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INTRODUCTION

Background

7.1 This Chapter of the Environmental Impact Assessment Report (EIAR) addresses the potential effects on surface water and groundwater of the proposed backfilling of an existing hard rock quarry by way of an inert landfill and the operation of a construction and demolition (C&D) waste recovery facilities at Ballinclare Quarry, near Kilbride, Co. Wicklow.

7.2 The proposed development provides for backfilling of the quarry to its original ground level using imported inert waste, principally soil and stone, generated by construction projects and.

7.3 The inert wastes to be imported and backfilled will principally comprise naturally occurring soil, stone and broken rock excavated in the course of construction and development projects in Counties Wicklow, Dublin and Wexford, with some occasional construction and demolition (C&D) waste being imported and used in the construction of internal haul roads. All imported waste accepted at the facility will comply with the waste acceptance criteria (WAC) for inert landfills set by Council Decision 2003/33/EC .

7.4 As part of the development, suitable uncontaminated natural, undisturbed soil waste and/or soil by-product (ie. non-waste) which conforms to an engineering specification will be imported for re-use in the construction of the basal and side clay liners required for the inert landfill.

7.5 On completion, the inert landfill will be restored to a long-term grassland / scrub habitat, similar to that which existed prior to quarry development, and possibly some agricultural grassland use.

7.6 Some complementary C&D waste recovery facilities will also be established at the application site to produce recycled (secondary) aggregate by crushing and soil washing and provide an integrated waste management facility for inert C&D waste.

7.7 The key elements of the proposed development are as follows:

- The backfilling of the existing quarry void by developing and operating an inert waste landfill facility with a total intake capacity of approximately 6,165,000 tonnes of inert soil and stone waste and (non-waste) soil and stone by-product and its progressive restoration to long-term grassland / scrub habitat thereafter;
- Continued use of established site infrastructure and services including, site / weighbridge office, staff welfare facilities, wastewater treatment plant, weighbridge, garage / workshop, wheelwash, hardstand areas, fuel and water storage tanks to service the proposed development;
- Installation of a new weighbridge along the inbound lane of the quarry access road;
- Decommissioning of any remaining fixed plant and infrastructure associated with former rock extraction activities or with aggregate, concrete and asphalt production activities at the application site;
- Off-site removal of any materials or bulky wastes associated with the former quarrying and production activities;
- Construction of an industrial shed (portal frame structure) at the paved blockyard area to house crushing and screening equipment and process / recycle inert C&D waste (principally solid / reinforced concrete, bricks, ceramics and solid bituminous waste mixtures);
- Use of any remaining external paved area surrounding the C&D waste processing shed as a hardstanding area for the external handling and storage of both unprocessed and processed C&D wastes;

- Installation and operation of a soil washing plant in the former concrete / asphalt yard in the south-eastern corner of the application site to recover sand and gravel aggregate for use in construction;
- Construction of an on-site (passive) wetland treatment system and attendant drainage infrastructure to treat surface water run-off / groundwater collecting in the sump / floor of the quarry area during backfilling / landfilling operations and surface water run-off from the C&D waste recovery area prior to its discharge off-site;
- Re-use of an existing storage shed as a dedicated waste inspection and quarantine facility to inspect and store suspect waste consignments as required;
- Upgrading and ongoing maintenance of established internal haul roads across the application site;
- Temporary stockpiling of topsoil pending re-use as cover material for final restoration of the inert landfill / backfilled quarry;
- Environmental monitoring of noise, dust, surface water and groundwater for the duration of the site backfilling and restoration works and for a short period thereafter.

7.8 Further details on the proposed development (site infrastructure, site access, landfill design, waste operations, water management systems, environmental management systems and controls, closure and aftercare etc.) are provided in Chapter 2 of this EIAR.

7.9 This Chapter of the EIAR provides a description of the water, including surface water (hydrology) and groundwater (hydrogeology) conditions in the local area, both in the context of the site and its regional setting, and assesses the potential impacts that the proposed development will have on surface water and groundwater.

7.10 Available information on the hydrology and hydrogeology of the Ballinclare / Kilbride area and its surrounds was collated and evaluated as part of this impact assessment . Unmitigated potential impacts on hydrology and hydrogeology are considered for the initial assessment, before appropriate mitigation measures for the potential impacts are identified are discussed. The identified potential impacts are then reassessed, assuming the identified mitigation measures are in place. Impacts are focused on the quality and quantity of both surface water and groundwater.

7.11 In terms of potential adverse impacts on the hydrology and hydrogeology the key elements of the development which relate to surface water and groundwater at the application site are:

- The placement of imported soil and storage of C&D materials at the site on groundwater;
- The discharge of water off-site to the Potters River; and
- Run-off from the site both during and following the final restoration.

Scope of Work / EIA Scoping

7.12 The scope of this EIA Chapter includes:

- An assessment of the existing water (hydrology and hydrogeology) within and close to the application site area;
- An assessment of the potential impact of the proposed landfilling and soil / C&D waste recovery activities on surface water and groundwater; and
- Where necessary, recommendation(s) of mitigation measures to reduce or eliminate any potential impact(s).

Consultations / Consultees

7.13 A pre-planning consultation meeting was held between officials of Wicklow County Council and representatives of Kilsaran Concrete and SLR Consulting Ireland on 7th February 2019 at the offices of Wicklow County Council in Wicklow Town. Staff from the roads, water and environment services departments of Wicklow County Council were also in attendance. Specific concerns were raised at that meeting in respect of the potential for contaminant emissions from the inert landfill and recovery activities and their impact on local groundwater resources and on the Potters River.

7.14 Following a review of available information, and follow up engagement with Wicklow County Council in respect of discharge licensing, it was considered that there was no requirement for any further formal external consultations to be carried out in respect of surface water and groundwater for the purposes of this assessment. There was consultation with other specialist contributors, principally ecologists preparing the biodiversity chapter of this EIAR (Chapter 5).

7.15 As this development constitutes Strategic Infrastructure Development (SID), a formal consultation exercise was also undertaken with statutory consultees and nearby residents / members of the general public between October and December 2020. Details of these consultations and the feedback obtained therefrom is provided in a separate report submitted in support of the SID application to An Bord Pleanála. Any specific feedback provided in respect of waste related impacts has been considered and addressed as appropriate in drafting this Chapter of the EIAR.

Contributors / Author(s)

7.16 This Chapter of the EIAR was prepared by SLR. The project team consists of:

- Clodagh Gillen BSc, MSc
- Dominica Baird BSc, MSc, CGeol, EurGeol, MIAH
- Peter Glanville BA, PhD, PGeo, EurGeol

Limitations / Difficulties Encountered

7.17 The assessment of the hydrological and hydrogeological environment is based on visual observations from published information, site visits, groundwater monitoring borehole data and sampling undertaken in 2019.

7.18 The assessment undertaken here should be viewed as a largely qualitative assessment of the hydrology and hydrogeology.

REGULATORY BACKGROUND

Legislation

7.19 This section references legislation and guidelines which may, as required be consulted for the preparation of this Chapter of the EIAR.

7.20 The key European Directives / European Union Legislation apply to this hydrology and hydrogeology assessment are:

- Environmental Impact Assessment Directive (2011/92/EU); and
- Directive of the European Parliament and of the Council amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (2014/52/EU).

7.21 Other European Directives to which this EIAR Chapter refers are listed in Appendix 7-A.

7.22 The Irish Government Acts, National Legislation and Regulations which apply to this hydrology and hydrogeology assessment are also listed in Appendix 7-A.

7.23 Under Regulation 4 of the Groundwater Regulations 2010, a duty is placed on public authorities to promote compliance with the requirements of the regulations and to take all reasonable steps including, where necessary, the implementation of programmes of measures, to:

"(a) prevent or limit, as appropriate, the input of pollutants into groundwater and prevent the deterioration of the status of all bodies of groundwater;

(b) protect, enhance and restore all bodies of groundwater and ensure a balance between abstraction and recharge of groundwater with the aim of achieving good groundwater quantitative status and good groundwater chemical status by not later than 22 December 2015;

(c) 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;

(d) achieve compliance with any standards and objectives established for a groundwater dependent protected area included in the register of protected areas established under Regulation 8 of the 2003 Regulations [S.I. No. 722 of 2003] by not later than 22 December 2015, unless otherwise specified in the Community legislation under which the individual protected areas have been established."

Planning Policy and Development Control

7.24 Planning Policy and Development Control relating to surface water and groundwater at the application site is governed by the Wicklow County Development Plan 2016-2022/

Guidelines

7.25 The following key Guidelines apply to this hydrology and hydrogeology assessment:

- Institute of Geologists of Ireland. Guidelines for the Preparation of Soils, geology and Hydrogeology Chapters of Environmental Impact Statements, April 2013; and
- National Roads Authority, 2008. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

7.26 In addition, this EIAR Chapter also refers to other guidelines listed in Appendix 7-A where applicable.

Technical Standards

7.27 Technical standards, where applicable to this EIAR Chapter, are listed in Appendix 7-A.

RECEIVING ENVIRONMENT

Study Area

7.28 The application site is located in the townlands of Ballinclare and Carrigmore in Co. Wicklow. The site can be accessed via the M11 Motorway and L1113 Local Road and via the R772 Regional Road and L1157 Local Road.

7.29 The application site is bounded to the west by the L1113 Local Road and to the south by the L1157 Local Road. There are agricultural lands and occasional dwellings to the east of the site, with the M11 Motorway c. 300m east of the site boundary. There are further agricultural lands and dwellings to the north of the site.

Baseline Study Methodology

7.30 The methodology used in the investigation follows the guidelines and advice notes provided by the Environmental Protection Agency on environmental impact assessments, and with due regard also had to the Institute of Geologists of Ireland's (IGI) guidelines (2013).

7.31 The methodology involved in the assessment of the hydrogeology and hydrology baseline at the application site can be summarised as follows:

- Review of existing reports, EIAR and site investigation data (groundwater monitoring wells and boreholes);
- A desk study in which available site-specific data and relevant regional data sources for the wider area were examined;
- Site visits in which the aspects of the sites hydrology and hydrogeology were assessed;
- Sampling of groundwater and water from the site; and
- Analysis of the information gathered.

Sources of Information

7.32 The existing reports and EIA reports reviewed for the purposes of this assessment are :

- Hydrological and Hydrogeological Assessment for Proposed Quarry Extension at Ballinclare, Co Wicklow, report reference CE04177, White Young Green, 2007; and
- Environmental Impact Statement, Ballinclare and Carrigmore Townlands, December 2006.

7.33 The desk study involved the examination of several datasets to determine the geological and hydrogeological setting of the area, as detailed in Table 7-1.

Table 7-1
Regional Data Consultation

Data	Dataset	Data Type/ Scale
Subsoil Geology	Teagasc Database	Digital
Soil Geology	GSI Bedrock Geology Sheet 16	1:100,000
	GSI Groundwater Data Viewer – Teagasc Soils	Digital
Surface Water	OSi Discovery mapping, Environmental Protection Agency, and Water Framework Directive mapping. OPW flood risk, and PFRA mapping.	Digital
Groundwater	GSI bedrock and gravel aquifer maps Groundwater body description documents Environmental Protection Agency and Water Framework Directive mapping	1:100,000 Digital

Data	Dataset	Data Type/ Scale
Elevation	OSi Discovery Series Mapping	1:50,000
Climate	Met Eireann	Digital
Protected Areas, Environmental Pressures	Environmental Protection Agency, National Parks and Wildlife Service	Digital

7.34 A site visit and inspection of the application site was originally undertaken by an SLR hydrogeologist on 1st September 2014. During that site visit, the water supply well was identified, existing surface water management activities at the site established and the hydrological and hydrogeological environment confirmed. There was no significant groundwater inflow noted at the time of the site visit. Further site visits were undertaken by SLR staff in 2019 for the purposes of this assessment.

Previous Site Investigations

White Young Green - 2005

7.35 Site investigation works were carried out by White Young Green (WYG) in 2005 and included:

- drilling of four trial wells, using a quarry rig, to assess underlying geology and to ascertain the groundwater flow direction and gradient;
- a well survey to provide information on domestic wells within the vicinity of the quarry;
- groundwater sampling at the site;
- surface water sampling upgradient and downgradient of the site; and
- surface water drainage survey to characterize the drainage pattern in the area.

7.36 WYG reported the presence of three operational wells for Ballinclare Quarry - PW1, PW2 and PW2A. The location of PW1 only was shown on one WYG figure (Figure 5). PW1 was drilled over 15 years ago and is reported to be 60m deep. This was used as the potable water supply for the offices and for toilet water. Quarrying activities were reported not to have affected PW1 and the volumes abstracted were reported at $1m^3/d$. After dry summer months, a shortage of process water for the quarrying operation was reported.

7.37 PW2/ PW2A is believed to refer to the current water supply well, although the location cannot be confirmed from the WYG report. PW2A was drilled 6m from PW2, to act as a standby well. PW2 is reported to have a yield of between 150-$200m^3$/day. Only a fraction of PW2's potential yield was used and only when there is insufficient water available from the recycling system. It is reported that both wells were drilled to 120m. There is however no log of PW2 available. According to the driller's logs, PW2A contained 10.5m of 'gravel' and this is the main productive zone. The underlying 80m of diorite and 30m of granite were not very productive. An additional production well, PW3, was drilled to 120m in the base of the existing quarry; however, the inflows were not sufficient to provide process water. A note on the driller's log estimates the yield at $13m^3/d$.

7.38 Wells PW1 and PW3 are no longer present at the quarry. In summary, well PW2A has a groundwater yield from a gravel layer. The gravel layer was not encountered in other boreholes. There were no significant inflows noted from the bedrock and the yield may not be sustainable over an extended period of pumping.

7.39 Four additional boreholes, designated TW1 to TW4, were drilled at the quarry by WYG in June 2005. Two additional wells, TW5 and TW6 were also drilled. Wells TW2 and TW3 were subsequently deepened in May 2007. The borehole locations were located to the north-west of the main quarry, at the location of the (then) proposed Carrigmore extension and have not been maintained. The

boreholes were drilled to a depth of 30.5m below ground level (bgl) with the corresponding reduced level at the base of the boreholes varying from 33mOD to 37mOD. The quarry floor level across much of the quarry is currently at 37mOD.

7.40 All six wells drilled in 2014 contained clay overburden and thicknesses varied from a maximum of 4.6m in TW3 to a minimum of 0.9m in TW2. Beneath the overburden, all six wells contained competent diorite for the entire depth, with little or no inflows recorded. Inflows were estimated by WYG to be less than 5m^3/d, and to be more accurately described as seepages.

SLR Geological Investigation - 2014

7.41 In 2014, following an initial field visit, a site investigation was designed with two geological rotary cored boreholes (BH1 and BH2) to investigate geological conditions beneath the quarry floor in advance of an application to extends the depth of the quarry. Three groundwater boreholes (GW1, GW2 and GW3) were also drilled to approximately 10m below the proposed final floor level to allow for baseline groundwater quality and groundwater level monitoring (and on-going monitoring throughout any future extraction phase).

7.42 The borehole rationale for both the groundwater and geological boreholes is presented in Table 7-2 below. The 2014 borehole locations are shown on Figure 7-1.

Table 7-2
2014 Geological Investigation Borehole Rationale

Borehole Number	Location	Target Depth	Comments
GW1	Outside quarry footprint to west Existing ground level at c. 61m AOD	68m	Groundwater borehole to south west of proposed quarry footprint Installation of monitoring borehole
GW2	Outside quarry footprint to south east Existing ground level assumed at 52mOD	61m	Groundwater borehole to south of proposed quarry footprint Installation of monitoring well
GW3	Outside quarry footprint to north west Located at Council Yard Existing ground level assumed at 55mOD	65m	Groundwater borehole to north of proposed quarry footprint Installation of monitoring borehole
BH1	Central area of existing quarry floor Existing floor level assumed at 37mOD	40m	Ground conditions confirmed from existing quarry floor
BH2	Western area of existing quarry floor. Existing floor level assumed at 37mOD	40m	

7.43 The site investigation works were undertaken from the 8th October 2014, under the supervision of SLR Consulting, when both the groundwater and geological drilling rigs commenced drilling. The three groundwater boreholes were drilled by Dempsey Drilling and were completed on 10th October 2014. The geological boreholes were completed by Irish Drilling Ltd. on 14th October 2014. All boreholes reached target depths.

7.44 The geological boreholes were drilled on the quarry floor, which is currently at 37m AOD. Rotary drilling was undertaken to obtain continuous rock core to the borehole depth. The rock core was logged by SLR Consulting, and the geological logs are presented in Appendix 6-A. Borehole BH1 was

located to the south east of the quarry sump, whilst borehole BH2 was located in the north western corner of the current excavation. Diorite was confirmed to be present to the target depths. A temporary 35mm standpipe was placed in borehole BH1 to allow for groundwater level monitoring. Blasting of rock was undertaken at the location of borehole BH2 immediately following drilling and so no standpipe was placed in this borehole.

7.45 Three groundwater boreholes were placed at locations surrounding the quarry footprint excavation. Borehole GW1 is located adjacent to an existing building to the west of main excavation and process area. Borehole GW2 is located on the south eastern boundary of the site, in the process area. Borehole GW3 is located on the north western boundary of the site, in an area that is used as a Council Yard. Initial consultation with Council personnel indicated that the shed adjacent to the planned borehole location housed a disused petrol pump and that underground storage tanks had previously been located in front of the shed. The tanks had previously been removed. On the advice of Council personnel, the borehole location was moved into the corner, near the ditch.

7.46 All boreholes encountered groundwater; however, inflows were generally minor with the exception of borehole GW2. Borehole GW1 in particular encountered very little groundwater and the groundwater took some time to enter the borehole following drilling. The groundwater was left to recover overnight. A significant groundwater inflow was encountered at borehole GW2, at approximately 6mbgl and is most likely the result of a cavity in the bedrock. There was a slight hydrocarbon odour noted in overburden at GW2. The overburden consists of reworked ground. There was no evidence of hydrocarbons at borehole GW3. All boreholes encountered a few metres of overburden overlying the diorite bedrock.

7.47 The groundwater boreholes were installed with 125mm casing. The top sections where overburden was encountered were fitted with plain well casing, and the remainder was fitted with slotted well casing. Groundwater levels were recorded and water samples taken.

Potential Soil and Groundwater Contamination

7.48 The site investigations undertaken in 2014 did not identify any widespread soil or groundwater contamination. The only visual or olfactory evidence of continuation was a slight hydrocarbon odour in overburden soils at location GW2.

7.49 Extraction activity at the quarry ceased after a thin vein of naturally occurring asbestos (NOA) was exposed within the diorite at the quarry. This vein exposure has been contained and the associated risks to human health have been deemed by the Health and Safety Authority (HSA) to be acceptably low. Subsequent detailed visual assessment of fibrous coated discontinuities within the exposed diorite indicated that they were typically very thin (<5mm), with the quantity of fibrous material present within them described as rare / very rare.

7.50 Surface water samples were tested for asbestos identification. The asbestos identification was carried out on the surface water and quarry sump samples, and no asbestos was reported. It is noted that the fibrous asbestos encountered is bound in rock and is not mobile

Topography, Physical Features, and Land-use

7.51 The quarry is located in the townlands of Ballinclare and Carrigmore, Kilbride, Co. Wicklow. The main quarry face is along the northern site boundary cutting into the slope of the land. Ground levels in the vicinity of the application site vary between c. 50m AOD at the southern site boundary, rising to c. 90m AOD at the highest point on the northern boundary. Typical levels over the northern boundary range from 60mAOD to 80mAOD.

7.52 When operational, the quarry used to be worked dry with very little inflow of groundwater reported within the quarry void area. A quarry sump located on the lowest floor level was used to collect any surface water falling over the void area and any minor inflows of groundwater and were used for production or dust suppression. Periodic pumping of the water from the quarry sump to the on-site storage tanks was carried out.

7.53 The quarry faces consist of an upper 20m face followed by three further smaller faces of between 12-15m in height each. The lowest quarry floor level is at c.21.5AOD.

7.54 Land-use at the application site comprises the quarry void and ancillary concrete/ asphalt / block production areas. Surrounding land use is mainly agricultural farmland, with dispersed residential housing and areas of forestry.

Rainfall and Climate

7.55 The Average Annual Rainfall (AAR) in the area around Ballinclare is c. 1,127mm/yr. for the period 1981-2010 (Met Éireann, 2012). The monthly average rainfall values for 1981-2010 are shown in Table 7-3 below.

Table 7-3
Average Monthly Rainfall Total (mm) 1981-2010 at Ballinclare

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AA
117	83	85	82	78	73	62	84	92	126	128	117	1,127

7.56 The nearest rainfall gauging station is Casement in Co. Dublin, which is c. 50km north-west of the site. Evaporation at Casement has a reported mean value of 764.3mm/yr from January 2015 to December 2018 (Met Eireann, 2019).

7.57 Groundwater Recharge maps published by the GSI show an effective rainfall for the application site of 647mm/yr. Evapotranspiration is therefore 480mm/yr (Evapotranspiration = Rainfall – Effective Rainfall). Met Eireann report potential evapotranspiration as 530.5mm/yr. Potential evaporation will always be higher than the actual value.

7.58 The application site comprises a mixture of vegetated and unvegetated areas (satellite imagery Google, 2020). The glacial till subsoil, where present in some areas, will reduce recharge to the underlying bedrock aquifer due to the relatively impermeable nature of the material. Recharge will also be dependent on the thickness of the subsoil material.

7.59 GSI Groundwater Recharge mapping suggests a recharge value of 100mm/yr. for the application site. Where vegetation has been removed to facilitate quarry development and bare rock / subsoils are exposed, recharge will be higher.

Soils and Geology

Soils and Subsoils

7.60 The Geological Survey of Ireland (GSI) publishes online soil and subsoil mapping prepared by Teagasc and the EPA. Detailed information on soils and subsoils are provided in Chapter 6 of this EIAR and are summarised below.

7.61 Teagasc soil mapping indicates soil cover was thin to absent over the original extraction area. The soils in the western part of application site are classified as AminSW, shallow well drained mineral soil, derived from mainly non-calcareous materials. The soils at the eastern part of the application

site are classified as AminSP, shallow poorly drained mineral soil, also derived from mainly non-calcareous materials, refer to Figure 6-1.

7.62 Teagasc / EPA maps indicate that there are no subsoils at the application site and that bedrock is at the surface across the majority of the site area, refer to Figure 6-2. The western corner of the site is indicated to be underlain by glacial till subsoils derived from Lower Palaeozoic sandstones and shales.

Local Bedrock Geology

7.63 The GSI online mapping database shows the area to be underlain by the Diorite (Di) Formation consisting of micro diorite to microgranite sills and minor dykes. There are north-south running faults to the east and west of the quarry. The bedrock geology beneath the current quarry floor level has been confirmed as diorite to 40m beneath the quarry floor. The local bedrock geology is shown on Figure 6-3 and the geology is discussed in detail in Chapter 6 of this EIAR.

Surface Water - Hydrology

7.64 The quarry lies entirely within the Water Framework Directive (WFD) Ovoca-Vartry Catchment and the Redcross Sub-Catchment. At the EPA Sub-Basin level the quarry is within the Potter's River catchment.

7.65 Potter's River is located to the north and east of the application site. It flows in an easterly direction initially and then turns to flow in a south-easterly direction. It is located c. 300m from the site at its closest point. The Kilmacurra Stream is located c. 200m to the south of the application site and flows in an easterly direction, to its confluence with the Potter's River, see Figure 7-2.

7.66 The Irish Sea is c. 7.5km east of the application site. The coastal area of the Irish sea east of the site is designated a Special Area of Conservation (SAC) for species and habitat.

7.67 An assessment of the impact of quarry discharges to the Potters River was previously undertaken for the purposes of an application for a Discharge Licence, details of which are provided below.

7.68 The potential impact of the proposed development on the designated SAC is assessed in the Biodiversity Chapter of this EIAR and the Natura Impact Statement (NIS) submitted in support of this application.

Surface Water Abstractions

7.69 The water in the Potters River is not abstracted for drinking water or recreational use (refer to www.catchments.ie). There are no recorded surface water abstractions from Potter's River in the vicinity of the application site indicated by the EPA 2009 abstraction register (www.epa.ie).

Surface Water Discharges

7.70 There is an existing Discharge Licence (Ref. No. WPL-116) for the application site which provides for the discharge of treated water to the Potters River, see Appendix 7-B. The discharge licence limits the volume of discharge from the application site to a maximum of 72m^3/hr (1,728m^3/day). Discharge emission limit values are set out in Table 1 of the licence.

7.71 An impact assessment of the discharge from the quarry on the Potters River undertaken for a discharge licence application submitted in 2019 (Ref. No. WPL-116) comprised an assessment of the Assimilative Capacity (AC) in the river and a calculation of the Mass Balance (MB) for the river with the discharge from the site. A copy of the AC and MB submitted with the Discharge Licence Application is provided in Appendix 7-C.

7.72 The only other Section 4 Discharge Licence for discharge to the Potters River is for the Tap Pub (DL Ref. No. WPL/96) at Kilbride which lies approximately 2.7km downstream of Ballinclare Quarry.

Surface Water Quality

7.73 The overall status of the Potter's River and Kilmacurra Stream is moderate according to the EPA River Waterbody WFD Status Report for 2010-2015. Surface water quality in the Potters River is monitored at Kilboy bridge, approximately 1.5km south east of the application site. The Q value is 3-4, indicating a moderate water quality, and was last measured in 2015.

7.74 Inland Fisheries Ireland notes that 2018 EPA biological monitoring recorded Q values 3-4 at EPA Site 0300 at Kilboy Bridge downstream of the site and also commented "the macroinvertebrate fauna continues to indicate unsatisfactory ecological conditions at Kilboy Bridge.". The water quality from an ecological perspective is discussed in the Biodiversity Chapter of this EIAR.

7.75 The rivers passed acidification, dissolved oxygen saturation, general conditions, nutrient conditions, oxygenation conditions, pH, and supporting chemistry conditions. The rivers were classed as moderate in biological status and invertebrate status, and in terms of nitrates. They were classed as high in other oxygenation conditions.

7.76 Inland Fisheries Ireland notes that the Potters River and catchment is a very important salmonid system supporting Atlantic salmon (Salmo salar listed under Annex II and V of the EU Habitats Directive), lamprey (Annex II) Sea trout (Salmo trutta) in addition to resident Brown trout. Potter's River is not designated as a Salmonid River, however as part of a previous planning application at the quarry WYG undertook consultation with the Eastern Regional Fisheries Board and it was reported that downstream of the quarry site is an important spawning ground for salmon and trout.

7.77 WYG took surface water samples in May 2007, from a drain upstream of the quarry entrance (SW1), at its confluence with Potter's Bar downstream of the quarry (SW2) and from a containment pond at the quarry entrance (SW3). These samples were analysed for major anions, cations and suspended solids. All surface water samples were found to comply with the EPA Interim Guideline Values, with the exception of potassium in SW3. The water sample from the settlement pond showed the highest value for conductivity, alkalinity, sulphate, and calcium of all the samples but these levels are still within the recommended limits and are probably a result of concentration due to evaporation.

7.78 The overall status of the coastal Irish Sea directly east of the site is high according to the EPA Coastal Waterbody WFD Status 2010-2015. It was classed as high in biological status, invertebrate status, phytoplankton status, dissolved oxygen saturation, oxygenation conditions, other oxygenation conditions, general conditions, nutrient conditions, other nutrient conditions, and supporting chemistry conditions. The Coastal Water Quality 2010-2012 is unpolluted. It is not at risk of deterioration.

7.79 The overall status of the coastal Irish Sea south-east of the application site, where the Potters River discharges into the sea, is unassigned according to the WFD Status 2010-2015. The Coastal Water Quality (2010-2012) is classified as being unpolluted.

7.80 Surface water samples were taken from three surface water locations (SW1, SW3B and SW4) and the existing sump at Ballinclare Quarry on two locations in March 2019. As can be seen in Figure 7-2, sample location SW1 is on the small stream which runs past the quarry, into which off-site discharges flow. Location SW3B is located on the Potters River upstream of the application site and location SW4 is at the bridge downstream of it. Results of water testing on collected samples are presented in Table 7-4 below

Table 7-4
Surface Water Quality

Parameter	Units	05/03/19				26/03/19				Quality Standards				
		SW1	SW3B	SW4	Quarry sump	SW1	SW3B	SW4	Quarry sump	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
Ammonia (Surface Water)	mg/L as N	0.02	0.02	0.01	0.01	0.11	0.81	0.12	0.05				0.065-0.175	0.30
Arsenic (Dissolved)	ug/L	<1.0	<1.0	<1.0	591.1	1.0	<1.0	<1.0	522.8	25 (AA)	20 (AA)	10	7.5	10
Asbestos Identification*	N/A	-	-	-	-	-	-	-	-					
BOD (Surface Water) (River)	mg/L	1.2	1.6	1.1	1.1	2	4	4	3	"High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)"				
Cadmium (Dissolved)	ug/L	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09			5		5
Chloride (Surface Water)	mg/L	21.7	18.9	19.8	17.6	19.9	18.1	17.9	17.2	0.45 - 1.5	0.45 - 1.5	30	24-187.5	250
Chromium (Surface Water)	ug/L	3	2	2	3	1	<1	<1	1			30	37.5	50
COD (Surface Water)	mg/L	17	14	15	19	47	5	<5	7	32				
Conductivity (Surface Water at 20°C)	µS/cm @ 20°C	178.0	191.0	163.0	364.0	167.2	185.7	152.1	364.0			1000	800 - 1875*	2500

Parameter	Units	05/03/19				26/03/19				Quality Standards				
		SW1	SW3B	SW4	Quarry sump	SW1	SW3B	SW4	Quarry sump	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
Copper (Dissolved)	ug/L	2	2	1	3	1	2	<0.142	2			30		2000
Dissolved Oxygen (mg/l)	mg/L	10.3	10.3	10.3	10.6	11.0	10.7	11	11.2	5 or 30 (AA)	5 (AA)			
Hardness Total (Surface Water)	mg/L CaCO3	57	72	49	131	56	64	46	129			200		
Lead (Dissolved)	ug/L	0.4	0.2	0.3	<0.173	0.3	0.3	1.4	0.2			10	7.5	10
Mercury (Dissolved)	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	7.2 (AA)	7.2 (AA)	1	0.75	1
Nickel (Dissolved)	ug/L	3	3	4	5	<0.374	2	1	3	0.07	0.07	20		20
Nitrate (Surface Water)	mg/L as N	3.38	5.60	4.04	<0.51	4.17	6.64	4.44	<0.51	20 (AA)	20 (AA)	25	37.5	50
Nitrite (Surface Water)	mg/L as N	<0.01	<0.01	<0.01	<0.01	0.02	0.02	0.01	0.01			0.1	0.375	0.5
pH (Surface Water)	pH Units	7.46	7.41	7.38	8.16	7.51	7.55	7.36	8.22			6.5 - 9.5		6.5 - 9.5
Phosphate (Ortho) Surface Water	mg/L as P	<0.014	<0.014	<0.014	0.060	0.059	0.374	0.036	0.047			0.03		
PRO (>C6-C12)	ug/L	<5	<5	<5	<5	<5	<5	<5	<5					
Solids (Total Suspended)	mg/L	<2	<2	<2	<2	<2	<2	<2	<2					

Parameter	Units	05/03/19				26/03/19				Quality Standards				
		SW1	SW3B	SW4	Quarry sump	SW1	SW3B	SW4	Quarry sump	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
Sulphate (Surface Water)	mg/L	11	16	10	73	10	12	10	69			200	187.5	250
Zinc (Surface Water)	ug/L	18	20	18	19	51	27	26	9			100	75	

Environmental Quality Standard (EQS) green: SI 272 of 2009

Environmental Quality Standard (EQS) blue: SI 327 of 2012

7.81 The water quality results from sample locations SW1, SW3B and SW4 were compared against quality thresholds set out in the Surface Water Regulations (SI 272 of 2009 and SI 327 of 2012). The results from the quarry sump were also compared against the Surface Water Regulations as well as the EPA Interim Guideline Values (EPA IGVs), Groundwater Regulations SI 9 of 2010 (GW Regs) and Drinking Water Regulations (SI 278 of 2007, DW Regs). The following exceedances were noted:

- At SW1, zinc concentrations exceed threshold values in SW SI 272 of 2009 EQS Other Surface Waters (MACs) on 26/03/19.
- At SW3B, BOD is neither high nor good quality on the 26/03/19, based on SI 272 of 2009
- At SW4, BOD is neither high nor good quality on the 26/03/19, based on SI 272 of 2009
- The recorded concentrations at the quarry sump exceeds all assessment criteria for arsenic on both sampling dates; exceeds EPA IGV criteria for orthophosphate on both dates; exceeds EPA IGV criteria for potassium on the 05/03/19 (not tested for on 26/03/19); exceeds Drinking Water limits for antimony on the 05/03/19 (not tested for on 26/03/19) and BOD is neither high nor good quality on 26/03/19, based on limits in SI 272 of 2009.

