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HYDROLOGY AND HYDROGEOLOGY 7

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 operation of a construction and demolition (C&D) waste recovery facilities and the backfilling of an existing hard rock quarry by way of an inert landfill at Ballinclare Quarry, near Kilbride, Co. Wicklow by Kilsaran Concrete Unlimited Company (hereinafter 'Kilsaran' or 'the Applicant').

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.

7.3 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 will provide for an integrated waste management facility for inert C&D waste at the application site.

7.4 The inert wastes to be imported and backfilled at the landfill facility 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 for disposal at the landfill facility will comply with the waste acceptance criteria (WAC) for inert landfills set by Council Decision 2003/33/EC.

7.5 As part of the development, 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 basal and side clay liners required for the inert landfill.

7.6 On completion, the inert landfill will be restored to a long-term native woodland habitat, similar to that which existed prior to quarry development, and will include provision for establishment of native oak plantations in defined areas around the site.

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

- Installation and operation of a soil washing plant at the former concrete / asphalt yard to produce construction grade sand and gravel aggregate from imported excess soil and stone. The soil washing plant comprises a loading hopper, a number of soil screens in series with connecting conveyor systems, a primary wastewater treatment tank (thickener), a buffer tank holding sludge and recycled water, an elevated plate press and filter cake discharge area;
- Construction of a close-sided industrial shed (portal frame structure with roof mounted solar panels) at the existing paved area to the west of the access road 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 external paved and hardstanding areas surrounding the C&D waste processing shed for the external handling and storage of both unprocessed and processed C&D wastes;
- Separation of any intermixed solid construction and demolition (C&D) wastes (principally metal, timber, PVC pipes and plastic) prior to its removal off-site to authorised waste disposal or recovery facilities;
- Substantial backfilling of the existing quarry void to a maximum level of 80mOD through disposal of imported inert soil and stone waste and residual fines from the soil washing process and the use of non-waste soil by-product for engineering, capping and/or landscaping purposes

- The progressive restoration of the completed landfill landform to long-term native woodland habitat;
- Continued use of established site infrastructure and services including, site / weighbridge office, staff welfare facilities, surface water run-off and wastewater treatment systems, weighbridge, garage / workshop, wheelwash, hardstand areas, fuel and water storage tanks to service the proposed development;
- Clearance of vegetation and felling of a number of mature trees to facilitate widening of the internal site access road and make provision for off-road queuing of inbound HGVs within the application site boundary;
- Decommissioning of any remaining fixed plant and infrastructure associated with former rock extraction or concrete / asphalt production activities;
- Off-site removal of any waste materials or bulky wastes associated with former quarrying or production activities;
- Installation of a new weighbridge along the inbound lane of the quarry access road;
- Installation of an additional wheelwash facility on the eastern side of the former concrete / asphalt yard;
- Modification / upgrade of existing drainage channel along the site access road, Installation of silt trap and hydrocarbon interceptor to treat run-off and provision of additional pumping capacity to transfer run-off from existing surface water pond at site entrance to quarry sump
- Installation of a silt trap and hydrocarbon interceptor at the proposed C&D waste recovery facility to treat run-off prior to being pumped to the soil wash plant or surface water ponds elsewhere on site.
- Installation of a sub-surface concrete wastewater holding tank;
- Construction and establishment of an on-site (passive) wetland treatment system and any associated drainage infrastructure to treat / polish water collected from the active backfilling / landfilling cells prior to its discharge off-site to the Ballinclare Stream;
- Re-use of an existing storage shed as a dedicated waste inspection and quarantine facility to inspect and store suspect waste consignments as required. Any waste which has been accepted at the facility and which is likely (on basis of visual inspection) or confirmed (on basis of compliance testing) to be non-compliant with waste acceptance criteria for the facility will be temporarily stored at this location pending results of further waste classification testing and a decision as to how and where they should ultimately be disposed of or recovered;
- Re-alignment, upgrading and ongoing maintenance of internal haul routes across the application site;
- Temporary stockpiling of topsoil pending re-use as cover material for final restoration of the inert landfill / backfilled quarry void;
- Implementation of a series of measures to enhance local biodiversity including the retention of habitats and features of biodiversity value (e.g. ponds, buildings), quarry face retention for nesting peregrine falcon, establishment of an artificial sand martin colony, creation of roost space / deployment of bird boxes for bats, creation of habitat / erection of bird nest boxes for breeding / roosting birds and erection of fence along the site perimeter to include access points for mammals.
- Environmental monitoring of noise, dust, surface water and groundwater for the duration of the landfilling and restoration works and C&D waste recovery / recycling activities and for a short period thereafter;
- All ancillary site works, landscaping and perimeter fencing.

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 and 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 / groundwater at the application site are:

- The placement of imported inert soil and stone in the quarry void in terms of the potential effects on groundwater;
- The storage of C&D materials at the site in terms of the potential effects on groundwater and surface water;
- 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 / recycling activities on surface water and groundwater;
- A review and assessment of issues previously raised in the previous Strategic Infrastructure Development (SID) application for a waste management facility at the application site and associated Inspectors Report (Ref. No. ABP-309991-21), specifically related to the water environment; and,
- Where necessary, recommendation(s) of mitigation measures to reduce or eliminate any potential impact(s).

