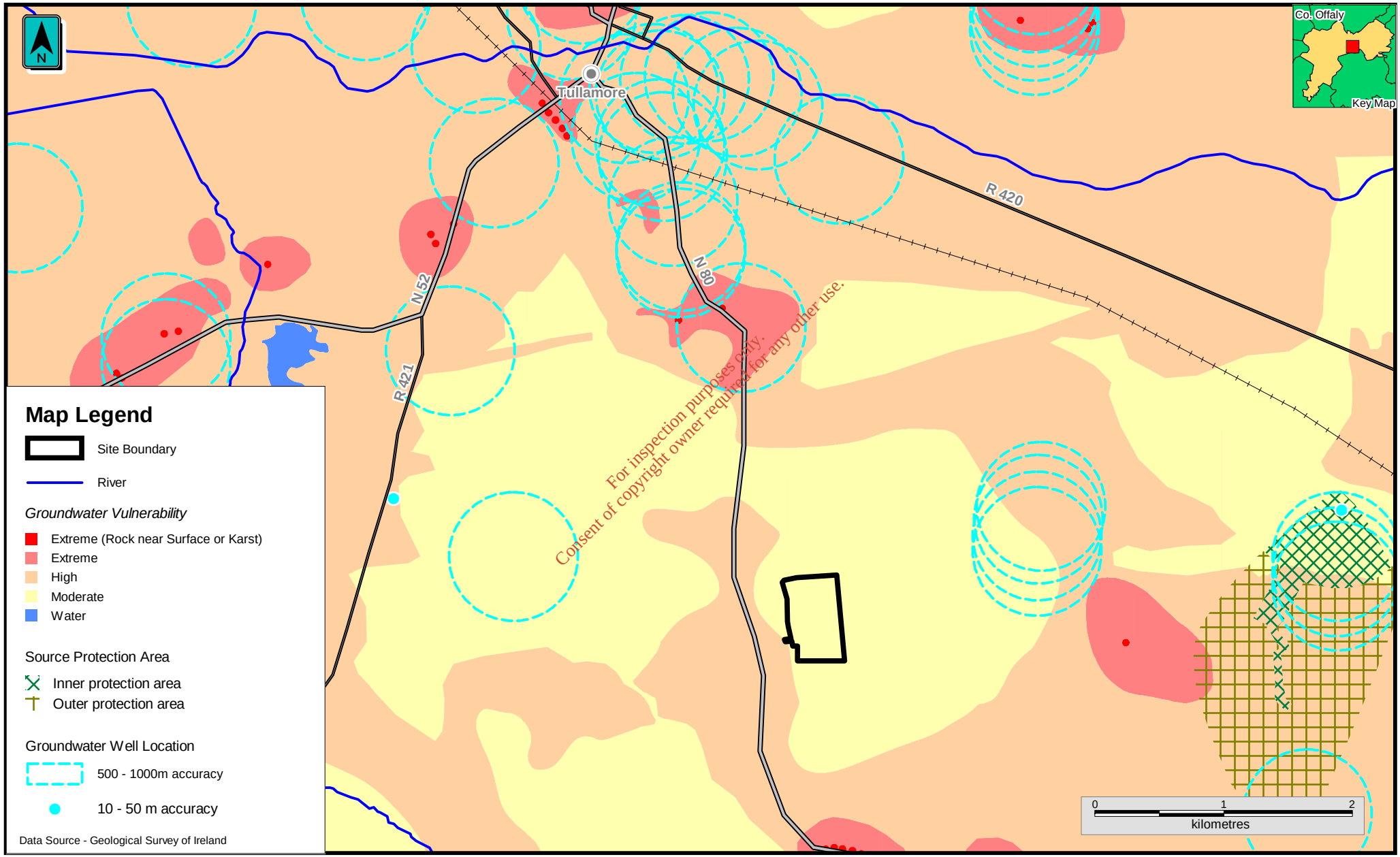
4.3 Potential Impacts on Geology and Hydrogeology

A detailed description of the proposed development is provided in Section 2. No additional construction or expansion of the landfill beyond the area already licensed for development is proposed, therefore the additional impact on the geology and hydrogeology will be nil. In fact the intensification of the site will lead to a reduction in the quantity of leachate generated as the cells will be capped in a shorter period reducing the volume of rainwater infiltration, implying a reduction of the risk of pollution of groundwater. Intensification activities will only occur within fully engineered cells where leachate is contained and managed in accordance with best practice.

4.4 Mitigation Measures for Geology and Hydrogeology

The increase in waste landfilling activities will only occur within the fully engineered cells. These are designed and operated in accordance with the Landfill Directive. No further mitigation measures are considered necessary.

Date 04/06/08 SW/AG R:\Map Production\2008\CE07\286\01\Workspace\
CE07-286-01_Figure 4.4_Groundwater Vulnerability and Source Protection Areas_Rev A



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Groundwater Vulnerability and Source Protection Areas

Figure 4.4

5. HYDROLOGY

Notwithstanding the fact that this proposal for increased waste intake not entailing any increased footprint, will not affect the hydrological regime of the site, the foregoing is a detailed assessment of surface water management at the site.

This assessment is included to give the reader an opportunity to appreciate how surface water is managed in the context of the overall operation of the site.

This section addresses hydrology and surface water runoff in the existing environment, identifies potential impacts of the proposed development and outlines measures to avoid, reduce and mitigate potential impacts. Residual impacts that cannot be avoided are also identified and discussed.

5.1 Methodology

This section was prepared using available published literature and following a walkover survey of the site and a windscreen survey of the surrounding area. The literature reviewed included:

1. Bord na Móna(2001) – Environmental Impact Statement of Derryclure Landfill, Derryclure, Tullamore, Co. Offaly
2. Environmental Assessment of the Quality of Surface Waters at the Derryclure Landfill site, Tullamore, WLR No. W0029-02.
3. EPA (2006) – The Biological Survey of River Quality – Results of the 2005 Investigations, www.epa.ie
4. Michael MacCarthaigh (2002). Parameters of Low Flow and Data on Low Flow in Selected Irish Rivers. Paper presented in the National Hydrology Seminar 2002, Tullamore, Ireland.
5. National flood hazard mapping website www.floodmaps.ie
6. OPW website www.opw.ie/hydro
7. Shannon International River Basin District (SIRBD) Management Project, http://www.shannonrbd.com

Hydrological features at the site and in the surrounding area were assessed from the Discovery map, topographic map of the area, layout map of the Derryclure Landfill Site and the information available in the above sources.

Following the compilation of data and information on the existing environment as well as the surface water management facilities at the existing landfill at Derryclure, Tullamore, the details of the proposed development were reviewed with the project engineers to identify potential impacts on hydrology.

5.2 Existing Hydrology and Drainage of the Area

5.2.1 General Hydrology and Drainage of the area

Derryclure Landfill is located in the Hydrometric Area No. 25 of the Irish River Network, in the Shannon International River Basin District (ShIRBD). The River Shannon is the main surface water feature of the ShIRBD, together with rivers Suck, Inny, Brosna, Fergus, Maigue, Deel and Mulkear as the principle tributaries of the Shannon River. The small ditches flowing from the northern, western and southern side of the Derryclure Landfill site ultimately discharge to the Clodiagh River, approximately 5 km to the west of the site. The Clodiagh River is one of the tributaries of the River Brosna, which itself is a tributary of the River Shannon.

Ditches flowing from the eastern side of the facility ultimately discharge to the Tullamore River. The Tullamore River is a tributary of the Clodiagh River.

The OPW National Flood Hazard Mapping website (www.floodmaps.ie) does not show history of recurrence flooding along the reach of the Clodiagh River (see Figure 5.1). However, recurrence flooding is reported at Charleville Road close to the N52 crossing of the Clodiagh River. According to the above website, this low lying area floods every year after heavy rain and the road is also liable to flood after very heavy rain. Therefore, this recurrence flooding at the Charleville Road does not seem to be as a result of flooding in the Clodiagh River.

According to the national flood hazard mapping website (www.floodmaps.ie), the Tullamore River has a history of recurring flooding along its reach (see Figure 5.1). Recurring flooding incidents have been reported in the Tullamore River at Cloncollog on the south side of the river and at eastern and northern location in Tullamore town.

Derryclure Landfill consists of a total of approximately 29.6 ha of land area. This includes an old “dilute and disperse” landfill area located at the western part of the site; an active landfill cell located at the northern part of the site; and an undeveloped bog area located on the east/south-eastern part of the site.

The site is located on the border of the catchment area of the Tullamore River (to the east) and the Clodiagh River (to the west), the Clodiagh being a tributary of the Brosna River, and the Tullamore being a tributary of the Clodiagh. However, the natural drainage of surface water from the Derryclure Landfill site is primarily towards the Clodiagh River (to the west) through a series of ditches located to the north, south and west side of the site. There is a single discharge point on the eastern perimeter, where surface water from the facility discharges to an existing land drain through adjacent land (under the ownership of Bord na Mona). This drain takes surface water run-off from the currently undeveloped bog area in the east/south-eastern portion of the site, and also run-off from approximately 15,000m^2 of the capped unlined cell on a temporary basis. This drain passes through a series of silt traps and lagoons (on Bord na Mona property, outside of the boundary of Derryclure Landfill) prior to discharging to the Tullamore River.

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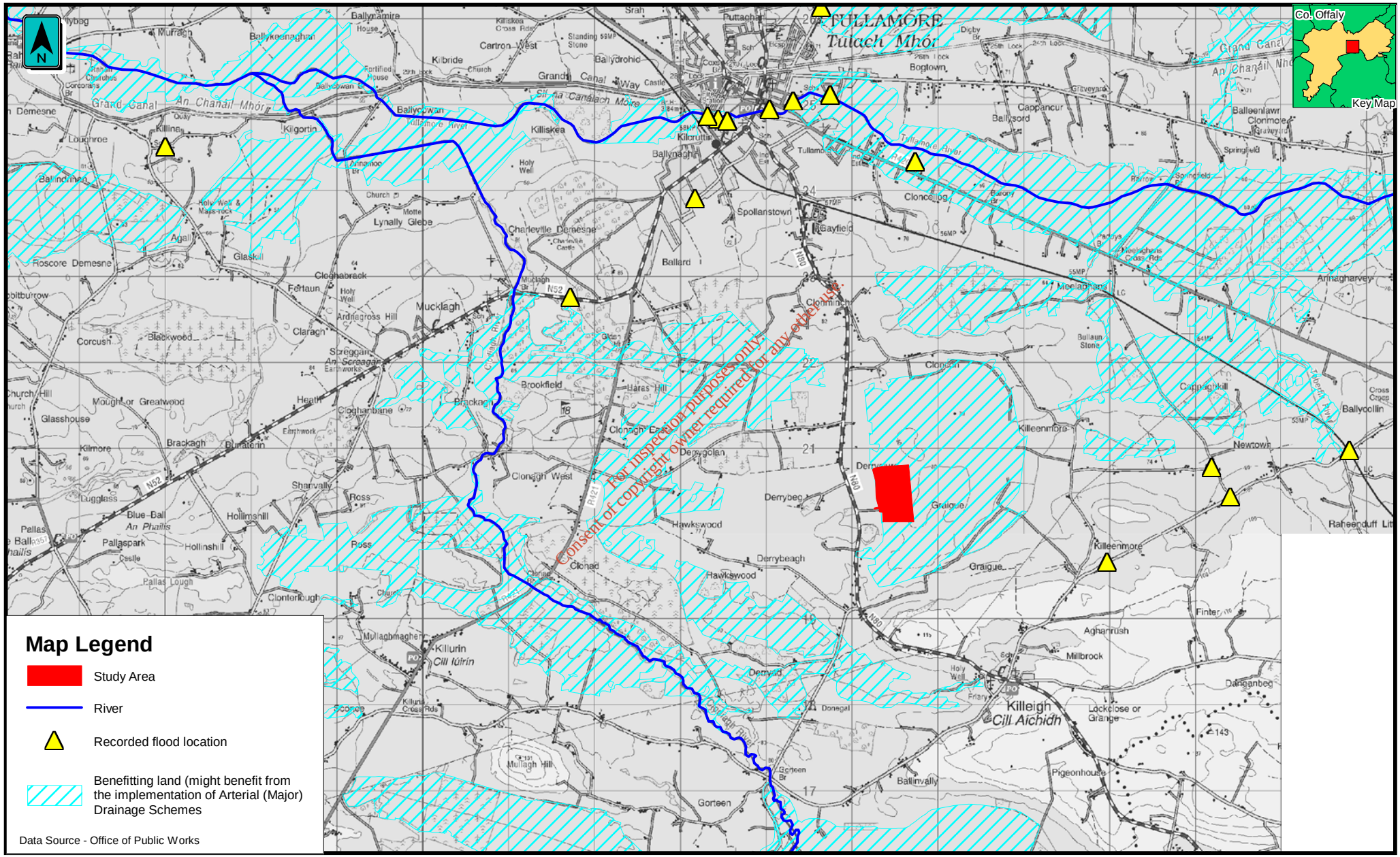
CE07-286-01_Figure 5.1_Identified Flooding Areas in Vicinity of Site_Rev A



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Identified Flooding Areas in Vicinity of Site

Figure 5.1

At present, the wastewater from toilets and canteen is discharged to an on-site holding tank. Wastewater is removed from site periodically by tanker and discharged to Tullamore Wastewater Treatment Plant. This means no wastewater is being discharged to the surface water drains and water courses. The leachate from the landfill cell is collected in a leachate lagoon and removed from site periodically by tanker and discharged to Tullamore Wastewater Treatment Plant.

The surface water run-off from all paved areas passes via a silt trap and dedicated interceptor to a surface water collection system. The surface water from the capping of the old landfill area is collected in a circumferential swale. Surface water from both of these sources is discharged to a local ditch located to the west of the landfill site through an outfall, with the exception of the eastern swale which discharges to the eastern perimeter discharge point. The surface water quality at the western discharge point is being monitored through the monitoring point SW08. The layout of Derryclure Landfill together with the surface water monitoring points is shown on Fig. 2.6. (section 2). An additional surface water monitoring point SW-14 has recently been constituted at the eastern boundary discharge point. There is no data yet available at this location.

5.2.2 Low Flow Hydrology of the nearby river/streams

Western Perimeter Discharge Point

The majority of surface water from the developed area is discharged to a local ditch located to the west of the landfill site. This ditch first flows in a west to east direction, then after being joined by several other local ditches, flows in a generally north-west direction for approximately 4.5 km to discharge into Charleville Lake. Charleville Lake ultimately discharges to the Clodiagh River near Mucklagh Bridge on the N52. The catchment area of the Clodiagh River at this location is approximately 100 km^2.

The register of hydrometric stations in Ireland shows a list of 6 hydrometric stations on the Clodiagh River. The OPW website www.opw.ie/hydro details hydrometric data of this river at the Rahan gauging station (No. 25016), the catchment area at which is 274 km^2. The summary statistics of the flow data at this station shows that the 95-percentile flow in the Clodiagh River is 0.55 m^3/s. With a catchment area ratio of 0.365 (= 100 / 274), the 95-percentile flow in the Clodiagh near Muclagh Bridge (hear the outfall from the Charleville lake) can be estimated as approximately 0.2 m^3/s.

