7 WATER

7.1 INTRODUCTION

This Chapter presents an assessment of the potential impact of the existing facility on the water environment, including the use of this natural resource and should be read in conjunction with the site layout plans and project description in Chapter 3 (Description of the Existing Environment, Ongoing and Future Activities). Relevant mitigation measures are also presented in this Chapter.

At present, Drehid WMF comprises an Engineered Landfill for treated MSW and a Composting Plant. The Engineered MSW Landfill has operated on the site since 2008. It is currently permitted to accept municipal waste for landfill disposal at the facility to a maximum of 120,000 TPA, until the end of the life of the currently permitted facility in 2028. The Composting Facility is permitted to accept a maximum of 25,000 TPA.

The existing facility at Drehid is located in a large Bord na Móna landholding, comprising 2,554 ha, in north County Kildare. All activities and construction is confined to a 179 ha landbank, which is referred to as the site activity area, outlined in red in Figure 3.1 and Figure 3.2.

The Bord na Móna landholding in this area has been utilised for the industrial harvesting of peat for approximately 50 years. Artificial drainage of the bog has resulted in an alteration of the natural hydrology and therefore this assessment details the surface water and groundwater environment in its current state.

The information included in Chapter 6 (Soils, Geology and Hydrogeology) and Chapter 5 (Biodiversity) should be read in conjunction with this Chapter.

This Chapter has been prepared in the main by Mr. John Dillon, who is employed as a Senior Scientist with TOBIN Consulting Engineers. Mr. Dillon holds an honours degree (BScEnv) in Environmental Science from National University of Ireland, Galway (2001) as well as a Masters and Diploma in Environmental Engineering (2003), from Imperial College London and is also a Professional Geologist (P.Geo.). Mr. Dillon was supported in the compilation of this Chapter by the wider team of hydrologists and hydrogeologists employed by TOBIN Consulting Engineers.

7.2 METHODOLOGY

The assessment of the potential effect of the existing facility on the water environment was carried out according to the methodology specified in the following guidance documents:

- Environmental Protection Agency (EPA), *Draft Guidelines on the Information to be Contained In Environmental Impact Statements* (2017);
- EPA, *Draft Guidelines on the Information to be Contained in Environmental Impact Statements* (2015);
- EPA, *Guidelines on the Information to be Contained in Environmental Impact Statements* (2002);
- EPA, *Draft Advice Notes for Preparing Environmental Impact Statements* (2015);

- EPA Advice Notes on Current Practice (in the Preparation of EIS) (2003); and
- The National Roads Authority (NRA) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes* (2009) were also considered in the preparation of this Chapter.

The following sources of information were utilised to establish the baseline environment:

- The Geological Survey of Ireland (GSI) groundwater records for the area were inspected, with reference to hydrology and hydrogeology;
- Office of Public Works (OPW) flood mapping;
- Catchment Flood Risk Assessment and Management (CFRAM) and Preliminary Flood Risk (PFRA) Map data;
- EPA water quality monitoring data for watercourses in the area;
- Results from the chemical analysis of water samples taken in 2003 - 2018;
- EPA Water Framework Directive Monitoring Programme;
- Information from the River Basin Management Plan for the South Eastern River Basin District (SERBD); and
- Site visits of the study area.

Investigation was carried out by TOBIN Consulting Engineers from 2003 to 2017, in order to assess the water environment in the vicinity of the existing facility.

Recommendations arising from consultations with both Inland Fisheries Ireland (IFI) and KCC (see Table 1.2) were incorporated into the water impact assessment and mitigation measures.

In this Chapter, the potential effects on the water environment resulting from the existing facility is evaluated and mitigation measures to reduce any significant impacts. Based on the mitigation measures, the significance of the residual impact on the water environment is determined.

Criteria for evaluating impact level have been derived and are shown in Table 7.1. Terminology for impact significance and duration follows that set out in the EPA's Draft *Guidelines on Information to be contained in Environmental Impact Assessment Report* (2017). The magnitude of any effects considers the likely scale of the predicted change to the baseline conditions, resulting from the predicted effect and takes into account the duration of the effect i.e. temporary or permanent. Definitions of the significance and magnitude of any effects are provided in Table 7.1 and Table 7.2.

Table 7.1: Significance Criteria and Examples

Importance	Criteria	Selected Examples
Very High	Attribute has a high quality and rarity on a regional or national scale.	Site protected under EU/ Irish legislation (SAC, cSAC, SPA, pSPA, NHA, pNHA)
High	Attribute has a high quality and rarity on a local scale.	Large rivers, important social or economic uses such as water supply or navigation. Good quality rivers (Q4 to Q5). May be designated as a local wildlife site.
Medium	Attribute has a medium quality and rarity on local scale.	May support a small / limited population of protected species. Limited social or economic uses. Regionally important aquifer. Inner source protection for locally important water source.
Low	Attribute has a low quality and rarity on a local scale.	No nature conservation designations. Low aquatic fauna and flora biodiversity and no protected species. Minimal economic or social uses.

Table 7.2: Magnitude Criteria and Examples

Magnitude	Criteria	Examples
Major Adverse Impact	Fundamental change to water quality or flow regime.	Calculated risk of serious pollution incident >2% annually.[31] Loss of protected area. Pollution of large potable sources of water abstraction. Deterioration of water body leading to a failure to meet Good Status [32] under the WFD and reduction *in class (or prevents the successful implementation of mitigation measures for heavily* modified or artificial water bodies).
Moderate Adverse Impact	Measurable change to water quality or flow regime.	Loss in production of fishery. Discharge of a polluting substance to a watercourse but insufficient to change its water quality status (WFD class) in the long term. No reduction in WFD class, but effect may prevent improvement (if not already at Good Ecological Status) or the successful implementation of mitigation measures for heavily modified or artificial water bodies. Calculated risk of serious pollution incident >1% annually [33]
Slight Adverse Impact	Slight change to water quality or flow regime.	Measurable changes in attribute but of limited size and / or proportion, which does not lead to a reduction in WFD status or failure to improve. Where the existing facility provides an opportunity to enhance the water environment but does not result in an improvement in class, status, output or other quality indicator.

[31] Based on NRA guidelines (2009).
[32] Good Status as defined under the Water Framework Directive (2000/60/EC).
[33] Based on NRA guidelines (2009).

Magnitude	Criteria	Examples
Neutral or Negligible Impact	No measurable impacts on water quality or flow.	Calculated risk of serious pollution incident <0.5% annually. No effect on features, or key attributes of features, on the Protected Areas Register. Discharges to watercourse but no significant loss in quality, fishery productivity or biodiversity. No effect on WFD classification or water body target.

Impact ratings may have negative, neutral or positive application where:

- Positive impact – A change which improves the quality of the environment;
- Neutral impact – A change which does not affect the quality of the environment; and
- Negative impact – A change which reduces the quality of the environment.

Terms relating to the duration of impacts are as described in the EPA's Draft *Guidelines on Information to be contained in Environmental Impact Statements* (2017) as:

- Temporary Effects - Effects lasting less than a year;
- Short-term Effects - Effects lasting one to seven years;
- Medium-term Effects - Effects lasting seven to fifteen years;
- Long-term Effects - Effects lasting fifteen to sixty years;
- Permanent Effects - Effects lasting over sixty years; and
- Reversible Effects - Effects that can be undone, for example through remediation or restoration.

A qualitative approach was used in the evaluation, generally following the significance classification in Table 7.3 and through professional judgment. The significance of a predicted impact is based on a combination of the sensitivity or importance of the attribute and the predicted magnitude of any effect. Effects are identified as beneficial, adverse or negligible, temporary or permanent and their significance as major, moderate, slight or not significant (negligible).

Table 7.3: Impact Assessment Criteria Matrix

Importance/ Sensitivity	Magnitude			
	Major Adverse/Beneficial	Moderate Adverse/ Beneficial	Low Adverse/ Beneficial	Negligible
Very High	Major/ profound	Major	Moderate	Negligible
High	Major	Moderate	Slight	Negligible
Medium	Moderate	Slight	Slight	Negligible
Low	Slight	Slight	Negligible	Negligible

In order for a potential impact to be realised, three factors must be present. There must be a source or a potential effect, a receptor which can be adversely affected, and, a pathway or connection which allows the source to impact the receptor. Only when all three factors are present can an effect be realised.

7.3 RECEIVING ENVIRONMENT/BASELINE DESCRIPTION

7.3.1 Drainage

The local and regional surface water features are shown on Figure 7.1 and Figure 7.2. The natural and artificial surface water channels within (and immediately adjacent to) the existing facility at Drehid are shown on Figure 7.2 and the current surface water monitoring locations are shown in Figure 7.3.

