EU Habitats Directive

Screening Statement

in relation to

Dunmanway Landfill

for

Cork County Council

Doherty Environmental

December 2013

Cork County Council.

Habitats Directive Screening Assessment

Dunmanway Landfill

9th December, 2013

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For and on behalf of
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Signed:

Date: 9th December, 2013

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Table of Contents

1 Introduction

The EU Birds and Habitat Directive oblige member states to establish a network of designated conservation areas known as the Natura 2000 (N2K) Network. The N2K network includes sites designated as Special Areas of Conservation (SACs), under the EU Habitats Directive and Special Protection Areas (SPAs) under the EU Birds Directive. Article 6 of the EU Habitats Directive imposes strict land-use control measures on SACs and SPAs, with Articles 6(3) and 6(4) establishing a prior authorisation process for any land-use plan or project likely to have a significant effect on an N2K site.

In the case of the Dunmanway Landfill it is has been considered necessary Cork County Council and as part of the EPA methodology for the assessment of disused landfill sites to examine whether the landfill and/or any proposed remediation activity at the landfill will have the potential to significantly effect the integrity and conservation status of qualifying interests associated with European Sites occurring within the vicinity of the landfill site.

The approach for this Article 6 assessment broadly follows the guidelines outlined in the European Commission (2001) guidance document *Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the EU Habitats Directive 92/43/EEC* (to be referred to throughout this report as the "EC guidance"). The completion of an Article 6 Assessment may involve the completion of a number of assessment stages with Stage 1 Screening determining whether additional Stages in the Article 6 Assessment process are required. These stages, as outlined in the above EC guidance and in more recent guidance published by the DOEHLG[1], include:

- Stage 1 Screening for AA: This stage defines the project or activity to be assessed, establishes whether the project/activity is necessary for the conservation management of the European site and assesses the likelihood of the project having a significant effect, alone or in combination with other plans or projects, upon a European Site.

- Stage 2 AA: If a project is likely to have a significant effect, an Appropriate Assessment must be undertaken. In this stage the impact of the project to the Conservation Objectives of the European site is assessed and measures are proposed to avoid or reduce impacts so that they do not result in significant effects to the site. The outcome of this assessment will establish whether the project will have an adverse effect upon the integrity of the European site.

- Stage 3 Alternative Solutions: If it is concluded that, subsequent to the implementation of mitigation measures, a project has an adverse impact upon the integrity of a European site, it must be objectively concluded that no alternative solutions exist before the project can proceed to Stage 4.

- Stage 4 IROPI: Where no alternative solutions exist and where adverse impacts remain but imperative reasons of overriding public interest (IROPI) exist for the implementation of a project, an assessment of compensatory measures that will effectively offset the damage to the European Site will be necessary.

The remainder of this report outlines the results of a Stage 1 Screening Assessment.

2 Overview of the Habitats Directive Screening Assessment

The function of the Screening Assessment is to identify whether or not the project will have a likely significant effect on European Sites. In this context "likely" refers to the presence of doubt with regard to the absence of significant effects (ECJ case C-127/02) and "significant" means not trivial or inconsequential but an effect that has the potential to undermine the site's conservation objectives (English Nature, 1999; ECJ case C-127/02). In

[1] Department of the Environment Heritage and Local Government (DEHLG) (2010). *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities*. Second Edition, February, 2010

other words, any effect, which would compromise the functioning and viability of a site, and interfere with achieving the conservation objectives of the site, would constitute a significant effect.

The nature of the likely interactions between the landfill and the integrity of European Sites will depend upon the sensitivity of the European Site's qualifying features to potential impacts arising from the landfill; the current conservation status of the European Sites occurring within the sphere of influence of the landfill; and the likely changes to water quality that will result from activities associated with the landfill, in combination with other plans and projects.

The EC guidance outlines the steps involved in undertaking a Screening Assessment, which involves the following:

1. Describe the project and determine whether it is necessary for the conservation management of European Sites;

2. Identify and describe the European Sites likely to be influenced by the project;

3. Assessment of the likely effects of the project and whether they are (alone or in combination with other plans or projects) likely to adverse effect any European Sites; and

4. Screening Conclusions.

3 Project Description

The project proposes to remediate the Dunmanway Landfill site so that the potential for landfill derived pollution is minimised to a negligible/low risk. Environmental assessments at the landfill site have concluded that leachate generated in the waste body is resulting in low level but persistent pollution to the Dirty River (a review of these assessments is provided in Section 4 below). The project proposes to implement a recommendation of a Quantitative Risk Assessment (QRA) undertaken for the Dunmanway Landfill that aims to minimise leachate generation at the landfill site. The minimisation of leachate generation is considered to be a principal measure to ensure that the landfill does not have an adverse effect on the water quality of the Dirty River. In order to minimise the generation of leachate the QRA has recommended that the existing soil cover/cap over the waste body at the landfill be reworked so that it is evenly distributed over the site.

The existing cap comprises a soil layer across the entire waste deposition area (9,000m^2) with an average depth of 1000mm. The thickness varies across the site and there is no information on the type and permeability of the soils. Based on the Risk Assessment the cap should have a minimum thickness of 500mm with a minimum permeability of 1x10m-7m/s.

While the existing capping layer is currently adjudged to be sufficiently thick, it will require compaction to achieve a permeability of 1x10m-7m/s. Soil tests, including Plasticity Index (plastic limit and liquid limit), Particle Density and Permeability will be required to determine the method for re-working and compaction.

The capping layer will be graded to falls (1:100) that shed surface water to perimeter swales, which are designed to accommodate estimated peak run-off and channel the water to the Dirty River. The swales will direct surface water runoff, via a drainage ditch, to the Dirty River

All remediation activities will be undertaken within the current footprint of the waste deposition area. A protective bund is already in place along the northern, western and eastern boundaries of the landfill. This bund will be retained and will, along with the perimeter swales, provide a effective barrier to direct surface runoff to the Dirty River.

All surface runoff collected in the perimeter swales will pass through gravel filters positioned at the entrance to the drainage ditch and again immediately upstream of the drains confluence with the Dirty River. The placement of gravel filters along the drain will mitigate the discharges to the river.

Furthermore, it is proposed to seed the exposed surface soils upon completion of remediation activities in order to minimise the timeframe within which silt-laden surface water could be generated. The seeding of the soil surface will accelerate colonisation by vegetation. Once vegetation becomes established the potential for silt-laden runoff to occur will be eliminated.

As the existing capping layer is sufficiently thick, it is anticipated at this stage that the importation of additional soil material will not be required. However, should additional material be required in the future as part of the remediation works the following measures will be adhered to:

- Only inert soil material will be imported to the landfill site;
- The current bund along the northern, western and eastern perimeter of the landfill will be maintained so that an effective barrier to surface runoff towards the Dirty River is in place;
- All perimeter swales will be maintained and runoff from areas receiving imported materials will pass through gravel filters prior to final discharge to the Dirty River.

The implementation of these measures will ensure that any surface runoff from areas receiving imported materials will be mitigated prior to entering the Dirty River.

4 Site Description

4.1.1 Site Overview

The disused landfill site is located to the southwest of the centre of Dunmanway town (G.R. V12285 52345). The site operated as a landfill since the 1940's and closed in 1997/98 and was capped with topsoil, stone and chips. A variety of waste was thought to have been disposed here including municipal, construction and demolition, commercial and possibly food waste. Burning of waste was common at this landfill site.

The site is located at approximately 70m OD Malin and is located approximately 40m to the south of the Dirty River. The land cover to the north of the site is characterised by wet grassland, marsh and swamp habitats. These habitats are located within the riparian floodzone of the Dirty River and are characterised by a high water table. The land cover to the east and south of the site is characterised by built urban land. The soils are characterised by peaty podzols and mineral alluvium. The sub-soils are characterised by Devonian sandstone and undifferentiated alluvium.

The land cover within the site is dominated by spreading scrub habitats and establishing semi-natural grassland habitats. The previous deposition of landfill within the site has changed the topography of the site with a steep embankment present towards the north, east and west of the site. This embankment represents an artificial bund constructed during the operation of the landfill to avoid interaction between the waste body and the Dirty River during times of flood. The bund is between 4m and 6m thick and separates the landfill site from floodplain wetland habitats and the Dirty River to the north.

4.1.2 Description of the Waste Body

(i) Summary of Tier II Site Investigation Report

A Tier II Site Investigation Report was undertaken by Cork County Council, the results of which are described in detail the Tier II Site Investigation Report. The Tier II Report describes the waste body at Dunmanway Landfill and also describes the results of an environmental risk assessment for the landfill. This environmental risk assessment was based on a Source-Pathway-Receptor (SPR) model and was undertaken in line with the EPA guidance document *A Code of Practice: Environmental Risk Assessment for Unregulated Waste Sites* (2007).

The report described the waste body at the landfill as having a footprint of approximately 0.9ha with an average thickness of 4m. There is approximately 54,000 tonnes of waste intermingled with sand and clay. The waste

mainly consists of domestic waste such as glass, plastics, papers, wiring, concrete, steel fragments and timber. The waste is incorporated in a sandy, gravely clay matrix and no significant contaminated material was observed during Tier II Site Investigations. No evidence of staining or odours consistent with the presence of such material was identified during the Site Investigations.

The waste was screened with a Photo Ionisation detector and did not detect elevated VOC readings. Based on the results of these reading combined with the results of the trial pit investigations the Tier II Report concluded that the waste could be considered to be typical non-hazardous municipal solid waste. Leachate samples were also analysed from trial pits and the results of this analysis indicates the landfill to be in a late Stage IV or in early Stage V of the biodegradation process.

A brown firm clay was found below 81% of the trial pits undertaken throughout the site during the Tier II investigations. The base clay layer was found to be dry in all cases and appeared to be forming an effective barrier between the landfill and the underlying aquifer. A large clay bund is located on the northern, western and eastern boundaries of the site. The clay bund was constructed by Cork County Council over a number of years to avert the risk of waste being washed away during times of flood. The bund is between 4 to 6m thick.

While the Tier II Site Investigation Report concluded that the landfill posed no risk to groundwater it concluded that the adjacent surface water (i.e. the Dirty River) is being impacted slightly by the landfill. The Tier II Report also noted that the nearest European Site to the landfill is approximately 1km downstream from the landfill site and the risk from the landfill to this European Site (i.e. the Bandon River SAC) is low.

The recommendations of the Tier II Report are as follows:

- Prevent leachate migration off site by breaking the main "*Source Pathway Receptor*" linkage: *leachate to surface water*.
- Prevent as far as possible leachate generation on site.
- Complete a Tier III Quantitative Risk Assessment (QRA) on the Site.

(ii) Summary of Quantitative Risk Assessment

Following the recommendation of the Tier II report a Quantitative Risk Assessment was completed for the landfill site. The QRA concluded that the only potential source-pathway-receptor risk that may be present at the site is leachate discharge to surface water. Surface water monitoring, taken from three locations, upstream, adjacent to and downstream of the site, indicated elevated levels of ammonia in the Dirty River. Samples taken from points adjacent to and downstream of the landfill site showed raised levels of ammonia while upstream the levels of ammonia were below EQS limits. Based on these results the QRA concluded that the source of the increased ammonia levels in the Dirty River is via lateral migration of landfill leachate to the surface water (further water quality information on which the QRA is based is provided in Section 4.1.6 below).

