

## 13.0 HYDROGEOLOGY

### INTRODUCTION

- 13.1 The protection of surface and groundwater resources is a determining factor in the assessment of the acceptability of a site for landfill development. The potential impact on surface and groundwater resources generally depends on the prevailing geological and hydrogeological setting of the landfill and the nature and volume of any leachate leakage from the site.
- 13.2 The potential environmental impacts on groundwater and surface waters that may arise from landfilling of wastes principally relate to the generation of leachate within the landfill and its leakage into the environment. Leachate is generated by the infiltration of rainfall into the waste and its combination with the solutes produced by decomposing organic waste and liquid waste inputs. Historically, many of the problems associated with landfills occurred as a result of their operation as non-engineered 'dilute and disperse' facilities which permitted the uncontrolled migration of leachate into the environment. Under current legislation, however the primary objective of landfill design is to provide effective control measures to prevent or reduce as far as possible leachate emissions from a site to ensure potential impacts on the environment are reduced to an acceptable level.
- 13.3 Landfill sites are subject to a range of legislative controls, which relate to the protection of groundwater resources. These principally include the Waste Management Act of 1996, Waste Management (Licensing) Regulations, 1997 and the Local Government (Water Pollution) Act, 1977. These relate to the EC Groundwater Directive (80/86/EEC), the Landfill Directive (1999/31/EC) and the Water Framework Directive (2000/60/EEC).
- 13.4 The Environmental Protection Agency (EPA) is responsible as the regulatory body, for the implementation and enforcement of this legislation in relation to the protection of water resources from potential impacts arising from landfill developments.
- 13.5 The EPA Manual on Landfill Site Design requires that the design and engineering of a landfill should be supported by a comprehensive risk assessment. This assessment should assess in particular the risk of any adverse environmental impacts on both groundwater and surface waters that may arise as a result of the proposed development.

13.6 This section provides an assessment of the potential risk to groundwater downgradient of the proposed landfill extension at Ballynacarrick, while the impact on surface waters is considered in Section 12. The assessment was based on the specific geological conditions prevailing at the site (as outlined in Section 11.0) and the proposed design of the landfill as an engineered containment facility (as outlined in Section 6.0).

#### **METHODOLOGY**

13.7 In accordance with the EPA Licensing Guidelines the following assessments have been carried out for the proposed landfill site at Ballynacarrick:

- Exploratory Site Investigation;
- Groundwater Protection Rating;
- LandSim Probabilistic Risk Modelling

13.8 Intrusive ground investigations, testing and monitoring of the geological deposits and groundwater regime beneath the proposed landfill extension, as outlined in Section 11, were undertaken to ascertain the geological and hydrogeological characteristics of the site. The objectives of the investigation were to determine:

- Hydraulic properties of the solid and drift deposits and geological features
- Hydraulic gradient of the water table and direction of groundwater flow across the site,
- Vulnerability of groundwater resources
- Baseline quality of groundwater abstracted from monitoring boreholes

13.9 The investigation data was used to develop a conceptual ground model for the site and provide an understanding of the groundwater flow within the landfill extension area. This formed the basis for the hydrogeological assessment of the sites suitability for landfill development and provided environmental parameters for modelling the developments impact on groundwater resources.

13.10 The assessment of the sites suitability for development as a landfill was based on the groundwater protection scheme developed by the Geological Survey of Ireland (GSI) for the selection and management of landfill sites.

13.11 The impact of a landfill on groundwater was examined within the context of a risk management framework, following the source-pathway-target model related to the site specific conditions. This was based on the LandSim2 model, a probabilistic risk assessment tool to quantify the potential impact of a landfill site on groundwater resources.

- 13.12 The model allows the environmental performance of landfill liner and leachate collection systems to be evaluated, to enable the optimum engineering design to be adopted which will minimise impacts on the local groundwater.

#### **ENVIRONMENTAL SETTING**

- 13.13 The environmental impact of a landfill site is examined in the overall context of its setting within the hydrological cycle. This represents a closed system that relates to the water budget of a catchment area, which takes into account climatic conditions, including the amount of rainfall that provides recharge to the surface water and groundwater systems via which water is transmitted back to the oceans. The groundwater and surface water systems represent the principal resources that may be impacted by the leakage of landfill leachate into the environment.

#### ***Meteorology***

- 13.14 The meteorology of the Ballintra area is typical of coastal sites on the western seaboard of Ireland, where rainfall is distributed throughout the year, with the months from October to January being the wettest. The 30 year standard annual average rainfall data for the Ballintra rainfall station, with an elevation of 40mOD, indicates that an average precipitation of 1264mm/year falls over the area.
- 13.15 Potential evapotranspiration (PE) data for the Donegal region is measured by Met. Eireann at the synoptic weather station at Malin Head. The standard annual average data for 1968-97 indicates that 577mm/year of the incident rainfall is lost through evapotranspiration per annum. On this basis the effective rainfall (incident rainfall minus potential evapotranspiration) for the Ballintra area would equate to approximately 687mm/year.

#### ***Landfill Operation***

- 13.16 Ballynacarrick landfill site has historically operated as an unlined landfill facility where leachate leakage is released in an uncontrolled manner into the geosphere where its concentration is attenuated by dilution and dispersal processes in receiving waters. To meet the requirements of the Landfill Directive and EPA Landfill Design Manuals the final phase of the existing operation has been engineered as a fully lined containment cell. This is designed to provide sufficient capacity to extend the life of the existing facility by a further 2 years at the current rate of waste input. The unlined facility will be capped and restored to reduce infiltration and the generation of leachate.

- 13.17 The proposed extension to the landfill will enclose approximately 3.5 hectares of unimproved agricultural land that extends some 200m from the western boundary of the existing site down a broad hollow. To the west the extension is bounded by a minor road beyond which the ground rises under a shallow gradient toward Ballynacarrick Hill with an elevation of 120mOD. To meet Landfill Directive standards the extension will be engineered as a fully lined containment landfill facility which will be divided into 2 phases of 2 cells. This will provide an estimated capacity of 200,000m<sup>3</sup> to extend the lifespan of the landfill an estimated 8 ½ years at the current rate of waste input.

### **HYDROGEOLOGY**

- 13.18 The movement of contaminants through the groundwater system relates to the site specific hydrogeological conditions, where groundwater flow principally relates to the hydraulic properties of the prevailing geology and the hydraulic gradient of the water table.

#### ***Ground Conditions***

- 13.19 The ground conditions recorded by the exploratory investigations at Ballynacarrick Landfill are described in Section 11 of this environmental statement. The investigations indicate that bedrock is exposed at or near surface beneath a veneer of recent peat deposits across the greater site area, with a maximum depth of overburden recorded beneath the ridge line that adjoins the northern site boundary, where 3-10m of stratified glacial till deposits overlie the rockhead. Three principal rock types were recorded to underlie the site as outlined below:

##### Carboniferous

- Lower Ballyshannon Formation (muddy limestones)
- Basal Ballyshannon Formation (gritstones)

##### Monian

- Lough Derg Psammites

#### ***Hydraulic Properties***

- 13.20 The hydraulic characteristics of the overburden and bedrock materials were determined by in situ variable head and packer permeability tests undertaken in boreholes during the exploratory investigations for the existing and proposed landfill. The range of permeability results determined for the geological deposits and strata that underlie the site is listed in Table 13.1



**Table 13.1 Summary of Permeability Test Results**

<b>Stratum Description</b>	<b>Permeability (m/sec)</b>
<b>Drift Geology</b>	
Glacial Till (silt and clay horizons)	$1.4 \times 10^{-5}$ to $3.9 \times 10^{-8}$
Glacial Till (sand and gravel horizons)	$3.3 \times 10^{-3}$ to $2.2 \times 10^{-6}$
<b>Solid Geology</b>	
Lower Ballyshannon Formation (muddy limestones)	$1.3 \times 10^{-5}$ to $1.7 \times 10^{-9}$
Basal Ballyshannon Formation (gritstones)	$1.2 \times 10^{-5}$ to $4.1 \times 10^{-7}$
Lough Derg Psammities	$2.4 \times 10^{-6}$ to $6.4 \times 10^{-11}$

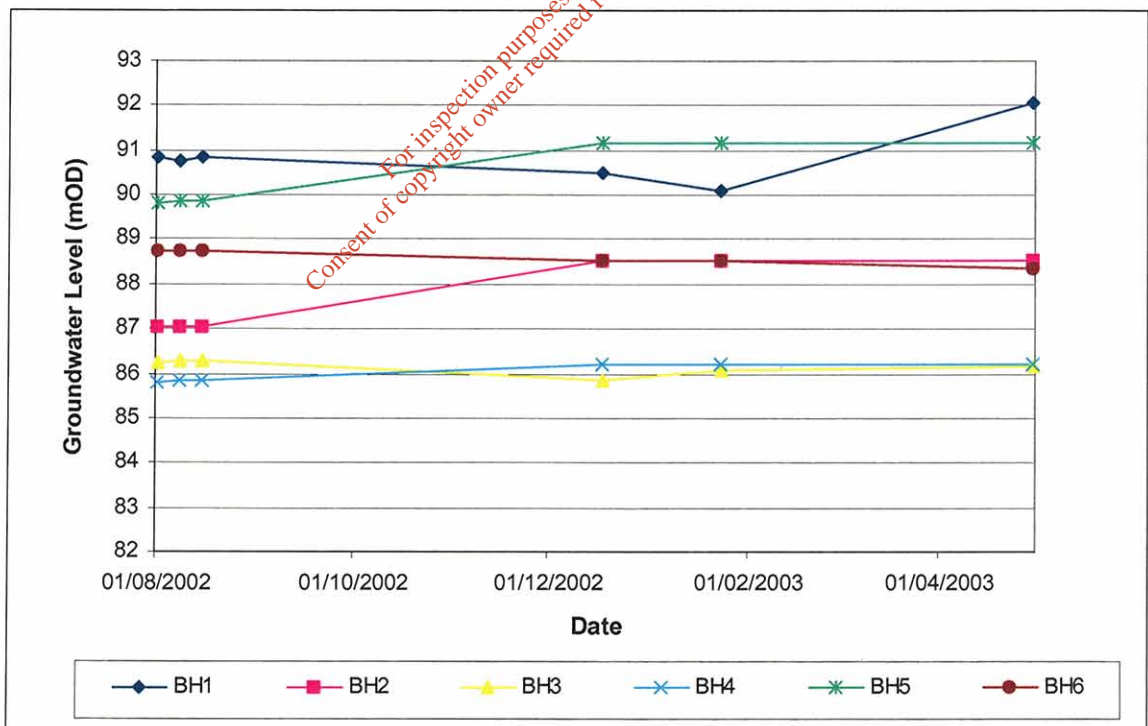
13.21 The rocks which underlie the site are fine grained or crystalline materials which lack significant intergranular porosity. Groundwater movement through the bedrock is principally confined to fracture flow or other discontinuities within the rock mass, including bedding and joint planes. Logs of the rock cores recovered within the proposed landfill extension indicate that the three rock formations that underlie the site have similar hydraulic properties, with respect to the porosity of the rock and frequency of fractures and other discontinuities. This aspect is reflected by the test results summarised in Table 13.1, which shows that the three principal rock types have comparable hydraulic conductivities. No evidence of any karst features of the Lower Ballyshannon Formation was recorded in the intact cores recovered from the muddy limestone and shale sequence.

13.22 The drift deposits that underlie the site will largely be removed during the construction of the landfill extension, however the glacial deposits that underlie the northern ridgeline will be maintained to support the side slope lining system. The permeability results indicate there is up to 2 orders of magnitude difference between the hydraulic conductivity of the sand horizons and the intervening silt clay bands. The sands would therefore potentially represent a non-extensive migration pathway for intergranular groundwater movement through the drift deposits. Conversely the silt and clay horizons, due to their inherently low permeability, represent potential barriers to groundwater movement and are classified as aquitards. The ground investigation records indicate that the sand horizons are laterally discontinuous.

**Groundwater Movement**

- 13.23 The hydraulic gradient of the water table typically mirrors the surface contours of the prevailing topography, which confines the groundwater drainage into independent sub-catchments. The topography and watershed divides between adjoining catchments dictates the direction of groundwater flow.
- 13.24 The area to the northwest of the proposed landfill extension boundary represents the downgradient area with regard to groundwater movement from the site. The existing dilute and disperse landfill facility is located upgradient of the proposed extension within the groundwater catchment area shown in Figure 13.1.
- 13.25 To facilitate groundwater monitoring, boreholes put down within the proposed landfill extension were installed with standpipe piezometers. These were sealed into the rock or permeable horizons within the drift underlying the northern ridge line. Groundwater levels within the standpipes were monitored over a two week period on completion of the exploratory fieldwork, with follow-up monitoring generally undertaken at monthly intervals. The results of the groundwater level monitoring are presented as borehole hydrographs in Graph 13.1.

**Graph 13.1 Borehole Hydrographs**



- 13.26 The groundwater table within the extension area is at a relatively shallow level where the bedrock is exposed at or near surface, with artesian conditions encountered in isolated horizons locally. This corresponds with groundwater observations recorded by trial pit investigations where seepages to slight flows of groundwater were recorded within the permeable drift and fractured rock horizons near surface. Such high water table conditions are generally associated with low permeability strata where infiltration is impeded while surface run-off is promoted. The widespread development of peaty subsoils within the development area reflects this situation.
- 13.27 The borehole hydrographs were also used to construct hydraulic contours for the water table surface, as indicated by Figure 13.2. The hydraulic contours indicate that the water table surface is inclined in a west to northwesterly direction across the site, under a hydraulic gradient that broadly corresponds with the topography of the landfill hollow. Beyond the site boundary it is anticipated that groundwater flow is restricted by Ballynacarrick Hill and mirrors the surface water regime along the drainage pathway toward Durnesh Lough.

#### **Baseline Groundwater Quality**

- 13.28 To determine the impact of the existing dilute and disperse landfill on groundwater resources downgradient of the site and establish baseline water quality conditions for the proposed landfill extension area, water samples were recovered from the borehole standpipe installations for geochemical analysis on 25 July 2002 for upgradient borehole GW1 and 31 January 2003 for downgradient boreholes BH 2, 3, 4 and 6. The water samples were analysed by an accredited laboratory for a suite of contaminants listed in the EPA manual on Landfill Monitoring. The results of this analysis are presented in Table 13.2, with parameters not analysed listed as N/A.
- 13.29 The chemical test results indicate that compared with the upgradient baseline concentrations, the levels of chloride and ammoniacal nitrogen are locally slightly elevated within the extension area and downgradient of the site. Ammoniacal nitrogen levels also exceed the drinking water standard locally. These parameters as key indicators of leachate contamination reflect the historical impact of the uncontrolled leakage from the unlined dilute and disperse landfill on groundwater quality. Notwithstanding this, if there was a problem with the borehole construction the contamination levels recorded may be compounded by the agricultural use of the lands for rough grazing by cattle. This potential anomaly may explain the elevated level of ammonia recorded at borehole 3.

**Table 13.2 Baseline Groundwater Quality Results**

Contaminant Parameter	Units	Upgradient	Extension Area		Downgradient		EC MAC
		GW1	BH2	BH6	BH3	BH4	
Arsenic	ug/l	N/A	<5	<5	<5	<5	50
Barium	mg/l	N/A	0.19	<0.05	0.1	<0.05	1
Boron	mg/l	<0.05	0.09	<0.05	0.29	<0.05	2
Cadmium	ug/l	<0.05	<0.4	<0.4	<0.4	<0.4	5
Calcium	mg/l	N/A	93.9	25.93	72.77	92.06	250
Chromium	ug/l	<0.05	2	2	4	<1	50
Copper	ug/l	<0.05	5	10	6	<5	3000
Iron	ug/l	0.05	18	87	43	4	200
Lead	ug/l	<0.05	8	<5	<5	<5	50
Magnesium	mg/l	8.38	19.11	4.92	14.74	31.84	50
Manganese	ug/l	3.31	516	119	2	140	50
Mercury	ug/l	<0.05	<0.05	<0.05	<0.05	<0.05	1
Nickel	ug/l	N/A	<10	<10	<10	<10	50
Phosphorous	mg/l	N/A	<0.05	<0.05	<0.05	0.13	2.2
Potassium	mg/l	7	6.5	4.9	39	3.6	12
Selenium	ug/l	N/A	<5	<5	<5	<5	10
Silver	ug/l	N/A	<10	<10	<10	<10	10
Sodium	mg/l	315	228	123.2	148	95.2	150
Zinc	ug/l	<0.05	7	<5	8	<5	5000
Ammoniacal Nitrogen	mg/l	0.9	5.7	0.9	47.6	0.4	0.5
Chloride	mg/l	45	81	86	104	84	400
Electrical Conductivity	mS/cm	1.61	1.09	0.433	1.223	0.869	1.5
Fluoride	mg/l	<0.05	<0.5	<0.5	<0.5	0.6	1.5
Ortho-Phosphate	mg/l	N/A	1.7	1.8	1.7	1.7	100
pH	pH-units	7.02	7.42	6.6	8.15	8.09	5.5-9.5
Sulphate	mg/l	413	29	33	13	36	250
Total Alkalinity as CaCO <sub>3</sub>	mg/l	320	500	110	520	270	>30
Total Cyanide	mg/l	<0.05	<0.05	0.06	<0.05	<0.05	0.05
Total Organic Carbon	mg/l	21	33	30	83	29	
Total Oxidised Nitrogen	mg/l	0.11	<0.3	5	<0.3	<0.3	
Total Phenols	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.5
Total Solids	mg/l	N/A	684	334	584	585	

13.30 The concentration of certain trace metals, particularly calcium, iron, magnesium, manganese and potassium; in association with total alkalinity values, are locally more elevated in the downgradient boreholes. These trace metals are common constituent of the rock that underlies the site. The variation in levels is therefore likely to be related to mineralogical variations in the bedrock geology between the metamorphic rocks upgradient and the calcareous limestones downgradient boreholes and is not considered to be indicative of leachate contamination.

## GROUNDWATER AND SURFACE WATER ABSTRACTIONS

- 13.31 The groundwater abstractions located in the vicinity of the landfill and within a 3km radius downgradient of the site are shown in Figure 13.1.
- 13.32 The nearest groundwater abstraction point to Ballynacarrick Landfill is a domestic well located 750m to the north of the site, at an upgradient location in an adjoining groundwater catchment area. Three boreholes utilised as private groundwater supply points, are recorded downgradient of the landfill. The nearest is located 1.25km from the site in a quarry, while the others are located around 2.3km away in close proximity. The form of construction of these wells is presently unknown, although it is anticipated that they penetrate the upper Ballyshannon Limestone formation.
- 13.33 The watercourses downstream of the landfill are not used as surface water drinking supplies for human consumption. The principal surface bodies used as a potable water source in the area are Lough Gorman and its catchment which supplies Ballymagroaty; and Glen Lough and its catchment which supplies Ballintra. Both of these surface water supplies are located in separate surface and groundwater catchments to the landfill.

## GROUNDWATER PROTECTION RATING

### *Methodology*

- 13.34 Groundwater protection policy for the development of landfills in Ireland has been developed by the Geological Survey of Ireland (GSI) as a Groundwater Protection Matrix. This provides a determination of the acceptability of the proposed site for development as a landfill, based on the prevailing geological conditions at the site. Application of the matrix incorporates two main elements, namely:
- Groundwater Vulnerability: This is based on the geological and hydrogeological setting of the site. The rating ranges from Extreme (E) where bedrock is at or near surface to Low (L) where bedrock is overlain by in excess of 10 m of low permeability overburden;
  - Resource Protection: This is based on the value and importance of the groundwater aquifer underlying and downgradient of the site. Aquifers are classified by a prefix code according to their importance as a resource. Major aquifers are designated to be of Regional Importance (R), minor aquifers to be of Local Importance (L) whilst unproductive aquifers are described as Poor (P) these codes are further qualified by a suffix, which reflects the productivity and nature of the aquifer zone. The suffix (k) reflects conduit flow, (f) reflects fracture flow, (g) reflects intergranular flow, (m) reflects moderate productivity, and (u) reflects poor productivity, whilst (l) reflects localised zones of productivity.