7.82 An asbestos identification was carried out on the surface water and quarry sump samples, and no asbestos was reported.

Surface Water Flows

7.83 For the Water Framework Directive, the EPA has developed a catchment-based model for the calculation of flow duration curves for ungauged catchments[1]. For the Potters River at the quarry, the catchment area is estimated at c. 23.8km^2 with an average annual rainfall of c. 1,053mm/yr. (1960-1991). The estimation of flow duration report for the Potters River estimates the 5th%ile flow at c. 1.685m^3/s and the 95th%ile lower flow is estimated at 0.057m^3/s, refer to Appendix 7-D.

7.84 There are no flow monitoring stations on the Potter's River in the vicinity of the application site. The closest catchment with a flow monitoring station is on the Avonmore River over 6km west of the site. Flow and water levels in the Avonmore River would not be representative of the Potter's and Kilmacurra Stream.

Flooding

7.85 The Office of Public Works (OPW) is the government agency with statutory responsibility for flooding in Ireland. The OPW website (www.floodmaps.ie) indicates that there are no recorded flood events in the vicinity of the application site from the Potters River.

7.86 The Preliminary Flood Risk Assessment (PFRA) maps prepared by the OPW under the Floods Directive (2007/60/EC) indicate areas of potential flooding identified from mapping / modelling exercises. PFRA Map Reference 2019/MAP/188/A covers the area around the application site and indicates no flooding potential associated with the Potters River. However, areas with an indicative pluvial 1%AEP (100 year) event (associated with overland flow and ponding) are noted in the vicinity of the application site along the Potters River.

7.87 There are no benefiting lands from flood protection works along the Potters River at the application site (www.floodmaps.ie). Benefiting lands is a dataset prepared by the OPW identifying land that benefited from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and identifies areas of land which were previously subject to flooding or poor drainage.

[1] http: // watermaps.wfdireland.ie /HydroTool/

Water Management

7.88 Currently, rainfall across the application site infiltrates naturally to the ground and recharges the underlying groundwater with diffuse recharge. During storm events surface water runoff across most of the site will drain to the quarry void, while some runoff from the western end of the site will go to the discharge drain at the western boundary of the site.

7.89 The existing quarry void is currently flooded with surface water run-off and groundwater. The volume of water in the quarry void is estimated to be of the order of 270,000m^3. At present there is no discharge of groundwater from the quarry void off site to the Potters River.

7.90 When operational the quarry was effectively worked dry with very little inflow of groundwater reported within the void. A quarry sump located at the lowest level on the quarry floor collected any surface water falling over the void area and any minor inflows of groundwater which occurred. This water was recycled and used in concrete production activities and on-site dust suppression, with periodic pumping of water to on-site storage tanks as required.

7.91 Since quarrying ceased and management of quarry water was suspended in 2016, the quarry void has now partially flooded. To enable the quarry to be re-engineered as a landfill the flooded quarry void will first need to be emptied of water. It is anticipated that his will be undertaken in accordance with the conditions attaching to the current discharge licence for the quarry.

7.92 The quality of water in the existing void has been established above with the water samples analysed from the quarry sump. Daily discharge volumes during the emptying of the quarry will not exceed the discharge licence limit of a maximum of 72m^3/hr (1,728m^3/day). Details of the approved water treatment measures to be implemented during quarry dewatering and subsequent operation of the waste management facility are outlined in the later section on proposed water management and treatment systems.

Groundwater – Hydrogeology

7.93 The application site is underlain by the diorite bedrock, identified as the Carrigmore Diorite. The bedrock outcrops at the surface or is overlain by a thin cover of glacial till. The diorite bedrock has been proven to 40m below the existing quarry floor level (to below 0mOD).

7.94 Bedrock aquifer maps published on the GSI website provide a detailed classification of bedrock aquifer types and indicate that the diorite bedrock is classified as a poor aquifer (Pl) which is generally unproductive except in local zones, refer to Figure 7-3.

7.95 The closest classified sand and gravel aquifer is a locally important aquifer, located approximately 9km to the north of the application site and not connected to it.

Groundwater Body

7.96 Ballinclare Quarry is located within the Wicklow Groundwater Body (GWB). Initial characterisations of GWBs have been developed by the GSI and augmented by the River Basin District (RBD) consultants. A summary of the GSI groundwater body descriptions is provided below.

7.97 The groundwater at the application site is of good status according to the EPA Groundwater Body WFD Status Report for 2010-2015. The overall objective is to protect the water body and the groundwater body overall risk is described as "*Possibly at risk of not achieving good status*".

7.98 The Wicklow GWB covers an area of 1,396km^2 and is described as being as generally poorly productive aquifer being composed primarily of low permeability rocks. There are large areas of the GWB where the rock is close to surface, which would suggest high potential recharge values, but

recharge calculations also consider the effect of rejected recharge from the lower permeability rocks. The aquifers within the GWB are generally unconfined.

7.99 The majority of groundwater flow is reported to occur in the upper 3m of the bedrock. This flow is mostly along a weathered zone in the bedrock, with flow in a lateral direction towards rivers and springs. As well as discharging to overlying streams and rivers as baseflow, groundwater flow also discharges directly to the sea along the coast.

7.100 In some instances, a greater degree of structural deformation may provide a fracture network which will allow groundwater movement at greater depth. Deep-water strikes are often encountered (between 10m and 40m bgl), but these are more isolated features along open fractures which allow groundwater flow. Only flow in isolated fractures is expected to occur below 30m depth (bgl).

7.101 Regional groundwater flow paths are not considered to develop as the rocks do not have sufficient transmissivity to transport water over long distances. Typical groundwater flow paths are reported to be of the order of a couple of hundred metres, with discharge occurring to the closest surface water feature.

7.102 The dominant recharge process within the GWB is diffuse recharge from water percolating through the overlying tills and into the aquifer. Although high rates of potential recharge would be expected in areas where there are very thin subsoils, a large portion of the potential recharge in the area is rejected because the rock formations are considered to be poor aquifers with low storativity. In addition, the steep slopes across the GWB area also give rise to increased surface water run-off.

7.103 The hydrochemical groundwater signature is a calcium bicarbonate type and is soft to moderately hard (50–250 mg/l CaCO3). Low conductivity values are recorded at 130 – 220 µg/l.

Groundwater Vulnerability

7.104 The GSI has developed a groundwater vulnerability classification for Ireland. The groundwater vulnerability at a particular point can be determined based on the natural geological and hydrogeological characteristics at that location. The groundwater vulnerability depends on the nature of the subsoils (i.e. their permeability characteristics), the type of recharge (point or diffuse) and the thickness of the unsaturated zone (depth to groundwater).

7.105 As can be seen in Figure 7-4, GSI mapping indicates that the aquifer at the application site has a vulnerability rating of E (Extreme) or X (rock at or near the surface, or karst). The GSI vulnerability rating table, reproduced in Table 7-5, indicates that this rating arises as there is less than 3m of subsoil present at the site.

7.106 As the soil and subsoil cover has been removed from the quarry footprint, and therefore there is no protection, the groundwater vulnerability rating will be X or E. However, when the quarry is completely backfilled, the groundwater vulnerability across the quarry footprint will be reduced to Low (L) as the combined thickness of the low permeability liner, inert soil material and restoration surface will be >10m in thickness, refer to Table 7-5 below.

Table 7-5
Vulnerability Rating

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

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

7.107 The application site is reported to have very low to low sub-surface and low to very high near surface nitrate susceptibility. It also is reported as having low to moderate near surface phosphate susceptibility (EPA, www.catchments.ie).

Groundwater Recharge

7.108 The main hydrogeological controls on groundwater recharge include the permeability and thickness of superficial deposits (mainly glacial tills), the presence of saturated soils, and the ability of the underlying aquifer to accept percolating waters. Combinations of these factors are assessed, and a 'recharge coefficient' is established for different hydrogeological scenarios.

7.109 The dominant recharge process is typically diffuse recharge from rainfall / water percolating through the overlying soils and subsoils, where present, and into the aquifer. High rates of potential recharge are usually expected in areas where there are very thin subsoils.

7.110 However at Ballinclare, a large portion of potential recharge is rejected because the rocks in the area are considered to be poor aquifers with low storativity and most potential recharge will therefore run-off overground to surface water features. Mapping published by the GSI indicates that the maximum recharge capacity for the area surrounding the quarry is 100mm/yr.

Groundwater Abstraction and Wells

7.111 A water supply well is located at the western boundary of the application site, shown in Figure 7-1. The water from this well supplies the wheelwash and provides a top-up supply for concrete production, dust suppression and toilet flushing as required. It is not used as a potable supply. The pumping well is located adjacent to a pump house and is approximately 28cm diameter. The water level in the pumping borehole was recorded at 3.25m bgl on 1st September 2014.

7.112 The GSI national well database (www.gsi.ie) identifies a number of wells in the immediate vicinity of the application site (<1km), refer to Figure 7-5:

- Borehole number 3217NWW139 is located to the north west of the site and was drilled in 1967 to a depth of 25.6m. Reported depth to rock is 4m. The borehole is for domestic use only and reported a poor yield 27m^3/d;
- Borehole number 3217NWW126 is located to the south east of the site and was drilled in 1973 to a depth of 30.5m. The borehole is for domestic use only and the yield was reported as poor; and
- Borehole number 3217NWW103 was drilled in 1996 to a depth of 91.4m, with a yield class of poor reported at 20m^3/d.

7.113 WYG undertook a well survey in the vicinity of Ballinclare Quarry in June 2005 and identified four domestic wells which supplied three houses. The water levels were recorded where possible, to establish baseline conditions. It was not possible to use the data to produce a groundwater contour map because the levels in the wells fluctuate depending on use. The results of the survey are presented in Table7-6 below and well locations (where known) are shown on Figure 7-1.

Table 7-6
White Young Green Well Survey 2005

Well number	Location	Owner	Depth (m)	Water level (m bgl)	Diameter (mm)	Comments
PW1	Ballinclare	Ballinclare Quarry	60	6	150	Potable water supply to existing quarry
PW2	Ballinclare extension		120	-	150	Groundwater ingress <10m bgl. Standby process and dust suppression
PW2a	Ballinclare extension		122	-	150	Added in 2007, standby process and dust suppression
PW3	Ballinclare quarry		152	Artesian	150	Added in 2007, abandoned
DWA	Kilmacurra West	George Lawless	51.8	2.9	150	Steel casing, no PVC
DWB	Carrigmore	Dieter Clissman	122	1.1	150	Steel casing, no PVC
DWC	Carrigmore	Mrs Olstoff	30	1.45	150	Steel casing, no PVC
DWD	Carrigmore	Mrs Olstoff	4	2.85	1000	Gravity fed dug well
DWE	Carrigmore	John Kinsella	-	-	-	-

7.114 It is understood that there is no mains water supply or group water scheme in the area, and that dwellings in the area each have individual private groundwater wells. The closest domestic dwelling at Knockanereagh to the south of the quarry, is approximately 220m from the quarry void.

7.115 The application site is not located within a public supply source protection area. The closest such is that for the Redcross Public Water Supply (PWS) located approximately 5km south of the site.

7.116 It is envisaged that an updated well survey will be undertaken to identify groundwater wells within 2km of the application site prior to commencement of any on-site activities. A number of downgradient wells will be selected for monitoring and will have groundwater quality sampling undertaken prior to commencement of waste intake and at least biannually during the subsequent construction and operational phases.

7.117 As previously noted, there are currently three on-site groundwater monitoring boreholes on site at Ballinclare Quarry (GW1, GW2, GW3). Well installation logs are shown in Appendix 7-E.

Groundwater Levels

7.118 As previously noted, various boreholes have been drilled oat the application site. Groundwater levels were monitored in these boreholes and the results are presented in Table 7-7 below.

Table 7-7
Groundwater Levels in GW and BH (mOD)

Borehole	Depth (m)	10/10/14	16/10/14	04/11/14	26/03/19	02/04/19
GW1	68	54.895	55.99	56.040	58.04	57.43
GW2	61	51.144	-	50.769	50.80	50.85
GW3	75	c. 47	54.196	54.096	53.14	54.08
BH1	40	37.892	37.842	37.892	-	-

7.119 The groundwater levels show highly localised variations and do not indicate a particular groundwater flow direction across the application site (refer to Figure 7-6). However, localised groundwater flow in the area is presumed to be towards the Potter's River, to the south and east of the site, with regional groundwater flow towards the coast to the east.

7.120 Topographically, the catchment area is small. It is likely that rain falling within the catchment runs-off rapidly rather than recharging through the almost impermeable bedrock and so reaches the application site in the form of surface water rather than groundwater. Any groundwater flowing through the upper (fractured) bedrock will eventually discharge into Potters River.

Groundwater Quality

7.121 Groundwater samples were taken from the three existing monitoring wells boreholes (GW1-GW3) once a month from May to November 2019 (seven samples total).

7.122 The groundwater results were compared with the following assessment criteria, in the order listed below:

- European Communities Environmental Objectives (Groundwater) Regulations, 2016. S.I. No 3669 of 2016;
- European Communities (Drinking Water) Regulations 2014 Quality. S.I. No 122 of 2014; and
- EPA Interim Report Towards Setting Guideline Values for The Protection Of Ground Water in Ireland.

7.123 Where assessment criteria are available for a particular quality parameter / contaminant, the threshold limits set by the EC Environmental Objectives Regulations 2016 are taken to supersede EPA IGVs.

7.124 The results of groundwater quality testing are presented in Appendix 7-F. Average, minimum, and maximum results are presented in Table 7-8, and indicate the baseline groundwater quality. PAHs and hydrocarbons were also scheduled for analysis for completeness.

Table 7-8
Groundwater Quality Results 2019

		GW1 Avg	GW1 Max	GW1 Min	GW2 Avg	GW2 Max	GW2 Min	GW3 Avg	GW3 Max	GW3 Min
Conductivity (25°C)	µS/cm	452.67	567	321	368.50	424	345	534.67	599	273
pH	pH units	7.76	7.98	7.56	7.18	7.91	6.9	8.02	8.1	7.9
Total Ammonia (as N)	mg/l	0.12	0.2	0.1	0.10	0.11	0.1	0.10	0.11	0.1
Ammoniacal Nitrogen (NH3-N)	mg/l	0.1	0.1	0.1	0.1	0.1	0.1	0.11	0.11	0.11
Chloride (as Cl-)	mg/l	11	11	11	21	21	21	63	63	63
Sulphate (as SO42-)	mg/l	15	15	15	10	10	10	10	10	10
Fluoride (as Fl-)	mg/l	0.13	0.13	0.13	0.43	0.43	0.43	0.17	0.17	0.17
Nitrate (as NO3)	mg/l	1.15	3.1	0.5	1.65	3.1	0.55	0.69	0.95	0.5
Nitrite (as NO2)	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Orthophosphate (as PO4)	mg/l	0.13	0.46	0.065	0.11	0.41	0.065	0.17	0.65	0.065
Total coliforms	MPN/100ml	1269.14	>2420	55	1418.86	>2420	51	1456.43	>2420	4
E coli	MPN/100ml	10	19	1	102	613	1	4	6	2
Cyanide (total)	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

		GW1 Avg	GW1 Max	GW1 Min	GW2 Avg	GW2 Max	GW2 Min	GW3 Avg	GW3 Max	GW3 Min
Cyanide (free)	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sulphide	mg/l	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sodium	mg/l	9.1	9.1	9.1	120	120	120	49	49	49
Total Calcium	mg/l	34	34	34	14	14	14	140	140	140
Total Potassium	mg/l	26	26	26	3.1	3.1	3.1	5.8	5.8	5.8
Total Magnesium	mg/l	6.2	6.2	6.2	2.1	2.1	2.1	4	4	4
Aluminium (total)	mg/l	0.07	0.07	0.07	0.017	0.017	0.017	0.03	0.03	0.03
Arsenic (total)	mg/l	0.044	0.13	0.0043	0.022	0.12	0.0033	0.123	0.16	0.089
Boron (total	mg/l	0.026	0.026	0.026	0.44	0.44	0.44	0.046	0.046	0.046
Barium (total)	mg/l	0.033	0.033	0.033	0.027	0.027	0.027	0.0084	0.0084	0.0084
Cadmium (total)	mg/l	0.003	0.005	0.00008	0.003	0.005	0.00008	0.003	0.005	0.00008
Chromium (total)	mg/l	0.004	0.01	0.001	0.004	0.008	0.001	0.003	0.005	0.001
Copper (total)	mg/l	0.015	0.025	0.001	0.015	0.025	0.001	0.015	0.025	0.001
Iron (total)	mg/l	0.69	2	0.24	0.77	2.7	0.14	0.69	1.3	0.18
Mercury (total)	mg/l	0.001	0.00075	0.0005	0.001	0.0013	0.0005	0.001	0.0016	0.0005

		GW1 Avg	GW1 Max	GW1 Min	GW2 Avg	GW2 Max	GW2 Min	GW3 Avg	GW3 Max	GW3 Min
Manganese (total)	mg/l	0.022	0.022	0.022	0.0029	0.0029	0.0029	0.14	0.14	0.14
Nickel (total)	mg/l	0.009	0.022	0.001	0.011	0.023	0.001	0.020	0.1	0.001
Lead (total)	mg/l	0.015	0.025	0.0011	0.019	0.031	0.001	0.020	0.025	0.0094
Antimony (total)	mg/l	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Selenium (total)	mg/l	0.0012	0.0012	0.0012	0.001	0.001	0.001	0.001	0.001	0.001
Zinc (total)	mg/l	0.016	0.025	0.001	0.017	0.037	0.001	0.015	0.025	0.001

Underlined numbers are 'less than'

Exceeds Groundwater Regulations

Exceeds Drinking Water Regulations

Exceeds EPA IGVs

Limit of Detection is higher than regulations

7.125 The groundwater quality testing identified the following exceedances:

- Ammonia is elevated above assessment criteria in GW1 in November 2019 only. This is likely to be as a result of agricultural practices in the area.
- Orthophosphate is elevated above the assessment criteria in all three boreholes during every sampling round, again this is likely to be as a result of agricultural practices in the area.
- Total coliforms is elevated above assessment criteria in all three boreholes during every sampling round.
- Potassium was only sampled in May 2019, concentrations were elevated in GW1 and GW3.
- Arsenic is elevated in all three boreholes during the majority of sampling rounds. Arsenic is not used on site and again is expected to be naturally occurring, with soil concentrations of 31.47mg/kg recorded by the EPA. The Soil Geochemical Atlas of Ireland shows the wider area to have arsenic in the area at >15mg/kg.
- Iron is elevated in all three boreholes during the majority of sampling rounds.
- Mercury is elevated at all three boreholes during the sampling round in August 2019, but not in another other sampling round in 2019.
- Manganese was only sampled in May 2019, the concentration was elevated in borehole GW3 only. This is likely to be naturally occurring and the EPA Soils Database records 2147 mg/kg for a soil sample to the south of the site (ID 138). The Soil Geochemical Atlas of Ireland shows the wider area to have manganese in the area at >1400mg/kg.
- Nickel is elevated in GW1 in September and GW2 in October 2019.
- Lead was elevated in GW2 and GW3 in June and July 2019. From August to November 2019, the limit of detection was above the assessment criteria.

7.126 Hydrocarbons were below detection limit in all three boreholes during every sampling round. PAHs were tested for in May 2019 and all were below detection limit in all three boreholes. It is noted that the water pumped from the production borehole is not used for potable supply and that bottled drinking water is brought onto the site for consumption as required.

Local Wastewater Treatment

7.127 There is no local mains sewer serving residential properties in the local area around the application site at Ballinclare Quarry. Local residences have individual wastewater treatment systems comprising either a basic septic tank with adjacent percolation area or a packaged wastewater treatment system.

Designated Areas

7.128 The National Parks and Wildlife Service (NPWS) map viewer identifies several Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and proposed Natural Heritage Areas (pNHAs) within a 10km radius of the application site.

7.129 The assessment of development related ecological impacts on these designated sites is addressed in Chapter 5 of this EIAR and in the Natura Impact Assessment which accompanies this application. An outline assessment of the protected areas from a hydrogeological perspective is presented in Table 7-9 below.

Table 7-9
Protected Areas Assessment

Protected Area	Location in Relation to Application Site	Comment
Glenealy Woods pNHA (001756)	1.1km north-west and upstream	Located in the same GWB as the site (Wicklow GWB) but a different aquifer.
Deputy's Pass Nature Reserve SAC (000717)	1.6km north-west and upstream	Located in the same GWB as the site but a different aquifer.
Vale of Clara (Rathdrum Wood) SAC and pNHA (000733)	6.5km west	Located in the same GWB as the site but a different aquifer. Located at a distance.
Magherabeg Dunes SAC and pNHA (001766)	7.5km east	Located in the same GWB as the site but a different aquifer. Located at a distance.
Buckroney-Brittas Dunes and Fen SAC and pNHA (000729)	7.5km south-east and downstream	Located downstream of the site and discharge to the Potters River. Partially in the same GWB as the site and partially in the GWDTE-Buckroney-Brittas Dunes GWB. Located in a different aquifer and at a distance.
Murrough SPA (004186, SAC (002249), and pNHA (000730)	8km north	Located in the same GWB as the site but a different aquifer. Located at a distance.
Devil's Glen pNHA (000718)	8.5km north	Located in the same GWB as the site but a different aquifer. Located at a distance.
Wicklow Head SPA (004127) and pNHA (000734)9km east	9.5km east	Located in the same GWB as the site but a different aquifer. Located at a distance.
Wicklow Reef SAC (002274)	9.5km east	Not located in the same GWB or aquifer. Located off the coast at a distance.

Sensitive Receptors

7.130 The following water environment sensitive receptors have been identified in the receiving environment and are assessed for significance and sensitivity in Table 7-10 below:

- Surface Water - Potter's River which includes an important salmonid system;
- Groundwater - good quality, poorly productive diorite bedrock aquifer; and
- Groundwater - nearby domestic and agricultural local groundwater supply wells.

7.131 The Glenealy Woods pNHA and Deputy's Pass Nature Reserve SAC are located c. 1km and 1.6km north-west of the application site. However as both are at a higher ground level, in different aquifers

and upstream of the discharge to the Potter's River and are not therefore impacted by any site based activities.

7.132 Of the designated sites indicated in Table 7-9 above, only the Buckroney-Brittas Dunes and Fen SAC and pNHA is located downstream of the surface water discharge from the quarry. It is located at the coast, a distance of 7.5km downstream and in a different aquifer.

7.133 The Natura Impact Statement accompanying this application concludes that the qualifying interests of the Buckroney-Brittas Dunes and Fen SAC pertain to terrestrial habitats that are not evidently hydrologically linked to the Potters River and therefore the integrity of these habitats will not be affected by any potential development related change in river system.

7.134 Given that the qualifying interests at this SAC are not hydrologically or hydrogeologically linked to the application site, it is not considered for further assessment in this Chapter of the EIAR.

Table 7-10
Existing Environment – Significance and Sensitivity

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H/M/L/N)
1	Surface Water - Potters River	Local significance only. Noted to include important salmonid system.	The Potters River is classified as being of is moderate quality but at risk of deteriorating. EPA noted unsatisfactory conditions at Kilboy bridge (Q values).	**Medium - Attribute has a medium quality or value at the local catchment scale only.** The river would be sensitive to any reduction in surface water quality.
2	Groundwater - Bedrock aquifer	Local significance only.	Diorite bedrock is classified as a poor aquifer which is generally unproductive except in local zones	**Low - Attribute has a low quality or value as it is a poor aquifer.** The bedrock aquifer at the site is classified as a Poor Aquifer
3	Private Water Supplies	The well survey determined that there are a number of domestic supply wells for residences in the local area around the quarry.	Private water supplies will be sensitive to changes in quality of groundwater. Activities at the site have the potential to result in a reduction in the groundwater quality	**Low - Attribute has a low quality or value on a local scale** Boreholes surrounding the site would be sensitive to a reduction in quality however there are a limited number of supplies in the local area.

Site Baseline Summary

7.135 The proposed soil and C&D waste recovery facility development is located at Ballinclare Quarry, Co. Wicklow. The proposed development consists of backfilling of the quarry through the establishment

and operation of an inert lined landfill and the establishment and operation of a C&D waste recovery facility.

7.136 A site investigation carried out in 2014 comprised 3 No. groundwater monitoring boreholes and 2 No rotary cored boreholes which proved diorite bedrock to 40m below the quarry floor.

7.137 Minor groundwater inflows were encountered at most well locations, with the exception of borehole GW2 where a suspected cavity was encountered at 6m bgl causing significant groundwater inflow. In comparison, borehole GW1 encountered very little groundwater and the groundwater took some time to enter the borehole following drilling.

7.138 The soils and subsoils at the site have been removed previously to facilitate the extraction of bedrock. Soil cover is thin to absent over the original extraction area and Teagasc / EPA maps indicate no subsoil cover and bedrock at or close to the surface. GSI online mapping database shows the area to be underlain by the Diorite (Di) Formation consisting of microdiorite to microgranite sills and minor dykes.

7.139 The Potter's River is located to the north and east of the site, c. 300m from the site at its closest point. The Kilmacurra Stream is c. 200m south of the site. The quarry lies entirely within the Ovoca-Vartry Catchment, which is in the Eastern River Basin District. Surface water quality in both rivers is moderate but indicated to be at risk of deteriorating.

7.140 The diorite bedrock is classified as a poor aquifer (Pl) which is unproductive except in local zones and the groundwater vulnerability beneath the application site is classified as being extreme, with rock at or near the surface.

7.141 There are large areas where the rock occurs close to surface. While this would suggest high potential recharge, when the effect of rejected recharge from lower permeability rocks is modelled, GSI groundwater recharge mapping estimates the maximum recharge capacity to be 100mm/year.

7.142 A number of groundwater supply boreholes are located within 1km of the quarry with poor yields recorded in all boreholes.

IMPACT ASSESSMENT

Evaluation Methodology

7.165 The impacts on the local surface water and groundwater environment of the proposed soil and C&D waste recovery activities at Ballinclare Quarry are assessed in this section.

7.166 The methodology applied here is a qualitative risk assessment methodology in which the nature of the potential impacts are described in terms of the character, magnitude, duration, probability and consequence of the impact.

7.167 The description of the potential impact is screened against the significance and sensitivity of the receiving environment to determine the significance of the impact.

7.168 This approach provides a mechanism for identifying the areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by the planned development. This approach allows effort to be focused on reducing risk where the greatest benefit may result.

7.169 The assessment of risk is based on a matrix on importance of attributes and the magnitude of impacts. Various criteria tables have been developed to facilitate assessments for the likelihood and magnitude of hydrological and hydrogeological impacts. These are presented in Appendix 7-G, Appendix 7-H and Appendix 7-I respectively.

7.170 In addition to their nature and significance, the potential impacts will be assessed in terms of their duration, whether they are direct or indirect impacts. Any cumulative impact of the potential impacts will be assessed.

7.171 The following sections describe the water management system to be implemented at the proposed waste facility at Ballinclare Quarry and identifies the impacts of the proposed development on the hydrogeological environment. It also assesses the likelihood of occurrence of each identified impact in accordance with the above. It should be noted that the impacts are initially assessed with no mitigation or design measures incorporated to reduce the effects.