The QRA recommended that the Risk Rating for the Dunmanway Landfill site should remain at Moderate Risk. As a means to breaking the link between leachate and the Dirty River the QRA recommended that infiltration of rainfall through the waste is minimised by re-working the existing soil cover so that it is evenly distributed over the site. The QRA notes that further soil cover may be necessary to further enhance the cover and compaction of the soil layer and in doing so the overall permeability of the surface layer would reduce.

As noted above it is this recommendation of the QRA that the current project proposes to implement.

4.1.3 Habitats occurring within the Landfill Site

Three broad (Level 1) habitat groups were identified within the site area:

1. Grassland

2. Woodland & Scrub; and

3. Exposed Rock and Disturbed Ground.

Each of the broad habitats and the individual habitats (Level 3 habitats) making up these broad groups are described below. Habitats that represent a transition between two individual habitats will be described in the text below under the Level 3 habitat that they most resemble and details of such transitions will be outlined.

(i) Grassland

The grassland habitats identified within the site have been classified as:

- Dry meadow and grassy verges (GS2)
- Wet grassland (GS4)

The dry meadow habitat occurs to the south of the site. The absence of ongoing management of this habitat has led to the establishment of a high sward characterised by tussock grass species such as Yorkshire fog (*Holcus lanatus*), Cock' foot (*Dactylis glomerata*) and false oat-grass (*Arrhenatherum elatius*).

The wet grassland habitat occurs to the north of the site. This habitat was inundated during the habitat survey. A dominance of soft rush (*Juncus effusus*) was noted within this habitat.

(ii) Woodland and Scrub

The woodland and scrub habitats identified within the site have been classified as:

- Scrub (WS1)
- Treeline

Immature scrub is the dominant habitat occurring within northern and section of the site. This scrub is characterised by spreading gorse (*Ulex europeaus*) and willow (*Salix sp.*) species. Recent vegetation clearance has reduced the overall cover of this habitat. An area of established scrub dominated by willow species occurs to the east of the site entrance. A mature stand of conifers occurs to the west of this site while a stand of immature birch (*Betula sp.*) is located to the south of the site.

A coniferous treeline consisting of Leyland cypress (*Cupressocyparis leylandii*) occurs along the southern boundary of the site. A second birch treeline also occurs within the centre of the site.

(iii) Exposed Rock and Bare Ground

The exposed rock and bare ground habitats identified within the site have been classified as:

- Spoil and bare ground (ED2)

Recent disturbance to the site has resulted in the removal of much of the site's vegetation, with resultant bare ground dominating areas of the site. No vegetation is associated with this habitat.

4.1.4 Fauna

No records or evidence of mammal activity was recorded on site. The mature trees and the shed occurring within the site were assessed for their potential to support roosting bats. The trees were examined for features used by bats for roosting. These features include crevices, hollows, ivy cover and limb fractures. The trees occurring within the site boundaries did not display such features and it is considered that these trees are unlikely to support roosting bat species.

The shed occurring within the site does not display features typically associated with a bat roost structure. This shed is of limited potential for supporting roosting bats and is likely to support at most day roosting bat species.

While no evidence of otters (*Lutra lutra*) was recorded during the field survey, the Bandon River system is known to support populations of otter. It is considered likely that otters foraging along the Dirty River adjacent to the site.

The site was surveyed for field signs indicating the presence of badgers. These field signs, as described by Neal & Cheeseman (1996) include prints, pathways, setts, latrines, hairs and scratch marks. No evidence was noted during the field survey.

The area surrounding the site has the potential to support a range of small mammal species such as hedgehog and pygmy shrew.

The following bird species were recorded on site: hooded crow (*Corvus corone cornix*), jackdaw (*Corvus monedula*), robin (*Erithacus rubecula*), wren (*Troglodytes troglodytes*), pigeon (*Columbus palumba*), stonechat (*Saxicola torquata*), chaffinch (*Tringella coelebs*) and blackbird (*Turdus merula*).

No amphibians or signs indicating the presence of amphibian species were recorded on site. However the presence of wet grassland within and adjacent to the site and the presence of marsh habitats to the north of the site increases the likelihood for amphibians to occur within and adjacent to the site.

4.1.5 Ecological Evaluation of the Landfill Site

The site supports a mosaic of habitats that provide support for a range of fauna species. The high sward associated with the dry meadow to the south of the site is likely to support a range of invertebrate species and also offers shelter for foraging small mammals such as hedgehog and pygmy shrew. The wet grassland to the north of the site is dominated by soft rush (*Juncus effusus*) and stands of greater tussock sedge (*Carex paniculata*). This habitat is likely to support a diverse range of floral and invertebrate species. However, the timing of the survey and the high water levels prevented the survey from recording the range of species associated with this habitat.

The immature scrub, stand of immature birch and coniferous treelines provides ideal habitat for nesting bird species.

The bare ground habitats are of low ecological value and are of limited value for supporting faunal species.

Overall, due to the presence of established and immature scrub, the occurrence of wetland habitats such as wet grassland and the potential for these habitats to support a range of fauna species the site is considered to be of moderate ecological value.

4.1.6 Dirty River Water Quality

The water quality of the Dirty River, which is a direct tributary of the Bandon River is reviewed in this Section. The permanent channel of the Dirty River is located 40m to the north of the Dunmanway Landfill site. It is noted that the section of the river adjacent to the landfill is representative of a spate river and when in spate will inundate lands up to the landfill's northern embankment.

The Environmental Protection Agency undertakes regular biological water monitoring at three sampling stations along the Dirty River. Two of these station (at Sillahertane Bridge and the bridge northwest of Tonafona) are located upstream of the Dunmanway Landfill site. The third station is located downstream of the landfill site at a bridge upstream of the confluence with the Bandon River. *Table 4.1* below provides the results of EPA biological water quality assessments at these stations from 1978 to 2009 (note 2009 water quality results are not available for the downstream station).

Table 4.1: Q-values at EPA Monitoring Stations along the Dirty river 1978 - 2009

Site Name	EPA Station Code	1978	1982	1986	1989	1994	1997	2000	2003	2006	2009
Sillahertane Bridge	20DO010005	-	-	-	4	4	4	4	4	4	-
Bridge NW of Tonafona	20DO010050	-	3 – 4	3 – 4	3	4	4	4	3 – 4	4	4
Bridge upstream of Bandon River	20DO010100	3 – 4	3 – 4	3 – 4	3 – 4	4	4	3 – 4	4	4	-

Previous decreases in water quality at the downstream site (i.e. Q 3 – 4 in 2000) were considered to be related to overflows at a discharge outfall from the Quarry Road Pumping Station. Adverse effects on the Dirty River's water quality have been noted from other sources such as road run-off. In 2003 the results of water quality analysis were reversed with a Q-value of 3 – 4 being assigned at the Tonafona monitoring station, while a Q-value of 4 was assigned at the downstream site. However, following the Q-value analysis of the river, undertaken in 2006, the EPA assessments concluded that the status of the Dirty River was satisfactory throughout following improvements at the second monitoring station i.e. at the Bridge northwest of Tonafona. More recent analysis in 2009 has led to a classification of good ecological status for the Dirty River.

As part of Cork County Council's Tier II Site Investigations in October 2009 water samples were taken from three locations along the Dirty River: SW1 (located downstream of the landfill); SW2 (located adjacent to the landfill and taken from the floodplain area while the Dirty River was in flood in late 2009); SW3 (upstream of the landfill). A variety of parameters were analysed and the results indicated that the only parameter that was detected at increasing concentrations between the sampling points upstream and downstream of the landfill site was ammonia. The levels detected at SW2 and SW3 exceeded EQS limits, while a very low level of ammonia (<0.01mg/l) was detected in the upstream sampling point at SW3. In light of the significant increase in ammonia levels between SW3 upstream and SW2 downstream the QRA for the Dunmanway Landfill noted that it is "*highly likely that the source of the ammonia is leachate escaping from the landfill site"*. All other parameters analysed from the 2009 samples were within EQS limits.

In March 2013 Cork County Council analysed the water quality of samples taken again from SW1, SW2 and SW3. A report detailing these results is provided in Annex 1. A similar pattern of results for ammonia was recorded. Levels were shown to be higher downstream of the landfill site when compared to the levels upstream. As with the 2009 results, the ammonia levels recorded in the 2013 samples suggest leachate emissions from the landfill are resulting in elevated ammonia levels downstream.

The 2013 water quality analysis reported similar results for Phosphate, chloride, sulphates, pH, biological oxygen demand (BOD) and chemical oxygen demand (COD) upstream and downstream of the landfill site. Total organic carbon (TOC) results were similar upstream and downstream of the landfill site at <4mg/l. Cyanide- Free levels were recorded at <5.0ug/l. Atrazine and simazine results were recorded at <0.01ug/l. Trace metals (arsenic, cadmium, chromium, mercury, nickel, lead calcium, copper, potassium and sodium) were all below EQS limits. Tributhyl Tin results were recorded as <0.02ug/l upstream and downstream of the landfill site. Volatile Organic Carbon (VOC) compounds were all below the limit of detection. There was no increase in levels between upstream and downstream sampling points for VOCs.

The following parameters indicate a variation in results between upstream and downstream of Dunmanway Landfill Site. Iron levels varied from upstream SW3 (58.4 ug/l) to downstream at SW1 (70.8ug/l). The result

for SW2 was 77.8 ug/l. Manganese levels upstream and downstream were similar at (SW3- 36.3 ug/l and SW1-30.1 ug/l). Manganese results for SW2 were 54.5 ug/l. Zinc levels between upstream and downstream were similar at (SW3 -3.5ug/l and SW1-3.3ug/l). Zinc levels at SW2 were 4.2ug/l. No metal result exceeded the EQS value for that metal.

Total Coliforms and Faecal Coliforms between upstream and downstream were similar at 240MPN/100ml and 93MPN/100ml counts. Total Coliforms counts at SW2 were elevated at 1100MPN and Faecal Coliforms counts were 240 MPN. Raised faecal coliform at SW2 indicates pollution.

A comparison of the 2013 and 2008 Tier II results is provided in this paragraph. pH results in 2008 were recorded at 7.0, similar to 2013 results. BOD results in 2008 and 2013 were <10mg/l. Sodium results in 2008 ranged from 6.40 mg/l (SW3) to 10.60mg/l (SW1). Sodium level at SW2 was 5.20mg/l. Sodium results in 2013 range between 7.7 mg/l (SW2), 8.2 mg/l (SW1) to 8.4 mg/l (SW3). No site exceeded the EQS limit of 250mg/l. Potassium results for 2008 and 2013 were <2mg/l. No site exceeded the EQS limit of 5mg/l. In 2008 Sulphate results for SW3 and SW1 were 1.61 mg/l. Sulphate result for SW2 was slightly elevated 2.06mg/l. In 2013, Sulphate results for all sites were above 2008 readings. All sulphate results were similar between upstream and downstream.

A comparision of the results between 2008 to 2013 indicate no deterioration in the water quality of the Dirty River. However , results from SW2 in 2013 indicate a low level of contamination from the landfill site and ammonia results from SW2 and SW1, which show significant increases in both sampling years when compared to SW3 also supports the assumption that the landfill is resulting in contamination to the Dirty River.