The 19th Century 6-inch to 1-mile scale geological field sheets indicate that prior to exploitation of the peat resources within the existing facility there were no natural surface water channels crossing the existing facility. The only natural features are recorded close to the margin of the peat deposits.

In its natural state, an undisturbed peat bog is predominantly water, with a moisture content of approximately 95% near the surface, reducing to approximately 90% in the deepest layer, due to compaction of material. The eco-system of an undisturbed bog depends solely on rainfall for its water supply. A natural bog comprises two discrete layers, the acrotelm and the underlying catotelm. The acrotelm is the top 10-30 cm of living and poorly humified sphagnum mosses, which is periodically aerated and highly permeable. The catotelm is the lower thicker layer which is more highly humified with depth and has low permeability.

Although the surface of an undisturbed bog lies above the natural water table of the adjoining free draining lands, the water table lies within 0.3 m of the surface within the bog itself. Therefore, a bog can be viewed, as a very large reservoir of water and also as a natural resource. The bog will naturally regulate the release of water; therefore, there is very little seasonal fluctuation in the water table within a bog.

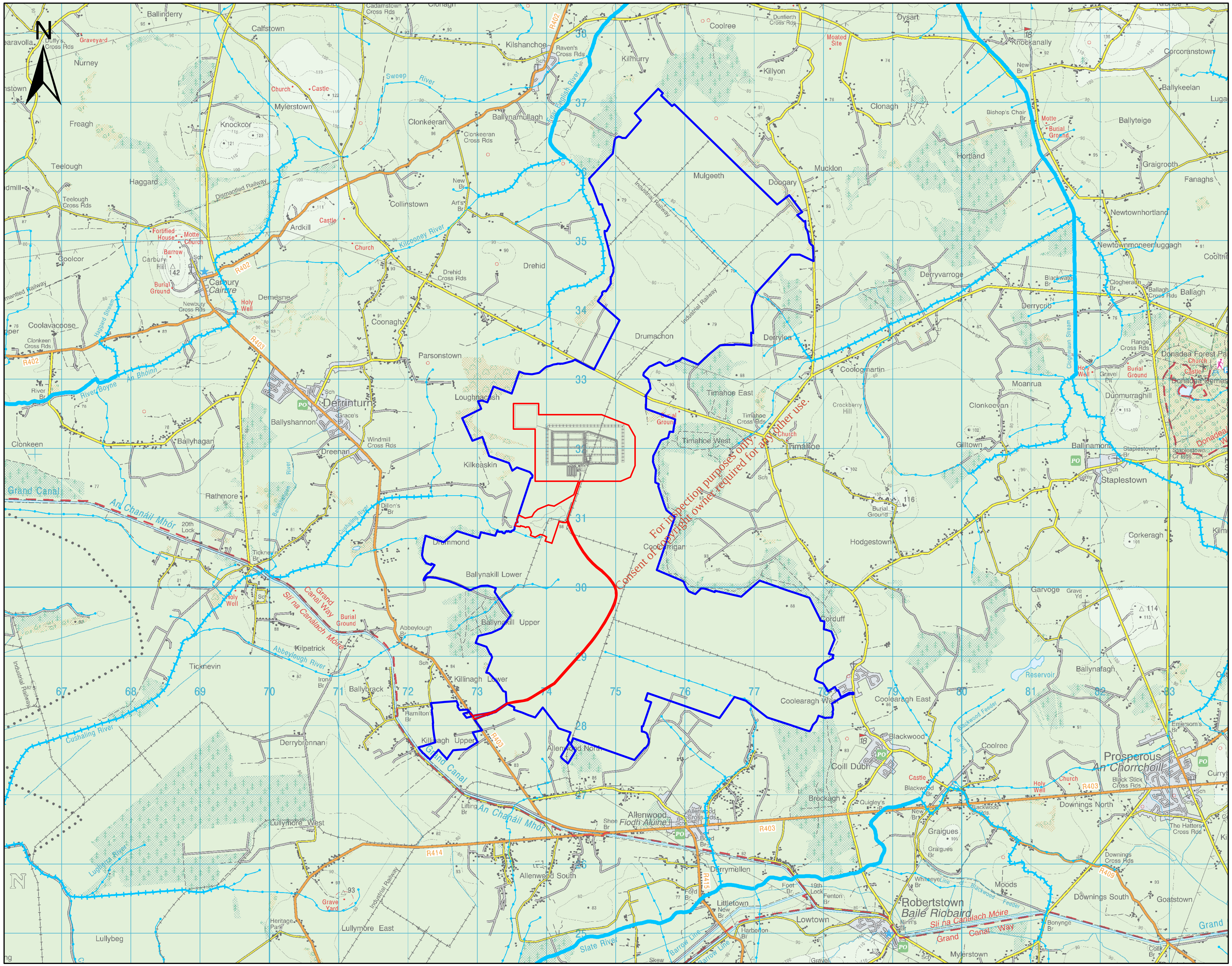
Discharges from natural bogs are dependent on seasonal factors. During summer months bogs will largely absorb all precipitation to replenish its reservoir and this ensures that the water table does not fall too low. During winter months precipitation is absorbed to an optimal level, after which all precipitation will be rejected. Hydrographs at the margins of bogs show peak flows during and shortly after winter rainfall events with quick recessions in surface flow following the cessation of rainfall.

The Bord na Móna landholding has been subject to industrial peat activity for approximately 50 years and landfill and composting infrastructure development for 10 years. To reduce the moisture content of the peat material for extraction purposes, it was necessary to systematically drain the whole bog. A network of large artificial drains were opened up across the bog in order to reduce the water content of the peat and increase the bearing capacity, thus allowing the land to be traversed by heavy plant and machinery. The drainage plan involved the progressively deepening of drains over a period of 7-10 years.

The artificial drainage network heavily influences the current appearance of the bog. The entire Bord na Móna landholding has been divided into a number of discrete sections, referred to as 'peat fields', by the excavation of southeast-north west trending artificial surface drains. These artificial surface drains discharge to a central underground culvert, trending in a general north to south direction. The hydraulic capacity of these central drains is limited by the fall in topographic elevation and the flow to natural hydrological discharge points. Figure 7.2 shows the orientation of the drainage channels at the existing facility.

In the vicinity of the activity area of the existing facility, all water draining from the artificial drain's discharges to the central culvert/main drain, which flows towards the existing attenuation lagoon located to the south-west of the existing facility (see Figure 7.3). The attenuation lagoon allows for some level of treatment of the run off prior to discharge to the Cushaling River at the western margins of the bog.

The surface water drainage pattern in the broader vicinity of the applicant's property was also assessed as part of the baseline assessment to determine the catchment conditions in the region. The catchment divides were delineated from the EPA Water Quality in Ireland annual publications (1998 – to date) and the South Eastern River Basin District (SERBD) (www.wfdireland.ie). The Ordnance Survey of Ireland (OSI) Discovery Series (Sheet No. 49) was also used to refine the catchment and sub-catchment divides.



Legend

- Site Boundary
- Bord na Móna Ownership Boundary
- Existing MSW Landfill

River - Stream Order

- 1st Order
- 2nd Order
- 3rd Order

0 0.5 1 2
Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

D01	AUG '18	EIAR Issue	F.H.	J.D.
Issue	Date	Description	By	Chkd.

Client:

BORD NA MÓNA
Naturally Driven

Project:

EXISTING DREHID WASTE MANAGEMENT FACILITY

Title:

REGIONAL SURFACE WATER MAP

Scale @ A3: 1:50,000

Prepared by: F.Healy
Checked: J. Dillon
Date: August 2018

Project Director: D.Grehan

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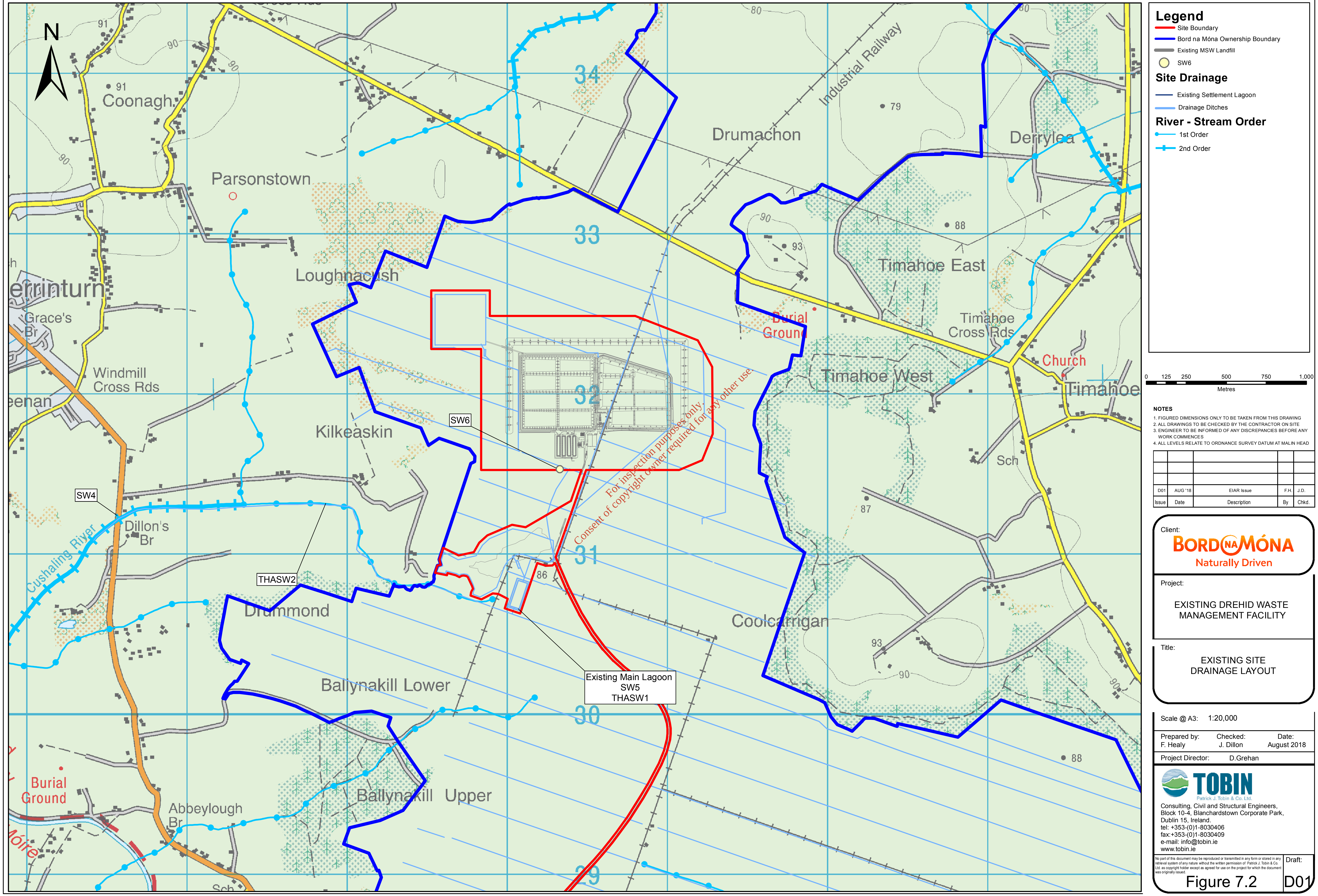
Draft: D01

Figure 7.1



0 125 250 500 750 1,000
Metres

NOTES

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2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

Issue	Date	Description	By	Chkd.
D01	AUG '18	EIAR Issue	F.H.	J.D.

Client:
BORD NA MÓNA
Naturally Driven

Project:
EXISTING DREHID WASTE MANAGEMENT FACILITY

Title:
EXISTING SITE DRAINAGE LAYOUT

Scale @ A3: 1:20,000

Prepared by: F. Healy
Checked: J. Dillon
Date: August 2018

Project Director: D.Grehan

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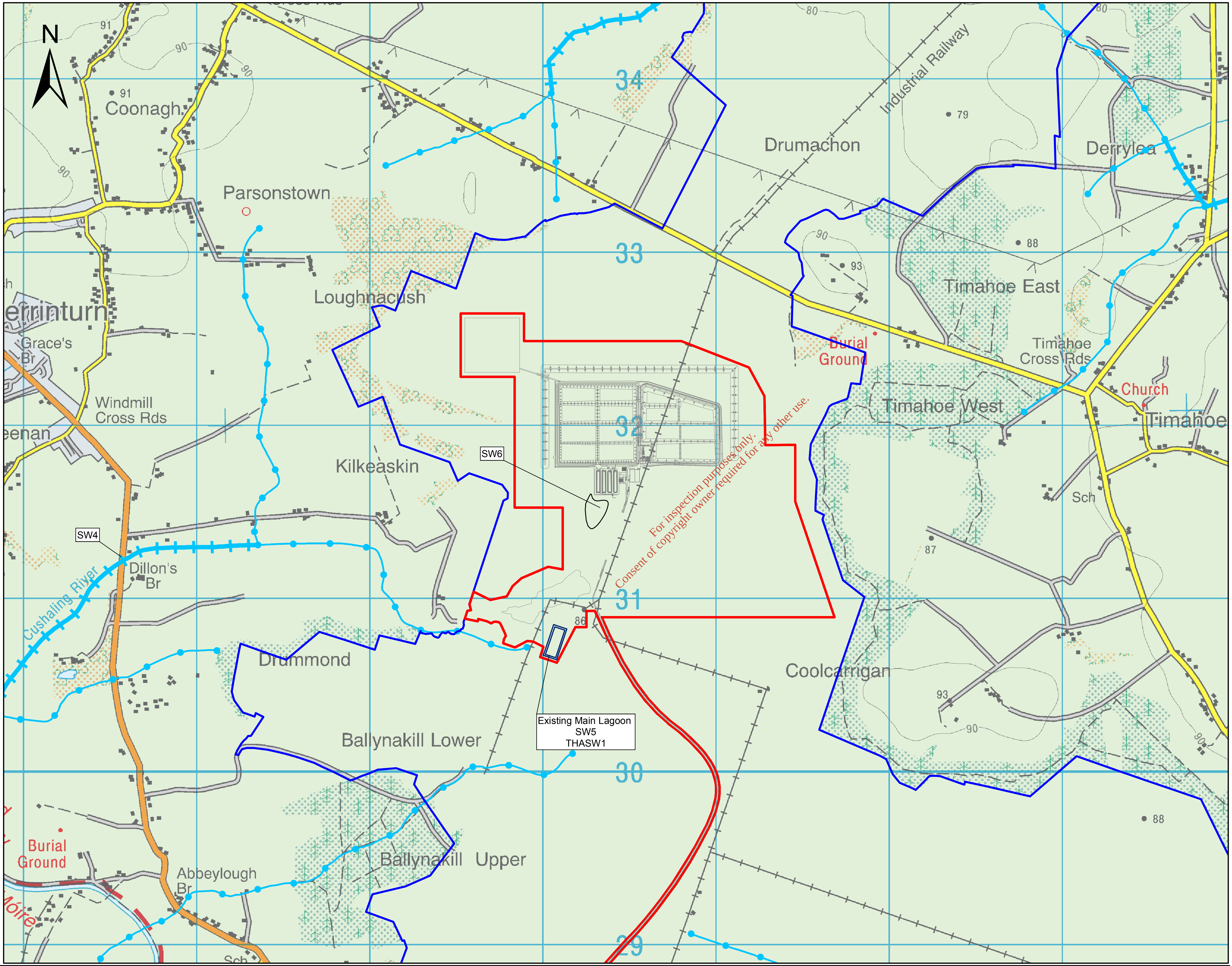
Draft: D01

Figure 7.2



Legend

- Site Boundary
- Bord na Móna Ownership Boundary
- Existing MSW Landfill

River - Stream Order

- 1st Order
- 2nd Order

Drains

- Existing Settlement Lagoon

0 125 250 500 750 1,000
Metres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

Issue	Date	Description	By	Chkd.
D01	AUG '18	EIAR Issue	F.H.	J.D.

Client: BORD NA MÓNA
Naturally Driven

Project:
EXISTING DREHID WASTE MANAGEMENT FACILITY

Title:
SURFACE WATER MONITORING AT BOUNDARY AND DOWNSTREAM

Scale @ A3: 1:20,000

Prepared by:	Checked:	Date:
F. Healy	J. Dillon	August 2018

Project Director: D.Grehan

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Figure 7.3

Draft: D01

Reference to Figure 7.2 indicates that all lands within the existing facility activity area are located within the catchment of the River Cushaling (Hydrometric Area 14). All surface water from the existing facility drains to the west to the Cushaling River, which is a tributary of the Figile River. The existing access road from the R403 to the Drehid WMF passes through the sub-catchment of the Abbeylough River, which is also a tributary of the Figile River (see Figure 7.2). The Figile River is a sub-catchment of the River Barrow.

The Slate River sub-catchment encroaches on the southern portion of the applicant's property. No activities associated with the existing facility are located within the sub-catchment of the Slate River. The Slate River and the Figile River converge to the north of Bracknagh, County Offaly to form a water feature referred to as the Black River, which in turn converges with the River Barrow just north of Monasterevin, County Kildare.

The catchment divide between the regional catchments of the River Barrow and the River Boyne is delineated approximately 0.75 km to the north east of the existing facility activity area.

