10. Archaeology, Cultural Heritage and Architectural Heritage

The purpose of this assessment is to identify and assess the significance of, and impacts, to any known or proposed archaeological, architectural and cultural heritage resources associated with the proposed Project.

There are six recorded monuments in the vicinity of the proposed Project site, one of which (a mound) is within the proposed Project area. This mound, which may have represented an early medieval settlement, is recorded as having been disturbed by quarrying activity in the 1950s although the plotted location is outside of the area infilled as part of the Kerdiffstown Landfill. No structures of architectural heritage significance are located within the existing site. There are no Protected Structures located within the area of the proposed Project, although nine structures are situated within a 500m radius.

During the Remediation Phase ground disturbances in the west of the site may have an impact on the site of the recorded mound, however the mound location is currently uncertain and may have been removed by quarrying activity. No features of archaeological potential were noted in this area during a geophysical survey. Ground disturbances within the Kerdiffstown Demesne may impact on a recorded church and graveyard site and associated remains that may survive beneath the existing ground level with no surface expression. A series of mitigation measures are proposed to reduce impacts to the archaeological features. No direct or indirect impacts are predicted upon the remaining recorded archaeological sites located within the receiving environment surrounding the proposed Project. No potential impacts are predicted upon the built architectural resource as part of the proposed remediation works.

During the Operational Phase it is envisaged that there will be a significant positive impact on both the archaeological and architectural resources surrounding the proposed Project through the reduction and stabilisation of slopes as well as the visual improvement of the landscape.

10.1 Introduction

10.1.1 General

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as “the proposed Project”) on Archaeology, Cultural Heritage and Architectural Heritage, anticipated to occur during the Remediation and Operational Phases.

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

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children’s playground, etc. and management of the site as a remediated landfill. Table 10.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

Table 10.1: Summary of Key Activities during the Remediation and Operational Phases

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

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

This study determines, as far as reasonably possible from existing records, the nature of the cultural heritage resource within the area of proposed Project using appropriate methods of study. Desk based research is defined as an assessment of the known or potential archaeological resource within a specified area consisting of a collation of existing written and graphic information. The assessment takes place in order to identify the likely character, extent, quality and worth of the known or potential archaeological resource in order to make an assessment of its merit in context, leading to one or more of the following:

- The formulation of a strategy to ensure the recording, preservation or management of the cultural heritage resource;
- The formulation of a strategy for further investigation, whether or not intrusive, where the character and value of the resource is not sufficiently defined to permit a mitigation strategy or other response; or
- The formulation of a proposal for further archaeological investigation within a programme of research. (Institute of Field Archaeologists 2014a, p.4).

The study involved detailed interrogation of the archaeological, historical and architectural background of the proposed Project. This included information from the Record of Monuments and Places of County Kildare, the County Development Plan, the topographical files of the National Museum of Ireland and cartographic and documentary records. Aerial photographs of the study area were also consulted. A field inspection was carried out on 10 November 2016 in an attempt to identify any known cultural heritage sites and previously unrecorded features, structures and portable finds within the proposed Project area. An impact assessment and a mitigation strategy have been prepared. The impact assessment is undertaken to outline potential adverse impacts that the proposed Project may have on the cultural heritage resource, while the mitigation strategy is designed to avoid, reduce or offset such adverse impacts. How impacts can occur upon the potential archaeological or architectural resource are described in Appendix A10.1.

10.1.2 Consultations

As part of the EIAR scoping process a consultation letter including the Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report (Jacobs, September 2016) was issued to the Development Applications Unit – The Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, the Kildare County Council Heritage section and to the Heritage Council inviting comment on the proposed scope of the environmental assessment.

Following the initial research, a number of statutory and voluntary bodies were consulted to gain further insight into the cultural background of the background environment, receiving environment and study area, as follows.

- Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs – the Heritage Service, National Monuments and Historic Properties Section: Record of Monuments and Places; Sites and Monuments Record; Monuments in State Care Database; Preservation Orders and the Register of Historic Monuments;
- National Museum of Ireland, Irish Antiquities Division: topographical files of Ireland;
- National Inventory of Architectural Heritage: County Kildare;
- Kildare County Council: Planning Section; and
- Trinity College Dublin, Map Library: Historical and Ordnance Survey Maps.

10.2 Methodology

10.2.1 Guidance and Legislation

The following legislation, standards and guidelines were also consulted as part of the assessment.

- National Monuments Acts, 1930-2014;
- The Planning and Development (Strategic Infrastructure) Act, 2006
- Heritage Act, 1995;
- EPA 'Advice Notes for preparing Environmental Impact Statements' (Draft 2015);
- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, (formerly) Department of Arts, Heritage, Gaeltacht and Islands;
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 2000 and the Local Government (Planning and Development) Act 2000; and
- Architectural Heritage Protection: Guidelines for Planning Authorities, 2011), (formerly) Department of Arts, Heritage and the Gaeltacht.

Research for the assessment has been undertaken in three phases. The first phase comprised a paper survey of all available archaeological, architectural, historical and cartographic sources covering a receiving environment of 500m from the edge of the proposed Project. The second phase involved a field inspection of the proposed Project area. The third phase consisted of a geophysical survey of a small part of the site that remains undisturbed and contained a recorded monument. An assessment of the outline design for the proposed Project was undertaken with potential impacts identified and mitigation measures determined.

10.2.2 Paper Survey

This is a document search. The following sources were examined and a list of areas of archaeological, architectural and cultural heritage potential was compiled:

Record of Monuments and Places (RMP) is a list of archaeological sites known to the National Monuments Section, which are afforded legal protection under Section 12 of the 1994 National Monuments Act and are published as a record.

Sites and Monuments Record (SMR) holds documentary evidence and field inspections of all known archaeological sites and monuments. Inclusion within the SMR does not necessarily result in statutory protection. Some information is also held about archaeological sites and monuments whose precise location is not known e.g. only a site type and townland are recorded. These are known to the National Monuments Section as 'un-located sites' and cannot be afforded legal protection due to lack of locational information. As a result, these are omitted from the RMP.

SMR/ RMP sites are also listed on a website maintained by the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DoAHRRGA): archaeology.ie.

National Monuments in State Care Database is a list of all the National Monuments in State guardianship or ownership. Each is assigned a National Monument number whether in guardianship or ownership and has a brief description of the remains of each Monument.

The Minister for the DoAHRRGA may acquire national monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister. There are no National Monuments in the vicinity of the proposed Project.

Preservation Orders List contains information on Preservation Orders and/or Temporary Preservation Orders, which have been assigned to a site or sites. Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 National Monuments Act, which also makes any interference with such a site an offence. Temporary Preservation Orders can be attached under the 1954 National Monuments Act, with these performing the same function as Preservation Orders under the 1934 National Monuments Act; however, these are limited to a time limit of six months, after which time the basis for the Temporary Preservation Order must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders/Temporary Preservation Orders with the written consent, and at the discretion, of the Minister. There are no sites under preservation order within the vicinity of the proposed Project.

Register of Historic Monuments was established under Section 5 of the 1987 National Monuments Act, which requires the Minister to establish and maintain such a record. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places.

Topographical files of the National Museum of Ireland is the national archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information on the discovery of sites of archaeological significance.

Cartographic sources are important in tracing land use development within the proposed Project area as well as providing important topographical information on areas of archaeological potential and the development of buildings. Cartographic analysis of all relevant maps has been made to identify any topographical anomalies or structures that no longer remain within the landscape. These include:

- Sir William Petty, Down Survey Map, Barony of Naas and Salt, (c. 1655);
- Noble and Keenan's Map of County of Kildare (1752);
- Alexander Taylor's Map of the County of Kildare (1783); and
- Ordnance Survey maps of County Kildare (1839, 1871 and 1910).

Documentary sources were consulted to gain background information on the archaeological, architectural and cultural heritage landscape of the proposed Project area. These include a range of academic texts and texts that relate specifically to County Kildare.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its likely potential for archaeology. A number of sources were consulted including aerial photographs held by the Ordnance Survey and Google Earth and the results of an aerial survey of the proposed Project area undertaken in February 2016.

Place Names are an important part in understanding both the archaeology and history of an area. Place names can be used for generations and in some cases can be used to give an insight to history and heritage of an area.

Development Plans contain a catalogue of all the Protected Structures and archaeological sites within the county. Protected Structures are afforded statutory protection under the Planning and Development Act (2000). The Kildare County Development Plan (2017-2023) was consulted to obtain information on cultural heritage sites in and within the immediate vicinity of the proposed Project.

The **National Inventory of Architectural Heritage (NIAH)** is a state initiative established under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999 tasked with making a nationwide record of significant local, regional, national and international structures, which in turn provides county councils with a guide as to what structures to list within the Record of Protected Structures. The architectural survey for County Kildare was completed during 2003. The NIAH have also carried out a nationwide desk-based survey of historic gardens, including demesnes that surround large houses. This has also been completed for County Kildare and was examined in relation to the surviving demesnes within the surrounding area of the proposed Project.

Excavations Bulletin is a summary publication that has been produced every year since 1970. This summarises every archaeological excavation that has taken place in Ireland during that year up until 2010 and since 1987 has been edited by Isabel Bennett. This information is vital when examining the archaeological content of any area, which may not have been recorded under the SMR and RMP files. This information is also available online from 1970–2015.

10.2.3 Field Inspection

Field inspection is necessary to determine the extent and nature of archaeological and architectural remains, and can also lead to the identification of previously unrecorded or suspected sites and portable finds through topographical observation and local information.

The archaeological and architectural field walking inspection entailed:

- walking the proposed Project area and its immediate environs;
- noting and recording the terrain type and land usage;
- noting and recording the presence of features of archaeological, architectural or cultural heritage significance;
- verifying the extent and condition of recorded sites; and
- visually investigating any suspect landscape anomalies to determine the possibility of these being anthropogenic in origin.

10.2.4 Geophysical Survey

Geophysical survey is used to create ‘maps’ of subsurface archaeological features. Features are the non-portable part of the archaeological record, whether standing structures or traces of human activities left in the soil. Geophysical instruments can detect buried features when their electrical or magnetic properties contrast measurably with their surroundings. In some cases, individual artefacts, especially metal, may be detected as well. Readings taken in a systematic pattern become a dataset that can be rendered as image maps. Survey

results can be used to guide excavation and to give archaeologists insight into the patterning of non-excavated parts of the site. Unlike other archaeological methods, geophysical survey is not invasive or destructive.

A geophysical survey of a small area of greenfield within the western part of the proposed Project was carried out by Joanna Leigh in March 2017 under licence 17R0027, due to the presence of a recorded mound site (KD019-018). The survey showed a large amount of magnetic disturbance across the area. A faint curving trend was noted and whilst an archaeological interpretation may be possible the feature was barely discernible in the data. The report is included as Appendix A10.2.

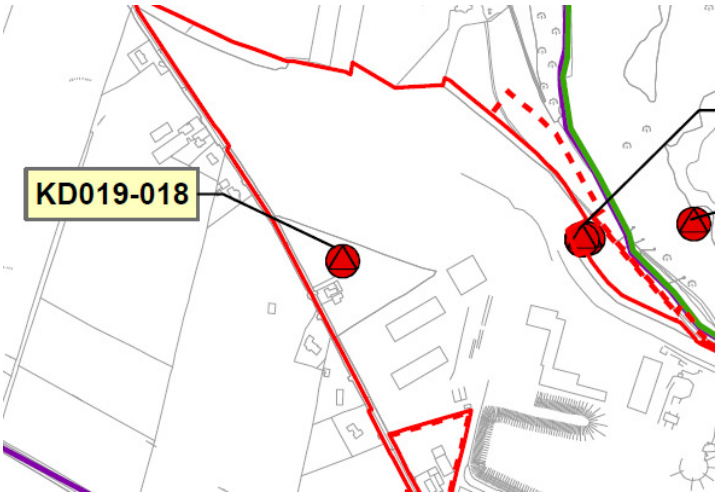


Diagram 10.1: Location of the Recorded Mound Site (KD019-018)

Definitions

In order to assess, distil and present the findings of this study, the following definitions apply.

'Cultural Heritage' where used generically, is an over-arching term applied to describe any combination of archaeological, architectural and cultural heritage features, where –

- the term 'archaeological heritage' is applied to objects, monuments, buildings or landscapes of an (assumed) age typically older than AD 1700 (and recorded as archaeological sites within the Record of Monuments and Places);
- the term 'architectural heritage' is applied to structures, buildings, their contents and settings of an (assumed) age typically younger than AD 1700; and
- the term 'cultural heritage', where used specifically, is applied to other (often less tangible) aspects of the landscape such as historical events, folklore memories and cultural associations. This designation can also accompany an archaeological or architectural designation.

For the purposes of this report the terms 'architectural heritage' and 'built heritage' have the same intended meaning and are used interchangeably.

Table 10.2: Impact Definitions (as defined by the EPA 2017 Guidelines, p.50)

Effects	Description
Imperceptible Effects	An effect capable of measurement but without significant consequences.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment.
Profound Effects	An effect which obliterates sensitive characteristics.

10.3 Baseline Conditions

10.3.1 Archaeology

Archaeological and Historical Background

The site of the proposed Project, is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. A large majority of the site comprises a former sand and gravel quarry, which has been backfilled from the 1950s onwards. It is bordered to the west by the L2005 Kerdiffstown Road from Sallins to Johnstown and to the north and east by demesne landscapes associated with Kerdiffstown House and Palmerstown House.

There is one recorded monument within the proposed Project area. This consists of the site of a mound that was recorded as being disturbed by quarrying activity in the 1950s, which may have represented an early medieval settlement area (KD019-018). The files within the National Museum suggest that the site was located within the existing landfilled area; however, the record is not located within an area which has been infilled as part of the Kerdiffstown Landfill. There are a further five sites or groups of sites located within a 500m radius of the proposed Project. The nearest of these comprise the church, graveyard and two grave slabs (KD019-006001–4) located to the immediate east of site (refer to Figure 10.1 and Appendix A10.3 and Appendix A10.4).

Diagram 10.2: Location of the Church, Graveyard and Two Grave slabs (KD019-006001–4)

Prehistoric Period

The earliest recorded activity in proximity to the proposed Project can be dated to The Bronze Age (c. 2500–800BC). As with the earlier transition from Mesolithic to Neolithic, significant social change is associated with the early Bronze Age. This is reflected in the material culture of the time, but also in the excavated evidence for settlement and ritual. Large communal tombs were replaced in favour of individual, subterranean cist or pit burials that were either in isolation or in small cemeteries.

Evidence for funerary activity has been identified through excavation in advance of the N7 Naas Road Widening Scheme in the townland of Killhill (KD020-021 and KD020-022002), approximately 2.4km east of the proposed Project. Records in the Topographical Files of the National Museum of Ireland (NMI) note the discovery of cremated bone from a 'sandy hill' in Sherlockstown townland in 1983. It is likely that these remains represent a Neolithic or Bronze Age burial site.

The Bronze Age landscape is often defined by these burial monuments but also by other monuments such as standing stones, stone rows and stone circles. A single example of a standing stone (KD019-059, RPS B19-15) is located within proximity to the proposed Project, 360m to the south-east in Maudlings townland. It is believed locally to be a scratching post but may date to the Bronze Age period.

Bronze Age activity is commonly identified in the landscape by the presence of *fulachta fiadh* or burnt mounds. Over 4,500 of these sites have been recorded in the country with the majority comprising of a mound of burnt stone, commonly in horseshoe shape, in low lying marshy areas or in proximity to streams. These sites are generally uncovered in or near riverine and waterlogged environments which provide the ideal circumstances for the construction, use and ultimate preservation of the sites. While there are none of these sites identified to date within the vicinity of site, riversides are attractive locations for such activity.

Early Medieval Period (AD 400–1100)

The territory of the *Uí Faeláin* was the tribal grouping who ruled the northern part of County Kildare up until the coming of the Normans. Naas, located approximately 3km south-west of the proposed Project, is regarded as the residence of the Kings of Leinster. According to Bradley et al (1986 vol. 4, 343–383), Naas was the site of an early Christian monastery known as 'Cill Corbain' or 'Cill Náis' (RMP KD019-030046), the former's name being preserved in the present day Corban's Lane, whose curving course may preserve the line of a pre-Norman monastic enclosure. However, the precise location of the monastery is uncertain. The town is also known as 'Nás na Rí' or 'The assembly place of the Kings', because between the 8th and 10th century it was a seat of the Kings of Leinster. The fort ('dún') of Naas is first referred to in 705 AD, and may subsequently have been incorporated into the Anglo-Norman motte that is located within the town (RMP KD019-030009). A second motte (RMP KD019-030023) may have stood at the southern end of the town.

During this period Ireland was not a united country but rather a patchwork of minor monarchies all scrambling for dominance. Borders were ever changing as alliances were formed and battles fought. Kingdoms were a conglomerate of clannish principalities with the basic territorial unit known as a *túath*. Byrne (1973) estimates that there were probably at least 150 kings in Ireland at any given time during this period, each ruling over his own *túath.* The landscape surrounding the proposed Project area is characterised by the remains of early medieval activity in the form of secular settlement and ecclesiastical activity.

The most common indicator of settlement during the early medieval period is the ringfort. Ringforts (raths and cashels) are also the most common monument type encountered within the surrounding region. Ringforts, (also known as rath, *lios, caiseal, cathair* and *dún*) are a type of defended homestead comprising of a central site enclosed by a number of circular banks and ditches. The number of ditches can vary from one (univallate) to two or three (bivallate or multi-vallate) and is thought to reflect the status and affluence of the inhabitants. Another morphological variation consists of the platform or raised rath – the former resulting from the construction of the rath on a naturally raised area. Ringforts are most commonly located at sites with commanding views of the surrounding environs which provided an element of security. While raths, for the most part, avoid the extreme low and uplands, they also show a preference for the most productive soils (Stout 1997, p.107). The most recent study of the ringfort (Stout 1997) has suggested that there is a total of 45,119 potential ringforts or enclosure sites throughout Ireland. While rath and *lios* seem to refer to earthen ringforts, *caiseal* (cashel) and *cathair* refer to their stone-walled equivalents. Cashels are more frequent in the west of the country. No ringforts are recorded within the immediate vicinity of the proposed Project but examples are known in Turnings Upper townland (KD014-024 and KD014-037) further to the north. It is possible that the recorded mound (KD019-018) within the western section of the proposed Project area may relate to early medieval habitation activity, as during the 1950s several artefacts were recovered during quarrying that may be contemporary with the period. However, the exact location of the site is unknown and whilst it is marked within a greenfield, it may have been located within what is the land filled area.

From early medieval historical texts, it is clear that the idea of a great road system existed within the country and this was formalised in the tradition that five great roadways radiated from Tara. The *Slighe Dhála Meic Umhóir*, one such road way, made its way south from the Hill of Tara in County Meath, to County Kildare before turning west and passing through Naas and the Curragh. O'Lochlainn (1940) describes part of the western section of the *Slighe Dhála Meic Umhóir*, meaning 'The Road of *Dála*, son of *Umhóir*', (or *Belach Muighe Dála*) as running along the northern boundary of Munster.

Medieval Period (AD 1100–1600)

Upon the arrival of the Anglo-Normans in Kildare, the cantred of *Uí Faeláin* was granted to Adam de Hereford prior to 1176. It is likely that there was an influx of an immigrant farming population and by the end of the 12th century Norman settlement was effective over the whole county. This marked the beginning of the rule of the Fitzgerald family as Earls of Kildare. Naas was granted by John, Earl of Morton, to William Fitzmaurice. This included adjacent territory and a variety of important privileges, including a market (Lewis 1837). It was at this time that Naas, fortified with an enclosing wall and several castles, rapidly rose into importance within the Pale. In 1569 Queen Elizabeth granted a charter declaring that Naas be a free and undoubted borough.

A medieval church and graveyard (KD019-014001, 2) are located approximately 425m east-south-east of the proposed Project area in the Palmerstown townland. The church may have been built originally by the Knights Hospitallers of St John of Jerusalem, from whom Johnstown village took its name (National Monuments Service, 2016). The church was dedicated to St. John the Baptist. The church is partially restored and the interior contains the 15th century 'Flatesbury Monument' (KD019-014003), a medieval font (KD019-014002) and a 19th century high cross marking the burials of the Bourke (Mayo) family. The Flatesbury Monument, comprising a limestone slab carrying an eight-pointed cross of mixed floriated and pointed terminals on a stepped-base and two heraldic shields, possibly commemorates the marriage of Eleanor Wogan and James Flatesbury in 1564.

Buckley (2008, p.29) noted that the word 'palmer' indicates a pilgrim during the medieval period who had been to the Holy Land (and brought back a palm leaf in token of the fact). She states that these pilgrims were frequently lepers and thus leper hospitals are associated with places named Palmerstown, Palmerston or Palmershill (*ibid.*). In addition, some saints' names are associated with leper hospitals including St Stephen, St James, St Nicholas and St Mary Magdelene to name a few. Leper hospitals were frequently known as Maudlin houses; Maudlin being a corruption of Magdelene or Madeline. The site and grounds of a hospital or its endowed lands were often called 'The Maudlins' (Lee 1996, p.19). The townland of Maudlings adjacent to Palmerstown may indicate the presence of a medieval leper hospital in the area. Lee suggests that the Palmerstown Demesne lands may have been part of the endowment of the hospital of Naas. In 1606 the townland of Maudlings was recorded as belonging to the chantry priests of St. David's church (*ibid.*) associated with a 12th century priory and hospital at Stephenstown nearby (*ibid.*).

Summary of Previous Archaeological Fieldwork

A review of the Excavations Bulletin (1970–2016) has revealed that several archaeological investigations have been carried out within the immediate vicinity of the proposed Project. One programme of archaeological monitoring was carried out within the proposed Project area during 2003 (O'Carroll; Licence Ref.: 03E1527). Ground disturbances associated with the southern extension of the landfill facility were monitored. Two modern features, along with one feature of negligible archaeological potential were identified during the course of the works.

In the wider area archaeological testing was undertaken in advance of the improvements to Naas Dual Carriageway in the Naas, Johnstown and Kill area (O' Donnchadha 2003b; Licence Ref.: 03E1257). A number of sites were identified and excavated under separate licence.

Testing of a possible dwelling site in Kerdiffstown approximately 500m north-west of the Project Area identified late 19th and 20th century remains (O' Donnchadha 2003b; Licence Ref.: 03E1261 and O' Donnchadha 2003c; Licence Ref.: 03E1262).

Monitoring of the Bord Gáis Éireann pipeline through Johnstown Main Street revealed nothing of archaeological significance (O' Riordáin 1998; Licence Ref.: 98E0113). A small number of other programmes of work have

been undertaken within or near the village of Johnstown; however, nothing of archaeological significance was identified (McCabe 2002, Licence Ref.: 02E1820; O' Donovan 2002, Licence Ref.: 02E1838 and Larsson 2003, Licence Ref.: 03E0917).

During the 1950s the site of the recorded mound (KD019-018) was visited by the UCD Archaeological Society which is recorded within the topographical files held by the National Museum. Upon visiting the site, they found that it had been completely removed. The driver of the bulldozer or mechanical excavator said that there had been a mound in the area, which was removed. Archaeological investigation was not deemed possible owing to the condition of the area. Two bone comb fragments and a section of bronze wire were recovered from the site and it was agreed that the site likely represented an early medieval settlement.

Geophysical Survey

A geophysical survey of a small area of greenfield (1.3ha) within the western part of the proposed Project was carried out by Joanna Leigh in March 2017 under licence 17R0027, due to the presence of a recorded mound site (KD019-018). A large magnetic shadow from the adjacent spoil of the landfill site obscures a large section of the data. The location of the recorded mound (KD019-018) lies partially within the magnetic shadow. No responses indicative of an archaeological mound were recorded. In the south of the application area (Area B) a faint curving trend has been identified. Although this is barely discernible in the data, this may represent the remains of a circular archaeological feature, although this is speculative. The report is included as Appendix A10.2.

Cartographic Analysis

Down Survey Map of the Barony of Naas and Salt c. 1655

The Down Survey Map shows the parishes and townlands known within the baronies at this time. Naas town is shown as a fortified walled town with several castles and large houses within the settlement. There is no detail included for the proposed Project area.

Noble and Keenan's Map of County Kildare, 1752

This map provides a more detailed depiction of the surrounding landscape. The main infrastructural routes and topographical features are shown including many of the main houses. A large house is shown at 'Cardiffs tonn' sited between two watercourses. Palmerstown House, to the east, is one of the most substantial residences in the area with large gardens and an avenue shown to the south. Johnstown village comprises of six houses and a church (RMP KD019-014001, NIAH Ref.: 11812009) bordered to the east and west by rivers. A water wheel is shown on the river to the immediate west of Johnstown and the fields to the north, in the vicinity of the proposed Project area, are annotated as 'Bleachy'. To the south Naas has grown in size.

Taylor's Map of County Kildare, 1783

This map shows a slightly more accurate depiction of the network of roads, rivers and topographical features of the area. The demesne lands of Palmerstown and 'Kerdiffstown' to the north of Naas appear heavily wooded. Milestones are depicted along the Dublin to Naas road with numbers 13 and 14 located to the north and west of Johnstown. A mill race runs to the south of Johnstown and a watercourse to the west of the village is annotated as 'A run for the bleachfield'. The proposed Project area is located in undeveloped fields to the east of this mill race and west of the road leading to Kerdiffstown House (RPS B19-23).

First Edition six inch Ordnance Survey Map, 1839, scale 1:10560

The first edition Ordnance Survey (OS) mapping is the first accurate representation of the landscape in question. The proposed Project area is shown as being located within a rural landscape, to the north-west of Johnstown Village and west of a demesne landscape associated with Kerdiffstown House. The site itself is shown as being partially located within a demesne landscape associated with Kerdiffstown House (RPS B19-23). The house is marked approximately 150m north of the proposed Project with a large walled garden shown between the site and the house. A belt of trees shown within the south-western part of the demesne is located

within the proposed Project area. The demesne, which is relatively narrow and modest landscape, is traversed by a drive way that runs through part of the eastern part of the Project area.

No previously unrecorded sites of archaeological or architectural heritage potential were noted within the mapping. The recorded church and graveyard (KD019-029001-4) is indicated to the immediate east of the site. No features are marked within the vicinity of the recorded mound (KD019-018).

Second Edition six inch Ordnance Survey Map, 1871, scale 1:10560

There are no major changes to note within the second edition OS map. Several houses have been built to the south-east of Johnstown along the Dublin-Naas road.

Ordnance Survey Map, 1910, scale 1:2500

By the time of this map the demesne associated with Kerdiffstown House has been extended significantly and now contains the proposed Project area (refer to Diagram 10.3). Additional demesne planting has been added, including scattered trees and clumps. One semi-circular clump is shown in the south-western part of the demesne and a proposed leachate and foul sewer pipelines will run through the southern tip of this feature. Johnstown village has grown slightly with the construction of a terrace of houses to the south of the road at the location of a flour mill (RPS B19-38 and B19-039, NIAH 11812012 and 11812029). A lodge house and entranceway are shown within the current footprint of the M7 for Kerdiffstown House (NIAH 11812022) and Roseborough House (NIAH 11812028).

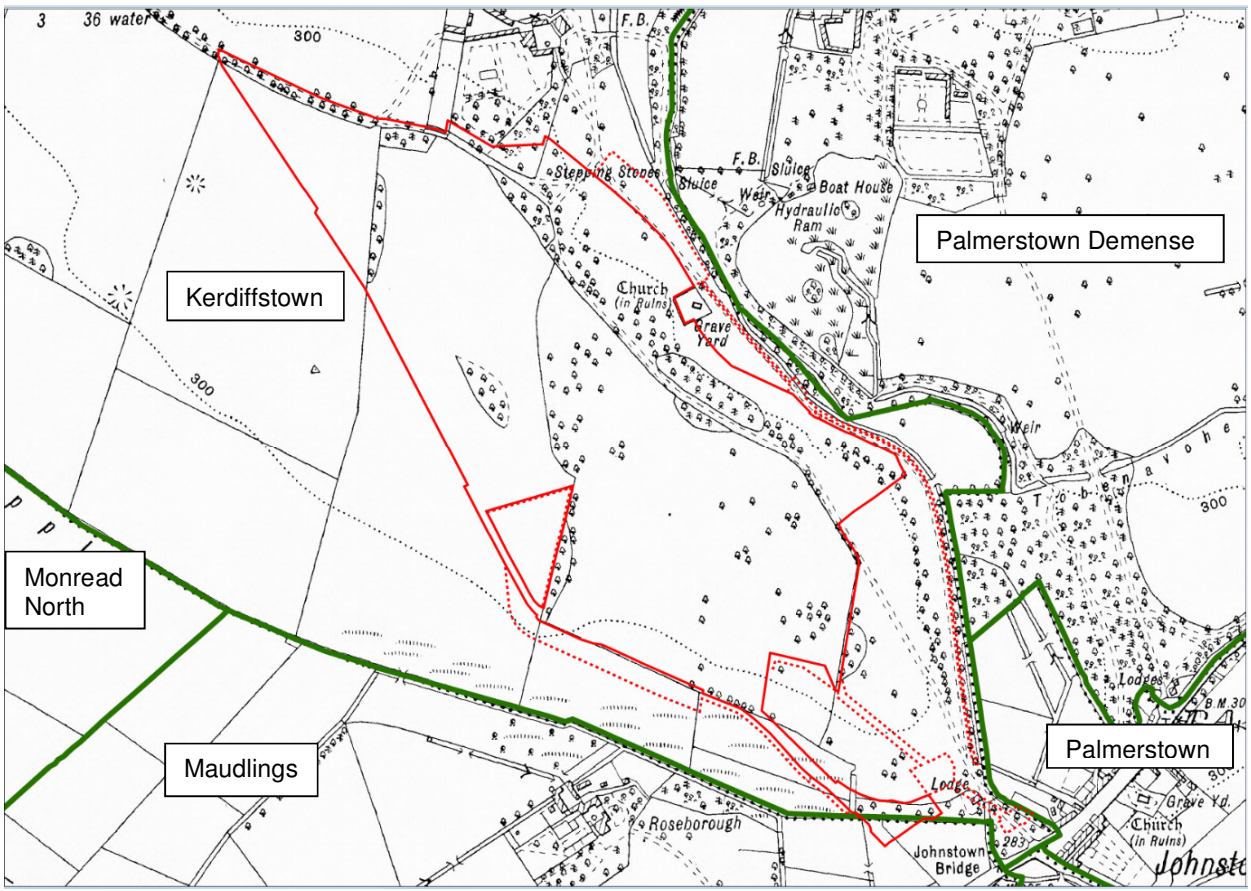


Diagram 10.3: Extract from the 1910 OS Map Showing the proposed Project Area and Townland Boundaries

County Development Plan

The Kildare County Development Plan 2017–2023 recognises the statutory protection afforded to all RMP sites under the National Monuments Legislation (1930–2004). The development plan lists a number of aims and objectives in relation to archaeological heritage (refer to Appendix A10.5). Table 10.3 provides details on recorded archaeological sites within 500m of the proposed Project, full records from the National Monuments Service are provided in Appendix A10.3 and marked on Figure 10.1.

Table 10.3: Recorded Archaeological Sites within 500m of proposed Project

Site ID	Statutory Status	Townland	Classification	Distance to Site boundary
KD019-018	RMP	Kerdiffstown	Mound	0m
KD019-006001-4	RMP	Kerdiffstown	Church, graveyard & two grave slabs	To the immediate east
KD019-067	RMP	Palmerstown Demesne	Architectural fragment	145m north-east
KD019-059	RMP (and RPS)	Mauldings	Standing stone	360m south-east
KD0190014001-4	RMP	Palmerstown Demesne	Church, graveyard, font, graveslab	425m east-south-east
KD019-064	RMP	Palmerstown Demesne	Mill	460m north-east

Aerial Photographic Analysis

A review of the aerial photographic coverage of the proposed Project area (OSI, Google Earth and Digital Globe and a high resolution aerial survey flown in 2016) has shown that the development area has been subject to continuing modern disturbance. No previously unrecorded sites of archaeological potential were noted within the surrounding landscape.

Field Inspection

The field inspection sought to assess the site, its previous and current land use, the topography and whether any areas or sites of archaeological potential were present. During the course of the field investigation the proposed Project area and its surrounding environs were inspected for known or previously unknown archaeological sites.

A majority of the proposed Project area was formerly in use as a quarry before being used as a landfill site. As such the entire site has been subject to significant quarrying and disturbance (Photo 10.1-Photo 10.3). No areas of archaeological potential were noted within the proposed Project area.

The western part of the proposed Project area is formed by a small triangular field which contains the recorded site of a mound (KD019-018) The location of the site is visible from the proposed Project, between bunds that form the western boundary. The area is characterised by a field of rough pasture and does not possess any surface expression of a mound.

Photo 10.1: Proposed Project area, facing west

Photo 10.2: Proposed Project area, facing south-east

Photo 10.3: Northern-end of proposed Project area, facing south-east

To the immediate east of the proposed Project area is a recorded church and graveyard, along with two grave slabs (KD019-006001-4). This was previously incorporated in the demesne associated with Kerdiffstown House, as a landscape feature. However, today the site is located at the foot of a man-made slope associated with the former landfill site. It is surrounded with trees and the graveyard is very overgrown. The western gable of the church is clearly visible from the access drive to Kerdiffstown House (Photo 10.4) and the surrounding vegetation has enabled the preservation of its current landscape context to a degree.

Photo 10.4: Church and Graveyard (KD019-006001-4), facing west

To the north of the recorded church site it is intended to realign the existing drive that provides access to Kerdiffstown House, Here the drive is characterised by a tarmac road way running through level pasture, with the Morell River to the east. The river is flanked by mature trees.

At the southern end of the proposed Project area, the proposed leachate and foul sewer pipelines will run from the existing landfill site in a south-easterly direction before passing beneath the existing N7. The pipeline wayleave will cross a section of surviving demesne landscape associated with Kerdiffstown House. This includes a semi-circular clump of trees apparent on the early 20th century OS map. Here the existing pasture falls away to the south. The original southern boundary of the demesne has been removed and replaced with modern boundary treatments, due to the construction of the N7.

With the exception of the recorded archaeological sites, no specific features of archaeological potential were noted. However, works within the vicinity of the Morell River will be located within a landscape that possesses a general archaeological potential, due to the activity that water courses have attracted since the prehistoric periods.

10.3.2 Architecture

Built heritage refers to all built features in the environment including buildings and other structures such as harbours, bridges, and wells. These sites have been identified through consultation with the County Development Plan 2017–2023, National Inventory of Architectural Heritage (NIAH) and through cartographic analysis and field inspection.

Background

The built heritage within the landscape surrounding the proposed Project area is typified by large country manors and associated demesne landscapes. The 18th century, a relatively peaceful period, saw the large-scale development of demesnes and country houses in Ireland. Demesnes were dominant features of the rural landscape throughout the 18th and 19th centuries. The large country house was only a small part of the overall estate of a large landowner and provided a base to manage often large areas of land that could be located nationwide. Lands associated with the large houses were generally turned over to formal gardens, which were much the style of continental Europe. Gradually this style of formal avenues and geometric garden designs was replaced during the mid-18th century by the adoption of parkland landscapes – to be able to view a large house

within a natural setting. Although the creation of a parkland landscape involved working with nature, rather than against it, considerable constructional effort went into their creation. Earth was moved, field boundaries disappeared, streams were diverted to form lakes and quite often roads were completely diverted to avoid travelling anywhere near the main house or across the estate.

In 1837 Lewis described Johnstown as a neat village consisting of c. 13 houses and 101 inhabitants. At this time the village contained a constabulary police station, an inn and two flour-mills, which were the property of the Earl of Mayo. Palmerston Demesne borders the village to the north. Palmerstown House, a large mansion, was built by the Earl of Mayo in 1872 to the design of James Wyatt. The house is located approximately 690m north-east of the proposed Project. This replaced an earlier house, which was marked on the first edition OS map approximately 390m north-east of the proposed Project. The 1872 house, now restored, was burnt during the 1920s. The main entrance to Palmerstown Demesne, consisting of high stone estate walls and recessed gates (RPS B19-10, NIAH 11812027) were relocated during the construction of the N7 Naas Road in the mid 1960's. Both the house and the entrance are listed as protected structures.

Kerdiffstown House, in the demesne adjacent to the proposed Project area, is an impressive early 19th century three-storey, stone-built house with rusticated brick surrounds to the windows (Bence-Jones 1978). The house is located approximately 150m north of the site and is a protected structure (B19-023). A Kerdiff family has been recorded within the Naas area since the 16th century, although the house dates to the first half of the 19th century. However, an earlier house is marked within the 18th century mapping of the landscape, suggesting an earlier house once occupied the site of the current house. In 1883 the Kerdiffstown estate consisted of 3,088 acres. In the 1901 Census Hans Hendrick Aylmer is recorded as inhabiting the house. The Aylmers had a governess for their three children, Muriel (11), Violet (9) and Gerald (3). During this time the house was recorded as having six rooms and 29 windows in the front; 12 stables, three coach-houses, a harness room, three cow houses, six calf houses, two piggeries, a dairy, a barn and two sheds. The mansion, along with 600 acres of land was sold by Lt. Colonel Richard M. Aylmer, in March 1938, to the Dominican Order of Nuns. It subsequently became a convent and a Chapter Room and Sacristies were also added. Since the late 1960s the house has been under the ownership of the Society of Saint Vincent de Paul.

Vernacular architecture is defined in James Steven Curl's Encyclopaedia of Architectural Terms as '*a term used to describe the local regional traditional building forms and types using indigenous materials, and without grand architectural pretensions*', i.e. the homes and workplaces of the ordinary people built by local people using local materials. This is in contrast to formal architecture, such as the grand estate houses of the gentry, churches and public buildings, which were often designed by architects or engineers. The majority of vernacular buildings are domestic dwellings. Examples of other structures that may fall into this category include shops, outbuildings, mills, lime kilns, farmsteads, forges, gates and gate piers. No obvious structures of this type are shown in the OS maps of the proposed Project area.

Industrial development and rapid social and political change during the 19th century initiated a new phase of building throughout rural and urban areas. This included advances in infrastructure, with the construction of the Royal and Grand Canals and the railway network and associated bridges and railway stations, the erection of mills, distilleries and other industrial buildings. The commencement of the Grand Canal in 1756 and the Royal Canal in 1789 helped sustain urban and industrial growth in 18th century Kildare. The canal provided conveyance for corn, coal and turf for the supply of the surrounding neighbourhood. A branch of the Grand Canal, completed in 1789, commencing to the south of Sallins, passed through Naas. The canal passes approximately 550m to the north of the proposed Project at its closest point as it approaches Sallins.

The route of the N7 functioned as a turnpike road in the 18th and 19th century. Taylor and Skinner's Maps of the Roads of Ireland shows the turnpike road between Dublin and Naas in the late 18th century, with 16 milestones marked and numbered. The 13th milestone, located at the south-east corner of Palmerstown Demesne on the north side of the road was recently discovered during an earlier phase of work on the N7 widening. Although the Ordnance Survey six-inch maps mark the location of the stones from the late 19th century onwards, many of the milestones pre-date these later edition OS maps. The majority of the Irish milestones were laid out in the 18th and 19th centuries, during which period roads were the responsibility of the Grand Juries; the Turnpike Trusts, and later, the Post Office.

Cartographic Analysis

See the text on Cartographic Analysis under Section 10.3.1Archaeology.

County Development Plan

The Kildare County Development Plan 2017-2023 was reviewed as part of this assessment. The development plan lists a number of aims and objectives in relation to architectural heritage (Appendix A10.6). County Kildare has a wealth of structures of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. Such features are contained in the Record of Protected Structures (RPS). County Kildare boasts a large number of country houses and demesnes where the grounds and settings constitute an intrinsic element of their character.

There are no Protected Structures located within the area of the proposed Project although nine structures are situated within a 500m radius. The nearest of these comprises of Kerdiffstown House, located approximately 150m north of the proposed Project. With the exception of one site, standing stone (RPS B19-15) all of the Recorded Protected Structures are also included in the NIAH survey (Table 10.4). The structures are described in detail in Appendix A10.7 and marked on Figure 10.1.

Table 10.4: Recorded Protected Structures (RPSs)

RPS No. NIAH No.	Statutory Status	Townland	Classification	Distance to Site
RPS - B19-23 NIAH - 11812025	RPS	Kerdiffstown	Kerdiffstown House	150m north
RPS – B19-23 NIAH - 11812022	RPS	Kerdiffstown	Kerdiffstown House entrance	210m south-east
RPS – B19-22 NIAH - 11812020	RPS	Maudlings	Johnstown House	340m south-east
RPS – B19-15	RPS (and RMP)	Mauldlings	Standing stone	360m south-east
RPS – B19-37 NIAH 11812004	RPS	Palmerstown Demesne	Former houses within Johnstown Village	360m south-east
RPS – B19-39 NIAH 11812029	RPS	Palmerstown Demesne	House within Johnstown Village	370m south-east
RPS B19-38 NIAH 11812012	RPS	Palmerstown Demesne	House within Johnstown Village	375m south-east
RPS – B19-21 NIAH - 11812011	RPS	Palmerstown Demesne	Former RIC Barracks	385m east-south-east
RPS – B19-20 NIAH - 11812007	RPS	Palmerstown Demesne	House within Johnstown Village	425m east-south-east

National Inventory of Architectural Heritage (NIAH)

A review of both the architectural survey and garden survey was undertaken as part of this assessment. An area up to 500m that surrounds the proposed Project was examined in order to identify any buildings or areas of architectural significance. The results of this survey are summarised below.

There are 20 structures located within the vicinity of the site that are recorded in the NIAH survey. Of these eight structures are also protected structures. Whilst the remainder are not subject to statutory protection, they may be added to the RPS by the Local Authority and as such should be considered as cultural heritage constraints. The nearest NIAH structure is Kerdiffstown House, located approximately 150m north of the proposed Project (refer to Figure 10.1).

Table 10.5: National Inventory of Architectural Heritage (NIAH)

Site ID	Statutory Status	Townland	Classification	Distance to Site
NIAH 11812025	RPS	Kerdiffstown	Kerdiffstown House	150m north
NIAH 11812022	RPS	Kerdiffstown	Kerdiffstown House entrance	210m south-east
NIAH 11812028	No	Maudlings	Entrance gates to Roseborough House	300m south
NIAH 11812018	No	Johnstown, Mauldings & Kerdiffstown	Bridge	315m south-east
NIAH 11812017	No	Palmerstown Demesne	House within Johnstown Village	335m south-east
NIAH 11812020	RPS	Maudlings	Johnstown House	340m south-east
NIAH 11812015	No	Palmerstown Demesne	House within Johnstown Village	350m south-east
NIAH 11812010	No	Palmerstown Demesne	Outbuilding within Johnstown Village	350m south-east
NIAH 11812008	No	Palmerstown Demesne	Former stables within Johnstown Village	360m south-east
NIAH 11812004	RPS	Palmerstown Demesne	Former houses within Johnstown Village	360m south-east
NIAH 11812013	No	Palmerstown Demesne	Water pump within Johnstown Village	365m south-east
NIAH 11812029	No	Palmerstown Demesne	House within Johnstown Village	370m south-east
NIAH 11812005	No	Palmerstown Demesne	Former Coaching Inn within Johnstown Village	370m south-east
NIAH 11812012	RPS	Palmerstown Demesne	House within Johnstown Village	375m south-east
NIAH 11812011	RPS	Palmerstown Demesne	Former RIC Barracks	385m east-south-east
NIAH 11812002	No	Palmerstown Demesne	School within Johnstown Village	400m east-south-east
NIAH 11812001	No	Palmerstown Demesne	House within Johnstown Village	400m east-south-east
NIAH 11812006	No	Palmerstown Demesne	Cobbling within Johnstown Village	410m east-south-east
NIAH 11812009	(RMP)	Palmerstown Demesne	Church	425m east-south-east
NIAH 11812007	RPS	Palmerstown Demesne	House within Johnstown Village	425m east-south-east

Three demesne landscapes are located within 500m of the proposed Project. These are also recorded in the NIAH Garden Survey.

Kerdiffstown House demesne (NIAH garden Ref.: KD-49-N-914226) is recorded as '*Main features unrecognisable - peripheral features visible*' within the survey. Whilst the house and entrance drive is still present, the demesne has been impacted upon by quarrying activity that formerly took place within the proposed Project area.

Palmerstown House demesne (NIAH garden Ref.: KD-49-N-916226) is recorded as '*Main features substantially present - peripheral features unrecognisable*' and is located directly east of Kerdiffstown House demesne. Today, whilst the principal structure and outbuildings are still present, the southern part of the demesne has been impacted upon by the widening of the N7 and the demesne now contains a golf course.

Roseborough House (NIAH garden Ref.: KD-49-N-914215) is located approximately 130m south of the proposed Project area. It is recorded within the survey as '*Main features substantially present - peripheral features unrecognisable*'. The principal structure is present but the southern side of the demesne has been impacted upon by the widening of the N7.

Field Inspection

The field inspection sought to assess the proposed Project area and whether any structures of architectural merit survive in or within the immediate vicinity of it.

The proposed Project area was formerly in use as a quarry before being used as a landfill site. As such the entire site has been subject to significant quarrying and disturbance (Photo 10.1-Photo 10.3). No structures are

marked on the historical mapping within the site and those structures that are present today relate to the use of the site as a landfill and are of no architectural heritage merit.

The proposed Project area is located within part of the demesne formerly associated with Kerdiffstown House, but no features relating to that landscape survive within the site. Remains of the demesne do survive to the east, including the driveway (Photo 10.5) and relocated entrance (moved after N7 expansion). This entrance, despite it not being in-situ is also a protected structure (RPS B19-23) (Photo 10.6). The adjacent lodge is a modern structure.

At the southern end of the proposed Project area, the proposed leachate and foul sewer pipelines will run from the existing landfilled site in a south-easterly direction before passing beneath the existing N7. The pipeline wayleave will cross a section of surviving demesne landscape associated with Kerdiffstown House. This includes a semi-circular clump of trees apparent on the early 20th century OS map. Here the existing pasture falls away to the south. The original southern boundary of the demesne has been removed and replaced with modern boundary treatments, due to the construction of the N7.

Photo 10.5: Kerdiffstown House demesne, facing south with the proposed Project area visible as an artificial hill in the background

Kerdiffstown House (RPS B19-23) is situated approximately 150m north of the proposed Project. It survives in good condition and is currently owned by the charity Society of Saint Vincent de Paul. The main elevation of the house faces north-east and there is a convent chapel to the south, with outbuildings to the west and the remains of walled gardens to the west and south-west. These abut the north-eastern boundary of the proposed Project (Photo 10.7 and Photo 10.8). Generally, the house and grounds are overlooked by the man-made mound that dominates the proposed Project area.

Within the wider landscape, Johnstown House (RPS B19-22) is screened from the proposed Project area by a mature demesne landscape. This is also the case for Roseborough House. The house, which is not a protected structure, but still of merit, is located within a mature demesne approximately 225m south of the proposed Project area. The remaining protected structures within Johnstown Village are not discernible from the proposed Project area. This is mostly due to the present of the M7, which travels between the village and the proposed Project.

Photo 10.6: Entrance to Kerdiffstown House (RPS B19-23), facing north-north-west

Photo 10.7: Kerdiffstown House, facing north-west

Photo 10.8: Kerdiffstown House, convent chapel and outbuildings, facing north-north-west

10.3.3 Cultural Heritage

The proposed Project is located within the townland and parish of Kerdiffstown. A very small section of the scheme extent is located in Maudlings. The surrounding townlands consist of Palmerstown, Palmerstown Demesne, Maudlings, Sallins and Sherlockstown located within the parishes of Naas, Johnstown, Sherlockstown and Bodenstown in the Barony of North Naas and South Salt, County Kildare. The boundaries are marked on Diagram 10.3.

Placename Analysis

Townland and topographic names are an invaluable source of information on topography, land ownership and land use within the landscape. They also provide information on history; archaeological monuments and folklore of an area. A place name may refer to a long forgotten site, and may indicate the possibility that the remains of certain sites may still survive below the ground surface. The Ordnance Survey surveyors wrote down townland names in the 1830's and 1840's, when the entire country was mapped for the first time. Some of the townland names in the study area are of Irish origin and through time have been anglicised. The main reference used for the place name analysis is Irish Local Names Explained by P.W Joyce (1870).

As discussed previously placenames such as Palmerstown, Palmerston or Palmershill and Maudlings are often associated with leper hospitals (Lee, 1996). It is likely that the name Kerdiffstown directly relates to the Kerdiff family that formerly inhabited the Naas area. This may be the case for Sherlockstown too. The name Sallins possibly derives from the word *Sailín*, meaning 'a little heel, or projection'.

Townlands

The townland is an Irish land unit of considerable longevity as many of the units are likely to represent much earlier land divisions. However, the term townland was not used to denote a unit of land until the Civil Survey of 1654. It bears no relation to the modern word 'town' but like the Irish word *baile* refers to a place. It is possible that the word is derived from the Old English *tun land* and meant '*the land forming an estate or manor*' (Culleton 1999, p.174).

Gaelic land ownership required a clear definition of the territories held by each sept and a need for strong, permanent fences around their territories. It is possible that boundaries following ridge tops, streams or bog are more likely to be older in date than those composed of straight lines (*ibid.* p.179).

The vast majority of townlands are referred to in the 17th century, when land documentation records begin. Many of the townlands are mapped within the Down Survey of the 1650s, so called as all measurements were carefully 'laid downe' on paper at a scale of forty perches to one inch. Therefore, most are in the context of pre-17th century landscape organisation (McErlean 1983, p.315).

In the 19th century, some demesnes, deer parks or large farms were given townland status during the Ordnance Survey and some imprecise townland boundaries in areas such as bogs or lakes, were given more precise definition (*ibid.*). Larger tracks of land were divided into a number of townlands, and named Upper, Middle or Lower, as well as Beg and More (small and large) and north, east, south and west (Culleton 1999, p.179). By the time the first Ordnance Survey had been completed a total of 62,000 townlands were recorded in Ireland.

There are no townland boundaries crossing the proposed Project area. The boundaries between the adjacent townlands of Maudlings and Palmerstown Demesne are formed by existing watercourses.

10.4 Predicted Impacts

10.4.1 Remediation Phase

Archaeological Heritage

It is possible that ground disturbances associated with the proposed remediation works, such as the construction of a playing pitch, may have a significant or profound negative impact on the site of a recorded mound (KD019-018) located in the western part of the proposed Project area. However, the location of this site is uncertain, as it may have been removed by quarrying activity in the 1950s. No definite archaeological anomalies were identified within this area during the geophysical survey.

It is possible that ground disturbances associated with the realignment of the driveway and insertion of drainage swales to the immediate north and south of the boundary that surrounds the recorded church site (KD019-006001-4) may have a significant or profound negative impact on associated remains that may survive beneath the existing ground level with no surface expression. The driveway realignment is located c. 25m north of the church, whereas the drainage swales are located c. 26m south-west of the church. Such buried remains may include burials or the foundations of additional structures. In addition, the movement of plant within this area has the potential to have a direct and negative impact on the upstanding remains of the church and associated graveyard.

It is possible that the insertion of a surface water outfall pipeline into the Morell River may have a significant or profound negative impact on any archaeological features, deposits or artefacts that have the potential to survive within this area due to the presence of the water course.

It is possible that ground disturbances associated with the insertion of the pipeline routes through the southern part of the Kerdiffstown demesne, may have a significant or profound negative impact on any archaeological remains that may survive beneath the existing ground level with no surface expression.

No direct or indirect impacts are predicted upon the remaining four recorded archaeological sites located within the receiving environment surrounding the proposed Project.

Architectural Heritage

No potential impacts are predicted upon the built architectural resource as part of the proposed remediation works. No structures of architectural heritage significance are located within the existing site. The closest protected structures and NIAH structures are Kerdiffstown House (located approximately 150m to the north) and the relocated entrance to Kerdiffstown House (located approximately 210m to the south-east).

As part of the proposed works, the driveway through Kerdiffstown Demesne will be subject to realignment. It will be moved a maximum of 15m to the north-east of its current position and will run parallel with the former drive way. This modification is minor and does not affect the character of the demesne as it exists today and is deemed to be neutral. Views of Kerdiffstown House from the approach will not be affected.

Cultural Heritage

No potential impacts are predicted upon the cultural heritage resource as part of the proposed remediation works (other than those outlined above).

10.4.2 Operational Phase

Archaeological Heritage

It is predicted that the Operational Phase will have a significant positive impact on the archaeological resource surrounding the proposed Project area, including the church and graveyard (KD019-006001-4). This would be due to the reduction and stabilisation of slopes surrounding the structure and visual improvement of the landscape from a former quarry/ waste facility to recreational grounds.

Architectural Heritage

It is predicted that the Operational Phase will have a significant positive impact on the architectural resource surrounding the proposed Project area, including Kerdiffstown House and entrance (RPS B19-23). This would be due to the visual improvement of the landscape from a former quarry/ waste facility to recreational grounds.

It is predicted that the Operational Phase will also have a significant positive impact on the cultural heritage resource surrounding the proposed Project area, including Kerdiffstown House demesne and the other surrounding demesne landscapes. This would be due to the visual improvement of the landscape from a former quarry/ waste facility to recreational grounds.

Cultural Heritage

No potential impacts are predicted upon the cultural heritage resource as part of the operation of the proposed Project (other than those outlined above).

10.5 Mitigation Measures

Archaeological Heritage

A programme of archaeological testing shall be carried out within the small area of greenfield in the western section of the proposed Project area, which contains the recorded mound (KD019-018). This shall be undertaken under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).

A limited programme of archaeological testing shall be carried out to the immediate north and south of the recorded church site, within the footprint of the proposed works due to the proximity of the church and the potential for these areas to contain buried archaeological remains. This investigation will be carried out under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA). The standing remains of the church and graveyard shall be fenced off with non-intrusive fencing during the course of remediation works in this area, in order to prevent inadvertent impacts with plant and equipment.

An archaeological wade survey shall be carried out at the proposed location of the surface water outfall point into the Morell River. This investigation will be carried out under licence to the DoAHRRGA. Full provision shall

be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).

All topsoil stripping associated with the proposed remediation works, including the surface water outfall pipeline and pipelines through the southern part of Kerdiffstown demesne, shall be monitored by a suitably qualified archaeologist. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).

10.6 Residual Impacts

Once all of the above mitigation measures are carried out, there will be no residual impacts upon the archaeological, architectural and cultural heritage resource.

10.7 Difficulties Encountered in Compiling Information

No difficulties were encountered during the compilation of this EIAR.

10.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on archaeology, cultural heritage and architectural heritage.

10.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

10.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

10.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future) are anticipated.

10.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development

proposed the cumulative impacts from the housing development project and the proposed Project no cumulative impacts are anticipated.

10.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact. It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

10.9 References

- Bence-Jones, M. (1978). Burke's Guide to Country Houses. Volume I, Ireland. London. Burke's Peerage.
- Bennett, I. (ed.) (1987–2016). Excavations: Summary Accounts of Archaeological Excavations in Ireland. Bray. Wordwell.
- Byrne, F. J. (1973). Irish Kings and High Kings. London.
- Buckley, L. (2008). Outcasts, or Care in the Community? *Archaeology Ireland*, 22 (1), 26–31.
- Culleton, E. (1999). Celtic and Early Christian Wexford. Dublin. Four Courts Press.
- Curl, J.S. (1997). Encyclopaedia of Architectural Terms. Donhead Publishing.
- Department of Arts, Heritage, Gaeltacht and the Islands (1999a). Framework and Principles for the Protection of the Archaeological Heritage. Dublin. Government Publications Office.
- Department of Arts, Heritage, Gaeltacht and the Islands (1999b). Policy and Guidelines on Archaeological Excavation. Dublin. Government Publications Office.
- Edwards, N. (1996). The Archaeology of Early Medieval Ireland. Routledge. London.
- Environmental Protection Agency (2015). Advice Notes for preparing Environmental Impact Statements (DRAFT Sept. 2015). Dublin, Government Publications Office.
- Environmental Protection Agency (2015). Revised Guidelines on the Information to be contained in Environmental Impact Statements (DRAFT Sept. 2015). Dublin: Dublin: Government Publications Office.
- Harbison, P. (1992). Guide to the National and Historic Monuments of Ireland. Dublin. Gill and Macmillan.
- Institution of Field Archaeologists (2014a). Standards & Guidance for Field Evaluation.
- Institution of Field Archaeologists (2014b). Standards & Guidance for Archaeological Excavation.
- Institution of Field Archaeologists (2014c). Standards & Guidance for an Archaeological Watching Brief (Monitoring).
- Kildare County Development Plan 2011–2017.
- Kildare County Development Plan 2017–2023
- Lee S.C., G. A. (1996). Leper Hospitals in Medieval Ireland. Dublin. Four Courts Press.
- Lewis, S. (1837). Topographical Dictionary of Ireland [Online] Available from www.libraryireland.com [Accessed 25 August 2016]
- National Inventory of Architectural Heritage Handbook (2011) [Online] Available from http://www.buildingsofireland.ie/Resources/NIAHHandbook/NIAH%20Handbook%20Edition%20July%202011.pdf [Accessed 25 August 2016]
- National Monument Section, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs. Sites and Monuments Record, County Kildare.
- National Museum of Ireland. Topographical Files, County Kildare.
- O'Farrell P. (2003). A History of County Kildare. Gill & MacMillan. Dublin.
- O Lochlainn, C. (1940). Roadways in Ireland. In J. Ryan (ed.), *At the Sign of the Three Candles: Essays and Studies Presented to Professor Eoin MacNeill*, 465–74. Dublin.
- Stout, M. (1997). The Irish Ringfort. Dublin. Four Courts
- Stout, G. and Stout, M. (1997). Early Landscapes: from Prehistory to Plantation. In F.H.A. Aalen et. al. (eds), *Atlas of the Irish Rural Landscape*. Cork. Cork University Press.

Cartographic Sources

- Sir William Petty, Down Survey Map, *Barony of Naas and Salt* (c. 1655)
- Noble and Keenan's *Map of County Kildare* (1752)

- Alexander Taylor's *A Map of the County of Kildare* (1783)
- Ordnance Survey maps of County Kildare (1839, 1871 and 1910)

Electronic Sources

- Bennett, I. Summary of archaeological excavation from 1970-2016 [Online] Available from www.excavations.ie [Accessed 25 August 2016]
- McCabe, S. (2002). 'Johnstown, 02E1820', Excavations.ie Bulletin, 2002:0915 [Online] Available from www.excavations.ie/Pages/Details.php?Year=&County=Kildare&id=8260
- O'Donnchadha, B. (2003a). 'Naas/Johnstown/Kill, 03E1257', Excavations.ie Bulletin, 2003:963 [Online] Available from www.excavations.ie/Pages/Details.php?Year=&County=Kildare&id=9791
- O'Donnchadha, B. (2003b). 'Kerdiffstown, 03E1261', Excavations.ie Bulletin, 2003:917 [Online] Available from http://www.excavations.ie/report/2003/Kildare/0009960/
- O'Donnchadha, B. (2003c). 'Kerdiffstown, 03E1262', Excavations.ie Bulletin, 2003:918 [Online] Available from http://www.excavations.ie/report/2003/Kildare/0009961/
- O' Donovan, E. (2002). 'Kerdiffstown, 03E1527', Excavations.ie Bulletin, 2003:920 [Online] Available from http://www.excavations.ie/report/2003/Kildare/0009962/
- O' Carroll, F. (2003). 'Johnstown Bridge, Johnstown, 02E1838', Excavations.ie Bulletin, 2002:0916 [Online] Available from www.excavations.ie/Pages/Details.php?Year=&County=Kildare&id=8261
- O' Ríordáin, B. (1998). 'Main Street Johnstown, 98E0113', Excavations.ie Bulletin, 1998:313 [Online] Available from www.excavations.ie/Pages/Details.php?Year=&County=Kildare&id=1241
- DoAHRRGA website listing all SMR sites with aerial photographs. Available from www.archaeology.ie [Accessed 25 August 2016]
- NIAH website listing the result of the County Kildare architectural and garden survey Available from www.buildingsofireland.ie [Accessed 25 August 2016]
- Ordnance Survey aerial photographs dating to 1995, 2000 & 2005 and 6-inch/25-inch OS maps. Available from www.osiemaps.ie [Accessed 25 August 2016]
- www.googleearth.com – Aerial photographs of the proposed Project area. [Accessed 25 August 2016]
- www.booksulster.com/library/plnm/placenamesC.php - Contains the text from Irish Local Names Explained by P.W Joyce (1870). [Accessed 25 August 2016]
- www.bingmaps.com – Aerial photographs of the proposed Project area. [Accessed 25 August 2016]
- www.svp.ie/What-We-Do/Holiday-Centres/Kerdiffstown-House.aspx - History of Kerdiffstown House. [Accessed 25 August 2016]

Legislation

- Convention for the Protection of Architectural Heritage (Granada Convention), 1985
- European Communities (Environmental Impact Assessment) Regulations, 1989
- Local Government (Planning and Development) Act (1963-1999)
- National Cultural Institutions Act, 1997
- National Monuments Act (1930-2014)
- Planning and Development Act, 2000

11. Biodiversity

This Chapter assesses any potential effects the proposed Project may have on biodiversity and the ecological environment in and around the proposed Project location. The proposed Project is not situated within or next to any European sites and there are no Qualifying Interest (QI) habitats or species of any SAC or SPA within the Zone of Influence (ZoI) of the proposed Project.

There are a number of potential impacts to biodiversity associated with the Remediation Phase of the proposed Project. These include habitat loss, severance, mortality, disturbance and contamination, with the majority of these impacts being generally short-term in nature and often significant in the absence of mitigation. As a result, a number of appropriate mitigation measures are proposed in order to reduce impacts to biodiversity as far as is reasonably practicable, including appropriate scheduling of works; protection of certain trees; translocation of certain species; and the halting of any site discharge to surface waters throughout the remediation works. A number of the mitigation measures identified will need supervision by, or liaison with, a suitably qualified ecologist.

Predicted Operational Phase impacts include impacts to water quality and aquatic fauna associated with the new surface water outfall into the Morell River, as well as impacts to fauna from the new public park lighting. A series of mitigation measures and opportunities for future enhancement have been proposed in order to improve the biodiversity of the proposed multi-use public park. Such mitigation and enhancement includes but is not limited to water quality monitoring; replacement of habitats lost during remediation through planting of new flora; installation of nest boxes and reptile hibernacula; and avoidance of lighting in particularly sensitive areas. The proposed Project has the potential to benefit and contribute to the overall biodiversity of the area. In particular habitats will be created and/or enhanced, particularly wetland habitats to the benefit of species associated with such habitats.

11.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") on the ecological environment anticipated to occur during the Remediation and Operational Phases.

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

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 11.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

Table 11.1: Summary of Key Activities during the Remediation and Operational Phases

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

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

11.1.1 Consideration of European Sites

Regarding European sites, which comprise Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), all potentially significant impacts are assessed in this Chapter. "European site" replaced the term "Natura 2000 site" under the EU Environmental Impact Assessment and Habitats Regulations 2011 (S.I. No. 473 of 2011). There are currently no SACs in Ireland. All remain 'candidate' (cSAC) until the European Commission approves and ratifies the final list of cSACs. cSACs are afforded the same protection as SACs. The process of making cSACs SACs by means of Statutory Instrument has begun. While this process is ongoing the term SAC will be used, in conformance with nomenclature used in National Parks and Wildlife Service (NPWS) databases.

A Screening for Appropriate Assessment was completed in March 2017. The screening concluded that an Appropriate Assessment is not required as it can be excluded, on the basis of objective scientific information, and in light of the conservation objectives of relevant sites, that the proposed Project, either individually or in combination with other plans or projects, could have likely significant effects on any European site.

11.1.2 Location of Proposed Project

The site is located in County Kildare, approximately 3km north-east of central Naas and approximately 400m north-west of Johnstown village as shown on Figure 3.1. To the north-east are lands associated with Kerdiffstown House and to the north is a golf course. The western boundary of the proposed Project comprises of the L2005 Kerdiffstown Road, from Sallins to Johnstown, which includes some residential properties that are

adjacent to the southern end of the proposed Project. To the west of Zone 1 of the proposed Project is a worked out quarry.

Land use around the remainder of the site principally comprises agricultural and pasture fields grazed by horses. There are a number of waterbodies in the vicinity of the proposed Project. The Morell River (WB005) is located approximately 15m to the east of proposed Project at its nearest point, contained in a woodland corridor. South-east of the site, the Rathmore Stream also known as the Hartwell River (WB006) joins the Morell, while further north the Mill Race watercourse (WB007) departs from the Morell River. There are also a number of lakes/ponds associated with the Palmerstown House Estate & Golf Course (WB001 and WB002), which lie approximately 100m to the east of the proposed Project. The Canal Feeder Stream (WB004) is an engineered feature that collects surface water runoff from lands generally to the south and south-west of the site. The Canal Feeder Stream flows generally westward to the Grand Canal proposed Natural Heritage Area (pNHA) which is located approximately 2km west of the site. Waterbodies in the vicinity of the proposed Project are shown in Figure 13.2. There are no European sites within or abutting the proposed Project.

Habitats within the site in particular dominant habitats including scrub and grassland are growing directly on uncapped waste with very shallow ground and soil cover, interspersed with protruding rebar and processed plastics.

11.1.3 The Proposed Project Description

The proposed Project is described in detail in Chapter 4 Description of the Proposed Project. In summary, the proposed Project involves the remediation of a former landfill and waste processing facility. The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site, see Section 4.3.1 for details on the outline phasing of the works. The end-use proposal for the site is a multi-use public park with multi-use sports pitches, changing rooms, a children's playground, etc. (the Operational Phase). To facilitate remediation and the end-use and for the purposes of this assessment the entire site has been deemed to be at risk of development, including the removal of all surface cover/vegetation, which may include the removal of some mature boundary trees (dependant on slope stability). Outline Remediation Phasing is shown on Figure 4.8 and Figure 4.9.

11.1.4 Scope of the Assessment

Impacts Assessed in Full

Various elements of the proposed Project could give rise to potentially significant impacts on ecological receptors, and have informed the delineation of the Zone of Influence (ZoI). Different potential impacts will arise during Remediation and Operational Phases, and both types of potential impacts are described in Section 11.4.

The following key impacts were assessed:

- Direct and indirect impacts during Remediation Phase including direct habitat loss, severance, mortality (including protected species), disturbance (noise and lighting) and pollution (discharge of surface water); and
- Direct and indirect impacts during Operational Phase including disturbance (from increased visitor pressure and lighting) and pollution (discharge of surface water).

11.2 Methodology

11.2.1 Guidance

The surveys undertaken to inform this Chapter followed guidance on ecological survey techniques produced by the Transport Infrastructure Ireland [formerly National Roads Authority (NRA)] (NRA, 2009a, 2009b). Whilst NRA guidelines were originally written for the assessment of ecological impacts of road schemes, the survey techniques employed and potential impacts on protected species do not vary greatly between road and non-

road projects and therefore can be applied across various project types. A list of guidance used in the assessment is provided in Appendix A11.1 and summarised below;

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- Chartered Institute of Ecology and Environmental Management (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland -–Terrestrial, Freshwater, and Coastal;
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust: London (Collins, J. (ed.) (2016));
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016); and
- Good Practice Guidelines for Developers. Biodiversity and Development in County Kildare. Kildare Heritage Series 2. An Action of the County Kildare Heritage Plan.

11.2.2 Relevant Legislation, Policy and Guidelines

The assessment detailed in this Chapter was carried out in accordance with the relevant legislation, policy and guidelines as set out in Appendix A11.1.

11.2.3 Consultation

In undertaking the assessment, consideration has been given to the scoping responses and other consultation as undertaken and detailed in Table 11.2 below.

Table 11.2: Consultation Responses

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
National Parks and Wildlife Service (NPWS)	Inter-agency group meeting held on 31 March 2016	Damien Clarke (NPWS District Conservation Officer for Kildare, Laois and Offaly) noted that no Special Area of Conservation (SAC) is in close proximity to the site	Separate AA screening was undertaken to assess any potential for Likely Significant Effects (LSE) arising from the proposed Project.
Development Application Unit (DAU)	Scoping report acknowledged. Further letter sent to the DAU on 23 February 2016 to request feedback.	-	-
Inland Fisheries Ireland (IFI)	Scoping response received on the 18 November 2016	- Highlighted the importance of the Morell River and its tributaries for spawning Atlantic salmon and brown trout, lamprey and white-clawed crayfish. - Reiterated the need for implementation of comprehensive leachate and surface water management measures to avoid ecological impacts on receiving waters.	All issues raised are addressed in the EIAR and appropriate mitigation put in place to avoid any impacts on ecological interests within the Morell River and the Grand Canal.

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
An Taisce	Scoping response received on the 18 November 2016	- Any wetland habitat created will be beneficial to wildlife, use of plants of local provenance. - Where unavoidable damage to the habitats and protected species, ensure strong mitigation measures are implemented.	All issues raised are addressed in the EIAR and appropriate mitigation put in place to avoid any impacts on protected species and overall biodiversity of the site.
EPA	Scoping response received on the 18 November 2016	- In relation to Biodiversity the EPA raised concerns about the spread of invasive species (listed on Part 1 or Part 3 of the Third Schedule of the European Communities Regulations, 2011) and/or the risk of invasive species being brought on site in vector material (imported soils).	All issues raised are addressed in the EIAR and appropriate mitigation put in place to avoid the spread of invasive species or the importation of invasive species into the site via vector materials (see Chapter 4 Description of the Proposed Project).

11.2.4 Zone of Influence

Guidance on Zone of Influence

The Zone of Influence (ZoI) is the likely area over which the proposed Project could have potential impacts on a given receptor. The ZoI over which significant impacts may occur will differ for different Key Ecological Receptors, depending on the pathway. Significant impacts are deemed to be those impacts resulting in a likely change in conservation status of a Key Ecological Receptor. According to NRA Guidelines (2009a), Key Ecological Receptors (KER's) will be features of sufficient value to be material in the decision-making process for which potential impacts are likely. According to the NRA Guidelines, KER's are therefore defined as features of Local (Higher Value), County, National, or International Importance.

In their *Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland* the Chartered Institute of Ecology and Environmental Management (CIEEM) recognise that the ZoI will vary for different ecological features, depending on their sensitivity (CIEEM, 2016). The need to identify receptor-specific ZoI is also supported by guidance from the Department of Environment, Heritage and Local Government (DoEHLG) for assessing impacts in the context of Appropriate Assessment (DoEHLG, 2010; p.23, para 1).

Method to Determine Zones of Influence

The starting point for determining Zones of Influence (ZoI) is to analyse the characteristics of the proposed Project (Chapter 4 Description of the Proposed Project) and identify the range of ZoI using the source-pathway-receptor conceptual model. For instance, in the case of borehole installation affecting protected mammals during construction;

- Source(s) – e.g. Drilling.
- Pathway(s) – e.g. Vibration.
- Receptor(s) – e.g. Underground mammal resting site at risk of collapse.

As recommended by CIEEM (2016), professionally accredited or published studies have been used to determine ZoI (see Appendix A11.2). In the example above, the ZoI is 150m, based on guidance from the NRA (2006a) regarding the distance to underground otter (*Lutra lutra*) sites, within which disturbing works are likely to require licensing (NRA, 2006a). Once identified, a receptor-specific ZoI is used to determine the field survey areas (i.e. in the case above, the field survey area for underground mammal sites is 150m from piling works).

For designated sites, a slightly different approach may be employed. Initially, a single worst-case ZoI encompassing all pathways for significant impacts generates a list of preliminary sites potentially impacted. Next, the list of sites and features is revised by scoping out features based upon the receptor-specific ZoI for which the sites are designated. A ZoI is identified based on professional judgement and published studies (see Appendix A11.2 for full details).

The number of different Zones of Influence can be reduced by grouping features based on shared ecological dependencies and sensitivities. For instance, the potential risk of piling resulting in the collapse of underground resting sites in similar habitats for otter and badger (*Meles meles*), is presumed to be similar.

11.2.5 Desk Study

Extent

The desk study areas were defined differently for different ecological features, by applying the ZoI identified in Appendix A11.2. For instance, the ZoI of effects to breeding birds from the proposed Project boundary was determined to be up to 100m. However, in line with NRA guidelines (NRA 2009a), records of known bat roosts should be obtained for areas up to 1km from the boundary of the proposed Project.

Some records from the National Parks & Wildlife Service (NPWS) research branch are considered accurate only to 10km. Therefore, the desk study area for obtaining existing ecological records was set at 10km from the centre of the proposed Project (grid reference: N 91400 22051), to account for the potential spatial error associated with these ecological records.

Desktop Data Sources

Records for rare / protected species within 10km of the proposed Project site were obtained from the NPWS Research Branch on the 18 September 2015. Records were also obtained from the online database of the National Biodiversity Data Centre (NBDC). Bat roost records were obtained from Bat Conservation Ireland (BCI) for the centre of the proposed Project site to a distance of 10km on the 25 June 2016.

Key desktop sources were:

- Mapping of European site boundaries from NPWS available online at www.npws.ie;
- Mapping and aerial photography available online from Ordnance Survey Ireland (www.osi.ie) and Google Maps (http://maps.google.com/);
- Land zonings and land use plans available from the Department of the Environment, Community and Local Government available online (www.myplan.ie);
- Botanical Society of Britain and Ireland website – Species Distribution Maps available online (www.bsbi.org.uk/; accessed on various dates in 2015);
- National Biodiversity Data Centre – Species Distribution Maps available online (www.biodiversityireland.ie/; accessed on various dates in 2015);
- Data on the conservation status of species, and the distribution and ecology of such species in the full suite of all Ireland 'Red Lists';
- Habitat mapping and plant species recorded at the Kerdiffstown site in September 2011 as per the unpublished 2011 report produced by Roger Goodwillie & Associates on behalf of SKM Enviros entitled: *Remediation of Landfill at Kerdiffstown, Naas, Co Kildare. Ecological assessment*;
- Ecological walkover undertaken as part of the baseline report. SKM Enviros (2013). Kerdiffstown Landfill Environmental Baseline Report; and
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to Kerdiffstown Facility In Co. Kildare (Aquens Ltd. 2012, 2015, 2016).

11.2.6 Field Survey

A suite of ecological surveys was undertaken between September 2015 and September 2016 as summarised in Table 11.3. Surveys spanned all four seasons and covered the optimal survey periods for all flora and fauna. Surveys had due consideration for best practice guidelines published by e.g. the NRA (NRA 2009b) and the Bat Conservation Trust (BCT) (Collins 2016; Hundt 2012).

Study Area Description

For the purposes of the assessment, the 'study area' referred to throughout this Chapter extends to a series of buffers within which impacts have been assessed. The study area extends beyond the extents of the site as detailed in Table 11.3 below. Detailed habitat and faunal surveys were undertaken to include a range of buffers from the study area based on best practice guidance. The study area for the assessment ranges from the site boundary only (habitats), to buffers of 150m for species groups, given best practice guidance, species and their specific sensitivities, the ZoI of the likely sources of impact and the nature of the proposed Project. These buffers were extended based on professional judgement when and if required.

Surveys Scoped Out

As outlined in the Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report (Jacobs 2016) the requirement to assess the following ecological features has been scoped out:

- **Winter bird surveys.** Habitats found within the study area are not considered suitable to support any significant wintering bird populations due to their distance from any designated, coastal, or wetland bird habitats, and the absence of potential winter roosting habitats (e.g. reed beds, moorland).
- **Invertebrate (aquatic) / fish surveys.** The majority of aquatic habitats within the study area are artificial in nature and considered unlikely to support any aquatic invertebrates of conservation interest. However, the Morell River is likely to support a good macroinvertebrate assemblage. Water quality monitoring reports produced by Aquens were reviewed to identify the potential for any incidental records of notable aquatic invertebrate species such as white–clawed crayfish (*Austropotamobius pallipes*). The Morell River and surrounding tributaries are known to support good populations of Salmonids including Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) as well as lamprey (*Lampetra sp.*) spawning habitat. Given the nature of the proposed works (e.g. minor instream works to accommodate a new surface water outfall) additional aquatic surveys were not considered necessary, instead these species were presumed to be present and works will be undertaken to avoid impacts on these species.
- **Invertebrate surveys (terrestrial).** Terrestrial habitats within the study area are considered unlikely to support any protected invertebrate species, as the study area does not support the food plants of the protected small blue (*Cupido minimus*) and marsh fritillary (*Euphydryas aurinia*) butterflies or suitable habitat for the protected whorl snail species *Vertigo spp.*
- **Reptile surveys.** Areas of the study area provide suitable basking and refuge habitat for protected viviparous lizard (*Zootoca vivipara)*, in particular south-facing slopes and log-piles in the north-west of the site. However, as shown on historical aerial mapping much of the site was devoid of vegetation between 2003 and 2010 when the site was an operational landfill. The site has since re-vegetated and there is potential for small numbers of reptile to have recolonised from surroundings areas. However, the numbers of reptile if present are likely to be low and unlikely to be picked up in a survey. Consequently, common lizard is presumed to be present in low numbers. A precautionary mitigation plan will be prepared to potentially include targeted hand clearance of surface vegetation in areas likely to have highest lizard densities, as well as compensatory habitat creation where required.

Table 11.3: Ecology Surveys Informing the EIAR

Species / Habitat	Study Area (meters beyond site boundary)	Survey Date(s)
Habitat Survey (incl. invasive species and rare or notable flora)	0m (field to south of site, outside site boundary also surveyed)	24 September 2015
Daytime Assessment of Bat Roost Potential (trees and buildings)	50m	26 November 2015 and 10 March 2016
Bat Roost Surveys (trees and buildings with bat roost potential)	0m	Various between June – September 2016
Bat Activity Surveys using static detector recording devices (unmanned)	0m	September 2015; various between June – September 2016
Breeding Bird Survey (territory mapping)	50m (150m for kingfisher [*Alcedo atthis*])	31 March and 30 June 2016
Protected Mammal Surveys	150m	26 November 2015 and 10 March 2016
Amphibian Surveys	0m	10 March 2016
Water Quality Monitoring (Aquens Ltd.)	Monitoring points approximately 1km upstream and downstream of the proposed Project.	11 December 2012, 11 October 2015 and 23 June 2016.

Habitats and Flora Survey

The field survey area for terrestrial habitats was within the proposed Project boundary. The field south of the site (outside the site boundary) was also surveyed to account for a potential increase in the footprint of the proposed Project to accommodate ancillary works such as temporary storage and/or access routes.

Habitats and flora were classified using the Heritage Council's *Guide to Habitats in Ireland* (Fossitt 2000). Within each habitat, dominant and abundant plant species and indicator species were recorded. Searches in suitable habitat were made for any species listed on the Red Data Book for vascular plants (Jackson *et al.* 2016), the Red List for bryophytes (Lockhart et al. 2012), any species protected on the Flora Protection Order 2015, and any invasive species listed on Schedule 3 to the Bird and Habitat Regulations 2011-2015. Vascular plant nomenclature follows that of the Checklist of the Flora of Britain & Ireland (BSBI 2007) and as such any name changes since 2007 (including Stace 2010) are not included. Bryophyte nomenclature follows the British Bryological Society (Atherton et al. 2010).

Protected Fauna (other than bats)

Field survey areas varied for different fauna and extended up to a maximum of 150m from the proposed Project boundary for mammals. These buffers were extended based on professional judgement when and if required. The suitability of the study area to support notable or protected fauna including birds, amphibians and mammals was assessed using field surveys to recognised standards such as those published by the NRA, British Trust for Ornithology (BTO) and the BCT. Habitats on-site were assessed for signs of usage by protected fauna and/or those of conservation concern or on national red lists. Fauna were recorded by direct observation and indirectly using field signs including tracks, feeding signs, droppings, and breeding and resting sites. Observations on potentially suitable habitat were also made.

Badger and Otter

The field survey area for badger and otter resting sites extended up to a 150m from the proposed Project boundary. This was based on *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes* (NRA 2006b), which state that intrusive earthworks (e.g. piling) within 150m of a protected badger or otter breeding or resting site is likely to require licencing from the NPWS due to the risk for disturbance potentially including entombment of animals from hole collapse. The status of any badger setts, otter holts (both

underground breeding or resting sites), or otter couches (temporary above-ground resting places) were recorded along with any evidence of activity, including paths, paw-prints, feeding signs, latrines and spraints.

Pygmy Shrew, Hedgehog, and Stoat

No formal surveys were undertaken for other protected mammal species for which field signs are less frequent and/or reliable than other larger mammals. Care was taken to search for activity signs such as searching soft muds for tracks, and to look for droppings. Potential presence of these species in suitable habitat was recorded based on the habitat preferences described in Hayden & Harrington 2001. Road mammal fatalities in the locality were also recorded (if observed) as these are sometimes the only reliable indication of hedgehog *(Erinaceus europaeus*) or Irish stoat (*Mustela erminea hibernica*) presence in an area, beyond live sightings.

Breeding Birds

The field survey area for breeding birds was 50m beyond the proposed Project boundary (with the exception of kingfisher) to record all birds within the potential ZoI during Remediation and Operational Phases. The breeding bird surveys involved walking along a route and recording birds within the study area. Birds were recorded when signs of breeding were observed such as singing to hold a territory, feeding young, family groups and nest sites. Field surveys were complemented by a desktop search of potentially suitable breeding habitat for highly sensitive breeding species, for which the ZoI of disturbance could extend up to 1km. This desktop search, including analysis of aerial photography, concluded there was no potential for highly sensitive breeding bird species. No suitable Kingfisher habitat was noted within the ZoI.

Breeding birds were surveyed on two visits on 31 March 2016 and the 30 June 2016, in calm conditions, between sunrise and 11:00, having regard for the Common Birds Census territory mapping method (Gilbert *et al*. 1998). Both visits in spring and summer 2016 recorded breeding activity of resident and migratory birds. The visit in June recorded evidence of breeding including juvenile birds, nests, parents feeding young and roaming families. The categories of breeding evidence developed by the BTO (available at http://www.bto.org/volunteer-surveys/birdatlas/methods/breeding-evidence) were applied to all birds recorded. All birds were assessed for their conservation importance in accordance with the traffic light system of Green (Low), Amber (Medium) and Red (High) conservation concern for the island of Ireland (Colhoun & Cummins 2013)

Amphibians and Reptiles

Amphibian surveys were cognisant of the NRA guidelines (NRA 2009b). The main waterbody identified within the site was artificial in nature and comprised a surface water lagoon (WB003) which receives water runoff from temporary capping surface of the lined cell (Zone 3, refer to Figure 3.2). Water quality within the lagoon appeared to be poor given the presence of algae growing in the water column. This waterbody was also lacking any significant aquatic vegetation and as such was deemed unsuitable to support protected smooth newt (*Triturus vulgaris*). However, it was deemed suitable to support protected common frog (*Rana temporaria*). Furthermore, terrestrial habitats and other temporary waterbodies including a water filled wheel rut, and drainage ditch were also deemed suitable to support common frog. A site walkover and survey of all waterbodies (where accessible) was conducted in March 2016 to look for frog spawn.

As noted above no formal surveys were undertaken for reptiles. However, care was taken to look for common lizards at exposed basking sites in suitable habitat during the course of other ecological survey work.

Invertebrates (aquatic)

Biological water quality monitoring was undertaken by Aquens Ltd in 2012, 2015 and 2016. Monitoring in 2016 was undertaken at eight sampling localities on the Morell River and two on the Rathmore Stream to assess the upstream and downstream water quality as indicated by the benthic macroinvertebrate community. The Rathmore Stream (also known as the Hartwell River) joins the Morell River adjacent to the site and therefore the water quality had to be assessed to determine its influence on the Morell River. The sampling method adopted was that applied by the EPA in the national river monitoring programme (McGarrigle et. al. 2002 cited in Aquens Ltd. 2016). Using a Freshwater Biological Association (FBA) pond net (1mm mesh), a 2-minute, multi-habitat kick-sample was taken at each site. In addition, one-minute stone-washing was also undertaken. The samples were preserved in 70% Industrial Methylated Spirit (IMS) and processed in the laboratory. Samples were sorted

in an illuminated tray and all the macroinvertebrates identified to the appropriate taxonomic resolution using FBA taxonomic keys. The detailed water quality monitoring report(s) are provided in Appendix A13.3.

Protected Fauna (Bats)

The field survey area for foraging and roosting bats was determined to be approximately 50m beyond the footprint of the proposed Project boundary. This was based on professional judgement and considered sufficient to address potential impacts from light spill and the potential for increases in the footprint of the proposed Project to accommodate any new access routes. Bat surveys had due consideration for best practice guidelines NRA (NRA 2009b) and BCT (Collins 2016; Hundt 2012).

Assessment of Bat Roost Potential (Initial Daytime Assessment)

A daytime assessment of buildings and trees with potential to be removed as part of the proposed Project and treelines / woodland edges potentially affected by the proposed Project was undertaken in November 2015. A further assessment was undertaken in March 2016. Subsequent to these surveys all but one of the buildings were confirmed to have negligible potential to support a bat roost. The buildings with negligible potential were removed as part of a demolition contract undertaken in 2016 due to the unsafe nature of the buildings and structures at the site. One building was therefore subject to further dusk and dawn emergence/re-entry surveys. A further three properties (REC010, REC011 and REC016) will be demolished during the Remediation of the site. These private properties and surrounding gardens were not surveyed during the initial bat assessment and surveys. Daytime assessments and potential further roost surveys of these buildings will be required prior to them being demolished. Surveys will be undertaken by a suitably qualified ecologist. If a bat roosts is identified in any of these buildings, they will have to be demolished under licence from the NPWS and appropriate mitigation put in place.

These assessments comprised an external inspection of trees and buildings within the site boundary to identify potential roost features (PRFs). Close focusing binoculars were used to look for features which may support bat roosts, and evidence of bat activity. Bats may utilise several different roosts throughout the year and may only occasionally make use of any given feature, particularly cracks, crevices and fissures. The criteria used to categorise the PRFs or suitability of buildings and trees as a roost are summarised in Table 11.4 below (based on Collins 2016). Figure 11.1 shows trees and buildings that were assessed as having PRFs.

Table 11.4: Bat Roost Potential Categories

Category	Description	Recommended No. of Survey Visits*	Recommended Survey Timings**
High Trees / buildings that are suitable for use by large numbers of bats on a regular basis	Features include holes, cracks or crevices that extend or appear to extend back to cavities suitable for bats. In buildings, examples include eaves, barge boards, gable ends and corners of adjoining beams, ridge and hanging tiles, behind roofing felt or within cavity walls. In trees, examples include rot holes, woodpecker holes, splits and flaking or raised bark which could provide roosting opportunities. Any ivy cover is sufficiently well-established and matted so as to create potential crevices beneath. **Further survey is required to determine whether or not bats are present and if so, the bat species present. Appropriate mitigation and potentially licensing requirements may then be determined. Seasonal constraints may apply.**	**Buildings / trees –** Three separate visits. One dusk emergence and a separate dawn re-entry survey. The third survey visit can be dusk or a dawn survey. **NB.** Multiple survey visits should be spread out as much as possible, with surveys at least two weeks apart, preferably more.	**Buildings / trees –** May to September (with at least two of the surveys between May and August)

Category	Description	Recommended No. of Survey Visits*	Recommended Survey Timings**
Moderate Moderate potential is assigned to trees / structures with potential to support bat roosts but supports fewer features than a high potential building / tree and is unlikely to support a roost of high conservation value.	From the ground, building / tree appears to have features (e.g. holes, cavities or cracks) that may extend back into a cavity. However, owing to the characteristics of the feature, they are deemed to be sub-optimal for roosting bats. **Further survey is required to determine whether or not bats are present and if so, the bat species present. Appropriate mitigation and potentially licensing requirements may then be determined. Seasonal constraints may apply.**	**Buildings / trees –** Two separate visits. One dusk emergence and a separate dawn re-entry survey. **NB.** Multiple survey visits should be spread out as much as possible, with surveys at least two weeks apart, preferably more.	**Buildings / trees –** May to September (with at least one of the surveys between May and August)
Low Low potential is assigned to structures and trees with features that could support individual bats opportunistically.	If no features are visible but owing to the size and age and structure, hidden features, sub-optimal for roosting bats, may occur that only an elevated inspection may reveal. In respect of ivy cover, this is not dense (i.e. providing PRF in itself) but may mask presence of PRF features. **Further survey may be required for buildings only or works may proceed using reasonable precautions (e.g. controlled working methods, under licence or supervision of a bat worker. Seasonal constraints may apply).**	**Buildings –** One survey visit. One dusk emergence or dawn re-entry survey. **Trees** – No further Surveys Required	**Buildings –** May to August **Trees** – No further Surveys Required

Notes
Bat Roost Potential Categories as per latest guidance Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust: London.
* Recommended minimum number of survey visits to give confidence in a negative result for structures (also recommended for trees but unlikely to give confidence in a negative result).
** Recommended timing for presence/absence surveys to give confidence in a negative result for structures (also recommended for trees but unlikely to give confidence in a negative result).