Consultations / Consultees

Previous SID Application (2021)

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 C&D recovery / recycling activities and their impact on local groundwater resources and on the Potters River.

7.14 As the development constituted 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. Specific feedback provided at that time in respect of water related impacts was considered and addressed as appropriate in the EIAR which accompanied the SID application.

Current SID Application (2024)

7.15 A formal consultation exercise was undertaken with statutory consultees and nearby residents / members of the general public in August 2024. Details of these consultations and the feedback obtained therefrom is provided in a separate report submitted in support of this application. Any specific feedback provided in respect of water related impacts has been considered and addressed as appropriate in drafting this Chapter of the EIAR.

7.16 Water related issues raised during public consultation include:

- The proposal will occur below the water table and as a result presents a significant risk relating to groundwater quality, groundwater flow, and local groundwater users (e.g. domestic and farm wells).
- Drainage management and water discharge from the site will cause water quality and contamination impacts within the Potters River, and also to the downstream SAC at Brittas (Buckroney-Brittas Dunes and Fen SAC).
- There is insufficient site investigation and monitoring data to characterise the local hydrogeology and groundwater regime. Not enough borehole data to establish groundwater flow direction.
- Concern that backfilling will decrease available groundwater resources by disrupting groundwater flow patterns, and also effect local groundwater quality.
- Dewatering of the quarry commenced in advance of the determination of the current planning application.
- A detailed baseline monitoring proposal for water wells and groundwater quality and surface water quality should be implemented before the development proceeds.
- The lowest point of the site will be the swale and not the wetland, and water from the swale will discharge, completely untreated, into a dyke and onto the Potters River.

7.17 A review of the Inspectors report from the previous SID application (Ref. No. ABP-309991-21) indicated that the key issues to be resolved related to surface water quality and protection and its relationship to the ecological environment, and that groundwater (while also a very important issue) was not part of the core reason for refusal.

Contributors / Author(s)

7.18 This Chapter of the EIAR was prepared by HES on behalf of SLR and Kilsaran. Hydro-Environmental Services (HES) is a specialist geological, hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and its office is located in Dungarvan, County Waterford.

7.19 HES' core areas of expertise and experience include quarry hydrogeology and quarry drainage management. The company routinely completes impact assessments for hydrology and hydrogeology for quarries and infill sites, and a large variety of other project types.

7.20 This chapter of the EIAR was prepared by Michael Gill and Adam Keegan.

7.21 Michael Gill PGeo. (BA, BAI, Dip Geol., MSc, MIEI) is a Civil / Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of quarry extraction and infill projects in Ireland. He has worked on the following quarry infill assessments: Clasheen Pit (Killarney), Garyhesta (Cork), Middleton (Cork), Killarney East, Kilmeague (Kildare), and Kilmessan (Meath).

7.22 Adam Keegan PGeo (BSc, MSc) is a hydrogeologist with five years of experience in the environmental sector in Ireland. Adam has been involved in numerous hydrological and hydrogeological impact assessments, flood risk assessments and hydrogeological monitoring as part of the team at HES. Adam has worked on quarry infill assessments at Brownswood Quarry (Wexford), Clasheen Pit (Kerry) and Killarney East pit (Kerry).

Limitations / Difficulties Encountered

7.23 The assessment of the hydrological and hydrogeological environment is based published data / information, visual observations from various site visits, analyses and interpretation of surface water data and groundwater monitoring borehole data and sampling undertaken in 2019, along with contemporary monitoring and groundwater and surface water sampling completed in 2024.

7.24 While the site has its physical challenges, notably the localised presence of naturally occurring asbestos in bedrock, there were no other significant limitations / difficulties encountered during the preparation of this Chapter of the EIAR.

REGULATORY BACKGROUND

Legislation

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

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

- Environmental Impact Assessment Directive (2011/92/EU);
- 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).
- The management of waste from extractive industries (2006/21/EC); and,
- Environmental Liability Directive (2004/35/EC).

7.27 Other European Directives to which this EIAR Chapter refers are listed in Appendix 7-A. The Irish Government Acts, National Legislation and Regulations which apply to this hydrology and hydrogeology assessment are also listed in Appendix 7-A.

7.28 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:

1. “prevent or limit, as appropriate, the input of pollutants into groundwater and prevent the deterioration of the status of all bodies of groundwater;
2. 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;
3. 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;
4. 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. 722/2003] 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

7.29 Planning Policy and Development Control relating to surface water and groundwater at the application site is governed by the Wicklow County Development Plan 2022-2028.

Guidelines

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

- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);
- Environmental Protection Agency (2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- Environmental Protection Agency (1997): Landfill Manuals - Landfill Operational Practices;
- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on ‘Control of Water Pollution from Linear Construction Projects’ (CIRIA Report No. C648, 2006); and,
- National Roads Authority, 2008. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

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

Technical Standards

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

RECEIVING ENVIRONMENT

Study Area

7.33 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.

7.34 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

7.35 The methodology used in the investigation follows the guidelines and advice notes provided by the Environmental Protection Agency on environmental impact assessments (2022), and with due regard also had to the Institute of Geologists of Ireland’s (IGI) guidelines (2013).