13.35 These factors are incorporated into a groundwater protection matrix, presented in Table 13.3. The matrix yields a code of acceptability for the sites development as a landfill. This ranges from acceptable (R1 and R2<sup>1-2</sup>) to not acceptable (R4), with (R3<sup>1-2</sup>) designated as being generally not acceptable. Landfills taking domestic/municipal waste should ideally plot in the bottom right hand corner of the matrix.

**Table 13.3 Groundwater Protection Scheme Matrix for Landfills (after Daly, 1995)**

Vulnerability Rating	Resource Protection					
	Regionally Important		Locally Important		Poor Aquifers	
	Rk	Rf/Rg	Lm/Lg	LI	PI	Pu
Extreme (E)	R4	R4	R3 <sup>2</sup>	R2 <sup>2</sup>	R2 <sup>2</sup>	R2 <sup>1</sup>
High (H)	R4	R4	R3 <sup>1</sup>	R2 <sup>1</sup>	R2 <sup>1</sup>	R1
Moderate (M)	R4	R3 <sup>1</sup>	R2 <sup>2</sup>	R2 <sup>1</sup>	R2 <sup>1</sup>	R1
Low (L)	R3 <sup>1</sup>	R3 <sup>1</sup>	R1	R1	R1	R1

#### **Groundwater Vulnerability Rating**

13.36 The exploratory investigations carried out at the site indicate that drift cover over the greater site area is generally less than 1m thick with rock exposed at or near surface locally. In accordance with the engineered design of the landfill extension the drift cover will largely be removed and formation levels reduced over the base area of the site. On this basis the hydrogeological conditions at the site the groundwater vulnerability rating (after Daly & Warren, 1994) is classified as Extreme (E) as no natural protection would be afforded by drift cover over the site.

#### **Resource Protection Rating**

13.37 The potential of a bedrock aquifer to yield water in significant quantities depends on the capacity of the strata to store and transmit water through intergranular pores or fissures. Aquifers are therefore classified according to their potential yield, which relates to their importance as either a regional, local or poor groundwater resource. The resource potential of bedrock aquifers has been provisionally determined by the Geological Survey of Ireland (GSI), based on local well information and hydrogeological investigations. In accordance with the GSI classification rocks are subdivided into regionally important, locally important or poor aquifers. Regionally important aquifers represent rocks with a large capacity to store and yield significant quantities of groundwater sufficient for public supply purposes.

13.38 Locally important aquifers are capable of yielding sufficient water for group schemes or villages, while the yields from poor aquifers are generally only sufficient for domestic supply purposes.



- 13.39 In situ testing undertaken indicates that the sedimentary and metamorphic rock formations which underlie the site are low permeability aquifers, with limited transmissivity and storativity, i.e. groundwater flow in the rocks and its reservoir potential are limited.
- 13.40 The fractured state of the rock mass underlying the site was investigated by a series of rotary drilled boreholes which were used to recover of intact cores of the rock and facilitate in situ testing of the permeability of the strata. The rock structure of the recovered cores revealed no evidence of high density fracture zones or karst solution features that would increase the permeability of the strata, as indicated by the in situ test results.
- 13.41 The Geological Survey of Ireland (GSI) classify the sedimentary strata of the Carboniferous Basal Clastic and Lower Ballyshannon Limestone formations as Locally Important aquifers, which are considered to be moderately productive in local zones, where the fracture permeability of the rock is well developed. On this basis the strata are provisionally assigned the code "LI". By comparison the metamorphic strata of the Monian formation are classified as Poor and generally unproductive aquifers, which are assigned the code "Pu" by the GSI.
- 13.42 The clean limestones of the Upper Ballyshannon Limestone Formation are classified as a regionally important groundwater resource, where the potential aquifer yield principally relates to the karstification of the rock. This formation outcrops beyond the site boundaries separated by the north east to south west trending fault that extends along the back of the ridgeline to the north of the site. This fault acts as a hydraulic boundary.

#### **Assessment of Groundwater Protection Rating**

- 13.43 The combination of the groundwater vulnerability and resource protection ratings for the site give the rating code R2<sup>2</sup> (Table 13.3), which is defined as follows:

R2<sup>2</sup> Acceptable Subject to Guidance in the EPA Landfill Design Manual, however special attention should be given to:

1. Checking for high permeability zones
2. Wells downgradient
3. Groundwater control requirements

- 13.44 In accordance with the EPA Landfill Design Manual the design proposals for the protection of groundwater resources have included the phased development of the site in banded cells, with progressive capping and restoration of the completed areas. The engineered containment systems included in the design for the site will minimise leachate leakage from the site, while operational practices and leachate management systems will also control leachate generation and build up within the site.

### LANDSIM PROBABILISTIC RISK ASSESSMENT MODELLING

- 13.45 The impact of a landfill site on groundwater resources is examined within the context of a risk management framework following the source-pathway-target model for all potential exposure linkages. This is related to the hydrological setting of the site and the prevailing geological and hydrogeological conditions determined by intrusive ground investigations.
- 13.46 The source of contamination at the Ballynacarrick Landfill Site relates to the leachate generated by rainfall infiltration into the landfill. The principal migration pathway relates to the leakage of leachate through defects in the basal lining system in the engineered containment phases and through the unsaturated zone in the case of the existing unlined facility. The secondary migration pathway relates to the migration of contaminants under a hydraulic gradient through the bedrock aquifer toward the specified target (receptor) point.
- 13.47 In the absence of any groundwater abstraction points in the downgradient vicinity of the landfill, the impact on groundwater quality was examined at an assumed target point located within 10m of the downgradient margin of the proposed landfill extension. Full details of the LandSim analysis carried out are included in Appendix F.

#### **Assessment of LandSim Results**

- 13.48 The LandSim modelling indicates that the existing unlined 'dilute and disperse' phase gives rise to a high volume of leachate leakage from the site, which is allowed to escape into the environment in an uncontrolled manner with limited dilution in groundwater. The results indicate that the leakage from the uncapped site impacts on groundwater quality at the assumed compliance point. This is principally reflected by elevated levels of chloride, nitrite and potassium, and subsequently by the break through of ammoniacal nitrogen, where the predicted concentrations exceed EEC drinking water limits. This situation is reflected locally by the baseline chemistry of groundwater sampled from monitoring boreholes within the extension area and on the downgradient boundary, as listed in Table 13.2. However, given the limited potential of the bedrock aquifer and the absence of any downgradient groundwater abstractions locally, this should not result in an adverse impact on groundwater resources in the area.
- 13.49 The analysis for the final phase of operations in the proposed site extension, indicates that the volume of leachate leakage from the lined phases of the site will be reduced to a minimum by its development as an engineered containment landfill, operated in accordance with current best practices. The capping of the existing unlined landfill and progressive restoration of completed phases of the fully engineered containment landfill also minimises the infiltration into the landfill and consequently substantially reduces the volume of leachate leakage from the site.

- 13.50 Following this the results indicate that the impact of the unlined landfill on groundwater quality will be substantially reduced by the capping of the existing site and that no significant increase in groundwater contaminant loading arises from the leakage from the engineered containment phases.

#### IMPACTS AND MITIGATING MEASURES

##### *Impacts*

- 13.51 Ballynacarrick Landfill site is underlain by locally important bedrock aquifers that are considered to be moderately productive in localised zones. These potential groundwater resources are rated to have an extreme vulnerability as the drift cover is thin or absent within the extension area. On the basis of its geological and hydrogeological setting, following the Geological Survey of Ireland groundwater protection response, the site is classified as acceptable for development as a landfill site subject to the guidance in the EPA Landfill Design Manual.
- 13.52 Environmental pollution with respect to surface water and groundwater resources is defined in Section 40(4)(b) of the Waste Management Act, 1996, as:  
*“the holding, transport, recovery and disposal of waste in the manner which would to a significant extent endanger human health or harm the environment, and in particular:*  
a) *Create a risk to waters, the atmosphere, land, soil, plants and animals”.*
- 13.53 Following the above probabilistic modelling indicates that the ongoing impact of the ‘dilute and disperse’ landfill site will be reduced by the capping and restoration of the existing facility. This is reflected by a substantial reduction in the volume of leakage from the site that is reflected by slightly elevated levels of ammoniacal nitrogen, chloride, nitrite and potassium, with respect to drinking water limits, at an assumed downgradient compliance point, located on the western extension boundary.
- 13.54 The phased development of the proposed landfill extension, as a fully engineered lined containment landfill facility with a range of leachate collection and management systems, is designed to minimise leakage from the site and mitigate any further groundwater impacts. A probabilistic analysis of the final phase of landfilling operations indicates that no additional impact on groundwater quality arises from the proposed extension as the volume of leakage is minimised by the engineering measures included in the design and by the progressive capping of completed phases.

13.55 On the above basis the proposed development would satisfy the requirements of Section 40(4)(b) of the Waste Management Act, 1996. The risk modelling indicates that the site is suitable for development as an engineered landfill and that ongoing operations are unlikely to create any added impacts on groundwater quality.

***Mitigating Measures***

13.56 In accordance with the EPA Landfill Design Manual the proposed extension of the site will be an engineered lined containment landfill facility with a range of leachate management controls designed to minimise leakage from the site and resultant impacts on groundwater quality.

13.57 In addition to minimise the leakage from existing dilute and disperse landfill the site will be capped and leachate collection systems installed. Following capping of the existing dilute and disperse site the baseline groundwater quality will be established downgradient of the proposed extension. Groundwater control and trigger levels will then be derived for leachate parameters on the basis of this information combined with approximate environmental quality standards. The trigger levels will form the basis for compliance monitoring of any potential impacts following development of the proposed landfill extension. However in the long term a net improvement in groundwater quality would be anticipated with a decline in the source concentration of the leachate in the unlined site. The groundwater control and trigger levels would therefore be reviewed on an annual basis.

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## BIBLIOGRAPHY

Landfill Manuals, Landfill Site Design Manual. Environmental Protection Agency (2000)

Groundwater Protection Schemes. Geological Survey of Ireland and Environmental Protection Agency (1999)

Selection and Management of Landfill Sites Geological and Groundwater Aspects. Daly D (1995)

Mapping Groundwater Vulnerability to Pollution. Daly D and Warren W P (1994)

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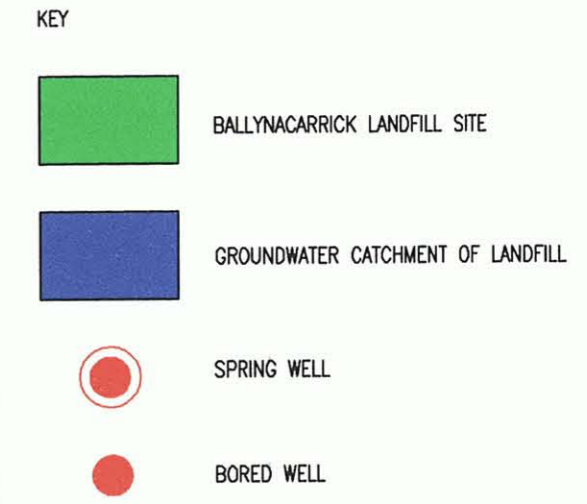
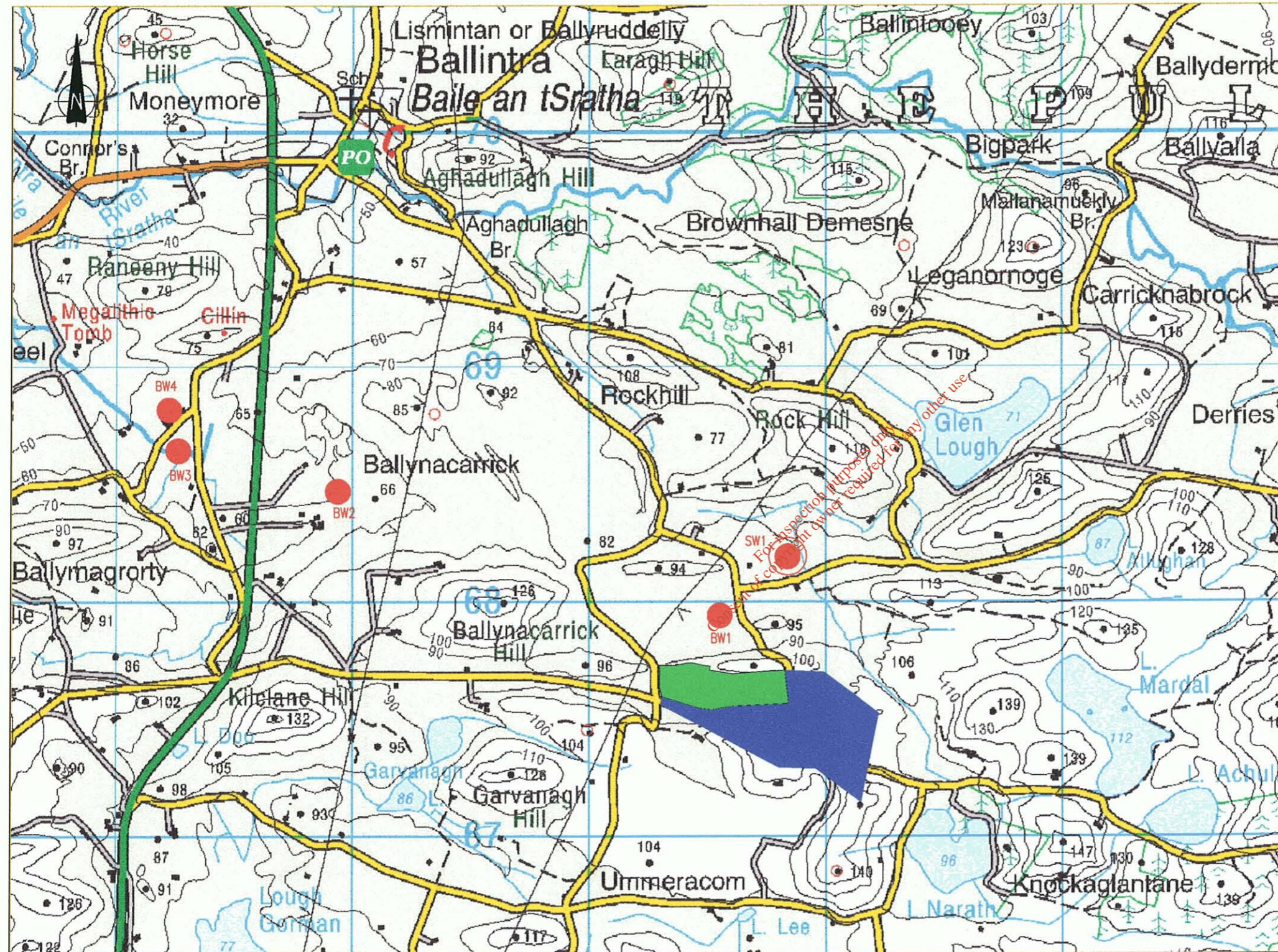


## FIGURES



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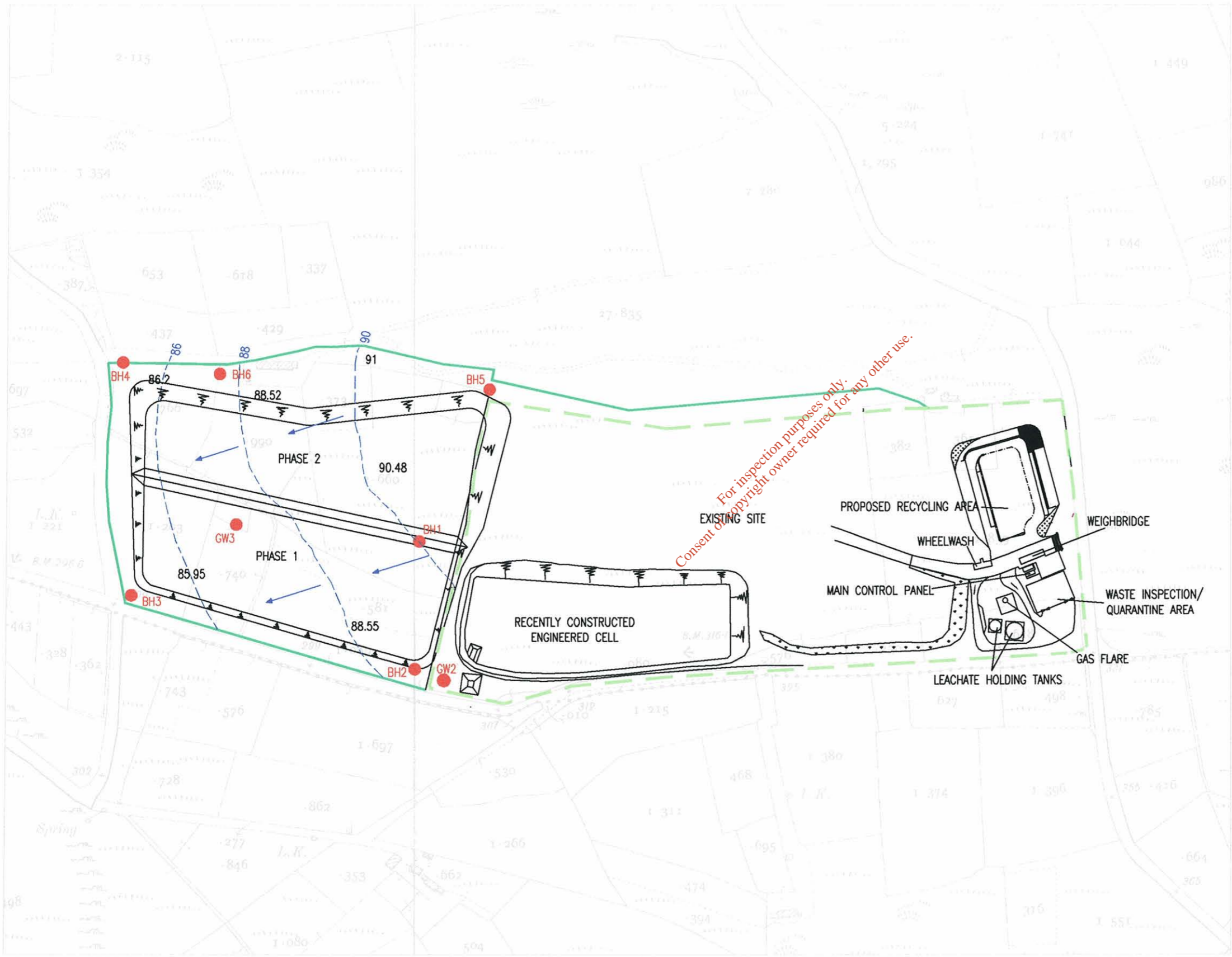
 <p><b>KIRK McCLURE MORTON</b> CONSULTING ENGINEERS</p>	 <p>Comhairle Chontae Dhún na nGall Donegal County Council</p>
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PROJECT  
BALLYNACARRICK LANDFILL PROJECT

TITLE GROUNDWATER ABSTRACTIONS	FIGURE 13.1
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- KEY**
- BOUNDARY OF EXISTING LANDFILL
  - BOUNDARY OF PROPOSED EXTENSION
  - GROUNDWATER CONTOUR
  - GROUNDWATER FLOW PATH
  - BOREHOLE