The 2013 Water Quality Report by Cork County Council (see Annex 1) further noted that any impact from the landfill site on water quality is low and reduced further during flooding.

The strong likelihood that leachate generated in the landfill is escaping to the Dirty River and causing some contamination to this surface watercourse is the principal reason for Cork County Council's proposal to remediate the landfill site to reduce/avoid the potential for leachate generation, thereby reducing/eliminating the source of contamination to the Dirty River.

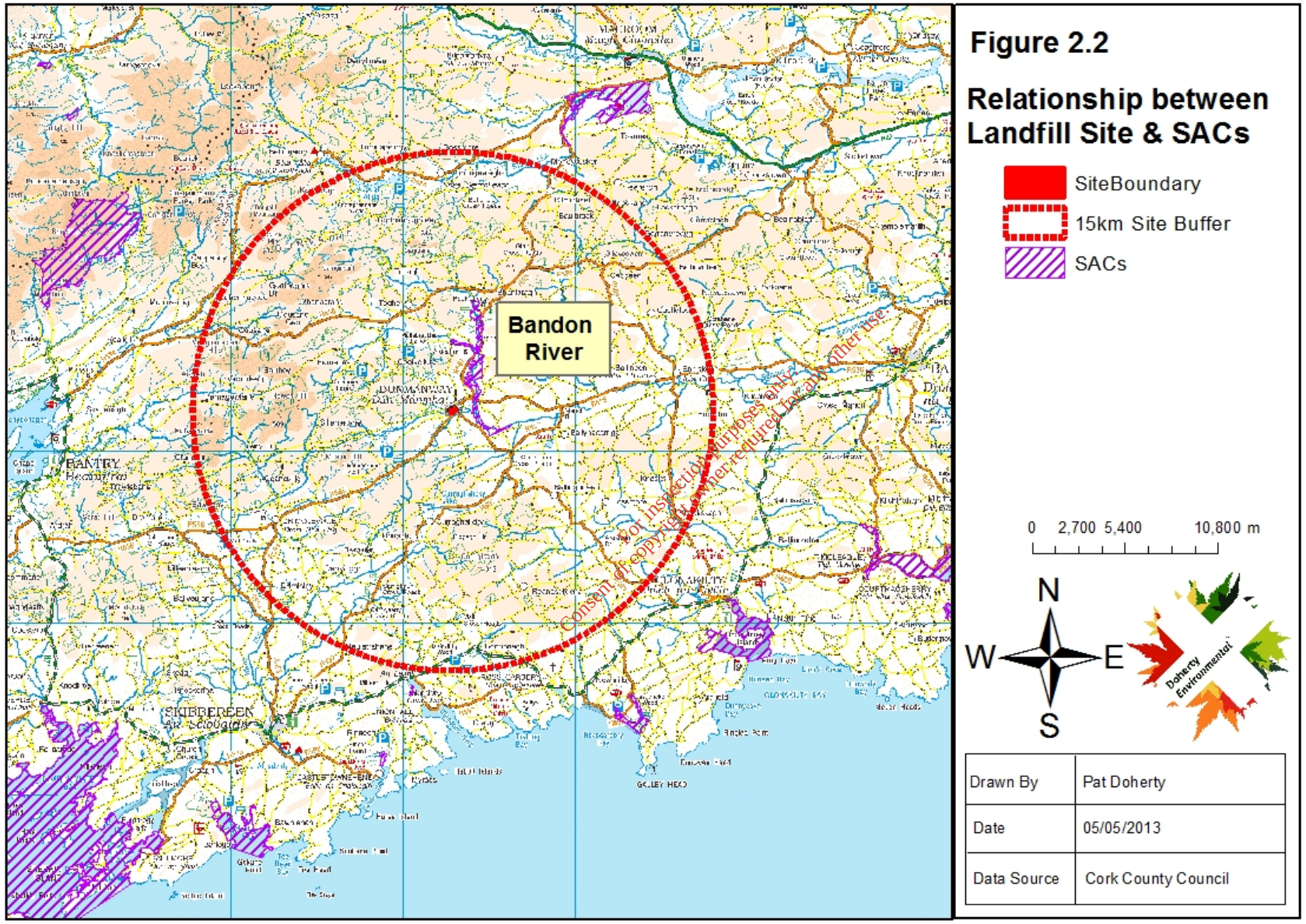
5 Identification and Description of European Sites

5.1.1 Identification of European Sites

Current guidance on undertaking EU Habitats Directive Article 6 Assessments advises that all European Sites occurring within a 15km radius of a project site should be included within a Screening Assessment (Scott Wilson *et al.*, 2006; DOEHLG, 2010). One SAC, the Bandon River SAC, occurs within the surrounding 15km radius of the site. No SPAs are located within this surrounding buffer area. The spatial relationship between SACs and SPAs occurring in the wider surrounding landscape and the landfill site is shown in Figures 2.2 and 2.3 below. Figure 2.4 shows a detailed view of the spatial relationship between the landfill site and the Bandon River SAC.

With regard to the potential effects of leachate emissions, the Tier II Assessment noted that the potential for leachate to negatively affect the Bandon River SAC downstream is low. However the continued emission of leachate or any increase in leachate emissions, under the current un-remediated landfill scenario, could pose a risk to sensitive qualifying species, namely the freshwater pearl mussel of the Bandon River SAC. Therefore it is considered that the overall aim of the project to reduce leachate generation and associated risks to sensitive qualifying species, will have the potential to result in positive effects for the Bandon River SAC.

Notwithstanding this the project activities associated with achieving these aims will, if carried out in an inappropriate manner, have the potential to negatively effect water quality and sensitive qualifying features of the SAC. The potential negative effects associated with the project are evaluated in Section 6.