7.36 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, including the previous EIAR and all available 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 monitored and assessed;
- Monitoring of groundwater level at the site, and in monitoring wells and domestic wells surrounding the site;
- Appropriate sampling of groundwater and surface water for baseline characterisation from the site and around and upgradient of the site; and
- Analysis of the all information gathered.

Sources of Information

7.37 The existing reports and EIAR 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;
- Environmental Impact Statement, Ballinclare and Carrigmore Townlands, December 2006; and,
- Environmental Impact Assessment Report (Water Chapter) for Proposed Inert Landfill and C&D waste recovery at Ballinclare, Co Wicklow, 2021.

7.38 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
Elevation	OSi Discovery Series Mapping – sheet 62	1:50,000
Climate	Met Eireann	Digital
Protected Areas, Environmental Pressures	Environmental Protection Agency, National Parks and Wildlife Service	Digital

7.39 A site visit and inspection of the application site was originally undertaken by SLR 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 during 2019 (relating to baseline survey work for the 2021 EIAR).

7.40 HES staff completed walkover surveys and investigative field work on the following dates: 26th January 2024, 08th March 2024, 19th April 2024, 29th May 2024, 19th June 2024, 26th

June 2024, and 04th July 2024. During those site visits, the following site work was undertaken by HES:

- A site walkover was completed, locating existing groundwater monitoring wells;
- Groundwater wells were manually dipped and water levels recorded;
- Diver water level loggers were installed in on-site wells GW1, GW2 and GW3 with electronic logging completed at 15-minute and 2-hour intervals. Dataloggers were also installed in a number of off-site groundwater wells;
- An audit of local domestic and farm groundwater supplies was completed;
- Groundwater sampling was completed in on-site and off-site groundwater wells on 19th June and 04th July 2024; and,
- Surface water sampling was completed on 29th May and 19th June at 5 no. locations (SW1, SW4, SW5, SW6 and SW7) along nearby upstream and downstream watercourses.

Historic Site Investigations

7.41 A detailed description of the available historical site investigation completed within the quarry is provided in the following section as those data provide valuable insights into the hydrogeology (groundwater conditions) at the application site.

White Young Green - 2005

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

- drilling of four trial wells (TW series 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.

7.43 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/day. Historically, after dry summer months, a shortage of process water for the quarrying operation was reported.

7.44 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/day.

7.45 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.

7.46 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 33mAOD to 37mAOD. The quarry floor level across much of the quarry is currently at 37mAOD. The TW series well locations are shown on Figure 7-1.

7.47 All six wells drilled in 2005 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 groundwater inflows or water strikes recorded. Inflows were estimated by WYG to be less than 5m^3/day, and to be more accurately described as seepages.

SLR Geological Investigation - 2014

7.48 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 extend 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).

7.49 The 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 52mAOD	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 55mAOD	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 37mAOD	40m	Ground conditions confirmed from existing quarry floor
BH2	Western area of the existing quarry floor. Existing floor level assumed at 37mAOD	40m	

7.50 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 (GW1, GW2, and GW3) were drilled by Dempsey Drilling and were completed on 10th October 2014. The geological boreholes (BH1 and BH2) were completed by Irish Drilling Ltd on 14th October 2014. All boreholes reached target depths.

7.51 The geological boreholes were drilled on the quarry floor, which at that time was at ~37m AOD. Rotary drilling was undertaken to obtain a 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. The data from the drilling of BH1 and BH2 provides valuable information about the bedrock geology and hydrogeology below the proposed infill area.

7.52 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.

7.53 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 (fill) the borehole following drilling. The groundwater was left to recover overnight. A significant groundwater inflow was encountered at borehole GW2, at approximately 6mbgl, and while this is logged as being associated with a cavity, this is reinterpreted as being a more permeable subsoil strata overlying bedrock (Refer to Para 7.120). The overburden consists of reworked ground. There was no evidence of hydrocarbons at borehole GW3. All boreholes encountered a few metres of overburden overlying competent diorite bedrock.

7.54 The groundwater boreholes (GW1, GW2, and GW3) were installed with 125mm plastic casing. The top sections where overburden was encountered were fitted with plain well casing, and the remainder was fitted with slotted well casing. These installations allowed future groundwater level monitoring and groundwater sampling to be completed.

Potential Soil and Groundwater Contamination

7.55 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 the overburden soils at location GW2.

7.56 Extraction activity at the quarry was suspended 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.

7.57 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

7.58 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.

7.59 When operational, the quarry was worked dry with very little inflow of groundwater reported within the quarry void area. This is a very important point and will be referred to again below with respect to the hydrogeology of the site. A quarry sump (~70,000 m^3 in volume) located on the lowest quarry floor level was used to collect any surface water falling over the void area and any minor inflows of groundwater. During previous quarrying operations, periodic pumping of the water from the quarry sump to on-site storage tanks was carried out. This water was recycled and used in concrete production activities and on-site dust suppression.

7.60 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 the base of the central sump at c.21.5mAOD. The wider quarry floor is at ~37mAOD.

7.61 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 along local roads and areas of commercial forestry.