Proposed Water Management and Treatment Systems

Dewatering of Quarry Void

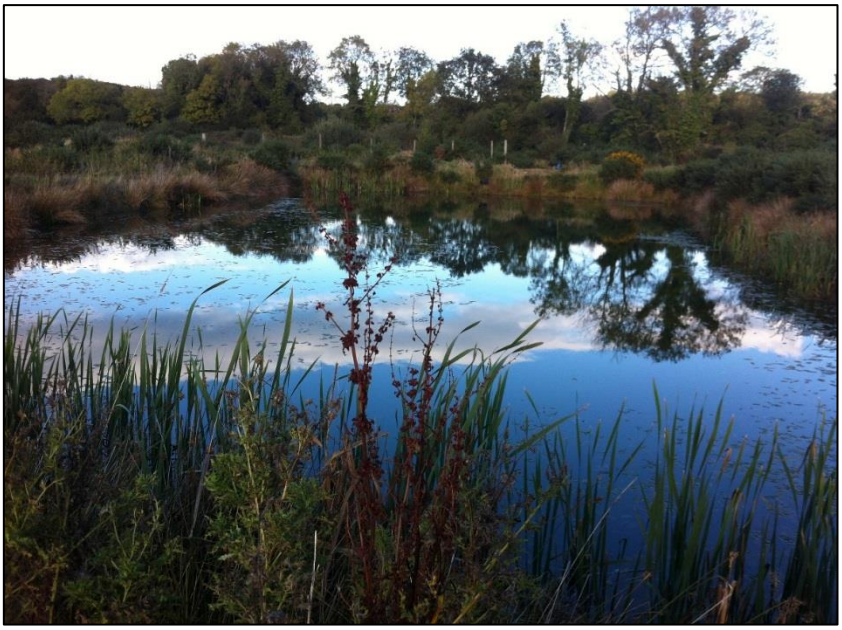
7.143 Prior to commencement of waste activity at Ballinclare Quarry, the existing quarry void will be dewatered and the water in it treated before being discharged to the Potters River under the terms of the existing discharge licence (Ref. WPL 116). The approved water treatment measures provide for use of the existing settlement ponds at the site, as well as a bespoke water treatment system to treat the discharge.

7.144 Due to elevated natural levels of arsenic in the water collecting in the quarry void, the discharge will be treated via a bespoke Siltbuster treatment system which will also provide for the removal of suspended solids from the water. Details of the Siltbuster treatment system are included in Appendix 7-J. Following treatment to remove the arsenic in the water, the water will pass through the existing settlement lagoons for final polishing before being discharged off-site.

7.145 Photographs of two existing settlement lagoons are shown in Plate 7-1 and Plate 7-2 below.

Plate 7 1
Existing Lagoon at Ballinclare

Plate 7 2
Existing Final Lagoon at Ballinclare



7.146 On completion of dewatering, the Siltbuster treatment system will remain in place to continue treating off-site discharges of water from the application site over the life of the proposed development.

Landfill / C&D Waste : Leachate Treatment

7.147 There will be on-going generation of leachate from rainfall on the landfill over the operational life of the inert landfill facility at the application site and as a result of the containment provided by the basal and side liners, any leachate will need to be removed and treated prior to being discharged off-site.

7.148 Leachate is the name given to the slightly contaminated liquid that is generated as influent rainwater and/or groundwater flows through a waste mass, picking up soluble and particulate matter as it moves downward towards the base of the landfill. Landfill leachates have varying compositions that reflect the types of wastes at each individual site, in this case the inert soils and/or C&D materials which will be imported to site.

7.149 Based on past experience with similar inert landfill facilities, it is likely that the inert waste landfill at Ballinclare will have little or no ammoniacal nitrogen, BOD and COD in the leachate, but could have *potentially* elevated concentrations of sulphate, reduced pH and detectable concentrations of metals. In addition, as inert C&D wastes can often contain road planings and other materials associated with road repairs and construction, some hydrocarbons could also be present.

7.150 Leachate may also be generated for a period after landfilling activities have ceased. However, once landfilled areas are filled and a low permeability cap installed to reduce the infiltration of rainfall then the volume of leachate generated will be reduced significantly.

7.151 A number of potential leachate treatment and disposal options were considered for the proposed inert landfill and C&D waste recovery facilities at Ballinclare. Following a review of options it was considered that the most suitable option for treatment of a leachate which principally requires reduction of inorganic substances would be an on-site (passive) wetland treatment system.

7.152 When installed in parallel, wetland areas can be independently placed out of service to allow for remediation and replenishment of infiltration / substrate media whilst still allowing on-going treatment of leachate through the active bed. Wetland treatment systems have a low visual and

amenity impact and require little on-going intervention once installed. The main drawback which can arise with wetlands is that they often require a large footprint area to treat the anticipated input volumes.

7.153 As the inert landfill / C&D waste recovery areas are not currently in existence at Ballinclare Quarry, some initial assumptions have been made about the likely quality of leachate that will be produced by the inert landfill and recovery area and the volumes that will be generated over time. Worst case scenarios have been considered both in terms of leachate quality (most problematic in terms of composition) and volume (highest generation volume).

7.154 An initial assessment indicates that there is sufficient spare land available at Ballinclare for a wetland treatment system in the western part of the site, adjacent to the planned inert landfill footprint. It is anticipated that the volumes requiring treatment at the facility will be limited by the progressive restoration of the completed landform with a low permeability capping over its operational life, this minimising the amount of leachate generated and requiring treatment.

7.155 The effectiveness of the passive wetland treatment systems can be enhanced by the temporary addition of various, more active treatment systems, such as chemical dosing, aeration or other such processes if required. This can allow a wetland system to handle higher contaminant loads or flows for periods of time (should it be necessary) before reverting back to more standard passive mode of operation, therefore providing flexibility should leachate generation rates and chemical constituents change over time.

7.156 Based on the initial assessment and design, the proposed passive wetland treatment system at Ballinclare Quarry will comprise:

i. Leachate reception tank: up to 50m^3, self-bunded storage tank with level controls.

ii. Pump will be housed is a standard shipping container (6.0m x 2.4m x 2.6m) containing feed, discharge and chemical dosing pumps;

iii. Passive wetland treatment system: comprising the following elements in series:

- Anaerobic (biochemical reactor) wetland;
- Iron Sequestering Unit (ISU);
- Aerobic wetland.

iv. Off-site discharge via existing ditch / drainage channel to Potters River.

7.157 Based on the assumption that the leachate flow rate is generated from a progressively capped inert landfill, the area of on-site wetland required at Ballinclare is assessed to be of the order of 3.8 hectares.

Landfill Groundwater Control System

7.158 Once the quarry void has been pumped dry, a groundwater control system will be installed beneath the proposed clay liner system to ensure hydrostatic uplift pressures do not damage the proposed liner system. It is envisaged that the drainage system at the base of the quarry / inert landfill will comprise a herringbone system of granular drainage channels and that these would feed groundwater to the sump at a low point on the quarry floor. Any water collecting in the sump will be removed by pumping for treatment and off-site discharge.

7.159 To prevent damage to the clay liner system, groundwater will need to be lowered by pumping from the sump until such time as any inert waste landfilling has reached a depth that overcomes the hydrostatic pressure of the surrounding groundwater table. By developing the quarry void from west to east, the existing sump in the quarry floor can be kept in use and maintained for as long as possible.

7.160 The previous experience of operating the quarry at the site is that the surrounding volcanic rock is relatively tight, with few faults or fractures and therefore relatively limited volumes of groundwater would flow through it to the quarry void. Once the quarry void is dewatered, the volume of groundwater likely to collect in the sump is expected to be low, with the bulk of any water removed comprising infiltrating rainfall and/or surface water run-off over (or possibly through) the landfilled inert soil and stone.

7.161 During the operational life of the landfill, the sump will remain open until Phase 3 of landfilling commences, at which point a riser pipe will be installed progressively upwards to allow a submersible pump to access the sump to lift and remove any collected groundwater and infiltrated rainfall / run-off. Pumping will continue until such time that the overlying inert waste has achieved a height where the weight of waste exceeds the maximum uplift pressure from surrounding groundwater. At that point in time, pumping of groundwater may cease and the riser pipe decommissioned.

7.162 Within the footprint of the Phase 4 landfill area, a surface water lagoon will be formed at the low point of the area and infiltrated rainfall / run-off would be continually pumped until such time as the basal liner is placed across the entire area to facilitate placement of inert waste.

Soil Washing Plant

7.163 There will be no surface water / groundwater emissions or off-site discharges arising from the proposed soil washing and aggregate recovery activities at the former concrete / asphalt production yard in the south eastern corner of the application site. All process water associated with eth winning of recycled aggregate from more granular waste soils or from claybound C&D will be re-circulated within a closed loop system. As such, there is therefore no requirement to make provision for treatment for any process water associated with the activity. Top-up water will be periodically required for the plant and will be provided from the on-site water management system.

7.164 The filter cake produced by the plate filter press at the end of the aggregate recovery process contains 85% dry solids. This materials will be picked up by a front end loader and transferred via haulage truck for disposal at the adjoining lined landfill facility.

Wastewater Management

7.165 Wastewater from the site offices and staff welfare facilities is piped to an existing on-site effluent treatment system. This system, which comprises an aeration treatment unit and two modular Puraflo system over a 300mm deep gravel bed, and was previously approved by way of the recent (2016) quarry planning permission and will continue in service for the duration for the life of the proposed waste management facility. A copy of the site characterisation form and details of the on-site waste water treatment system are provided in Appendix 7-K for reference.

Wheelwash

7.166 There is an existing wheelwash facility at the application site which will continue to be used over the life of the proposed waste management facility. Water supplied to the wheelwash is recycled in a closed system and is topped up with water from the supply well or from the quarry sump as required. The wheelwash generates very little run-off and any it does either rapidly evaporates or infiltrates to ground.

Long-Term (Post Closure) Surface Water Management

7.167 Following completion of landfilling and restoration works, the wetland area at the western end of the application site will remain in-situ and allowed to naturally evolve and re-wild, with no provision being made for any active long-term maintenance. The wetland system will be retained as a wildlife feature as part of the restoration, refer to Chapter 2 of this EIAR and Figure 2.4.

7.168 Post closure, the surface water management system at the landfill provides for a shallow interceptor drains (scrape or swale) to intercept surface water run-off from the restored landform and to direct it to the wetland area on the western side of the application site.

7.169 The wetland area will effectively serve as a long-term soakaway, settlement lagoon and/or attenuation pond for surface water run-off (from both the restored landfill and the restored C&D waste recovery area) prior to its discharge off-site via the established drainage network to the Ballinclare Stream.

7.170 Due to the topography of the proposed landform, it will not be possible to direct all the run-off from the restored landfill to the wetland / proposed settlement lagoon by gravity and as such, the residual, southern flank will be drained to a swale along the southern boundary that will discharge to an existing stream which flows to the Kilmacurra Stream.

Construction Stage Impacts

7.172 The potential direct and indirect impacts to surface waters and groundwater arising from the proposed inert waste management facility at Ballinclare Quarry are discussed below. In the context of the proposed new landfill and C&D waste recovery facilities, the construction stage is taken to be site preparation which involves any required dewatering from the quarry sump and the construction of the required infrastructure and site preparation, which is outlined in Chapter 2 of this EIAR.

Direct Impacts

Groundwater

7.173 The groundwater receptors at the site consist of the good quality, poorly productive diorite bedrock aquifer and nearby domestic and agricultural local groundwater supply wells. The surface water receptor is the Potters River.

7.174 Direct impacts during the construction stage have the potential to arise from:

- The accidental leaking of fuels and other petroleum-based products (lubricating oil, greases, etc.) from plant and machinery, or the storage of such materials has potential to impact on groundwater quality aquifer. This would be an **adverse effect.**

Surface Water

7.175 The surface water receptor at the site is the Potters River. Direct impacts during the construction stage have the potential to arise from:

- The uncontrolled discharge of water from the flooded quarry void during the initial dewatering phase and potential leak of fuels and other petroleum-based products at site preparation areas has the potential to reduce water quality of the off-site discharge and impact the Potters River and its salmonid system . This would be an **adverse effect.**
- The uncontrolled discharge of water from the flooded quarry void during the initial dewatering phase has the potential to result in an increase in flood risk downstream in the Potters River. This would be an **adverse effect.**
- Fugitive dust on HGV's leaving the site has the potential to wash into watercourses. This would be an **adverse effect.**

Indirect Impacts

7.176 No indirect impacts are anticipated from the construction stage.

Operation Stage Impacts

7.177 During the operational stage the dry quarry void will be backfilled and restored using imported soil waste and C&D materials will be recovered at the proposed recovery facility. Therefore, groundwater quality and surface water discharge are the principal impacts during this stage

Direct Impacts

Groundwater

7.178 It is noted that the groundwater receptors at the site are the bedrock aquifer and local groundwater wells.

7.179 Direct impacts on groundwater during the operational stage have the potential to arise from:

- The accidental leaking of fuels and other petroleum-based products (lubricating oil, greases, etc.) from plant and machinery, or the storage of such materials has potential to impact on groundwater quality aquifer. This would be an **adverse effect.**
- Contaminants in imported soil and C&D materials have the potential to impact on groundwater quality in the aquifer. This would be an **adverse effect.**

7.180 Each of the above impacts is assessed in terms of the character, magnitude, duration, probability and consequence in Table 7-11 below.

Surface Water

7.181 It is noted that the surface water receptor in the vicinity of the site is the Potters River in terms of surface water quality and flow volumes during flood events.

7.182 Direct impacts on surface water quality and flood flows during the operational stage have the potential to arise from:

- Any contaminants in imported soil and C&D material or accidental leaking of fuels or other petroleum based products have the potential to impact the surface water quality of the off-site discharge to the Potters River. This would be an **adverse effect;** and
- Any suspended solids in the discharge have the potential to impact on surface water quality. This would be an **adverse effect.**

7.183 Each of the above impacts is assessed in terms of the character, magnitude, duration, probability and consequence in Table 7-11 below.

Indirect Impacts

7.184 No indirect impacts are anticipated from the operational stage.

Post - Operational Stage Impacts

7.185 Post operational stage impacts are those impacts which may occur during the final restoration of the site and following the full restoration or during the aftercare period .

7.186 Post operational stage impacts would generally be long term effects in duration.

Direct Impacts

7.187 A restoration scheme has been prepared for the application site and will be implemented in phases with the final restoration works being carried out following permanent cessation of landfilling activities, refer to Chapter 2 of this EIAR for details. The final surface of the site will be graded and subsoiling will be undertaken to improve soil drainage and functioning to promote grass growth and restore the site to grassland / scrub habitat.

7.188 During the post-operational stage, dewatering at the facility will cease and the groundwater will be allowed to rise to its natural level.

7.189 There will be no effluent discharge to any surface water course from the site following cessation of site operations. Natural storm / surface water run-off from the restored site will be directed via site drains to local watercourses; this is a natural process.

7.190 No indirect impacts are anticipated from the post-operational stage following the restoration of the site.

Indirect Impacts

7.191 There are no indirect post closure impacts anticipated.

Unplanned Events

7.192 It is considered highly unlikely that any unplanned events within the application site would result in a noticeable impact on the hydrology and hydrogeology of the local area.

7.193 The quarry void and the wider site area is not located within the floodplain of the local stream and is not therefore considered to be at risk of flooding.

7.194 Accidents at the waste facility could result in the spillage or leak of fuels (or other petroleum-based products), which has been considered in the assessment of impacts above.

Trans Boundary Impacts

7.195 The site does not cross any international boundaries, hence transboundary impacts are disregarded for this site.

The 'Do Nothing' Scenario

7.196 If the proposed landfilling and waste recovery activities do not proceed at the application site, the bare, disturbed landform which currently exists across much of the existing site would remain unchanged, with only very slow and gradual recolonization of natural vegetation occurring over time.

7.197 In dry periods, in the absence of any site management practices, dust emissions would be likely to arise from the site on an ongoing basis and surface water bodies / groundwater would be vulnerable to impacts from any future human activities within and/or around the quarry.

Rating of Identified Potential Impacts and Significance

7.198 The potential impacts outlined above during the construction and operational stages have been described in terms of the character, magnitude, duration, probability and consequence, and each impact is rated in terms of High, Medium, Low and Negligible based on the magnitude, extent, duration and consequence of the identified effects.

7.199 The description of the potential effects and rating for each identified impact is presented in Table 7-11 below.

7.200 The significance of impacts is based on the significance/ sensitivity of the existing environment and the description of identified potential impacts, refer to Table 7-11 below. The significance of Impact is determined from the Classification of the Significance of Impacts in Appendix 7-I.

Table 7-11
Direct Impacts: Description and Significance of Impact

	Potential Impacts	Character	Magnitude	Duration	Probability	Consequences	Description of Impact	Significance of Impact
Construction Stage: Groundwater								
1	Impact on groundwater from **accidental fuel leakage/ spillage**	Potential to affect groundwater quality in underlying bedrock aquifer. Vertical migration in the bedrock aquifer will be impeded by the bedrock at the site which hosts a poor aquifer.	Size and scale depend on volume of any fuel leaked. Extent in the bedrock aquifer would be limited by the nature of the bedrock.	Duration of effect would be temporary to short-term. Frequency would be non-occurring to rarely.	Unlikely as any leakage/ spillage would be accidental only	Reduction in groundwater quality in underlying bedrock aquifer	The potential impact on groundwater is rated as being **Medium** based on the character, magnitude, duration and consequence of the identified effects.	**Moderate**
Construction Stage: Surface Water								
2	Impact on **surface water quality** in the Potters River during the initial dewatering phase of the quarry void **or accidental leaking of fuels or other petroleum based products**	Potential to affect surface water quality in the Potters River, and impact on salmonid system.	Extent in the river would be downstream of the discharge point. With groundwater contaminants, size and scale would depend on the flow and resultant Assimilative Capacity of the river. With fuel leaks, size and scale of impact depend on volume of leaked	Duration of effect would be temporary (duration of construction stage dewatering). With groundwater contaminants, frequency would be constant during the dewatering phase. With fuel leaks, frequency would be non-occurring to rarely	With groundwater contaminants, likely as the water in the quarry void will be discharged to the river With fuel leaks, unlikely as any leakage/ spillage would be accidental only	Reduction in surface water quality in the river	The potential impact on surface water quality is rated as being **Medium** based on the character, magnitude, duration and consequence of the identified effects.	**Moderate**
3	Impact on **surface water flow/levels** in the Potters River during the initial dewatering phase of the quarry void. There are no sensitive flood receptors along the Potters River other than agricultural land	Potential to affect surface water levels and increased flood risk in the Potters River.	Extent in the river would be downstream of the discharge point. Size and scale would depend on the flood flow / capacity in the river channel.	Duration of effect would be temporary (duration of construction stage dewatering). Frequency would be constant during the dewatering phase.	Likely as the water in the quarry void will be discharged to the river	Increased flood risk to lands further downstream in the river	The potential impact on surface water levels is rated as being **Low** based on the character, magnitude, duration and consequence of the identified effects.	**Slight**
Operational Stage – Groundwater								
4	Impact on groundwater quality from **accidental fuel leakage/ spillage**	Potential to affect groundwater quality in underlying bedrock aquifer. Vertical migration in the bedrock aquifer will be impeded by the bedrock at the site which hosts a poor aquifer.	Size and scale depend on volume of any fuel leaked. Extent in the bedrock aquifer would be limited by the nature of the bedrock.	Duration of effect would be temporary to short-term. Frequency would be non-occurring to rarely.	Unlikely as any leakage/ spillage would be accidental only	Reduction in groundwater quality in underlying bedrock aquifer	The potential impact on groundwater is rated as being **Medium** based on the character, magnitude, duration and consequence of the identified effects.	**Moderate**

	Potential Impacts	Character	Magnitude	Duration	Probability	Consequences	Description of Impact	Significance of Impact
5	Impact on groundwater quality from **contaminants in rogue loads of imported material and / or C&D material**	Potential to affect groundwater quality in underlying aquifer and supply wells through horizontal migration. The vertical migration in the bedrock aquifer will be impeded by the bedrock at the site which hosts a poor aquifer.	Size and scale depend on volume and nature of the rogue imported material. Extent in the aquifer will be limited by the nature of the aquifer which is classified a poor aquifer. .	Duration of effect could be temporary to long term depending on the nature and volume of rogue material imported. Frequency would be non-occurring to rarely.	Unlikely as intake material is inert, would only be accepted from sites where prior land-use / history is known and / or has been tested at source	Reduction in groundwater quality	The potential impact on groundwater is rated as being **High** based on the magnitude, extent, duration and consequence of the identified effects.	**Moderate to Slight**
Operational Stage: Surface Water								
6	Impact on surface water quality in the Potters River from **contaminants in rogue loads of imported soil / C&D materials or accidental leaking of fuels or other petroleum based products**	Potential to affect surface water quality in the Potters River, and impact on salmonid system.	Extent in the river would be downstream of the discharge point. With waste contaminants, size and scale would depend on the flow and resultant Assimilative Capacity of the river. With fuel leaks, size and scale of impact depend on volume of leaked	With waste contaminants, duration of effect could be temporary to long term depending on the nature and volume of rogue material imported. With fuel leaks, frequency would be non-occurring to rarely	With waste contaminants, unlikely as intake material would only be accepted from sites where the prior land-use history is known With fuel leaks, unlikely as any leakage/ spillage would be accidental only	Reduction in surface water quality	The potential impact on surface water quality is rated as being **High** based on the magnitude, extent, duration and consequence of the identified effects.	**Significant to Moderate**
7	Impact on surface water quality in the Potters River from **suspended solids in discharge**	Potential to affect surface water quality in the Potters River, and impact on salmonid system.	Extent in the river would be downstream of the discharge point. Size and scale would depend on the flow and resultant Assimilative Capacity of the River.	Duration of effect could be long term. Frequency would be occasional.	Likely as the material imported an managed will be mainly particulate / soil	Reduction in surface water quality	The potential impact on surface water quality is rated as being **Medium** based on the magnitude, extent, duration and consequence of the identified effects.	**Moderate**
Post Closure Stage : Surface Water								
8	Impact on surface water quality in the Potters River from **suspended solids in runoff from restored landform**	Potential to affect surface water quality in the Potters River, and impact on salmonid system.	Extent in the river would be downstream of the discharge point. Size and scale would depend on the soil erosion at the site before the grass vegetation cover had been established.	Duration of effect could be short term. Frequency would be occasional.	Likely if final restoration occurs in autumn / winter when there is no grass growth.	Reduction in surface water quality	The potential impact on surface water quality is rated as being **Medium** based on the magnitude, extent, duration and consequence of the identified effects.	**Moderate**

Description of Likely, Significant Effects: Summary

7.201 A summary of those impacts which have been identified as having a likely, significant effect is provided in Table 7-12 below. Only one potential impact has been identified as having a likely, significant effect:

- Potential impact on surface water quality in the Potters River from contaminants in rogue loads of imported soil / C&D materials or accidental leaking of fuels or other petroleum based products (Impact 6).

Table 7-12
Summary Description of Identified, Likely Significant Effects

Effects	For each identified *likely, significant* effects
Magnitude and spatial extent of the effects	• The identified receptor is the Potters River (Surface Water); • Rogue contaminated material could impact on water quality; and • The extent in the potential impact would be downstream from the discharge point to the river.
Nature of the Effects	• The effects will result in a reduction in surface water quality in the Potters River • The potential effect will be adverse.
Transboundary nature of the Effects	• There are no transboundary effects associated with the proposed development.
Intensity and complexity of the Effects	• The significance / sensitivity is of the Potters River is its water quality.
Probability of the Effects	• The probability of the effects is considered to be unlikely as intake materials will be inert, will only be accepted from sites where the prior land use history is known and / or the material has been tested.
Expected onset, duration, frequency and reversibility of the Effects	• The expected onset is during the operational phase; • The duration of effect would be temporary to long-term. • Frequency would be non-occurring to rarely; and • Effects would be reversible with remediation.
Cumulation of the Effects with the Effects of other existing and/or approved projects	• There are no cumulative effects identified with the proposed development.
Possibility of effectively reducing the Effects	• The potential impact on the river water quality can be mitigated at the site and this will reduce the significance of the impact on water quality.

MITIGATION MEASURES

7.202 Proposed mitigation measures to reduce the potential impacts associated with the proposed development to acceptable levels with a low risk to the receiving environment, are identified in this section. These measures are designed to either reduce the likelihood of an event occurring or reduce the magnitude of the consequences if the event does occur.

7.203 Some mitigation measures were previously / are currently in place at the existing quarry to prevent any reduction in the quality of the local aquatic environment. These measures are in accordance with the "best practice / possible remedial measures" set out in Chapter 3.4 of the DoEHLG (2004) Quarries and Ancillary Activities: Guidelines for Planning Authorities.

7.204 The measures outlined below are designed to mitigate any adverse impacts on surface water and groundwater identified here through the sequential approach of:

(i) Avoidance;
(ii) Prevention;
(iii) Reduction; and
(iv) Remedy / Offsetting.

7.205 The majority of mitigation measures identified here seek to avoid, prevent and reduce any adverse impacts on surface water and groundwater.

Construction Stage

7.206 The following measures will be implemented at the site to prevent leaks and/or spills, these are mitigation by **prevention**:

- The discharge water to the Potters River will comply with the conditions in the discharge licence;
- The discharge water will be treated in a water treatment plant and will pass through the settlement lagoons / attenuation pond at the site;
- No refuelling of plant / machinery, maintenance or repairs will take place in the quarry void to prevent accidental spillages reaching the ground or being washed off in surface water;
- A refuelling pad with connection to hydrocarbon separator is provided at the application site, beside the workshop. All mobile plant and machinery refuelling will take place on the refuelling pad.
- Drip trays will be used for all refuelling activities;
- All plant / machinery maintenance and repairs will take place under cover in the existing workshop at the site or on the hardstand refuelling pad;
- All plant will be regularly maintained and inspected daily for leaks of fuels, lubricating oil or other contaminating liquids;
- Fuel storage will continue at the existing bunded storage facility at the site;
- All petroleum-based products (lubricating oils, waste oils, etc.) will be stored on drip trays under cover in the workshop to prevent pollution due to accidental leakages;
- Waste oil and grease containers will be stored under cover in the workshop. Waste containers will be collected and disposed of by a suitably licenced contractor;
- An emergency spill response kit (with containment booms, absorbent materials and drip tray) will be provided on-site to contain/ stop the migration of any accidental spillages, should they occur;

- Plant operators will be briefed during 'toolbox' talks and site induction on where the spill kit is kept and how and when it is deployed;
- Regular visual inspection and testing will be undertaken of the integrity of tanks, drums, bunded pallets and double skinned containers;
- Traffic management systems at the site will reduce potential conflicts between vehicles, and the potential risk of collisions and associated fuel spills or oil leaks; and
- Site speed limits will be implemented across the site to further reduce the likelihood and significance of collisions and the possibility of a fuel leak from such a collision.

Water Management Systems

7.207 Water in the quarry void will be pumped to the treatment plant and will then go to the settlement / attenuation ponds for further treatment (settlement) prior to discharge at the Potters River. Should the capacity of the settlement ponds be exceeded then additional ponds will be constructed. The location of existing back up settlement ponds is shown on Figure 2-1 of this EIAR.

7.208 All surface water discharges to the Potters River will comply with the emission limits set by the discharge licence (or those which may supersede them in any waste licence issued by the EPA).

7.209 The volume of water discharged from the site compared to flood flows in the Potters River is negligible and therefore the discharge water will not result in increased flood risk in the river.

Operational Stage

7.210 The proposed mitigation measures outlined above for the construction stage will also be implemented for the operational stage particularly in relation to accidental fuel leaks and spillages of any hydrocarbons and the settlement / attenuation ponds for the removal of suspended solids.

7.211 The following additional mitigation measures will also be implemented:

Inert Landfill Liner

7.212 Suitable uncontaminated natural, undisturbed soil waste and/or soil by-product (i.e. non-waste) which conforms to an engineering specification will be imported for re-use in the construction of the 1m thick basal and side clay liners required for the inert landfill at the application site. This clay liner will be of sufficiently low permeability (less than or equal to $1x10^{-7}$m/s) to provide an appropriate level of protection to groundwater and the surrounding aquifer, in line with accepted inert landfill design standards (and current legislative requirements).

On-site Passive Wetland Treatment System

7.213 A separate drainage system will be provided to reduce pressures and dewater groundwater beneath the basal liner. Dewatered groundwater and storm runoff from the inert landfilling activities will be collected at a sump and pumped up to the approved (Siltbuster) treatment plant and from there to the proposed on-site (passive) wetland treatment system before being discharged off-site to the Potters River. The sizing and design of the wetland treatment system has been developed having regard to the likely contaminants (and concentrations thereof) which could be present in the inert soil / C&D waste intake source from construction sites.

7.214 The effectiveness of the proposed wetland treatment systems can be enhanced by the temporary addition of various, more active treatment systems, such as chemical dosing, aeration or other such processes. This can allow a wetland system to handle higher contaminant loads or flows for periods of time (should it be necessary) before reverting to more standard (passive) modes of operation, therefore providing flexibility should leachate generation rates and chemical constituents change over time.

7.215 Based on the initial assessment and design, the proposed wetland treatment system at Ballinclare Quarry will comprise the existing approved treatment system plus

(i) A leachate reception tank : up to 50m^3, self-bunded storage tank with level controls.

(ii) A pump house : housed is a standard shipping container (6.0m x 2.4m x 2.6m) containing feed, discharge and chemical dosing pumps;

(iii) A wetland treatment system: comprising the following elements in series
  (a) Anaerobic (biochemical reactor) wetland;
  (b) Iron Sequestering Unit (ISU);
  (c) Aerobic wetland.

(iv) Off-site discharge via existing ditch / drainage channel to the Ballinclare Stream and the Potters River further downstream.

Testing and Inspection of Imported Material

7.216 Only soil and stone waste and C&D material carried by authorised waste collectors will be accepted at the proposed waste facility at Ballinclare Quarry. All waste intake and acceptance will be subject to regulation and control by way of any EPA Waste Licence issued in respect of the proposed facility.

7.217 Insofar as practicable, the source of each large consignment of soil imported to site for landfilling purposes shall be identified in advance and subject to basic characterisation testing to confirm that it is inert according to the criteria set by Council Decision 2003/33/EC. Ideally, characterisation testing will be undertaken in advance by customers, clients or sub-contractors forwarding soil and stone backfill materials to the application site.

7.218 Operating procedures at the proposed facility will require all wastes forwarded for landfilling and/or recovery purposes to be pre-sorted at source, inert and free any non-hazardous / hazardous domestic, commercial or industrial wastes. Any waste consignment arriving at the facility with such wastes intermixed with it will be deemed unacceptable for acceptance at the facility on the basis of a CCTV / visual inspection at the weighbridge and will be immediately rejected and re-directed off-site to an alternative authorised waste facility.