The EPA website (www.epa.ie) shows the dry weather flow (DWF) and 95-percentile flow (q95) in the Clodiagh River at Groteen Station (No. 25007, catchment area = 50.5 km^2) as 0.02 m^3/s and 0.06 m^3/s respectively. With the catchment area of approximately 100 km^2, the DWF and q95 flow values in the Clodiagh River near Mucklagh Bridge can be estimated as approximately 0.04 m^3/s (i.e., 40 l/s) and 0.12 m^3/s (i.e., 120 l/s) respectively.

Eastern Perimeter Discharge Point

There is a single discharge point on the eastern perimeter, where surface water from the undeveloped peat bog area and a portion of the capped area discharges to an existing land drain through adjacent land (under the ownership of Bord na Mona).

This drain passes through a series of silt traps and lagoons (on Bord na Mona property, outside of the boundary of Derryclure Landfill) prior to discharging to the Tullamore River.

There are a number of hydrometric gauging stations on the Tullamore River, with two of them at or near to Tullamore town; namely, Station No. 25149 which is now obsolete and Station No. 25331 at Tullamore weir. However, no hydrometric data are available on the OPW website (www.opw.ie/hydro) for the Tullamore River.

The EPA website (www.epa.ie) shows dry weather flow (DWF) in the Tullamore River at Station No. 25149 (obsolete), with a catchment area of 111.3 km^2, as 0.1 m^3/s (i.e.100 l/s). As the 95-percentile flow (q95) values in most Irish rivers are approximately twice the DWF values, the q95 value in the Tullamore River at Station 25149 can be considered as approximately 200 l/s. From this, the specific q95 value in the Tullamore River catchment can be considered as being approximately 1.8 l/s per km^2 of the catchment area.

At the confluence of the drainage ditch with the Tullamore River, the catchment area of the river is approximately 85 km^2. Considering the specific 95-percentile flow as 1.8 l/s per km^2 of the catchment area, the 95-percentile flow in the Tullamore River at this location can be estimated as approximately 153 l/s.

5.2.3 Existing Water Quality

Clodiagh River

The EPA monitors water quality of the Clodiagh River at various locations, as indicated on Figure 5.2. The EPA Biological Survey of River Quality Report (2005) included the following stations:

- Station 25C060220 - just u/s of Gorragh River Confluence
- Station 25C060250 - Bridge of Brockagh
- Station 25C060300 - Gorteen Bridge
- Station 25C0340 – Bridge north of Clonagh, located approximately 2 km upstream of the Charleville Lake outfall
- Station 25C0400 – Annamoe Bridge, located approximately 2 km downstream of the Charleville Lake outfall
- Station 25C060500 – Bridge at Rahan, located further downstream of the Charleville Lake outfall

The biological index (Q-value) monitored by EPA at the above mentioned 6 stations on the Clodiagh River are summarised in Table 5.1 over.

Table 5.1: Water Quality (Q-value) of the Clodiagh River at various locations

Year	Stn. No. 25C060220	Stn. No. 25C060250	Stn. No. 25C060300	Stn. No. 25C060340	Stn. No. 25C060400	Stn. No. 25C060500
1971	-	-	-	-	5	4
1974	-	-	-	-	5	4
1975	-	-	-	-	5	4
1978	-	-	5	-	5	-
1982	-	-	5	-	4-5	4
1984	-	4-5	5	-	4-5	3-4
1987	3	4	4-5	-	4-55	3-4
1993	3-4	4-5	5	-	4-5	4
1996	3	4	4-5	4	4	3-4
1999	3	4-5	4-5	4	3-4	3-4
2002	3-4	4-5	4-5	4	3-4	3-4
2005	1	4-5	4-5	4	3-4	4

Table 5.1 shows that the water quality of the Clodiagh River upstream of the outfall from the Charleville Lake is unpolluted (Q4 and Q4-5) whereas that immediately downstream of the Charleville Lake outfall is slightly polluted (Q3-4). However, at a further downstream location (at station 25C060500) the water quality is again unpolluted (Q4).

According to the EPA Water Quality Monitoring Report (2005), the Clodiagh River continued to be of a highly satisfactory quality standard in its upper reaches in August 2005 but it then deteriorated under the influence of suspected water treatment discharge in Clonaslee and by a combination of those and suspected sewage effluents below the town (at 25C060220). The report further states that satisfactory conditions were restored at Brockagh (25C060250) and, with the exception of the Annamoe area (25C060400) where marked eutrophication was again evident, the remainder of the river was in a generally satisfactory condition.

At present, the surface water runoff from Derryclure landfill is being monitored on a quarterly basis. The monitoring is being carried out at the ditch where the surface water from the Derryclure Landfill site is discharged (SW-08) as well as at two other locations, namely at SW-7 on the ditch located along the access road and at SW-12 on the ditch located to the north of the landfill site (see Figure 2.6 in Section 2).

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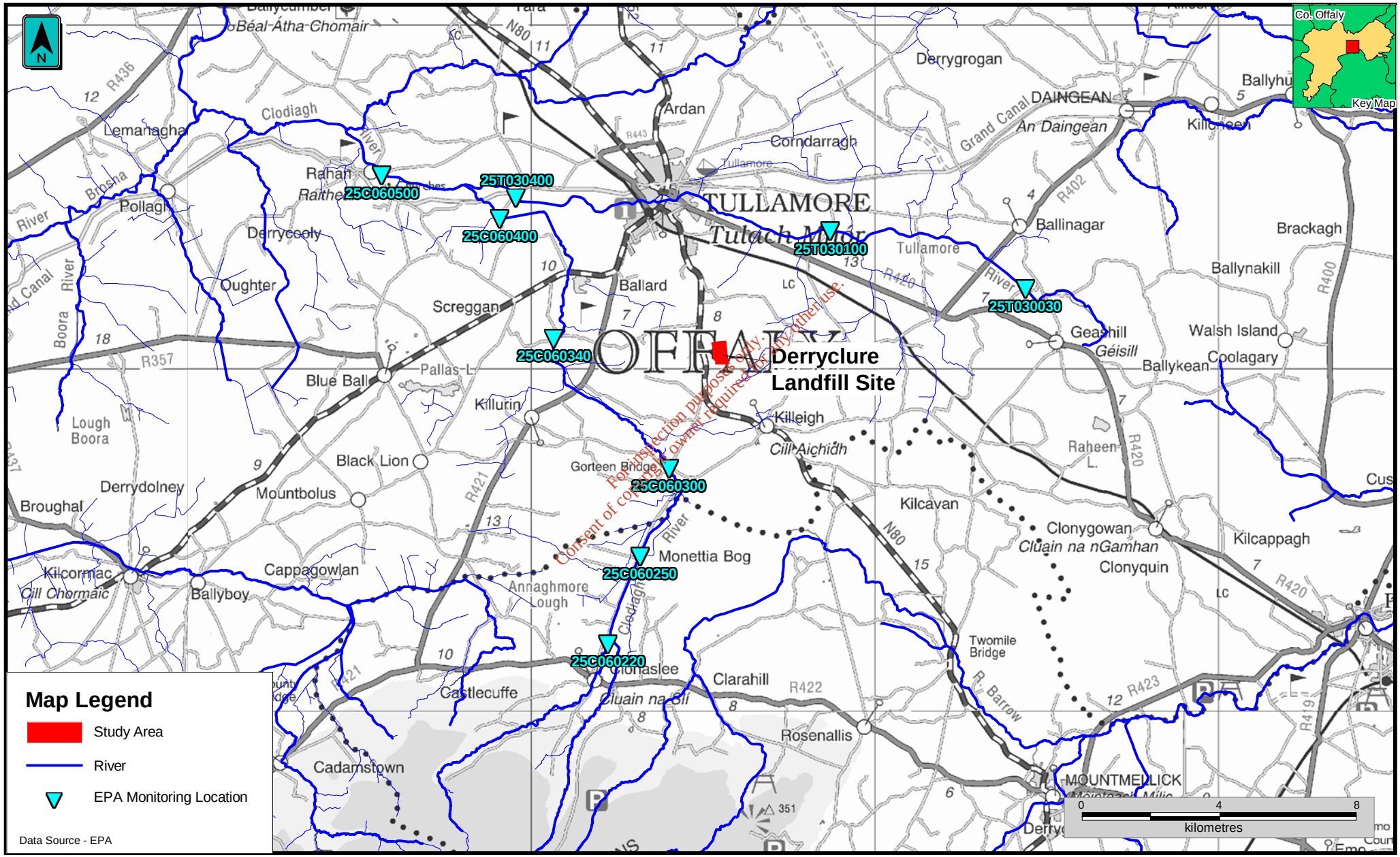
CE07-286-01_Figure 5.2_EPA Water Quality Monitoring Locations on the Clodiagh and Tullamore Rivers_Rev A



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EPA Water Quality Monitoring Locations on the Clodiagh and Tullamore Rivers

Figure 5.2

Table 5.2: Results of Chemical Analysis of Surface Water Samples in 2007

Parameter	SW-7				SW-8				SW-12				Discharge Limit
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Ammonia as N (mg/l)	6.92	-	0.81	155.4	58.29	77.5	19.41	11	7.41	3.3	6.05	4.14	
BOD (mg/l)	9	-	3	15	8	21	60	10	4	3	4	9	25
DO (% Sat. O_2)	53.4	-	54.7	50.4	43.3	10.4	47.2	33.3	55.2	69.3	55.2	72.5	
Conductivity (µS/cm) @ 25^0C	797	-	933	4350	1827	1844	1331	762	792	676	740	819	
Total Susp Solids (mg/l)	140	-	144	114	25	18	411	384	18	6	15	15	60
COD (mg/l)	135	-	102	580	128	184	216	20	24	35	18	38	
Ph (pH units)	7.02	-	7.12	7.4	7.4	7.62	7.27	6.91	7.41	7.52	7.37	7.06	
Temperature ^{o}C	6	-	14.3	10.6	6.4	12.1	16	9.7	9.4	10.9	13	10.9	
Chloride (Cl)	36.7	-	23	367	223	171	86	27	26.	12	40	34.7	
Boron (B)	-	-	-	0.5	-	-	-	0.136	-	-	-	0.123	
Calcium (Ca)	-	-	-	239	-	-	-	64.89	-	-	-	114.9	
Cadmium (Cd)	-	-	-	0.003	-	-	-	0.0035	-	-	-	0.0035	
Total Chromium (Cr)	-	-	-	0.01	-	-	-	0.01	-	-	-	0.01	
Copper (Cu)	-	-	-	0.2	-	-	-	0.015	-	-	-	0.015	
Iron (Fe)	-	-	-	0.5	-	-	-	0.156	-	-	-	0.595	
Lead (Pb)	-	-	-	0.01	-	-	-	0.002	-	-	-	0.002	
Magnesium (Mg)	-	-	-	8.1	-	-	-	18.45	-	-	-	5.89	
Manganese (Mn)	-	-	-	0.2	-	-	-	0.023	-	-	-	0.014	
Nickel (Ni)	-	-	-	0.05	-	-	-	0.005	-	-	-	0.008	
Potassium (K)	-	-	-	155	-	-	-	15.47	-	-	-	1.2	
Sodium (Na)	-	-	-	268	-	-	-	30.85	-	-	-	12.83	
Zinc (Zn)	-	-	-	0.011	-	-	-	0.011	-	-	-	0.011	
Mercury (Hg)	-	-	-	0.005	-	-	-	0.005	-	-	-	0.0005	
Sulphate (SO_4)	-	-	-	80	-	-	-	48.5	-	-	-	1.57	
Total Alkalinity (as $CaCO_3$)	-	-	-	108	-	-	-	197	-	-	-	340	
Orthophosphate (as P)	-	-	-	2	-	-	-	0.34	-	-	-	0.07	
Total Oxidised Nitrogen	-	-	-	6.5	-	-	-	9.57	-	-	-	1.23	

The 2007 monitoring data for all four quarters, at the three monitoring stations are presented in Table 5.2 above. Table 5.2 indicates that the BOD value in the surface water was generally less than the set limit of 25 mg/l at all three surface water monitoring locations, except at the discharge location (SW-8) where the BOD was 60 mg/l in the 4th quarter of 2007. Similarly, the total suspended sediment was less than the discharge limit of 60 mg/l for all four quarters of 2007 at the monitoring location SW-12, whereas the SS concentration was higher than the discharge limit of 60 mg/l for all four quarters of 2007 at the monitoring location SW-7. At the discharge location (SW-8), the concentration of SS was less than the discharge limit of 60 mg/l for the first two quarters of 2007, whereas it was higher than the limit at the last two quarters of 2007.

The other parameters such as the pH at all three monitoring locations (SW-7, SW-8 and SW-12) was neutral and remain within pH range set by the European Communities Drinking Water Regulations (2000) of ≥ 6.5 and ≤ 9.5 pH units.

Conductivity at the SW discharge location (SW-8) was higher than 1000 µS/cm in the 1st, 2nd and 3rd quarter but it decrease to less than 1,000 µS/cm in the 4th quarter of 2007. The conductivity of SW-12 was less than 1000 µS/cm for all four quarter whereas that at SW-7, it was more than 1000 µS/cm in the 4th quarter only.

The concentration of ammonia was generally elevated in all three monitoring points, with the discharge location SW-8 having ammonia in the range of 11 to 77.5 mg/l in the year 2007.

It can be summarised from the water quality monitoring data that, although the BOD value was generally within the limit of 25 mg/l (except in the 4th quarter of 2007 at SW-8), the other water quality parameters were generally not satisfactory at the surface water monitoring points. This is partly explained by the fact that some of the sampling locations are seasonal ditched with a tendency to stagnate during dry periods. Water quality at SW08 can largely be accounted for by the fact that surface water run-off from the unlined cell would be expected to have collected contaminants through contact with waste and with temporary soil cover.

Capping of the unlined cell was completed in the second quarter of 2008, with vegetation developing in the 3rd quarter of 2008. Water quality at SW08 from the last quarter of 2008 onwards should gradually improve.

Both the current and future cells are designed as engineered cells with formal arrangements both for surface water and leachate management. There is thus virtually no risk that surface water contamination will occur in the future. As soon as practicable, each new cell will be capped off resulting in clean surface water runoff only.

Tullamore River

The EPA monitors water quality on the Tullamore River at the following three stations (See Fig 5.2):

- The first at Geashill Stream (Station 0030, catchment area = 10 km^2) located approximately 7 km upstream of the facility
- The second at Springfield Bridge (Station No. 0100, catchment area = 72 km^2) located approximately 1 km upstream of the facility
- The third near Ballycowan Bridge (Station 0400, catchment area = 132 km^2) located approximately 9 km downstream of the facility

The biological index (Q-value) monitored by EPA at the three monitoring stations on the Tullamore River are summarised in Table 5.3.

Table 5.3: Summary of Surface Water Quality Data of the Tullamore River

Sampling Stations		Q-Value										
No.	*Location*	*1971*	*1975*	*1977*	*1981*	*1986*	*1987*	*1993*	*1996*	*1999*	*2002*	*2005*
0030	Br d/s Geashill Stream	-	-	-	-	-	-	3	3	3	3	3
0100	Springfield Bridge	4	3-4	3-4	4	4	3	4-5	3	3	3	3-4
0400	Br near Ballycowan Br	1-2	2	1-2	2	2	2	2-3	2-3	2	2	2

(Source: www.epa.ie)

Table 5.3 shows that the water quality of the Tullamore River is seriously polluted downstream of Tullamore Town and moderate to slightly polluted upstream of the town i.e. upstream of the existing Derryclure Landfill facility.