Rainfall and Climate

7.62 The Standard Average Annual Rainfall (SAAR) at Ballinclare is c. 1,142mm/yr (i.e. at ING 325000, 189000) for the period 1991-2020 (Met Éireann, SAAR database). The monthly average rainfall values (at the same node) for 1991-2020 are shown in Table 7-3 below.

Table 7-3
Average Monthly Rainfall Total (mm) 1991-2020 at Ballinclare

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AAR
112	86	82	80	74	78	70	84	90	128	139	119	1142

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

7.64 Groundwater Recharge maps published by the GSI show an effective rainfall for the Application site of 647mm/yr. Evapotranspiration is therefore 495mm/yr (Evapotranspiration = Rainfall – Effective Rainfall). Met Eireann report potential evapotranspiration as 530.5mm/yr. Potential evaporation will always be higher than the actual value.

7.65 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 and on the recharge capacity of the underlying diorite bedrock, which in general is very low.

7.66 GSI Groundwater Recharge mapping suggests a recharge cap of 100mm/yr for the application site. This is due to the lack of permeability, or ability to accept recharge within the underlying Diorite bedrock.

7.67 Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM's). Projections for the period 2041-2060 (mid-century) are available from Met Eireann (www.met.ie). The data indicates a projected decrease in summer rainfall from 0 to 13% under the medium-low emission range scenario and an increase in the frequency of heavy precipitation events of c.20%. In total the projected annual reduction in rainfall near the site is modelled as c. 10% under the medium-low emission scenario and c. 8% under the high emissions scenario. As stated above the local average long term rainfall data for the site is estimated to be 1,142mm/yr. Under the medium-low emissions scenario this may reduce to c. 1,028mm/yr, while under the high emissions scenario this figure may reduce to c. 1,051mm/yr.

Soils and Geology

Soils and Subsoils

7.68 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.

7.69 Teagasc soil mapping indicates soil cover was thin to absent over the original extraction area. The soils in the western part of the Application site are classified as AminSW, shallow well drained mineral soil, derived from mainly non-calcareous materials. The soils towards the east of the site are classified as AminSP, shallow poorly drained mineral soil, also derived from mainly non-calcareous materials, refer to Figure 6-1.

7.70 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

7.71 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, but none are mapped within the quarry footprint. The bedrock geology beneath the current quarry floor level has been confirmed as diorite to 40m beneath the quarry floor (from borehole drilling at BH1 and BH2). The local bedrock geology is shown on Figure 6-3 and the geology is discussed in detail in Chapter 6 of this EIAR.

7.72 The geology of the site is described based on the following available datasets:

- Desk study data and GSI mapping;
- Historic boreholes described in Paras 7-109 to 7-114
- On site drilling (GW1, GW2, and GW3) described in Paras 7-118 to 7-119
- Observation and mapping of the hundreds of meters of exposed bedrock along the various quarry faces within the quarry.

Surface Water - Hydrology

7.73 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 Potters River catchment (IE_EA_10P010500).

7.74 The Potters River (IE_EA_10P010500) 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 [EPA name: Ballinameesda lower stream (IE_EA_10P010300)] is located c. 200m to the south of the application site and flows in an easterly direction, to its confluence with the Potters River, see Figure 7-2.

7.75 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.

7.76 The Irish Sea is c. 7.5km east of the application site. The Potters River flows southeast for ~7.5km, before discharging to the Irish Sea at Potters Point.

7.77 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 of the quarry.

7.78 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 WFD Status

7.79 The Potters_010 SWB (surface water body) achieved ‘Moderate’ status in all 3 no. WFD cycles. This SWB is currently deemed to be ‘at risk’ of failing to meet its WFD objectives. Significant pressures on this SWB include agriculture and forestry. The Potters_020 SWB that lies downstream of the application site achieved ‘Good’ status in all 3 no. WFD cycles. This SWB is deemed to be ‘not at risk’ of failing to meet its WFD objectives. No significant pressures have been identified to be impacting this SWB. The Southwestern Irish Sea – Brittas Bay (HA 10) SWB achieved ‘High’ status in the 2016-2021 WFD cycle. This coastal waterbody is also deemed to be ‘Not at risk’ and no significant pressures are listed to be impacting this SWB.

7.80 A WFD Compliance Report is attached as Appendix 7-N.

Surface Water Abstractions

7.81 The Potters_010 SWB in the vicinity of the application site is listed as a Drinking Water Protected Area (DWPA) under Article 7 Abstraction for Drinking Water (IE_EA_10P010300). This DWPA occurs upstream and downstream of the application site discharge and also includes the Kilmacurra Stream. The abstraction from the Potters River is for the Glenealy Public Supply which is reported to have a maximum abstraction volume of 185m^3/day. The abstraction point for the Glenealy water supply is from the Barnbawn stream, and this is located ~4km northwest of the Application site.

Surface Water Discharges

7.82 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.

7.83 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.

7.84 The only other Section 4 Discharge Licence for discharge to the Potters River is for the Green Angel Skincare premised (former Tap Restaurant), Licence Ref. No. WPL/96, at Kilbride which lies approximately 2.7km downstream of Ballinclare Quarry.