SCALE: 1:2500

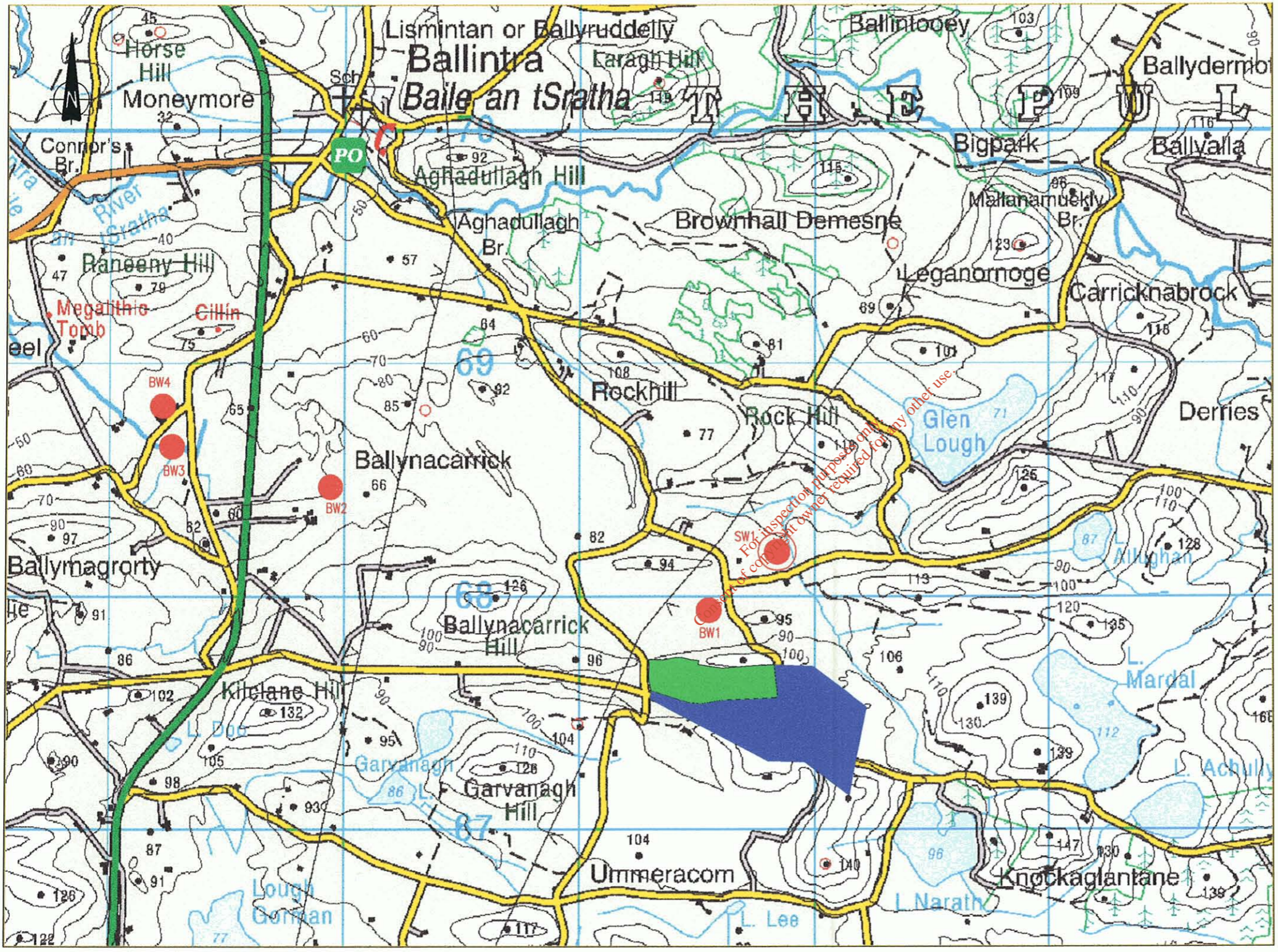
 <p><b>KIRK McCLURE MORTON</b> CONSULTING ENGINEERS</p>	 <p>Comhairle Chontae Dhún na nGall Dongal County Council</p>
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PROJECT  
**BALLYNACARRICK LANDFILL PROJECT**

TITLE <b>GROUNDWATER CONTOUR PLAN</b>	FIGURE <b>13.2</b>
--	-----------------------

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KEY

- BALLYNACARRICK LANDFILL SITE
- GROUNDWATER CATCHMENT OF LANDFILL
- SPRING WELL
- BORED WELL

SCALE 1: 20,000

 <p><b>KIRK McCLURE MORTON</b> CONSULTING ENGINEERS</p>	 <p>Comhairle Chontae Dhún na nGall Donegal County Council</p>
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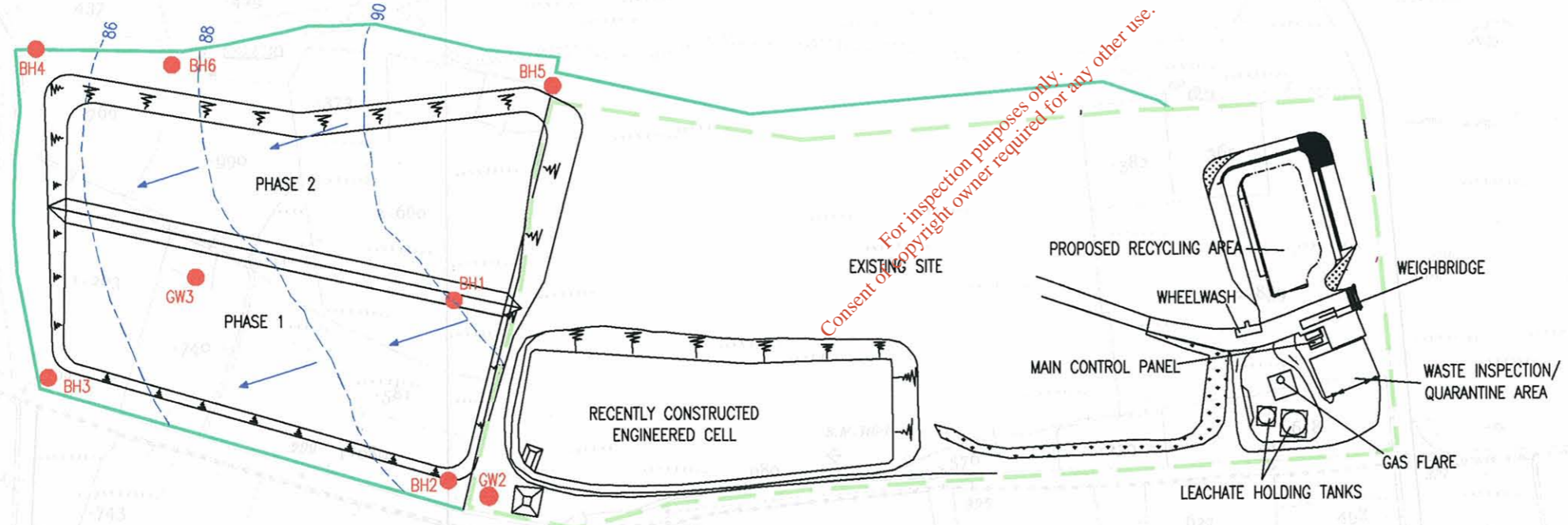
PROJECT  
BALLYNACARRICK LANDFILL PROJECT

TITLE  
GROUNDWATER ABSTRUCTIONS

FIGURE  
13.1



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- KEY
- BOUNDARY OF EXISTING LANDFILL
  - BOUNDARY OF PROPOSED EXTENSION
  - - - GROUNDWATER CONTOUR
  - GROUNDWATER FLOW PATH
  - BOREHOLE

SCALE: 1:2500

 <b>KIRK McCLURE MORTON</b> CONSULTING ENGINEERS	 Comhairle Chontae Dhún na nGall Donegal County Council
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PROJECT  
BALLYNACARRICK LANDFILL PROJECT

TITLE GROUNDWATER CONTOUR PLAN	FIGURE 13.2
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## 14.0 HUMAN BEINGS

14.1 Human beings form one of the most important aspects of the environment to be considered. Any likely significant impacts on the character of human beings must therefore be addressed. This section of the Environmental Impact Statement is split into three parts, socio-economic aspects, tourism aspects and human health. The first two parts considers the human environment in the vicinity of the application site in terms of its population profile and trends, labour force profile, socio-economic profile and an assessment of the tourism impacts. The final part considers current available literature from Health Research Board on the health effects of landfills.

### THE SOCIO-ECONOMIC ENVIRONMENT

14.2 The proposed development site is situated south of Ballintra village in the townland of Ballynacarrick which is located in Ballintra District Electoral Division (DED). Ballintra DED is part of Donegal Rural District (RD) and is located in South County Donegal.

14.3 Small Area Population Statistics (SAPS) were obtained for Ballintra DED but to create a comparative picture of population and employment dynamics occurring in Ballintra DED, comparisons have been made with a neighbouring DED, Cavangarden, as well as with Donegal County and State levels.

14.4 The structure for assessing the impact of the proposed development is based upon guidelines prepared by the Environmental Protection Agency (EPA 1995a and 1995b). The statistics used in compiling this section of the report are from the 1991 and 1996 census and were obtained from the Central Statistics Office. Unfortunately only preliminary results from the 2002 census are available as yet, final results from the 2002 census are not expected before the end of 2003.

### ***Characteristics of the Proposal***

14.5 The proposed landfill site is located in the townland of Ballynacarrick, on an elevated site approximately 3 km southwest of Ballintra, 10.5 km south of Donegal town and 8.5 km north of Ballyshannon. The elevation of the site varies between 90 metres (295 feet) and 100 metres (328 feet). The site is currently used for agricultural purposes but adjoins an existing landfill site. The proposed site was therefore deemed to be a practical extension to the existing landfill at Ballynacarrick.

14.6 The site offices at the existing facility will be utilised for the proposed development. The Environmental Protection Agency (EPA) will have licensing control over the site and Donegal County Council will operate it. Entry to the proposed landfill site will be from the third class road to the north of the site, which is accessed from the regionally and nationally important N15, as discussed in Section 18. This road is an important north-south link for the County of Donegal, linking as it does Sligo to Lifford/Strabane and also linking with the N13 to Letterkenny.

**Receiving Environment**

14.7 Donegal County is predominantly a rural county with only three towns containing a population greater than 3,000 (1996). Ballintra and Cavangarden DEDs typify the above description. The landuse surrounding the site is predominantly agriculture with widespread cattle and sheep grazing throughout. Housing throughout the area is sparse, the closest resident to the site is within 200 metres of the entrance to the existing facility.

14.8 The existing and proposed landfill sites are located away from established settlements. The proximity of urban centres is highlighted in Table 14.1 below.

**Table 14.1 Proximity of Nearby Settlements (as the crow flies)**

Town	Distance	
	Miles	Km
Ballintra	1.8	2.9
Ballyshannon	5.3	8.5
Bundoran	8.9	14.3
Belleek	5.3	8.6
Pettigo	10.8	17.3
Donegal	6.5	10.5

**Demography**

14.9 Preliminary results from the 2002 census have been released from the Central Statistics Office (CSO) containing population figures only. Table 14.2 below contains the population of Ballintra DED, Cavangarden DED, County Donegal and the state for the years 1991, 1996 and 2002.



**Table 14.2 Population Change at Local, Regional and National Level Between 1991 and 1996**

Area	Year			Percentage Change 1991-1996	Percentage Change 1996 - 2002
	1991	1996	2002		
Ballintra DED	557	560	502	0.5%	-10.4%
Cavangarden DED	352	328	311	-6.8%	-5.2%
Donegal	128,117	129,994	137,383	1.5%	5.7%
Ireland	3,525,719	3,626,087	3,917,336	2.8%	8.0%

Source: Census of Population 1991, 1996 & 2002

- 14.10 Between 1996 and 2002 the population of Ireland grew by almost 8%, while the population of County Donegal grew by 6%. The rate of population growth in County Donegal was the highest experienced since the 1970s.
- 14.11 Ballintra DED grew in population between the inter censal period, 1991 to 1996. A growth in population was also experienced in County Donegal and the State as a whole. However the positive increase in population in Ballintra DED is considerably less than was experienced in the County and State. However, during the subsequent inter censal period, 1996 to 2002, the population of the Ballintra DED fell by over 10% which is not reflected in the statistics for County Donegal and the State. The neighbouring DED of Cavangarden has also shown a continual decline in population since 1991. Rural migration in general is viewed negatively as it can reduce the vibrancy and shift the social balance of an area. Table 14.2 suggests that the rate of decline is slowing but a continued decline is evident nonetheless.
- 14.12 The negative change in population in such rural areas such as Ballintra and Cavangarden is not uncommon with other areas throughout the country. Over the past number of years participation rates and indeed the dependency on the primary industries such as agriculture and forestry has diminished. This may explain the why the population of Ballintra DED and Cavangarden DED has fallen over recent years.
- 14.13 The age profile of the subject area allows an investigative assessment of the likely trends in population over ensuing years. As shown in Table 14.3 the population of Ballintra DED is ageing and is evident in the proportion of its residents aged 65 plus and those who are aged between 45 and 64. Both percentages are significantly higher than the county and national average. This corresponds to a low proportion of the population who are within the 0-14 and 25-44 age group when comparisons are made with County Donegal and the State. An aging population may explain the decline in population between 1996 and 2002, however other factors also play a significant role in population growth/decline such as employment opportunities etc.

14.14 The figures for Cavangarden DED are somewhat different to that of Ballintra DED. The 45-64 and 65+ age groups are similar to that of the State and only slightly different to that of County Donegal. The percentage in the 0-14 age group and 25-44 age group however is noticeably different to all of the other areas analysed. The former is elevated considerably while the latter is reduced. It is suggested that the population decline experienced over the past number of years may be reversed or at least stabilised over the coming years. The high proportion of 0-14 years olds indicates that the DED is an attractive area to raise children.

**Table 14.3 Age Profile of the Population at a Local, Regional and National Level in 1996**

	Age				
	0-14	15-24	25-44	45-64	65+
Ballintra DED	22.9%	16.1%	24.5%	22.1%	14.5%
Cavangarden DED	29.3%	17.7%	21.6%	20.1%	11.3%
Donegal	25.5%	16.8%	25.1%	19.4%	13.2%
Ireland	23.7%	17.5%	28.0%	19.4%	11.4%

Source: Census of Population 1996

14.15 Combining the percentages of the 0-14 and 65+ age groups gives an indication of the level of dependency within the areas analysed. The national average for 1996 was 35.1%. Ballintra DED, Cavangarden DED and County Donegal are above the national average at 37.4%, 40.6% and 38.7% respectively.

#### ECONOMIC ACTIVITY & EMPLOYMENT

14.16 Ireland has undergone a major economical change over recent years, which has impacted positively on the majority of its inhabitants. It is therefore unfortunate that full census figures for 2002 are not yet available. However analysis and comparison of the relevant figures for 1996 do provide an indication of an areas strengths/weaknesses.

14.17 Amongst the other factors affecting population growth and decline is the availability of paid employment. Table 14.4 shows the employment levels within the catchment of Ballintra DED for the years 1991 and 1996. The available workforce in the DED has grown in parallel with County and State trends. However the reverse is true of the percentage of unemployed. The level of unemployment in County Donegal and indeed Ireland as a whole has reduced between 1991 and 1996. This is a positive shift, but one which is not replicated in Ballintra DED. It has experienced a significant increase in its unemployment level over the inter censal

period. The negative increase is reflective of an increase in its labour force allied to a lack of increased employment opportunities.

**Table 14.4 Employment Levels**

	1991			1996		
	Available <sup>1</sup> w'force	At work <sup>2</sup>	Un- <sup>3</sup> employed	Available <sup>1</sup> w'force	At work <sup>2</sup>	Un- <sup>3</sup> employed
Ballintra DED	348	46.0%	11.21%	382	53.9%	11.26%
Cavangarden DED	208	56.7%	5.51%	207	48.8%	13.04%
Donegal	77,597	45.3%	15.41%	82,985	48.0%	13.7%
Ireland	2,261,403	50.8%	10.34%	2,426,775	53.9%	9.3%

Source: CSO 1991 and 1996

Available workforce = Population 15+ who are not either retired or unable to work

At work = Percentage of the available workforce who are in paid employment ie excludes students, home duties etc.

Unemployed = 1st job seekers plus unemployed as a percentage of the available workforce.

14.18 The fortunes experienced in Ballintra DED are not replicated in Cavangarden DED. In 1991 the DED had a large percentage of its available workforce at work and a correspondingly low percentage of persons who are unemployed. The situation has altered both dramatically and negatively between 1991 and 1996. Unemployment levels have risen sharply and the percentage of the available workforce in employment has diminished. This was most probably due to the closure of a single industrial unit which provided ample employment in 1991 and unfortunately laid off staff during the inter censal period. The figures from the CSO reveal that in 1991 36 people were employed in the manufacturing industry, this figure fell to 22 by 1996. While the actual numbers may be small, the effect of such an occurrence can be devastating to the rural economy of areas such as these.

14.19 Agriculture is the dominant industry in Ballintra DED, the manufacturing and commercial industries are the next largest employer. This trend can be seen in Table 14.5. The level of participation in agriculture is more than double the national average and is almost twice the level of participation in County Donegal. Manufacturing and commerce are the next most prominent employment sectors. The results for agriculture and interestingly the professional services are the only sectors which differ greatly with the county and state averages.

14.20 The situation in the neighbouring Cavangarden is markedly different than in Ballintra and indeed all other areas analysed. While agriculture is also the principal industry its percentage participation is three times that of the State and one and half times that of Ballintra. The next biggest sector is manufacturing which is similar to Ballintra. Building and construction are higher than the other areas, while the level of participation in the other sectors is lower than all other areas analysed.

**Table 14.5 Employment by Industry**

	<b>Agriculture</b>	<b>Building &amp; Construction</b>	<b>Manufacturing</b>	<b>Commerce</b>	<b>Professional Services</b>
Ballintra DED	23.3%	6.3%	21.8%	21.8%	11.2%
Cavangarden DED	35.6%	9.9%	21.8%	7.9%	10.9%
Donegal	13.6%	7.8%	25.7%	15.9%	17.3%
Ireland	10.2%	6.7%	19.1%	20.8%	18.5%

**SOCIO-ECONOMIC PROFILE**

- 14.21 The unemployment rate, which is taken as a percentage of the total population of the area analysed, is almost double the national average. The figure for county Donegal is above the national average but considerably less than for Ballintra DED.
- 14.22 Cavangarden DED has a the lowest unemployment figure of all the areas analysed due in no small part to the high proportion of under 14 year olds who live within the DED as well as the high level of participation in the agricultural sector. The nature of farming is such that a retirement age is immaterial and many farmers will continue to work beyond the normal or conventional retirement age.
- 14.23 The percentage of residents who are classified as being at work (in 1996 census) in Ballintra DED is slightly above the national average and considerably higher than the County average. Cavangarden DED is similar to that of the county average. However, the unemployment rate in Ballintra DED is almost double that of the national average and is considerably higher than the county average. This is not the case for Cavangarden DED whose unemployment rate is below the county average and significantly higher than the national average. In conjunction both of these figures would suggest that employment opportunities in the area are scarce. This becomes more evident when considering the socio-economic groupings with the areas.
- 14.24 The socio economic groupings are based on all persons aged 15 years and over who are at work as determined by their occupation and additionally in some cases by their employment status. Unemployed or retired persons are classified by socio-economic group according to their former occupation.
- 14.25 As shown in Table 14.6, the percentage of the population who are employed/unemployed managers or employers in Donegal in general is markedly lower than in the State as a whole. These figures decrease when analysis is made of the statistics for Ballintra DED and Cavangarden DED. While the percentage of manager/employer in Ballintra DED is only 0.6%

points lower than the county average the corresponding figure for Cavangarden DED is approximately half that of the national average.

- 14.26 The percentage of skilled manual labour for Ballintra DED, County Donegal and Ireland are somewhat similar with a mere 1.2% points separating the three areas. However the percentage in Cavangarden DED is significantly higher and is possibly reflective of the level of participation in the manufacturing industry which would require a labour force of this nature.
- 14.27 Unskilled manual labourers in Ballintra DED is only slightly lower than the national average but the percentage in Cavangarden DED is over 3 times the level of the state and 2.5 times that of the county. Much of this may be attributed to the proportion of residents who are employed in sectors such as “building and construction” and “manufacturing” where skill levels of varying degrees are required.
- 14.28 Educational attainment and employment prospects are inextricably linked. The proportion of the populations who have only attended primary and lower secondary school is very high in the Ballintra and Cavangarden DEDs, this is replicated in County Donegal, when compared to the national average. The high percentages in this grouping correspond to a low level of participation in third level education. Both DEDs and the County figures fall considerably short of the national average.
- 14.29 The household make up of the two DEDs is comparable with the County and State averages. Both DEDs have similar percentages of single person and couples with children households to County Donegal and the State as a whole.