The total flow in the surface water channels arises from two different flow mechanisms. The dominant flow mechanism, due to the soil cover in the area, comprises overland run-off of surface water. The flow in the surface water features responds quickly to rainfall during winter months, when the peat is fully saturated. This 'flashy flow' is common in areas where bog cover dominates, due to their low infiltration capacity characteristics. The fall-off in surface water flow is also relatively quick following the rainfall event.

The second flow mechanism comprises a slow release of shallow groundwater base flow to the surface water environment at the margins of the bog. This portion of the total surface water flow may be quite small during heavy rainfall events, compared to the surface run-off portion. However, during periods of low precipitation and during summer droughts, the groundwater contribution will comprise almost all the surface water flow. This slow release of the groundwater maintains a surface water flow throughout the year.

7.3.2 Surface Water Flow Measurements

Hydrological studies have been undertaken in other bog areas to determine the impact of peat harvesting. The removal of surface vegetation from the bog is considered to have the greatest effect on the quantity of surface water run-off which discharges to the receiving waters. The function of the drainage channels within the existing facility is to divert rainwater from the surface of the bog. Research suggests that as much as 80% of rainfall during winter periods will discharge to receiving waters from a drained bog, compared to less than 20% from an intact bog.

It should be noted that harvesting of peat has now ceased within the existing facility and re-growth of scrub and heath is well established across the site and elsewhere in the Bord na Móna landholding. The drainage ditches across the site have been excavated to a depth where the base of the ditch is mainly within the mineral subsoil. The drainage ditches are approximately 3-4 m wide and approximately 3 m deep. Water is retained in the drainage ditches even during summer months, which suggests that the channels are acting as storage channels and discharging to the main drain at a slow steady rate. Therefore, the run-off rate from the current bog environment is considered to be significantly less than when peat was being harvested from the bog.

The only available hydrometric data for surface water flows in this area are from a hydrometric station maintained by the OPW at Clonbulloge on the River Figile. The information available is included in Appendix 7.1 and summarised below.

As detailed above, all surface water generated from the existing facility activity area drains from the bog to the Cushaling River, which is a tributary of the River Figile. Historical hydrometric data from the OPW hydrometrics station (Stn. 14004) at Clonbulloge are available for the years 1957 to 2015. This hydrometric station records water levels and a rating curve is used to estimate flows. The hydrometric station is approximately 21.4 km downstream of the existing facility activity area and a number of surface water channels contribute to the flow in the River Figile along its course.

The information interpreted from the hydrometric dataset relates to annual maximum flows from 1957 to 2015. Annual maximum flows on the River Figile at Clonbulloge range from 13.2 m^3/sec to 28.8 m^3/sec. The annual maximum flow in 2008 was significantly elevated above those of previous years, with the flow measured on the 18/08/2008 comprising 28.8 m^3/sec. The 2008 peak flow event resulted from extreme rainfall across Ireland on the date in question. August rainfall totals were above normal everywhere, the third successive month of wetter than normal weather in 2008.

The highest flows on the River Figile were recorded on the 19/11/1965, when flows were estimated at 38.4 m^3/sec. This flow was generated by an extreme rainfall event on the 17/11/1965, when the rainfall of 70.8 mm was recorded over a 24-hour period. Interpretation of the annual maximum flows at Clonbulloge and rainfall measurements from Lullymore indicate that the storm peak flows occur at the hydrometric station approximately two days after the extreme rainfall event.

7.3.3 Site Specific Hydrometric Data

The discharge from the majority of the southern half of the applicant's property flows into the Cushaling River. This flow is discharged via an existing attenuation lagoon, prior to gravity flow to the Cushaling River. The groundwater baseflow to the Cushaling River is considered to be low, due to the artificial drainage of the Bord na Móna landholding.

Two monitoring stations (THASW 1 and THASW 2) were established pre-development on the Cushaling River in 2003-2004, as shown in Figure 7.2. At these locations, a hydrometric flow gauge and a data logger were installed to determine the hydrometric conditions on the Cushaling River. The flow in the watercourse was determined by measuring the water level using an electronic bubble gauge, in a known cross sectional area of water, with these water levels being recorded every 2 minutes on a data-logger.

Using appropriate empirical formulae for the cross-sectional area of the water course and the water levels recorded by the data-logger, it was possible to determine the flow in the watercourse. The hydrographs are presented in Appendix 7.1.

The first monitoring station (Code: THASW 1) is a 12-inch concrete outfall pipe from the central drain of the northern section of the cutover bog and it controls the overall outfall from the Bord na Móna landholding. A faceplate was installed on this pipe to allow the flow across the area of the pipe to be determined and to allow an accurate flow measurement by the instrumentation installed.

At the second location (THASW 2), a weir was installed at a monitoring point on the Cushaling River, approximately 1 km downstream of the outfall point from the central drain. The monitoring station was established pre the existing landfill development (2003-2004) along a narrow section of the watercourse, with a minimal area of flood plain. This weir was constructed using wood and was sealed using local clay fill from the bankside. The weir achieved laminar flow across the weir face and the flow meter (water height) was installed behind this weir.

The hydrometric data was downloaded during each water sampling occasion, and the data logger was serviced to ensure correct operation. The ranges in flow recorded at the flow stations indicate the flashy nature of the Cushaling River. The maximum recorded flow was 218 m^3/hour (60.6 l/sec) with an average flow of 65.3 m^3/hour. The maximum flow recorded at THASW 2 (at a temporary weir) was 338 m^3/hour (93.9 l/sec) with an average flow of 102 m^3/hr.

During the period of monitoring, the average flow on the Cushaling River, as it exits the Bord na Móna landholding, was approximately 0.0376 m^3/sec (3,250 m^3/day). The flow on the Cushaling River at Dillon's Bridge, approximately 2.25 km downstream was approximately 0.0771 m^3/sec (6,660 m^3/day), indicating that the flow had more than doubled in a short lateral interval. As stated above, the Cushaling River originates within the Bord na Móna landholding and therefore the stream is gaining flow along its course, as would be expected. Based on the catchment area and predicted runoff volumes, the average flow from the landholding is approximately 260 m^3/hr. The flow in the Cushaling River was well contained within the capacity of the flow channel. It is estimated that the channel could accommodate an approximate three to four-fold increase in flow without exceeding the capacity of the stream channel.

The carrying capacity of the river channel was determined by utilising Manning's Equation. The maximum channel capacity of the Cushaling River at the western boundary of the existing facility, where the channel cross sectional area is approximately 9.5 m^2, is estimated to be approximately 8,550 litres/sec. The maximum channel capacity of the Cushaling River at Dillon's Bridge, where the Cushaling River flows under the R403 road, is estimated to be approximately 9,900 litres/sec, with a channel cross sectional area of 6.61 m^2. The culvert under the R403 is a concrete box culvert, of dimensions 3 m high and 2.2 m wide. The stream channel upstream and downstream of the bridge is incised deeply into the ground and extends to up to 6-7 m, with shallow flood plains which attenuate flow in the mid part of the stream.

7.3.4 Flooding Data

Substantial areas of the existing facility and surrounding area have been artificially drained to enable industrial harvesting of peat from the 1960's to 1990's. The OPW 'Flood Hazard Database' was used in order to obtain information on historical flooding events within the existing facility area. This information was used to establish the current baseline conditions.

Areas of pluvial flooding were noted on the OPW Preliminary Flood Risk Assessment (PFRA) mapping, but no records of fluvial flooding were noted on the OPW /CFRAM website for the existing facility. Drainage improvement works have rectified the drainage on the existing facility and reduced the potential for surface water ponding.

Data on historical flooding is limited but records do not indicate that flooding occurs on the Cushaling River downstream of the site. The network of drainage ditches effectively drain the existing facility and surrounding area. The groundwater monitoring data indicates that the water table is shallow (<2 m bgl). The presence of tall scrub is also an indication that the existing facility is not waterlogged and is not inundated during winter periods.

Small areas of pluvial flooding occur to the northwest and west of the existing landfill; however improved drainage and water management has limited the potential for flooding in this area.

Additional sources of information including historical maps, data from CFRAMs and PFRA and internet searches were also consulted. No incidents of flooding were noted at the site. The existing facility is not located in a flood prone area (Flood Zone A or B) based on the PFRA maps.

7.3.5 Surface Water Quality

7.3.5.1 Regional Surface Water Quality

The water quality of the major rivers in Ireland is monitored continuously by the EPA. The monitoring programme was established under the Environmental Protection Act 1992. The objectives of the programme include the following:

a) To establish the ongoing quality status of our rivers and streams;
b) To monitor quality changes and trends over time;
c) To assess the performance of pollution control and abatement measures;
d) To provide feedback to the responsible control agencies; and
e) To inform the general public.