Surface Water Quality

7.85 The overall status of the Potters River and Kilmacurra Stream is moderate according to the EPA River Waterbody WFD Status Report for 2016-2021. 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 2020. Approximately 500m further downstream, at Kilbride Bridge, a Q rating of 4 (Good) is assigned to the Potters River.

7.86 A Biological Q-value assessment has been completed at 2 No. locations along the Potters River, upstream (MP1) and downstream (MP2) of the off-site discharge from Ballinclare Quarry (refer to Appendix 7-L). Following kick sampling and macroinvertebrate examination, a Q-value of 3-4 is assigned to location MP1 upstream of the discharge point, while a Q-rating of 4 is assigned to location MP2, situated downstream of the discharge point. The locations of monitoring points MP1 and MP2 are shown on Figure 7-2.

7.87 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 (Chapter 5).

7.88 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.

7.89 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. Potters 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.

7.90 WYG took 3 No. surface water samples in May 2007, from a drain upstream of the quarry entrance, at the drain's confluence with Potters Bar downstream of the quarry and from a containment pond at the quarry entrance. 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 the containment pond at the quarry entrance. 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.

7.91 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 situated on the small stream which runs past the quarry, into which the licensed discharge flows. 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. Elevated arsenic concentrations were recorded in the quarry sump water samples taken at that time.

7.92 Further Surface water samples were taken by HES on 29th May 2024 and 19th June 2024 at SW1 and SW4-SW7 (at locations shown in Figure 7-2). Sampling locations are upstream and downstream of Ballinclare Quarry. The results of these analysis demonstrated good quality water across the sampling locations, with no analytes above the relevant environmental quality standard. Suspended solids ranged between <5-7 mg/L, while BOD ranged between <1-1.8 mg/L. The results are also presented in Table 7-5 below.

7.93 In addition to the above-mentioned sampling, surface water quality monitoring has been ongoing since the commencement of discharge from the quarry under WPL-116. Water quality sampling has been completed at locations MP1 and MP2, and daily analysis of discharge water from the quarry has been completed since late 2021. Quarry discharge data are summarised in Table 7-6 while MP1 and MP2 data are summarised in Table 7-7 and Table 7-8 respectively.

7.94 The overall status of the coastal Irish Sea directly east of the site is high according to the EPA Coastal Waterbody WFD Status 2016-2021. 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. It is not at risk of deterioration.

Table 7-4
Surface Water Quality 2019

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	0.5
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
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	5

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
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					
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: S.I. 272 of 2009

Environmental Quality Standard (EQS) blue: S.I. 327 of 2012

*** Field Measurement**

Table 7-5
Surface Water Quality 2024

Parameter	Units	29/05/24					19/06/24					Quality Standards				
		SW1	SW4	SW5	SW6	SW7	SW1	SW4	SW5	SW6	SW7	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
Ammonia (Surface Water)	mg/L as N	0.028	0.018	<0.01	0.01	0.027	0.014	0.015	0.027	0.123	0.021				0.065-0.175	0.5
Arsenic (Dissolved)	ug/L	2.97	0.687	0.455	1.14	2.52	2.65	0.862	0.499	10.7	2.01	25 (AA)	20 (AA)	10	7.5	10
Asbestos Identification*	N/A	-	-	-	-	-	-	-	-	-	-					
BOD (Surface Water) (River)	mg/L	1.1	<1	1.1	<1	1.8	<1	<1	<1	<1	<1	"High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)"				
Cadmium (Dissolved)	ug/L	<0.1	<01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.45 - 1.5	0.45 - 1.5	5		5
Chloride (Surface Water)	mg/L	-	-	-	-	-	-	-	-	-	-			30	24-187.5	250
Chromium (Surface Water)	ug/L	-	-	-	-	-	-	-	-	-	-	32		30	37.5	50
COD (Surface Water)	mg/L	-	-	-	-	-	-	-	-	-	-					
Conductivity (Surface Water at 20°C)	µS/cm @ 20°C						345*	302.5*	158.9*	355.4*	158*			1000	800 - 1875*	2500
Copper (Dissolved)	ug/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	5 or 30 (AA)	5 (AA)	30		2000
Dissolved Oxygen (mg/l)	mg/L						9.11*	5.41*	10.17*	6.83*	9.79*					
Hardness Total (Surface Water)	mg/L CaCO3	-	-	-	-	-	-	-	-	-	-			200		
Lead (Dissolved)	ug/L	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	7.2 (AA)	7.2 (AA)	10	7.5	5
Mercury (Dissolved)	ug/L	-	-	-	-	-	-	-	-	-	-	0.07	0.07	1	0.75	1
Nickel (Dissolved)	ug/L	2.24	1.23	<0.5	0.549	3.47	2.42	1.1	<0.5	1.14	0.657	20 (AA)	20 (AA)	20		20