**Table 14.6 Socio Economic Profile**

	<b>Ballintra DED</b>	<b>Cavangarden DED</b>	<b>County Donegal</b>	<b>Ireland</b>
<b>Economic Status</b>				
Residents classified as retired	8.9%	5.8%	7.8%	7.1%
Residents classified as at work	36.8%	30.8%	30.6%	36.1%
Unemployed rate	11.8%	8.2%	8.7%	6.3%
<b>Socio Economic Groups</b>				
Manager / Employer	7.7%	5.5%	8.3%	11.4%
Skilled Manual	15.4%	23.8%	14.5%	14.2%
Unskilled manual	7.5%	26.2%	10.4%	7.6%
<b>Education Attainment</b>				
Primary and lower secondary	67.6%	76.5%	61.3%	48.5%
Third level	10.6%	9.8%	13.1%	19.0%
<b>Households</b>				
Single person h'holds	23.9%	20.6%	22.3%	21.5%

**IMPACT OF THE PROPOSED DEVELOPMENT ON THE SOCIO-ECONOMIC FABRIC OF THE AREA**

- 14.30 The extension of the landfill site in the Ballynacarrick area of Donegal will impact on the inhabitants of the area. The majority of these impacts will be positive and are detailed below.
- 14.31 During the construction phase of the development employment may be created and sourced from the surrounding area. This will have a positive impact on employment levels in the short term. The proposed landfill will require operatives to collect refuse, transport, compress and oversee the process. The proposed development will therefore sustain current employment levels in the refuse collection/disposal sector but may potentially create additional employment for inhabitants of the area. There are approximately 4 people currently employed at the landfill site.
- 14.32 The remote nature of the site will ensure that disturbance to nearby residents is effectively eliminated. The impact on agricultural practices will be negligible. To date there have been no complaints about the existing landfill facility from neighbouring residents and landowners.
- 14.33 The public perception of landfill sites has been negative in the past and is reflective of the lack of education on waste management and disposal in general. As a society we all contribute to the problem of waste disposal. The proper disposal of waste is vital to ensure that human



health is unaffected and that our quality of life remains undiminished. This is a positive impact not just for local residents but also for the wider community.

- 14.34 Landfill sites are strictly controlled and regulated by the EPA. They are highly engineered structures and highly controlled and managed, therefore the perceptions and the reality are not one in the same.

#### **MITIGATION MEASURES**

- 14.35 Ultimately all impacts on the environment, whether positive or negative impact on human beings. Therefore the topic of human beings is addressed in the succeeding sections of the Statement by means of an appraisal of the effects of the development on the environment in general. Where appropriate, mitigation measures to reduce adverse impacts are identified and incorporated into the proposal.

#### **TOURISM ASSESSMENT - RECEIVING ENVIRONMENT**

##### ***Trends In Tourism - Nationally***

- 14.36 Tourism in Ireland is emerging as the largest industry in the country in terms of income revenue. While the industry has grown at an enormous rate over the past 10 years, 2001 saw a decline in visitor numbers to the country compared to 2000. The revenue generated by tourism however increased. The decline in visitor numbers, at just over 5%, was partly due to the Foot and Mouth outbreak as well as the events of the 11<sup>th</sup> September 2001.
- 14.37 There were 6,081,000 overseas visits to Ireland by non-residents in the year 2001, compared with 6,409,000 in 2000. During the same period Irish residents travelling abroad rose by 11.5%. The majority of visitors to Ireland are from Great Britain (58%), while other European countries and America/Canada contribute 22% and 15% respectively.
- 14.38 While visitor numbers declined in 2001, earnings from tourists rose by 8% on the previous year. This is an increase of over 32% on the same figure for 1997. The total revenue generated by overseas visitors amounted to €3,960 million in 2001.
- 14.39 The total number of nights spent by overseas visitors in Ireland during 2001 was 45,276,000, a decrease of 893,000 on the year 2000.
- 14.40 The main tourist season in Ireland is from April to September with approximately 66% of visitors arriving during this period, however 41% of the annual total arrive between the months of July and September.



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***Glenveagh Castle and National Park***

- 14.44 Ranked at number 10 in the country is Glenveagh Castle and National Park with over 75,000 visitors each year. Glenveagh Castle was built between 1870 and 1873. It consists of a four storey rectangular keep and has a distinctly Scottish feel. It was originally used as a shooting/sporting retreat. It is open from mid March to early November and boasts facilities such as exhibitions, tearoom, restaurant, free bus ride to the Castle from the exhibition centre as well as guided tours of the castle and free access to the gardens. The national park at Glenveagh comprises some 16,540 hectares of mountains, lakes, glens and woods with a herd of red deer roaming its contours. Over recent years the re-introduction of the Golden Eagle to Ireland has commenced in the National Park.

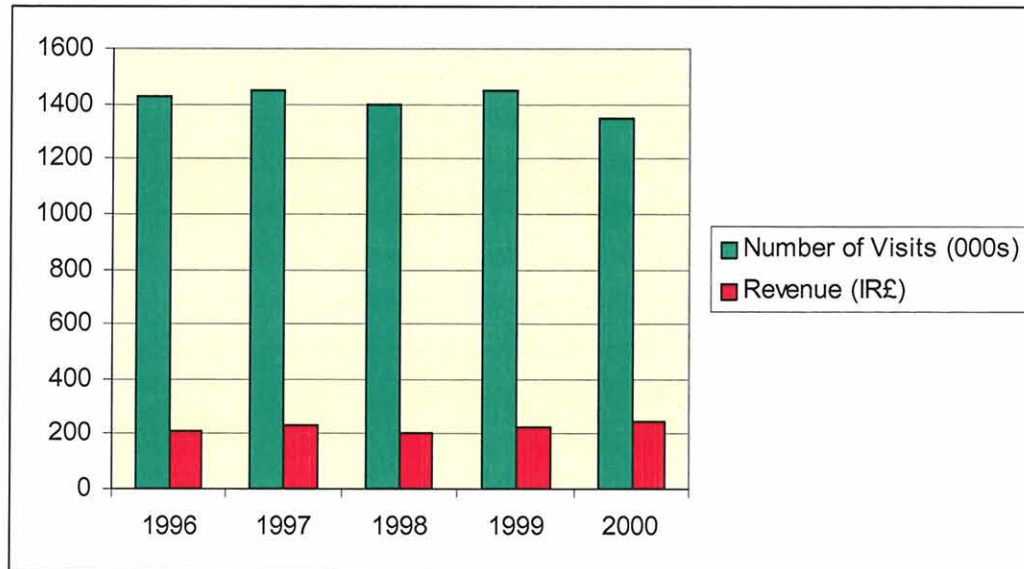
***Donegal Castle***

- 14.45 Ranked at number 17 in the country is Donegal Castle with over 32,000 visitors per year. Donegal Castle was built by the O'Donnell chieftain in the 15<sup>th</sup> century beside the River Eske. The castle underwent extensive 17<sup>th</sup> century additions by the then occupier Sir Basil Brooke. The castle is furnished throughout and includes Persian rugs and French tapestries. Information panels chronicle the history of the castle owners from the O'Donnell chieftains to the Brooke family.

***Trends In Tourism - Regionally***

- 14.46 Donegal is part of the North Western Region along with Monaghan, Cavan, Leitrim and Sligo. Figure 14.2 below shows the fluctuations in tourist numbers and revenue to the region over the period 1996 to 2000. Tourism numbers can rise and fall year on year due to a number of factors which are outside the control of a particular region or indeed country. Factors such as exchange rates, relative cost, access and global stability all influence the movement of tourists.

**Figure 14.2: Regional Tourist Numbers and Revenue Between 1996 and 2000**



14.47 The latest figures from Bord Failte (The Irish Tourist board) for the North West Region are for the year ended 2000. The numbers indicate a growth in revenue (18%) but a decline in visitor numbers (1%) between 1999 and 2000. However the growth in revenue and visitor numbers between 1996 and 2000 are 46% and 14% respectively.

14.48 Overseas tourism and domestically generated tourism are almost evenly split, 607,000 from overseas, 738,000 from both northern and southern Ireland. Of the overseas visitors 48% are from Britain, 22% from mainland Europe and 23% from North America. The revenue generated by tourism in the region is also evenly split between overseas visitors (54%) and Irish (North & South) (46%). The bulk of the overseas visitor revenue is from British guests (57%), the percentage from mainland Europe and North America are far less at 17% and 21% respectively.

14.49 Tables 14.7 and 14.8 below show the breakdown of tourism to the North West region by County. Table 14.7 shows the number of visitors to each county, while Table 14.8 shows the revenue generated. Donegal receives the largest percentage of visitors to the North West Region compared to any other county in the region. It accounts for 42% of all visitors to the region. It also has a different pattern of tourism as compared to other counties. While the majority of visitors to other counties are from Britain, this is not the case for Donegal. Donegal receives only 29.9% of its visitors from Britain as compared to a range of between 46.3% (Sligo) and 72% (Leitrim). Tourists to Donegal are evenly split between Britain, Mainland Europe and North America, North American visitors are marginally in the majority.



14.50 The North American market is vitally important to the tourism sector in Donegal as the table shows, but a reduction of 12.6% of North American visitors in 2001 to Ireland as a whole will have had a negative impact on the county's tourism sector.

**Table 14.7 Overseas Tourists to Counties, 2000 (000s)**

County	Total	%	Britain		Mainland Europe		North America		Other Areas	
			No.	%	No.	%	No.	%	No.	%
Cavan	107	15.4%	70	65.4%	12	11.2%	21	19.6%	4	3.7%
<b>Donegal</b>	<b>291</b>	<b>42.0%</b>	<b>87</b>	<b>29.9%</b>	<b>89</b>	<b>30.6%</b>	<b>90</b>	<b>30.9%</b>	<b>26</b>	<b>8.9%</b>
Leitrim	50	7.2%	36	72.0%	6	12.0%	6	12.0%	2	4.0%
Monaghan	40	5.8%	23	57.5%	7	17.5%	8	20.0%	2	5.0%
Sligo	205	29.6%	95	46.3%	54	26.3%	45	22.0%	11	5.4%

Source: Bord Fáilte, 2001

14.51 County Donegal receives over 34%, amounting to €58m, of the total revenue generated by tourism in the North West Region, exceeding all other counties in the region. The next highest is Sligo with just over 30%. The amount of revenue generated from the differing country categories differs greatly for Donegal as its visitor numbers revealed, to the other counties. Only 39% of its revenue is generated from British tourists, as compared to a range of 55.6% (Monaghan) to 75% (Cavan) for the other counties.

14.52 As mentioned above the percentage of visitors from the three main origin categories is similar but the income from these origin countries differs greatly. British tourists spend the most, €23m or 39% of the total. North America, with the majority share of tourist numbers, comes next with €18m or 30.4%.



**Table 14.8 Revenue generated by overseas tourists to counties within the North West Region – 2000. (Values = € m)**

County	Total	%	Britain		Mainland Europe		North America		Other Areas	
			€	%	€	%	€	%	€	%
Cavan	30	17.9%	23	75.0%	3	8.3%	5	16.7%	0	0.0%
<b>Donegal</b>	<b>58</b>	<b>34.4%</b>	<b>23</b>	<b>39.1%</b>	<b>13</b>	<b>21.7%</b>	<b>18</b>	<b>30.4%</b>	<b>5</b>	<b>8.7%</b>
Leitrim	18	10.5%	13	71.4%	3	14.3%	1	7.1%	1	7.1%
Monaghan	11	6.7%	6	55.6%	3	22.2%	1	11.1%	1	11.1%
Sligo	52	30.6%	33	63.4%	9	17.1%	9	17.1%	3	4.9%

Source: Bord Fáilte, 2001

14.53 The provision of quality accommodation of varying types is an important factor in retaining visitors and indeed encouraging their return. Table 14.9 below reveals the shifts in accommodation stock provision between 1996 and 2000. The upper end of hotel accommodation provision, 3 and 4 star hotels, have risen by 5.9% and 5.3% respectively. The opposite is the case for 1 and 2 star hotels whose numbers fell by 48% and 7.2% during the same period. The category of "others" includes non-classified hotels and 5 star hotels have risen by 200% over the period. Guesthouses and Bed and Breakfast provision also increased. While camping and caravan accommodation stock increased dramatically, the level of self-catering and hostel places decreased. The figures suggest that significant levels of investment in the tourism sector have been allocated to provide essential infrastructure development. The quality and type of provision is largely determined by visitor demand and it is evident that Donegal has adapted its targeting to suit client needs.

**Table 14.9 Accommodation Stock in the North West Region – 2000**

		1996	2000	Percentage Change 1996 - 2000
Hotels	4 Star	338	358	5.9%
	3 Star	1426	1501	5.3%
	2 Star	538	499	-7.2%
	1 Star	407	210	-48.4%
	Other	248	744	200.0%
	Total	2957	3312	12.0%
Guesthouses and B&Bs		2408	2586	7.4%
<b>Total Paid Serviced</b>		<b>5365</b>	<b>5898</b>	<b>9.9%</b>
Self Catering (Registered) *		480	436	-9.2%
Caravan & Camping **		888	1136	27.9%
Hostels ***		917	753	-17.9%

Notes: As of May 2000

\* Based on average of 2 persons per room

\*\* Caravan/Camping refers to number of pitches

\*\*\* Hostel figures are beds available

Source: Bord Failte, 2001

**Trends In Tourism - Local Tourism**

14.54 There are a number of tourist attractions/tourist activities, which are located within a short commuting distance from the proposed landfill site. The nearby centres of Donegal town and Ballyshannon are prime tourist locations offering an abundance of attractions to foreign and domestic travellers. The village of Rossnowlagh is renowned for its beaches and is a popular beach side village. There are over 4 miles of Blue Flag beaches in this region. Other attractions in the area include Lough Derg, Lower Lough Erne and Belleek.

**Table 14.10 Distance to tourist centres (as the crow flies).**

	Distance (km)
Lough Derg	14.0
Rossnowlagh	6.0
Donegal	10.8
Ballyshannon	8.5
Lough Erne	10.1
Belleek	8.6
Bundoran	14.3

- 14.55 Lough Derg which extends to over 2000 acres is renowned for its religious significance. Station Island on the Lough is the location of a Pilgrimage which is often referred to as Saint Patrick's Purgatory. It is a living remnant of the early Irish Church, spanning some fifteen centuries. The island is open to pilgrims between 13 June and 15 August and attracts some 30,000 people every year for the three day event.
- 14.56 Lough Derg is also an important fishing lake containing an important stock of brown trout.
- 14.57 Lower Lough Erne extends to over 100 km<sup>2</sup> and is located in county Fermanagh. The Lough Erne system comprising Upper Lough Erne and Lower Lough Erne is an important resource in the northern region not only as a fishery but also for environmental purposes. The two Loughs are joined by the River Erne.
- 14.58 The Upper Lough and the shallower regions of Lower Lough Erne present an example of a flooded drumlin landscape which has created an intricate mosaic of land and water. The lake supports a fish population which includes roach, pike, perch, bream and trout. Its unique character makes it an attractive area for fishermen, walkers/hikers, cyclists and nature lovers in general. Facilities for all forms of tourist are available in the many villages and towns around its shores.

#### ***Tourism Funding & Policy***

- 14.59 The importance of tourism to the rural economy is unquestionable. The downturn in agricultural incomes has necessitated a shift to diverse sources of income. In some areas the principal area of income generation for such rural economies has become tourism due to Irelands naturally picturesque environment and wealth of historical heritage.
- 14.60 Because of the tourism industry's' emerging importance to the economy over recent years, various interested parties in the tourism sector have produced reports on the future of tourism in Ireland, the regions and County Donegal. It is the allocation of sufficient funding as well as the policies and vision of various organisations that will drive the future development of tourism in the Donegal and safeguard the natural and built environment of the County.
- 14.61 The Operational Programme for Tourism (1994 to 1999) sets out the national spend for tourism under the community support framework. The strategic objective of Irelands tourism strategy over the period 1994-1999 was to maximize Irelands tourism potential thereby increasing tourism revenue and tourism employment. Of the total grants approved under these measures 10% of grant aid was allocated to the North West region and of this 42% was allocated to County Donegal. However, it is worth noting that Donegal received no funding for Measure One "Large National or Regional Tourism projects". The lack of a key quality

attraction of national and international standards in the county has been cited as a major contributor to the low tourism profile of the County.

- 14.62 Also between 1994 and 1999 grant aid was available for tourism development under a number of other programmes, including the EU Special Support Programme for Peace and Reconciliation 1995-1999 (Peace Programme and the International Fund for Ireland).
- 14.63 In relation to tourism, the co-operation between the public bodies measure allocated support to joint tourism (Marketing actions by Bord Failte and the Northern Ireland Tourist Board).
- 14.64 The National Development Plan 2000-2006 recognises the imbalance between and within the regions in the distribution of national economic progress. The Border, Midlands and Western Regions have retained Objective 1 status for structural funds for the period of the plan. Substantial resources exist for major flagship projects and clusters of tourism activity to be supported through the Regional operation Programme.
- 14.65 A new all Ireland tourism body, Tourism Ireland, has been established. This body will have responsibility for all Ireland destination marketing in all markets outside the island of Ireland. This new approach will present great opportunities for tourism development in County Donegal.
- 14.66 The Donegal County Development Plan, 2000<sup>1</sup> has stated that it will develop a more proactive and focused involvement in the development of tourism in the county. It recognises that the sector is part of the service sector where greatest job expansion has taken place over recent years and where job expansion is likely in the future. It is the goal of the Council "to support the development of sustainable tourism as a key element of an overall economic development strategy at both County and local level."
- 14.67 An area of the tourism industry which is of paramount importance to County Donegal is that of marine tourism. This has been highlighted in a report<sup>2</sup> by the Donegal County Development Board. The report states that marine and water leisure activities are estimated to create an additional €25 m in tourism revenue and give employment to around 650 people.
- 14.68 The report has stated that the goal of the Board is "To promote the sustainable development of all fisheries in order to safeguard and increase economic activity in peripheral coastal and rural communities", and "To ensure that the tourism and leisure potential of the County's rivers, lakes and marine resources is fully organised, developed and promoted".



- 14.69 Amongst its key objectives in achieving these goals are;
- To pursue the establishment of a second Donegal based Inshore Fisheries Development Committee in the South Donegal region;
  - To ensure conservation, monitoring and protection of the natural resource; And
  - To market the Donegal water leisure product to home and overseas visitors.
- 14.70 The sustainable development of Donegal's rich fishing resource was further outlined in a report<sup>3</sup> by the Northern Regional Fisheries Board and Donegal County Development board.
- 14.71 The report states that "County Donegal is richly endowed with angling resources capable of providing local leisure needs while simultaneously attracting significant tourism revenue. Unfortunately, many of the County's game and sea stocks have been depleted and there is a clear need for improved management and substantial investment." The report concludes that "conservation and strategic marketing are highlighted as the critical issues" affecting further development of the sector.
- 14.72 The report highlighted the decline in visitor numbers from overseas fishermen to Ireland between 1996 and 2000. These figures are reproduced here.

**Table 14.11 Market distribution of overseas visitors engaging in angling (000's)**

		1996	1997	1998	1999	2000	Growth/Decline 1996-2000
Britain		102	93	84	78	75	-26.5%
Mainland Europe		54	49	43	40	36	-33.3%
	France	14	13	12	10	9	-35.7%
	Germany	21	18	16	15	14	-33.3%
North America		10	11	11	10	10	0.0%
Other Areas		3	3	1	1	1	-66.7%
<b>Total</b>		<b>204</b>	<b>187</b>	<b>167</b>	<b>154</b>	<b>145</b>	<b>-28.9%</b>

Source: Northern Regional Fisheries Board & Donegal County Development Board, 2002

- 14.73 As Table 14.11 above shows, the number of overseas visitors to Ireland, for the purpose of angling over the 5 year period, 1996 to 2000, has declined considerably. The largest proportion of overseas anglers come from Britain but the numbers of coming to Ireland has declined steadily over the period 1996 to 2000. However the decline is most notable amongst mainland Europe where visitors fell by 33.3%. On average, the percentage decline amounts to 28.9% or 59,000 visitors.