According to the EPA Water Quality Monitoring Report (2005), sewage from Geashill and Tullamore is suspected as the most likely cause of the unsatisfactory condition of the Tullamore River in 2005. The upper reaches (0030) were very heavily silted and lacked sensitive macroinvertebrate species and although some sensitive species were observed downstream. At Springfield Bridge (0100) the abnormally luxuriant crops of water weed and algae plus heavy siltation indicated significant eutrophication at that location: dissolved oxygen (DO) was reduced to just 59% at that time. Downstream of Tullamore town, the river was again seriously polluted at Ballycowan (0400) where DO was reduced to just 35% of saturation.

Offaly County Council has only recently commenced discharging to the eastern perimeter discharge point. Agreement has been sought with the EPA to open this discharge point, and water sampling at this location will be incorporated into the quarterly sampling regime henceforth. It should be noted that the only developed area of the facility discharging to this location is approximately 15,000 m^2 of engineered landfill cap. Run-off from this is very small.

Once future cells have been constructed, open swales will be designed to enable discharge back to the western discharge point, and ultimately to the Clodiagh River downstream of Tullamore Town.

5.2.4 Assessment of the Assimilative Capacity of the Receiving Water

The water quality monitoring data of Table 5.2 indicates that surface water runoff from the existing site could increase pollutant load on the main drainage channel that ultimately discharges to the Clodiagh River.

However, Table 5.1 indicates that the biological water quality of the Clodiagh River at EPA monitoring station 25C060400, located downstream of the point where the surface water from the site ultimately discharged to this river, has a status of 'slightly polluted (Q3-4)' for the entire duration from the year 1999 to the year 2005. This indicates that the surface water from the landfill site is significantly assimilated before reaching the Clodiagh River, thus having an insignificant impact on the existing water quality of the Clodiagh River. This is attributed to the following reasons:

- The ditch rises near the landfill, thus it has a very small catchment area near the discharge location (SW-8). However, the stream's catchment area increases significantly within a kilometre of its reach
- The drainage network passes through a large area of cutaway peatland. This peatland offers a significant source of contaminant retardation.
- The large area of wetland surrounding Charleville Lake into which the stream drains before discharging to the Clodiagh River, offers a vast reservoir for the natural treatment of pollutant load.
- The Charleville Lake also acts as a flood attenuation reservoir, thus help to reduce the flood discharge into the Clodiagh River.

Due to the above reasons, the surface water runoff from Derryclure landfill is not impacting on the water quality of the Clodiagh River (receiving waters). Given the fact that from now on, engineering measures (capping, swales etc) will ensure that surface water runoff will be clean, the nett effect will be that any residual discharges from the unlined area will be diluted.

5.2.5 Shannon International River Basin District (ShIRBD)

The Shannon International River Basin District (RBD) Management Project is a project that "*seeks to maintain and improve the quality*" of the surface and groundwaters of the Shannon River Basin District, in accordance with the terms of the EU Water Framework Directive (WFD). The main objective of the WFD is to obtain good status in all waters by 2015.

The ShIRBD is the largest river basin district in Ireland, comprising a land area of approximately 18,000 km^2 and includes an extensive area of central Ireland, and drains significant portions of counties Cavan, Clare, Galway, Kerry, Leitrim, Limerick, Longford, Offaly, Roscommon, Tipperary and Westmeath and lesser areas of counties Cork, Laois, Mayo, Meath and Sligo. A small portion of the RBD is in Northern Ireland and so the Shannon is formally designated as an International RBD.

The Rivers Suck, Inny, Brosna, Fergus, Maigue, Deel and Mulkear are among the principle tributaries of the Shannon River. The surface water from Derryclure landfill ultimately flows to the lower reach of the Clodiagh River, which is one of the major tributaries of the River Brosna, which itself is a tributary of the River Shannon, and also to the Tullamore River, which is a tributary of the Clodiagh.

Four types of pressures, created by human activities, were identified which can cause deterioration of water quality if not managed properly. These are:

- Sewage and other effluents discharged to waters from point sources, e.g. outfall from treatment plant
- Discharges arising from diffuse or dispersed activities on land
- Abstractions from waters
- Structural alterations to water bodies

Risk assessment procedures were developed to analyse the impact of these pressures on water bodies in the district. Four categories of risk were created to assess how sensitive the water bodies are from the pressures above.

- Not at Risk: Sufficient information is available to determine that the impact of the pressures on the water body is such that the water body is likely to achieve good status. In some cases monitoring data is available to confirm the good quality status of the water body. Measures must be considered here to ensure deterioration from good status does not occur. Approximately 6% of the catchment area of the ShIRBD falls under this category.
- Probably Not at Risk: Sufficient information is not available at present to determine whether the water body is at risk of failing to meet good status. However, based on existing available data, it is probable that the water body will be found to be not at risk when further information becomes available. Approximately 17% of the catchment area of the ShIRBD falls under this category.
- Probably at Risk: Sufficient information is not available at present to determine whether the water body is at risk of failing to meet good status. However, based on existing available data it is probable that the water body will be found to be at risk when further information becomes available. Approximately 45% of the catchment area of the ShIRBD falls under this category.
- At Risk: Sufficient information is available to determine that the impact of pressures on the water body is such that the water body is unlikely to achieve good quality status unless measures are taken to reduce the impact, thereby improving the water quality. Approximately 32% of the catchment area of the ShIRBD falls under this category.

The results of this assessment, and with reference to Figure 5.3, indicates that the Clodiagh and Tullamore Rivers are either “at risk” or “probably at risk”. It is important to note that the designation “at risk” is not necessarily an indication of the present quality of the water. The water quality may be good but the magnitude of the pressures which exist within the catchment, if not properly managed, poses a risk that the water body may not achieve good status in accordance with the WFD, or that the water quality is in danger of deterioration.

5.3 Potential Impacts & Mitigation Measures in Surface Water

The proposed intensification of the site will not significantly impact on surface water. As the majority of surface water from the landfill site ultimately flows into Charleville Lake, it would act as a natural attenuation system, thus preventing flood flows into the Clodiagh River. The following procedures will continue to be carried out during the proposed intensification of the site:

1. There are three different stages of landfill cells, namely, the old cell which is capped, the active cell (which is being filled) and new cells (to be developed in the future).
    a. The surface water from the capped cell is collected through a circumferential swale, which will also help in slowing down the surface runoff discharge from the cell cap.

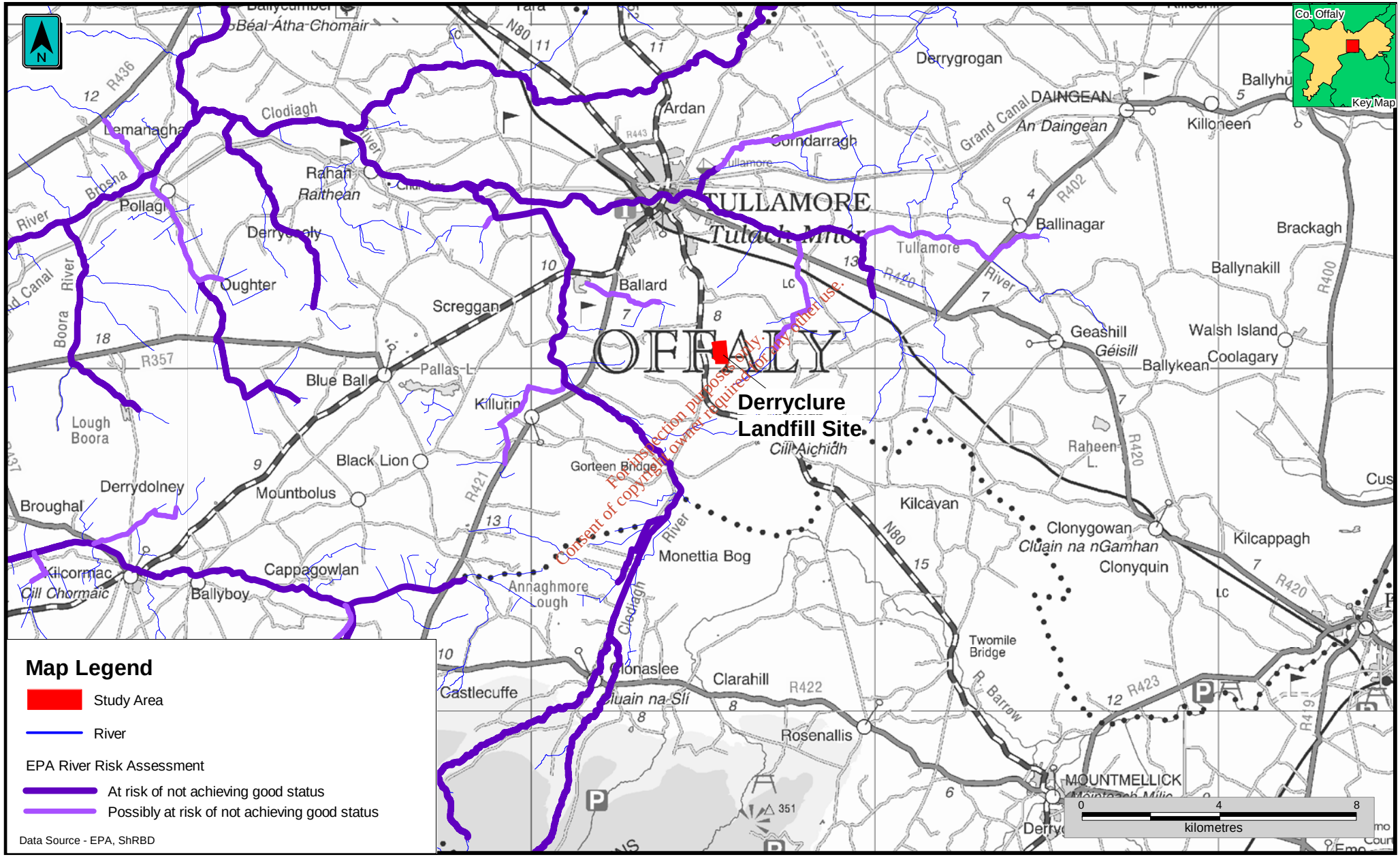
    b. The surface water from within the active cell (currently being filled) is pumped out as leachate and stored in the leachate lagoon, so it has no effect on the overall surface water runoff.

    c. The surface water from any new clean cell (prior to landfilling) will be collected in the cell itself, thus acting as a temporary attenuation pond.

2. The surface water runoff from any roofed area will continue to be discharged directly to the collection system. The surface water from paved areas first passes to a silt-trap and then to an oil separator before discharging to the collection system. The collected surface water is discharged to the ditch located to the west of landfill site through an outfall.

3. The leachate generated in the landfill cell is collected and conveyed to a leachate lagoon and tankered off the site to a waste water treatment plant. Therefore, this is has no effect on the surface water quality. Similarly foul water is collected and tankered off-site for treatment

4. Surface water quality will continue to be monitored in accordance with any conditions of the waste licence required for the site's activities.



Map Legend

- Study Area
- River

EPA River Risk Assessment

- At risk of not achieving good status
- Possibly at risk of not achieving good status

Data Source - EPA, ShRBD

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EPA Water Quality Risk Assessment

Figure 5.3

The following mitigation measures will be incorporated in addition to those already in operation at the site:

- To reduce/attenuate the surface water runoff from the capped cells area, swales with large cross sections and flat gradient will be provided on the circumference of the cell. These swales also help to infiltrate water and provide some sort of attenuation during extreme rainfall events.
- The water quality monitoring data at the SW discharge point and at other locations indicated that the level of pollutants in the surface water exceeds the discharge limit at several occasions. As the quantity of water in the ditch increased within 1 km of its reach, and the water passes through the Charleville Lake before discharging to the Clodiagh River, it is generally considered that the elevated pollutant is assimilated before reaching the Clodiagh River. However, the surface water management system will be further reinforced at the site to control the level of pollutants in the surface water.
- Future surface water system designs will divert collected surface water to discharge points at the western and/or northern perimeters to achieve discharge to the Clodiagh River. This will reduce the possibility of increasing flood risk upstream of Tullamore Town on the Tullamore River. As soon as practical, surface water discharging from the capped cell towards the eastern perimeter discharge point will be re-diverted to a discharge point draining to the Clodiagh River.

OCC is considering direct pumping of leachate, following methane stripping, to the Tullamore sewage treatment plant. This may be feasible once the next phase of development is complete in 2011.

6. ECOLOGY

As the intensification of the landfill will occur within the already permitted boundary of the landfill, it is unlikely that the development will have any effect on the site's natural ecology. However, a full ecological assessment has been undertaken both to test that thesis and also to establish a robust ecological baseline that can be used to measure the effect as the development progresses.

An ecological impact assessment of the Derryclure Landfill Facility was carried out on the 11th and 12th of June 2008. Standard ecological survey techniques were used (Lawrence & Brown, 1973; Clark, 1990; Institute of Environmental Assessment, 1995 Institute of Ecology and Environmental Management 2006; Smal, 1995; Bibby *et al*., 2000; Sargent & Morris, 2003; Bang & Dahlstrom, 2004; JNCC, 2004; The Heritage Council, 2005; Sutherland, 2006). Cognisance was taken of a previous Environmental Impact Statement (EIS) conducted at the facility (Bord na Mona, 2001). The purpose of this study was to:

- Undertake a desktop study of available ecological data for the site and area, including a review of designated sites within 10 km of the site
- Undertake ecological field surveys of the site and surrounding area in order to identify the flora and fauna present
- Evaluate the ecological significance of the site
- Assess the potential impact(s) of the proposed development on the ecology of the site and surrounding areas
- Recommend mitigation measures to reduce any potential negative impact(s) of the proposed development on the ecology of the site and surrounding area

6.1 Methodology for Ecological Investigation

6.1.1 Designated Sites

A desktop study was carried out to identify designated sites within 10 km of Derryclure landfill, such as Natural Heritage Areas (NHAs), Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). FTC holds an archive of GIS data that includes the location and extent of designated conservation areas. These were plotted on OSI background map using MapInfo Professional (v 8.5) GIS application. Designated sites identified by this aspect of the study are outlined in Section 6.3.1.

6.1.2 Habitats & Botanical Survey

Dominant habitats within the site boundary and buffer zone were classified according to Fossitt (2000). This involved a walkover of the site and buffer zone and the recording of the main habitats on a field map (1:2,500 scale). The botanical survey was conducted in parallel with the habitats survey, with botanical species identified and recorded per habitat type. The main habitats and botanical species identified are outlined in Section 6.3.2.

6.1.3 Fauna Survey

Mammal Survey

The landfill site and buffer zone were carefully walked during the ecological survey to ascertain the presence of mammals. Mammal signs, such as dwellings, feeding traces, tracks or droppings indicate their presence on site with occasional direct observations also made. The methods used to identify the presence of mammals in the survey area followed international best practice (Lawrence & Brown, 1973; Clark, 1990; Smal, 1995; Sargent & Morris, 2003; Bang & Dahlstrom, 2004; JNCC, 2004).

Sightings or signs of all mammal species encountered during the survey were recorded on a field map of the site (1:2500 scale) and where possible locations positioned with the aid of handheld GPS. A bat survey was also carried out. A remote trail camera was set up and baited in order to record any activity by mammals active during darkness. The camera was located at the northeast corner of the existing civic waste facility. The camera is triggered by heat and/or motion and documents any activity within the detectable range. The location of the camera is shown on Figure 6.1. The results of the mammal survey work are provided in Section 6.3.3.