Parameter	Units	29/05/24					19/06/24					Quality Standards				
		SW1	SW4	SW5	SW6	SW7	SW1	SW4	SW5	SW6	SW7	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
Nitrate (Surface Water)	mg/L as N	-	-	-	-	-	-	-	-	-	-			25	37.5	50
Nitrite (Surface Water)	mg/L as N	-	-	-	-	-	-	-	-	-	-			0.1	0.375	0.5
pH (Surface Water)	pH Units	6.7	7.0	7.0	7.0	6.9	6.6	7.0	6.5	6.8	7.1			6.5 - 9.5		6.5 - 9.5
Phosphate (Ortho) Surface Water	mg/L as P	<0.01	<0.01	0.011	<0.01	0.028	<0.01	0.01	0.01	0.022	0.02			0.03		
PRO (>C6-C12)	ug/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1					
Solids (Total Suspended)	mg/L	<5	5	<5	<5	7	<5	<5	<5	5	<5					
Sulphate (Surface Water)	mg/L	-	-	-	-	-	-	-	-	-	-			200	187.5	250
Zinc (Surface Water)	ug/L	1.41	1.2	1.38	2.72	25.3	28.5	25.4	37.3	32.5	32.2			100	75	

Environmental Quality Standard (EQS) green: S.I. 272/2009

Environmental Quality Standard (EQS) blue: S.I. 327/2012

* Field Measurement

Table 7-6
Summary Surface Water Quality at Quarry Discharge 2021 - 2024

Parameter	Units	n	Range	Exceedance of DL ELVs	Exceedance of SW Regs (S.I. 272/2009 as amended)
pH	[H⁺]	660	6.0-7.9	0	0
BOD	mg/L	653	0.03-6.6	42	achieves Good status on mean and 95%ile
Suspended Solids	mg/L	661	2.0-31	5	2^
Total Ammonia as N	mg/L	659	0.01-1.33	54	Good status on mean
Ortho-P as P	mg/L	657	0-2.08	15	achieves High status on mean and 95%ile
Arsenic (Dissolved)	µg/L	614	0.336-9.429	2	0
Mercury (Dissolved)	µg/L	85	<0.003-0.1	4	2
Nickel (Dissolved)	µg/L	291	0.583-9.65	270	0
Asbestos	MF/L	41	0	0	n/a

Notes: ^ELV = 25mg/L (Salmonid Regs S.I. 293/1988); n = number of data points.

Table 7-7
Summary Surface Water Quality at MP1 2021 - 2024

Parameter	Units	n	Range	Exceedance of SW Regs (S.I. 272/2009 as amended)
pH	[H⁺]	656	6.0-8.05	0
BOD	mg/L	634	0.1-8.0	achieves Good status on mean
Suspended Solids	mg/L	648	2-135	18^
Total Ammonia as N	mg/L	659	<0.01-4.49	Does not achieve Good status on mean
Ortho-P as P	mg/L	654	<0.01-4.89	achieves Good status on mean and High status on 95%ile
Arsenic (Dissolved)	µg/L	628	0.02-4.731	0
Mercury (Dissolved)	µg/L	82	<0.03-0.1	4
Nickel (Dissolved)	µg/L	297	0.4-6.669	0
Asbestos	MF/L	37	0	n/a

Notes: ^ELV = 25mg/L (Salmonid Regs S.I. 293/1988); n = number of data points.

Table 7-8
Summary Surface Water Quality at MP2 2021 - 2024

Parameter	Units	n	Range	Exceedance of SW Regs (S.I. 272/2009 as amended)
pH	[H$^+$]	656	6.0-8.97	0
BOD	mg/L	636	0.2-32.5	achieves Good status on the mean
Suspended Solids	mg/L	648	2-208	44$^+$
Total Ammonia as N	mg/L	649	<0.01-3.56	Does not achieve Good status on mean or 95%ile
Ortho-P as P	mg/L	647	<0.01-0.27	achieves High status on mean, and Good status on 95%ile
Arsenic (Dissolved)	µg/L	625	0.01-3.998	0
Mercury (Dissolved)	µg/L	87	<0.03-0.1	3
Nickel (Dissolved)	µg/L	296	0.4-5.237	0
Asbestos	MF/L	41	0	n/a

Notes: ^ELV = 25mg/L (Salmonid Regs S.I. 293/1988); n = number of data points. $^+$ As noted in the Q reports in Appendix 7-K, there are observed sedimentation issues upstream of the bridge at MP2 and this issue is not related to the quarry discharge.

7.95 **2019 Surface Water Data**: The water quality results from sample locations SW1-SW7 were compared against quality thresholds set out in the Surface Water Regulations (S.I. 272/2009 and S.I. 327/2012). 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 S.I. 9/2010 (GW Regs) and Drinking Water Regulations (S.I. 99/2023, DW Regs). The following exceedances were noted:

- At SW1, zinc concentrations exceed threshold values in SW S.I. 272/2009 EQS Other Surface Waters (MACs) on 26/03/19.
- At SW3B, BOD exceeds both the good and high-quality standard (S.I. 272/2009) on 26th March 2019.
- At SW4, BOD exceeds both the good and high-quality standard (S.I. 272/2009) on 26th March 2019.
- The recorded concentrations at the quarry sump:
  - exceeds the environmental quality standards for arsenic on both 05th and 26th March 2019;
  - exceeds EPA IGV criteria for orthophosphate on 05th and 26th March 2019;
  - exceeds EPA IGV criteria for potassium on 05th March (not tested for on 26/03/19); and,
  - exceeds Drinking Water limits for antimony on 05th March 2019 (not tested for on 26/03/19).