Q Values are used by the EPA to express biological water quality, based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. See Table 7.4 for an explanation of the ratings. Q1 indicates a seriously polluted water body; Q5 indicates unpolluted water of high quality. Appendix 7.2 shows a more detailed description of the Biological Quality Classes.

Table 7.4: Q-Rating Table

Quality Ratings	Quality Class	Pollution Status	Condition
Q5, Q4-5, Q4	Class A	Unpolluted	Satisfactory
Q3-4	Class B	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Class C	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Class D	Seriously Polluted	Unsatisfactory

Available information for the Figile River catchment was referenced to determine the existing quality of the surface water environment. Reference to information obtained from the EPA and Southern Regional Fisheries Board indicates that the Figile and Slate Rivers, of which the Cushaling and Abbeylough Rivers are tributaries, support both salmonid and cyprinid fish populations.

Reference to EPA information indicates that there are four water sampling stations between the existing facility and Clonbullogue (approximately 21.4 km downstream of the existing facility). Table 7.5 and Table 7.6 should be read in conjunction with the Q-Rating system as outlined in Table 7.4. The most recent published Q rating are from 2015 (EPA website accessed 8th August 2018).

Table 7.5: EPA Monitoring of Biological Quality of Waters on the River Figile

Location	Bridge South of Ticknevin Bridge	Cushaling Bridge	Kilcumber Bridge	Clonbullogue Bridge
Station No	050	100	200	300
Grid Ref.	E269675, N230150	E265100, N225850	E261050, N226800	E261000, N223450
2015	Q3	Q3-4	Q3-4	Q4
2011	Q3	Q3-4	Q3-4	Q4
2009	Q2-3	Q3-4	Q3-4	-
2006	Q2-3	Q3-4	Q3-4	Q4
2003	Q2	Q3	Q3-4	Q4
2000	Q1-2	Q3	Q3-4	Q4-5
1997	Q1	Q2	Q3	Q3-4
1994	Q1	No Sample	No Sample	No Sample
1993	Q2	Q3-4	Q3-4	No Sample
1990	Q1-2	No Sample	No Sample	No Sample
1989	Q2	Q3-4	Q3	Q4
1986	No Sample	Q3-4	Q3-4	Q4

The closest EPA sampling station to the existing facility is at Ticknevin Bridge (Nat. Grid Ref.: E269675, N230150), which is approximately 4.5 km downstream of the existing facility. The biological analysis of the surface waters indicates that the surface water quality was considered seriously polluted (Q1-Q2) and in unsatisfactory condition (1989-2003) but appears to indicate a moderate improvement from 2006 to 2015 (moderately polluted).

The EPA physio-chemical summary of results indicates that the water quality is low with the dissolved oxygen depleted by either biological or chemical uptake. It is likely that the water in the Cushaling River at Ticknevin Bridge is affected by a high chemical demand on the Dissolved Oxygen, due to the predominance of peat upstream of the sampling point.

Further downstream at Cushaling Bridge (Nat. Grid Ref.: E265100, N225850), approximately 11 km downstream of the existing facility, the biological analysis indicates that the water quality was polluted (Q2-Q3) between 1989 and 2003 with improvements noted since 2006. The location of this sampling point is further downstream of the site with a mixture of peatland, free draining agricultural lands and reclaimed peatlands under agricultural land use.

The biological analysis indicates that the water quality of the River Figile at Kilcumber Bridge (Nat. Grid Ref.: 261050, N226800) is slightly polluted and unpolluted at Clonbulloge Bridge (Nat. Grid Ref.: 261000, N223450). The impacts on the water quality at these locations appears to be related to agricultural activity, with oxidised nitrogen, ammonia and ortho-phosphate elevated above normal background levels.

The closest sampling station to the existing facility is at Dillon's Bridge (Nat. Grid Ref.: E271600, N231230), which is approximately 2.7 km downstream of the existing facility activity boundary. This location is monitored as required by the EPA IED Licence for the Drehid WMF (W0201-03). The biological analysis of the surface waters indicates that the surface water quality was considered slightly polluted (Q3-Q4), as shown in Table 7.6 below. The most recent Benthic macro-invertebrates were sampled in 2017 qualitatively using kick-sampling and the results indicated that the Q value to be Q3, which is moderately polluted.

Table 7.6: Biological monitoring at Dillon's Bridge (Source: W0201-03 AER)

Location	Dillon's Bridge (SW-4)
Grid Ref.	E271600, N231230
2017	Q3
2016	Q3-4
2015	Q3-4
2011	Q3-4

2010	Q3-4
2008	Q3-4

7.3.5.2 Site Specific Surface Water Quality

Data points

As part of the environmental site investigations for the existing Drehid WMF, a number of water sampling stations were established at the boundary of the Bord na Móna landholding.

These monitoring locations included the following:

- SW4 – Monitoring location at Dillon's Bridge (Cushaling River);
- SW5 – Monitoring location for discharge from the existing attenuation lagoon for Bord na Móna landholding, prior to discharge to the Cushaling River (as per Figure 7.3); and
- SW6 – Monitoring location for discharge from existing landfill attenuation lagoons, Lagoon No.1 to Lagoon No.4 (as per Figure 7.3).

As the potential surface water discharges from the existing facility will enter the Cushaling River, it is considered appropriate to focus monitoring on this watercourse. Weekly monitoring results from 2014-2016 at Dillon's Bridge (SW4), at the monitoring location (SW5) for discharge from the existing Bord na Móna attenuation lagoon and at the monitoring location (SW6) for discharge from the existing landfill attenuation lagoons (No.1 to No. 4) are included in Appendix 7.3. Water quality results indicated that the water samples were within the permitted guidelines.

Discussion of results

Suspended solids concentrations in 2017/2018 at all three locations are recorded within the range <5 to 25 mg/l, which is within normal background levels. Weekly surface water results indicate chloride concentrations are typically less than 18 mg/l.

The pH values recorded are slightly basic ranging from 7.1 to 8.4, which is within the maximum allowable concentration (MAC) for drinking water (>6.5<9.5) and typical of surface water samples in the surrounding environment.

Ammonium concentrations at the Bord na Móna landholding in 2017 were variable and typically range from 0.06 to 0.11 mg/l. Elevated levels of ammonia are considered to be reflective of the redox conditions (chemical oxidation and reduction conditions) within the peat subsoils, the redox conditions being reducing in this case. There is no evidence of increasing ammoniacal nitrogen at the discharge point to the Cushaling River (SW5) over the last 9 years of monitoring data and results are comparable to the pre-development concentrations. Ammoniacal nitrogen levels at the Bord na Móna landholding are naturally high due to the peat environment and are similar to pre-construction levels (0.3 to 2 mg/l). The monitoring results of the surface water discharge from the overall Bord na Móna landholding are generally in compliance with the appropriate surface water discharge standards specified in the current IED Licence for the existing facility.

7.4 WATER FRAMEWORK DIRECTIVE REQUIREMENTS

The Water Framework Directive (WFD) requires 'good water status' for all European waters. This is to be achieved through a system of river basin management planning and extensive monitoring. In 2004, a characterisation and analysis of all River Basin Districts (RBD's) in Ireland was undertaken as required by Article 5 of the WFD. In this characterisation study the impacts of a range of pressures were assessed including diffuse and point pollution, water abstraction and morphological pressures (e.g. water regulation structures). The Cushaling River was identified as at risk of failing to meet the objectives of the WFD by 2021.

A review of the WFD in relation to the Cushaling River indicates the following:

- There are no RPA (Registered Protected Area) nutrient sensitive rivers within 5 km of the existing facility;
- There are no RPA habitat rivers within 5 km of the existing facility;
- There are no RPA nutrient sensitive lakes and estuaries within 5 km of the existing facility; and
- There are no RPA shell fish areas within 5 km of the existing facility.

Based on the available information, the Cushaling River catchment is *'at Risk of not achieving Good Status'* in relation to Surface Water (*1a status*). The catchment is predominantly cutover peat and agricultural land.

7.4.1 Likely Future Environment/Do Nothing Scenario

In the do-nothing scenario, the existing baseline conditions detailed in Section 7.3 will remain and the existing permitted facility will remain operational. The area surrounding the facility will continue to contain typical re-vegetating cutover bog. As the water level is managed at the site and in the surrounding area by a large number of drains the potential for peatland restoration is low. There is no significant change to the existing surface water management at the site.

7.5 POTENTIAL EFFECTS ON WATER

7.5.1 Construction Phases (phased through the lifetime of the landfills)

As with all construction projects, the management of surface water and groundwater (natural resources) is a very important aspect of the development. Water control measures and discharge management is maintained where construction occurs as outlined herein. All construction and activities are confined to the 179 ha landbank, the existing facility activity area, and comprise mainly the construction of additional landfill capacity.