Bat Survey

The purpose of the bat survey was to:

a) Identify bat species feeding and/or roosting on or closely adjacent to the site
b) Quantify the relative abundances of the species encountered
c) Make digital recordings for species identification
d) Assess the structures and vegetation on-site for evidence of roost emergence

The site was visited by two fieldworkers on the night of the 12th June 2008. The weather was dry, calm and mild. A site walkover was undertaken to assess the habitats present for bat potential. Due to the difficulty of navigating the site after dark, the walkover was restricted to existing internal pathways. The survey was carried out between the hours of 22:30 and 01:30.

Bats emit rapid ultrasonic pulses and process information in the echoes (or returned signals) to orientate themselves and to detect prey in their environment. Ultrasound is effective in prey detection as the wavelengths of lower frequencies are longer than the body length of most insects. Bats have distinct activity patterns – usually showing a peak at dusk and another just prior to dawn. The most commonly used methods of bat monitoring involve the use of a bat detector. Bat detectors transform the ultrasound emitted by bats into audible sound. In this survey a Pettersson D-240X was employed. This is a combination heterodyne and frequency division bat detector. This detector has a frequency range of 17-125 kHz. In addition, the sounds output when bat activity was detected were saved as a digital WAV file on an Roland EDIROL R-09 Digital WAV Recorder.

Many bats have distinctive echolocation calls (when heard on a heterodyne bat detector) that are recognisable to experienced bat workers even without sonogram analysis. When the bats are visible in the field other characteristics are also useful as identification aids: these include flight height, size, speed, habitat preference and general appearance of the wing (sometimes called 'jizz').

However, post-survey analysis of field recordings can be a very useful tool for identification of bats to species level. The process of making recordings and producing clear sonograms is complex and requires a basic understanding of sound theory. The subject is explained in detail in Tupinier (1997).

In recent years, specialist software for the analysis of echolocation calls has been developed. In the analysis of the field recordings made at the Derryclure site, FTC used BatSound (v.3.31) software, a specially developed PC application for the analysis of recordings.

Once an interesting bat call has been captured in a spectrogram image, a spectrum plot can be created at any point in time to show details of the frequency-division spectrum. A plot will be created showing the detailed power spectrum at that point in time. The peak frequency in the pulse of a bat call can also be a reliable indicator of the bat species, especially where bats of the same genus are differentiated most easily by their sonar calls. Also, where several bat species are flying together they can easily be spotted and separated on the spectrogram. The results of the bat survey work are provided in Section 6.3.3.

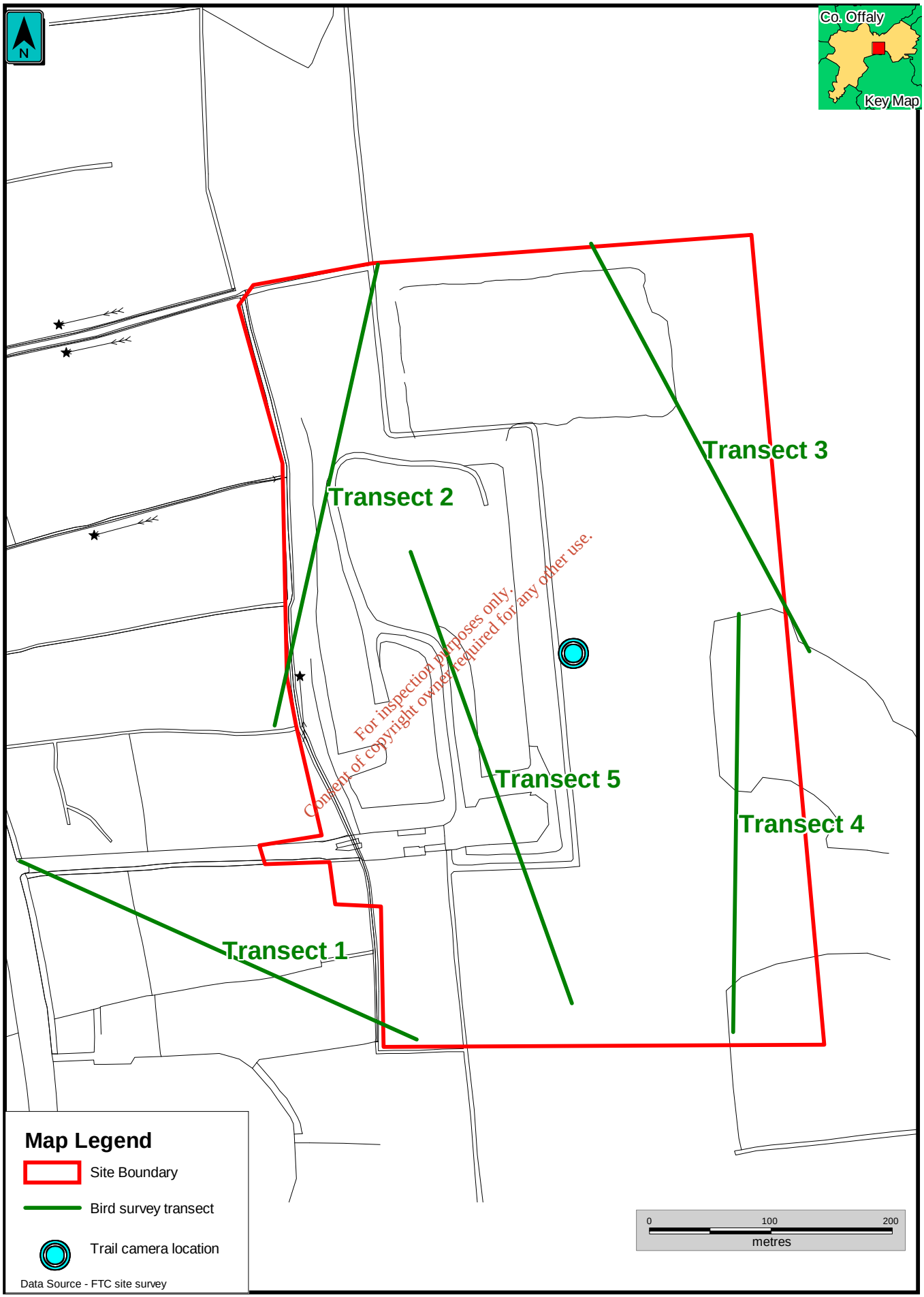
Bird Survey

Avian surveys were carried out in order to sample a variety of habitats within the landfill site and the surrounding buffer zone. The weather during the survey days was good: cloudy but dry with good visibility. The conditions were all comfortably within the acceptable range for conducting an avian survey (Bibby *et al*., 2000). All surveys were carried out during times of highest bird activity i.e. before 12 noon. Observations were recorded using field notes and transect locations were recorded using a handheld GPS unit (Garmin GPSMAP 60CSx) and large scale (1:2500) field map.

Within the site boundary a standard avian transect technique analogous to the Countryside Bird Survey (CBS) methodology was used to assess the avifauna that use and that might potentially occur at the site. The method was as follows:

1. Five linear transects of c. 500 metres in length were walked in order to survey all of the habitats present within the site boundaries (see Figure 6.1)
2. All species encountered (seen or heard) on these transects were recorded and where possible their abundance was noted. Any species where 50 or more individuals were recorded was noted as being abundant. In addition casual observations made during other surveys were recorded
3. Birds observed flying over, or near, the site were not recorded unless obviously using the site
4. Binoculars (Kowa 8x40 and Swarovski 8x30) were used to aid species identification
5. Note was taken of the habitat composition of the local landscape to better assess the avian community in the wider locality.

In this manner, a list of the birds present in the area, their relative abundance and behaviour, as well as their association with various habitats could be generated. In addition species not encountered, but likely to use the available range of habitats during the year, could reasonably be assessed.



Survey Locations

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Figure 6.1

The conservation status of the species found on the site was also assessed. BirdWatch Ireland and the RSPB (Royal Society for the Protection of Birds) have agreed a list of priority bird species for conservation action in the whole of Ireland (Lynas *et al*., 2007; Newton *et al.*, 1999). These *Birds of Conservation Concern in Ireland* are published in a list known as the BoCCI List (BirdWatch Ireland www.birdwatchireland.ie). In this BoCCI List, birds are classified into three separate lists (*Red*, *Amber* and *Green*), based on the conservation status of the bird and hence conservation priority. These conservation designations take into account the dangers faced by bird species that occur in Ireland. These lists have recently been updated (Lynas *et al.*, 2007) to reflect changes in the status of bird species in Ireland.

Red-listed species are of highest conservation concern and *Amber-listed* species are of medium conservation concern; 25 species are currently *Red-listed*, while a further 85 are considered *Amber-listed*. Green-listed species are considered of no particular conservation concern.

Other Fauna

The presence of any other species, e.g. macroinvertebrates or amphibians, encountered during other surveys was recorded. Special note was taken of the habitats in which these species were observed. These fauna are outlined in Section 6.3.3.

6.2 Ecology in the Existing Environment

6.2.1 Designated Sites within 10 km of the Site

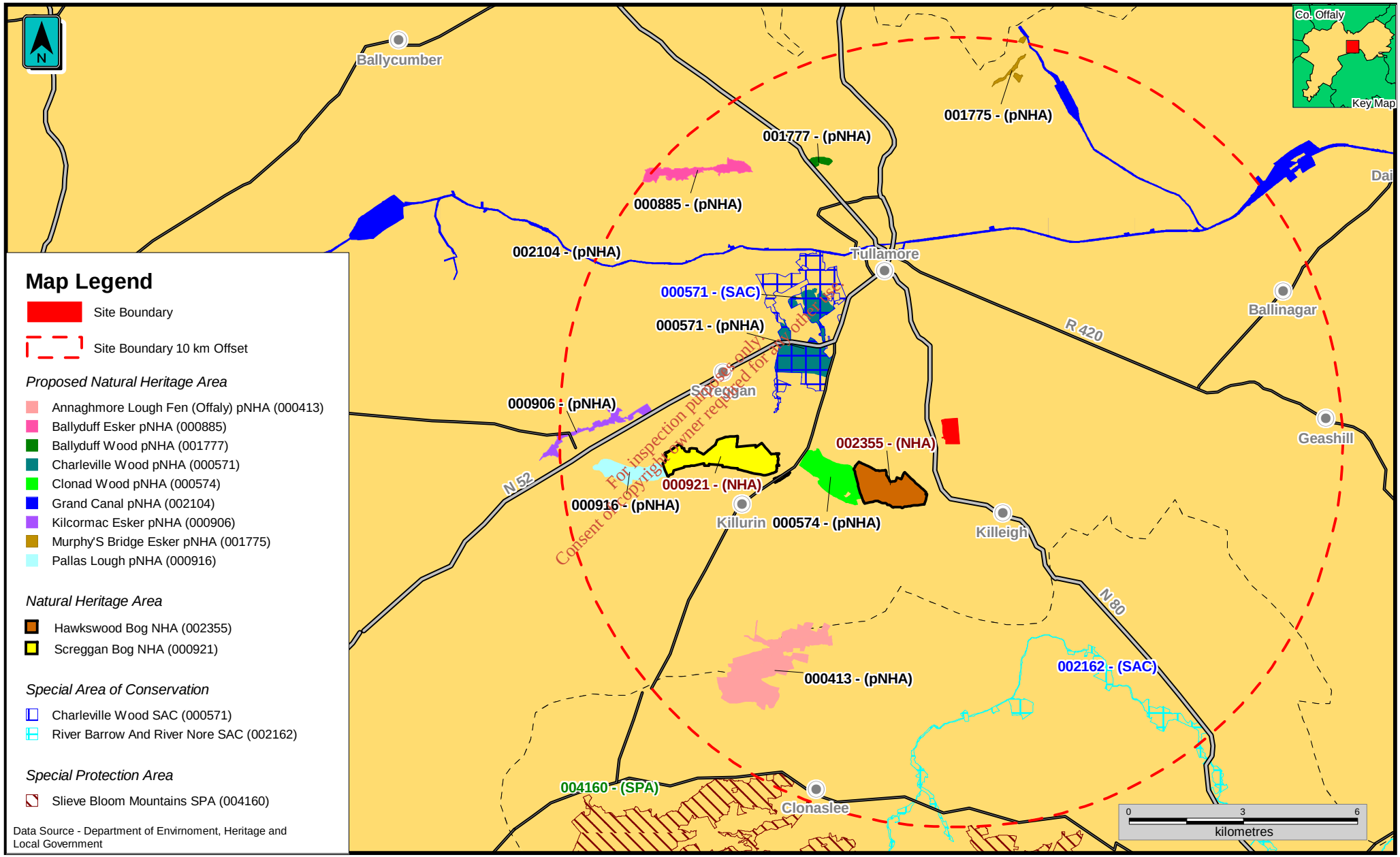
The proposed development area is not part of any designated site. However, there are several proposed National Heritage Area's (pNHA's), Special Area's of Conservation (SAC) and Special Protection Area's for birds (SPA) within 10 km of the proposed development site (Table 6.1 and Figure 6.2). The NPWS site synopses for these designated areas are included in Appendix 6. In addition, historical records show that a number of protected flora and fauna species have been recorded within 10km of the proposed development site (www.NPWS.ie/MapsData). These records are displayed in Appendix 7.

Table 6.1: Summary of designated sites within 10 km of the proposed development

Site Name	Designation	Site Code	Reason for Designation	Minimum Distance from Site (km) (approx.)
Hawkswood Bog	NHA	002355	The site is comprised of raised bog. This site supports a good diversity of raised bog microhabitats, including hummocks, lawns and pools.	1.3
Clonad Wood	pNHA	000574	Clonad Wood is an area of deciduous woodland. The rare Alder Buckthorn (*Frangula alnus*) and Bird Cherry (*Prunus padus*) are found in the woodland, while Irish Whitebeam (*Sorbus hibernica*) is also abundant.	2.4
Charleville Wood	pNHA, SAC	000571	An ancient woodland site with a varied age structure. Contains Old Oak woodland and the rare snail species, *Vertigo moulinsiana*. The wetland areas have good bird populations and rare insect and *Myxomycete* species.	3
Screggan Bog	NHA	000921	The site is comprised of a raised bog that includes areas of cutover bog	4
Grand Canal	pNHA	002104	The ecological value of the canal lies in the diversity of species it supports as well as protected species including common newt, otter and opposite-leaved pondweed.	4.5
Pallas Lough	pNHA	000916	The lake is a 'marl lake' and is of botanical interest due to the diversity of plant habitats and the species richness of those habitats. There are two small wet birch woods, and an area of limestone grassland which yields such species as Field Gentian (*Gentianella campestris*) and Centaury (*Centaurium erythraea*). Significant numbers of wildfowl and waders use the lake. The peripheral wet grassland is grazed in the winter by geese.	7
Annamore Lough Fen	pNHA	000413	A former lake, the area is now a peat accumulating, calcareous fen.	6
Ballyduff Wood	pNHA	001777	An area of beech woodland that is gaining a more natural composition through regeneration	7
River Barrow and River Nore	SAC	002162	The site is a SAC selected for alluvial wet woodlands and petrifying springs, priority habitats and also for old oak woodlands, floating river vegetation, estuary, tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, dry heath and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive - Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Nore Freshwater Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon, Otter, Desmoulin's Whorl Snail *Vertigo moulinsiana* and the Killarney Fern	5

Table 6.1 - *Continued* - Summary of designated sites within 10 km of the proposed development

Site Name	Designation	Site Code	Reason for Designation	Minimum Distance from Site (km) (approx.)
Kilcormac Esker	pNHA	000906	An esker with pockets of woodland containing abundant bluebell and primrose in the ground flora	8
Ballyduff Esker	pNHA	000885	This is one of the best known remaining eskers which still support an open and relatively natural flora.	8
Murphy's Bridge Esker	pNHA	001775	This site remains a good example of an intact esker and has a range of habitats. Of particular interest is its rich flora on exposed gravel slopes, which includes two rare species.	8.5
Slieve Bloom Mountains	SPA	004160	One of the recently designated SPAs for Hen Harriers	9.5



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Designated Sites within 10 km of Site Boundary

Figure 6.2

6.2.2 Habitats & Botanical Species in the Existing Environment

Eight dominant habitat types were identified at the site and in adjacent buffer zone (Figure 6.3). A total of 77 botanical species were recorded on the site and these are outlined, together with their scientific names, in Table 6.2.