14.74 The decline in visitor numbers has resulted in declines in the numbers participating in the three categories of fishing in Ireland. The most pronounced declines are in coarse and sea angling with these pastimes declining by 40.8% and 34.0% respectively between 1996 and 2000. Game fishing, a sport which Donegal is particularly renowned for, has had the lowest decline over the period but a downward trend is still evident. This can be observed in the figures reproduced in Table 14.12.

**Table 14.12 Type of Angling – Overseas Visitors (000's)**

	1996	1997	1998	1999	2000	Growth/Decline 1996-2000
Coarse	76	68	54	51	45	-40.8%
Game	53	51	52	47	46	-13.2%
Sea	47	39	33	28	31	-34.0%
<b>Totals</b>	<b>176</b>	<b>158</b>	<b>139</b>	<b>126</b>	<b>122</b>	<b>-30.7%</b>

Source: Northern Regional Fisheries Board & Donegal County Development Board, 2002

14.75 Donegal forms part of the North West tourism sector and Table 14.13 shows the breakdown by region of the destination of overseas fishermen. The majority of anglers pursue their sport in the South West. This is due to the accessibility of the South West Ballest to international visitors. The area is close to a major international airport, has its own regional airport, as well as having train links and is close to a ferry terminal. The accessibility issue for the North West has been acknowledged by many as the principal reason for its poor performance in tourism terms. The North West however is the next biggest destination point for anglers, attracting over 18% of overseas anglers to the country.

**Table 14.13 Percentage breakdown of overseas visitors to angling destinations.**

	All	Britain	Mainland Europe	France	Germany
Dublin	1	2	-	-	-
Midlands/East	6	7	4	6	4
South East	10	13	4	4	2
South West	32	28	35	27	39
Shannon	8	6	13	11	11
West	18	17	19	29	10
<b>North West</b>	<b>18</b>	<b>21</b>	<b>16</b>	<b>24</b>	<b>15</b>

Source: Northern Regional Fisheries Board & Donegal County Development Board, 2002

14.76 The principal challenge facing the angling tourism sector in County Donegal and indeed Ireland as a whole is to halt the decline in visiting fishermen numbers to the county. Safeguarding the quality of water in the County's rivers, ensuring effective conservation and management practices are employed and promotion of the total angling product is vital to ensure the long term stability of the sector to all regions of the country.

#### IMPACT OF THE PROPOSED DEVELOPMENT ON THE TOURISM INDUSTRY

14.77 Visiting tourism numbers are affected by a host of factors such as cost, foreign exchange rates, access etc. The development of this proposed landfill site will have a negligible impact on the number of tourists traveling to the County. The site is not on any recognised tourism routes and therefore its presence will be unknown to visitors unless happened upon by chance.

14.78 Any change in land use may have a corresponding impact on the character of an area. The degree of any impact will depend on a number of aspects including the historical or personal associations with the sites, uniqueness of the environment and the extent to which this will change the nature of the surrounding land uses.

14.79 The impact of the development on the site will be significant, in so far as it will alter the agricultural use of the site. The impact on the wider landscape however could be said to be slight as the undulating terrain provides a natural screen to the site.

- 14.80 In the short term the development of the site may have some negative impact, due to construction activity on the site and the movement of heavy earth moving machinery. Ultimately however, this would be limited and significant adverse impact is not expected.
- 14.81 Sites or areas with tourism potential close to the landfill may be impacted by the following:
- Road network improvements and their effects on the surrounding countryside. The impact on existing established roads surrounding the site will be limited to a short section bounding the site. The visual impact from the road tends to be of limited, in that the impact lasts only for the period for which travel is within the zone of visual influence of the proposed development.
  - There may be potential impact through construction traffic and disruption to existing traffic route at stages during the construction period.
  - Good construction practice including the use of wheel wash facilities will reduce potential impacts caused by soil and landfill materials being driven off site by construction vehicles.
  - Effects of additional vehicle movements on both road safety and air quality.
  - The ability of the landfill site to provide effective screening for the operations through a combination of topography and vegetation.
- 14.82 The proposed development will not adversely impact on the established tourism centres of Donegal, Rosstown, Ballyshannon, Belleek or Bundoran. It will not impact on the angling tourism of Lough Derg or Lough Erne. Indeed the development of the proposed extension is an important factor in ensuring the required waste management infrastructure is available in South Donegal to allow the tourism industry to develop.

#### MITIGATION MEASURES

- 14.83 The site will be operated to EU standards, which should reduce the risk to air and water quality. This is dealt with in full within the EIS (Section 9 and 12).
- 14.84 The proposed landfill development will not lead to increased traffic flows on the surrounding road network. Current traffic levels will be sustained. It is proposed to improve the narrow access road through the provision of passing lay-bys. This will allow the passing of vehicles without significantly altering the character of the local roads, which are narrow, largely unscreened county roads. This will also improve the existing situation, particularly for local inhabitants and farm vehicles.



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## HUMAN HEALTH

- 14.85 The proposed extension to the existing landfill facility at Ballynacarrick is for the receipt of non hazardous waste.
- 14.86 Landfill sites produce gas and leachate as a result of waste decomposition. An emission from a landfill site does not necessarily result in human exposure as a person can only be exposed if they come into contact with the emission. The potential risks to human health from landfill sites include migration of landfill gas, the contamination of water by leachate and vermin/bird control. The design of modern landfill sites which include lining and capping systems, aims to minimise emissions of leachate and landfill gas from a landfill. These topics are dealt with in Chapters 6, 9, 12 and 13.
- 14.87 A study on the health effects of landfilling and the incineration of waste was undertaken by Health Research Board (HRB), 2003 at the request of the Department of the Environment Heritage and Local Government. The specific research objectives of the study were as follows:
- *To review national and international literature relating to the effects of landfill and thermal treatment of waste on (a) human health and (b) the environment.*
  - *To describe the knowledge and attitudes of service providers, special interest groups and the general public to waste management options and to undertake an analysis of the source and basic knowledge and attitudes.*
  - *To describe (a) the current policy and practice of waste management in Ireland in terms of the hierarchy of principles in waste management, including methods of monitoring of waste and surveillance of emissions, and (b) practices in waste management in other countries, in order to identify best practices in terms of efficiency and safety. This will include technical descriptions of different waste management options and new technologies.*
  - *To review national and international literature on environmental risk assessment and to identify and describe formal risk assessments that have been carried out on landfill and thermal treatment facilities to date. This will also describe those emissions that have been identified as hazardous to human health and the environment.*
  - *To compare the risks posed to public health and the environment by emissions and health by emissions from landfill and from modern thermal treatment plants with those posed by similar emissions from other sectors.*
- 14.88 The study involved qualitative studies including focus groups and semi-structured interviews with representatives of service providers, industry, environmental health officers and the general public. Advertisements were also placed in the local press inviting submissions.

14.89 In its summary in relation to the health effects of landfilling it reported:

- *“There have been many studies of different potentially adverse effects. These studies show an increased risk of some adverse health effects linked to residence near certain specific sites. However, although a great number of studies have been carried out, evidence of a causal relationship between specific health outcomes and landfill exposure is still inconclusive. For many reasons, it is impossible to give definitive answers to questions about these health effects. In the future, examination of specific types of defect, possibly related to exposure to specific environmental agents, may serve to clarify this link. This is further complicated by the fact that little is known about the causes of birth defects in general.*
  
- *At present there is insufficient evidence to demonstrate a clear link between cancer and exposure to a landfill. When residence in proximity to a landfill has been examined as a health risk, excesses of bladder, lung, leukaemia and stomach cancer have been reported in some studies and not in others. Reports of increased risk of respiratory, skin and gastrointestinal illnesses are based mainly on self-reported symptoms. These studies are hard to interpret when trying to establish causal relationship.*

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## BIBLIOGRAPHY

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<sup>1</sup> "County Donegal Development Plan 2000 – Volume 1, Core Document". Published by Donegal county Council, 2000.

<sup>2</sup> "An Straiteis – Donegal County Strategy – 2002 – 2012." Published by Donegal County Development Board, 2002.

<sup>3</sup> "Outline Proposal for the Development and Management of Angling in Donegal – Consultation Document" – Northern Regional fisheries Board & Donegal County Development Board, 2002.

<sup>4</sup> "Health and Environmental Effects of Landfilling and Incineration of Waste – A Literature Review" – Health Research Board, 2003.

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## 15.0 LANDSCAPE AND VISUAL

### INTRODUCTION

- 15.1 The landscape and visual impact assessment of the proposed Ballynacarrick Landfill Site Co. Donegal, is concerned with a description of the existing landscape character of the area, the impact of the proposed development on the landscape and visual character, and on views of it. Mitigation measures are also described.

### BASIS FOR THE LANDSCAPE IMPACT ASSESSMENT

- 15.2 The assessment of the landscape impact of the proposed development is based on the guidelines laid out by the Landscape Institute and the Institute of Environmental Assessment in the *Guidelines for Landscape and Visual Impact Assessment (2002)* and *The Environmental Protection Agency Guidelines on the information to be contained in Environmental Impact Statements (2002)*.

#### **Landscape in the Existing Environment**

- 15.3 The Guidelines note that landscape is a combination of two separate but closely related aspects. "The first is visual impacts, that are the extent to which new developments can be seen. The second is impacts on the character of the landscape, that is, responses that are felt towards the combined effects of the new development".
- 15.4 The Guidelines recommend the following to be included in any assessment.
- (i) Context

Areas from which the existing site can be seen are generally noted with particular attention to views from roads, residences and designated tourism routes and viewpoints. Areas from beyond the site boundary from which the site can be seen should be noted. Principal landscape features and areas of distinctive character should be mapped.
  - (ii) Character

A description of the landscape character differentiates between subjective assessments and objective description. A description of the character of the site as perceived both within the site and wider landscape is important, as is a description of the intensity and character of land use.
  - (iii) Significance

This entails the level of intrusion upon designated views, designated landscape and designated landscape amenity areas.



(iv) Sensitivity

The extent to which the existing landscape or views are capable of being changed before altering the perceived character.

**Definition of Visual Impacts**

15.5 Visual impact may occur by means of intrusion and/or obstruction. The terminology used in the assessment of impacts is set out in table 15.1.

**Method of Landscape and Visual Assessment**

15.6 The process for assessing the landscape and visual environment includes;

- Field and photographic survey
- Desktop survey of ordnance survey maps and photographs
- On site visual appraisal
- Analysis of the survey results

**Desktop Survey**

15.7 The area of visual influence was evaluated using the 1:50,000 and 1:20,000 and 1:10,000 Ordnance Survey maps along with 1:1,000 Survey maps of the Landfill site.

15.8 Three constraints govern the size of the Visual Envelope (VE) or zone of visual influence within the study area. They are:

- the physical limits to visibility
- the nature of the developments
- the landscape context of the developments and their surroundings

15.9 Physical limits are determined by the intervening elements of the landscape arising from topographical settings, vegetation and land uses. These inhibit or screen views of the site, e.g. ridges, hills, buildings, walls and vegetation etc. The mass, colour and form of the landfill facility and its relationship to the landscape i.e. hills, valleys, vegetation etc also influence the VE. The VE has been measured with consideration given to local inhabitants, local and visiting travellers and relates to the road network and adjacent landuses (Figure 15.1).

**Table 15.1 Definition of the terminology used in the assessment of visual impacts**

Visual Intrusion	This occurs where a proposed development impinges on an existing view, without obscuring the view.
Visual Obstruction	This is an impact on a view which also involves obscuring the existing view.
<b>Quality of Impacts</b>	
Positive Impact	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or removing nuisances or improving amenities).
Neutral Impact	A change which does not affect the quality of the environment.
Negative Impact	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
<b>Significance of Impacts</b>	
Imperceptible Impact	An impact capable of measurement but without noticeable consequences.
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Impact	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends.
Significant Impact	An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound Impact	An impact which obliterates sensitive characteristics.
<b>Duration of Impacts</b>	
Temporary Impact	Impact lasting for one year or less.
Short-term Impact	Impact lasting one to seven years.
Medium-term Impact	Impact lasting seven to fifteen years.
Long-term Impact	Impact lasting fifteen to sixty years.
Permanent Impact	Impact lasting over sixty years.
<b>Types of Impacts</b>	
Cumulative Impact	The addition of many small impacts to create one larger, more significant impact.
'Do Nothing Impact'	The environment as it would be in the future should no development of any kind be carried out.
Indeterminable Impact	When the full consequences of a change in the environment cannot be described.
Irreversible Impact	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
Residual Impact	The degree of environmental change that would occur after the proposed mitigation measures have taken effect.
Synergistic Impact	Where the resultant impact is of greater significance than the sum of its constituents.
'Worst Case' Impact	The impacts arising from a development in the case where mitigation measures substantially fail.

### **Field and Photographic Survey**

- 15.10 The study area was surveyed in changeable conditions, from overcast and dull through to clear, providing an understanding of visibility across a range of weather conditions.
- 15.11 The purpose of the field and photographic survey was:
- To confirm and record specific viewpoint locations; (Figure 15.2).
  - To record specific objective and subjective information for each chosen viewpoint;
  - To photographically record each viewpoint; (Figure 15.3-15.6).
  - To provide base data for analysis of both existing and proposed landscape and visual analysis.
- 15.12 The assessment seeks to define the extent of the areas from which the landfill facility may be seen and within that area, quantify the sensitivity of a particular view point, which would be affected by characteristics such as:
- Distance of view from the site.
  - Frequency of use of the view point.
  - Landscape characteristics.
  - Duration of the view.
  - Viewer response (residents/travellers).
- 15.13 Three types of impact were considered:
- Predicted Impact
  - 'Do Nothing' Impact
  - 'Worst Case' Impact

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### **THE RECEIVING LANDSCAPE**

#### **Surrounding Area/Background**

- 15.14 The proposed extension to the landfill facility in Ballynacarrick is in a 4.2 hectare field adjacent to an existing landfill site, which lies in the drumlin country of Donegal (Grid ref H195366) 2km south of the village of Ballintra. The greater agricultural landscape comprises drumlins and small lakes and rural roads with hedgerows of varying quality. Landuse is a mixture of cultivated fields and pastureland, poor quality scrubland and commercial forestry. The landscape is dotted with farmsteads, individual dwellings and occasional industrial and commercial buildings.
- 15.15 The landscape character reflects the underlying geological structure of the area, which has been influenced by human activities over the centuries, and is both rural and agricultural. In recent times, the continued rural depopulation and the increase in employment in the industrial sector has decreased the dependency on the land.

### **Towns and Settlements**

- 15.16 The site lies 3km southeast of Ballintra and 7km south of Laghy. The nearest large town is Donegal town 12km to the north. Residential properties and farmsteads are scattered throughout the VE, some with large farm sheds which, due to their colour and scale, are prominent, in the landscape.

### **Natural Features**

- 15.17 The site lies in a broad linear hollow surrounded by higher ground to the west, southwest and south while to the east lies a low lying area of blanket bog. This area is part of the Donegal Bay syncline which represents a folded area of the crust and is underlain by limestones, shales and sand of the Lower Carboniferous Period. This has been covered with glacial outwash deposits to create a distinctive drumlin topography. The drift geological if of glacial materials overlain with allouviium and peat deposits. Soils are mainly peaty top soils.
- 15.18 7km to the northeast the ground rises to Oughtarnid (271m), to the east to Shinnan Hill (147m) and to the southeast to Bradlieve Mountain (270m). To the west, the land falls gently to Donegal Bay (7km).
- 15.19 The wider study area is an agricultural landscape of drumlins and small lakes. Much of the remaining land is bog or scrub and of poor quality. The undulating nature of the drumlin topography is a feature that greatly reduces the extent of visibility within the landscape.
- 15.20 Drainage in the local area is restricted by the nature of the topography. The drainage system from the local area flows into Durnesh Lake 5-6km from the site.
- 15.21 Roads in the locality of the site are third class roads, many of which are not much larger than laneways. For the purposes of this study they have been given a reference number e.g. TCR 1 (Figure 15.2). The local roads are often defined with mature hedgerows and trees. However, the roads are not visually significant in the general context of the landscape. The nearest main road is the N15, National Primary Road to Donegal, which lies 2km to the west of the site.

### **Donegal (Development Plan Designations)**

- 15.22 1.5km to the northwest of the proposed site is an area which has been designated a Natural Heritage Area and a Special Area of Conservation. The unique qualities of this area would not be physically affected by the proposals and the proposed extension to the landfill site would not be visible from the area. Currently vehicles travelling to the existing landfill site travel along a road adjacent to this area and if the extension to the landfill site is approved vehicles would continue to use this road and past the site.



### **Landuse**

- 15.23 Apart from some forestry and quarrying, agriculture is the main economic activity in the area (dairying and beef production). Field sizes are generally small and are surrounded by hedges. The adjacent site is a landfill site, which is undergoing a major phase of construction to provide a contained site facility.
- 15.24 The local area is rich in archaeological evidence, with cairns and megalithic tombs testimony to a long period of settlement from mesolithic times to the present. No evidence of archaeological material has been found on the site to date.

### **Vegetation**

- 15.25 The vegetation in the VE combines with the topography to create intermittent enclosure and opening of the landscape. Small blocks of coniferous forest are present amongst the pastureland and hedgerow grid which characterises the area. Bog and scrubland habitats are common, along with herb rich pastures.
- 15.26 The main tree species include Ash, Rowan, Alder and Hawthorn. Small woods, trees and hedgerows are significant elements in the local scenery and contribute to the ecology of the area. (See Flora and Fauna Section 10.0 for a more detailed description of existing vegetation).

## **EXISTING ENVIRONMENT**

### **Site Description**

- 15.27 The environs of the site are characterised by fields and hedgerows with occasional trees; areas of poorly drained agricultural land and pockets of woodland and scrub. Farm buildings and dwellings are scattered throughout the area on the many minor roads surrounding the site.
- 15.28 The proposed site is currently in unimproved pastureland, used for grazing cattle. The scene is generally peaceful in nature. This is in marked contrast to the adjacent landfill site where the landform and vegetation have been significantly modified by previous landfilling operations and ongoing constructions works. With its spoilheaps, overburden areas; skips and temporary buildings, the scene here is one of disruption and activity.
- 15.29 The proposed site is defined by two third class roads, a laneway and a landfill site. The proposed landfill site would be a continuation of the existing landfill site into an adjoining field, which runs parallel to TCR 1 (180m). It is bounded by TCR 3 (140m) (Figure 15.2) and a laneway. The entrance to the proposed extension site would be through the existing site along a new internal road. A landfill gas flare is required for the existing landfill and will also

serve the extension to the site and will be located adjacent to the existing infrastructure of the landfill site.

15.30 The site is roughly square in shape, would have a capacity of 225,000 tonnes and would take approximately 8 years to fill. The site is south-west facing and has a cross fall of approximately 8.3 metres. It is bordered to the north and west by mature hedgerows and on the east and south by post and wire fencing. There are some farm buildings and mature trees on the northern boundary of the site, but they, along with the western hedgerow, would not be physically affected by the proposed development.

15.31 The proposed landfill site would be excavated to a depth of 2-8 metres, with some of the fill material being used to cover parts of the existing landfill site; the remainder being stored in mounds for future covering. 2m high earth mounds would be created on the southern and western boundaries of the proposed site, to act as visual barriers.

### ***Project Description***

- 15.32 The proposed development would involve the following:
- Excavation of the site and the storage of over burden materials for future use.
  - The creation of earth bunds on the northern, southern and western boundaries to help screen the site from view. These would be planted up to create a visual barrier.
  - The lining of the containing area, provision of drainage and gas collection facilities.
  - The construction of a new internal road to provide access for construction traffic to the site.
  - Litter containment facilities.
  - Progressive filling and capping of 4 phases of operation.
  - Regrading the final contours to create a landform, which would harmonise with the surrounding area and the proposed landform to be created at the existing landfill site.
  - Landscape treatments to assimilate the development back into the landscape setting, i.e. grassing and planting works, (native species).
  - A landfill gas flare 5m high would be required and this would be located in the existing landfill site.