Potential effects on the surface water environment due to the existing facility are associated with water draining to the Cushaling River sub-catchment. The construction of additional landfill capacity has the potential to have a negative impact on the surface water environment if not managed properly.

Based on an assessment of the drainage pattern, approximately 11.8 km^2 of the southern bog, which includes the existing facility, drains to the Cushaling River sub-catchment. Two surface water channels of the Cushaling River sub-catchment originate within the southern portion of the applicant's property, namely the Cushaling River that drains 573 ha (5.7 km^2) of the property and the Abbeylough River that drains the remaining 605 ha (6.1 km^2).

All surface water draining from the operations area of the existing facility, from the sand and gravel borrow area, and from the clay borrow area, drain to the west to the Cushaling River, which is a tributary of the River Figile. The access road from the R403 to the facility entrance passes through the sub-catchment of the Abbeylough Stream, which is also a tributary of the River Figile.

The industrial harvesting of peat across the Bord na Móna site at Drehid has ceased and re-colonisation of the bog surface is established in many areas of the site. The majority of the peat reserves have been exported from the site.

The drainage channels within the permitted site area have been excavated to the base of the peat material. The drainage ditches within the existing facility both store water and transmit it to the central drain and main discharge lagoon. The storage capacity of run-off water in the drainage network lessens the impact of sediment mobilisation to receiving water, due to the low velocity of the water and the retention time in the drains. The existing Timahoe Bog drainage infrastructure is utilised to manage surface water and to minimise the construction area footprint as described below.

The surface water drainage pattern will only be impacted in areas of the site where construction occurs. Drainage channels at the periphery of the site area, as shown on Figure 7.2 are rerouted to minimise the volume of water that could potentially be impacted during the construction phase. The re-routing of the artificial drainage ditches does not significantly impact the receiving environment as the water continues to discharge to the main central drain and continues to discharge to the Cushaling River.

Water control measures and discharge management is maintained where construction occurs. The re-routing of drainage channels was already taken place during the construction of the existing MSW Landfill.

The design of the facility has taken account of the risk that the development poses to the surface water environment and provision has been made in the design to mitigate these risks at source. The landfill design specification, as detailed in Chapter 3, indicates the construction method and phasing of the landfill, which is in accordance with the principle of best available technology (BAT) and relevant EU legislation.

Reference to Section 6.3 of Chapter 6 and to Appendix 6.8, the Hydrogeological Risk Assessment (HRA) indicates that the risk to the groundwater environment is low due to the natural low-moderate permeability of the mineral subsoil and landfill liners. However, due to the naturally low-moderate permeability of the subsoil across most of the site, the management of surface water is an important aspect of the development.

Within the site activity area, the significant defined areas associated with the WMF are as follows:

- The entire landfill footprint, including the permitted area;
- The already permitted clay borrow area, to provide construction and capping material for the landfill throughout its operational lifetime;
- The facility reception, internal road network, waste acceptance/management hardstanding and compost facility;
- The water settlement and stormwater attenuation lagoons.

Rainwater falling on these areas is managed and discharged to the receiving waters in a controlled manner. Groundwater seepages to excavation are minor due to the low permeability of the material throughout much of the site. Any seepage to excavation is treated in the same manner as captured rainwater.

There is the potential for the release of sediments into watercourses as a consequence of soil stripping (required to construct the remaining landfill phase capacity) and also due to potential run-off and erosion from soil stockpiles (prior to reinstatement and seeding). It is noted however, that the majority of soil stripping required for construction of the landfill phases has already been completed to date as only Phase 15 is yet to be completed.

The result of increased sediment loading to watercourses is potentially to degrade the water quality of the receiving waters and to change the substrate character. Details of water control measures (where appropriate) are outlined below.

Plant and equipment moving around in the base of any excavations founded on the mineral subsoil will disturb the soil. Rainwater falling on the disturbed soil will result in sediment laden water that is discharged from the excavation to the adjoining drain network. Sediment laden waters have the potential to result in a negative impact on the surface water quality.

During the ground clearance for each phase of the existing landfill facility, as has been the practice with the infrastructure already constructed, water control measures are implemented by the contractor to limit the volume of water that requires treatment. The contract documents and works requirements specify the necessity for the contractor to take all precautions needed to prevent sedimentation of water channels.

The locations of the surface water attenuation lagoons are shown on Figure 3.1 and Figure 3.2.

The excavation of material from the remaining landfill area, as necessary, will require a degree of water control. Excavations of material from the areas will be undertaken for relatively short durations (summer months where possible) over the remaining lifetime of the facility. Discharge limits for suspended solids as set out in the existing IED Licence will continue to be adhered to.

The division of the footprint of the landfills into phases reduces the area of construction into discrete compartments, which minimises the area of exposed soil surfaces at any one time. This construction detail significantly reduces the potential impact of sediment laden run-off affecting the surface water environment by limiting the areas where water may accumulate sediment.

The water management system is developed in three stages, during the lifetime of the facility. The water management requirement within the landfill will be at its maximum following the capping of the final phase of the landfill. At this stage the water run-off from the capped landfill will be collected in the surface water swale, from which it will drain to the four attenuation lagoons. The attenuation lagoons have been sized to cater for an extreme rainfall events during the period when it is at its full capacity.

Overflow from the attenuation lagoons is diverted through integrated constructed wetlands (ICWs) to provide an additional step in the treatment train, prior to discharge to the peatland drainage system.

The regional hydrological setting is not significantly impacted by the existing facility. There will be a temporary reduction in run-off contribution from the existing facility to the surface water environment, due to the fact that water falling on active landfill areas will be diverted to the Leachate Storage Tanks and ultimately disposed of off-site. This loss will however be negligible to the overall flows in the Cushaling River. The net contribution from the site will be restored to natural levels following the installation of the capping system on the landfill.

As detailed above, waste deposition is placed in lined cells on a phased basis. Cells which have been lined and which accept waste will generate leachate, which is generated from rainwater percolating through the waste material. The lining of the landfills, designed to the proper standards, will prevent lateral and vertical movement of this leachate out of the cell.

The volume of leachate generated within the landfill throughout its lifetime is discussed in more detail in Chapter 3. The development of the site and the lining of the landfill, with a low permeability BES and HDPE liner, are undertaken on a progressive basis. The containment of leachate within the waste body significantly reduces the risk to the surface water environment.

A perimeter swale has already been excavated for the MSW Landfill. All rainwater run-off from the capped landfills is collected in the swale, which drains to the attenuation lagoons and ICWs, to allow settlement of suspended particles prior to discharge of the rainwater to the receiving environment.

The water intercepted from the constructed paved roads and low risk hardstanding is managed to ensure no uncontrolled water discharges take place to natural surface water bodies. The stormwater collected in the gully system is collected and diverted through a sediment grit trap and oil interceptor, prior to discharge to the attenuation lagoon and ICW for final polishing. All construction vehicles leaving the site pass through a wheel wash, to ensure that debris and soil from the site do not impact on the public roads.

The site access road from the R403 road to the facility entrance is similar to public roads and run-off from these roads is not contaminated and does not pose a risk to the surface water environment. Run-off from these roads drain to the adjoining lands and ultimately to the existing artificial site drainage network.

Reference to Section 6.3 of Chapter 6 indicates that the risk to the groundwater environment is low due to the naturally low permeability of the mineral subsoil across the existing facility. Groundwater seepages to excavations is minor and insignificant during heavy rainfall events, due to the low permeability of the underlying subsoil material throughout the existing facility.

Concrete (specifically, the cement component) is highly alkaline and any spillage to a local watercourse could be detrimental to water quality and fauna and flora. Standard mitigations measures used in the previous site development phases are detailed in Section 7.6 and include appropriate site management practices, runoff control measures and treatment.

7.5.2 Operational Phase

Diesel fuel is currently stored in a 20,000 litre tank and kerosene fuel in a 5,000 litre tank, located at the Maintenance Building and Bunded Fuel Storage Area. These tanks are contained in a reinforced concrete bund and are covered with a roof. Drainage from the roof is directed to the surface water collection system.

Surface water runoff from all yard areas, buildings and impermeable hardstand areas is collected via a network of drainage pipes. This runoff passes through an oil interceptor prior to reaching the surface water attenuation lagoons and the ICWs.

Leachate generated from the landfill is collected through a leachate collection system. This system is designed in accordance with the Landfill Design Manual. The leachate is collected and pumped to the leachate storage tanks prior to export by tanker to an appropriately licensed WWTP.

The composting process generates wastewater in the form of leachate and condensate. Leachate is generated by the leaching of moisture from feedstock within the composting tunnels (particularly in the early stages of the process) to the floor of the tunnels. Condensate is generated by the cooling of high humidity process air (exhausted from the tunnels) in aeration system ductwork. This collected leachate is used in a closed loop system and does not generate surplus leachate.