Dusk Emergence and Dawn Re-entry Surveys

Dusk emergence and dawn re-entry surveys of trees and buildings identified as having PRFs were undertaken to determine the presence / probable absence of bat roosts. The location of trees and buildings surveyed are shown in Figure 11.2. Surveys were undertaken on the following dates:

- 14, 15 and 16 June 2016
- 18, 19, 26 and 27 July 2016

Surveyors were positioned at potential roost access / egress points. Surveyors recorded bat activity using heterodyne Elekon Batscanner detectors and / or the frequency division Anabat SD2. Dusk emergence surveys commenced approximately 15 minutes before, and continued for at least 90 minutes after sunset. Dawn re-entry surveys commenced at least 90 minutes prior to, and continued until, sunrise. Surveys were undertaken during suitably warm and dry weather conditions.

Static Monitoring (Activity Surveys)

To provide additional data concerning the use of the proposed Project site by bats, static detector surveys were carried out between June and September 2016. The static detector records bat activity to a memory card and this information was analysed to confirm the species present as well as air temperature, times and dates of bat activity. Static monitoring locations are shown in Figure 11.2. Static monitoring locations were chosen to incorporate the different habitat features of the study area which may be used by bats for commuting and

foraging (i.e. rough grassland, woodland, treelines and water bodies). Separate transect / walked activity surveys were not undertaken as a number of the dusk emergence and dawn re-entry surveys were undertaken in the immediate vicinity of potential commuting and foraging habitat within the proposed Project boundary. Bat activity and use of these potential foraging and commuting habitats were sufficiently recorded during the dusk/dawn surveys.

Bat Call Analysis

Bat call analysis was undertaken using Analook software. Analook software was used to analyse bat calls recorded on the Anabat during static monitoring and dusk emergence and dawn re-entry surveys.

Bat species identification was interpreted using known call parameters (British Bat Calls: A Guide to Species Identification, Jon Russ 2012) and existing literature on the ecology of Irish and UK bat species, including distribution, range, habitat associations and behavioural characteristics, in addition to professional judgement. Every attempt was made to identify bats to species level. However, in some instances it was only possible to take the analysis to genus level (distinguishing between certain bat species echolocation calls can be very difficult due to the overlap in call parameters e.g. those species within the *Myotis* genus).

11.2.7 Ecological Valuation and Impact Assessment Methodology

The ecological assessment was undertaken in accordance with guidelines produced by the NRA (NRA 2009a).

In line with the NRA guidelines (NRA 2009a), the impact assessment was only undertaken of Key Ecological Receptors (KERs). These are features within the ZoI of an effect from the proposed Project (ZoI is defined in Section 11.2.4) which are *'both of sufficient value to be material in decision making and likely to be affected significantly'*. Features qualifying as KERs must be similar in ecological value to examples of "Local Importance (Higher Value)" or higher as per the NRA examples in Table 11.5. Features similar in ecological value to the NRA's examples of Local Importance (Lower value) are excluded from impact assessment. All potential impacts were assigned a significance level at a particular geographic scale corresponding to the examples in the NRA guidance. The assessment also had due consideration for the following guidelines;

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017); and
- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2016).

Table 11.5: Ecological Evaluation Criteria from NRA Guidelines (NRA 2009a)

Examples of Ecological Valuation

International Importance:
• 'European site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.
• Site that fulfils the criteria for designation as a 'European site' (see Annex III of the Habitats Directive, as amended).
• Features essential to maintaining the coherence of the Natura 2000 Network [Note 1].
• Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.
• Resident or regularly occurring populations (assessed to be important at the national level) [Note 2] of the following:
  ○ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and / or International Importance:
  ○ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
• Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
• World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage 1972).
• Biosphere Reserve (UNESCO Man & The Biosphere Programme).
• Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
• Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
• Biogenetic Reserve under the Council of Europe.
• European Diploma Site under the Council of Europe.
• Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988). [Note 3]

Examples of Ecological Valuation

National Importance:
• Site designated or proposed as a Natural Heritage Area (NHA).
• Statutory Nature Reserve.
• Refuge for Fauna and Flora protected under the Wildlife Acts.
• National Park.
• Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
• Resident or regularly occurring populations (assessed to be important at the national level) [Note 4] of the following:
  ○ Species protected under the Wildlife Acts; and/or
  ○ Species listed on the relevant Red Data list.
• Site containing 'viable areas' [Note 5] of the habitat types listed in Annex I of the Habitats Directive.

County Importance:
• Area of Special Amenity. [Note 6]
• Area subject to a Tree Preservation Order.
• Area of High Amenity, or equivalent, designated under the County Development Plan.
• Resident or regularly occurring populations (assessed to be important at the County level) [Note 7] of the following:
  ○ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  ○ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  ○ Species protected under the Wildlife Acts; and/or
  ○ Species listed on the relevant Red Data list.
• Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.
• County important populations of species, viable areas of semi-natural habitats or natural heritage features identified in the National or Local Biodiversity Action Plan (BAP) if this has been prepared.
• Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.
• Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

Local Importance (Higher value):
• Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared.
• Resident or regularly occurring populations (assessed to be important at the Local level) of the following:
  ○ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  ○ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  ○ Species protected under the Wildlife Acts; and/or
  ○ Species listed on the relevant Red Data list.
• Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality.
• Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (Lower value): • Sites containing small areas of semi-natural habitat that are of some local importance for wildlife. • Sites or features containing non-native species that are of some importance in maintaining habitat links.

Notes

1 See Articles 3 and 10 of the Habitats Directive.

2 It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

3 Note that such waters are designated based on these waters' capabilities of supporting Atlantic salmon, trout, char (Salvelinus) and whitefish (Coregonus).

4 Note that such waters are designated based on these waters' capabilities of supporting salmon, trout, char and whitefish.

5 A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

6 It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

7 It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County importance where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

All potential impacts are assessed against parameters as set out within the NRA guidance and take cognisance of guidance produced by the EPA (EPA 2002) and CIEEM (CIEEM 2016). Via this approach, a scientific and repeatable method is applied whereby all aspects of a potential impact are considered. Unless otherwise stated, impacts identified in the assessment are considered to be adverse.

Impacts are considered with reference to the following parameters;

- Magnitude.

- Extent.
- Duration.
- Reversibility.
- Timing and Frequency.
- Integration of impact characteristics.

A degree of confidence is assigned to assess the likelihood of an impact occurring (integration of impact characteristics). The following scale (as defined within the NRA guidelines) is referred to;

- Near-certain: >95% chance of occurring as predicted.
- Probable: 50-95% chance of occurring as predicted.
- Unlikely: 5-50% chance of occurring as predicted.
- Extremely unlikely: <5% chance of occurring as predicted.

Based on these parameters, an impact is then considered to be either significant or not significant and likely to be either beneficial or adverse. An impact is considered to be significant if it has the potential to affect the integrity of a habitat or the conservation status of a species.

With respect to ecology, best practice guidance advises that significance should not be defined as 'high', 'moderate' or 'low' due to the complexities of ecological processes. Therefore, all impacts defined as 'significant' are considered to be significant in the context of the EIA Regulations.

Furthermore, the EPA guidance (EPA 2002) further defines duration of impacts as follows:

- Short-term Impact – *Impact lasting one to seven years.*
- Medium-term Impact – *Impact lasting seven to fifteen years.*
- Long-term Impact – *Impact lasting fifteen to sixty years.*

11.3 Baseline Conditions

11.3.1 Site Overview

The site is located in County Kildare, approximately 3km north-east of central Naas and approximately 400m north-west of Johnstown village as shown on Figure 3.1. The study area supports a variety of habitats. Scrub and grassland were dominant, while treelines and hedges were common along the site boundary. Other habitats included recolonising bare ground, buildings and artificial waterbodies. Scrub and grassland habitats dominated in the north while the majority of buildings and areas of hardstanding were associated with the southern end of the site. The site also supported steep sandy banks along the north-east and south-eastern boundaries. As noted in Section 11.2.6 (Assessment of Bat Roost Potential - Initial Daytime Assessment) some buildings were demolished in 2016 due to their unsafe nature.

11.3.2 Desk Study Results

Designated Sites

The proposed Project is not situated within or next to any European sites and there are no Qualifying Interest (QI) habitats or species of any SAC or SPA within the ZoI of the proposed Project. The two closest European sites are the 'Red Bog, Kildare' SAC, located approximately 7.5km south-east of the site and the Ballynafagh Lake SAC, located approximately 10km away. The two closest SPAs are Poulaphouca Reservoir located 10km from the site and Wicklow mountains located over 16.5km from the site boundary. There is no hydrological link to these features from the site, refer to Chapter 13 Water – Hydrology for details on the hydrology assessment. The nearest nationally designated site is the Grand Canal proposed National Heritage Area (pNHA) which is located approximately 550m north of the proposed Project boundary at its closest point. The Morell River lies approximately 15m to the east of proposed Project at its closest point. The Morell River flows north to its confluence with the River Liffey at Straffan, approximately 3km north of the proposed Project boundary. There is

a second pNHA Liffey at Osberstown 4km west of the proposed Project boundary. All nationally and internationally designated sites potentially within the ZoI of the proposed Project are shown in Figure 11.3.

All waterbodies in the vicinity of the proposed Project are shown in Figure 13.2. The Canal Feeder Stream flows generally westward to the Grand Canal pNHA which is located approximately 550m north of the proposed Project at its closed point. This provides indirect hydrological connectivity with the proposed Project. The protected aquatic plant species opposite-leaved pondweed (*Groenlandia densa*) is one of the most important species in the Grand Canal according to the NPWS site synopsis for the pNHA.

The River Liffey is not designated for nature conservation at its confluence with the Morell River, or downstream of the confluence. The River Rye, which flows into the River Liffey downstream of the proposed Project at Leixlip is designated as the Rye Water Valley/Carton SAC, but is upstream of any hydrological effect pathway with the proposed Project. A preliminary list of all SACs potentially within the ZoI of the proposed Project is shown in Table 11.6 and all SPAs are shown in Table 11.7.

Table 11.6: Preliminary List of SACs potentially within the ZoI of the proposed Project

Site and Code	Distance from Proposed Project Boundary (km)	Qualifying Interests (cSACs/SPAs) or Reason for Designation (pNHAs) (* = Priority Habitat)
Red Bog, Kildare SAC (000397)	7.5	Transition mires and quaking bogs [7140]
Ballynafagh Bog SAC (000391)	10	Active raised bogs [7110]
		Depressions on peat substrates of the Rhynchosporion [7150]
		Degraded raised bogs still capable of natural regeneration [7120]

Table 11.7: Preliminary List of SPAs potentially within the ZoI of the proposed Project

Site and Code	Distance from Proposed Project Boundary (km)	Qualifying Interests (cSACs/SPAs) or Reason for Designation (pNHAs)
Poulaphouca Reservoir SPA (004063)	10	Greylag Goose (*Anser anser*) Lesser Black-backed Gull (*Larus fuscus*)
Wicklow mountains SPA (004040)	16.5	Merlin (*Falco columbarius*) Peregrine (*Falco peregrinus*)

Records of Protected/Rare Flora and Fauna Species

Records of rare or protected flora within 10km of the proposed Project obtained from the NPWS are shown in Table 11.8 and records of rare of protected fauna (also obtained from the NPWS) are shown in Table 11.9.

Table 11.8: Records of Protected and Red Data Book Flora (data from NPWS)

Common Name	Scientific Name	Protection*	Status**	Habitat Preference	Flowering Time
Musk thistle	*Carduus nutans*	None	Indeterminate	Pastures, waysides, arable fields and waste places.	May-September
Narrow-leaved helleborine	*Cephalanthera longifolia*	FPO	Endangered	White-flowered orchid of damp woods and scrub.	May-June
Basil thyme	*Clinopodium acinos*	None	Endangered	Exposed esker ridges, in arable fields, on gravel, and on sandy soils. It has a preference for calcareous soils.	May-September

Common Name	Scientific Name	Protection*	Status**	Habitat Preference	Flowering Time
Blue fleabane	*Erigeron acer*	None	Endangered	It occurs on eskers, in dry grassland, sandy pastures and on walls - especially on calcium-rich substrates.	June-August
Darnel	*Lolium temulentum*	None	Endangered	Annual grass of cultivated fields and waste ground.	Unknown
Greater broomrape	*Orobanche rapum-genistae*	None	Vulnerable	This parasite on the roots of shrubby Leguminosae (chiefly gorse or broom) is restricted to south-east Ireland.	July-September
Green figwort	*Scrophularia umbrosa*	None	Endangered	This erect perennial of river banks and lake shores.	June-September
Green-winged orchid	*Anacamptis morio*	None	Endangered	Occurs in meadows, pastures and sandhills.	April to June
Hairy violet	*Viola hirta*	Flora Protection Order (FPO)	Endangered	Occurs on dry banks, rocky ground and scrub on limestone soils in the southern half of Ireland. It has been recorded in Kildare in the past (one site).	March to May
Heath cudweed	*Gnaphalium sylvaticum*	FPO	Vulnerable	This woolly, perennial herb of upland pastures and damp sandy places.	July-August
Henbane	*Hyoscyamus niger*	None	Vulnerable	Grows in sandhills, sandy open areas and waste ground. Prefers disturbed ground, including rabbit warrens and building sites. Lowland.	May-August
Meadow saxifrage	*Saxifraga granulata*	FPO	Critically Endangered	Pastures and sandhills near the coast, has been recorded from 21 sites in nine counties. In 13 sites in the vicinity of counties Kildare, Meath, Dublin and Wicklow.	April to June
Opposite-leaved pondweed	*Groenlandia densa*	FPO	Endangered	Grows in running or still freshwater habitats, including canals. It colonises fine mud sediments.	June- July
Red hemp-nettle	*Galeopsis angustifolia*	FPO	Endangered	Found in eskers, arable fields and waste places.	July-September
Small-white orchid	*Pseudorchis albida*	FPO	Endangered	Orchid of upland pastures and heaths.	May-July
Yellow archangel	*Lamiastrum galeobdolon subsp. montanum*	None	Vulnerable	Found in hedges and woods. Only in the south-east of Ireland, with an outlying site in Westmeath.	April-July
Corncockle	*Agrostemma githago*	None	Extinct	An annual weed of cereal and other arable crops, tolerant of various soil types.	N/A
Corn chamomile	*Anthemis arvensis*	None	Extinct	An aromatic annual of light calcareous or sandy soils, growing in arable fields, especially cereals; also in leys, field-borders and waste places, and on roadsides and disturbed ground near the sea. I	N/A

Common Name	Scientific Name	Protection*	Status**	Habitat Preference	Flowering Time
Bog orchid	*Hammarbya paludosa*	FPO	Rare	A pseudobulbous herb of boggy areas where the water is usually acidic but subject to some lateral movement. Typically, it grows amongst saturated Sphagnum, but also on peaty mud and among grasses on the edges of runnels and flushes.	July - September
Shepherd's-needle	*Scandix pecten-veneris*	None	Extinct	An annual of arable fields, particularly on calcareous clay soils; occasionally on paths and banks beside current or former arable sites, and rarely on waste ground, coastal cliffs, and in gardens.	N/A

Notes
* HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora Protection Order; WA = Wildlife Acts; BD I = Birds Directive Annex I.
** Mammal Red-list from Marnell *et al*. 2009. Birds from Birds of Conservation Concern in Ireland (Colhoun & Cummins 2013); vascular flora from the Irish Red Data Book 1 Vascular Plants (Curtis & McGough 2005); Fish and Amphibians from King *et al*. 2011; Non-Marine Molluscs from Byrne et.al. 2009.

In addition to data obtained from the NPWS the BCI provided records of bat roosts within 10km of the proposed Project, with a total of 22 known roosts recorded. According to BCI records the nearest known roost is located approximately 1km from the proposed Project boundary. This comprised a roost of three species including brown long-eared bat, soprano pipistrelle and common pipistrelle. The full list of records provided by BCI is included in Appendix A11.3.

Table 11.9: Records of Protected, Rare and other Notable Fauna (data from NPWS and BCI)

Common Name	Scientific Name	Protection*	Conservation Status**, ***
White-clawed crayfish	*Austropotamobius pallipes*	WA, HD II	Endangered
Red deer	*Cervus elaphus*	WA	Least Concern
Sika deer	*Cervus nippon*	WA	Not assessed (introduced post 1500)
Hedgehog	*Erinaceus europaeus*	WA	Least Concern
Badger	*Meles meles*	WA	Least Concern
Brook lamprey	*Lampetra planeri*	HD II	Least Concern
Brown long-eared bat	*Plecotus auritus*	WA, HD IV,	Least Concern
Desmoulin's Whorl Snail	*Vertigo moulinsiana*	HD II	Endangered
Common Frog	*Rana temporaria*	WA	Least Concern
Pygmy shrew	*Sorex minutus*	WA	Least Concern
Red squirrel	*Sciurus vulgaris*	WA	Near Threatened
Otter	*Lutra lutra*	HD II/IV, WA	Near Threatened
Irish Hare	*Lepus timidus subsp. hibernicus*	WA	Least Concern
Stoat	*Mustela erminea subsp. hibernica*	WA	Least Concern
Narrow-mouthed whorl snail	*Vertigo angustior*	WA	Vulnerable
Pine marten	*Martes martes*	WA	Least Concern
Smooth newt	*Lissotriton vulgaris*	WA	Least Concern
Common pipistrelle	*Pipistrellus pipistrellus*	WA, HD IV,	Least Concern

Common Name	Scientific Name	Protection*	Conservation Status**, ***
Soprano pipistrelle	*Pipistrellus pygmaeus*	WA, HD IV,	Least Concern
Leisler	*Nyctalus leisleri*	WA, HD IV,	Near Threatened
Brown long-eared	*Plecotus auritus*	WA, HD IV,	Least Concern
Daubenton's	*Myotis daubentonii*	WA, HD IV,	Least Concern
Black rat	*Rattus rattus*	None	Vulnerable

Notes
* HDII/IV/V = Habitats Directive Annexes II/IV/V; FPO = Flora Protection Order; WA = Wildlife Acts; BD I = Birds Directive Annex I.
** Mammal red-list from Marnell *et al*. 2009; bird red-list from *Birds of Conservation Concern in Ireland* (Colhoun and Cummins 2013); red-listed fish and amphibians from King *et al*. 2011; red-listed non-marine molluscs from Byrne et.al. 2009; red-listed dragonflies and damselflies from Nelson *et al*. 2011; red-listed water beetles from Foster *et al*. 2009.
*** IUCN red list http://www.iucnredlist.org/ - accessed December 2016

Likelihood of Occurrence of Protected, Rare and Notable Species

Flora

The majority of flora species listed in Table 11.8 occur in habitats not found within the study area, as determined following habitat surveys. Many of these species are found in upland habitats. All suitable habitats were surveyed for their floristic interest and none of the flora species listed was recorded. Habitat Preferences and distribution data from Parnell & Curtis (2012), Curtis & McGough, Doogue *et al.*, 1998, and the online atlas of the British and Irish Flora.

Fauna (other than Fish)

Based on the habitats present, determined following habitat survey, there was potential for a small number of mammal species from Table 11.9 to occur within the ZoI of the proposed Project. The study area has the potential to support foraging and breeding habitat for badger, stoat, hedgehog, pygmy shrew and bats. Protected amphibians including common frog are likely to occur within the proposed Project boundary and surrounding habitats given suitable waterbodies are present on-site. The potential occurrence of all species is elaborated upon in the field survey results section, and potential impacts and mitigation subsequently addressed as relevant. There was no suitable habitat for red squirrel, smooth newt, marsh fritillary present within the study area.

Rare Flora

A population of rare spiked sedge (*Carex spicata)* was recorded by Roger Goodwillie & Associates within the site (northern end of the site) in September 2011 but its precise location was not provided in the report. The species, which flowers from May to July, was not located in subsequent surveys undertaken by Jacobs in 2016. It is likely that the small population recorded in 2011 is no longer present within the site.

Fish and Water Quality

Water Quality

Full details of the baseline water quality relevant to the proposed Project are provided in Chapter 13 Water – Hydrology and summarised below.

Water Quality -Aquens Report

Benthic macroinvertebrates are used as they exhibit differential responses to physical and chemical changes in their environment. Some macroinvertebrates are sensitive to pollution while others are tolerant. They can provide a realistic record of the baseline water quality conditions. The 2012 biological Q-rating assessment found that the water quality was good along the Morell River's length with sites achieving scores of Q4 and most achieving Q4-5. In 2015 and 2016 the assessment found that both the Morell River and Rathmore Stream were impacted. The water quality of the Morell River was moderately polluted (Q3) upstream of the landfill and

improves to slightly polluted (Q3-4) downstream as it flows past Kerdiffstown Landfill which is consistent with the WFD status. However, these assessment shows that there is still no evidence of ecological deterioration or impact from the landfill. These three reports are contained in Appendix A13.3.

Water Quality -EPA Classification

The EPA assesses the water quality of rivers and streams across Ireland using a biological assessment method. The EPA assigns biological river quality (biotic index) ratings from Q5-Q1 to watercourse sections. Q5 denotes a watercourse with high water quality and high community diversity, whereas Q1 denotes very low community diversity and a bad water quality. Table 13.7 provides details of the Q water quality status of the Morell River and the Rathmore Stream for the period 2004-2015 as shown in the EPA Envision Mapper (EPA 2017). Information pertaining to the EPA monitoring station locations and current status can be found in Table 13.8 in Chapter 13 Water – Hydrology.

Fish

The Morell River provides spawning habitat for lamprey and a key population of Atlantic salmon in addition to supporting significant populations of brown trout. The River Liffey and several of its tributaries (including the Morell River) are exceptional in the area in supporting Atlantic salmon and sea trout, in addition to resident brown trout populations (IFI scoping response, 2016). River habitat in the vicinity of a new surface water outfall to be constructed to permit surface water discharge from the proposed Project (constructed in Remediation Phase; commissioned in Operational Phase) was described by Aquens Ltd. as mainly gravel and sand with some cobbles. Such habitat may have the potential to support spawning lamprey and/or Atlantic salmon. Immediately upstream of the proposed surface water outfall location (loosely corresponds to survey locations M2 and M3 in Aquens Ltd. report) the river bank has been heavily modified and has existing rock armour. A site walkover by Jacobs was undertaken in December 2016 at the location of the proposed surface water outfall (see Photo 11.5 and 11.6 in Appendix A11.4) found that there was little silty substrate in the vicinity of the proposed works and therefore low potential for juvenile lamprey to be present. Furthermore, the river bed in the vicinity of the proposed works is considered sub-optimal spawning habitat for fish due to the dominance of sandy substrates.

Invertebrates (Aquatic)

No formal surveys were undertaken for white-clawed crayfish (*Austropotamobius pallipes*) within the Morell River. However, incidental records of this species have been recorded during surveys undertaken by Aquens Ltd. In 2016 this species was recorded at sampling location M5 and M6 (see Aquens Ltd. Report, Appendix A13.3) downstream of the study area, in 2015 they were recorded at location M4 again downstream of the study area and in 2012 they were recorded at locations M1 and H1 upstream of the study area. M1 and H1 are in close proximity to the proposed surface water outfall location. For the purposes of the assessment this species is presumed to be present upstream and downstream of the study area and potentially within the footprint of the proposed surface water outfall location. Therefore, appropriate mitigation will be put in place to avoid impacts on this species.

11.3.3 Field Survey Results

Habitat descriptions below are in the past tense, to reflect their accuracy at a point in the recent past (i.e. September 2015).

Habitats and Flora

Habitats within the study generally comprised the following: dry meadows and grassy verges (GS2) and scrub (WS1). The proposed Project boundary was dominated by treelines (WL2), scrub and occasional hedgerow (WL1). Mixed broadleaved woodland (WD1) was limited in extent. Other habitats comprised earth banks (BL2), buildings (the majority now demolished) and artificial surfaces (BL3) and wetland habitats, including artificial lakes and ponds (FL8) and drainage ditches (FW4), were also recorded. A habitat map is presented in Figure 11.4. A full flora species list by habitat is provided in Appendix A11.5.

Other Artificial Lakes and Ponds (FL8)

There is one artificial waterbody on-site, comprising a surface water lagoon in Zone 4 and several temporary water features. At the time of survey, the lined cell was partially infilled with leachate present on the open gravel area. Subsequently, infilling to the cell has taken place using waste that had been located within the buildings that have now been demolished and new temporary capping system applied hence the open gravel area (and presence of leachate) is no longer visible. The surface lagoon and cell were both predominately devoid of vegetation. A third much smaller temporary feature which appeared to be fed by a pipe was also recorded within the south-west of the site at the base of a scrubbed over earth mound. This temporary pond supported denser vegetation including bulrush (*Typha latifolia*), water-starwort (*Callitriche sp.*) and marsh foxtail (*Alopecurus geniculatus*). Finally, a small number of temporary features were noted throughout the season while conducting various surveys. This included a drainage ditch between the lined cell and the surface water lagoon and a wheel rut that was filled with water at the time of conducting surveys for frog spawn.

Drainage Ditches (FW4)

A single gravel bedded swale was recorded running approximately east to west along the base of the lined cell just west of the surface water lagoon. This swale appeared to link up the surface water lagoon and the lined cell, taking runoff from the temporary capped area of the cell to the lagoon. The swale was dry at the time of survey and was devoid of vegetation save for a small patch of filamentous algae.

Rivers (FW2)

The Morell River channel has an artificially straightened planform throughout its length, with likely modifications to account for surrounding land uses and drainage requirements. Within the study area, there are lengths of bank reinforcement with a modified channel cross-section. The bed consists primarily of cobbles and gravels. Immediately adjacent to the site the river is rather narrow (3.9-4.9m) with a relatively shallow bed and fast flowing water. In-stream vegetation was limited at this point and the river bed comprised mainly gravel. There is evidence that the river bank has been modified where rock armour has replaced the natural bank over a length of approximately 45m, presumably to protect the foundations of the adjacent private access road to Kerdiffstown House. The new proposed surface water outfall from the site to the Morell River will be located immediately downstream of this rock armour protection zone.

Improved Agricultural Grassland (GA1)

This habitat type was recorded to the south-east of the study area just outside of the site boundary. Dominant species included those indicative of heavily improved grasslands such as perennial rye-grass (*Lolium perenne*), clover (*Trifolium sp.*) and Yorkshire-fog (*Holcus lanatus*).

Dry Meadows and Grassy Verges (GS2)

This habitat type dominated the north of the study area and was mainly associated with a large raised vegetated area, termed Zone 1 (refer to Figure 3.2). It formed a mosaic with areas of scrub and tall ruderal vegetation. Two smaller areas were recorded along a relatively steep bank bordering the north-eastern site boundary. A range of species were recorded within the sward (an expanse of short grass) including grasses such as cock's-foot (*Dactylis glomerata*), common bent (*Agrostis capillaris)*, false oat-grass (*Arrhenatherum elatius)*, perennial rye-grass and timothy (*Phleum pratense*). Herbs within the sward comprised creeping buttercup (*Ranunculus repens*), creeping cinquefoil (*Potentilla reptans*), creeping thistle (*Cirsium arvense*) and dove's-foot crane's-bill (*Geranium molle*). This grassland typed for the most part supported a relatively rank overgrow sward with a shorter sward in areas that were heavily grazed by rabbit. A single stand of the invasive species Japanese knotweed (*Fallopia japonica*) was recorded within this habitat type in the north-east of the study area bordering the access track. This stand has subsequently been treated.

Wet Grassland (GS4)

Small stands of wetter / inundated areas of grassland which were too small to map were occasionally noted within the GS2 habitat above, here species such as hard rush (*Juncus inflexus*) and pendulous sedge (*Carex pendula*) were abundant. A small area of wet grassland was recorded in the north-west corner of the study area at the base of a relatively steep scrubby bank. Hard rush dominated here. Frequent species included broad-

leaved willowherb (*Epilobium montanum*), creeping bent (*Agrostis stolonifera*), cut-leaved crane's-bill (*Geranium dissectum*), red fescue (*Festuca rubra*), silverweed, Yorkshire-fog and the moss *Pseudoscleropodium purum*.

Scrub (WS1)

This was the most frequently recorded semi-natural habitat within the study area, dominating in both the north and south extents. The dominant species comprised butterfly-bush (*Buddleja davidii*) and bramble (*Rubus fruticosus agg*). Frequent species included dogwood (*Cornus sanguinea*) and wild raspberry (*Rubus idaeus*). A relatively diverse assemblage of rose species was also recorded in the north of the study area including field rose (*Rosa arvensis*), Japanese rose (*Rosa rugosa*), Sherard's downy-rose (*Rosa sherardii*) and dog-rose (*Rosa canina*). Boundary scrub was dominated by blackthorn (*Prunus spinosa*), elder (*Sambucus nigra)* and hawthorn (*Crataegus monogyna)*,

Hedgerow (WL1) and Treelines (WL2)

These habitat types occurred where scrub habitats graded into hedgerows and treelines around the periphery of the site. Treelines were dominated by ash (*Fraxinus excelsior)* and beech (*Fagus sylvatica*). Hedgerows were limited on site mainly providing screening for adjacent properties and were generally species poor, dominated by beech and Leyland (cypress *x Cupressocyparis lylandii*).

Mixed Broadleaved Woodland (WD1)

This habitat type was rare within the study area. A small copse was recorded in the south-east corner. The woodland canopy was relatively closed, to 20m high, and was dominated by beech and oak. The understory was open with occasional stands of hawthorn and elder while the field layer was dominated by common nettle (*Urtica dioica*) with frequent dock (*Rumex sanguineus*), hogweed (*Heracleum sphondylium*), garlic mustard (*Alliaria petiolate)* and occasional wood avens (*Geum urbanum*).

Scattered Trees and Parkland (WD5)

Two mature oak trees were recorded within the improved grassland field to the east of the study area just outside of the site boundary.

Spoil and Bare Ground (ED3) and Recolonising Bare Ground (ED2)

The habitats were predominantly associated with access tracks, hardstanding and / or areas of recently cleared vegetation. Species were those usually associated with disturbed ground, comprising chickweed (*Stellaria media*), common poppy (*Papaver rhoeas*), fat-hen (*Chenopodium album*), giant viper's-bugloss (*Echium pininana*) and nipplewort (*Lapsana communis*). A number of non-native, garden escapees were also recorded including garden dahlia (*Dahlia pinnata*), apple-of-Peru (*Nicandra physalodes*), caper spurge *(Euphorbia lathyris*) and Bilbao fleabane (*Conyza floribunda*).

Earth Banks (BL2)

This habitat type was recorded in the north-west corner of the study area at the base of a relatively steep scrubby bank. A large mammal hole was recorded within this steep sandy bank.

Buildings and Artificial Surfaces (BL3)

Buildings and associated hardstanding were mainly concentrated in the centre of the study area. The majority of the structures and buildings on-site were no longer in use, in a poor state of disrepair and were demolished by the end of 2016.

Invasive Species

The invasive species Japanese knotweed was previously recorded within the site. This was successfully treated by Greentown Environmental Ltd working on behalf of KCC. The company issued a letter to KCC on the 5 June 2016 which stated:

"Kerdiffstown Landfill was treated in 2013 – 2014 and we monitored the re-growth in 2015 and again on Monday the 25/05/16 and can confirm that we have witnessed two consecutive years with no re-growth and

therefore can confirm that all the identified sites have been eradicated and study area is currently free from Japanese Knotweed".

It should be noted that Japanese knotweed was also recorded within Kerdiffstown House lands, to the north and outwith the site boundary (refer to Figure 11.4).

Protected Fauna (other than bats)

Table 11.9 lists the fauna recorded within 10km of the proposed Project boundary as provided by the NPWS research branch. This includes details on the protection afforded to these species. Figure 11.1 includes signs of fauna recorded within the study area.

Otter and Badger

No evidence of otter was recorded within the study area. The section of the Morell River which falls within the study area surveyed did not provide suitable habitat for otter resting or breeding sites.

Badger were recorded during the surveys. Due to the high level of persecution of badger and legal protection afforded to this species, information pertaining to the location of setts is treated as confidential. For this reason, detailed information on the location of badger setts including figures identifying sett locations are not provided in this Chapter. This information is contained within a separate confidential report which has been provided to NPWS. NPWS have confirmed this approach in writing. The assessment of impacts of the proposed Project on Badger is presented in this Chapter.

Pygmy shrew, Hedgehog and Stoat

All three species have been recorded within 10km of the study area based on desktop data provided by the NPWS research branch. No visual sightings were recorded of pygmy shrew, hedgehog or stoat during surveys; this is not unusual however as sightings of these species are rare. The site supports suitable habitat for pygmy shrew which is often found in long grass in dense vegetation (including damp conditions), under rocks or logs, wherever adequate insect food supplies exist (habitat preference from Haydyn & Harrington 2001). There is also suitable nesting habitat for hedgehog (typically hedges or scrub in particular where these habitats border woodland) within the site. Such habitats were mainly recorded along the boundary of the site or immediately adjacent to it. Stoat dens are predominantly associated with woodland habitats which are limited in extent within the site.

Protected Fauna (Bats)

Buildings and trees with potential roost features (PRFs) are shown in Figure 11.1 and bat survey locations shown in Figure 11.2. Full survey results are provided in Appendix A11.6. The study area supports optimal habitat for roosting bats (within trees and buildings) and foraging and commuting bats (particularly associated with treelines along the proposed Project boundary, and woodland (immediately adjacent to the site). At least four species of bat have been recorded on-site:

- Common pipistrelle;
- Soprano pipistrelle;
- Leisler; and
- *Myotis spp.* (likely to be Natter's *Myotis nattereri* or Daubenton's *Myotis daubentonii*)

Assessment of Bat Roost Potential

Features assessed for their PRFs are shown in Figure 11.1. The assessment of PRFs for buildings and trees is summarised in Table 11.10 below. Assessments were based on external surveys undertaken from the ground using binoculars. No internal inspections of buildings or climbing of trees was undertaken. At the time of the surveys buildings were not structurally sound and therefore could not be accessed to be surveyed internally, while a climbing assessment was not deemed necessary to inform the assessment, hence dusk and dawn

emergence surveys were conducted. Photos of suitable features are included in Appendix A11.4 (see Photos 11.1 -11.4).

Table 11.10: Assessment of Buildings and Trees with PRF

Feature reference (refer to Figures 11.1 and 11.2)	Type	PRF Classification	Detailed Inspection findings
Point A	Building	High	Numerous crevices in brick work on south-east face of building above door and under metal clad roof. North-east face of building with dense ivy cover.
Point B	Tree (mature ash) on high steep bank	High	Large wound on main trunk (SW facing, approx. 8m up) which appeared to extend back into large cavity.
Point C	Trees along north / north-western boundary	Moderate	Number of semi-mature / mature trees along boundary with dense ivy cover.
Point D	Tree (mature ash)	High	Large wound on main trunk (S facing, approx. 5m up) which appeared to extend back into large cavity. Only one dusk emergence survey was completed at this location.
Point E	Mature oak in field SE of the proposed Project (site boundary)	High	Numerous suitable features including wounds (which appear to extend back into a cavity. Split and lose bark. No dusk/dawn emergence surveys undertaken (not considered necessary given proposals, tree to be retained, no new lighting in this area).
Point F	Mature beech trees in Kerdiffstown House woodland.	High	A number of large mature beech trees within woodland at Kerdiffstown House.

Roost Surveys

The location of roost surveys, static monitoring points and confirmed roosts are shown on Figure 11.2. A summary of the surveys undertaken at each PRF is provided in Table 11.11.

Table 11.11: Bat Roost Survey Methods by Feature

Feature (map reference)	Roost Survey		Anabat Static Monitoring	Confirmed Roost
	Dusk Emergence	Dawn Re-entry		
Point A	Yes	Yes	No	No
Point B	Yes	Yes	No	Yes
Point C	Yes	Yes	No	No
Point D	Yes (1 survey, no predicted impacts)	No	No	No
Point E	No (no impacts predicted)	No (no impacts predicted)	No	No
Point F	No	No	Yes	Potential roost within woodland
Point G	No	No	Yes	No

Anabat Static Monitoring Summary – Indicative Relative Abundance

Static monitoring locations are provided in Figure 11.2. Static monitoring was undertaken within the woodland south of Kerdiffstown House (Point F, Figure 11.2) and in the south of the site next to the building scheduled for removal (Point G, Figure 11.2). As shown in Table 11.12 below, the mean number of 'sound files' or 'passes' recorded for each bat species at each location in July (one week) has been used to provide a comparable measure of 'relative' abundance between species and locations. Detailed findings are provided in Appendix A11.6.

Table 11.12: Summary of Bat Activity by Location

Anabat Location	Mean number of sound files per species					Total Number of Species
	Common Pip (Pip 45)	Soprano Pipi (Pip 55)	Leisler	Pip Social Call (PipSoc.)	Myotis Sp.	
Point F	27	15	89	2	125	4
Point G	21	23	103	1	1	4

Confirmed Bat Roost

No roosts were identified in the building (Point A, Figure 11.2) this building has subsequently been demolished. A single bat roost was identified within a mature ash tree in the north of the study area (Point B, Figure 11.2). Leisler bats were recorded emerging on the third survey undertaken of this tree. A further dawn survey (fourth survey) was undertaken the following morning to confirm the number of bats present (bats are easier to count when swarming). Bats were recorded emerging on the 18 July, the first bat emerging at 21:56 (14 minutes after sunset) with the final bat emerging at 22:18. In total 10 bats were recorded emerging from the roost. The following morning, the 19 July, bats were observed swarming around the tree at 04:48 (32 minutes before sunrise) and the last bat entered the tree roost at 05:08 (16 minutes before sunrise). Given the time of year and number of bats recorded this is likely to be a maternity roost. Plate 11.1 below shows the sonogram (call) of the Leisler's bat at 22kHz recorded at the confirmed roost.

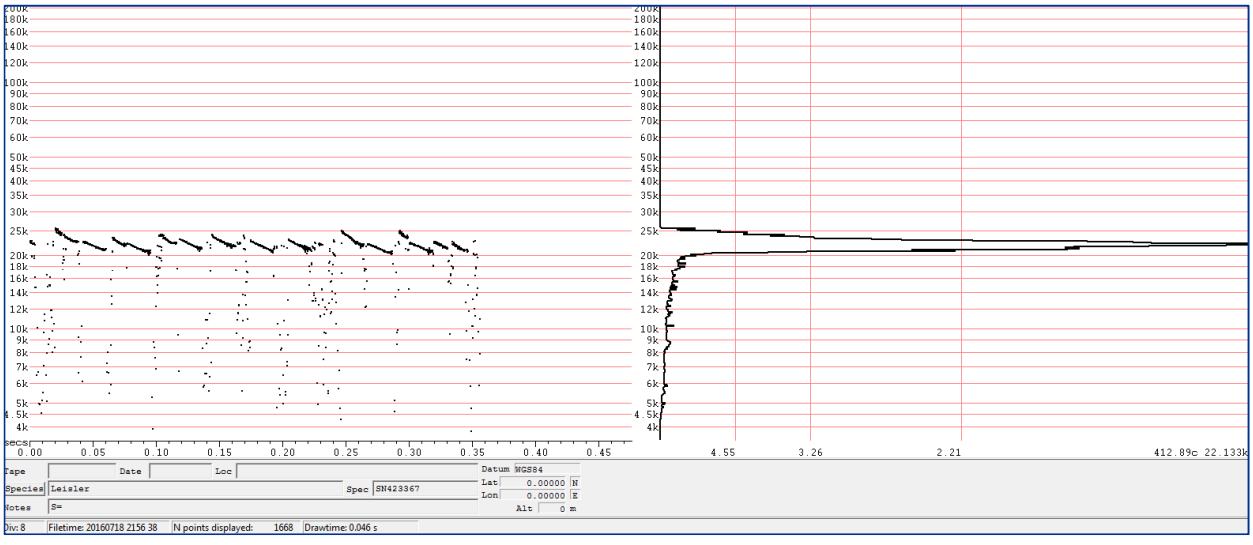


Plate 11.1: **Sonogram of Lesiler's bat emerging from tree roost at 21:56 on 18 July**

While conducting additional surveys of trees in this area it was noted that Leisler were recorded soon after sunset on a number of the surveys indicating another potential roost nearby. An additional tree (Point D, Figure

11.2) had PRFs, however, no bats were observed emerging from this tree during a single dusk emergence survey. Leisler bats are known to move frequently between roosts as highlighted by the BCT publication on Leisler's Bat www.bats.org.uk/publications_download.php/218/leislers.pdf (accessed September 2016). It is likely that both trees (Point B and Point D) are utilised by this species.

Bat Activity (Roost Surveys)

Bat activity was relatively constant throughout the dusk and dawn emergence / re-entry surveys. Leisler's, common pipistrelle and soprano pipistrelle were the most frequently recorded species, with a few *Myotis spp.* passes recorded during these surveys. Bat activity was more frequent throughout the surveys undertaken in July in comparison to June, with almost constant activity recorded throughout the roost surveys in July. Furthermore, activity was recorded during roost surveys undertaken of the trees in the north of the study area in comparison to surveys in the south. This is likely a reflection of better foraging habitat in the north, where there are more mature trees, scrub and where habitats are not lit. There was some limited light spill on the existing building from lighting associated with the main entrance. The south of the site has existing lighting associated with security huts. The first and last bat passes in the vicinity of the building occurred 30 minutes after sunset or over 30 minutes before sunrise indicating that there are no roosts within or in the vicinity of the building. In contrast the first bat passes in the north of the site were recorded between 10-15 minutes after sunset indicating potential for further roosts nearby.

Bat Activity (Static Monitoring Surveys)

In July static recorders were left in place for up to one week within the woodland of Kerdiffstown House (Point F, Figure 11.2) and next to the building in the south of the site (Point G, Figure 11.2). Bat activity was recorded every night at both locations.

Within the woodland of Kerdiffstown House only two species were recorded, including a small number of soprano pipistrelle passes and frequent *Myotis spp.* (likely Daubenton's and / or Natterer's). On all nights *Myotis spp.* were not recorded until approximately 40 minutes after sunset and the last pass for this species was generally up to an hour before sunrise indicating that this / these species are unlikely to be roosting within the woodland or very close by, instead likely to be using the woodland only to forage. On two nights soprano pipistrelle was first recorded 18 minutes after sunset and the last pass for this species was recorded at sunrise, indicating a potential roost (likely transitional) for this species within the woodland.

In contrast no *Myotis spp.* were recorded around the building (Point G, Figure 11.2). Frequently recorded species included Leisler's and pipistrelle bats (common and soprano pipistrelle). Leisler bats were generally recorded quite soon after sunset at this location. However, they are known to roost nearby elsewhere on the site and are not considered to be roosting in the building. Bat activity generally ceased in this area up to one hour before sunrise again indicating no roost in the immediate vicinity.

Myotis spp. were infrequently recorded within the proposed Project boundary (recorded during dusk/dawn surveys in the north of the site) but were more active within Kerdiffstown House woodland adjacent to the site. *Myotis spp*. such as Daubenton's and Natterers are less likely to forage in lit areas, while Natterers tend to forage within woodland habitats rather than more open areas (such as those provided within the site boundary). Plate 11.2 below shows the sonogram (call) of *Myotis spp*. recorded from within the woodland of Kerdiffstown House. The higher number of *Myotis spp.* passes within the woodland is likely to be a result of the darker more sheltered conditions provided within the woodland. Conversely Leisler's and pipistrelle bats are less sensitive to light and will forage in lit areas, which reflects the assemblage of species recorded around the building.

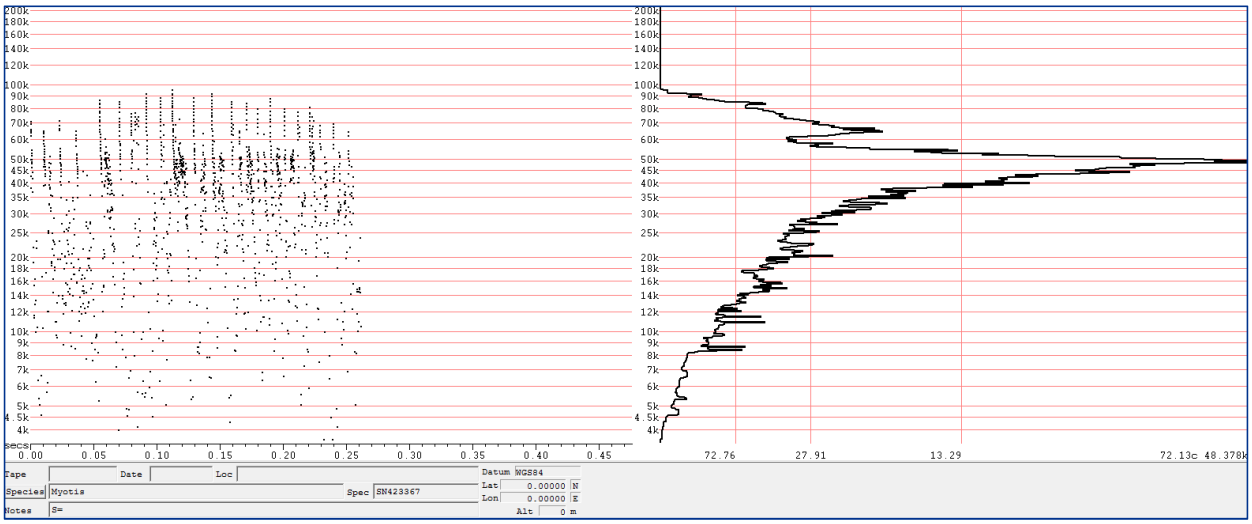


Plate 11.2: Sonogram of a Myotis spp. recorded in woodland to the south of Kerdiffstown House

Breeding Birds

A total of 38 species were recorded during the breeding bird surveys. The full list of species recorded within the study area during the surveys is provided in Appendix A11.7. All species were considered to be confirmed or probable breeders. Breeding territories were typically associated with hedgerow, grassland, woodland or scrub habitats within the study area.

A meadow pipit (*Anthus pratensis*) adult, a red-listed species, was observed carrying food and flying with young indicating a nest nearby. Grey wagtails (*Motacilla cinerea*) were observed, including juveniles, indicating breeding pairs of this red-listed species. Yellowhammers (*Emberiza citronella)* were recorded singing on the second visit, though no evidence of breeding was found, however it is probable this species is breeding within or adjacent to the site, this species is known to nest on the ground below hedgerows or shrubs.

Various amber listed species were also recorded including swallows (*Hirundo rustica)* with numerous juveniles, these are likely nesting nearby; and robin (*Erithacus rubecula*) feeding young. Long-eared owl (*Asio otus*) was noted foraging on-site by one of the surveyors while they were undertaking a bat survey. This species is highly unlikely to breed on-site given the lack of suitable habitat (usually breeds in stands of conifer). However, the site does provide a suitable foraging habitat for this species.

Sand martins (*Riparia riparia)* were previously observed nesting in a large sand bank in the south-east of the site (SKM Enviros 2013). Sand martins were not recorded on-site during either of the breeding bird surveys undertaken in 2016. The sand banks around the site are unstable and have collapsed in parts, and in particular where the sand martins were previously recorded in 2013. It is likely that the sand banks currently offer limited suitable nesting opportunities for this species.

The territories of probable / confirmed breeding birds of Medium (Green/Amber) or High (Red) Conservation within 50m of the proposed Project are illustrated in Figure 11.5 and summarised in Table 11.13.

Table 11.13: Probable/Confirmed Breeders of Medium or High Conservation Concern

Common Name	Scientific Name	Status	Conservation Status
Goldcrest	*Regulus regulus*	Probable	Amber
Greenfinch	*Carduelis chloris*	Probable	Amber
Grey wagtail	*Motacilla cinerea*	Confirmed	Red
Kestrel	*Falco tinnunculus*	Probable	Amber
Linnet	*Carduelis cannabina*	Probable	Amber
Meadow pipit	*Anthus pratensis*	Confirmed	Red
Robin	*Erithacus rubecula*	Probable	Amber
Skylark	*Alauda arvensis*	Probable	Amber
Sparrowhawk	*Accipiter nisus*	Probable	Amber
Starling	*Sturnus vulgaris*	Probable	Amber
Swallow	*Hirundo rustica*	Probable	Amber
Yellowhammer	*Emberiza citrinella*	Probable	Red

Amphibians and Reptiles

There was no suitable habitat for protected smooth newt within the study area. Although the site provides suitable foraging and basking habitat for common lizard there are no records of this species within 10km of the proposed Project. However, this species is likely to be under recorded. No surveys were undertaken for this species, instead it is presumed to be present in low numbers. Frog spawn was recorded in two locations within the study area (refer to Figure 11.1). Three clumps were recorded within the lagoon to the south and an additional clump recorded in a water filled wheel rut in the north of the study area. An incidental record of an adult frog was recorded by Jacobs's staff working at the project offices on-site in February 2016.

Invertebrates (Aquatic)

As noted in Section 11.3.2 white-clawed crayfish were recorded as present within the Morell River by Aquens Ltd. in 2012, 2015 and 2016. The section of the Morell River in the vicinity of the site supports suitable habitat for this species. Although the river bed around the proposed surface water outfall from the site is mainly gravel and sand, which provides sub-optimal habitat for this species, potential refuges are provided in the form of river substrate cobbles and crevices within rocky banks.

11.3.4 Ecological Valuation and Identification of Key Ecological Receptors

Table 11.14 summarises the ecological evaluation, taking into consideration legal protection, conservation status and local abundance. KER's are identified in grey in Table 11.14. European sites are also listed in Table 11.14 below and were also assessed separately in the Appropriate Assessment Screening Statement (Jacobs, 2017) provided in Appendix A11.10.

Table 11.14: Summary of Valuation of Key Ecological Receptors

Ecological Feature Type	European protection	Ecological Importance as per NRA, 2009	Key Ecological Receptor (s)? *
Designated Sites			
Red Bog, Kildare cSAC (000397)	Yes	International	Yes
Ballynafagh Bog cSAC (000391)	Yes	International	Yes
Poulaphouca Reservoir SPA (004063)	Yes	International	Yes
Wicklow mountains SPA (004040)	Yes	International	Yes
Other Designated Sites	No	National	Yes
Habitats			
GS2 Dry meadows and grassy verges	No	Local (Higher value)	Yes
GS4 Wet grassland	No	Local (Higher value)	Yes
GA1 Improved agricultural grassland	No	Local (Lower value)	No
WD1 Mixed broadleaved woodland	No	Local (Higher value)	No - because remediation of the site will not result in the loss of this habitat type.
WS1 Scrub	No	Local (Higher value)	Yes
WL2 Treeline	No	Local (Higher value)	Yes
WL1 Hedgerow	No	Local (Lower value)	No – because this habitat type is limited on site and where present is species poor. Although this habitat may provide some limited nesting opportunities for birds there is an abundance of other suitable nesting habitat on site, considered to be of higher value (Scrub/Treelines). Hedgerows on site are sparse and gappy providing sub-optimal commuting habitat for bats. Furthermore, the majority of existing hedgerows will be retained.
ED3 Recolonising bare ground	No	Local (Lower value)	No
ED2 Spoil and bare ground	No	Local (Lower value)	No
FW4 Drainage ditches	No	Local (Lower value)	No
FW2 Rivers	No	County Value	Yes
FL8 Other artificial lakes and ponds	No	Local (Lower value)	No
BL2 Earth banks	No	Local (Lower value)	No
BL3 Buildings and artificial surfaces	No	Local (Lower value)	No
Rare/Notable Flora Species			
Spiked sedge	No	County	No – no longer present on site (confirmed by habitat surveys)

Ecological Feature Type	European protection	Ecological Importance as per NRA, 2009	Key Ecological Receptor (s)? *
Species			
Badger (setts)	No	Local (Higher value)	Yes
Badger (foraging habitat)	No	Local (Higher value)	Yes
Other mammals presumed present (hedgehog, pygmy shrew)	No	Local (Higher value)	Yes
Bats (roosting)	Yes	Local (County value)	Yes
Bats (foraging/commuting)	Yes	Local (Higher value)	Yes
Breeding Birds of Conservation Concern	No	Local (Higher value)	Yes
Common lizard (presumed present)	No	Local (Higher value)	Yes
Common Frog	No	Local (Higher value)	Yes
White-clawed crayfish	Not outside SAC	Local (County value)	Yes
Fish (lamprey and salmonids)	Not outside SAC	Local (County value)	Yes
Smooth newt	No	Local (Higher value)	No – not within ZoI
Invertebrates (terrestrial)	Not outside SAC	Local (Lower value)	No
Otter	Yes	Local (Higher value)	No – not within ZoI
Invasive species	N/A	N/A	Treatment completed in 2014 (Refer to Section 11.3.3 Field Survey Results)

* Note: KERs highlighted in grey

11.3.5 Ecological Features Scoped out from the Assessment

In accordance with best practice guidance (NRA 2009 and CIEEM 2016): recolonised bare ground; spoil and bare ground; drainage ditches; buildings; other artificial lakes; ponds; hedgerows and earth banks were scoped out from the impact assessment, as they were assessed as being of Local (Lower value). Receptors are generally valued at Local (Lower value) because they are considered widespread, unthreatened, resilient or of little ecological importance. Spiked sedge which was previously recorded on-site in 2011 could not be located during surveys undertaken in 2015 / 2016 and is presumed to no longer be present on-site; it has therefore been scoped out from further assessment. Invasive Japanese knotweed present within the site boundary was successfully treated and is also scoped out from the impact assessment. However, this species is still present in neighbouring land where appointed contractors may be required to access therefore measures to avoid the spread of invasive species are discussed further in Section 11.5.

Smooth newt and otter were scoped out from the impact assessment as habitats within the study area are not considered suitable to support these species or surveys indicated that they were not present. These species are not considered to be within the ZoI and have therefore been scoped out. Finally, the study area is not considered to support significant number of or notable terrestrial invertebrates, therefore these have also been scoped out of the assessment.

11.4 Predicted Impacts of the Proposed Project

The remediation of the site and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately 4 years of intensive construction works to remediate the site. Potential impacts associated with remediation include but are not limited to:

- **Direct habitat loss** - vegetation removal associated with land-take particularly areas of grassland and scrub.

- **Severance** - i.e. fragmentation of habitat, prevention of animal and seed dispersal and discontinuity of habitat or loss of foraging habitat.
- **Mortality** – of protected species associated with vegetation removal and construction activities.
- **Disturbance** – associated with works in the vicinity of retained habitats, for example impacting tree roots or hydrology or which provide shelter for protected species.
- **Contamination** –such as hydrological impacts associated with accidental pollution events, spillages.

The predicted impacts on KERs during the Remediation Phase in the absence of mitigation are provided below.

11.4.1 Remediation Phase

Potential Impacts to European and National Designated Sites

Having identified a preliminary list of sites in Section 11.3.2, the source-pathway-receptor conceptual model was applied, given the characteristics of the proposed Project, to identify which sites, and specific features within sites, should be scoped into the impact assessment. These are identified in Table 11.15 below.

Table 11.15: Identification of Designated Site Potentially Affected

Site and Code	Distance from Proposed Project (km)	Qualifying Interests (cSACs/SPAs) or Reason for Designation (pNHAs) (* = Priority Habitat)	Potential Source-~Pathway-Receptor Link?	Scoped into Assessment? *
Red Bog, Kildare SAC (000397)	7.5	Transition mires and quaking bogs [7140]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
Ballynafagh Bog SAC (000391)	10	Active raised bogs [7110]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
		Depressions on peat substrates of the *Rhynchosporion* [7150]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
		Degraded raised bogs still capable of natural regeneration [7120]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
Poulaphouca Reservoir SPA (004063)	10	Greylag Goose Lesser black-backed gull	No - desktop and field survey indicates no populations within ZoI of disturbance or other potential impacts. Furthermore, likely to be well outside core foraging range for greylag goose which is up to 12km from designated roosts/feeding sites**. Gulls have a large foraging range up to 40km. However, this species was not recorded within the study area.	No
Wicklow mountains SPA (004040)	16.5	Merlin Peregrine	No - desktop and field survey indicates no populations within ZoI of disturbance or other potential impacts. Nests within 500m of effect could be subject to disturbance***.	No
Grand Canal pNHA	2	Various flora and fauna of conservation interest. The Grand Canal feeder also represents an important ecological resource. The canal supports significant populations of coarse fish a range of other freshwater aquatic species, plus all associated floral and faunal components in adjacent habitats.	**Yes – pollution.** There is a direct hydrological link from the proposed Project to the Grand Canal pNHA. The Canal Feeder Stream (WB004) is an engineered feature that collects surface water runoff from lands generally to the south and south-west of the site. The Canal Feeder Stream flows generally westward to the Grand Canal pNHA which is located approximately 2km west of the site providing a direct hydrological link with the proposed Project.	**Yes**
Liffey at Osberstown pNHA	4	The site was surveyed in 1976 and comprised a scrubby steep 10m bank. The main plant of interest was black willow (*Salix nigricans)*. By 1983 the site had been cleared of woodland and no black willow was found.	**No.** No potential source-pathway-receptor links identified.	No

Notes
* Sites potentially impacted are highlighted in grey
** See reference list, Bell (1988).
*** . Nests are not mobile, but birds can perceive disturbance at significant distances to pose a threat. Distance is likely critical reaction distance based on Whitfield et al. (2008).

European Designated Sites

As outlined in Table 11.15 above there are no potential source-pathway-receptor links between the proposed Project and any European designated sites. There is no potential for the proposed Project to impact on QI species or habitats. There will be no impacts on European designated sites.

National Designated Sites

The Grand Canal pNHA (2104) is located approximately 550m north of the proposed Project. Given the distance of the pNHA from the study area there is no potential for habitat loss within the designated site associated with the proposed Project. However, as discussed in Table 11.15 above there is a direct hydrological link between the proposed Project and the Grand Canal. Therefore, potential pollution impacts during remediation associated with an accidental pollution event cannot be ruled out, however unlikely. In the absence of mitigation, a pollution event during the Remediation Phase has the potential to impact on aquatic species within the canal. However, given the distance of the pNHA from the proposed Project footprint impacts are likely to be localised, temporary and significant at the Local geographic scale only.

Potential Impacts to Habitats and Flora

Habitats

To facilitate remediation including capping of the entire site (area defined by the waste profile), excluding a small number of mature boundary trees in the north-east of the site and a section of hedgerow along the site entrance approach it is certain that the existing habitats within the study area will be removed. The habitats identified as KERs that will be directly impacted are listed in Table 11.16. Remediation works are planned to be undertaken in eight phases, subject to a number of aspects such as procurement approach, availability of suitable materials and programme constraints (ecology and weather). Although the majority of habitats on-site will be lost eventually, removal of habitats will be undertaken on a phased basis. The following areas of habitats valued as being of Local Importance (higher value) will be lost during construction: approximately 3.3ha of dry meadow grassland (GS2); approximately 10.3ha of scrub (WS1), approximately 300m of treelines (WL2) and 0.13ha of wet grassland (GS4). The loss of habitats identified as KERs is considered a temporary significant reversible impact at the Local geographic scale.

The area of instream habitat loss will be minimal where construction of the new surface water outfall from the site is required. A small area of the river bed (approx. 0.0004ha) will be dewatered to facilitate works during remediation. The river bed present in the location of the proposed works footprint (surface water outfall location) has the potential to provide suitable lamprey or salmonid spawning habitat. There is potential for white-clawed crayfish habitat (cobbles / rocky crevices in the bank) at this location. Although rivers have been evaluated at County geographic scale given the abundant ecological resources it supports (e.g. significant fish populations, spawning habitat and notable invertebrates) the loss of habitat will be temporary and covering a very small area therefore habitat loss in the Morell River will constitute a temporary, short-term significant impact at a Local geographic scale.

Table 11.16: Predicted Habitat Loss from the Proposed Project

Habitat Type	Approximate extent of habitat within footprint (ha)[2]	Approximate loss of habitat during remediation (%)	Ecological Importance of receptor within field survey area	Potential Impact Significance
GS2 Dry meadows and grassy verges	3.28	100	Local (higher value)	Local
GS4 Wet grassland	0.13	100	Local (higher value)	Local
WS1 Scrub	10.32	100	Local (higher value)	Local
WL2 Treeline	0.14	20	Local (higher value)	Local
FW2 Rivers	0.0004	N/A	County	Local

Potential Impacts to Water Quality (Morell River)

Due to the historical use of the site, the exact nature of the existing waste material cannot be fully determined. During the Remediation Phase, there will be some movement of waste to allow for re-profiling of slopes to provide stability pre and post-settlement. There will also be a requirement for the temporary stockpiling of materials, such as crushed concrete and imported fill materials. During incidents of heavy rainfall there is potential for newly uncovered waste to generate leachate which could penetrate ground water sources within the site which are hydrologically linked to the Morell River. Such impacts would likely be intermittent, short-term and significant at the Local geographic scale.

An accidental pollution event during remediation, although unlikely, would result in a near-certain, short-term significant impact at Local to County geographic scale in relation to water quality in receiving waters.

Potential Impacts to Fauna

In the absence of mitigation there is potential for impacts to a number of KERs including badger, bats, breeding birds, hedgehog (and other small mammals), amphibians, reptiles, white-clawed crayfish and fish during remediation of the site. All other receptors were scoped out (see Section 11.3.5).

Badger

Badger activity was mainly concentrated around the site periphery associated with woodland, grassland and scrub habitats. Woodland habitat, located on the perimeter and outwith the site, will be unaffected during the Remediation Phase. However, remediation works will result in the permanent loss of some scrub and grassland habitats which will reduce the availability of existing foraging resource for badger. However, despite the study area being of Local Importance (higher value) for badger there is an abundance of optimal badger habitat within the immediate wider landscape outside the proposed Project boundary. Impacts on badger foraging resource are considered non-significant.

The study area supports two badger setts. The two potentially affected badger setts are considered to be that of the same group (single territory) given their proximity to each other (within 250m). A national study of badgers and their habitats across Ireland indicated that one badger social group will be found per 2km^2 (Smal 1995).

One main sett will be subject to direct, temporary disturbance as a result of noise and vibration associated with the remediation works. One subsidiary sett will be removed to facilitate remediation of the site. In the absence of mitigation remediation works in close proximity to the setts has the potential to result in sett collapse, badger mortality and/or disturbance. Remediation works will result in the permanent loss of one sett and temporary disturbance to another. The works, although phased, will also result in a short-term, temporary loss of available setting habitat. Impacts on this badger group will be temporary and significant at the Local geographic scale.

[2] Habitat areas based on habitat map provided in Figure 11.4

Other Mammals (Pygmy shrew, Hedgehog and Stoat)

There are three other mammal species, protected under the *Wildlife Acts*, which are likely to occur within the proposed Project boundary and surrounding habitats, based on the habitat types present and include Irish stoat, hedgehog and pygmy shrew. Site clearance during remediation of the site is unlikely to result in any significant mortality to the larger and more mobile species such as stoat (if present). However, it is probable that vegetation clearance may result in some accidental mortality to the smaller pygmy shrew if present. The potential impact would be anticipated to be greater during the breeding season when juveniles would be present in burrows (April-October), or in the case of hedgehog impacts may be greater during their hibernation period which is November – March (inclusive). Remediation of the site will also result in the permanent loss of available foraging habitat for these species during construction. Impacts on these mammal species will be short-term and significant at the Local geographic scale.

Bats

Bat Roosts

There will be no loss of any known bat roosts during remediation of the site. A single tree roost of high conservation value (Leisler maternity roost) was recorded in a mature ash tree in the north-east of the site, refer to Figure 11.2. There is potential for disturbance to this roost during Remediation Phase from lighting associated with plant or mobile lighting. Lighting has been shown to affect emergence at roost sites and could result in the permanent abandonment of a roost. Lighting impacts would result in a permanent significant impact at the County geographic scale, the level at which this receptor has been valued.

Bat Foraging and Commuting Habitat

Remediation of the site will predominantly result in temporary loss of grassland and scrub habitats. However, bats tend to commute and forage along linear features such as hedgerows, treelines and woodland edges. The majority of existing mature treelines to the north-east of the site will be retained. Woodland associated with Kerdiffstown House in the wider field survey area will continue to be an available foraging resource. A small number of semi-mature trees will be lost along the north-eastern flank to accommodate a new surface water drainage system. The tree line along this flank has existing gaps and tree loss will be minimal, hence this is unlikely to have a significant impact on bat commuting habitat. However, clearance of grassland and scrub habitats will near certain result in a reduction of available invertebrate prey resource in the short-term. Impacts on bat commuting habitat are considered non-significant while impacts on bat foraging are considered a short-term significant impact at the Local geographic scale.

Light spill over retained habitats including suitable commuting and foraging habitats could result in disturbance to bats. Lighting can alter bats use of a site, the feeding behaviour of bats (either displacing bats or attracting insects away from unlit feeding areas), and can result in a barrier effect to commuting routes to and from feeding / roosting sites (Stone 2013). In relation to noise impacts, a recent study (Luo et al. 2015) has shown that anthropogenic noise, in this case traffic, reduced foraging activity and prey capture in Daubenton's bat. If lighting and noise impacts occur during the Remediation Phase, associated with construction traffic and mobile lighting they would result in a short-term significant impact at the Local geographic scale.

Breeding Birds

Remediation of the site will result in the clearance of an extensive area of suitable bird nesting habitat mainly associated with scrub and grassland habitats. This will result in a reduction in the availability of suitable nesting habitat for several species resulting in a decrease in the number of nesting territories.

Breeding Birds - Birds of Conservation Concern in Ireland (BoCCI) Red List Species

A total of three Red-listed species were recorded within the field survey area, with grey wagtail and meadow pipet confirmed to be breeding on-site. Yellowhammer were recorded to the west of the proposed Project boundary and are likely to be utilising the site for nesting as well as neighbouring agricultural land. Meadow pipet and yellowhammer are known to nest on the ground under dense vegetation. All three species will be negatively impacted by habitat loss and disturbance during remediation of the site. However, these red-listed species are likely to be relatively abundant in the local area in which further additional suitable habitat to support these species is present.

Clearance of suitable bird nesting habitat in the absence of mitigation would result in the mortality of a potentially large number of birds, particularly those species associated with grassland and scrub habitats. Mortality, disturbance and loss of potential breeding habitat would result in a short-term significant impact on red list species at the Local geographic scale.

BoCCI Amber and Green List Species

All of the amber and green-listed bird species present will be negatively impacted by habitat loss, to both potential and existing nesting habitat and foraging habitat. The majority of species recorded are all common species in agricultural and urban / suburban habitats. Species such as kestrel and sparrowhawk are unlikely to be nesting in the habitats to be cleared as part of the site remediation. However, foraging resources for these species will be reduced.

Clearance of suitable bird nesting habitat in the absence of mitigation would near-certain result in the mortality of green and amber listed birds, particularly those species associated with grassland and scrub habitats. Mortality, disturbance and loss of potential breeding habitat would result in a near-certain short-term significant impact on green list species at the Local geographic scale.

Amphibians and Reptiles

Common frog was the only amphibian species recorded within the site. Frog spawn was recorded in one permanent water body (surface water lagoon) in the south-east of the site. Additional frog spawn was recorded in a temporary water body (wheel rut) in the north-west of the site. Furthermore, an incidental record of an adult frog was recorded within the site. There is potential for this species to be present in suitable habitat across the site at the time of remediation; in particular, any waterbodies or suitable damp habitats (grassland). Remediation will result in the temporary loss of all waterbodies. Clearance of the site including draw down of the ponds will be phased. If this occurs during a period that coincides with the frog breeding season (February to April inclusive) frogs and / or frog spawn could be present resulting in the mortality of this species. Such an impact would be permanent and significant at the Local geographic scale.

Common lizard has not been recorded on-site. However, parts of the site provide suitable basking and refuge habitat for this species. If present, this species is presumed to be present in low numbers. The clearance of grassland, scrub, rock and log piles during remediation has the potential to disturb or result in mortality of a small number of individuals. The risk of mortality would be reduced in summer months (warmer conditions) when this species is much more mobile. Impacts may be greater in winter months when this species is in hibernation. Clearance of the site associated with remediation works would result in a near-certain, short-term, significant impact at the Local geographic scale.

White-Clawed Crayfish

White-clawed crayfish are known to be present in the Morell River and Rathmore Stream. There is potential for this species to be present within the vicinity of the proposed new surface water outfall location. Construction of the surface water outfall could result in mortality, disturbance or injury of a small number of individuals.

An accidental spillage or pollution event into a surface water feature is likely to have a negative impact on this species. The impact is likely to be temporary and localised but would be dependent on the nature and scale of the pollution event.

This species has been valued at County value, however, impacts on this species if they occurred would likely be localised to the area of the surface water outfall location. Potential impacts on this species during the Remediation Phase including mortality, injury, and disturbance would result in a short-term, significant impact at the Local geographic scale.

Fish (Salmonids and Lamprey)

There is currently no direct hydrological link between the study area and the Morell River. However, the Morell River lies approximately 15m to the east of proposed Project at its closest point. This is a highly sensitive watercourse which supports important lamprey, salmon and brown trout populations. Contaminated surface water runoff and sediments could be washed overland and enter the Morell River during the Remediation Phase. Depending on the volumes and contaminants concerned, potential impacts could be significant at Local to County geographic scales of significance (i.e. the maximum ecological value of Salmonids and Lamprey).

Construction of the new surface water outfall to the Morell River and the leachate and foul sewer pipelines to be installed via directional drilling techniques under the Morell River in Johnstown could cause disturbance to fish from vibration and drilling. However, this impact would be localised, short-term, and temporary at the Local geographic scale. There is potential suitable spawning habitat for lamprey and salmonids in the vicinity of the proposed surface water outfall location. Construction of the new surface water outfall could result in mortality of a small number of fish or disturbance to spawning habitat through dewatering of the works area. There is no potential for barriers to fish mitigation as a result of construction of the surface water outfall as a continuous flow of water around the working area will be maintained.

Impacts on lamprey and salmonids during the Remediation Phase associated with disturbance, mortality and pollution would result in a short-term significant impact at Local geographic scale. Impacts associated with disturbance to spawning habitat would be temporary, short-term and significant at the Local geographic scale only.

11.4.2 Operational Phase

There are no predicted Operational Phase impacts for European sites, habitats, pygmy shrew, stoat, hedgehog, breeding birds, amphibians and reptiles. For some of these KERs the Operational Phase will have a significant beneficial impact. This is discussed further in Section 11.6 Residual Impacts.

National Designated Sites

There is currently a direct hydrological link between the proposed Project and the Grand Canal pNHA associated with the Canal Feeder Stream that discharges a local surface water catchment area off the site. The connection to the Canal Feeder Stream will be removed during the Remediation Phase and hence will no longer be in use during the Operational Phase. There will be no Operational Phase impacts.

Potential Impacts to Water Quality (Morell River)

The Operational Phase of the proposed Project will result in a new hydrological link between the proposed Project and the Morell associated with the new surface water outfall. The surface water outfall will discharge from the site into the Morell River. In the absence of mitigation, a pollution event during operation has the potential to impact on water quality. An accidental pollution event during Operational Phase, although unlikely, would near-certain result in a short-term significant impact at Local to County geographic in receiving waters.

Potential Impacts to Fauna

Badger

During the Operational Phase the integrity of the engineered capping system could be undermined if badger were to try and dig a new sett. It is proposed that mammal proof fencing will be installed on the perimeter of the site along the edge of the woodland behind Kerdiffstown House, but within the site boundary. This will be installed throughout the Remediation Phase once the capping is in place and will be maintained during the Operational Phase. This will reduce the total foraging area available to badger. Loss of foraging habitat during Operational Phase will be permanent at the Local geographic scale. However, given that there is an extensive area of suitable foraging habitat available immediately adjacent to the site and the wider landscape impacts associated with loss of foraging habitat are considered non-significant.

Bat Roosts

Potential impacts on the tree roost (Leisler's maternity roost) during Operational Phase would be associated with any new lighting where installed, such as for the multi-use sports pitches, site office and access roundabout. However, impacts are highly unlikely as the new infrastructure is to be constructed in the south of the site away from the confirmed roost. If the tree roost was subject to new lighting impacts this could result in the permanent abandonment of the roost. This would near-certain result in a permanent, significant impact at the County geographic scale, the level at which this receptor has been valued.

Bat Foraging and Commuting Habitat

Operational Phase impacts on bat foraging and commuting bats would be associated with lighting of retained habitats. The majority of existing mature treelines to the north-east of the site will be retained. Woodland associated with Kerdiffstown House in the wider field survey area will continue to be an available foraging resource. Lighting of retained habitats including suitable commuting and foraging habitat corridors is probable to result in disturbance to bats altering their use of the site. However, impacts are highly unlikely as the new infrastructure is to be constructed in the south of the site away from the retained habitats. If lighting impacts were to occur, it is possible that areas of currently suitable foraging and commuting habitat could be rendered permanently unsuitable for use by some species. For example, species such as common pipistrelle, soprano pipistrelle, and Leisler's bat are less sensitive to light displacement impacts in foraging areas than many other bat species; e.g. *Myotis spp*. (Stone 2013). *Myotis spp.* are known to forage within the woodland immediately adjacent to the site. This area is currently dark and lighting impacts during Operational Phase could render this area unsuitable for these species. In the absence of mitigation impacts on foraging and commuting bats are likely to result in a permanent significant impact at the Local geographic scale.

Fish (Salmonids and Lamprey)

During the Operational Phase there will be a direct hydrological link between the proposed Project and the Morell River through a single new surface water outfall. The new surface water outfall will discharge from the site into the Morell River. In the absence of mitigation, a pollution event during operation has the potential to impact on fish including salmonids and lamprey the impact of which is near-certain to result in a short-term, temporary impact significant at the Local to County geographic scale.

White-Clawed Crayfish

White-clawed crayfish are known to be present in the Morell River and Rathmore Stream. The Operational Phase of the proposed Project will result in a new hydrological link between the proposed Project and the Morell associated with the surface water new surface water outfall. The surface water outfall will discharge from the site into the Morell River. In the absence of mitigation, a pollution event during operation has the potential to impact on this aquatic species.

This species has been valued at County value, however, a pollution impact if it occurred would likely be localised. Pollution impacts on this species during the Operational Phase would result in a short-term, significant impact at the Local geographic scale.

11.5 Mitigation Measures

There are a number of key mitigation measures that will be undertaken in order to minimise the overall impact of the proposed Project. Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP). The CEMP shall contain these mitigation measures and plans identified in the following sections and ensure that they are fully implemented during the construction phase, to prevent or reduce the impacts identified in the impact assessment.

The CEMP will include a Site Biodiversity Management Plan which will address the following as a minimum:

- Badgers;
- Bat (including the retained Leisler's maternity roost); and
- Habitat including retention of habitats during Remediation Phase and the development of new habitats during the Operational Phase.

All proposed ecological mitigation measures and enhancements for biodiversity are outlined below and detailed in Figure 11.6. A number of the mitigation measures outlined below will need supervision or liaison with a suitably qualified ecologist.

11.5.1 Remediation Phase

National Designated Sites

The first phase of remediation works will involve the disconnection of the existing hydrological link between the site and the Grand Canal pNHA, via the Canal Feeder Stream. Surface water drainage from the adjacent property REC012 will be realigned and reconnected to the existing outfall to the Canal Feeder Stream outside of the site boundary and the site connection to the Canal Feeder Stream will be removed. This outlet will not be reconnected during the Operational Phase. Surface water will be retained on site during the Remediation Phase. Therefore, there is no potential for contaminated surface water to enter the pNHA via this pathway during the Remediation Phase.

Habitats

Measures to Reduce the Potential for Impacts on Retained Habitats (Trees, Scrub and Hedgerows)

Any trees, scrub or hedgerows adjacent to, or within, the site boundary which are intended to be retained will be afforded adequate protection prior to remediation works commencing. Mitigation measures will be in accordance with the *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes* (National Roads Authority, 2006b), as follows:

- All trees along the site boundary that are intended to be retained, both within and adjacent to the site boundary (where the root protection area of the tree extends into the site boundary), will be fenced off at the outset of works in the adjacent working area and for the duration of the remediation works in that area to avoid structural damage to the trunk, branches or root systems of the trees. Temporary fencing (post and rail) will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. In general, the RPA covers an area equivalent to a circle with a radius 12 times the stem diameter (measured at 1.5m above ground level for single stemmed trees, or above the root flare for multi-stemmed trees);
- Where fencing is not feasible due to insufficient space, protection for the trees will be afforded by wrapping hessian sacking (or equivalent) around the trunk of the tree and strapping stout buffer timbers around it;
- The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). The storage of hazardous materials (e.g. hydrocarbons) will not be undertaken within 10m of any retained trees, hedgerows and treelines; and
- If construction activities are required within the RPA, e.g. excavation work, then a qualified arborist will advise on the best methods for protecting the tree. For example, any excavation works carried out within the RPA will need to avoid damage to the protective bark covering larger roots. This may involve excavation by mini-digger and/or hand as deemed appropriate. Exposed roots will be wrapped in a hessian sacking to avoid desiccation and roots less than 2.5cm in diameter can be pruned back to a side root. The advice of a qualified arborist will be sought if larger roots that influence anchorage need to be severed. Any remedial works required to trees will be carried out by a qualified arborist.
- Where tree removal may be required (due to health and safety considerations) in areas not previously identified liaison with a suitably qualified ecologist will be required.

Mitigation Measures to Reduce the Potential for Impacts to Aquatic Habitats and Water Quality

Mitigation and monitoring measures in relation to water quality are detailed in Chapter 13 Water – Hydrology.

Mitigation Measures to Control and Prevent the Spread of Invasive Species

Japanese knotweed has been eradicated from within the site boundary. It was, however, found to be present within the land of Kerdiffstown House immediately adjacent to the site (refer to Figure 11.4). If the appointed contractor is required to work within 7m of the infested area an invasive species specialist will be appointed. The invasive species specialist will identify the extents of Japanese knotweed and provide recommendations to the appointed contractor on what measures may be required to remove or avoid spreading this invasive species. This would need to be detailed in the invasive species management plan which will be developed as

part of the CEMP. Any mitigation strategy in relation to invasive plant species will be based on the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (National Roads Authority, 2010a).

The following non-exhaustive measures shall be included in the Invasive Species Management Plan:

- Works including access will need to avoid disturbing the Japanese knotweed or potentially contaminated soil within at least 7m of the infested area.
- If works cannot be avoided within the exclusion zone the Japanese knotweed and contaminated soil will need to be treated and/or excavated and potentially removed off site or buried on site under licence from the NPWS, this would be detailed in the invasive species management plan.

Measures to Mitigate Potential Impacts to Fauna

Badger

Pre-construction surveys for badger will be undertaken prior to commencement of remediation works to assess the status of the existing setts and any potential newly established setts as specified in the Wildlife Act Licence (DER/BADGER 2017-92) as granted by NPWS – licence has been provided to NPWS as part of the confidential badger report. The findings of these surveys will inform any updates to the derogation licence. The mitigation measures described below follow the recommendations set out in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006c).

The location containing the main sett will be retained and as such, the permanent removal of the sett as a result of remediation activities will not occur. The subsidiary sett will be removed prior to remediation works to facilitate remediation and installation of the engineered capping system. The mitigation measures that apply in relation to each badger sett within the ZoI are discussed below.

Prior to remediation works commencing within the vicinity of the main sett all site personnel will be given a Toolbox talk where they will be briefed on the presence of the sett and the legal protection that badgers, and their setts, are afforded.

Badger - Closure of Subsidiary Sett

Prior to commencement of remediation works in this area and the closure of the sett, the log pile immediately adjacent to the sett will be removed under licence and supervision by a suitably qualified ecologist. Any additional sett entrances identified will be gated as part of the exclusion.

Prior to closure, the sett will be assessed to determine the use of each hole. Any holes that appear to be disused will be soft-blocked (backfilled with earth and vegetation) and then hard-blocked and proofed to prevent badgers digging back into the sett.

Badger gates will then be fitted to all of the used holes on the sett. Sett exclusion will be carried out over a minimum period of 21 days, with the setts being monitored every three days. This will provide information on whether the badgers are still active at the sett. Camera traps will be placed facing the most well used entrance hole, in order to establish that the badger gates are working correctly and are preventing the badgers from re-entering the sett. In order to monitor all other holes where cameras have not been placed, small sticks will be leant in front of the gate to enable an assessment of badger activity. Monitoring will also confirm that the gates are functioning properly. Once there is certainty that all badgers have been excluded from the sett the gates will be locked permanently stopping any access into or out of the sett.

Standard guidance (NRA 2006) states that a sett should be destroyed as soon as the exclusion has been completed. However, the standard methods usually employed for safe destruction of a sett will not be feasible in this instance. The sett is located within a steep sandy bank, located on the northern perimeter of the site and is considered to extend in a northerly direction into lands beyond the site. Assessment has shown that the bank could become destabilised and collapse if the sett tunnels and chambers were to be excavated. Furthermore, there is very high risk of the bank including mature trees (one of which contains a bat roost) collapsing using standard methods for destruction of the sett.

The remediation works required at this area of the site will comprise backfilling and raising up to be almost level with the existing bank; as such the sett will be buried as part of the remediation works. Rather than destroying the sett it is proposed to leave the gates on for the duration of the works until this area is infilled. The gates would be left in place and the bank covered with wire mesh to prevent badger digging back in. The area immediately surrounding the sett will also be fenced off with mammal proof fencing and vegetation in the vicinity removed to make it less favourable to badger. The area would be monitored once a month to ensure that the gates/mesh and fencing are all in proper working order.

Badger- Measures to Minimise Disturbance to Main Sett

The following lists of mitigation measures are to be undertaken during remediation works in the vicinity of the main sett to minimise disturbance within retained habitat areas immediately adjacent to the site. These measures will be incorporated into the relevant contract documents:

- Any works within 30m of the sett will be supervised by a suitably qualified ecologist (extended to 50m during the breeding season). A 30m buffer will be demarcated around the sett, using barrier tape. Where any works are planned in the vicinity of these exclusion zones (and where they could encroach into same the ecologist will be contacted prior to any such works. The ecologist will ensure that the appointed contractor is complying with the mitigation measures outlined below.
- Night-time working will be restricted as far as possible within 100m of the sett. As badgers are nocturnal, disturbance will be reduced by restricting the amount of night-time working within the vicinity of sett. Night-time, in terms of badger nocturnal activity, is defined as beginning one hour before sunset and lasting to one hour after sunrise;
- The use of noisy plant and machinery in the vicinity of badger setts will cease before sunset; If the works involve excavations they will either be covered (with plywood), fenced or have an escape ramp installed overnight to prevent badgers, or other wildlife, from falling into them and becoming trapped;
- Any borrow pits or spoil heaps will be sited at a minimum distance of 30m from setts;
- Chemicals shall not be used within 20m of a badger sett;
- Mammal proof fencing to be installed in the vicinity of the sett will be hand dug under supervision.

A licence has been granted by NPWS to enable the Remediation Phase works. The licence allows for the monitoring of the setts prior to commencement of remediation works, for exclusion of the subsidiary sett, for the installation of the fence line and to permit works within the distance bands described above. Works within the distance bands described above will only be carried out during daylight hours so as not to disturb foraging badgers.

Bats

Three properties (REC010, REC011 and REC016) will be demolished during the Remediation Phase of the site. These private properties and surrounding gardens were not accessed during the initial bat assessment and surveys. Daytime bat assessments and potential further roost surveys of these properties and trees will be required to be undertaken by a suitably qualified ecologist prior to them being demolished. If a bat roost is identified the roost will be removed under licence from the NPWS and appropriate mitigation implemented per the licence requirements.

Other Mammals (Pygmy shrew and Hedgehog)

There is no known method for excluding pygmy shrew or hedgehog from nest / hibernation sites and therefore the seasonal clearance of vegetation for breeding birds (as described below) will be implemented. This means vegetation clearance works will avoid the period 1 March – 31 August as far as practicable; a significant portion of the main breeding season for both species. This mitigation will simultaneously avoid the majority of the main breeding season for most small mammal species (Hayden & Harrington 2001).

Bats

The lighting design principles will be avoidance of lighting within particularly sensitive areas. Measures to mitigate the impact of lighting disturbance on bats during The Remediation Phase will include:

- Avoid lighting of retained habitats, particularly in the vicinity of woodland, boundary treelines and the confirmed roost. This will ensure that important roosting, foraging and commuting corridors are maintained;
- Lighting if required shall be of a low height (as low as possible without compromising safe working standards) to ensure minimal light spill and where feasible timers or motion sensors shall be used to ensure areas are retained in darkness as much as possible. Lighting shall be directed to where it is required only and this can be achieved by fitting louvres to the lighting; and
- White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact in comparison to other lighting types as it is less attractive to insects and as such insects will not be diverted away from darker areas where more sensitive bat species will be foraging.

Breeding Birds

Vegetation (e.g. hedgerows, trees, scrub and grassland) will not be removed between the 1 March and 31 August, to avoid impacts on nesting birds. Although the Wildlife Acts provide an exemption from this seasonal restriction to vegetation removal for some construction activities, there is no exemption provided for the destruction of nest sites. It is recognised that the remediation works are to be phased, hence vegetation clearance will not be undertaken across the entire site in one operation but will be targeted based on appropriate working areas that can be controlled and managed. Where the remediation programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist for the presence of breeding birds prior to clearance. Where nests are present, an ecologist will make a decision as to whether a licence is required for vegetation removal. Alternatively, the ecologist can demarcate a suitable buffer around an active nest and clearance within this area will be postponed until the chicks have fledged. A suitable exclusion zone will be established dependant on the species identified. Areas found not to contain nests must be cleared within three days of the inspection; otherwise repeat inspections will be required. If vegetation is to be cleared in the breeding season (under supervision of an ecologist) it will be chipped, removed or covered (ideally) on the same day to prevent birds from nesting.

Amphibians and Reptiles

Areas of suitable reptile habitat such as grassland will initially be cut to 10cm high in order to avoid harm to any reptiles should they be present. This will be carried out by hand using hand tools, or if machinery is used, this will be set to a height of 10cm as advised by the suitably qualified ecologist. Refugia such as log piles will be cleared in warmer months (typically April – September) when reptiles are active. Newly created habitat can be enhanced for reptiles, which will entail provision of artificial hibernacula (see Appendix A11.4, Photo 11.7). Newly created hibernacula will be south-facing and free-draining.

If works to clear the existing waterbodies are to be undertaken during the season where frogspawn / tadpoles may be present (February – July) a pre-construction survey will be undertaken to determine whether breeding amphibians are present. If found to be present, the species will be removed by hand net and translocated to the nearest available habitat that is suitable, under licence from the NPWS. There is an abundance of suitable receptor habitat in the immediate locality including ponds located within Kerdiffstown House adjacent to the site.

A licence has been granted by the NPWS (Refer to Appendix A11.8) to enable the removal of frog spawn prior to remediation works should it be required.