### ***Drainage***

15.33 The site is drained by a small stream, which rises to the east of the site in an area of blanket bog and drains to Durnesh Lake. It would be diverted during the proposed construction works.

### ***Vegetation***

15.34 Site vegetation is largely poor quality pastureland which contains some herb rich species. Hedges are overgrown and contain Hawthorn, Elder, Bramble and Holly. There is also some scrub vegetation beside the stream. However, this would be lost during proposed construction

works. The larger trees on the northern boundary are Ash and Sycamore and would be retained and reinforced to provide screening from the north.

### **Site Visibility**

15.35 Visibility of the proposed landfill site extension is primarily determined by topography, local screening vegetation and the density of the trees growing in and around the area.

15.36 A combination of fieldwork and a desktop study of Ordnance Survey maps, suggests that the landfill site has a visual envelope as shown on Figure 15.1. This was largely determined by the locations of raised ground in the undulating drumlin landscape.

### **North**

15.37 Generally, views of the site from the north are restricted by the intervening landform and the existing trees, hedge and buildings on the northern boundary of the site.

15.38 The site cannot be seen whilst travelling south towards the site along the TCR 3, from the direction of Ballintra. This is evident in Views 1-4, a series of viewpoints on the road. There are no views of the site from the NHA and SAC area which are located 0.8km to the north.

15.39 In view 2 the top of the spoil heaps of the current landfill site can be seen in the distance but the rising ground prevents views of the proposed site. Further along this road (View 3), there is a view towards the site, but all that can be seen are the hedge, trees and buildings on the northern boundary.

15.40 View 4 is from a caravan (Dwelling A) on the north east boundary, where the spoil heap and rising ground prevent views of the proposed site. (For clarification, dwellings have been labelled as dwelling A, B, C, D, and E on Figure 15.7) Travelling west along TCR 4 from the north east, there are no views of the proposed site (View 5). There would be views of the proposed landfill gas flare for this dwelling.

### **East**

15.41 There are no views of the site from the east as these are restricted by the intervening landform, hedges and the rising ground of the existing landfill site.

15.42 View 6 is taken, looking east, from within the existing landfill site and shows the undulating landscape with occasional dwellings in the distance. The existing landfill site, with its ongoing construction works and palisade fencing, are in marked contrast to the surrounding landscape setting. The proposed landfill gas flare would be located behind this fence. Proposed perimeter planting and restoration works would in time soften this view. (A less intrusive type

of fencing is recommended for future fencing operations). View 7 is looking into the site from the junction of TCR 1 and 2. Again the rising ground screens the proposed site from view.

- 15.43 Views towards the site from the southeast are limited. View 8 is from a vantage point on the eastbound TCR 2 with Dwelling B on the extreme right. The intervening drumlin limits views in the direction of the site. Part of the proposed landfill gas flare would be visible from this dwelling. Further along the road, below one of the existing houses (Dwelling C), View 9 shows the current landfill site in the distance. The proposed site cannot be seen from the road, however as the house is in an elevated position, a glimpse of the site may just be visible. Dwelling C would have views of part of the proposed landfill gas flare. Another dwelling (Dwelling D) close to this location, does not have views of the site, due to the intervening rising ground. The hedgerows along this road also act as a visual barrier (View 10).

### **South**

- 15.44 A series of small hills, including Garvanagh Hill, screen the site from view beyond 0.5km. There are no views from TCR 5.

- 15.45 Descending Garvanagh Hill on TCR 6, there are panoramic views of the proposed site and much of the existing landfill site (View 11). It is from this viewpoint that the greatest visual intrusion is likely to occur as all of the proposed site would be in view along with much of the existing landfill site. Further down the road, existing planting helps to filter views (View 12). View 13 is from the westbound TCR 1, showing the new facility under construction along with the start of the proposed earth bunds. Part of the proposed landfill gas flare would be visible from this road. Proposed planting on the bunds would in time help to screen this view along this road. It is clear that the proposed site would be visible along this road (View 14).

### **West**

- 15.46 Travelling eastwards along the N15 National Primary Road the site is not visible. Views 15, 17 and 18 shows a series of views along TCR 1. View 15 shows the site just visible in the distance, but little detail can be seen. Local hedges help to screen the proposed site from view (Views 17&18). Within 0.5km of the site the landscape opens, the site is revealed and remains in view until it is passed (View 18).
- 15.47 Travelling north along TCR 3, there are glimpses into the site, through the overgrown hedgerow. After leaf fall, these views are likely to be increased (View 19).
- 15.48 The view is lost as the road descends. The existing hedges, trees and unoccupied farm building are seen on the skyline, however no view of the site is visible (View 20).

15.49 Further along the road a new dwelling (Dwelling E), is under construction, but the site cannot be seen from this point (View 21). The proposed landfill gas flare would not be visible from the west as it would be screened by the landform of the existing landfill site.

### **Significance**

15.50 Landform and existing trees and hedges limit views of the site from properties and roads. Views are generally of a rural and agricultural nature associated with the farmed landscape. Apart from the active construction and landfilling activities, interest is generally passive, low key and peaceful in nature. Although the landscape is scenic, it has not been officially designated as being sensitive or significant. The area is never the less important to the local population.

15.51 Figure 15.2 shows the location of a National Heritage Area and a Special Area of Conservation, which is located .8km to the north of the proposed site. The proposed site would not be visible from this area, but site traffic would pass this area and create slight visual intrusion.

15.52 If the proposed landfill site is approved there would be a temporary loss of grassland cover and the removal of an area of scrub. The loss of these elements, which are common in the area, is not considered important. New planting works would offset this loss of habitat. A new landform would emerge to replace the existing one and would replicate the surrounding drumlin landscape.

15.53 The adjacent landfilling activities have clearly modified the landscape setting of the area, creating an area of disturbed land. The proposed extension to the landfill site would increase the areas of disturbed land; however, this would be offset by ongoing planting and progressive restoration works on the existing landfill site. Proposed earth bunds and planting works would be used to limit the visual intrusion of the proposed extension, which be followed by progressive restoration of the site that would reduce the amount of disturbed land and the visibility of the site. Planting and earth bunds would in time screen the proposed landfill gas flare from view.

### **Sensitivity**

15.54 This is the degree to which the existing landscape can accommodate the proposed development without detrimental effects on its character.

15.55 The pattern and scale of the existing landscape is small. The proposed development would take place within an existing field and so the pattern and scale of the landscape would not be disrupted. Also, the existing landfill site would be largely restored before the proposed site comes into operation, so that the effects of both sites would not be cumulative.



- 15.56 It is accepted that the area has been damaged by landfilling activities at the existing site and the visual qualities of the area have been modified. Landfilling and progressive restoration in the current landfill would, in the long term, help to reduce the existing scars and help to assimilate the site into the local landscape setting.
- 15.57 The proposed extension would prolong the period of landfilling and the extent of land disturbance. It would have a negative impact on the existing landscape but this would be moderate in effect and of short term duration. A new landform would involve replicating the drumlin type of landform that would be in character with the local area.
- 15.58 New planting around the existing landfill site would help to limit views of the existing landfill site and would also link the area to its local setting. Additional earth bunds and planting would be located within the existing landfill site to help screen the landfill gas flare. This would be supplemented with new planting to screen the proposed landfill site extension. This planting would add to the ecological diversity of the area.
- 15.59 The undulating nature of the local landscape and the fact that there are few residents or travellers in the area, gives the area a tolerance to this type of development. The short duration of the project would also limit the time scale of any adverse effects.
- 15.60 High standards in the design and management of the proposed landfill operation would be necessary to ensure that the local area is not compromised in the future. This would include ongoing monitoring of the planting.

#### LANDSCAPE IMPACT ASSESSMENT

- 15.61 The landscape impact assessment (Figure 15.7) of the area is based on criteria set out in detail in section 1.0, *Basis of Landscape Impact Assessment*. Impacts may be indirect, secondary or cumulative and visual impacts may occur by means of intrusion and/or obstruction. The assessment includes an appraisal of the 'Do Nothing' approach along side the predicted impacts of changes in character, visibility and patterns of landuse.

#### ***Scope of Existing and Proposed Impact***

- 15.62 Currently the proposed site is a field that blends in with the surrounding agricultural landscape. The proposed landfill site extension would have an impact on the landscape of the site, giving rise to changes in the landscape character of the VE. Visual impacts would occur as a result of intrusion on views of the area. Visual impact would be considered in relation to local residents within 0.5km of the site, travellers on the third class road network and the landscape.

### 15.63 **Proposed Impacts**

#### ▪ **Site Development**

Construction of the site and facilities would be completed in approximately 6 months, followed by site infilling, which would be a phased programme lasting 7-8 years with 4 phases. (Figure 15.8) Site construction traffic would use existing roads bounding the site. The construction and infilling works would cause general noise and physical disturbance to residents and road users around the site and create a visual impact in the area. This would be in addition to the impacts of the current landfill site.

#### ▪ **Changes in Land Use**

The land would change from agricultural use to a landfill site and on completion returned to agricultural use. In visual terms, the proposed physical development of the site would represent a significant change to existing conditions. However, as landfilling has already taken place on the adjacent site, it would not be a new feature in the local landscape.

#### ▪ **'Do Nothing' Landscape Impacts**

Presently the site is a green field used for grazing, surrounded on two sides by hedgerows. Its character is compromised by the adjacent landfill site. If the proposed extension does not take place, the site would remain as it is and the setting would be improved over time as the existing landfill site is progressively restored.

### **IMPACT ON VISUAL CHARACTER**

### 15.64 **Visual impacts would be likely to occur as a result of the following:**

- Excavation and construction works to prepare the site for landfilling
- Stockpiles of soil/fill materials.
- Vehicles entering and leaving the site and on surrounding local roads.
- Filling operations, with vehicles moving and spreading fill materials.
- Fencing used to limit the movement of wind blown materials.
- Dust, particularly during periods of dry weather.
- Exposed areas of bare ground.
- The colours of fill areas in contrast to surrounding areas.
- Earth bunds with their steep gradients, until grassing and planting helps to soften their outline.
- Pollution of roads by run off from lorries
- Alteration of ground levels
- Changes in landuse from grassland to landfill site and to grassland with perimeter planting.
- A landfill gas flare 5m high

15.65 When viewed from a number of locations around the site, the completed development would produce visual intrusion as expanded below:-

**North**

15.66 Views of the proposed landfill site from the north are limited by the nature of the existing landforms, which screen the site from view. The existing trees, hedges and buildings on the northern boundary would be retained, along with a 6m wide buffer between the landfill site and the existing onsite features. This would be planted up with woodland trees to reinforce the existing trees. The construction works and site filling operations would not be visible from the north. When the infilling is taking place in the upper cells of the site and during capping and restoration works, machinery and fencing may be visible through the existing vegetation and additional planting. Visual impact is likely to be imperceptible.

15.67 Views 1-4 show that there would be no views of the proposed site from local roads to the north of the site.

15.68 There would be no views of the proposed site from dwelling A (View 5), even when the temporary spoil heaps are removed, as the newly created landform in the existing landfill site rises gently to screen the site from view. There would, however, be views of the 5m high landfill gas flare, vehicles entering the site and glimpses of the upper parts of temporary fencing until the proposed planting works associated with the existing landfill site are established. When the proposed planting becomes established on the site boundary, visual obstruction would limit views into the site. This would also screen the proposed landfill gas flare.

**East**

15.69 Views of the proposed site from the east would be imperceptible and would be limited to vehicles entering and leaving the site via the existing entrance. As the landform of the existing landfill area rises to the west, it screens the site from the east. The palisade fencing around the existing site is out of character in this rural landscape, however its impact would be softened by proposed new planting behind it. Temporary storage of fill material on the western boundary of the existing landfill site would also help to screen the site from view. However as they are being progressively removed they would give rise to some visual intrusion with vehicles visible on the skyline.

15.70 In the existing landfill site 3m high bunds would be formed and planting to reduce the impact of the proposed 5m landfill gas flare. Travelling south along the TCR 2 there would be glimpses of the proposed landfill gas flare through the perimeter planting. However only the top 2 m of the flume would be visible over the bund and as the proposed planting mature its impact would become slight.

15.71 Travelling along TCR 2 from the south east, the existing landfill site is clearly visible. However, the proposed extension would not be visible due to the intervening landform and vegetation (View 9&10). Two dwellings, B and C, in elevated positions, have clear views of the existing site. The proposed extension would not be visible from these dwellings however, they would continue to see vehicles entering and leaving the site. Due to the intervening distance, visual impact from vehicles would be slight and of short term. The top of the proposed landfill gas flare would be visible from these dwellings however, proposed earth bunds and proposed planting would help to reduce the impact of the flume. Visual impact from the proposed landfill gas flare would be imperceptible.

### **South**

- 15.72 Visual impact of the proposed development would be most noticeable from the south, where significant visual intrusion would be experienced.
- 15.73 Negative visual intrusion would be evident from TCR 6, as it descends from Garvanagh Hill and provides panoramic views over both the proposed landfill site and the existing landfill site beyond (View 11). The cumulative effect of the two sites would be to create significant visual intrusion, which would remain until progressive restoration gradually transforms the area of disturbed land. Visual impact would be short term. Planting on the perimeter of the site would, in time, help to soften views, however from this height it would be impossible to screen the site from view. The road is not heavily trafficked, so the site would not be seen by many travellers.
- 15.74 The frontage of the proposed site along TCR 1 would be in clear view to travellers using this road, particularly during the construction works and ongoing infilling operations close to this boundary (View 13&14).
- 15.75 A proposed earth bund (2m high) and planting works along the road at the existing landfill site would help to limit views of the proposed site from the westbound TCR 1. It is important that this work is executed as soon as possible, to allow the planting to become established and start to reduce views.
- 15.76 A similar earth bund (2m high) and planting would be extended along the road to its junction with TCR 3. This mounding and planting should be created early in the construction phase so that the planting can become established and help to screen views into the site. This would be more important as the filling reaches higher levels within the proposed site. Ongoing filling, capping and grassing works would play an important role in limiting the amount of disturbed land seen at any one time and also in screening later phases of filling.

- 15.77 The proposed landfill gas flare located in the existing landfill site would be visible travelling along the TCR1 as it would be located close to the road and stands 5m high. A new 3m high bund would help to screen much of the gas flare from view and with additional planting its impact would be reduced. In the short term until the planting establishes it would give rise to moderate visual intrusion.
- 15.78 There are no dwellings with views of the site from the south. Visual impact from the TCR 1 is likely to be significant and of short term duration until screening and restoration works reduce the amount of visual intrusion experienced.

**West**

- 15.79 There are longer distance views of the site from the west along the route of TCR 1. However, at a distance of 1.8km, little detail can be seen (View 15). At this distance, due to its contrasting colour, the proposed site would only be visible as an area of disturbed land. The proposed landfill gas flare would not be visible from the west as the landform of the existing landfill would screen it from view.
- 15.80 Travelling east along this road, local hedges play an important role in limiting views in the direction of the proposed site (View 17). Within 1km of the site there would be occasional glimpses of the landfill site. Beyond 0.5km the hedgerows disappear and the landfill site would come into view (View 18). Visual impact would be significant, but of short term duration.
- 15.81 It is likely that greater visual intrusion would occur as filling reaches higher levels. The movement of vehicles, storing of inert materials and protective fencing would all impact on the hillside and skyline. However, progressive restoration works would help to limit the amount of disturbed land and whilst visual impact would be significant, it would be short term.
- 15.82 The bunds and planting would be more effective closer to the site.
- 15.83 Views into the site from TCR 3 would be screened by the existing hedgerow; a proposed 2m high bund and planting beyond the hedge (View 19).
- 15.84 Views of the site from the north west, including those from a newly constructed dwelling (Dwelling E) would be limited by the existing hedges, trees and buildings and by a proposed woodland belt designed to reinforce the screening. It is possible that this property may have glimpses of vehicles, fences and spoilheaps after leaf fall. At a distance of 0.5km from the site, visual impact is likely to be imperceptible.



***Predicted Impact on Visual Character of the VE (Refer to Figure 15.7)***

- 15.85 The undulating drumlin topography of the Ballynacarrick area, along with existing hedges and trees, would play an important part in screening the proposed landfill area from general view.
- 15.86 The development would give rise to significant temporary visual intrusion during the period of construction and short term moderate impact from the infilling of the landfill area. Initially there would be a loss of vegetation as the grass cover is removed and the ground is exposed. There would be an increase in vegetation cover as progressive restoration of the site occurs and bare ground is put into grassland again. Planting works around the site would help to ameliorate the impact of the development.
- 15.87 It would take 2-3 years for the proposed planting to provide a degree of screening and until this time the earth bunds would be the main form of screening.
- 15.88 Phasing of the land filling has been designed so that completed cells would help to screen later infilling operations. Longer distance visual intrusion is likely to occur only when filling and capping reach higher portions of the site.
- 15.89 The greatest visual impact is likely to occur close to the site within the 0.5km zone, as beyond this distance intervening topography and screening vegetation restrict views towards it. The visual effects of the site also diminish with distance. Travelling eastward along TCR1 the site would be in partial view (View 18) and would give rise to significant visual intrusion particularly when filling is reaching higher levels.
- 15.90 Certain raised viewpoints in the surrounding landscape, (View 11) would continue to have full views over the site. Neither the earth bunds nor planting works would have any real impact in reducing visual intrusion from this viewpoint and the most important element in limiting visual intrusion would be the progressive restoration of the site.
- 15.91 It is important to remember that, when considering the visual and landscape impacts of the proposed development, much of the filling would take place behind bunds and plant screening and that the phasing of the filling has been designed so that completed phases would help to screen later filling operations (See Figure 15.8). There would be visual intrusion from the proposed landfill gas flare located in the proposed landfill site until proposed planting limits its impact.

***Predicted Impact on Landscape Character***

- 15.92 The impact on landscape character is dependent upon the vulnerability and sensitivity of the affected landscape, its importance within the local, regional and national context and its ability to accommodate change.

- 15.93 The development site is a field, surrounded by agricultural and rural land.
- 15.94 The proposed development would give rise to visual intrusion during construction and infilling operations. However, on completion, the restored area would be returned to agricultural use.
- 15.95 The proposed development would also affect the character of the area. This would be of a temporary nature until remedial works are undertaken, i.e. grassing and planting. The re-establishment of hedgerows within the site could, over time, help to link the area with the surrounding landscape. The creation of a large, featureless grass area would be out of character and would be more noticeable from higher ground to the south west of the site.

## MITIGATION

### *Mitigation Measures*

- 15.96 The following section describes the mitigation measures and landscape objectives considered as part of the development.

Mitigating measures are designed to:

- Avoid development of insensitive or prominent landscapes
- Avoid insensitive or visually intrusive designs
- Reduce the visual intrusion of the design
- Reduce the visibility of the project

- 15.97 It has to be accepted that it would be extremely difficult to screen such a development from every location, particularly from higher ground, but where feasible, its impact should be reduced, particularly in the context of the surrounding roads and houses.

- 15.98 The site would be restored to its pre-existing agricultural use and would benefit by additional planting work which would increase the ecological diversity of the site.

### 15.99 **Avoidance**

#### (i) Location

- Site the proposed development in an area, which is generally well screened from many viewpoints.

#### (ii) Layout

- Careful consideration of the site layout to reduce landscape and visual impacts
- Phased filling of the landfill area to limit visual disruption by ensuring that the whole of the site is not in use during the proposed life of the landfill area and screening later phases behind restored ground.

15.100 Progressive restoration of the filled areas with grass to help limit the amount of disturbed land that would be created.

**15.101 Remediation**

- Return the development to its former use and so help replicate the surrounding landforms.
- Integrate the development, physically and visually, into the receiving landscape, by creating a new landform which is sympathetically linked to surrounding contours and similar to the local drumlin topography. The grassland character of the site would be restored along with a hedgerow grid.