The separate leachate collection systems are fully isolated from the surface water collection system. Therefore, there is no discharge of leachate into the water environment. As such, the physico-chemical assimilative capacity of the Cushaling River is not impacted by the operation of the existing facility.

At present, there is no potable water supply to the Drehid landfill facility. Potable water is delivered to the site to facilitate the welfare of the workforce. It is not proposed to use the groundwater natural resource at the landfill as background groundwater quality does not meet the drinking water standards. Groundwater is currently used as grey water for flushing toilets and dust suppression etc.

The operation of the existing facility has the potential to increase the rate of surface water runoff from this site due to the construction of new paved and hardstand areas. In order to provide the necessary attenuation, permanent surface water attenuation lagoons (4 No.) and ICW areas have been constructed. It should be noted that further attenuation is also provided by the existing attenuation lagoon located downgradient of the 4 No. attenuation lagoons constructed at the existing facility.

In the event of a fire at the existing facility, the management of excess firewater will be required. Details of fire water storage and management provisions are provided in Chapter 3.

No evidence of flooding was recorded during the site investigations, site walkovers or during previous peat harvesting at the existing facility. As there is no history of flooding at the site, the potential flooding impacts are considered to be low/negligible as it is located in Flood Zone C.

In Chapter 6, details have been set out of the hydrogeological LandSim model which has been constructed and run for the existing facility. Based on the LandSim model, all potential contaminants including hazardous and non-hazardous substances will be below their respective guideline values.

There is a potential for a slight adverse impact on the River Cushaling as a result of the development. The overall sensitivity of the site is considered as low as there are no nature conservation designations on the River Cushaling downgradient of the site and it is of a low-moderate aquatic fauna and flora biodiversity. It is therefore considered that there is a slight potential impact on the environment as a result of the existing facility.

7.6 MITIGATION MEASURES

7.6.1 Mitigation Measures for Construction Phase

The purpose of the mitigation measures outlined herein is to minimise the direct and indirect impacts of the existing facility on the surrounding water environment during the construction and operational phases.

During both the construction and operational phases a high standard of environmental engineering practices has been and will continue to be implemented to minimise the impact of the facility on the surrounding surface water and groundwater environment.

Wash down and washout of concrete transporting vehicles takes place at a designated bin area to prevent cementitious material and water entering the surface water network. Waste material is removed from site to an appropriate waste facility, where required.

A number of drainage ditches have been excavated to divert existing surface water drainage away from the excavations and construction activities. Further detail on specific surface water management procedures is provided in the Specified Engineering Works submitted prior to commencement of construction activities.

In order to reduce the risk of sediment laden water adversely impacting surface water, measures are implemented during the construction stage to divert such water through treatment systems (attenuation lagoons and ICWs) prior to discharge to receiving waters. The contract documents specify the necessity for the contractor to take all precautions necessary to prevent silt laden run-off discharging directly to watercourses. Upper limits of sediment in discharges are specified in contract documents. Frequent sampling of discharges is a requirement of the construction contracts.

The attenuation lagoons and ICWs are designed to reduce the potential impact at source. It should be noted that the overall capacity of the attenuation lagoons has been designed to accommodate all impermeable areas at the existing facility (including hardstanding areas and roofed areas) and to cater for a 1 in a 50-year storm event. The existing surface water attenuation lagoon (adjacent to SW5) provides further attenuation prior to the discharge of surface water run-off to the Cushaling River. The surface water quality of all water discharged from the existing facility is monitored to ensure that the receiving water quality is not impaired.

To minimise any potential impact on the surface water and groundwater environments from material spillages, all fuel oils and other oils used during the construction phase are required to be stored within bunded areas. The design of all bunds will conform to EPA bunding specifications. The retention capacity of bunded areas must be 110% of the capacity of the largest tank or drum to be stored within the bunded area. Spill kits are retained on-site to ensure that all spillages or leakages are dealt with immediately and staff will be trained in their proper use. Any servicing of vehicles on-site is confined to designated areas.

The presence of significant numbers of workers on site during the construction period leads to the generation of foul sewage from temporary showers, toilets, canteens and washing facilities. This foul sewage is transferred to the leachate storage tanks and stored onsite prior to being tankered off-site for disposal at a licensed WWTP.

Contractors are required to ensure that the public roads in the vicinity of the site are maintained free from all mud, dirt and rubbish, which may arise from or by reason of the execution of the works. To facilitate this, contractors are requried to use the wheel wash installed at the facility.

7.6.2 Operational Phase

The leachate collection system is fully isolated from the surface water collection system during the lifetime of the facility. The 'Avoidance of Impact' was incorporated into the design of the landfill to have as low impact as possible on the groundwater environment. Laboratory testing of the mineral subsoil, based on tri-axial constant head permeability tests, indicates that the in-situ natural vertical permeability of the quaternary overburden varies between 2.2 x10^{-10} m/s (lower limit) to 1.5 x 10^{-9} (upper limit), with an average vertical permeability of 6.78 x 10^{-10} m/s.

The landfill liner contractor, in order to maintain the thoroughness of all aspects of their quality control, testing and installation regime, is required to establish a comprehensive quality assurance plan (CQA). Quality assurance is the responsibility of an experienced and fully qualified contractor.

A temporary cap is progressively installed to limit infiltration into the waste and subsequent generation of leachate, in accordance with the EPA landfill site design manual. In areas that have been temporarily capped/restored the infiltration rate is reduced to 25-30% of the annual rainfall. Potential infiltration rates decrease dramatically when the final cap is installed. A final cap is in place on Phases 1 – 4.

Landfill

The low permeability natural mineral subsoil is overlain by a 0.5 m thick barrier layer of Bentonite Enhanced Soil (BES), which is processed to achieve a permeability of less than or equal to 5 x 10^{-10} m/s. The BES is in turn overlain by a geomembrane HDPE liner in the Landfill, to prevent leakage of leachate. A high permeability drainage blanket overlies the geomembrane, with leachate collection pipework embedded. This drainage blanket and pipework creates a fast-track for leachate movement to leachate collection sumps, thus further reducing the risk to the groundwater environment. This system is designed in accordance with the Landfill Design Manual, and in such a way to prevent liquid levels rising to such an extent that they can spill over and cause uncontrolled pollution to ditches, drains, watercourses etc. Leachate generated within the landfill body is collected and subsequently exported from the site to an approved WWTP.

Surface water

Rainwater falling on impermeable areas (including hardstanding areas and roofed areas) is collected, stored and discharged to the receiving waters in a controlled manner (i.e. to replicate greenfield run-off rates) in accordance with the principles set down by the Greater Dublin *Strategic Drainage Study* (GDSDS). The control of the surface water discharge rate to the receiving environment can be classified as a SuDs (sustainable urban drainage) measure.

The attenuation lagoons have been designed to provide an adequate retention time to allow suspended solids to fall out of suspension prior to discharge of surface water to the receiving environment. The attenuation lagoons also serve as a fire water supply and as a supply of fresh water, thereby allowing reuse and recycling of water within the existing facility. Water is recycled within the existing facility where possible.

The attenuation lagoons were constructed from suitable material sourced on-site and compacted to ensure stability. Following the completion of earthworks associated with the formation of the attenuation lagoons, the integrity of the lagoons were further secured by the installation of a HDPE geomembrane liner.

The provision of a storm water freeboard has been accounted for in the design of the attenuation lagoons, thereby providing for storage of storm water in the event of intense rainfall events. The attenuation lagoons are sized to provide sufficient retention time to facilitate adequate settlement of suspended solids prior to discharge through ICWs to the surface water environment.

The extreme rainfall event chosen for the sizing of the attenuation lagoons is a 1 in 50-year return period and takes into account potential increase in rainfall due to climate change.

Interpretation of the meteorological data using the GDSDS/SuDs methodology allows an estimation of the peak rainfall run-off intensity. The surface water management system is designed to capture and control the run-off and allow outflow to receiving waters at a regulated rate.

The surface water discharge system has been designed as follows:

- The surface water attenuation lagoons cater for storm events (and include for process requirements and firefighting requirements); and
- The surface water attenuation lagoons have a minimum free board of 1 m.

In extreme rain fall events, the storm water freeboard in the attenuation lagoons provide sufficient storage to maintain a regulated discharge rate (i.e. greenfield run off rate) to receiving waters.

The design of the attenuation lagoon complete with ICWs is based on creating a low energy water environment to settle out suspended solids from aqueous suspension. The theory behind the design of the attenuation lagoons is the application of Stoke's Law. The attenuation lagoons have been designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment. Interpretation of Stoke's Law of settlement indicates that a 12 hour retention time will allow 100% removal of sand and silt down to 10 µm.