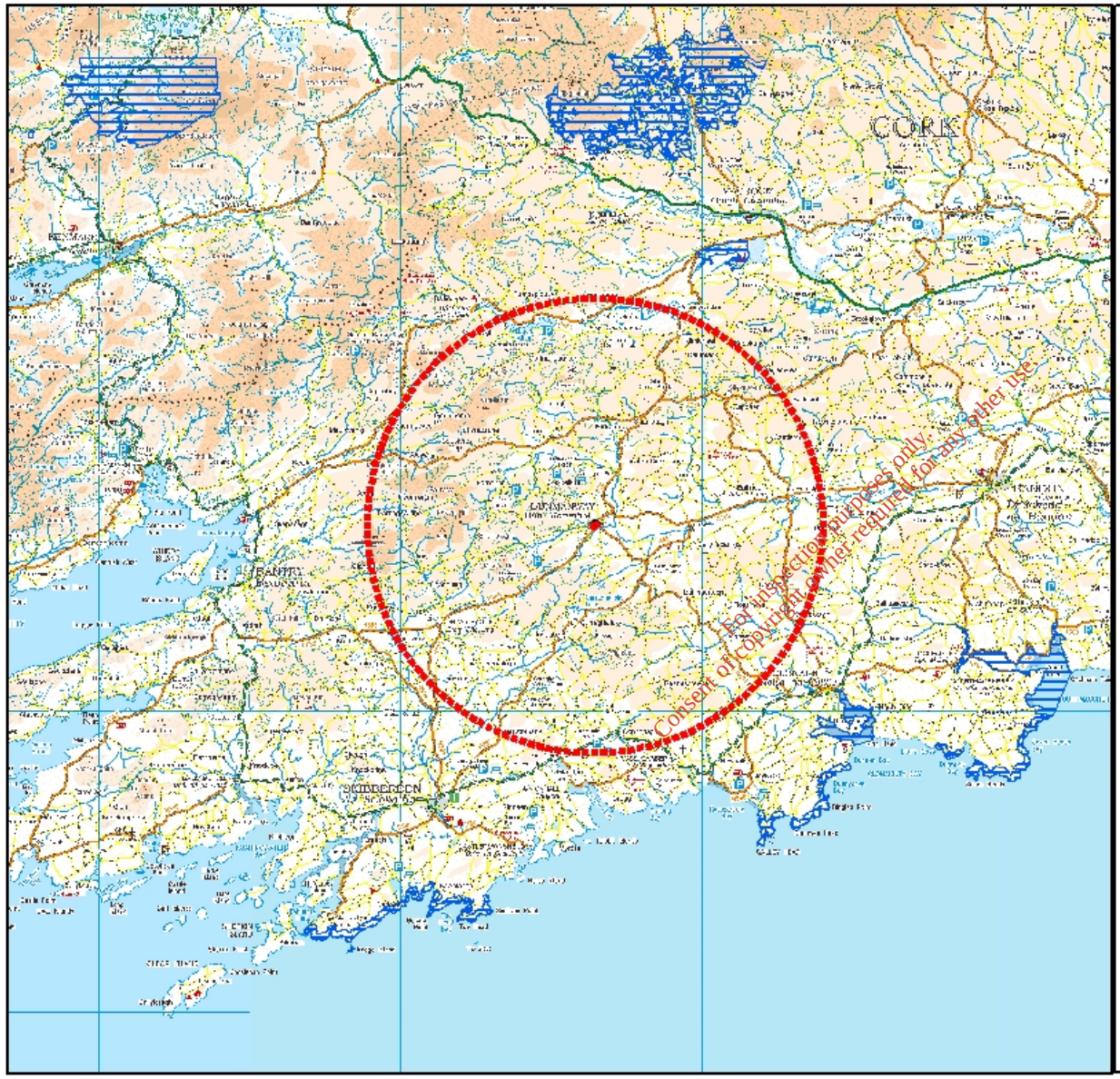


Figure 2.3

Relationship between Landfill Site & SPAs

SiteBoundary

15km Site Buffer

SPAs

0 3,600 7,200 14,400 m

N

W E

S

Doherty Environmental

Drawn By	Pat Doherty
Date	05/05/2013
Data Source	Cork County Council

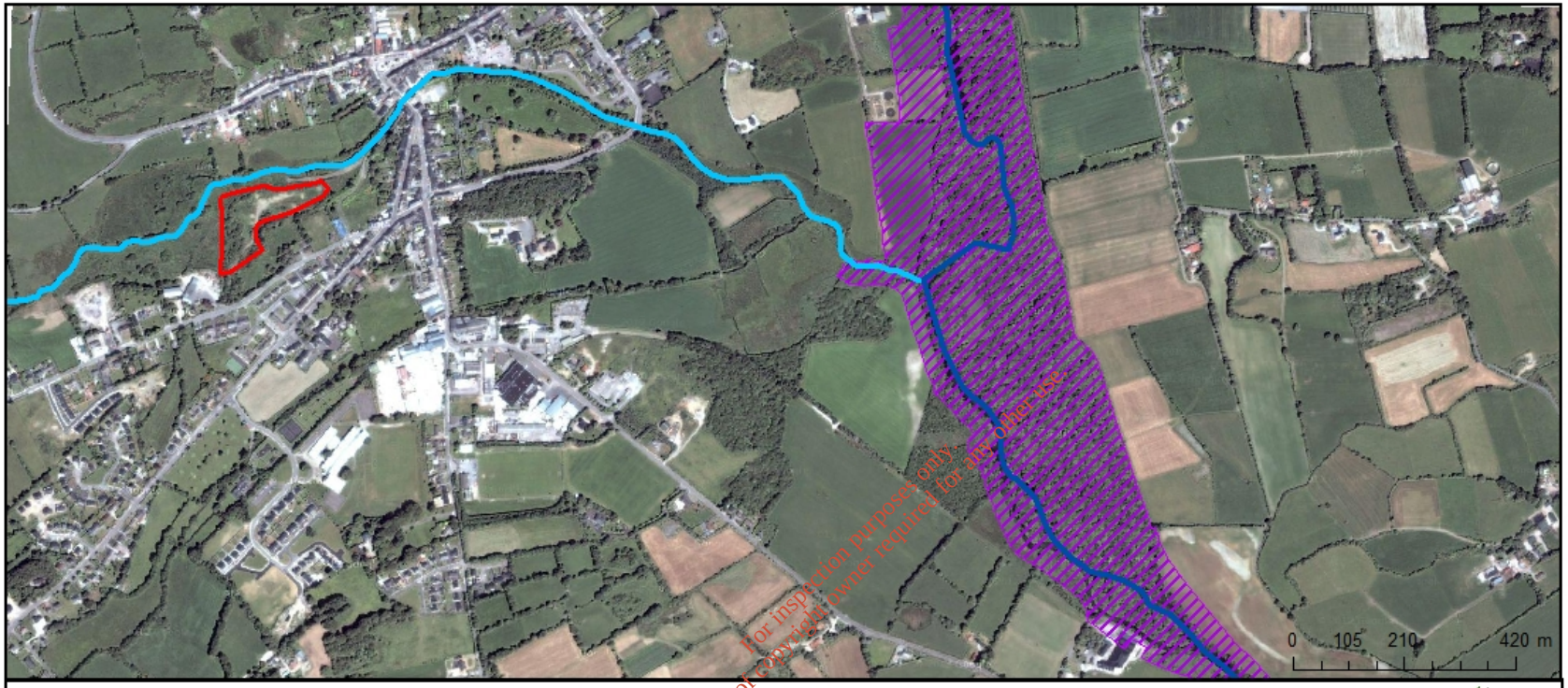


Figure 2.4

Relationship between the Landfill Site and Bandon River SAC

- Site Boundary
- Bandon River SAC
- Dirty River
- Bandon River

N
W E
S

Doherty Environmental

Drawn By	Pat Doherty
Date	05/05/2013
Data Source	NPWSI

5.2 Bandon River SAC Baseline Conditions & Sensitivities

Table 5.1 provides information on the following elements associated with the Bandon River SAC:

- Qualifying interests;
- Site sensitivity/vulnerability;
- Current Conservation Status based on the findings of the Article 17 Report submitted by the NPWS on behalf of the Department to the EC (see NPWS, 2008); and
- Threats (see NPWS, 2008).

As noted above the qualifying interests are the features for which the Bandon River has been designated as a European Site under the Habitats Regulations.

At the time this assessment was undertaken, no Conservation Management Plan was available for this European Site. In the absence of these plans a list of generic conservation management objectives (CMOs) have been provided by the NPWS. These are:

- To maintain the bird species of special conservation interest, for which the SPA has been designated, at favourable conservation status.

Favourable conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, is stable or increasing, and
- The ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- The conservation status of its typical species is favourable as defined below.

Favourable conservation status of a species is achieved when:

- Population data on the species concerned indicate that it is maintaining itself, and
- The natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Table 5.1: European Sites Qualifying Interests

EUROPEAN Site	Location	Qualifying Interests	Site Sensitivity	Conservation Status	Threats
Bandon River SAC	Nearest point is located approximately 1.2km downstream of the Landfill Site	Freshwater Pearl Mussel (*Margaritifera margaritifera*)	Highly sensitive to perturbations in water quality and flow regime.	Bad	No information is currently available on the threats to the qualifying features of this site.
		Brook Lamprey (Lamptera planeri)	Sensitive to perturbations in water quality and obstacles to instream movements	Good	
		Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (to be referred to as Floating River		Bad	

		Vegetation)			
		Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)		Bad	

5.2.1 Freshwater Pearl Mussels

(i) Distribution in the Bandon Catchment

A Sub-basin Management Plan (SBMP) has been prepared for the freshwater pearl mussel population of the Bandon Catchment. Pearl mussels require specific habitat conditions for the survival of viable populations. The principal habitat requirements are oligotrophic, well oxygenated waters of high water quality with low levels of sedimentation and a firm substrate of gravels and sand.

Such conditions occur throughout the Bandon catchment and the distribution of pearl mussel in this catchment is known to be widespread (see Figure 2.5 below), with records from as high as Cullenagh Lake to as low as Bandon Town. The Caha and Blackwater Rivers also have wide distributions of the mussel. Significant survey effort to establish the extent of the population within the Bandon River at Dunmanway was undertaken between the mid 1990's and 2005. More recent attempts to survey the population along the river in 2009 were repeatedly thwarted by spate conditions. Thus it is noted in the SBMP that the current status of the population is based on survey work completed up to 2005.

While the surveys undertaken to date found the population to be abundant in places, with up to 75 individuals per square metres recorded (Ross, 2005), the population consisted mainly of adult mussels: the surveys recorded no mussels with shell lengths lower than 65mm. The results of surveys also suggested that juvenile habitat is seriously impaired. High levels of silt in the Caha River have been recorded and are likely to be affecting juvenile survival. Examination of salmonids during electro-fishing surveys in 2009 found none to be encysted with glochidia, suggesting that although good numbers of salmonids are present within the Bandon River the mussel population may be too stressed to brood glochidia to maturity. Other unfavourable conditions have been recorded within the catchment such as macrophyte cover over 5% at pearl mussel habitats (legislation requires cover to be <5%). The SBMP does note that the population of the Bandon River is likely to support in excess of 50,000 individuals. Notwithstanding these numbers the conservation status of the Bandon River catchment mussel populations is considered to be unfavourable due to low levels of recruitment and impaired juvenile habitat.

The nearest location of known pearl mussel beds to the Dunmanway Landfill site is 1.2km downstream at the confluence of the Dirty River and the Bandon River. Extensive mussel beds occur along the main channel of the Bandon River immediately upstream and downstream of this confluence.

The instream habitats along the Dirty River adjacent to and immediately downstream of the landfill site are not representative of good pearl mussel habitat (as described above) and displays features inimical to pearl mussel survival. High levels of macrophyte growth (dominated by *Ranunculus sp.*) were noted along this stretch of the Dirty River during a bankside survey in March 2013. The streambed was covered with fine silt and glide conditions characterised the instream habitat. Water depth within the channel was over 1m and visibility was slightly impaired.

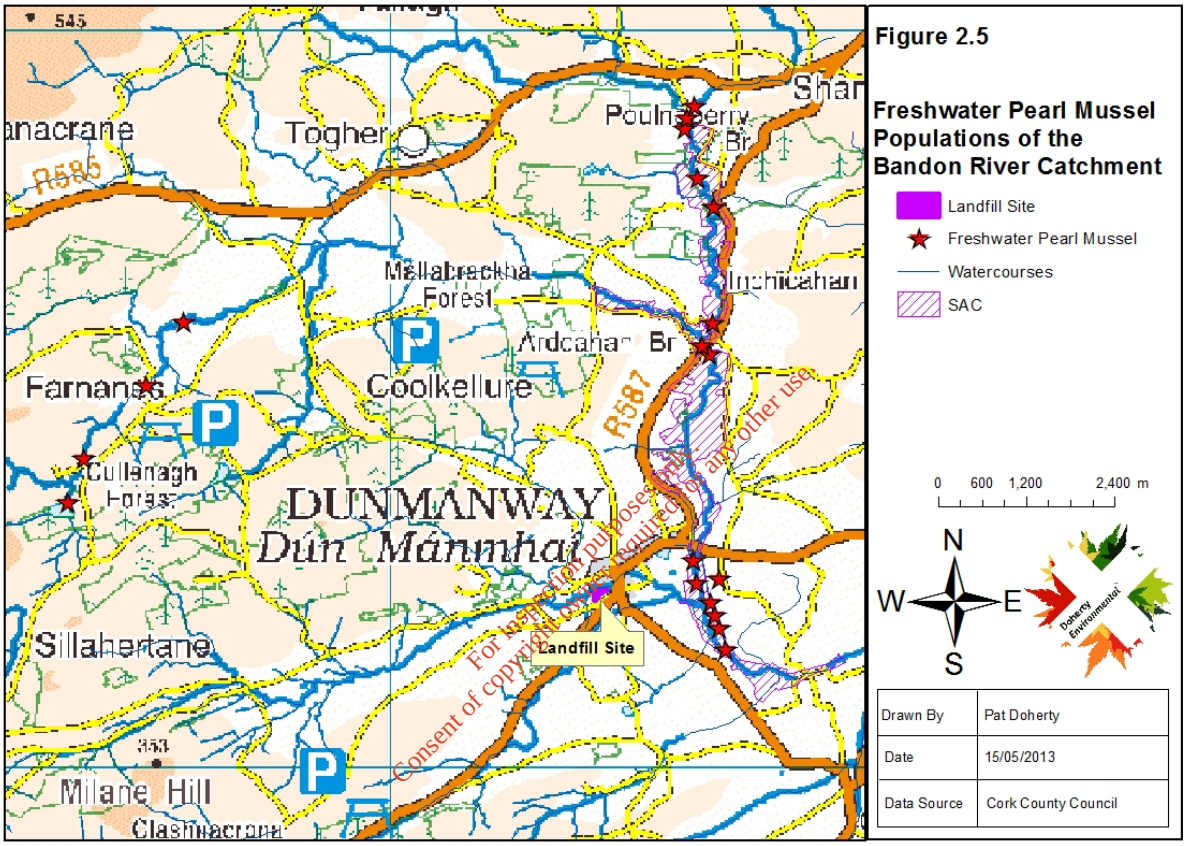
(ii) Sensitivities

Pearl mussels are very sensitive to perturbations in water quality. Mussels use their gills for feeding and respiration and high levels of suspended solids within watercourses can significantly affect mussel respiration and feeding by clogging gills. Persistent exposure to high levels of suspended solids can result in starvation or respiratory stress resulting in asphyxiation.

Silt accumulation on river-beds also significantly affects recruitment and the viability of a population. During the juvenile stage mussels will spend several years buried beneath the coarse river-bed. A constant flow of oxygen through the riverbed to the juvenile mussels is required for survival. The deposition of silt material over mussel beds will clog the interstice and reduce or prevent the penetration of oxygen to juveniles resulting in death.

The growth of instream vegetation including algae and macrophytes can also affect mussels by increasing the biological oxygen demand within the watercourse, thereby reduces the levels of oxygen available for mussel respiration. Macrophytes can also entrain sediment and lead to the build up of silt.

In light of the already perturbed and unfavourable conservation status of the pearl mussels in the Bandon Catchment, the population is considered to be very sensitive to further disturbance to water quality. Any migration of excessive silt-laden water and suspended solids from the project site to the Dirty River could exacerbate conditions downstream.