The landfill site and buffer zone are dominated by refuse and other waste (ED5), spoil and bare ground (ED2), re-colonising bare ground (ED3) and a large area of cutover bog (PB4) found on the periphery of the site.

The active landfill site is the dominant habitat type and is classed as being refuse and other waste (ED5). Much of this area has now been capped and seeded with a wildflower/grass mix. In the mean time, the bare earth has provided suitable habitat for Oilseed Rape (*Brassica napus var. oleifera*) to colonise these areas. A small area of buildings and artificial surfaces (BL3) is found on the western edge of the site and comprises the entrance road, the western access road and the civic amenity facility. These are chiefly tarmac surfaces with very little vegetation.

Spoil and bare ground (ED2) habitat adjoins the landfill area. These are areas of bare ground that have recently been cleared or are the access tracks for vehicles to reach the active landfill area. Vegetation cover in these areas is very low and consists chiefly of colonising species such as annual meadow grass (*Poa annua*) and dandelion (*Taraxacum officinale* agg). To the east and south, these areas grade into re-colonising bare ground (ED3) habitat. The boundary between the two habitat types is not always clear and mosaics of the two occur. To the south, an area of raised ground has now been re-colonised with soft rush (*Juncus effusus*) with some willow (*Salix* sp.) saplings becoming established. Water can gather in some of the low lying areas and contains elements of wetland vegetation (eg sedges, lesser spearwort and celery-leaved buttercup) but these wet areas comprise only a small part of the habitat area.

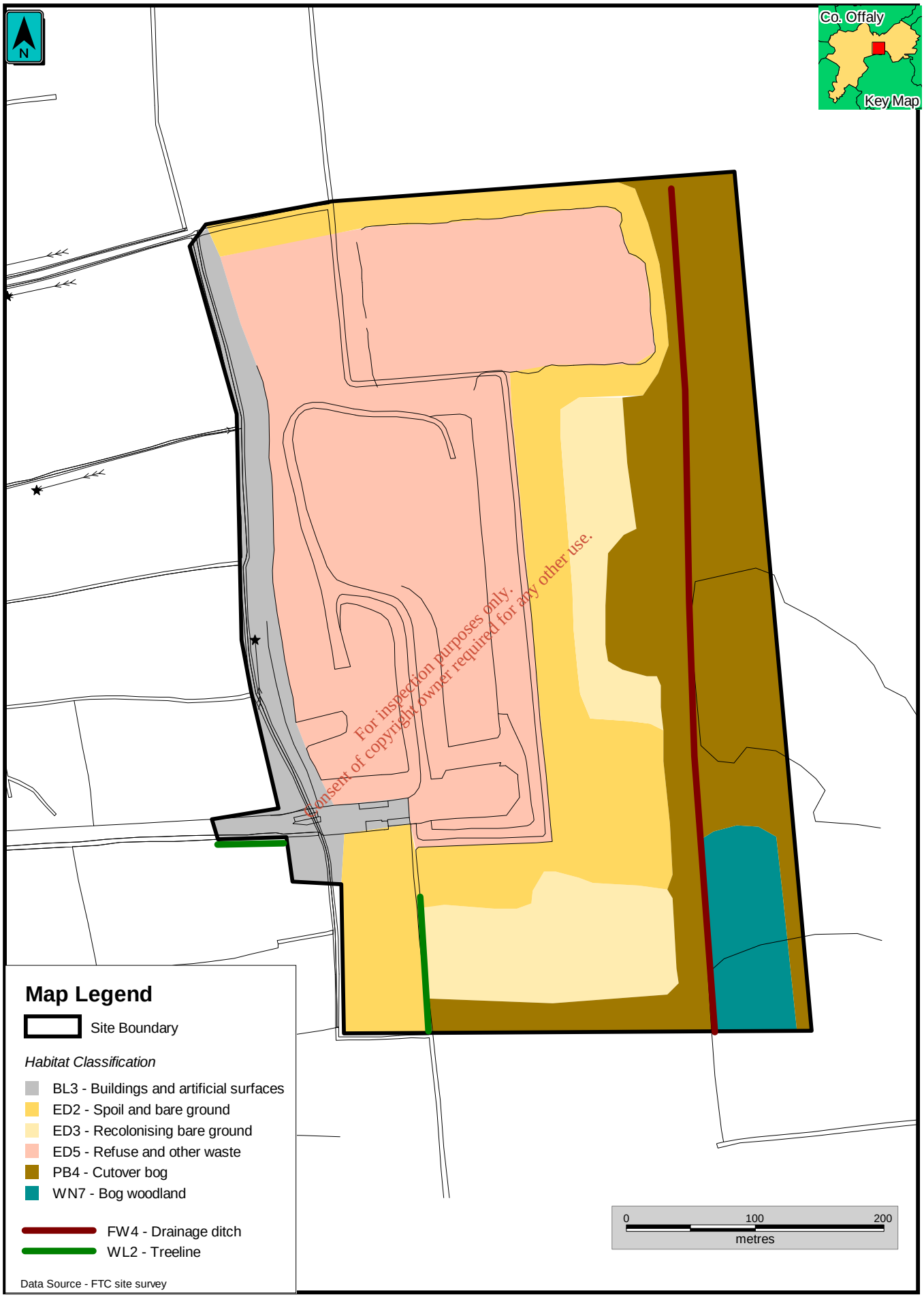
Cutover bog (PB4) habitat is found at the southern and eastern edges of the site. Numerous narrow drainage ditches are found throughout this area, frequently covered by the overhanging vegetation. The original bog habitat has been lost through drainage of the area and the original vegetation type has been altered so that now Heather (*Calluna vulgaris*) is the dominant plant species along with remnants of original bog species; cotton grasses (*Eriophorum* spp) and deer grass (*Trichophorum cespitosum*). Some *Sphagnum* mosses are still found within the area although conditions are not suitable for active bog growth. Birch (*Betula* sp) and Scot's pine (*Pinus sylvestris*) occurs within the cutover bog and this gradually increases towards the southeast corner of the site where it forms an area of bog woodland (WN7). The bog woodland area is dominated by Birch with Scot's Pine and Willow (*Salix* sp) being the other dominant tree species. The dominant species found beneath the canopy are Bramble (*Rubus fruticosus* agg), Ivy (*Hedera helix*) and Raspberry (*Rubus idaeus).*

A drainage ditch (FW4) runs the length of the site, from north to south through the cutover bog (PB4) area. It is up to 3 m deep with vertical sides. It contains little vegetation with some Water Starwort (*Callitriche* sp.) in patches. Spoil produced by excavation of this ditch has been deposited on the adjoining cutover bog (PB4) and bog woodland (WN7) habitats. This ditch opens into a network of drainage ditches that occur within the area of bog that is being harvested to the south of the site. This network of ditches eventually leads to a silt trap and settlement ponds (outside the boundary of Derryclure Landfill) which are part of the peat harvesting operation.

Two tree lines (WL2) were recorded on site. The first is a mature tree line that runs alongside the entrance road. The main tree species are Beech (*Fagus sylvatica*), Ash (*Fraxinus excelsior*) and Hazel (*Corylus avellana*) with some Pedunculate Oak (*Quercus robur*). The second tree line consists almost entirely of tall Birch. The site boundaries are chiefly post and wire fences alongside minor ditches with little ecological significance.

All the species recorded in this botanical survey are distributed in the general area (Webb *et al* 1996). In addition, no endangered species or Red Listed species of high conservation concern were recorded by this survey (Curtis & McGough, 1988).

The adjoining land to the west is improved agricultural fields, which are bounded by hedgerows and tree lines. The land to the north, east and south is cutover bog, with the land to the north and south still being actively worked.



Habitats Map

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Figure 6.3

Table 6.2: Summary of Botanical Species Recorded in the Survey Area

Common Name	Scientific Name	Habitat of occurrence
Ash	*Fraxinus excelsior*	WL2, WN7
Annual Meadow-grass	*Poa annua*	ED2, ED3
Birch	*Betula sp*	PB4, WN7
Beech	*Fagus sylvatica*	WL2
Bottle Sedge	*Carex rostrata*	ED3
Birds Foot Trefoil	*Lotus corniculatus*	WL2, ED3
Bracken	*Pteridium aquilinum*	WN7, PB4
Bramble	*Rubus fruticosus agg.*	WN7, PB4, ED3
Bullrush	*Typha latifolia*	ED3
Celery Leaved Buttercup	*Ranunculus sceleratus*	ED3
Cocksfoot	*Dactylis glomerata*	WL2, ED2, ED3
Coltsfoot	*Tussilago farfara*	BL3, ED2
Common Mouse-ear	*Cerartium fontanum*	ED2, ED3
Common Cotton-grass	*Eriophorum angustifolium*	PB4
Crack Willow	*Salix fragilis*	WN7
Creeping Bent	*Agrostis stolonifera*	ED2, ED3, PB4
Creeping Buttercup	*Ranunculus repens*	BL3, ED5, ED2
Creeping Cinquefoil	*Potentilla reptans*	ED2, ED3
Creeping Thistle	*Cirsium arvense*	BL3, ED2, ED3
Curled Dock	*Rumex crispus*	ED2, ED3
Dandelion	*Taraxacum officinale*	ED2, ED3, ED5
Dames Violet	*Hesperis matronalis*	ED3
Deer Grass	*Trichophorum cespitosum*	PB4, WN7
Dog Rose	*Rosa canina*	WL2, WN7
Gorse	*Ulex europaeus*	ED3
Cross-leaved Heath	*Erica tetralix*	PB4
Field Horsetail	*Equisetum arvense*	ED2, Ed3
Fools Watercress	*Apium nodiflorum*	FW4
Groundsel	*Senecio vulgaris*	ED3, BL3
Hairy sedge	*Carex hirta*	ED3, PB4
Hawthorn	*Crataegus monogyna*	WL2
Hazel	*Corylus avellana*	WL2
Harestail Cotton-grass	*Eriophorum vaginatum*	PB4
Heath Bedstraw	*Galium saxatile*	PB4, ED3
Heather	*Calluna vulgaris*	PB4, WN7
Herb Robert	*Geranium robertianum*	WL2
Hogweed	*Heracleum sphomdylium*	ED2, ED3
Holly	*Ilex aquifolium*	WL2
Ivy	*Hedera helix*	WL2, WN7
Jointed Rush	*Juncus articulatus*	ED3
Lady's Smock	*Cardamine pratensis*	ED2, ED3, PB4
Lesser Trefoil	*Trifolium dubian*	ED3
Marsh Thistle	*Cirsium palustre*	PB4
Marsh Willowherb	*Epilobium palustre*	ED3
Meadow Buttercup	*Ranunculus acris*	ED2, ED3, WL2
Meadowsweet	*Filipendula ulmaria*	WL2, ED3
Nettle	*Urtica dioica*	BL3

Common Name	Scientific Name	Habitat of occurrence
Ox-eye Daisy	*Leucanthemum vulgare*	ED3
Pedunculate Oak	*Quercus robur*	WL2
Perrenial Rye-grass	*Lolium perenne*	BL3, ED3
Pondweed	*Potomogeton sp*	FW4, ED3
Poppy	*Papaver sp*	BL3
Ragwort	*Senecio jacobaea*	ED3, ED5, BL3
Rape	*Brassica napus var. oleifera*	BL3, ED5
Raspberry	*Rubus idaeus*	WN7
Red Clover	*Trifolium pratense*	ED3
Red Dead Nettle	*Lamium purpureum*	ED2, ED3, BL3
Redshank	*Polygonum maculosa*	ED3
Reed Sweet Grass	*Glycerea maxima*	ED3
Ribwort Plantain	*Plantago lanceolata*	ED3, BL3
Rosebay Willowherb	*Chamerion angustifolium*	ED2, WL2
Rough Hawksbeard	*Crepis biennis*	ED3
Scarlet Pimpernel	*Anagallis arvensis*	ED3
Silverweed	*Potentilla anserina*	ED3, BL3
Smooth Hawksbeard	*Crepis capillaris*	ED3, PB4
Soft Rush	*Juncus effusus*	ED3
Spear Thistle	*Cirsium vulgare*	ED3
St John's Wort	*Hypercium sp*	ED3
Sweet Vernal Grass	*Anthoxanthum ordoratum*	ED3, PB4
Sycamore	*Acer pseudoplatanus*	WL2
Toad Rush	*Juncus bufonius*	ED2
Tormentil	*Potentilla erecta*	ED3
Tufted Vetch	*Vicia craca*	WL2
Water starwort	*Callitriche sp*	FW4
White Clover	*Trifolium repens*	ED2, ED3
Willow	*Salix sp*	WN7, PB4
Yorkshire Fog	*Holcus lanatus*	ED2, ED3, PB4

6.2.3 Fauna in Existing Environment

Mammal Species in the Existing Environment

A total of three mammal species (excluding bats) were recorded using the site. Fox (*Vulpes vulpes)* tracks were found in the eastern part of the site, particularly in the steep sides of the drainage ditch where mammals were obviously using this path as an access and exit point.

Similarly, numerous Fallow Deer (*Dama dama*) tracks were found in the soft ground alongside the boundary fence on the eastern site boundary. A high count of Fallow Deer tracks were discovered in the area of harvested bog to the south of the site (outside of the Derryclure facility), indicating a healthy population of deer in this area. Fallow deer are a protected game species under the Irish Wildlife acts and may only be hunted with a licence from the National Parks and Wildlife Service (NPWS). Fallow bucks may be hunted from September 1st until December 31st and does may be hunted from November 1st to February 28th

The remote trail camera recorded the presence of feral cats (*Felis cattus*). Several individuals were observed on-site during the course of the survey.

Neither fox nor feral cat are protected by legislation or listed in the Irish Red Data Book (Whilde, 1993). Given the habitats available at the site and surrounding area, other mammal species, not recorded by this study, are likely to pass through or use the site from time to time (e.g. Pygmy Shrew, *Sorex minutes* Brown Rat, *Rattus norvegicus*).