7.219 All inert soil and stone imported to the facility will be unloaded (end-tipped) from trucks at the active landfill area. In addition to visual / CCTV inspection at the weighbridge(s), it will be inspected again by site based personnel to ensure that there is no non-hazardous or hazardous waste intermixed with it. Should any intermixed, non-inert waste be identified at this point, the entire consignment will be rejected and reloaded back onto the HGV / tipper truck and the haulier directed to remove it off-site to another authorised (ie. permitted or licensed) waste facility.

7.220 Similarly, should any non-inert or non-C&D waste be identified amongst incoming waste consignments at the C&D waste recovery areas, the entire waste consignment will also be rejected and reloaded onto the HGV / tipper truck and the haulier directed to remove it off-site to another authorised waste facility.

Waste Quarantine and Compliance Testing

7.221 Any soil and stone waste and C&D material which is accepted for intake to the facility but is subsequently suspected to be non-compliant with agreed waste acceptance criteria will be re-loaded onto HGV trucks and transferred to the waste inspection and quarantine facility for closer examination and/or testing.

7.222 It is proposed to designate the existing shed to the east of the weighbridge as the on-site waste inspection and quarantine facility. The shed is roofed, closed on all four sides and has a concrete floor, thereby protecting any quarantine material from incident rainfall and avoiding the potential to

generate (suspect) contaminated surface water run-off (and a requirement for separate wastewater collection and storage infrastructure).

7.223 A representative sample will be taken (in line with any waste licence requirements) of the inert soil accepted and placed at the facility for compliance test purposes. This data shall be used to confirm that the accepted soil intake is inert and complies with acceptance criteria.

Post – Operational Stage

7.224 The proposed mitigation measures outlined above for the construction and operational stages will also be implemented for the post-operational stage while site infrastructure is being decommissioned and the final landscaping works are being undertaken to restore the site to a grassland / scrub habitat.

7.225 In addition, appropriate seasonal timing of site restoration works, soil subsoiling and grass seeding will reduce the any adverse impacts of soil erosion across the site.

Mitigation Measures - Summary

7.226 Taken together, the measures outlined here for the pre-construction, construction and post-construction stages will reduce the identified potential impacts:

Construction Stage -

- **Impact 1 - Groundwater:** impact of accidental fuel leakage / spillage 'moderate' to '**not significant**';
- **Impact 2 - Surface Water:** impact on water quality from 'moderate' to '**not significant**';
- **Impact 3 - Surface Water:** impact on water quality from 'moderate' to '**not significant**';

Operational Stage -

- **Impact 4 - Groundwater:** impact of accidental fuel leakage / spillage 'moderate' to '**not significant**';
- **Impact 5 - Groundwater:** impact of contaminants in rogue loads of imported material 'moderate to slight' to '**imperceptible**';
- **Impact 6 - Surface Water:** impact on water quality from 'significant to moderate' to '**not significant**';
- **Impact 7 - Surface Water:** impact of suspended solids on water quality from 'moderate' to '**not significant**';

Post Operational Stage -

- **Impact 8 - Surface Water:** impact of suspended solids on water quality from 'moderate' to '**not significant**';

7.227 The one adverse impact which was identified as having a potentially ***likely, significant effect*** (Impact No. 6), with mitigation measures in place at the site will be reduced to '**not significant**'.

RESIDUAL IMPACT ASSESSMENT

7.228 Examination of the identified potential impacts on the receiving environment, provided the appropriate identified mitigation measures are put in place, then there are no significant residual impacts with respect to groundwater and/or surface water during the construction, operational or post-construction stages of the proposed development.

7.229 It is therefore considered that with the implementation of the mitigation measures outlined above, the proposed development will not result in any likely, significant effects on groundwater and/or surface water.

MONITORING

7.230 Surface water monitoring will be undertaken in line with the conditions set out in the Discharge Licence for the site, refer to Appendix 7-B (or any variation thereto required by an EPA waste licence).

7.231 The following programme of groundwater monitoring will be implemented by the Applicant at the application site (subject to review and approval by the EPA in its determination of an application for a waste licence):

- Groundwater levels will be monitored at each of the 3 existing wells (designated GW1, GW2 and GW3) on a monthly basis;
- Selected groundwater quality testing will be undertaken on samples recovered from the 3 No. groundwater monitoring wells on a quarterly basis, and;
- More detailed groundwater quality testing (to include metals and a number of specified hazardous substances) will be undertaken on an annual basis.

7.232 Test results will be maintained on site and will be furnished to the EPA as required by conditions attaching to any future waste licence.

7.233 An updated well survey will be carried out within 2km of the application site, and selected downgradient wells will be monitored. The selected wells will have groundwater quality sampling undertaken prior to works commencing and at least biannually during the construction and operational phases.

7.234 The groundwater monitoring regime will remain in place for the life of the proposed landfilling and recovery operations and for a limited closure and aftercare period thereafter.

REFERENCES

Geological Survey of Ireland (October 2017). A description of Irish Aquifer Categories.

Geological Survey of Ireland, 2007, 1:100,000 Bedrock Geology of Ireland (Digital-Map).

Geological Survey of Ireland Bedrock Geology Sheet 16 (1:100,000), Geology of Kildare-Wicklow, and accompanying geological memoir **(1994)**.

Institute of Geologists of Ireland (2013) 'Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements'.

(See also Appendix 7-A for guidelines and legislation as applied to this Chapter of the EIAR)

GLOSSARY

AA	Annual Average
AOD	Above Ordnance Datum
bgl	below ground level
C&D	Construction & Demolition
EIAR	Environmental Impact Assessment Report
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
EC	European Communities
EU	European Union
GSI	Geological Survey of Ireland
GWB	Groundwater Body
IGVs	Interim Guideline Values
MAC	Maximum Allowable Concentration
NPWS	The National Parks and Wildlife Service
OPW	Office of Public Works
OSi	Ordnance Survey of Ireland
pNHA	proposed Natural Heritage Area
SAC	Special Area of Conservation
SPA	Special Protection Area
S.I.	Statutory Instruments
toc	top of casing
WAC	Waste Acceptance Criteria
WFD	Water Framework Directive

FIGURES

Figure 7-1
Borehole Locations

Figure 7-2
Site Location and Surface Water Features

Figure 7-3
Bedrock Aquifer

Figure 7-4
Groundwater Vulnerability

Figure 7-5
GSI Groundwater Wells

Figure 7-6
Groundwater Flow Contours

L1113 LOCAL ROAD

POTTERS RIVER

SW3b

SW4

SW1

QUARRY SUMP

BALLINCLARE STREAM

L1157 LOCAL ROAD

R772 REGIONAL ROAD

POTTERS RIVER

M11 MOTORWAY

N

NOTES

1. EXTRACT FROM ORDNANCE SURVEY 1:50,000 DISCOVERY SERIES MAPPING SHEET NO. 56 & 62

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50167032 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

LEGEND

- LANDHOLDING BOUNDARY (c.36 Ha. / 89 acres)
- PLANNING APPLICATION AREA (c. 32.5 Ha.)
- SURFACE WATERCOURSE
- DISCHARGE POINT TO BALLINCLARE STREAM
- SURFACE WATER SAMPLE LOCATION

0 500 1000 1500 2000m 3000 4000 5000

Metres 1:50,000

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BALLINCLARE QUARRY RESTORATION & INERT LANDFILL & C+D WASTE RECOVERY FACILITY KILBRIDE (N11), CO. WICKLOW

SURFACE WATER COURSES

FIGURE 7-1

Scale: 1:50,000 @ A3

Date: MARCH 2021

00036.00080.0.16.FIG 7-1.0.Surface Water Catchments.dwg

NOTES

1. EXTRACT FROM ORDNANCE SURVEY 6 INCH MAPPING WW030 & WW0311

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50167032 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

3. EXISTING SURVEY (MAY 2016) PROVIDED BY KILSARAN

LEGEND

- LANDHOLDING BOUNDARY (c. 36 Ha. / 89 acres)
- PLANNING APPLICATION AREA (c. 32.5 Ha.)
- PROPOSED SOIL WASTE RECOVERY AREA (c. 17.0 Ha.)
- BOREHOLE LOCATION (2014)
- GROUNDWATER WELL LOCATION (2014)

N

ARRIGMORE

GW03

WCC COMPOUND

WS

WATER SUPPLY WELL

DISCHARGE CHANNEL

SCREENING BERM

SETTLEMENT LAGOONS

TREATED WATER TO SETTLEMENT PONDS

BACK UP SETTLEMENT LAGOONS (IF REQUIRED)

WATER TREATMENT PLANT

GW01

BH02

EXISTING FLOOR LEVEL C. 37mOD

Stockpiling of Topsoils and Subsoils

10m Wide Reservation strip

QUARRY SUMP

BH01

DISCHARGE WATER FROM QUARRY SUMP

10m Wide Reservation strip

CONCRETE YARD

WORKSHOP

CANTEEN

BUNDED FUEL TANKS

TOILETS

PUMPING CHAMBER

WEIGHBRIDGE

SITE OFFICE

CAR PARKING AREA

WHEELWASH

DISTRIBUTION ROOM & CONTROL SWITCH GEAR (AGGREGATE PLANT)

TERTIARY TREATMENT UNIT (2 MODULE PURAFLO)

ESB SUBSTATION & SWITCHROOM

AERATION TREATMENT UNIT

CAR PARKING AREA

LABORATORY

TOILETS

SAND STORAGE SHED

SITE ENTRANCE

GW02

SCREENING BERM

0 80m 200

Metres 1:2500

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WATER SUPPLY & BOREHOLE LOCATIONS

FIGURE 7-2

Scale	Date
1:3,000 @ A3	MARCH 2021

00036.00080.0.16.FIG 7-2.0.Water Supply and Borehole Locations.dwg

NOTES

1. EXTRACT FROM GSI MAPPING

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50167032 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

LEGEND

- LANDHOLDING BOUNDARY (c.36 Ha. / 89 acres)
- LOCALLY IMPORTANT AQUIFER - MODERATELY PRODUCTIVE IN LOCAL ZONES (Ll)
- POOR AQUIFER - UNPRODUCTIVE EXCEPT IN LOCAL ZONES (Pl)
- POOR AQUIFER - UNPRODUCTIVE (Pu)

N

0 800m 2000

Metres 1:25,000

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BEDROCK AQUIFER MAP

FIGURE 7-3

Scale 1:25,000 @ A3

Date MARCH 2021

00036.00080.0.16.FIG 7-3.0.Bedrock Aquifer Map.dwg

NOTES

1. EXTRACT FROM TEAGASC / EPA SOIL MAPPING

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50167032 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

LEGEND

LANDHOLDING BOUNDARY (c.36 Ha. / 89 acres)

ROCK NEAR SURFACE OR KARST - X

EXTREME - E

HIGH - H

MEDIUM - M

LOW - L

N

0 800m 2000

Metres 1:25,000

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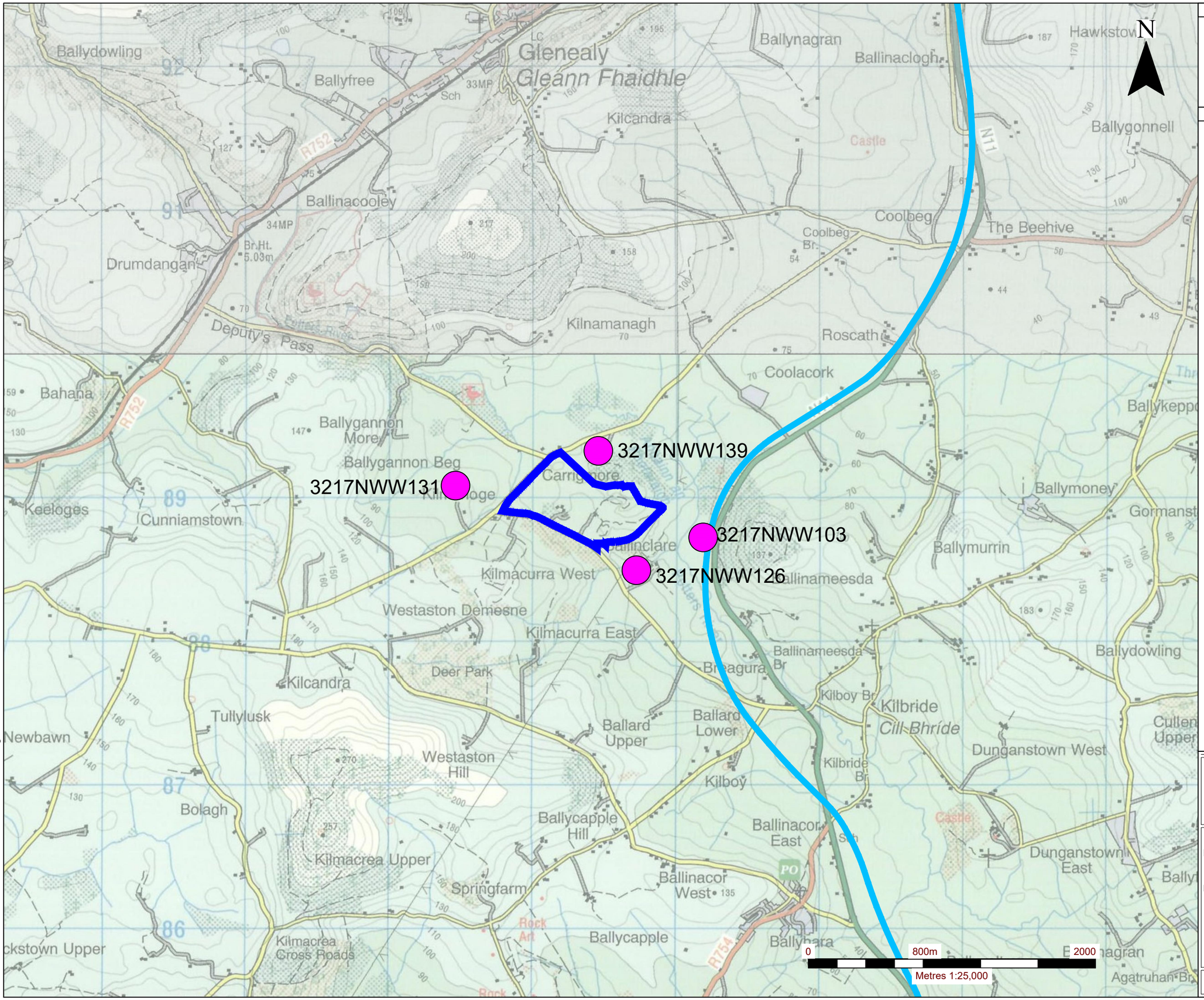
GROUNDWATER VULNERABILITY MAP

FIGURE 7-4

Scale 1:25,000 @ A3

Date MARCH 2021

00036.00080.0.16.FIG 7-4.0.Groundwater Vulnerability Map.dwg



NOTES

1. EXTRACT FROM GSI MAPPING

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50167032 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

LEGEND

LANDHOLDING BOUNDARY (c.36 Ha. / 89 acres)

GROUNDWATER WELLS (GSI DATABASE)

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GSI GROUNDWATER WELLS

FIGURE 7-5

Scale: 1:25,000 @ A3

Date: MARCH 2021

00036.00080.0.16.FIG 7-5.0.GSI Groundwater Wells.dwg

NOTES

1. EXTRACT FROM ORDNANCE SURVEY 6 INCH MAPPING WW030 & WW0311

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50167032 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

3. EXISTING SURVEY (MAY 2016) PROVIDED BY KILSARAN

LEGEND

- LANDHOLDING BOUNDARY (c. 36 Ha. / 89 acres)
- PLANNING APPLICATION AREA (c. 32.5 Ha.)
- PROPOSED SOIL WASTE RECOVERY AREA (c. 17.0 Ha.)
- BOREHOLE LOCATION (2014)
- GROUNDWATER WELL LOCATION (2014)
- INTERPOLATED GROUNDWATER CONTOURS BASED ON LEVELS TAKEN ON THE 26/03/2019

N

CARRIGMORE

GW03

WCC COMPOUND

WATER SUPPLY WELL

DISCHARGE CHANNEL

SETTLEMENT LAGOONS

TREATED WATER TO SETTLEMENT PONDS

WATER TREATMENT PLANT

GW01

SCREENING BERM

BH02

EXISTING FLOOR LEVEL C. 37mOD

10m wide Reservation strip

Stockpiling of Topsoils and Subsoils

QUARRY SUMP

BH01

DISCHARGE WATER FROM QUARRY SUMP

10m wide Reservation strip

CONCRETE YARD

WORKSHOP

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BUNDED FUEL TANKS

TOILETS

PUMPING CHAMBER

WEIGHBRIDGE

SITE OFFICE

CAR PARKING AREA

WHEELWASH

DISTRIBUTION ROOM & CONTROL SWITCH GEAR (AGGREGATE PLANT)

TERTIARY TREATMENT UNIT (2 MODULE PURAFLO)

ESB SUBSTATION & SWITCHROOM

AERATION TREATMENT UNIT

CAR PARKING AREA

LABORATORY

TOILETS

SAND STORAGE SHED

SITE ENTRANCE

GW02

60mOD

55mOD

50mOD

0 80m 200

Metres 1:2500

00036.00080.0.16.FIG 7-6.0.Groundwater Flow Contours.dwg

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GROUNDWATER FLOW CONTOURS

FIGURE 7-6

Scale 1:3,000 @ A3

Date MARCH 2021

Appendix 7-A
Guidelines and Legislation

European Directives

- Water Framework Directive (2000/60/EC);
- Groundwater Directive (2006/118/EC);
- Flooding Directive (2007/60/EC)
- Integrated Pollution and Prevention Control Directive (2008/1/EC); and
- The management of waste from extractive industries (2006/21/EC).

Irish Government Acts, National Legislation and Regulations

- S.I. No. 349 of 1989, European Communities (Environmental Impact Assessment) Regulations, and subsequent amendments (S.I. No. 84 of 1994, S.I. No. 352 of 1998, S.I. No. 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001);
- The Planning and Development Acts, 2000 to 2009, The Planning and Development (Amendment) Act 2010, S.I. 600 of 2001 Planning and Development Regulations and subsequent amendments including, S.I. No. 364 of 2005 and S.I. 685 of 2006.

Since 2000, water management in EU member states has primarily been directed by the Water Framework Directive (2000/60/EC) and the associate 'daughter' Groundwater Directive (2006/118/EC). Irish legislation implementing these, and other relevant directives currently includes:

- S.I. No. 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010 and amendments (S.I. 389 of 2011 and S.I. 149 of 2012).
- S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009 and amendment (S.I. 327 of 2012);
- S.I. No. 684 of 2007 Waste Water Discharge (Authorisation) Regulations, 2007, as amended (S.I. 231 of 2010);
- S.I. No. 278 of 2007 European Communities (Drinking Water) (No. 2) Regulations;
- Water Services Acts 2007 and 2012;
- S.I. No. 722 of 2003 European Communities (Water Policy) Regulations;
- S.I. No. 122 of 2010 European Communities (Assessment and Management of Flood Risks) Regulations 2010;
- S.I. No. 457 of 2008 European Communities (Environmental Liability) Regulations which bring into force the European Liability Directive (2004/35/EC);
- European Union (Planning and Development) (Environmental Impact Assessment) (No. 2) Regulations 2018 (S.I. No. 404 of 2018);
- Local Government (Water Pollution) Acts 1977 to 1990;
- European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988);
- European Communities (Quality of Shellfish Waters) Regulations, 2006 (S.I. No. 268 of 2006);
- European Union (Drinking Water) Regulations 2014 (S.I. No. 122 of 2014);
- Bathing Water Quality Regulations, 2008 (S.I. No. 79 of 2008);
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010), and;
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 (S.I. No. 610 of 2010).

Guidelines

- CIS (2007). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC) Guidance on preventing or limiting direct and indirect inputs in the context of the Groundwater Directive 2006/118/EC. Guidance Document No. 17.
- CIS (2010). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC). Guidance on risk assessment and the use of conceptual models for groundwater. Guidance document No. 26.
- DEHLG (2004). National Urban Waste Water Study. National Report.
- DEHLG (2009). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities.
- DELG/EPA/GSI (1999). Groundwater Protection Schemes. Document prepared jointly by the Geological Survey of Ireland (GSI), the Environmental Protection Agency, and the Department of Environment, Heritage and Local Government.
- EPA (2010b). Methodology for Establishing Groundwater Threshold Values and the Assessment of Chemical and Quantitative Status of Groundwater, Including and Assessment of Pollution Trends and Trend Reversal.
- EPA (2011). Guidance on the Authorisation of Discharges to Groundwater. Version 1, December 2011.
- EPA (2003). Towards Setting Guideline Values for the Protection of groundwater in Ireland. Interim Report.
- EPA (2006). Ireland Water Framework Directive Monitoring Programme.
- Fitzsimons, V., Daly, D. and Deakin, J. (2003). Draft GSI guidelines for assessment and mapping of groundwater vulnerability to contamination. Groundwater Chapter, Geological Survey of Ireland.
- GSI (2006). Criteria used in aquifer classification. Available from http://www.gsi.ie/Programmes/Groundwater/Aquifer+Classification.htm
- IGI (2007). Guidelines on Water Well Construction. Available from http://www.igi.ie/assets/files/Water%20Well%20Guidelines/Guidelines.pdf
- Kilroy, G., Dunne, F., Ryan, J., O'Connor, A., Daly, D., Craig, M., Coxon, C., Johnston, P. and Moe, H. (2008). A Framework for the Assessment of Groundwater – Dependent Terrestrial Ecosystems under the Water Framework Directive. Environmental Research Centre Report Series No. 12.
- Institute of Geologists of Ireland, 2007. Recommended collection, presentation and interpretation of geological and hydrogeological information for quarry developments.

Technical Standards

- British Standards (1999). Code of Practice for Site Investigations BS5930. As amended.
- British Standards (2009). Water quality. Sampling. Guidance on sampling of groundwaters. BS ISO 5667-11:2009, BS 6068-6.11:2009. As amended.
- CIRIA (2007). The SuDS Manual. (C697). CIRIA publication, February 2007.

Appendix 7-B
Discharge Licence WPL-116

Comhairle Contae Chill Mhantáin
Wicklow County Council

Forbairt Pleanála agus Comhshaol
Planning Development and Environment

Seirbhísí Comhshaoil - Environmental Services
Guthán / Tel: (0404) 20236
Bainistiú Dramhaíola - Waste Management
Guthán / Tel: (0404) 20127

Áras An Chontae / County Buildings
Cill Mhantáin / Wicklow
Guthán / Tel: (0404) 20236
Faics / Fax: (0404) 67792
Rphost / Email: env@wicklowcoco.ie
Suíomh / Website: www.wicklow.ie

Ref: TG/KK/MO'G. WPL116.

- 7 NOV 2019

5th November, 2019.

Kilsaran Concrete t/a Kilsaran Build,
Piercetown,
Dunboyne,
Co. Meath.

RE: Local Government (Water Pollution) Act 1977 – Application for a Licence to Discharge Trade and/or Domestic Waste Water to Surface Water - Kilsaran Concrete t/a Kilsaran Build, Ballinclare, Carrigmore, Kilbride, Co. Wicklow - LICENCE NO. WPL116.

A Chara,

Enclosed herewith, Licence issued under Section 4 of the Local Government (Water Pollution) Acts, 1977 – 1990, to discharge sewage effluents from the premises of Kilsaran Concrete t/a Kilsaran Build, Ballinclare, Carrigmore, Kilbride, Co. Wicklow, to groundwater via percolation, after appropriate treatment. **This Licence supersedes Licence No. WPL110 dated 13th November, 2017.**

Mise, le meas,

Kiara Kavanagh

KIARA KAVANAGH,
SENIOR STAFF OFFICER,
PLANNING, DEVELOPMENT & ENVIRONMENT.

Enc.

cc. SLR Consulting, 7 Dundrum Business Park, Windy Arbour, Dublin D14 N2Y7.

LOCAL GOVERNMENT (WATER POLLUTION) ACTS, 1977 – 1990
LOCAL GOVERNMENT ACT 2001
WATER SERVICES ACT 2007

LICENCE TO DISCHARGE TRADE AND/OR SEWAGE EFFLUENT TO WATERS

Reference number in Register: - **WPL 116**

Local Authority: - **Wicklow County Council**

To: **Kilsaran Concrete T/a Kilsaran Build**
Piercetown
Dunboyne
Co. Meath

C/O: **SLR Consulting**
7 Dundrum Business Park
Windy Arbour
D14 N2Y7

Wicklow County Council, in exercise of the powers conferred by the Local Government (Water Pollution) Acts, 1977 - 1990, hereby grants a licence to discharge trade effluents from the premises of Kilsaran Concrete T/a Kilsaran Build at Ballinclare Quarry, Ballinclare, Carrigmore, Kilbride, Co. Wicklow, to Surface Water, after appropriate treatment, subject to the following conditions: -

LICENCE CONDITIONS

1. General Layout and Operation

1.1 This Licence shall be in respect of the discharge of treated quarry effluent from the premises of **Kilsaran Concrete t/a Kilsaran Build at**

Ballinclare Quarry, Ballinclare, Carrigmore, Kilbride, Co. Wicklow, to the Ballinclare Stream, a tributary of the Potters River, at X325003, Y189167, after appropriate treatment.

1.2 The Licensee's wastewater treatment system shall be designed, operated and maintained in such manner as to ensure that the discharge of treated effluent is in accordance with the volume and parametric limits set out in Conditions 2.1 and 2.2.

1.3 Any oil or chemical storage tanks located above ground shall be provided with an adequately designed bund system complete with impervious base. Filling and off-take points shall be located within the bund system.

1.4 The wastewater treatment system areas shall be maintained in a tidy and safe condition. No nuisance odours or noise from the treatment system shall be allowed at sensitive locations. Adequate precautions shall be made to prevent unauthorised access to the wastewater treatment areas and to prevent any damage to the wastewater treatment system.

2. Effluent Volume and Characteristics

2.1 The treated effluent from the wastewater treatment plant shall be discharged between the hours of 6:00am and 6:00pm, 7 days a week, until a history of compliance is established. The effluent may then, with the approval of the Licensing Authority, be discharged over a 24-hour period, 7 days a week. The total volume of the treated effluent discharged from the wastewater treatment plant shall not exceed 1,728 m^3/day or 72m3/hr.

2.2 The final treated effluent discharged from the wastewater treatment system shall comply with the quality standards set out in respect of the parameters in Table 1.

Table 1. Final Discharge Standards and Monitoring Frequency

Parameter	Units	Emission Limit Value	Emission Limit Load	Frequency	Sample Type
pH	pH Units	6 to 9		Daily	Grab
$cBOD_5$	mg/l	2	3.46 kg/day	Daily	24 hr Composite
COD	mg/l	10	17.3 kg/day	Daily	24 hr Composite
Suspended Solids	mg/l	10	17.3 kg/day	Daily	24 hr Composite
Ammonia (N)	mg/l	0.06	0.103 kg/day	Daily	24 hr Composite
Nitrate (N)	mg/l	3	5.18 kg/day	Weekly	24 hr Composite
Nitrite (N)	mg/l	0.014	0.026 kg/day	Weekly	24 hr Composite
Ortho-Phosphate (P)	mg/l	0.04	0.069 kg/day	Daily	24 hr Composite
Chloride	mg/l	50	86 kg/day	Weekly	24 hr Composite
Sulphate	mg/l	100	172 kg/day	Weekly	24 hr Composite
Arsenic (dissolved)	ug/l	7.0	12 g/day	Daily	24 hr Composite
Cadmium (dissolved)	ug/l	0.057	0.098 g/day	Weekly	24 hr Composite
Chromium (total)	ug/l	1.4	1.98 g/day	Weekly	24 hr Composite
Lead (dissolved)	ug/l	0.2	1.98 g/day	Weekly	24 hr Composite
Mercury (dissolved)	ug/l	0.034	0.059 g/day	Weekly	24 hr Composite
Nickel (dissolved)	ug/l	3.216	5.56 g/day	Weekly	24 hr Composite
Zinc	ug/l	20	34.5 g/day	Weekly	24 hr Composite
Asbestos (dissolved)	MF/l	5	8,640 MF/day	Weekly	24 hr Composite

2.3 There shall be no discharge when flow in the river is lower than the 95%ile flow, or when the river is in flood to the extent that it is likely to overspill its riverbanks.

2.4 In the event that the effluent does not meet the conditions in Table 1, the effluent shall be diverted back to the quarry sump.

2.5 Regular measurements of Arsenic, Orthophosphate and Ammonia shall be made throughout each day using a portable testing kit and all results recorded and submitted to the licensing Authority electronically weekly at **dischargelicences@wicklowcoco.ie**. Certified standards at a concentration of the licence limits shall be used to check the performance of the portable testing kits daily. The portable test kit results shall also be compared to the daily certified test results.

3. Wastewater Treatment

3.1 The wastewater treatment plant shall be appropriately designed, sized and laid out as per licence application and with appropriate regard to the treatment standards contained within this licence.

3.2 A certificate from a suitably qualified person (with professional indemnity insurance) shall be submitted to the licensing authority, stating that the above wastewater treatment system has been designed and installed as stipulated above. This shall include certification of the design and performance of all the components, including the treatment plant, any dosing sump and pump, the length and diameter of any rising main and any associated plant. It shall also include photographic evidence of the components and their installation.

3.3 Before commencement of the initial discharge to the Ballinclare Stream, the effluent from the wastewater treatment plant shall be returned to the quarry sump for at least one week to allow the licensee to demonstrate that the effluent standards stipulated in Table 1 Condition 2.2 are being consistently achieved.

3.4 In advance of the discharge commencing or resuming following suspension. The Licensee shall submit compliance reports for approval of the licensing authority.

4. Treatment Plant Maintenance

4.1 The Licensee shall, within one month of the date of issue of the Licence, inform the Licensing Authority of the name, address, email and telephone number of the nominated person(s), who shall be trained and have responsibility, for the routine inspection and operation of the wastewater treatment plant. The Licensee shall make provision for substitute trained persons as may be necessary during the absence of the nominated person. A log of the inspection and operation of the wastewater treatment plant shall be kept on file for inspection.

4.2 The Licensee shall employ the services of a competent engineering/environmental consultant, for the maintenance of the wastewater treatment plant, on a contractual basis for the term of the discharge licence. The contract shall provide for an emergency call-out service in the event of breakdown of the treatment plant.