5.2.2 Brook Lamprey

(i) Distribution in the Bandon Catchment

The brook lamprey spends its life in freshwater. It breeds in areas of gravelly river bed before spending the juvenile stage of the lifecycle buried in areas of fine silt downstream. Juvenile lamprey habitat is generally found along rivers where deposition occurs such as in lateral areas along straight stretches flowing at low to level grades or on the inner sides of bends and meanders. Adult brook lamprey undertake relatively short migrations upstream with distances travelled often less than 1km[2].

The instream habitat conditions occurring in the Dirty River adjacent to and immediately downstream of the landfill site provide suitable habitat for juvenile brook lamprey. Known juvenile lamprey sites are located downstream of the landfill site along the main channel of the Bandon River. Large numbers of juvenile lamprey

[2] Hardisty, M. W. and Potter, I. C. 1971 The general biology of adult lampreys. In M.W. Hardisty and I. C. Potter (eds.) The Biology of Lampreys, Volume 1, Academic Press, London.

were recorded along the braided channels of the Bandon River to the east of Dunmanway during survey work for the Dunmanway Flood Relief scheme (King et al. 2008). This area corresponds to the area of alluvial wet woodland shown in Figure 2.7 below.

(ii) Sensitivities

While eutrophication is not considered to be highly significant in impacting lamprey conservation status, pollution from contaminating substances has been shown to have a significant mortality effect on lampreys. Obstacles to passage along watercourses and instream river drainage and maintenance works are noted as a significant pressure and threat to this species. Brook lamprey are particularly vulnerable to riverbed disturbance during the juvenile stage of their lifecycle. Once hatched juvenile lamprey burrow into areas of soft riverbed sediment where they can remain for anywhere between three and seven years. Disturbance to such areas and particularly sediment removal will reduce the area of suitable habitat available for lamprey and leave individuals at risk of predation.

5.2.3 Floating River Vegetation

(i) Distribution in the Bandon Catchment

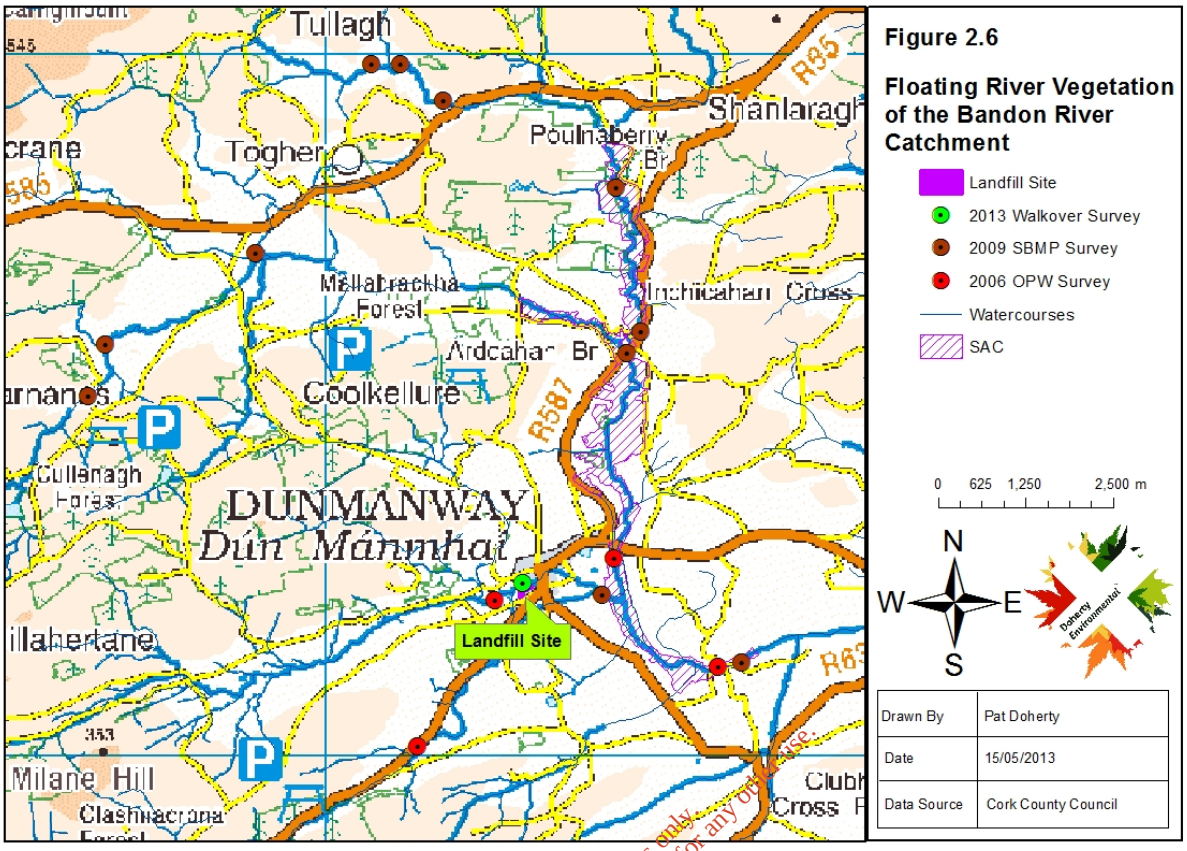
Floating river vegetation occurs throughout the Bandon River catchment. Species associated with the floating river vegetation community within the catchment include Water Crowfoot *Ranunculus* spp., Milfoil *Myriophyllum alterniflorum* , Pondweed *Potamogeton natans*, four varieties of Starworts *Callitriche hamulata*, *Callitriche obtusangula*, *Callitriche platycarpa* and *Callitriche stagnalis* and the aquatic moss *Fontinalis antipyretica*. *Ranunculus* sp. is reported to be the dominant floating river vegetation on the Bandon River.

It is noted that current research is being undertaken to further define the characteristics of Annex 1 floating river vegetation communities in an Irish context. High status rivers can support abundant *Ranunculus* vegetation, however rivers artificially enriched with nutrients can also support species-poor examples of floating river vegetation, dominated by *Ranunculus sp.* (particularly *R. fluitans*). Examples of the latter are not likely to be representative of the Annex 1 community.

Ranunculus sp. and *Calitriche* sp. were noted along the Dirty River adjacent to the landfill during a bankside walkover survey in March 2013. A detailed analysis of this vegetation to species level was not undertaken. However in 2006 detailed surveys of the extent of floating river vegetation was undertaken within the Bandon Catchment for the OPW arterial drainage schemes. Ten sampling points were surveyed for the presence of floating river vegetation within the catchment upstream and downstream of Dunmanway. Floating river vegetation was recorded at four of the sampling points (see Figure 2.6 below). One of these sites is located along the Dirty River, upstream of the landfill site. The floating vegetation recorded at this site was dominated by *Ranunculus aquitilis* and *Callitriche stagnalis.* It is likely that these species were also the dominant species occurring along the Dirty River adjacent to the landfill during the March 2013 bankside walkover survey.

The floating river vegetation recorded during the 2006 survey downstream of the landfill site along the main channel of the Bandon River was more diverse with two *Ranunuculus* sp. and three *Callitriche* sp. being recorded.

The Bandon River SMBP also recorded the presence of macrophyte vegetation dominated by *Ranunculus* or *Callitriche* sp. during macroinvertebrate water quality surveys in 2009. The location of these areas are shown in Figure 2.6. At each of the SMBP sampling points shown on Figure 2.6 *Ranunculus* cover ranged from 10% to 80% and was mainly dominated by *Ranunculus fluitans*.



(ii) Sensitivities

The favourable conservation status of this habitat is sensitive to a range of impacts. A simplified overview of the type of impacts affecting this habitat include: modifications to flow regimes; increases in sediment loading; diffuse pollution and eutrophication; channel modification and the introduction of non-native species.

5.2.4 Alluvial Woodland

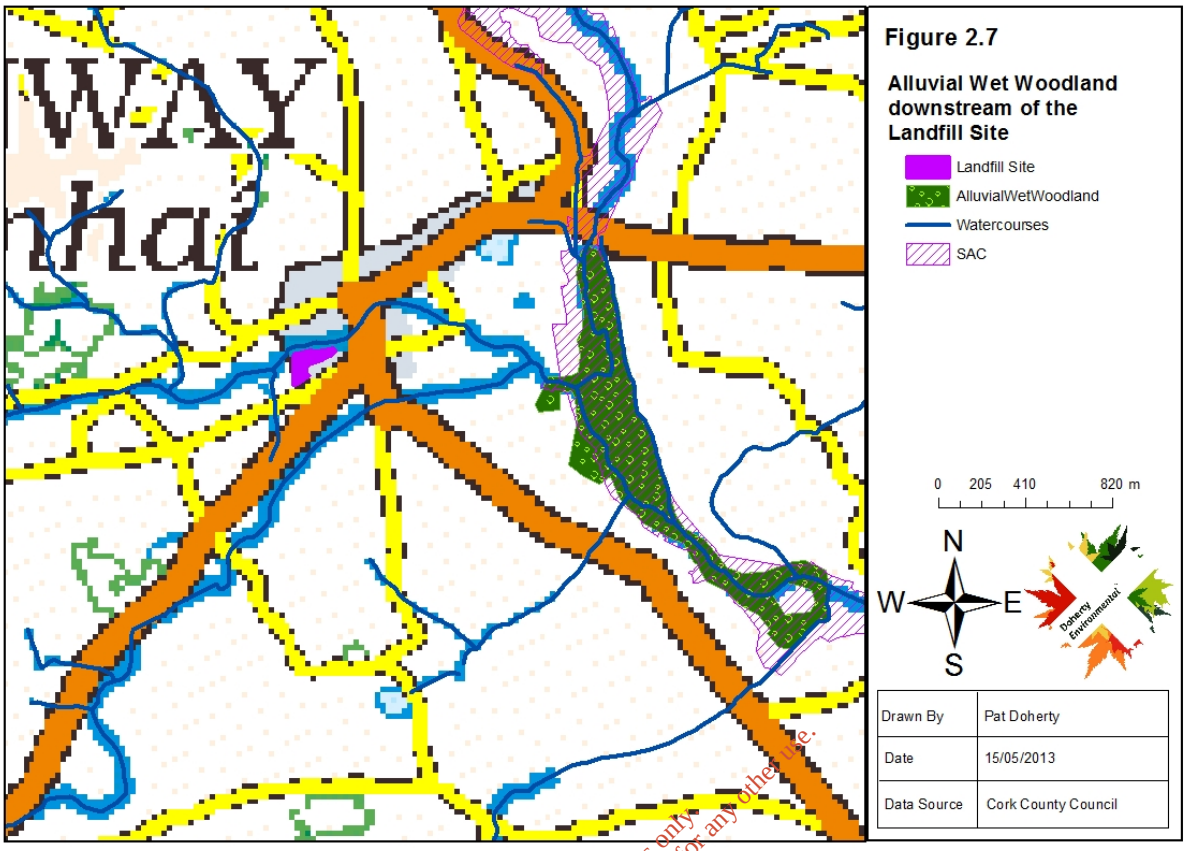
(i) Distribution in the Bandon Catchment

Extensive area of alluvial woodland occurs downstream of the landfill site at the confluence of the Dirty River and the Bandon River. The extent of this woodland stretches from the Long Bridge south to the confluence of the Kealrootha and Bandon River (See Figure 2.7).