White-Clawed Crayfish

Mitigation measures to protect water quality during the Remediation Phase are detailed in Section 11.1.4. The mitigation approach to protect the white-clawed crayfish during the proposed work is to undertake capture and relocation of individuals immediately prior to undertaking the construction of the surface water outfall, following pre-construction surveys to confirm the presence of white-clawed crayfish in the vicinity of the outfall and associated works. As the mitigation approach will require the capture of crayfish and the potential disturbance of refuges, it will require a licence from the NPWS. As these works are proposed for year three of the Remediation Phase a licence has not yet been sought. This will be applied for by the KCC (or a nominated representative)

prior to the works being undertaken. Capture and translocation if required will be undertaken between July – September (to avoid the sensitive period for fish). All works will be undertaken in line with the following documents:

- *Guidance on works affecting white-clawed crayfish* (Peay 2000);
- *Guidance on Habitat for White-clawed crayfish and its restoration* (Peay 2002); and
- *Conservation management of the white-clawed crayfish,* (*Austropotamobius pallipes*) (Reynolds 2010).

Fish (Salmonids and Lamprey)

All works will be carried out in accordance with the requirements of IFI as set out in *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI 2016). If instream work outside July-September period is required these shall be agreed in writing with IFI. The following measures will be implemented to mitigate the potential impacts to fish species:

- Maintaining water quality in the surface water network
- Maintaining fish passage while the surface water outfall is being constructed. Only a small section of the river may require to be de-watered using sandbags or similar, hence a continuous flow will be maintained around the de-watered area;
- Prior to dewatering the area will be electrofished and fish will be placed upstream of works; and
- Instream works will only be carried out during the period July - September (inclusive).

11.5.2 Operational Phase

Mitigation Measures to Reduce the Potential for Impacts to Aquatic Habitats and Water Quality

Mitigation and monitoring measures in relation to water quality are detailed in Chapter 13 Water – Hydrology.

Habitats

Measures to Mitigate for Habitat Loss

The landscaping design is outlined in Chapter 4 Description of the Proposed Project (Refer to Figure 4.20). Wherever possible, mature trees and tree lines will be retained. The main mitigation measures relate to tree and shrub planting within and around the site. There are limitations as to where tree planting can take place so as not to compromise the integrity of the engineered capping system. This leaves peripheral areas and site boundaries available for such planting and this will occur wherever practicable. As outlined in the All-Ireland Pollinator Plan 2015-2020 all planting will, where practicable, comprise native species of local provenance. In summary, the following landscape planting and measures will be implemented:

- Perimeter tree planting and hedgerow planting to include amenity planting around the site entrance as well as native hedgerow screen planting along the boundary;
- Wetland ponds are proposed for the north and south central portion of the site, and these will be planted up with a variety of wetland plants to benefit biodiversity;
- Wetland ponds have been designed with gradual sloping edges to create a variety of niche habitats to benefit biodiversity;
- Dry meadows and grassy verges (GS2) and wet Grassland (GS4) will all be lost as a result of the proposed Project, therefore species-rich native seed mixes will be incorporated into the final design with localised areas of wildflower planting; and
- Drainage ditches and wetland swales across the site will be planted up with wetland herbs and grasses at appropriate locations.

Fauna

Badger

No specific Operational Phase mitigation measures are proposed. There is an abundance of optimal badger habitat within the immediate wider landscape outside the proposed Project boundary. Impacts on badger foraging resource are considered non-significant.

Other Mammals (Pygmy shrew and Hedgehog)

To mitigate for loss of small mammal habitat and nesting opportunities four hedgehog nest boxes will be installed in retained woodland and scrub areas. Boxes will be placed in deep scrub or wooded areas away from obvious paths of disturbance by humans or dogs within the wildlife area fenced off from the public (Refer to Figure 4.20). Furthermore, newly created habitats outlined will provide suitable foraging and resting habitat for these species.

Bats

The lighting design principal will be avoidance of lighting within particularly sensitive areas. The end-use proposal for the site will include three new multi-use sports pitches, changing rooms, a children's playground, etc. These will be located in the centre and south of the site away from sensitive areas which include the woodland in the lands of Kerdiffstown House and existing unlit areas in the north of the site where the confirmed roost is located. The new access route to the north of the site will be for pedestrians only and will not be lit at night. Measures to mitigate the impact of lighting disturbance on bats during the Operational Phase will include:

- Avoidance of lighting, particularly in the vicinity of retained woodland, boundary treelines and the confirmed roost. This will ensure that important foraging and commuting corridors are maintained;
- Reduced light spill through the use of baffles / hoods to ensure that light is directed to the sports pitches as required and not wider;
- White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact in comparison to other lighting types as it is less attractive to insects and as such insects will not be diverted away from darker areas where more sensitive bat species will be foraging; and
- Where lighting is required within sensitive areas (i.e. in the vicinity of retained woodland habitats / tree lines) light levels will be that of full moon light levels, typically between 0.1-0.3 lux.

Breeding Birds

To mitigate for loss of nesting habitat trees, hedgerows, scrub and grassland habitats will be provided, refer to Figure 4.20. Whilst no significant impacts are anticipated during the Operational Phase, this will provide compensatory habitat for some bird species. Nest boxes will also be provided to compensate for passerine habitat loss. Ten nest boxes to accommodate different species will be provided and these will be erected under supervision of a suitably qualified ecologist at appropriate locations in secluded/unlit treelines proposed for retention.

Amphibians and Reptiles

Whilst no significant impacts are anticipated during the Operational Phase, to account for any loss of potential reptile habitat newly created habitat can be enhanced for reptiles through the provision of artificial hibernacula (see Appendix A11.4, Photo 11.7). Newly created hibernacula will be south-facing and free-draining.

A wetland soakaway pond is proposed for Zone 1A and the surface water management ponds in Zone 4, will be planted up with a variety of wetland plants providing optimal breeding habitat for common frog.

11.5.3 Opportunities for Future Enhancement

Ecological mitigation and enhancement measures are outlined in Figure 11.6. Habitat mitigation measures identified above will enhance the habitats within the proposed Project footprint. Key features to enhance the site's biodiversity have been targeted to benefit local biodiversity. Enhancement measures are driven by local planning policy and guidance and national plans relating to the protection and enhancement of biodiversity:

- Installation of bat boxes on retained trees
- Planting of wildflowers to benefit pollinators.
- Creation of new and diverse wetland habitats, including reed beds and wet grassland swales;
- Although no residual impacts have been predicted for breeding birds there is an opportunity to enhance the site for these species and in particular for sand martin given the materials available on-site. There is an opportunity to create artificial sand martin banks with reject sand from the site (Refer to Appendix A11.4, Photo 11.8). This shall be built according to key sand martin specifications including a vertical face (2.5 meters high) to limit predation impacts from predators such as stoat and foxes. Further details are provided in Appendix A11.9. This would further enhance the site for promoting wildlife to public visitors.

This opportunity is dependent on the presence of waste and the suitability and stability of slopes; to be confirmed during detailed design and Remediation Phase.

11.6 Residual Impacts

Residual significance is defined as the level of significance of a potential impact following the implementation of mitigation. A summary of impacts before and after proposed mitigation measures is provided in Table 11.17. Impacts on the various ecological features ranged from those considered to be significant at the County to Local geographic scale.

Through the implementation of well-established approaches to mitigation, which will be implemented in accordance with best practice guidance, it will be possible to reduce the impacts to not significant for all ecological features.

As a result of the proposed mitigation and enhancement measures, no residual significant adverse impacts are predicted for the ecological receptors in the long-term following implementation of mitigation measures. Indeed, as a result of the proposed Project and habitats features to be created, significant beneficial impacts are predicted for the Operational Phase of the proposed Project for the following ecological receptors: wetland habitats, amphibians and reptiles.

Table 11.17: Summary of Impacts

Key Ecological Receptor	Ecological Valuation (as per NRA, 2009b)	Impact Type	Significance	Mitigation Measures	Residual Significance
Remediation					
Designated Sites and Habitats					
Designated Sites (Grand Canal pNHA)	National	• Contamination	Significant Adverse (Local)	• Link between the site and the Grand Canal pNHA, via the Canal Feeder Stream will no longer exist as the current outfall will be permanently disconnected during remediation. • There will be no direct hydrological connection from the site to the Morell River during the Remediation Phase	Not Significant
Habitats (retained)	Local (Higher value)	• Contamination • Disturbance	Significant Adverse (Local)	• All trees along the site boundary that are to be retained, both within and adjacent to the site boundary (where the root protection area of the tree extends into the site boundary), will be fenced off at the outset of works • Temporary fencing (post and rail) will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. • Where fencing is not feasible due to insufficient space, protection for the trees will be afforded by wrapping hessian sacking (or equivalent) around the trunk of the tree and strapping stout buffer timbers around it; • The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). • The storage of hazardous materials (e.g. hydrocarbons) or concrete washout areas will not be undertaken within 10m of any retained trees, hedgerows and treelines; and • If construction activities are required within the RPA, the advice of a qualified arborist will be sought	Not Significant
Habitats (Aquatic) and Water Quality	County	• Contamination • Direct Habitat loss	Significant Adverse (Local to County)	• Monitoring and mitigation measures in relation to water quality are outlined in Chapter 13 Water - Hydrology.	Not Significant

Key Ecological Receptor	Ecological Valuation (as per NRA, 2009b)	Impact Type	Significance	Mitigation Measures	Residual Significance
Fauna					
Badger	Local (Higher value)	• Mortality • Disturbance • Habitat loss (foraging and resting sites)	Significant Adverse (Local)	• Pre-construction surveys • Toolbox Talk • Exclusion and removal of subsidiary sett will be undertaken under licence from the NPWS. • Clearance of log piles next to subsidiary sett will be undertaken using by hand and/or light machinery to identify any potential sett entrances below. • Potentially disturbing works in the vicinity of main sett will be undertaken under licence and supervised by a suitably qualified ecologist • The suitably qualified ecologist will be notified of any potentially disturbing works to be undertaken within 50m of the sett before they commence. • Any borrow pits or spoil heaps will be sited at a minimum distance of 30m from setts; • Chemicals shall not be used within 20m of a badger sett; • Mammal proof fencing to be installed in the vicinity of the sett will be hand dug under supervision	Not Significant
Bats (Roosting)	Local (County Value)	• Mortality • Abandonment of roosting sites • Disturbance	Significant Adverse (County)	• Retention of tree roost (Point B on Figure 11.2). • Avoidance of lighting, particularly in the vicinity of retained woodland, boundary treelines and the confirmed roost (refer to Figure 11.6). • Pre-construction surveys of properties (REC010, REC011 and REC016) will be required prior to them being demolished. If a bat roost is identified it will have to be removed under licence from the NPWS and appropriate mitigation put in place.	Not Significant
Bats (Foraging)	Local (Higher value)	• Disturbance • Habitat loss (foraging)	Significant Adverse (Local)	• Where security lighting and lighting for remediation works is required in the vicinity of retained woodland habitats it will be of a low (as low as possible without compromising safe working standards) height to ensure minimal light spill and where possible timers or motion sensors may be used • Fitting louvres to the lighting to ensure that light is directed only as required • White LED or amber coloured LED lighting will be used	Not Significant
Breeding Birds	Local (Higher value)	• Mortality • Habitat loss (nesting sites) • Disturbance	Significant Adverse (Local)	• Vegetation clearance will be phased and not be removed between the 1 March and 31 August. • Where the remediation programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist. • The suitably qualified ecologist will make a decision as to whether a licence is required for vegetation removal/ demarcate a suitable buffer around an active nest and clearance within this area will be postponed until the chicks have fledged.	Not Significant

Key Ecological Receptor	Ecological Valuation (as per NRA, 2009b)	Impact Type	Significance	Mitigation Measures	Residual Significance
Other Mammals (Pygmy Shrew, Hedgehog and Stoat)	Local (Higher value)	• Mortality • Habitat loss (nesting / hibernation sites) • Disturbance	Significant Adverse (Local)	• No known method for excluding pygmy shrew or hedgehog from nest / hibernation sites and therefore the seasonal works mitigation for breeding birds will be implemented.	Not Significant
Common Lizard	Local (Higher value)	• Mortality • Habitat loss (basking / hibernation sites) • Disturbance	Significant Adverse (Local)	• Areas of suitable reptile habitat such as grassland will initially be cut to 10cm high in order to avoid harm to any reptiles. • Refugia such as log piles will be cleared in warmer months (May – September).	Not Significant
Common Frog	Local (Higher value)	• Mortality • Habitat loss • Disturbance	Significant Adverse (Local)	• Pre-construction survey for all works where it is necessary to clear ponds or other waterbodies. • If found, frogs will be removed by hand net and translocated to the nearest available habitat that is suitable, under licence from the NPWS.	Not Significant
White-clawed Crayfish	Local (County value)	• Mortality • Disturbance	Significant Adverse (County)	• Capture and relocation of individuals immediately prior to undertaking the proposed works (surface water outfall construction) under licence from the NPWS.	Not Significant
Fish (lamprey and salmonids)	Local (Higher Value) to County	• Mortality • Disturbance	Significant Adverse (Local to County)	• Maintaining fish passage while the surface water outfall is being constructed. • Instream works will only be carried out during the period July to September (inclusive). • Removal of fish from dewatered area and placed upstream of works.	Not Significant
Operation					
Designated sites and Habitats					
Designated Sites (Grand Canal pNHA)	National	• Contamination	No impact	• The connection to the Canal Feeder Stream will be removed during the Remediation Phase and hence, will no longer be in use during the Operational Phase.	Not Significant
Habitats	Local (Higher value) -Dry meadows and grassy verges (GS2) -Wet grassland (GS4) -Scrub (WS1) -Treeline (WL2)	• Habitat loss	Significant Adverse (Local)	• Detailed landscaping is included in Figure 4.20 and will include: • Post-construction remediation and enhancement of grassland habitats including meadow creation • Wetland habitat creation. • Native hedgerow planting. • Tree planting • Marsh and wet grassland • Species rich grassland	Not Significant Wetland habitats (Significant beneficial)

Key Ecological Receptor	Ecological Valuation (as per NRA, 2009b)	Impact Type	Significance	Mitigation Measures	Residual Significance
Water Quality	Local to County (based on receptors within the Morell)	• Contamination	Significant Adverse (Local to County)	• During operation measures to attenuate and treat the surface water runoff in order to avoid significant impacts have been incorporated into the drainage design of the proposed Project including the provision of a Surface Water Management Pond (SWMP). • The SWMP will be fitted with a penstock / shut-off valve when constructed to deal with any event of accidental spillage. • During operation water quality monitoring will continue as indicated in the IEAL. • Mitigation and monitoring measures in relation to water quality are detailed in Chapter 13 Water – Hydrology.	Not Significant
Fauna					
Badger	Local (Higher value)	• Loss of foraging areas	Not significant	• None	Not Significant
Bats (Foraging and Roosting)	Local (Higher value – County)	• Disturbance	Significant Adverse (Local to County)	• Reduced light spill through the use of baffles/hoods to ensure that light is directed to the sports pitches as required. • White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact. • No lighting of retained woodland habitat/treelines.	Not Significant
Breeding Birds	Local (Higher Value)	• Loss of nesting habitat	Not significant	• Compensatory habitat for some bird species provided through the planting of trees, hedgerows, scrub and grassland habitats as well as the extension of the existing woodland (Refer to Figure 4. 20) • Ten nest boxes will be provided to compensate for habitat loss (Refer to Figure 11.6)	Not Significant
Other Mammals (Pygmy Shrew and Hedgehog)	Local (Higher value)	• Habitat loss (nesting / hibernation sites)	Not significant	• Four hedgehog nest boxes will be installed in retained woodland and scrub areas (Refer to Figure 11.6) • Habitat creation as outlined above (Refer to Figure 4.20)	Not Significant
Common Lizard	Local (Higher value)	• Habitat loss (basking / hibernation sites)	Not significant	• Newly created habitat can be enhanced for reptiles with the use of artificial hibernacula (Refer to Figure 11.6)	Not Significant
Common Frog	Local (Higher value)	• Habitat loss	Not significant	• Habitat creation as outlined above in particular wetland habitat creation (Refer to Figure 4.20)	Not Significant

11.7 Difficulties Encountered in Compiling Information

No significant difficulties were encountered.

11.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on Key Ecological Receptors. These projects are discussed in the following paragraphs.

11.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018.A Waste Facility Permit has been granted for the proposed quarry infilling.

There will be a cumulative loss of locally valuable habitats in this area associated with the development of both sites should these be undertaken within similar timescales. However, such impacts will be short-term in nature, during the Remediation Phase of the proposed Project. New tree and scrub planting, and newly created wetlands will be provided within the lands of the proposed Project as part of the remediation which will negate for any habitat loss in the short-term.

Clearance of vegetation in the adjacent quarry will result in a cumulative loss of local foraging and nesting habitat for birds and bats. This will limit the available foraging and nesting habitat for these species in the short-term. New tree and scrub planting, and newly created wetlands will be provided within the proposed Project boundary and the provision of nest and bat boxes will also be provided within the end design to account for the loss of nesting and foraging habitat in the short-term.

11.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. Clearance of vegetation to allow for widening of the M7 carriage way could also result in a cumulative loss of foraging habitat and resting sites for badger and bats if vegetation clearance was undertaken on both projects within similar timeframes, this would likely result in a short-term temporary impact given that new tree and scrub planting proposed.

11.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future) are anticipated.

11.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the

proposed Project site. Due to the distance between the two sites and the type of development proposed, no cumulative impact from the housing development project and the proposed Project on biodiversity is anticipated.

11.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. Mitigation has been proposed in relation to the potential impact from the Remediation Phase of the proposed development. It is assumed that the contractors responsible for the construction of the sewerage Scheme will implement best practice measures to protect ecological receptors during the construction phase. Therefore, potential cumulative impacts are not anticipated for ecological receptors during construction. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

11.9 References

- All-Ireland Pollinator Plan 2015-2020.National Biodiversity Data Centre Series No. 3, Waterford.
- Atherton, I., Bosanquet, S., Lawley, M. (eds) (2010). *Mosses and Liverworts of Britain and Ireland. A Field Guide*, British Bryological Society. Latimer Trend & Co. Ltd: Plymouth.
- Aquens Ltd. (2016). Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare.
- Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I., Fuller, R. (2014). Bird Atlas 2007-2011.British Trust for Ornithology.
- BCT species memo http://www.bats.org.uk/publications_download.php/218/leislers.pdf (accessed September 2016)
- BTO, (2012). A Field Guide to Monitoring Nests. British Trust for Ornithology: Thetford.
- Botanical Society of Britain & Ireland (2007). Checklist of the British and Irish Flora. Botanical Society of Britain and Ireland. Available online at <http://www.bsbi.org.uk/taxonomy.html>.
- Byrne, A., Moorkens, E.A., Anderson, R., Killeen, I.J. & Regan, E.C. (2009). Ireland Red List No. 2 – Non-Marine Molluscs. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- Chartered Institute of Ecology and Environmental Management (2016). Guidelines for Ecological Impact Assessment in the UK and Ireland -–Terrestrial, Freshwater, and Coastal.
- Colhoun, K., & Cummins, S. (2013). Birds of Conservation Concern in Ireland 2014-2019, Irish Birds, 9, pp. 523-544.
- Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust: London.
- Department of Environment, Community and Local Government (2011). Guidance for Planning Authorities on Drainage and Reclamation of Wetlands (Department of Environment, Community and Local Government, 2011)
- Department of Environment, Heritage and Local Government (2010). Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities.
- EPA envision map viewer http://gis.epa.ie/Envision (accessed September 2016).
- European Topic Centre (2015). Reporting under Article 12 of the Birds Directive (period 2008-2012). Available online at http://bd.eionet.europa.eu/article12/report
- Fitzpatrick, U., Murray, T.E., Byrne, A., Paxton, R.J., Brown, M.L.F. 2006) Regional Red List of Irish Bees. Higher Education Authority.
- Foster, G. N., Nelson, B. H. & O Connor, Á. (2009). Ireland Red List No. 1 – Water beetles. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Fossitt, J. (2000). Guide to Habitats in Ireland. The Heritage Council.
- Fowles, A.P. (2003). Guidance Notes for the Mapping of Habitat Quality for Marsh Fritillaries. Natural Science Report No. 03/05/01.
- Gilbert, G., Gibbons, D.W., & Evans, J. (1998). Bird Monitoring Methods: A manual of techniques for key species. RSPB/BTO/JNCC/WWT/ITE/The Seabird Group .RSPB/BTO: Sandy.
- Haydyn, T., Harrington, R. (2001). Exploring Irish Mammals. Town House: Dublin.
- Highways Agency (2001). Design Manual for Roads and Bridges. Nature Conservation Advice in relation to Otters. Volume 10, Part 4, HA 81/99. Available at https://www.gov.uk/government/organisations/highways-agency.
- Hundt, L. (2012). Bat Surveys: Good Practice Guidelines, 2nd edition
- IFI (2016). Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.

- Jon Russ (2012). British Bat Calls: A Guide to Species Identification. Pelagic Publishing Limited
- King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011). Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht: Dublin, Ireland.
- Luo, J., Siemers, B. M. & Koselj, K. (2015). How anthropogenic noise affects foraging. Global Change Biology
- Lockhart, N., Hodgetts, N. & Holyoak, D. (2012). Ireland Red List No.8: Bryophytes. National Parks and Wil dlife Service, Department of Arts, Heritage and the Gaeltacht: Dublin, Ireland.
- Marnell, F., Kingston, N. & Looney, D. (2009). Ireland Red List No. 3: Terrestrial Mammals, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- Mathews F, Roche N, Aughney T, Jones N, Day J, Baker J, Langton S (2015). Barriers and benefits: implications of artificial night-lighting for the distribution of common bats in Britain and Ireland. Philosophical Transactions of the Royal Society B: Biological Sciences 370 (1667).
- National Roads Authority (NRA) (2000). National Roads Project Management Guidelines. National Roads Authority.
- National Roads Authority (NRA) (2005a). Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. National Roads Authority.
- National Roads Authority (NRA) (2005b). Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes. National Roads Authority.
- National Roads Authority (NRA) (2006a). Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes. National Roads Authority.
- National Roads Authority (NRA) (2006b). Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes. National Roads Authority.
- National Roads Authority (NRA) (2006c). Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. National Roads Authority.
- National Roads Authority (NRA) (2006d). Guidelines for the Protection of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes. National Roads Authority.
- National Roads Authority (NRA) (2009a). Guidelines for assessment of Ecological Impacts of National Road Schemes. National Roads Authority.
- National Roads Authority (NRA) (2009b). Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. National Roads Authority.
- National Roads Authority (NRA) (2011). Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes National Roads Authority.
- Notice Nature. Wildlife, Habitats and Development. Guidelines for the protection of biodiversity in Construction Projects. Accessed January, 2016 http://www.noticenature.ie/files/Construction_v12.pdf
- Nakicenovic, N. and Swart, R. (2000). Special report on emissions scenarios. Special Report on Emissions Scenarios. Cambridge University Press: UK.
- Nelson, B., Ronayne, C. & Thompson, R. (2011). Ireland Red List No.6: Damselflies & Dragonflies Odonata). National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government: Dublin, Ireland.
- NPWS (2013a). The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 3, Version 1.0. Department of Arts, Heritage and the Gaeltacht: Dublin, Ireland.
- NPWS (2013b). The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 3, Version 2.0. Unpublished Report. Department of Arts, Heritage and the Gaeltacht, Dublin: Ireland.
- NPWS (2013c). Conservation Objectives supporting document: Cummeen Strand/Drumcliff Bay (cSAC) – Marine Habitats and Species. Version 1. Department of Arts, Heritage and the Gaeltacht: Dublin, Ireland.

- NPWS (2013d). Conservation Objectives: Cummeen Strand SPA 004035. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht: Dublin, Ireland.
- NPWS (2013e). Conservation Objectives: Ballysadare Bay SPA 004129. Version 1. Department of Arts, Heritage and the Gaeltacht: Dublin, Ireland.
- Parnell, J. & Curtis, T. (2012). Webb's An Irish Flora. Cork University Press: Cork.
- Peay, S (2000). Guidance on works affecting white-clawed crayfish. English Nature and Environment Agency
- Peay, S (2002). Guidance on Habitat for White-clawed Crayfish and its Restoration English Nature and Environment Agency.
- Regan, E.C., Nelson, B., Aldwell, B., Bertrand, C., Bond, K., Harding, J., Nash, D., Nixon, D., & Wilson, C.J. (2010). Ireland Red List No. 4 – Butterflies. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government: Ireland.
- Reynolds, J.D., O'Connor, W., O'Keeffe, C. & Lynn, D. (2010). A technical manual for monitoring white-clawed crayfish Austropotamobius pallipes in Irish lakes. Irish Wildlife Manuals, No 45, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.
- Scottish Environmental Protection Agency (SEPA) (2014). Land-Use Planning System SEPA Guidance Note 4. Planning Guidance on on-shore windfarm developments. Version 7.
- Shiel, C.B, Shiel, R.E, & Fairley, J.S. (2006). Seasonal Changes in the foraging behaviour of Leisler's Bats (Nyctalus leisleri) in Ireland as revealed by radio telemetry. Journal of Zoology 249, pp. 347-358.
- Smal, C. (1995). The Badger and Habitat Survey of Ireland. National Parks and Wildlife Service, Office of Public Works, Dublin.
- Stace, C.A. (2010). New Flora of the British Isles. Third Edition, Cambridge University Press.
- Stone, E.L. (2013). Bats and lighting: Overview of current evidence and mitigation guidance.
- Symons PEK & Heland M (1978). Stream habitats and behavioural interactions of underyearling and yearling Atlantic salmon. Journal of the Fisheries Research Board of Canada 35, 175–183.
- Toner, P., Bowman, K., Clabby, K., Lucey, J., McGarrigle, M, Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MaCarthaigh, M., Craig, M., and Quinn, R. (2005). Water Quality in Ireland 2001-2003. Environmental Protection Agency, Wexford.
- Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M. & Wright, M. (2016). Ireland Red List No. 10: Vascular Plants. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Dublin, Ireland.
- Whitfield, D. P., Ruddock, M., & Bullman, R. (2008). Expert opinion as a tool for quantifying bird tolerance to human disturbance. Biological Conservation,141 (11), pp. 2708-2717.

12. Soils, Geology, Contaminated Land and Groundwater

This Chapter assesses what effects the proposed Project may have on the soils, geology, contaminated land and groundwater in and within close proximity to the proposed site.

There are a number of adverse impacts predicted during the Remediation Phase, the magnitudes of which range from negligible to moderate. Impacts include changes to landfill gas migration routes; encountering perched leachate and increase in contamination through disturbance of wastes particularly near the water table. In order to mitigate against these predicted impacts, a number of measures are proposed primarily involving a regime of gas and groundwater monitoring at regular intervals throughout the remediation works. The monitoring regime will be formulated based on risk, and will evolve as remediation works progress.

The Operational Phase impacts will be largely beneficial to the environment. Once the site has been capped, infiltration to the landfill will be reduced and therefore less leachate will be produced. Re-profiling of the site will remove low points and therefore prevent pooling and increase landfill stability. The reduction in infiltration may also result in the reduction of the local water table, thereby reducing the amount of waste lying beneath the water table. The increased landfill gas control measures will also reduce the potential for gas migration off the site. As with the Remediation Phase, groundwater and gas monitoring will be carried out on the site at regular intervals once it is operational as a multi-use public park.

12.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as “the proposed Project”) on the on soils, geology and groundwater anticipated to occur during the Remediation and Operational Phases.

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

The remediation of the site and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children’s playground, etc. Table 12.1 summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

Table 12.1: Summary of Key Activities during the Remediation and Operational Phases

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

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

Reference has been made to the extensive geological and hydrogeological data collected in relation to the Kerdiffstown Landfill and the immediate surrounding area over the last six years (2011 to present) by organisations on behalf of the Environmental Protection Agency (EPA) and more recently Kildare County Council (KCC). The most recent information includes the ground investigation and environmental monitoring and risk assessments undertaken in the autumn/winter of 2016/2017.

12.1.1 Study Area

The soils, geology, contaminated land and groundwater study area (hereafter referred to as "the hydrogeology study area" comprises the existing site itself and an area covering a 3km radius from the centre of the existing site (Figure 12.1). This study area has been determined in accordance with the Institute of Geologists of Ireland (IGI) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI 2013) which recommends a minimum distance of 2km from the site boundary and by using professional judgement. Whilst the proposed Project is unlikely to impact on the geology or soils outside of the proposed Project boundary, it does have the potential to impact on other receptors, particularly those associated with migration of contamination including the movement of contaminated groundwater. The 3km radius incorporates all of the proposed Project area and captures the groundwater and surface water features considered to have the highest potential of being affected by the proposed Project. This includes the Morell River closest to the existing site and aquifers down hydraulic gradient from the existing site.

12.1.2 Legislation

Water and Waste

Groundwater in Ireland is protected under European Community and national legislation, and local authorities and the EPA are responsible for enforcing this legislation. Efforts to protect groundwater resources in Europe began in the 1970s resulting in the adoption of the first Groundwater Directive (80/68/EEC). However, the European Community identified that there was a need for further action to avoid long-term deterioration of quality and quantity of all freshwater resources, including groundwater and this led to a framework for an Integrated European water policy; the Water Framework Directive (WFD, 2000/60/EC). The WFD includes groundwater in its river basin management planning, and sets clear milestones for groundwater bodies in terms of delineation, economic analysis, characterisation (analysis of pressures and impacts), monitoring, and the design of programmes of measures to ensure that there is a sufficient quantity of groundwater of "good" chemical status.

The WFD was later complemented by the adoption in 2006 of a daughter directive (Directive 2006/118/EC, the so called "Groundwater Daughter Directive" [GWDD]) laying down additional technical specifications on the protection of groundwater against pollution and deterioration and led to the repeal of the original 1980 Groundwater Directive in 2013.

The requirements of the WFD and GWDD have been enacted into Irish law through S.I. No. 9 of 2010 — European Communities Environmental Objectives (Groundwater) Regulations 2010. The regulations require measures to be implemented to prevent the input of hazardous substances to groundwater bodies. "Hazardous substances" means substances or groups of substances that are toxic, persistent and liable to bio-accumulate and other substances or groups of substances that give rise to an equivalent level of concern

S.I. No. 9 of 2010 also limits the input of non-hazardous substances to groundwater. The input of non-hazardous substances shall be limited so as to ensure that such inputs do not cause deterioration in groundwater status or cause significant and sustained upward trends in the concentration of pollutants in groundwater.

Under the regulations, the EPA may issue exemptions to the "prevent and limit" requirements of the regulations if, for example:

- Inputs are considered to be of a quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of the receiving groundwater;
- Inputs are considered incapable, for technical reasons, of being prevented or limited without using:
  i. measures that would increase risks to human health or to the quality of the environment as a whole, or
  ii. disproportionately costly measures to remove quantities of pollutants from or otherwise control their percolation in, contaminated ground or subsoil.

An example of where such an exemption could apply is given in Guidance on the Authorisation of Discharges to Groundwater (EPA December 2011) as an old, unlined landfill where full remediation may do more environmental harm than good.

It is also relevant to make reference to the Waste Management Act 1996 (as amended) which implements EU Council Directive 99/31/EC (referred to as the Landfill Directive) on the landfill of waste. The overarching purpose of the Directive is to reduce the amount of waste being landfilled and to increase the standard of operation of those sites which continued to operate.

The Waste Management Act 1996 (as amended) list the control and monitoring procedures which the operator must ensure are carried out from the start of the Operational Phase of a waste facility such as a landfill until closure. They also provide for closure and after care procedures for landfills which may relate to the whole or part of the landfill in order to protect the underlying groundwater and wider environment.

The Environmental Liability Directive (2004/35/EC) has been partially transposed into Irish law through the European Communities (Environmental Liability) Regulations (2008). The principal aims of the European Communities (Environmental Liability) Regulations 2008 are to prevent and remedy water damage, land

damage and damage to natural habitats and protected species. Furthermore, these Regulations require operators to initiate preventive measures where there is an imminent threat of environmental damage occurring (as defined under the Directive). The European Communities (Environmental Liability) Regulations 2008 do not apply to damage that took place before 1 April 2009 or damage caused by an emission, event or incident which took place after the 1 April 2009, when it is derived from a specific activity that took place and finished before this date.

With respect to groundwater, environmental damage under the European Communities (Environmental Liability) Regulations 2008 means damage to the groundwater body such that it has a significant adverse effect on the groundwater body chemical status under the Water Framework Directive. It is noted in the EPA's recently issued document 'Determining Groundwater Pollution: A Proposed Approach for the Development and Application of Guideline Values for Groundwater' (EPA 2017a) setting out proposed guideline values for groundwater quality that where groundwater monitoring indicates that where a groundwater Threshold Value is exceeded over a significant extent of the groundwater body or if there is a contaminant plume, where concentrations exceed the Threshold Value over an area > 2km^2, the groundwater body may be classified as being at poor chemical status.

Contaminated Land

Currently there is no specific legislation addressing contaminated land in Ireland and to date numerous approaches to managing contaminated land have been adopted including the ad hoc application of standards and methodologies from other countries. However, under existing EPA licenses, new releases of contaminants to land and groundwater are controlled.

There is no specific statutory guidance in how to deal with a remediation project for a formerly licensed site which was operated in a non-compliant manner. The risk-based approach taken in the assessment of the site and outline design of the remediation of the site has been cognisant of the principles set out in guidance published by the EPA including:

- The "Code of Practice Environmental Risk Assessment for Unregulated Waste Disposal Sites (EPA 2007)" which was drafted to provide "*guidance on how to deal with illegal landfills that have come into being since the introduction of the waste licensing regime.*"; and
- The "Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (EPA 2013)" which was drafted to cope with contaminated land and groundwater issues at all EPA licensed facilities (i.e. industrial, waste etc., but excluding illegal landfills).

The use of key principles such as: a tiered approach, detailed site investigation, use of source-pathway-target(receptor) methodology, detailed quantitative risk assessment and design of remedial measures are clearly applied in the approach taken to assessing the proposed Project, with the approach taken tailored to cope with the unique challenges of the Kerdiffstown Landfill site.

Soils and Geology

Whilst at the European level there were proposals for a Soil Framework Directive tabled in 2006 the directive was never adopted and there is no specific soil protection legislation in place in Ireland.

Section 6 of the Heritage Act (1995) defines national heritage to include, amongst other things, landscapes and geology. The Heritage Act established The Heritage Council which is an independent body which has a statutory responsibility to "*propose policies and priorities for the identification, protection, preservation and enhancement of the national heritage*".

Landfill Gas

Section 4 of Annex 1 of the 1999 EU Landfill Directive outlines the gas control requirements for all classes of landfills. The specific requirements with regards to treatment and use of landfill gas are:

- *4.2 Landfill gas shall be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and used. If the gas collected cannot be used to produce energy, it must be flared.*

- *4.3 The collection, treatment and use of landfill gas under paragraph 4.2 shall be carried on in a manner which minimises damage to or deterioration of the environment and risk to human health.*

This Directive was transposed into Irish law by the Waste Management Licensing Regulations 2004 (SI 395 of 2004) and the Waste Management Act 1996 (as amended).

12.2 Methodology

The methodology used to assess and mitigate potential impacts to soils, geology and groundwater is based on established best practice. Risk assessments and conceptual site models (CSMs) for land contamination have been prepared and the findings of these assessments have been used to inform the outline design of the proposed Project. The assessments and development of appropriate mitigation measures have followed best practice advice including:

- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, Institute of Geologists of Ireland, 2013;
- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009);
- The EPA Landfill Manual guidance notes (EPA 1995, 1997, 1999, 2000 and 2003b):
  - Environmental Protection Agency (1995). Landfill Manual - Guidance Note on Investigations for Landfills;
  - Environmental Protection Agency (1997). Landfill Manual - Guidance note of Landfill Operational Practices;
  - Environmental Protection Agency (1999). Landfill Manual - Guidance note of Landfill Restoration;
  - Environmental Protection Agency (2000). Landfill Manual - Landfill Site Design;
  - Environmental Protection Agency (2003b). Landfill Manual - Guidance note of Landfill Monitoring.
- EPA document Management of Low Levels of Landfill Gas (EPA 2011b);
- England's Environment Agency's Model Procedures for the Management of Land Contamination (EA 2004);
- The Building Research Establishment's guidance Concrete in Aggressive Ground. Special Digest 1 (BRE 2005) and UK Water Industry Research Limited's Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (WIR 2010).

There are no permitted or proposed mineral extraction activities within the site boundary.

Groundwater

The assessment has considered the sensitivity of the groundwater environment (and surface water where these are in continuity with the groundwater) in the context of prevailing hydrogeological conditions. The baseline characteristics in the vicinity of the proposed Project have been determined using the following information:

- Publicly available geological data from the Geological Survey of Ireland (GSI) and EPA (e.g. geological maps, hydrogeological maps and borehole records);
- Publicly available information (e.g. GSI aquifer classification, WFD classifications and assessments, soil designation maps);
- Information regarding groundwater and surface water abstractions including recorded information on private supplies obtained from the GSI website (GSI 2016);

- Reports and data interpretation from ground investigations which provide local geological and groundwater level and quality information;
- Water quality data obtained from monitoring of surface waters and groundwater;
- Observations from site walkovers.

Landfill Gas

The controls required for landfill gas will be based on the conceptual model and Landfill Gas Management Plan (Appendix A4.5) for the site (Jacobs, 2017). The controls which will be employed through the remediation of the site will be based on the Best Available Techniques (BAT) principle and ensure that the long-term environmental risk is minimised through effective containment, monitoring, and control.

A Landfill Gas Risk Assessment has been completed for the site using GasSim for the 'Source Term' module to determine the quantity of landfill gas generation over time based on the mass of waste deposited and the composition of the waste. Further details of GasSim2.5 can be found at www.GasSim.co.uk.

The GasSim2.5 Source Term module, which calculates the bulk gas generation from the site, relies on estimated inputs of waste tonnages, definition of waste types to determine the biodegradable portion of the wastes and other landfill characteristics. A Landfill Gas Management Plan has been developed based on the risk assessment. This includes an assessment of the temporary works required for the site remediation, as well as proposals for landfill gas management infrastructure for the final end-use. The Landfill Gas Management Plan has been developed with consideration of the requirements of the Landfill Directive, and the EPA Landfill Guidance manuals where possible with due regard of the scope of the remediation.

The GasSim 'Global Impact' module has also been used to assess the global warming potential and ozone depletion potential of the emissions calculated by the source term model and through associated combustion processes (e.g. flaring or utilisation of the landfill gas). Due to the limitation in the GasSim 'Lateral Migration' module the sub-surface migration risk has been undertaken using a risk assessment matrix based on the conceptual model. Air dispersion assessments have been completed using US AERMOD software (refer to Chapter 7 Air Quality, Odour and Climate).

Waste

To assess the biodegradability of the wastes descriptions within the available site borehole logs were interrogated. A representative sample of borehole logs was selected based on:

- spatial representation for the Zones;
- quality of the recorded descriptions of the wastes and strata; and
- boreholes which did not hit early obstructions and terminate early.

Assessment criteria

Consideration has been given to the assessment criteria presented in contaminated land and environmental risk assessment guidance to make them applicable to the assessment. Impacts are compared to a 'Do Nothing' approach i.e. compared to the current (baseline) conditions.

The assessment identifies the likely impacts during the Remediation and Operational Phases of the proposed Project. This has involved assessing the significance of any potential effects by determining the sensitivity of the receptor and the magnitude of the potential effect. Recognising that EIA is a predictive process and that a degree of uncertainty is attached to the assessments being made, the assessment indicates the degree of confidence or certainty attached to the assessment.

A generic list of standard definitions in relation to assessing the impacts of a proposed Project has been produced by the EPA entitled Guidelines on the Information to be Contained in Environmental Impact Statements (EPA 2002) (and revised guidelines, due to be finalised in 2017). Each term has been defined to

describe the "quality", "significance", "duration" and "type" of a potential impact. With respect to geology and hydrogeology, further definitions of the terms are presented in Appendix C of the IGI "*Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013)*" document, which in turn are based on the guidance provided by the NRA; Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009). This approach has been adopted for this assessment and the process takes three stages:

Stage 1: Estimate the importance of a geological or hydrogeological feature (Table 12.2).

It should be noted that the NRA guidance does not provide an estimate of importance or magnitude of impact for human health or property impacts. Therefore, terms associated with these aspects have been added to Table 12.2 and Table 12.3 and have been marked with an asterisk.

Table 12.2: Estimation of Importance of Geological and Hydrogeological Attributes

Importance	Criteria for Geology/Soils and Contaminated Land	Typical Examples for Geology/Soils and Contaminated Land		Criteria for Hydrogeology	Typical Examples for Hydrogeology
Extremely High	None identified	Human receptors i.e. construction workers, future site users, maintenance workers, adjacent land users and future construction workers*		Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
Very High	Attribute has a high quality, significance or value on a regional or national scale Degree or extent of soil contamination is significant on a national or regional scale Volume of peat and/or soft organic soil underlying the site is significant on a national or regional scale	Geological feature rare on a regional or national scale (NHA) Large existing quarry or pit Proven economically extractable mineral resource		Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - NHA status Regionally important potable water source supplying >2,500 homes Inner source protection area for regionally important water source
High	Attribute has a high quality, significance or value on a local scale Degree or extent of soil contamination is significant on a local scale Volume of peat and/or soft organic soil underlying route is significant on a local scale	Contaminated soil on site with previous heavy industrial usage Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site) Well drained and/or highly fertility soils Moderately sized existing quarry or pit Marginally economic extractable mineral resource		Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers Locally important potable water source supplying >1,000 homes Outer source protection area for regionally important water source Inner source protection area for locally important water source

Importance	Criteria for Geology/Soils and Contaminated Land	Typical Examples for Geology/Soils and Contaminated Land		Criteria for Hydrogeology	Typical Examples for Hydrogeology
Medium	Attribute has a medium quality, significance or value on a local scale Degree or extent of soil contamination is moderate on a local scale Volume of peat and/or soft organic soil underlying the site is moderate on a local scale	Contaminated soil on site with previous light industrial usage Small recent landfill site for mixed wastes Moderately drained and/or moderate fertility soils Small existing quarry or pit Sub-economic extractable mineral resource Property, including below ground services, building foundations and domestic animals*		Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes Outer source protection area for locally important water source
Low	Attribute has a low quality, significance or value on a local scale Degree or extent of soil contamination is minor on a local scale Volume of peat and/or soft organic soil underlying the site is small on a local scale	Large historical and/or recent site for construction and demolition wastes Small historical and/or recent landfill site for construction and demolition wastes Poorly drained and/or low fertility soils Uneconomically extractable mineral resource		Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes

* These terms are not included in the NRA guidance and have been added so that the impacts on human health and property from contaminated land can be determined

Stage 2: Estimate the scale of the impact on the geological or hydrogeological feature from the proposed Project (Table 12.3).

Table 12.3: Estimation of Magnitude of Impact on Soil/Geology and Hydrogeology Attribute

Magnitude of Impact	Criteria for Geology/Soils and Contaminated Land	Typical Examples for Geology/Soils and Contaminated Land		Criteria for Hydrogeology	Typical Examples for Hydrogeology
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves Irreversible loss of high proportion of local high fertility soils Removal of entirety of geological heritage feature Requirement to excavate / remediate entire waste site Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath the site Soil contamination is considered to pose a high risk to potential receptors with one or more pollutant linkages certain to be present*		Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems Potential high risk of pollution to groundwater from routine runoff Calculated risk of serious pollution incident >2% annually

Magnitude of Impact	Criteria for Geology/Soils and Contaminated Land	Typical Examples for Geology/Soils and Contaminated Land		Criteria for Hydrogeology	Typical Examples for Hydrogeology
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Loss of moderate proportion of future quarry or pit reserves Removal of part of geological heritage feature Irreversible loss of moderate proportion of local high fertility soils Requirement to excavate / remediate significant proportion of waste site Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath the site Soil contamination is considered to pose a moderate risk to potential receptors with one or more pollutant linkages present*		Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems Potential medium risk of pollution to groundwater from routine runoff Calculated risk of serious pollution incident >1% annually
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Loss of small proportion of future quarry or pit reserves Removal of small part of geological heritage feature Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils Requirement to excavate / remediate small proportion of waste site Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath the site Soil contamination is considered to pose a low risk to potential receptors with one or more pollutant linkages possibly present*		Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems Potential low risk of pollution to groundwater from routine runoff Calculated risk of serious pollution incident >0.5% annually
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes Soil contamination is considered to pose a very low risk to potential receptors with one or more pollutant linkages unlikely to be present*		Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature		-	-
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature		-	-
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature		-	-

* These terms are not included in the NRA guidance and have been added so that the impacts on human health and property from contaminated land can be determined

Stage 3: Estimate the significance of the impact on the geological or hydrogeological feature from a matrix based on the importance of the feature and the scale of the impact (Table 12.4).

Table 12.4: Matrix for Rating of Significant Environmental Impacts at EIA Stage

		Magnitude of Impact			
		Negligible	**Small**	**Moderate**	**Large**
Importance of Attribute	**Extremely High**	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/Moderate	Profound/Significant	Profound
	High	Imperceptible	Moderate/Slight	Significant/Moderate	Severe/Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

The definitions used for the significance of the impacts are shown in Table 12.5.

Table 12.5: Definitions for the Significance of Environmental Impacts

Magnitude of Impact	Definition
Imperceptible	An impact capable of measurement but without noticeable consequences
Slight	An impact that alters the character of the environment without affecting its sensitivities
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound	An impact which obliterates all previous sensitive characteristics

Further Descriptors

The above terms have been used and applied to soils, geology, contaminated land and groundwater assessment and the terms used are summarised below. Each of these criteria will have further descriptors associated with them as summarised below.

- The duration of an impact is described in terms of whether it is “temporary”, “short-term”, “medium-term”, “long-term” or “permanent” as follows:
  - Temporary (construction-related and lasting less than one year).
  - Short-term (lasting one to 7 years).
  - Medium-term (lasting between 7 to 15 years).
  - Long-term (lasting 15 to 60 years).
  - Permanent (lasting over 60 years).
- The impact assessment considers the type of the impact. This will be described as “cumulative”, “indeterminable”, “irreversible”, “residual”, “synergistic” or “worst case”.
- To show the uncertainty that is inherent in any hydrogeological and contaminated land, landfill gas and soils assessment, the impact assessment considers the certainty that the impact will occur using the terms “certain”, “likely”, “possible” or “unlikely” as set out below:
  - Certain: >95% chance of occurring as predicted.
  - Likely: 50-95% chance of occurring as predicted.
  - Possible: 5-50% chance of occurring as predicted.
  - Unlikely: <5% chance of occurring as predicted.

- . If the assessment considers an impact is unlikely this will not be considered in the assessment.

The embedded mitigation measures which have been designed and incorporated into the proposed Project have then been considered in the initial assessment. If following this initial assessment additional mitigation is required, the additional mitigation measures will be described and the significance and magnitude of the residual impacts described again, using the above terms, identifying a reduction of impact where possible.

The following disciplines may interact with soils, geology, hydrogeology and landfill gas to a greater or lesser extent and the following Chapters should be considered alongside this Chapter;

- Air Quality, Odour and Climate (Chapter 7): consideration of soil gas generated by waste and contaminated land;
- Biodiversity (Chapter 11): the inter-relationship of groundwater and any ecological features to be protected needs to be considered for example surface water ecosystems dependent on groundwater baseflows;
- Water Quality (Chapter 13): consideration of groundwater and surface water interactions; and
- Waste (Chapter 15): contaminated land and volumes of waste to be excavated based on ground conditions need to be considered.

12.3 Baseline Conditions

12.3.1 Historical Site Investigations

The baseline data provided in this Chapter was largely obtained from site investigations that the EPA and KCC commissioned to establish geological and groundwater conditions as summarised in Table 12.6. The locations of investigation points are shown in Figure 12.2.

Table 12.6: Summary of Groundwater Site Investigations

Investigation Name	Dates of Site Investigation	No. of Boreholes Drilled	No. of Monitoring Wells Installed	On / off site	Monitoring Well No.s
EPA SI	10/05/10 to 12/05/10	10	9	Off-site	EMW01* to EMW10
EPA SI	06/06/11 to 19/06/11	7	7	On-site	EMW11 to EMW17
Phase 1 SI	09/01/12 to 06/02/12	24	4	On-site	BH2, BH6, BH7, BH24
Phase 2 SI	14/08/12 to 21/09/12	61	21 (17 groundwater, 1 leachate (now dry) 2 Inclinometer, 1 Gas)	On and off-site	BH26, BH36B, BH39B, BH40B, BH42, BH48, EMW18 to EMW24, BHEMW27 to EMW33.
Phase 3	November 2016 to February, 2017	69	44	On-site and off-site	RM01 to RM06 BB01 to BB04 BH60 to BH70 DB01 to DB15 (excluding DB13)
Former abstraction wells	Not relevant	2	2	On-site	GW1D, GW2S

* EMW01 was backfilled due to health and safety concerns by the landowner regarding the location of the well on a pathway.

Investigations involved installation of approximately 40 groundwater monitoring wells (not all wells were completed) on and off the existing site (Table 12.6). Wells were established to collect data to define the geological and hydrogeological site setting and provide groundwater monitoring points. Subsequent rounds of

groundwater monitoring have been undertaken monthly to establish the chemical quality of the groundwater with the most recent round prior to this report being undertaken in December 2016.

In addition to the intrusive ground investigations summarised above, there have also been non-intrusive geophysical investigations to aid the assessment of the geology and to detect the presence of or any changes in contaminant plumes flowing from the existing site. As noted in Chapter 3 The Need for the Proposed Project, these surveys have been undertaken annually with the most recent survey undertaken in February 2016. Each survey has comprised electrical resistivity tomography profiles (repeating lines undertaken in previous surveys) and conductivity mapping. These surveys have concentrated on the land to the east of the landfill where contaminant plumes may move from the site to the Morell River.

Due to the potential for groundwater to discharge to the local surface waters, a series of surface water samples are collected along the Morell River and the Canal Feeder Stream at the locations shown in Figure 13.2 (refer to Chapter 13 Water - Hydrology for a description of surface water quality).

In addition to the groundwater and surface water investigations and monitoring, works have been undertaken to investigate and control landfill gas (which principally comprises methane and carbon dioxide, as well as odorous trace compounds). This included installation of boreholes into the waste to allow for the abstraction and flaring of landfill gas (refer to Chapter 7 Air Quality, Odour and Climate for the assessment air quality and odour impacts).

12.3.2 Land Use

The Coordination of Information on the Environment (CORINE) database shows the land use at the site to be defined as “dump” (EPA 2016), refer to Figure 9.1. However, within the hydrogeology study area, the majority of the land use is agricultural, with the soil to the west of the site described in the CORINE database as “pastures”. A sport and leisure land use is shown to the east of the existing site and urban and industrial areas associated with Naas and Sallins are present in the west and south of the hydrogeology study area.

The GSI online mapping portal shows that historically the site was a quarry with a historical quarry present to the west of the site (GSI 2016). The maps also show that land surrounding the site has high potential for granular aggregate extraction and the limestone bedrock underlying the overburden deposits has a low or moderate potential to be used for crushed stone aggregate. No historical mine sites are identified within the hydrogeology study area (EPA 2016).

12.3.3 Soils

The natural soils beneath the existing site have almost entirely been removed due to the historical site development, particularly the use of the site for mineral extraction. The main area of natural soils that haven’t been disturbed by historical quarrying and landfilling operations within the site boundary are identified as being along the site’s southern boundary to the south of Zones 3 and 4. Investigation logs show that topsoil in this area is thin (0.05 to 0.2m). Adjacent to the existing site, where remediation works will extend outside of the former waste licence boundary to the east, borehole logs have identified that “top soil” is in the region of 0.3m thick, however further details of the soil structure are not provided in these logs. These soils form part of the Palmerstown House Estate grounds and the CORINE database (EPA), refer to Figure 9.1, shows land use in this area is for sport and leisure facilities and is therefore not used for agricultural purposes (EPA 2016).

The ground in the triangle of land known as Tunney’s Field to the south-west of Zone 1 also has not been used for quarrying or landfilling purposes, therefore the historical site investigations have not included significant investigation in this area although some trial pits and a borehole have been completed close to the boundary with Zone 1. It is thought that Tunney’s Field has natural soils at the surface. The vegetation in this area is seen to be relatively scrubby grassland.

Diagram 12.1: Location of Tunney's Field

In the wider area around the proposed Project area, the soils are designated on the Teagasc soil map (Teagasc 2016) as follows:

- River alluvium associated with the Morell River;
- Fine loamy drift with limestone;
- To the north of the existing site, soils associated with an urban environment.

Sub-soils beneath the site are shown to be Carboniferous limestone sands and gravels with undifferentiated gravelly alluvium sub-soils associated with the Morell River (EPA 2016).

12.3.4 Geology Overview

A summary of the geology, including the made ground deposits identified at the existing site, is shown in Table 12.7. Geological cross sections through the site are shown in Figure 12.3 and the base of waste elevation and waste thickness are shown in Figures 12.4 and 12.5. The natural geological sequence in the vicinity of the site comprises overburden deposits of glacial origin (sands and gravels, silt and clays), with alluvial (river) deposits close to the major rivers (including along the Morell River). These overburden deposits overlie limestone bedrock. On the existing site, the natural geology has been altered by the quarrying of the sand and gravel deposits and subsequent deposition of waste materials

Table 12.7: Summary of Geology

Geological strata	Occurrence	Thickness (m)	Further Comments
Made ground	Present in Zone 1, Zone 2, Zone 3 and Zone 4 (see Figure 12.5 for extent of the waste). Potentially present in other in-filled quarries to the north-west of the existing site	0 to 36m	The greatest thickness is observed in Zone 1 of the existing site. Made ground likely to be absent in Tunney's Field.
Glacial overburden deposits	Beneath the entire existing site and adjacent area.	5 to 25m	The glacial deposits are dominantly sand and gravel in nature and it is this material that would have been quarried at the site. However, deposits of a more clayey or silty nature are present, particularly to the south of the existing site in Zone 4.
Alluvium (overburden)	Deposits laid down by the major rivers in the region including the Morell River	Approximately 5m to 7m	Identified as a silty, clayey material, although sandy in places.
Limestone bedrock	Present beneath the whole region	Over 100m	

No recorded landslides within the hydrogeology study area are shown on the GSI landslide map (GSI 2016).

12.3.5 Occurrence of Waste Materials and Made Ground

Made ground (principally in the form of waste deposits) is present over most of the proposed Project area, with the greatest thickness and lowest elevation of made ground being in the centre of Zone 1 where approximately 36m of made ground has been observed (see Figures 12.4 and 12.5 for the areas where waste has been encountered). The made ground is principally waste material comprising a mixture of municipal solid wastes (MSW and also known as "household waste") and construction and demolition (C&D) waste. In general, the MSW is identified in greater proportions beneath Zone 1 and Zone 2A. Beneath Zone 2B and beneath Zone 4, C&D wastes predominate with much of the waste within Zone 4 appearing to consist of the residuals from waste that has previously been processed on site (Table 12.8). No hazardous wastes have been noted in the ground to date.

Table 12.8: Occurrence of Waste by Zone

Zone	Waste type	Thickness (m)	Further Comments
Zone 1	Principally MSW described as containing varying quantities of timber, paper, textiles, soft plastic, rubber, metal, brick and concrete.	Maximum thickness over 36m	The greatest thickness of waste on the existing site is observed in Zone 1.
Zone 2A	MSW and C&D waste described as containing varying quantities of timber, paper, cardboard, textiles, soft plastic, rubber, metal, brick and concrete. Measurements of methane during the ground investigations showed high concentrations indicating a high proportion of putrescible waste.	Up to 16m	Waste is present directly beneath concrete hardstanding in this area. Also, the bund which bounds the south of this zone also contains waste. The presence of waste in the bund to the west is uncertain.
Zone 2B	Principally C&D waste described as containing varying quantities of hardcore, plastic, timber, concrete and brick. Measurements of methane during the ground investigations showed low concentrations indicating a low proportion of putrescible waste.	3m to 12m	The thickest waste deposits in this zone are present along the zone's north-eastern boundary where a "bund" of waste material is present. Beneath a concrete pad associated with this zone, around 6m of waste is present.
Zone 3	This zone contains C&D wastes with varying amounts of clay, gravel, concrete, brick, wood, textile, plastic, rubber and metal. Non-hazardous waste excavated from the location of the fire at the site in 2011 was also deposited in the lined cell; volume approximately 35,000m^3. Following demolition of the site buildings in 2016, non-hazardous wastes that had been stockpiled in and around the buildings was removed and deposited to the lined cell; approximate volume 14,000m^3.	Up to 13m	Wastes in this zone are in an engineered lined cell.
Zone 4	Principally C&D waste described as containing varying quantities of hardcore, plastic, timber, concrete and brick.	Up to 20m in mounds and bunds. Away from the mounds, the waste thickness is up to 5m	Wastes in this zone are largely present in mounds or bunds the latter of which border the north-eastern and eastern boundary of the zone.

12.3.6 Overburden Geology

On a regional scale, the existing site is indicated to be in an area of glacio-fluvial sands and gravels which extend over an area of 2km^2 (Figure 12.6). Due to the nature of the historical development of the site, originally as a sand and gravel quarry, the overburden deposits beneath much of the existing site have been removed at least in part. However, it should be noted that boreholes which have fully penetrated the waste have all

identified overburden deposits beneath the waste with no waste having been indented as sitting directly on the bedrock.

Boreholes installed immediately at the edge of the landfilled areas (shown by the extent of waste in Figure 12.5) and off-site are completed in the natural overburden deposits where little or no made ground is identified.

In general, this glacial overburden is characterised by an initial, more silty, clayey sand and gravel horizon approximately 3m thick underlain by gravelly sands approximately 10m thick and then sandy gravels around 7m thick. To the east and south-east of the existing site the glacial deposits tend to become more silty and clayey. However, within these clayey deposits, sand and sand and gravel horizons are present. In several boreholes installed along the Morell River and the site's eastern boundary, a hard conglomeritic horizon (a coarse-grained sedimentary rock that comprises a substantial amount of rounded to subangular gravel to cobble sized rock fragments) was encountered and this horizon appears to be observed in the river's bed.

Based on the information gained in the site investigations, a greater thickness of overburden deposits are found running through the centre of the site in a broadly north-south direction with a thickness in the region of 25m for example in borehole BH68, BB02 and DB02 (see Figure 12.2 for the location of these boreholes). The thinnest overburden deposit that has been proven by fully penetrating the deposits is in BB04 in the east of the site (on the northern boundary) where 6.7m of natural overburden deposits were proven.

Along the northern and eastern boundaries of the landfill, a number of monitoring wells were advanced to define the full thickness of the overburden deposits. The boreholes show that the thickness of overburden deposits increases in a northerly direction along the eastern boundary with the thickest deposits being encountered in borehole BB2 at 25m. The data suggests there is a buried channel running through the site in a generally south to north direction. Within the site itself, even thicker overburden deposits were encountered in borehole BH68 with the deposits being 26.8m thick. It should be noted, that this feature was speculatively identified in the resistivity survey as being present in the first geophysical investigation undertaken in 2010 (Apex Geoservices 2010).

In the Morell River valley, clayey alluvium associated with the river predominates. However, the borehole logs for the north-east of the existing site show that sandy lenses (isolated pockets of overburden deposits) are present in the clay-dominated alluvium (for example in boreholes EMW02 and EMW05).

12.3.7 Bedrock Geology

The majority of the existing site is mapped by the GSI as being underlain by bedrock of the Ballysteen Formation (Figure 12.7). This formation is described as dark muddy limestone/shale and not susceptible to processes which would cause an increase in permeability such as karstification. The far north-west corner of the existing site is underlain by the Waulsortian Limestone, which is described as a pale grey muddy limestone

Ground investigations in 2012 and 2016/2017 reached the bedrock in 12 boreholes although the 2012 borehole logs do not provide a description of the bedrock strata. The 2016/2017 investigation included coring of the bedrock in a number of boreholes to provide a detailed description of the bedrock. Based on the 2016/2017 investigation, the bedrock is generally described as a strong to medium strong, thickly to thinly bedded, grey/dark grey, fine-grained, limestone. Based on these descriptions and appearance of the limestone, the rock encountered would appear to be the limestones of the Ballysteen Formation which is shown on the geological maps as underlying the majority of the site.

Fracture logging in the Factual Report of Ground Investigation (IGSL 2017) shows the upper sections of the bedrock to be highly fractured, with the number of fractures reducing with depth. The logs show the rock quality designation (RQD) which is an indication of the degree of fracturing within the rock mass, measured as a percentage of the drill core recovered in lengths of 0.1m or more. High quality, competent rock has a RQD of more than 75% and low quality, fractured rock has a RQD of less than 50%. The log for borehole BB4 shows that there is less fracturing at depths with RQDs of over 95% being recorded from a depth of 15m onwards (this

being approximately 8m from rockhead) and in borehole BB1, a RQD of 90% is recorded at around 5m below rockhead.

The borehole logs also show that within many of the fractures clay is recorded as being present.

The depth to bedrock was recorded in the borehole logs as being between 7.1m and 26.8m bgl (metres below ground level) with the bedrock elevation varying from 62mOD (metres Ordnance Datum) in borehole BB02 to 79.5mOD in BH60. The plan showing the contours of the bedrock (Figure 12.8) would indicate that there is a buried channel running through the site in a south to north direction, with the lowest point being identified on the north-eastern boundary in borehole BB02. The estimated depth to bedrock is shown in Figure 12.9.

The GSI website (GSI 2016) shows that there are no mapped karst features (cavities and cave systems created by weathering of limestone) present in the limestones within the hydrogeology study area.

12.3.8 Geological Features of Interest

The Geological Survey of Ireland (GSI) publishes a list of “Sites of Geological Interest”. The audit of County Geological Sites in County Kildare was completed in 2005 and there are no sites within the hydrogeology study area (GSI 2005; GSI 2016).

12.3.9 Hydrogeology Overview

Beneath the existing site, the overburden deposits form one aquifer and the limestone bedrock forms a second aquifer although the GSI overburden aquifer designation map (GSI 2016) does not show the glacial sand and gravel deposit to be a recognised aquifer in the vicinity of the site. The map does show the bedrock (both the Ballysteen Formation and Waulsortian Limestone) to be classified by the GSI as being a Locally Important aquifer which is moderately productive only in local zones (Figure 12.10). The GSI’s vulnerability classification for the bedrock aquifer in the vicinity of the existing site is ‘high’ (Figure 12.11).

Within the overburden deposits, groundwater flow will be within the pore spaces between the sand and gravel deposits. Whilst the clay and silt deposits may have a relatively high percentage of pore space, there will be very limited groundwater movement in these deposits with the clays forming a barrier to groundwater flow.

In the bedrock aquifer, flow will be dominantly in fractures rather than within the rock matrix itself. A review of available data indicates that groundwater flow in these deposits is likely to occur in the upper few metres of the deposits according to Poorly Productive Aquifers – Monitoring Installations and Conceptual Understanding (EPA 2010d). Whilst there are no relevant published data for the bedrock in the immediate vicinity of the existing site, similar rocks in the region (which are classed as both “Locally Important” aquifers and “Poorly Productive” aquifers), show that the top metre or so of the bedrock is classed as a “transition zone” where the rock is often highly fractured and has a “rubbly” appearance (EPA 2010d). This transition zone is likely to be less than a metre thick and is underlain by a “shallow bedrock” zone where fractures are present which may or may not be clogged with residual clays. This shallow bedrock zone is unlikely to reach a depth from rockhead of greater than 10 to 20 metres and in turn is underlain by the “deep bedrock” zone. This deep bedrock zone is a zone in which fractures become fewer with depth and in which there is reduced groundwater flow compared to the two overlying zones. However, it is important to note that all these zones may not be present or apparent at any given location (EPA 2010d).

Based on the borehole logs from the 2016/2017 investigation, it is apparent that there is this transition zone and fractured “shallow bedrock” zone beneath the Kerdiffstown site. Although the thickness of the transition zone is not easily determined, it is apparent that the upper five to ten metres of the bedrock is fractured and will provide the dominant pathway for groundwater movement in the bedrock.

The site is located in the Eastern River Basin as defined under the Water Framework Directive and within the Kildare River Basin District. The basin’s management plan was produced in 2010 (the Eastern River Basin District River Basin Management Plan. 2009 – 2015, Department of Environment, Heritage and Local

Government 2010). The site is shown on the GSI mapping portal to lie on the south-western edge of the Dublin Groundwater Body which covers an area of 824km^2 (GSI 2016). In 2004 the groundwater body in the vicinity of the site was “not at risk” and is shown to be of good chemical and quantitative status. The second cycle of the River Basin Management Plans (RBMPs) is currently underway and the draft second cycle RBMPs setting out the status of waters, the proposed environmental objectives and the draft programme of measures to achieve those objectives by 2021 will be issued early in 2017.

12.3.10 Groundwater Levels and Flow

Groundwater strikes within the overburden deposits observed during the time of site investigations did not generally record large water inflows following the strike (see the borehole logs in IGSL 2017). Many of the boreholes did not record water strikes, even though subsequently the completed boreholes were found to contain groundwater. However, when drilling the bedrock boreholes, it was noted that large inflows occurred when the fractured transition zone at the top of the bedrock was encountered. This would indicate that this zone is potentially an important flowpath for groundwater and any contamination within the groundwater, although where the fractures are clay-filled the importance of this zone for groundwater flow will be reduced.

The borehole logs (IGSL 2017) also show that following water strikes in the overburden deposits, the water levels rose slightly and this, together with the presence of “blowing sand” in some boreholes would indicate that there is a degree of confinement in the overburden deposits with the more clayey horizons (sometimes associated with alluvial deposits along the Morell River) providing the confining layer. The conglomeratic horizon encountered close the Morell River also has the potential to provide a confining layer or a barrier to the downward flow of groundwater.

Groundwater levels in all available monitoring wells (Figure 12.12) are measured monthly. Groundwater contour plans for the overburden deposits and the underlying bedrock recorded in February 2017 are shown in Figures 12.13 and 12.14 (levels at this time were, in most boreholes, close to the yearly low levels although water level data from other dates show a similar pattern for the two geological strata). Over the existing site, the groundwater contours for the overburden deposits indicate a general fall in groundwater levels from south to north indicating a broadly north-easterly groundwater flow direction. Groundwater levels to the south of the existing site are in the order of 81mOD with levels to the north-east of the existing site being in the order of 78mOD. However, the data also show an easterly flow component with flow from the site to the Morell River.

There are a number of wells in Zone 4 which appear to be perched levels (where local groundwater levels are higher than the regional level) with, for example, BH2 (water levels around 84mAOD), DB09 (88mAOD) and DB10 (88.3mAOD) all having water levels much higher than measured at the other wells in this part of the site. There are also a number of high groundwater levels recorded at a number of wells completed in the waste in Zones 2 and 3, and these too are likely to be perched water levels.

A weir on the Morell River adjacent to the existing site has an elevation of 79.79mOD. The well RM05, is closest in proximity to the Morell River and in February and March 2017 it had a groundwater level of 79.31 mOD and 79.37 mOD respectively suggesting the river and groundwater are in hydraulic connection. To the south of the weir, the river levels would be greater than 79.79mOD, whilst to the north the river levels would generally be less than 79.79mOD. It is noted that groundwater levels on the site to the north of the weir in Zone 4 do fall below the weir elevation at times of low groundwater levels, indicating that on occasions there is the potential for water to flow from the river to groundwater.

The Morell River flows generally northwards to flow into the River Liffey. The River Liffey itself lies approximately 3km north-west of the existing site at its closest point, also flowing generally northwards, before following a more eastward flow direction some 5km to 6km north of the site. There is a major public water supply abstraction from the River Liffey at Leixlip, which serves Fingal, Kildare and north Dublin.

Spot measurement of the water level in the Canal Feeder Stream to the west of the existing site has shown this feature to be at an elevation of approximately 80.6mOD adjacent to the existing site (at monitoring point SW10).

This suggests that the Canal Feeder Stream may be hydraulically connected with groundwater, although the observed groundwater flow direction (i.e. south to north) indicates that there is likely to be little groundwater input to this stream from groundwater in the vicinity of the site.

There are now 11 monitoring wells in the bedrock aquifer from which water levels are obtained. The pattern of inferred contours for the bedrock is shown in Figure 12.14 which shows a generally south to north flow with water levels being around 79mOD in the south and 76mOD in the north. The groundwater levels recorded in the bedrock boreholes are typically in the order of 10m to 15m higher than the bedrock surface elevation.

Comparison of measured water levels between the overburden and bedrock aquifers indicates higher water levels within the overburden deposits across the existing site (typically in the order of 2m to 3m). This difference in groundwater level provides a mechanism for potential downward flow of groundwater (and potential contamination from the wastes in the landfill) into the bedrock aquifer. However, in borehole BB04 which is completed near to the Morell River in the south-east of the site, the groundwater elevation in the bedrock is close to the elevation recorded in the overburden deposits and the Morell River elevation. This would indicate that in this part of the site there is potential that groundwater in the bedrock is in connection with the Morell River. Furthermore, as often occurs in groundwater systems, it is possible that beneath the length of the river the bedrock groundwater level is higher and groundwater from the bedrock could discharge to the river as the river would act as a discharge point.

Since groundwater level monitoring commenced in 2010 for off-site boreholes and 2011 for on-site boreholes, the groundwater level data show that there has been a gradual increase in overall water levels up to January 2013 by between approximately 0.5m and 2m (refer to Diagram 12.2 below). This is likely to be the result of increased rainfall during 2012 which was a wet year relative to 2011, with 861mm of rainfall recorded at Casement weather station in 2012 compared to 429mm of rainfall recorded in 2011. Following this rise in groundwater levels, the levels have been exhibiting a seasonal fluctuation in the region of 0.5m to 1m with the high groundwater levels being recorded in the late winter/early spring and the low water levels recorded in late summer. This seasonal variation is typical of groundwater levels in Ireland where high winter rainfall and low evapotranspiration rates lead to groundwater recharge over the winter. In the spring and summer, little or no rainfall will reach the groundwater table due to evapotranspiration and rainfall reducing soil moisture deficits. As a result, groundwater levels fall during the spring and summer and start rising again in the autumn, although due to a relatively dry autumn and early winter in 2016 water levels in 2016 were not observed to have risen by December.

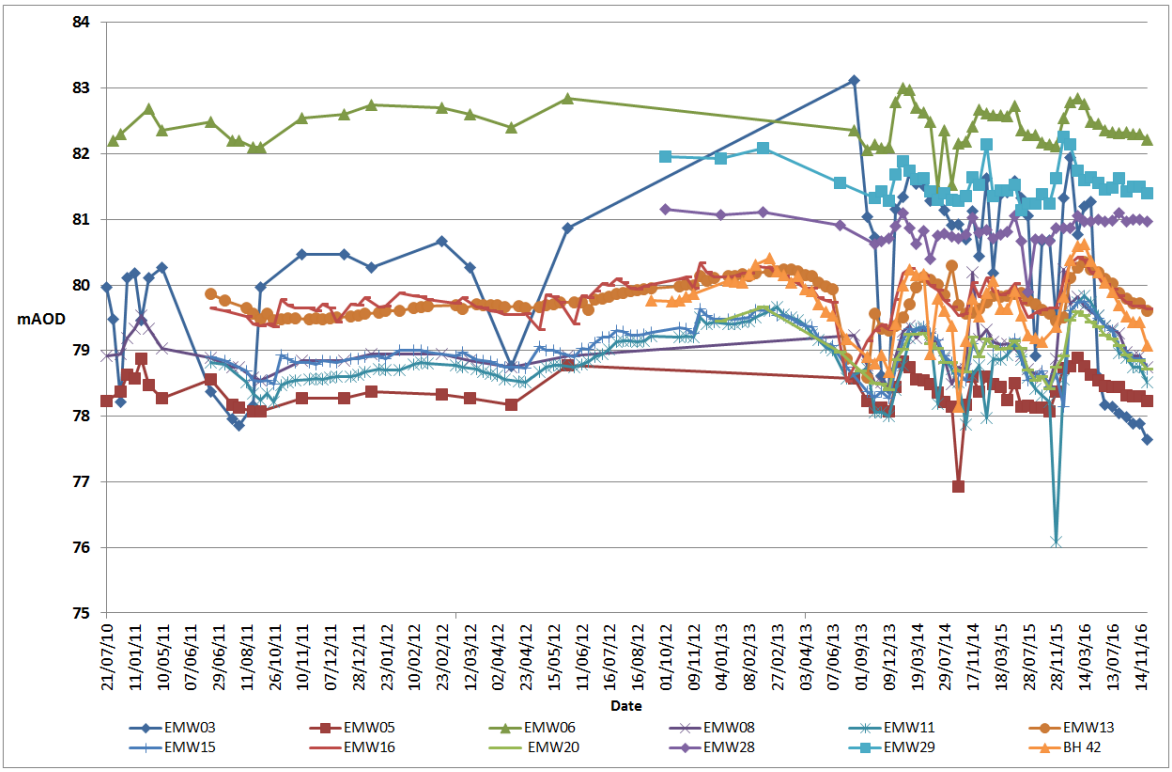


Diagram 12.2: Groundwater Levels Recorded Over Time for Selected Overburden Boreholes

Data produced by the GSI (GSI 2016) shows that in the vicinity of the site the effective rainfall (that is the rainfall which will either recharge ground or runoff as shallow flow to streams) is 391mm/year with the groundwater recharge to the limestone bedrock being 200mm/year. Recharge to the shallow sand and gravel deposits and the wastes within the Kerdiffstown Landfill site boundary is likely to be higher than the recharge to the limestone and closer to the effective rainfall value (in assessments undertaken where groundwater infiltration is a required parameter, an infiltration rate to waste of 350mm/year has been assumed).

With respect to groundwater levels and the base of the waste, in most areas, the waste is above the groundwater table. However, in the south and east of Zone 1 and the north-east of Zone 2B, the data show that the waste is below the groundwater table such that the waste is saturated in this area (Figure 12.15). Up to 5m of waste may be saturated in parts of Zone 1. Within Zone 4, the data also show that wastes are locally present below the water table in areas where there are mounds of waste. Zone 3, the lined landfill cell, was constructed above the water table, although there is local perching of groundwater to the south and west of the zone where the perched groundwater table is locally above the base of the liner.

12.3.11 Groundwater Abstractions

Whilst the GSI website (GSI 2016) shows 74 wells and springs to be present within the hydrogeology study area, most of these wells appear to relate to boreholes installed for ground investigation, other investigation purposes or relate to historical wells. However, based on the “well use” description, wells shown in Table 12.9 have been identified as potentially being in use. The location of these abstractions is shown on Figure 12.1:

Table 12.9: Potential Groundwater Abstractions within the Hydrogeology Study Area

Well Type	Location		Locational Accuracy (m)	Depth (m)	Use
	Easting	Northing			
Dug well	690311	724559	50	14.1	Agricultural and domestic use
Borehole	690961	720979	10	15	Industrial use
Dug well	691401	724788	50	2	Agricultural and domestic use
Borehole	690531	721229	10	11.9	Industrial use
Unknown	689971	724059	50	NR	Agricultural and domestic use
Dug well	690891	724798	50	4.4	Agricultural and domestic use
Dug well	691191	724598	50	1.5	Agricultural and domestic use
Dug well	691241	724688	50	2	Agricultural and domestic use
Dug well	690301	724479	50	4.2	Agricultural and domestic use
Dug well	690911	724948	50	6.8	Agricultural and domestic use
Dug well	690880	724998	50	NR	Agricultural and domestic use

NR – Not recorded

Two groundwater abstractions were situated on the Kerdiffstown Landfill site but these are effectively no longer operational other than for a minor abstraction used very occasionally for site operations (details are also not fully known in terms of depth or how much water they historically abstracted). In addition to these former abstractions, the data presented in the Kerdiffstown Remediation Project Groundwater Management Plan (SKM Enviros 2013a) identified a further abstraction associated with Palmerstown House Golf Course, situated approximately 500m to the north-east of the existing site. As this is situated to the east of the Morell River it is unlikely to be a receptor for groundwater from the Kerdiffstown Landfill and its use is understood to be for watering the golf course rather than being for the more sensitive end-use of a drinking water supply.

With respect to the Waulsortian Limestone, due to the variable nature of the limestone, it is known that wells regularly fail in this horizon and that poor yielding wells can occur very close to more successful wells. This indicates the unpredictability of this rock unit in terms of providing a water source. The Ballysteen Limestone also shows variable productivity and a small number of wells are described as having excellent productivity in the County Kildare Groundwater Protection Scheme Volume 1: Main Report (GSI 2002).

12.3.12 Permeability and Groundwater Flux

In-situ permeability (hydraulic conductivity) tests have been completed in a number of boreholes on two occasions as follows, with the results shown in Table 12.10.

- In 2012, permeability tests were completed in groundwater monitoring wells installed in the 2011 and 2012 ground investigations. These tests were principally in wells completed in the overburden deposits although one test was also undertaken in one of the completed bedrock boreholes (EMW12D).
- During the 2016/2017 ground investigation further permeability tests were undertaken in boreholes at the time of drilling. Four of the tests were undertaken in the bedrock.

The results from the 2016/2017 tests undertaken in boreholes at the time of drilling show results which are generally orders of magnitude below those in the competed wells with the highest value being 1.9m/d (only two results in the tests undertaken in completed boreholes were below this value).

For the test undertaken in the completed borehole in bedrock (EMW12D) the result was similar to the tests undertaken in the over burden deposits. EMW12D is completed in the shallow bedrock deposits (the top 7.5m of bedrock) and as such is likely to be completed in the zone where fracturing of the bedrock is enhanced. As with permeability tests in the overburden deposits, the results from permeability tests undertaken during the 2016/2017 site investigation shows values to be orders of magnitude lower than the test in the completed EMW12D borehole.

Table 12.10: Permeability Measurements

Borehole	Geological Horizon	Permeability (m/day)	Permeability (m/s)
Overburden Deposits – tests undertaken in completed wells			
EMW11	Gravelly SAND	2.0	2.31E-05
EMW13	Silty, sandy coarse GRAVEL	5.7	6.60E-05
EMW14	Silty, gravelly CLAY	0.01	1.16E-07
EMW15	Silty, sandy coarse GRAVEL	13.5	1.56E-04
EMW16	Sandy, silty gravelly CLAY	0.1	1.16E-06
EMW17	SAND and GRAVEL	24.5	2.84E-04
EMW18	SAND and GRAVEL	32.5	3.76E-04
EMW20	GRAVEL, occasional cobbles	147.5	1.71E-03
EMW21	GRAVEL, occasional cobbles	119.5	1.38E-03
EMW23	Sandy GRAVEL	9.06	1.05E-04
EMW28	Sandy GRAVEL	11.4	1.32E-04
EMW30	Gravelly SAND	18.3	2.12E-04
Overburden Deposits – tests undertaken in boreholes during drilling			
DB01	Firm brown very sandy silty CLAY with some fine gravel bands. Sand is fine to coarse. Gravel is fine.	0.038	4.35E-07
DB01	Stiff to very stiff brown slightly sandy gravelly CLAY with some cobbles	0.012	1.36E-07
DB03	Medium dense to dense grey slightly silty gravelly fine to coarse SAND. CLAY at base	0.181	2.09E-06
DB03	Gravelly SAND (driller's description)	1.875	2.17E-05
DB12	Medium dense to dense, brown, slightly gravelly silty SAND with gravel/sand conglomerate from 8.5m.	0.055	6.31E-07
BB02	Sandy gravelly clay with occasional cobbles	0.023	2.71E-07
BH60	Gravelly CLAY with occasional cobbles overlying rock (driller's description)	0.009	1.05E-07
RM01	Medium dense brown/grey silty sandy fine to coarse GRAVEL	0.027	3.15E-07
RM01	Dense brown/grey fine to coarse GRAVEL with some lenses of blowing gravelly sand and some small cobbles overlying stiff, brown, slightly sandy very gravelly CLAY with many cobbles	0.346	4.00E-06
RM02	Dense grey slightly sandy fine to coarse GRAVEL with occasional silty sand pockets	0.005	6.19E-08
RM02	Dense grey slightly sandy fine to coarse GRAVEL with occasional silty sand pockets	0.005	6.10E-08
RM03	Dense grey slightly sandy silty fine to coarse GRAVEL	0.005	5.22E-08
RM03	Dense grey fine to coarse GRAVEL	0.632	7.32E-06
RM04	Medium dense brown/grey silty sandy fine to coarse GRAVEL	0.005	5.58E-08
RM04	Dense grey sandy fine to coarse GRAVEL with many fine to coarse cobbles	0.022	2.55E-07
RM05	Medium dense to dense grey very silty sandy fine to coarse GRAVEL	0.005	5.46E-08
RM05	Dense grey slightly sandy fine to coarse GRAVEL	0.056	6.49E-07
RM06	Dense grey slightly sandy fine to coarse GRAVEL	0.175	2.03E-06
RM06	Dense grey coarse GRAVEL with many cobbles	0.164	1.90E-06

Borehole	Geological Horizon	Permeability (m/day)	Permeability (m/s)
Bedrock – tests undertaken in completed well			
EMW12D	Bedrock (no further description provided in borehole log)	5.4	6.25E-05
Bedrock – tests undertaken in boreholes during drilling			
BB01	Strong to medium strong, thickly to thinly bedded, grey/dark grey, fine-grained, LIMESTONE	0.032	3.76E-07
BB03	Strong to medium strong, thickly to thinly bedded, grey/dark grey, fine-grained, LIMESTONE	0.003	3.25E-08
BB04	Medium strong, thickly to thinly bedded, grey to brownish grey, fine-grained, LIMESTONE	0.083	9.62E-07
BH68	Strong, thickly to thinly bedded, grey/dark grey, fine-grained, LIMESTONE	0.004	4.61E-08

It should be noted that the method of testing only provides an indication of the hydraulic conductivity in the immediate vicinity of the borehole and not on an aquifer-wide scale which will be more important for contaminant flow from the existing site. In relatively complex geological settings as observed in the overburden deposits at Kerdiffstown, whilst local hydraulic conductivities may be high in the sand horizons, the bulk movement of water in the aquifer may be controlled more by the lower permeability values present in the clays and silts which can provide a barrier to flow (both vertically and horizontally) if there is no continuous sand horizon.

Boreholes installed into the bedrock are at a relatively shallow depth and likely to be monitoring the “transition zone” or “shallow bedrock” zone (as defined in EPA 2010d). Insufficient details are provided on the boreholes logs to confirm if these zones are present or their depths due to the drilling method employed. However, the GSI has indicated that the transmissivity of both the Ballysteen and Waulsortian in this area is less than $10m^2$/day with a bulk permeability for the two formations of 0.1 to 0.2m/day. Yields from the boreholes installed in the Ballysteen and Waulsortian bedrock are usually less than $30m^3$/day (EPA 2010d). The measured bedrock permeability value for the one borehole measured at Kerdiffstown (EMW12D) of 5.4m/day would therefore suggest that this borehole is monitoring a transition / fractured zone.

Based on the measured hydraulic gradient and the permeability values, the groundwater flux (the volume of water which flows through a volume of rock over a given time), has been calculated for flow from Zone 1 in the overburden deposits to the east towards the Morell River as $160m^3$/day to $640m^3$/day, as per the report on Groundwater and Surface Water Monitoring at Kerdiffstown Landfill February 2013 (Geosyntec 2013). Further assessment of the impacts of groundwater contamination on river water concentrations for Zone 1 and other zones adjacent to the river based on the groundwater DQRA is provided in Section 12.3.17.

12.3.13 Baseline Leachate and Groundwater Quality

Leachate quality

Landfill leachate is a liquid which forms when water passes through degrading waste which dissolves environmentally harmful substances which may then enter the environment. The main components of concern with respect to water contamination are ammonia (directly toxic to fish and other aquatic life), dissolved organic material (mainly organic acids) which give rise to high demands for oxygen (chemical oxygen demand [COD] and biochemical oxygen demand [BOD]) which can deoxygenate waters (leading to fish kills) and chloride which increases salinity of water and changes the ecological make-up. Leachate also contains other components such as dissolved metals and trace organic compounds, and the extent of these depends principally on the origin of the wastes.

The EPA’s web-based Envision mapping system (EPA 2016) does not show any groundwater quality monitoring points within the hydrogeology study area.

Boreholes have been drilled into the wastes in Zone 1 and elsewhere. However, the majority of these boreholes were installed to investigate waste depth and composition. Due to difficult drilling conditions including impenetrable objects in the waste such as large concrete blocks and boulders, determination of waste thickness was not achieved. Further, as the majority of the site is unlined leachate is unlikely to have been collected in a discrete layer to enable detection and thus boreholes have not been completed as monitoring points to collect leachate. The 2016/2017 investigation did install monitoring points within Zone 1 although again difficulties completing the holes meant that the base of the waste was not always reached although casing to allow monitoring was installed. As such, leachate composition for each individual zone is not always available. Measurements of leachate levels in the boreholes completed in the waste in Zone 1 in early 2017 did not identify leachate to be present in these boreholes (see Appendix A12.1).

Samples of leachate are routinely collected from the lined cell in Zone 3 and these are analysed for a small range of parameters to allow the leachate to be disposed of off-site. Leachate is collected for temporary storage in tanks. Road tankers then extract the leachate from the tanks on a daily basis for off-site disposal at Ringsend Wastewater Treatment Plant. In addition, sampling of groundwater from boreholes completed below or adjacent to waste deposits provides an indication of the contaminants which are leaching from the waste.

The likely leachate composition based on the data from Zone 3 and groundwater quality data from below and around Zone 1 was assessed in the Kerdiffstown Landfill Remediation Project Groundwater DQRA Report for the Environmental Protection Agency (SKM Enviros 2014). The Zone 3 leachate results (Table 12.11) show that the leachate being produced at the site is typical of a landfill that has accepted MSW and C&D waste in that it has elevated chloride and ammoniacal nitrogen concentrations. Assessment of the groundwater data also shows elevated concentrations compared to background groundwater quality and environmental quality standards for certain metals (including nickel and zinc) and trace organic compounds including mecoprop (a pesticide used in “feed and weed” formulas so frequently found in landfills which have accepted domestic and construction and demolition waste) and phenol which shows that leachate is being produced in Zone 1.

Table 12.11: Leachate Monitoring Results from Zone 3

Determinand*	No. of samples	IGV	Minimum	Average	Maximum
Ammoniacal nitrogen	231	0.15	**87.7**	**350**	**833**
Arsenic	9	0.01	<0.001	**0.057**	**0.224**
Benzene	4	0.001	<0.0005	**0.0046**	**0.0059**
Chloride	233	30	**171**	**434**	**1142**
Mercury	121	0.0001	<0.00005	0.0018	0.005
Nickel	158	0.02	<0.001	**0.098**	**0.605**
Phenol	1	0.0005	<0.05	<0.05	<0.05
Zinc	157	0.1	0.013	**0.302**	**3.7**

All values mg/l
* Results from samples taken from 2010 to 2016
Average calculated using the detection limit value where the result is reported as less than the detection limit
Results in bold show exceedance of the IGV

Groundwater Quality

To assess the impact on groundwater quality from the leachate, regular (monthly and six monthly) groundwater and surface water monitoring is undertaken. Monthly monitoring has been undertaken from selected boreholes for a reduced analytical suite. Six monthly sampling has been undertaken from all serviceable monitoring boreholes with analysis for an expanded analytical suite which includes organic parameters. Monthly monitoring commenced in October 2013 and results and findings of groundwater monitoring are included in monthly monitoring reports. The most recent six-monthly groundwater monitoring report is included as Appendix A12.2. Groundwater sampling of the wells installed in the 2016/2017 ground investigation was undertaken in early 2017. Results from this monitoring are reported in Appendix A12.1. Monitoring includes the collection and analysis of groundwater samples for a range of potential contaminants associated with landfill leachate. These

have been collected from both on-site and off-site monitoring wells installed within overburden deposits and the underlying bedrock.