4.3 A copy of each maintenance report shall be submitted to the Licensing Authority within one month of the date of the report becoming available. The Licensee shall submit electronic copies of the maintenance report to the Licensing Authority at dischargelicences@wicklowcoco.ie within two weeks of the period to which they relate. Paper copies of these records shall also be submitted to the Licensing Authority upon request.

4.3 The Licensee shall ensure that the nominated and trained persons receive detailed instruction and training about the routine inspection and operation of wastewater treatment plant from the manufacturer/supplier of the plant or from the competent engineering or environmental consultant. The Licensee shall also ensure that the nominated and substitute trained persons receive instruction manuals detailing the inspection and operation of the grease trap and wastewater treatment plant.

5. Provision of Monitoring Stations

5.1 The Licensee shall provide safe, permanent, unhindered and immediate access to the sampling point locations:

(i) Effluent: Suitable chambers shall be provided for sampling the effluent from (a) the wastewater treatment plant and (b) the discharge location. The sampling chambers shall be labelled and facilitate flow measurement, grab and composite sampling of the effluent.

(ii) Receiving Water - Up-stream & down-stream of discharge: Safe access to the ambient sampling locations upstream and downstream of the discharge shall be made available. All sample locations shall be labelled.

5.2 The sampling locations upstream and downstream of the discharge shall be agreed with the Licensing Authority prior to initial Discharge.

6. Monitoring Regime

6.1 The Licensee shall install, calibrate and maintain a suitable flow-measuring device on the effluent discharge line from the wastewater treatment plant and record the daily and hourly discharge volumes.

6.2 A certificate of calibration for the flow-measuring shall be forwarded to the Licensing Authority within six months of the date of issue of this Licence. Further such certificates shall be submitted on request.

6.3 The Licensee shall arrange to have representative samples of the treated effluent taken from the sampling chamber after wastewater treatment system and tested **at the frequency stipulated in Table 1 in condition 2.2**, in respect of the parameters listed in Table 1.

6.4 The Licensee shall install a composite sampler to provide daily composite samples of the final effluent for analysis.

6.5 The Licensing Authority may give its written consent to a reduced frequency of monitoring of the treated effluent where a pattern of full compliance with the licence conditions has become established.

6.6 Where the treatment plant does not perform satisfactorily, monitoring of influent and process wastewater shall also be carried out to improve the process.

6.7 The Licensee shall enter into a contract with an approved laboratory to ensure that the treated effluent samples are tested in accordance with conditions 6.2 and 6.3. The contract shall be annually renewed.

6.8 The Licensee shall arrange to have the receiving water sampled at suitable locations up-stream and down-stream of the discharge point, during normal discharge, in respect of the parameters listed in **Table 2** to check for compliance with the Surface Water Regulation SI 272 of 2009.

Table 2. Receiving Water Monitoring Requirements

Parameter	Units	Frequency	Sample Type
pH	pH Units	Daily	Grab
Dissolved Oxygen	%	Daily	Grab
$cBOD_5$	mg/l	Daily	Grab
COD	mg/l	Daily	Grab
Suspended Solids	mg/l	Daily	Grab
Ammonia (N)	mg/l	Daily	Grab
Nitrate (N)	mg/l	Weekly	Grab
Nitrite (N)	mg/l	Weekly	Grab
Ortho-phosphate (P)	mg/l	Daily	Grab
Chloride	mg/L	Weekly	Grab
Sulphate	mg/L	Weekly	Grab
Arsenic (dissolved)	ug/l	Daily	Grab
Cadmium (dissolved)	ug/l	Weekly	Grab
Chromium (total)	ug/l	Weekly	Grab
Lead (dissolved)	ug/l	Weekly	Grab
Mercury (dissolved)	ug/l	Weekly	Grab
Nickel (dissolved)	ug/l	Weekly	Grab
Zinc (dissolved)	ug/l	Weekly	Grab
Asbestos	MF/l*	Weekly	Grab
Invertebrates	Q-value	Monthly	Kick Sample

*MF/L refers to Million Fibres per Litre

7. Sludge and Other Waste Disposal

7.1 The sludge and other waste material arising from the wastewater treatment plant shall be disposed of in accordance with the appropriate Waste Management Regulations as specified under the Waste Management Act, 1996 as amended. The Licensee shall inform and agree with the Licensing Authority the manner in which it is proposed to dispose of sludge within two months of the date of issue of this Licence.

8. Monitoring Records

8.1 Legible traceable records of all flow and analytical data (with appropriate units shown) referred to in condition 6 (the monitoring regime) shall be kept on file at the premises. The Licensee shall arrange with their contract laboratory to send electronic copies of the analytical records to the Licensing Authority at **dischargelicences@wicklowcoco.ie** one month of the period to which they relate. The Licensee shall send electronic copies of the flow records to the Licensing Authority within one month of the period to which they relate. Paper copies of these records shall also be submitted to the Licensing Authority upon request.

8.2 The Licensee shall maintain legible traceable records and receipts of sludge removal and other waste material from the wastewater treatment plant and logs of the inspection and operation of the treatment plant.

8.3 The records referred to in conditions 8.1 and 8.2, shall also be made available by the Licensee for inspection by Authorised Officers of the Licensing Authority, and any other Person authorised under Section 28 of the Local Government (Water Pollution) Act, 1977, or under Section 14 of the Waste Management Act, 1996 at any time on request.

9. Access by Authorised Personnel

9.1 Authorised officers of the Licensing Authority or its agents and any other person authorised under Section 28 of the Local Government (Water Pollution) Act, 1977 shall have access to the Licensee's wastewater treatment plant, sample locations and drainage systems at all reasonable times including if necessary, times other than normal working hours.

10. Monitoring Contribution to the Licensing Authority

10.1 The Licensee shall pay on demand a contribution fee of €3027.81 towards the Licensing Authority's (Wicklow County Council) monitoring costs. The first such fee shall be the portion of the annual fee for the period from the date of issue of the Licence to the end of the calendar year. The subsequent annual contribution fees shall be reckoned on the initial sum of €3027.81 when adjusted in accordance with the consumer price index for the intervening period.

11. Notification to the Licensing Authority

11.1 The Licensee shall notify the Licensing Authority in writing of any changes in ownership of the premises or company name or personnel referred to in conditions 4.1 of this Licence.

11.2 The Licensee shall notify the Licensing Authority in advance of any proposed change in the operation of the premises which could cause a material alteration in the nature or an increase in the volume or concentration of the treated effluent discharged.

11.3 The Licensee shall notify the Licensing Authority of any breaches in discharge limits by telephone at 0404-20236 and email at **dischargelicences@wicklowcoco.ie** without delay.

11.4 The Licensee shall notify the Licensing Authority as above, of any accidental discharge, spillage or deposit of polluting matter, which enters or is likely to enter the surface water drains, or the groundwater or watercourses, as soon as practicably possible, in accordance with Section 14 of the Local Government (Water Pollution) Act.

SIGNED: Theresa O'Brien

THERESA O'BRIEN,
SENIOR EXECUTIVE OFFICER,
PLANNING, DEVELOPMENT & ENVIRONMENT.

Date: 1st November 2019

NOTE:

An Appeal against the above decision may be made before the expiration of one month from the date of the above decision. Such appeal shall:

(a) be made in writing,
(b) state the subject matter of the appeal
(c) state the grounds of appeal
(d) state the reference number of the Licence
(e) state in full the grounds on which they are based.

An appeal which does not comply with these requirements shall be invalid.

Appeals should be addressed to The Secretary, An Bord Pleanala, 64 Marlborough Street, Dublin 1 and should be accompanied with the appeal fee of €500.00 or €220.00 reduced appeal fee (prescribed bodies). If an Oral Hearing is requested an additional fee of €50.00 is applicable. Request for an Oral Hearing should be submitted before the expiration of one month from the date of the above decision.

Appendix 7-C
Discharge Licence Impact Assessment on the Potters River

ASSIMILATIVE CAPACITY ASSESSMENT AND MASS BALANCE CALCULATION

An Assimilative Capacity (AC) assessment and Mass Balance (MB) calculation has been undertaken to assess the potential impact of the treated discharge waters from Ballinclare Quarry on the receiving waters of the Potters River.

The Potters River has been assessed here as the receiving waters for the treated discharge as it is the principal receiving waters; the surface watercourse at the discharge point is a small drain only and therefore has not been assessed as the receiving waters for the discharge.

The assessment and calculations have been undertaken using the 95th%ile value and Annual Average Environmental Quality Standards (EQS) for the parameters where applicable for 'Good Status' as set out in S.I. No. 272 2009 - *European Communities Environmental Objectives (Surface Waters) Regulations 2009*.

The potential impact of the discharge on the receiving waters is assessed in two parts, firstly an AC assessment for the receiving waters and then a MB calculation of the discharge in the receiving waters.

The Assimilative Capacity Assessment and Mass Balance were undertaken in accordance with the methodology set out by the Local Government Water Services Training Group[2].

The calculations undertaken for this assessment are:

i. Assimilative capacity of the receiving waters;

ii. The concentration of the chemical parameters in the mine water discharge; and

iii. The mass balance of the receiving waters.

Assimilative Capacity Assessment

The Assimilative Capacity of the Receiving Water is calculated as:

Assimilative Capacity = (Cmax - Cback) x F *Eqn. 1*

Where:

Cmax, is the maximum permissible concentration (EQS value);

Cback, is the background concentration in the receiving waters; and

F, is the flow in the receiving waters.

Once the assimilative capacity of the receiving water has been established, the percentage of the assimilative capacity that will be used by the discharge may be calculated using the effluent load information.

The load of the discharge is calculated as:

Load = Discharge flow x Concentration *Eqn. 2*

Mass Balance Calculation

The Mass Balance formula is used to calculate the concentration of a parameter in the receiving water downstream of the discharge. This downstream concentration may then be compared directly with the water quality standard (EQS) to determine whether the discharge will cause an exceedance of the EQS value in the receiving waters.

[2] Appendix C of the Application for a Licence to Discharge to Surface Waters - Guidance to the Applicant (Department of the Environment Heritage and Local Government Water Services Training Group) August 2011 Rev. B.

The Mass Balance is calculated as:

$$T = \frac{FC + fc}{F + f} \qquad \textit{Eqn. 3}$$

Where:

T, is the concentration of pollutant in the receiving waters;

F, is the river flow;

C, is the concentration of pollutant in the river;

f, is the flow of the discharge; and

c, is the maximum concentration of pollutant in the discharge.

Assessment Parameters

The parameters used in the AC assessment and MB calculations are set out in Table A below.

Table A -
AC Assessment and MB Calculation Parameters

Assessment Parameters	Value	Source
95th %ile flow in Potters River	0.075 m^3/s	EPA Hydrotool
Quarry Discharge	0.02 m^3/s	Discharge Licence WPL 110
Water Quality for Quarry Discharge and Receiving waters	see **Error! Reference source not found.** & **Error! Reference source not found.**	Water quality monitoring
Environmental Quality Standards	See **Error! Reference source not found.**	S.I. 272 of 2009

Assessment Results

The results of the AC assessment MB calculations for the proposed treated discharge from the quarry to the receiving waters are shown in **Error! Reference source not found.**.

The Assimilative Capacity assessment and Mass Balance calculations for the impact of the discharge on the receiving waters of the Potters River is based on the discharge volume, discharge quality, river flow and water quality input values outlined above.

The inputs were used to calculate the assimilative capacity (*Eqn. 1*), effluent concentration (*Eqn. 2*) and the mass balance (*Eqn. 3*) under low flow conditions in the receiving waters - refer to Section xx above.

Under low flow conditions (95%'ile flow) in the Potters River the results of the Assimilative Capacity assessment and Mass Balance calculations are shown in Table B below

Table B
Assimilative Capacity and Mass Balance Results for the Potters River

Parameters	Assimilative Capacity Potters River (kg/day)	Mass Balance Receiving Waters – with quarry discharge	EQS Achieved
Ortho Phosphate	0.14 kg/day	0.016 mg/L	Yes
Suspended Solids	149 kg/day	2.00 mg/L	Yes
Arsenic	0.156 kg/day	1.842 µg/L	Yes
Lead	0.046 kg/day	0.173 µg/L	Yes
Mercury	-0.0011 kg/day	0.193 µg/L	No
Chromium	0.024 kg/day	1.000 µg/L	Yes
Nickel	0.127 kg/day	0.37 µg/L	Yes

The results shown in Table B indicate that under low (95%'ile) flow conditions in the receiving water (Potter River) Bursk there is available assimilative capacity in the receiving waters for the above parameters except Mercury.

The results of the assessment show that the Good Status / Standard is achieved in the receiving waters for the parameter values assessed here except for Mercury.

There is no Assimilative Capacity in the Potters River for Mercury upstream of the discharge from the site; the EQS for Mercury is exceeded upstream of the site.

The water quality results (03/05/2019) for Mercury are:

- Upstream (SW3B) 0.22 µg/L;
- Discharge (Quarry Sump) 0.09 µg/L;
- Downstream (SW4) 0.06 µg/L.

The Mass Balance calculation for the quarry discharge in the Potters River shows a Mercury concentration of 0.193 µg/L in the river.

Conclusion

The Mass Balance calculation shows that the discharge from the quarry will reduce the concentration of Mercury in the Potters River from 0.22 µg/L to 0.193 µg/L; this represents an improvement, i.e. reduction in concentration, for Mercury in the Potters River.

On-going treatment of water from the quarry sump will ensure that the naturally occurring arsenic is removed prior to discharge.

Appendix 7-D
EPA Hydro Tool Ungauged Catchment Report

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

River Name	Potter's(10_1301)
XY Location	326103,189141 (ING)

River Segment Map

Disclaimer

The source of hydrometric data used to estimate the flow duration curve ordinates for ungauged catchments was obtained from (1) water level data and (2) the rating curve(s) generated for each hydrometric station. The Environmental Protection Agency and the Office of Public Works used these data, respectively, to calculate daily mean flows. The daily mean flows were then used by the Environmental Protection Agency to prepare flow duration curves for each station. Neither body accepts any liability for the subsequent handling of the data.

The user should familiarise himself/herself with the catchment being studied and confirm that the ungauged site is in a natural catchment where flows conditions are suitable for the use of the model.

It is strongly recommended that the user examine the catchment descriptors contained in the report produced and confirm that the percentages of the various constituent elements are comparable to a natural catchment.

If the flow in a catchment is not entirely natural, the estimation of flows using the model in these catchments could be affected due to:

- existence of local conduit karst within the catchment;
- the selected location itself is on local conduit karst;
- regulation of the river flow on the river channel (e.g. power station, sluice gates etc)
- impacts of abstractions upstream of the selected location or the impact of the discharge associated with the abstraction into the same/different catchment;
- estimates of flow being sought at locations effected by storage effects at, or near, lake outfalls;
- lack of similar catchments with observed flows, ie where catchment descriptors lie outside the range of available gauging station catchments (e.g. the catchment area is under 5 km²);
- any other special circumstances that may affect river flows.

Expert judgement will be required to ensure that the estimate of flow is not unduly affected by any of these influences.

Please note that the model does not provide estimates of flood peaks and, specifically, should not be used for that purpose.

The EPA has also prepared estimates of DWF and long term 95 percentile flows which are also presented on the EPA web site. These data are presented at http://www.epa.ie/whatwedo/monitoring/water/hydrometrics/data/

The data produced by the model for specific stations should be compared to the data contained in this file of DWF and long term 95percentile flows.

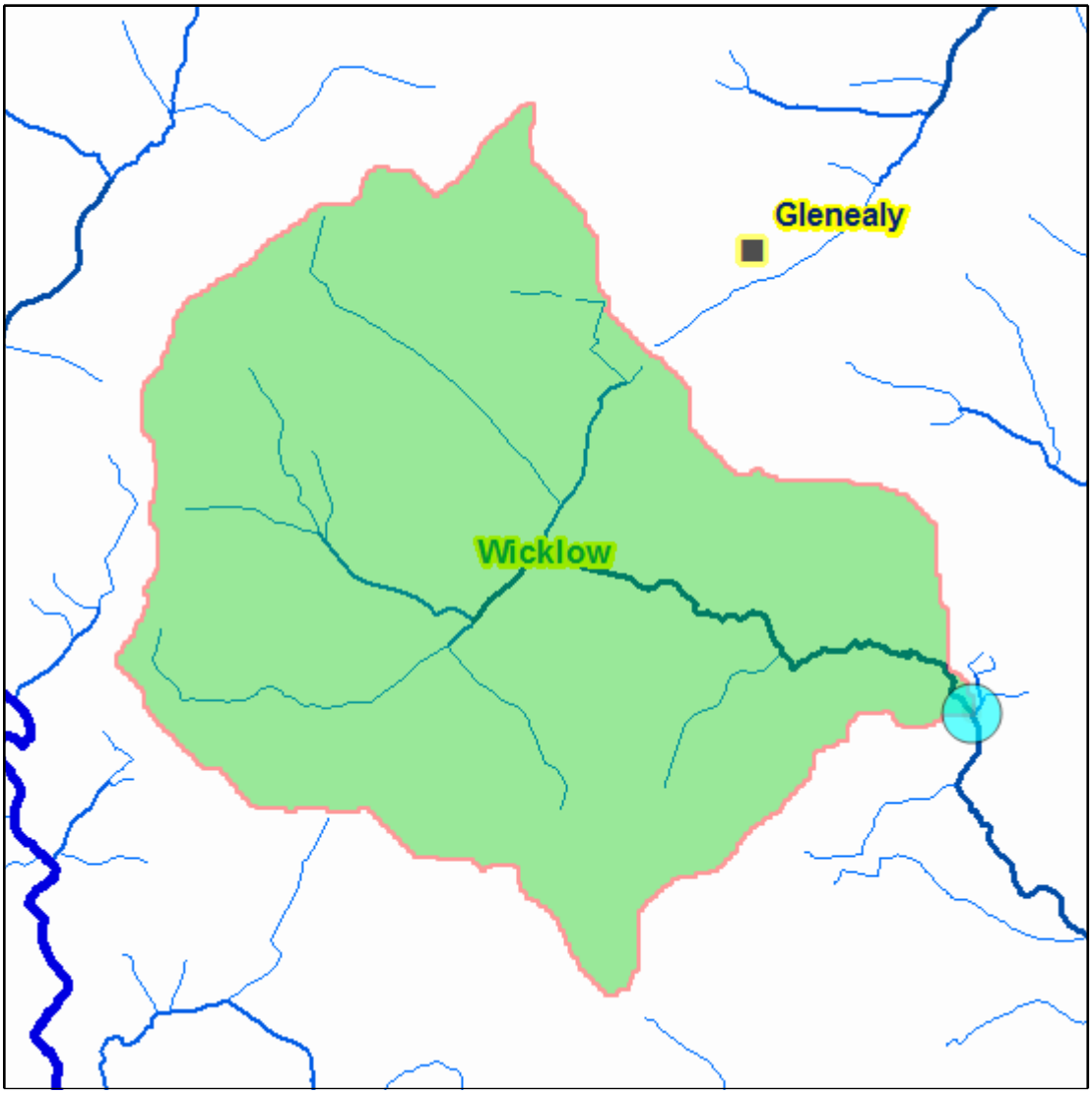
Disclaimer
The source hydrometric data used to estimate the flow duration curve ordinates for ungauged catchments was obtained from (1) water level data and (2) the rating curve(s) generated for each hydrometric station. The Environmental Protection Agency and the Office of Public Works used these data, respectively, to calculate daily mean flows. The daily mean flows were then used by the Environmental Protection Agency to prepare flow duration curves for each station. Neither body accepts any liability for the subsequent handling of the data.

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

River Name	Potter's(10_1301)
XY Location	326103,189141 (ING)

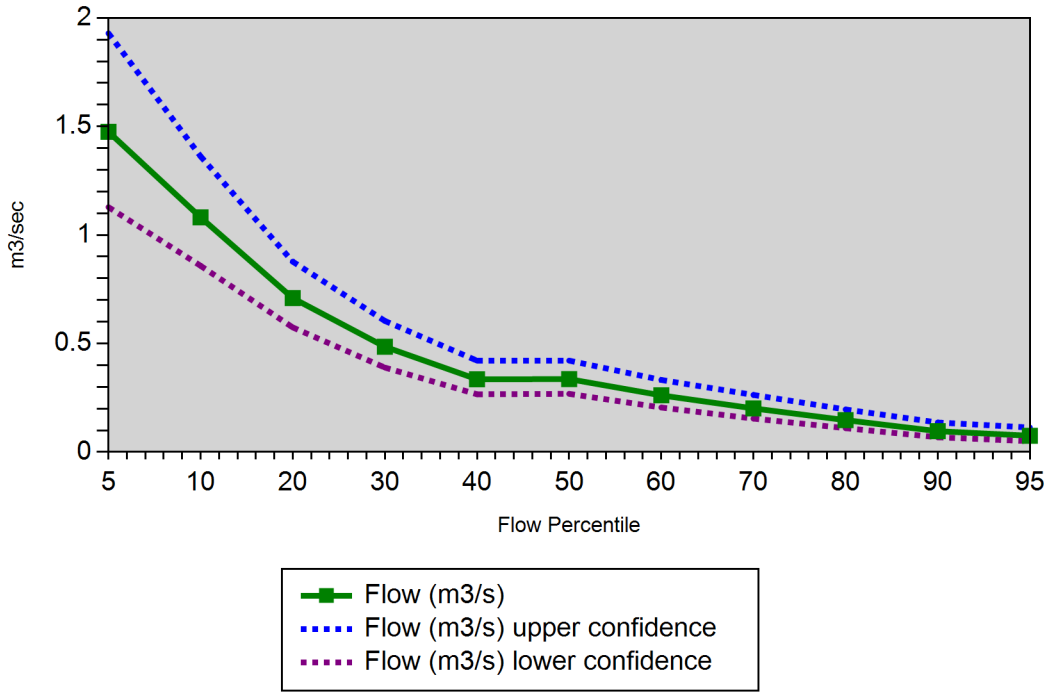
Nested Catchment Map



Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Flow Duration Curve (Flow in m3/sec)



%ile	flow(m3/sec)	upper 95% confidence limit m3/sec	lower 95% confidence limit m3/sec
5	1.475	1.929	1.128
10	1.081	1.362	0.858
20	0.709	0.877	0.574
30	0.485	0.604	0.389
40	0.335	0.421	0.266
50	0.336	0.421	0.268
60	0.261	0.332	0.205
70	0.201	0.263	0.154
80	0.147	0.196	0.11
90	0.096	0.136	0.068
95	0.075	0.113	0.05

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Catchment Descriptors		
General		
Descriptor	**Unit**	**Value**
Area	sq km	20.8
Average Annual Rainfall (61-90)	mm/yr	1066
Stream Length	km	21.1
Drainage Density	Channel length (km)/catchment area (sqkm)	1
Slope	Percent Slope	10.7
FARL	Index (range 0:1)	1

Soil	
Code	**% of Catchment**
Poorly Drained	3.8
Well Drained	92.4
Alluvmin	3.4
Peat	0
Water	0
Made	0.5

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Subsoil Permeability		
Code	**Explanation**	**% of Catchment**
H	High	0
M	Moderate	13.2
L	Low	10.1
ML	Moderate/Low	0
NA	No Subsoil/Bare Rock	76.7

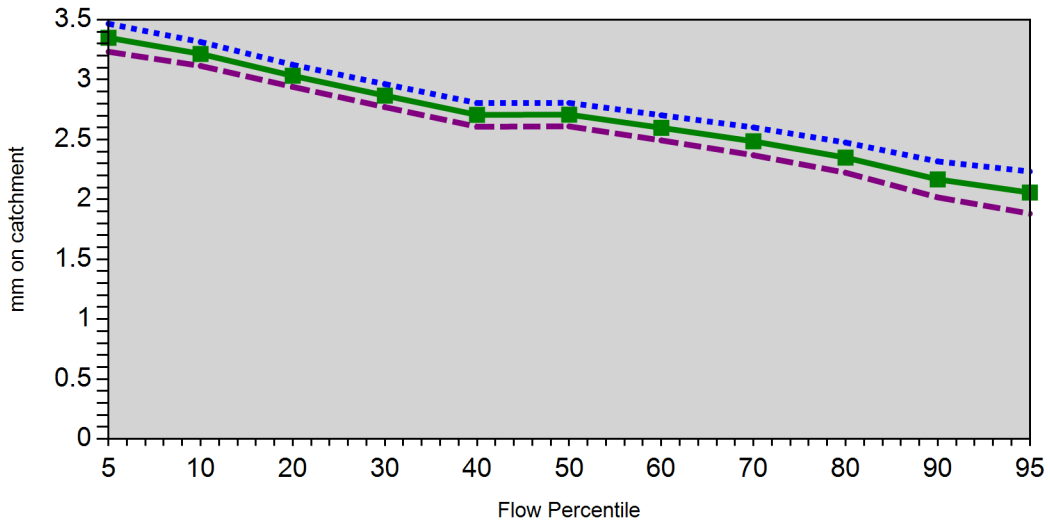
Aquifer		
Code	**Explanation**	**% of Catchment**
LG_RG	LG:Locally important sand-gravel aquifer RG: Regionally important sand-gravel aquifer	0
LL	Locally important aquifer which is moderately productive only in local zones	68.5
LM_RF	LM: Locally important aquifer which is generally moderately productive RF: Regionally important fissured bedrock aquifer	0
PU_PL	PU: Poor aquifer which is generally unproductive PL: Poor aquifer which is generally unproductive except for local zones	31.5
RKC_RK	Regionally important karstified aquifer dominated by conduit flow	0
RKD_LK	Regionally important karstified aquifer dominated by diffuse flow	0

Stations in Pooling group			
%ile Flow	**Station 1**	**Station 2**	**Station 3**
5	14033	07033	26056
10	14033	07033	26056
20	14033	07033	26056
30	14033	07033	26056
40	14033	07033	26056
50	18005	19001	25038
60	18005	19001	25038
70	18005	19001	25038
80	25038	18005	19001
90	25038	18005	19001
95	25038	18005	19001

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Flow Duration Curve (mm on catchment)



Log Flow (mm on catchment)			
%ile	mm	upper 95% confidence limit	lower 95% confidence limit
5	3.35	3.467	3.233
10	3.215	3.315	3.115
20	3.032	3.124	2.94
30	2.867	2.963	2.771
40	2.706	2.805	2.607
50	2.708	2.806	2.61
60	2.598	2.703	2.493
70	2.485	2.601	2.369
80	2.349	2.475	2.223
90	2.167	2.317	2.017
95	2.057	2.233	1.881

Appendix 7-E
Borehole Logs for GW01, GW02 and GW03

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Well No. **GW1**
Sheet 1 of 3

Project Name: Ballinclare EIS	Co-ords: 725161E - 688982N	Hole Type
Location: Ballinclare, Co. Wicklow	Level: 60.95 m AOD	Scale 1:125
Client: Kilsaran Concrete	SLR Project No. 501.00036.00030 Date: 08/10/2014	Logged By TM

Peizo (m)	Depth (m)	Level (m OD)	Water Strike (m OD)	Litho	Stratum Description
	1.80	59.15			WEATHERED ROCK (WEATHERED ROCKHEAD) Weathered Rock
					DIORITE Diorite

Continued next sheet

Remarks:

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Well No. **GW1**
Sheet 2 of 3

Project Name: Ballinclare EIS	Co-ords: 725161E - 688982N	Hole Type
Location: Ballinclare, Co. Wicklow	Level: 60.95 m AOD	Scale 1:125
Client: Kilsaran Concrete	SLR Project No. 501.00036.00030 Date: 08/10/2014	Logged By TM

Peizo (m)	Depth (m)		Level (m OD)	Water Strike (m OD)	Litho	Stratum Description
		26				DIORITE
		27				
		28				
		29				
		30				
		31				
		32				
		33				
		34				
		35				
		36				
		37				
		38				
		39				
		40				
		41				
		42				
		43				
		44				
		45				
		46				
		47				
		48				
		49				

Continued next sheet

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Well No. **GW1**
Sheet 3 of 3

Project Name: Ballinclare EIS	Co-ords: 725161E - 688982N	Hole Type
Location: Ballinclare, Co. Wicklow	Level: 60.95 m AOD	Scale 1:125
Client: Kilsaran Concrete	SLR Project No. 501.00036.00030 Date: 08/10/2014	Logged By TM

Peizo (m)	Depth (m)	Level (m OD)	Water Strike (m OD)	Litho	Stratum Description
					DIORITE
			57		Water Strike - 20gls/hr Very little water encountered
	68.00	-7.05			End of Borehole at 68.00 m

Remarks:

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Well No. **GW2**
Sheet 1 of 3

Project Name: Ballinclare EIS	Co-ords: 725442E - 688737N	Hole Type
Location: Ballinclare, Co. Wicklow	Level: 51.89 m AOD	Scale 1:125
Client: Kilsaran Concrete	SLR Project No. 501.00036.00030 Date: 09/10/2014	Logged By TM

Peizo (m)	Depth (m)	Level (m OD)	Water Strike (m OD)	Litho	Stratum Description
					(MADE GROUND) MADE GROUND - Reworked ground with a slight hydrocarbon odour
	6.00	45.89			Water Strike - 2000gls/hr CAVITY Cavity
	7.00	44.89			DIORITE Strong to very strong, dark grey to green, crystalline, medium to coarse grained DIORITE

Continued next sheet

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Well No. **GW2**
Sheet 2 of 3

Project Name: Ballinclare EIS	Co-ords: 725442E - 688737N	Hole Type
Location: Ballinclare, Co. Wicklow	Level: 51.89 m AOD	Scale 1:125
Client: Kilsaran Concrete	SLR Project No. 501.00036.00030 Date: 09/10/2014	Logged By TM

Peizo (m)	Depth (m)		Level (m OD)	Water Strike (m OD)	Litho	Stratum Description
		26				DIORITE
		27				
		28				
		29				
		30				
		31				
		32				
		33				
		34				
		35				
		36				
		37				
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		39				
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		42				
		43				
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		45				
		46				
		47				
		48				
		49				

Continued next sheet

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Well No. **GW2**
Sheet 3 of 3

Project Name: Ballinclare EIS	Co-ords: 725442E - 688737N	Hole Type
Location: Ballinclare, Co. Wicklow	Level: 51.89 m AOD	Scale 1:125
Client: Kilsaran Concrete	SLR Project No. 501.00036.00030 Date: 09/10/2014	Logged By TM

Peizo (m)	Depth (m)	Level (m OD)	Water Strike (m OD)	Litho	Stratum Description
					DIORITE
	61.00	-9.11			End of Borehole at 61.00 m