Bat Species in the Existing Environment

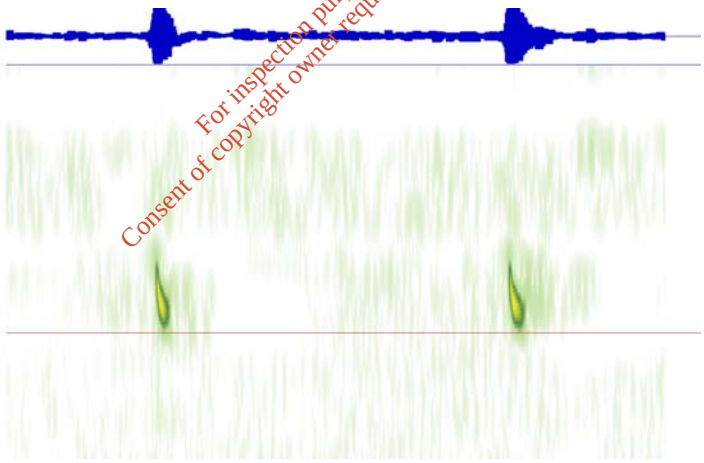
The Soprano Pipistrelle Bat, *Pipistrellus pygmaeus* was confirmed to occur on the site using a bat detector (see Figure 6.4). The closely related Common Pipistrelle, *Pipistrellus pipistrellus* was also present, but in much smaller numbers (see Figure 6.5). Bat activity was low on the site and was restricted to a few localised areas.

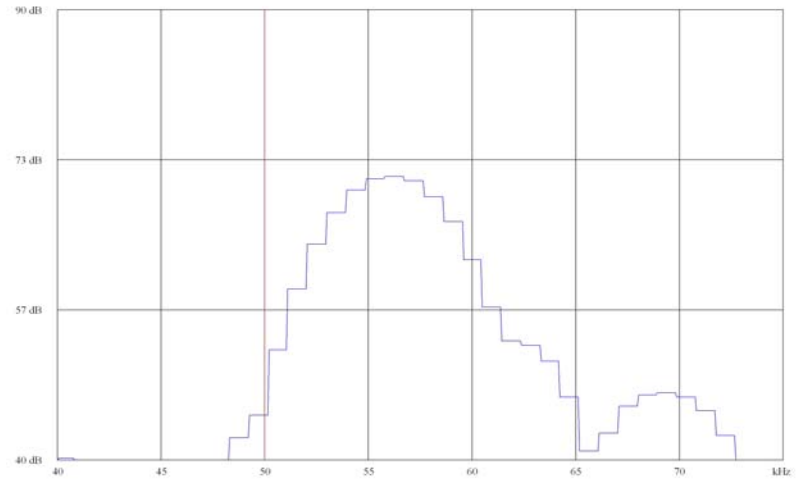
Pipistrelles were recorded around an area of standing water in the active cell region of the site as well as along the tree lines in the southwest of the site.

There was no evidence of any roost at the site. Furthermore, there was no obvious emergence or return pattern that might indicate the presence of roosting bats.

Figure 6.4: Sound analysis for Soprano Pipistrell

a) Sonogram b) Power Spectrum – note peak at approx 55kHz

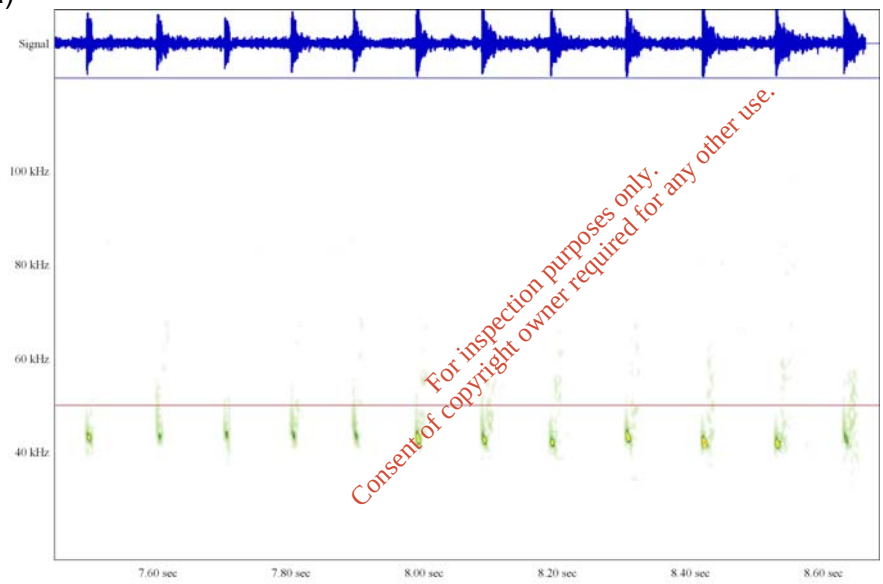




b)

Figure 6.5: Sound Analysis of Common Pipistrell

a)



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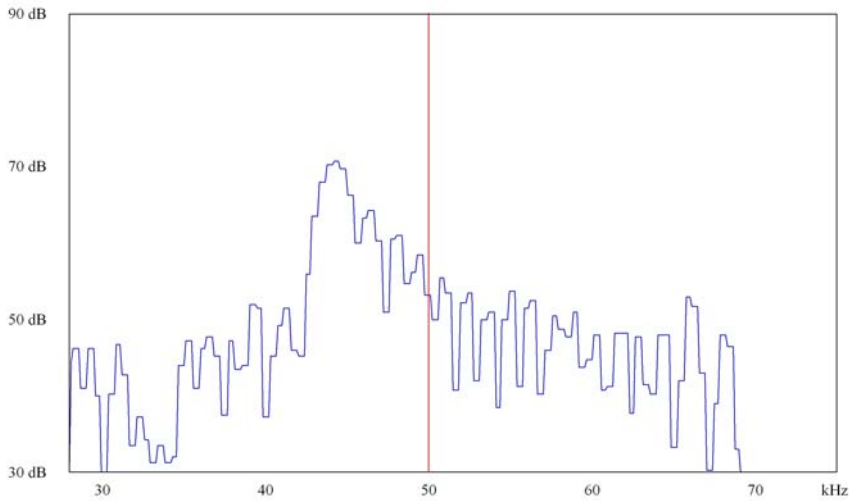


Birds in the Existing Environment

Table 6.3 shows the species recorded on the five transects during the on-site avian surveys. In total, 36 species were recorded on the survey transects. An additional six species; Long-tailed tit (*Aegithalos caudatus*), Mallard (*Anas platyrhynchos*), Skylark (*Alauda arvensis*), Spotted Flycatcher (*Musciapa striata*), Siskin (*Carduelis spinus*) and Treecreeper (*Certhia familiaris*) were recorded whilst undertaking other survey work. Rook (*Corvus frugilegus*) was the most abundant species occurring on site and is recorded as 'abundant' as more than 50 individuals were noted on five transects and in excess of 200 birds were recorded on Transect 5. Casual records noted during other survey work also record high numbers of Rooks and Jackdaws with a mixed flock of c.85 corvids loafing on adjacent field (corvid is a term to describe any member of the crow family, in this case it refers to Jackdaws and Rooks), 350 birds disturbed from the surrounding trees and an early morning record of an estimated flock of 800 corvids, the majority of which were Rook.

High numbers of Rooks are to be expected given that areas within the landfill site and on the surrounding harvested bog areas provide foraging habitat for Rooks. In addition, the areas of mature trees that are found just off site also provide roosting and loafing sites for the birds if they are disturbed from the landfill site.

A maximum total number of 50 Wrens (*Troglodytes troglodytes*) were recorded on the survey transects. Wren were also recorded on all transects. It is a common species found throughout Ireland and in a wide variety of habitats.

All transects showed a similar range and number of species with the exception of Transect 5. Transect 5 ran over the top of the capped area of the existing landfill, which has recently been seeded but currently has very little vegetation cover, whilst all of the other transects include areas of vegetation and birds could also be detected in nearby areas of tree cover, increasing the range of species recorded. Results from the transects indicate that the majority of the bird species recorded are associated with habitats that lie outside the landfill boundary and that only a limited number of species occur on the landfill itself. The species that do occur on the landfill are chiefly Rooks and Jackdaws, although they do occur in large numbers.

The transect of highest species richness (17 species) was Transect 2, which ran through the agricultural fields with their associated hedgerows and also included an area of mature trees that lie outside the site boundary. Goldfinch (*Carduelis carduelis*), Lesser Black-Backed Gull (*Larus fuscus*) and Pheasant (*Phasianus colchicus*) were recorded exclusively here.

Table 6.3 shows that two species that were recorded on site are red listed under the review of the Birds of Conservation Concern in Ireland (BoCCI) (Lynas *et al*, 2007); Black-Headed Gull (*Larus ridibundus*) and Herring Gull (*Larus argentatus* as their breeding population has declined by more than 50% over the last 25 years. Four amber listed species occur at this site: Lesser Black-backed gull, Linnet (*Carduelis cannabina*), Starling (*Sturnus vulgaris*) and Swallow (*Hirundo rustica*).

The remainder of species observed during the on-site survey are common birds, locally and nationally and are not believed to be of any elevated conservation concern.

Table 6.3: Avian Species Recorded During the Site Survey, June 2008

Common Name	Scientific Name	Visit 1	Visit 2	Max no	BoCCI Status
Blackbird	*Turdus merula*	15	5	15	Green
Blackcap	*Sylvia atricapilla*	2	0	2	Green
Black-headed Gull	*Larus ridibundus*	12	0	12	Red
Blue Tit	*Parus caeruleus*	3	4	4	Green
Bullfinch	*Pyrrhula pyrrhula*	2	0	2	Green
Chaffinch	*Fringilla coelebs*	17	5	17	Green
Coal Tit	*Parus ater*	9	0	9	Green
Dunnock	*Prunella modularis*	2	2	2	Green
Goldcrest	*Regulus regulus*	6	8	8	Green
Goldfinch	*Carduelis carduelis*	3	0	3	Green
Great Tit	*Parus major*	3	0	3	Green
Greenfinch	*Carduelis chloris*	3	0	3	Green
Grey Heron	*Ardea cinerea*	4	0	4	Green
Herring Gull	*Larus argentatus*	1	0	1	Red
Hooded Crow	*Corvus corone cornix*	5	0	5	Green
Jackdaw	*Corvus monedula*	36	20	36	Green
Lesser Black-backed Gull	*Larus fuscus*	3	17	17	Amber
Linnet	*Carduelis cannabina*	3	11	11	Amber
Magpie	*Pica pica*	9	8	9	Green
Meadow Pipit	*Anthus pratensis*	4	3	4	Green
Mistle Thrush	*Turdus viscivorus*	1	0	1	Green
Pheasant	*Phasianus colchicus*	1	0	1	Green
Pied Wagtail	*Motacilla alba*	8	6	8	Green
Redpoll	*Carduelis flammea*	0	3	3	Green
Reed Bunting	*Emberiza schoeniclus*	2	0	2	Green
Robin	*Erithacus rubecula*	20	8	20	Green
Rook	*Corvus frugilegus*	Abundant	Abundant	Abundant	Green
Song Thrush	*Turdus philomelos*	12	4	12	Green
Starling	*Sturnus vulgaris*	4	7	7	Amber
Stonechat	*Saxicola torquata*	5	4	5	Green
Swallow	*Hirundo rustica*	7	2	7	Amber
Swift	*Apus apus*	0	1	1	Green
Whitethroat	*Sylvia communis*	1	0	1	Green
Willow Warbler	*Phylloscopus trochilus*	20	14	20	Green
Wood Pigeon	*Columba palumbus*	15	13	15	Green
Wren	*Troglodytes troglodytes*	50	20	50	Green

Other Fauna

The only other species of note recorded was a single Common Frog (*Rana temporaria*) which was found in an area of long vegetation within the recolonising bare ground habitat (ED3). Common frogs are largely terrestrial outside the breeding season, and can be found in a wide variety of habitats and are widely distributed throughout Ireland. They breed in puddles, ponds, lakes and canals, preferring areas of shallow water. The Common Frog is protected under the Irish Wildlife Acts and is on the Red list of threatened vertebrates in Ireland (Whilde, 1993).

6.3 Potential Impacts of the Proposed Development on Ecology

6.3.1 Potential Impacts on Designated Areas

The landfill site and the surrounding buffer zone do not lie within or adjacent to any site that has been designated for nature conservation and the proposed development will not lead to any direct impact on any designated site.

6.3.2 Potential Impacts on Habitats and Flora

There will be no increase in the existing footprint of the landfill arising from the proposed development and as a result, there will be no loss of habitat through direct removal. An increase in waste intake will result in an increase in traffic and potentially an increase in dust and noise. Dust has the potential to damage certain plants and can lead to an increase in coarse rank vegetation. The tree line along the entrance road may intercept some dust however, the under-storey of this tree line contains common species and as there is little vegetation within the landfill itself, any impact arising from dust deposition is likely to be insignificant.

6.3.3 Potential Impacts on Fauna

Mammals

There does not appear to be a diverse mammalian fauna at the site and mammal activity is restricted almost exclusively to the buffer zones. The species assemblage is dominated by Foxes and Fallow Deer, which are abundant throughout the buffer zone of the site and the adjoining land. Feral Cat was also present. There will be no impact from the proposed development on the mammal species currently found on site.

Bats

Bat activity was low on the site and restricted to a small number of tree lines and artificial standing water areas in the south of the site. The two species of bat (Common and Soprano Pipistrelle) recorded on the site are the most common and second most common species in Ireland respectively (Roche *et al*., 2005). Both species commonly roost in buildings with the Soprano Pipistrelle believed to form much larger roosts. Both species recorded at the site can travel up to several kilometres a night to feeding grounds.

There was no evidence of any roosts of these species in the proposed extension zone. Given the availability of alternative feeding sites and the apparent lack of suitable roost sites, it is unlikely that there will be any adverse impact on the locally occurring bats. .

Birds

The avian community at the site is dominated by Rooks and Jackdaws, birds that are using the adjacent trees for roosting and the capped landfill area and surrounding fields for foraging. The landfill operator uses a bird management company to control numbers of birds at the site but large numbers of corvids are still present at the site.

The existing avian community uses this area with the landfill site already in operation and with the background of an existing bird management regime. No habitat changes will occur as a result of the proposed development and therefore there is no predicted impact on the avian community at this site.

6.4 Mitigation Measures for Ecology

6.4.1 Mitigation Measures

No additional mitigation measures above those required by the current waste licence are needed to alleviate any potential impacts to the ecology of the development site and the surrounding area resulting from the proposed intensification of the disposal rate.

6.5 Conclusions for Ecology

The survey details the local flora and fauna community at the landfill site and surrounding buffer zone. The regions of greatest species diversity occurred in re-colonising bare ground and cutover bog habitats. The flora and fauna species recorded were well represented in the surrounding area and were not of high conservation concern. As the intensification of the landfill will occur within the already permitted boundary of the landfill, there will be no significant impact on the ecological environment.

7. LANDSCAPE

This chapter describes the existing landscape, the visual character of the existing Derryclure landfill development and the potential visual impact of the proposed intensification of waste acceptance on the landscape.

In this context, the term 'landscape' refers primarily to the visual appearance of the area, including its shape, form and colour, and the interaction of these elements to create specific patterns that are distinctive to particular localities. However, the landscape character is also a function of the local physical geography and environmental history. It covers items such as:

- topography
- ecology
- landscape history
- land use
- buildings and settlement
- architecture

This chapter deals with these factors only in so far as the development may impinge on the landscape and visual characteristics of the locality, setting out how the proposed development interacts with them and specifying any significant visual effects.

7.1 Existing Landscape

7.1.1 Surrounding Landscape

The surrounding area comprises of generally flat terrain at approximately 80 mOD with a gentle slope in a westerly direction towards the Clodiagh River. The northern, southern and eastern sides of the landfill perimeter are bounded by raised peatlands. The western perimeter of the facility is bounded by grazed agricultural land. Both the peatland and the grazing pasture areas are divided by cross sections of hedgerows and deciduous tree lines. The surrounding area also has a number of scattered woodlands in the landscape.