7.96 **2024 Surface Water Data**: The water quality results from sample locations SW1-SW7 were compared against quality thresholds set out in the Surface Water Regulations (S.I. 272/2009 and S.I. 327/2012). 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 S.I. 9/2010 (GW Regs) and Drinking Water Regulations (S.I. 99/2023, DW Regs). The following exceedances were noted:

- The BOD value recorded at SW7 on 29th May 2024 (1.8 mg/L), exceeds both the Good and High limits for surface waters (S.I. 272/2009) of 1.3 and 1.5 mg/L respectively, however the mean BOD recorded at SW7 is below both the Good and High mean limits (2.2 and 2.8 mg/L respectively).

- The recorded Arsenic value at SW6 (10.6 µg/L) on 19th June 2024 exceeds the Drinking Water Guideline threshold value of 10 µg/L. This concentration does not exceed the Surface Water guideline values (25 µg/L).
- There were no further exceedances of water quality limits from the samples taken from SW1 and SW1-SW7 on 29th May and 19th June 2024.

7.97 An asbestos identification was carried out on the surface water and quarry sump samples in 2019, and no asbestos was reported.

7.98 **Discharge Licence Monitoring Data**: The water quality results from sample locations MP1 and MP2 were compared against environmental quality standards set out in the Surface Water Regulations (S.I. 272/2009 and S.I. 327/2012). The results from the quarry discharge were also compared with these standards, as well as the water quality criteria stipulated in the quarry Discharge Licence (WPL-116). As noted above, the results are summarised in Table 7-6 (Quarry Discharge), Table 7-7 (MP1), and Table 7-8 (MP2). The following is noted form the data:

- There is a significant quantity of analyses for each parameter. As a result, there is a high confidence level in the interpretation of the data.
- The variation of pH at all monitoring points is comparable. All data meets the EQS thresholds.
- The range of BOD values recorded at the quarry discharge is lower than at MP1 and MP2, although data from all locations indicate Good status water quality is achieved for BOD.
- The range of TSS values recorded at the MP2 are higher than the quarry discharge and higher than those recorded at MP1, and the range recorded at MP1 is higher than the quarry discharge. Background TSS variations recorded in the Potters River are higher than what is being discharged from the quarry.
- The range of Ammonia concentrations recorded at the quarry discharge is lower than at MP1 and MP2. Data from the quarry discharge would meet Good status water quality requirements, but data from MP1 and MP2 would not. Background ammonia variations recorded in the Potters River are higher than what is being discharged from the quarry.
- The range of Ortho-P concentrations recorded at MP2 is lower than both MP1 and the quarry discharge, and would achieve Good/High status at MP2 (downstream) on mean/95%ile analysis. Data from the quarry discharge has a lower range than MP1. Data from the quarry discharge would meet Good status water quality requirements. Background ortho-P variations recorded in the Potters River at MP1 are higher than what is being discharged from the quarry, but downstream concentrations of Ortho-P recorded at MP2 are much lower than at MP1.
- Except for Mercury, all other dissolved metals concentrations are lower than the Surface Water Regulation EQSs (S.I. 272/2009 as amended) at all monitoring points. The Mercury exceedances occur at the detection limit value (0.1µg/L), but with the absence of the "<" sign. These may be a laboratory reporting error and should be <0.1µg/L (i.e. the detection limit of the analysis).
- It is noted that there were 2 (of 614 data points) exceedances of the Arsenic Discharge Licence ELV (2 samples had Arsenic concentrations >7µg/L (but all results were less than the MAC-EQS of 20 µg/L stated in S.I. 272/2009).
- There were 270 (of 291 data points) exceedances of the Nickel Discharge Licence ELV (270 samples had Nickel concentrations of >3.22µg/L (but based on all data for 2022, 2023, and 2024 the annual average (AA) value is less than the AA-EQS of

20 µg/L stated in S.I. 272/2009) (AA of Nickel for 2022: 5.3 µg/L (n = 26); AA for Nickel for 2023: 4.8 µg/L (n = 235); AA for Nickel for 2024: 3.9 µg/L (n = 28)).

- Monthly biological Q Value sampling has been carried out at MP1 and MP2 since December 2022 (refer to Appendix 7-L). Upstream and downstream Q Values have been recorded as fluctuating between Q 3-4 and Q4. JKW Environmental conclude that "***Based on the conducted kick sampling and using a direct comparison of samples taken upstream and downstream from December 2022 to June 2024 it can be concluded that discharges from dewatering at Ballinclare Quarry have not had any notable adverse impact on the aquatic ecosystem of the Potters River.***"
- As such, all available data indicates that the ongoing discharge from the quarry has not had a notable adverse impact on water quality or the aquatic ecosystem of the Potters River.

7.99 There has been no detection of asbestos in any of the monitoring at MP1 (41 samples), MP2 (37 samples) and the quarry discharge (41 samples).

Surface Water Flows

7.100 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 5%ile flow at c. 1.685m^3/s and the 95%ile lower flow is estimated at 0.057m^3/s, refer to Appendix 7-D.