Remarks:

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Well No. **GW3**
Sheet 1 of 3

Project Name: Ballinclare EIS	Co-ords: 724981E - 689247N	Hole Type
Location: Ballinclare, Co. Wicklow	Level: 55.44 m AOD	Scale 1:125
Client: Kilsaran Concrete	SLR Project No. 501.00036.00030 Date: 10/10/2014	Logged By TM

Peizo (m)	Depth (m)	Level (m OD)	Water Strike (m OD)	Litho	Stratum Description
					OVERBURDEN (BOULDER CLAY) Overburden comprising clay and weathered rock
	6.00	49.44			DIORITE Strong to very strong, dark grey to green, crystalline, medium to coarse grained DIORITE
			▽		Water Strike - 100gls/hr

Continued next sheet

Remarks:

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Well No. **GW3**
Sheet 2 of 3

Project Name: Ballinclare EIS	Co-ords: 724981E - 689247N	Hole Type
Location: Ballinclare, Co. Wicklow	Level: 55.44 m AOD	Scale 1:125
Client: Kilsaran Concrete	SLR Project No. 501.00036.00030 Date: 10/10/2014	Logged By TM

Peizo (m)	Depth (m)		Level (m OD)	Water Strike (m OD)	Litho	Stratum Description
		26				DIORITE
		27				
		28				
		29				
		30				
		31				
		32				
		33				
		34				
		35				
		36				
		37				
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		46				
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		48				
		49				

Continued next sheet

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Well No. **GW3**
Sheet 3 of 3

Project Name: Ballinclare EIS	Co-ords: 724981E - 689247N	Hole Type
Location: Ballinclare, Co. Wicklow	Level: 55.44 m AOD	Scale 1:125
Client: Kilsaran Concrete	SLR Project No. 501.00036.00030 Date: 10/10/2014	Logged By TM

Peizo (m)	Depth (m)	Level (m OD)	Water Strike (m OD)	Litho	Stratum Description
					DIORITE
	65.00	-9.56			End of Borehole at 65.00 m

Remarks:

Appendix 7-F
Groundwater Sampling Results

Parameter	Units	366 of 2016 (GW	of 2014 (Drinking W	EPA IGVs	WHO DWS	Oct-14 GW1	Oct-14 GW2	Oct-14 GW3	07/05/2019 GW1	07/05/2019 GW2	07/05/2019 GW3
Water level	m								3.36	1.89	2.21
Conductivity (25°C)	µS/cm	800-1875*	2500	1000		514	557	2439			
pH	pH units		6.5 - 9.5	6.5 - 9.5		7.89	8.07	8			
Total ammonia (as N)	mg/l	0.065-0.175	0.30			0.25	0.55	0.27	<0.1	<0.1	0.11
Ammonical nitrogan (as NH3-N)	mg/l	0.07891-0.21245		0.1821		0.21	0.45	0.23	<0.1	<0.1	0.11
Chloride (as Cl-)	mg/l	24-187.5	250	30					11	21	63
Sulphate (as SO42-)	mg/l	187.5	250	200					15	10	10
Fluoride (as Fl-)	mg/l		0.8	1					0.13	0.43	0.17
Nitrate (as NO3)	mg/l	37.5	50	25		0.4	0.8	0.7	3.1	3.1	0.95
Nitrite (as NO2)	mg/l	0.375	0.5	0.1		0.03	0.03	<0.02	<0.05	<0.05	<0.05
Orthophosphate (as PO4)	mg/l			0.03		<0.06	<0.06	0.23	0.46	0.41	<0.2
Total coliforms	MPN/100ml			0					55	1986	4
E coli	MPN/100ml								ND	16	ND
Cyanide (total)	mg/l		0.050	0.01	0.07				<0.05	<0.05	<0.05
Cyanide (free)	mg/l		0.05	0.01		<0.01	<0.01	<0.01	<0.05	<0.05	<0.05
Sulphide	mg/l								<0.05	<0.05	<0.05
Sodium	mg/l					17.4	17.6	198.1	9.1	120	49
Total calcium	mg/l			200		56.1	63.7	191.5	34	14	140
Total potassium	mg/l			5		3.4	18.9	6.2	26	3.1	5.8
Total magnesium	mg/l					14.1	12.5	57.4	6.2	2.1	4
Aluminium (total)	mg/l	0.15	0.2	0.2		0.02	0.0149	<0.0015	0.07	0.017	0.03
Arsenic (total)	mg/l	0.0075	0.01	0.01	0.01	0.0414	0.1257	0.0028	0.0043	0.013	0.13
Boron (total	mg/l		1			0.037	0.065	0.226	0.026	0.44	0.046
Barium (total)	mg/l			0.1		0.045	0.0445	0.3854	0.033	0.027	0.0084
Cadmium (total)	mg/l		0.005	0.005	0.003	<0.00003	<0.00003	0.00008	<0.00008	<0.00008	<0.00008
Chromium (total)	mg/l	0.0375	0.05	0.03	0.05	<0.0002	0.0006	<0.0002	0.0014	0.0029	<0.001
Copper (total)	mg/l		2	0.03	2	0.003	<0.003	<0.003	0.0011	<0.001	0.001
Iron (total)	mg/l		0.2	0.2		<0.0047	0.0101	0.2076	0.27	0.14	0.61
Mercury (total)	mg/l	0.00075	0.001	0.001	0.006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (total)	mg/l		0.05	0.05		0.5095	0.2535	0.4555	0.022	0.0029	0.14
Nickel (total)	mg/l		0.02	0.02	0.07	0.0012	0.0074	0.0142	0.0019	0.0014	0.004
Lead (total)	mg/l	0.0075	0.01	0.01					0.0011	<0.001	0.0094
Antimony (total)	mg/l		0.005			0.004	0.008	<0.002	<0.001	<0.001	<0.001
Selenium (total)	mg/l		0.01			<0.0012	<0.0012	<0.0012	0.0012	<0.001	0.001
Zinc (total)	mg/l	0.075		0.1					0.0066	0.0051	0.0027
Non-Carbonate Hardness	mg/l					215	308	787			
Total Hardness Dissolved	mg/l					199	212	720			
Total Alkalinity as CaCO3	mg/l					216	284	224			
Apparent colour	PCU					<15	499	193			
Total suspended solids	mg/l					15	323	49			
Turbidity	NTU					0.2	0.4	0.8			
Hydrocarbons											
Mineral oil	mg/l								<0.01	<0.01	<0.01
TPH>C6-C10	mg/l								<0.0001	<0.0001	<0.0001
TPH>C10-C21	mg/l								<0.0001	<0.0001	<0.0001
TPH>C21-C40	mg/l								<0.0001	<0.0001	<0.0001
Total TPH >C6-C40	mg/l					<0.01	0.78	<0.01	<0.01	<0.01	<0.01

Parameter	Units	19/06/2019			04/07/2019			07/08/2019			04/09/2019			03/10/2019			04/11/2019		
		GW1	GW2	GW3	GW1	GW2	GW3	GW1	GW2	GW3	GW1	GW2	GW3	GW1	GW2	GW3	GW1	GW2	GW3
Water level	m	2.08	4.2	2.34	2	2.84	1.83	1.01	0.92	1.02	1.92	4.58	2.09	1.7	2.7	2	1.5	2.3	2
Conductivity (25°C)	µS/cm	520	372	584	567	345	567	321	350	273	400	374	599	404	346	590	504	424	595
pH	pH units	7.6	7.1	8.1	7.9	7	8.1	7.98	7.91	8.05	7.9	6.9	8	7.6	7.2	7.9	7.56	6.96	7.96
Total ammonia (as N)	mg/l	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	0.12	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1
Ammonical nitrogan (as NH3-N)	mg/l																		
Chloride (as Cl-)	mg/l																		
Sulphate (as SO42-)	mg/l																		
Fluoride (as Fl-)	mg/l																		
Nitrate (as NO3)	mg/l	<0.5	1.5	<0.5	<0.5	2.1	<0.5	0.54	0.55	0.55	0.62	2.2	0.73	1.5	1.2	0.8	1.3	0.93	0.83
Nitrite (as NO2)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Orthophosphate (as PO4)	mg/l	<0.065	<0.065	<0.065	0.098	<0.065	0.065	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065	<0.065	<0.65	<0.065	<0.065	<0.065
Total coliforms	MPN/100ml	>2420	51	166	>2420	2420	345	>2420	>2420	>2420	411	387	>2420	579	2420	2420	579	248	>2420
E coli	MPN/100ml	-	12	-		10	4	1	1	2	19	613	6		54			8	
Cyanide (total)	mg/l																		
Cyanide (free)	mg/l																		
Sulphide	mg/l																		
Sodium	mg/l																		
Total calcium	mg/l																		
Total potassium	mg/l																		
Total magnesium	mg/l																		
Aluminium (total)	mg/l																		
Arsenic (total)	mg/l	0.016	0.0062	0.16	0.014	0.0033	0.15	0.13	0.12	0.12	0.045	0.0048	0.11	0.021	0.0056	0.1	0.079	0.0042	0.089
Boron (total	mg/l																		
Barium (total)	mg/l																		
Cadmium (total)	mg/l	<0.00008	0.00009	<0.00008	<0.00008	<0.00008	<0.00008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium (total)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	0.01	0.005	<0.005	<0.005	0.008	<0.005	<0.005	<0.005	<0.005
Copper (total)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Iron (total)	mg/l	0.35	0.34	1.3	0.24	0.17	1.2	0.76	0.73	0.76	2	0.87	0.5	0.82	2.7	0.18	0.39	0.44	0.31
Mercury (total)	mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00075	0.0013	0.0016	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (total)	mg/l																		
Nickel (total)	mg/l	<0.001	<0.001	<0.001	0.0024	0.0082	0.0028	<0.01	0.011	<0.01	0.022	0.015	<0.1	0.013	0.023	<0.01	0.013	0.015	<0.01
Lead (total)	mg/l	0.0021	0.031	0.011	0.0013	0.0022	0.018	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Antimony (total)	mg/l																		
Selenium (total)	mg/l																		
Zinc (total)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.025	<0.025	<0.025	<0.025	0.037	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Non-Carbonate Hardness	mg/l																		
Total Hardness Dissolved	mg/l																		
Total Alkalinity as CaCO3	mg/l																		
Apparent colour	PCU																		
Total suspended solids	mg/l																		
Turbidity	NTU																		
Hydrocarbons																			
Mineral oil	mg/l																		
TPH>C6-C10	mg/l	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
TPH>C10-C21	mg/l	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
TPH>C21-C40	mg/l																		
Total TPH >C6-C40	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Parameter	Units	07/05/2019 GW1	GW2	GW3
PAHs				
Naphthalene	mg/l	<0.0001	<0.0001	<0.0001
Acenaphthylene	mg/l	<0.0001	<0.0001	<0.0001
Acenaphthene	mg/l	<0.0001	<0.0001	<0.0001
Fluorene	mg/l	<0.0001	<0.0001	<0.0001
Phenanthrene	mg/l	<0.0001	<0.0001	<0.0001
Anthracene	mg/l	<0.0001	<0.0001	<0.0001
Fluoranthene	mg/l	<0.0001	<0.0001	<0.0001
Pyrene	mg/l	<0.0001	<0.0001	<0.0001
Benzo(a)anthracene	mg/l	<0.0001	<0.0001	<0.0001
Chrysene	mg/l	<0.0001	<0.0001	<0.0001
Benzo(b)fluoranthene	mg/l	<0.0001	<0.0001	<0.0001
Benzo(k)fluoranthene	mg/l	<0.0001	<0.0001	<0.0001
Benzo(a)pyrene	mg/l	<0.0001	<0.0001	<0.0001
Indeno(1,2,3-c,d)pyrene	mg/l	<0.0001	<0.0001	<0.0001
Dibenzo(a,h)anthracene	mg/l	<0.0001	<0.0001	<0.0001
Benzo(g,h,i)perylene	mg/l	<0.0001	<0.0001	<0.0001
Coroene	mg/l	<0.0001	<0.0001	<0.0001
Total of 17 PAHs	mg/l	<0.002	<0.002	<0.002
Volatile organic compounds				
Dichlorodifluoromethane	mg/l	<0.001	<0.001	<0.001
Chloromethane	mg/l	<0.001	<0.001	<0.001
Vinyl chloride	mg/l	<0.001	<0.001	<0.001
Bromomethane	mg/l	<0.005	<0.005	<0.005
Chloroethane	mg/l	<0.002	<0.002	<0.002
Trichlorofluoromethane	mg/l	<0.001	<0.001	<0.001
1,1-Dichloroethene	mg/l	<0.001	<0.001	<0.001
Trans 1,2-Dichloroethene	mg/l	<0.001	<0.001	<0.001
1,1-Dichloroethane	mg/l	<0.001	<0.001	<0.001
cis 1,2-Dichloroethene	mg/l	<0.001	<0.001	<0.001
Bromochloromethane	mg/l	<0.005	<0.005	<0.005
Trichloromethane	mg/l	<0.001	<0.001	<0.001
1,1,1-Trichloroethane	mg/l	<0.001	<0.001	<0.001
Tetrachloromethane	mg/l	<0.001	<0.001	<0.001
1,1-Dichloropropene	mg/l	<0.001	<0.001	<0.001
Benzene	mg/l	<0.001	<0.001	<0.001
1,2-Dichloroethane	mg/l	<0.002	<0.002	<0.002
Trichloroethene	mg/l	<0.001	<0.001	<0.001
1,2-Dichloropropane	mg/l	<0.001	<0.001	<0.001
Dibromomethane	mg/l	<0.01	<0.01	<0.01
Bromodichloromethane	mg/l	<0.005	<0.005	<0.005
cis-1,3-Dichloropropene	mg/l	<0.01	<0.01	<0.01
Toluene	mg/l	<0.001	<0.001	<0.001
Trans-1,3-Dichloropropene	mg/l	<0.01	<0.01	<0.01
1,1,2-Trichloroethane	mg/l	<0.01	<0.01	<0.01
Tetrachloroethane	mg/l	<0.001	<0.001	<0.001
1,3-Dichloropropane	mg/l	<0.002	<0.002	<0.002
Dibromochloromethane	mg/l	<0.01	<0.01	<0.01
1,2-Dibromoethane	mg/l	<0.005	<0.005	<0.005
Chlorobenzene	mg/l	<0.001	<0.001	<0.001
1,1,1,2-Tetrachloroethane	mg/l	<0.002	<0.002	<0.002
Ethylbenzene	mg/l	<0.001	<0.001	<0.001
m&p-xylene	mg/l	<0.001	<0.001	<0.001
o-xylene	mg/l	<0.001	<0.001	<0.001
Styrene	mg/l	<0.001	<0.001	<0.001
Tribromomethane	mg/l	<0.001	<0.001	<0.001

Isoproppylbenzene	mg/l	<0.001	<0.001	<0.001
Bromobenzene	mg/l	<0.001	<0.001	<0.001
1,2,3-Trichloropropane	mg/l	<0.05	<0.05	<0.05
N-Propylbenzene	mg/l	<0.001	<0.001	<0.001
2-Chlorotoluene	mg/l	<0.001	<0.001	<0.001
1,3,5-Trimethylbenzene	mg/l	<0.001	<0.001	<0.001
4,Chlorotoluene	mg/l	<0.001	<0.001	<0.001
Tert-Butylbenzene	mg/l	<0.001	<0.001	<0.001
1,2,4-Trimethylbenzene	mg/l	<0.001	<0.001	<0.001
Sec-Butylbenzene	mg/l	<0.001	<0.001	<0.001
1,3-Dichlorobenzene	mg/l	<0.001	<0.001	<0.001
4-Isopropyltoluene	mg/l	<0.001	<0.001	<0.001
1,4-Dichlorobenzene	mg/l	<0.001	<0.001	<0.001
N-Butylbenzene	mg/l	<0.001	<0.001	<0.001
1,2-Dichlorobenzene	mg/l	<0.001	<0.001	<0.001
1,2-Dibromo-3-Chloropropane	mg/l	<0.05	<0.05	<0.05
1,2,4-Trichlorobenzene	mg/l	<0.001	<0.001	<0.001
Hexachlorobutadiene	mg/l	<0.001	<0.001	<0.001
1,2,3-Trichlorobenzene	mg/l	<0.002	<0.002	<0.002
Methyl Tert-Butyl Ether	mg/l	<0.001	<0.001	<0.001
N-Nitrosodimethylamine	mg/l	<0.0005	<0.0005	<0.0005
Phenol	mg/l	<0.0005	<0.0005	<0.0005
2-Chlorophenol	mg/l	<0.0005	<0.0005	<0.0005
Bis-(2-Chloroethyl)Ether	mg/l	<0.0005	<0.0005	<0.0005
1,3-Dichlorobenzene	mg/l	<0.0005	<0.0005	<0.0005
1,4-Dichlorobenzene	mg/l	<0.0005	<0.0005	<0.0005
1,2-Dichlorobenzene	mg/l	<0.0005	<0.0005	<0.0005
2-Methylphenol (o-Cresol)	mg/l	<0.0005	<0.0005	<0.0005
Bis(2-Chloroisopropyl)Ether	mg/l	<0.0005	<0.0005	<0.0005
Hexachloroethane	mg/l	<0.0005	<0.0005	<0.0005
N-Nitrosodi-n-propylamine	mg/l	<0.0005	<0.0005	<0.0005
4-Methylphenol	mg/l	<0.0005	<0.0005	<0.0005
Nitrobenzene	mg/l	<0.0005	<0.0005	<0.0005
Isophorone	mg/l	<0.0005	<0.0005	<0.0005
2-Nitrophenol	mg/l	<0.0005	<0.0005	<0.0005
2,4-Dimethylphenol	mg/l	<0.0005	<0.0005	<0.0005
Bis(2-Chloroethoxy)Methane	mg/l	<0.0005	<0.0005	<0.0005
2,4-Dichlorophenol	mg/l	<0.0005	<0.0005	<0.0005
1,2,4-Trichlorobenzene	mg/l	<0.0005	<0.0005	<0.0005
Naphthalene	mg/l	<0.0005	<0.0005	<0.0005
4-Chloroaniline	mg/l	<0.0005	<0.0005	<0.0005
Hexachlorobutadiene	mg/l	<0.0005	<0.0005	<0.0005
4-Chloro-3-Methylphenol	mg/l	<0.0005	<0.0005	<0.0005
2-Methylnaphthalene	mg/l	<0.0005	<0.0005	<0.0005
Hexachlorocyclopentadiene	mg/l	<0.0005	<0.0005	<0.0005
2,4,6-Trichlorophenol	mg/l	<0.0005	<0.0005	<0.0005
2,4,5-Trichlorophenol	mg/l	<0.0005	<0.0005	<0.0005
2-Chloronaphthalene	mg/l	<0.0005	<0.0005	<0.0005
2-Nitroaniline	mg/l	<0.0005	<0.0005	<0.0005
Acenaphthylene	mg/l	<0.0005	<0.0005	<0.0005
Dimethylphthalate	mg/l	<0.0005	<0.0005	<0.0005
2,6-Dinitrotoluene	mg/l	<0.0005	<0.0005	<0.0005
Acenaphthene	mg/l	<0.0005	<0.0005	<0.0005
3-Nitroaniline	mg/l	<0.0005	<0.0005	<0.0005

Dibenzofuran	mg/l	<0.0005	<0.0005	<0.0005
4-Chlorophenylphenylether	mg/l	<0.0005	<0.0005	<0.0005
2,4-Dinitrotoluene	mg/l	<0.0005	<0.0005	<0.0005
Fluorene	mg/l	<0.0005	<0.0005	<0.0005
Diethyl Phthalate	mg/l	<0.0005	<0.0005	<0.0005
4-Nitroaniline	mg/l	<0.0005	<0.0005	<0.0005
2-Methyl-4,6-Dinitrophenol	mg/l	<0.0005	<0.0005	<0.0005
Azobenzene	mg/l	<0.0005	<0.0005	<0.0005
4-Bromophenylphenyl Ether	mg/l	<0.0005	<0.0005	<0.0005
Hexachlorobenzene	mg/l	<0.0005	<0.0005	<0.0005
Pentachlorophenol	mg/l	<0.0005	<0.0005	<0.0005
Phenanthrene	mg/l	<0.0005	<0.0005	<0.0005
Anthracene	mg/l	<0.0005	<0.0005	<0.0005
Carbazole	mg/l	<0.0005	<0.0005	<0.0005
Di-N-Butyl Phthalate	mg/l	<0.0005	<0.0005	<0.0005
Fluoranthene	mg/l	<0.0005	<0.0005	<0.0005
Pyrene	mg/l	<0.0005	<0.0005	<0.0005
Butylbenzyl Phthalate	mg/l	<0.0005	<0.0005	<0.0005
Benzo[a]anthracene	mg/l	<0.0005	<0.0005	<0.0005
Chrysene	mg/l	<0.0005	<0.0005	<0.0005
Bis(2-Ethylhexyl)Phthalate	mg/l	<0.0005	<0.0005	<0.0005
Di-N-Octyl Phthalate	mg/l	<0.0005	<0.0005	<0.0005
Benzo[b]fluoranthene	mg/l	<0.0005	<0.0005	<0.0005
Benzo[k]fluoranthene	mg/l	<0.0005	<0.0005	<0.0005
Benzo[a]pyrene	mg/l	<0.0005	<0.0005	<0.0005
Indeno(1,2,3-c,d)Pyrene	mg/l	<0.0005	<0.0005	<0.0005
Dibenz(a,h)Anthracene	mg/l	<0.0005	<0.0005	<0.0005
Benzo[g,h,i]perylene	mg/l	<0.0005	<0.0005	<0.0005
4-Nitrophenol	mg/l	<0.0005	<0.0005	<0.0005
PCB 28	mg/l	<0.00001	<0.00001	<0.00001
PCB 52	mg/l	<0.00001	<0.00001	<0.00001
PCB 90+101	mg/l	<0.00001	<0.00001	<0.00001
PCB 118	mg/l	<0.00001	<0.00001	<0.00001
PCB 153	mg/l	<0.00001	<0.00001	<0.00001
PCB 138	mg/l	<0.00001	<0.00001	<0.00001
PCB 180	mg/l	<0.00001	<0.00001	<0.00001
Total PCBs (7 congeners)	mg/l	<0.00001	<0.00001	<0.00001
Alpha-HCH	mg/l	<0.0002	<0.0002	<0.0002
Gamma-HCH (Lindane)	mg/l	<0.0002	<0.0002	<0.0002
Beta-HCH	mg/l	<0.0002	<0.0002	<0.0002
Delta-HCH	mg/l	<0.0002	<0.0002	<0.0002
Heptachlor	mg/l	<0.0002	<0.0002	<0.0002
Aldrin	mg/l	<0.0002	<0.0002	<0.0002
Heptachlor Epoxide	mg/l	<0.0002	<0.0002	<0.0002
Gamma-Chlordane	mg/l	<0.0002	<0.0002	<0.0002
Alpha-Chlordane	mg/l	<0.0002	<0.0002	<0.0002
Endosulfan I	mg/l	<0.0002	<0.0002	<0.0002
4,4-DDE	mg/l	<0.0002	<0.0002	<0.0002
Dieldrin	mg/l	<0.0002	<0.0002	<0.0002
Endrin	mg/l	<0.0002	<0.0002	<0.0002
4,4-DDD	mg/l	<0.0002	<0.0002	<0.0002
Endosulfan II	mg/l	<0.0002	<0.0002	<0.0002
Endrin Aldehyde	mg/l	<0.0002	<0.0002	<0.0002
4,4-DDT	mg/l	<0.0002	<0.0002	<0.0002
Endosulfan Sulphate	mg/l	<0.0002	<0.0002	<0.0002
Methoxychlor	mg/l	<0.0002	<0.0002	<0.0002
Endrin Ketone	mg/l	<0.0002	<0.0002	<0.0002
Total Phenols	mg/l	<0.03	<0.03	<0.03

Appendix 7-G
Rating of Existing Environment Significance / Sensitivity
(based on IGI, 2013 Guidelines)

Importance	Criteria	Typical Example
High	Attribute has a high quality or value on an international scale	Groundwater/ Surface Water supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
	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 – e.g. NHA status. Regionally important potable water source supplying >2,500 homes Inner source protection area for regionally important water source. Drinking water supply from river. Amenity use of waterbody
	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 >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	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. No specific recreational use of waterbody
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes. No water supply from surface water, no abstraction designation for watercourse No amenity value of waterbody
Negligible	Attribute has negligible quality or value on a local site scale	No groundwater supply from a bedrock aquifer inn vicinity of site. Surface water not used for any specific purpose.

Appendix 7-H
Descriptions of Effects
(EPA, May 2017 - Draft)

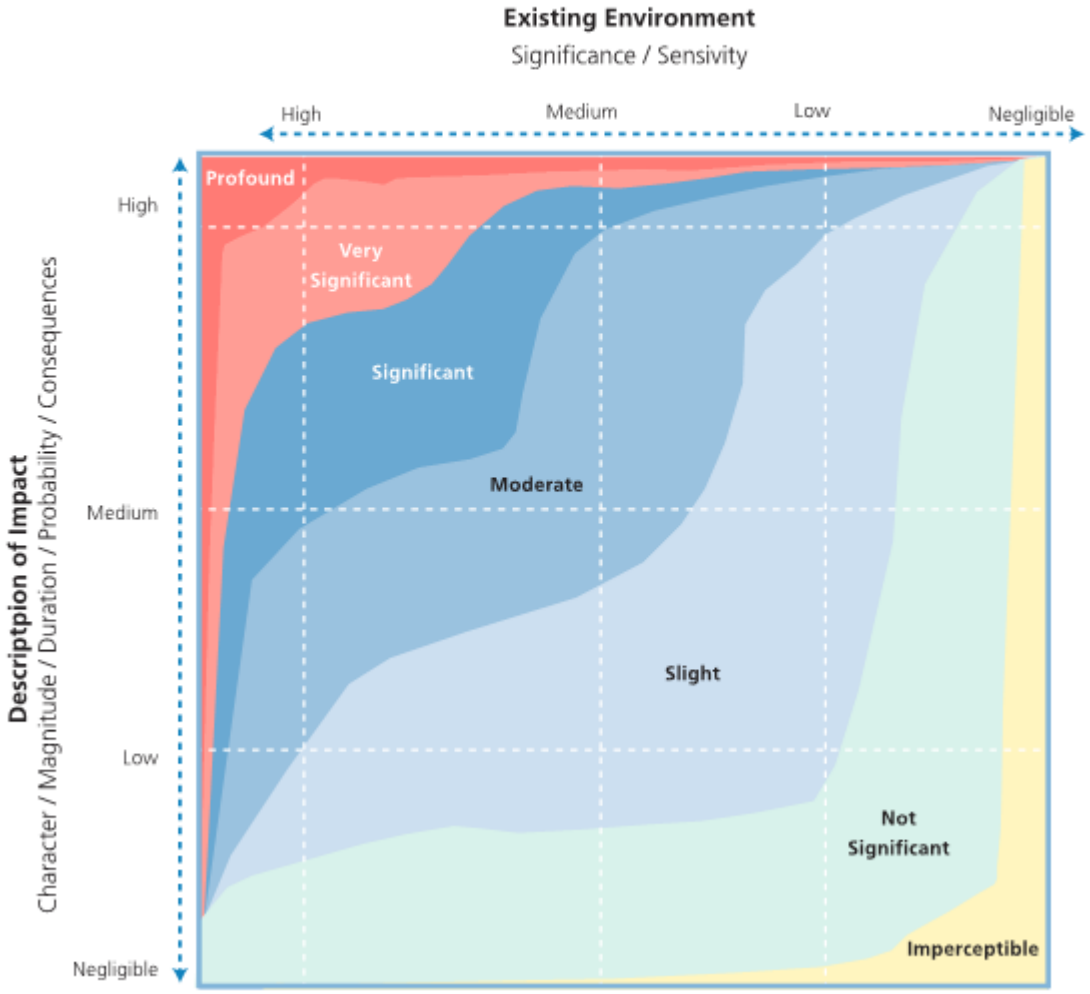
Impact Characteristic	Term	Description
Quality of Effects	Positive Effects	A change which improves the quality of the environment
	Neutral Effects	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative / Adverse Effects	A change which reduces the quality of the environment
Describing the Significance of Effects	Imperceptible	An effect capable of measurement but without significant consequences
	Not significant	An effect which causes noticeable2 changes in the character of the environment 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	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects	An effect which obliterates sensitive characteristics
Describing the Extent and Context of Effects	Extent	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect
	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Probability of Effects	Likely Effects	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Unlikely Effects	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Duration and	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting less than a day

Impact Characteristic	Term	Description
Frequency of Effects	Temporary Effects	Effects lasting less than a year
	Short-term Effects	Effects lasting one to seven years
	Medium-term Effects	Effects lasting seven to fifteen years
	Long-term Effects	Effects lasting fifteen to sixty years
	Permanent Effects	Effects lasting over sixty years
	Reversible Effects	Effects that can be undone, for example through remediation or restoration
	Frequency of Effects	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually.
Describing the Types of Effects	Indirect / Secondary Effects	Likely, significant effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative Effects	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	Do-Nothing Effects	The environment as it would be in the future should the subject project not be carried out.
	Worst Case Effects	The effects arising from a project in the case where mitigation measures substantially fail.
	Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
	Irreversible Effects	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents, (e.g. combination of SOx and NOx to produce smog).

Appendix 7-I
Classification of Significance of Impacts
(EPA, May 2017 – Draft)

Determining Significance

The diagram below shows how comparison of the character of the predicted impact to the sensitivity of the receiving environment can determine the significance of the impact.



Appendix 7-J
Siltbuster Water Treatment System

Siltbuster Ltd., Unipure House,
Wonastow Road West, Monmouth NP25 5JA
Tel: 01600 772256 Fax: 01600 775312
E-mail: enquires@siltbuster.com
Web: www.siltbuster.com

SE14027-KD-01
13th March

Michael Gill
Hydro Environmental Services

By Email: michael@hydroenvironmental.ie

Arsenic Removal from Quarry Water
Ireland

Dear Michael

Further to your email of the 23/02/17, we are pleased to provide our proposal for the hire of the plant to remove arsenic contamination from groundwater due to be pumped from a flooded quarry.