The attenuation lagoons are sized to provide adequate capacity for a 100-year storm event, to meet facility fire-fighting water requirements and to provide water to meet process demands when necessary. Overflow from these attenuation lagoons is diverted through ICWs to provide an additional step in the treatment train, prior to discharge to the peatland drainage system. The attenuation lagoon design calculations do not account for the additional settlement provided in the existing Bord na Móna settlement attenuation lagoon located downgradient of the existing facility. The ICWs are designed to polish surface water run-off from the site. The ICWs are densely planted with appropriate wetland emergent species, such as Carex riparia, Typha latifolia and Iris pseudacorus. The ICWs for the have been designed to provide greater management of surface water runoff while also ensuring that the concentration of parameters, such as ammonium, do not exceed the emission limit values set on the discharge. The ICWs have been designed so that they will provide continuous treatment and management of the surface water runoff at the facility in order that the quality of the discharge does not exceed the emission limit values, including ammonium concentration of 0.5 mg/l. ICWs have consistently shown high treatment efficiency for a wide range of parameters, with ammonia treatment efficiency at 99% being achieved through processes such as nitrification and denitrification.

In terms of the capacity of the Cushaling River to transmit the water discharged from the existing facility, the channel capacity was assessed at the two locations where site specific hydrometric readings were taken (refer to Section 7.3.3). The carrying capacity of the river channel was determined using Manning's Equation.

The maximum channel capacity of the Cushaling River at the western boundary of the existing facility is estimated to be approximately 8,550 litres/sec, with a channel cross sectional area of approximately 9.5 m^2. The maximum channel capacity of the Cushaling River at Dillon's Bridge, where the Cushaling River flows under the R403 road, is estimated to be approximately 9,900 litres/sec, with a channel cross sectional area of 6.61 m^2. The culvert under the R403 is a concrete box culvert, of dimensions 3 m high and 2.2 m wide. The stream channel upstream and downstream of the bridge is incised deeply into the ground and extends to up to 6-7 m, with shallow flood plains which attenuate flow in the mid part of the stream. With respect to the existing facility, a maximum discharge of 8.3 litres/second/hectare occurs from the existing facility during extreme rainfall events. This maximum discharge corresponds to the greenfield runoff rate.

All surface water discharged from the existing facility will comprise clean treated surface water. The water discharged is diverted through attenuation lagoons and wetlands to reduce any potential for siltation of the river channel. Wetlands are installed to provide further treatment of the surface runoff from the landfill areas. While elevated concentrations of ammonia occur in peatlands, there is no evidence of increasing ammoniacal nitrogen at the discharge point to the Cushaling River over the last 13 years of monitoring data. Ammoniacal nitrogen levels at the Bord na Móna landholding are naturally high due to the peat environment. However, the monitoring results of the surface water discharge from the overall Bord na Móna landholding are generally in compliance with the appropriate surface water discharge standards specified in the current IED Licence for the facility. Ammoniacal nitrogen concentrations in the surface water runoff from the existing landfill (SW6) are on average lower than the runoff from the remainder of the peatlands (SW5) and those downgradient of the site (SW4).

During the operational phase, the attenuation lagoons capture and treat rainwater which naturally has low ammonium levels, and discharges to the surface water network.

The surface water quality of all water discharged from the existing facility is continuously monitored in accordance with the requirements of the IED Licence to ensure that there is no negative impact on the receiving water quality. Continuous monitoring takes place at the inlet and outlet of the surface water attenuation lagoons. Instrumentation linked to a SCADA system continuously monitors the following parameters (as per IED Licence W0201-03):

- Dissolved Oxygen; and
- Electrical Conductivity.

Lagoon Level

An actuated valve at the surface water attenuation lagoon outlets is controlled by the SCADA system. This valve is programmed to close should any of the above parameters fall outside permitted levels. The volume of surface water discharged to the surrounding environment is also controlled through the same actuated valve and SCADA system.

Leachate, process wastewater or any other potentially contaminated material from the existing facility is fully contained and isolated from the surface water collection system. As such, the physico-chemical assimilative capacity of the Cushaling River is not impacted.

All construction vehicles exiting the existing facility are required to divert through the wheelwash located along the access road of the existing facility. This infrastructure ensures that vehicles do not cause soiling of roads. Water is recycled within the wheelwash facility to minimise the water requirement. A tank stores water for washing purposes and a pump re-circulates the water back into the tank during washing. Solids that settle at the base of the tank are removed by a vacuum tanker. Water is only discharged to the foul water system during the periodic replenishment of the used process water with fresh water.

To minimise any impact on surface water from material spillages, all fuel oils, other oils, chemicals and process water used during operations is stored within bunded areas. The design (volume and construction) of all bunds conforms to EPA bunding specifications. The retention capacity of bunded areas is 110% of the capacity of the largest tank or drum to be stored within the bunded area. Spill kits are retained on-site to ensure that all spillages or leakages are dealt with immediately & staff are trained in their proper use. Any servicing of vehicles on-site takes place within the bunded Maintenance Building.

In the event of a fire at the existing facility, excess firewater will be collected and retained in the surface water attenuation lagoons. The firewater will subsequently be analysed prior to possible tankering off-site to an approved WWTP.

The collection, storage, treatment and monitoring of surface water prior to being discharged at greenfield run off rates is considered the principal mitigation measure to ameliorate the potential impacts of the development during operations.

Water Supply

Currently, no potable water supply exists on the site. Potable water is delivered to the site to facilitate the welfare of the workforce. Due to the potential for high Ammonium, Iron, Manganese and metals within the underlying aquifer, a treatment system would be required to meet the drinking water standards set out in S.I. 122 of 2014. Groundwater is utilised in grey water uses such as flushing toilets to limit the demand from offsite supplies.

A groundwater supply borehole was sunk on-site to ensure an adequate supply of grey water for the existing operations. This borehole is screened within the bedrock aquifer and grout sealed to prevent contamination of the groundwater. There is no significant adverse direct or indirect impacts on the groundwater environment as a result of the existing water well during the operational phase of the facility. Pump test data (compiled in 2003) indicates a potential yield of 40 m^3/day. This data demonstrates that there is a sufficient supply of groundwater within the bedrock aquifer to satisfy the requirements of the existing facility. Any additional non-potable water for fire suppression, dust control etc. will be extracted from the surface water attenuation lagoons.

Foul Sewerage

All wastewater is fully contained at the existing facility and no wastewater discharge will occur to groundwater or the River Cushaling.

Impacts arising from the existing facility on water environment are site-specific and would be limited to the immediate area of the existing facility. The Bord Na Móna peatlands outside of the existing facility will continue to be managed in accordance with the existing IPC Licence for the boglands. The cumulative impacts of the granted (but not yet built) MBT facility, future proposed development works and external developments with the existing facility have been assessed as part of the Proposed Development EIAR and are not repeated here.

7.7 RESIDUAL EFFECTS

Due to the low magnitude of impact and low sensitivity of the surrounding environment, the residual impacts on the surrounding hydrological and hydrogeological regime at the site are considered to be slight and mainly long term in nature. Detailed mitigation measures have been provided with regard to the design, construction, and ongoing maintenance of the existing facility. It is considered that there is no significant residual impact on the water environment as a result of this development.

7.8 CONCLUSION

Leachate is collected from the landfill through a leachate collection system. This system is designed in accordance with the Landfill Design Manual, and in such a way to prevent excessive leachate levels in the landfill. The leachate is collected and pumped to the leachate storage tanks for treatment on-site before offsite disposal.

Based on the Hydrogeological Risk Assessment and risk modelling contained in Chapter 6, it is predicted that the impact at the nearest receptor will be negligible and all hazardous parameters will be below their respective limits in the bedrock aquifer and at all groundwater monitoring locations downgradient of that location. All non-hazardous parameters are below their respective limits at the nearest sensitive receptor, the River Cushaling.

Sewage generated by welfare facilities at the site is transferred to the onsite leachate storage tanks and stored prior to being transported offsite to a licensed WWTP.

There is currently and will continue to be no uncontrolled discharge from the existing facility to the surface water or groundwater environment during construction works or the operational phase. Regular sampling of the surface water environment is undertaken downstream to ensure that existing facility activities are not causing an adverse impact on the natural water quality. This information is compared to pre-development water quality data to determine any cumulative impacts or negative trends and is reported on a regular basis to the EPA.

Given the above mitigation measures, the use of Best Available Technologies (BAT) and the high design standard of the existing facility, the risk to the surface water and groundwater environment is significantly reduced. The measures employed will ensure that there is no significant adverse impact on the surface water or groundwater environment.

Mitigation measures outlined in this Chapter will continue to ensure the reduction of any impacts of the existing facility during construction works and the operational phase on the wider environment. Given the mitigation measures outlined in this Chapter, it is considered that the impact on the water environment will be slight and permanent.