(ii) Sensitivities

Alluvial woodlands are sensitive to changes in drainage regimes, grazing and encroachment by non-native species. Recent research carried out for this habitat[3] found invasive non-native species in every alluvial woodland surveyed. The presence of such species are negatively affecting the status of alluvial woodlands. Other potential pressures such as the presence of paths and tracks and grazing were considered to be resulting in a neutral effect to this woodland type.

[3] O'Neill, F.H. & Barron, S.J. (2011) Results of the first year of a monitoring survey of Annex I sessile oak and alluvial woodlands. Unpublished report submitted to National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.



6 Assessment of Effects

Describe the individual elements of the project that could give rise to impacts (either alone or in combination with other plans or projects) on the European Site.

The aim of the project is to prevent leachate emission from the Dunmanway landfill to the Dirty River. Achieving this aim will have a positive effect on the water quality of the Dirty River downstream of the landfill site and will minimise/avoid any potential risks posed by such emissions to qualifying features, particularly pearl mussels, of the Bandon River SAC.

Project activities associated with the remediation of the landfill could, if undertaken in an inappropriate manner, have the potential to result in negative impacts to the water quality of the Dirty River and downstream within the SAC. Such impacts could arise should excessive silt-laden water and suspended solids migrate from the denuded soil cover within the landfill site to the Dirty River. The potential effects of increased silt deposition to the Dirty River and downstream within the SAC have been outlined under the sensitivities section for each of the qualifying features in Section 5.2 above. It is noted that the potential for silt-laden runoff to be generated on site will be restricted to a relatively short timeframe between the commencement of the remediation activities and prior to the establishment of surface vegetation over the re-worked soil cover.

As outlined in Section 3 above a range of measures have been incorporated into the approach to the project to ensure that any potential silt influxes do not have the potential to result in significant effects to surface water quality or instream habitats in the receiving Dirty River and Bandon River downstream.

The following assessment, undertaken with regard to assessment criteria outline in EC Guidelines (EC, 2001), evaluates the potential for the project to result in likely significant effects to European Sites. When assessing the potential for likely significant effects, this assessment takes into account the various water quality protection measures outlined in Section 3.

Table 3.1: Assessment of Likely Significant Effects to the Bandon River SAC

Assessment Criteria	
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the European Site by virtue of	
Size and Scale	The project site occupies an area of land approximately 9,000m^2 in size.
Land-take	The project will not involve any land take from European Sites.
Distance from European Sites or key features of the site	The project site is located approximately 1.2km from the nearest point of the Bandon River SAC.
Resource requirements	No resources associated with European Sites (e.g. water or mud/sand for abstraction etc.) will be required for, or utilized by the project.
Emissions	Two sources of emissions are associated with the project: 1. Leachate emissions, which the project aims to eliminate; and 2. Uncontrolled surface water runoff during the remediation activities. Risks associated with both sources of emissions and the project's approach to avoiding them are outlined below. **Leachate Emissions** Under the current scenario, without the implementation of the project, leachate generated at the landfill site will continue to emit to the Dirty River. Assessments have concluded that these emissions are resulting in low levels of pollution within the Dirty River. The effect this pollution is having on the status of qualifying features, particularly pearl mussels, has not been quantified. However it is likely that continuous leachate inputs will play a part in inhibiting the achievement of high status in the Dirty River and may, in combination with other sources of water quality perturbations, result in cumulative downstream impacts within the Bandon River SAC. Successful application of the project's aims will avoid or minimise to a negligible level the emission of leachate to the Dirty River and eliminate it as a source of pollution to this watercourse. Such an outcome will represent a positive effect for the Bandon River SAC and associated qualifying features downstream of the landfill site. **Uncontrolled Surface Water Runoff** In the absence of a proper approach, the activities associated with the project's implementation will have the potential to result in water quality impacts to the Dirty River and downstream within the Bandon River SAC. These water quality impacts could arise through the migration of silt-laden surface waters from the project site to the Dirty River. The ingress of such surface water runoff could result in excessive sedimentation downstream within the Bandon River SAC. As noted in Section 5.2.1 freshwater pearl mussels are particularly sensitive to sedimentation. To avoid such eventualities the project proposed to incorporate a range of measures to

	ensure no silt-laden surface water enters the Dirty River during the remediation of the landfill. The existing bund to the north and east of the site will ensure that surface water is prevented from running to the Dirty River. The implementation of perimeter swales will be designed to capture all surface water runoff from the landfill site. All surface waters within the swale will be filtered to remove excessive suspended solids prior to discharge to the Dirty River. As noted above the potential for silt-laden water to arise will be restricted to the period between reworking of the soil cover and the establishment of surface vegetation. Once surface vegetation is consolidated over the re-worked and remediated landfill cap the potential for silt-laden surface water generation within the site will be eliminated. The proposal to seed the soil cover will reduce the time required for vegetation to become established. The proposed perimeter swale filters will provide sufficient filtration of suspended solids during this time-frame to ensure that the discharges from the site do not present a risk to water quality within the Dirty River or further downstream within the Bandon River SAC. Furthermore, in the event that imported soil material is required for the completion of the remediation works, the measures outlined in Section 3 to: • use only inert soil; • retain the existing bunds; and • collect and filter surface water runoff from areas receiving imported soil material along perimeter swales, will ensure surface runoff and potential suspended solids generated during remediation activities, where additional imported material is required, will be adequately filtered prior to discharge to the Dirty River and will not present a risk to the water quality of this river or the Bandon River SAC further downstream.
Excavation requirements	The project will not involve any excavations from European Sites.
Transportation requirements	The transport requirements will be minimal and will not have the potential to result in likely significant effects to the Bandon River SAC.
Duration of the project	With regard to leachate generation the landfill is assessed as being in the latter stages of degradation. As the degradation process continues through Stage V the concentration of contaminating parameters such as ammonia will decrease. However the time required for the establishment of benign conditions within the leachate cannot be estimated. It is anticipated that the maximum timeframe required for the completion of the remedial works at the land fill will be 3 months.
Other	See Below
Describe any likely changes to the European site arising as a result of:	

Reduction of habitat area	The remedial activities at the landfill site will not result in a reduction in the extent of qualifying habitats or habitats that support qualifying species.
Disturbance of key species	The remedial works will involve the short-term presence of human activity on site during the re-working of the landfill cover and possible importation of additional soil cover, if required. The only potential pathway for disturbance to key qualifying species is via disturbance to water quality. As outlined above under the Emissions section surface water runoff will be adequately filtered to remove excessive suspended solids prior to discharge. The removal of excessive suspended solids will ensure that the project will not have the potential to negatively effect surface water quality during remediation activities. Furthermore once the landfill soil cover/cap is successfully re-worked the project should result in positive effects for surface water quality by eliminating leachate emissions to the Dirty River.
Habitat or species fragmentation	The project does not pose a threat of habitat or species fragmentation.
Reduction in species density	The project will not have the potential to reduce the density of qualifying species of the Bandon River. As outlined under the emissions section, the successful application of the project with adherence to water quality protection measures will have the potential to contribute to an improvement in surface water quality within the Bandon catchment. Such improvements may also contribute to other measures that aim to increase pearl mussel density within the catchment.
Changes in key indicators of conservation status	The European Commission (2006) Explanatory Notes and Guidelines for the Assessment, Monitoring and Reporting under Article 17 of the Habitats Directive outlines key indicators for assessing the conservation status of designated sites. The key indicators for assessing the conservation status of key species i.e. species listed on Annex 1 of the EU Birds Directive and Annex 2 of the EU Habitats Directive are: *Range:* as outlined above the elements of the project will not result in direct or indirect negative impacts to the Bandon River SAC. Therefore the distribution of qualifying species associated with this SAC will not be negatively effected by the project. *Population:* Populations of qualifying species will not be negatively effected by the project. The aim to eliminate or reduce to a negligible level leachate emissions to the Dirty River will have a positive impact for water quality conditions within the catchment and contribute to achieving preferential conditions for increase pearl mussel numbers. The proper implementation of the water quality protective measures outlined in Section 3 will also ensure that the project will not have the potential to negatively effect surface water quality during the remediation activities. *Habitat for the species*: As direct or indirect impacts to the SAC are not predicted to occur, habitats which support foraging qualifying species will not be affected by the project; and *Future Prospects*: As the landfill will not result in direct or indirect affects to the SAC the future prospect of the qualifying interests of this site will not be affected.

Climate change	There is currently insufficient information to predict the effects of climate change on the site. It is predicted that on a national level winters will become wetter and summers drier but the effect on local precipitation is unknown.
Describe any likely impacts on the European Site as a whole in terms of:	
Interference with key relationships that define the structure and function of the site	The key relationships that define the structure and function of the Bandon River SAC are high water quality status, natural river morphology and flow regimes. These attributes combine to provide the conditions necessary for qualifying habitats and species to be supported by the Bandon River. No element of the project will have the potential to interfere with the water quality, morphology or flow regime of the Dirty River adjacent to the landfill site or the Bandon River, downstream.
Describe from the above the elements of the project or plan or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.	
Detailed Tier II and QRA Investigations have been undertaken for the Dunmanway Landfill site. During these investigations it was established that the landfill represents a risk to surface water quality. The Tier II investigation noted that the risk posed by emissions from the landfill to the Bandon River SAC is likely to be low. However during this Screening Assessment it was considered that the continued emission of leachate to the Dirty River could, in combination with other sources of disturbance to water quality within the catchment, result in negative effects downstream within the Bandon River SAC. Thus the overall aim of the project to avoid or minimise to a negligible level leachate emissions to the Dirty River will represent a positive effect for water quality of the Bandon catchment. However it was recognized that, without incorporating measures to protect water quality, the project's remediation activities could negatively effect water quality and in particular degrade pearl mussel habitats downstream through the discharge of silt-laden surface water to the Bandon catchment. The project has incorporated measures to manage and filter surface water generated during the remediation activities that will ensure discharges to the Dirty River will not result in siltation to this receiving watercourse or the Bandon River further downstream. Furthermore, as outlined above, suitable measures to safeguard water quality will also be implemented in the event that additional soil material from outside sources will be required for the completion of the remediation activities. The implementation of these measures will ensure that remediation activities do not present a risk to the water quality of the Dirty River or the Bandon River downstream and will ensure potential threats to the SAC's qualifying features, particularly pearl mussel habitat are avoided.	

7 Screening Conclusions

This Stage 1 Screening Assessment has resulted in a Finding of No Significant Effects to the Bandon River SAC, which represents the only European Site occurring within the potential sphere of influence of the project site.

As the implementation of the proposed project will not result in likely significant effects to European Sites a Stage 2 Appropriate Assessment is not required.