Based on the information provided we understand that:

- Approximately 64,000m^3 of water needs to be pumped out of a flooded quarry over a period of between 40 and 100 days to allow the quarry to be backfilled (i.e. a flow rate of between 133m^3/hr and 53m^3/hr – assuming a 12 hour working day)
- The water contains circa 500µg/l of arsenic, the concentration of which needs to be reduced to an acceptable level to allow the water to be safely discharged off site.

Proposed treatment Process

The solubility and hence the ease with which arsenic can be removed from the groundwater is a function of the valency state of the arsenic. With Arsenic 5+ being less soluble and hence more easily removed that Arsenic 3+. Therefore the first stage in any arsenic removal process is to ensure all the arsenic is oxidised to As^{5+} by dosing the water with peroxide under slightly acidic to neutral pH conditions. Following oxidation the arsenic can be precipitated as ferric arsenate by the addition of ferric chloride. Importantly, provided the iron is added in excess, the resulting ferric-arsenate sludge exhibits low leachability and subject to suitable laboratory testing may, following dewatering, be disposed of a low hazard waste.

Experimental work undertaken on a synthetic ground water sample containing 500µg/l of dissolved arsenic has revealed that to reduce the residual arsenic concentration to less than 50µg/l, it is necessary to:

Provide a minimum of 45min retention time

Dose the water with iron at molar ratio of 20:1 Fe:As

Dose the water with peroxide at a molar ration of 10:1 H_2O_2:As

Based on the results from these tests the proposed treatment process would comprise:

- Adjusting the pH of the water to a circum neutral value (if required)
- Dosing the water with hydrogen peroxide to ensure all the arsenic has been oxidised from the As^{3+} to the As^{5+} valency state.
- Precipitating the As^{5+} arsenic with iron to form ferric - arsenate.
- Dosing the treated water with a flocculate to aggregate the ferric arsenate particles into larger more rapidly settling
- Removing the flocculated ferric-arsenic particles in a lamella clarifier.

At 45 minutes retention time, one of our standard 30m^3 reaction tank would be capable of treating around 40m^3/hr. Therefore by operating 2 streams in parallel the plant would be able to treat circa 80m^3/hr. On this basis, it would take 60 to 70 days to empty the quarry.

The reaction time can be reduced to less than 10min by reducing the pH of the water to 3.5 (using either hydrochloric or sulphuric acid), which would allow a pair of tanks operating in parallel to treat around 200m^3/hr of flow (albeit at additional operating cost due to both the initial acid consumption and the need to bring the pH back up to circum neutral value prior to discharging the water off site - we have therefore not considered this option any further at this stage).

Subject to maintaining an appropriate iron to Arsenic ratio we would envisage that the resultant ferric arsenate solids would exhibit a sufficiently low arsenic leachability to pass the Waste Acceptance Criteria (WAC) test for non-hazardous.

Proposed Scope of Supply

As indicated above, we would propose to treat the water using a 2 stream plant, with each stream comprising:

- Inlet magnetic flow meter to record the volume of water treated and allow flow proportional flocculant, peroxide and ferric iron dosing
- 1No 30m^3 reaction tank
- 1No duty only acid dosing system operated by a pH probe to allow reduction of influent pH to circum neutral (or pH 3.5 if the flow rate needs to be increased)
- 1No duty only flow proportional peroxide dosing pump
- 1no duty only flow proportional ferric sulphate/chloride dosing pump.
- 1No duty only caustic dosing pump to allow the pH to be increased back to circum neutral in the event of the plant needing to be operated the maximum flow rate.
- IBC spill stands to allow safe storage of acid, peroxide, ferric sulphate/chloride, caustic.
- Flocculant make up system to allow the precipitated solids be aggregated into larger more rapidly settling “clumps”
- 1No duty only flow proportional flocculant dosing pump.
- 1No HB40R lamella clarifiers operated in parallel to separate the ferric arsenic precipitate from the treated water.
- 1No 6m^3 sludge storage tank (to provide buffer storage- prior to the sludge being either taken off site to Waste Management Centre for dewatering or dewatering on site with a small filter press).
- Interconnecting pipe work
- Delivery, installation, commissioning and familiarisation of your operators with the plant.

Exclusions

At this stage we have excluded the following items from our scope of supply:

- Feed pump and associated pipe-work.
- Discharge pipe-work.
- Power Supply.
- Supply of dilution water for polymer make up, estimated 1 to 2 m^3 per day.
- Lightning protection.
- Heating protection.
- Man power to operate the equipment.
- Disposal of waste.

Dr Richard Coulton

Appendix 7-K
Wastewater Site Characterisation Form

SITE CHARACTERISATION FORM
COMPLETING THE FORM

Step 1:

Goto Menu Item **File, Save As** and save the file under a reference relating to the client or the planning application reference if available.

Use the **Clear Form** button to clear all information fields.

Notes:

All calculations in this form are automatic.

Where possible information is presented in the form of drop down selection lists to eliminate potential errors.

Variable elements are recorded by tick boxes. In all cases only one tick box should be activated.

All time record fields must be entered in twenty hour format as follows: HH:MM

All date formats are DD/MM/YYYY.

All other data fields are in text entry format.

This form can be printed out fully populated for submission with related documents and for your files. It can also be submitted by email.

Section 3.2

In this section use an underline _____ across all six columns to indicate the depth at which changes in classification / characteristics occur.

Section 3.4

Lists supporting documentation required.

Section 4

Select the treatment systems suitable for this site and the discharge route.

Section 5

Indicate the system type that it is proposed to install.

Section 6

Provide details, as required, on the proposed treatment system.

SITE CHARACTERISATION FORM

File Reference:

1.0 GENERAL DETAILS (From planning application)

Prefix: First Name: Kilsaran Concrete Surname:

Address: Piercetown, Dnboyne Co. Meath

Site Location and Townland: Ballinclare Quarry Co. Wicklow

Telephone No: Fax No:

E-Mail:

Maximum no. of Residents: No. of Double Bedrooms: No. of Single Bedrooms:

Proposed Water Supply: Mains ☐ Private Well/Borehole ☑ Group Well/Borehole ☐

2.0 GENERAL DETAILS (From planning application)

Soil Type, (Specify Type): Bedrock Outcrop

Aquifer Category: Regionally Important ☐ Locally Important ☐ Poor PI

Vulnerability: Extreme ☑ High ☐ Moderate ☐ Low ☐ High to Low ☐ Unknown ☐

Bedrock Type: Granite and Other igneous Intrusive Rocks

Name of Public/Group Scheme Water Supply within 1 km: None

Groundwater Protection Scheme (Y/N): Yes Source Protection Area: SI ☐ SO ☐

Groundwater Protection Response: R2¹

Presence of Significant Sites (Archaeological, Natural & Historical): None

Past experience in the area: Not in immediate area

Comments:

(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions).

The bedrock aquifer is classes as poor. Vulnerability is extreme Response is therefore taken as R2(1)
Groundwater will be a target at risk
There are 10 Quarry workers (40L/person)and 10 Drivers (10L/Person) giving a total of 500 L or a PE of 4

Note: Only information available at the desk study stage should be used in this section.

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

Landscape Position: Undulating countryside surrounds stone quarry Quarry

Slope: Steep (>1:5) ☐ Shallow (1:5-1:20) ☐ Relatively Flat (<1:20) ☑

Surface Features within a minimum of 250m (Distance To Features Should Be Noted In Metres)

Houses: No houses within 200m

Existing Land Use: Quarry

Vegetation Indicators: No rushes on site or in adjoining lands

Groundwater Flow Direction: North

Ground Condition: Firm

Site Boundaries: Site not defined

Roads: Road to Southwest

Outcrops (Bedrock And/Or Subsoil): Quarry

Surface Water Ponding: None

Lakes: None

Beaches/Shellfish: None

Areas/Wetlands: None

Karst Features: None

Watercourse/Stream*: None

Drainage Ditches*: None

Springs / Wells*: Well in Quarry

Comments:
(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed system within the site).

The site is to rear of new power station in the Ballinclare quarry. Stone and aggregates excavated - no watertable encountered in the quarry suggests watertable is well below the surface
Subsoils are likely to be high in sand & gravel - good soakage and groundwater will be a target at risk

***Note and record** water level

3.2 **Trial Hole** (should be a minimum of 2.1m deep (3m for regionally important aquifers))

To avoid any accidental damage, a trial hole assessment or percolation tests should not be undertaken in areas, which are at or adjacent to significant sites (e.g. NHAs, SACs, SPAs, and/or Archaeological etc.), without prior advice from National Parks and Wildlife Service or the Heritage Service.

Depth of trial hole (m): 1.60

Depth from ground surface to bedrock (m) (if present):

Depth from ground surface to water table (m) (if present):

Depth of water ingress:

Rock type (if present): None Present

Date and time of excavation: 23/10/2014

Date and time of examination: 24/10/2014

	Depth of P/T Test*	Soil/Subsoil Texture & Classification**	Plasticity and dilatancy***	Soil Structure	Density/ Compactness	Colour****	Preferential flowpaths
0.1 m	P	Fill containing mix of silty aggregates and pockets of clean aggregates. Some large concrete "Boulders"	No Trds or ribs	Structureless	Stiff to Hard depending on material	Grey/Brown	There are some metal bars but presence of pockets of clean aggregates will mean this material will have preferential flow-paths
0.2 m	P						
0.3 m	P						
0.4 m	P,						
0.5 m	T1-3						
0.6 m	T1-3						
0.7 m	T1-3						
0.8 m	T3						
0.9 m							
1.0 m							
1.1 m							
1.2 m							
1.3 m							
1.4 m							
1.5 m							
1.6 m		---------- Base of Pit due to presence of concrete slab.		----------			
1.7 m							
1.8 m							
1.9 m							
2.0 m							
2.1 m							
2.2 m							
2.3 m							
2.4 m							
2.5 m							
2.6 m							
2.7 m							
2.8 m							
2.9 m							
3.0 m							

Evaluation:

No watertable encountered. Material is very variable and therefore is unlikely to be suitable for treatment but will be within the acceptable range fo the hydraulic discharge

Likely T value: 10.00

Note: *Depth of percolation test holes should be indicated on log above. (Enter P or T at depts as appropriate).
** See Appendix E for BS 5930 classification.
*** 3 samples to be tested for each horizon and results should be entered above for each horizon.
**** All signs of mottling should be recorded.

3.3(a) Percolation ("T") Test for Deep Subsoils and/or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm) (A)	500	500	700
Depth from ground surface to base of hole (mm) (B)	900	900	1,100
Depth of hole (mm) [B - A]	400	400	400
Dimensions of hole [length x breadth (mm)]	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

Date and Time pre-soaking started	23/10/2014		23/10/2014		23/10/2014	

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring T_{100}

Percolation Test Hole No.	1	2	3
Date of test	24/10/2014	24/10/2014	24/10/2014
Time filled to 400 mm	09:31	09:31	09:33
Time water level at 300 mm	09:34	09:40	09:57
Time to drop 100 mm (T_{100})	3.00	9.00	24.00
Average T_{100}			12.00

If T_{100} > 300 minutes then T-value >90 – site unsuitable for discharge to ground
If $T_{100} \leq 210$ minutes then go to Step 4;
If T_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)
1	09:34	09:39	5.00	09:40	09:55	15.00	09:57	10:31	34.00
2	09:39	09:43	4.00	09:55	10:12	17.00	10:31	11:09	38.00
3	09:43	09:48	5.00	10:12	10:31	19.00	11:09	12:15	66.00
Average Δt Value			4.67			17.00			46.00
	Average Δt/4 = [Hole No.1]		1.17 (t_1)	Average Δt/4 = [Hole No.2]		4.25 (t_2)	Average Δt/4 = [Hole No.3]		11.50 (t_3)

Result of Test: T = 5.64 (min/25 mm)

Comments:

Overall Result is in the acceptable range but there is variation. Therefore need good treatment prior to discharge to ground

Step 5: Modified Method (where $T_{100} > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of water in hole (mm)	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}
300 - 250	8.1				8.1				8.1			
250 - 200	9.7				9.7				9.7			
200 - 150	11.9				11.9				11.9			
150 - 100	14.1				14.1				14.1			
Average T- Value	T- Value Hole 1= (t_1)			0.00	T- Value Hole 1= (t_2)			0.00	T- Value Hole 1= (t_3)			0.00

Result of Test: T = 0.00 (min/25 mm)

Comments:

3.3(b) Percolation ("P") Test for Shallow Soil / Subsoils and/or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm)			
Depth from ground surface to base of hole (mm)			
Depth of hole (mm)	0	0	0
Dimensions of hole [length x breadth (mm)]	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

Date and Time pre-soaking started						

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring P_{100}

Percolation Test Hole No.	1	2	3
Date of test			
Time filled to 400 mm			
Time water level at 300 mm			
Time to drop 100 mm (P_{100})	0.00	0.00	0.00
Average P_{100}			0.00

If P_{100} > 300 minutes then T-value >90 – site unsuitable for discharge to ground
If $P_{100} \leq 210$ minutes then go to Step 4;
If P_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $P_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δp (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δp (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δp (min)
1			0.00			0.00			0.00
2			0.00			0.00			0.00
3			0.00			0.00			0.00
Average Δp Value			0.00			0.00			0.00
	Average Δp/4 = [Hole No.1]		0.00 (p_1)	Average Δp/4 = [Hole No.2]		0.00 (p_2)	Average Δp/4 = [Hole No.3]		0.00 (p_3)

Result of Test: P = 0.00 (min/25 mm)

Comments:

P - Value not tested as are is built-up and therefore no topsoil

Step 5: Modified Method (where $P_{100} > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of water in hole (mm)	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P – Value = 4.45 / K_{fs}	Time Factor = T_f	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	P – Value = 4.45 / K_{fs}
300 - 250	8.1				8.1				8.1			
250 - 200	9.7				9.7				9.7			
200 - 150	11.9				11.9				11.9			
150 - 100	14.1				14.1				14.1			
Average P- Value	P- Value Hole 1= (p_1)			0.00	P- Value Hole 1= (p_2)			0.00	P- Value Hole 1= (p_3)			0.00

Result of Test: P = 0.00 (min/25 mm)

Comments:

3.4 The following associated Maps, Drawings and Photographs should be appended to this site characterisation form.

1. Discovery Series 1:50,000 Map indicating overall drainage, groundwater flow direction and housing density in the area.
2. Supporting maps for vulnerability, aquifer classification, soil, bedrock.
3. North point should always be included.
4. (a) Sketch of site showing measurements to Trial Hole location and
   (b) Percolation Test Hole locations,
   (c) wells and
   (d) direction of groundwater flow (if known),
   (e) proposed house (incl. distances from boundaries)
   (f) adjacent houses,
   (g) watercourses,
   (h) significant sites
   (i) and other relevant features.
5. Cross sectional drawing of the site and the proposed layout[1] should be submitted.
6. Photographs of the trial hole, text holes and site (date and time referenced).

[1] The calculated percolation area or polishing filter area should be set out accurately on the site layout drawing in accordance with the code of practice's requirements.

4.0 CONCLUSION of SITE CHARACTERISATION

Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude the type of system(s) that is (are) appropriate. This information is also used to choose the optimum final disposal route of the treated wastewater.

Not Suitable for Development ☐

Suitable for [1]		**Discharge Route**
1. Septic tank system (septic tank and percolation area)	No	Discharge to Ground Water
2. Secondary Treatment System		
a. septic tank and filter system constructed on-site and polishing filter; or	Yes	
b. packaged wastewater treatment system and polishing filter	Yes	

5.0 RECOMMENDATION

Propose to install: Septic tank system (septic tank and percolation area)

and discharge to: Ground Water

Trench Invert level (m): 0.80

Site Specific Conditions (e.g. special works, site improvement works testing etc.

Although the average T-value is acceptable for a standard septic tank the variation within the soil means it is unsuitable and a higher level of treatment will be required. It is recommended to install a Package treatment plant with polishing in a peat filter with discharge to ground. To achieve this it is proposed to follow the amendment to the EPA code of Practice as published Feb. 2012 (Clarification on the Disposal of Effluent from Polishing Filters - +Tertiary Treatment Systems) This allows the area for disposal of treated wastewater to be calculated from the formula Area = 0.125 x T x PE.
The proposed approach is to achieve secondary treatment in a Platinum unit and Tertiary treatment in a 2 Module Puraflo unit. The disposal of the treated wastewater (effluent from the Puraflo) is then achieved by distributing the effluent from the puraflo over a 300mm deep gravel distribution layer. On this site the T-value is 5.64 and the PE is 4
Area for disposal = 0.125 (5.64) x 4 m2. Area = 2.8m2 It is recommended to increase this to 10m2 to facilitate placement of the Puraflo Modules.
A 300mm layer of gravel is to beplaced at about 300mm bgl. It is proposed to remove material down to about 300mm BGl and to construct the 300mm disposal pad at this level. The Puraflo is placed on this pad and the effluent is discharged from the Puraflo by gravity.

[1] note: more than one option may be suitable for a site and this should be recorded

[2] A discharge of sewage effluent to "waters" (definition includes any or any part of any river, stream, lake, canal, reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial) will require a licence under the Water Pollution Acts 1977-90. Refer to Section 2.6.2.

6.0 TREATMENT SYSTEM DETAILS

SYSTEM TYPE: Septic Tank System

Tank Capacity (m^3)		Percolation Area		Mounded Percolation Area	
		No. of Trenches		No. of Trenches	
		Length of Trenches (m)		Length of Trenches (m)	
		Invert Level (m)		Invert Level (m)	

SYSTEM TYPE: Secondary Treatment System

Filter Systems

Media Type	Area (m^2)*	Depth of Filter	Invert Level
Sand/Soil			
Soil			
Constructed Wetland			
Other			

Package Treatment Systems

Type	Platinum P6
Capacity PE	4.00
Sizing of Primary Compartment	3.00 m^3

SYSTEM TYPE: Tertiary Treatment System

Polishing Filter: Surface Area (m^2)*

or **Gravity Fed:**

No. of Trenches	
Length of Trenches (m)	
Invert Level (m)	

Package Treatment System: Capacity (pe) 4.00

Constructed Wetland: Surface Area (m^2)*

DISCHARGE ROUTE:

Groundwater	✓	Hydraulic Loading Rate * ($l/m^2.d$)	
Surface Water **		Discharge Rate (m^3/hr)	

TREATMENT STANDARDS:

Treatment System Performance Standard (mg/l)	BOD	SS	NH_3	Total N	Total P
	20.00	30.00	20.00		

QUALITY ASSURANCE:

Installation & Commissioning	On-going Maintenance
Certified by qualified assessor	Annual maintenance contract - including desludging

* Hydrolic loading rate is determined by the percolation rate of subsoil

** Water Pollution Act discharge licence required

7.0 SITE ASSESSOR DETAILS

Company: Trinity Green

Prefix: Dr. First Name: Eugene Surname: Bolton

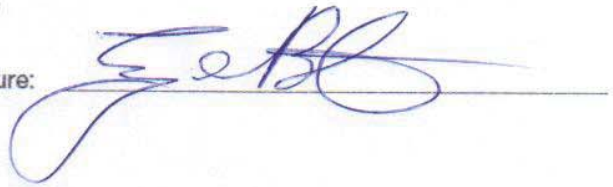
Address: Clonfert, Maynooth, Co. Kildare

Qualifications/Experience: PhD Microbiology, Site Suitability Assessment Course (FETAC)

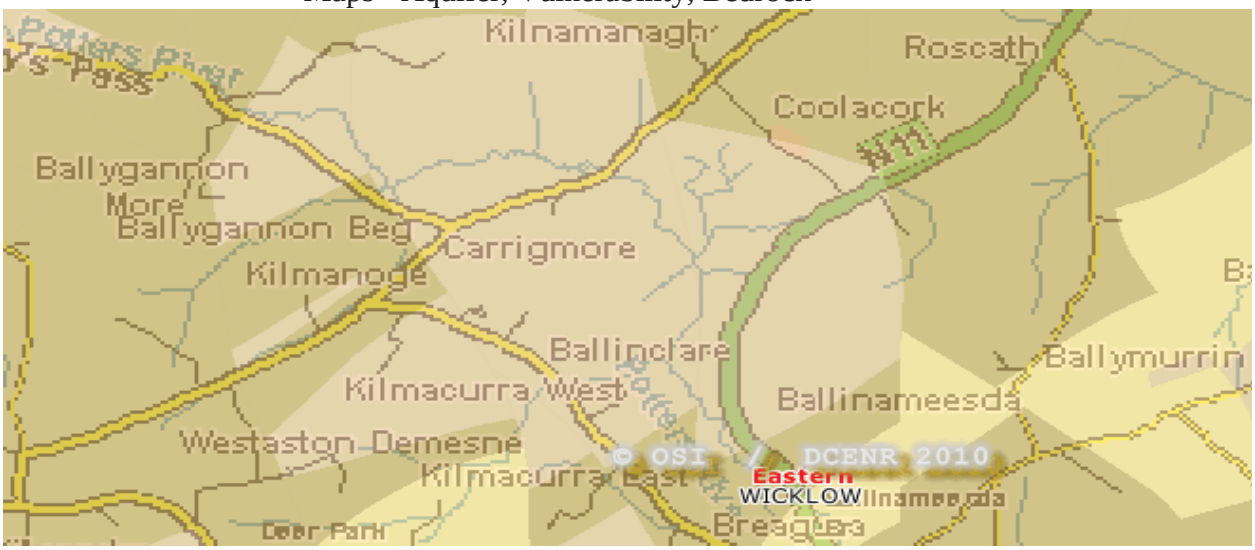
Date of Report: 30/10/2014

Phone: 086 2434828 Fax: e-mail eugenembolton@gmail.com

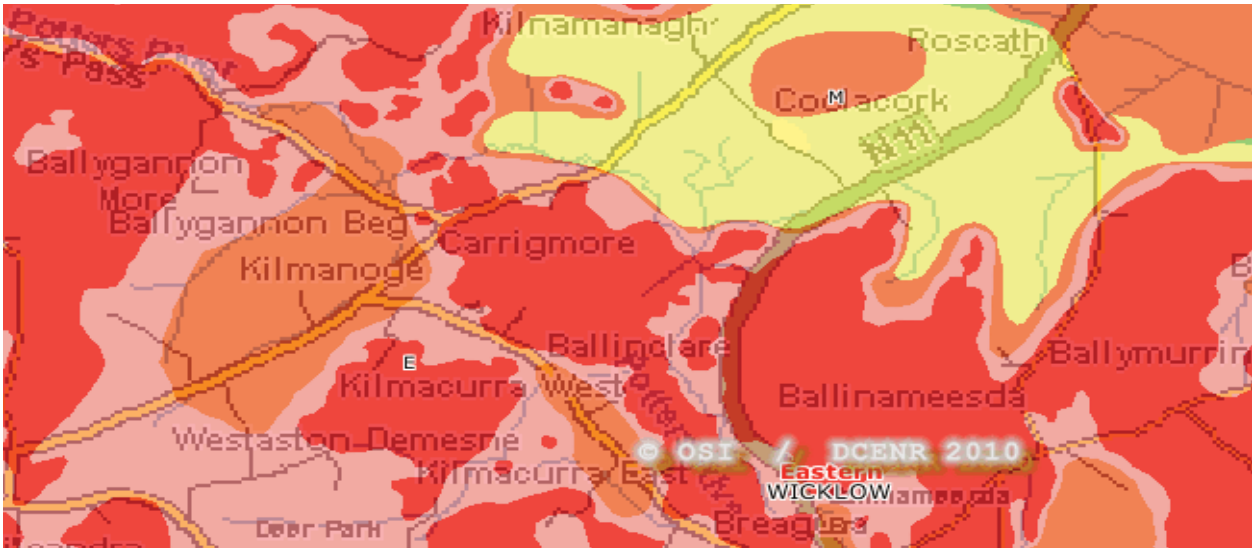
Indemnity Insurance Number: BOEU01PI901

Signature: 

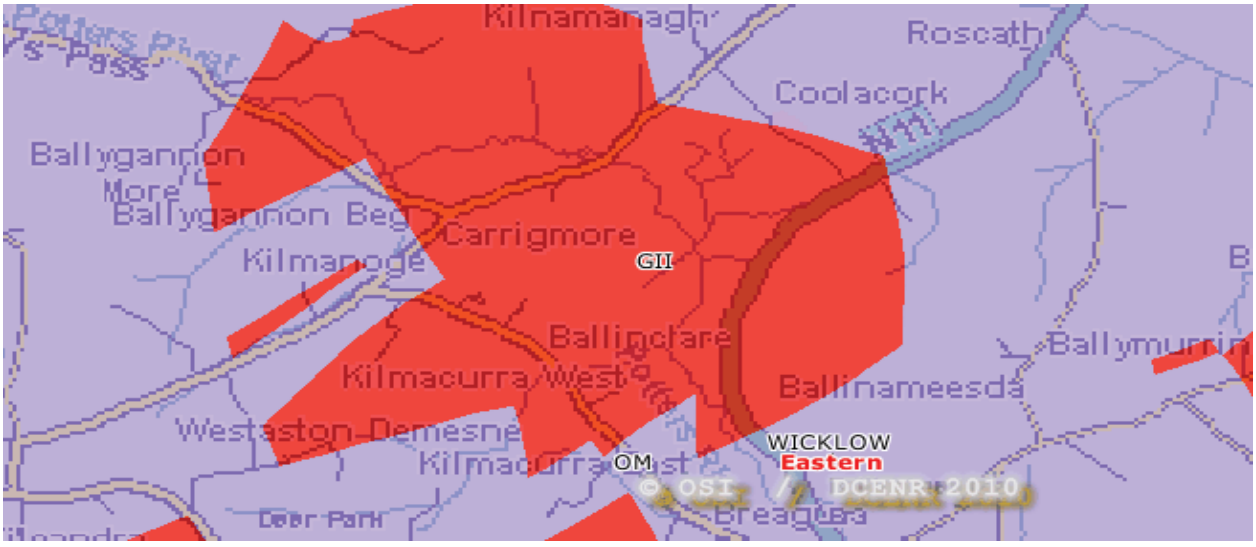
Maps - Aquifer, Vulnerability, Bedrock



Aquifer is PI

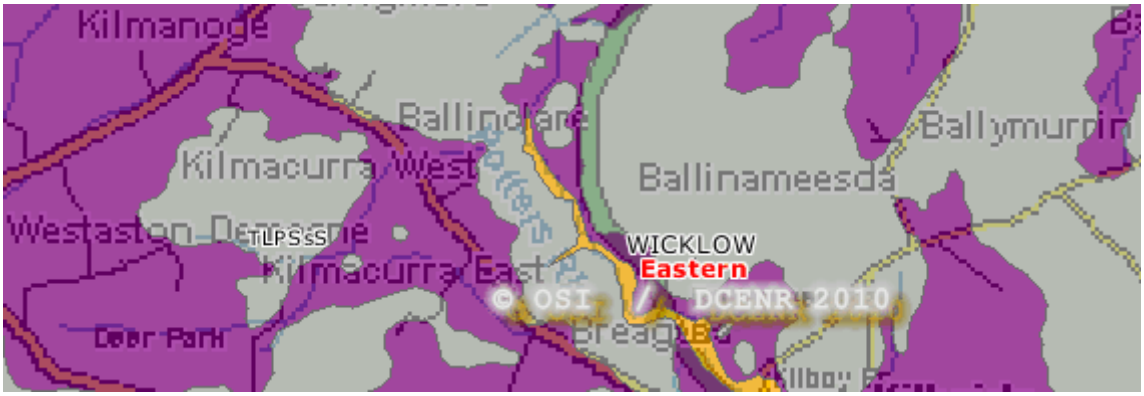


Vulnerability is Extreme



Bedrock Granites and other Igneous Intrusive Rocks

Soil



Teagasc Subsoils	
Parent Material Code:	Rck
Subsoil Name:	Bedrock outcrop and subcrop
Description:	Bedrock at surface
County:	WICKLOW

Site Location

Photos

T1

T2

T3

Trial Pit#

Site specific report - Mr. Kilsaran Concrete, Ballinclare Quarry, Wicklow, Co. Wicklow

Site Report no. 73

Site assessor

Dr. Eugene Bolton
Clonfert
maynooth
Co. Kildare
* Address is the site address

Planning applicant*

Mr. Kilsaran Concrete
Ballinclare Quarry
Wicklow
Co. Wicklow

Specifier details

Dr. Eugene Bolton
Clonfert
maynooth
Kildare

Type of system

Based on the information provided for the above location by the customer's representative, the wastewater generated from the proposed dwelling will undergo primary, secondary & tertiary treatment as follows:

• Primary treatment and secondary treatment within a Anua Platinum Aeration Treatment Unit.

• Tertiary treatment through a two modular Puraflo Wastewater treatment System. This will reduce the BOD: TSS to a < 10:10 standard and will also allow for substantial reduction in micro organisms, 99.9 % removal of total coliforms and pathogenic bacteria absent.

• Final Polishing via gravity discharge through a soil polishing filter sized/designed in accordance with the EPA's recent 'Clarification on disposal of effluent from Polishing Filters for Tertiary Treatment Systems'.

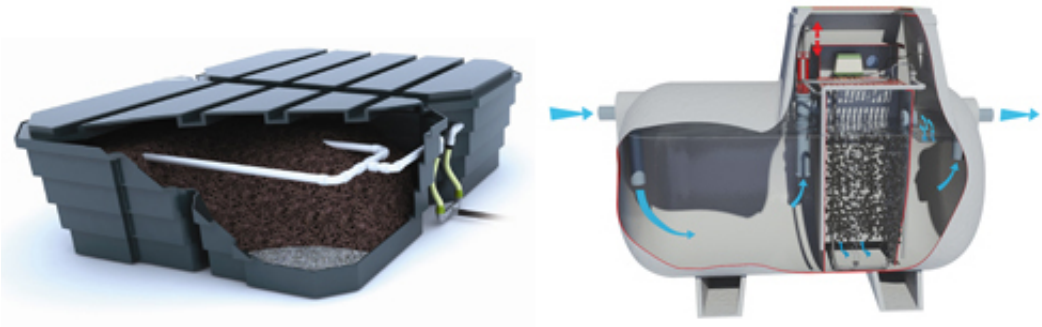
System description

Tertiary Treatment System:

Tertiary wastewater treatment systems provide additional treatment to wastewater from secondary treatment systems. Essentially, an additional or 'tertiary treatment' stage is added to a standard wastewater treatment system which raises the effluent quality before it is discharged to the receiving environment.