Groundwater chemical analysis results indicate elevated concentrations of parameters present in the leachate including ammoniacal nitrogen, chloride and trace organic compounds. Concentrations of certain substances are recorded as exceeding interim environmental quality objectives and standards set for protecting groundwater quality in the EPA interim report Towards Setting Guideline Values for the Protection of Groundwater in Ireland (EPA 2003c). Table 12.12 sets out exceedances for certain key determinands which are identified in the groundwater. It should be noted that the EPA recently issued for consultation proposed revised guideline values for groundwater (EPA 2017a). These proposed values are also shown on Table 12.12 with the key differences being for chloride (30mg/l as the IGV and increasing to 125mg/l) and for mecoprop (decreasing from 0.01mg/l as the IGV to 0.00005mg/l). Potassium has not been included in the proposed revised guideline values.

Table 12.12: Exceedances of Interim Guideline Values for Key Leachate Parameters Measured Around the Whole Site

Determinand	IGV*	Proposed Guideline Value for Groundwater**	Maximum Concentration measured in groundwater^	Location of Maximum
Ammoniacal nitrogen	0.15	0.15	**273**	EMW14
Chloride	30	125	**475**	BH26
Mecoprop	0.01	0.00005	**0.084**	EMW14
Phenols	0.0005		**0.230**	BH26

All values mg/l
* Interim Guideline Value (EPA 2003c)
** Proposed Guideline Value for Groundwater (EPA 2017a).
^ Measured up to December 2016
Values in bold show exceedances for the IGV

Figures 12.16 to 12.19 show the distribution of chloride, ammoniacal nitrogen, phenol and mecoprop (an organic herbicide) across the existing site and off-site in December 2016 whilst Figures 12.20 to 12.23 show the same parameters for the samples taken in February 2017 (these latter figures include samples taken from the boreholes installed in the 2016/2017 investigation). These key contaminants occur in elevated concentrations in leachate for landfills that accepted household wastes and wastes that are likely to degrade. Ammoniacal nitrogen is linked to ammonia which is highly toxic to aquatic species. Whilst chloride provides a good “tracer” for landfill leachate as it is very mobile and discharges to surface water can alter the ecology of the receiving water. Phenol is an organic compound with relatively high mobility and is frequently found in leachates and groundwater, as has been the case at Kerdiffstown. Mecoprop is an active ingredient in many broadleaf weed killers and is commonly detected in landfill leachate and has been detected in the groundwater at Kerdiffstown. Both phenol and mecoprop have relatively low guideline values in groundwater.

Figures 12.15 to 12.22 do not show a clear contaminant plume emanating from the site, although figures show that substances are present in on-site monitoring wells completed in the overburden deposits and in groundwater off-site. These occur principally in monitoring wells located along the north-eastern boundary of the existing site near to the unlined and uncapped area of the landfill (Zone 1 and Zone 2B) and along the site’s northern boundary (wells DB2 and DB3). However, wells situated closest to the Morell River do not show greatly elevated concentrations of the key substances although there is evidence that increases in concentrations of determinands associated with landfill leachate are observed such as EMW05 during times of lower water levels during the summer.

Monitoring of the river does not show a discernible impact from these substances with the probable exception of slight changes in chloride concentrations (typically in the range of 1 to 2mg/l) as the river flows past the site. In the winter, the monitoring shows a slight increase in the chloride concentration observed downstream whilst during the last two summers the concentrations downstream are slightly lower than upstream.

Groundwater monitoring has shown seasonal variation in quality in certain boreholes, with the highest concentrations being detected in late summer. This likely occurs due to dilution of leachate in the winter from increased groundwater recharge. Elevated concentrations of determinands associated with landfill leachate are observed in the well closest to the Morell River (EMW05) during times of lower water levels during the summer. However, the measured concentrations are significantly lower than measured in boreholes on the site boundary such as EMW13 and EMW03.

The most recent groundwater monitoring reports (Appendices A12.1 and A12.2) includes plots of groundwater quality data over time. In the majority of boreholes, there is no indication of substance concentrations increasing or decreasing over time. However, in borehole BH26, completed in the overburden deposits at the base of the waste in Zone 1, the ammoniacal nitrogen concentration has increased since the borehole was installed (Diagram 12.3). Furthermore, in 2016 concentrations of certain substances, including ammoniacal nitrogen (Diagram 12.4) and chloride, increased in EMW20 on the existing site's north-eastern boundary. The increase in concentrations in borehole EMW20 is likely to reflect seasonal increases observed since monitoring began in certain other boreholes on the north-eastern boundary such as in EMW03 (Diagram 12.5).

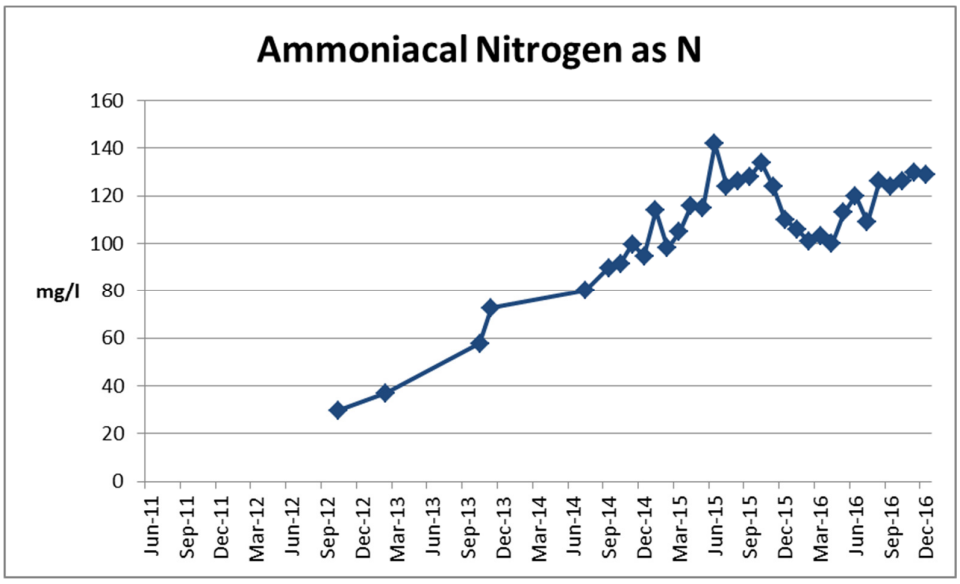


Diagram 12.3: Ammoniacal Nitrogen Concentration in BH26 over Time

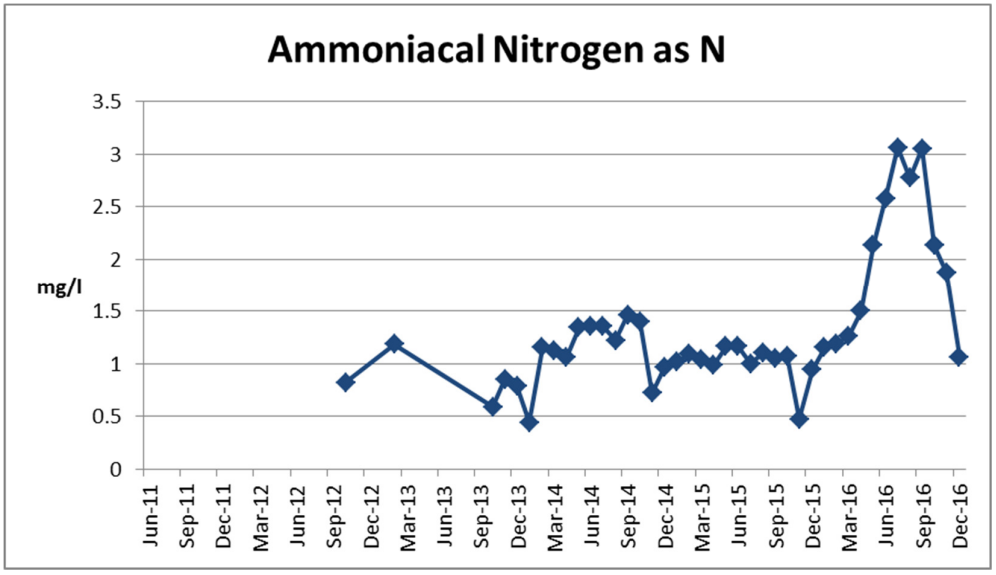


Diagram 12.4: Ammoniacal Nitrogen Concentration in EMW20 over Time

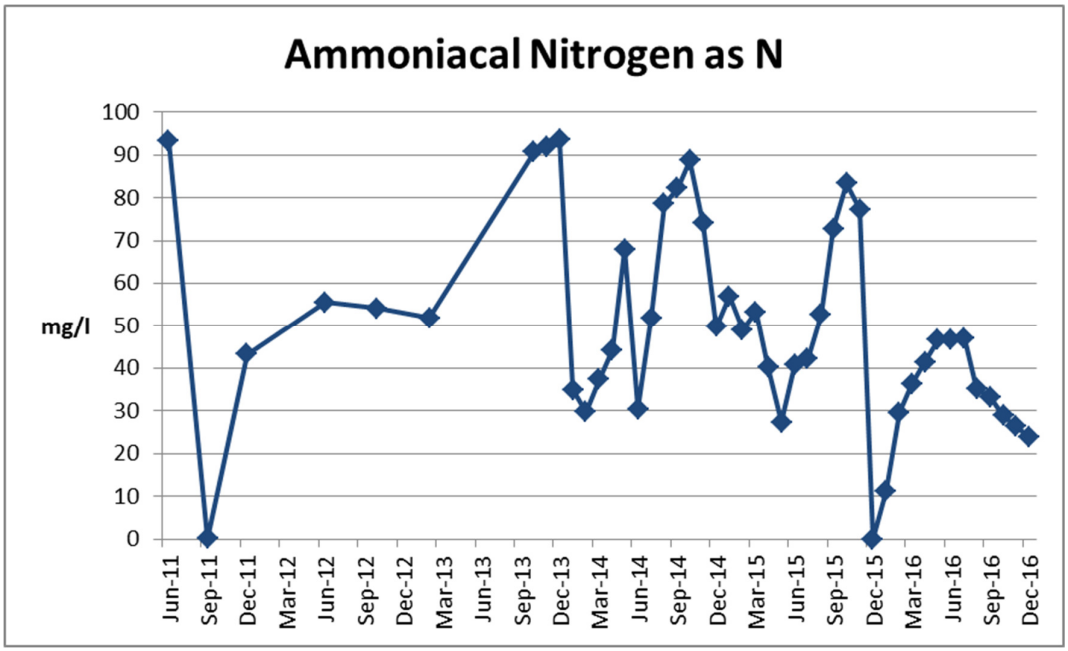


Diagram 12.5: Ammoniacal Nitrogen Concentration in EMW03 over Time

An assessment of the seasonal variation in contaminant concentrations with respect to rainfall is presented in Appendix A12.1 for selected boreholes. No clear correlation between rainfall and contaminant concentration is apparent throughout the site, although following a wet month in December 2015 (205mm) concentrations of ammoniacal nitrogen were noted to significantly decrease in borehole EMW03 and EMW05, but it did not appear to affect the concentration in EMW19. Furthermore, in spite of the dry weather in the autumn of 2016, concentrations of ammoniacal nitrogen in the boreholes continued to show the seasonal trend of reducing in the autumn, suggesting that seasonal recharge periods are more important than individual rainfall events.

In certain circumstances the ratio of potassium to sodium can be used to determine groundwater contaminated by organic material and in Irish groundwaters the potassium:sodium ratio is usually less than 0.4 as noted in the County Kildare Groundwater Protection Scheme Volume II: Source Protection Zones (KCC and GSI 2004). A potassium:sodium ratio greater than 0.4 can be used to indicate contamination by plant organic matter, usually from farmyard 'dirty water', but occasionally from landfill sites from the breakdown of paper. Groundwater quality data collected in June 2016, December 2016 and sampling of the new wells (installed in the 2016/2017 ground investigation) in February 2017 shows that in most cases the potassium:sodium ratio of 0.4 is not exceeded. Even in boreholes where contamination from landfill leachate is evident and including boreholes situated between the waste boundary and the Morell River. However, as shown in Table 12.13 the ratio does exceed 0.4 in 10 boreholes on each occasion the wells were sampled in 2016 (out of 34 boreholes sampled) and seven samples (out of 23 wells sampled) in February 2017. The three cases where the ratio is elevated for the off-site locations (boreholes EMW23, EMW32, BB03 and possibly EMW24) are likely to be elevated due to a source other than landfill leachate with an agricultural input the most likely source. For the other elevated ratios landfill leachate is the most likely source.

Table 12.13: Locations where the Potassium:Sodium Ratio Exceeds 0.4

Area of site	Borehole	K:Na ratio, June 2016*	K:Na ratio, December 2016*	K:Na ratio, February 2017*
Northern and eastern boundary of Zone 1	EMW03	<0.4	0.48	NS
	EMW06	0.58	0.90	NS
	EMW13	0.41	0.40	NS
	EMW24	0.40	<0.4	NS
Zone 2A	EMW11	0.90	0.59	NS
	BH68	NS	NS	0.95
	BH77	NS	NS	1.76
Zone 2B	EMW15	0.62	0.55	NS
Zone 3	BH78	NS	NS	0.82
Zone 4	BH6	0.58	0.73	NS
	BH7	0.96	0.68	NS
	BH42	0.47	0.56	NS
	BH70	NS	NS	0.70
	BH71	NS	NS	0.65
	BH69	NS	NS	0.81
Off-site to the north	EMW23	1.58	1.50	NS
	EMW32	0.67	0.69	NS
Off-site to the west	BB03	NS	NS	0.55

NS – Well not sampled or not tested for potassium
* 34 wells were sampled in June and December 2016 and 23 wells were sampled in February 2017

With respect to groundwater quality in the bedrock, low concentrations of substances associated with landfill leachate (including ammoniacal nitrogen and potassium) are measured in boreholes EMW12, EMW19 and BB01. However, concentrations are significantly lower than measured in the overburden deposits in the vicinity of Zone 1.

In the 2016/2017 ground investigation, chemical testing was undertaken on selected soil samples in the form of leaching tests, to assess how much contamination could leach from the soils and reach groundwater. Full results of the leaching tests are provided in the IGSL Factual Report of Ground Investigation (IGSL 2017) and summarised in Table 12.14.

The results show that in Zone 1, high leaching rates can occur with the average ammoniacal nitrogen and chloride concentrations exceeding the IGV for these substances. Zone 1 was also the only zone where phenol

was detected, although mecoprop was not measured in any sample. Relatively high concentrations of ammoniacal nitrogen were also measured in the leachate from samples taken at the top of Zone 3 (the lined cell) although the concentrations were not as high as the values recorded in the leachate collected from the zone and removed for off-site treatment. For Zone 4, the maximum ammoniacal concentration detected was 21.8mg/l although chloride was not greatly elevated. For the samples from the other zones, relatively low concentrations of ammoniacal nitrogen and chloride were measured, and in the case of phenol and mecoprop these substances were not detected.

Table 12.14: Leaching Test Results from 2016/172016/2017 Ground Investigation (all results mg/l)

Zone	No. of tests	Determinand	IGV	Minimum leachate concentration	Average leachate concentration*	Maximum leachate concentration
Zone 1	14	Ammoniacal nitrogen	0.15	<0.03	**42.3**	**171.98**
		Chloride	30	0.5	**45.3**	**187.9**
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	**0.0043**	**0.01**
Zone 2A	4	Ammoniacal nitrogen	0.15	<0.03	0.0625	0.1
		Chloride	30	0.3	0.875	1.6
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	<0.0005	<0.0005
Zone 2B	5	Ammoniacal nitrogen	0.15	0.07	**0.778**	**2.47**
		Chloride	30	0.5	5.92	21.4
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	<0.0005	<0.0005
Zone 3	4	Ammoniacal nitrogen	0.15	1.83	**37.0**	**57.76**
		Chloride	30	1.2	20	**31.7**
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	<0.0005	<0.0005
Zone 4	5	Ammoniacal nitrogen	0.15	0.03	**7.18**	**21.8**
		Chloride	30	0.8	9.5	25.3
		Mecoprop	0.01	<0.0001	<0.0001	<0.0001
		Phenol	0.0005	<0.0005	<0.0005	<0.0005

* Average value calculated using the detection limit where a result is reported to be below the detection limit. Results in **bold** show exceedance of the IGV

12.3.14 Baseline Landfill Gas

Currently active gas extraction occurs in two areas of the site; the lined cell (Zone 3) where the majority of the currently in-place waste has gas extraction well coverage, and the north-western section (Zone 1) where only approximately a quarter of the in-place waste has gas well coverage.

The aims of the existing measures are to control off-site migration along the north-western boundary of the site where wastes are deep and close to the edge of the original sand quarry wall, and houses and outbuildings are present within 10m of the site boundary. Also to reduce emissions to the atmosphere and to control odours (these two areas of the site were identified in the Kerdiffstown Odour Control Plan (SKM Enviros 2013b) as being significant for gas emissions to the atmosphere and hence odour.

Within the lined cell, wastes have been covered with a temporary heavy duty membrane to assist with odour management and to reduce air from being drawn in during gas extraction operations.

Gas extraction is accomplished via a network of gas extraction wells and pipework. Gas is removed and burnt in specially manufactured stainless steel high temperature gas flares. There are two flares on site, one with capacity 250m^3/hr and the second with capacity 500m^3/hr. Valves are incorporated within pipework which enables gas from both fields to go to a single flare, or to separate flares, depending on gas yields and quality. Currently, all gas extracted is being directed to the '250' flare, with the '500' flare acting as standby.

The overall quality of gas entering the 250 flare has declined gradually over time with current flows of approximately 100m^3/hr and gas concentrations noted at 23% methane, 23% carbon dioxide and 0.3% oxygen. This represents a decrease of more than a half for the gas flows compared to initial gas yields during July/August 2011. The decline in gas yields has been seen to be relatively steady since April 2012 despite weekly monitoring and adjustment of gas flow rates to ensure the landfill gas reaching the flare is suitable quality for flaring.

12.3.15 Hydrogeological Conceptual Site Models

Hydrogeological Conceptual Site Models (CSMs) for the different zones of the existing site have been developed based on the following guidance:

- Code of Practice: Environmental Risk Assessment for Unregulated Disposal Sites 2007 (EPA 2007);
- Framework Approach for the Management of Contaminated Land and Groundwater at EPA Licensed Facilities 2012a (EPA 2012a); and
- Model Procedures for the Management of Land Contamination (EA 2004).

The conceptual models are based on the long-established "source-pathway-receptor" approach that without all three components being in place there can be no risk to the receiving environment. The CSMs for the zones are presented graphically in Figures 12.24 to 12.27 with further explanation provided in Table 12.15. Within each figure and the table, the CSMs show how the identified source-pathway-receptor linkage will be addressed within the remediation works. The available information (historical aerial photos and the logs from DB09 and DB10) for the area of land to the south of Zones 3 and 4 would indicate that there is no waste in this area, and as such there is no source present and a pollution linkage does not exist for this land.

Whilst there has been no investigation of the area of land known as Tunney's Field, the historical aerial photos would suggest that waste is absent in this area and as such there is no source present and a pollution linkage does not exist for this area of land.

Table 12.15: Hydrogeological Conceptual Site Models by Zone for Current Conditions and how the Pollutant Linkage is being Addressed by Remediation

Zone	Source	Pathway	Potential Receptor	Approach to addressing the pollutant linkage
Zone 1*	Principally MSW wastes above the groundwater table	Rainfall infiltration and leaching of contaminants from the wastes with vertical and lateral groundwater migration	Groundwater in the overburden deposits	This zone will be capped with an engineered landfill cap. Capping of the zone will reduce rainfall infiltration and leaching from the unsaturated wastes leading to a lower input of contaminants to the groundwater in the overburden deposits.
			Groundwater in the limestone bedrock, principally within the transition zone	Capping of the zone will reduce rainfall infiltration and leaching from the unsaturated wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent vertical migration to the bedrock aquifer. Capping the zone has the potential to reduce the groundwater level in the overburden deposits beneath the zone and reduce the driving head (the pressure moving the groundwater vertically from one rock unit to another) in to the limestone caused by the groundwater in the overburden deposits being higher than the groundwater levels in the bedrock.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Capping of the zone will reduce rainfall infiltration and leaching from the unsaturated wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent migration to the surface water receptors. Capping the zone has the potential to reduce the groundwater level in the overburden deposits beneath the zone and reduce the hydraulic gradient between the zone and the Morell River, therefore reducing the contaminant flux.
	Principally MSW wastes below the groundwater table in the centre and east of the zone	Groundwater flowing through the wastes, leaching of contaminants and vertical and lateral groundwater migration	Groundwater in the overburden deposits	Capping the zone may reduce the groundwater level beneath the zone and thus the thickness of saturated waste may reduce. However, even after capping it is very likely that wastes at the base of Zone 1 will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits.
			Groundwater in the limestone bedrock, principally within the transition zone	As with the wastes situated above the water table, capping the zone may reduce the driving head into the bedrock aquifer. However, even after capping the zone, the saturated waste will continue to provide an ongoing source of contaminants to groundwater with the potential for downward migration into the limestone bedrock.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Even after capping the zone, the saturated waste will continue to provide an ongoing source of contaminants to the overburden groundwater with the potential for migration to the surface waters. However, reduction in the groundwater hydraulic gradient may reduce the groundwater flux.
Zone 2A	MSW and C&D wastes above the groundwater table	Rainfall infiltration and leaching of contaminants from the wastes with vertical and lateral groundwater migration	Groundwater in the overburden deposits	This zone will be remediated by installation of a low permeability layer at the surface to reduce rainfall infiltration. Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits.
			Groundwater in the limestone bedrock, principally within the transition zone	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent vertical migration to the bedrock aquifer.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent migration to the surface water receptors.
Zone 2B	MSW and C&D wastes above the groundwater table	Rainfall infiltration and leaching of contaminants from	Groundwater in the overburden deposits	This zone will be remediated by installation of a low permeability layer at the surface to reduce rainfall infiltration. Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits.

Zone	Source	Pathway	Potential Receptor	Approach to addressing the pollutant linkage
		the wastes with vertical and lateral groundwater migration	Groundwater in the limestone bedrock, principally within the transition zone	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent vertical migration to the bedrock aquifer.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent migration to the surface water receptors.
	MSW and C&D wastes below the groundwater table	Groundwater flowing through the wastes, leaching of contaminants and vertical and lateral groundwater migration	Groundwater in the overburden deposits, principally within the transition zone	Even after placement of the low permeability materials it is likely that wastes at the base of Zone 2B will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits.
			Groundwater in the limestone bedrock	Even after placement of the low permeability materials, it is likely that wastes at the base of Zone 2B will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits with the potential for downward migration into the limestone bedrock.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Even after placement of the low permeability materials, it is likely that wastes at the base of Zone 2B will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits with the potential for migration to the surface water receptors.
Zone 3	Wastes within the lined cell (the origin of the wastes is uncertain but is likely to reflect wastes elsewhere on the existing site comprising processed MSW and C&D wastes)	Rainfall infiltration through the geomembrane, leaching of contaminants from the wastes and leakage through the basal liner (engineered liner at the base of the landfill) with vertical and lateral groundwater migration	Groundwater in the overburden deposits, principally within the transition zone	Following infilling of this zone, the zone will be capped with an engineered landfill cap with leachate abstraction from the lined cell. Control of leachate levels will minimise the leakage of contaminants through the basal liner into the overburden groundwater flowing beneath the zone.
			Groundwater in the limestone bedrock, principally within the transition zone	Minimising the input of contaminants to the overburden deposits would also minimise the subsequent vertical migration of contaminants to the bedrock aquifer.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Minimising the input of contaminants to the overburden deposits would also minimise the subsequent migration of contaminants to the surface water receptors.
Zone 4	Wastes above the groundwater table	Rainfall infiltration and leaching of contaminants from the wastes with vertical and lateral groundwater migration	Groundwater in the overburden deposits	This zone will be remediated by installation of a low permeability layer at the surface to reduce rainfall infiltration. Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits.
			Groundwater in the limestone bedrock, principally within the transition zone	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent vertical migration to the bedrock aquifer.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Reducing infiltration to the zone will reduce leaching from the wastes leading to a lower input of contaminants to the groundwater in the overburden deposits and subsequent migration to the surface water receptors.
	Wastes below the groundwater table locally present at	Groundwater flowing through the wastes and	Groundwater in the overburden deposits	Even after placement of the low permeability materials it is possible that wastes at the base of Zone 4 will locally remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits.

Zone	Source	Pathway	Potential Receptor	Approach to addressing the pollutant linkage
	the base of the mounds of waste	vertical and lateral groundwater migration	Groundwater in the limestone bedrock, principally within the transition zone	Even after placement of the low permeability materials, it is possible that wastes at the base of Zone 4 will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits with the potential for downward migration into the limestone bedrock.
			Surface waters (Morell River, River Liffey) including abstraction from the River Liffey	Even after placement of the low permeability materials, it is possible that wastes at the base of Zone 4 will remain saturated and provide an ongoing source of contaminants to groundwater in the overburden deposits with the potential for migration to the surface water receptors.

* For Zone 1A as there are no significant putrescible waste deposits present in this area (and hence no source-pathway-receptor linkages), a conceptual model has not been defined for the zone.

12.3.16 Potential Changes to Baseline Due to Climate Change

Over the medium and long term, groundwater resources in the Study Area may be affected by climate change. Future precipitation changes in Ireland are subject to uncertainty. However, modelling has shown that winter rainfall in Ireland by the 2050s is projected to increase by approximately 10% while reductions in summer rainfall of 12 to 17% are projected by the same time. By the 2080s, winter rainfall will have increased by 11 to 17% and summer rainfall will have reduced by 14 to 25% (EPA, 2008). Changes in the frequency of extreme events will accompany these climate changes. Lengthier heatwaves, a substantial reduction in the number of frost days, lengthier rainfall events in winter and more intense downpours in summer are projected. At the same time an increased summer drought propensity is indicated, especially for eastern and southern parts of Ireland.

The direct effect of climate change on groundwater resources depends primarily upon the change in the volume and distribution of groundwater recharge. If drier, warmer summers lead to the seasonal deficits in the moisture content of soils extending into the autumn, the winter groundwater recharge season may be shortened. This could be compensated, at least to some extent, by an increase in winter rainfall. However, aquifers are recharged more effectively by prolonged steady rain, which continues into the spring, rather than short periods of intense rainfall where surface water runoff usually predominates.

The effects of climate change on groundwater therefore may include:

- a long term decline in groundwater storage;
- increased frequency and severity of groundwater droughts;
- increased frequency and severity of groundwater-related floods; and
- mobilisation of pollutants due to seasonally high water tables.

These effects could mean locally significant impacts on water supplies (public and private), and on streams and groundwater dependent terrestrial ecosystems that are sustained by groundwater flows.

12.3.17 Hydrogeology Risk Assessment

In order to put potential impacts into context for Zone 1, a detailed quantitative risk assessment (DQRA) was undertaken for Zone 1 in 2014 (SKM Enviros 2014) to assess the potential impacts to the overburden groundwater and Morell River receptors and the benefits of capping the landfill in this zone. The DQRA utilised the LandSim modelling package (EA 2001) which estimates leachate leakage through the base of a landfill with subsequent mixing (dilution) of leachate in the underlying groundwater and migration away from the landfill. Through the various pathways, “attenuation” processes are applied including retardation and degradation of organic substances. The retardation process means that the speed at which a substance travels through an aquifer is less than the speed at which the groundwater itself moves such that the substance will take a longer time to reach a receptor. Degradation will remove organic substances from the groundwater system by the breakdown of the substance, usually by bacteriological processes and usually to less harmful components (for example, hydrocarbon fuels will ultimately breakdown to water and carbon dioxide). These processes can occur in both the unsaturated and saturated zones.

The DQRA predicted that based on the current layout of Zone 1, substances present in leachate would be present in the groundwater beneath and adjacent to Zone 1. Furthermore, the assessment predicted that significant impacts on groundwater adjacent to the Morell River would be seen. The groundwater monitoring identified that these substances are present in groundwater beneath and adjacent to the existing site at similar concentrations as predicted by the model. However, substances are not seen at the predicted concentrations in groundwater monitoring undertaken in boreholes between the existing site and the Morell River.

Following the DQRA in 2014, further DQRA was undertaken during the 2016/2017 ground investigation (Jacobs 2017) and reproduced as Appendix A12.3). This DQRA was undertaken for all zones, using updated ground investigation and monitoring information, and so that the impacts of wastes present beneath the water table could be assessed.

For Zones 1, 2A, 2B and 4, the DQRA used the ESI RAM modelling software (ESI 2008) as this allowed, where required, each zone to be modelled as having two distinct sources of contaminant input to the groundwater system:

- Contaminants leaching from the waste as rainwater percolates through the waste with contaminants migrating through the unsaturated zone and mixing with groundwater as it flows beneath the zone; and
- A direct input of contaminants to the groundwater from wastes which are present below the water table. This input is not allowed for in LandSim which assumes that all wastes are present above the groundwater table.

For Zone 3, the 2017 DQRA utilised the LandSim modelling package as described above for Zone 1. Zone 3 attributes, in terms of landfill construction, closely match the assumptions of LandSim, including with wastes only being present above the groundwater table.

A DQRA has not been undertaken for Zone 1A as no significant putrescible waste deposits were identified in this zone and as such there is no source-pathway-receptor linkage.

For each zone, the DQRA assessed a capped zone and an uncapped zone to understand the effects of capping the zone. A summary of the DQRA results and effects of undertaking the remediation works is provided below with full results in Appendix A12.3.

Zone 1 DQRA Results

For Zone 1, the uncapped and capped models do not clearly show an improvement in groundwater quality following installation of the cap, although this is thought to be due to limitations of the RAM model (Refer to Appendix A12.3 for further details). The model shows that the source term is dominated by the saturated waste component, and this is likely to remain the case for this zone such that even after capping, the saturated wastes would continue to have the major input of contaminants to groundwater. However, in reality the cap would reduce rainfall infiltration (that is migrating through the waste), reduce leachate generation and leachate build up within the cell and potentially reduce the water levels beneath the landfill (any potential reduction in groundwater level is not included in the RAM model). A reduction in groundwater level beneath the waste, even if this reduction is small, would have benefits to the groundwater environment by:

- Reducing the amount of waste that is saturated and hence reducing the source term;
- Reducing the hydraulic gradient between the site and the Morell River such that the migration of contaminants would be slowed (allowing more time for degradation of organic compounds) and the volume of groundwater discharging to the river would be reduced; and
- Reducing the difference in groundwater levels between the overburden and bedrock water bodies and therefore reducing the flow of groundwater from the overburden deposits to the bedrock transition zone.

Zone 2A DQRA Results

For Zone 2A, the uncapped and capped models show that there would be an improvement in groundwater quality following installation of the low permeability materials in this zone. This occurs due to lower infiltration into the wastes and subsequent higher dilution of leachate in the groundwater for the capped scenario. As this zone is modelled as having negligible saturated waste, there is no input of leachate from this source which plays a significant role in other zones.

Zone 2B DQRA Results

For Zone 2B, the uncapped and capped models show that there would be an improvement in groundwater quality following installation of the low permeability materials in this zone. This occurs due to lower infiltration into the wastes and subsequent higher dilution of leachate in the groundwater for the capped scenario. However, as the saturated waste provides the dominant input component for this zone and the wastes are likely to remain saturated after the zone is capped. The predicted improvement in groundwater quality is marginal.

Zone 3 DQRA Results

The capped model has a larger area than the uncapped model due to the addition of waste materials from other zones as part of the remediation. Despite these conditions, the capped scenario results in concentrations of the same order of magnitude than the uncapped scenario, with concentrations below the IGVs in both cases. Furthermore, it should be considered that by transferring waste materials from other zones to Zone 3, the risks in those other areas is reduced. Placing waste materials in a fully engineered landfill cell would provide overall betterment for the site.

Zone 4 DQRA Results

For Zone 4, the uncapped and capped models show that there would be an improvement in groundwater quality following installation of the low permeability materials in this zone. This occurs due to lower infiltration into the wastes and subsequent higher dilution of leachate in the groundwater for the capped scenario. However, as the saturated waste provides the major input component for this zone, and the wastes are likely to remain saturated after the zone is capped. The predicted improvement in groundwater quality is limited.

Surface water impacts DQRA results

The RAM modelling package has also been used to assess the potential impacts on water quality in the Morell River for the three zones adjacent to the river (Zones 1, 2B and 4). Within the RAM model, the receptor in the river was set to the Q95 flow (0.322m^3/s) calculated from the 2008 to 2016 daily flow data for the Morell River at Kerdiffstown as provided on the EPA's HydroNet website (EPA 2017b).

To assess a worst case scenario, the 95 percentile concentration in the river has been considered to assess the predicted impact of the remediation works on the river quality by comparing the maximum predicted concentration under the current situation with that for the remediated site. The results of the DQRA for ammoniacal nitrogen for the river impacts are shown in Table 12.16 and show that for the remediated site the impacts are reduced from the current situation, indicating that the remediation works are likely to reduce impacts on river quality. For Zone 1, the model predicts that the remediation works would result in the ammoniacal nitrogen concentration falling below the IGV whereas without the works it is above the IGV.

Table 12.16: Model Predictions from the RAM Models on Water Quality in the Morell River for Ammoniacal Nitrogen

Zone	Peak Morell River concentration (mg/l)	
	Pre-remediation	Following remediation
1	**0.291**	0.100
2B	0.017	0.007
4	0.005	0.001

Result in **bold** shows exceedance of the ammoniacal nitrogen IGV of 0.15mg/l.

12.3.18 Contaminated Land and Human Health Risks

Human health risks are currently managed by preventing public access to the site and having appropriate health and safety measures in place for staff working on the site. As there is no impact of leachate on surface water bodies outside of the existing site or nearby groundwater abstractions, there is no human contact with contaminated water. Even though a source (contaminants within the waste) and a receptor (site workers) have been identified, based on the source-pathway-receptor model described for the hydrogeology CSM, there is no pollution linkage as there is no pathway from the source to the receptor due to the safe working methods of site workers including the use of PPE as appropriate. It should be noted that this could change following site remediation when members of the public are allowed on to the site and this is considered in the impact assessment. The assessment of human health risks from landfill gas is considered later in this Chapter.

12.3.19 Contaminated Land and Property Risks

Below ground services and structures have the potential to be attacked by contaminants in contaminated land. These include concrete structures which can be attacked by water with high sulphate or chloride concentrations or acid conditions (low pH). Plastic pipes can be attacked by organic compounds (including phenol) can permeate plastic water supply pipes such that drinking water is tainted. The potential for chemical attack depends on the presence of water as a carrier of the substance, the concentration of the substance and the degree of contact between the substance and the below ground infrastructure.

At Kerdiffstown, the majority of the existing site surface is significantly above the groundwater table (only the low points of Zone 4 are relatively close to the water table). As such, the below ground infrastructure, which will be at shallow depth beneath the ground surface, is unlikely to be in contact with contaminated groundwater, although there is the potential that contaminated water in the unsaturated zone, produced as rainwater infiltrates through the waste, does come into contact with the below ground services.

12.3.20 Landfill Gas Risks

Off-site boreholes show variable sequences of silt, sand, gravel and clay around the site. Gas migration risk is highest along bands of sand and gravel deposits which have lower permeability silts and clays above and below them, thus concentrating gas movement along the sand and gravel layer. The boreholes from the site investigation indicate that much of the natural geology is conducive to gas movement. The variability of the strata and the presence of sand and gravel layers cannot be defined to the level required to consider the risk of migration through specific routes. It must be assumed that without suitable gas controls there is a high risk of off-site gas migration.

Although the surrounding strata are considered suitable for potential gas migration, only receptors on or within 250m of the site are considered to be at risk from lateral sub-surface landfill gas migration. Other receptors at risk from emissions to air and emissions from combustion are considered within Chapter 7 Air Quality, Odour and Climate.

There are a number of buildings and structures (enclosed spaces) on site (site offices, ESB switch gear room, security huts) and houses and outbuildings close to the north-western, western and southern boundaries of the site which could be vulnerable to landfill gas entry. Gas present in soils can enter buildings through cracks or holes in the floor slab, or via services which enter buildings below ground if no protection measures have been incorporated into building design. The following provides a list of the sensitive receptors for the proposed Project:

- Domestic properties and occupants along the L2005 (REC005 to REC018), some of which are within 20m of the landfill;
- Kerdiffstown House (REC001) and occupants, the nearest building being approximately 110m from the landfill;
- Naas Golf Course (COM017) to the north of the site;
- Naas Driving Range (COM018) and residential properties to the north-west of the site, within 200m of the north-west site boundary;
- Palmerstown House Estate and Golf course (COM001), approximately 500m to the northern boundary;
- Johnstown Garden Centre (COM002) and domestic properties to the south of the site, within 200m of the southern site boundary

Landfill gas receptors are shown on Figure 4.21.

An explosion protection document has been prepared for the proposed Project, detailing a risk assessment for the current conditions of the site including zoning around infrastructure and setting out working procedures. The explosion protection document will require to be updated following remediation works in advance of operation of the public park (as a minimum). This is discussed further in Section 12.6.2.

12.4 Predicted Impacts

12.4.1 Impact Assessment Criteria

Following the Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009) and Guidance for the preparation of Soil Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI 2013) EIA assessment methodology, the sensitivity and importance of the environmental soil, geology, hydrogeology and by extension, human health, environment are classified in Table 12.177.

Table 12.17: Importance of Relevant Soil, Geology and Hydrogeology Features

Environmental Attribute	Importance	Comments
Groundwater in overburden deposits	Low	The overburden deposits in the vicinity of Kerdiffstown Landfill are not recognised on the GSI aquifer map as an aquifer.
Groundwater in the bedrock aquifer.	Medium	The limestone bedrock aquifer is designated by the GSI as a Locally Important Aquifer.
Groundwater abstractions for non-potable use (golf course).	Medium	These abstractions have an economic value.
Human Health through exposure to contaminated materials or effects of landfill gas (asphyxiation or explosion).	Extremely High	Human health has a very high sensitivity.
Property – below ground services and building foundations.	Medium	This could include water and sewer pipes and below ground concrete structures.
Property – On-site buildings.	Medium	
Property – Off-site buildings.	Medium	
Vegetation – economical crops and grassland on adjacent golf course. Also, the public park and recreational land following site remediation.	Medium	These vegetation types have economic value.
Vegetation – rough grassland within the landfill boundary.	Low	Vegetation within the landfill site boundary has no economic value.
Soils (off-site) and Tunney's Field.	Low	The assessment of the soils has identified that the soils around the boundary are of low economic value in terms of being used for arable crops.
Mineral resources (sand and gravels) beneath Tunney's Field	Low	Given the relatively small area of the field and presence of the bounding road and the landfill site, the mineral reserves beneath Tunney's Field are likely to be an uneconomically extractable mineral resource.

The geology of the surrounding area will not be significantly affected by the proposed works. The landfill has minimal impact upon the geology and so this is not characterised as a receptor. Also, as no potable groundwater abstractions have been identified in the vicinity of the site, the effects of contaminated groundwater on human health are not considered. It should also be noted that the potential impacts on surface water receptors such as the Morell River and surface water abstractions which may be impacted by contaminants that migrate in groundwater are considered in Chapter 13 Water - Hydrology.

12.4.2 Do-Nothing Scenario

Under a “Do-nothing” scenario, the site would remain in its current condition with leachate production and contaminant concentrations in the groundwater and surrounding environment remaining generally stable with the current baseline condition. However, over time there is the potential for increased leachate production as rainfall infiltration continues. Leachate would continue to be abstracted from Zone 3 and tankered off site for treatment and disposal.

Under this scenario, environmental monitoring would continue (albeit potentially at a reduced frequency due to a better understanding gained over time) as would the extraction and flaring of landfill gas. The site would remain fenced off with 24-hour security such that members of the public would not have access. The magnitude of impacts under the “do nothing” scenario is shown in with the significance of the impact shown in Table 12.18.

Table 12.18: Magnitude of Impacts – Do Nothing Scenario

Potential Impact	Importance of attribute	Magnitude of Impact	Significance of Impact	Comments
Contaminated land and groundwater				
Impacts to groundwater quality in the overburden deposits due to leaching of contaminants from waste deposits.	Low	Moderate adverse	Slight Permanent Residual Certain	Contamination is currently identified in the groundwater, including outside of the landfill boundary. However, the overburden deposits are not classified as an aquifer by the GSI. As such the groundwater is considered more as pathway to other receptors such as the Morell River or groundwater abstractions.
Impacts to water quality in the limestone aquifer due to leaching of contaminants from waste deposits.	Medium	Moderate adverse	Moderate Permanent Residual Likely	Potential medium risk of pollution to groundwater in the Locally Important bedrock aquifer although only limited impact is identified in the limestone aquifer.
Impacts to groundwater abstractions (non-potable).	Medium	Negligible	Imperceptible	Given the distance of the abstractions from the site and groundwater flow directions, the impacts on the abstractions is likely to be negligible and no impacts have been observed to date.
Impacts to human health through direct contact with exposed waste.	Extremely High	Negligible	Imperceptible	As public access to the site is restricted, those coming onto contact with contaminated material would be site workers (including security staff). However, these workers are aware of the risks and working practices prevent contact with the wastes.
Degradation of on-site below ground services and building foundations due to contact with contaminated ground or groundwater.	Medium	Small adverse	Slight Permanent Residual Possible	No adverse impacts have been observed to date on below ground services or building foundations. Currently the occupied buildings on site do not have deep foundations.
Landfill gas				

Potential Impact	Importance of attribute	Magnitude of Impact	Significance of Impact	Comments
Impacts to human health though migration of landfill gas into on-site properties leading to asphyxiation explosion or toxicological effects.	Extremely High	Small adverse	Significant Long term Residual Possible	There is limited monitoring of landfill gas. Landfill gas control operates in Zone 1 and Zone 3 to minimise the risks of landfill gas migration into on-site properties. However, there are potential impacts from landfill gas generation, particularly in Zone 2A although buildings at this location are situated on hardstanding and of the raised, modular type with no below ground structures. With the current gas control measures in place, although the likelihood of any impacts is small, the sensitivity of the receptor is extremely high which results in a significant significance.
Impacts to human health though migration of landfill gas in to off-site properties leading to asphyxiation explosion or toxicological effects.	Extremely High	Small adverse	Significant Long term Residual Possible	Landfill gas G control operates in Zone 1 and Zone 3 to minimise the risks of landfill gas migration in to off-site properties in these zones. However, there are potential impacts from landfill gas generation, particularly in Zone 2A. There is limited monitoring of landfill gas in this area. With the current gas control measures in place, although the likelihood of any impacts is small, the sensitivity of the receptor is extremely high which results in a significant significance.
Impacts to on-site buildings though migration of landfill gas and subsequent explosion.	Medium	Small adverse	Sight Long term Residual Possible	There is limited monitoring of landfill gas. Landfill gas control operates in Zone 1 and Zone 3 to minimise the risks of landfill gas migration in to on-site properties in these zones. However, there are potential impacts from landfill gas generation, particularly in Zone 2A although buildings at this location are situated on hardstanding and of the raised, modular type with no below ground structures. With the current gas control measures in place, the likelihood of any impact is small.
Impacts to off-site buildings though migration of landfill gas and subsequent explosion.	Medium	Small adverse	Slight Long term Residual Possible	There is limited monitoring of landfill gas. Landfill gas control operates in Zone 1 and Zone 3 to minimise the risks of landfill gas migration in to off-site properties. However, there are potential impacts from landfill gas generation, particularly in Zone 2A. With the current gas control measures in place, the likelihood of any impact is small.
Landfill gas causing die back of vegetation outside of the landfill boundary, including on nearby golf course.	Medium	Negligible	Imperceptible	No impacts on vegetation outside of the landfill site has been identified to date and with the current gas control measures in place, the likelihood of any impacts is negligible. As landfill gas generation rates decrease over time, future impacts are considered unlikely.

Potential Impact	Importance of attribute	Magnitude of Impact	Significance of Impact	Comments
Landfill gas causing die back of vegetation within the landfill boundary.	Low	Small adverse	Imperceptible	Impacts of landfill gas on the site vegetation are not readily apparent. However, there may be areas where vegetation growth is being affected. Local die back within the site boundary would have no economic effects, although secondary effects such as reduction of evapotranspiration causing increased infiltration may occur. As landfill gas generation rates decrease over time, future impacts are considered unlikely.

12.4.3 Remediation Phase

Chapter 4 Description of the Proposed Project outlines the proposed remedial solution and the construction techniques that will be employed to achieve the remediation. The relevant aspects of the Remediation Phase in relation to the soil, geology, hydrogeology and contaminated land environment are: -

- Human health risks – As works are undertaken, contaminated material in the waste has the potential to come into contact with construction workers undertaking the work and affect human health. This could be by direct contact, ingestion, or inhalation.
- Waste Relocation – Within Zone 4, the base of inert waste materials in the mounds and bunds is relatively close to the water table (or below it in some areas). Removal of overlying inert waste has the potential to disturb the ground close to the water table which has the potential to increase impacts from leachate. For example, if waste is compacted by machinery squeezing out leachate or by creating a more level profile to the waste may allow greater rainfall infiltration. The removal of the current top layer of materials in Zone 1 to re-profile the site would need to be undertaken so that the waste can be moved to form more stable shapes. This top layer is likely to reduce recharge to the wastes to some degree. As a result of the works there will be a period of time where the waste is uncovered allowing increased rainfall infiltration and the potential for increased leachate production.
- Landfill gas risks – Changes to the landfill gas migration routes may occur as the works progress. This could occur due to the exposure of waste releasing landfill gas or the placement of low permeability material on to the zones (as construction works progress), forcing gas to take a lateral rather than a vertical migration route. During works, the current landfill gas abstraction system has the potential to be disrupted. Receptors for landfill gas would include on-site and off-site properties, people and vegetation.
- As works are undertaken within Zone 1 to re-profile the site, there is potential that perched leachate horizons are encountered which lead to the release of leachate. If released in sufficient quantities, this leachate then has the potential to migrate to receptors such as the Morell River or soak into the ground outside of the landfill site leading to local contamination.

The magnitude and significance of impacts under the Remediation Phase is shown in Table 12.19. Table 12.19 considers, in isolation from the baseline, the potential impact from each activity during the remediation works. Where an impact could increase an existing impact (as identified in the “do-nothing” assessment in Table 12.18), it is noted in the comments section of Table 12.19. However, for imperceptible significance outcomes during the Remediation Phase, it is assumed that these impacts would not affect the significance as shown in the “do-nothing” table.

.

Table 12.19: Magnitude of Impacts – Remediation Phase

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contaminated land and groundwater				
Changes to infiltration to the overburden deposits due to disturbance of the existing ground surface and exposure of waste materials to infiltration.	Low	Small adverse	Imperceptible	Disturbance of the existing ground surface (including removal of the existing vegetation) to re-profile the site is likely to allow greater rainfall infiltration to the waste. This would allow for greater leachate production or reduction in the waste's adsorptive capacity and potential increase in contaminant concentrations in the overburden and bedrock aquifers. Exposure of waste to rainfall would allow leachate to be produced. Compaction of soils from plant has the potential to reduce infiltration although this is likely to be a more local effect where soils are heavily trafficked.
Changes to infiltration to the bedrock aquifer due to disturbance of the existing ground surface and exposure of waste materials to infiltration.	Medium	Small adverse	Slight Temporary Residual Possible	
Removal of inert waste mounds in Zone 4 leading to disturbance of wastes near to the water table and increase in contaminant concentrations in groundwater in the overburden deposits.	Low	Small adverse	Imperceptible	Whilst the remediation works would not move any waste from below the water table, locally the waste removed may be close to the water table leading to disturbance of waste below the water table from plant undertaking the remediation works and increasing leaching of contaminants.
Removal of existing structures and hardstanding leading to increased infiltration to groundwater in the overburden deposits	Low	Small adverse	Imperceptible	Whilst the majority of the site building would have been removed by the time the remediation works start, some will remain until the works are completed. Hardstanding in Zone 4 would be removed as part of the works to construct the drainage pond, although it considered that there are limited quantities of waste below this section of hardstanding. Other hardstanding would remain in place and there is a small likelihood that work could lead to increased cracking of the hardstanding and therefore a very minor increase in infiltration. However, cracks within it would be repaired as part of the works thus reducing infiltration as works progress.
Construction of landfill gas venting trenches leading to changes in groundwater infiltration to the overburden deposits.	low	Small adverse	Imperceptible	While trenches would be a positive during the Operational Phase the initial construction of gas venting trenches has the potential to lead to increased rainfall infiltration during their construction due to the removal of lower permeability surface materials. This would lead to an increase in recharge and potentially leachate production.

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contamination of groundwater in the overburden deposits from fuels and oils stored and used for site plant.	Low	Small adverse	Imperceptible	Groundwater contamination has the potential to occur due to spills and leaks of stored fuels and oils (used for re-fuelling site plant) or leaks from site plant during operation. However, handling procedures for fuels and emergency procedures for spills or leaks of fuels and oils would be covered in the CEMP.
Effects on human health for construction workers from contact with waste materials.	Extremely high	Negligible	Imperceptible	Although construction workers would come into contact with waste material, there would be working procedures including risk assessments in place to minimise these risks. These would include procedures for actions to be taken if unexpected hazardous materials were encountered.
Effects on human health for construction workers through direct exposure to any contaminated materials within soils being brought on to site for capping works.	Extremely high	Negligible	Imperceptible	Although materials brought on to site have the potential to be a contaminant source, testing of the materials will be undertaken as part of the remediation works. Working procedures including risk assessments would be in place to minimise these risks.
Encounter perched leachate	Low	Moderate adverse	Slight Temporary Residual Possible	The potential exists that during excavation of the waste body in Zone 1 or bunds around the site boundary, perched leachate could be encountered and released to locally contaminate groundwater in the overburden deposits. Whilst this is unlikely, the serious nature of this impact results in the magnitude being classed as Moderate.
Landfill gas				
Changes to landfill gas migration routes and impacts to off-site human health receptors.	Extremely High	Small adverse	Significant Temporary Residual Possible	Disturbance of the current ground surface has the potential to allow greater landfill gas to vent to air rather than migrate laterally. However, during remediation works the landfill gas extraction system has the potential to be interrupted such that less landfill gas is collected with potential for greater migration rates off-site. As the zones are capped there is then greater potential for gas to migrate laterally rather than vertically to off-site receptors. The extremely high sensitivity of the receptors results in a significant impact.

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Changes to landfill gas migration routes and impacts to off-site property receptors (including vegetation).	Medium	Small adverse	Slight Temporary Residual Possible	Disturbance of the current ground surface has the potential to allow greater landfill gas to vent to air rather than migrate laterally. However, during remediation works the landfill gas extraction system has the potential to be interrupted such that less landfill gas is collected with potential for greater migration rates off-site. As the zones are capped there is then greater potential for gas to migrate laterally rather than vertically to off-site receptors. While the sensitivity of landfill gas reaching the public would be high, the likelihood of such an occurrence is low. As a result, the significance of the impact has been classified as slight.
Changes to landfill gas migration routes and impacts to on-site human health receptors.	Extremely High	Negligible	Imperceptible	For the on-site landfill gas receptors, including human health, these would be controlled by safe working procedures including risk assessments in place to minimise these risks. These would include procedures for actions to be taken if unexpected events occurred.
Changes to landfill gas migration routes and impacts to on-site property receptors.	Medium	Negligible	Imperceptible	
Soils and geology				
Loss of soils	Low	Small adverse	Imperceptible	Only a small area of soils will be affected and areas where soil is present which are used for stockpiling of materials such as Tunney's Field will be stripped of soils so the soils can be used elsewhere on site or as cover.

12.4.4 Operational Phase

Potential impacts after the construction of the remedial solution would generally be positive for the environment:

- Human health risks – the site will become available for public amenity use as the pathways between contaminated material in the waste (source) and human health (receptors) by direct contact, ingestion, and inhalation (pathways) will have been removed through provision of a barrier between the waste and site end users.
- Addition of a cap to reduce infiltration to the landfill and so decrease leachate generation.
- Completion of the lined cell in Zone 3 with a fully engineered cap.
- Removal of low points within Zone 1 to prevent pooling and increase landfill stability;
- Addition of perimeter drainage system to collect surface water runoff from the capped landfill including use of a soakaway in the north of the site and a swale to collect surface water runoff from the east of Zone 1 (see Chapter 4 Description of the Proposed Project for further details).
- Potential for reduction in the local water table beneath capped areas, decreasing the amount of waste that lies beneath the water table.
- Increase in vegetation at the surface leading to an increase in evapotranspiration further reducing infiltration.
- Increased landfill gas control measures reducing the potential for gas migration off site.

Only one potential adverse impact has been identified for the Operational Phase of the proposed Project. This relates to the potential for the pipe leading from the leachate treatment plant to the local sewer to leak and lead to local groundwater contamination.

The magnitude and significance of impacts under the Operational Phase is shown in Table 12.20

Table 12.20: Magnitude of Impacts – Operational Phase

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contaminated land and groundwater				
Presence of a low permeability cap to reduce infiltration to wastes and reduce the production of leachate for migration to groundwater in the overburden deposits	Low	Minor beneficial	Imperceptible	The capping of the wastes would reduce leachate production and vertical migration of contaminants into the underlying groundwater. However, wastes below the groundwater table would continue to leach contaminants and the DQRA does not clearly show that there would be a significant improvement to groundwater quality in all zones.
Presence of a low permeability cap to reduce infiltration to wastes and reduce the production of leachate for migration to groundwater in the bedrock aquifer.	Medium	Minor beneficial	Slight beneficial Permanent Residual Possible	
Presence of a low permeability cap leading to reduction in the local water table decreasing the amount of waste that lies beneath the water table and reducing the impact on groundwater in the overburden deposits.	Low	Minor Beneficial	Imperceptible	Reducing the amount of waste in contact with the water table would decrease the generation of leachate in the groundwater and when combined with the decreased infiltration a greater decrease in leachate production would occur. However, the significance of this on the water table are likely to be slight as the change in water level is unlikely to be great and some wastes are likely to remain saturated.
Presence of a low permeability cap leading to reduction in the local water table decreasing the amount of waste that lies beneath the water table and reducing the impact on groundwater in the bedrock aquifer.	Medium	Minor beneficial	Slight beneficial Permanent Residual Possible	
Increased leakage from the lined cell in Zone 3 with impacts on the quality of groundwater in the overburden deposits.	Low	Negligible	imperceptible	The amount of waste that is in Zone 3 and the waste footprint will increase as a result of the remediation works, as such for this zone, impacts are likely to increase, although the overall benefit is likely to increase due to the removal of wastes from areas which aren't currently in an engineered landfill.
Increased leakage from the lined cell in Zone 3 with impacts on the quality of groundwater in the bedrock aquifer.	Medium	Small adverse	Slight Permanent Residual Possible	

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Increase in vegetation at the surface leading to an increase in evapotranspiration, further reducing infiltration to the wastes and leachate production in the overburden deposits.	Low	Minor Beneficial	Imperceptible	The reduction in infiltration would help to reduce infiltration and leachate production. The vegetation will also increase stability of the ground, particularly on the steeper slopes.
Change to groundwater recharge points to the overburden deposits due to the use of a soakaway and swale for the discharge of surface water.	Low	Negligible	Imperceptible	These drainage features would locally alter groundwater recharge points and potentially flow routes to other receptors such as the Morell River. However, the effects of the change to recharge points would not significantly change the overall recharge rate. Recharge via soakaway and lagoons would be in areas where waste is not present so that additional leachate would not be produced.
On-site below ground services such as water pipes and drainage and building foundations being in contact with contaminated land or groundwater leading to degradation of the infrastructure (property damage) or permeation into water supplies.	Medium	Negligible	Imperceptible	Whilst substances are present in the wastes and groundwater at the existing site that have the potential to attack below ground infrastructure or permeate drinking water pipes, installation of new below ground structures would take the nature of the ground into account and follow the appropriate guidance.
Landfill gas				
Enhanced landfill gas control measures leading to improved monitoring and control of landfill gas (on-site and off-site human health receptors).	Extremely high	Major beneficial	Profound beneficial Permanent Residual Certain	The remediation works allow for greater control of landfill gas through the installation of capping to reduce fugitive emissions through the ground surface and additional gas extraction wells in Zone 1 and gas venting trenches in other zones. Enhanced gas monitoring will be undertaken with additional gas monitoring boreholes on the site's periphery. Remediation works would therefore provide enhanced landfill gas control measures compared with the "do nothing" scenario.
Enhanced landfill gas control measures leading to improved monitoring and control of landfill gas (on-site and off-site property receptors).	Medium	Major beneficial	Significant beneficial Permanent Residual Certain	

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Presence of a cap over all waste deposits reduces the likelihood of people coming into contact with waste, reducing the human health risk.	Extremely high	Minor beneficial	Significant beneficial Permanent Residual Certain	Waste is currently exposed at the ground surface and the remediation would ensure that this waste is covered. However, the use of the site for recreational purposes would mean that more people are on site than in the "do nothing" scenario.
Use of fertilizers and pesticides for the recreation ground or to establish site vegetation leading to contamination of groundwater in the overburden deposits.	Low	Small adverse	Imperceptible	The application of fertilizers and pesticides have the potential to increase the nitrate concentration in the groundwater underlying the site if applied at too high a concentration. However, providing pesticides and fertilizers are applied in accordance with manufacturer's recommended application rates, impacts would be imperceptible.
Soils and geology				
Loss of mineral reserves beneath Tunney's Field	Low	Small adverse	Imperceptible	Use of the field for a sports pitch would permanently prevent the mineral deposits beneath the field from being extracted. However, the area which would be lost is relatively small and the presence of the local road and housing means that the mineral reserve in the field is unlikely to be an economically viable deposit.

12.4.5 Modelling Limitations

The groundwater beneath the site is contaminated and monitoring data shows clear evidence of contamination on the eastern fringes of the site. However, no sustained upward trend in the level of contaminants such as ammoniacal nitrogen and chloride is observed between the site and the Morell River. Across the entire site area monitoring data gathered over a 7-year period (since 2010), comprising groundwater samples and geophysical monitoring, illustrate there is no evidence of a sustained upward trend in contamination or evidence of any significant changes in the geophysical characteristics of the area that would indicate the movement of a plume of leachate. While a leachate plume would represent a significant risk to the groundwater and surface water quality in the area it does not appear, at present, that contaminants are very mobile indicating either a level of lower permeability in strata that has been supposed or detected to date; or that the contaminants are migrating in a manner that does not result in a detectable impact.

In spite of extensive efforts undertaken to date to characterise the site a full understanding of how the groundwater system functions may never be achieved due to the heterogeneity observed. The efforts to understand the groundwater have also included groundwater modelling, detailed below, which have predicted more pessimistic outcomes than have been observed by real-world monitoring to date. It is recoded that while groundwater modelling is a useful tool results cannot be considered in isolation when taking decisions regarding mitigation of predicted impacts. The EPA cautions against an approach where an over-reliance on modelling can lead to poor decision making in their *Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites EPA; 2013)*:

> "For some sites, a combination of modelling and on- and off-site data gathering and monitoring may be required. It should be noted that in some cases, modelling may not be appropriate at all. Such decision-making should ensure that risks are assessed in a consistent and meaningful way and that the environment is protected."

One of the key limitations of any kind of groundwater modelling is the complexity of the system to be represented by the model. If the natural ground conditions are highly variable, as is the case in the proposed Project area, the ability of the model to represent this in a meaningful way is compromised. The models used are also highly conservative and assume a worst-case to ensure that the decisions taken would protect the environment in the vast majority of circumstances even though there is a low likelihood that such circumstances would arise. An overly optimistic model outcome could lead to decisions not to intervene or remediate a site; conversely an overly pessimistic model could lead to the view that despite intervention there will be no benefit to the environment, while real-world experience has demonstrated that such interventions do result in benefits. Such is the case with the capping of landfills. With the limitation of the generation of new leachate and the control of hydraulic gradients a key benefit is achieved by capping. This is observed by many landfill operators installing interim capping at the earliest opportunity before final, permanent capping is required.

The models which have been undertaken as part of this EIAR in a genuine effort to understand the site in as much detail as possible have predicted very limited benefit to capping the waste, principally due to the presence of some waste beneath the water table. However, the benefits of capping waste to in terms of groundwater protection and landfill gas control are key pillars of landfill management and the model results should be viewed in context and not used as the key decision-making tool.

The waste beneath the water table will continue to contaminate groundwater into the future. Much of this waste has been beneath the water table for a period greater than 20 years and has been contributing to the impact on groundwater quality at the site (albeit with limited impact off-site). Considering the issue in isolation the option to dig this waste out should of course be considered. However, given the depth at which this waste is located and the volume of waste present above it means that the environmental consequences of moving millions of tonnes of waste to protect the groundwater where limited impacts have been observed would be highly significant and, over such a sustained period, would be unacceptable.

12.5 Mitigation Measures

For any negative impacts identified as being adverse moderate or greater, additional mitigation measures would need to be proposed. This assessment identified the significance of the majority of impacts during the Remediation and Operational Phase would be slight or lower, and in many cases the works would have a positive impact. However, during the Remediation Phase, the impacts of landfill gas to off-site human health receptors were identified as being significant, largely due to the extremely high importance of the receptor.

12.5.1 Remediation Phase

As noted above, the potential impact from landfill gas to off-site human health receptors is significant and mitigation measures are required. These mitigation measures are provided in the Landfill Gas Management Plan (Appendix A4.5) which sets out the likely requirements for gas mitigation measures and monitoring to be undertaken by the appointed contractor during the remediation works (subject to agreement with the regulatory authorities and specified in the IEAL). During the works additional or replacement interim gas controls may need to be installed to ensure the risk of lateral off-site migration is not increased.

The proposals for gas monitoring will need to be bespoke for the remediation works in order to assess the changing nature of the site and associated impacts from gas migration. However, throughout the period of remediation works monitoring of all off-site boreholes shall be conducted at least monthly. During active remedial works, or where materials are moved to uncapped areas of wastes for temporary storage, more frequent monitoring of off-site boreholes adjacent to affected areas is likely to be required. Frequency will be determined by the risk assessment produced by the appointed contractor for each phase of works and incorporated within their method statement for working.

The installation of gas extraction wells within the site as works progress will be in a phased manner, moving from zone to zone as the active remediation works move around the site. Details of the gas control measures and monitoring that will be in place for the Remediation Phase are provided in the Landfill Gas Management Plan (Appendix A4.5).

Whilst the significance of impacts to groundwater are determined as being no greater than slight, due to the uncertainty which is inherent in any groundwater impact assessment, groundwater quality monitoring will be undertaken during the Remediation Phase to ensure that potential negative impacts are not occurring in the groundwater.

Groundwater quality monitoring will be undertaken during the Remediation Phase to ensure that potential negative impacts are not occuring in the groundwater. The boreholes and analytical suite to be used will be agreed with the regulatory authorities and will be specified in the Industrial Emissions Activities Licence (IEAL) for the site. The monitoring will be based on results of ongoing baseline monitoring. The need for installation of new boreholes (which may be required if existing boreholes are to be lost as part of the remediation works) will be considered and if required new boreholes will be installed prior to the remediation works starting. The results of this monitoring will be reported to the EPA to comply with the conditions of the IEAL.

12.5.2 Operational Phase

As with the Remediation Phase, groundwater and soil gas monitoring will be agreed with the EPA and will be specified in the site's IEAL. For groundwater monitoring frequency following remediation may reduce over time as the level of impact and associated risk becomes better understood.

As noted in Chapter 5 Consideration of Alternatives, the installation of a cut-off wall or other perimeter remedial measure to be located between the landfill and the Morell River has been considered as an alternative to (or in addition to) capping the site. As the remediation scheme design has been developed, most notably through 2016, the protection of groundwater in all zones has remained a key consideration. The scheme design will utilise capping systems to reduce infiltration to the waste mass across the site; for Zones 1 and 3 this will comprise a geosynthetic liner system; Zones 2 and 4 will utilise low permeable soils (depth and performance specification to be determined).

Review of monitoring data and assessment of the remediation design proposals has identified that the need for remediation measures (e.g. cut-off wall or series of groundwater abstraction boreholes, or combination thereof) has been determined to not be required at this time. This conclusion is founded on the following rationale:

- Water quality monitoring and ecological assessments have not shown any direct impacts from leachate on the Morell River.
- Geophysical surveys undertaken annually for the past five years along the site's eastern boundary have not identified a contaminant plume emanating from the site and discharging to the river.
- One of the remediation objectives of the work at Kerdiffstown is to "reduce the environmental risk profile to an acceptable level". The adoption of capping systems across the site will reduce infiltration and hence the potential for leachate generation and migration to groundwater, giving a reduction to the environmental risk profile of the site to a likely acceptable level.
- Regulation 4 of the Groundwater Regulations places a duty on public authorities to take all reasonable steps to prevent the input of hazardous substances and limit the input of non-hazardous substances to groundwater and reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater. As the proposed remediation design for the site involves reducing infiltration to the waste by installing capping systems, leaching of contaminants from historical wastes which will remain on site will be reduced.
- The discharge of contaminants to the river cannot be fully eliminated as wastes would remain saturated in parts of the site and recharge from groundwater cannot be avoided. The installation of remedial measures between the boundary of the site and the river, such as a barrier, would not change the input of contaminants to groundwater; only control the discharge.
- An option for a typical remedial measure for the site boundary being installation of a cut-off wall is not without risk of destabilising the current groundwater system. Installing a cut-off wall would alter the existing groundwater flow regime and potentially cause problems as contaminated groundwater backs up behind a wall or groundwater flows to a greater depth beneath the wall (if the wall could not be keyed in to a low permeability horizon) or flows around the edge of the wall. Modelling cannot fully predict this behaviour and there are many examples of cut-off wall/ barrier systems that are not performing as required.
- High dilution in the river from groundwater discharges will make it difficult to record changes in river quality and concentrations of contaminants in groundwater significantly higher than have been measured in boreholes adjacent to the river to date would be required in order for impacts in the river to be recorded. However, consideration of dilution in the river does imply that dilution is an acceptable form of contaminant attenuation.
- The general principle of preventing water from discharging to the river could have an impact on the river flow rates and potential knock-on effects on river ecology. Similarly use of a pumping solution as part of a remedial measures option to control groundwater could also have a negative impact on the river flows and ecology as pumping may also draw in water from the river to the pumping wells.
- As there is no evidence to support the installation of remediation measures another of the key project objectives of having "embedded sustainability in both remediation and post closure" is also realised, as installing a cut-off wall/ barrier system now would require resources (e.g. cement, water) and lead to increased impacts during the works, such as through traffic movements, dust and noise.
- The installation of a cut-off wall/ barrier is likely to require dewatering. As there is no evidence to support any requirement for such a system at this time, the need to remove and treat groundwater would be unnecessary and hence lead to impacts on the river, ecology and public sewer network (as a likely outlet for disposal of any treated waters).
- Should future monitoring highlight that remediation measures are required it is considered that such a system could be installed relatively quickly. Installation of such a system is not reliant on other remediation works, e.g. capping systems on the site, and could be undertaken as "stand alone" works (although removal of any groundwater from the cut-off wall/ barrier system may require additional infrastructure on and off site to facilitate treatment and disposal).
- The DQRA assessment has shown that capping of the site is likely to improve the current situation overall.

- It is noted that due to the potential effects that a cut-off wall could have and the presence of the transition zone in the bedrock providing a preferential pathway for contaminant migration which could not be sealed, the option of installing a cut-off wall is not considered practicable or sustainable.

In terms of the gas monitoring, the Landfill Gas Management Plan (Appendix A4.5) accompanying the IEAL application identifies that gas management proposals for the Operational Phase are likely to follow those that identified for the Remediation Phase, augmented by the addition of the new gas management system and requirements of specific guidance on flares and surface emissions.

12.6 Residual Impacts

12.6.1 Remediation Phase

Following implementation of the mitigation measures for landfill gas, the magnitude and significance of the residual impact during the Remediation Phase is presented in Table 12.21.

Table 12.21: Magnitude of Impacts Following Implementation of Additional Mitigation– Remediation Phase

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contaminated land and groundwater				
Changes to infiltration to the overburden deposits due to disturbance of the existing ground surface and exposure of waste materials to infiltration.	Low	Small adverse	Imperceptible	Disturbance of the existing ground surface (including removal of the existing vegetation) to re-profile the site is likely to allow greater rainfall infiltration to the waste. This would allow for greater leachate production or reduction in the waste's adsorptive capacity and potential increase in contaminant concentrations in the overburden and bedrock aquifers. Exposure of waste to rainfall would allow leachate to be produced. Compaction of soils from plant has the potential to reduce infiltration although this is likely to be a more local effect where soils are heavily trafficked.
Changes to infiltration to the bedrock aquifer due to disturbance of the existing ground surface and exposure of waste materials to infiltration.	Medium	Small adverse	Slight Temporary Residual Possible	
Removal of inert waste mounds in Zone 4 leading to disturbance of wastes near to the water table and increase in contaminant concentrations in groundwater in the overburden deposits.	Low	Small adverse	Imperceptible	Whilst the remediation works would not move any waste from below the water table, locally the waste removed may be close to the water table leading to disturbance of waste below the water table from plant undertaking the remediation works and increasing leaching of contaminants.
Removal of existing structures and hardstanding leading to increased infiltration to groundwater in the overburden deposits	Low	Small adverse	Imperceptible	Whilst the majority of the site building would have been removed by the time the remediation works start, some will remain until the works are completed. Hardstanding in Zone 4 would be removed as part of the works to construct the drainage pond, although it considered that there are limited quantities of waste below this section of hardstanding. Other hardstanding would remain in place and there is a small likelihood that work could lead to increased cracking of the hardstanding and therefore a very minor increase in infiltration. However, cracks within it would be repaired as part of the works thus reducing infiltration as works progress.
Construction of landfill gas venting trenches leading to changes in groundwater infiltration to the overburden deposits.	low	Small adverse	Imperceptible	While trenches would be a positive during the Operational Phase the initial construction of gas venting trenches has the potential to lead to increased rainfall infiltration during their construction due to the removal of lower permeability surface materials. This would lead to an increase in recharge and potentially leachate production.

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Contamination of groundwater in the overburden deposits from fuels and oils stored and used for site plant.	Low	Small adverse	Imperceptible	Groundwater contamination has the potential to occur due to spills and leaks of stored fuels and oils (used for re-fuelling site plant) or leaks from site plant during operation. However, handling procedures for fuels and emergency procedures for spills or leaks of fuels and oils would be covered in the CEMP.
Effects on human health for construction workers from contact with waste materials.	Extremely high	Negligible	Imperceptible	Although construction workers would come into contact with waste material, there would be working procedures including risk assessments in place to minimise these risks. These would include procedures for actions to be taken if unexpected hazardous materials were encountered.
Effects on human health for construction workers through direct exposure to any contaminated materials within soils being brought on to site for capping works.	Extremely high	Negligible	Imperceptible	Although materials brought on to site have the potential to be a contaminant source, testing of the materials will be undertaken as part of the remediation works. Working procedures including risk assessments would be in place to minimise these risks.
Encounter perched leachate	Low	Moderate adverse	Slight Temporary Residual Possible	The potential exists that during excavation of the waste body in Zone 1 or bunds around the site boundary, perched leachate could be encountered and released to locally contaminate groundwater in the overburden deposits. Whilst this is unlikely, the serious nature of this impact results in the magnitude being classed as Moderate.
Landfill gas				
Changes to landfill gas migration routes and impacts to off-site human health receptors.	Extremely High	Negligible	Imperceptible	Disturbance of the current ground surface has the potential to allow greater landfill gas to vent to air rather than migrate laterally. However, during remediation works the landfill gas extraction system has the potential to be interrupted such that less landfill gas is collected with potential for greater migration rates off-site. As the zones are capped there is then greater potential for gas to migrate laterally rather than vertically to off-site receptors. However, additional mitigation would be in place and during the works the appointed contractor would produce a bespoke landfill gas monitoring plan and risk assessment to control the risk of off-site migration.

Potential Impact	Sensitivity & Importance	Magnitude of Impact	Significance of Impact	Comments
Changes to landfill gas migration routes and impacts to off-site property receptors (including vegetation).	Medium	Small adverse	Slight Temporary Residual Possible	Disturbance of the current ground surface has the potential to allow greater landfill gas to vent to air rather than migrate laterally. However, during remediation works the landfill gas extraction system has the potential to be interrupted such that less landfill gas is collected with potential for greater migration rates off-site. As the zones are capped there is then greater potential for gas to migrate laterally rather than vertically to off-site receptors. While the sensitivity of landfill gas reaching the public would be high, the likelihood of such an occurrence is low. As a result, the significance of the impact has been classified as slight.
Changes to landfill gas migration routes and impacts to on-site human health receptors.	Extremely High	Negligible	Imperceptible	For the on-site landfill gas receptors, including human health, these would be controlled by safe working procedures including risk assessments in place to minimise these risks. These would include procedures for actions to be taken if unexpected events occurred.
Changes to landfill gas migration routes and impacts to on-site property receptors.	Medium	Negligible	Imperceptible	
Soils and geology				
Loss of soils	Low	Small adverse	Imperceptible	Only a small area of soils will be affected and areas where soil is present which are used for stockpiling of materials such as Tunney's Field will be stripped of soils so the soils can be used elsewhere on site or as cover.

12.6.2 Operational Phase

Due to no known effects greater than small adverse identified for the Operational Phase of the development, no additional mitigation measures are proposed for the Operational Phase. However, groundwater and landfill gas monitoring will continue to be undertaken and this will be specified in the site's IEAL. As there would be no change to effects as identified in Table 12.20, the effects as shown in the table remain for the Operational Phase.

The site engineering (including an engineered capping design and gas management proposals for the final end-use) will limit vertical migration of the landfill gas to the site surface. However, there is a risk that landfill gas may accumulate in voids, or structures associated with the proposed Project, which may intentionally or unintentionally vent landfill gases.

During detailed design of the remediation and end-use, risks from landfill gas will be considered through the implementation of the requirements of the ATEX Directives. In Ireland, the ATEX Directives and the Work (Explosive Atmospheres) Regulations 2003, have since been revoked and replaced by Part 8 of the Safety Health and Welfare (General Application) Regulations 2007 (Statutory Instrument No. 299 of 2007) as amended.

Where explosive atmospheres might occur in a workplace (or in this case the landfill), the Regulations require employers to:

- assess the potential risks of any work activities involving flammable substances or work activities in potentially explosive atmospheres;
- determine measures to eliminate, reduce or control the risks as far as reasonably practicable;
- provide equipment and procedures to deal with accidents and emergencies;
- provide information and training to all employees; and
- classify places where explosive atmospheres may occur into zones and mark those zones as necessary.

Where an explosive atmosphere is, or is likely to be, present at or may, from time to time, arise in a workplace, the employer is required to make a suitable and appropriate assessment of the risk arising from such explosive atmosphere to the employees concerned having regard to all the circumstances. In this case users of the 'workplace' would be extended to public users of the parkland and recreational facilities. It cannot be ruled out that public users will not use ignition sources, therefore the site and infrastructure would need to be appropriately assessed, zoned and access restrictions put in place. The Regulations require the employer to prepare an explosion protection document to confirm the risk assessment undertaken and set out the applicable zoning of the site. An explosion protection document has been prepared for the current conditions of the site. This will require to be updated following remediation works, most notably to embrace the findings of the pumping trials and as-built gas management system, for adoption in the management of the public park.

Key infrastructure to be assessed for the explosion protection document includes:

Underground services - Underground services on-site and off-site are potentially at risk from landfill gas entry and accumulation, unless the services have been designed to prevent gas ingress. The risk to underground services from landfill gas ingress is associated with the flammability and potential explosion risk of methane. Locations of existing surface water drainage on site are known and sections of drainage around the site offices and access road have been subject to drainage surveys. In addition, services can act as pathways for gas to migrate into buildings via service entries. These risks would be considered and assessed during the detailed design stage.

Utility workers - The risks to utility workers from landfill gas are associated with flammability and potential explosion risk of methane, and asphyxiation arising from accumulation of carbon dioxide and/or reductions in

oxygen. It is likely that practices for working below ground and within buildings will take account of potential risks arising from accumulation of potentially asphyxiant and explosive atmospheres before work commences, although this may not be recognised by individuals working on their own premises.

Vegetation/agricultural land and golf courses - Landfill gas which migrates into soils will tend to displace oxygen from the root zone and in extreme cases can lead to anaerobic conditions in the soil. This can result in vegetation stress or perish. Deep rooted vegetation is generally more prone to effects of landfill gas presence in soils than shallow rooted vegetation.

The landfill gas CSMs are shown diagrammatically in Figures 12.28 to 12.31. The potential gas migration pathways would be addressed by the cap installed on Zones 1 and 3 and the extraction of landfill gas from these zones. For Zones 2A and 2B the gas would be controlled to prevent migration into off-site and on-site receptors by the use of gas venting trenches on the edge of the zones.

12.7 Difficulties Encountered in Compiling Information

No difficulties were encountered during the assessment.

12.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on soils, geology and groundwater. These projects are discussed in the following paragraphs.

12.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. Given that the materials to be used for infilling the quarry are to be inert, they would not lead to additional groundwater or soil gas quality effects. As such, there would be no cumulative effect on groundwater or soil gas quality.

12.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

12.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

12.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the

proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

12.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic.

The works are unlikely to introduce new sources of groundwater contamination or interrupt groundwater flows as groundwater levels are relatively deep to the west of the proposed Project site along the L2005. However, below ground works do have the potential to increase impacts to off-site workers as there would be additional workers working in excavations. However, providing the workers are made aware of the risks and take appropriate measures then the cumulative impacts would be neutral. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

12.9 References

- Apex Geoservices (2010). Kerdiffstown Landfill. Report on the Geophysical Survey for the EPA
- Building Research Establishment (2005). Concrete in Aggressive Ground. Special Digest 1
- Department of Environment Heritage and Local Government (2010). Eastern River Basin District River Basin Management Plan. 2009 – 2015
- Environment Agency (2001). LandSim Version 2 Users Guide, Environment Agency R&D Publication 120
- Environment Agency (2004). Model Procedures for the Management of Land Contamination.
- Environmental Protection Agency (1995). Landfill Manual - Guidance Note on Investigations for Landfills
- Environmental Protection Agency (1997). Landfill Manual - Guidance note of Landfill Operational Practices
- Environmental Protection Agency (1999). Landfill Manual - Guidance note of Landfill Restoration
- Environmental Protection Agency (2000). Landfill Manual - Landfill Site Design
- Environmental Protection Agency (2002). Guidelines on the Information to be Contained in Environmental Impact Statements.
- Environmental Protection Agency (2003a). Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)
- Environmental Protection Agency (2003b). Landfill Manual - Guidance note of Landfill Monitoring
- Environmental Protection Agency (2003c). Towards Setting Guideline Values for the Protection Of Groundwater In Ireland. Interim Report
- Environmental Protection Agency (2007b). Code of Practice: Environmental Risk Assessment for Unregulated Disposal Sites.
- Environmental Protection Agency (2008). Climate Change – Refining the Impacts for Ireland (2001-CD-C3-M1). STRIVE Report.
- Environmental Protection Agency (2010d). Poorly Productive Aquifers. Monitoring Installations and Conceptual Understanding
- Environmental Protection Agency (December 2011). Guidance on the Authorisation of Discharges to Groundwater.
- Environmental Protection Agency (2011b). Management of Low Levels of Landfill Gas
- Environmental Protection Agency (2012a). Framework Approach for the Management of Contaminated Land and Groundwater at EPA Licensed Facilities.
- Environmental Protection Agency (2012c). Guidance Note on Landfill Flare and Engine Management and Monitoring (AG7)
- Environmental Protection Agency (2016). EPA on-line mapping portal. http://gis.epa.ie/Envision/ (accessed August 2016)
- Environmental Protection Agency (2017a). Determining Groundwater Pollution: A Proposed Approach for the Development and Application of Guideline Values for Groundwater. Consultation Draft
- Environmental Protection Agency (2017b). HydroNet (on-line river flow data). http://www.epa.ie/hydronet/#Water%20Levels. Accessed February 2017.
- ESI Ltd (2008). Guide to Using RAM3 Risk Assessment Model
- Geological Survey of Ireland (2002). County Kildare Groundwater Protection Scheme Volume I: Main Report First Draft.
- Geological Survey of Ireland (2005). The Geological Heritage of Kildare. An audit of County Geological Sites in Kildare
- Geological Survey of Ireland (2016). GSI on-line.

- Spatial Resources Mapping. http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 (accessed August 2016).
- Geosyntec Consultants Ltd. (2013). Groundwater and Surface Water Monitoring at Kerdiffstown Landfill February 2013
- IGSL (2017). Kerdiffstown Landfill Remediation Project. Additional Monitoring, Ground Investigation and Gas Extraction Boreholes. Geotechnical Investigation Report. Project No. 19600.
- Institute of Geologists of Ireland (2013). Guidance for the preparation of Soil Geology and Hydrogeology Chapters of Environmental Impact Statements
- Jacobs (2017). Kerdiffstown Landfill Remediation Project. Landfill Gas Management Plan
- Kildare County Council and Geological Survey of Ireland (2004). Kildare Groundwater Protection Scheme. Volume II. Overview of Groundwater Quality.
- National Roads Authority (2009). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes
- SKM Enviros (2013a) (*on behalf of the Environmental Protection Agency*). Kerdiffstown Remediation Project. Groundwater Management Plan
- SKM Enviros (2013b) (*on behalf of the Environmental Protection Agency*). Kerdiffstown Landfill. Kerdiffstown Odour Control Plan.
- SKM Enviros (2014) (*on behalf of the Environmental Protection Agency*). Kerdiffstown Landfill Remediation Project. Groundwater DQRA Report for the Environmental Protection Agency.
- Teagasc (2016). Teagasc soil map. http://gis.teagasc.ie/soils/map.php (accessed August 2016)
- The UK Climate Impact Programme website, available online at http://www.ukcip.org.uk/ Last accessed 2nd July 2015.
- UK Water Industry Research (2010). Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites.

13. Water – Hydrology

This Chapter assesses the likely impacts to the surface water environment of the proposed Project site and the surrounding areas.

The Remediation Phase impacts associated with the construction of the surface water outfall and pipelines will be negative and temporary. There have been a number of mitigation measures proposed for the Remediation Phase. The preparation of an Erosion and Sediment Control Plan (ESCP) prior to commencement of works shall be required which will include provisions to prevent the release of sediment into the Morell River (e.g. cofferdams, sediment fences and silt curtains). Surface water runoff from the site will not be permitted during remediation works, with all runoff to be retained within the site for reuse and/or disposal offsite, there will be no discharge to the Morell River during the Remediation Phase.

Operational Phase impacts will range from negative to positive and will all be long term in nature. The presence of a new surface water outfall structure within the Morell River will have a slight negative impact through the altering of the flows and removal of bank and vegetation. Accidental spillages into the site surface waters also have the potential to have a negative impact on the Morell River. Provision of real time monitoring and a penstock at the outlet from the surface water pond will hold back the water in the case of any contamination. Emergency response procedures will also be in place to manage in the event of a spillage. Only clean surface water will be allowed to discharge through the surface water outfall into the Morell River.

The remediation of the site will have a positive long-term impact on the hydrology of the area through the reduction in generation of leachate from the site following the placement of the low permeability cap across the waste bodies.

13.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") on the surface water environment anticipated to occur during the Remediation and Operational Phases.

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

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 13.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

Table 13.1: Summary of Key Activities during the Remediation and Operational Phases

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

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

The potential impacts on various hydrological aspects such as water quality, flooding, hydromorphology and amenity value, likely to be caused by the proposed Project, have been identified as a result of:

- Works in or adjacent to watercourses;
- Water quality impact on receiving rivers and streams due to potential discharges both during the Remediation Phase and the Operational Phase including from groundwater influences; and
- Potential increased flood risk.

13.2 Legislative Context

The EU Water Framework Directive (2000/60/EC) (WFD) established a framework for the protection of both surface and groundwater. Transposing legislation (S.I. 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended) outlines the water protection and water management measures required in Ireland to maintain high status of waters where it exists, prevent any deterioration in existing water status and achieve at least good status for all waters. A number of River Basin Management Plans (RBMPs) were developed to address the requirements of the WFD. The RBMP of relevance to this assessment (the Eastern RBMP 2009-2015) was adopted in 2009 and includes a programme of measures required to facilitate the achievement of the WFD objectives. This programme of measures included full implementation of existing legislation including the Water Pollution Acts, Water Services Act, Bathing Water Quality Regulations, Integrated Pollution Prevention and Control (IPPC) Regulations, Urban Wastewater Treatment Regulations, the Foreshore Acts and the Birds and Habitats Directives (particularly the Appropriate

Assessment process). The second cycle of the river basin management planning is currently underway (this was delayed due to significant reform in the water sector in recent years) and the second consolidated draft RBMP which will include the merging of the Eastern, South Eastern, South Western, Western and Shannon River Basin Districts to form one national River Basin District is currently open for consultation, with the final RBMP due to be published by the end of 2017.

Other important EU and national legislation pertaining to the hydrological environment include:

- The EU Floods Directive 2007/60/EC;
- S.I. 722 of 2003, European Communities (Water Policy) Regulations, as amended;
- S.I. 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended;
- S.I. 350 of 2014, European Union (Water Policy) Regulations 2014;
- S.I. 122 of 2010, European Communities (Assessment and Management of Flood Risks) Regulations; and
- S.I. 81 of 1988, European Community Environmental (Quality of Surface Water Intended for Human Consumption) Regulations 1984 as amended.

13.3 Methodology

The assessment was carried out in accordance with the following guidance and tailored accordingly based on professional judgement:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- National Road Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009); and
- Office of Public Works (OPW) Guidelines for Planning Authorities (GPA) 20: The Planning System and Flood Risk Management (OPW and Department of Environment, Heritage and Local Government 2009).

In line with the above guidance this assessment covered the potential impacts to water quality and described the existing hydrological and hydromorphological environment and any potentially significant impacts associated with the Remediation and Operational Phases of the proposed Project. The impact assessment process involved:

- Assigning the receptor/attribute sensitivity and importance;
- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts; and
- Assessing the significance of any residual effects after mitigation.

The assessment also considered the potential impact to local abstractions potentially affected by the proposed Project.

A Flood Risk Assessment (FRA) Stage 1 was carried out in accordance with the Office of Public Works Guidelines for Planning Authorities (GPA) 20: The Planning System and Flood Risk Management. Refer to Appendix A13.1.

13.3.1 Appraisal Method used for Assessment of Impacts

The following impact assessment methodology was adapted from the NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009), specifically Section 5.6 (impact quality, type, magnitude/ significance and duration are considered relative to the importance of the hydrological attribute), see Table 13.2 to Table 13.4. The assessment also took account of the guidance set out in the EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017).

Table 13.2: Criteria for Rating Site Attributes - Estimation of Importance of Hydrology Attributes

Importance	Criteria	Typical example
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European communities (Quality of Salmonid Waters) Regulations, 1988. River has sediment regime which provides a diverse mosaic of habitat types, with highly varied morphological features (e.g. pools, riffles, bars) and no sign of channel modification. River displays natural fluvial process and natural flow regime, which would be highly vulnerable to change.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation (NHA status). Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities River has sediment regime which provides highly varied habitat types with varied morphological features and very limited signs of modification.
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Regionally important amenity site for wide range of leisure activities River has sediment regime which provides varied habitat types and appears largely in natural equilibrium. River exhibiting natural range of morphological features with limited signs of artificial modification or morphological pressures.
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding River has sediment regime which provides some habitat and has some natural processes occurring. Rivers exhibit some morphological features; however, the channel cross-section is partially modified with obvious signs of modification.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure Activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people River has sediment regime which provides limited physical habitat and has been extensively modified. River has uniform flow and banks and absence of morphological features.

Table 13.3: Criteria for Rating Impact Significance - Estimation of Magnitude of Impact on Hydrology Attribute

Magnitude of Impact	Criteria
Large Adverse	Results in loss of attribute and/ or quality and integrity of attribute.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.
Minor Beneficial	Results in minor improvement of attribute quality.
Moderate Beneficial	Results in moderate improvement of attribute quality.
Major Beneficial	Results in major improvement of attribute quality.