7.1.2 Site Development/ Existing Facility Landscape

Derryclure landfill began accepting waste in c. 1977 and has been part of the landscape for approximately 30 years. The unlined cell reached capacity in late 2006 and has since been restored with a fully engineered cap. The capped unlined cell is visible from the adjacent N80. The maximum level on top of the cap is +95.70 mOD. This cap has been planted with a wildflower/meadow grass mix in the ratio of 20:80, with flowers of variable seasonality selected to maximize the visual effect throughout the spring/summer seasons. The capped portion of the landfill is the predominant feature on the site at present.

Offaly County Council has received statutory permission to construct a further nine lined cells at the facility, to maximise the use of lands available for landfill development. Two of these nine cells have been constructed and currently filled to approximately 50% capacity. These cells are located to the north, north east of the capped cell. The remaining cells will be constructed to the east and the south of the capped cell. This area is currently dominated by spoil and bare ground, cut over bog and bog woodland.

In an EIS prepared by Bord Na Mona in 2001 for the extension of the facility, a detailed restoration and aftercare plan was outlined. From this, it is proposed to cap all future cells to a similar specification to the capped cell. The objective of this landscaping plan is to integrate the landfill visually with the surrounding landscape, and also to minimise the visual intrusion of the facility. The planting regime will also provide a natural habitat to encourage biodiversity, attracting insect species such as moths and butterflies, which in turn will attract varies avian species. The restoration contours and landscape plan for the facility is include overleaf.

7.1.3 Visual Envelope

Due to the low-lying topography, the distance between houses and roads to the north, south and east of the facility and screening vegetation, visibility of the facility is limited in these directions. However, to the west of the facility views of the landfill are available from the N80.

7.1.4 Landscape Character - County Offaly

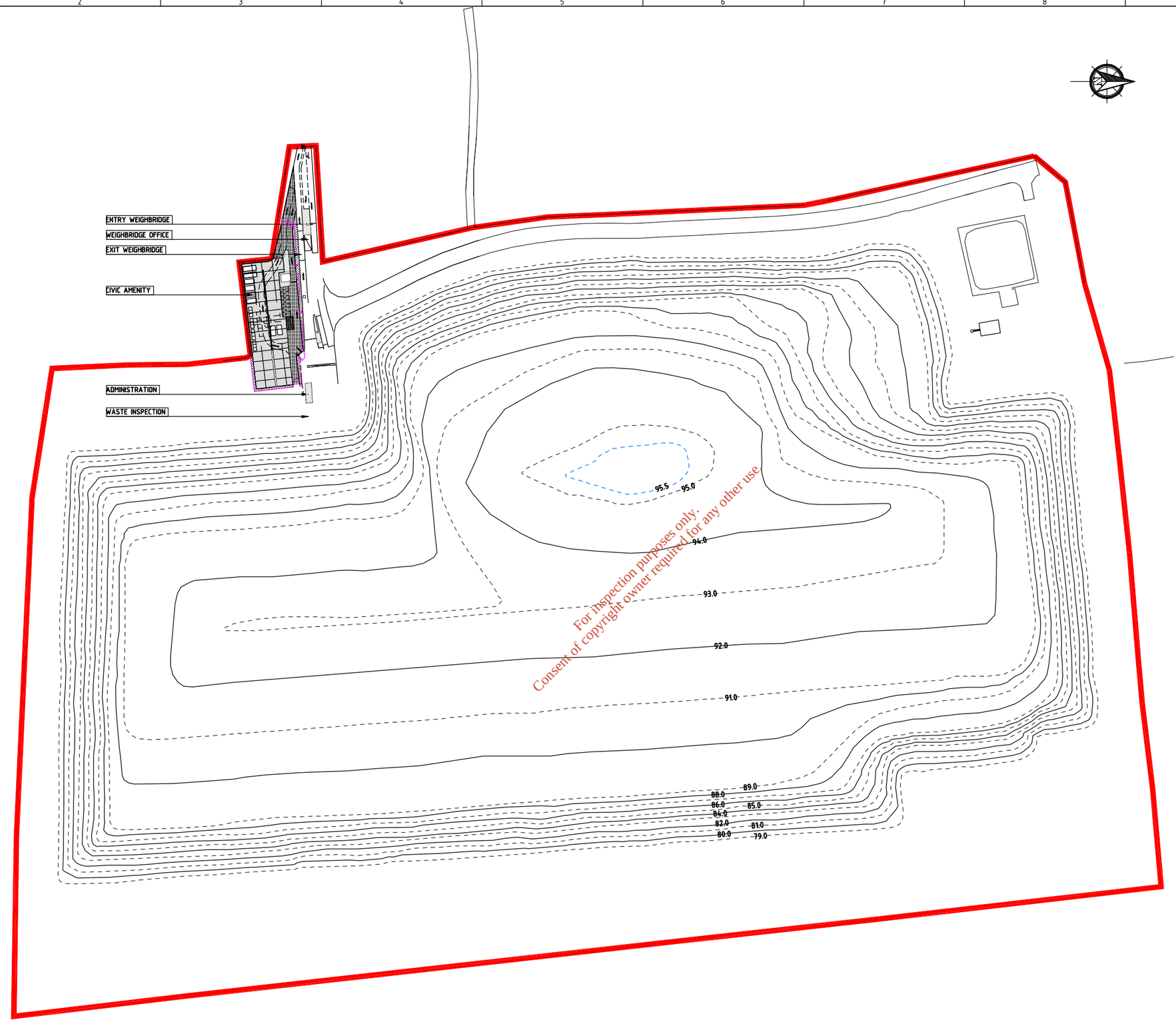
Offaly County Council have carried out a Landscape Character Assessment of the county in compliance with the Local Government (Planning and Development) Act, 2000 and the Governments Draft Guidelines for Landscape and Landscape Assessment (2000). This has resulted in the different landscape areas of County Offaly being characterised in relation to their values and degree of sensitivity to development.

The peatlands to the north, south and east of the facility are considered of moderate sensitivity. Cutaway bogs cover a large part of the landscape of Offaly and cutaway bog landscape is considered in the county development plan to be “potentially valuable as a “green” backdrop to future development”. The agricultural grazing land to the west of the facility is considered of low sensitivity and is able to absorb appropriately designed and located development.

County Scenic Routes

Offaly County Council aims to protect the visual and scenic amenities of Offaly’s built and natural environment. A number of scenic routes have been identified in the County Development Plan. Two scenic routes ate located within 10 km of the development.

V1 is just west and south of the development along the N80 through the townlands of Ballynasragh, Pigeonhouse, Killeigh, Derryclure, Derrybeg and Cloncon. This view is focused to the south and west towards the Slieve Bloom Mountains and Killeigh Village.



NOTE

All Finally Capped Areas to be Landscaped With a Wildflower/Meadow Grass Mix

Rev.	Drawn	Chkd	Appd		
A	MM	SM	DO'S	Cork 21.10.08	ISSUE FOR APPROVAL
				Rev Origin / Date	Description

Revision History: A

Name of Client

OFFALY COUNTY COUNCIL

Name of Job

DERRYCLURE LANDFILL WASTE LICENCE REVIEW

Title of Drawing

FINAL CONTOURS & LANDSCAPING PLAN

Scales Used
1:2500

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V5 approximately 8 km west of the facility along the N52 in the townland of Heath, Bunaterin, Derrydolney, Ballywilliam, Curraghmore, Ballynacard and Bally na Curra. This view is also focused south east towards the Slieve Bloom Mountains

Visibility of the facility from the V1 route is available; however some screening by vegetation especially to the south of the facility limits visibility in this direction. The landfill does not impact on the scenic view from this road as it is focused to the south and west away from the landfill facility.

The V5 viewpoint is 5 km away from the landfill facility and due to this distance and screening by woodlands and vegetation, the landfill is not visible and does not impact on this viewpoint.

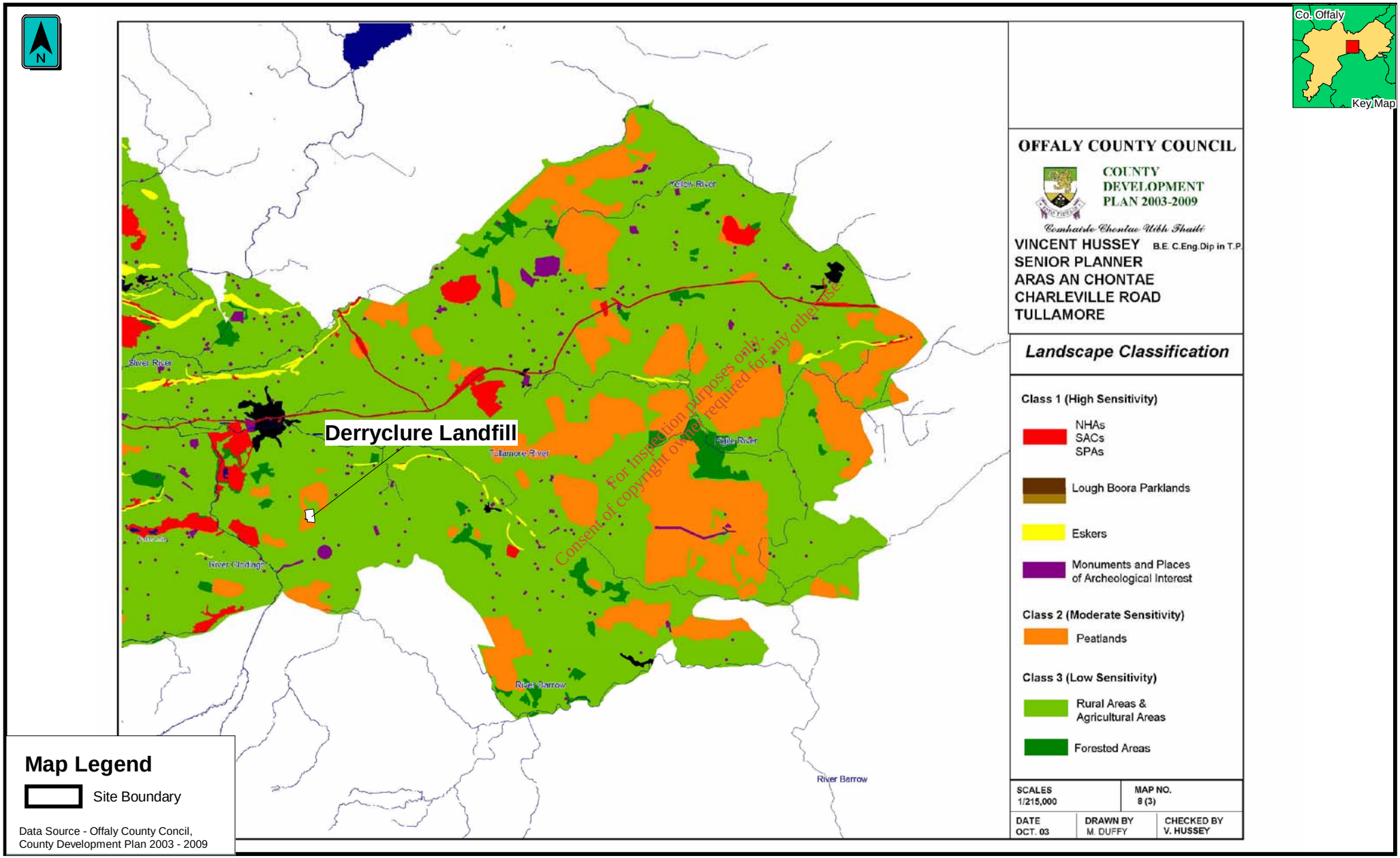
Environmentally Designated Areas

There are no areas of high amenity in proximity to the facility however; there are approximately ten environmentally designated areas within 10 km of the facility (refer to Chapter 6). Visibility is limited from the nearest designated areas due to distance and screening by hedgerows and tree stands.

Archaeological and Architectural Features

There are ten sites and monuments and eleven architectural heritage sites within 2 km of the facility. Only one feature from the sites and monuments record is within 1 km (652 m) of the site boundary and that is a mound located at Derrybeg.

There are two houses within 1 km (426 and 774 m) on the National Inventory of Architectural Heritage (NIAH) record and these are also located in Derrybeg. The landfill has no physical impact on such features. The landfill development is currently visible from these features however; screening by vegetation reduces the impact of the development on these locations.



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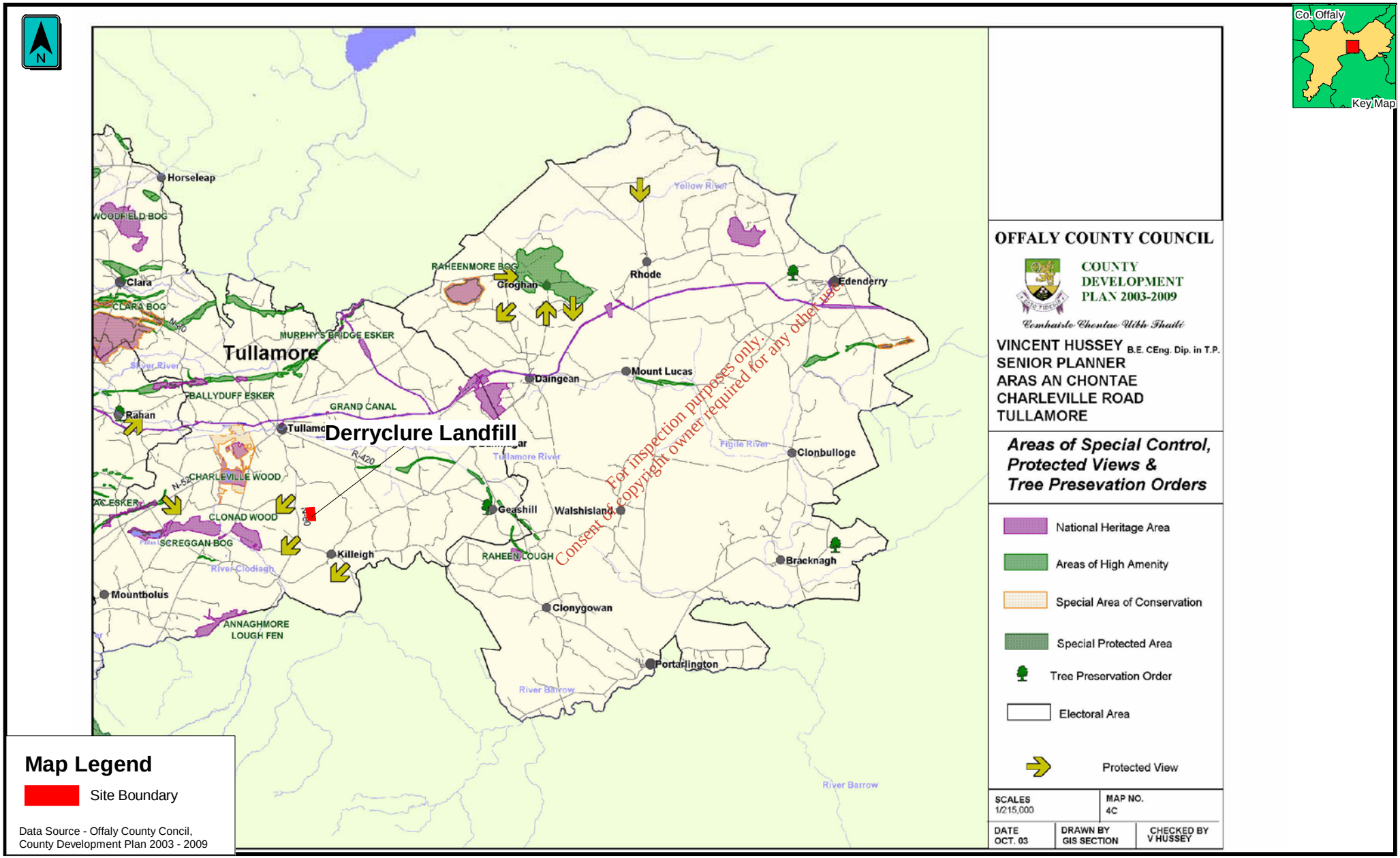
Landscape Classification

Figure 7.2



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Areas of Special Control and Protected Views

Figure 7.3

7.2 Potential Visual and Landscape Impacts

7.2.1 Visual Impact Assessment

Visual impacts are defined as 'Visual Intrusion' and 'Visual Obstruction' as follows:

- Visual Intrusion is concerned with the relative perception of visual impact based on the degree to which the proposal or its associated features and/or operation impinge on a view without blocking it
- Visual Obstruction is defined as the blocking of a view by the proposal or its associated features and/or operation.