**15.102 Reduction**

- Where possible, screen the site from adjacent properties and roads. This would be important beside TCR 1 and would take the form of 2m high earth bunds which would be planted with a hedgerow of thorn and native species with scrub vegetation on the bunds i.e. Alder, Willow, Elder and Holly. The hedge along TCR 3 would be reinforced along with a belt of woodland planting. The northern section of the site would have a 6m wide woodland belt of trees. An earth bund and planting would be employed to limit the impact of the proposed landfill gas flare. Planting to take place in year one to allow increasing growth to screen the proposed development. The restoration proposals are shown on Figure 15.8.

**Site Planting**

15.103 Provision of native tree shrub and grass areas to help to create an integrated landscape scheme.

- Provision of selective native woodland planting including understorey planting.
- Provision of additional tree planting at key areas to ensure that visual intrusion is minimised.
- Regrassing disturbed areas with native species.
- Reinstatement of field boundaries similar to those on past ordnance survey plans.

15.104 Maintenance and Management

- Maintenance and management of all planting stock in perpetuity.

**Establishment of Planting**

15.105 Where feasible certain planting works would be commenced at the time of site approval or no later than the beginning of the next planting season after the completion of the construction works. In this respect some of the planting works would develop early so allowing the establishment of the necessary basic site screening.

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**Form and Specification of Site Planting**

15.106 Establishment of planting using a range of indigenous trees and woodland lower canopy shrubs.

15.107 Establishment of planting in groups and linear forms to provide adequate screening.

15.108 Planting species to be both evergreen and deciduous and include the following:

Ash	(Fraxinus excelsior)
Hawthorn	(Crataegus monogyna)
Alder	(Alnus glutinosa)
Holly	(Ilex aquifolium)
Elder	(Sambucus nigra)
Hazel	(Corylus avellana)
Willow	(Salix caprea and cinerea)
Birch	(Betula pubescens)
Sorbus	(Sorbus acuparia)

15.109 Trees would range in size from feathered whips to selected standards of 10-12cm girth Whips, transplants and forestry stock would range in size from 20-30cm to 30-90cm in overall height from ground level.

15.110 Woodland planting would be at least 1-2 per m<sup>2</sup>.

15.111 In order to create a more natural grass cover, typical of that already found in the area, grassing would be of a native species (Native Irish Species).

## BIBLIOGRAPHY

Guidelines for Landscape and Visual Impact Assessment. Landscape Institute and the Institute of Environmental Assessment (2002).

Guidelines on the information to be contained in Environmental Impact Assessment. Environmental Protection Agency (2002)

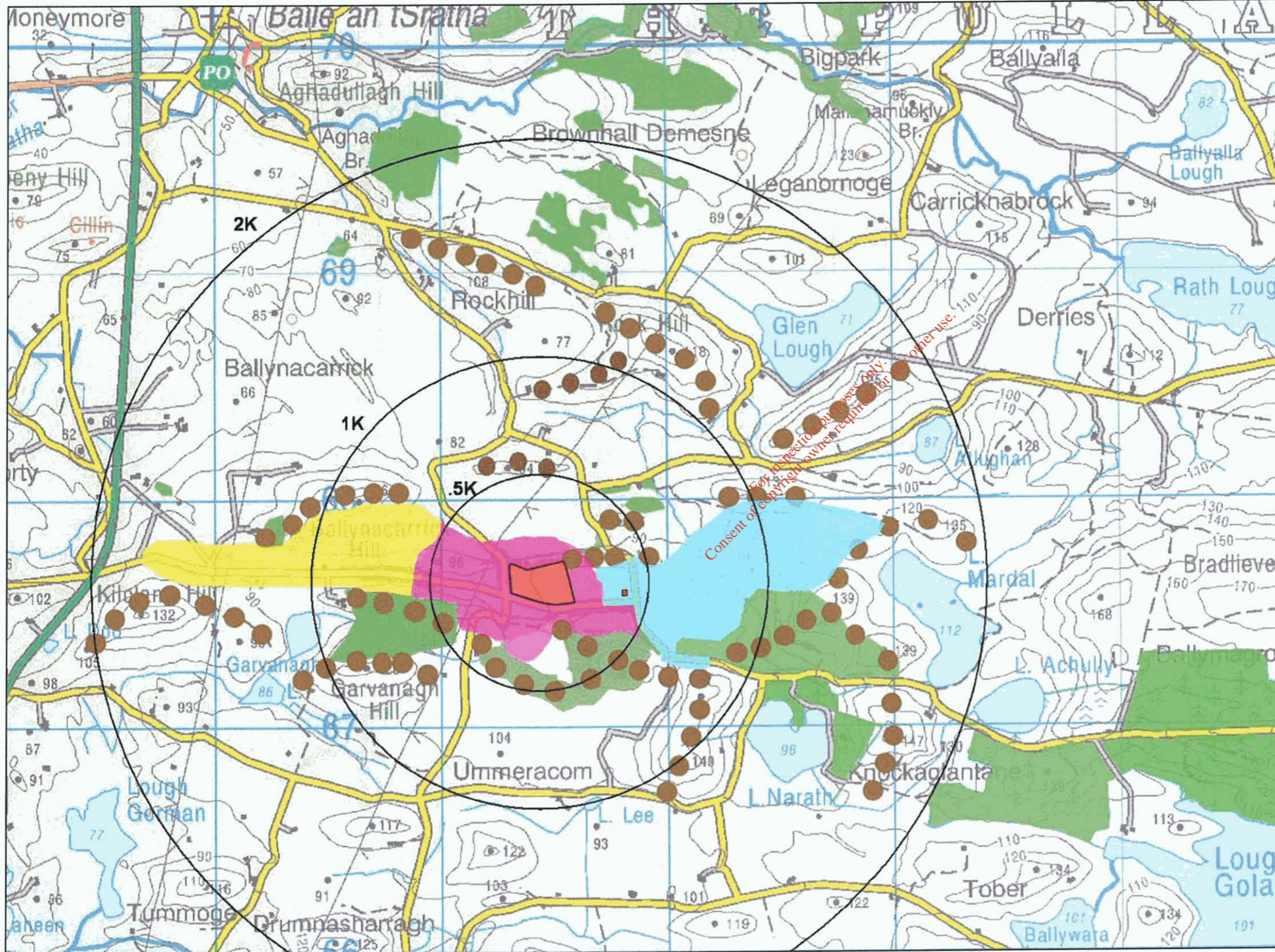
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## FIGURES

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- KEY
- DEVELOPMENT SITE
  - SIGNIFICANT VEGETATION
  - ZONE OF IMMEDIATE VISUAL INFLUENCE
  - ZONE OF DISTANT VISUAL IMPACT
  - EXTENDED ZONE OF VISUAL INFLUENCE OF LANDFILL GAS FLARE
  - MAJOR VISUAL BARRIER
  - PROPOSED LOCATION OF LANDFILL GAS FLARE

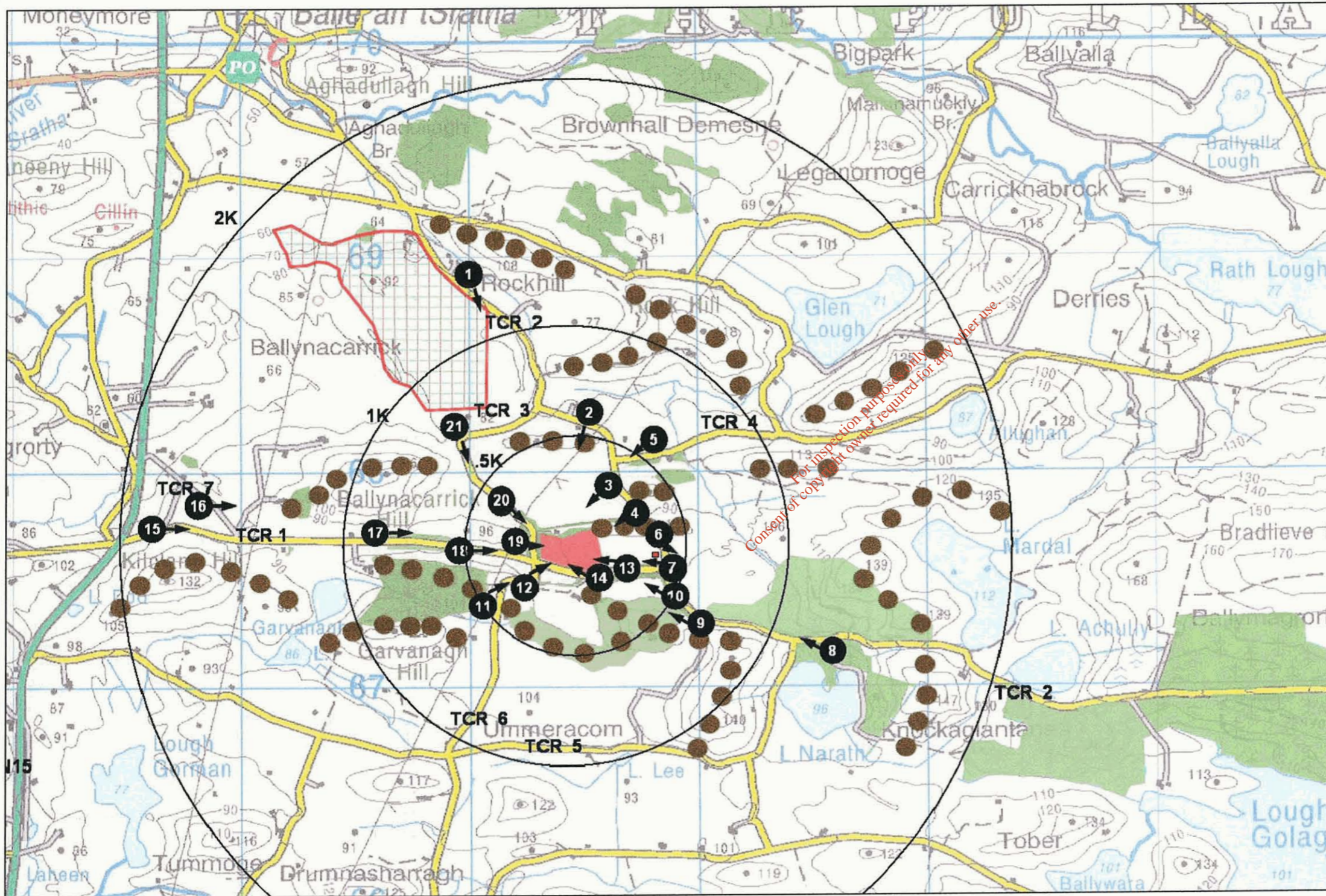
SCALE 1:20,000








 <p><b>KIRK McCLURE MORTON</b> CONSULTING ENGINEERS</p>	 <p>Comhairle Chontae Dhún na nGall Donegal County Council</p>
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PROJECT  
BALLYNACARRICK LANDFILL PROJECT

TITLE ZONE OF VISUAL INFLUENCE	FIGURE 15.1
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- KEY
-  DEVELOPMENT SITE
  -  SIGNIFICANT VEGETATION
  -  NATIONAL HERITAGE AREA
  -  SPECIAL AREA OF CONSERVATION
  - TCR 2** THIRD CLASS ROAD
  -  PHOTO LOCATION
  -  MAJOR VISUAL BARRIER
  -  PROPOSED LOCATION OF LANDFILL GAS FLARE

SCALE 1: 20, 000



PROJECT  
BALLYNACARRICK LANDFILL PROJECT

TITLE  
LOCATION OF PHOTOGRAPHS

FIGURE  
15.2

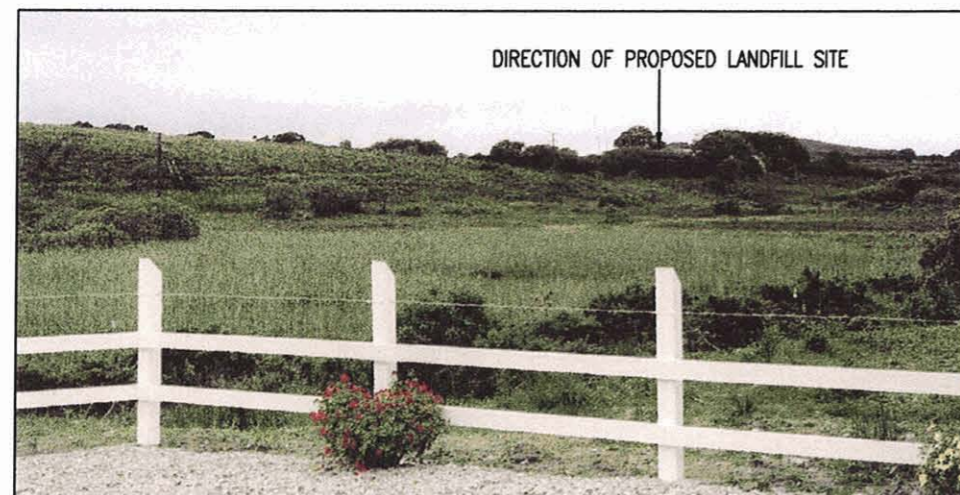




VIEW 1: VIEW LOOKING SOUTH ALONG TCR 2 IN THE DIRECTION OF THE PROPOSED SITE, EXISTING LANDFORMS SCREEN THE SITE.



VIEW 2: A SIMILAR VIEW ALONG THE ROAD, AGAIN THE SITE IS NOT VISIBLE. A TEMPORARY SPOIL HEAP FROM THE EXISTING LANDFILL SITE CAN BE SEEN IN THE DISTANCE.



VIEW 3: VIEW TOWARDS THE SITE WITH THE EXISTING LANDFORM, HEDGES AND TREES ON THE NORTHERN BOUNDARY OF THE SITE SCREEN THE SITE FROM VIEW.



VIEW 4: VIEW FROM A DWELLING LOCATED BY THE NORTHEAST BOUNDARY OF THE EXISTING LANDFILL SITE. THE RISING GROUND AND TEMPORARY SPOIL HEAPS, SCREEN THE SITE FROM VIEW.



VIEW 5: VIEW FROM THE NORTHEAST ON TCR 4 AGAIN THE SITE IS NOT VISIBLE.



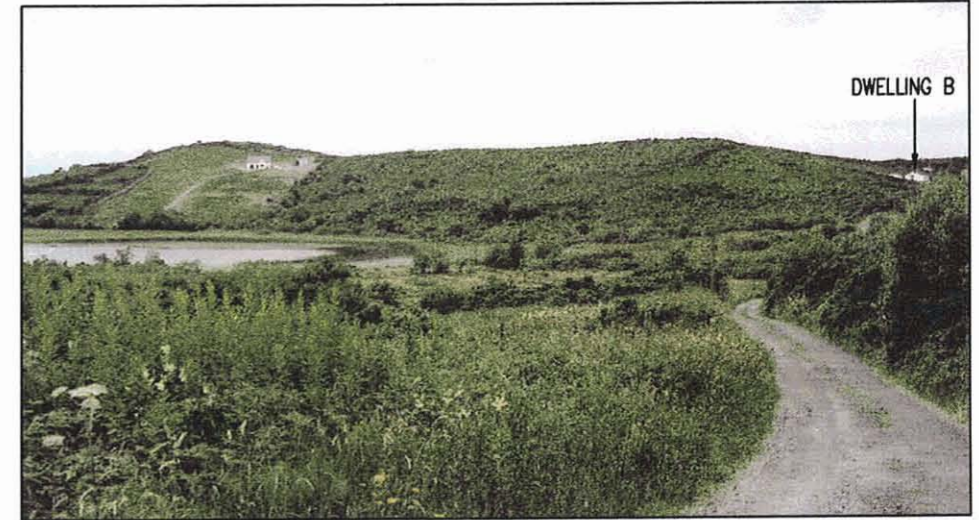
VIEW 6. VIEW LOOKING EAST FROM THE ENTRANCE TO THE EXISTING LANDFILL SITE, SHOWING THE LANDSCAPE BEYOND WITH THE OCCASIONAL DWELLING.

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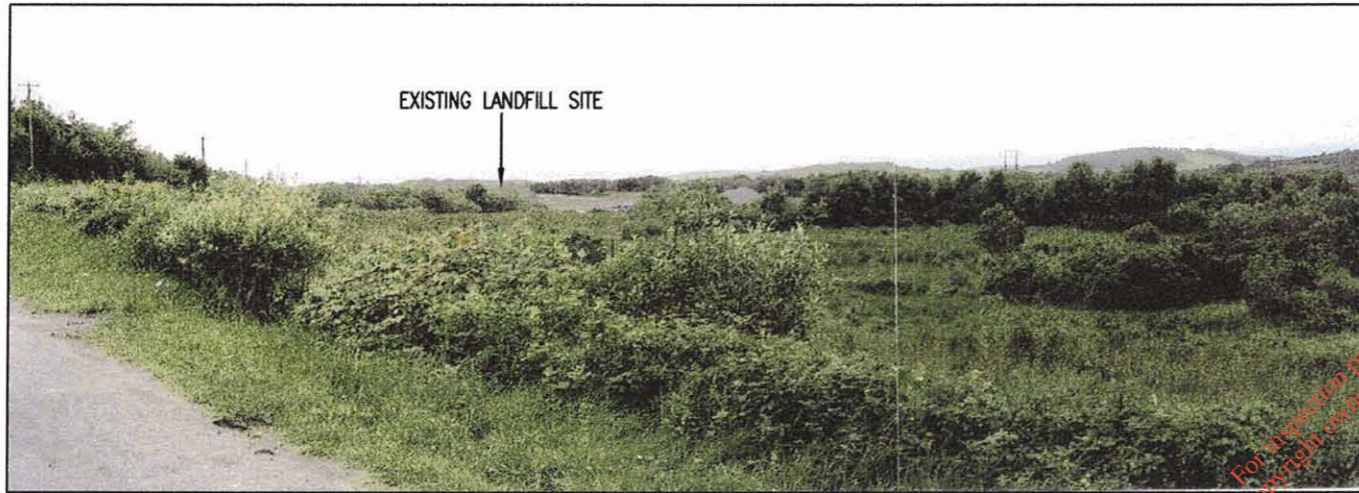




VIEW 7: VIEW FROM TCR 2 LOOKING WEST ALONG TCR 1. THE RISING GROUND SCREENS THE PROPOSED SITE FROM VIEW. PLANTING AS PART OF THE REINSTATEMENT WORK WILL IN TIME TRANSFORM THIS VIEW.



VIEW 8: VIEW FROM THE SOUTH EAST TRAVELLING WEST. THE DRUMLIN TOPOGRAPHY IS AN IMPORTANT VISUAL BARRIER.

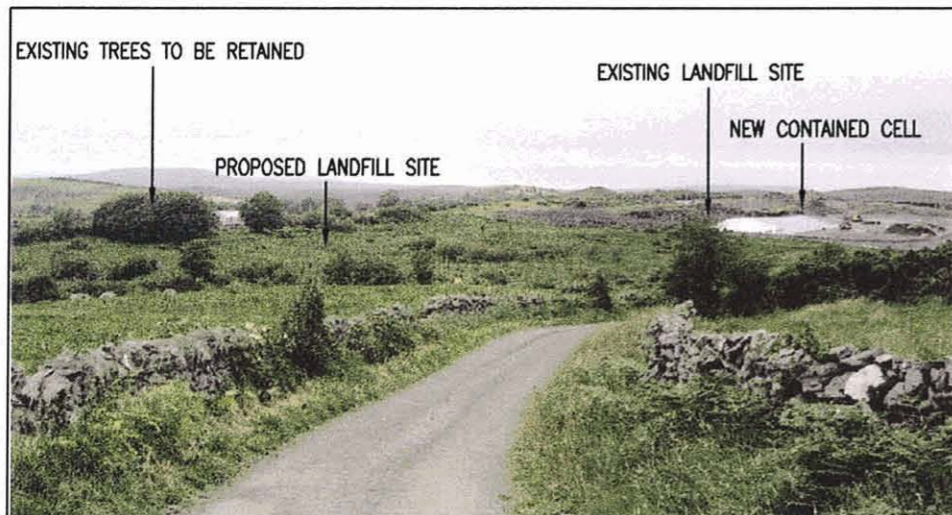


VIEW 9: CLOSE TO THE SITE BESIDE AN EXISTING DWELLING [C], THE EXISTING LANDFILL SITE IS CLEARLY VISIBLE BUT THE PROPOSED LANDFILL SITE IS SCREENED FROM VIEW BY THE EXISTING LANDFORM AND VEGETATION.