Table 13.4: Rating of Significant Environmental Impacts

		Magnitude of impact			
		Negligible	Small	Moderate	Large
Importance of Attribute	Extremely High	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
	High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Profound/ Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/ Moderate

13.4 Baseline Conditions

13.4.1 Desktop Study

A desk study was carried out to collate the available information on the hydrology water quality of the study area (1km beyond the land-take boundary of the proposed Project). The following data sources were referred to during the assessment:

- Ordnance Survey of Ireland - current and historic mapping;
- Aerial photographs;
- EPA - water quality monitoring database and reports;
- Met Éireann (http://www.met.ie);
- EPA - flow and water level measurements (EPA Hydronet System);
- EPA Hydrotool Report for the Morell River Catchment 2016;
- Water Framework Directive Ireland Database (http://www.wfdireland.ie);
- The Eastern RBMP 2009-2015 and the Liffey WMU Action Plan 2009-2015;
- National Parks and Wildlife Service (NPWS) - designated sites;
- Kildare County Development Plan 2011-2017;
- Kildare County Development Plan 2017-2023;
- Inland Fisheries Ireland - fishery resources;
- Office of Public Works - flood records and the Eastern Catchment Flood Risk Assessment and Management Study (ongoing);
- Kerdiffstown Remediation Project Surface Water Management Plan (SKM Enviros, September 2013);
- Kerdiffstown Environmental Baseline Report (SKM Enviros 2013);

- Monthly and Bi-annual Surface Water Monitoring Data (Jacobs, October 2013 to December 2016);
- Groundwater and Surface Water Monitoring at Kerdiffstown Landfill (Geosyntec Consultants Ltd, May 2013);
- Preliminary Environmental Site Assessment – Kerdiffstown Landfill (Ford Consulting Group Ltd, April 2012);
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare (Aquens Ltd, December 2012);
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare (Aquens Ltd, October 2015);
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare (Aquens Ltd, September 2016);
- N7 Naas Road Interchange Scheme: Hydraulic Model & Flood Alleviation Measures Report (J B Barry & Partners Limited, January 2002);
- Kerdiffstown Landfill Facility; Briefing Note: Water Management Plan Surface water quality monitoring data (SKM Enviros, March 2012);
- Kildare County Council, National Roads Design Office, N7 Naas Road Widening & Interchanges Scheme, Kill & Johnstown Flood Alleviation Measures Report (June 2002);
- Kildare County Council, National Roads Design Office, N7 Naas Road Widening Interchange Scheme, Hydraulic Model & Flood Alleviation Measures Report (January 2002);
- Kildare County Council Memo, Report Re: Flooding In County Kildare, 5-7 November 2000; and
- OPW Flood Event Report, Flooding at Killeenmore, Co. Kildare, 26 November 2012.

13.4.2 Field Survey and Monitoring

Hydrological Field Surveys

Site walkovers were undertaken in September and December 2016 to gain an understanding of the hydrological environment in the vicinity of the proposed Project. Visual inspections have been made of the Morell River (WB005), Canal Feeder Stream (WB004) and the other minor watercourses or features in the study area.

Baseline Water Quality Monitoring

Baseline water quality monitoring is currently undertaken monthly at seven locations including the Morell River and the Canal Feeder Stream. An extended suite of sampling is undertaken on a bi-annual basis for an increased number of locations (sixteen) and parameters, see Table 13.5 and Figure 13.2.

Table 13.5: Water Quality Sampling Locations

Water Body	Sampling Location	Orientation from site	Monthly Sampling	Bi annual Sampling
Morell River (WB005)	SW01	Upstream SE	✓	✓
	SW02	Upstream E	✓	✓
	SW03	Adjacent E	✓	✓
	SW04	Adjacent E		✓
	SW05	Downstream NE	✓	✓
Mill Race (off Morell River) (WB007)	SW17	Upstream SE		✓

Water Body	Sampling Location	Orientation from site	Monthly Sampling	Bi annual Sampling
Canal Feeder Stream (WB004)	SW13	Upstream S	✓	✓
	Site Discharge	Adjacent to S	✓	✓
	SW10	Downstream S		✓
	SW11	Downstream SW	✓	✓
	SW12	Downstream SW		✓
Watercourse on Palmerstown House Estate & Golf Course (WB001)	SW16	Upstream SE		✓
	SW08	Upstream SE		✓
	SW06	Adjacent E		✓
	SW15	Adjacent E		✓
Watercourse on Palmerstown House Estate & Golf Course (WB002)	SW14	Downstream NE		✓

Surface water runoff samples are also collected on-site from a manhole chamber located directly downgradient from an oil interceptor located adjacent to the existing site entrance road in the southern part of the site (Zone 2A), with ultimate discharge to the Canal Feeder Stream.

Surface water samples are analysed for a suite of inorganic parameters including major ions and metals/metalloids as well as a broad suite of organic compounds including volatile organic compounds (VOC's), semi volatile organic compounds (SVOC's) and pesticides. Existing sampling locations are shown on Figure 13.2 and parameters are listed in Appendix A13.2.

A biological Q-rating assessment of the Morell River using benthic macroinvertebrates as bio-indicators was also carried out in 2012, 2015 and 2016 (Aquens Ltd, 2012, 2015, 2016). This involved macroinvertebrate sampling at seven locations: six in the Morell River and one in its tributary, the Rathmore Stream (also known as the Hartwell River) for the 2012 and 2015 assessment. In 2016 three additional sites were added, two on the Morell River and one on the Rathmore Stream, to represent upstream water quality. The macroinvertebrate data was used to derive a Q-value for each monitoring location based on the proportions of different macroinvertebrate groups, refer to Appendix A13.3 for the Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare 2012, 2015 and 2016 reports.

13.4.3 Consultation

Consultation on the surface water impact assessment was undertaken with the following organisations:

- EPA;
- Water Policy Advisory Committee (Department of Housing, Planning, Community & Local Government);
- The National Parks and Wildlife Service (NPWS);
- The Office of Public Works (OPW);
- Water Service Department of Kildare County Council and Irish Water (IW);
- Inland Fisheries Ireland (IFI); and
- Waterways Ireland.

Consultation responses available are summarised in Chapter 6 The Consultation Process and are included in Appendix A6.2.

13.4.4 Description of the Existing Environment

Study Area

The study area lies within the Eastern River Basin District (ERBD), Hydrometric Area (HA) 9 (Liffey and Dublin Bay) within the Liffey Water Management Unit (WMU). The catchment of this HA is drained by the River Liffey with all associated watercourses entering tidal water in the Liffey Estuary, north-east of the study area. The assessment has primarily focused within 1km of the proposed Project land-take boundary, including both upstream and downstream extents of surface waters receptors in the vicinity of the site; this was extended as required dependent upon professional judgement. There is one EPA delineated catchment (Liffey and Dublin Bay) and two sub-catchments (Liffey_SC_060 and Liffey_SC_070) within the study area as shown in Figure 13.1.

Major Surface Waterbodies

The key waterbodies (WB) within the study area are shown in Figure 13.2 and an in Diagram 13.1 below.

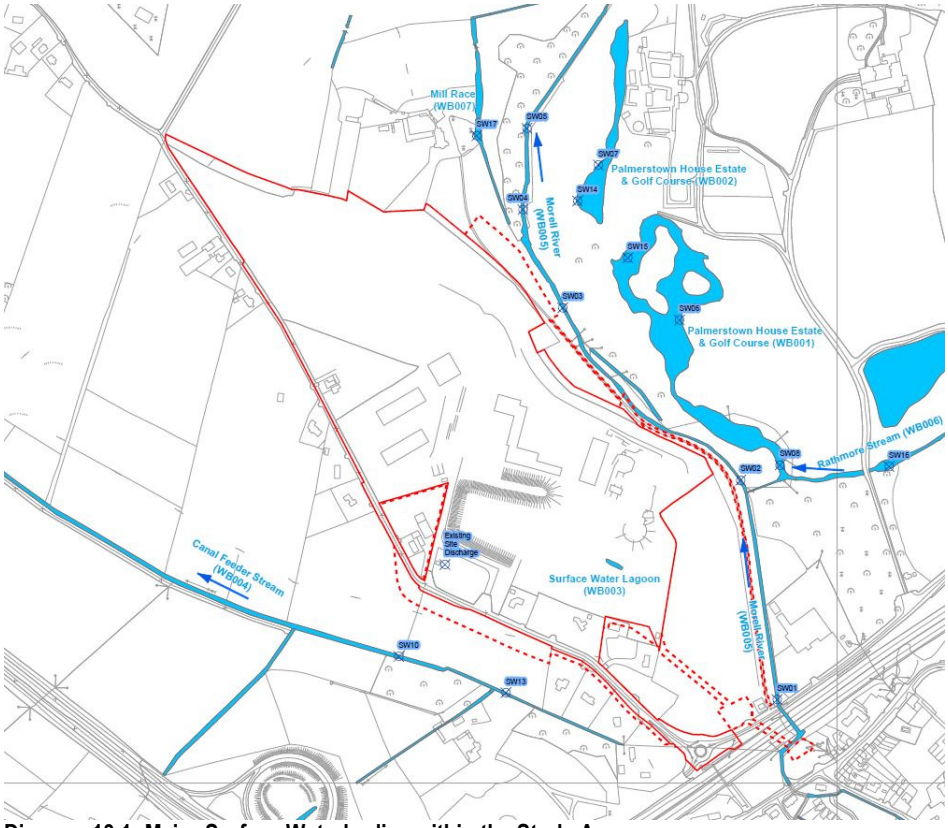


Diagram 13.1: Major Surface Waterbodies within the Study Area

The closest surface water body to the site is the Morell River (WB005) which lies to the east of the proposed Project. The Morell River flows generally northwards joining the River Liffey approximately 5-6km from the site boundary. The Morell River itself is located approximately 15m east of the site boundary. The river channel has an artificially straightened planform throughout its length, with likely modifications to account for surrounding land uses and drainage requirements. Within the study area, there are lengths of bank reinforcement with a modified channel cross-section. The bed consists primarily of cobbles and gravels. A pool-riffle sequence was also noted, providing variation in low flow and some morphological diversity.

The Rathmore Stream (WB006) has its source approximately 8.5km south-east of the proposed Project between the town of Rathmore and Kilteen and joins the Morell River east of the proposed Project. The connection from the Rathmore Steam to the Morell River is not shown on any published maps but has been confirmed via field surveys carried out for the project, refer to Figure 13.2.

The watercourse has a predominantly sinuous planform which flows through pastoral agricultural fields. The channel appears to be laterally adjusting with several lengths of erosion and large deposits visible along the entire course. The watercourse has a limited vegetated riparian buffer, with an intermittent tree lining that shades some lengths of the channel and acts to stabilise the banks (i.e. through the root network).

The Canal Feeder Stream (WB004) is an engineered feature that collects surface water runoff from lands generally to the south and south-west of the site. The Canal Feeder Stream flows generally westward to the Grand Canal, which is located approximately 2km west of the site. The Canal Feeder Stream has a modified channel cross-section with uniform flow and limited morphological features.

Minor Surface Water Features

Other surface water features in the study area include the lakes/ponds associated with the Palmerstown House Estate & Golf Course (WB001 and WB002), which lie approximately 100m to the east of the proposed Project; as shown in Figure 13.2. There is also an existing surface water lagoon (WB003) located within the boundary of the proposed Project.

Overview of Surface Water Quality

Water Quality and the Water Framework Directive Classification

The status of the Morell River and the Rathmore Stream adjacent to the site is moderate, see Table 13.6. To note as shown in the recent EPA WFD data from the EPA Catchments online portal (EPA 2017) the status of the Morell River and the Rathmore Stream upstream of the site is poor and downstream of the site the status of the Morell River is recorded as good.

Table 13.6: WFD Waterbodies and Current Status in or adjacent to the Study Area

Water Body	Heavily Modified Water Body	Waterbody Code (former code 2009 RBMP)	Type	Status 2010-2015	Element causing less than good	Achieve Good Status by (under the 2009 RBMP)
Morell River	No	IE_EA_09M010100 (IE_EA_09_1480)	River	Moderate	Macroinvertebrates	2021
Rathmore Stream	No	IE_EA_09R020300 (IE_EA_09_1602)	River	Moderate	Macroinvertebrates	2021

Water Quality and EPA Classification

The EPA assesses the water quality of rivers and streams across Ireland using a biological assessment method. The EPA assigns biological river quality (biotic index) ratings from Q5-Q1 to watercourse sections (refer to Table 13.7). Q5 denotes a watercourse with high water quality and high community diversity, whereas Q1 denotes very low community diversity and a bad water quality. Table 13.8 provides details of the Q water quality status of the Morell River and the Rathmore Stream for the period 2004-2015 as shown in the EPA Envision Mapper (EPA 2017).

Table 13.7: EPA Biotic Indices ("Q Values")

Q Value*	WFD Status	Pollution Status	Condition**
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously Polluted	Unsatisfactory

Notes
* These Values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily also snails, worms, shrimps etc.) resident at a river site.
** "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses.

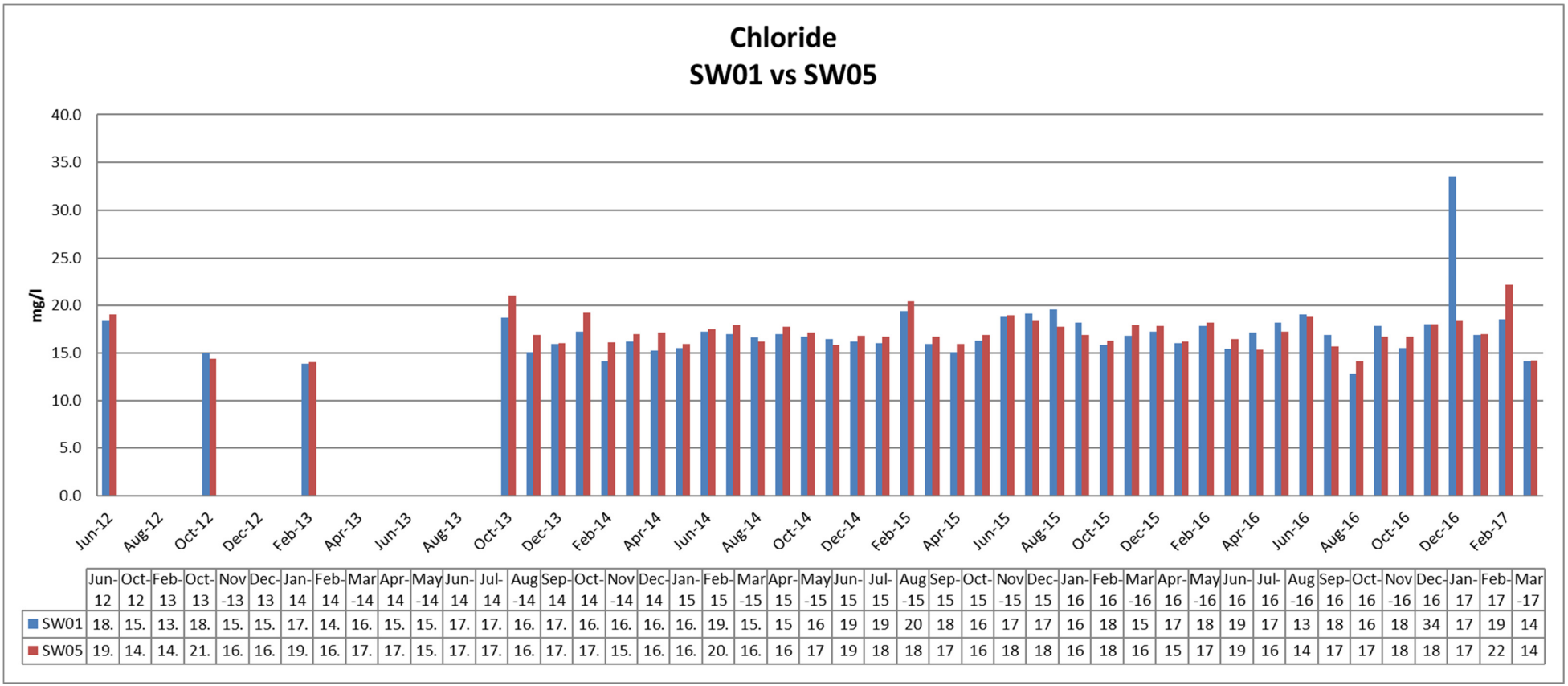
Table 13.8: EPA Monitoring Station Locations and Current Status

EPA River Reference	Location	Q Value	Status 2004-2015
RS09M010100	Morell River	Q 2-3, Q3	Poor
RS09R020300	Rathmore Stream	Q 3-4	Moderate

Baseline Water Quality Monitoring Results

Monthly baseline water quality monitoring is currently undertaken at seven key strategic locations on the Morell River and Canal Feeder Stream, to assess whether the landfill is having an adverse impact upon water quality within these water bodies as detailed in Section 13.4.2. Bi-annual surface water monitoring involves the collection and analysis of sixteen samples from the Morell River and Canal Feeder Stream and water bodies located on Palmerstown House Estate & Golf Course, see Table 13.5 and Figure 13.2.

Sampling and monitoring of surface water upstream and downstream of the landfill indicates that the quality of water within the Morell River is good, with no evidence of an increase in key landfill leachate indicators such as ammoniacal nitrogen, alkalinity and Chemical Oxygen Demand (COD). Historically, the chloride concentration at sampling location SW05 has been higher than the concentration recorded at the upstream sampling location SW01 which could be attributed to the landfill. However, as seen in Diagram 13.2 below, chloride concentrations in the Morell River for the four months (April-July 2016) have had a slight decrease downstream from SW01 (16.9mg/l) to SW05 (15.7mg/l). This trend was similarly seen in the summer to autumn of 2015, where three consecutive months (July, August and September) recorded a lower concentration at SW05 than SW01.



	Jun-12	Oct-12	Feb-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17
SW01	18.	15.	13.	18.	15.	15.	17.	14.	16.	15.	15.	17.	17.	16.	17.	16.	16.	16.	16.	19.	15.	15	16	19	19	20	18	16	17	17	16	18	15	17	18	19	17	13	18	16	18	34	17	19	14
SW05	19.	14.	14.	21.	16.	16.	19.	16.	17.	17.	15.	17.	17.	16.	17.	17.	15.	16.	16.	20.	16.	16	17	19	18	18	17	16	18	18	16	18	16	15	17	19	16	14	17	17	18	18	17	22	14

Diagram 13.2: Chloride in Morell River – Upstream (SW01) versus Downstream (SW05)

Previous monitoring indicated that the Canal Feeder Stream was of good quality however, some recent results were higher downstream of the site than upstream e.g. calcium, potassium, sodium, alkalinity, sulphate and chloride. The data collected could indicate that runoff from roads in the vicinity of the proposed Project is impacting the Canal Feeder Stream with elevated chloride concentrations seen during the winter months from road salt but decreasing through the summer.

Where available, these results are compared to the standards in the European Communities Environmental Objective (Surface Water) Regulations, S.I. 272 of 2009. The following metal and metalloids are measured against the Surface Water Regulations: Arsenic, Cadmium, Chromium, Copper, Lead, Nickel and Zinc. The results between October 2013 and July 2016 show that almost all of the analytes are testing below the surface water regulation standards, refer to Appendix A13.2.

Benthic macroinvertebrates are used as bio-indicators as they exhibit differential responses to physical and chemical changes in their environment. Some macroinvertebrates are sensitive to pollution while others are tolerant. They can provide a realistic record of the baseline water quality conditions. The 2012 biological Q-rating assessment found that the water quality was good along the Morell River's length with sites achieving scores of Q4 and most achieving Q4-5. In 2015 and 2016 the assessment found that both the Morell River and Rathmore Stream were impacted. The water quality of the Morell River was moderately polluted (Q3) upstream of the landfill and improves to slightly polluted (Q3-4) downstream as it flows past Kerdiffstown Landfill which is consistent with the WFD status. However, these assessments show that there is still no evidence of ecological deterioration or impact from the landfill. These three reports are contained in Appendix A13.3.

Flow Measurement

Flow measurements within rivers are taken throughout the Republic of Ireland by the OPW and the EPA. Within the study area the OPW measure water level and flow on the Morell River at station No. 09036 (water level only) and Kildare County Council / EPA at gauging station No. 09044 (Water Level and Flow) at Kerdiffstown House, refer to Figure 13.1.

The summary flow statistics downloaded from the EPA for the existing hydrometric station near the weir adjacent to Kerdiffstown House (gauging station No. 09044) indicates an annual minimum dry weather flow of 0.059m^3/s and Q95 (95 percentile flow) of 0.119m^3/s (a statistical measure of flow rate based on long-term flow records).

Water Supply Sources

A review of EPA abstraction data and previous reports, such as the Kerdiffstown Landfill Facility; Briefing Note: Water Management Plan (SKM Enviros, March 2012) surface water quality monitoring data did not identify any known drinking water abstraction points or designated surface water drinking sources downstream of the proposed Project. The closest major public water supply abstraction from the River Liffey at Leixlip, which serves Fingal, Kildare and north Dublin, is located approximately 15km north-east of the landfill site. There is also a known industrial abstraction downstream on the Liffey near Leixlip.

Discharges, IPC/Industrial Emissions Activities Licenced Facilities and Urban Wastewater Treatment Plant (UWWTP)

There are approximately six licensed IPC facilities and two licensed waste facilities within 7km of the proposed Project, see Table 13.9. The Osberstown (UWWTP) which serves the Upper Liffey Valley Regional Sewerage Scheme agglomeration (D0002-01) lies within 5km of the proposed Project.

Table 13.9: Licensed Facilities and Facility Type

Facility Name	Facility Type	Licence No.	Orientation from site	Approx. distance from the centre of the of the site (km)
Boran Plastic Packaging Limited	IPC Facility	P0819-01	West	2.4
Greenisle Foods Limited (Naas)	IPC Facility	P0805-01	West	1.5
Trimite Truecoat Limited	IPC Facility	P0239-01	South-West	1
Dennison Trailers Limited	IPC Facility	P0782-01	South-West	1
Arrow Group	IPC Facility	P0812-01	South-West	1.2
Saint Gobain Building Distribution (ROI) Limited T/a PDM	IPC Facility	P0325-01	East	6.2
Arthurstown Landfill	Waste Facility	W0004-04	South-East	4
Rehab Glassco Limited	Waste Facility	W0279-02	South-East	5
Osberstown Upper Liffey Valley UWWTP	UWWTP	D0002-01	South-West	4

Ecological Designations

The site is not situated within or next to any European sites. The nearest European site to the proposed Project is Red Bog, Kildare SAC approximately 7.5km south-east of the proposed Project. There is no hydrological or source-pathway-receptor connectivity between the Kerdiffstown site and this SAC (refer to Chapter 11 Biodiversity). Surveys to date have recorded no species or habitats associated with designated European sites within the site. The nearest European site hydrologically connected to the site is at least 20km downstream (Dublin Bay), measured by connecting watercourses, including the Morell River which lies within 15m of the north-east site boundary at its closest point. However, designated sites in Dublin Bay do not support any aquatic Qualifying Interest (QI) species such as Atlantic salmon or lamprey. The Canal Feeder Stream discharges into the Grand Canal, which is designated as a proposed Natural Heritage Area (pNHA) 2km north of the site boundary. The ecological value of the canal lies in the diversity of species it supports along its linear habitats than in the presence of rare species (refer to Chapter 11 Biodiversity).

Amenity Areas

The site is in close proximity to a number of commercial and leisure receptors along the access road to Kerdiffstown Landfill. The site neighbours a number of recreational land uses, specifically Palmerstown House Estate & Golf Course and Naas Golf Course to the north-east and north-west respectively. In addition to this is the Grand Canal (pNHA), located approximately 550m north of the propose Project at the nearest point. The Grand Canal provides the area with an amenity site suitable for walking, running and cycling.

History of Flooding and Flood Risk Assessment

With reference to the OPW National Flood Hazard Mapping (www.floodmaps.ie) which contains flood information, a number of historical flood events were identified within the areas around the proposed Project, namely the Kill, Johnstown and Sallins areas, refer to Appendix A13.1.

13.4.5 Receptor Importance

Table 13.10 summarises the importance of the surface water receptors within the study area using the criteria from NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, professional judgement and consultation feedback The surface water lagoon (WB003) is part of the existing site drainage and is not consider a receptor for the purpose of the assessment. The Mill Race (WB007) is considered under the Morell River (WB005) assessment.

Table 13.10: Receptor Importance within the Study Area

Receptor	Water Body	Receptor Importance	Rationale
Morell River	WB005	High	The Morell River provide spawning habitat for a key population of Atlantic salmon in addition to supporting significant populations of Brown trout
Canal Feeder Stream	WB004	Medium	Downstream connection 2km to the Grand Canal pNHA
Rathmore Stream (also known as the Hartwell River)	WB006	High	Quality Class B (Biotic Index Q3-4) and connection to the Morell River see above
Watercourse on Palmerstown House Estate & Golf Course	WB001 & WB002	Low	Limited ecological potential but some local/regional amenity value

13.4.6 Current Site Conditions and Drainage

Current Site Conditions and Drainage – Pre-Remediation

The site has been divided into zones as shown Figure 3.2. Table 13.11 summarises those elements within each zone of relevance to this surface water assessment. The existence of uncapped wastes means that surface water currently infiltrates the landfill to generate leachate, most notably in Zones 1 and 3.

It is noted that there is only one existing discharge point from the site into the Canal Feeder Stream in the form of the overflow from the settlement tank (including an oil interceptor) adjacent to the site entrance. There is currently no direct discharge from the site to the Morell River.

Table 13.11: Zonation of Kerdiffstown Site

No.	Zone Characteristics (relating to Surface/Ground Water refer to Section 3.4 for more details and Figure 3.2 for the location of each Zone)
1/1A	Wastes in this area of the Site are uncapped although large areas are covered in vegetation. This zone is unlined and localised areas of free leachate are present within the wastes. Currently there is no surface water control within Zone 1 and rainfall largely infiltrates into the ground, runs-off to the surrounding ground or evaporates.
2A/2B	Much of these zones is covered by thick, reinforced concrete pads, which form an impermeable layer over the wastes and prevent direct rainwater ingress. The smaller area of wastes not covered by concrete allows rainwater to infiltrate in a similar manner to Zone 1 above. Leachate production in this area is already significantly reduced by presence of the concrete slabs. Currently, hard-standing surface water runoff from Zone 2A (from around the site office, former buildings and the site access road) drains into road gullies and flows through a settling tank and subsequently through an oil interceptor via piped network to the Canal Feeder Stream. Foul drainage from the site offices currently drains to a septic tank which is cleaned out on a regular basis.
3	This zone comprises a lined cell, which has been partially infilled with wastes, and this infilled area has been capped (temporarily) with a geosynthetic liner. Leachate is collected by pumps transferring the leachate to two tanks above the cell area for removal by road tanker, where the leachate is treated at Ringsend Wastewater Treatment Plant (WWTP). The lined cell has not been completely infilled to date. Waste was removed from within the former buildings that were demolished in 2016 and disposed to the lined cell, with new temporary capping installed over this waste mass. Around this temporary cap, a ditch shape has been formed to collect surface water runoff from the temporary capped area, which transfers surface water to a surface water channel and to a surface water lagoon (WB003) located in Zone 4, refer to Figure 13.2. This lagoon has no outlet hence waters dissipate to groundwater. Due to a permeable horizon lying above a clay layer on the south slope of the cell, groundwater has been noted to build up behind the liner. This water is extracted via pin wells and drains into the surface water channel feeding the surface water lagoon.

No.	Zone Characteristics (relating to Surface/Ground Water refer to Section 3.4 for more details and Figure 3.2 for the location of each Zone)
4	Zone 4 contains the surface water lagoon, which is cut into the surface which is considered to include some waste deposits. Any leachate generated in this area is considered to be weak and discharges directly to groundwater.

An area located to the south extents of the proposed Project, within the land ownership boundary, comprises houses, access roads, a stockpile of fill material and drainage features. Refer to Figure 3.2 for the location of the zones.

To facilitate the remediation works a compulsory purchase process will be undertaken for adjacent lands. There are a number of properties that will then be affected within the Compulsory Purchase Order (CPO) boundary. Reference should be made to Figure 3.4 for the location of the properties discussed below.

Foul water from REC010 is discharged to a septic tank within the bounds of the property. This property will be demolished as part of the works to construct the new Landfill Infrastructure Compound. Foul water from REC011 discharges to a septic tank within the bounds of the property. This property will be demolished as part of the works to construct the new site access.

Surface water drainage from a property (REC012) currently flows into drains, transferring into road gullies to a settlement tank and oil interceptor, then discharging via a piped network to the Canal Feeder Stream. This connection will be realigned as part of the remediation works to remove pipes from within the licensed boundary. Foul water for REC012 is assumed to discharge to a septic tank within the bounds of the property.

Foul water for REC016 is discharged to a septic tank within the bounds of the property. This property will be demolished as part of the enabling works to permit stockpiling of clean imported materials.

A septic tank, of soakaway design, extends from property REC039 and discharges within the site boundary. This discharge will be removed and a sewer connection provided for this property.

Foul and grey waters drainage from the existing site offices are collected in a septic tank and are removed from site on a regular basis.

13.5 Predicted Impacts

This Section considers and assesses the impact of the proposed Project with regards to surface water receptors. Flooding impacts are addressed in detail in the FRA specialist report contained in Appendix A13.1 and are summarised in Section 13.5.5.

13.5.1 Site Drainage Conditions – During Remediation

A suitably competent contractor(s) will be appointed to undertake remedial works at the site, with surface water management a particular aspect to be closely monitored and controlled. The contractor will be required to construct temporary perimeter bunds and silt fences to enable separation of working areas from remediated areas. However, it is anticipated that until initial vegetation coverage is established silty runoff from capping soils requires control. As a result, the surface water management design proposals do not permit surface water discharge to the Morell River during the Remediation Phase.

The appointed contractor(s) responsible for the remediation works will be required for ensuring a break between working (exposed waste) areas and remediated areas (restored) is maintained to prevent cross contamination. The appointed contractor(s) may also utilise temporary on site lagoons to retain surface water runoff, with silt buster tanks (or similar) used to limit the amount of silt being disposed to the ponds/ lagoons. Water collected in these lagoons will be used for dust suppression across the open working areas and, if not contaminated, over restored areas with any contaminated waters removed from the site by road tanker. The appointed contractor will be required to prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC,

for the contractor to then implement through the Remediation Phase, with water contamination testing requirements and limits to be agreed with the EPA.

13.5.2 Future Site Drainage Conditions – Post Remediation

Details of the future site drainage conditions are provided in the Surface Water Management Plan (Appendix A4.6). Details of leachate management are included in the Leachate Management Plan (Appendix A4.4).

Foul water: Foul water from the proposed amenity facilities (changing room and the site management offices) will be directed via a new sewer pipeline, crossing under the N7 and Morell River, connecting to Johnstown Pumping Station for discharge into the public sewer network and then transferred onto Osberstown WWTP, refer to Figure 4.17.

Leachate: Leachate will be collected from Zone 3 and may also be extracted from Zone 1 when required. Leachate will be pumped to the Landfill Infrastructure Compound (refer to Figure 4.13), where it will be treated (by methane stripping) and then pumped via a new leachate pipeline, crossing under the N7 and Morell River, to Johnstown Pumping Station, for discharge into the public sewer network and then transferred on to Osberstown WWTP. This will be a separate pipeline from the foul water connection. If required leachate can be collected from the Landfill Infrastructure Compound and tankered off-site for disposal, as discussed in Chapter 4 Description of the Proposed Project. A Leachate Management Plan has been prepared and is provided in Appendix A4.4.

Clean surface runoff: Following capping and remediation works clean surface water runoff, collected within the proposed development area via a series of open channels, will be directed to lined surface water ponds located within Zone 4 where it will ultimately be discharged at the proposed new surface water outfall to the Morell River, refer to Figure 4.19.

A local area over the north flank of the Site in Zone 1 cannot be collected and transferred to the pond due to topographical constraints, hence this will be collected in a swale located at the toe of the slope and will infiltrate to ground. Due to the site topography a limited area to the north-west of the site (delineated as Zone 1A) cannot connect to the Zone 4 ponds, hence will collect surface water in a lined storage pond (Pond 1) and attenuated before overflowing to a soakaway, refer to Figure 4.19.

Potentially contaminated runoff: Surface water runoff from the car parks and internal road network will be directed via a kerb and gully system to a petrol interceptor and then on to the surface water pond in Zone 4 (Pond 2 & 3) where it will be ultimately discharged to the Morell River.

Surface water from the new Landfill Infrastructure Compound will be collected by system of road gullies and underground pipework which will be supplied with silt and oil interceptor(s). Flows from the Compound will be discharged to the main site road drainage and onto Zone 4 (Pond 2 & 3). However due to the risk of runoff from the Compound containing contaminants due to leachate spillages the drainage system from the Compound will also be provided with an isolation point before discharge into the main site road drainage.

As part of the remediation works a new site access and realignment of the L2005 Kerdiffstown Road will be constructed, to include provision of a new footpath and cycleway. This realigned road will tie into the existing road drainage system.

Properties REC010, REC011 and REC16 will be demolished. Where these areas are within the licensed boundary the surface water drainage will tie into surface water system of the proposed Project. Any foul water systems associated with these properties will be decommissioned.

Surface water drainage for property REC012 will be realigned as part of the remediation works to remove pipes from within the licensed boundary to continue current discharge via the piped network to the Canal Feeder Stream. Foul water will continue to discharge to a septic tank as per currently understood arrangements.

Foul water for property REC039 will be connected to a new sewer pipeline which will discharge to the public sewer network via Johnstown Pumping Station.

Details of the future site drainage conditions are provided in the Surface Water Management Plan (Appendix A4.6).

13.5.3 Remediation Phase

During the Remediation Phase there is the potential for pollution of surface water features due to sediment loading and associated anthropogenic polluting substances entering watercourses as a result of surface water runoff that could potentially be contaminated by waste material and/or spills on-site and/or groundwater influx. Potential sources of pollution which may occur during the Remediation Phase of the proposed Project include:

- Construction works within and adjacent to the Morell River associated with the provision of the surface water pond (Pond 3) outfall;
- Pipeline crossing of the Morell River for the provision of the leachate pipeline and separate foul pipeline;
- Site clearance works;
- Crushing of construction/concrete works;
- Realignment of the L2005 Kerdiffstown Road;
- Excavations including those associated with the provision of drainage works;
- Re-profiling of the waste material to create the necessary safe slopes and topographic landform for the proposed capping solution which has the potential to generate dust and encounter perched leachate;
- Infiltration of surface water into the waste body following rainfall and during dry weather water spraying to supress dust generation on the site;
- Stockpiling of materials (imported and processed on site);
- Traffic accessing and egressing the site (carrying mud onto surrounding roads);
- Accidental spillage of anthropogenic polluting substances in or adjacent to watercourses; and
- Construction plant and vehicle washing.

Outline details of the Remediation Phase works are provided in Section 4.3.1 in Chapter 4 Description of the Proposed Project and in Figure 4.8 and Figure 4.9.

The remediation of the proposed Project which includes the development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site, see Section 4.3.1 for details on the outline phasing of the works.

More specifically, during remediation, construction works in and around the water environment will be as follows:

- In-channel working for the provision of the surface water pond outfall on the Morell River (WB005)
- Below river works (directional drilling) to facilitate the connection of the leachate and foul water pipelines to the Johnstown Pumping Station refer to Figure 4.17;
- Remediation/construction works within Zone 4 and Zone 1 will be within approximately 50m and 100m of the Morell River (WB005) respectively;
- Remediation/construction works within Zone 3 will be within approximately 120m of the Canal Feeder Stream (WB004); and
- Remediation/construction works within Zone 4 will be within approximately 250m of the Rathmore Stream (WB006).

Due to the historical use of the site, the exact nature of the existing waste material cannot be fully determined; refer to Chapter 12 Soils, Geology, Contaminated Land and Groundwater for a complete review of the ground investigation results. During remediation, there will be some movement of waste in Zones 1, 1A, 2A, 2B, 3 and 4, to allow for safe re-profiling of these zones. The waste from Zone 4 will be moved to Zones 1, 1A and 3 for re-profiling and infilling of these zones. There will also be a requirement for the temporary stockpiling of waste,

crushed concrete and clean materials as outlined in Chapter 4 Description of the Proposed Project. In the event that the remediation works uncover a waste type that requires off-site disposal, then measures to remove and dispose/recover such materials will be undertaken. During incidents of heavy rainfall there is potential for newly uncovered waste to generate leachate which could penetrate ground water sources within the site which are hydrologically linked to the Morell River.

In terms of the physico-chemical parameters relating to water quality, one of the main potential contaminants during the Remediation Phase is considered to be suspended solids. Increased suspended solid concentrations could cause aquatic ecological problems which include clogging fish gills, smothering spawning grounds, reducing light penetration for flora growth, and adding bacteria and algae to the water. Nutrients and contaminants can often be associated with the solids (inorganic nutrients such as phosphorus and organic pollutants such as hydrocarbons) and in turn can cause the deterioration of water quality and damage to aquatic life due to eutrophication of the water environment and eventual fish-kills due to lowering of oxygen supply.

During the Remediation Phase there potentially would be direct and indirect impacts on water quality and direct impacts on the Morell River (from works to construct the surface water outfall and the leachate/foul water pipeline and their associated protection). All other potential impacts are considered to be indirect, temporary, negative and slight and as a result of surface water runoff. Potential impacts from the remediation works in the absence of mitigation measures on the various sensitive receptors (watercourses) are described below.

Morell River (WB005)

The Morell River (WB005) is considered to be a receptor of High importance. Any potential impacts associated with increased sediment release or anthropogenic pollution during the Remediation Phase, including the construction of the 2 No. pipeline connections to Johnstown Pumping Station and 1 No. surface water outfall directly to the river could have an impact on this watercourse.

The construction of the surface water outfall is likely to require the removal of some riparian vegetation and potential replacement of natural bank and bed material with artificial material associated with the surface water outfall components. The proposed location of the surface water outfall is beside an existing length of rock armour. As a result, the impacts are unlikely to be significant; however, the new surface water outfall would lead to additional artificial material being introduced to the channel.

The provision of the pipelines crossing below the Morell River could cause localised disturbance to the bed of the river. It is intended that the 2 No. pipelines would be constructed using directional drilling techniques, with the pipelines having to cross underneath the watercourse and the N7 carriageway. The 2 No. pipelines will be the same size, anticipated to be fully welded 150mm (internal diameter) barrier Medium Density Polyethylene Pipe (MDPE) pipe and will be laid approximately 1m apart. The minimum distance between the crown of the 2 No. pipelines and the river bed is expected to be at least 400mm. Given the preliminary pipeline design proposed and based on discussions with Inland Fisheries Ireland, it is not proposed to install additional stream bed armour in order to minimise disturbance of the natural stream bed, but the detailed design of the pipeline will be agreed with Inland Fisheries Ireland. Should Inland Fisheries Ireland require stream bed armour to be installed additional works (potentially in stream) may be required to provide a protective cover to these pipes. Worst case it is assumed that the proposed method would require in stream works to lay concrete under the river bed, with the natural bed then replaced like-for-like. This work would require complete removal of the natural bed and banks with potential for fine sediment mobilisation. The concrete would alter the potential for natural processes such as incision, although the channel bed appeared stable at the time of survey. The reinstatement of the bed could lead to channel instability and adjustment depending on the remediation design and tie in with the existing channel cross section.

Runoff would be generated during the Remediation Phase and there is potential for waste material (that could contain non-compliant waste) and stockpiled material to become exposed to rainfall during the remediation works. This could subsequently generate leachate and/or surface water runoff which could contain

contaminants related to this material and this runoff/leachate could make its way to the Morell River. See also Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Impacts on the Morell River from the remediation works are considered to be direct during construction (provision of the new pipelines to facilitate connection to Johnstown Pumping Station, and the surface water outfall direct to the river) and indirect (spills or runoff which could potentially be contaminated) temporary, negative and significant. Potential ecological and hydrogeological impacts on the Morell River and surrounding environs are considered in Chapter 11 Biodiversity and Chapter 12 Soils, Geology, Contaminated Land and Groundwater respectively.

Canal Feeder Stream (WB004)

The Canal Feeder Stream (WB004) is considered to be a receptor of Medium importance due to its downstream connection with the Grand Canal pNHA. There are no anticipated direct impacts on the Canal Feeder Stream during remediation as the existing site connection will be removed in the first phase of remediation works. Any potential impacts associated with increased sediment release or anthropogenic pollution during the Remediation Phase (i.e. from site vehicles dispositioning material on the road during the ingress/egress) could have an impact on this watercourse. However, this is considered unlikely due to the distance of the Canal Feeder Stream to the site and it associated access. Therefore, it is not anticipated that there would be direct or indirect impacts on the Canal Feeder Stream during remediation.

Rathmore Stream (WB006)

The Rathmore Stream (WB006) is considered to be a receptor of High importance due to its connectivity with the Morell River. It is not anticipated that there would be direct or indirect impacts on the Rathmore Stream during remediation, due to its location (upstream) and the distance from the proposed Project.

Other Watercourses

Other watercourses in the study area are the lakes/ponds associated with the Palmerstown House Estate & Golf Course (WB001 and WB002). These are considered to be receptors of Low importance. It is not anticipated that they will be directly or indirectly impacted by remediation work due to their distance from the proposed Project.

13.5.4 Operational Phase

The proposed future site conditions and drainage is detailed on Section 13.5.2 and these have been considered as inherent to the design. Additional mitigation measures as required for the Operational Phase are outlined in Section 13.6.2.

Morell River (WB005)

The Morell River is considered to be a receptor of High importance. There will be a new surface water outfall proposed and pipelines crossing for the Morell River installed during the remediation works as outlined in Section 13.5.2. Commissioning of the new surface water outfall to the Morell River will occur during the final site works once all remediation works have been completed. The site surface water drainage system will carry runoff from Zones 1, 2A, 2B, 3 and 4 to the surface water pond located in Zone 4, where the water will be discharged via the surface water outfall to the Morell River. Potential long term hydromorphological impacts from the surface water outfall include but are not limited to:

- Changes to flow and sediment processes due to surface water outfall discharges and potential changes to the channel cross-section as a consequence of adjustment to modifications;
- Replacement of natural banks with concrete headwalls and reducing the vegetated riparian zone; and
- Increases in suspended sediment input into the Morell River potentially disturbing and/or smothering existing geomorphological features (including riffles and pools).

It is noted that the location of the proposed surface water outfall will be adjacent to existing rock armour which was constructed recently on the Morell River and therefore the bank is already modified.

If there was a breach in the capping liner integrity and subsequently leachate entering the on-site surface water system this could potentially reach the Morell River. However, this scenario is considered highly unlikely to occur given proposals for construction methodology, supervision and quality control which will be undertaken during the remediation works as detailed in Section 4.3. This is further mitigated post-remediation and through the Operational Phase by the requirement to monitor the surface water system in compliance with the Industrial Emissions Activities Licence (IEAL) as agreed by the EPA. A penstock will also be constructed during the Remediation Phase to permit closure of the current outfall to the Morell River should contamination of the surface water system be detected.

Surface water runoff from the north-west of the Site (Zone 1A) will be collected in a lined storage pond, attenuated and will drain to groundwater via a soakaway. Surface water from the north flank of the Site will be collected in a swale located at the toe of the slope and will infiltrate to ground. Potential impacts on hydrogeological receptors as a result of these features are addressed in Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Surface water from the Landfill Infrastructure Compound will be collected by system of road gullies and underground pipework which will be supplied with silt and oil interceptor(s). Flows from the Compound will be discharged to the main site road drainage.

Pollutants, for example oils and hydrocarbons from the internal road network could be deposited on the road surface and transported in surface water runoff via a kerb and gully system however, as described in Section 13.5.2 a petrol interceptor will be used prior to the surface water pond and the ultimate discharge to the Morell River.

There is a potential for accidental spillage of material on the internal road system or similar that could make its way to the surface water pond and ultimately the Morell River.

Pollutants, for example oils and hydrocarbons from the realigned L2005 Kerdiffstown Road could be deposited on the road surface and transported in surface water runoff to the Morell River. Full details of the traffic levels are provided in Chapter 14 Traffic and Transport but in summary the baseline traffic levels for the L2005 Kerdiffstown Road, south of access to the proposed Project, are 1,749 Annual Average Daily Traffic (AADT)) and the projected AADT for 2022 is 2,015. This increase of 266 vehicles a day is not considered significant in terms of increased pollutant load on this local road network.

Overall potential impacts on the Morell River during routine operation are as follows:

- There is a potential for a direct (discharge), long term, negative and slight for routine operation;
- There is a potential for a direct, long term, significant/profound impact in the event of an accidental spillage of contaminant such as leachate on the internal road system or as a result of linear integrity failure; and
- The reduced generation of contamination (leachate) from the site following the placement of the engineered capping system will have a positive (beneficial) impact on the quality of the receiving water, the Morell River due to the reduction in leachate entering the Morell River via groundwater, see Chapter 12 Soils, Geology, Contaminated Land and Groundwater. Therefore, there is a potential for an indirect, long term, Slight positive impact on the Morell River during routine operation, more details of this are provide in Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Canal Feeder Stream (WB004)

The Canal Feeder Stream is considered to be a receptor of Medium importance. It is anticipated that there would be no direct/indirect impacts to the Canal Feeder Stream during operation, as the current outfall will be permanently disconnected during the Remediation Phase.

Rathmore Stream (WB006)

The Rathmore Stream is considered to be a receptor of High importance, with no anticipated impacts on the Rathmore Stream during the operation of the proposed Project, due to its location upstream and distance from the proposed Project.

Other Watercourses

Similarly, the other waterbodies in the study area associated with the Palmerstown House Estate & Golf Course are not anticipated to have any predicted impacts associated with the operation of the proposed Project, due to their location from the proposed Project.

Table 13.12 summarises the impacts on water quality and morphology for each receptor during Remediation and Operational Phases (based on NRA, 2009).

Table 13.12: Summary of Environmental Impacts

Receptor	Importance	Source of Effect	Effect Summary Description	Potential Effect Unmitigated		
				Magnitude	Significance	Impact Type
Morell River	High	Remediation Direct impact on watercourse from construction of the discharge pipe, surface water outfall and pipeline crossing to Johnstown pumping station and indirect impact from accidental spillage/runoff entering the watercourse.	Remediation Potential release of suspended solids, and spillage of contaminants in general area during construction works which could impact on the watercourse. In-channel working and removal of natural bed and banks as well as riparian vegetation.	Moderate	Significant	Direct and indirect negative temporary
		Operation Surface runoff and accidental spillage during operation. Presence of a permanent surface water outfall structure.	Operation Structure removing natural vegetation and bank and altering flow processes	Small	Slight	Direct negative long term
			Operation Potential for pollutants to be transported in surface water runoff and enter the watercourse via the drainage system in the event of an accidental spillage event.	Moderate	Significant/ Profound	Direct negative long term
			Operation Reduced generation of contamination (leachate) from the site following the placement of the low permeability cap.	Small	Slight	Indirect positive long term
Canal Feeder Stream	Medium	No predicted impacts associated with remediation.	Remediation None anticipated.	N/A	N/A	N/A
		No predicted impacts associated with operation.	Operation None anticipated.	N/A	N/A	N/A
Rathmore Stream	High	No predicted impacts associated with remediation.	Remediation None anticipated.	N/A	N/A	N/A
		No predicted impacts associated with operation.	Operation None anticipated.	N/A	N/A	N/A
Watercourse on Palmerstown House Estate & Golf Course	Low	No predicted impacts associated with remediation No predicted impacts associated with operation.	Remediation None anticipated.	N/A	N/A	N/A
			Operation None anticipated.	N/A	N/A	N/A

13.5.5 Flood Risk

A flood risk assessment (FRA) in line with the Office of Public Works (OPW) Guidelines for Planning Authorities (GPA) 20: The Planning System and Flood Risk Management (OPW, 2009), has been undertaken. The full report is contained in Appendix A13.1. The primary objective of the FRA was to assess the flood risk in the existing situation and with the proposed Project in operation.

The initial surface water design for the proposed Project indicates there will be a surface water outfall with a discharge rate of 51.07 l/s to the Morell River from the pond located to the south extents of the site. An assessment was carried out using the existing Catchment Flood Risk Assessment and Management (CFRAM) fluvial (related to a river or stream) flood data for the area. Based on the initial surface water design, a discharge rate of 51.07 l/s would cause a less than 1% increase in flow in the 10% annual exceedance probability (AEP) and the 0.1% AEP CFRAM Flood Events (1 in 10 year event and 1 in 100 year event respectively). The increase in flow equates to a maximum increase in water level of approx. 5mm, which is considered negligible. Therefore, the impact on fluvial flood risk to the Morell River as a result of the proposed Project is anticipated to be negligible.

The FRA has initially concluded that all across the study area, comparison of the existing and the proposed Project demonstrate that the proposed works does not increase the flood risk. Table 13.13 below provides a summary of the potential flood risk impacts on surrounding areas as a result of the proposed Project.

Table 13.13: Flood Risk Assessment Summary

Flood Risk	Summary of Impact	Notes
Coastal	N/A	-
Fluvial	Negligible Impact	Any increase in flood risk from fluvial sources to the surrounding area is considered negligible.
Estuarial	N/A	-
Pluvial	No Impact	Flood risk from pluvial sources to the surrounding area will not be increased.
Artificial Drainage Systems	No Impact	Flood risk from artificial drainage systems sources to the surrounding area will not be increased.
Groundwater	No Impact	Flood risk from groundwater sources to the surrounding area will not be increased.
Climate Change	N/A	The impact from the proposed Project on Climate Change is considered non-applicable.

13.6 Mitigation Measures

This Section considers and assesses the mitigation measures of the proposed Project with regards to surface water.

13.6.1 Remediation Phase Mitigation

Prior to commencement of the Remediation Phase, the appointed contractor responsible for the remediation works shall prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC. The CEMP shall contain the mitigation measures and plans identified in the following Sections (as a minimum), the wider EIAR and shall implement the conditions set out in the planning approval and the requirements of the site's Industrial Emissions Activities Licence (IEAL). The appointed contractor shall also ensure that the CEMP is fully implemented during the Remediation Phase in agreement with KCC, to prevent or reduce the impacts identified in the impact assessment.

All construction works shall be completed in line with reference to the guidelines outlined below where applicable, and specified in the CEMP:

- 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (NRA, 2005);
- CIRIA C648 'Control of Water Pollution from Linear Construction Projects: Technical Guide' (Murnane *et al.*, 2006);

- CIRIA C649 'Control of Water Pollution from Linear Construction Projects: Site Guide' (Murnane *et al.*, 2006);
- CIRIA C692 Environmental Good Practice on Site 3rd Edition (2010);
- 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA, 2001);
- 'IFI Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters' (IFI, 2016); and
- UK Environment Agency:
  - PPG3 Use and design of oil separators in surface water drainage systems;
  - PPG5 Pollution Prevention Guidelines Works and Maintenance in/ or near Water;
  - PPG21 Incident Response Planning;
  - PPG22 Dealing with Spills; and
  - PPG26 Drums and Intermediate Bulk Containers.

The first phase of the remediation works will include the removal of the site connection to the Canal Feeder Stream. Therefore, there will be no direct hydrological connection from the site to the Canal Feeder Stream during the Remediation Phase.

Temporary construction surface drainage and sediment control measures will be in place before earthworks commence.

There will be no direct hydrological connection from the site to the Morell River during the Remediation Phase.

The surface water pond areas (to be utilised in the Operational Phase) will be used temporarily for the storage of runoff during the remediation works. These ponds will be lined. Further temporary ponds may be constructed at locations adjacent to working areas to assist with management of runoff if the phasing and timing works require additional storage volumes. These temporary ponds will also be lined. Therefore, any potentially contaminated runoff will be captured and contained and will not be discharged from the site. Water may be required for on-site purposes. Re-use on site will include dust suppression and irrigation where necessary (during periods of dry weather) and where the water has been appropriately tested for the intended use. Any waters confirmed to be contaminated and considered as unsuitable for treatment or reuse on site will require to be removed from the site via a road tanker or to sewer in agreement with Irish Water. The appointed contractor will be required to ensure that water is disposed of to a licensed treatment facility. Discharge to ground may be utilised via the soakaway in the north-west extents of the site (Zone 1A).

The appointed contractor will be required to prepare an Erosion and Sediment Control Plan (ESCP) prior to commencing the remediation works. The ESCP shall be included in the CEMP. To prevent or reduce the amount of sediment or other polluting substances being released into watercourses, the ESCP will include the following measures to be implemented by the appointed contractor:

- Provision of measures to prevent the release of sediment to the Morell River during the construction works (surface water outfall construction to the Morell River, pipeline crossings beneath the Morell River, and road realignment works to include footpath and cycleway with drainage connecting to existing road drainage outfall). Measures will include but not be limited to a cofferdam, sediment fences, and silt curtain; and
- Provision of exclusion zones and barriers (sediment fences) between earthworks (re-profiling of slopes), stockpiles and temporary surfaces and watercourses to prevent sediment washing into the watercourse.

No waste material, including wastewater, will be permitted to discharge into any watercourse during the works.

During the Remediation Phase there will be a requirement to expose existing waste, which may allow the infiltration of rainfall to the waste and result in contaminated runoff. To minimise this effect, works will be managed by the appointed contractor through a number of on-site operations, including:

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

These measures will be detailed by the appointed contractor in the ESCP.

Cleaning of roads to reduce mud and dust deposits will be carried out away from watercourses.

Any pouring of cement for the provision of the surface water outfall and or pipeline crossings for the works will be carried out in the dry and allowed to cure for 48 hours before re-flooding. Pumped concrete will be monitored to ensure no accidental discharge. Mixer washings and excess concrete will not be discharged to surface water.

No storage of hydrocarbons or any toxic chemicals will occur within 50m of a watercourse. Fuel storage tanks will be bunded to a capacity of at least 110% of the volume of the storage tank. Re-fuelling of machinery will not occur within 50m of any watercourse and only in bunded refuelling areas. Emergency procedures will be put in place and construction staff will be familiar with emergency procedures.

The appointed contractor shall consult with IFI in relation to the ESCP and shall include their requirements in this regard.

The detailed design of works within and adjacent to watercourses (e.g. directional drilling beneath the Morell River for the new pipeline crossings; construction of the new surface water outfall to the Morell River from the surface water ponds) would be undertaken with input from a hydromorphologist. Such works will only be conducted during forecast low flow periods and shall be done in July to September. Following in-channel working (i.e. for the surface water outfall and pipeline crossing) the channel cross-section would be reinstated as per pre-work conditions and tied into the structures.

The appointed contractor will detail emergency measures to be implemented in the event of a spillage or accidental discharge. This Emergency Plan will form part of the overall ESCP incorporated as part of the CEMP to be prepared by the appointed contractor and agreed with KCC.

(i) Monitoring During Remediation

Water quality monitoring will be undertaken as indicated in the IEAL as agreed by the EPA and this will be supported by a Monitoring and Control Management Plan.

The IEAL will require the licence holder (KCC) to undertake a monitoring regime to include the Morell River, with key pollution indicators analysed on a regular basis from locations up and downstream of the site. The results of this monitoring will be reported to the EPA to comply with the conditions of the licence.

In addition, daily visual inspections of the surface drainage and sediment control measures and the watercourses will be undertaken by the KCC Site Manager or nominated representative. Indicators that water pollution may have occurred include the following:

- Change in water colour;
- Change in water transparency;
- Increases in the level of silt in the water;
- Oily sheen to water surface;
- Floating detritus; or
- Scums and foams.

These inspections shall be recorded. In the event that such indicators are observed, a review of site works will be undertaken to determine potential linkage. Where a potential linkage is determined an investigation of the potential cause will be undertaken by the appointed contractor.

The above monitoring will allow KCC to be assured that the mitigation measures employed by the appointed contractor are successfully operating.

13.6.2 Operational Phase Mitigation

Measures to attenuate and treat the surface water runoff have been incorporated into the outline drainage design of the proposed Project including the provision of surface water ponds.

Any discharge from Ponds 2 and 3 must be fully compliant with EPA Emission Level Values for Emissions to Surface Water in the Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities (EPA 2011). The likelihood of a serious surface water pollution incident is considered low. However, a penstock/shut-off valve will be provided on Pond 3 to prevent the release of a discharge to the Morell River in the event of accidental spillage.

Surface water from the Landfill Infrastructure Compound will be collected by system of road gullies and underground pipework which will be supplied with silt and oil interceptor(s). Flows from the Compound will be discharged to the main site road drainage. However due to the risk of runoff from the Compound containing contaminants due to leachate spillages the drainage system from this Compound will also be provided with an isolation point before discharge into the main site road drainage.

In order to avoid adverse watercourse impacts due to spills or accidental leakages i.e. leachate spill, a Contaminant Spill Emergency Plan will be put in place to contain, remove or remediate spillages before they reach a surface water receptor. Emergency equipment/spill kits to facilitate the implementation of such a plan will be made available in secured locations within the Landfill Infrastructure Compound area.

Detailed design for the new site access, realignment of the L2005 Kerdiffstown Road and provision of a footpath and cycleway will be required to include appropriate mitigation measures such as petrol interceptors for the revised road drainage system prior to release to the Morell River.

For the pipeline crossing of the Morell River the following measures will be implemented:

- The minimum distance between crown of the pipes and the river bed will be 400mm to ensure that that the river bed will not be disturbed.
- A cover would be provided over the top of pipe (assumed to be concrete) to protect the pipe from any potential future downward erosion. The cover would be placed beneath the natural bed and the bed reinstated as per existing conditions and tied in with the existing bed and banks.

For the surface water outfall to the Morell River, the inclusion of the surface water ponds (Pond 2 and 3, located within Zone 4) and the provision of the petrol interceptor will reduce potential impacts of fine sediment input into the channel and excessive flows discharging from the surface water outfall. The design of the surface water outfall will aim to avoid disturbance of the natural bank and tie in with the existing rock armour. Specific mitigation measures include but are not limited to:

- Constructing the surface water pond to encourage deposition of suspended sediments and minimising sediment input to the river;
- Directing the surface water outfall downstream and away from the banks to minimise the impact to flow patterns and minimising any potential risk of erosion (particularly on the opposite bank); and
- Minimising the size and extent of headwalls where possible, reducing the potential impact on the banks.

Following completion of remediation works surface water runoff will not come into contact with waste materials. However, water may still contain some suspended solids and possibly oil, fuel and silt washed off roads. Silt

fences installed around the site as part of the remediation works will remain in place until the vegetation within the site is well established and perimeter ditches and swales grassed. Once it has been established that sediment retention techniques are no longer required, silt fences may be removed.

There will be no direct / indirect impacts from the proposed Project to the Canal Feeder Stream during operation, as the current outfall will be permanently disconnected during the Remediation Phase. Therefore, no mitigation is proposed.

(i) Monitoring During Operation

Water quality monitoring will be undertaken as indicated in the IEAL as agreed by the EPA supported by a Monitoring and Control Management Plan developed and implemented by KCCs site personnel. During the Operational Phase real time water quality monitoring (and control) in the pond is proposed to be used to measure key pollution indicator parameters to be agreed by the EPA, for inclusion in the IEAL and the site's Management Plan. The concentrations recorded in the pond shall be in accordance with the EPA Emission Level Values for Emissions to Surface Water in the Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities (EPA 2011). In the event of an exceedance of the agreed emission level values, the discharge from the pond will be automatically shut off.

Sampling of the infiltration swale at the northern perimeter of the site will also be undertaken. Sampling of the Morell River upstream and downstream of the surface water outfall from Pond 3 will continue (as a minimum). The frequency of monitoring at all locations is to be monthly unless otherwise stipulated in the IEAL, with the real time monitoring and control system recording data via a supervisory control and data acquisition (SCADA) system more frequently. The frequency of the monitoring of the Morell River may be reduced following sufficient data to support ongoing assessment.

The design of the surface water system will permit isolation of runoff from various parts of the site in the unlikely event that elevated concentrations of indicator parameters are detected, facilitating investigation to determine the source and remediate where necessary.

13.7 Residual Impacts

The residual impacts associated with the proposed Project after implementation of the mitigation measures during the Remediation Phase are detailed in Table 13.14.

Table 13.14: Residual Impact after Mitigation Measures for Construction

Attribute	Importance	Significance Pre Mitigation	Significance Post Mitigation
Morell River	High	Significant	Imperceptible
Canal Feeder Stream	Medium	Moderate	Imperceptible
Rathmore Stream	High	NA	NA
Watercourse on Palmerstown House Estate & Golf Course	Low	NA	NA

The drainage design for the proposed Project has been considered during the operational impact assessment and as required further mitigation has been proposed. Therefore, no significant residual impacts as a result of the proposed Project in terms of surface water receptors are anticipated.

In addition, the reduced generation of contamination (leachate) from the site following the emplacement of the low permeability cap will have a positive (beneficial) impact on the quality of the receiving water, the Morell River in the long term. This watercourse will be monitored in accordance with the IEAL.

13.8 Difficulties Encountered in Compiling Information

No difficulties were encountered during the assessment. However, at the time of assessment the exact drainage network of Palmerstown House Estate & Golf Course and the existing road drainage system on the L2005 was unknown. However, this does not alter the robustness of the assessment.

13.9 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on the hydrological environment. These projects are discussed in the following paragraphs.

13.9.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

13.9.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

13.9.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

13.9.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

13.9.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic.

Mitigation has been proposed in relation to the potential impact from the Remediation Phase of the proposed development. It is assumed that the contractors responsible for the construction of the sewerage Scheme will implement best practice measures to protect water receptors during the construction phase. Therefore, the potential magnitude of cumulative impacts is considered to be negligible and the significance of impacts would be imperceptible on surface water receptors during construction. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact. No Operational Phase cumulative impacts are predicted.

It is therefore not considered that any additional mitigation measures above those already provided, are required to account for cumulative impacts.

13.9.6 Water Framework Directive Compliance

The EU Water Framework Directive (WFD) and transposed legislation has introduced environmental targets with specific objectives for surface water bodies including:

- Prevention of deterioration in the status of surface water bodies; and
- Protection, enhancement and restoration of all surface water bodies with the aim of achieving good ecological and chemical status by 2015.

The assessment of potential surface water impacts for the proposed Project, including mitigation, has concluded that there would not be any significant impacts on surface water quality or geomorphology. With respect to the WFD water body, the proposed Project would not cause deterioration in the WFD quality elements (biological, physico-chemical and hydromorphological) for the WFD surface water bodies adjacent to the proposed development. A more detailed assessment of the biological quality elements is provided in Chapter 11 Biodiversity.

It can therefore be concluded that the proposed Project will not compromise the ability of the Morell River WFD designated water body to achieve good status or cause deterioration, and the proposed Project is therefore then in compliance with the provisions of the WFD in relation to surface water bodies.

13.10 References

- CIRIA C532 (2001). Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors
- CIRIA C648 (2006). Control of Water Pollution from Linear Construction Projects: Technical Guide (Murnane *et al*., 2006)
- CIRIA C649 (2006). Control of Water Pollution from Linear Construction Projects: Site Guide (Murnane *et al*., 2006)
- CIRIA C692 (2010). Environmental Good Practice on Site 3rd Edition
- Environmental Protection Agency (2002). Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2003). Advice notes on current practice in the preparation of Environmental Impact Statements
- Environmental Protection Agency (2015). Advice notes for preparing Environmental Impact Statements (Draft)
- Environmental Protection Agency (2015). Revised Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2016). Flow and Water Level Measurements Portal http://www.epa.ie/hydronet/#Water%20Levels (Accessed November 2016)
- Environmental Protection Agency (2016). Water Quality Monitoring Database and Reports Portal http://www.epa.ie/pubs/reports/water/waterqua/ (Accessed November 2016)
- Environmental Protection Agency (2017). EPA Catchments Mapping Portal https://www.catchments.ie/maps/ (Accessed on 15 March 2017)
- Environmental Protection Agency (2017). EPA Envision Mapping Portal http://gis.epa.ie/Envision (Accessed on 15 March 2017)
- Environmental Protection Agency (2016). Hydrotool Report for the Morell River Catchment
- Groundwater and Surface Water Monitoring at Kerdiffstown Landfill (Geosyntec Consultants Ltd, May 2013)
- Inland Fisheries Ireland (2016). Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters
- Kerdiffstown Environmental Baseline Report (SKM Enviros, 2013)
- Kerdiffstown Landfill Facility; Briefing Note: Water Management Plan Surface water quality monitoring data (SKM Enviros, March 2012)
- Kerdiffstown Remediation Project Surface Water Management Plan (SKM Enviros, September 2013)
- Kildare County Council (June 2002). National Roads Design Office, N7 Naas Road Widening & Interchanges Scheme, Kill & Johnstown Flood Alleviation Measures Report
- Kildare County Council (June 2002). National Roads Design Office, N7 Naas Road Widening Interchange Scheme, Hydraulic Model & Flood Alleviation Measures Report
- Kildare County Council Memo, Report Re: Flooding In County Kildare (November 2000)
- Kildare County Development Plan 2017-2023
- Met Éireann (2016). Portal http://www.met.ie (Accessed November 2016)
- Monthly and Bi-annual Surface Water Monitoring Data (Jacobs, October 2013 to December 2016)
- N7 Naas Road Interchange Scheme: Hydraulic Model & Flood Alleviation Measures Report (J B Barry & Partners Limited, January 2002)
- Naas Town Development Plan 2011-2017

- National Parks and Wildlife Service (2016). Designated Sites Portal https://www.npws.ie/protected-sites (Accessed November 2016)
- National Road Authority (2009). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes
- National Road Authority (2005). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes
- Office of Public Works (2016). Eastern Catchment Flood Risk Assessment and Management Study Portal http://www.cfram.ie/ (Accessed November 2016)
- Office of Public Works and Department of Environment, Heritage and Local Government (2009). Guidelines for Planning Authorities (GPA) 20: The Planning System and Flood Risk Management
- Office of Public Works Flood Event Report, Flooding at Killeenmore, Co. Kildare (November 2012)
- Office of Public Works National Flood Hazard Mapping (2016). Portal http://www.floodmaps.ie (Accessed November 2016)
- Ordnance Survey of Ireland (2016). Current and historic mapping portal https://www.osi.ie/products/professional-mapping/historical-mapping/ (Accessed November 2016)
- Preliminary Environmental Site Assessment – Kerdiffstown Landfill (Ford Consulting Group Ltd, April 2012)
- S.I. 792 of 2009, European Communities Environmental Objective (Surface Water) Regulations (2009 as amended)
- The Eastern River Basin Management Plan 2009-2015
- The Liffey Water Management Unit Action Plan 2009-2015
- UK Environment Agency (2007). PPG5 Pollution Prevention Guidelines Works and Maintenance in/ or near Water
- UK Environment Agency (2009). PPG21 Incident Response Planning
- UK Environment Agency (2011). PPG22 Dealing with Spills
- UK Environment Agency (2011). PPG26 Drums and Intermediate Bulk Containers
- Water Framework Directive Ireland Database (2016). Portal http://www.wfdireland.ie (Accessed November 2016)
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare (Aquens Ltd, December 2012)
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare (Aquens Ltd, October 2015)
- Water Quality Assessment of the Morell and Hartwell Rivers Adjacent to the Kerdiffstown Facility in Co. Kildare (Aquens Ltd, September 2016)

14. Traffic and Transport

This Chapter assesses the potential effects of the proposed Project on the local traffic and transport network during the Remediation and Operational Phases

Site access will be improved via a new junction arrangement including realignment of the L2005 Kerdiffstown Road to facilitate safe access to the site by, primarily, heavy goods vehicles (HGVs) during the Remediation Phase. These works will also comprise provision of a new footpath and cycleway. The footpath and cycleway will link to Johnstown via the footbridge over the N7 to the south-east of the site and offer linkage to Kill further to the east and Naas to the south. This improvement will provide safe passage to passers-by during remediation works and access by vehicles, cycles and pedestrians to the multi-use public park during the Operational Phase.

Potential sensitive receptors were identified in a desktop assessment. Site access arrangements and the significance of impacts in relation to traffic flow increases were assessed in terms of the quality of effects, the significance of the effects and the duration of how long the effect would last.

The additional traffic generated as a result of the anticipated Remediation Phase programme will result in increases of traffic flows on the primary and secondary roads leading to the proposed Project. An assessment has been undertaken, both in relation to the estimates of Remediation Phase traffic and the distribution of Remediation Phase traffic within the assessed road network. When considering actual volumes of traffic, the predicted increase in flows are minimal and will have a negligible impact on the practical operating capacity of these roads. Notwithstanding this, mitigation measures have been identified, including the provision of a Construction Traffic Management Plan (CTMP) and Mobility Management Plan (MMP), which will ensure that any potential traffic impacts are managed. As such, the overall environmental impact is therefore considered to be not significant, with the effective implementation of appropriate mitigation measures.

The increases in the levels of traffic anticipated during the Operational Phase of the proposed Project are not significant and therefore no mitigation is proposed.

14.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as “the proposed Project”) on the local traffic and transport network anticipated to occur during the Remediation and Operational Phases.

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

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children’s playground, etc. and management of the site as a remediated landfill. Table 14.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

Table 14.1: Summary of Key Activities during the Remediation and Operational Phases

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

To facilitate safe access to the site during the Remediation and Operational Phases a new site access is to be constructed, comprising a roundabout, in close proximity to the existing site access. This revised site access will also require realignment and widening of the L2005 Kerdiffstown Road. Construction of the new site access and road realignment is proposed to be undertaken as part of the first phase of works. The realignment works will extend to the immediate west of the existing site access and to the east, adjoining to an existing roundabout on the L2005 Kerdiffstown Road located to the south-east of the site. This section then links to Junction 8 of the N7, part of the strategic road network. Heavy goods vehicles (HGVs) traffic accessing to and from the site during the Remediation Phase of the proposed Project will route via Junction 8 of the N7 and will not be permitted to route via Sallins.

While providing a safe access arrangement for all road users during the Remediation and Operational Phases the proposed access design also includes provision of pedestrian and cycle infrastructure. This will be of particular benefit during the Operational Phase, offering linkage to nearby residential areas including Johnstown and Kill.

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

This Chapter is also supported by a Traffic and Transport Assessment, as contained in Appendix A14.1, with the approach and findings of this assessment included in Section 14.2.2 and Section 14.4.3 respectively. A Stage 1 Road Safety Audit has also been undertaken based on the preliminary design of the new site access, L2005 Kerdiffstown Road realignment and footpath and cycleway provision, as presented in Appendix A14.3.

14.2 Methodology

14.2.1 Policy, Legislation and Guidance

The majority of the roads considered within this study are strategic national primary roads and secondary roads and by their nature have a greater traffic capacity and better general safety record when compared with more rural roads. Only a short section of secondary road, the L2005 Kerdiffstown Road between the proposed site access and the roundabout west of N7 Junction 8, is used for access to the site. However, the assessment undertaken for the EIAR addressed the continuation of the L2005 Kerdiffstown Road toward Sallins.

In undertaking the assessment of the potential traffic and transport impacts on the local road network, the following guidance documents have been taken into account:

- Guidelines for the Environmental Assessment of Road Traffic, by the Institute of Environmental Management and Assessment (the IEMA Guidelines);
- Guidelines for Traffic Impact Assessment, The Institution of Highways and Transportation, September 1994;
- Design Manual for Roads and Bridges, Traffic Infrastructure Ireland;
- Traffic and Transport Assessment Guidelines, (Traffic Infrastructure Ireland, 2014) (TII Guidelines);
- Design Manual for Urban Roads and Streets (DMURS), Department of Environment, Community and Local Government, 2013;
- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017); and
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015).

A summary of the relevant traffic and transport related policy context in relation to the proposed Project is outlined below.

Kildare County Development Plan 2017 – 2023

The Kildare County Development Plan 2017 – 2023 (KCDP) is set out to provide an encompassing strategy for planning and sustainable development in the area. In relation to Movement and Transport (Chapter 6), Kildare County Council aims to:

> *"promote ease of movement within and access to County Kildare, by integrating sustainable land use planning with a high quality, integrated transport system; to support improvements to the road, rail and public transport network, together with cycleway and pedestrian facilities and to provide for the sustainable development of aviation travel within the county in a manner which is consistent with the proper planning and sustainable development of the county."*

The proposed Project is located in close proximity to the M7/N7 and the strategic road network, providing a good base-level of accessibility for both Remediation and Operational Phase traffic. HGV traffic, associated with the Remediation Phase, will not be permitted to route to the site via Sallins thus avoiding traffic through areas of housing and employment, and utilising instead the strategic road network for such traffic. In contrast, route options for cyclists and in particular for pedestrians from Naas to the site are restricted by the M7/N7 road which is routed directly between the site and settlements. The Operational Phase for the proposed Project comprises a multi-use public park to be used for recreational and exercising activities and as such is likely to increase the demand for active travel infrastructure. The site would therefore be a good catalyst for developing cycleway and pedestrian facilities in Kildare, as well as the overall sustainable development of the local area, in particular the Naas Neighbourhood Greenways initiative as mentioned below.

Aims in the KCDP include modal shift and sustainable travel which feature prominently throughout the Chapter. Key policies relating to the proposed Project include:

> *"*MT1: *Promote the sustainable development of the county through the creation of an appropriately phased integrated transport network that services the needs of communities and businesses."*
>
> "MT11: *Focus on improvements to the local road and street network that better utilise existing road space and encourage a transition toward more sustainable modes of transport, while ensuring sufficient road capacity exists for trips which will continue to be taken by private vehicle."*
>
> "WC1: *Prioritise sustainable modes of travel by the development of high quality walking and cycling facilities within a safe street environment."*
>
> "WC3: *Ensure that connectivity for pedestrians and cyclists is maximised in new communities and improved within the existing areas in order to maximise access to town centres, local shops, schools, public transport services and other amenities."*
>
> "LR1: *Ensure that the safety and capacity of the local road network is maintained and improved where funding allows and to ensure that local streets and roads within the county are designed to a suitable standard to accommodate the future needs of the county. The design of these roads and streets should balance the needs of place and movement with providing a safe street environment for all road users."*

These policies focus largely on sustainability within the community and encouraging sustainable travel choices to be made. Sustainable travel will be integrated into both the Remediation and Operational Phases of the proposed Project.

Furthermore, use of the remediated site as a multi-use public park would encourage active travel choices to be made, given the improved footpath and cycleway provision. This includes the village settlements of Johnstown and Kill. These factors would have a positive influence on the local community and its businesses, through the economic benefits of developing the site and infrastructure; social and health benefits of a new recreational space which encourages active lifestyles (e.g. walking and cycling); and the environmental benefit of remediating the former landfill site and developing it into a multi-use public park which would ideally be accessed through means of active travel.

Grand Canal Way

The Grand Canal Way provides a network of paths which provide a pedestrian and cycle link between Dublin and Shannon Harbour. From the proposed Project, access can be gained to the Grand Canal Way in Sallins from the L2005 Kerdiffstown Road or via a forest track through Palmerston House Estate. Any potential future improvements to connect the Grand Canal Way and the proposed Project would require agreement with third party landowners and is not included as part of the proposed Project.

In summary, reference to local policy and guidance indicates that the proposed Project comprising a multi-use public park would augment the development of this greenways network and could act as a key destination on the route of greenways. There is also the opportunity to use existing active travel infrastructure, such as the Johnstown footbridge, and create new active travel infrastructure between the site and residential areas such as Johnstown to the south and in Naas further south. This aligns with the previously mentioned policy documents which focus heavily on the need for sustainable development and infrastructure.

14.2.2 Approach

The approach to assessing the traffic and transport impacts of the proposed Project is based on an industry recognised methodology that has been successfully applied to assessments across Ireland, enhanced with

professional judgement where required. The assessment approach is undertaken with consideration for the policy documents detailed within Section 14.2.1.

The traffic impact of the proposed Project has been assessed utilising the following approach:

- Relevant transport policies were reviewed;
- The road sections likely to be affected by the traffic associated with the proposed Project have been identified;
- The existing character of the road network has been determined;
- Existing traffic levels on the road network have been measured;
- A review of accident data on the surrounding network has been undertaken;
- The additional traffic generated by all stages of the proposed Project has been estimated;
- The impact of the additional traffic has been assessed; and
- Appropriate mitigation measures have been identified to ensure that any potential traffic impacts are kept to a minimum.

The National Cycle Manual (NTA 2011) also provided guidance in relation to assessment of cycle provision for the proposed Project.

Initial assessment of predicted traffic volumes suggested that a standalone Traffic and Transport Assessment (TTA) may not be required. However, in order to ensure a robust assessment of impacts on the road network for both the Remediation Phase and Operational Phase a TTA has been undertaken for the proposed Project. Refer to Appendix A14.1 for the TTA which should be read in conjunction with this Chapter, and includes the following:

- An assessment of the proposed Project in relation to current and emerging local, regional and national transport policy and guidance;
- A review of sustainable and active travel opportunities to the proposed Project, prioritising the most sustainable modes of travel;
- People trip generation and distribution estimates for all relevant modes of travel;
- Junction capacity assessments at key junctions on the local road network; and
- A review of parking requirements for the proposed Project.

While the TTA should be read in conjunction with this Chapter, a brief summary of the findings is presented in Section 14.4.4 below.

14.2.3 Study Area

To define conditions for the proposed Project in terms of access and transportation, a baseline study comprising a strategic route review and local access assessment was undertaken.

The site is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The neighbouring and almost contiguous settlement of Sallins lies on the opposite side of the motorway to Naas and is approximately 1km to the north-west of the proposed Project. The smaller settlements of Johnstown and Kill lie on the opposite side of the N7 road corridor to the south-east and east of the site respectively. Though the area to the north-east of the site is relatively sparely populated in the context of the remainder of the study area the local roads that skirt this area are consistently lined with rural dwellings.

The traffic impact study area was defined as comprising the following sections of the road network:

- N7 in the vicinity of Junction 8;
- Access road south of N7 Junction 8, between N7 and Johnstown; and

- L2005 Kerdiffstown Road between N7 Junction 8 and the proposed Project access; and
- L2005 Kerdiffstown Road from the proposed Project access to Sallins via Church Avenue.

14.2.4 Sensitive Receptors

A desktop assessment was undertaken to identify potential sensitive receptors (e.g. settlements, schools etc.) along potential vehicle access routes to the site, which may be impacted by traffic associated with the proposed Project during either the Remediation or Operational Phases.

Professional judgement was applied to assign a level of sensitivity to receptors (low; medium; or high) and to determine the nature of the foreseen impact (beneficial, negligible or adverse), while also taking into consideration the EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017)

Receptors considered to be of 'high' sensitivity would typically include hospitals, schools, day-care facilities or nursing homes, where disruption would result in a significant inconvenience to the residents and/or the functionality of the receptor. Receptors of 'medium' sensitivity would typically be those that would be resilient enough to overcome the challenges posed by the proposed Project, for example commercial businesses. Receptors considered to be of 'low' sensitivity would include, for example, disused recreational space and unoccupied buildings.

Refer to Figure 3.4 for the location of local residential and commercial receptors in close proximity to the proposed Project.

The means by which the impacts of the proposed Project, on any such sensitive receptors, are to be mitigated are considered in Section 14.5.

Settlements

Sallins

In terms of traffic assessments, the town of Sallins is located in relatively close proximity to the proposed Project and as such is considered a sensitive receptor. It will be a stated requirement in procurement documentation for the Remediation Phase of the works that HGVs will not be permitted to pass through Sallins, hence all Remediation Phase HGV traffic will route via the N7 Junction 8. Notwithstanding this, there is a posted 3 tonne weight limit on the railway bridge on the L2005 Kerdiffstown Road to the west of Sallins. However, Sallins has still been considered as a sensitive receptor for the purposes of robustness in approach.

Sallins National School, located in close proximity to Church Avenue which would accommodate any traffic travelling to the site via Sallins during the Operational Phase, is considered to be a sensitive receptor given that there is potential interaction between staff, pupils and parents on their way to / from school and traffic leading towards the proposed Project. While this receptor would ordinarily be deemed highly sensitive given the location of the school, the fact that no HGV traffic will route via Sallins during the Remediation Phase ensures that a low sensitivity rating can be assigned as only a small proportion of proposed Project related traffic is predicted to route via Sallins.

It is observed that queueing is currently experienced at the junctions assessed in Sallins (see Appendix A14.1 for further details). This is reflective of the existing road network and the resolution of this is not within the scope of the proposed Project. However, any further impacts and the significance of these is discussed herein.

Properties on Kerdiffstown Road (L2005)

There are a number of residential and commercial properties along both sides of L2005 Kerdiffstown Road located on the route to the proposed Project from the N7 which are considered as sensitive receptors, given their proximity to passing Remediation Phase HGV traffic heading to the site in particular. Furthermore, given the proposals to realign and upgrade the southern section of the L2005 Kerdiffstown Road, these residential

properties are considered as key sensitive receptors during the Remediation Phase and during the Operational Phase. These receptors are shown in Figure 3.4 and in Table 14.2 below.

Table 14.2: Receptor on Kerdiffstown Road (L2005)

Receptor Ref	Description
COM002	Commercial: Johnstown Garden Centre
COM007	Commercial: Mike Brown's Caravans
REC005	Residential
REC006	Residential
REC007	Residential
REC008	Residential
REC010	Residential
REC011	Residential
REC039	Residential

Given the likelihood that a significant proportion of Remediation Phase traffic, including all HGVs, will pass these properties these receptors are considered to be high sensitivity receptors.

During construction of the new site access and realignment of the L2005 Kerdiffstown Road traffic management measures will be employed. This will impact on the sensitive receptors along this section of road as listed in Table 14.2. However, access to all properties will be maintained during the works thus impacts are considered to be not significant.

Properties on Kerdiffstown Road (L2005) / Church Avenue

There are a number of residential and commercial properties along both sides of L2005 Kerdiffstown Road leading onto Church Avenue, north of the existing site entrance, which are considered as sensitive receptors. Whilst Remediation Phase HGV traffic will not be permitted to access the site from the Sallins direction and passing these properties, these properties are considered as key sensitive receptors for the purposes of this assessment to give a robust approach due to some Operational Phase traffic accessing the proposed Project using this route. Notwithstanding this, a low sensitivity rating has been applied to these sensitive receptors given that only a small proportion of proposed Project related traffic is predicted to route via Sallins. These receptors are shown in Figure 3.4.

Naas

The town of Naas is located in relatively close proximity to the proposed Project and as such is considered as a sensitive receptor. There are a number of schools within the town, all of which are considered as sensitive receptors. Furthermore, Naas General Hospital, located in the south of the town, along with a number of doctors' surgeries within the town are also considered as key sensitive receptors.

While these receptors would ordinarily be deemed highly sensitive given the location of the school, hospital and doctors surgeries, the fact that it is unlikely that HGV traffic will route via Naas allows a low sensitivity rating to be assigned as only a small proportion of proposed Project related traffic is predicted to route via Naas.

Naas Golf Club

Naas Golf Club, the access to which is located approximately 1km north-west of the existing access to the site, is considered to be a sensitive receptor given that it is a local trip generator.

No HGV traffic accessing the site for the remediation works will interact with Naas Golf Club and as such, given that only a small proportion of proposed Project related traffic is predicted to route via Church Avenue and the northern section of the L2005 Kerdiffstown Road, a low sensitivity rating has been attributed to this receptor.

Johnstown Garden Centre

Johnstown Garden Centre is a busy and notable commercial operation immediately to the south-east of the site, the access to which is located approximately 750m south-west of N7 Junction 8, and is enroute to the site. As a result, this is considered a sensitive receptor given that it generates a high level of trips and the majority of Remediation Phase (HGV) traffic will pass its access.

Given the possibility that all Remediation Phase traffic, including HGVs, will pass this location this receptor has been considered a high sensitivity receptor.

Palmerstown House Estate

Palmerstown House Estate, the access to which is located approximately 600m south-west of N7 Junction 8 on the route to the site from N7 Junction 8, is considered a sensitive receptor given that it is a local trip generator and the majority of Remediation Phase (HGV) traffic will pass its access.

Given the possibility that all Remediation Phase traffic, including HGVs, will pass this location this receptor has been considered a high sensitivity receptor.

Kerdiffstown House

Kerdiffstown House, the access to which is located approximately 900m south-west of N7 Junction 8 on the route to the site from the N7, is considered a sensitive receptor given that the majority of proposed Project Remediation Phase (HGV) traffic will pass its access.

Given the possibility that all Remediation Phase traffic, including HGVs, will pass this location this receptor has been considered a high sensitivity receptor.

14.2.5 Assessment of Environmental Impacts

While the EPA Guidelines provide a qualitative approach to understanding impacts relating to traffic and transport, the IEMA Guidelines provide thresholds upon which impacts associated with increases in traffic can be assessed and in turn ensures that a robust assessment of impacts is undertaken. Consequently, the traffic and transport related impacts of the proposed Project have been assessed based on the IEMA Guidelines, with any qualitative assessment of impacts based on EPA Guidelines as this is a more robust approach.

14.2.6 Significance of Effects

The IEMA Guidelines identify that the following environmental effects may be considered when assessing the traffic related to developments:

- accidents and safety;
- air pollution;
- driver delay;
- dust and dirt:
- hazardous loads;
- noise;
- pedestrian amenity;
- pedestrian delay;
- severance (of communities);
- heritage and conservation;
- visual effects;

- ecological effects; and
- vibration.

Of the above effects, the following have been considered within other Chapters of this EIAR, if the effects are considered to be potentially significant:

- Air pollution, dust and dirt – these are considered within Chapter 7 Air Quality, Odour and Climate;
- Noise and vibration – these are considered within Chapter 8 Noise and Vibration;
- Visual impacts – these are considered within Chapter 9 Landscape and Visual;
- Heritage and conservation - these are considered within Chapter 10 Archaeology, Architectural Heritage and Cultural Heritage; and
- Ecological impacts – these are considered within Chapter 11 Biodiversity.

14.2.7 Significance Criteria

The TII and IEMA Guidelines suggest that two broad principles are used as a screening process to focus the scale and extent of the assessment. These are:

- *Traffic to and from the development exceeds 10% of the traffic flow on the adjoining road; and*
- *Traffic to and from the development exceeds 5% of the traffic flow on the adjoining road where congestion exists or the location is sensitive.*

Moreover, criteria for assessing the significance of the increases in traffic volumes as a result of the proposed Project have been derived on this basis as shown in Table 14.3.

Table 14.3: Significance of Impacts in Relation to Traffic Flow Increases

Significance Criteria	Increase in Traffic Flow
Major	Above 90%
Moderate	Between 60% and 90%
Minor	Between 30% and 60%
Negligible	Under 30%

While in the first instance, impacts are assessed against these criteria, an element of professional judgement has been applied with respect to the carrying capacity of the roads being considered. Where existing traffic levels are exceptionally low (e.g. on some unclassified roads), any increase in traffic flow is likely to exceed these thresholds. Where this situation is identified it is important to consider any increase both in terms of its relative increase in respect of existing traffic flows, as well as the overall total flow in respect of the available capacity of the section of road being considered.

For example, a 100% increase in traffic flow on a road which currently only carries 90 vehicles Annual Average Daily Traffic (AADT) flow, will potentially indicate an impact of major significance if considered simply in terms of the significance criteria presented in Table 14.3. However, a typical 6m wide road is capable of accommodating approximately 5,000 two-way vehicles per day, in accordance with thresholds contained in TII TD 9/12 (DN-GEO-03031). Therefore, such an increase will be unlikely to create major impacts given the road's overall capacity. Table 14.4 refers to the link capacity of varying rural road types.

Table 14.4: Link Speed and Link Capacity (TII Design Manual for Roads and Bridges, Volume 6, TD 9 Road Link Design; DN-GEO-03031)

Description	Capacity (two way per day)
6.0m wide Single Carriageway	5,000
7.0m wide Single Carriageway	8,600
7.3m wide Single Carriageway	11,600
Standard Motorway	52,000

The existing carriageway width of the L2005 Kerdiffstown Road is approximately 5.5m. As outlined in Section 14.2.5, while the IEMA Guidelines provide a robust threshold approach in which to assess effects and the EPA Guidelines are also considered. The characteristics of the impact assessment in line with the Guidelines on the Information to be contained in an Environmental Impact Statement (revised 2015) are defined below, as per the EPA Guidelines (EPA 2002, EPA 2015).