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Annex 1 Cork County Council Dirty River Water Quality Report

Jean Sayers

Environment Section

Cork County Council

9th April 2013

On the 11th of March 2013, Cork County Council Staff carried out surface water sampling on the Dirty River. The Dirty River is located approx 20-30m from the northern boundary of the Dunmanway Landfill Site. Three surface water sites were identified from the TIER II assessment; SW1 is located downstream, SW2 is located at the boundary earthen wall of the landfill site (sampled when river was in flood) and SW3 is located up stream of the landfill site. This report will assess the water quality in comparison to 2008 results (Appendix 3) and reference EQS limits for Surface Water (See Appendix 4)

The following parameters show no increase in SW3 (upstream) and SW1 (downstream) of Dunmanway Landfill in 2013. Phosphate, chloride, sulphates, pH, biological oxygen demand (BOD) and chemical oxygen demand (COD) results are similar compared to upstream and downstream sample point results. Total organic carbon (TOC) results were similar upstream and downstream of the landfill site at <4mg/l. Cyanide- Free levels were recorded at <5.0ug/l. Atrazine and simazine results were recorded at <0.01ug/l. Trace metals (arsenic, cadmium, chromium, mercury, nickel, lead calcium, copper, potassium and sodium) were all below EQS limits. Tributhyl Tin results were recorded as <0.02ug/l upstream and downstream of the landfill site. Volatile Organic Carbon (VOC) compounds were all below the limit of detection. There was no increase in levels between upstream and downstream sampling points for VOCs.

The following parameters indicate a variation in results between upstream and downstream of Dunmanway Landfill Site. Iron levels varied from upstream SW3 (58.4 ug/l) to downstream at SW1 (70.8ug/l). The result for SW2 was 77.8 ug/). Manganese levels upstream and downstream were similar at (SW3- 36.3 ug/l and SW1- 30.1 ug/l). Manganese

results for SW2 were 54.5 ug/l. Zinc levels between upstream and downstream were similar at (SW3 -3.5ug/l and SW1-3.3ug/l). Zinc levels at SW2 were 4.2ug/l. No metal result exceeded the EQS value for that metal.

Total Coliforms and Faecal Coliforms between upstream and downstream were similar at 240MPN/100ml and 93MPN/100ml counts. Total Coliforms counts at SW2 were elevated at 1100MPN and Faecal Coliforms counts were 240 MPN. Raised faecal coliform at SW2 indicates pollution. See Appendix 4 Water Quality EQS.

The following parameters are be compared to 2008 Tier II results. PH results in 2008 were recorded at 7.0, similar to 2013 results. BOD results in 2008 and 2013 were <10mg/l. Sodium results in 2008 ranged from 6.40 mg/l (SW3) to 10.60mg/l (SW1). Sodium level at SW2 was 5.20mg/l. Sodium results in 2013 range between 7.7 mg/l (SW2), 8.2 mg/l (SW1) to 8.4 mg/l (SW3). No site exceeded the EQS limit of 250mg/l. Potassium results for 2008 and 2013 were <2mg/l. No site exceeded the EQS limit of 5mg/l. In 2008 Sulphate results for SW3 and SW1 were 1.61 mg/l. Sulphate result for SW2 was slightly elevated 2.06mg/l. In 2013, Sulphate results for all sites were above 2008 readings. All sulphate results were similar between upstream and downstream. See Appendix 3 for results.

Comparing 2008 to 2013 results we can see water quality in the Dirty River has not deteriorated .However , results from SW2 indicate a low level of contamination from the landfill site .Any impact from the landfill site on water quality is low and reduced further during flooding.

Regards

Marie Mortell

Facility Scientist

Bottlehill Landfill

Cork County Council

Appendix 1: Cork County Water Quality Results

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.irishwatertesting.com

Contact Name	Marie Mortell	**Report Number**	**64388 - 1**
Address	Cork CC(WW-Mallow)	**Sample Number**	64388/001
	Environmental Laboratory,	**Date of Receipt**	13/03/2013
	Annabella,	**Date Started**	13/03/2013
Tel No	022 30443	**Received or Collected**	Courier
Fax No		**Condition on Receipt**	Good
Customer PO	001065712	**Date of Report**	29/03/2013
Quotation No	QN001861	**Sample Type**	Surface Waters
Customer Ref	B083/13		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
AQ2-UP1								
Phosphate-Ortho(as P)		EW154M	0.009		<0.009	mg/l P	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.600		12.0	mg/L	INAB	
Sulphate		EW154M-1	1.000		6.9	mg/L	INAB	
BOD								
BOD		EW001	1.0		4.0	mg/L	INAB	
COD								
COD		EW094	8.000		9.0	mg/L	INAB	
Cyanide-Free								
Cyanide-Free		EW154M	5.000		<5.0	ug/L		
GCMS-Triazines								
Atrazine		EM129	0.010		<0.010	ug/L		
Simazine		EM129	0.010		<0.010	ug/L		
Ion Chromatography								
Fluoride		EW137	0.10		<0.10	mg/L	INAB	
Metals-Trace								
Arsenic		EM130	0.200		0.3	ug/L	INAB	
Cadmium		EM130	0.100		<0.1	ug/L	INAB	
Chromium		EM130	1.000		<1.0	ug/L	INAB	
Iron		EM130	20.0		70.8	ug/L	INAB	
Mercury		EM130	0.020		<0.02	ug/L	INAB	
Manganese		EM130	1.000		30.1	ug/L	INAB	
Nickel		EM130	0.500		<0.5	ug/L	INAB	
Lead		EM130	0.300		<0.3	ug/L	INAB	
Zinc		EM130	1.000		3.1	ug/L	INAB	
Boron		EM130	0.020		<0.02	mg/L	INAB	
Calcium		EM130	1.000		7.8	mg/L	INAB	
Copper		EM130	0.003		<0.003	mg/L	INAB	
Potassium		EM130	0.200		1.0	mg/L	INAB	
Sodium		EM130	0.500		8.4	mg/L	INAB	
Micro -Total & Faecal (Sub 1)								
Total Coliforms (Coliform Count)	*	Default	0		240	MPN/100ml	YES	
Faecal coliforms	*	Default	0		93	MPN/100ml	YES	

Sample Pick-Charge Per sample

Signed : _____ 29/03/2013

Technical Manager (or Deputy): **Brendan Murray**

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS
4.LOQ=Limit of Quantification or lowest value that can be reported for the test
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited

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Fax No		**Condition on Receipt**	Good
Customer PO	001065712	**Date of Report**	29/03/2013
Quotation No	QN001861	**Sample Type**	Surface Waters
Customer Ref	B083/13		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Sample Pick-Charge Per sample									
	Sample Pick-Charge Per sample		Default	0		Yes	EA		
Suspended Solids									
	Suspended Solids		EW013	5.000		<5	mg/L	INAB	
Titralab									
	pH		EW153	0.300		7.0	pH Units	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10.000		26.4	mg/L CaCO3	INAB	
Total Dissolved Solids (TDS)									
	Total Dissolved Solids (TDS)		EW046	10		70	mg/L	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.330		3.34	mg/L	INAB	
Tributyl Tin (Sub)									
	Tributyl Tin (Sub)	*	Default	0.02		<0.02	ug/L	YES	
VOC-WW-VOC									
	Toluene		EO025	0.500		<0.5	ug/L	INAB	
	Dichloromethane		EO025	0.500		<0.5	ug/L	INAB	
	Xylene-O		EO025	0.500		<0.5	ug/L	INAB	
	Xylene P&M		EO025	0.500		<0.5	ug/L	INAB	
	Xylenes-Total (Calc)		EO025	1.000		<1.0	ug/L		

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Technical Manager (or Deputy): **Brendan Murray**

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Contact Name	Marie Mortell	**Report Number**	**64388 - 1**
Address	Cork CC(WW-Mallow) Environmental Laboratory, Annabella,	**Sample Number** **Date of Receipt** **Date Started**	64388/002 13/03/2013 13/03/2013
Tel No	022 30443	**Received or Collected**	Courier
Fax No		**Condition on Receipt**	Good
Customer PO	001065712	**Date of Report**	29/03/2013
Quotation No	QN001861	**Sample Type**	Surface Waters
Customer Ref	B084/13		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
AQ2-UP1								
Phosphate-Ortho(as P)		EW154M	0.009		<0.009	mg/l P	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.600		11.7	mg/L	INAB	
Sulphate		EW154M-1	1.000		7.6	mg/L	INAB	
BOD								
BOD		EW001	1.0		<1.0	mg/L	INAB	
COD								
COD		EW094	8.000		<8.0	mg/L	INAB	
Cyanide-Free								
Cyanide-Free		EW154M	5.000		<5.0	ug/L		
GCMS-Triazines								
Atrazine		EO129	0.010		<0.010	ug/L		
Simazine		EO129	0.010		<0.010	ug/L		
Ion Chromatography								
Fluoride		EW154	0.10		<0.10	mg/L	INAB	
Metals-Trace								
Arsenic		EM130	0.200		0.2	ug/L	INAB	
Cadmium		EM130	0.100		<0.1	ug/L	INAB	
Chromium		EM130	1.000		<1.0	ug/L	INAB	
Iron		EM130	20.0		77.8	ug/L	INAB	
Mercury		EM130	0.020		<0.02	ug/L	INAB	
Manganese		EM130	1.000		54.5	ug/L	INAB	
Nickel		EM130	0.500		<0.5	ug/L	INAB	
Lead		EM130	0.300		<0.3	ug/L	INAB	
Zinc		EM130	1.000		4.2	ug/L	INAB	
Boron		EM130	0.020		<0.02	mg/L	INAB	
Calcium		EM130	1.000		7.6	mg/L	INAB	
Copper		EM130	0.003		<0.003	mg/L	INAB	
Potassium		EM130	0.200		1.0	mg/L	INAB	
Sodium		EM130	0.500		8.2	mg/L	INAB	
Micro -Total & Faecal (Sub 1)								
Total Coliforms (Coliform Count)	*	Default	0		1100	MPN/100ml	YES	
Faecal coliforms	*	Default	0		240	MPN/100ml	YES	
Sample Pick-Charge Per sample								
Sample Pick-Charge Per sample		Default	0		Yes	EA		

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Contact Name	Marie Mortell	**Report Number**	**64388 - 1**
Address	Cork CC(WW-Mallow) Environmental Laboratory, Annabella,	**Sample Number** **Date of Receipt** **Date Started**	64388/002 13/03/2013 13/03/2013
Tel No	022 30443	**Received or Collected**	Courier
Fax No		**Condition on Receipt**	Good
Customer PO	001065712	**Date of Report**	29/03/2013
Quotation No	QN001861	**Sample Type**	Surface Waters
Customer Ref	B084/13		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Suspended Solids									
	Suspended Solids		EW013	5.000		7	mg/L	INAB	
Titralab									
	pH		EW153	0.300		7.0	pH Units	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10.000		31.6	mg/L CaCO3	INAB	
Total Dissolved Solids (TDS)									
	Total Dissolved Solids (TDS)		EW046	15		67	mg/L	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.250		3.30	mg/L	INAB	
Tributyl Tin (Sub)									
	Tributyl Tin (Sub)	*	Default	0.02		<0.02	ug/L	YES	
VOC-WW-VOC									
	Toluene		EO025	0.500		<0.5	ug/L	INAB	
	Dichloromethane		EO025	0.500		<0.5	ug/L	INAB	
	Xylene-O		EO025	0.500		<0.5	ug/L	INAB	
	Xylene P&M		EO025	0.500		<0.5	ug/L	INAB	
	Xylenes-Total (Calc)		EO025	1.000		<1.0	ug/L		