Impacts can be indirect, secondary or cumulative. Visual impacts can occur because of intrusion and/or obstruction. They are dependant on the degree of change to an existing view resulting from various factors including:

- contrast between the existing and proposed view
- removal of existing features
- alteration of landform and topography
- proximity of the viewpoint
- elevation of the development.

Visual impacts by means of intrusion or obstruction on a particular view may be viewed as positive, neutral or negative and can be rated under the *"Guidelines on the information to be contained in Environmental Impact Statements"* (EPA, 2002) as listed in Table 7.1 below:

Table 7.1: Definitions of Visual Impact Ratings

Impact Rating	EPA Rating	Definition
No/Little Impact	Imperceptible	Not quantifiable and without noticeable consequences.
Slight	Slight	Arises where views affected by the proposed scheme form only a small element in the overall panorama or where there is substantial intervening screening in the form of topography and/or vegetation.
Moderate	Moderate	Arises where an appreciable segment of the existing view is affected or where there is intrusion in the foreground. Changes do not substantially alter the overall scene.
Significant	Significant	Arises where the proposed scheme has a significant effect on the existing view or where the view is obstructed or so dominated by the proposed scheme that it becomes the focus of attention. Generally, there will be open views of the development located in the foreground. Visual obstruction may impinge on the skyline.
Severe	Profound	Arises where the proposed scheme alters the existing visual environment or so completely block an existing view as to entirely eliminate the existing visual character.

In line with EPA recommendations, impacts are also classified as:

- temporary (associated with construction, lasting between one year or less)
- short-term (initial operation prior to mitigation establishment, lasting between 1 to 7 years)
- medium term (lasting between 7 to 15 years)
- long-term (lasting in excess of 15 to 60 years)
- permanent (lasting over 60 years)

7.2.2 Potential Visual Impacts

The proposed development is for the intensification of waste intake only and additional construction will be not required as part of this proposal (above that already granted). The proposed development does not propose to visibly alter or change any of the future cell extension developments or restoration plans that have received statutory approval previously. Therefore, there will be no increased impact on existing views from the proposed development over and above what is already permitted. The elevation, landform and topography will not be altered from that which was proposed in the restoration plan previously approved by the EPA.

A positive impact of the proposed development is that the site will be filled and restored in a shorter time frame reducing the lifetime of the landfill from 24 years to 9.5 years and thus decrease the visual impacts from long-term to medium term. The proposed development will lead to earlier remediation of the facility and the early development of a natural habitat that will foster biodiversity of flora and fauna.

7.3 Mitigation Measures

No further mitigation measures are required other than the installation of the mitigation measures specified for the extension of the facility in the previous EIS prepared to accompany the application for waste licence W0029-02.

The capping and restoration of the older unlined cell has reduced the visual impact of the facility in the area, especially where visibility is highest to the west of the facility. Offaly County Council will also complete the filling to final level of the western side of the current active cells and then fill eastwards. This will allow the most visible active cell area to be covered with a clay layer as soon as possible, and will reduce the visible impact from the west and the north to short term. These restored areas will also act as a screen to minimise the visual impact of the construction and filling of the new lined cells to the east and south of the facility.

7.4 Conclusions on Landscape Assessment

A desk top study established landscape character, scenic routes, environmental designated areas and archaeological and architectural features within 10 km of the site boundary.

The proposed development will not require any additional physical infrastructure to be constructed, therefore there will be no adverse visual impact from the proposed development.

A positive impact on the landscape will be the reduction of the lifetime of the landfill and thus the reduction of the visual impacts from long-term to medium term.

8. ARCHAEOLOGY, ARCHITECTURE AND CULTURAL HERITAGE

This section assesses the impacts, if any, of the proposed intensification of waste acceptance at the facility on the archaeological, historical and cultural environment in the vicinity of the site. This section will also propose mitigation measures to safeguard any monuments, features or finds of antiquity if required.

The objectives of this section are to:

- Identify all known features of archaeological, architectural and cultural heritage importance in the vicinity of the proposed development.
- Determine any potential impacts of the proposed development on archaeology, architecture and cultural heritage.
- Identify measures to mitigate any potential impacts of the development on archaeology, architecture and cultural heritage.

8.1 Methodology

A desk-based assessment of existing records as well as other potentially relevant sources was undertaken within 1 km of the site boundary. The following legislation and guidelines were consulted in the production of this section:

- National Monuments Act, 1930-2004
- Heritage act, 1995
- '*Guidelines on the information to be contained in Environmental Impact Statements*' 2002, EPA.

The following information sources were consulted to determine the presence of relevant records in the vicinity of Derryclure landfill:

- Department of the Environment, Heritage and Local Government – Sites and Monuments Record.
- Excavation Bulletin (www.excavations.ie).
- Department of the Environment, Heritage and Local Government - National Inventory of Architectural Heritage (NIAH).
- Offaly County Council – Draft County Development Plan 2009 – 2013.

8.2 Archaeology, Architecture & Cultural Heritage in the Existing Environment

8.2.1 Sites and Monuments Record

The Sites & Monuments Record (SMR) consists of Ordnance Survey 6-inch maps with annotated known and suspected archaeological sites that generally pre-date AD 1700.

The SMR was collated from documentary sources; various editions of Ordnance Survey maps, aerial photography, historical and archaeological literature, seventeenth century Down Survey and Civil Survey maps, eighteenth century estate maps and folklore/oral traditions.

The proposed development site is not within an area of archaeological interest in terms of recorded archaeological monuments. There is one recorded site (OF01161) within a 1 km radius of the proposed development site (Table 8.1 and Figure 8.1). There are a further 9 sites within a 2 km radius with the majority in a cluster to the southeast around the existing town of Killeigh, which was the site of an Early Christian monastery dating from around the 12th century.

Table 8.1: Sites and monuments within 2 km of the site boundary

Entity ID	Distance to Boundary (m)	Easting (ING)	Northing (ING)	Townland	Class
OF01161	652	234758	221181	Derrybeg (Geashill By.)	Mound
OF01167	1318	236540	219000	Graigue	Enclosure possible
OF01162	1579	237190	221270	Killeenmore	Enclosure
OF01185	1733	236640	218570	Millbrook	Ringfort - Rath possible
OF01189	1761	236660	218550	Millbrook	Mound possible
OF01180	1813	236541	218429	Millbrook	Religious House - Augustinian Canons
OF01183	1871	236274	218269	Killeigh	Ritual Site - Holy Well
OF01192	1980	236593	218269	Killeigh	Castle - Unclassified possible
OF04612	1993	236600	218257	Killeigh	Architectural Fragment(s)
OF01186	1998	236577	218242	Ballinvally, Killeigh, Millbrook	Souterrain possible

8.2.2 Excavation Bulletin

This database contains summary accounts of all the excavations carried out in Ireland – North and Republic from 1970 to 2004.

A pre-development walkover and subsequent testing was carried out at Derryclure Bog in 2004 (Site Number - 2004:1406) which is adjacent to the proposed development. No archaeology was uncovered in the course of the investigation.

8.2.3 National Inventory of Architectural Heritage (NIAH)

The purpose of the NIAH is to identify, record, and evaluate the post-1700 architectural heritage of Ireland, uniformly and consistently to aid in the protection and conservation of the built heritage.

Two houses of architectural and technical interest have been recorded (14925002 and 14925010) within 1 km of the site boundary. There are a further 9 within 2 km, mainly centered in the vicinity of the existing town of Killeigh, south east of the landfill (Table 8.2 and Figure 8.1).

Table 8.2: National Inventory of Architectural records within 2km of Site

Reg Number	Name	Distance to Site Boundary (m)	Original Use	Date	Rating	Townland	Categories Of Special Interest	Easting (ING)	Northing (ING)
14925002	House	425.8	House	1780-1820	Regional	Derrybeg (Bb. By.)	Architectural Technical	234826	220867
14925010	House	773.7	House	1780-1820	Regional	Derrybeg (Bb. By.)	Architectural Technical	234645	221245
14925001	House	1134.0	House	1780-1820	Regional	Hawkswood	Architectural Technical	234358	219505
14813011	House	1190.6	House	1780-1820	Regional	Killeigh	Architectural Technical	235531	218873
14917009	House	1271.1	House	1780-1820	Regional	Cloncon	Architectural Technical	235722	222077
14917027	Clonminch Cemetery	1831.1	Graveyard / Cemetery	1850-1860	Regional	Clonminch	Architectural Social	234960	222557
14813003	Farmyard Complex	1849.6	Farmyard Complex	1840 - 1880	Regional	Killeigh	Architectural Technical	236535	218361
14813009	Gates / Railings / Walls	1904.8	Gates / Railings / Walls	1800-1820	Regional	Killeigh	Architectural Artistic Social Technical	236815	218420
14813004	House	1912.6	Forge / Smithy	1840 - 1880	Regional	Killeigh	Architectural Technical	236636	218353
14813005	House	1965.1	Presbytery / Parochial House	1820-1860	Regional	Killeigh	Architectural	236710	218330
14813002	The Abbey Farm	1973.9	House	1780-1820	National	Killeigh	Architectural Archaeological Historical Technical	236585	218257

8.2.4 Offaly County Council – Draft County Development Plan 2009 – 2013

The Draft County Development Plan 2009 – 2013 identifies protected structures within the County, none of which are recorded within 1 km of the site other than those listed in the National Inventory of Architectural Heritage above.

8.3 Potential impacts of the proposed development on Archaeology, Architecture and Cultural Heritage

The proposed intensification of Derryclure landfill will occur within the existing site boundary. An extension to the landfill footprint will not be required. Therefore the proposed development will not have a significant impact on archaeology, architecture or cultural heritage in the surrounding area.

The proposed development is not expected to further degrade the existing views from features of cultural heritage in the area. Visual impacts from the proposed development have been discussed in greater detail in Chapter 7.

8.4 Mitigation Measures

Avoidance of known archaeological, architectural or cultural heritage is the favoured option where possible. From previous investigations there are no recorded features within the site boundary. As the proposed development will not require any further construction no mitigation measures are required. Features of significance outside the site boundary are located greater than 1 km from the facility; therefore no mitigation measures are required for these features.

8.5 Conclusions on Archaeology, Architecture and Cultural Heritage

Given the nature of the development and the absence of identifiable archaeological monuments on the site no direct mitigation measures need to be put into place.

9. THE DEVELOPMENT & ITS IMPACTS IN CONTEXT

Chapters 3 to 8 outline the impacts of the proposed intensification of waste intake on environmental aspects such as surface water, groundwater, ecology and human beings. Interactions between impacts can also occur when the impact caused by the project causes interaction or dependency with other environmental aspects. This section discusses the interaction between impacts and assesses them as positive, negative or neutral (as having no interaction or interdependency). Figure 9.1 is a matrix showing the interactions.

9.1 Interactions

Traffic

The intensification of waste intake results in increased traffic movement on the N80 before accessing the site. This increase will cause a negative imperceptible impact on the climate.

The increased traffic flows will also cause a corresponding slight increase in noise level and a slight decrease in air quality due to increased traffic to the landfill. There will also be greater visual impact from the increased traffic movements on the N80, impacting predominantly on local road users and residents.

Because OCC will improve the N80/site road junction by providing a 'right-turn lane', there will be a net reduction in traffic hazard.

Noise

Both the increased traffic flows and the intensified waste deposition works will have an imperceptible short to medium term noise effect on human beings in the environment. The noise model in Section 3 predicts that resulting noise from the intensification of waste intake will remain compliant with the EPA waste licence noise emission limits. There will be a positive impact in the medium term because as the landfill will be filled and closed earlier, the potential source of noise generation will be eliminated earlier.

Landscape and Visual Impact

As discussed above, there is a slight negative impact from traffic on the landscape due to increased HGVs on the N80. However, the proposed development will result in accelerated landfilling; consequently the period of possible visible impact of exposed waste is reduced. The accelerated remediation, capping and landscaping of the waste mass will improve the visual impact of the facility. This implies a positive interaction with ecology as the landscaping plan will encourage biodiversity at the facility.

Air Quality

The proposed development implies a positive interaction between air quality and climate. The proposed intensification of waste intake will allow sufficient landfill gas generation to make feasible installation of a gas utilisation plant. This will reduce the odour potential for landfill gas. This also positively impacts the climate as the methane in the landfill gas is converted to carbon dioxide, a much less harmful greenhouse gas, and the utilisation of methane as a fuel source displaces the need to use other fossil fuels for power generation.

Surface Water/Groundwater

The proposed development will result in a significant positive impact on surface water and groundwater. The volume of leachate generated at the facility will be significantly reduced as a result of intensification. This will reduce the risk of escape of contaminants to groundwater and surface water. This also implies a positive interaction with traffic, climate and noise. The number of tankers visiting site to remove leachate will be reduced, positively impacting on noise and traffic. The number of tanker visits to and from the treatment plant will be reduced, thus resulting in the burning of less fossil fuel. Energy consumption at the treatment plant will also be reduced, again implying a slightly positive impact with regard to carbon dioxide emissions.

Figure 9.1: Matrix of Impact Interactions

	Climate	Traffic	Noise	Soils and geology	Surface water	Groundwater	Ecology	Landscape and Visual Aspects	Human Beings and Material Assets	Air quality
Climate		~	O	O	O	O	O	O	O	++
Traffic	~		-	O	O	O	O	~	O	-
Noise	O	-		O	O	O	O	O	~	O
Soils and geology	O	O	O		O	O	O	O	O	O
Surface water	O	O	O	O		O	O	+	O	O
Groundwater	O	O	O	O	O		O	+	O	O
Ecology	O	O	O	O	O	O		+	O	O
Landscape and Visual Aspects	O	~	O	O	+	+	+		++	O
Human Beings and Material Assets	O	O	~	O	O	O	O	++		++
Air quality	++	-	O	O	O	O	O	0	++	

Legend

O	**Neutral**	-	Slight negative	+	Slight positive
~	Imperceptible impact	--	Significant negative	++	Significant positive

9.2 Cumulative Impacts with Other Projects

There are no known existing or proposed developments that will cause impacts that will accumulate or interact with the proposed intensification of waste intake at Derryclure to create a significant negative effect. The current project to bypass Tullamore will reduce the traffic impact whether the landfill intensifies or not.

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