- **Quality of Effects**
  - **Positive Effects:** A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities);
  - **Neutral Effects:** No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error; and
  - **Negative/Adverse Effects:** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance).
- **Significance of Effects**
  - **Imperceptible:** An effect capable of measurement but without significant consequences;
  - **Not significant:** An effect which causes noticeable changes in the character of the environment but without noticeable consequences;
  - **Slight Effects:** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities;
  - **Moderate Effects:** An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends;
  - **Significant Effects:** An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment;
  - **Very Significant Effects:** An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment; and
  - **Profound Effects:** An effect which obliterates sensitive characteristics.
- **Duration of Effects**
  - **Momentary Effects:** Effects lasting from seconds to minutes;
  - **Brief Effects:** Effects lasting less than a day;
  - **Temporary Effects:** Effects lasting less than a year;
  - **Short-term Effects:** Effects lasting one to seven years;
  - **Medium-term Effects:** Effects lasting seven to fifteen years;
  - **Long-term Effects:** Effects lasting fifteen to sixty years; and
  - **Permanent Effects:** Effects lasting over sixty years.

- The significance of any environmental impact is assessed on the basis of the magnitude of the impact and the likelihood of the impact occurring. Any potential environmental impacts including accidents and safety, driver delay, pedestrian amenity, pedestrian delay and severance are considered on a case by case basis using professional judgement and reasoned argument.

There are no general thresholds for determining the significance of increased traffic on road safety. Professional judgement is therefore required in order to determine any potential detrimental impacts associated with the traffic generated by the proposed Project.

Appropriate mitigation measures have been identified to ensure that any potential traffic impacts are kept to a minimum. The means by which the impacts of the proposed Project, on any such sensitive receptors, are to be mitigated are considered in Section 14.5.

14.2.8 Site Access Arrangements

As part of the proposed Project, an assessment of the existing access arrangements for the site was undertaken. This confirmed that the existing access would not be fit for purpose in terms of accommodating HGV traffic associated with the Remediation Phase of the proposed Project, given poor levels of visibility on egress from the site. An assessment of alternatives was therefore undertaken, embracing the following activities:

- A high level desk study of potential site access options;
- A comprehensive site visit to assess the strengths and weaknesses of all potential site access options and to consider additional options not identified from the desk study activity. The site visit eliminated non feasible access options and identified options to be taken forward to feasibility design stage;
- Preparation of feasibility design drawings of potential access options determined from the site visit; and
- Design of the preferred access option.

The assessment identified that a new site access would comprise a roundabout, in close proximity to the existing site access. The location and make-up of the proposed access represents the most appropriate option to enable safe access to the site for both the Remediation Phase and Operational Phase. The roundabout has been designed in accordance with the National Road Authority Design Manual for Roads and Bridges (NRA DMRB) (DN-GEO-TD16 Geometric Design of Roundabouts). To accommodate the revised site access realignment and widening of the L2005 Kerdiffstown Road is required. This comprises works to the immediate west of the existing site access and to the east, adjoining to an existing roundabout on the L2005 Kerdiffstown Road located to the south-east of the site. The geometric design parameters for this road realignment are set out in the Design Manual for Urban Roads and Streets (DMURS) (Section 4.4.6 Alignment and Curvature) (refer to Appendix A4.1).

Furthermore, while providing a safe access arrangement for all road users during the Remediation and Operational Phases the proposed access design includes provision of pedestrian and cycle infrastructure. This will be of particular benefit during the Operational Phase. This provision of a new shared use pathway alongside the L2005 Kerdiffstown Road comprises:

- Linkage of the site via the existing footbridge to Johnstown to the south (and onward to Naas);
- Linkage of the site via the N7 Junction 8 to the east, towards Kill;
- Several uncontrolled crossings;
- A section of shared use pathway linking to L2005 Kerdiffstown Road to the north-west of the new site access; and
- A ramp providing cyclists access to the shared use trail south of the proposed site access roundabout.

Details of the new access, road realignment and pedestrian/ cycleway provision are shown on Figures 4.10 to 4.12 of the EIAR.

The design has been subject to a Stage 1 Road Safety Audit (RSA). The RSA was approved by Kildare County Council project team, and the design revised accordingly. The RSA and associated feedback is provided in Appendix A14.3.

14.3 Baseline Conditions

14.3.1 Description of Existing Conditions

The sections of the road network included within this assessment have been determined on the basis of the potential impact of increased traffic associated with the Remediation Phase and Operational Phase of the proposed Project.

14.3.2 Local Road Network

The N7 / M7 Motorway is a route of national significance which travels between Dublin in the north-east and Limerick in the south-west. In the vicinity of N7 Junction 8, which gives access to the proposed Project, the N7 / M7 takes the form of a 3 lane motorway in each direction, with a hard shoulder. Access to the proposed Project is via the grade separated Junction 8.

L2005 Kerdiffstown Road, between N7 Junction 8 and Sallins, which passes the existing site access, is a single carriageway road which accommodates two-way traffic. While the carriageway is of good quality between the N7 Junction 8 and the roundabout south-west of Johnstown Garden Centre, the road narrows from this point north towards Sallins to an approximate 5.6m carriageway width, which creates issues for the continuation of two-way operation of the road at points. Furthermore, there is a posted 3 tonne weight limit on the railway bridge on the L2005 Kerdiffstown Road to the west of Sallins.

Segregated shared use paths exist both north and south of the N7 directly south of the site and eastward. A pedestrian bridge provides access over the N7 to Johnstown, though cyclists must walk bicycles across due to low parapet height of the bridge. Many roads in the vicinity do not have segregated facilities or marked cycle lanes; cyclists share the carriageways with vehicular traffic.

The proposed Project includes construction of a new site access and realignment of the south section of the L2005 Kerdiffstown Road, from the site access to an existing roundabout. Impacts are likely during these construction works as traffic management measures would be employed.

14.3.3 Baseline Traffic Data

Traffic flow data for the primary road network within the study area has been obtained from the Transport Infrastructure Ireland (TII) Traffic Data Website. Classified junction traffic count and queue length surveys were undertaken by Nationwide Data Collection on 26 January 2017 between 07:00 and 19:00 at the following junctions:

1. R407 / Church Avenue, Sallins;
2. R407 / Church Avenue (E), Sallins;
3. Church Avenue (W) / Church Avenue (S), Sallins;
4. L2005 Kerdiffstown Road Roundabout;
5. N7 Junction 8 North Roundabout; and
6. N7 Junction 8 South Roundabout.

Automatic Traffic Counters (ATCs) were installed at the following locations on the local road network:

7. Church Avenue Railway Bridge, Sallins (January 2017);

8. L2005 Kerdiffstown Road, North of Existing Landfill Access (September 2016); and

9. L2005 Kerdiffstown Road, South of Existing Landfill Access (September 2016).

Further details on these counts and a location plan of surveys and ATCs are provided in the TTA (refer to Appendix A14.1).

The data has been processed, using the Design Manual for Roads and Bridges, Volume 13, Economic Assessment of Road Schemes, Section 1, The COBA Manual to estimate 5-day Annual Average Daily Traffic (AADT) flows for two way (return journeys) traffic. AADT relates to the 5-day week (Monday to Friday) over a 12-month time period. The AADT is established as an average of this whole time period in order to account for any holiday and seasonal variations over the 12-month period. In terms of traffic flow information for the road network surrounding the proposed Project, sufficient information has been obtained to calculate the estimated AADT and to allow a suitable, robust assessment to be made of the potential traffic impacts as a result of the proposed Project.

14.3.4 Traffic Growth

Traffic growth for the surrounding road network is based on the medium growth rates for East Ireland obtained from NRA Project Appraisal Guidelines, Unit 5.5 Link-Based Traffic Growth Forecasting.

The commencement of the Remediation Phase is subject to the determination of the planning process, the period for which is not defined. As a result, a start date of remediation works for the purposes of this traffic and transport assessment has been assumed as 2018. This ensures a robust assessment of the Remediation Phase impacts.

By assuming that the peak traffic volumes relating to the remediation works occur in the first year of the Remediation Phase, i.e. 2018, baseline traffic is projected to an earlier year and thus utilises a lower projected baseline. The addition of the associated percentage increase to this baseline, taking cognisance of the estimated total daily construction traffic volumes, would be higher than use of a later start date (this would see a higher projected baseline but lower percentage increase). It is therefore considered that this assumed start date of 2018 represents a more robust approach.

Furthermore, with the intensive construction period of the proposed Remediation Phase estimated to last a minimum of four years, therefore the Operational Phase of the proposed Project is anticipated to commence (at the earliest) in 2022. As a result, and in a similar approach to that above, baseline traffic has been updated to this year for the purposes of the Operational Phase assessment. As such, this represents a robust approach to determining the impacts of Operational Phase traffic.

The following medium growth rates, from the TII Project Appraisal Guidelines, have been applied to the base flows for the following scenarios:

- Medium growth rate of 1.022 (All Traffic) and 1.016 (HGVs) for peak Remediation Phase year of 2018; and
- Medium growth rate of 1.066 (All Traffic) and 1.048 (HGVs) for Operational Phase year of 2022.

Table 14.5: Baseline and Projected AADT

Location	Northbound baseline AADT (2016)	Southbound baseline AADT (2016)	Combined AADT (2016)	Combined HGVs (2016)	% HGVs (2016)	Combined projected AADT (2018)	Combined projected HGV (2018)	Combined projected AADT (2022)	Combined Projected HGV 2022)
N7 west of Junction 8	29,582	31,217	60,798	4,384	7.2%	62,137	4,454	64,812	4,594
Access road north of N7 Junction 8	1,542	1,476	3,018	47	1.6%	3,084	48	3,217	49
Access road south of N7 Junction 8	2,812	1,945	4,757	91	1.9%	4,862	92	5,071	95
Kerdiffstown Road, south of access to proposed Project	866	883	1,749	14	0.8%	1,787	14	1,864	15
Kerdiffstown Road, north of access to proposed Project	855	834	1,689	44	2.6%	1,726	45	1,800	46

14.3.5 Road Condition

Whilst this Chapter will demonstrate that impacts of the proposed Project on the local road network will be limited, it is observed that the importation of materials to the site using HGVs during the Remediation Phase may have an impact on the condition of the road surface, between the N7 junction and L2005 Kerdiffstown Road (where the road after the existing roundabout is realigned). As a result, the appointed contractor responsible for the remediation works will be required to undertake a pre-condition survey of the existing road from the N7 to the site with the scope and method of assessment to be agreed with KCC Transportation Department. Following completion of the importation works, a further survey will be undertaken to determine any deterioration and the requirement for any remedial works, for agreement with the KCC Transportation Department.

14.4 Predicted Impacts

Reference should be made to the TTA contained in Appendix A14.1.

14.4.1 Remediation Phase

Assessment of Remediation Phase Traffic Generation

The traffic impact of the additional vehicles associated with the Remediation Phase of the proposed Project can be categorised as:

- Additional traffic volumes associated with the Remediation Phase activities, primarily HGV's for the proposed Project travelling on the existing road network; and
- Delays to non-Project related journeys as a result of slow moving vehicles i.e. HGVs.

The remediation of the site and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. Further details on the outline phasing of the works are provided in Section 4.3.1. The traffic movements associated with

all eight phases of the Remediation Phase have been estimated based on approximate volumes of materials to be imported to support the capping and remediation of the site (refer to Appendix A4.7). This assessment focuses on the traffic impacts of the busiest phase of Remediation Phase (anticipated to be around Phase 2 and Phase 3).

A total of 180 two-way vehicle trips per day are predicted during the worst case Remediation Phase, comprising 140 two-way HGV movements and 40 two-way car / Light Goods Vehicles (LGV) movements. The trip generation has been added to the projected 2018 AADT, detailed in Table 14.6, in order to confirm the percentage increase in traffic associated with the proposed Project Remediation Phase. In order to assess the worst case impact, assumptions have been made regarding the proportion of Remediation Phase related traffic passing any particular traffic counter, notably that 100% of traffic will pass all traffic counter locations. This is a robust approach as the volumes of traffic passing certain ATC locations will in reality be significantly lower and therefore the assessment of Remediation Phase related traffic is considered a worst case scenario. Table 14.6 details the percentage increases in total traffic. Table 14.7 details the percentage increases in HGV traffic. The following paragraphs discuss the impacts on key sections of the road network (based on strategic ATC locations) and sensitive receptors as a result of the increase in traffic associated with the Remediation Phase of the proposed Project.

Table 14.6: Worst Case Remediation Phase Percentage Increase in Total Traffic

ATC Location	% Split at each ATC	Projected Base AADT (2018)	Worst Case Daily Remediation Total Vehicles (Two Way)	% Increase in Total Vehicles
N7 west of Junction 8	100%	62,137	180	0.3%
Access road north of N7 Junction 8	100%	3,084	180	5.8%
Access road south of N7 Junction 8	100%	4,862	180	3.7%
Kerdiffstown Road, south of access to proposed Project	100%	1,787	180	10.1%
Kerdiffstown Road, north of access to proposed Project	100%	1,726	180	10.4%

Table 14.7: Worst Case Remediation Percentage Increase in HGV Traffic

ATC Location	% Split at each ATC	Projected Base HGV (2018)	Worst Case Daily Remediation Phase HGVs (Two Way)	% Increase in HGVs
N7 west of Junction 8	100%	4,454	140	3.1%
Access road north of N7 Junction 8	100%	48	140	293.2%
Access road south of N7 Junction 8	100%	92	140	151.4%
Kerdiffstown Road, south of access to proposed Project	100%	14	140	984.3%
Kerdiffstown Road, north of access to proposed Project	100%	45	140	N/A*

* HGVs will not be permitted to access the site via Sallins.

Summary of Remediation Phase Traffic Generation Impacts

During construction of the new site access and realignment of the L2005 Kerdiffstown Road traffic management measures will be employed. This will impact on the sensitive receptors along this section of road as listed in Table 14.2. However, access to all properties will be maintained during the works thus impacts are not considered to be significant.

In terms of the percentage increase of total vehicles shown in Table 14.6, the proposed Project will have a negligible impact on all assessed road sections based on the criteria outlined in Table 14.1, where a negligible impact is predicted on percentage increases of less than 30%.

While the increase in total Remediation Phase related traffic on Kerdiffstown Road marginally exceeds both the TII and IEMA thresholds detailed within Section 14.2.7, it is important to consider the increases in traffic in relation to actual vehicles. As detailed above, an increase of 180 two-way movements per day (total vehicles) are predicted during the worst case phase in terms of traffic increases which equates an average of 18 two-way movements per hour (9 arrivals and 9 departures).

It is important to consider the increase on Kerdiffstown Road in the context of the existing low levels of baseline traffic and the carrying capacity of the road. It is noted that this road is currently operating significantly below its capacity. Table 14.4 provides typical capacities for a variety of road types and it is estimated that the capacity of a road such as the L2005 Kerdiffstown Road is a 5,000 two-way flow per day. During the busiest month of the Remediation Phase, the total vehicles per day on this road (including baseline traffic) will be 1,967 per day (1,787 projected 2018 AADT + 180 Remediation Phase traffic). As such, it is considered that Kerdiffstown Road is currently operating below its capacity and will continue to do so with the addition of the Remediation Phase traffic flows. Despite undertaking an assessment of Remediation Phase impacts within the EIAR, the actual increases in traffic numbers will be minimal.

With regards to HGV movements, the percentage increases for the L2005 Kerdiffstown Road section outlined in Table 14.7 suggests an impact of major significance on the road network in accordance with the IEMA criteria as detailed in Table 14.3. However, this high percentage is a result of the low levels of baseline HGV traffic at this location. It has been determined that during the worst case phase of the remediation works, the total two-way HGV movements per hour will be on average only 14 (7 arrivals and 7 departures). Therefore, despite the high percentage increases, the numerical increase in HGVs is low. Moreover, the impacts of worst case Remediation Phase traffic will occur over a relatively short period and the existing road infrastructure is currently operating well below capacity, therefore reducing the overall impact.

Consequently, taking the existing low baseline and overall carrying capacity of the L2005 Kerdiffstown Road and the short term period of the works, no significant impacts are predicted to arise from Remediation Phase related traffic generated by the proposed Project.

14.4.2 Operational Phase

In order to determine trip generations associated with the Operational Phase of the proposed Project, reference has been made to the Trics 2016 database (managed by Trics Consortium Limited) in which daily vehicle trip rates were established. Trip rates for the following leisure land use (term as defined in the Trics 2016 database) have been considered:

- Country Park

Given that the Country Park land use in Trics can include facilities such as a nine-hole golf course, café and visitor centre, it is assumed that the trip rates provided are robust in relation to the end-use of the proposed Project. As such, it is assumed that the robustness of the trip rates will offset any trip generation associated with the multi-use public park including playing pitches. Trics outputs files are contained in Appendix A14.2 for reference.

The vehicle trip rates have been applied to the area of the proposed Project in order to ascertain a daily trip generation profile associated with the Operational Phase of the proposed Project. Country Park trip rates are only available for a Saturday, which would be considered as a peak usage period for such land use hence in order to provide a robust assessment, these trip rates have been assumed to also apply to the weekday scenario. As with Remediation Phase related traffic, the trip generation has been added to the projected 2022 AADT in order to confirm the percentage increase in traffic associated with the Operational Phase of the proposed Project. In order to assess the worst case impact, robust assumptions have been made regarding the proportion of Operational Phase traffic passing any particular traffic counter, notably that 100% of traffic will pass all traffic counter locations. This is an extremely robust approach as the volumes of traffic passing each ATC location will, in reality, be significantly lower and therefore the assessment of Operational Phase traffic can very much be considered as worst case.

Table 14.8 details the predicted Operational Phase traffic levels; and Table 14.9 details the percentage increase to baseline traffic flows on the road network as a result of the Operational Phase of the proposed Project.

Table 14.8: Total Weekday Operational Phase Trip Generation

Land Use	Two-Way Daily Trip Generation
Country Park	151

Table 14.9: Worst Case Operational Phase Percentage Increase in Traffic

ATC Location	% Split at each ATC	Projected Base AADT (2022)	Worst Case Daily Operational Phase Total Vehicles (Two Way)	Projected Base + Worst Case Operational Phase	% Increase in Total Vehicles
N7 west of Junction 8	100%	64,812	151	64,963	0.23%
Access road north of N7 Junction 8	100%	3,217	151	3,368	4.69%
Access road south of N7 Junction 8	100%	5,071	151	5,222	2.97%
Kerdiffstown Road south of public park access	100%	1,864	151	2,015	16.02%
Kerdiffstown Road north of public park access	100%	1,800	151	1,951	8.38%

The impacts of this level of traffic during the Operational Phase fall substantially below the guidance thresholds detailed in Section 14.2.7 and consequently the significance of the impacts is considered negligible.

14.4.3 Environmental Impacts

Assessment of Environmental Impacts (Remediation and Operational Phases)

Environmental Impacts have been assessed for both the Remediation and Operational Phases for the proposed Project in relation to the EPA Guidelines on the Information to be contained in an Environmental Impact Statement (revised 2015) (as detailed in Section 14.2.7). Works to realign the L2005 Kerdiffstown Road, including construction of the new site access and provision of a footpath and cycleway, have been considered with the Remediation Phase assessment as these will be undertaken during the first phase of works. Review text is provided below including summaries detailed in Table 14.10 and Table 14.11 below.

Accidents and Safety

A review of Road Safety Authority Collision Statistics (RSA 2014) was undertaken, which provided details of all collisions on the roads in the immediate vicinity of the proposed Project, between 2009 and 2013. The following accidents were identified:

- Minor accident on Kerdiffstown Road, north of proposed site access, in the vicinity of the railway bridge; and
- Minor accident on N7 Eastbound, at Junction 8 off-slip.

While no data is available from 2013, it is clear from the observed data that only a small number of minor accidents have occurred in the vicinity of the proposed Project, none of which are linked to operations at the site and as such it is clear that there are no existing accident or safety issues based on these statistics. However, given the identified need for significant volumes of material import via HGV during the Remediation Phase there is a perceived increase in risk of accidents due to the current site access arrangements. This forms the basis of the proposed new access arrangements and realignment of the L2005 Kerdiffstown Road. With these improvements it is anticipated that the safety of vulnerable road users (VRU) would be improved for both the Remediation and Operational Phases. This is therefore a permanent positive significant impact.

Driver Delay

Traffic delays as a result of Remediation Phase traffic could occur along the chosen site access and egress routes. The IEMA Guidelines note that *"these delays are only likely to be significant when the traffic on the network surrounding the development is already at, or close to, the capacity of the system"*.

The road network surrounding the proposed Project is currently operating comfortably within capacity, which is confirmed by comparing the baseline and projected AADT flows in Table 14.5 with the anticipated capacity outlined within Table 14.4. Projections show that the road will continue to operate below its capacity with the addition of Remediation Phase related traffic flows, taken as the worst case scenario. The increases in flow are therefore anticipated to have a negligible impact on driver delay. Notwithstanding this, mitigation will be provided as described in Section 14.5.

The impacts from the Operational Phase are then neutral and therefore not significant following adoption of mitigation as identified for the Remediation Phase.

Fear, Intimidation and Pedestrian Amenity / Delay

Traffic volume, composition and speeds, in combination with pedestrian footways and crossings, contribute to the level of general unpleasantness, fear, intimidation and delay experienced by pedestrians and other vulnerable road users.

There are no footways on L2005 Kerdiffstown Road to the immediate north and south of the site access, however a footway exists on the east side of Kerdiffstown Road, approximately 350m south of the existing site access. This footway connects to Johnstown Garden Centre (Receptor ID COM002) to the east of the proposed Project; and to the settlement of Johnstown via a crossing at the roundabout, approximately 415m to the south of the site and a footbridge over the N7, located approximately 460m to the south of the site access. This bridge is suitable for use by pedestrians and also allows cyclists access to the new cycleway linking to the proposed Project. It is noted that the parapet height on this bridge is insufficient to permit cycling hence signage will be required to direct cyclists to dismount. As part of the proposed Project, a shared use cycleway / footway will be developed on the eastern side of the L2005 Kerdiffstown Road, which will provide a segregated and direct link between the proposed Project site access roundabout and the existing pedestrian bridge connecting over the N7 to Johnstown.

During the worst case Remediation Phase traffic, it is predicted that 180 two-way movements per day will access the proposed Project, which equates to an average of 18 two-way movements per hour. Consequently, the impact of the potential for HGVs moving to and from the site in platoons has been assessed. It is clear when comparing the worst case traffic impact during the Remediation Phase, with the theoretical operating capacity of a road such as the L2005 Kerdiffstown Road (Table 14.4), that there is ample available capacity in order to accommodate the increases in traffic associated with all parts of the Remediation Phase of the proposed Project. Furthermore, with the provision of segregated footpath and cycleway, protection will be afforded to VRU's during the Remediation Phase. As such, the impact of the Remediation Phase of the proposed Project is neutral and therefore not significant regarding impact on fear, intimidation and delay. Notwithstanding this, mitigation measures outlined in Section 14.5 will ensure that any impacts are kept at a minimum.

With the opening of the public park and the provision of segregated footpaths and cycleways the access is considered to provide a significant, positive effect on fear, intimidation and pedestrian amenity/ delay. The increases in traffic are reduced from that assessed in the Remediation Phase hence the effect would be neutral and not significant.

Severance

The IEMA Guidelines note that "*Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery*".

Whilst the proposed Project does not comprise the construction of a new major traffic artery the increase in HGV traffic may be perceived to increase severance. During the worst case of the Remediation Phase works, it

is predicted that 180 two-way movements per day, the majority of which are HGVs, will access the proposed Project, which equates to an average of 18 two-way movements per hour. Consequently, the impact of the potential for HGVs moving to and from the site in platoons has been assessed. This is not likely to lead to any severance issues.

Furthermore, HGVs travelling to the site will not be permitted to route via Sallins and will therefore predominantly travel on the strategic road network. Whilst the low levels of additional traffic generated by the proposed Project coupled by the strategic routing of HGVs is not significant, the issue of severance due to this traffic has been conservatively considered as adverse and significant. Mitigation measures outlined within Section 14.5 will ensure that any impacts are kept at a minimum. The Operational Phase will provide improved connectivity from Johnstown to the proposed Project hence is considered to be a slight permanent positive effect.

Summary of Environmental Impacts (Remediation Phase)

In terms of the above outlined environmental impacts the performance of the Remediation Phase for the proposed Project in relation to the EPA Guidelines (as detailed in 14.2.7) is summarised in Table 14.10 below.

Table 14.10: Summary of Environmental Impacts (Remediation Phase)

Environmental Impact	Environmental Impact description	Quality of Effects	Significance	Duration	Comments
Accidents and Safety	Improvements to the proposed site access junction and associated realignment of L2005 Kerdiffstown Road	Positive	Significant	Permanent	The proposed mitigation measures will assist in managing and reducing these effects.
	Increases in traffic, most notably HGVs.	Adverse	Slight	Short-term	
Driver Delay	Increases in traffic on the road network as a result of Remediation Phase activities, most notably slow moving HGVs.	Adverse	Not significant	Short-term	The proposed mitigation measures, most notably the timing and routing of Remediation Phase traffic, will assist in minimising these effects.
Fear, Intimidation and Pedestrian Amenity / Delay	Increases in traffic on the road network as a result of Remediation Phase activities, most notably HGVs.	Adverse	Not significant	Short-term	The proposed mitigation measures, most notably the timing and routing of Remediation Phase traffic, will assist in minimising these effects.
	The potential for HGVs moving to / from the site in platoons.	Adverse	Significant	Short-term	
Severance	Increases in traffic on the road network as a result of Remediation Phase activities, most notably HGVs.	Adverse	Significant	Short-term	The proposed mitigation measures, most notably the timing and routing of Remediation Phase traffic, will assist in minimising

Environmental Impact	Environmental Impact description	Quality of Effects	Significance	Duration	Comments
	The potential for HGVs moving to / from the site in platoons.	Adverse	Significant	Short-term	these effects.

Summary of Environmental Impacts (Operational Phase)

In terms of the above outlined environmental impacts the performance of the Operational Phase for the proposed Project in relation to the EPA Guidelines (as detailed in 14.2.7) the scenarios described above in the discussions of assessment of environmental impacts (Remediation Phase) remain largely valid and are presented as a summary in Table 14.11.

Table 14.11: Summary of Environmental Impacts (Operational Phase)

Environmental Impact	Environmental Impact description	Quality of Effects	Significance	Duration
Accidents and Safety	Improvements to the proposed site access junction and associated realignment of L2005 Kerdiffstown Road	Positive	Significant	Permanent
	Increases in traffic are negligible.	Neutral	Not significant	Permanent
Driver Delay	Increases in traffic on the road network as a result of the Operational Phase are negligible.	Neutral	Not significant	Not applicable.
Fear, Intimidation and Pedestrian Amenity / Delay	Increases in traffic on the road network as a result of the Operational Phase are negligible.	Neutral	Not significant	Not applicable.
	Improved pedestrian and cycle access to the public park as part of the L2005 Kerdiffstown Road realignment works.	Positive	Significant	Permanent
Severance	Increases in traffic on the road network as a result of the Operational Phase are negligible.	Positive	Slight	Permanent

14.4.4 Traffic and Transport Assessment

The initial assessment of predicted traffic volumes suggested that a standalone TTA may not be required. However, in order to ensure a robust assessment of impacts on the road network for both the Remediation Phase and Operational Phase a TTA was undertaken for the proposed Project. While the TTA should be read in conjunction with this Chapter, a brief summary of the findings relating to the operation of the local road network are presented below. Refer to Appendix A14.1 for the TTA.

A key consideration of the TTA relates to the impact on the local road network with the addition of traffic related to the proposed Project, during both the AM and PM peak periods. A microsimulation model was developed in February 2017, with the approach, methodology and extents of the assessment agreed with the KCC Transportation Department following the submission of a scoping report. The model extends from Junction 8 of the N7, to the south-east of the site, to the R407 / Church Avenue junction in Sallins, to the north-west of the site.

The scenarios considered within the TTA for the AM and PM peak periods are:

- 2017 Base;
- 2018 Projected Do Minimum (assumed Remediation Phase start);

- 2022 Projected Do Minimum (assumed Operational Phase start);
- 2027 Projected Do Minimum (5 years after assumed Operational Phase start);
- 2037 Projected Do Minimum (15 years after assumed Operational Phase start);
- 2018 Projected + Remediation Phase Traffic (assuming 30% (based on professional judgement) of daily Remediation Phase traffic arrives / departs during the AM / PM peak hours);
- 2018 Projected + Remediation Phase Traffic (Sensitivity Test) (assuming 100% of daily Remediation Phase traffic arrives / departs during both AM and PM peak hours);
- 2022 Projected + Operational Phase Traffic;
- 2027 Projected + Operational Phase Traffic; and
- 2037 Projected + Operational Phase Traffic.

While this report assesses the worst case impacts of both the Remediation and Operational Phases of the proposed Project, the assessment has shown that it is extremely unlikely that either of the Remediation Phase scenarios outlined above will occur in reality given that the appointed contractor will be bound by a Construction Traffic Management Plan (CTMP). The CTMP, details of which are provided in Section 14.5, will include details of the routes that Remediation Phase traffic must take when travelling to the site, along with details of delivery windows confirming when traffic is predicted to arrive on-site, which is likely to be outside of the AM and PM peak periods.

A summary of the model results for each assessed scenario is provided below. Reference should be made to Diagram 14.1 and Diagram 14.2 for identification of the study area.

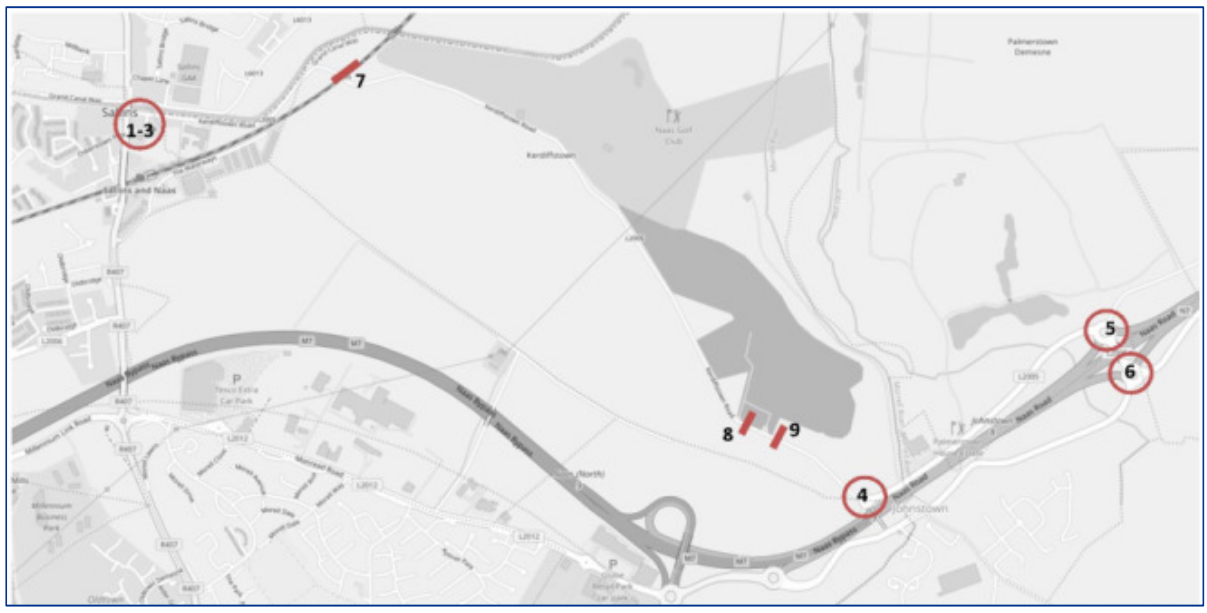


Diagram 14.1: Location of all Traffic Surveys

Diagram 14.2: Focus on Traffic Survey Locations 1-3

2017 Base Network

During both the AM and PM peak periods, Junctions 1 – 3 in Sallins experience varying levels of queuing and delay, with existing queues of up to 30 vehicles reported in the AM peak period on the R407 (S) arm of the R407 / Church Avenue junction. It is important to note, however, that despite this level of queuing, vehicles are only reported to experience a delay of up to 9 seconds when negotiating the junction.

Similar levels of performance are noted in the PM peak, albeit to a lesser extent, with existing queues of up to 26 vehicles noted on the R407 (S) arm of the R407 / Church Avenue junction. As with the AM peak the levels of delay are manageable, with vehicles only reported to experience a delay of up to 8 seconds when negotiating the junction.

Notwithstanding this, it is clear that there are existing capacity issues within Sallins, however levels of queueing and associated vehicle delay are manageable.

There are no predicted queuing issues at any other assessed location on the network.

Reference should be made to the TTA (Appendix A14.1) for a more detailed narrative of the existing road network performance.

2018 / 2022 / 2027 / 2037 Projected Network

While it is natural that any increases in traffic will exacerbate existing issues on the network for the 2018 / 2022 / 2027 / 2037 future year projections, only minor increases are anticipated in relation to maximum queuing and delay at a number of locations on the network, but overall delay and maximum queuing remain manageable.

2018 Projected + Remediation Phase Traffic

With the addition of Remediation Phase traffic to the 2018 projected traffic, as expected there would be increased levels of queuing and delay on the L2005 Kerdiffstown Road at the proposed Project roundabout, although again this equates to a small increase in vehicles and a small increase in delay.

Very little change would be anticipated at other junctions on the network, when Remediation Phase trips are added to projected traffic.

The impacts on the local road network during the Remediation Phase are anticipated to be negligible. Furthermore, the mitigation measures detailed below will ensure that impacts associated with Remediation Phase traffic in the AM and PM peaks are minimal. It is recorded that HGV traffic (which comprises the majority of Remediation Phase traffic) will not be permitted to route via Sallins, hence no impacts to future traffic flows from Remediation Phase traffic is anticipated for junctions in Sallins.

2018 Projected + Remediation Phase Traffic (Sensitivity Test)

Despite the sensitivity assessment, assuming that 100% of daily Remediation Phase traffic movements will occur during the AM and PM peak period, a situation which is not predicted to occur, the increases in maximum queuing and delay are anticipated to be minor. During the AM peak, it is predicted that queuing on the L2005 Kerdiffstown Road will increase by 4 vehicles, with a minimal increase in delay. Furthermore, minor increases in queuing and delay are predicted at other locations on the network.

Despite a robust assessment of Remediation Phase activities, the impacts on the local road network are anticipated to be negligible. Furthermore, the mitigation measures detailed below will ensure that impacts associated with Remediation Phase traffic in the AM and PM peaks are minimal. It is recorded that HGV traffic (which comprises the majority of Remediation Phase traffic) will not be permitted to route via Sallins, hence no impacts to future traffic flows from Remediation Phase traffic is anticipated for junctions in Sallins.

2022 / 2027 / 2037 Projected + Operational Phase Traffic

As outlined above, there are existing capacity issues at the junctions assessed in Sallins, however these issues are manageable given the levels of queueing and, more importantly, the maximum delay for vehicles. Given that predicted increases in traffic associated with the Operational Phase of the proposed Project are anticipated to be low (as demonstrated within this assessment), the additional traffic is predicted to have a minor effect on the operation of the road network within Sallins across all future year scenarios, with very slight increases in queueing and delay anticipated. Importantly, overall levels of queueing and delay will remain manageable.

The additional traffic associated with the proposed Project Operational Phase can be accommodated on all other assessed junctions on the network with no detrimental impact.

14.5 Mitigation Measures

14.5.1 Remediation Phase

Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Traffic Management Plan (CTMP). The purpose of the CTMP is to set out management and mitigation measures to prevent or minimise the transport impacts during the Remediation Phase of the proposed Project.

The CTMP shall include details of the following:

- Identify to all staff and contractors the appropriate and safe routes to and from the proposed Project;
- Confirmation that routing of HGV traffic is not permitted via Sallins, all Remediation Phase HGV traffic will route via the N7 Junction 8;
- Timing of HGV movements to take place outside of peak flow hours, where practicable, in order to minimise disruption to general traffic flows on the road network, including details of delivery windows confirming when traffic is predicted to arrive on-site;

- Consideration of location of weighbridge within the site in order to minimise queueing of site traffic on the L2005 Kerdiffstown Road;
- Measures to ensure access to all private properties along the L2005 Kerdiffstown Road is maintained throughout the Remediation Phase works; and
- Appropriate warning signs to be erected to warn other road users of the presence of HGV's and general Remediation Phase related traffic.

Through the CTMP, regular engagement with the existing Community Liaison Group shall be undertaken in order to engage with the local residents on when remediation works will commence, including;

a) The schedule of works;

b) Disseminate details of signage;

c) The direction from where HGV loads will be travelling from;

d) A dedicated telephone number which the residents can contact to report any issues;

e) Provide details of the dates of the community liaison group meetings; and

f) Obtain local resident's feedback on other issues that need to be addressed including details of any forthcoming public events etc. that need to be considered.

The CTMP shall provide for regular inspections to be carried out to ensure that agreed mitigation measures, as outlined above, are being undertaken.

The appointed contractor responsible for the remediation works will be required to undertake a pre-condition survey of the existing road from the N7 to the site with the scope and method of assessment to be agreed with KCC Transportation Department. Following completion of the importation works, a further survey will be undertaken to determine any deterioration and the requirement for any remedial works, for agreement with the KCC Transportation Department.

A Mobility Management Plan (MMP) shall be prepared by the appointed contractor prior to initiation of the Remediation Phase, the purpose of which is to provide the mechanism to support and promote sustainable travel for staff, contractors and visitors travelling to the proposed Project.

The MMP shall seek to eliminate where feasible the barriers preventing users of the site from accessing via sustainable travel modes, improving travel choices and managing single occupancy car use.

14.5.2 Operational Phase

As identified within this assessment, the traffic generated during the Operational Phase for the proposed Project is anticipated to be minimal and will not have a significant impact on the existing road network. As such no specific mitigation relating to this phase is required, however the MMP shall continue through the Operational Phase and seek ways in which to promote active and sustainable travel to all staff and visitors to the public park.

Notwithstanding this, the proposals to provide a shared footway / cycleway, segregated from the carriageway on the L2005 Kerdiffstown Road, will present a safe and desirable opportunity for walking and cycle trips to the public park. There will also be provision of adequate car parking facilities to accommodate members of the public arriving by road.

14.6 Residual Impacts

14.6.1 Remediation Phase

While the nature of traffic increases will be short-term and the impacts negligible, the mitigation measures outlined will minimise any residual impacts. A summary justification is as follows:

- A CTMP will minimise, as far as practicable, traffic impacts during the Remediation Phase;
- Large sections of the proposed delivery routes are on national roads, which are established HGV routes;
- The maximum traffic increases as a result of Remediation Phase related traffic will be temporary;
- Safety of all road users will be improved with the construction of a new site access, realignment of the L2005 Kerdiffstown Road and provision of a footpath and cycleway during the first phase of remediation works; and
- Environmental impacts identified will be managed through the mitigation measures outlined above, thus ensuring the impacts are not significant.

14.6.2 Operational Phase

The traffic generated during Operational Phase of the proposed Project will not have a significant impact on the existing road network. Suitable signage will be erected advising of the appropriate access to the proposed Project.

Furthermore, staff and visitors to the proposed Project, once operational, will benefit from the pedestrian and cycle infrastructure that will provide a safe and desirable opportunity for walking and cycling to the public park.

14.7 Difficulties Encountered in Compiling Information

There were no specific difficulties encountered when carrying out this assessment.

14.8 Cumulative Impacts

The cumulative impact of the proposed Project and other permitted developments in the area has been assessed by taking account of the existing baseline environment and the predicted impacts associated with the operation of the proposed Project in combination with predicted impacts of any other proposed developments in the area.

The key permitted developments proposed in the vicinity of the proposed Project that are considered in terms of a cumulative impact on traffic and transport within the study area are discussed in the following paragraphs.

14.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018.

The Waste Facility Permit restricts the truck movements onto the quarry site to a maximum of 35 per day and restricts the working hours to 08:00 to 17:00 Mondays to Fridays and 08:00 to 13:00 on Saturdays. The access route to the quarry site is from the south using the L2012 Monread Road and crossing over the M7 motorway. This will result in keeping all the quarry infilling traffic well removed from the proposed Project works in the event of the quarry infilling works occurring at the same time as the Remediation Phase works. The use of different approach roads to serve the two sites is also beneficial since this will minimise the traffic movements on each road thereby minimising the impact on nearby receptors.

14.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The proposed M7 Osberstown Interchange and R407 Sallins Bypass Scheme comprises an interchange on the M7 between the M7 Maudlins and Newhall Interchanges, north and south of Naas respectively and a bypass of Sallins town. Following review of the scheme Environmental Impact Statement (EIS), there are likely to be cumulative impacts associated with the construction of this project and the remediation of the proposed Project.

The M7 Osberstown Interchange and R407 Sallins Bypass Scheme EIS has undertaken a worst case assessment whereby construction of the M7 Osberstown Interchange and Sallins Bypass occur at the same time over an 18-month construction period. In order to ensure that a robust cumulative assessment is undertaken, the assessment has considered the worst case construction months of both schemes and the proposed Project remediation occurring concurrently in order to robustly assess cumulative impacts.

From Table 4.11 of the M7 Osberstown Interchange and Sallins Bypass EIS, it is predicted that 193,500 construction traffic movements will be generated across all phases of the project over the 18-month construction period, which generates an average of 10,750 vehicles per month and 384 per day (assuming 28 working days per month). During the busiest phase of Kerdiffstown remediation a total of 180 vehicles per day are anticipated.

On reviewing the local road network, relevant to the proposed Project, only the counter on the N7 West of Junction 8 is predicted to accommodate vehicle movements from both developments. Table 14.12 details the cumulative percentage impact based on the worst case months for both developments.

Table 14.12 ATC Counters Experiencing Cumulative Impacts

ATC Location	Cumulative Daily Traffic	Two Way Projected AADT 2018	% Increase in Total Vehicles
N7 West of Junction 8	564	62,137	0.91%

It is demonstrated in Table 14.12 that following the cumulative assessment, all locations on the road network, will experience a percentage increase of less than 30% which is of negligible significance in terms of the criteria within Table 4.3

14.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

14.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

14.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment of this section of road as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment of the L2005 Kerdiffstown Road to minimise potential impacts on local residents and

traffic. It is likely that to facilitate installation of the new sewer traffic management will be required on L2005 Kerdiffstown Road and hence impacts may be experienced. On confirmation of works programme for the new sewer and the proposed Project, a strategy for managing cumulative impacts will be developed. This requirement for collaboration will be embraced within the appointed contractor's Construction Traffic Management Plan. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

14.9 References

- Department of Environment, Community and Local Government (2013) / Traffic Infrastructure Ireland. Design Manual for Roads and Bridges.
- Design Manual for Urban Roads and Streets (DMURS), Department of Environment, Community and Local Government, 2013 (DMURS).
- Highways England Company Limited / Transport Scotland / The Welsh Government / The Department for Regional Development (Northern Ireland) (2015). Design Manual for Roads and Bridges" (DMRB).
- Environmental Protection Agency (2002). EPA Guidelines on the Information to be Contained in Environmental Impact Statements.
- Environmental Protection Agency (2015). Revised EPA Guidelines on the Information to be Contained in Environmental Impact Statements.
- Environmental Protection Agency (2017). Draft EPA Guidelines on the Information to be Contained in Environmental Impact Statements.
- Environmental Protection Agency (2003) EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.
- Environmental Protection Agency (2015) EPA Revised Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.
- Institute of Environmental Management and Assessment (IEMA; 1993). Guidelines for the Environmental Assessment of Road Traffic.
- The Institution of Highways and Transportation (1994). Guidelines for Traffic Impact Assessment.
- Traffic Infrastructure Ireland, (2014) Traffic and Transport Assessment Guidelines.
- Department for Transport (2004). Cost Benefits Analysis (COBA) program.

15. Waste

This Chapter assesses the potential impacts of waste on the environment as a result of the proposed Project. It is envisaged that none of the in-situ waste will be removed from the site for disposal, except where the waste material has a resale value (e.g. rebar), or materials are encountered which are deemed to be non-compliant. This impact assessment therefore did not assess the impact of the in-situ waste which is to stay on-site, and focussed on the likely wastes which will be generated by the proposed Project needing off-site disposal, both during Remediation and Operation.

During remediation works the majority of waste is likely to arise through the demolition of the remaining concrete structures, demolition of the residential properties which will be acquired through Compulsory Purchase Orders (CPOs), and general and hazardous wastes which will arise from the remediation works as is typical of any construction project. The main waste types which will be generated by the proposed Project are rebar from demolished concrete structures, hazardous wastes such as oily wastes from plant and vehicle maintenance and chemical drums, general wastes from site personnel and activities, and the continued generation of effluent (leachate and wastewater from site facilities).

Waste-related impacts will be managed through the Construction Environmental Management Plan (CEMP) which will detail how waste generated by the remediation works will be managed by the appointed contractor(s) in accordance with best practice and applicable legislation.

Once operational the waste generated from the multi-use public park will be minimal, composed predominantly of landscaping waste, general waste from park visitors and the infrastructure compound, maintenance wastes, and leachate and wastewater. The management of effluent will have improved when compared to the baseline with leachate and wastewater leaving the site via a sewer connection to Johnstown Pumping Station for treatment at Osberstown WWTP.

15.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as “the proposed Project”) and the waste that may occur during the Remediation and Operational Phases.

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

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children’s playground, etc. and management of the site as a remediated landfill. Table 15.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

Table 15.1: Summary of Key Activities during the Remediation and Operational Phases

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

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

15.2 Methodology

The methodology sets out the approach for assessing the potential waste impacts as a result of activities associated with the Remediation and Operational Phases of the proposed Project. An analysis of the available information was undertaken, consisting of the following:

- A desktop study of the available information and publicly available datasets for the establishment of the baseline conditions at the site of the proposed remediation project and in the wider area;
- A review of relevant plans and strategic documents;
- An assessment of all likely impacts to the environment arising from waste generated in the Remediation and Operational Phases based on the information gathered from the desktop study, using the EPA criteria; and
- Identification of mitigation measures to reduce or remove the impacts identified in the impact assessment.

The methodology is consistent with relevant guidance including, but not limited to:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- National Roads Authority Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008);

- National Roads Authority Guidelines for the Management of Waste from National Road Construction Projects (NRA, 2008); and
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects (2006).

The characteristics of an impact relates to the quality, significance and duration of the impact. The definition of these impact characteristics as per the draft EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017) is provided below:

Quality of Effects

- **Positive Effects**: A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities);
- **Neutral Effects:** No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error; and
- **Negative/Adverse Effects:** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance).

Significance of Effects

- **Imperceptible:** An effect capable of measurement but without significant consequences;
- **Not significant:** An effect which causes noticeable changes in the character of the environment but without noticeable consequences;
- **Slight Effects:** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities;
- **Moderate Effects:** An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends;
- **Significant Effects:** An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment;
- **Very Significant Effects:** An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment; and
- **Profound Effects:** An effect which obliterates sensitive characteristics.

Duration of Effects

- **Momentary Effects:** Effects lasting from seconds to minutes;
- **Brief Effects:** Effects lasting less than a day;
- **Temporary Effects:** Effects lasting less than a year;
- **Short-term Effects:** Effects lasting one to seven years;
- **Medium-term Effects:** Effects lasting seven to fifteen years;
- **Long-term Effects:** Effects lasting fifteen to sixty years; and
- **Permanent Effects:** Effects lasting over sixty years.

The impact assessment and identification of mitigation measures aims to manage the generation of waste and resources more efficiently in order to reduce the amount of waste requiring final disposal during the Remediation and Operational Phases. Any waste which is generated will be dealt with in adherence to the waste hierarchy (Refer to Diagram 15.1), with the main priority being to prevent waste from being generated in the first place.

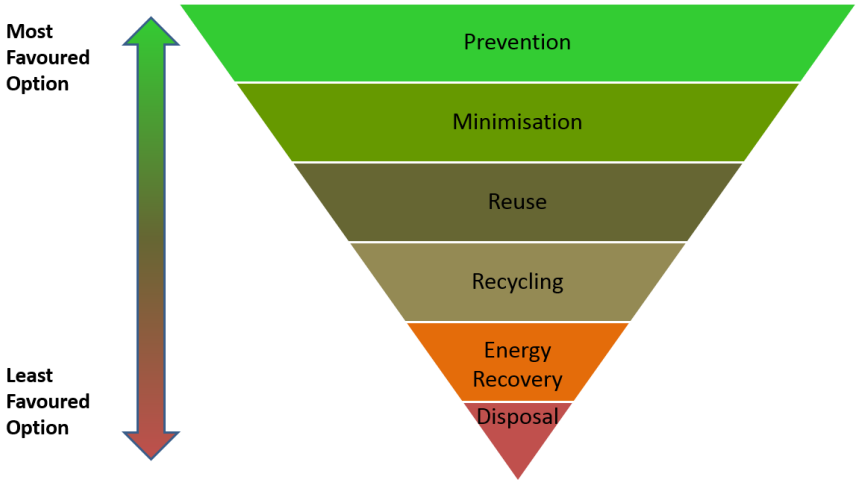


Diagram 15.1: Waste Hierarchy

15.3 Baseline Conditions

15.3.1 Study Area

The study area of the proposed Project, is located in County Kildare. The site is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The site is located in close proximity to a number of residential and commercial receptors as well as being a short distance away from the larger settlements of Johnstown, Sallins and Naas. The materials brought to site for the purposes of remediation will include heavy plant and machinery, construction materials, inert fill material and landscaping supplies. All materials on-site will be reused and recycled where possible to reduce the necessity to utilise alternative disposal routes for waste materials.

15.3.2 Plans and Policies

As part of the compilation of this EIAR Chapter the following local and national policy documents were reviewed with respect to waste management policies:

- Eastern – Midlands Region Waste Management Plan 2015-2021;
- Kildare County Development Plan 2017-2023;
- Naas Town Development Plan 2011-2017;
- Sallins Local Area Plan 2016-2022; and
- National Hazardous Waste Management Plan 2014-2020.

The Eastern – Midlands Region Waste Management Plan 2015 – 2021 (DCC 2015), compiled by Dublin City Council on behalf of all local authorities in the Eastern and Midlands Region, commits to a large and varied number of waste management policies for the region. The plan contains several policies about generally improving waste management; for example, Policy A3 sets out an objective to '*Contribute to the improvement of*

management performance across all waste streams through the implementation of policy actions and monitor progress towards national targets' (DCC 2015, p.25).

The Eastern – Midlands Region Waste Management Plan also contains policies specific to landfill remediation. For example, Policy E11 states that '*The plan supports the consideration of appropriate alternative future land uses at authorised inactive landfills…*' with the list of potential activities including '*Development of public and recreational amenities*' (DCC 2015, p.168), while Policy G2 makes a commitment to '*Roll-out the plan for remediating historic closed landfills prioritising actions to those sites which are the highest risk to the environment and human health*' (DCC 2015, p.131).

The Kildare County Council Development Plan 2017-2023 (KCC 2017) outlines eighteen waste management policies for the county, for example Policy WM3 states that it is the policy of the Council to '*Support the implementation of the Eastern-Midlands Region Waste Management Plan 2015-2021 by adhering to overarching performance targets, policies and policy* action'. WM10 states that the County Council will *'Encourage waste prevention, minimisation, reuse, recycling and recovery as methods of managing waste…*' (KCC 2017, Section 7.6.5). The County Development Plan also contains a policy specific to the Kerdiffstown Landfill Remediation Project, namely WM16 which states that the County Council are '*To work in conjunction with the Department of the Environment and all other relevant stakeholders to remediate the Kerdiffstown Landfill in a socially, economically and environmentally sustainable manner to deliver an appropriate scheme to manage and reduce environmental risk*' (KCC 2017, Section 7.6.5).

While the Naas Town Development Plan 2011-2017 (Naas Town Council 2011) and the Sallins Local Area Plan 2016-2022 (KCC 2016) do not contain any objectives specific to the Kerdiffstown Landfill site, they both contain objectives to reduce waste. The Sallins LAP contains a Strategic Environmental Objective number S4 to '*Minimise the amount of waste to landfill*', while the Naas Town Development Plan includes a policy (WM3) '*To encourage waste prevention, minimisation, reuse, recycling and recovery as methods of managing waste*'.

The National Hazardous Waste Management Plan 2014-2020 (EPA 2014) includes a section (Section 7.1) on the legacy issues of closed landfills in the context of hazardous waste. The Plan states that '*While most of these old landfills would not be expected to contain significant quantities of hazardous waste, an identification, assessment and action-planning exercise is required to deal with them*'.

15.3.3 Baseline

The Eastern – Midlands Region Waste Management Plan 2015 – 2021 (DCC 2015) includes some waste statistics for the region between 2010 and 2012. Overall there was an increase in the total amount of waste generated in the region during this period, with these volumes projected to increase further in the coming years. Whilst it has ceased operating and is listed as closed, Kerdiffstown Landfill is one of sixteen EPA authorised facilities within County Kildare (detailed within Appendix E of the Eastern – Midlands Region Waste Management Plan), only six of which are currently active. The Waste Management Plan lists 28 legacy and historic landfills within County Kildare (DCC 2015, Appendix F).

The Remedial Options Report (SKM Enviros 2013) estimates that Kerdiffstown Landfill contains a volume of approximately 3.1 million cubic metres of waste. The landfill ceased operating in 2010, at which point waste was no longer accepted at the site. The remedial options outlined in the report (SKM Enviros 2013) for the site identified the proposed option, to retain wastes on site and apply an engineered capping system, to be the most environmentally and economically viable. Discussion regarding the existing waste deposits is therefore limited in this Chapter, with reference made in Chapter 4 Description of the Proposed Project and Chapter 5 Consideration of Alternatives. Waste gas emissions as a result of the degradation of the existing waste will be controlled through the landfill gas management infrastructure. Further detail on this is addressed in Chapter 7 Air Quality, Odour and Climate.

The site was previously licensed to accept non-hazardous and inert wastes (EPA Licence W0047-02); however, the lack of available detailed waste records from the former operations means that the existence of other, non-compliant waste materials cannot be ruled out completely. There have also been a number of ground investigations carried out which have not detected any hazardous waste or any other non-compliant wastes, as well as no evidence within the groundwater monitoring results. An exception to this may be asbestos. During the

demolition of the site buildings there were trace amounts of asbestos encountered. Also given the fact that the landfill accepted C&D waste there is a risk of asbestos being found within the existing waste bodies. There is also a risk of asbestos existing in the pre-1980s residential properties due to be demolished.

The waste types currently contained within the site are summarised in Chapter 3 The Need for the Proposed Project. Please refer to Figure 3.2 for the location of the zones.

2016 / 2017 Demolition Works

A number of buildings remained on site in an unsafe condition following cessation of works at the site in 2010. Subsequently, partial demolition of these buildings, leaving only the concrete walls, was undertaken in 2016 and 2017, with materials re-used or recycled as outlined below:

- Steel frames and metal cladding – removed off-site by demolition contractors for segregation and reuse or recycling;
- Timber poles – creosote treated timber poles were removed off-site for re-use at other sites and/or sent to PDM in Kill, Co. Kildare for refurbishment and reuse;
- Rubber tyres – reused on the site where possible (to hold down temporary capping liner). Any surplus tyres were removed off-site for recycling by Crumb Rubber in Co. Louth; and
- Containers, elevated platforms, storage tanks, sorting machines and conveyors – removed off-site to the segregation facility where different material components were segregated and sent to appropriate facilities for reuse / recycling.

Remaining materials, including processed waste which had been stored within these buildings, was removed to the lined cell (Zone 3) of the site for disposal.

As part of the demolition works a waste quarantine area was identified for use on-site during the works, located beside former Building 2 near the current site office. This bunded quarantine area was utilised for the storage of suspected non-compliant wastes, until the waste can be tested and appropriate disposal route identified.

Waste Tyres

Whole tyres have been used on site to provide an engineering function, being the weighting and anchorage to the temporary (geosynthetic) capping system in the lined cell (Zone 3). These tyres will require to be removed as part of the remediation works as they cannot be disposed to landfill under the Landfill Directive (1999/31/EC). The List of Wastes Code (LoW) (also often referred to as the EWC code) and the estimated quantity of tyres (based on aerial photography) is outlined in Table 15.2 below.

Table 15.2: Tyres Currently Existing on Site to be Removed During the Remediation Phase

LoW Code	Description	Quantity Estimate
16 01 03	End of Life Tyres	5,000 @ 10kg = 50 tonnes

Site Management Waste

The types of waste currently generated on-site due to ongoing management, maintenance and security activities are:

- General waste and mixed recyclables from the site office and security huts;
- Minimal amounts of hazardous waste such as fluorescent lightbulbs, lab reagents, batteries and fuel containers from the site office and security huts;
- Wastewater from on-site sinks and toilets;
- Leachate, collected from the lined cell (Zone 3), tankered off-site for disposal; and
- Occasional interceptor waste from the on-site surface water drainage network.

The lined cell located in Zone 3 of the site includes leachate collection facilities. Leachate collects within the lined cell and is tankered off-site to a licenced facility, currently Ringsend WWTP (licence D0034-01) for disposal. Since 2011 there has been an average of 12,142 cubic metres of leachate disposed of in this manner per year, or 1,012 cubic metres per month. The amount of leachate needing to be removed during any time period has been dependent on the amount of rainfall during that period.

The waste types currently generated by the site are summarised in Table 15.3 below. Information on waste quantities were taken from the 2014 and 2015 Annual Environmental Reports as applicable.

Table 15.3: Waste Types Currently Generated On-Site

Waste Type	Approx. Annual Quantity	Disposal Route
General Waste (LoW: 20 03 01)	0.506 tonnes (2015)	Disposed of through Thornton's Recycling (NWCPO-09-01190-01) or AES (NWCPO-08-10601-05)
Mixed Dry Recyclables (LoW: 20 03 01)	0.095 tonnes (2015)	Disposed of through Thornton's Recycling (NWCPO-09-01190-01) or AES (NWCPO-08-10601-05)
Hazardous Waste (LoW: Various)	Minimal	Disposed of on an as required basis through appropriate fully licensed hazardous waste contractor.
Wastewater (from sinks and toilets)	Relatively small quantities which are stored in an on-site tank.	Storage tank periodically emptied by Elsatrans Ltd. (NWCPO-12-11124-01) to Ringsend Wastewater Treatment Plant (EPA Licence D0034).
Leachate (LoW: 19 07 03)	12,142m^3 (annual average since 2011)	Collected by Elsatrans Ltd. (NWCPO-12-11124-01) to Ringsend Wastewater Treatment Plant (EPA Licence D0034-01).
Interceptor Wastewater (LoW: 13 05 07*)	Occasional as required - none in 2015, 32,940 kg in 2014	Transported by Enva (NWCPO-08/01116-02) to Enva Facility (EPA Licence W0196-01).

15.4 Predicted Impacts

A description of the proposed Project is included in Chapter 4 Description of the Proposed Project, but key elements will include re-profiling of the site, installation of an engineered capping system across the waste, and construction of infrastructure to manage gas and leachate.

15.4.1 Remediation Phase

An application for an Industrial Emissions Activities Licence (IEAL) is to be submitted to the EPA in parallel with the planning application. Acceptance of imported materials will be controlled under specifications and acceptance criteria, to comply with the IEAL. Operations on site will also be regulated by the EPA during the Remediation and Operational Phases.

Excavated Materials / Demolished Structures

The proposed Project will involve re-profiling of the site to address the current over-steep slope angles and to accommodate infrastructure for long-term maintenance of the site. This will involve the re-profiling and movement of waste material within the site. It is anticipated that this material would not be removed from the site as it would all be used to re-profile the site except in the unlikely event that hazardous material is found within the excavated waste. If there is hazardous waste within the waste bodies, the excavation and disturbance of the waste bodies would have the potential to mobilise contaminants. See the Section on Hazardous Waste below for further detail on hazardous waste.

The remaining existing concrete structures located within the site will be demolished. There will be waste rebar arising as a result of this demolition, which will be removed from the site for reuse or recycling. Concrete will be crushed and screened on site for re-use in the remediation works. Three properties, located to the west and south of the site, will be demolished to facilitate construction of a new access roundabout and provide additional

area for temporary storage of materials (during the Remediation Phase) and a third multi-use sports pitch (during the Operational Phase). The current site office prefab structure will also need to be removed once the new site compound has been constructed.

Due to the generation of waste such as rebar from the demolition works, the impact of excavated materials and demolished structures is assessed as negative with a slight significance and a short-term duration.

Surplus Material

Surplus material and waste may occur where material supply exceeds material demand. While some surplus materials may have reuse potential, other materials may be considered as waste and fall under relevant regulatory controls. Materials brought to site but not fully utilised for their original purpose can result in waste such as damages, off-cuts and surplus products. There is unlikely to be any surplus materials arising from re-profiling works as it is envisaged that all such material will be reused in the remediation of the site.

The potential environmental effects of surplus materials would primarily be associated with the production, movement and transport, processing and, if required, the disposal of the materials at licensed / permitted facilities. It is therefore assessed to have a negative impact of slight significance and a short-term duration.

Waste Management

Poor practice when it comes to the storage, handling, transportation and/or disposal of waste materials during the Remediation Phase could have the potential to cause pollution to the air, soil, groundwater and/or surface waters. Such poor practices could include locating unmanaged stockpiles of wastes near sensitive receptors, improper storage of chemicals, or improper segregation of wastes on-site.

Without proper implementation of waste management plans on-site, the impact is assessed as negative, with a moderate significance and a short-term duration.

Hazardous Waste

Due to the need to re-profile the site there is the possibility that hazardous wastes may be encountered. The disturbance of this ground during the remediation works may lead to the release of contaminants into the air, ground or water. To date there has been no hazardous waste discovered mixed within the waste bodies at the site as per the Remedial Options Report (SKM Enviros 2013), however the impact and management of such waste needs to be considered in the event that any is encountered during the remediation works.

Aside from the possibility of discovering unknown hazardous wastes within the existing on-site waste during re-profiling works, there is likely to be some hazardous waste generated during the Remediation Phase through maintenance of plant and machinery, such as waste chemical containers and waste oils, and the demolition of some pre-1980s houses which may contain asbestos. There will also continue to be minimal amounts of hazardous waste produced by the site offices such as fluorescent tubes, lab reagents and batteries.

Due to the slight potential of disturbing unknown hazardous waste during re-profiling works and remobilisation of contaminants into the environment, the impact is assessed as negative, with a moderate significance and short-term duration.

Leachate and Effluent

Leachate and effluent will continue to be produced during the Remediation Phase of the proposed Project, with management of both to continue as per the baseline until planned sewer connections have been installed and commissioned. Surface water runoff will also continue to be generated during the remediation of the site. During the Remediation Phase of the proposed Project the leachate management system and sewer connection to Johnstown Pumping Station will be constructed allowing for leachate to leave the site for treatment at Osberstown WWTP.

Any interruption to leachate management processes, or uncontrolled discharge of leachate, effluent or surface water runoff from the site during remediation works could have the potential to cause pollution to the soil, groundwater and surface waters during the Remediation Phase of the proposed Project. Without proper implementation of good leachate, effluent and surface water management practices on-site, the impact is assessed as negative, with a moderate significance and a short-term duration.

15.4.2 Operational Phase

The likely waste types which will arise during the Operational Phase of the proposed Project will be generated through general multi-use public park use and maintenance activities. The nature of the proposed Project being a multi-use public park, there is likely to be small amounts of general waste and littering associated with the use of the public park by the general public. Operation, maintenance and upkeep of the public park is likely to generate some general waste, hazardous waste (fluorescent tubes and batteries), green waste through landscaping activities, wastes from surface water drainage maintenance (i.e. drainage and interceptor cleaning), and effluent and leachate through a wastewater drainage connection to Johnstown Pumping Station and on to Osberstown Wastewater Treatment Plant for treatment.

As there are only small amounts of waste likely to be generated on the site during the Operational Phase, foul sewage from changing rooms and the site office will be discharge to Johnstown Pumping Station via a buried pipeline and, other than in emergency situations, the tankering of leachate off-site for disposal will have ceased with the introduction of a further buried connection to Johnstown Pumping Station, the impact is assessed as positive, with slight significance and a long-term duration.

15.5 Mitigation Measures

15.5.1 Remediation Phase

Excavated Materials / Demolished Structures

It is estimated that all of the material removed during re-profiling works will be reused on-site as part of the remediation of the site. Inspections will be undertaken of the material to ensure suitability for reuse and any opportunity for processing to achieve other uses on site. Should any waste material be suspected to be non-compliant, the appointed contractor will be required to quarantine that waste by constructing a perimeter bund and placement of a tarpaulin or other suitable cover over the waste until such time as testing is undertaken and waste classification confirmed. In the event that any of the excavated material is deemed to be hazardous, it will be removed for disposal by a licensed waste contractor to a suitably licensed facility.

With respect to the demolition of the on-site concrete structures, the rebar will be removed from the site for reuse or recycling. The appointed contractor will be responsible for the compliant management of the waste rebar. The concrete which arises from the demolition of the concrete structures will be crushed and reused on-site. Waste arising from the demolition of the three properties which fall under CPOs will be managed by the appointed contractor in accordance with the Construction Environmental Management Plan (CEMP).

Surplus Material

All waste materials excavated as part of the remediation works will remain on-site, with no surplus materials envisaged to be generated. An exception to this is the rebar from the concrete structures and waste tyres currently used to anchor the temporary geosynthetic capping in Zone 3, which will be removed off-site for reuse or recycling. In the event that any materials are generated during excavation, which cannot be used on the site, it will be inspected, handled and disposed of in accordance with the CEMP or as stated in the Section on hazardous waste below.

Materials which will require to be imported to the site to facilitate the remediation works will be appropriately sourced and managed to ensure that the material is of suitable engineering grade for the proposed Project. In so far as is possible, materials will be ordered within a reasonable timeframe of when they will be required on-site. This should prevent waste being generated through over-ordering, or through materials degrading due to long periods of storage on-site prior to use.

Where material needs to be stockpiled within the site the appointed contractor will be responsible for management of the stockpiles in accordance with the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA 2009) to ensure that surface water and groundwater are protected from contamination and these provisions will be detailed in the CEMP. Please refer to Chapter 4 Description of the Proposed Project for further information and requirements on stockpile management.

As a minimum stockpile management will include:

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

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

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

Waste Management

The appointed contractor(s) responsible for the remediation works will ensure that any facility to which waste is brought is licensed / permitted in compliance with waste management legislation and will obtain the appropriate certification of disposal / destruction of waste.

Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a CEMP. The CEMP shall contain the mitigation measures and plans identified in the following Sections and ensure that they are fully implemented during the Remediation Phase, to prevent or reduce the impacts identified in the impact assessment.

The CEMP will outline measures and provisions for the management of waste during the Remediation Phase, and will take the following guidance documents into consideration:

- Best Practice Guidelines on the preparation of Waste Management Plans of Construction and Demolition Projects, Department of the Environment, Heritage and Local Government, July 2006;
- CIRIA document C692 – Environmental Good Practice on site;
- CIRIA document 133 Waste Minimisation in Construction;
- National Hazardous Waste Management Plan 2014-2020; and
- Guidelines for the Management of Waste from National Road Construction Projects, NRA 2008.

Hazardous Waste

As well as hazardous wastes generated by the remediation works, there is a slight possibility of encountering some unknown hazardous waste during the remediation works. If such waste types are uncovered, further investigation, testing and risk assessment will be undertaken to determine the appropriate actions to be taken with regards to compliant removal and disposal of such waste.

Materials identified as hazardous will be required to be suitably disposed of in a licensed hazardous waste disposal facility. Where practicable, the closest suitable facilities to the proposed Project will be selected to reduce impacts associated with vehicle movements such as air emissions and noise. There are no facilities within County Kildare which accept hazardous wastes. There are a number of facilities located in Dublin, the

closest of which is Rilta which is approximately 17km from the proposed Project. There is also an Enva facility in Dublin which is approximately 25km from the proposed Project. Enva also have a facility in Portlaoise for the treatment of contaminated soils, which is approximately 60km from the site of the proposed Project.

Any such material will be managed in accordance with waste management legislation and the following requirements:

- Excavation will be targeted and stockpiling will be managed in order to prevent potential contaminants from being released into the surrounding environment;
- All hazardous waste will be segregated from non-hazardous waste, with different types of hazardous waste being segregated from each other if safe to do so. Each hazardous waste storage location will be clearly signposted stating the type of waste and that it is hazardous; and
- A Waste Transfer Form (WTF) will be used to record the transportation of hazardous waste within the State and will be required of any movements of hazardous waste arising during construction of the proposed Project. Should the need arise for the Transfrontier Shipment (TFS) of waste, the movement between countries is subject to control procedures under the EU and national legislation and guidance, such as the Waste Management (Transfrontier Shipment of Waste) Regulations, 2007.

The appointed contractor, as the waste producer, will be responsible for ensuring the compliant disposal of all wastes during the Remediation Phase of the proposed Project, and as such will be required to retain records of all hazardous wastes. Kildare County Council will monitor that all waste arising as part of the Remediation Phase is handled and disposed of compliantly by the appointed contractor as per these requirements. Copies of all testing will be retained by the KCC Site Manager.

Leachate and Effluent

During the Remediation Phase of the proposed Project, the management of leachate and effluent will need to be maintained at the baseline levels at a minimum. A Leachate Management Plan (Appendix A4.4) has been developed and shall be implemented to ensure continued collection and compliant disposal of leachate being generated from the site.

The Leachate Management Plan outlines leachate management proposals throughout a number of different stages of the remediation works. These include:

- Operation in discrete areas to minimise the area of exposed waste;
- Interception of any leachate outbreaks during waste excavation or re-profiling activities;
- Provision of daily cover to exposed wastes; and
- Progressively remediate the site with a landfill cap.

Discharge of runoff during remediation works will not be permitted as per the Surface Water Management Plan (Appendix A4.6), with ponds lined with geomembrane liner to offer additional protection to groundwater during this period. Should a situation arise where runoff levels are becoming higher than can be adequately collected and maintained within the site, the collected water will be tankered off-site by a suitably licensed contractor for disposal at a suitably licensed facility.

The leachate pipeline and Landfill Infrastructure Compound shall be built during the early Phases of the remediation works, allowing for the leachate collected in Zone 3 to be discharged from the site through the new system to the Johnstown Pumping Station. The appointed contractor will be responsible for ensuring the compliant management and disposal of leachate during the Remediation Phase of the proposed Project.

15.5.2 Operational Phase

Management of wastes arising during the Operational Phase of the proposed Project will be the responsibility of Kildare County Council as the licensee. The Council may appoint contractor(s) to provide waste management and landscaping services on their behalf. Management plans for the operation and maintenance of the multi-use public park shall be produced and adhered to by all landscaping and maintenance personnel.

Waste silts and hydrocarbons / oily waters collected in the on-site drainage interceptors will be handled and disposed of through appropriately licensed contractors as and when required. The specialist contractors will clean out the interceptors and the waste material will be sent to a suitable licensed facility for treatment and/or disposal.

Leachate and effluent from the site compound and changing room facilities will be disposed of to Johnstown Pumping Station for treatment at Osberstown WWTP via a sewer connection to the local sewer network under agreement with Irish Water. There may be occasions where leachate will need to be tankered off-site for disposal. This will only arise at times when there are any abnormal occurrences with the treatment process or restrictions on discharge to sewer. It is anticipated that there will be a call-off agreement in place with a licensed contractor such that when tankers are needed they can be mobilised prior to full utilisation of leachate storage capacity at the site. Refer to Appendix A4.4 Leachate Management Plan for further detail on leachate management and disposal.

15.6 Residual Impacts

The residual impacts associated with the proposed Project after adherence to the implementation of mitigation measures are summarised in Table 15.4.

Table 15.4: Residual Impact after Mitigation Measures

Impact	Significance Pre Mitigation	Significance Post Mitigation
Remediation Phase		
Excavated Material / Demolished Structures	Slight Negative	Imperceptible Negative
Surplus Material	Slight Negative	Imperceptible Negative
Waste Management	Moderate Negative	Imperceptible Negative
Hazardous Waste	Moderate Negative	Slight Negative
Leachate Management	Moderate Negative	Imperceptible Negative
Operational Phase		
Operation of the multi-use public park	Slight Positive	Moderate Positive

15.7 Difficulties Encountered in Compiling Information

There is some degree of uncertainty with regards to the types of waste contained within the site. To date, no hazardous waste has been encountered within the waste body at the site; however, the scale of the waste body and the need to excavate some materials in order to re-profile the landscape may result in the disturbance of some hazardous materials heretofore unknown about. The outline design of the remediation works has taken into consideration a cut-fill balance, reducing as far as practicable the need for excavation to existing materials to reduce impacts and disturbance.

15.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact of waste. These projects are discussed in the following paragraphs.

15.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western

boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

15.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

15.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

15.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

15.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. It is not anticipated that there would be any significant cumulative impact with respect to waste as a result of this project.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

15.9 References

- CIRIA (1997). CIRIA Special Publication 133: Waste Minimisation in Construction – Site Guide
- CIRIA (2010). CIRIA Report C692 – Environmental Good Practice on site
- Department of Food, Environment and Rural Affairs UK (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites
- Department of Environment, Heritage and Local Government (2006). Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects
- Dublin City Council (2015) (*on behalf of the Eastern-Midlands Waste Region*). Eastern-Midlands Region Waste Management Plan 2015-2021
- Environmental Protection Agency (2002). Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2003). Advice notes on current practice in the preparation of Environmental Impact Statements
- Environmental Protection Agency (2015). Revised Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2015). Advice notes for preparing Environmental Impact Statements (Draft)
- Environmental Protection Agency (2014). National Hazardous Waste Management Plan 2014-2020
- Jacobs (2014) (*on behalf of the Environmental Protection Agency*). Kerdiffstown Landfill Annual Environmental Report 2014
- Jacobs (2015) (*on behalf of Kildare County Council*). Kerdiffstown Landfill Annual Environmental Report 2015
- Kildare County Council (2017). Kildare County Development Plan 2017-2023.
- Kildare County Council (2016). Sallins Local Area Plan 2016-2022
- Naas Town Council (2011). Naas Town Development Plan 2011-2017
- National Roads Authority (2008). Environmental Impact Assessment of National Road Schemes – A Practical Guide
- National Roads Authority (2008). Guidelines for the Management of Waste from National Road Construction Projects
- National Roads Authority (2008). Guidelines for the Management of Waste from National Road Construction Projects
- SKM Enviros (2013) (*on behalf of the Environmental Protection Agency*). Kerdiffstown Landfill Remediation Project – Remedial Options Report

16. Population and Human Health

This Chapter assesses the potential effects of the proposed Project on the people in the surrounding community. The assessment of the impact to receptors within a 1km radius was considered in line with best practice given the fixed nature of the site boundary.

Generally, the proposed Project will have moderate beneficial effects on the surrounding community. Only the Remediation Phase works are anticipated to have some short-term slight negative impacts related to increases in noise, odour and the visual intrusion of the works. A series of mitigation measures have been proposed to reduce these impacts on nearby receptors, including regular communication with local residents and the Community Liaison Group to ensure that they are kept up to date on progress and allowing a forum through which concerns or complaints can be made.

The proposed Project as a whole will benefit the local community. Improvements in site access for vehicles, cyclists and pedestrians will have a permanent positive impact on the community who use the L2005 Kerdiffstown Road. There will be employment created by the remediation works which will in turn benefit the local economy. The remediation of the site from a brownfield site into a multi-use public park will positively contribute to the health of the local community due to the improvement of the environment in and around the site as well as the provision of an amenity for the community to use for recreational activities.

16.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as "the proposed Project") on the surrounding community during the Remediation and Operational Phases.

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

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children's playground, etc. and management of the site as a remediated landfill. Table 16.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

Table 16.1: Summary of Key Activities during the Remediation and Operational Phases

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

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

Socio-economics can be defined as the interaction between social and economic factors that have potential to affect people and communities. These factors may include changes in employment levels and economic opportunities, community demographics, demand for public services and the amenity value of the local area. These factors will be assessed along the basis of anticipated consequences arising from a change in site conditions at Kerdiffstown Landfill once the Remediation process is complete and the final end-use of the site is operational.

The term 'community' can be defined in many ways, and at different geographic scales. For example, the catchment area for those who use services such as schools and other educational institutions, GP surgeries, libraries, town halls, local shops, recreation facilities, green spaces and any other communal facilities may be defined as the local community. The wellbeing of a community may also be influenced by economic factors such as the state of the economy and the availability of employment opportunities.

This assessment covers effects at a local level which may affect people that live in the Kerdiffstown and Johnstown communities and wider effects upon the urban centre of Naas, which comprises of a population of approximately 21,393 (CSO, 2016).

16.1.1 Policy and Plan Context

A brief outline of some of the key national, regional and local plans and policies is provided below, which provide context as to the importance of taking appropriate action to protect the local environment and population with regard to existing and legacy waste management facilities.

The National Hazardous Waste Management Plan was published by the EPA in 2014. The 'National Hazardous Waste Management Plan' sets out measures aimed at improving the management of hazardous waste, reducing the possibility of environmental and health impacts of unregulated waste disposal and preventing and reducing the generation of hazardous waste in general. Following review of the plan, it was determined that the Kerdiffstown Landfill site is a non-hazardous waste site.

The Eastern-Midlands Region Waste Management Plan 2015 - 2021 is the Waste Management Plan for the Eastern-Midlands Region which is made up of the local authorities of Louth, Offaly, Meath, Wicklow, Westmeath, South Dublin, Dublin City, Fingal, Dún Laoghaire, Kildare, Laois and Longford. In its policy document it states as one of its strategic objectives that "*Protecting the environment and health of citizens in the region from potential adverse impacts resulting from waste management activities is a key responsibility of the local authorities. The location of waste facilities can help to address many of their potential impacts, and local authorities will aim to improve guidance in this area*. The known environmental hazards at Kerdiffstown and the possible future consequences of these hazards are directly related to the proposed objective to remediate the site which is being led by Kildare County Council.

The Kildare County Development Plan 2017 - 2023 sets out the overall strategy for the proper planning and sustainable development of County Kildare over the period of the plan, in this case 2017-2023. The Kildare County Development Plan 2017-2023 has been published and includes policy WM 16 *"To work in conjunction with the Department of the Environment and all other relevant stakeholders to remediate the Kerdiffstown Landfill in a socially, economically and environmentally sustainable manner to deliver an appropriate scheme to manage and reduce environmental risk".*

While the site is outside the zone of influence that is under the remit of the Naas Development Plan 2011-2017, the town's development plan was consulted as Naas possesses the majority of sensitive and community receptors that may be adversely impacted as a result of any negative event at the site.

16.1.2 Study Area

The site of the proposed Project, is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The site is located in close proximity to a number of residential and commercial receptors as well as being a short distance away from the larger settlements of Johnstown and Naas. In addition to the above, the site neighbours a number of recreational land uses, specifically Palmerstown House Estate and Naas Golf Course to the north-east and north-west respectively.

The proposed Project is to remediate the existing site to reduce risk to the environment and allow for a suitable and practical site end-use thereafter. The end-use option being proposed is for a multi-use public park with facilities such as sports pitches, changing rooms, a children's playground and running/walking tracks. This end-use option has the potential to bring socio-economic/community benefits to the surrounding area.

16.2 Methodology

An initial desktop scoping exercise (Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report, Jacobs 2016) was completed in October 2016, whereby available information on the receptors within the study area was identified (1km beyond the land-take boundary of the proposed Project) (refer to Figure 3.4, and outlined in Diagram 16.1). Professional judgement was applied to assign a level of sensitivity to receptors (low, medium, or high), and to determine the nature of the foreseen impact (beneficial, negligible or adverse).

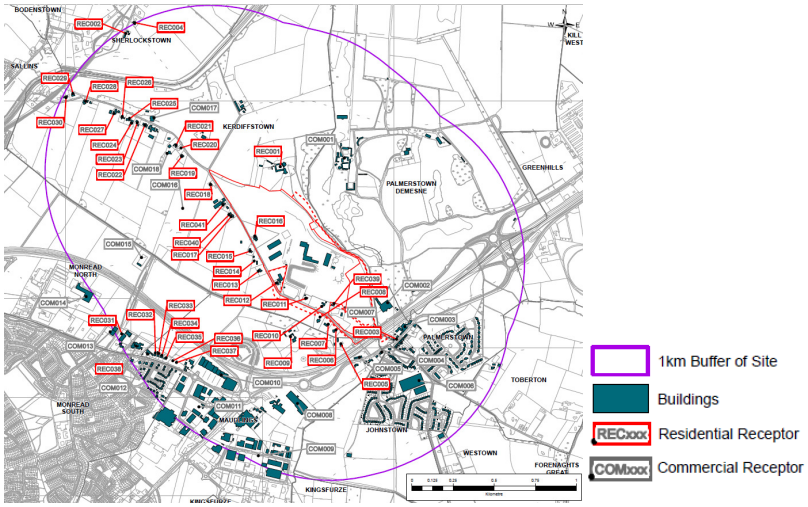


Diagram 16.1: Key Residential and Commercial Receptors within 1km of the Site

Receptors considered to be of 'high' sensitivity would typically include hospitals, schools, day-care facilities or nursing homes, where disruption would result in a significant inconvenience to the residents and/or the functionality of the receptor. Receptors of 'medium' sensitivity would typically be those that would be resilient enough to overcome the challenges posed by the Project, for example commercial businesses. Receptors considered to be of 'low' sensitivity would include, for example, disused recreational space and unoccupied buildings.

Following the approach adopted for the EIS Scoping Report, the assessment themes for the purpose of this report, together with the identified receptors and their level of sensitivity, are set out in Table 16.2. Refer to Figure 3.4 for the location of residential and commercial receptors within 1km of the site.

Table 16.2: Identified Receptors within the Study Area

Assessment Theme	Receptors Identified Within the Study Area	Level of Sensitivity (Low; Medium; or High)
A. Amenities & Recreation	Kerdiffstown House, St. Vincent de Paul (REC001) Palmerstown House Estate (COM001) Naas Golf Club (COM017) and Naas Driving Range (COM018) Grand Canal Morell River	High Medium Medium Medium Medium
B. Community Severance & Accessibility	Access – non motorised users Access – motorised users Receptors on the L2005 Kerdiffstown Road North Leinster Ambulance Service Depot (Monread Road in Naas)	High High High High
C. Employment	Johnstown Garden Centre (COM002) Johnstown Inn (COM003) Discount Designer Tiles and Bathrooms (COM005) Londis Distribution Centre (Vacant at Present – May 2017) (COM006) Mike Brown Caravans (COM007) Naas Industrial Estate (COM009) Globe Retail Park (COM010) The Maudlins Industrial Estate (COM011) Centra, Monread Road (COM012) Centra, Johnstown (COM004) Green Isle Foods (COM014)	Medium Medium Medium Medium Medium Medium Medium Medium Medium Medium Medium
D. Land-use	Landfill Site Surrounding Lands	Low Medium
E. Economy & Tourism	Grand Canal Naas Town Centre Monread North Centre (Tesco Extra) Sallins Village Johnstown Village	High High Medium High High
F. Human Health	Naas Town Centre Johnstown Village Sallins Village Refer to Chapter 7 Air Quality, Odour and Climate specific receptors Refer to Chapter 8 Noise and Vibration specific receptors Refer to Chapter 12 Soils, Geology, Contaminated Land and Groundwater specific receptors Refer to Chapter 14 Traffic and Transport specific receptors	High High High High High High High

A comprehensive literature review of existing data sets and reports was completed, including the following:

- Kerdiffstown Environmental Baseline Report (SKM Enviros, 2013);
- Kerdiffstown Landfill Facility; Site Profile Material Use and Capping (SKM Enviros, 2013);
- Sallins Local Area Plan: 2016 - 2022;
- Naas Town Development Plan 2011 – 2017;
- Kildare County Development Plan 2011 – 2017;

- Kildare County Development Plan 2017 – 2023;
- National Hazardous Waste Management Plan; and
- A Framework for Health and Wellbeing 2013 – 2025.

A site visit was carried out in Summer 2016 of the surrounding area around the site to a distance of 1km radius approximately, consistent with a similar initial assessment carried out as part of the Kerdiffstown Landfill Remediation Project Environmental Impact Statement Scoping Report (Jacobs, September 2016). This distance was extended where required to include the relevant potential receptors. Visual inspections were also made of the surrounding residential/commercial properties and community amenities within the study area. The assessment of 1km radius was considered in line with best practice given the fixed nature of the site boundary.

Regular consultation has been held by the project team with the Community Liaison Group, consisting of the following parties:

- Kerdiffstown Residents Association;
- St. Vincent de Paul;
- Naas Chamber of Commerce;
- Clean Air Naas (up to November 2016); and
- Local landowners.

Consultation on the EIAR has also been undertaken with the following bodies and institutions:

- An Taisce;
- Birdwatch Ireland;
- Commission for Electricity Regulation;
- Coras Iompair Éireann (CIE);
- Department of Agriculture, Food, and the Marine;
- The Department of Arts, Heritage and the Gaeltacht (including the Development Application Unit);
- Department of Communications, Climate Action & Environment;
- Department of the Defence;
- Department of Jobs, Enterprise, and Innovation;
- Department of Justice and Equality;
- Department of Housing, Planning, Community & Local Government;
- National Transport Authority;
- Environmental Protection Agency;
- Electricity Supply Board;
- Fáilte Ireland;
- Geological Survey of Ireland;
- Health and Safety Authority;
- Health Service Executive (HSE);
- Inland Fisheries Ireland;
- Inland Waterways Association – Kildare;
- Kildare County Council;

- Transport Infrastructure Ireland;
- Office of Public Works;
- South Dublin County Council;
- Teagasc;
- The Heritage Council;
- Tourism Ireland;
- Waterways Ireland; and
- Wicklow County Council

This assessment is a study of the potential indirect and direct socio-economic impacts of remediating the site as well as the designated end-use option that will be employed thereafter. The study was undertaken and aided by the undertaking of an extended study of the environmental baseline, site visit, public consultation and further assessment where deemed appropriate.

This assessment has had regard for and was carried out in accordance with relevant national and EU legislation and guidance, including but not limited to the following documents:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised guidelines, due to be finalised in 2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015);
- Department of Public Expenditure and Reform's - The Public Spending Code;
- Additionality Guide (Homes and Communities Agency) (2014); and
- Fáilte Ireland guidelines on the treatment of Tourism in an Environmental Impact Assessment (2007).

Receptors were assessed for sensitivity, magnitude and significance to provide an appropriate and adequate assessment of how they could be impacted by the Remediation and Operation of the proposed Project. The characteristics of this impact assessment are defined below, as per the EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, March 2002 and draft guidelines for consultation, EPA, 2015):

- **Quality of Effects**
  - **Positive Effects:** A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities);
  - **Neutral Effects:** No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error; and
  - **Negative/Adverse Effects:** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance).
- **Significance of Effects**
  - **Imperceptible:** An effect capable of measurement but without significant consequences;
  - **Not significant:** An effect which causes noticeable changes in the character of the environment but without noticeable consequences;
  - **Slight Effects:** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities;
  - **Moderate Effects:** An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends;

- **Significant Effects:** An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment;
- **Very Significant Effects:** An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment; and
- **Profound Effects:** An effect which obliterates sensitive characteristics.

- **Duration of Effects**
  - **Momentary Effects:** Effects lasting from seconds to minutes;
  - **Brief Effects:** Effects lasting less than a day;
  - **Temporary Effects:** Effects lasting less than a year;
  - **Short-term Effects:** Effects lasting one to seven years;
  - **Medium-term Effects:** Effects lasting seven to fifteen years;
  - **Long-term Effects:** Effects lasting fifteen to sixty years; and
  - **Permanent Effects:** Effects lasting over sixty years.