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Contact Name	Marie Mortell	**Report Number**	**64388 - 1**
Address	Cork CC(WW-Mallow) Environmental Laboratory, Annabella,	**Sample Number** **Date of Receipt** **Date Started**	64388/003 13/03/2013 13/03/2013
Tel No	022 30443	**Received or Collected**	Courier
Fax No		**Condition on Receipt**	Good
Customer PO	001065712	**Date of Report**	29/03/2013
Quotation No	QN001861	**Sample Type**	Surface Waters
Customer Ref	B085/13		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
AQ2-UP1									
	Phosphate-Ortho(as P)		EW154M	0.009		<0.009	mg/l P	INAB	
AQ2-UP2									
	Chloride		EW154M-1	2.600		11.9	mg/L	INAB	
	Sulphate		EW154M-1	1.000		7.3	mg/L	INAB	
BOD									
	BOD		EW001	1.0		<1.0	mg/L	INAB	
COD									
	COD		EW094	8.000		<8.0	mg/L	INAB	
Cyanide-Free									
	Cyanide-Free		EW154M	5.000		<5.0	ug/L		
GCMS-Triazines									
	Atrazine		EO129	0.010		<0.010	ug/L		
	Simazine		EO129	0.010		<0.010	ug/L		
Ion Chromatography									
	Fluoride		EW1	0.10		<0.10	mg/L	INAB	
Metals-Trace									
	Arsenic		EM130	0.200		0.3	ug/L	INAB	
	Cadmium		EM130	0.100		<0.1	ug/L	INAB	
	Chromium		EM130	1.000		<1.0	ug/L	INAB	
	Iron		EM130	20.0		58.4	ug/L	INAB	
	Mercury		EM130	0.020		<0.02	ug/L	INAB	
	Manganese		EM130	1.000		36.3	ug/L	INAB	
	Nickel		EM130	0.500		<0.5	ug/L	INAB	
	Lead		EM130	0.300		<0.3	ug/L	INAB	
	Zinc		EM130	1.000		3.5	ug/L	INAB	
	Boron		EM130	0.020		<0.02	mg/L	INAB	
	Calcium		EM130	1.000		7.5	mg/L	INAB	
	Copper		EM130	0.003		<0.003	mg/L	INAB	
	Potassium		EM130	0.200		1.0	mg/L	INAB	
	Sodium		EM130	0.500		7.7	mg/L	INAB	
Micro -Total & Faecal (Sub 1)									
	Total Coliforms (Coliform Count)	*	Default	0		240	MPN/100ml	YES	
	Faecal coliforms	*	Default	0		93	MPN/100ml	YES	
Sample Pick-Charge Per sample									
	Sample Pick-Charge Per sample		Default	0		Yes	EA		

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Contact Name	Marie Mortell	**Report Number**	**64388 - 1**
Address	Cork CC(WW-Mallow) Environmental Laboratory, Annabella,	**Sample Number**	64388/003
		Date of Receipt	13/03/2013
		Date Started	13/03/2013
Tel No	022 30443	**Received or Collected**	Courier
Fax No		**Condition on Receipt**	Good
Customer PO	001065712	**Date of Report**	29/03/2013
Quotation No	QN001861	**Sample Type**	Surface Waters
Customer Ref	B085/13		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Suspended Solids									
	Suspended Solids		EW013	5.000		<5	mg/L	INAB	
Titralab									
	pH		EW153	0.300		7.2	pH Units	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10.000		26.1	mg/L CaCO3	INAB	
Total Dissolved Solids (TDS)									
	Total Dissolved Solids (TDS)		EW046	15		99	mg/L	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.250		3.02	mg/L	INAB	
Tributyl Tin (Sub)									
	Tributyl Tin (Sub)	*	Default	0.02		<0.02	ug/L	YES	
VOC-WW-VOC									
	Toluene		EO025	0.500		<0.5	ug/L	INAB	
	Dichloromethane		EO025	0.500		<0.5	ug/L	INAB	
	Xylene-O		EO025	0.500		<0.5	ug/L	INAB	
	Xylene P&M		EO025	0.500		<0.5	ug/L	INAB	
	Xylenes-Total (Calc)		EO025	1.000		<1.0	ug/L		

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Appendix 2: Tier II Water Quality Results

Surface water samples for Dunmanway Landfill					
Parameter	Units	SW3	SW2	SW1	EQS Values
pH (Surface Water)	pH Units	6.6	6.5	7	6.5 - 9.5
Conductivity (Surface Water)	uscm -1@25C	80	99	85	1000
Solids (Total Suspended)	mg/L			5	~
Solids (Total Dissolved)	mg/L			<5	~
Ammonia (Surface Water)	mg/L as N	<0.01	0.032	0.064	0.02 mg/L
Nitrogen (Total Oxidised) (Surface Water)	mg/L as N			0.53	~
Total Organic Carbon	mg/L			6.57	~
BOD (Surface Water)	mg/L	<2	<2	<2	~
COD (Surface Water)	mg/L			9	~
Calcium	mg/L			10.80	~
Magnesium	mg/L			1.30	0.3 mg/L
Sodium	mg/L	6.40	5.30	10.60	~
Potassium	mg/L	1.60	1.30	1.60	~
Iron (Surfacewater)	ug/L			448	1000 ug/L
Manganese (Surface Water)	ug/L			58.7	~
Cadmium (Surface Water)	ug/L			<0.01	5 ug/L
Chromium (Surface Water)	ug/L			0.8	30 ug/L
Copper (Surface Water)	ug/L			3.1	30 ug/L
Nickel (Surface Water)	ug/L			0.9	50 ug/L
Lead (Surface Water)	ug/L			1.4	10 ug/L #
Zinc (Surface Water)	ug/L			1	100 ug/L #
Arsenic (Surface Water)	ug/L			0.4	25 ug/L #
Boron (Surface Water)	ug/L			157.7	2000 ug/L #
Mercury	ug/L			<0.02	1 ug/L #
Alkalinity (Surface Water)	mg/L CaCO3			14	~
Sulphate	mg/L as SO4	1.61	2.06	1.64	200 mg/L
Chloride (Surface Water)	mg/L	11.87	14.49	11.62	250 mg/L
Phosphate (Ortho) Surface Water	mg/L as P			0.018	~
Cyanide	ug/L			<5	10 ug/L #
Fluoride (Surface Water)	mg/L			0.08	5 mg/L #
Atrazine	ug/L			<0.01	1 ug/L
Dichloromethane	ug/L			<1	10 ug/L
Simazine	ug/L			<0.01	1.0 ug/L
Toluene	ug/L			<0.28	10 ug/L
Tributyltin*	ug/L as Sn			<0.02	~
Xylene (Total)	ug/L			<1	10 ug/L
Coliforms (Faecal)	no/ 100ml			110	~
Coliforms (Total)	no/ 100ml			400	~

Note:
Standard where hardness of water is > 100mg/L $CaCO_3$

Appendix 3

Table 1: 2008 and 2013 Results Comparison

Parameter	SW1		SW2		SW3	
Year	2008	2013	2008	2013	2008	2013
pH	7.0	7.0	7.0	7.2	7.0	7.0
Sodium	10.60	8.2	5.30	7.7	6.40	8.4
Potassium	1.60	1.0	1.30	1.0	1.60	1.0
Sulphate	1.64	7.6	2.06	7.3	1.60	6.9
Chloride	11.62	11.7	14.49	11.9	11.37	12.0
BOD	<2	<1.0	<2	<1.0	<2	4.0

Appendix 4 Water Quality EQS

Table 3.1: Interim Guideline Values for Characterisation List of Parameters

PARAMETER	List I or List II	Drinking Water Standards (units)	GSI Trigger Values	EQSs for Surface Waters	Interim Guideline Value	Source of Interim GVs
CORE PARAMETERS or NATURAL SUBSTANCES						
Physicochemical-Microbiological						
Coliforms (faecal)		0 counts per 100ml	0 counts per 100ml		0 counts per 100ml	B, I
Coliforms (total))		0 counts per 100ml	0 counts per 100ml		0 counts per 100ml	B, I
Electrical Conductivity		1500 µS/cm		1000µ S/cm	1000µS/cm	K
Temperature		25°C			25°C	B
TOC		*No abnormal change*			*No abnormal change*	-
Colour					*No abnormal change*	A
pH (pH units)		≥ 6.5 and ≤ 9.5			≥ 6.5 and ≤ 9.5	A
Inorganic						
Alkalinity					*No abnormal change*	-
Ammonia (as ammonium)	II	0.30 mg/l	0.15 mg/l	0.02 NH3	0.15 mg/l	I
Bicarbonate		*No abnormal change*			*No abnormal change*	-
Calcium		200 mg/l			200 mg/l	B
Carbonate		*No abnormal change*			*No abnormal change*	-
Chloride		250 mg/l	30 mg/l	250 mg/l	30 mg/l	I
Dissolved Oxygen		*No abnormal change*			*No abnormal change*	-
Hardness (as $CaCO_3$)		200 mg/l			200 mg/l	G
Iron		0.2 mg/l		1.0 mg/l	0.2 mg/l	A
Magnesium		50 mg/l			50 mg/l	B
Manganese		0.05 mg/l		0.3 mg/l	0.05 mg/l	A
Nitrate (as NO_3)		50 mg/l	25 mg/l	50 mg/l	25 mg/l	I
Nitrite (as NO_2)	II	0.1 mg/l		0.2 mg/l	0.1 mg/l	A
Orthophosphate		0.03 mg/l			0.03 mg/l	F
Potassium		12 mg/l	5 mg/l		5 mg/l	I
Sodium		150 mg/l			150 mg/l	B
Sulphate mg/l		250 mg/l		200 mg/l	200 mg/l	K
Metals						
Aluminium		0.2 mg/l		0.2 mg/l	0.2 mg/l	A, K
Arsenic and its compounds	II	0.01 mg/l		0.025mg/l [a]	0.01 mg/l	A
Boron	II	1.0 mg/l		2.0 mg/l	1.0 mg/l	A
Cadmium and its compounds	I	0.005 mg/l		0.005 mg/l	0.005 mg/l	A, K
Chromium and its compounds	II	0.05 mg/l		0.03 mg/l [a]	0.03 mg/l [a]	J
Copper and its compounds	II	2.0 mg/l		0. 03 mg/l [a]	0.03 mg/l [a]	J
Mercury and its compounds	I	0.001 mg/l		0.001 mg/l	0.001 mg/l	A, K
Nickel and its compounds	II	0.02 mg/l		0.05 mg/l [a]	0.02 mg/l	A
Zinc and its compounds	II	5.0 mg/l		0. 1 mg/l [a]	0.1 mg/l [a]	J
Organics						
TON mg/l		*No abnormal change*			*No abnormal change*	-
Total Hydrocarbons to include mineral oil by GC** mg/l	I	0.01 mg/l		0.01 mg/l	0.01 mg/l	B, K

** TPH by Gas Chromatography: This analysis can serve as a 'catch-all' and will present results for the general term 'Gasoline Range Organics' and the separate 'BTEX' parameters including MTBE. 'Diesel Range Organics' (DRO) should also be specified in order to determine mineral oil concentration.

Appendix 5: Map of Surface Water Sample Points

Source : Image from Tier II Assessment