Many sites are refused planning permission because they are deemed too 'environmentally sensitive', or the site is simply too small to build on, or the site is too small to accommodate a polishing filter/percolation area designed in accordance with Section 10.1 of the EPA CoP 2009.

However, in certain circumstances, proposing the installation of an Anua 'Tertiary Treatment System' i.e. the Platinum Aeration Treatment Unit followed by the Puraflo Peat Biofilter system can overcome certain 'planning hurdles' or 'site restrictions'.



Primary & Secondary Treatment using the Platinum Aeration Treatment system

The Anua Platinum Aeration Treatment system is in itself a three stage treatment unit incorporating a primary settlement phase, a submerged

biological aerated filter, and a final settlement phase.

The primary settlement phase provides for the initial settlement and separation of the gross solids. Once the solids have settled the liquid effluent passes forward for treatment in the submerged biological aerated filter (BAF).

The BAF phase is the treatment zone and it contains a set of inactive modules media blocks that provide a large surface area on which naturally occurring bacteria can develop. The bacteria require oxygen which is supplied by a linear low pressure compressor via porous membrane known as diffusers, beneath the media bed.

In the final settlement phase, as the bacteria in the submerged aerated filter dies off, it falls away from the media and is passed forward to the settlement chamber where it settles, further reducing the level of suspended solids in the final effluent.

The only moving part in the Platinum 6 is a small compressor unit which has a 50 watt power consumption and requires no lubrication whatsoever. This compact, highly efficient unit is housed on a separate enclosure above the water level of the system. The compressor works on the principle of electromagnetic oscillation. This means that it is completely oil free and has no sliding parts (it is the sliding parts which can give trouble in other types of compressor). It also means the compressor is very efficient and requires far less power to operate than other types. An added bonus is that this makes the unit virtually silent in operation.

The Platinum 6 has a continuous recycle system and secondary sludge return system (features normally only found on much larger and more expensive plants). These features ensure that the sewage liquor is passed through the filter media over and over again resulting in improved solids breakdown.

The system produces a final effluent of 20 mg/l:30mg/l BOD:TSS, which is normally suitable for discharge to an approved percolation area. However, given the marginal conditions of the site, it is proposed to further 'polish' the effluent with the Puraflo Peat Biofilter before final disposal.

Tertiary Treatment using the Puraflo Peat Biofilter system

The highly treated effluent from the Platinum Aeration System unit shall be evenly distributed over the surface of the Puraflo peat biofibrous media and will percolate through the media before emerging as a treated liquid at the base of the unit.

The Puraflo system consists of 700mm depth of a biofibrous media, thus providing additional vertical separation and added afforded protection to the subterranean environs and groundwaters.

The Puraflo technology is based on simple passive, biofiltration principles. The bio-filter is low maintenance and requires no desludging or backwashing. Provided that the primary/septic tank and sump unit are maintained by regular desludging, as required, the system will continue to operate efficiently

The expected level of treatment is a minimum of 10:10 BOD:TSS with 99.9% removal of faecal coliforms, with pathogenic bacteria absent.

The Puraflo Peat Biofilter is now recognised by most Local Authorities as the only system meeting strict requirements for the removal of pathogenic organisms for use in areas where the groundwater is at risk.

The Puraflo unit is installed by trained Anua installers. An electrical control panel and alarm warning system, essential elements of a wastewater treatment system, are included in the price. A sample chamber is provided to allow sampling of the highly treated effluent. The media is housed within containers that cannot be accessed easily by the general public thus safeguarding against unwarranted interference.

The system is ideally suited for intermittent or seasonal use, achieving consistently high treatment results even under variable and/or seasonal loading conditions.

The efficiency of the system does not diminish with time. In fact, the long life of the system coupled with the very low maintenance requirements ensures that the Puraflo® Peat Biofilter will be the most cost-effective solution for years to come.

Site details

Groundwater protection responses

R2[1]: The site has been categorized with a groundwater protection response of R2[1].

Therefore, the site is deemed acceptable subject to normal good practice. Where domestic water supplies are located nearby, particular attention should be given to the depth of subsoil over bedrock such that the minimum depth required i.e. 0.9m (Table 6.2,

	Section 6, EPA CoP 2009) is met and the likelihood of microbial pollution is minimised.
Depth of trial hole	A trial hole was excavated to a depth of **1.6m** BGL
Depth to bedrock	Bedrock was encountered at **1.6m** BGL
Depth to watertable	No watertable was encountered.
Mottling	No mottling was evident.
P value	No P value recorded.
T value	A T value of **6** was recorded

Polishing filter details

Polishing filter

Tertiary wastewater treatment systems provide additional treatment to wastewater from secondary treatment systems. Essentially, an additional or 'tertiary treatment' stage is added to a standard wastewater treatment system which raises the effluent quality before it is discharged to the receiving environment. Many sites are refused planning permission because they are deemed too 'environmentally sensitive', or the site is simply too small to build on, or the site is too small to accommodate a polishing filter/percolation area designed in accordance with Section 10.1 of the EPA CoP 2009. However, in certain circumstances, proposing the installation of an Anua 'Tertiary Treatment System' i.e. the Platinum Aeration Treatment Unit followed by the Puraflo Peat Biofilter system can overcome certain 'planning hurdles' or 'site restrictions'. Given the area restrictions of the site, the treated effluent from the Puraflo Tertiary Treatment System will be discharged via gravity through a soil polishing filter sized/designed in accordance with the EPA's 2012 Clarification on disposal of effluent from Polishing Filters for Tertiary Treatment Systems. Recent EPA Clarification: The EPA has recently provided clarification on the disposal of effluent from Tertiary Treatment Systems. The reason for the clarification was that up until now, the EPA's 2009 Code of Practice provided no guidance on what to do with the effluent discharging from tertiary treatment systems (sand filters, reed beds, peat filters or package treatment systems).According to the under-riding principles of the Code, the tertiary treated effluent has been treated to a high enough standard such that it can discharge to the groundwater. However, the hydraulic issue still needs to be accounted for such that the effluent does not back up and create problems to the tertiary treatment process itself. Hence, some calculations have been carried out to discharge an appropriate percolation area for the discharge of such clean effluent depending on the T-value of the subsoil into which it is being discharged.

Size of Polishing Filter/Percolation Area

These calculations (which include a safety factor of 3.5) show that the area of subsoil required for the discharge of tertiary treated effluent, A, is as follows:- A = 0.125 x T (M2 per P.E.)

Polishing Filter Area Calculation:

Maximum Occupancy:	4 people (P.E.)
1 Person:	150 litres/wastewater/day
Percolation Values (T) value:	6
Soil Disposal Method:	Direct Discharge
Size of Polishing filter required:	A = 0.125 x T (M2 per P.E.) A = 0.125 x 6 (M2 x 4) A = 3 m^2

The highly treated wastewater from the Puraflo system will be discharged by gravity via distribution gravel to the 3 m^2 soil polishing filter situated adjacent to/underneath the modules.

Invert level

The invert level to percolation shall be located such that there is at least 0.9m of suitable unsaturated soil above the watertable or bedrock in accordance with a groundwater protection response of R2[1].

Minimum separation distance

Precise siting of the effluent treatment system and subsequent percolation area should be such that the appropriate setback distances are maintained.

Receptor	Septic Tank, intermittent filters, packaged systems, percolation area, polishing filters (m)
Wells[1]	-
Surface water soakaway[2]	5
Watercourse/stream[3]	10
Open drain	10
Heritage features	-
NHA/SAC[3]	50
Lake or foreshore	7 septic tank; 10 percolation area
Any dwelling house	3
Site boundary	3
Trees[4]	4
Road	4
Slope/break cuts	-

[1]See Annex B: Groundwater Protection Response.
[2]The soakaway for surface water drainage should be located down gradient of the percolation area or polishing filter and also ensure that this distance is maintained from neighbouring storm water disposal areas or soakaways.
[3]The distances required are dependent on the importance of the feature.
[4]Tree roots may lead to the generation of preferential flow paths. The canopy spread indicates potential root coverage.

Conclusion

The treated effluent from the Tertiary (EPA Clarification) system will permeate through the polishing filter for tertiary polishing before discharge to the insitu subsoil. Any remaining residual contaminants will be depleted by attenuation before reaching the groundwater.

It is contended that this treatment and disposal method will work satisfactorily at the above site, and conforms to all EPA guidelines.

Please note that the recommendations outlined in this site report are subject to the installation of the specified Anua system only. Any deviation from the specified system renders the recommendations of this report null and void.

Compiled by the Anua Sales Team.

Ph: 1850 381136
Email: irlinfo@anuainternational.com
Web: www.anuainternational.com

APPLICANT TO ENSURE COMPLIANCE WITH THE EPA'S CODE OF PRACTICE AND THE PLANNING AUTHORITY'S REQUIREMENTS.

THIS REPORT IS FOLLOWED OR ACTED UPON ENTIRELY AT THE RISK OF THE SPECIFIER AND ACCORDINGLY ANUA WILL NOT, UNDER ANY CIRCUMSTANCES BE LIABLE TO THE PLANNING APPLICANT FOR ANY LOSS, DAMAGE OR EXPENSE INCURRED IN RESPECT OF RELIANCE ON THIS REPORT AND THE SPECIFIER ACCEPTS FULL RESPONSIBILITY FOR THE CONSEQUENCES OF ANY INACCURACIES THEREIN.

Puraflo

Wastewater Treatment System for the Residential Market

ANUA

Technology That Serves Customers and the Environment

Anua means 'to renew'. It describes our renewed contract with nature and our renewed focus on the development of innovative environmental solutions. We continue to develop and produce the sustainable technologies that our customers demand.

Anua is part of Bord na Móna, a highly successful organisation and Ireland's leading resources company for over 75 years, which has a unique heritage and understanding of the natural environment. Bord na Móna has used its expert insights into natural processes, allied to its excellent in-house research facilities, to develop sustainable solutions across a wide range of environmental challenges – wastewater treatment, odour abatement, land reclamation, power generation, resource recovery and renewable energy. This is both Anua's history and our mission for the future.

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Complete Solutions

We don't just sell technologies. With our extensive laboratories and Innovation Centres located in Europe and the USA, we understand new challenges, pioneer research and create new processes. We work with you to create the systems you require, ensure correct installation and offer the full services of our nationwide network of support agents and technicians. From pre-planning to installation, service and maintenance, as well as the offer of monitoring and laboratory services, Anua stands by its technology and its customers.

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We're with you every step of the way.

The Environmental Advantages of Puraflo

- Puraflo is a 100% natural system that draws on the remarkable filtration properties of peat and uses no chemical additives in achieving exceptional results.
- Puraflo's unique bio-fibrous peat filter provides unsurpassed treatment of domestic water, reducing the risk of pollution whilst providing protection for homes, the environment and public health.
- Low carbon footprint.
- 99.9% reduction in total coliforms.
- Elimination of pathogenic bacteria.
- Micro-biological treatment of wastewater.
- Phosphorous reduction <2mg/litre*.
- Existing septic tank system can be easily upgraded to a high performance treatment plant by adding Puraflo modules.
- The media covering the effluent distribution grid in the Puraflo module has odour absorption properties therefore suppressing sewage odours.

*optional extra if required

The Puraflo Advantages for You

- Puraflo has minimal power requirements, costs typically averaging approximately €10 per annum.
- The modular design of Puraflo can be installed above or at ground level. Puraflo units do not require concrete backfill and can utilise the existing excavated material as backfill.
- The Puraflo bio-filters require no de-sludging or backwashing. Provided the septic tank and sump receive regular de-sludging, the system will continue to operate efficiently.
- Intermittent or seasonal flows have no detrimental effect on treatment levels, making Puraflo ideally suited where fluctuating loads are expected.
- The use of a septic tank means fewer de-sludging operations and reduced operational costs.
- The only mechanical device in the system is the pump, which works on an intermittent basis, minimising the possibility of mechanical problems.
- To further enhance the treated effluent quality with a tertiary treatment option the treated effluent can be passed through an additional Puraflo module capable of achieving a 5:5mg/1 BOD: SS standard.

The Puraflo Residential System At Work

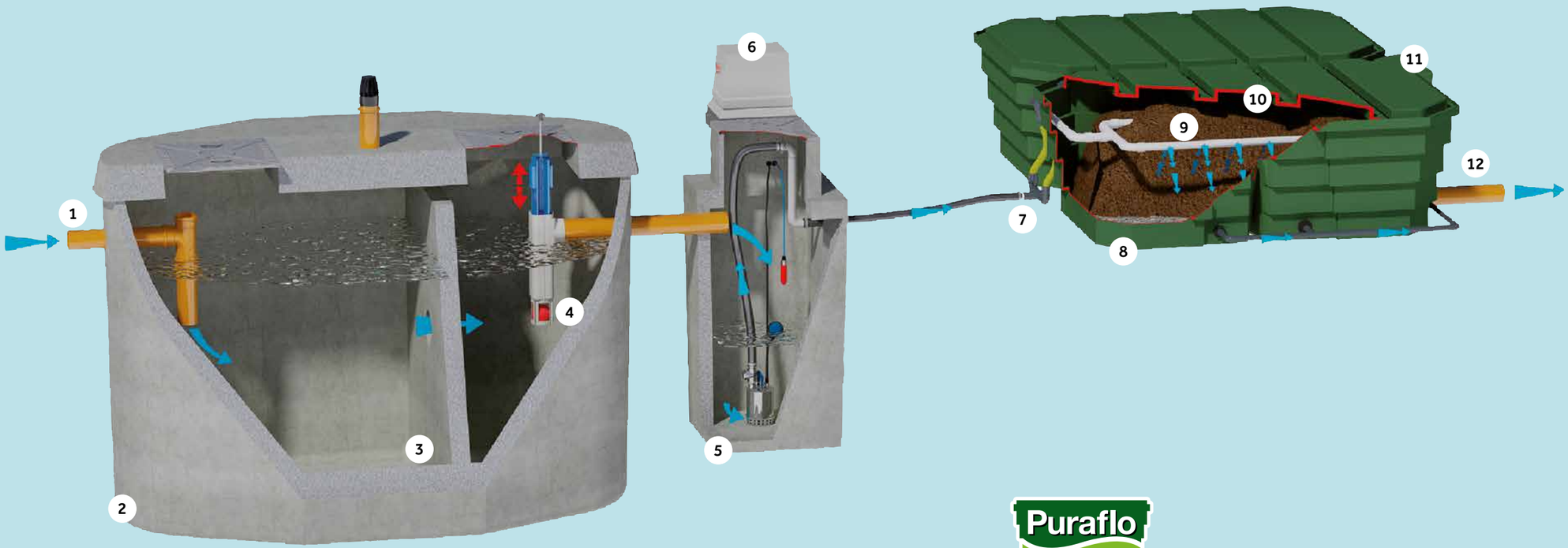
The Puraflo Residential System is an advanced sustainable technology for the treatment of wastewater in domestic homes.

Stage One: Primary Settlement - Physical Treatment

1. The wastewater from the house flows into the septic tank.
2. Initial settlement occurs.
3. The gross solids sink to form a sludge layer at bottom of the tank.
4. The liquid effluent flows by gravity into the pump chamber.

Stage Two: Puraflo Biofiltration - Secondary Treatment

5. The liquid effluent is pumped to the Puraflo modules.
6. A pipework system at top level in the modules evenly distributes the effluent onto a naturally occurring filter media.
7. A combination of biological, chemical and physical processes treat the effluent as it filters through the media in the modules.
8. The treated effluent emerges from the modules through the outlet pipework for an approved disposal method.



The illustration above is a typical Puraflo System installation

For further information about how the Anua Puraflo Residential system works, go to www.anuainternational.com

Diagram Index

Stage One
1 Inlet pipe
2 Septic tank
3 Baffle wall
4 Effluent filter
5 Pump chamber
6 Control panel

Stage Two
7 Inlet pipe
8 Puraflo module
9 Distribution pipework
10 Biofibrous peat
11 Sample chamber
12 Outlet pipe

Sewage Treatment Simplified

Sewage Treatment: Combination of physical and biological processes which breakdown the organic and inorganic sewage content which cause pollution to receiving waters.

Receiving Waters: All groundwaters and watercourses such as streams and rivers.

Population Equivalent (PE): A measure of the number of people the treatment plant serves.

Media: Bio-fibrous peat.

Sludge: The solids that settle to the bottom of the tank chambers.

BOD: Biological Oxygen Demand measured in milligrams per litre (mg/l) is a relative measure of how polluting the sewage is.

SS: Suspended Solids measured in milligrams per litre (mg/l) includes all suspended matter both organic and inorganic.

Coliform bacteria : A commonly used bacterial indicator of sanitary quality of foods and water.

Pathogenic Bacteria: Pathogenic bacteria such as Streptococcus are bacteria which cause disease in humans and animals.

The Puraflo Residential System has undergone a rigorous performance testing regime to achieve the highest results required. The tables alongside show the sizes and the wastewater treatment capability of Puraflo.

If you have any specific requirements, the Anua sales team will assist and guide you along from enquiry stage through to after-sales service.

Treated Wastewater Quality

pH (pH units)	5-8
BOD (mg/l)	<15
SS (mg/l)	<15
NH_2-N (mg/l)	< 5
Nitrate - N (mg/l)	20
Total Coliforms elimination	>99.9%
Faecal Coliforms elimination	>99.9%
*Patogenic Bacteria	Absent

*Including Salmonella spp, Shigella spp, Sulphide reducing Clostridia, Staphylococcus and Psudomonas aeruginosa.

Puraflo Module Dimensions

Length	2,150 mm
Height	760 mm
Width	1,400 mm

Meeting the Highest Standards

Anua is committed to meeting and surpassing the highest quality standards required for each of its products. That's why you will always see national and/or international standards, accreditations for all Anua products.

Simple Installation, Minimum Maintenance

While the Puraflo Residential sewage treatment system is made up of a number of separate components, we understand the pressures to minimise installation costs while maintaining quality. Therefore we design and manufacture the system to provide a packaged solution with ease of installation and reduced maintenance in mind.

The Anua Guarantee

Every Puraflo Residential System comes with a 12-month parts and labour warranty, but Anua's commitment to you goes far beyond this.

We have a national network of approved agents and installers, who will provide you with:

- **Free Pre-Planning and Site Reports**
- **Free No Obligation Quotations**
- **Expert Customer Support**
- **Nationwide Maintenance Call-out Service**

For further information, go to
www.anuainternational.com

Complementary Products for the Puraflo Residential System

- Plant Alarm System
- High Level Alarm(s)
- Sample chambers
- Weatherproof GRP Enclosures & Kiosks
- Nutrient removal for SSI (Special Scientific Interest) areas
- Tertiary treatment for enhanced treatment levels

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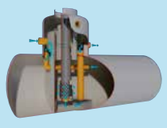
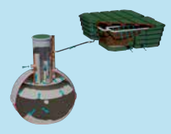
For further information, go to **www.anuainternational.com**

Renew	Recover	Re-direct	Recycle	Rarefy	Retain
					
Wastewater Treatment	Rainwater Harvesting	Pumps	SUDS	Odour Abatement	Holding Tanks

In keeping with company policy of continuing research and development and in order to offer our clients the most advanced products, Anua reserves the right to alter specifications and drawings without prior notice.

Platinum

Wastewater Treatment for the Residential Market

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Bord na Móna ~ with nature

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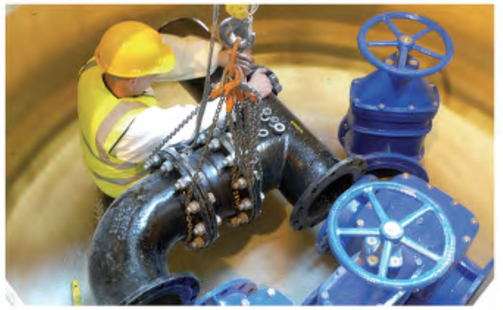
The Platinum Residential System

Platinum is an advanced sustainable technology for the treatment of wastewater in domestic homes.

Naturally occurring micro-organisms present in the sewage remove the biological (organic) content which causes water pollution. Our system provides the conditions for these micro-organisms (biofilm) to grow, providing highly efficient treatment to achieve a high standard final effluent quality.



The Environmental Advantages of Platinum	The Platinum Advantages for You	
Protection of groundwaters	Simple minimal maintenance	Low sludge production
Low power usage	No moving internal parts	Automatic sludge /effluent recycle system
No chemical additives	Ease of installation	Highly effective certified performance
No noise pollution	Complete underground installation	Proven reliability
Designed for minimal visual impact	Low energy consumption	

Testing Institute for Wastewater Technology

PERFORMANCE RESULTS

Anua – Bord na Móna

Main Street, Newbridge,
Co. Kildare, Ireland

part of which is

Anua

Polden Business Centre,
Bistol Road, Bridgwater,
TA6 4AW, United Kingdom

EN 12566-3

Results corresponding to the Irish National Annex for IS EN 12566-3

Platinum small wastewater treatment system

Fluidised bed reactor

Nominal organic daily load*	0.33	kg/d	
Nominal hydraulic daily load	0.90	m³/d	
Material	GRP		
Structural behaviour (calculation)	pass (also wet conditions)		
Durability	pass		
Watertightness (water test)	pass		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	COD	92.9 %	52 mg/l
	BOD_5	96.5 %	12 mg/l
	SS	96.2 %	16 mg/l
	NH_4-N**	98.1 %	0.7 mg/l
Electrical consumption	0.68	kWh/d	

* *at a test influent of ≥ 300 mg/l BOD_5 (mean)*

** *determined for temperatures ≥ 12°C in the bioreactor*

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
D-52074 Aachen

Certified according to ISO 9001:2008

Notified Body number: 1739

This document replaces neither the declaration of conformity nor the CE marking.

Prüfinstitut für Abwassertechnik GmbH
geprüft - tested - testé

Elmar Lancé July 2012

The Platinum Residential System At Work

Stage One: Primary Settlement - Physical Treatment

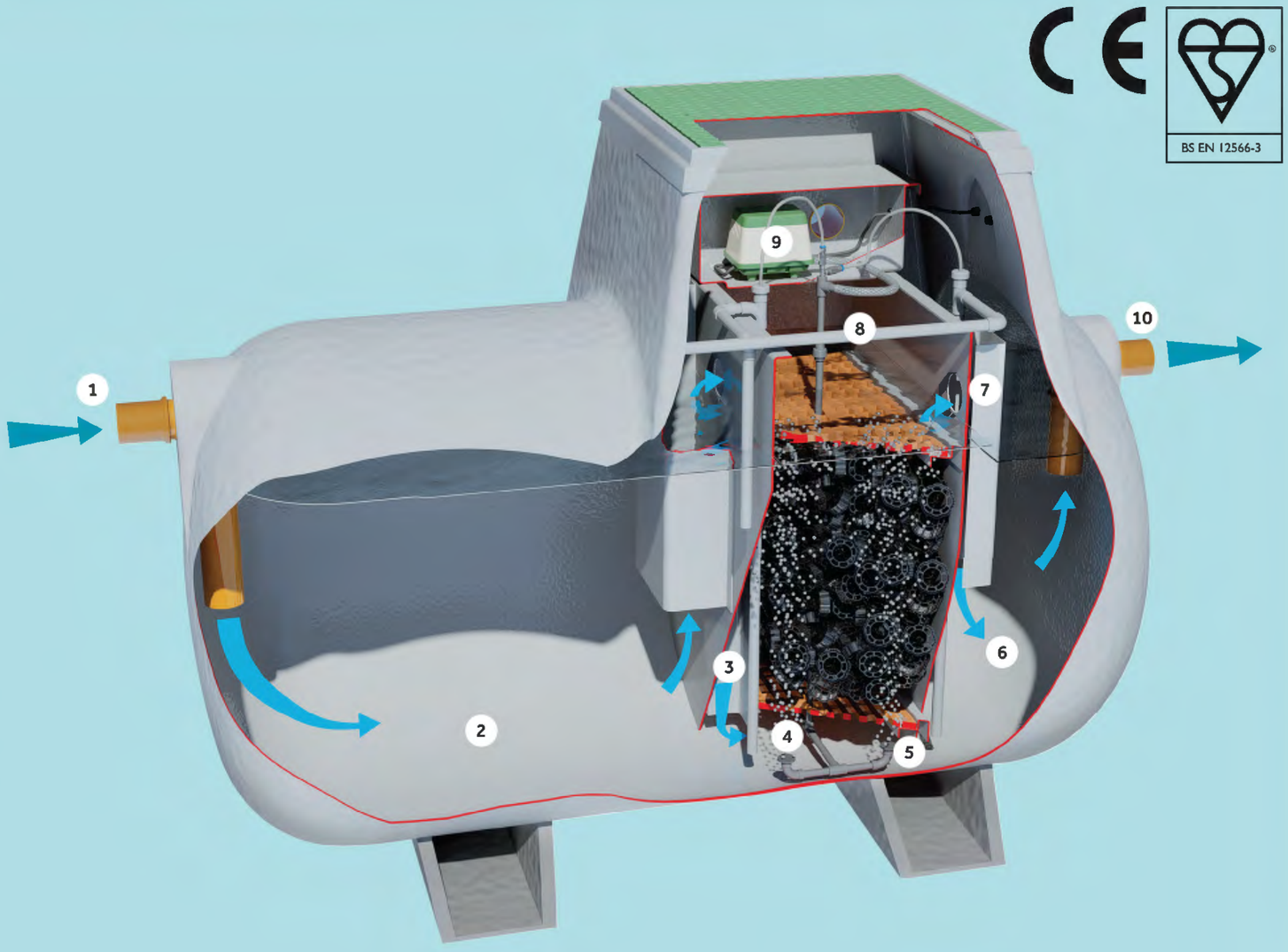
1. The wastewater from the house flows into the primary chamber.
2. Initial settlement occurs.
3. The gross solids sink to form a sludge layer at the bottom of the tank.
4. The settled liquid effluent passes forward for treatment in the aeration zone.

Stage Two: Submerged Aerated Filtration - Biological Treatment

5. The lightweight durable filter media in the aeration zone provides a large surface area where the naturally occurring micro-organisms develop into a thin layer called a biofilm.
6. In conjunction with the media, oxygen is pumped into the liquid effluent by a compact, highly efficient air blower via a diffuser grid, supplying the oxygen required for the micro-organisms to develop and survive.
7. As the sewage makes contact with the media, the micro-organisms come in contact with the sewage to reduce levels of contaminants, ensuring it reaches the necessary treatment standard.

Stage Three: Final Settlement - Physical Treatment

8. As the micro-organisms are regenerated, the oldest layer of the biofilm is removed from the media and passes with the effluent into the final chamber. Here settlement of this layer and any remaining solids occurs, reducing the levels of the SS (Suspended Solids) in the final effluent.
9. When these solids settle as sludge, they are returned via the sludge return system to the primary settlement chamber for storage. This application also allows enhanced treatment of the effluent as it is recycled through the system.
10. The clarified liquid effluent then emerges from the Platinum system for an approved disposal method.



The product shown above is for illustration purposes only.
For further information, go to **www.anuainternational.com**

Diagram Index

1 Inlet
2 Primary settlement
3 Inlet duct to aeration
4 Aeration zone
5 Diffuser arrangement
6 Secondary settlement zone / Clarifier
7 Inlet to Clarifier
8 Sludge return line
9 Air blower
10 Outlet

Sewage Treatment Simplified

Sewage Treatment: Combination of physical and biological processes which breakdown the organic and inorganic sewage content which cause pollution to receiving waters.

Receiving Waters: All groundwaters and watercourses such as streams and rivers.

Population Equivalent (PE): A measure of the number of people the treatment plant serves.

Biofilm: A thin layer of micro-organisms attached to a media.

Media: Any material or surface which allows growth of Biofilm.

Sludge: The solids that settle to the bottom of the tank chambers.

BOD: Biological Oxygen Demand measured in milligrams per litre (mg/l) is a relative measure of how polluting the sewage is.

SS: Suspended Solids measured in milligrams per litre (mg/l) includes all suspended matter both organic and inorganic.

Typical Design Detail*

Model Reference	APG6	APG8	APG10
Population Equivalent (PE)	6	8	10
Max BOD (kg/day)	0.36	0.48	0.6
Daily Design Flow Rate (m^3/day)	0.9	1.2	1.5

Treated Effluent* - EN12566-3 Test Results

	Efficiency	Effluent		Efficiency	Effluent
COD	92.9%	52mg/l	NH_4-N	98.1%	0.7mg/l
BOD_5	96.5%	12mg/l	N_{tot}	71.2%	19.4mg/l
SS	96.2%	16mg/l	P_{tot}	47.6%	3.9mg/l
Electrical Consumption			0.68	kWh/d	

Typical Specification*

Model Reference	APG6	APG8	APG10
Inlet Invert Depth from cover (mm)	750	750	750
Outlet Invert Depth from cover (mm)	850	850	850
Inlet/Outlet Diameter (mm)	110	110	110
Overall Length (mm)	2600	2800	3000
Overall Depth (mm)	2100	2100	2100
Overall Width (mm)	1500	1500	1500
Electrical Requirement (voltage/phase)	230v1ph	230v1ph	230v1ph
Dry Unit Weight (kg)	250	300	350

*Details correct at time of going to press.

Platinum Pump Unit Detail*

Discharge Pipework Size	1 1/2 inch BSP Female
Discharge Pipework Material	PVC
Power Rating	0.55 KW (typical standard pump)
Electrical Requirement (voltage/phase)	230v 1ph
Air Blower Location	External Weatherproof Housing

Pumped Outlet Units: Platinum residential systems can be supplied with an integral pump unit where required. The standard pump typically has a power rating of 0.55 kW.

The Correct Solution for You

The Platinum Residential System has undergone a rigorous performance testing regime to achieve the highest standards required by EN12566 Part 3. The tables, (to the left), are a guide in selecting the best treatment solution for your needs. If you have any specific requirements the Anua sales team will assist and guide you along from enquiry stage through to after-sales service.

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Complementary Products for the Platinum Residential System

Alarm Systems
- General Plant Alarm
- Pressure Alarm
- High Level Alarm

Sample chambers

Weatherproof GRP Enclosures & Kiosks

Nutrient removal for SSI (Special Scientific Interest) areas

Tertiary treatment for enhanced treatment levels

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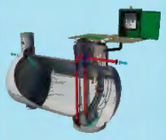
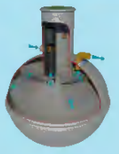
Renew	Recover	Re-direct	Recycle	Rarefy	Retain
					
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