GIS mapping was used to visually record information relevant to the assessment.

The assessment considers receptors under the following main study themes: Amenities & Recreation, Community Severance & Accessibility, Employment, Land-Use, Economy & Tourism and Human Health. Note that 'Amenities' has been extended here to include 'Recreation'. This allows for further differentiation to be made between effects on recreation versus effects on tourism.

The approach to assessing each of these Assessment Themes is described as follows:

A. Amenities & Recreation

The assessment considers the potential impacts on amenities of a recreational nature in the immediate locality of the proposed Project, including the ability of the local population to enjoy the general character and surrounding quality of the area. Leisure activities (e.g. walking, running, golf) in the areas located in close proximity (1km approximately) to the site were considered, including local green spaces, wooded areas, and waterbody amenities.

B. Community Severance & Accessibility

The assessment focuses on the degree to which the general public is able to access community services and facilities, and whether this is enabled or hindered by the proposed Project, as well as whether or not the proposed Project enhances or is detrimental to the visual amenity of the area. Also included in the assessment is the proximity of the site to educational receptors. Given that the anticipated construction workforce would not exceed 50 No. at any given time on site, the cultural integration of the workforce within the locality during remediation is not anticipated to be a factor.

C. Employment

The assessment of employment was based on the anticipated size of the workforce, the practiced norms within the construction industry, and the duration of the proposed works with respect to the Remediation Phase and the impact of these factors on direct and indirect employment opportunities locally close to the proposed Project. An analysis of impacts on employment during the Operational Phase was not undertaken as direct employment opportunities during this Phase are anticipated to be minimal and not anticipated to promote indirect employment opportunities.

D. Land Use

The assessment considered the existing and future use of land at the site of the proposed Project, and assessed the impact on the land use economic function.

E. Economy & Tourism

This assessment considers the potential for impacts on the local and regional economy and the general economic stimulation that could result from the proposed Project's remediation and end-use operation. The local economy is defined as the town of Naas and its immediate environs. The regional economy is defined as the Greater Dublin Area (GDA) - the area encompassing the Dublin and Mid-East Regions, respectively, comprising of Dublin City and counties Dun Laoghaire-Rathdown, Fingal and South Dublin in the Dublin Region, together with the counties of Kildare, Meath and Wicklow in the Mid-East Region.

Tourism is often considered an important sector for the local and regional economy and as such, the assessment also considers potential impacts on the tourism industry.

F. Human Health

According to the Institute of Public Health in Ireland (IPH), Public Health is the science and art of promoting and protecting health and well-being, preventing ill-health and prolonging life. According to IPH, public health is population based, emphasising a collective responsibility for the health, its protection and prevention of disease. They also link public health to the underlying socio-economic and wider determinants of health within the subject society.

Health impacts are assessed via biophysical factors such as air, noise and water, as relevant. The human health aspect will primarily be addressed under other Chapters of the EIAR, mainly Air Quality, Odour and Climate, and Soils, Geology, Contaminated Land and Groundwater and Traffic and Transport as outlined and indicated within the EPA's revised (draft) Guidelines on the Information to be Contained in Environmental Impact Statements (EPA 2015). The Air Quality, Odour and Climate assessment includes a quantitative assessment of the potential air quality impacts of the proposed Project and benchmarking the results against Air Quality Standards and Guidelines formulated for the protection of human health. The Soils, Geology, Contaminated Land and Groundwater assessment includes a human health risk assessment via comparison with appropriate assessment criteria. The Traffic and Transport assessment will include an assessment of accidents and safety, pedestrian amenity and severance of the community.

16.3 Baseline Conditions

16.3.1 Amenities and Recreation

The site is located approximately 3km north-east of Naas town centre within an extensive green belt, consisting of linear residential and commercial properties, undeveloped agricultural land as well as recreational/leisure amenity areas in the form of golf courses. This green belt possesses considerable tree coverage and shrubbery along site boundaries and within the lands of the recreational/leisure amenities, creating an extensive open landscape. The urban footprint of Naas and suburban village of Johnstown are located within 1km of the site, existing as a highly developed and concentrated area of residential, commercial, community and leisure receptors.

Information on the utilisation of golf courses close to the site is presented in Table 16.3.

Table 16.3: Utilisation of Amenity Lands (Golf Courses) Close to the Site

Golf Courses in Close Proximity to Site. / Baseline Conditions	Palmerstown House Estate (Golf Course)	Naas Golf Club	Killeen Golf Club
Location (At closest point from site boundary)	Approx. 50m west	<50m north	Approx. 1.5km north-east
No. of Annual Users (2016)	37,000 per annum (720 users on average per week)	20,000 per annum (385 users on average per week)	20,800 per annum (400 users on average per week)
Under or Oversubscribed Membership	Under-subscribed	Under-subscribed	Under-subscribed
Exclusiveness*	Medium	Low	Low

*Exclusiveness has been determined based on the quality standard of the facility/amenity as well as the cost and obligations attached to player/club membership.

The Grand Canal, considered as a cultural asset to the local community, is located approximately 550m north-west of the site and provides the local community with an amenity site suitable for walking, running and cycling.

The Morell River (located in close proximity to the eastern boundary of the site) is a tributary of the River Liffey which is the water source for the Greater Dublin Area. This river is narrow in nature with a considerable volume and velocity of water running south to north. While in the vicinity of the site, the river is not currently suitable for recreational purposes and is not easily accessible.

The Kerdiffstown site has been seen in a negative light for a considerable amount of time due to the historical activities at the site along with the fire event in 2011. The public knowledge of the landfill's negative history has contributed to additional negativity regarding the area that surrounds the site. The visual amenity/impact of the site is currently considered to be poor with most of the site's make up consisting of overgrown grassland, concrete dilapidated infrastructure and associated steel structures as well as a lined waste cell. Having said this, residential and commercial properties situated next to the site are sufficiently protected, sheltered or screened from the visual impact of the site by existing fencing and somewhat overgrown vegetation.

16.3.2 Community Severance and Accessibility

A significant community receptor or vital primary public service in proximity of the proposed Project is the North Leinster Ambulance Service Depot on the Monread Road in Naas. The location of this depot is on the northern fringes of Naas, 815m south-west of the site.

Further to this, there are no educational or community facilities within 1km of the site.

The receptors closest to the site are one-off residential dwellings or commercial premises that surround the site boundary.

There are currently no footways, cycleways or bridleways providing non-motorised access to the site. Access to the surrounding areas, including the golf courses and Kerdiffstown site itself, is provided by the L2005 Kerdiffstown Road, which forms the western boundary of the site. The L2005 Kerdiffstown Road links to the M7/N7 which forms the main motorway artery from Dublin across the East & Midlands region to Limerick in the south-west of Ireland. The strategic nature of this route and its proximity to Naas, Johnstown and Sallins has meant that a comprehensive network of routes has been developed around the site.

The site neither hinders nor promotes community accessibility. The main M7/N7 route acts to sever north from south, irrespective of the position of the site. It is likely that in its current state, the site acts as a disincentive for further development of land in the immediate proximity, thereby limiting community/commercial interest to this

undeveloped land. The likelihood of further development, including the provision of new community amenities, is significantly diminished by the presence of this former landfill.

16.3.3 Employment

The preliminary findings of the 2016 Census, undertaken on the 24 April 2016, indicated that there was a growth in population of 5.6% in County Kildare between the previous census in 2011 and 2016. Similarly, to this, the electoral division of 'Naas Town, Co. Kildare' experienced a growth in population of 3.3%.

Table 16.4: Population in County Kildare, Naas & Johnstown (2016-2006)

Population for County Kildare, Naas & Johnstown			
	2016	**2011**	**2006**
County Kildare	222,504	210,312	186,335
Naas	21,597	20,713	20,044
Johnstown	173* (provisional)	179	167

*Lack of residential house building in Johnstown likely justification for no increase in population during this period.

According to the national census in 2011, County Kildare had an average unemployment rate of 17.9%, while Naas had an average unemployment rate of 15% which was below the national average of 19% at the time. This census also showed that over a quarter (26%) of those in employment worked within the 'Commerce and Trade' industry, while just 3% worked in 'Building and Construction'.

Table 16.5: Employment in County Kildare (By Industry – 2011)

Employment by Industry in County Kildare (2011)	Daytime Working Population in County Kildare (2011)
Agriculture, Forestry and Fishing	2,828
Building and Construction	1,860
Manufacturing	10,644
Commerce and Trade	14,494
Transport and Communications	2,795
Public Administration	3,536
Professional Services	13,521
Other	6,240
Total:	55,918

The main employment centres in the area are within the urban centres of Naas and Johnstown. Commercial receptors located along the L2005 Kerdiffstown Road connecting the N7 dual-carriageway to Sallins Village also act as small scale employment centres.

16.3.4 Land-Use

At present, the land proposed for the proposed Project consists of a closed landfill, and therefore is not economically active. However, ownership of the land for the proposed Project is fragmented with a considerable number of parties being the registered owners or leaseholders.

Kildare County Council will assume ownership of relevant land folios necessary for the proposed Project's requirements through the compulsory purchase order (CPO) process (permanent). There is also a requirement for KCC to assume ownership temporarily (via temporary CPO or wayleave) in a number of areas to ensure suitable working areas, to facilitate access in order to complete the remediation works and to allow for the realignment of the L2005 Kerdiffstown Road.

The surrounding land predominantly consists of agricultural land (open farmland and pastures) as well as local recreational amenities, specifically golf courses and local commercial enterprises such as Johnstown Garden Centre and Mike Brown Caravans. There are no land designations located near the proposed Project with the exception of the Grand Canal proposed Natural Heritage Area (pNHA) approximately 550m to the north of the proposed Project at the nearest point.

16.3.5 Economy and Tourism

County Kildare is included in Fáilte Ireland's new promotional campaign 'Ireland's Ancient East' that commenced in 2016 and which promotes tourism in the eastern region based on the ancient, viking, and medieval history of the region. Naas is uniquely placed within this context, as its Gaelic name translates to 'Nás na Ríogh' or 'Meeting Place of the Kings'. This tourism campaign is the most recent initiative for the region and is anticipated to boost the tourism industry considerably during its lifetime.

The top three attractions in County Kildare throughout the period (2009-2015) are as follows:

- Newbridge Silverware Museum of Style Icons (no fee) 350,000 visitors in 2015 (no change from data reported for 2014)
- Castletown House & Parklands (fee charging) 297,691 visitors in 2015 (18% increase in numbers since 2014)
- Irish National Stud & Japanese Gardens (fee charging) 120,138 visitors in 2015 (5% increase in numbers since 2014)

Palmerstown House Estate & Golf Course and Naas Golf Club as well as the Grand Canal were highlighted as the significant tourist attractions within the locality of Naas in the Naas Town Development Plan 2011 - 2017.

In 2015, County Kildare has approximately 214,000 overseas visitors while approximately 250,000 domestic visitors (i.e. residents in Ireland) visited the county resulting in a total visitor number of nearly half a million (domestic figure is number of visitors to counties Kildare and Carlow combined).

The key economic areas would include Naas Town Centre, Monread North Centre and Johnstown and Sallins Villages.

16.3.6 Human Health

The primary residential and commercial receptors have been outlined in the Sections above. In addition the baseline conditions associated with Air Quality, Odour and Climate are outlined in Section 7.3, the baseline conditions associated with Noise and Vibration are outlined in Section 8.3, the baseline conditions associated with Soils, Geology, Contaminated Land and Groundwater are outlined in Section 12.3 and the baseline conditions associated with Traffic and Transport are outlined in Section 15.3 of this EIAR.

16.3.7 Summary of Prominent Receptors According to Assessment Theme

The most prominent receptors within the study area (1km radius) according to Assessment Theme are presented in Table 16.6. Refer to Figure 3.4 for the location of local residential and commercial receptors in close proximity to the proposed Project.

Table 16.6: Summary of Sensitivity of Receptors Identified Within the Study Area According to Assessment Theme

Assessment Theme	Receptors Identified within the Study Area	Level of Sensitivity (Low; Medium; or High)
A. Amenities & Recreation	Kerdiffstown House, St. Vincent de Paul (REC001) Palmerstown House Estate (COM001) Naas Golf Club (COM017)	High Medium Medium
B. Community Severance & Accessibility	Access – non motorised users Access – motorised users Receptors on the L2005 Kerdiffstown Road North Leinster Ambulance Service Depot (Monread Road in Naas)	High High High
C. Employment	Johnstown Garden Centre (COM002) Johnstown Inn (COM003) Discount Designer Tiles and Bathrooms (COM005) Londis Distribution Centre (Vacant at Present – September 2016) (COM006) Mike Brown Caravans (COM007) Naas Industrial Estate (COM009) Globe Retail Park (COM010) The Maudlins Industrial Estate (COM011) Centra, Monread Road (COM012) Centra, Johnstown (COM004) Green Isle Foods (COM014)	Medium Medium Medium Medium Medium Medium Medium Medium Medium Medium Medium
D. Land-use	Landfill Site Surrounding Land	Low Medium
E. Economy & Tourism	Grand Canal Naas Town Centre Monread North Centre (Tesco Extra) Sallins Village Johnstown Village	High High Medium High High
F. Human Health	Naas Town Centre Johnstown Village Sallins Village Refer to Chapter 7 Air Quality, Odour and Climate Refer to Chapter 8 Noise and Vibration Refer to Chapter 12 Soils, Geology, Contaminated Land and Groundwater Refer to Chapter 14 Traffic and Transport	High High High High High High High

16.4 Predicted Impacts

16.4.1 Remediation Phase

A. Amenities & Recreation

An increase in baseline noise levels resulting from remediation-related activities could cause disruption to users of nearby recreation and amenity areas such as Kerdiffstown House, and users of the local golf courses in close proximity to the site. Disruption could also be experienced from possible odour releases/air and dust emissions from the movement of materials on-site. There could also be impacts associated with visual amenity on receptors in the vicinity as a result of remediation works required at the site i.e. site clearance works, excavation works and, re-profiling. These impacts are addressed in detail within the specific Chapters (Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration and Chapter 9 Landscape and Visual).

There is not anticipated to be any direct socio-economic impacts on the Grand Canal or Morell River during the Remediation Phase.

As a result of the impacts described above, the potential effects were assessed as adverse, of slight significance and are anticipated to be of short-term duration, therefore the potential effect is considered to be not significant.

B. Community Severance & Accessibility

As previously mentioned (refer to Section 16.3.2), the urban footprints of Naas and Johnstown are located within the study area (1km radius of the site boundary), forming a concentrated area of residential, commercial, leisure and community receptors. A significant community receptor (primary public service) is the North Leinster Ambulance Service Depot on the Monread Road in Naas. The location of this depot is on the northern fringes of Naas, 815m south-west of the site. Despite this concentration of economic activity and location of a primary public service, it is not anticipated that this area will be impacted during the Remediation Phase as construction-related traffic will be instructed to access the site using N7 Junction 8 (junction before Junction 9 Naas North leading directly to this area in which the North Leinster Ambulance Service Depot is located) and the L2005 Kerdiffstown Road. Construction-related traffic will be instructed to avoid entering Naas.

In addition, it is not anticipated that this area (northern fringes of Naas) will be affected by noise or visually-intrusive effects from the site during the Remediation Phase as the area has a degree of severance from the site by way of the M7/N7 dual-carriageway.

New access to the site, to include improvements to the L2005 Kerdiffstown Road to the south-east of the site, will provide safe passage for heavy goods and other vehicles accessing the site during the Remediation Phase, as well as offering protection to non-motorised users including pedestrians and cyclists through the provision of a shared footway and cycleway. The footpath and cycleway will be provided as part of the proposed Project and will link to the footbridge over the N7. The realignment of the L2005 Kerdiffstown Road is considered to be positive and of moderate significance due to the improvements around access for both motorised and non-motorised users.

During remediation, the workforce is anticipated to be made up of skilled labourers. Given the anticipated size of the workforce during the Remediation Phase, it is anticipated that in general, workers are likely to commute to the site from their existing home addresses using public and private modes of transport, presenting no challenge to local services and no cultural integration issues.

These workers would possibly contribute to an increase in construction-related traffic in the area, although this is anticipated to be minimal given the anticipated size of the workforce on-site during the Remediation Phase.

It is noted that the Compulsory Purchase Order (CPO) requirements for the realignment of the L2005 Kerdiffstown Road during the Remediation Phase of the proposed Project have the potential to give rise to some adverse effects in terms of access to local residential (REC006, REC007, REC008 and REC012), commercial (COM007) and community (REC001) receptors. However, the appointed contractor will be required to maintain access to these properties throughout the Remediation Phase regardless of construction processes on-site, and therefore ensuring that community severance is avoided. On this basis, the impacts are considered to be of slight significance and short-term in duration.

C. Employment

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site, see Section 4.3.1 for details on the outline phasing of the works. Remediation of the site will generate new jobs, (i.e. appointed contractors directly employing workers to undertake the necessary works on-site) along with the potential for indirect/induced employment opportunities within the local areas of Johnstown, Sallins and Naas.

Due to the nature of the works during the Remediation Phase, it is anticipated that the number of workers at the site would be kept as low as possible. It was therefore assumed that there would be a maximum of 50 full time equivalent (FTE) construction workers at the site at any one time. The 50 FTE construction jobs are anticipated to be procured by an appointed contractor who would be awarded the remediation works contract through the appropriate tendering process, which is yet to be undertaken. The construction workforce for the proposed Project is largely anticipated to commute into the area with the expectation that there will be an increased demand for services for such items as construction materials, convenience shopping, food and drink business and accommodation locally.

In addition, given the proximity of the site to the urban settlements of Johnstown, Sallins and Naas, and the strong likelihood that the construction workforce is anticipated to consume goods and services from convenience stores, local retailers and avail of some recreational amenities, the consumer demand from the construction workforce is anticipated to facilitate some indirect and induced employment opportunities within these areas.

As a result of the impacts described above and the potential employment opportunities that the proposed Project would bring to the local area, the potential effects are assessed as positive, of moderate significance and are anticipated to be of short-term duration. Therefore, the potential effect overall is considered to be a positive significant effect.

The employment (commercial) receptors in the immediate proximity of the site face the potential of some temporary disruption from noise, air (dust and odour), visual intrusion and traffic-related issues during the Remediation Phase from the anticipated activities on-site (i.e. earth-moving and removal of vegetation/shrubbery) and off-site in relation to construction related traffic and improvements to the L2005 Kerdiffstown Road as well as the new site access. Such potential effects are assessed as negative, of slight significance and anticipated to be of short-term duration.

D. Land Use

Currently the site is not economically active, as it is a former landfill site and therefore generates no revenue. There would therefore be no loss of economically active land use during remediation. The land is considered to have limited development potential due to the ongoing future need for environmental controls (i.e. leachate and landfill gas management and future settlement of the waste materials).

Remediation would impact upon the land use of various areas of land adjoining the present site boundary. It is anticipated that sections of land will be subject to a temporary CPO process in order to ensure the ability to undertake appropriate remediation works, namely, construction of the surface water drainage swale and surface water outfall connection to the Morell River. This land will be returned to its prior state following the completion of necessary works.

In addition to this, further land is anticipated to be subject to a permanent CPO process. This includes three residential dwellings REC010, REC011 and REC016, which would be demolished and become part of the site that is subject to the proposed Project. This additional land is required as a result of the planned final end-use of the site, including the Landfill Infrastructure Compound as well as the new junction and improvements to the L2005 Kerdiffstown Road to better serve the site during the Remediation and Operational Phases.

For the properties (REC006, REC007 and REC008) along the L2005 Kerdiffstown Road, there will be some loss of land and loss of front boundary vegetation to accommodate the realignment of the road (through a temporary CPO process). As part of the CPO process KCC will engage with the residents regarding appropriate fencing and screening along the realigned road at these properties to ensure the privacy of the residences during the Remediation Phase. It is anticipated that this may be undertaken by the erection of some form of additional wall or fencing and vegetative screening that would be agreed with the landowners in advance of the remediation works commencing.

As a result of the impacts described above it is considered that the overall potential impacts are assessed as negative, of slight significance and are anticipated to be of short-term duration (land subject to temporary CPO

process) and permanent duration (land permanently acquired under the CPO process). The potential effect overall is considered to be not significant.

E. Economy & Tourism

As outlined in 'C. Employment', the Remediation Phase of the proposed Project is expected to create a maximum of 50 full-time equivalent (FTE) construction jobs. Increased local and regional economic activity is expected to occur when the number of employed people increases in an economy. Such an increase in economic activity is likely to be realised more locally as money is likely to be spent in greater quantities closer to sources of new employment rather than elsewhere. On-site activity is anticipated to stimulate these economies by creating, not only direct employment opportunities, but also indirect employment opportunities as well from the increased economic spending and consumption within the locality during the Remediation Phase. In addition, the remediated site will help to promote a positive image of the local area, further encouraging economic activity and development in the area.

As a result of the impacts described that the proposed Project would bring to the local area, the overall potential effects are assessed as positive, of moderate significance and are anticipated to be of short-term duration.

F. Human Health

In a broad sense, public health within the local community, and to some degree the regional community, is expected to benefit considerably from the proposed Project, which is in effect, replacing a disused, brownfield, landfill with a recreational amenity in the form of a multi-use public park fit for recreational use by those communities in a variety of ways.

During the remediation of the site however it is expected that some construction activities and processes will hold some negative effects to wider public health concerns, primarily in regard to air quality and odour; soils, geology, contaminated land, and groundwater; traffic and transport; surface water and noise and vibration.

In terms of air quality and odour, the primary concerns in respect to potential impacts on public health are dust/particulate matter emissions and odour. Further details on these potential impacts are made account of in Section 7.4.1 of Chapter 7 Air Quality, Odour and Climate.

Noise and vibration, while not necessarily an obvious concern in terms of public health, excessive levels can result deficiencies in hearing and sleeping patterns. It can also contribute to hypertension, heart disease, and generally annoyance. All of these effects can assist in the deterioration of an individual's personal health and well-being. Potential impacts in regard to noise and vibration effects of the Remediation Phase of the proposed Project are detailed in Section 8.4.1 of Chapter 8 Noise and Vibration.

The potential impacts on public health from environmental effects associated with the soils, geology, groundwater as well as any potential contaminated land located at the site is a primary concern. Details of the potential impact in respect to this area are detailed in Section 12.4.3 of Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Likely to be the most "visible" potential impact of the Remediation Phase, as well as the one which may give a higher perception of disruption, is the potential impacts brought by the traffic and transportation requirements of the Remediation Phase for the proposed Project. Potential effects from traffic and transport include concerns relating to accidents and safety; driver delays; fear, intimidation, and pedestrian amenity/delay; and severance. Further details of such potential impacts are made in Section 14.4.1, Chapter 14 Traffic and Transport.

16.4.2 Significance of Effects during Remediation

A summary of the effects during the Remediation Phase of the development is presented in Table 16.7.

Table 16.7: Significance of Effects During the Remediation Phase

Receptor	Receptor Description	Quality of Effects	Significance	Duration
A. Amenities & Recreation	Amenities include local golf courses and the Kerdiffstown House	Adverse effects (noise, odour and visual impacts)	Slight	Short-term
B. Community Severance & Accessibility	Community facilities and services – including North Leinster Ambulance Service Depot (Monread Road in Naas)	No effect	Neutral	Neutral
	Receptors on the L2005 Kerdiffstown Road	Access to properties during the realignment of the L2005 Kerdiffstown Road	Slight	Short-term
	Access – non-motorised users	Beneficial effects - Improvement works to site access from the L2005 will be completed early stages of the Remediation Phase	Moderate	Permanent
	Access – motorised users	Beneficial effects - Improvement works to site access from the L2005 will be completed early stages of the Remediation Phase	Moderate	Permanent
C. Employment	Local employment in the urban centre of Naas and the neighbouring villages of Sallins and Johnstown	Positive effects resulting from the 50 direct employment opportunities during the Remediation Phase and the impact they would have on the local economy.	Moderate	Short-term
	Local employment centres in direct proximity to the proposed Project	Adverse effects - potential for disruption from the likes of dust, odour, noise and traffic resulting from the remediation works	Slight	Short-term
D. Land-use	Landfill site	Overall neutral effect– No loss of economically active land during remediation.	Neutral	Neutral
	Surrounding lands	Slight Adverse– CPO in respect to some of the surrounding land in order to accommodate appropriate works.	Slight	Short-term & Permanent
E. Economy & Tourism	Grand Canal; Naas Town Centre; Monread North Centre (Tesco Extra); Sallins Village; Johnstown Village;	Overall positive effects - direct impacts on amenity areas neighbouring the site (noise, odour and visual impacts). However, there is greater potential for economic stimulation for the area given the economic activity brought by the construction workers and indirect employment.	Moderate	Short-term
F. **Human Health**	The remediation of the site is expected to bring with it some wider public health concerns to the local community in regard to the necessary construction activities. These concerns are primarily in respect to air quality, odour and climate; noise and vibration; soils, geology, contaminated land, and groundwater; and traffic and transport; potential impacts which are presented in further detail in Chapter 7 Air Quality, Odour and Climate; Chapter 8 Noise and Vibration; Chapter 12 Soils, Geology, Contaminated Land and Groundwater; and Chapter 14 Traffic and Transport.			

16.4.3 Operational Phase

A. Amenities & Recreation

The final end-use of the site, once the Remediation Phase is completed, will be a multi-use public park with a variety of facilities. The amenity will include operational infrastructure such as access routes and car parking, and a Landfill Infrastructure Compound which will house landfill management infrastructure. Refer to Figure 4.20.

The purpose of this final end-use is to ensure that the land will be proactively utilised by the local community and sports clubs for recreational and leisure purposes, rather than leaving the site as vacant grassland. The multi-use public park would also have the capacity to act as a safe and visually appealing amenity for recreational walkers and joggers as well as young families through the incorporation of various provisions and amenities throughout the site. The diverse and multi-use nature of the final end-use will ensure the longevity and usability of the site over time.

During the consultation period, the Kildare Sports Partnership highlighted their concerns over the 'lack of capacity in sporting and recreational facilities within the Greater Naas Area'. In addition to this, a Ministerial Direction (Simon Coveney T.D., Minister for Housing, Planning and Local Government) subject to the 'Sallins Local Area Plan 2016-2022' raised concerns of 'the deficiency of local community and recreational facilities relative to the needs of the town'. Sallins is situated approximately 1.25km north-west of the site, indicating the necessity for such a facility and the potential widespread use of the proposed multi-use public park once constructed.

The potential effects are assessed as positive for the wider amenity and recreational receptors of moderate significance, and are anticipated to be of medium to long-term duration. It is therefore determined that the overall potential effect, as described above, is considered significant.

B. Community Severance & Accessibility

This amenity is anticipated to help address the lack of capacity in sporting and recreational facilities in the area while also the complementing the surrounding land uses, which are predominantly green space and recreational in nature. The multi-use public park would reduce the historical stigma attached to the site while also representing the opportunity to improve access and reduce severance issues in the area through the installation of the improved motorised and non-motorised access as outlined previously in Section 16.4.1 'B – Community Severance & Accessibility'. The proposed end-use design proposes will include the provision of an on-line pedestrian and cyclist access path from the L2005 Kerdiffstown Road, between the site and the pedestrian bridge over the M7/N7 dual-carriageway, bringing ease of access to the site from the communities of Johnstown, Kill and Naas.

The potential effects are assessed as positive, of moderate significance and are anticipated to have a medium to long-term duration. Such potential effects are considered to be significant.

The potential effects for the North Leinster Ambulance Service Depot (Monread Road in Naas) are considered to be neutral for the Operational Phase.

C. Employment

Employment during Operational Phase is anticipated to be limited to a KCC Site Manager role responsible for the ongoing management of the landfill infrastructure and park maintenance workers to manage refuse and landscaping. Overall, there are not expected to be significant levels of employment directly generated by the proposed Project during the Operational Phase.

Having said this, some level of induced employment is anticipated to be created in local convenience and commercial businesses by the economic activity anticipated by from the users of the multi-use public park during the Operational Phase.

As a result of the impacts described above, the potential effects are assessed as positive, of slight significance and are anticipated to be of medium to long-term duration. In this context, the potential effect overall is considered to be not significant.

D. Land Use

In its current state, the land use of the site generates no revenue and thus provides no economic benefit. Converting this land to a recreational facility therefore delivers a clear improvement in the economic performance of the land.

Based on the population data provided in Table 16.4 and the written submissions from Kildare Sports Partnership, using both as a best estimation for a baseline, it is reasonable to consider that a considerable number of individuals would visit the multi-use public park for recreational purposes considering that the main attractions in terms of visitor numbers would be the sporting facilities and separate area for young families.

For the properties (REC006, REC007 and REC008) along the L2005 Kerdiffstown Road, there will have been some loss of land and loss of front boundary vegetation to accommodate the realignment of the road (via a temporary CPO process). It is proposed that a new stonewall or fencing of 2m in height shall be erected along these properties. Semi-mature tree and shrub planting will also be provided to the inside of the wall for additional screening and amenity purposes. These mitigation measures would be implemented in consultation with the property owners in question.

Operational Management Plans and regular maintenance schedules will be put in place to manage and maintain the site and approaches to the proposed Project on an ongoing basis during the Operational Phase, therefore minimising any potential negative impacts of the proposed multi-use public park.

In terms of land use, it is generally considered that the potential effects are positive, of moderate significance and are anticipated to have a medium to long-term duration. The potential effect overall is determined to be significant.

E. Economy & Tourism

The successful remediation and establishment of a multi-use public park would present an investment in the local community and available services/facilities as part thereof. It is likely to encourage additional community activity in the area which may translate to additional economic activity in the local economy. Given the strategic location of the site in relation to the M7/N7 dual-carriageway corridor, the proposed Project is well positioned to deliver benefits to local economic and tourism interests. Although the site itself may not be an attraction that would increase local visitor numbers directly, it will add to the local tourism offering (connectivity to local greenways and walk/cycle routes), thereby supporting the regional tourism strategy, 'Ireland's Ancient East'.

It would be anticipated that the creation of additional greenspace would result in indirect economic benefits for the region, such as improving the image of the local area, new business start-ups and private investment.

However, the economic development of the area surrounding the former landfill is reliant on other external factors and cannot be directly attributed to the successful remediation and creation of the proposed Project. As a result, the impacts are assessed as positive, of slight significance and are anticipated to have a medium to long-term duration. Within this context, the overall potential effects of the Operational Phase on Economy and Tourism are determined to be not significant.

F. Human Health

As stated above under 'E - Economy and Tourism', the establishment of a multi-use public park would present an investment in the local community and services/facilities. Such provision is likely to provide considerable beneficial effects to public health in terms of positive physical and mental well-being from additional visual amenity, community facilities and greenspace that will be created as a result of the multi-use public park. Aside from its visual presentation as amenity parkland, the site will have operational obligations in terms of the continuous management processes which will continue during the Operational Phase. The site will continue to be managed by KCC, and regulated by the EPA, as a remediated landfill whilst operating as a multi-use public park (the Operational Phase). Potential impacts of this Operational Phase on public health are possible and summarised below.

Potential air quality and odour impacts associated with the Operational Phase of the proposed Project will primarily be associated with the landfill gas management system however these are not expected to be significant. Details of the potential impacts associated with this management system are presented in Chapter 7 Air Quality, Odour and Climate.

Noise and vibration are anticipated to be minimal during the Operational Phase of the proposed Project. Noise emissions associated with the amenity users will be similar to any town park and are not considered significant.

Details of such noise and vibration emissions are assessed within Section 8.4.2 of Chapter 8 Noise and Vibration.

As stated previously, during the Operational Phase, areas of the site will become available for public amenity use as the pathways between contaminated material in the waste (source) and public health (receptors) will have been removed through the provision of a barrier between the waste and site end users. Further details on this subject are provided within Section 12.4.4 of Chapter 12 Soils, Geology, Contaminated Land and Groundwater.

Traffic levels will reduce significantly during the Operational Phase once vehicle movements associated with the remediation works cease. Improved route access for motor vehicles, pedestrians and cyclists as a result of the realignment and new access junction to the site from the L2005 Kerdiffstown Road will provide greater safety for all users, and by extension contributing to a beneficial effect in terms of human or public health. Further details of such potential impacts are provided in Chapter 14 Traffic and Transport.

16.4.4 Significance of Effects during Operation

Table 16.8 below presents a summary of the effects during the Operational Phase of the proposed Project.

Table 16.8: Significance of Effects during Operation

Receptor	Receptor Description	Quality of Effects	Significance	Duration
A. Amenities & Recreation	Amenities include local golf courses and Kerdiffstown House	Positive effect - Amenities neighbouring the site will experience an improvement as a result of the roll-out of the Operational Phase of the project (multi-use public park) as these amenities will no longer be located next to a dis-used, brownfield site as is currently the case.	Moderate	Medium to Long-term
B. Community Severance & Accessibility	Community facilities and services – including North Leinster Ambulance Service Depot (Monread Road in Naas	No effect	Neutral	N/A
	Receptors on the L2005 Kerdiffstown Road	Positive – Improved motorised and non-motorised access in the vicinity of these properties	Moderate	Permanent
	Access – non-motorised users	Positive effect – Access for non-motorised users would be greatly improved with the creation of an off-line pedestrian access from Kerdiffstown House (REC001) and the M7/N7 pedestrian overbridge. There will also be the continuation of the pedestrian services (path and cycleway) associated with the L2005 Kerdiffstown Road from its present point up to the proposed realigned junction entrance to the site.	Moderate	Permanent
	Access – motorised users	Positive effect – Motorised access to the site would be improved as a result of the proposed redesigned and realigned junction entrance to the site and L2005 Kerdiffstown Road as well as the new provision of vehicle parking for use during the Operational Phase.	Moderate	Permanent
C. Employment	Local employment in the urban centre of Naas and the neighbouring communities of Sallins and Johnstown and including employment receptors in the vicinity of the proposed Project	Positive effect - Employment during operation is anticipated to be limited to a low number of site management roles, including the management of any ongoing maintenance operations (a maximum of 2-3 persons). Induced employment for some of the employment centres is anticipated to be created by the economic activity associated with the users of the multi-use public park during the Operational Phase.	Slight	Medium to Long-term

Receptor	Receptor Description	Quality of Effects	Significance	Duration
D. Land-use	Landfill site	Positive effect - Land-use of the site will be improved as it will be transformed from a brownfield, disused landfill to a multi-use public park and could encourage further future development of the surrounding area.	Moderate	Medium to Long-term
	Surrounding lands			
E. Economy & Tourism	Grand Canal; Naas Town Centre; Monread North Centre (Tesco Extra); Sallins Village; Johnstown Village;	The Operational Phase has the potential to encourage economic development in the area surrounding the site, which would provide new businesses and enterprises, resulting in a boost for the local economy while the operation of the site would improve the diversity of the local tourism offer	Slight	Medium to Long-term
F. Human Health	The Operational Phase of the proposed Project is not expected to result in any significant human health concerns but to be in itself a positive contribution to the human health of the local community as the site fulfils its new purpose as an area of recreation and amenity for public use. Details on the potential impacts to human health of the Operational Phase are made account of in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration; Chapter 9 Landscape and Visual; Chapter 13 Water - Hydrology; and Chapter 14 of this EIAR.			

16.4.5 Summary of Human Health Impacts

A summary of potential human health effects expected during the Remediation and Operational Phases of the proposed Project are outlined in Table 16.9.

Table 16.9: Summary of Human Health Impacts

Human Health Topic	Remediation Phase Impacts	Operational Phase Impacts	Mitigation Proposed	Conclusion for Human Health	Traffic Light Indication
Air Quality and Odour **Chapter 7** **Baseline - Section 7.3** **Potential Impacts – Section 7.4** **Mitigation Measures - Section 7.5**	Air Quality and Odour impacts on Human Health during the Remediation Phase are as follows: • Dust emissions as a result of required construction-related activities; • Release of odour and pollutant gases such as PM_{10}, $PM_{2.5}$, CO, SO_2, NO_2, and NO_X as a result of construction-related activities and movement of existing landfill waste as well as the operation of the Landfill Gas Flare (LFG) flare located on site throughout the Remediation Phase; and,	Air Quality and Odour impacts on Human Health during the Operational Phase are as follows: • Release of odour and pollutant gases such as PM_{10}, $PM_{2.5}$, CO, SO_2, NO_2, and NO_X as a result of the operation of the site as part of the final end-use design.	Air Quality and Odour mitigation measures are proposed including: <u>Remediation Phase:</u> • A Construction Environmental Management Plan (CEMP) developed before the commencement of the Remediation Phase will contain a Dust Management Plan to ensure that dust emissions do not cause significant nuisance for receptors in the vicinity of the site. In addition, the appointed contractor for the remediation works will be assigned with overall responsibility for Dust Management reporting back to the KCC Site Manager. • The design and in particular the phasing of the Remediation Phase considers dust impact management and chooses design approaches that will minimise dust emissions resulting in the potential for significant simultaneous dust generation to be reduced. • A dust monitoring programme will be implemented on site. • The CEMP will also include an Odour Management Plan which outlines the minimisation of odour at the site through best practice and regular monitoring. Odour derived from existing landfill waste located on site will also be minimised through the implementation of a phased approach to earthworks involving waste. • The release of pollutant gases is already mitigation through the existing LFG flare located on site. The flare will be monitored to ensure it is balanced and optimised to maximise gas collection from installed gas wells and flaring according to operational recommendations. <u>Operational Phase:</u> • The principle mitigation measures proposed for the Operational Phase of the proposed Project are the comprehensive proposals for the management of LFG at the proposed multi-use public park. LFG will be actively and passively managed by a means of an extensive network of extraction wells which will be diverted to a new purpose-built Landfill Infrastructure Compound and by perimeter gas venting trenches. This flare will convert the LFG into harmless substances.	Potential Air Quality and Odour effects of the Construction and Operational phase of the KLRP as assessed and reported in this EIAR have been modelled within an automatic Dispersion Model that is in accordance with US EPA AERMOD modelling suite and benchmarked against national Air Quality Standards and Guidelines for the protection of human health, amenity and the environment. Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from air quality and odour.	
Noise and Vibration **Chapter 8** **Baseline - Section 8.3** **Potential Impacts – Section 8.4** **Mitigation Measures - Section 8.5**	Noise and Vibration impacts on Human Health during the Remediation Phase are as follows: • Potential for noise emissions and vibration as a result of required construction-related activities and traffic on and off site. • Potential for noise emissions and vibration as a result of the construction and operation of the landfill management infrastructure.	Noise and Vibration impacts on Human Health during the Operational Phase are as follows: • Potential for noise emissions associated with amenity users. • Potential for noise emissions as a result of the operation of the landfill management infrastructure	Noise and Vibration mitigation measures are proposed including: Remediation Phase: • A CEMP developed before the commencement of the Remediation Phase will contain a Noise and Vibration Management Plan to ensure that noise emissions and vibration do not cause significant nuisance for receptors in the vicinity of the site. In addition, on–site work practices will be implemented to ensure that noise and vibration are minimised further. • The Remediation Phase will be undertaken in phases to assist in the minimisation of noise and vibration effects. • Acoustic screens and barriers shall also be used in certain locations where noise sensitive receptors are situated. • On-site noise monitoring during the Remediation Phase will also be undertaken. Operational Phase: • Not applicable.	Potential Noise and Vibration effects of the Remediation and Operational Phases of the KLRP as reported in this EIAR have been assessed in accordance with *ISO 1996 (2007): Acoustics – Description and Measurement of Environmental Noise Part 2 Determination of Environmental Noise Levels* and with reference to the EPA's publication *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).* Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from noise and vibration.	

Human Health Topic	Remediation Phase Impacts	Operational Phase Impacts	Mitigation Proposed	Conclusion for Human Health	Traffic Light Indication
Soils, Geology, Contaminated Land, & Groundwater **Baseline - Section 12.3** **Potential Impacts – Section 12.4** **Mitigation Measures - Section 12.5**	Soils, Geology, Contaminated Land and Groundwater impacts on Human Health during the Remediation Phase are as follows: • As works are undertaken, contaminated material in waste has the potential to come into contact with construction workers undertaking the work and affect human health. This could be from direct contact, ingestion, or inhalation. • During the re-profiling of the site, specifically in Zone 1, there is the potential that perched leachate horizons are encountered which may lead to the release of leachate. If released in sufficient quantities, this leachate then has the potential to migrate to receptors such as the Morell River or soak into the ground outside of the landfill leading to local contamination and therefore posing potential risk to human health.	Soils, Geology, Contaminated Land and Groundwater impacts on Human Health during the Operational Phase are as follows: • As the site will become available for public amenity use as the pathways between contaminated material in the waste (source) and human health (receptors) by direct contact, ingestion, and inhalation (pathways) will have been removed through provision of a barrier between the waste and site end users.	Mitigation measures regarding Soils, Geology, Contaminated Land and Groundwater are proposed including: Remediation Phase: • A CEMP developed before the commencement of the Remediation Phase will contain a Landfill Gas Management Plan to ensure that LFG emissions and gas do not raise to critical levels nor cause significant nuisance for receptors in the vicinity of the site. In addition, perimeter boreholes would be installed before remediation activities commence to ensure appropriate gas, soil, and groundwater monitoring can take place. Operational Phase: • Groundwater and gas monitoring will be agreed with the EPA and will be specified in the Industrial Emissions Activities Licence (IEAL) for the site.	As public access to the site is restricted during the Remediation Phase, those coming onto contact with contaminated material would be site workers (including security staff). However, these workers are aware of the risks and working practices to prevent contact with the wastes. In addition, additional mitigation would be put in place to remove any potential impact on human health from LFG. The Operational Phase will result in the removal of potential impacts from LFG and waste as engineered measures (i.e. waste capping, flares, etc.) will be implemented to remove potential risks. Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from soils, geology, contaminated land and groundwater.	
Traffic and Transport **Baseline - Section 14.3** **Potential Impacts – Section 14.4** **Mitigation Measures - Section 14.5**	Traffic and Transport impacts on Human Health during the Remediation Phase are as follows: • Additional traffic volumes (and associated air quality emissions/ issues) associated with the remediation activities, primarily HGV's, for the proposed Project travelling on the existing road network. • Traffic volume, composition and speeds, in combination with pedestrian footways and crossing would contribute to unpleasantness, fear, intimidation and delay experienced by pedestrians and other vulnerable road users.	Traffic and Transport impacts on Human Health during the Operational Phase are as follows: • Traffic volumes (and associated air quality emissions/ issues) associated with the Operational Phase of the site are expected to be minimal and so do not pose any significant impacts.	Mitigation measures regarding Traffic and Transport are proposed as follows: Remediation Phase: • Prior to the commencement of the Remediation Phase, a Construction Traffic Management Plan (CTMP) will be implemented. The CTMP will be used as a consultation document for regular engagement and consultation with the Community Liaison Group throughout the Remediation Phase. Operational Phase: • Not applicable.	The Remediation Phase of the proposed Project is not expected to have potential significant effects on Human Health in respect to traffic and transport. This is due to the implementation of appropriate mitigation measures as well as the proposed improvements to the site access road and site access junction with the L2005 Kerdiffstown Road. The Operational Phase is also not anticipated to bring potential significant effects on Human Health given that the site will be a functioning recreational/leisure amenity that will not require excessive vehicular (including HGV) traffic flows. This Phase will also bring about benefits in terms of improved pedestrian access in the area around the site. Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from Traffic and Transport.	
Surface Water – Hydrology **Baseline Section 13.4** **Potential Impacts Section 13.5** **Mitigation Measures Section 13.6**	Hydrological impacts on Human Health during the Remediation Phase are as follows: • Potential for pollution of surface water features due to sediment loading and associated anthropogenic polluting substances entering watercourses as a result of surface water run-off that could be contaminated by waste material and/or spills on-site and/or groundwater influx. Human health could be impacted if individuals interact with such waterbodies.	Hydrological impacts on Human Health during the Operational Phase are as follows: • Potential pollution of surface water will be removed as appropriate engineered measures are considered part of the capping design that will remove the potential for contamination.	Mitigation measures regarding Hydrology are proposed as follows: Remediation Phase: • Provision of measures to prevent the release of sediment concentrations to surface water features during the construction works. • Provision of exclusion zones and barriers (sediment fences) between earthwork stockpiles and temporary surfaces and watercourses to prevent sediment washing into watercourses. • The Remediation Phase may allow the infiltration of rainfall to the waste and encourage contaminated runoff. This will be control through the use of appropriate site and waste management measures.	Based on the proposed mitigation measures, it is not anticipated that there will be significant negative human health impacts from hydrological effects of the proposed Project.	
Recreational Amenity **Figure 4.20**	Not applicable – the site, in its existing state, is not suitable for recreational use and nor will it be available to the local community for recreational use during the Remediation Phase due to remediation activities.	Recreational amenity will be significantly improved as a result of the Operational Phase of the proposed Project as the final end-use of the site will be a multi-use public park. This amenity will incorporate the following facilities: • Changing Rooms/WC • Sports Pitches; • Playground Area; • Walking tracks; and • Green Space and appropriate landscaping	Mitigation measures for recreation amenity are not applicable as the Operational Phase of the proposed Project is in itself mitigation for the site as a whole.	With the nature and function of the site during the Operational Phase, it is anticipated that there will be significant positive human health impacts in terms of recreational amenity.	
Promoting Active Travel/ Healthy Lifestyle	The Remediation Phase will include improvements to realign the L2005 Kerdiffstown Road and the provision of new cycleways and footways along this route to provide a safer passageway for VRU during the Remediation Phase.	The improvements to the L2005 Kerdiffstown Road and the provision of new cycleways and footways during the Remediation Phase will already exist and will improve access and usability of the site during the Operational Phase.	Mitigation measures for Active Travel are not applicable as the facilitation of improved motorised and VRU access of the proposed Project is in itself mitigation for the Project as a whole.	With the nature and function of the site during the Operational Phase, it is anticipated that there will be significant positive human health impacts in terms of promoting Active Travel.	

16.5 Mitigation Measures

16.5.1 Remediation Phase

The proposed mitigation measures during the Remediation Phase for each assessment theme is summarised below. Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP). The CEMP shall contain the mitigation measures identified in the following sections and ensure that they are fully implemented during the Remediation Phase, to prevent or reduce the impacts identified in the impact assessment:

A. Amenities & Recreation

- During the Remediation Phase of the proposed Project, mitigation as detailed in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration and Chapter 9 Landscape and Visual will be implemented. This shall include the development of a CEMP by the appointed contractor. Full details of Remediation Phase mitigation measures are detailed in Chapter 19 Schedule of Environmental Commitments.
- The Kildare County Council Project Team with the appointed contractor will continue to communicate with the local residents, including the Community Liaison Group, as well as local recreation providers/local community. These communication channels will allow local groups to keep future visitors up to date on the proposed Project as well as providing an avenue to raise concerns or issues during this Phase of the project.

B. Community Severance & Accessibility

- The appointed contractor will be required to maintain access to residential and commercial properties throughout the Remediation Phase.

C. Employment

- The potential employment opportunities associated with the Remediation Phase are positive impacts, albeit in the short-term. These impacts require no mitigation.
- In relation to employment centres in direct proximity of the site, a CEMP shall be developed by the appointed contractor which shall implement appropriate measures to minimise impacts from Remediation Phase works (directly on site and in the realignment of the L2005 Kerdiffstown Road).

D. Land-Use

- Access to areas subject to the temporary CPO process will be maintained throughout the Remediation Phase to ensure severance and community access issues are not a factor. Areas subject to the temporary CPO process will also be returned to their approximate previous state after necessary works are completed.
- For the properties (REC006, REC007 and REC008), KCC will engage with the residents regarding appropriate fencing and screening along the realigned road at these properties to ensure the privacy of the residences during the Remediation Phase. This shall be undertaken by the erection of some form of additional wall or fencing and vegetative screening that would be agreed with the landowners in advance of the remediation works commencing.

E. Economy & Tourism

- During the Remediation Phase the proposed Project shall look to procure material and services from local providers, where reasonably practicable, and within the requirements of the procurement process. This would encourage additional economic activity in the local economy which may subsequently result in indirect employment opportunities being created.

16.5.2 Operational Phase

During the Operational Phase the creation of a multi-use public park will bring the site from its currently inactive economic state into productive land use and will provide a recreational/leisure area for the local and regional population. It has therefore been considered that the provision of a multi-use public park is satisfactory mitigation for the proposed Project in its entirety in regard to the population and human health (socio-economics) assessment.

In relation to Land Use, for the properties (REC006, REC007 and REC008) along the L2005 Kerdiffstown Road, a new wall or fencing shall be erected along these properties. Semi-mature tree and shrub planting may also be provided to the inside of the wall for additional screening and amenity purposes. These mitigation measures shall be implemented in consultation with the property owners in question.

Operational Management Plans and regular maintenance schedules will be put in place to manage and maintain the site and approaches to the proposed Project on an ongoing basis during the Operational Phase, minimising any potential negative impacts of the proposed multi-use public park.

16.5.3 Opportunities for Future Enhancement

Details on the proposed Project outline design and the features currently proposed are provided in Chapter 4 Description of the Proposed Project. Detailed below is an outline of potential future enhancements which could be considered, at a later date, for the multi-use public park in the future, to further enhance the proposed Project and provide the site with the greatest sense of utility so far as practicable.

A. Amenities & Recreation

- The provision of a park centre or community centre could enhance the social experience of the public park by providing a space for community, educational or leisure activities.
- Annual Council-sponsored community activities/event days for families with young children would encourage active participation, knowledge, and utility of the site over the long-term.
- Provision of designated areas for alternative recreational activities (Dog area, BMX/Skateboard Park, Outdoor Cinema, etc.) would further extend the services/facilities offered on-site.

B. Community Severance & Accessibility

- The proposed Project could be designated as a centre for recreation or sporting activities with links to other areas in the locality to promote more sustainable transport and lifestyle in the area. Locally there is the Dublin-Sallins-Naas Greenway along the Grand Canal and the Dublin Road Greenway within the urban centre of Naas that could link in with the proposed Project to promote and encourage sustainable living in the Naas area.

C. Employment

- Leisure related commercial businesses (i.e. group fitness classes) could be encouraged and promoted as a result of appropriate facilities located on-site.

D. Land Use

- None required (the conversation of a former landfill to a recreation facility or amenity provides an overall improvement in the land use).

E. Economy & Tourism

- None required (the establishment of a multi-use public park would present an investment in the local community and available services/facilities as part thereof. It is likely to encourage additional community activity in the area which may translate to additional economic activity in the local economy).

16.6 Residual Impacts

The residual impacts (impacts of the proposed Project that will remain despite the implementation of mitigation measures) of the Remediation Phase are set out in Table 16.10:

Table 16.10: Residual Effects during Remediation

Assessment Theme	Receptor Description	Nature of Effect(s)	Proposed Mitigation	Residual Effects
A. Amenities & Recreation	Amenities include local golf courses, Kerdiffstown House, Grand Canal, and the Morell River	Adverse effects (noise, odour, visual impacts and communication).	Mitigation as detailed in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration and Chapter 9 Landscape and Visual. This shall include the development of a CEMP by the appointed contractor. Full details of Remediation Phase mitigation measures are detailed in Chapter 19 Schedule of Environmental Commitments Continued communication between Kildare County Council Project Team and Community Liaison Group.	Not significant (Temporary)
B. Community Severance & Accessibility	Community facilities and services	No effect.	No mitigation required - Neutral	Neutral
	Receptors on the L2005 Kerdiffstown Road	Access to properties	The appointed contractor will be required to maintain access to residential and commercial properties throughout the Remediation Phase regardless of construction processes on-site.	Not significant (Temporary)
	Access – non-motorised users	No effect - (currently no access to site for non-motorised users).	No mitigation required – Improvement works to the L2005 Kerdiffstown Road to be completed in the early stages of remediation.	Moderate Beneficial (Permanent)
	Access – motorised users	No effect – (current site access is anticipated to be maintained as main access point to site during the remediation).	No mitigation required – Improvement works to the L2005 Kerdiffstown Road to be completed in the early stages of remediation	Moderate Beneficial (Permanent)
C. Employment	Local employment in the urban centre of Naas and the neighbouring villages of Sallins and Johnstown	Beneficial effects resulting from 50 potential employment opportunities during the Remediation Phase.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance– Positive impact in relation to local employment opportunities in the local economy.
	Local employment centres in direct proximity to the proposed Project	Disruption from the likes of dust, odour, noise and traffic	A CEMP shall be developed by the appointed contractor.	Not significant (Temporary)
D. Land-use	Landfill site	No change	No mitigation required.	Neutral
	Surrounding lands	Temporary and permanent land-take required.	Access maintained during Remediation Phase and returned to previous state upon completion. Provision of fencing/screening to maintain screening for properties specified along the L2005 Kerdiffstown Road.	Not significant (Temporary)

Assessment Theme	Receptor Description	Nature of Effect(s)	Proposed Mitigation	Residual Effects
E. Economy & Tourism	Grand Canal; Naas Town Centre; Monread North Centre (Tesco Extra); Sallins Village; Johnstown Village;	Overall positive effects - direct impacts on amenity areas neighbouring the site (noise, odour and visual impacts). However, there is greater potential for economic stimulation for the area given the economic activity brought by the construction workers and indirect employment.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance – Positive impact in relation to local economic activity in the local economy. Potential for some noise and odour impacts on recreational amenity areas are anticipated to remain.
F. Human Health	The remediation of the site is expected to bring with it some wider public health concerns to the local community in regard to the necessary construction activities. These concerns are primarily in respect to air quality and odour; noise and vibration; soils, geology, contaminated land, and groundwater; and traffic and transport; potential impacts which are presented in further detail in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration, Chapter 12 Soils, Geology, Contaminated Land and Groundwater and Chapter 14 Traffic and Transport. Mitigation measures outlined for each environmental topic are considered to be appropriate mitigation against any potential negative effects of the proposed Project on Human Health. It is within this context that the residual effect of the Remediation Phase on Human Health is assessment as having no effect.			

The residual impacts of the Operational Phase of the proposed Project are presented in Table 16.11.

Table 16.11: Residual Effects during Operation

Assessment Theme	Receptor Description	Nature of Effect(s)	Proposed Mitigation	Residual Effects
A. Amenities & Recreation	Amenities include local golf courses, Kerdiffstown House, Grand Canal, and the Morell River	Beneficial effect - Amenities neighbouring the site will experience an improvement as a result of the roll-out of the Operational Phase of the project (multi-use public park) as these amenities will no longer be located next to a dis-used, brownfield site.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance
B. Community Severance & Accessibility	Community facilities and services	No effect (currently no community facilities or services in the study area).	N/A	No effect.
	Receptors on the L2005 Kerdiffstown Road	Beneficial effect – Non-motorised and motorised access will be greatly improved.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance
	Access – non-motorised users	Beneficial effect – Non-motorised access will be greatly improved.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance
	Access – motorised users	Beneficial effect – Motorised access will be greatly improved.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance

Assessment Theme	Receptor Description	Nature of Effect(s)	Proposed Mitigation	Residual Effects
C. Employment	Local employment in the urban centre of Naas and the neighbouring villages of Sallins and Johnstown and including employment receptors in the vicinity of the proposed Project	Beneficial effect - Employment during operation is anticipated to be limited to a low number of site management roles, including the management of ongoing remediation operations, a maximum of 2-3 persons. There is the potential from some of the employment centres to benefit from induced employment opportunities. (There is the potential for other employment opportunities in regard to the facilities that could be located on-site as part of future enhancements).	No mitigation required as effect is of a positive nature.	Positive effect of slight significance
D. Land-use	Landfill site	Beneficial effect – Site transformed from former landfill site to recreational/leisure land use.	No mitigation required as effect is of a positive nature.	Positive effect of moderate significance
	Surrounding lands	Beneficial effect - Land-use of the surrounding area will be improved as the area will have a recreational amenity which could encourage investment and development.	Generally, no mitigation required as effect is of a positive nature. However, note the provision of a stonewall and planting at the properties specified along the L2005 Kerdiffstown Road	Overall Positive effect of moderate significance
E. Economy & Tourism	Grand Canal; Naas Town Centre; Monread North Centre (Tesco Extra); Sallins Village; Johnstown Village;	Beneficial effect - The Operational Phase has the potential to encourage additional community activity in the area surrounding the site, resulting in a boost for the local economy. Beneficial effect – The Operational Phase of the proposed Project has the potential to increase the utility of the Grand Canal and neighbouring recreational amenities (i.e. golf courses).	No mitigation required as effect is of a positive nature.	Positive effect of slight significance Moderate, beneficial (significant)
F. Human Health	The Operational Phase of the proposed Project is not expected to result in any significant human health concerns but to be in itself a positive contribution to the human health of the local community as the site fulfils its new purpose as an area of recreation and amenity for public use. Details on the potential impacts to human health of the Operational Phase are made account of in Chapter 7 Air Quality and Odour, Chapter 8 Noise and Vibration, Chapter 12 Soils, Geology, Contaminated Land and Groundwater and Chapter 14 Traffic and Transport of this EIAR. It is within this context that the residual effect of the Remediation Phase on Human Health is assessment as positive and of major significance.			

16.7 Difficulties Encountered in Compiling Information

There were no significant difficulties encountered in compiling the information contained in this Population and Human Health Chapter; however, census data (2016) is in provisional condition and is in need of revision once the appropriate data is released by the Central Statistics Office. It is not anticipated that any future revision of figures/data would result in a significant impact upon the findings of this assessment as detailed here.

16.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on the surrounding communities. These projects are discussed in the following paragraphs.

16.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonne. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

16.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

16.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

16.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

16.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. The impacts in respect to Population and Human Health would be additional disruption for neighbouring residential and commercial receptors in terms of dust, noise and vibration, visual amenity and traffic however appropriate and proportional mitigation measures would reduce any potential impact to be not significant. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

16.9 References

- Central Statistics Office (2011). Census 2011 Report
- Central Statistics Office (2016). Census 2016 Preliminary Report
- Department of Public Expenditure and Reform's (2016). The Public Spending Code Portal http://publicspendingcode.per.gov.ie/ (Accessed November 2016)
- Eastern-Midlands Region (2015). Eastern-Midlands Region Waste Management Plan 2015-2021
- English Partnerships (2008). Additionality Guide
- Environmental Protection Agency (2002). Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2003). Advice notes on current practice in the preparation of Environmental Impact Statements
- Environmental Protection Agency (2014). National Hazardous Waste Management Plan 2014-2020
- Environmental Protection Agency (2015). Advice notes for preparing Environmental Impact Statements (Draft)
- Fáilte Ireland (2007). Guidelines on the treatment of Tourism in an Environmental Impact Assessment
- Fáilte Ireland (2016). Ireland's Ancient East Portal http://www.failteireland.ie/ (Accessed September 2016)
- Jacobs (2016). Environmental Impact Statement Scoping Report
- Kerdiffstown Environmental Baseline Report (SKM Enviros, 2013)
- Kerdiffstown Landfill Facility; Site Profile Material Use and Capping (SKM Enviros, 2013)
- Kildare County Development Plan 2011-2017
- Kildare County Development Plan 2017-2023
- Kildare Sports Partnership (2016). Portal http://www.kildare.ie/kildaresp/ (Accessed September 2016)
- Naas Development Plan 2011-2017
- Sallins Local Area Plan: 2016-2022

17. Material Assets

This Chapter assesses and presents the potential impacts of the proposed Project on material assets. The material assets considered as part of this assessment are residential property, major utilities and imported material.

Impacts to material assets from the proposed Project will mainly occur during remediation works, with the loss of three residential properties being the largest potential impact as it is permanent. This will be mitigated through the implementation of the Compulsory Purchase Order process and consultation with the residents. The impact to major utilities will also potentially occur during remediation works, with mitigation to be put in place to limit impacts to neighbouring properties caused by temporary losses of services such as electricity. Impacts to services will be temporary in nature during remediation, with no disruption to occur during operation. Similarly, the need to import materials for use as capping (topsoils, sub-soils, sands, clays) will have short-term negative impacts, mainly through the increased HGV movements on the local roads.

The new sewer connection to Johnstown Pumping Station from the site for the purposes of leachate and wastewater disposal, will be the only real change to the major utilities in the area caused by the proposed Project. This additional input into the public sewer system can be accommodated by the local sewer system and will be completed under agreement with Irish Water. The impact will therefore be imperceptible.

Overall, the proposed Project will greatly improve the local landscape, making the site itself into a material asset for the local community and nearby larger settlements of Naas, Sallins and Johnstown once fully operational as a multi-use public park.

17.1 Introduction

This Chapter considers and assesses the effects of the Kerdiffstown Landfill Remediation Project (hereafter referred to as “the proposed Project”) on the material assets, including existing major utilities within and around the site during the Remediation and Operational Phases.

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

The remediation of the proposed Project and development of the multi-use public park is anticipated to take approximately five to seven years, with approximately four years of intensive construction works to remediate the site. The Operational Phase will be the operation of a public park with multi-use sports pitches, changing rooms, a children’s playground, etc. and management of the site as a remediated landfill. Table 17.1 below summarises the key activities anticipated to be carried out in each of the phases of the proposed Project. Further detail on the scope of the proposed Project is provided in Chapter 4 Description of the Proposed Project, and details on the outline phasing of the works are provided in Section 4.3.1 and outlined in Figure 4.8 and Figure 4.9.

Table 17.1: Summary of Key Activities during the Remediation and Operational Phases

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

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

Material assets are resources that are valued and intrinsic to the site of the proposed Project and the surrounding area.

The material assets to be considered as part of this assessment include:

- Residential property;
- Major utilities; and
- Imported material.

Other material assets which have the potential to be impacted by the proposed Project, but which are assessed in other EIAR Chapters include:

- Cultural heritage assets (Chapter 10 Archaeology, Cultural Heritage and Architectural Heritage);
- Groundwater (Chapter 12 Soils, Geology, Contaminated Land and Groundwater).
- Transport infrastructure (Chapter 14 Traffic and Transport);
- Land use (Chapter 16 Population and Human Health); and
- Social amenities (Chapter 16 Population and Human Health);

17.2 Methodology

The potential impacts to material assets as a result of the proposed Project were assessed through a desk-based study of available information, and consultation with major utility providers as required. The methodology is consistent with relevant guidance including:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised guidelines, due to be finalised in 2017);
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015); and
- NRA Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008).

Following a review of the EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA 2002, EPA 2015) and the revised draft Advice Notes (EPA 2003, EPA 2015) it is considered that the proposed Project falls most closely within the Project Type 32. Project Type 32 refers to '*Waste disposal installations for the incineration, chemical treatment or landfill of hazardous and non-hazardous waste*', where the former Kerdiffstown Landfill was licensed to receive non-hazardous and inert waste. The Advice Notes suggest that the primary considerations under the heading of Material Assets for this type of project are:

- Power supply;
- Road network;
- Potential for such projects affecting groundwater development in the area in the future, especially down gradient of the site; and
- Attraction of feeding birds and impact on aircraft operations.

The impact to power supply has been assessed in this Chapter. As described above the possible impact on the road network and groundwater are addressed in Chapter 14 Traffic and Transport and Chapter 12 Soils, Geology, Contaminated Land and Groundwater respectively. With regards to attracting feeding birds, the site in its current state does not offer a food source for birds and the re-profiling works are unlikely to attract birds; however, the end-use of a multi-use public park should enhance the environment for birds once completed. The likely impact of the proposed Project on birds is included in Chapter 11 Biodiversity.

The characteristic of an impact relates to the quality, significance and duration of the impact. The definition of these impact characteristics as per the EPA Guidelines on the Information to be Contained in Environmental Impact Statements and the revised draft Guidelines (EPA 2002, EPA 2015) is provided below:

- **Quality of Impacts**
  - **Positive Impact:** A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities);
  - **Neutral Impact:** No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error; and
  - **Negative Impact:** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance).
- **Significance of Impacts**
  - **Imperceptible Impact:** An impact capable of measurement but without noticeable consequences;
  - **Slight Impact:** An impact which causes noticeable changes in the character of the environment without affecting its sensitivities;
  - **Moderate Impact:** An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends;
  - **Significant Impact:** An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment; and
  - **Profound Impact:** An impact which obliterates sensitive characteristics.

- **Duration of Impacts**
  - **Temporary Impact:** Impact lasting for one year or less;
  - **Short-term Impact:** Impact lasting one to seven years;
  - **Medium-term Impact:** Impact lasting seven to fifteen years;
  - **Long-term Impact:** Impact lasting fifteen to sixty years; and
  - **Permanent Impact:** Impact lasting over sixty years.

17.3 Baseline Conditions

17.3.1 Study Area

The study area, the site of the proposed Project, is located in County Kildare. The site is located in County Kildare, approximately 3km north-east of central Naas, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1. The site is located in close proximity to a number of residential and commercial receptors as well as being a short distance away from the larger settlements of Johnstown, Sallins and Naas. There are a number of social amenities in close proximity to the site of the proposed Project, including Kerdiffstown House owned by St. Vincent de Paul, and a number of golf courses. Access to the site is via road only, with the site entrance located on the L2005 Kerdiffstown Road, part of which has a posted vehicular weight restriction of 3 tonnes for the bridge over the main Dublin to the south-west railway line. There are no footpaths to the site. There are no European designated sites in the vicinity of the proposed Project, with the nearest being Red Bog, Kildare approximately 7.5km from the proposed Project boundary. The site sits on top of a locally important aquifer, which is moderately productive in local zones (Ll).

There is one recorded monument within the proposed Project area, namely a mound (KD019-018) that was disturbed by quarrying activity in the 1950s. This mound may have represented an early medieval settlement area. Please refer to Chapter 10 Archaeology, Cultural Heritage and Architectural Heritage for further details.

17.3.2 Residential Properties

There are five residential properties bordering the site, three to the south (Receptors REC010, REC011 and REC039) and two to the west (Receptors REC012 and REC016). The exact locations of these properties are shown in Figure 3.4. These are all accessed via the L2005 Kerdiffstown Road.

17.3.3 Major Utilities

A number of utility providers have assets within and around the existing site including electricity, water, sewerage and telecommunications. Please refer to Figure 17.1 for an overview of the location of all current site services as laid out below.

Electricity

There are a number of overhead ESB Networks high voltage and low voltage electricity lines running adjacent to the site along the L2005 Kerdiffstown Road, as well as crossing the north of the site (Refer to Figure 17.1).

There is an existing electricity supply which supplies power to the current site infrastructure such as the site office, the existing landfill gas flares, security huts, leachate pumps and lighting. The electricity lines within the site run through above ground ducting.

There is also an ESB transformer located near the current site entrance (Refer to Figure 17.1).

Telecommunications

There is a telecommunications line which runs along the L2005 Kerdiffstown Road adjacent to the site as shown in Figure 17.1. The site office is connected into the telecommunications line.

Water Supply

Potable water is currently supplied into the site from the existing Irish Water network. The existing potable water main into which the site is connected runs along the L2005 Kerdiffstown Road as shown in Figure 17.1.

Wastewater Services

Wastewater from the site office facilities is currently discharged to a sealed concrete tank on-site. There is currently no sewer connection from the existing site. This wastewater tank is cleaned out periodically and tankered off site to Ringsend Wastewater Treatment Plant (WWTP).

As well as the site office wastewater, the lined cell located in Zone 3 of the site includes leachate collection facilities. Leachate collects in a controlled area within the lined cell and is tankered off-site to a licenced facility, currently Ringsend WWTP (licence D0034-01) for disposal daily. Since 2011 there has been an average of 12,142 cubic metres of leachate disposed of in this manner per year, or 1,012 cubic metres per month. The amount of leachate needing to be removed during any time period is dependent on the amount of rainfall during that period.

Surface Water Drainage

The management of surface water originating from within the site is detailed in Chapter 13 Water - Hydrology. Aside from the surface water originating on the site, there is a connection from an adjacent property (REC012) into the site's surface water drainage. This connection is located near the south-west corner of the lined cell. It crosses the site boundary here and connects into the site drainage, where it joins the site generated surface water and eventually discharges into the Canal Feeder Stream.

Gas Supply

There is currently no connection to the gas network at the site.

17.3.4 Imported Material

The site is a disused sand and gravel quarry which has been progressively back filled with waste material since the 1950s. The facility at Kerdiffstown was operated under a local authority waste permit followed by a waste licence, W0047-01, issued by the EPA in 2003, with a revised licence W0047-02 issued in 2006. The material imported largely consisted of C&D wastes and mixed municipal wastes over the years. As the site has been inactive since 2010, there has been no further importation of waste materials to the site on any meaningful scale.

17.4 Predicted Impacts

17.4.1 Remediation Phase

Residential Property

There are a number of constraints associated with the layout and siting of the proposed site entrance and the proposed Landfill Infrastructure Compound and which impact the overall land-take requirements for the proposed Project (refer to Chapter 5 Consideration of Alternatives for additional detail). Due to health and safety concerns caused by the number of bends on the L2005 Kerdiffstown Road along the extents of the site boundary, there are limitations on the options for the layout and siting of the proposed site access in order to maintain a safe line of sight for vehicles accessing and exiting the proposed Project. A roundabout has been proposed rather than a smaller footprint priority junction in order to minimise congestion at the site entrance and negate the need for HGVs to cross the road when entering or exiting the site. The proposed site entrance location minimises the impacts of the bend to the west and achieves the best possible forward visibility on all approaches to the junction.

For the location of the Landfill Infrastructure Compound, there are a number of considerations constraining the proposed location. Firstly, due to the sensitive equipment to be housed within (leachate piping and tanks) it must be constructed in an area with suitable, stable ground conditions. This necessitates construction in an area which is not on top of any waste body. Secondly, there is the requirement for vehicles, including HGVs, to be able to access the compound over the lifecycle of the site. Situating it near the site entrance and on a separate road from the rest of the internal road network keeps this additional traffic separate from public areas during the Operational Phase.

As a result of the above constraints, the land-take for the proposed Project will involve the demolition of two of the properties located at the southern boundary of the proposed Project. Property KE41129F (Receptor REC011) is located within the area required for the new site entrance roundabout. Similarly, property KE9594N (Receptor REC010) will need to be demolished in order to allow for the implementation of security and screening measures for the Landfill Infrastructure Compound.

In addition to the above two properties, there is also the need to acquire and demolish property KE9592N (Receptor REC016) in order to allow for the installation of a third multi-use sports pitch. The need for this third sports pitch was identified by Kildare County Council (KCC) based on submissions from numerous parties, with these lands being the only space available to do this. As waste also extends to and over the boundary of the property, this land is also required to facilitate the remediation and to provide access for maintenance of the pond in the north-west corner of the site.

As well as the demolition of the properties, there will also be some lands required in order to allow for the realignment of the L2005 Kerdiffstown Road and other project features. This includes strips of land from a series of properties located along the road, as well some parts of the grounds of Kerdiffstown House. There will also be the need to decommission the septic tank in the grounds of REC039 in order to allow for the Landfill Infrastructure Compound to be constructed.

The properties are shown in Figure 3.4. As the three residential properties will be demolished entirely, the impact will be negative, profound and permanent.

Major Utilities

There is the potential for temporary impacts to utility supplies during the remediation works. This would occur where there is a need to relocate existing utility lines or to shut off services during works. In the absence of mitigation, impacts on services would be profound as services would no longer be functioning.

Electricity

It is envisaged that during remediation works electricity will continue to be supplied from the existing site connection, with the current site offices location continuing to be used as a site compound during the remediation works. In the event that a connection to the existing electricity network is not possible at any point during remediation works, diesel generators will be utilised to provide electricity.

The realignment of the L2005 Kerdiffstown Road will likely result in the need to move the electricity poles which follow the road. Movement of these will result in temporary disruption of electricity supply to neighbouring properties.

It may be necessary to upgrade the transformer located near the site entrance as part of the remediation works. The need for this will be based on the loading required by the infrastructure within the completed end-use, namely the site compound, pumps, blowers, lighting and changing facility. Should an upgrade be required, there may be temporary disruptions to electricity supply at the proposed Project and potentially some temporary disruption to neighbouring properties.

Telecommunications

Similar to electricity supply, it is envisaged that during remediation works telecommunications will continue to be supplied from the existing above ground site connection, with the current site office location continuing to be used as a site compound during the remediation works.

As is the case with the electricity supply, the realignment of the existing L2005 Kerdiffstown Road will likely result in the need to move the telecommunication poles which follow the road. Movement of these will result in temporary disruption of service to neighbouring properties.

Water Supply

A water supply would be required on-site during the Remediation Phase of the proposed Project. The existing underground connection into the Irish Water network would be utilised to supply potable water to the site compound during remediation works.

In addition to the supply required by the proposed Project, there will also likely be the need to divert and reposition the watermain which follows the L2005 Kerdiffstown Road in order to allow for the construction of the new road layout and site entrance. There is also a watermain which crosses the field to the south-east of the site (KE6338F). This watermain is in close proximity to the planned new sewer lines to be constructed for leachate and effluent disposal from the proposed Project. This will require a diversion of the watermain at the time of the works. Watermain diversions will result in temporary disruptions to the water supply to the properties in the area.

Wastewater Services

A new sewer connection will be installed in the Remediation Phase to facilitate off-site disposal of leachate to Johnstown Pumping Station. From there it will discharge to the local public sewer network for subsequent treatment at Osberstown WWTP. Another sewer connection will also be installed to Johnstown Pumping Station for future connection to the new site office (in the Landfill Infrastructure Compound) and the changing rooms (for use in the Operational Phase).

Where additional site cabins and welfare facilities are required that cannot be connected to the existing infrastructure modular septic tanks will be utilised, with regular cleaning and removal from site as necessary.

Surface Water Drainage

As part of the remediation works the current surface water connection from the adjacent property (REC012) into the site will be redirected so as to stop external surface water entering the proposed Project drainage network. Realignment of this surface water connection around the boundary of the proposed Project will need to be undertaken, allowing it to be reconnected to the existing discharge via a new drainage pipe.

Gas Supply

There would be no gas supply required as part of the remediation works.

Imported Material

A description of the materials likely to be used during the remediation works is provided in Chapter 4 Description of the Proposed Project. As part of the remediation works material will be required to act as fill for re-profiling, and as capping material. It is anticipated that approximately 130,000m^3 of imported material will be required in total. This material will be mainly composed of topsoils, sub-soils and sands in order to construct the capping layer (Refer to Section 4.3.3 for more detail on material import to the site).

Further materials may be imported to mitigate against landscape and visual impacts as well as in the construction of the end-use for the site. Such materials would include but are not limited to materials required for construction of site buildings (Landfill Infrastructure Compound and changing rooms), materials for road

construction (gravels, bitumen, etc.), geosynthetic materials to be used as part of the capping, materials for the multi-use sports pitches, and palisade fencing to surround the site. However, these volumes are unlikely to be significant in comparison to the required import volumes of soils and subsoils.

Importation of material to the site will be carried out on a phased basis, with material being imported throughout much of the remediation works, with differing quantities to be imported from Remediation Phases 1 to 5. The highest volumes of material are anticipated to be imported during Phase 2 and 3, with slightly smaller quantities to be imported during Phases 4 and 5. Stockpiling of this imported material will be required on the site throughout remediation works.

There will be impacts associated with the importation of this material during the Remediation Phase, namely increased heavy goods vehicle movements on the local roads in the area when transporting this material to site. An estimated 70 daily HGV movements will occur within the vicinity of the proposed Project during the busiest period of the remediation works (Phases 2 and 3). This is covered in more detail in Chapter 8 Noise and Vibration and Chapter 14 Traffic and Transport. The impact is assessed as negative, with a slight significance and short-term duration.

17.4.2 Operational Phase

Residential Property

There are no predicted impacts associated with the Operational Phase of the proposed Project as the acquiring of the lands and removal of the properties will be completed prior to operation of the multi-use public park.

Major Utilities

Electricity

An electricity supply will be required for the operation of the multi-use public park. This will be required for the changing rooms, the Landfill Infrastructure Compound and sports pitch lighting. It is anticipated that the demand for electricity to operate the public park will be higher during the Operational Phase of the public park compared to the current electricity consumption to operate the site office and site infrastructure. As there is already electricity utilised by the site in its current state, it is not anticipated that there will be any significant additional impacts to electricity supply during the operation of the multi-use public park.

Telecommunications

The Landfill Infrastructure Compound will require a telecommunications connection during the Operational Phase. There is already a telecommunications connection at the existing site. There will be no anticipated additional impacts to telecommunications during operation of the multi-use public park.

Water Supply

Water will be required during operation of the public park for welfare facilities such as showers, sinks and toilets within the changing rooms and the Landfill Infrastructure Compound. This water will continue to be supplied to the site from the existing Irish Water network. It is not anticipated that there will be any additional impacts to water supply during the operation of the multi-use public park.

Wastewater Services

Leachate will be discharged to the Irish Water sewer network via a pipeline which is to be constructed as part of the Remediation Phase. This new pipeline shown in Figure 4.17 will exit the site near the south-east corner of Zone 4, cross the adjacent field and run under the N7 and the Morell River to the Irish Water Johnstown Pumping Station.

The leachate discharged to Johnstown Pumping Station will be treated at the Osberstown WWTP in County Kildare. Osberstown WWTP is undergoing an upgrade to increase treatment capacity and improve the level of treatment achieved. This upgrade is due to be completed by the end of 2017.

Aside from the leachate, there will be smaller quantities of wastewater generated during the Operational Phase, namely from showers, sinks and toilets within the changing rooms and site office. This will be discharged via the foul sewer connected into the Johnstown Pumping Station as part of the Remediation Phase. The changing room building and the Landfill Infrastructure Compound sewerage waste will be directed to a single sewerage main which will run parallel to the leachate main. Refer to Chapter 4 Description of the Proposed Project for more details.

As there is currently no sewer connection from the site, the additional input into the existing sewer network from the leachate main and sewerage main will result in an imperceptible negative impact which is permanent in nature. These proposed connections to the Irish Water sewer network have been subject to liaison and agreement with Irish Water, refer to Chapter 4 Description of the Proposed Project for more details on the connection.

Surface Water Drainage

As the realignment of the existing surface water drainage connection into the site from the adjacent property (REC012) will still result in discharge via the existing outfall (separate to the site), there will be no additional impacts. Other surface water impacts are assessed in Chapter 13 Water - Hydrology.

Gas Supply

It is not anticipated that there will be a gas supply required for the operation of the multi-use public park, therefore there will be no impact to gas supply.

Imported Material

As the impacts associated with the import of material will occur only during the Remediation Phase of the proposed Project, there is no anticipated impact during the Operational Phase.

17.5 Mitigation Measures

The following mitigation measures shall be implemented for the proposed Project.

17.5.1 Residential Property

All reasonable locations for the site access, Landfill Infrastructure Compound and third multi-use sports pitch have been explored in order to minimise impact to residential property. The three properties to be demolished as well as the areas of land required shall be the subject to Compulsory Purchase Orders (CPOs), with the landowners to be compensated accordingly for the loss of the asset. A septic tank, of soakaway design, extends from property REC039 and discharges within the site boundary. This discharge will be removed and a sewer connection provided for this property.

The implementation of the CPO process will reduce the impact to neutral.

17.5.2 Major Utilities

All possible precautions shall be taken to avoid unplanned disruptions to any services during the Remediation Phase of the proposed Project. This shall include thorough investigation to identify the location of all utility infrastructure within the working areas, and the implementation of robust procedures when undertaking works in and around known utility infrastructure such as overhead lines.

Service disruptions impacting the surrounding residential, social and commercial properties shall be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions shall be given to all impacted properties. This shall include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties shall be undertaken prior to any proposed disruptions.

Specific mitigation measures are as follows:

- Avoidance of interaction with overhead utility lines in and around the site;
- Protection in place of all underground services for which diversion is not required;
- Use of existing electricity, telecommunications and water connections where possible;
- The surface water drain from the adjacent property shall be reconnected to the existing outfall to the Canal Feeder Stream outside of the site boundary, with the site connection removed;
- Consultation and agreement in place with Irish Water on allowable quantities and acceptance criteria for the leachate and other wastewater to be discharged to the public sewer network; and
- Pre-treatment of leachate (methane stripping) prior to disposal to the sewer to remove explosion risk within mains.

When the mitigation is implemented, the severity of the impact is reduced to slight as the services will have been satisfactorily diverted or amended, and will therefore continue to operate in their current form as required.

17.5.3 Imported Material

Where additional material is required for re-profiling and capping of the site, this material shall be imported. Only materials which meet suitable engineering grade shall be sourced as required. A number of key issues shall be considered as part of the selection process. These include source; material specification; production and transport costs; and the availability of material. Proposals for material management are to be set out in the Construction Environmental Management Plan (CEMP) for the proposed Project. Any material being imported to the site must be accompanied by a source report completed by the provider of the material, which will give the history of the material and the land from which it has been taken. Material shall only be accepted based on the information contained in the source report. No material shall be accepted to site without a suitable source report.

The imported material shall be sourced locally as far as reasonably practicable in order to reduce the need for long distance transportation of the material. Possible future sources for this material may include nearby development sites. Upcoming construction projects in County Kildare and County Dublin include:

- The M7 Naas Newbridge Bypass Upgrade + M7 Osberstown Interchange & R407 Sallins Bypass Scheme which will include the addition of a third lane each way to the main carriageway (stretching from Naas to the M7/M9 interchange) and the construction of a new interchange;
- The large service station planned for Naas located less than 1km from the site of the proposed Project (Planning Application 15500 - Withdrawn);
- A 284-unit housing development in Craddockstown, Naas within 5km of the site of the proposed Project which has been granted planning permission (Planning Application 246340);
- A 385-unit housing development in Newbridge, within 15km of the proposed Project, for which planning is being sought (Planning Application 16/975);
- A planned extension to the Kildare Village retail development (planning application not yet lodged) less than 30km from the site of the proposed Project; and
- The development of the Cherrywood area of South County Dublin approximately 40km from the site. Construction of this development is planned to run in stages until 2030 and includes construction of approximately 3,000 residential units as well as retail and other business and leisure units.

These are some possible local examples of projects where suitable topsoil and subsoil material may be available for importation. As well as those specific developments, the Kildare County Development Plan 2017-2023 (KCC 2017) has a new housing target of over 32,000 units for the county by 2023, including 4,842 dwellings in Naas alone (Kildare County Development Plan, KCC, 2017, Table 3.3). There is also a great deal of land zoned for future housing in the plan. Should development of these lands proceed, material may also become available from these projects.

17.5.4 Opportunities for Future Enhancement

Details of the proposed Project outline design and the features currently proposed are provided in Chapter 4 Description of the Proposed Project. There may be other opportunities for enhancement of the public park's value as a material asset which may be explored as part of the detailed design process. One such enhancement for which the feasibility may be explored is the use of solar power to augment the public park's energy consumption. The use of grey water to supplement the potable water requirements of the toilet facilities could also be explored as part of detailed design.

17.6 Residual Impacts

Residual impacts on both the major utilities and the imported material are considered to be imperceptible.

17.7 Difficulties Encountered in Compiling Information

The utility information compiled has been gathered through requests from utility service providers. The gathering of this information from a number of different sources may result in some gaps in information. There is a risk that there could be more utilities located in and around the site which are unknown at the time of compiling the data for this Chapter. All possible precautions shall be taken to avoid unplanned disruptions to any services during the Remediation Phase of the proposed Project and this shall include thorough investigation to identify the location of all utility infrastructure within the all working areas, and the implementation of robust procedures when undertaking works in and around known utility infrastructure such as overhead lines.

17.8 Cumulative Impacts

In addition to the proposed Project there are a number of additional development projects proposed in the vicinity of the site that are considered in terms of a cumulative impact on material assets. These projects are discussed in the following paragraphs.

17.8.1 Kerdiffstown Quarry

A Waste Facility Permit has been granted for the recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purpose of the improvement or development of land at the former quarry at Kerdiffstown. In accordance with the permit (Waste Facility Permit Number: WFP – KE – 16 – 0084 – 01) the permit holder shall ensure that the maximum tonnage of soil and stone recovered at the site is 98,928 tonnes. The importation of inert materials will raise the ground levels at the site and stabilise the side slope of the redundant quarry. The quarry, receptor COM016 on Figure 3.4, is located across the L2005 Kerdiffstown Road opposite the western boundary of Zone 1 of the proposed Project site and west of the receptor REC018. No cumulative impacts from this project and the proposed Project are anticipated.

17.8.2 The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes

The M7 Naas Newbridge Bypass Upgrade and M7 Osberstown Interchange & R407 Sallins Bypass Schemes (within 1km of the proposed Project) involve the addition of a third lane to both the north-bound and south-bound lanes of the M7 Motorway between Johnstown and Greatconnell and a new re-configured interchange at Newhall. No cumulative impacts from this project and the proposed Project are anticipated.

17.8.3 Applegreen Service Station at Naas (withdrawn)

The Planning Application for the development of the Applegreen Service Station on the eastern outskirts of Naas town and south of the N7 Road has been withdrawn. The nearest boundary for the proposed Service Station is approximately 600m from the proposed Project site entrance. No cumulative impacts from this project (if it were to proceed in the future), and the proposed Project are anticipated.

17.8.4 Housing Development at Craddockstown, Naas

A housing development has been granted permission to build a 284 housing-unit scheme at Craddockstown to the south of Naas town centre. The proposed housing development site is located over 2km south of the proposed Project site. Due to the extended distance between the two sites and the type of development proposed, no cumulative impacts from this project and the proposed Project are anticipated.

17.8.5 Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade

The Upper Liffey Valley Sewerage Scheme & Osberstown Wastewater Treatment Plant Upgrade is an Irish Water project which proposes to upgrade various wastewater elements (gravity sewers, pumping stations, storm handling facilities and rising mains) in the vicinity of the proposed Project. Works will be undertaken on drainage networks collecting wastewater from three catchments, namely Catchment A (Sallins, Clane and Prosperous); Catchment B (Naas, Johnstown and Kill); and Catchment C (Newbridge, Kilcullen, Athgarvan, Curragh and Carragh). Part of the upgrade includes a proposed new pumped sewer, a section of which will be installed along the L2005 Kerdiffstown Road adjacent to the proposed realignment works as part of the proposed Project. It is anticipated that the construction of the new pumped sewer will be scheduled at the same time as the realignment works to the L2005 Kerdiffstown Road to minimise potential impacts on local residents and traffic. In the event that either the proposed Project or the new pumped sewer construction is delayed it is not anticipated that there will be any significant cumulative impact.

It is therefore not considered that any additional mitigation measures above those already provided are required to account for cumulative impacts.

17.9 References

- Environmental Protection Agency (2002). Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2003). Advice notes on current practice in the preparation of Environmental Impact Statements
- Environmental Protection Agency (2015). Revised Guidelines on the Information to be contained in Environmental Impact Statements
- Environmental Protection Agency (2015). Advice notes for preparing Environmental Impact Statements (Draft)
- Kildare County Council (2017). Kildare County Development Plan 2017-2023.
- National Roads Authority (2008). Environmental Impact Assessment of National Road Schemes – A Practical Guide

18. Environmental Interactions

18.1 Introduction

The interaction of environmental aspects was clearly identified at an early stage in the project to be an important factor to be considered in the full evaluation of the environmental impacts associated with the proposed Project.

While all environmental factors are inter-related to some extent, the significant interactions and interdependencies were taken into consideration by the specialist environmental and ecological consultants when preparing their assessments. Consequently, these interactions were integrated into the individual sub-Sections from Chapters 7 to 17 of this EIAR. In addition, a summary of the general interactions is presented in Table 18.1 and the detail of the interactions in Table 18.2.