VIEW 10: A SIMILAR VIEW CLOSER TO THE EXISTING LANDFILL SITE ENTRANCE. THE ADJACENT MATURE HEDGE PREVENTS VIEWS TO THE WEST.

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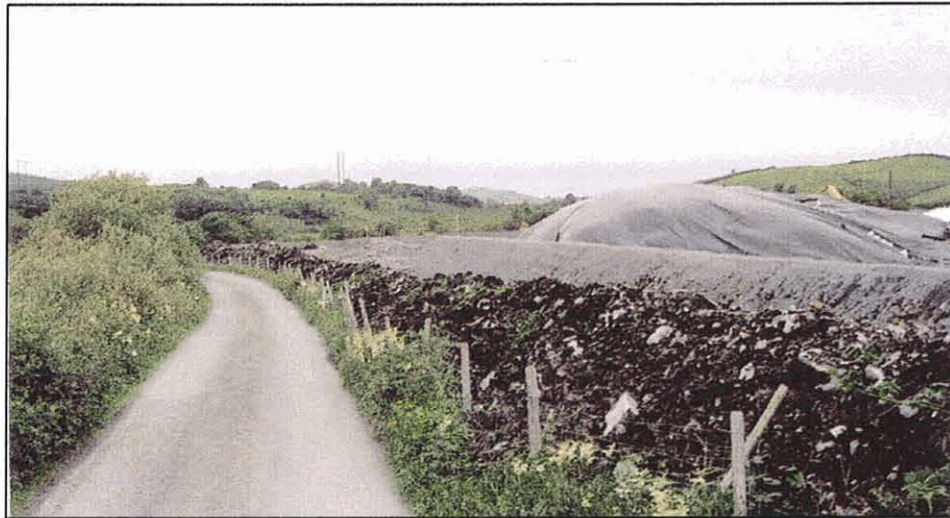


VIEW 11: DESCENDING TCR 6 FROM THE GARVAGH HILL IN THE SOUTH, THE SHOLE OF THE SITE IS REVEALED. SIGNIFICANT VISUAL INTRUSION WILL OCCUR FROM THIS VIEW POINT.

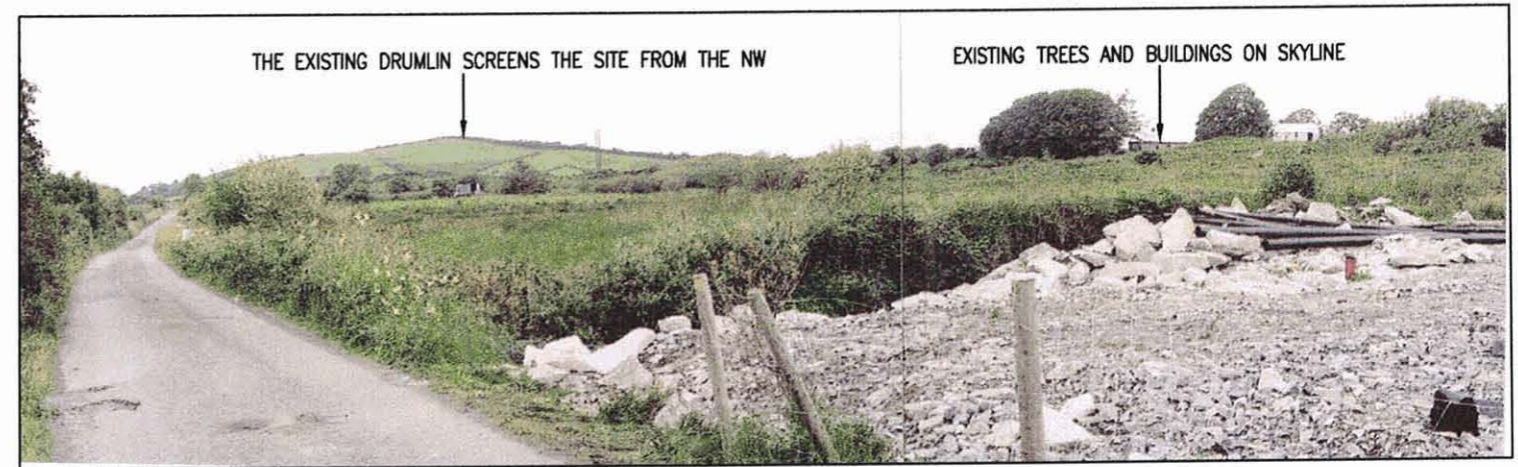


VIEW 12: FURTHER DOWN THE HILL, INTERVENING VEGETATION HELPS TO SOFTEN THE VIEW. PROPOSED SCREEN PLANTING ON THE PERIMETER OF THE SITE WILL HELP TO LESSEN THE VIEWS





VIEW 13: VIEW LOOKING WEST BESIDE THE EXISTING LANDFILL SITE WITH THE PROPOSED SITE BEYOND. AN EARTH BUND IS UNDER CONSTRUCTION WHICH WILL BE PLANTED UP AND IN TIME LIMIT VIEW OF THE PROPOSED SITE.



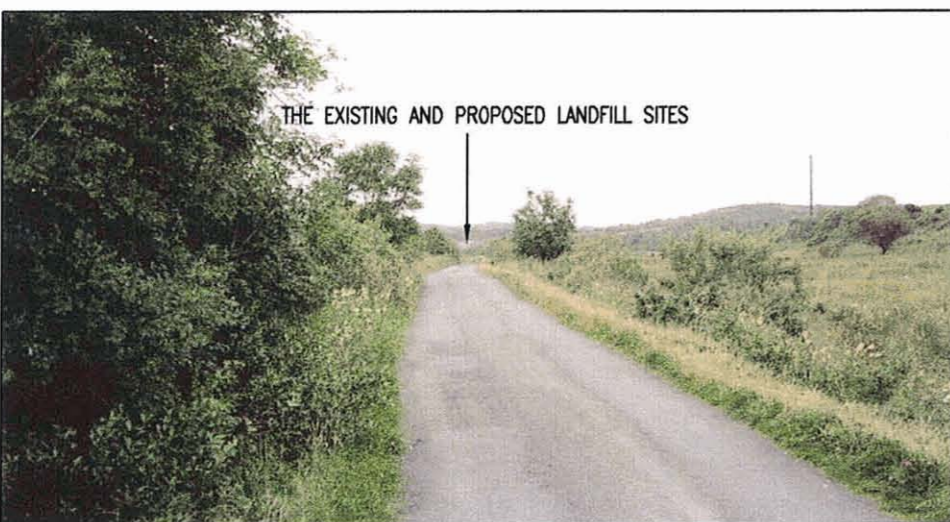
VIEW 14. FURTHER ALONG THIS ROAD THE WHOLE OF THE SITE IS REVEALED WITH THE TREES AND FARM BUILDING ON THE SKYLINE. THE PROPOSED DEVELOPMENT.



VIEW 15. TRAVELLING EAST FROM THE N15 ALONG TCR 1, THE EXISTING LANDFILL SITE IS VISIBLE IN THE DISTANCE [1.7K], HOWEVER NO DETAILS CAN BE SEEN. THE PROPOSED LANDFILL SITE WILL ALSO BE VISIBLE FROM THIS DIRECTION.



VIEW 16: A SIMILAR VIEW FROM TCR 7, AGAIN NO DETAILS ARE REVEALED.



VIEW 17: FURTHER ALONG TCR 1 THE EXISTING HEDGES LIMIT VIEWS TOWARDS THE SITE.



VIEW 18: CLOSER TO THE SITE, THE HEDGES DISAPPEAR AND THE LANDSCAPE OPENS UP. THE SITE IS CLEARLY VISIBLE FROM THIS SECTION OF THE ROAD.

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VIEW 19 TCR ON THE WESTERN BOUNDARY OF THE SITE HAS MATURE HEDGES WITH GAPS THAT REVEAL THE FULL EXTENT OF THE SITE.



VIEW 20: VIEW FURTHER ALONG THIS ROAD LOOKING BACK TOWARDS THE SITE. THE LANDFORM, BUILDING AND VEGETATION SCREEN THE SITE FROM VIEW.

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VIEW 21: VIEW FROM A NEW HOUSE BEING CONSTRUCTED ON TCR 3 [0.7K], HAS VIEWS TOWARDS THE SITE BUT NO DETAILS ARE REVEALED.

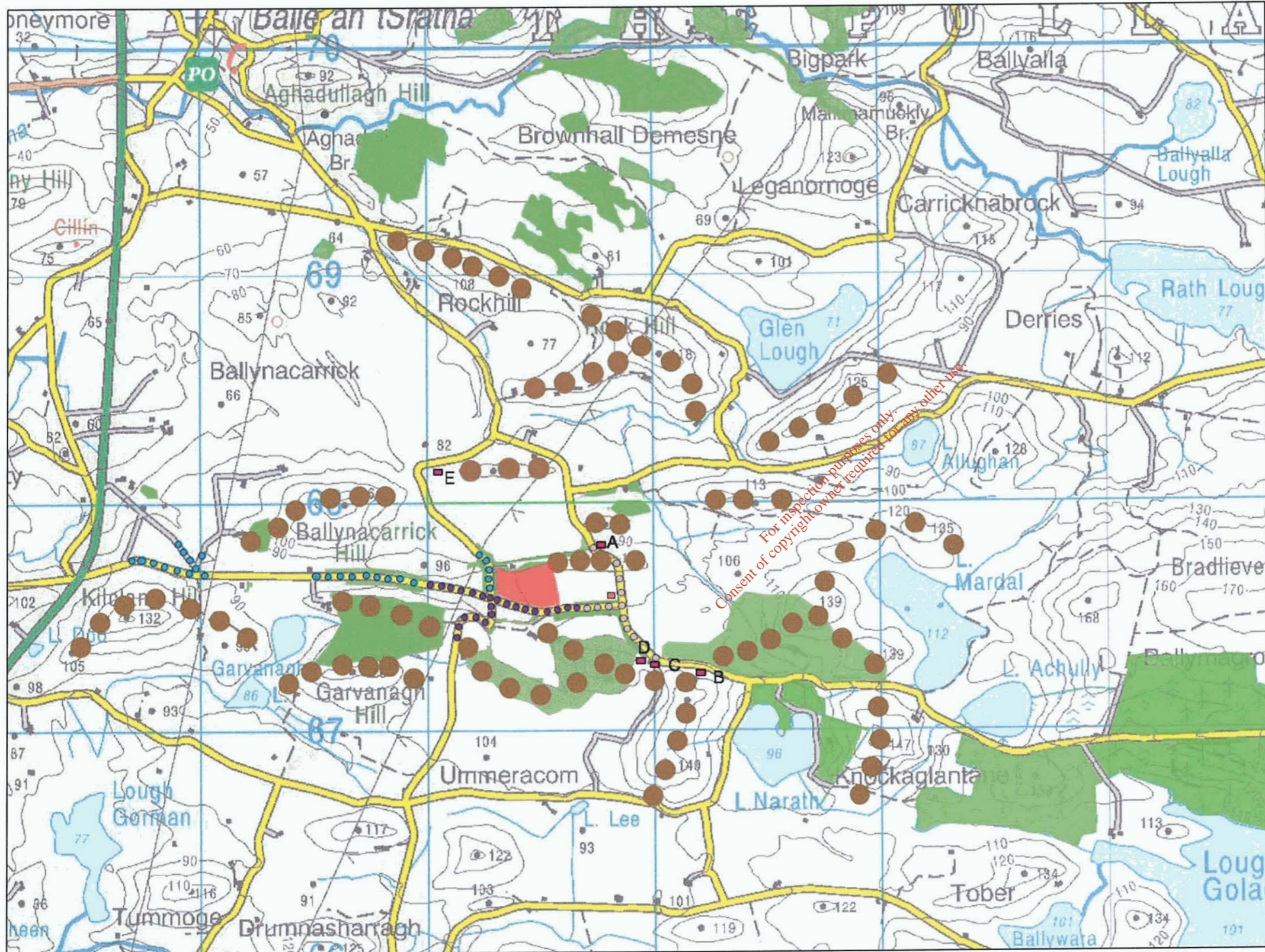


VIEW 23: VIEW FROM HIGHER GROUND LOOKING WEST OVER THE PROPOSED LANDFILL SITE WITH A CONTAINED CELL CURRENTLY UNDER CONSTRUCTION. THE PROPOSED SITE WILL BE VISIBLE FROM MUCH OF THE LANDSCAPE CURRENTLY IN VIEW.










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KEY

-  DEVELOPMENT SITE
-  SIGNIFICANT VEGETATION
-  RESIDENCES CLOSE TO DEVELOPMENT SITE
-  MAJOR VISUAL BARRIER
-  ROADS WITH GLIMPSES OF THE SITE
-  ROADS WITH OPEN VIEWS OF THE SITE
-  ROAD WITH GLIMPSES OF LANDFILL GAS FLARE

SCALE: 1:20,000

 <b>KIRK McCLURE MORTON</b> CONSULTING ENGINEERS	 <b>Comhairle Chontae Dhún na nGall</b> Donegal County Council
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PROJECT  
**BALLYNACARRICK LANDFILL PROJECT**

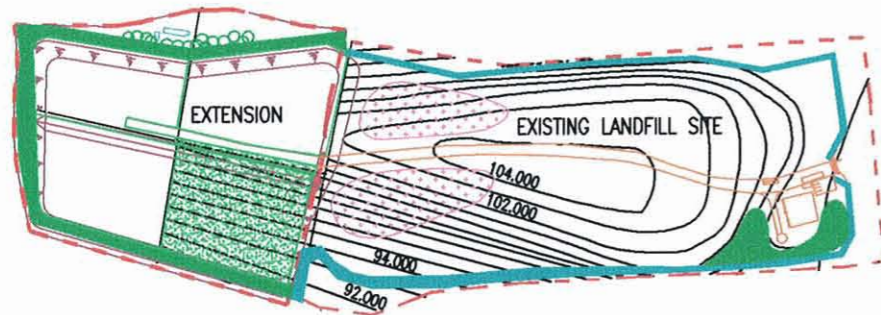
TITLE <b>VISUAL IMPACT</b>	FIGURE <b>15.7</b>
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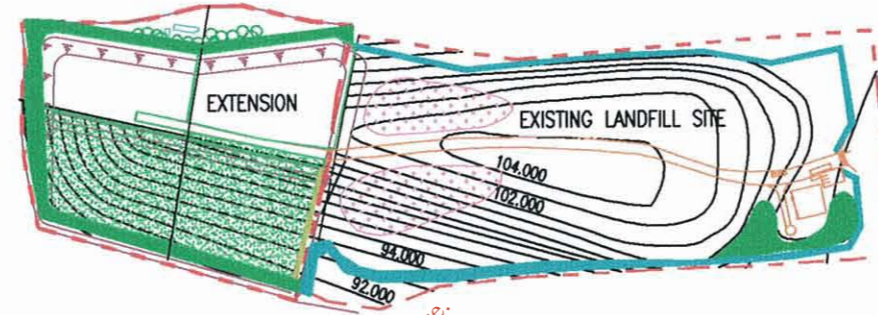
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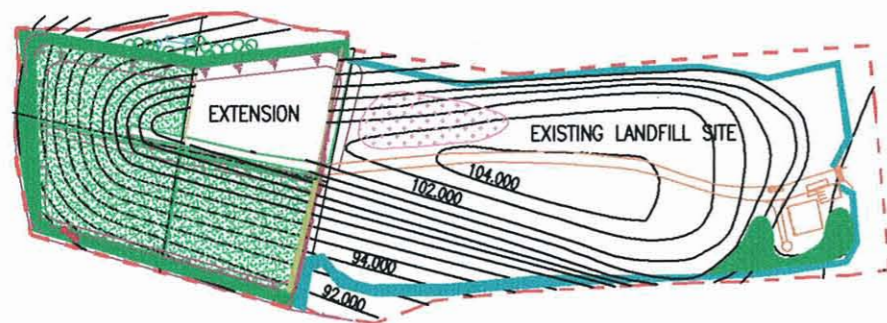
FIRST PHASE



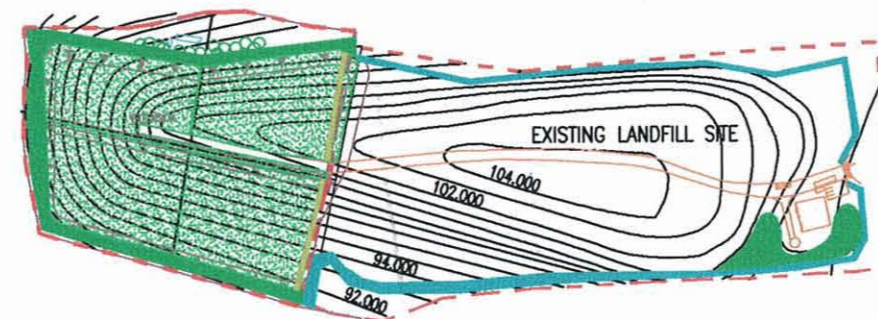
SECOND PHASE












THIRD PHASE



FINAL PHASE



KEY

- |   |   |
|---|---|
|  PROPOSED PLANTING IN EXISTING LANDFILL SITE |  SITE BOUNDARY         |
|  PROPOSED WOODLAND SCREEN PLANTING           |  TEMPORARY SPOIL HEAPS |
|  PROPOSED NEW HEDGE                          |  EXISTING BUILDING     |
|  PROPOSED NATIVE GRASS SEEDING               |  PROPOSED CONTOURS     |
|  INTERNAL SERVICE ROAD                       |   |

**PHASE 1**  
CONSTRUCTION OF CELLS 1-4, PERIMETER BUNDS CREATED AND COMPLETION OF PERIMETER SCREEN PLANTING WORKS. PROGRESSIVE FILLING OF CELL 1, CAPPING, TOPSOILING AND GRASS SEEDING.  
CONSTRUCTION OF 3M HIGH BUND AROUND THE GAS FLARE STACK IN THE EXISTING LANDFILL SITE AND THE BUND PLANTED WITH WOODLAND SCREEN PLANTING.

**PHASE 2**  
PROGRESSIVE FILLING OF CELL 2, CAPPING, TOPSOILING AND GRASS SEEDING.  
CONTINUED GROWTH AND MAINTENANCE OF PERIMETER SCREEN PLANTING.  
PLANTING OF HEDGE ON EASTERN BOUNDARY OF RESTORED CELL 1 ALONG WITH GRASS MAINTENANCE.

**PHASE 3**  
PROGRESSIVE FILLING OF CELL 3, CAPPING, TOPSOILING AND GRASS SEEDING.  
CONTINUED GROWTH AND MAINTENANCE OF PERIMETER SCREEN PLANTING.  
MAINTENANCE OF HEDGE ON RESTORED CELL 2 ALONG WITH GRASS MAINTENANCE.

**PHASE 4**  
PROGRESSIVE FILLING OF CELL 4, CAPPING, TOPSOILING AND GRASS SEEDING.  
CONTINUED GROWTH AND MAINTENANCE OF PERIMETER SCREEN PLANTING AND HEDGE.  
PLANTING NEW HEDGE ON EASTERN BOUNDARY OF RESTORED CELL 4 ALONG WITH GRASS MAINTENANCE.

CONTINUED MAINTENANCE OF PLANTING. HEDGES AND GRASS TO ENSURE PLANTING OBJECTIVES ARE REALIZED AND THE SITE IS ASSIMILATED BACK INTO THE LANDSCAPE SETTING.

SCALE: 1:5000

**KIRK McCLURE MORTON**  
CONSULTING ENGINEERS

  
Comhairle Chontae Dhún na nGall  
Dungál County Council

PROJECT

BALLYNACARRICK LANDFILL PROJECT

TITLE

PHASING PLAN

FIGURE

15.8