Table 18.1: Relationships between the Environmental Factors

Inter-relationship Matrix- Environmental Elements	Air Quality, Odour and Climate	Noise and Vibration	Landscape and Visual	Archaeology, Cultural Heritage and Architectural Heritage	Biodiversity	Soils, Geology, Contaminated Land and Groundwater	Water – Hydrology	Traffic	Waste	Population and Human Health	Material Assets
Air Quality, Odour and Climate											
Noise and Vibration											
Landscape and Visual											
Archaeology, Cultural Heritage and Architectural Heritage		✓	✓								
Biodiversity	✓	✓	✓								
Soils, Geology, Contaminated Land and Groundwater					✓						
Water – Hydrology			✓		✓	✓					
Traffic and Transport	✓	✓					✓				
Waste	✓		✓	✓		✓	✓	✓			
Population and Human Health	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Material Assets	✓				✓	✓		✓		✓	

Table 18.2: Explanatory Notes on the Relationships between the Environmental Aspects

Inter-relationship Matrix-Environmental Elements	Air Quality, Odour and Climate	Noise and Vibration	Landscape and Visual	Archaeology, Cultural Heritage and Architectural Heritage	Biodiversity	Soils, Geology, Contaminated Land and Groundwater	Water – Hydrology	Traffic and Transport	Waste	Population and Human Health	Material Assets
Air Quality, Odour and Climate											
Noise and Vibration											
Landscape and Visual											
Archaeology, Cultural Heritage and Architectural Heritage		Vibration generated from site activities impacting on cultural heritage assets	Landscape and Visual impacts on cultural heritage assets, including indirect impact on the setting of a cultural heritage feature								
Biodiversity	Air quality changes on flora and fauna – dust, odour, landfill gas	Disturbance to fauna from noise and vibration generated from site activities	Landscaping proposals and impacts on flora and fauna – retaining habitats, creating new habitats and the impact of the loss of habitats on landscape and visual amenity								
Soils, Geology, Contaminated Land and Groundwater					Leachate generation and management – impacts for flora and fauna						
Water – Hydrology			Visual impacts on surface water receptors		Surface water quality impacts on flora and fauna – surface water outfall Creation of new habitats	Leachate generation and management – impacts for nearby surface water receptors					
Traffic and Transport	Increase in air emissions associated with increased traffic generation	Increase in noise and vibration emissions associated with increased traffic generation					Increase runoff associated with traffic generation (oil, fuel and silt can be washed off) – impacts on surface water quality				
Waste	Storage, stockpiling, handling and transport material on site – dust and odour impacts		Storage, movement and stockpiling of material on site during the Remediation Phase – impact on landscape and visual receptors	Storage, movement and stockpiling of material on site during the Remediation Phase – impact on cultural heritage assets		Storage, stockpiling, handling and transport of material generated from the Remediation Phase such as excavated material.	Water unsuitable for reuse for dust suppression during the Remediation Phase is treated as a waste and will be removed to a licenced facility.	Transportation of waste generated during the Remediation Phase (typical construction type wastes) and during the Operational Phase (wastes generated within the Site Office and as part of the maintenance of the multi-use public park).			
Population and Human Health	Air quality changes on local community – dust, odour, landfill gas and emissions from increased traffic	Increase in noise levels and impacts on the local community – generated from site activities	Landscape and visual impacts associated with Remediation Phase works and the presence of a multi-use public park in the surrounding environment	Potential impacts on cultural heritage assets – amenity value from a local community perspective	The amenity value of future ecological habitat areas for the local community	Leachate generation and management – impacts for local communities	Impacts on surrounding surface water quality and impacts on local community	Increase in traffic levels and resultant travel time delays impacting on the local community – generated from remediation and operational activities	Storage, movement and stockpiling of material on site – impacts on local community		
Material Assets	Import of fill material to support Remediation Phase works – dust impacts				Import of fill material to support Remediation Phase works – dust impacts to flora and fauna	Import of fill material to support Remediation Phase works		Import of fill material resulting in increased traffic levels during Remediation Phase		Impacts on utilities during the Remediation Phase and the potential impact on local communities	

19. Schedule of Environmental Commitments

19.1 Introduction

The purpose of this Chapter is to collate the mitigation measures identified in the Environmental Impact Assessment Report (EIAR) that are considered necessary to protect the environment prior to the commencement and during the Remediation Phase and/or during the Operational Phase of the proposed Project.

As described throughout this EIAR, the outline design of the proposed Project has been progressed taking account of environmental constraints and considerations that have been identified, enabling avoidance of potential environmental impacts.

19.2 Mitigation Schedules

Mitigation and environmental commitments have been identified as general requirements which shall help to avoid, reduce or offset potential impacts and are relevant to a number of the environmental aspects addressed in the EIAR. These are provided in Section 19.3.

Specific mitigation measures specified within the EIAR technical assessments are provided in Section 19.4 to Section 19.15.

The timing of the implementation of the mitigation measure is indicated in within the tables as:

- Remediation Phase: The undertaking of the physical works to remediate the former landfill and construct the multi-use public park.
- Operational Phase: When the proposed multi-use public park has opened as well as the ongoing operation and maintenance of the landfill management infrastructure.

19.3 General Requirements

Table 19.1: General Requirement Mitigation

Mitigation No.	Description	Timing of the Measures	Technical Areas to which mitigation item is applicable											
			Proposed Works and Methods as described in Chapter 4 Description of the Proposed Project	Air Quality, Odour and Climate	Noise and Vibration	Landscape and Visual	Archaeology, Cultural Heritage and Architectural Heritage	Biodiversity	Soils, Geology, Contaminated Land and Groundwater	Water – Hydrology	Traffic and Transport	Waste	Population and Human Health	Material Assets
GR1	Prior to commencement of the Remediation Phase, the appointed contractor responsible for the remediation works shall prepare a Construction Environmental Management Plan (CEMP) for agreement with Kildare County Council (KCC). The CEMP shall contain the mitigation measures and plans identified in the following Sections (as a minimum), the wider EIAR and shall implement the conditions set out in the planning approval and the requirements of the site's Industrial Emissions Activities Licence (IEAL). The CEMP shall set out all the intended methods to manage potential environmental impacts from remediation of the proposed Project, and shall include the following as a minimum: • Groundwater Management Plan • Odour Management Plan (to be developed using the existing draft Odour Control Plan, SKM 2013) • Dust Management Plan • Noise and Vibration Management Plan • Invasive Species Management Plan • Site Biodiversity Management Plan • Erosion and Sediment Control Plan • Contaminant Spill Emergency Plan • Construction Traffic Management Plan • Mobility Management Plan • Waste and Materials Management Plan	Remediation Phase	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
GR2	The CEMP shall also incorporate the requirements of the existing plans developed for the proposed Project, including but not limited to: • Landfill Gas Management Plan (including risk assessment) • Leachate Management Plan • Surface Water Management Plan • Landscape Masterplan Statement • KLRP Management Plan Accident and Emergency Response • Monitoring and Control Management Plan These Plans and the CEMP are live documents and will be reviewed on a regular basis and updated accordingly by the appointed contractor, in particular the document shall be reviewed on receipt of planning approval and grant of the IEAL.	Remediation Phase		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GR3	The key elements of the CEMP shall include: • Appointment of an Environmental Officer by the appointed contractor for the duration of the Remediation Phase • Incorporation of environmental commitments and requirements • Incorporation of procedures to record any environmental incidents on site and procedures for implementing appropriate corrective and preventative measures • Outlining the methods by which the remediation works will be managed to meet these commitments and requirements • Outlining the relevant guidance (with those outlined in the EIAR as a minimum) that have informed the Plan development • Incorporation of procedures for communicating with KCC, the public and stakeholders • Incorporation of procedures for staff environmental awareness training • Incorporation of environmental monitoring procedures • Incorporation of a system of audit and review with regard to the effectiveness of the Plan	Remediation Phase		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Mitigation No.	Description	Timing of the Measures	Technical Areas to which mitigation item is applicable											
			Proposed Works and Methods as described in Chapter 4 Description of the Proposed Project	Air Quality, Odour and Climate	Noise and Vibration	Landscape and Visual	Archaeology, Cultural Heritage and Architectural Heritage	Biodiversity	Soils, Geology, Contaminated Land and Groundwater	Water – Hydrology	Traffic and Transport	Waste	Population and Human Health	Material Assets
GR4	The appointed contractor shall ensure that the CEMP is fully implemented during the Remediation Phase in agreement with KCC, to prevent or reduce the impacts identified in the impact assessment.	Remediation Phase	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GR5	Maintenance and active management of the landfill infrastructure is integral to the Operational Phase of the proposed Project. As described in this EIAR the continued monitoring and management of the site will provide assurance that the landfill management systems are operating effectively. KCC will appoint a Site Manager for the Operational Phase who shall be responsible for the control, operation and maintenance of the site and emissions shall take place as set out in the IEAL. The KCC Site Manager will be responsible for managing the sampling, analyses, measurements, examinations, maintenance and calibrations as set out in the IEAL and for reporting to the EPA, in the format specified in the IEAL. The KCC Site Manager will establish procedures to ensure that corrective action is taken should the specified limits of the IEAL not be fulfilled. These procedures will include the actions for initiating further investigation and implementing corrective action where appropriate. In the development of the outline design of the proposed Project consideration has been given to the nature of the works and where appropriate potential future management solutions have been identified. These solutions are available for KCC to implement in the future should they be required.	Remediation Phase	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

19.4 Proposed Works and Methods

Table 19.2: Proposed Works and Methods Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
WM1	4.2.4	On-site concrete structures are envisaged to be demolished by pneumatic breakers fitted to excavators. Where noise limits are likely to be exceeded noise barriers will be provided between the works and identified receptors in proximity to the working area in accordance with the mitigation measures specified in Chapter 8 Noise and Vibration. The broken out material will be processed using mobile crushing and screening plant to be located in Zone 2B, due to its reduced exposure to surrounding environs compared to Zone 2A. Dust suppression techniques will be employed, by spraying water from a site bowser or similar, in accordance with the Dust Management Plan developed as part of the Construction Environmental Management Plan (CEMP).	Remediation Phase
WM2	4.2.7	In order to prevent damage to the capping system only selected waste, to exclude large and bulky or sharp items such as concrete blocks and rebar, will be used to form the final lift of waste across Zones 1 and 3 immediately below the regulation layer. Selection and placement of the final layer of waste will be carried out under the supervision of a suitably trained and qualified person. Each waste layer placed will be covered at least by the end of the working day with the application of daily cover to assist with control of odours as well. This may comprise soils or geosynthetics, widely used for such purposes in the waste management industry as a temporary cover. The objective of the daily cover is to ensure windblown litter and debris are minimised, vermin is prevented from entering the waste mass and scavenging is prevented as far as practicable and the depth of cover is sufficient to avoid future problems of perched leachate. A stockpile of cover materials will be maintained, as necessary, in the vicinity of the operational area in order to ensure that exposed waste can be covered at the end of each working day. The use of alternative cover methods (e.g. proprietary geosynthetic sheeting) will be agreed with the EPA prior to use.	Remediation Phase
WM3	4.2.8	During the Remediation Phase the generation of leachate will be managed through a number of on-site management operations, including: • Working in discrete areas to minimise the area of exposed waste; • Interception of any leachate outbreaks identified during waste excavation and re-profiling activities; • Provision of daily cover to exposed wastes, occurring as part of the remediation works; and • Progressively remediate the site with a landfill cap.	Remediation Phase
WM4	4.2.9	During remediation works the flare will be moved around the site to support key extraction areas, to reduce emissions and odour if observed during the works.	Remediation Phase
WM5	4.2.9	A suitably competent contractor(s) will be appointed to undertake remedial works at the site, with surface water management a particular aspect to be closely monitored and controlled. The contractor will be required to construct temporary perimeter bunds and silt fences to enable separation of working areas from remediated areas. However, it is anticipated that until initial vegetation coverage, comprising grass, fully germinates silty runoff from capping soils may still be prevalent and require control. The appointed contractor(s) responsible for the remediation works will be required for ensuring a break between working (exposed waste) areas and remediated areas (restored) is maintained to prevent cross contamination. The appointed contractor(s) may also utilise temporary on site lagoons to retain surface water runoff, with silt buster tanks (or similar) used to limit the amount of silt being disposed to the ponds/ lagoons. Water collected in these lagoons will be used for dust suppression across the open working areas and, if not contaminated, over restored areas with any contaminated waters removed from the site by road tanker. The appointed contractor will be required to prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC, for the contractor to then implement through the Remediation Phase, with water contamination testing requirements and limits to be agreed by the EPA.	Remediation Phase
WM6	4.2.9	Oil interceptors will be required during the Remediation Phase to serve temporary working areas (e.g. potential laydown area, fuelling station, temporary car park and wheel wash area). These interceptors will be removed on completion of the remediation works.	Remediation Phase
WM7	4.2.9	Surface water management ponds in Zone 1A and Zone 4 are to be developed as part of the remediation works, only discharging once remediation works have been completed. An impermeable cap will isolate the waste body from interacting with rainfall on the site and nearly all rainfall will result in runoff which will have to be managed to avoid flooding or ponding of water on the site. This rainwater/surface water will not have interacted with waste or leachate in any way and will be equivalent in quality to runoff from parkland or agricultural fields with a degree of suspended solids which will need to be reduced before discharge, with the pond in Zone 1A discharging to groundwater via a soakaway and the ponds in Zone 4 discharging to surface water.	Remediation Phase

<table>
<tr><th>Mitigation No.</th><th>EIAR Section Reference</th><th>Description of Mitigation Measure / Environmental Commitments</th><th>Stage of Impact i.e. Remediation Phase / Operational Phase</th></tr>
<tr><td>WM8</td><td>4.3.4</td><td>To prevent possible contamination of clean materials by site wastes separate stockpiling areas for imported materials and site won materials will be established. Stockpiling arrangements are summarised in the following table with stockpile locations shown indicatively on Figures 4.8 and 4.9.
Stockpile locations are retained on existing concrete hardstanding areas as far as practicable, to offer a separation to and protection of the underlying materials.
Stockpiling Arrangements
<table>
<tr><th>Stockpile</th><th>Location</th><th>Uses</th></tr>
<tr><td>Existing sub-soil</td><td>Retained adjacent to existing site entrance.</td><td>Zones 1 and 4 capping</td></tr>
<tr><td>Imported ‘clean’ soils</td><td>Zone 2A</td><td>Zone 3 toe bund
Zone 4 ponds bunds
Zones 1 to 4 capping.</td></tr>
<tr><td>Crushed / screened concrete (aggregate)</td><td>Zone 2B</td><td>Gas wells, access tracks.</td></tr>
<tr><td>Site wastes (including fines from crushing of concrete)</td><td>Zone 2B</td><td>Infill to Zones 1 and 3
Export from site if classified as hazardous during waste classification</td></tr>
</table>
Other areas will require to be designated on site, such as holding areas, quarantine areas and storage of unprocessed waste. Storage of processed waste is unlikely to be necessary as it would be transported to the infill area (typically Zones 1 and 3) immediately to reduce the need for double handling.
The general segregation imported clean materials and site material stockpiles between Zones 2A and 2B respectively will also limit the risk of cross contamination of clean materials by avoiding the need for road going vehicles to directly traffic on or though areas containing exposed waste materials.
Surface water management proposals indicate that there will be no discharge from the site permitted during the remediation works. The ponds will be adopted as retention ponds during the remediation works, and the appointed contractor shall be required to utilise silt-buster traps as is typical on earthworks/ construction projects.
To further mitigate the risk of off-site contamination, all road going vehicles which access stockpile areas will be required to pass through a wheel washing facility prior to exiting the site. Further, site access roads including Kerdiffstown Road will be subject to regular road sweeping.
Sizing of stockpiles cannot be determined at this stage as it is dependent on the availability of suitable material for import, the programming of the works, subject to planning approval being granted, and the procurement approach adopted.
Stockpiling of materials will be undertaken in accordance with ‘Construction Code of Practice for the Sustainable Use of Soils on Construction Sites’ published by the UK Department for Environment Food and Rural Affairs or equivalent Irish guidelines.
As a minimum stockpile management will include:
• Visual screening for potential contaminated materials;
• Segregation of material suspected to be contaminated from clean materials;
• Stockpiling of materials at appropriate heights / batters to prevent potential instability;
• Protection of stockpiled materials from scour / erosion;
• The provision of adequate drainage to limit and control potential contaminated surface water runoff, including silt mitigation;
• The avoidance of un-necessary trafficking / handling of stockpiled materials;
• The following additional measures shall be applied to topsoil stockpiles:
• A limitation on stockpile height to prevent degradation of the topsoil structure; and
• Adequate control of weed growth.
With the exception of top soil (or soil forming materials), stockpile heights will be restricted to a maximum of 4m to facilitate adequate management during the works.
A reduced stockpile height of 2m will apply to any top soil / soil forming materials to prevent possible degradation of soil structure.</td><td>Remediation Phase</td></tr>
<tr><td>WM9</td><td>4.5</td><td>The proposed Project will not operate as a landfill and will not accept waste for disposal but will require importation of inert wastes for use as engineering materials, such as aggregate, subsoil and top soil. In such instances, waste acceptance procedures shall be followed. The procedures will be supported by a summary note of Waste Acceptance Procedures (for issue to Contractors when seeking appropriate materials) and an extract from Part VIII of the Waste Management (Licensing) Regulations 2004, to confirm the wastes that are prohibited from the proposed Project. For all soils proposed for the remediation of the site a source specific determination of their suitability shall be required. Source materials which have the potential to be contaminated shall be tested to determine the suitability of the soils for use in the remediation works. The testing protocols and the frequency of testing shall be determined from an assessment of the source site. This methodology shall be carried out for both greenfield and brownfield sites. Once the source information is available then a site specific risk assessment shall be undertaken to identify the actual risks posed by the contaminants in their proposed use at the site and the suitability of the soils for remediation purposes confirmed. This suitability assessment will include Waste Acceptance Procedures comprising:
• Basic characterisation;
• Compliance testing; and
• On-site verification.</td><td>Remediation Phase</td></tr>
<tr><td>WM9</td><td>4.5</td><td>The proposed Project will not operate as a landfill and will not accept waste for disposal but will require importation of inert wastes for use as engineering materials, such as aggregate, subsoil and top soil. In such instances, waste acceptance procedures shall be followed. The procedures will be supported by a summary note of Waste Acceptance Procedures (for issue to Contractors when seeking appropriate materials) and an extract from Part VIII of the Waste Management (Licensing) Regulations 2004, to confirm the wastes that are prohibited from the proposed Project. For all soils proposed for the remediation of the site a source specific determination of their suitability shall be required. Source materials which have the potential to be contaminated shall be tested to determine the suitability of the soils for use in the remediation works. The testing protocols and the frequency of testing shall be determined from an assessment of the source site. This methodology shall be carried out for both greenfield and brownfield sites. Once the source information is available then a site specific risk assessment shall be undertaken to identify the actual risks posed by the contaminants in their proposed use at the site and the suitability of the soils for remediation purposes confirmed. This suitability assessment will include Waste Acceptance Procedures comprising:
• Basic characterisation;
• Compliance testing; and
• On-site verification.</td><td>Remediation Phase</td></tr>
</table>

19.5 Air Quality, Odour and Climate

Table 19.3: Air Quality, Odour and Climate Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
A1	7.5.1	The CEMP will contain a Dust Management Plan which will be formulated for the Remediation Phase of the proposed Project, as the planned activities are likely to generate some dust emissions. The principal objective of the Dust Management Plan will be to ensure that dust emissions do not cause significant nuisance at receptors in the vicinity of the proposed Project. The Dust Management Plan shall address the following: • The appointed contractor for the remediation works will be assigned with overall responsibility for Dust Management reporting back to the KCC Site Manager; • The design, and in particular the phasing of the Remediation Phase work will consider dust impact management and choose design approaches to minimise dust emissions; • The Remediation Phase will be carried out in Phases so that all of the works with significant potential for generating dust emission will not all occur simultaneously; • An effective training programme in dust management for site personnel will be implemented for the duration of the Remediation Phase; • A strategy for ensuring effective communication with the local community will be developed and implemented; • A programme of dust minimisation and control measures will be implemented and regularly reviewed; and • A monitoring programme will be implemented.	Remediation Phase
A2	7.5.1	The areas on site which vehicles will be travelling on will be hard-surfaced where practicable thus significantly reducing the potential for dust emissions from the vehicles.	Remediation Phase
A3	7.5.1	A wheel washing facility with water collection and filtering before any discharge to the surface water management system will be set up. Gate security staff will be briefed on inspection of vehicles for cleanliness ahead of leaving site. During the initial stages of site set-up, a mobile wheel washing vehicle will be available at short notice, if necessary. The use of a wheel wash facility at the entrance to the proposed Project will minimise the transfer of any dust onto the roads in the vicinity of the site; this will also minimise the potential for dust build-up on surfaces which could be blown across the site.	Remediation Phase
A4	7.5.1	In order to minimise the potential for wind-generated emissions from storage of materials, the storage areas will be oriented in a favourable manner with respect to the prevailing wind to minimise the effects of wind blow on release of dust and particulate.	Remediation Phase
A5	7.5.1	Fixed and mobile water sprays will be used to control dust emissions from material stockpiles and road and hardstanding surfaces as necessary in dry and/or windy weather.	Remediation Phase
A6	7.5.1	A daily inspection programme will be formulated and implemented in order to ensure that dust control measures are inspected to verify effective operation and management.	Remediation Phase
A7	7.5.1	A dust deposition monitoring programme will be implemented at the site boundaries for the duration of the Remediation Phase in order to verify the continued compliance with relevant standards and limits.	Remediation Phase
A8	7.5.1	During the Remediation Phase the appointed contractor will work in accordance with the guidance provided in the National Guidelines for the prevention of Nosocomial Invasive Aspergillosis during construction/renovation activities (developed by a sub-committee of the Scientific Advisory Committee of the National Disease Surveillance Centre, 2002). Odour mitigation measures are discussed in the draft Odour Control Plan (OCP) for the proposed Project which will be finalised as part of the overall CEMP. A Draft OCP was formulated to inform the design process for this proposed Project and is attached in Appendix A7.7. Odour incidents are being minimised at the site through best practice and regular monitoring. Odour minimisation and prevention measures which are currently implemented and which will continue to be updated during the Remediation Phase will include: • Carrying out subjective odour assessments (sniff tests) and logging details of odorous emissions during daily and weekly site assessments, in accordance with EPA guidance; • Noting wind direction, temperature and barometric pressure on a daily basis; • Ensuring that landfill gas flaring is balanced and optimised to maximise gas collection from installed gas wells and flaring according to operational recommendations; • Investigating any odour that appears stronger than the normal emission; • Logging any odour complaints, and investigating circumstances on the day the complaint was made. This includes correlating wind direction and speed, barometric pressure, and whether any site works were being carried out; and • Notifying nearby sensitive receptors prior to any works being carried out, that may disturb the waste body and cause odours to be released.	Remediation Phase
A9	7.5.1	Minimisation of evaporation of odours will be promoted through adoption of the following measures: • Maintain an adequate supply of temporary cover material prior to any works commencing (e.g. clean topsoil, clay or liner membrane); • Any disturbance and exposure of odorous waste will be kept to the minimum practical duration; • The surface area of exposed waste will be kept to a minimum size at all times; • Temporary cover will be applied to all work areas as quickly as practicable; • The carrying out of major waste movements during hot weather when odours volatise most readily will be avoided; • Leaving open waste exposed in direct sunlight, which increases evaporation, will be avoided; • Water spray to lower the temperature of exposed waste, and inhibit evaporation will be used; • Screening of materials containing waste, unless adequately contained, will be avoided; and • Any waste containing material that has to be transported from one side of the site to another will be covered and contained during transport.	Remediation Phase
A10	7.5.1	Planning of works to take place under suitable weather conditions for minimising odours will be actively implemented during the Remediation Phase. If unacceptable odours are generated from a particular activity it may be necessary to cover the exposed waste, and cease the activity until additional odour control measures can be put in place. This may include the provision of additional water bowsers, or waiting for cooler weather conditions. The appointed contractor will agree such measures with the KCC Site Manager.	Remediation Phase
A11	7.5.1	Nearby sensitive receptors and local Community Liaison Group will be kept informed of the progress and plans regarding the Remediation Phase. Nearby sensitive receptors will be informed prior to any remediation works being carried out. They will be informed of the works phasing plan, and the locations of works planned for the duration of remediation works will be regularly updated and communicated. Where adverse metrological conditions coincide with works phasing that cannot be averted, residents will be informed of the heightened risk of short-term odour nuisances.	Remediation Phase

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
A12	7.5.1	During remediation works there will be a requirement for monitoring of odour emissions from the site to be undertaken which shall to include the following: • Frequent sniff sampling and logging of odour characteristics at the working face; • Frequent sniff tests at the site perimeter downwind from the working face; • Frequent sampling of specified compounds with colour indicator tubes specified at appropriately low detection ranges; • Frequent measurement of Total VOC concentrations using a FID (Flame Ionization Detector) handheld field detector; and • Regular sniff tests off-site near sensitive receptor locations.	Remediation Phase
A13	7.5.1	If monitoring indicates higher than expected odour emissions, or impacts at sensitive receptors, additional mitigation measures will need to be implemented. If necessary, and in adverse conditions, the works may have to be stopped and the workface contained with a temporary cover, until adequate mitigation can be assured. The appointed contractor will agree such measures with the KCC Site Manager.	Remediation Phase
A14	7.5.1	Kildare County Council will continue to monitor the level of hydrogen sulphide in the landfill gas on a weekly basis as part of the active management of landfill gas at the site throughout the Remediation Phase of the proposed Project. If higher sulfur, and H_2S, levels are detected in the landfill gas flare inlet during the Remediation Phase, then a suitable abatement system, likely to be an activated carbon filter, will be fitted to reduce the levels of sulfur reaching the flare	Remediation Phase
A15	7.5.2	Landfill gas will be actively and passively managed by means of an extensive network of extraction wells and perimeter gas venting trenches. Actively extracted gas will be diverted to the new flare located within the purpose-built Landfill Gas Infrastructure Compound which will convert the landfill gas into harmless substances. There will be two landfill gas flares, one operating in duty and one in back-up mode. The location of the Landfill Gas Infrastructure Compound and the height of the landfill gas flare stacks have been chosen to optimise the management of the landfill gas at the proposed Project.	Operational Phase
A16	7.5.2	The design of the pipeline to transfer leachate off site will require installation of air valves and manholes. These manholes will include be sealed with a gas-resistant sealant to prevent release of odours. The connection point to Johnstown Pumping Station will include be fitted with a carbon filter to further mitigate an odour release.	Operational Phase

19.6 Noise and Vibration

Table 19.4 Noise and Vibration Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
N1	8.5.1	Prior to the commencement of any on-site works, the appointed contractor will be required to prepare a Construction Environmental Management Plan (CEMP) in agreement with Kildare County Council. The CEMP shall contain a stand-alone Noise and Vibration Management Plan (NVMP) which will detail how the appointed contractor will comply with the noise criteria set out in this EIAR and will deal specifically with on-site activities in a strategic manner to remove or reduce significant noise and vibration impacts associated with the remediation works. The NVMP will detail the provision and installation of the acoustic barriers, the best practice noise measures that the appointed contractor will adhere to on-site and the noise and vibration monitoring programme that the appointed contractor will undertake during the remediation works.	Remediation Phase
N2	8.5.1	The appointed contractor shall be required to carry noise monitoring at NSR locations on a weekly basis and this shall be increased to continuous monitoring in agreement with the EPA and the conditions of the IEAL, once the remediation works begin to approach the NSR locations. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works., The results the noise monitoring will be available in real time to the KCC Site Manager. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works to ensure that the noise emissions from the various works are kept within the prescribed noise limits. The appointed contractor shall also be required to carry out vibration monitoring at the nearest NSR locations during sensitive phases of the remediation works and this data shall be reviewed daily to ensure the limits are being complied with.	Remediation Phase
N3	8.5.1	The NVMP will detail the best practice measures to be adhered to at the site including but not limited to the following: • the correct positioning of the mounted breakers in Zone 2A during Phase 1 on-site works to minimise their combined impact - To ensure that the noise limits are met, mounted breakers shall be positioned well apart from each other when operating simultaneously in Zone 2A. Scheduling of works for Zone 2A will ensure that the mounted breakers are correctly positioned to ensure that the relevant criteria are not exceeded at the nearest NSRs; • the correct sequencing of the building up or taking down of stockpiles on-site - Best Practice shall ensure that the stockpiling will be carried out in a sequence where the stockpile is built up from the boundary nearest to the receptors and added to so that the stockpile can act as a barrier between the noise source and the nearest receptors as the works develop; • the careful management of the number of plant items in simultaneous operation when the works are close to the NSRs along L2005 Kerdiffstown Road and other key locations; • the careful positioning of heavy plant items, such as the waste compactor, to minimise the potential for ground borne vibrations to be generated.	Remediation Phase
N4	8.5.1	The remediation works will be managed through the use of construction noise limits which the appointed contractor will be required to work within. Best practice control measures including choice of plant, scheduling of works on site, provision of temporary acoustic screening, on-site noise monitoring and other measures will be employed in order to ensure noise limits are not exceeded.	Remediation Phase
N5	8.5.1	Best practice noise management procedures for the control of noise and vibration from demolition and construction activities as presented in BS5228 will be followed. Such measures to be adhered will include the following: On-site Work Practices • Avoid unnecessary revving of engines and switch off equipment when not required; • Keep internal haul routes well maintained and avoid steep gradients; • Use rubber linings in chutes and dumpers to reduce impact noise; • Minimise drop height of materials; • Start-up plant and vehicles sequentially rather than all together; • Equipment shall be located away from noise sensitive areas, as much as is feasible; • Regular and effective maintenance by trained personnel shall be carried out to reduce noise and/or vibration from plant and machinery; and • Limit noisy construction works to 07:00 to 19:00 weekdays with Saturday working from 08:00 to 16:30 unless otherwise agreed with the relevant authority. In addition to the above BS5228 recommendations, Section 10.3 of NG4 discusses the management of Waste Related Operations and includes the following mitigation measures which will also be adhered to at the proposed Project: • Employ noise reducing technologies, such as attenuators or enclosures, where practicable; • Ensure that noise control measures are maintained as per the manufacturers requirements; • Minimise the number of vehicles/heavy plant on the proposed Project at any one time; • Maintain vehicles in good order, employ the principles of preventive maintenance and undertake reference vehicle noise measurements at defined intervals; • Ensure that noisy vehicles are parked as far as possible from noise sensitive areas; • Ensure that drivers are aware of the potential for noise to cause annoyance/disturbance to local residents – they shall show due regard to this, particularly when entering and leaving the proposed Project (e.g. no unnecessary horn blowing), and • Consider the use of alternative varieties of reversing alarm with reduced noise output, such as ambient noise sensing alarms with variable volume or directional modulated alarms – these must be evaluated on a case-by-case basis and regard must be had to any health and safety issues that may arise.	Remediation Phase
N6	8.5.1	Selection of Quiet Plant • In accordance with best practicable means, plant and activities to be employed on the proposed Project will be reviewed to ensure that they are the quietest available for the required purpose.	Remediation Phase
N7	8.5.1	Acoustic Screens and Barriers Acoustic screens are required to be erected in certain locations for the duration of the Remediation Phase works (refer to Figure 8.2 and Section 8.4.1 for more details). These screens shall be carefully positioned to be as effective as possible. In general, the barrier shall have no gaps or openings in the joins of the barrier material and the barrier material shall have a minimum mass per unit area of 7 kg/m^2. The minimum height of the barrier shall typically be such that no part of the noise source will be visible from the receiving point. This will not always be possible and therefore the minimum recommended height is prescribed at 2.4m. The existing screening banks along the western boundary of the proposed Project will be supplemented to give additional noise protection to the private residences along the L2005 Kerdiffstown Road. This shall be done with the use of straw bales (or equivalent) as that is the most readily accessible and highly mobile screen type with very effective mitigation properties. The low-reflection acoustic screens required around the boundary of Zone 2A shall be solidly constructed of straw bales (or equivalent) and shall be of minimum 5m height. The locations for the erection of the acoustic screens are shown on Figure 8.2.	Remediation Phase
N8	8.5.1	Noise Control • Improved sound reduction methods, such as equipment enclosures shall be used (this is also addressed in Environmental Protection Agency (2016). Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA,2016))	Remediation Phase

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
N9	8.5.1	Communications The appointed contractor shall continue the current engagement with local residents and stakeholders and will notify them before the commencement of any works forecasted to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. Throughout the Remediation Phase there shall be distribution of information circulars by the appointed contractor informing people of the progress of works and any likely periods of significant noise and vibration. A nominated contact for any communications in relation to noise and vibration for the duration of the project remediation works and any queries, complaints or other formal correspondence regarding noise and vibration shall be appointed by the contractor. Any liaison with local residents will be undertaken in agreement with the KCC Site Manager.	Remediation Phase
N10	8.5.1	Monitoring The appointed contractor shall be required to carry noise monitoring at NSR locations on a weekly basis and this shall be increased to continuous monitoring in agreement with the EPA and the conditions of the IEAL, once the remediation works begin to approach the NSR locations. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works., The results the noise monitoring will be available in real time to the KCC Site Manager. The measured noise levels at the NSR locations will be assessed against the noise limits and will be used to assist the scheduling of works to ensure that the noise emissions from the various works are kept within the prescribed noise limits. The appointed contractor shall also be required to carry out vibration monitoring at the nearest NSR locations during sensitive phases of the remediation works and this data shall be reviewed daily to ensure the limits are being complied with.	Remediation Phase

19.7 Landscape and Visual

Table 19.5 Landscape and Visual Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
LV1	9.5	Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP). The CEMP shall contain these mitigation measures and plans identified in this EIAR and ensure that they are fully implemented during the Remediation Phase, to prevent or reduce the impacts identified in the impact assessment. The landscaping and planting proposals for the proposed Project will be subject to confirmation during the detailed design stage.	Remediation Phase
LV2	9.5	Landscape mitigation measures are indicated on Figure 4.20 – Landscape Masterplan and outlined in greater detail in the Landscape Masterplan Statement contained in Appendix A4.8. Related ecological mitigation measures are also shown on Figure 11.6 – Ecological Mitigation and Enhancements.	Remediation Phase
LV3	9.5	Tree and shrub planting will occur wherever practicable (Refer to Figure 4.20). This will mainly occur in peripheral areas and site boundaries due to limitations as to where tree planting can take place so as not to compromise the integrity of the engineering capping system.	Remediation Phase
LV4	9.5	At the north-west end of the mound is a proposed pond to manage surface water runoff from this area of the site and this occurs adjacent to a patch of woodland contained within the neighbouring property of Kerdiffstown House. The area surrounding this pond will remain fenced off from the public providing an opportunity for ecological enhancement.	Remediation Phase
LV5	9.5	The swale proposed at the base of the eastern slope of Zone 1 will be outside of the capped area and will be planted with semi-mature parkland trees.	Remediation Phase
LV6	9.5	Perimeter tree and hedge planting will also be incorporated into the boundary treatment on the western side of the site. This will include amenity planting around the site entrance as well as native hedgerow screen planting to fill a short gap in the roadside vegetation adjacent to an existing residential dwelling on the eastern side of the Kerdiffstown road (see VP5). Two patches of woodland planting in the form of whips and feathered trees will be provided at the south-eastern end of the site to expand and consolidate existing woodland areas that occur immediately adjacent to the site (Intervention A14 on Figure 4.20). The Landfill Infrastructure Compound located to the east of the public park entrance will be planted with trees and shrubs to screen the compound insofar as possible. It should be noted that all proposed woodland and hedgerow amenity and mitigation planting will comprise of native and naturalised species.	Remediation Phase
LV7	9.5	Wetland ponds proposed for Zone 1A and central portion of Zone 4 will be planted up with a variety of wetland plants to benefit biodiversity.	Remediation Phase
LV8	9.5	For the three residential properties (REC006, REC007 and REC008) that will lose front boundary vegetation as part of the widening and realignment works, the local access road to the south of the site, new stonewall/fencing will be provided. Semi-mature tree and shrub planting will also be provided to the inside of the wall for additional screening and amenity purposes. These mitigation measures are subject to consultation with the property owners in question.	Remediation Phase

19.8 Archaeology, Cultural Heritage and Architectural Heritage

Table 19.6 Archaeology, Cultural Heritage and Architectural Heritage Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
ARC1	10.5	A programme of archaeological testing shall be carried out within the small area of greenfield in the western section of the proposed Project area, which contains the recorded mound (KD019-018). This shall be undertaken under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).	Remediation Phase
ARC2	10.5	A limited programme of archaeological testing shall be carried out to the immediate north and south of the recorded church site, within the footprint of the proposed works due to the proximity of the church and the potential for these areas to contain buried archaeological remains. This investigation will be carried out under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA). The standing remains of the church and graveyard shall be fenced off with non-intrusive fencing during the course of remediation works in this area, in order to prevent inadvertent impacts with plant and equipment.	Remediation Phase
ARC3	10.5	An archaeological wade survey shall be carried out at the proposed location of the outfall point into the Morell River. This investigation will be carried out under licence to the DoAHRRGA. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).	Remediation Phase
ARC4	10.5	All topsoil stripping associated with the proposed remediation works, including the surface water outfall pipeline and pipelines through the southern part of Kerdiffstown demesne, shall be monitored by a suitably qualified archaeologist. Full provision shall be made available for the preservation by record of any features or deposits that may be discovered, if that is deemed the most appropriate manner in which to proceed (following consultation with the DoAHRRGA).	Remediation Phase

19.9 Biodiversity

Table 19.7 Biodiversity Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
B1	11.5.1	There are a number of key mitigation measures that will be undertaken in order to minimise the overall impact of the proposed Project. Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Environmental Management Plan (CEMP). The CEMP shall contain these mitigation measures and plans identified in the following sections and ensure that they are fully implemented during the construction phase, to prevent or reduce the impacts identified in the impact assessment. The CEMP will include a Site Biodiversity Management Plan which will address the following as a minimum: • Badgers; • Bat (including the retained Leisler's maternity roost); and • Habitat including retention of habitats during Remediation Phase and the development of new habitats during the Operational Phase.	Remediation Phase
B2	11.5.1	Any trees, scrub or hedgerows adjacent to, or within, the site boundary which are intended to be retained will be afforded adequate protection prior to remediation works commencing. Mitigation measure will be in accordance with the *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes* (National Roads Authority, 2006b), as follows: • All trees along the site boundary that are intended to be retained, both within and adjacent to the site boundary (where the root protection area of the tree extends into the site boundary), will be fenced off at the outset of works in the adjacent working area and for the duration of the remediation works in that area to avoid structural damage to the trunk, branches or root systems of the trees. Temporary fencing (post and rail) will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. In general, the RPA covers an area equivalent to a circle with a radius 12 times the stem diameter (measured at 1.5m above ground level for single stemmed trees, or above the root flare for multi-stemmed trees); • Where fencing is not feasible due to insufficient space, protection for the trees will be afforded by wrapping hessian sacking (or equivalent) around the trunk of the tree and strapping stout buffer timbers around it; • The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils and chemicals). The storage of hazardous materials (e.g. hydrocarbons) will not be undertaken within 10m of any retained trees, hedgerows and treelines; • If construction activities are required within the RPA, e.g. excavation work, then a qualified arborist will advise on the best methods for protecting the tree. For example, any excavation works carried out within the RPA will need to avoid damage to the protective bark covering larger roots. This may involve excavation by mini-digger and/or hand as deemed appropriate. Exposed roots will be wrapped in a hessian sacking to avoid desiccation and roots less than 2.5cm in diameter can be pruned back to a side root. The advice of a qualified arborist will be sought if larger roots that influence anchorage need to be severed. Any remedial works required to trees will be carried out by a qualified arborist; and Where tree removal may be required (due to health and safety considerations) in areas not previously identified liaison with a suitably qualified ecologist will be required.	Remediation Phase
B3	11.5.1	Japanese knotweed has been eradicated from within the site boundary. It was, however, found to be present within the land of Kerdiffstown House immediately adjacent to the site (refer to Figure 11.4). If the appointed contractor is required to work within 7m of the infested area an invasive species specialist will be appointed. The invasive species specialist will identify the extents of Japanese knotweed and provide recommendations to the appointed contractor on what measures may be required to remove or avoid spreading this invasive species. This would need to be detailed in the Invasive Species Management Plan which will be developed as part of the CEMP. Any mitigation strategy in relation to invasive plant species will be based on the *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (National Roads Authority, 2010a). The following non-exhaustive measures shall be included in the Invasive Species Management Plan: • Works including access will need to avoid disturbing the Japanese knotweed or potentially contaminated soil within at least 7m of the infested area. • If works cannot be avoided within the exclusion zone the Japanese knotweed and contaminated soil will need to be treated and/or excavated and potentially removed off site or buried on site under licence from the NPWS, this would be detailed in the Invasive Species Management Plan.	Remediation Phase
B4	11.5.1	*Badger* Pre-construction surveys for badger will be undertaken prior to commencement of remediation works to assess the status of the existing setts and any potential newly established setts as specified in the Wildlife Act Licence (DER/BADGER 2017-92) as granted by NPWS – licence has been provided to NPWS as part of the confidential badger report. The findings of these surveys will inform any updates to the derogation licence. The mitigation measures described below follow the recommendations set out in the *Guidelines for the Treatment of Badgers during the Construction of National Road Schemes* (National Roads Authority, 2006c). The location containing the main sett will be retained and as such, the permanent removal of the sett as a result of remediation activities will not occur. The subsidiary sett will be removed prior to remediation works to facilitate remediation and installation of the engineered capping system. The mitigation measures that apply in relation to each badger sett within the ZoI are discussed below.	Remediation Phase
B5	11.5.1	*Badger* Prior to remediation works commencing within the vicinity of the main sett all site personnel will be given a Toolbox talk where they will be briefed on the presence of the sett and the legal protection that badgers, and their setts, are afforded.	Remediation Phase
B6	11.5.1	*Badger - Closure of Subsidiary Sett* Prior to commencement of remediation works in this area and the closure of the sett, the log pile immediately adjacent to the sett will be removed under licence and supervision by a suitably qualified ecologist. Any additional sett entrances identified will be gated as part of the exclusion. Prior to closure the sett will be assessed to determine the use of each hole. Any holes that appear to be disused will be soft-blocked (backfilled with earth and vegetation) and then hard-blocked and proofed to prevent badgers digging back into the sett. Badger gates will then be fitted to all of the used holes on the sett. Sett exclusion will be carried out over a minimum period of 21 days, with the setts being monitored every three days. This will provide information on whether the badgers are still active at the sett. Camera traps will be placed facing the most well used entrance hole, in order to establish that the badger gates are working correctly and are preventing the badgers from re-entering the sett. In order to monitor all other holes where cameras have not been placed, small sticks will be leant in front of the gate to enable an assessment of badger activity. Monitoring will also confirm that the gates are functioning properly. Once there is certainty that all badgers have been excluded from the sett the gates will be locked permanently stopping any access into or out of the sett. Standard guidance (NRA 2006) states that a sett should be destroyed as soon as the exclusion has been completed. However, the standard methods usually employed for safe destruction of a sett will not be feasible in this instance. The sett is located within a steep sandy bank, located on the northern perimeter of the site and is considered to extend in a northerly direction into lands beyond the site. Assessment has shown that the bank could become destabilised and collapse if the sett tunnels and chambers were to be excavated. Furthermore, there is very high risk of the bank including mature trees (one of which contains a bat roost) collapsing using standard methods for destruction of the sett. The remediation works required at this area of the site will comprise backfilling and raising up to be almost level with the existing bank; as such the sett will be buried as part of the remediation works. Rather than destroying the sett it is proposed to leave the gates on for the duration of the works until this area is infilled. The gates would be left in place and the bank covered with wire mesh to prevent badger digging back in. The area immediately surrounding the sett will also be fenced off with mammal proof fencing and vegetation in the vicinity removed to make it less favourable to badger. The area would be monitored once a month to ensure that the gates/mesh and fencing are all in proper working order.	Remediation Phase

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
B7	11.5.1	*Badger- Measures to Minimise Disturbance to Main Sett* The following lists of mitigation measures are to be undertaken during remediation works in the vicinity of the main sett to minimise disturbance within retained habitat areas immediately adjacent to the site. These measures will be incorporated into the relevant contract documents: • Any works within 30m of the sett will be supervised by a suitably qualified ecologist (extended to 50m during the breeding season). A 30m buffer will be demarcated around the sett, using barrier tape. Where any works are planned in the vicinity of these exclusion zones (and where they could encroach into same the ecologist will be contacted prior to any such works. The ecologist will ensure that the appointed contractor is complying with the mitigation measures outlined below. • Night-time working will be restricted as far as possible within 100m of the sett. As badgers are nocturnal, disturbance will be reduced by restricting the amount of night-time working within the vicinity of sett. Night-time, in terms of badger nocturnal activity, is defined as beginning one hour before sunset and lasting to one hour after sunrise; • The use of noisy plant and machinery in the vicinity of badger setts will cease before sunset; If the works involve excavations they will either be covered (with plywood), fenced or have an escape ramp installed overnight to prevent badgers, or other wildlife, from falling into them and becoming trapped; • Any borrow pits or spoil heaps will be sited at a minimum distance of 30m from setts; • Chemicals shall not be used within 20m of a badger sett; and • Mammal proof fencing to be installed in the vicinity of the sett will be hand dug under supervision. A licence has been granted by the NPWS to enable the Remediation Phase works. The licence allows for the monitoring of the setts prior to commencement of remediation works, for exclusion of the subsidiary sett, for the installation of the fence line and to permit works within the distance bands described above. Works within the distance bands described above will only be carried out during daylight hours so as not to disturb foraging badgers.	Remediation Phase
B8	11.5.1	*Other Mammals (Pygmy shrew and Hedgehog)* There is no known method for excluding pygmy shrew or hedgehog from nest / hibernation sites and therefore the seasonal clearance of vegetation for breeding birds (as described below) will be implemented. This means vegetation clearance works will avoid the period 1 March – 31 August as far as practicable; a significant portion of the main breeding season for both species. This mitigation will simultaneously avoid the majority of the main breeding season for most small mammal species (Hayden & Harrington 2001).	Remediation Phase
B9	11.5.1	*Bats* Three properties (REC010, REC011 and REC016) will be demolished during the Remediation Phase of the site. These private properties and surrounding gardens were not accessed during the initial bat assessment and surveys, . Daytime bat assessments and potential further roost surveys of these properties and trees will be required to be undertaken by a suitably qualified ecologist prior to them being demolished. If a bat roost is identified the roost will be removed under licence from the NPWS and appropriate mitigation implemented per the licence requirements. The lighting design principles will be avoidance of lighting within particularly sensitive areas. Measures to mitigate the impact of lighting disturbance on bats during the Remediation Phase will include: • Avoid lighting of retained habitats, particularly in the vicinity of woodland, boundary treelines and the confirmed roost. This will ensure that important roosting, foraging and commuting corridors are maintained; • Lighting if required shall be of a low height (as low as possible without compromising safe working standards) to ensure minimal light spill and where feasible timers or motion sensors shall be used to ensure areas are retained in darkness as much as possible. Lighting shall be directed to where it is required only and this can be achieved by fitting louvres to the lighting; and • White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact in comparison to other lighting types as it is less attractive to insects and as such insects will not be diverted away from darker areas where more sensitive bat species will be foraging.	Remediation Phase
B10	11.5.1	*Breeding Birds* Vegetation (e.g. hedgerows, trees, scrub and grassland) will not be removed between the 1 March and 31 August, to avoid impacts on nesting birds. Although the Wildlife Acts provide an exemption from this seasonal restriction to vegetation removal for some construction activities, there is no exemption provided for the destruction of nest sites. It is recognised that the remediation works are to be phased, hence vegetation clearance will not be undertaken across the entire site in one operation but will be targeted based on appropriate working areas that can be controlled and managed. Where the remediation programme does not allow this seasonal restriction to be observed, then these areas will be inspected by a suitably qualified ecologist for the presence of breeding birds prior to clearance. Where nests are present, an ecologist will make a decision as to whether a licence is required for vegetation removal. Alternatively, the ecologist can demarcate a suitable buffer around an active nest and clearance within this area will be postponed until the chicks have fledged. A suitable exclusion zone will be established dependent on the species identified. Areas found not to contain nests must be cleared within three days of the inspection; otherwise repeat inspections will be required. If vegetation is to be cleared in the breeding season (under supervision of an ecologist) it will be chipped, removed or covered (ideally) on the same day to prevent birds from nesting.	Remediation Phase
B11	11.5.1	*Amphibians and Reptiles* Areas of suitable reptile habitat such as grassland will initially be cut to 10cm high in order to avoid harm to any reptiles should they be present. This will be carried out by hand using hand tools, or if machinery is used, this will be set to a height of 10cm as advised by a suitably qualified ecologist. Refugia such as log piles will be cleared in warmer months (typically April – September) when reptiles are active. Newly created habitat can be enhanced for reptiles, which will entail provision of artificial hibernacula (see Appendix A11.4, Photo 11.7). Newly created hibernacula will be south-facing and free-draining. If works to clear the existing waterbodies are to be undertaken during the season where frogspawn / tadpoles may be present (February – July) a pre-construction survey will be undertaken to determine whether breeding amphibians are present. If found to be present, the species will be removed by hand net and translocated to the nearest available habitat that is suitable, under licence from the NPWS. There is an abundance of suitable receptor habitat in the immediate locality including ponds located within Kerdiffstown House adjacent to the site. A licence has been granted by the NPWS (Refer to Appendix A11.8) to enable the removal of frog spawn prior to remediation works should it be required.	Remediation Phase
B12	11.5.1	*White-Clawed Crayfish* Mitigation measures to protect water quality during the Remediation Phase are detailed in Section 13.6.1. The mitigation approach to protect the white-clawed crayfish during the proposed work is to undertake capture and relocation of individuals immediately prior to undertaking the construction of the outfall, following pre-construction surveys to confirm the presence of white-clawed crayfish in the vicinity of the outfall and associated works. As the mitigation approach will require the capture of crayfish and the potential disturbance of refuges, it will require a licence from the NPWS. As these works are proposed for year three of the Remediation Phase a licence has not yet been sought. This will be applied for by KCC (or a nominated representative) prior to the works being undertaken. Capture and translocation if required will be undertaken between July – September (to avoid the sensitive period for fish). All works will be undertaken in line with the following documents: • *Guidance on works affecting white-clawed crayfish* (Peay 2000); • *Guidance on Habitat for White-clawed crayfish and its restoration* (Peay 2002); and • *Conservation management of the white-clawed crayfish,* (*Austropotamobius pallipes*) (Reynolds 2010).	Remediation Phase

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
B13	11.5.1	*Fish (Salmonids and Lamprey)* All works will be carried out in accordance with the requirements of IFI as set out in *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI 2016). If instream work outside July-September period is required these shall be agreed in writing with IFI. The following measures will be implemented to mitigate the potential impacts to fish species: • Maintaining water quality in the surface water network • Maintaining fish passage while the outfall is being constructed. Only a small section of the river may require to be de-watered using sandbags or similar, hence a continuous flow will be maintained around the de-watered area; • Prior to dewatering the area will be electrofished and fish will be placed upstream of works; and • Instream works will only be carried out during the period July - September (inclusive).	Remediation Phase
B14	11.5.2	*Measures to Mitigate for Habitat Loss* The landscaping design is outlined in Chapter 4 Description of the Proposed Project (Refer to Figure 4.20). Wherever possible, mature trees and tree lines will be retained. The main mitigation measures relate to tree and shrub planting within and around the site. There are limitations as to where tree planting can take place so as not to compromise the integrity of the engineered capping system. This leaves peripheral areas and site boundaries available for such planting and this will occur wherever practicable. As outlined in the All-Ireland Pollinator Plan 2015-2020 all planting will, where practicable, comprise native species of local provenance. In summary, the following landscape planting and measures will be implemented: • Perimeter tree planting and hedgerow planting to include amenity planting around the site entrance as well as native hedgerow screen planting along the boundary; • Wetland ponds are proposed for the north and south central portion of the site, and these will be planted up with a variety of wetland plants to benefit biodiversity; • Wetland ponds have been designed with gradual sloping edges to create a variety of niche habitats to benefit biodiversity; • Dry meadows and grassy verges (GS2) and wet Grassland (GS4) will all be lost as a result of the proposed Project, therefore species-rich native seed mixes will be incorporated into the final design with localised areas of wildflower planting • Drainage ditches and wetland swales across the site will be planted up with wetland herbs and grasses at appropriate locations.	Operational Phase
B15	11.5.2	*Badger* No specific Operational Phase mitigation measures are proposed. There is an abundance of optimal badger habitat within the immediate wider landscape outside the proposed Project boundary. Impacts on badger foraging resource are considered non-significant.	Operational Phase
B16	11.5.2	*Other Mammals (Pygmy shrew and Hedgehog)* To mitigate for loss of small mammal habitat and nesting opportunities four hedgehog nest boxes will be installed in retained woodland and scrub areas. Boxes will be placed in deep scrub or wooded areas away from obvious paths of disturbance by humans or dogs within the wildlife area fenced off from the public (Refer to Figure 4.20). Furthermore, newly created habitats outlined will provide suitable foraging and resting habitat for these species.	Operational Phase
B17	11.5.2	*Bats* The lighting design principal will be avoidance of lighting within particularly sensitive areas. The end-use proposal for the site will include three new multi-use sports pitches, changing rooms, a children's playground, etc. These will be located in the centre and south of the site away from sensitive areas which include the woodland in the lands of Kerdiffstown House and existing unlit areas in the north of the site where the confirmed roost is located. The new access route to the north of the site will be for pedestrians only and will not be lit at night. Measures to mitigate the impact of lighting disturbance on bats during the Operational Phase will include: • Avoidance of lighting, particularly in the vicinity of retained woodland, boundary treelines and the confirmed roost. This will ensure that important foraging and commuting corridors are maintained; • Reduced light spill through the use of baffles / hoods to ensure that light is directed to the sports pitches as required and not wider; • White LED or amber coloured LED lighting will be used as this is considered to be relatively low impact in comparison to other lighting types as it is less attractive to insects and as such insects will not be diverted away from darker areas where more sensitive bat species will be foraging; and • Where lighting is required within sensitive areas (i.e. in the vicinity of retained woodland habitats / tree lines) light levels will be that of full moon light levels, typically between 0.1-0.3 lux.	Operational Phase
B18	11.5.2	*Breeding Birds* To mitigate for loss of nesting habitat trees, hedgerows, scrub and grassland habitats will be provided, refer to Figure 4.20. Whilst no significant impacts are anticipated during the Operational Phase, this will provide compensatory habitat for some bird species. Nest boxes will also be provided to compensate for passerine habitat loss. Ten nest boxes to accommodate different species will be provided and these will be erected under supervision of a suitably qualified ecologist at appropriate locations in secluded/unlit treelines proposed for retention.	Operational Phase
B19	11.5.2	*Amphibians and Reptiles* Whilst no significant impacts are anticipated during the Operational Phase, to account for any loss of potential reptile habitat newly created habitat can be enhanced for reptiles through the provision of artificial hibernacula (see Appendix A11.4, Photo 11.7). Newly created hibernacula will be south-facing and free-draining. A wetland soakaway pond is proposed for Zone 1A and the surface water management ponds in Zone 4, will be planted up with a variety of wetland plants providing optimal breeding habitat for common frog.	Operational Phase

19.10 Soils, Geology, Contaminated Land and Groundwater

Table 19.8 Soils, Geology, Contaminated Land and Groundwater Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
GW1	12.5.1	The potential impact from landfill gas to off-site human health receptors is significant and mitigation measures are required. These mitigation measures are provided in the Landfill Gas Management Plan (Appendix A4.5) which sets out the likely requirements for gas mitigation measures and monitoring to be undertaken by the appointed contractor during the remediation works (subject to agreement with the regulatory authorities and specified in the IEAL). During the works additional or replacement interim gas controls may need to be installed in agreement with KCC to ensure the risk of lateral off-site migration is not increased.	Remediation Phase
GW 2	12.5.1	The proposals for gas monitoring will need to be bespoke for the remediation works in order to assess the changing nature of the site and associated impacts from gas migration. Throughout the period of remediation works monitoring of all off-site boreholes shall be conducted at least monthly. During active remedial works, or where materials are moved to uncapped areas of wastes for temporary storage, more frequent monitoring of off-site boreholes adjacent to affected areas is likely to be required. Frequency will be determined by the risk assessment produced by the appointed contractor for each phase of works and incorporated within their method statement for working.	Remediation Phase
GW 3	12.5.1	The installation of gas extraction wells within the site as works progress will be in a phased manner, moving from zone to zone as the active remediation works move around the site. Details of the gas control measures and monitoring that will be in place for the Remediation Phase are provided in the Landfill Gas Management Plan (Appendix A4.5).	Remediation Phase
GW 4	12.5.1	Groundwater quality monitoring will be undertaken during the Remediation Phase to ensure that potential negative impacts are not occurring in the groundwater. The boreholes and analytical suite to be used will be agreed with the regulatory authorities and will be specified in the Industrial Emissions Activities Licence (IEAL) for the site. The monitoring will be based on results of ongoing baseline monitoring. The need for installation of new boreholes (which may be required if existing boreholes are to be lost as part of the remediation works) will be considered and if required new boreholes will be installed prior to the remediation works starting. The results of this monitoring will be reported to the EPA to comply with the conditions of the IEAL.	Remediation Phase
GW 5	12.5.2	The scheme design will utilise capping systems to reduce infiltration to the waste mass across the site; for Zones 1 and 3 this will comprise a geosynthetic liner system; Zones 2 and 4 will utilise low permeable soils (depth and performance specification to be determined).	Operational Phase
GW 6	12.5.2	In terms of the gas monitoring, the Landfill Gas Management Plan (Appendix A4.5) accompanying the IEAL application identifies that gas management proposals for the Operational Phase are likely to follow those identified for the Remediation Phase, augmented by the addition of the new gas management system and requirements of specific guidance on flares and surface emissions.	Operational Phase

19.11 Water – Hydrology

Table 19.9 Water - Hydrology Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
H1	13.6.1	Prior to commencement of the Remediation Phase, the appointed contractor responsible for the remediation works shall prepare a Construction Environmental Management Plan (CEMP) for agreement with KCC. The CEMP shall contain the mitigation measures and plans identified in the EIAR (as a minimum) and shall implement the conditions set out in the planning approval and the requirements of the site's Industrial Emissions Activities Licence (IEAL). The appointed contractor shall also ensure that the CEMP is fully implemented during the Remediation Phase in agreement with KCC, to prevent or reduce the impacts identified in the impact assessment. All construction works shall be completed in line with reference to the guidelines outlined below where applicable, and specified in the CEMP: • 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (NRA, 2005); • CIRIA C648 'Control of Water Pollution from Linear Construction Projects: Technical Guide' (Murnane *et al.*, 2006); • CIRIA C649 'Control of Water Pollution from Linear Construction Projects: Site Guide' (Murnane *et al.*, 2006); • CIRIA C692 Environmental Good Practice on Site 3rd Edition (2010); • 'Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors' (CIRIA, 2001); • 'IFI Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters' (IFI, 2016); and • UK Environment Agency: - PPG3 Use and design of oil separators in surface water drainage systems; - PPG5 Pollution Prevention Guidelines Works and Maintenance in/ or near Water; - PPG21 Incident Response Planning; - PPG22 Dealing with Spills; and - PPG26 Drums and Intermediate Bulk Containers.	Remediation Phase
H2	13.6.1	The first phase of the remediation works will include the removal of the site connection to the Canal Feeder Stream. Therefore, there will be no direct hydrological connection from the site to the Canal Feeder Stream during the Remediation Phase. Temporary construction surface drainage and sediment control measures will be in place before earthworks commence.	Remediation Phase
H3	13.6.1	There will be no direct hydrological connection from the site to the Morell River during the Remediation Phase. The surface water pond areas (to be utilised in the Operational Phase) will be used temporarily for the storage of run-off during the remediation works. These ponds will be lined. Further temporary ponds may be constructed at locations adjacent to working areas to assist with management of run-off if the phasing and timing works require additional storage volumes. These temporary ponds will also be lined. Therefore, any potentially contaminated run-off will be captured and contained and will not be discharged from the site. Water may be required for on-site purposes. Re-use on site will include dust suppression and irrigation where necessary (during periods of dry weather) and where the water has been appropriately tested for the intended use. Any waters confirmed to be contaminated and considered as unsuitable for treatment or reuse on site will require to be removed from the site via a road tanker or to sewer in agreement with Irish Water. The appointed contractor will be required to ensure that water is disposed of to a licensed treatment facility. Discharge to ground may be utilised via the soakaway in the north-west extents of the site (Zone 1A).	Remediation Phase
H4	13.6.1	The appointed contractor will be required to prepare an Erosion and Sediment Control Plan (ESCP) prior to commencing the remediation works. The ESCP shall be included in the CEMP. To prevent or reduce the amount of sediment or other polluting substances being released into watercourses, the ESCP will include the following measures to be implemented by the appointed contractor: • Provision of measures to prevent the release of sediment to the Morell River during the construction works (outfall construction to the Morell River, pipeline crossings beneath the Morell River, and road realignment works to include footpath and cycleway with drainage connecting to existing road drainage outfall). Measures will include but not be limited to a cofferdam, sediment fences, and silt curtain; and • Provision of exclusion zones and barriers (sediment fences) between earthworks (re-profiling of slopes), stockpiles and temporary surfaces and watercourses to prevent sediment washing into the watercourse. No waste material including wastewater, will be permitted to discharge into any watercourse during the works.	Remediation Phase
H5	13.6.1	During the Remediation Phase there will be a requirement to expose existing waste, which may allow the infiltration of rainfall to the waste and result in contaminated run-off. To minimise this effect, works will be managed by the appointed contractor through a number of on-site operations, including: • Working in discrete areas to minimise the area of exposed waste; • Interception of any leachate outbreaks identified during waste excavation and re-profiling activities; • Provision of daily cover to exposed wastes, occurring as part of the remediation works; and • Progressively remediate the site with a landfill cap. These measures will be detailed by the appointed contractor in the ESCP.	Remediation Phase
H6	13.6.1	Cleaning of roads to reduce mud and dust deposits will be carried out away from watercourses.	Remediation Phase
H7	13.6.1	Any pouring of cement for the provision of the outfall and/or pipeline crossings for the works will be carried out in the dry and allowed to cure for 48 hours before re-flooding. Pumped concrete will be monitored to ensure no accidental discharge. Mixer washings and excess concrete will not be discharged to surface water.	Remediation Phase
H8	13.6.1	No storage of hydrocarbons or any toxic chemicals will occur within 50m of a watercourse. Fuel storage tanks will be bunded to a capacity of at least 110% of the volume of the storage tank. Re-fuelling of machinery will not occur within 50m of any watercourse and only in bunded refuelling areas. Emergency procedures will be put in place and construction staff will be familiar with emergency procedures.	Remediation Phase
H9	13.6.1	The appointed contractor shall consult with IFI in relation to the ESCP and shall include their requirements in this regard.	Remediation Phase
H10	13.6.1	The detailed design of works within and adjacent to watercourses (e.g. directional drilling beneath the Morell River for the new pipeline crossings; construction of the new outfall to the Morell River from the surface water ponds) will be undertaken with input from a hydromorphologist. Such works will only be conducted during forecast low flow periods and shall be done in July to September. Following in-channel working (i.e. for the outfall and pipeline crossing) the channel cross-section will be reinstated as per pre-work conditions and tied into the structures.	Remediation Phase

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
H11	13.6.1	The appointed contractor will detail emergency measures to be implemented in the event of a spillage or accidental discharge. This Emergency Plan will form part of the overall ESCP incorporated as part of the CEMP to be prepared by the appointed contractor and agreed with KCC.	Remediation Phase
H12	13.6.1	Water quality monitoring will be undertaken as indicated in the Industrial Emissions Activities Licence (IEAL) as agreed by the EPA and this will be supported by a Monitoring and Control Management Plan. The IEAL will require the licence holder (KCC) to undertake a monitoring regime to include the Morell River, with key pollution indicators analysed on a regular basis from locations up and downstream of the site. The results of this monitoring will be reported to the EPA to comply with the conditions of the licence. In addition, daily visual inspections of the surface drainage and sediment control measures and the watercourses will be undertaken by the KCC Site Manager or nominated representative. Indicators that water pollution may have occurred include the following: • Change in water colour; • Change in water transparency; • Increases in the level of silt in the water; • Oily sheen to water surface; • Floating detritus; or • Scums and foams. These inspections shall be recorded. In the event that such indicators are observed, review of site works will be undertaken to determine potential linkage. Where a potential linkage is determined an investigation of the potential cause will be undertaken by the appointed contractor. The above monitoring will allow KCC to be assured that the mitigation measures employed by the appointed contractor are successfully operating.	Remediation Phase
H13	13.6.2	Any discharge from the Ponds 2 and 3 must be fully compliant with EPA Emission Level Values for Emissions to Surface Water in the Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities (EPA 2011). The likelihood of a serious surface water pollution incident is considered low. However, a penstock/shut-off valve will be provided on Pond 3 to prevent the release of a discharge to the Morell River in the event of accidental spillage.	Operational Phase
H14	13.6.2	Surface water from the Landfill Infrastructure Compound will be collected by system of road gullies and underground pipework which will be supplied with silt and oil interceptor(s). Flows from the Compound will be discharged to the main site road drainage. The Landfill Infrastructure Compound will also be provided with an isolation point before discharge into the main site road drainage. In order to avoid adverse watercourse impacts due to spills or accidental leakages i.e. leachate spill, a Contaminant Spill Emergency Plan will be put in place to contain, remove or remediate spillages before they reach a surface water receptor. Emergency equipment/spill kits to facilitate the implementation of such a plan will be made available in secured locations within the Landfill Infrastructure Compound area.	Operational Phase
H15	13.6.2	Detailed design for the new site access, realignment of the L2005 Kerdiffstown Road and provision of a footpath and cycleway will be required to include appropriate mitigation measures such as petrol interceptors for the revised road drainage system prior to release to the Morell River.	Operational Phase
H16	13.6.2	For the pipeline crossing of the Morell River the following measures will be implemented: • The minimum distance between crown of the pipes and the river bed will be 400mm to ensure that that the river bed will not be disturbed. • A cover will be provided over the top of pipe (assumed to be concrete) to protect the pipe from any potential future downward erosion. The cover will be placed beneath the natural bed and the bed reinstated as per existing conditions and tied in with the existing bed and banks.	Operational Phase
H17	13.6.2	For the outfall to the Morell River, the inclusion of the surface water ponds (Pond 2 and 3, located within Zone 4) and the provision of the petrol interceptor would reduce potential impacts of fine sediment input into the channel and excessive flows discharging from the outfall. The design of the outfall would aim to avoid disturbance of the natural bank and tie in with the existing rock armour. Specific mitigation measures include but are not limited to: • Constructing the surface water pond to encourage deposition of suspended sediments and minimising sediment input to the river; • Directing the outfall downstream and away from the banks to minimise the impact to flow patterns and minimising any potential risk of erosion (particularly on the opposite bank); and • Minimising the size and extent of headwalls where possible, reducing the potential impact on the banks.	Operational Phase
H18	13.6.2	Following completion of remediation works surface water run-off will not come into contact with waste materials. However, water may still contain some suspended solids and possibly oil, fuel and silt washed off roads. Silt fences installed around the site as part of the remediation works will remain in place until the vegetation within the site is well established and perimeter ditches and swales grassed. Once it has been established that sediment retention techniques are no longer required, silt fences may be removed. There will be no direct / indirect impacts from the proposed Project to the Canal Feeder Stream during operation, as the current outfall will be permanently disconnected during the Remediation Phase. Therefore, no mitigation is proposed.	Operational Phase
H19	13.6.2	Water quality monitoring will be undertaken as indicated in the IEAL as agreed by the EPA supported by a Monitoring and Control Management Plan developed and implemented by KCCs site personnel. During the Operational Phase real time water quality monitoring in the pond is proposed to be used to measure key pollution indicator parameters to be agreed by the EPA, for inclusion in the IEAL and the site's Management Plan. The concentrations recorded in the pond shall be in accordance with the EPA Emission Level Values for Emissions to Surface Water in the Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities (EPA 2011). In the event of an exceedance of the agreed emission level values, the discharge from the pond will be automatically shut off. The design of the surface water system will permit isolation of runoff from various parts of the site in the unlikely event that elevated concentrations of indicator parameters are detected, facilitating investigation to determine the source and remediate where necessary.	Operational Phase

19.12 Traffic and Transport

Table 19.10 Traffic and Transport Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
TT1	14.5.1	Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a Construction Traffic Management Plan (CTMP). The purpose of the CTMP is to set out management and mitigation measures to prevent or minimise the transport impacts during the Remediation Phase of the proposed Project. The CTMP shall include details of the following: • Identify to all staff and contractors the appropriate and safe routes to and from the proposed Project; • Confirmation that routing of HGV traffic is not permitted via Sallins, all Remediation Phase HGV traffic will route via the N7 Junction 8; • Timing of HGV movements to take place outside of peak flow hours, where practicable, in order to minimise disruption to general traffic flows on the road network, including details of delivery windows confirming when traffic is predicted to arrive on-site; • Consideration of location of weighbridge within the site in order to minimise queueing of site traffic on the L2005 Kerdiffstown Road; • Measures to ensure access to all private properties along the L2005 Kerdiffstown Road is maintained throughout the Remediation Phase works; and • Appropriate warning signs to be erected to warn other road users of the presence of HGV's and general Remediation Phase related traffic. Through the CTMP, regular engagement with the existing Community Liaison Group shall be undertaken in order to engage with the local residents on when remediation works will commence, including; • The schedule of works; • Disseminate details of signage • The direction from where HGV loads will be travelling from; • A dedicated telephone number which the residents can contact to report any issues; • Provide details of the dates of the community liaison group meetings; and • Obtain local resident's feedback on other issues that need to be addressed including details of any forthcoming public events etc. that need to be considered. The CTMP shall provide for regular inspections to be carried out to ensure that agreed mitigation measures, as outlined above, are being undertaken.	Remediation Phase
TT2	14.5.1	The appointed contractor responsible for the remediation works will be required to undertake a pre-condition survey of the existing road from the N7 to the site with the scope and method of assessment to be agreed with KCC Transportation Department. Following completion of the importation works, a further survey will be undertaken to determine any deterioration and the requirement for any remedial works, for agreement with the KCC Transportation Department.	Remediation Phase
TT3	14.5.1	A Mobility Management Plan (MMP) shall be prepared by the appointed contractor prior to initiation of the Remediation Phase, the purpose of which is to provide the mechanism to support and promote sustainable travel for staff, contractors and visitors travelling to the proposed Project. The MMP shall seek to eliminate where feasible the barriers preventing users of the site from accessing via sustainable travel modes, improving travel choices and managing single occupancy car use.	Remediation Phase
TT4	14.5.2	As identified within this assessment, the traffic generated during the Operational Phase for the proposed Project is anticipated to be minimal and will not have a significant impact on the existing road network. As such no specific mitigation relating to this phase is required, however the MMP should continue through the Operational Phase and seek ways in which to promote active and sustainable travel to all staff and visitors to the public park.	Operational Phase

19.13 Waste

Table 19.11 Waste Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
W1	15.5.1	It is estimated that all of the material excavated during re-profiling works will be reused on-site as part of the remediation of the site. Inspections will be undertaken of the material to ensure suitability for reuse and any opportunity for processing to achieve other uses on site. Should any waste material be suspected to be non-compliant, the appointed contractor will be required to quarantine that waste by constructing a perimeter bund and placement of a tarpaulin or other suitable cover over the waste until such time as testing is undertaken and waste classification confirmed. In the event that any of the excavated material is deemed to be hazardous, it will be removed for disposal by a licensed waste contractor to a suitably licensed facility.	Remediation Phase
W2	15.5.1	With respect to the demolition of the on-site concrete structures, the rebar will be removed from the site for reuse or recycling. The appointed contractor will be responsible for the compliant management of the waste rebar. The concrete which arises from the demolition of the concrete structures will be crushed and reused on-site. Waste arising from the demolition of the three properties which fall under CPOs will be managed by the appointed contractor in accordance with the Construction Environmental Management Plan (CEMP).	Remediation Phase
W3	15.5.1	Waste tyres currently used to anchor the temporary geosynthetic capping in Zone 3, will be removed off-site for reuse or recycling. These will be managed by the appointed contractor in accordance with the CEMP.	Remediation Phase
W4	15.5.1	Materials which will require to be imported to the site to facilitate the remediation works will be appropriately sourced and managed to ensure that the material is of suitable engineering grade for the proposed Project. In so far as is possible, materials will be ordered within a reasonable timeframe of when they will be required on-site. This should prevent waste being generated through over-ordering, or through materials degrading due to long periods of storage on-site prior to use.	Remediation Phase
W5	15.5.1	Where material needs to be stockpiled within the site the appointed contractor will be responsible for management of the stockpiles in accordance with the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA 2009) to ensure that surface water and groundwater are protected from contamination and these provisions will be detailed in the CEMP. Please refer to Chapter 4 Description of the Proposed Project for further information and requirements on stockpile management. As a minimum stockpile management will include: • Visual screening for potential contaminated materials; • Segregation of material suspected to be contaminated from clean materials; • Stockpiling of materials at appropriate heights / batters to prevent potential instability; • Protection of stockpiled materials from scour / erosion; • The provision of adequate drainage to limit and control potential contaminated surface water runoff, including silt mitigation; and • The avoidance of un-necessary trafficking / handling of stockpiled materials. With the exception of top soil (or soil forming materials), stockpile heights will be restricted to a maximum of 4m to facilitate adequate management during the works. A reduced stockpile height of 2m will apply to any top soil / soil forming materials to prevent possible degradation of soil structure.	Remediation Phase
W6	15.5.1	The appointed contractor(s) responsible for the remediation works will ensure that any facility to which waste is brought is licensed / permitted in compliance with waste management legislation and will obtain the appropriate certification of disposal / destruction of waste. Prior to commencement of the Remediation Phase, the appointed contractor shall prepare a CEMP. The CEMP shall contain the mitigation measures and plans identified in the EIAR and ensure that they are fully implemented during the Remediation Phase, to prevent or reduce the impacts identified in the impact assessment. The CEMP will outline measures and provisions for the management of waste during the Remediation Phase, and will take the following guidance documents into consideration: • Best Practice Guidelines on the preparation of Waste Management Plans of Construction and Demolition Projects, Department of the Environment, Heritage and Local Government, July 2006; • CIRIA document C692 – Environmental Good Practice on site; • CIRIA document 133 Waste Minimisation in Construction; • National Hazardous Waste Management Plan 2014-2020; and • Guidelines for the Management of Waste from National Road Construction Projects, NRA 2008.	Remediation Phase
W7	15.5.1	As well as hazardous wastes generated by the remediation works, there is a slight possibility of encountering some unknown hazardous waste during the remediation works. If such waste types are uncovered, further investigation, testing and risk assessment will be undertaken to determine the appropriate actions to be taken with regards to compliant removal and disposal of such waste. Materials identified as hazardous will be required to be suitably disposed of in a licensed hazardous waste disposal facility. Where practicable, the closest suitable facilities to the proposed Project will be selected to reduce impacts associated with vehicle movements such as air emissions and noise. There are no facilities within County Kildare which accept hazardous wastes. There are a number of facilities located in Dublin, the closest of which is Rilta which is approximately 17km from the proposed Project. There is also an Enva facility in Dublin which is approximately 25km from the proposed Project. Enva also have a facility in Portlaoise for the treatment of contaminated soils, which is approximately 60km from the site of the proposed Project. Any such material will be managed in accordance with waste management legislation and the following requirements: • Excavation will be targeted and stockpiling will be managed in order to prevent potential contaminants from being released into the surrounding environment; • All hazardous waste will be segregated from non-hazardous waste, with different types of hazardous waste being segregated from each other if safe to do so. Each hazardous waste storage location will be clearly signposted stating the type of waste and that it is hazardous; and • A Waste Transfer Form (WTF) will be used to record the transportation of hazardous waste within the State and will be required of any movements of hazardous waste arising during construction of the proposed Project. Should the need arise for the Transfrontier Shipment (TFS) of waste, the movement between countries is subject to control procedures under the EU and national legislation and guidance, such as the Waste Management (Transfrontier Shipment of Waste) Regulations, 2007. The appointed contractor, as the waste producer, will be responsible for ensuring the compliant disposal of all wastes during the Remediation Phase of the proposed Project, and as such will be required to retain records of all hazardous wastes. Kildare County Council will monitor that all waste arising as part of the Remediation Phase is handled and disposed of compliantly by the appointed contractor as per these requirements. Copies of all testing will be retained by the KCC Site Manager.	Remediation Phase

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
W8	15.5.1	During the Remediation Phase of the proposed Project, the management of leachate and effluent will need to be maintained at the baseline levels at a minimum. The Leachate Management Plan (Appendix A4.4) will be implemented to ensure continued collection and compliant disposal of leachate being generated from the site. The Leachate Management Plan outlines leachate management proposals throughout a number of different stages of the remediation works. These include: • Operation in discrete areas to minimise the area of exposed waste; • Interception of any leachate outbreaks during waste excavation or re-profiling activities; • Provision of daily cover to exposed wastes; and • Progressively remediate the site with a landfill cap. Discharge of run-off during remediation works will not be permitted as per the Surface Water Management Plan (Appendix A4.6), with ponds lined with geomembrane liner to offer additional protection to groundwater during this period. Should a situation arise where run-off levels are becoming higher than can be adequately collected and maintained within the site, the collected water will be tankered off-site by a suitably licensed contractor for disposal at a suitably licensed facility. The leachate pipeline and Landfill Infrastructure Compound shall be built during the early Phases of the remediation works, allowing for the leachate collected in Zone 3 to be discharged from the site through the new system to the Johnstown Pumping Station. The appointed contractor will be responsible for ensuring the compliant management and disposal of leachate during the Remediation Phase of the proposed Project.	Remediation Phase
W9	15.5.2	Management of wastes arising during the Operational Phase of the proposed Project will be the responsibility of Kildare County Council as the licensee. The Council may appoint contractor(s) to provide waste management and landscaping services on their behalf. Management plans for the operation and maintenance of the multi-use public park shall be produced and adhered to by all landscaping and maintenance personnel.	Operational Phase
W10	15.5.2	Waste silts and hydrocarbons / oily waters collected in the on-site drainage interceptors will be handled and disposed of through appropriately licensed contractors as and when required. The specialist contractors will clean out the interceptors and the waste material will be sent to a suitable licensed facility for treatment and/or disposal.	Operational Phase
W11	15.5.2	Leachate and effluent from the site compound and changing room facilities will be disposed of to Johnstown Pumping Station for treatment at Osberstown WWTP via a sewer connection to the local sewer network under agreement with Irish Water. There may be occasions where leachate will need to be tankered off-site for disposal. This will only arise at times when there are any abnormal occurrences with the treatment process or restrictions on discharge to sewer. It is anticipated that there will be a call-off agreement in place with a licensed contractor such that when tankers are needed they can be mobilised prior to full utilisation of leachate storage capacity at the site. Refer to Appendix A4.4 Leachate Management Plan for further detail on leachate management and disposal.	Operational Phase

19.14 Population and Human Health

Table 19.12 Population and Human Health Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
P1	16.5.1	Amenities & Recreation • During the Remediation Phase of the proposed Project, mitigation as detailed in Chapter 7 Air Quality, Odour and Climate, Chapter 8 Noise and Vibration and Chapter 9 Landscape and Visual will be implemented. This shall include the development of a CEMP by the appointed contractor. • The Kildare County Council Project Team with the appointed contractor will continue to communicate with the local residents, including the Community Liaison Group, as well as local recreation providers/local community. These communication channels will allow local groups to keep future visitors up to date on the proposed Project as well as providing an avenue to raise concerns or issues during this Phase of the project.	Remediation Phase
P2	16.5.1	Community Severance & Accessibility • The appointed contractor will be required to maintain access to residential and commercial properties throughout the Remediation Phase.	Remediation Phase
P3	16.5.1	Employment • The potential employment opportunities associated with the Remediation Phase are positive impacts, albeit in the short-term, however such impacts require no mitigation. • In relation to employment centres in direct proximity of the site, a CEMP shall be developed by the appointed contractor which shall implement appropriate measures to minimise impacts from Remediation Phase works (directly on site and in the realignment of the L2005 Kerdiffstown Road).	Remediation Phase
P4	16.5.1	Land-Use • Access to areas subject to the temporary CPO process will be maintained throughout the Remediation Phase to ensure severance and community access issues are not a factor. Areas subject to the temporary CPO process will also be returned to their approximate previous state after necessary works are completed. • For the properties (REC006, REC007 and REC008), KCC will engage with the residents regarding appropriate fencing and screening along the realigned road at these properties to ensure the privacy of the residences during the Remediation Phase. This shall be undertaken by the erection of some form of additional wall or fencing and vegetative screening that would be agreed with the landowners in advance of the remediation works commencing.	Remediation Phase
P5	16.5.1	Economy & Tourism • During the Remediation Phase the proposed Project shall look to procure material and services from local providers, where reasonably practicable, and within the requirements of the procurement process. This would encourage additional economic activity in the local economy which may subsequently result in indirect employment opportunities being created.	Remediation Phase
P6	16.5.2	In relation to Land Use, for the properties (REC006, REC007 and REC008) along the L2005 Kerdiffstown Road, a new wall or fencing shall be erected along these properties. Semi-mature tree and shrub planting may also be provided to the inside of the wall for additional screening and amenity purposes. These mitigation measures shall be implemented in consultation with the property owners in question. Operational Management Plans and regular maintenance schedules will be put in place to manage and maintain the site and approaches to the proposed Project on an ongoing basis during the Operational Phase, minimising any potential negative impacts of the proposed multi-use public park.	Operational Phase

19.15 Material Assets

Table 19.13 Material Assets Mitigation Measures

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Remediation Phase / Operational Phase
MA1	17.5.1	The three properties to be demolished, as well as the areas of land required, shall be the subject to Compulsory Purchase Orders (CPOs), with the landowners to be compensated accordingly for the loss of the asset. A septic tank, of soakaway design, extends from property REC039 and discharges within the site boundary. This discharge will be removed and a sewer connection provided for this property.	Remediation Phase
MA2	17.5.2	All possible precautions shall be taken to avoid unplanned disruptions to any services during the Remediation Phase of the proposed Project. This shall include thorough investigation to identify the location of all utility infrastructure within the working area, and the implementation of robust procedures when undertaking works in and around known utility infrastructure such as overhead lines. Service disruptions impacting the surrounding residential, social and commercial properties shall be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions shall be given to all impacted properties. This shall include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties shall be undertaken prior to any proposed disruptions. Specific mitigation measures are as follows: • Avoidance of interaction with overhead utility lines in and around the site; • Protection in place of all underground services for which diversion is not required; • Use of existing electricity, telecommunications and water connections where possible; • The surface water drain from the adjacent property shall be reconnected to the existing outfall to the Canal Feeder Stream outside of the site boundary, with the site connection removed; • Consultation and agreement in place with Irish Water on allowable quantities and acceptance criteria for the leachate and other wastewater to be discharged to the public sewer network; and • Pre-treatment of leachate (methane stripping) prior to disposal to the sewer to remove explosion risk within mains.	Remediation Phase
MA3	17.5.3	Where additional material is required for re-profiling and capping of the site, this material shall be imported. Only materials which meet suitable engineering grade shall be sourced as required. A number of key issues shall be considered as part of the selection process. These include source; material specification; production and transport costs; and the availability of material. Proposals for material management are to be set out in the Construction Environmental Management Plan (CEMP) for the proposed Project. Any material being imported to the site must be accompanied by a source report completed by the provider of the material, which will give the history of the material and the land from which it has been taken. Material shall only be accepted based on the information contained in the source report. No material shall be accepted to site without a suitable source report. The imported material shall be sourced locally as far as reasonably practicable in order to reduce the need for long distance transportation of the material. Possible future sources for this material may include nearby development sites.	Remediation Phase

20. Summary of Residual Impacts

The residual impacts associated with the proposed Project after adherence to the implementation of mitigation measures, are summarised in Table 20.1.

Table 20.1: Residual Impact after Mitigation Measures

Chapter No.	Environmental Aspect	Summary of Residual Impact
7	Air Quality, Odour and Climate	**Remediation Phase** The Remediation Phase will be managed so that there are no significant residual air quality impacts after completion.
		Operational Phase The comprehensive mitigation and management proposals will ensure that there are no significant residual impacts during the Operational Phase.
8	Noise and Vibration	**Remediation Phase** The overall noise and vibration impact from the Remediation Phase of the proposed Project is anticipated to be short term and moderate considering the existing noise environment and the predicted impact of the proposed Project.
		Operational Phase The impact assessment has shown that the facility can operate within the adopted day, evening and night-time noise limits for the site. The overall noise and vibration impact from the operation of the proposed Project is anticipated to be long term and imperceptible (not significant) considering the existing noise environment and the predicted impact of the proposed Project.
9	Landscape and Visual	**Remediation Phase** The Remediation Phase will be managed so that there are no significant residual impacts to landscape and visual amenity after completion.
		Operational Phase Residual visual impacts area assessed at each of the representative viewpoints using a period of approximately seven years for the substantial establishment of mitigation planting. In every instance it is considered that the residual visual impact of the Operational Phase will be either a positive improvement on the current un-remediated baseline scenario or have no effect on visual amenity. Minor increase in the level of illumination proposed within and around the site is not considered to be significant.
10	Archaeology, Cultural Heritage and Architectural Heritage	**Remediation and Operational Phase** With all of the specified mitigation measures are carried out, there will be no residual impacts upon the archaeological, architectural and cultural heritage resource.
11	Biodiversity	**Remediation Phase** Through the implementation of well-established approaches to mitigation, which will be implemented in accordance with best practice guidance, it will be possible to reduce the impacts to not significant for all ecological features. **Operational Phase** As a result of the proposed mitigation and enhancement measures, no residual significant adverse impacts are predicted for the ecological receptors in the long-term following implementation of mitigation measures. In addition, as a result of the proposed Project and habitats features to be created, significant beneficial impacts are predicted for the Operational Phase of the proposed Project for the following ecological receptors: wetland habitats, amphibians and reptiles.
12	Soils, Geology, Contaminated Land and Groundwater	**Remediation and Operational Phase** The comprehensive mitigation and management proposals will ensure that there will be no significant residual impacts on soils, geology, contaminated land or groundwater.

Chapter No.	Environmental Aspect	Summary of Residual Impact
13	Water – Hydrology	**Remediation and Operational Phase** The comprehensive mitigation and management proposals will ensure that there will be an imperceptible residual impact the Morell River, and the Canal Feeder Stream, and no residual impact on Rathmore Stream and the watercourse on the Watercourse on Palmerstown House Estate & Golf Course.
14	Traffic and Transport	**Remediation Phase** While the nature of traffic increases will be short-term and the impacts negligible, the mitigation measures outlined will minimise any residual impacts. **Operational Phase** The traffic generated during Operational Phase of the proposed Project will not have a significant residual impact on the existing road network. Suitable signage will be erected advising of the appropriate access to the proposed Project. Furthermore, staff and visitors to the proposed Project, once operational, will benefit from the pedestrian and cycle infrastructure provided from the realignment of the L2005 Kerdiffstown Road which will provide a safe and desirable opportunity for walking and cycling to the public park.
15	Waste	**Remediation Phase** With mitigation and management proposals in place, there will be no significant residual impacts. **Operational Phase** As a result of the management of leachate and effluent from to site, and the connection to the wastewater treatment plant, and the implementation of operational management plans, there will be a positive residual impact.
16	Population and Human Health	**Remediation Phase** With mitigation and management proposals in place, there will be no significant adverse residual impacts. Furthermore, there will be positive residual impacts in relation to local employment opportunities, economic activity as a result of this employment, and an improvement to the L2005 Kerdiffstown Road. **Operational Phase** There will be positive residual effects in relation to local employment opportunities, and an improvement to the L2005 Kerdiffstown Road, recreational amenity and an improvement in the surrounding area, a positive contribution to the human health of the local population due through use of the recreational and amenity areas, and potential to increase the utility of the Grand Canal and neighbouring recreational amenities.
17	Material Assets	**Remediation and Operational Phase** Residual impacts on both the major utilities and the imported material are considered to be imperceptible.