7.101 There are no flow monitoring stations on the Potters 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 Potters and Kilmacurra Stream.

Flooding

7.102 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.

7.103 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.

7.104 National Indicative Fluvial Mapping (NIFM) River Flood Extents (Present Day) flood mapping are also available for review (www.floodmaps.ie). These show flood zones along the Potters River downstream of the site.

7.105 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.

7.106 The quarry discharge is currently limited to 20L/s (72m^3/hr, or 1728m^3/day). This discharge flow is a very small proportion of likely larger flood flows in the Potters River. For example, the estimated 5%ile flow in the Potters River is 1.685m^3/s (1685 L/s), and the addition of the

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

20L/s from the quarry only accounts for ~1.2% of that river flow. Notwithstanding this, discharge (pumping) from the quarry can be turned off during extreme flood events.

Quarry Water Management

7.107 Currently, rainfall across the application site mostly drains toward the quarry void, with a smaller quantity slowly infiltrating to ground and it recharges the shallow overburden where permeability occurs, with some further limited recharge to the underlying bedrock also likely occurring. During storm events, surface water runoff across most of the site will drain to the quarry floor / void (it being the lowest point within the site), while some runoff from the western end of the site will flow towards the discharge drain at the western boundary of the site.

7.108 The existing quarry void is currently being dewatered. Water is being treated and discharged at the north of the site into the Ballinclare Stream (a small tributary of Potters River).

7.109 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.

7.110 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).

Groundwater – Hydrogeology

7.111 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 ~ -3mAOD (in BH1 and BH2).

7.112 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 (PI) which is generally unproductive except in local zones, refer to Figure 7-3.

7.113 Proven well yields for on-site boreholes were low (see Para 7.120 below), and water was mainly derived from the shallow interface between the base of the overburden and any upper weathered bedrock that existed / exists across the site. Deeper water strikes recorded were of limited inflow and were generally referred to as seepages.

7.114 Logging of bedrock BH1 and BH2 indicates generally high Total Core Recovery (%), high Solid Core Recovery (%), low Fracture index (%), and variable, but generally high Rock Quality Designation.

7.115 Fault gouge is recorded in BH2 (@ ~1-2mAOD, i.e. well below the base of the sump which has its deepest elevation at 21.5mAOD). The fault gouge implies that even where structural weakness occurs it is infilled with clay material that would impede deeper groundwater flow within the Diorite.

7.116 In BH1, the RQD and Fault Index increase and decrease respectively at 19.1m (18.8mAOD) and at 26.6m (11.3mAOD). These areas do not correlate with any change in lithology and may be related to some minor deeper faulting, however they are not significant and occur at depth below the base of the existing quarry.

7.117 As noted above, previous operation of the quarry to the ~37mAOD and~ 21.5mAOD (sump) floor levels required little or no dewatering, and any water pumped was put in storage for use in on- site production of concrete and for dust suppression.

7.118 From the Wicklow Groundwater Protection Report, there is little hydrogeological information on the Diorites, however they are likened to the hydrogeological characteristics of the Granites, due to their lithological similarity. Information on the Granites (as a proxy for the Diorite) includes the following:

- No primary permeability, a porosity normally less than 1%, and any pores present are generally small and unconnected (Davis & De Wiest, 1966). Permeability in the granites has developed through fracturing and weathering, which is generally restricted to the top 100m below ground (Daly, E.P. 1994).
- Permeability tests by De Buisonje (1977) and Van Engelen (1980) in weathered granite indicated values of 10-100 m/d but in the underlying fresh granite values of 1-3 m/d were obtained.
- The weathered zone may commonly be up to 15 m thick, and is overlain by a variable thickness of Quaternary deposits. Porosity of completely weathered granite can be up to 15%, giving significant groundwater storage and a permeability comparable with that of gravel. The permeability of un-weathered granite is in the order of 0.01-1 m/day.

7.119 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.

Site Investigation Data

7.120 Borehole logs are available for 3 No. groundwater wells at the Application site (GW1-GW3). A summary of the borehole logs is as follows:

- Borehole GW1 – WEATHERED BEDROCK encountered between 0-1.8m, overlying competent DIORITE from 1.8m to 68m depth. One minor water strike is noted at 57m, with a very small inflow volume of 20 gals/hr (0.09m^3/hr). No major or minor fractures are noted in the borehole log.
- Borehole GW2 – MADE GROUND recorded from 0m to -6m. A cavity is recorded from 6m to 7m in the interface between the Made Ground and the underlying diorite, with a significant water inflow of 2000 gals/hr (9 m^3/hr) in this section. This is considered a misinterpretation of soft made ground overlying the competent Diorite at 7m. The water strike in this section (6m-7m) is interpreted as reflecting groundwater in loose unconsolidated material, perched on top of the impermeable diorite bedrock at 7m. There is no geological reason that a cavity should occur in this type of formation (no karstification is possible). Strong to very strong, dark grey to green, crystalline, medium to coarse grained DIORITE is logged from 7m to 61m depth with no fractures or water strikes recorded.
- Borehole GW3 – Boulder clay is logged from 0m to 6m, overlying strong to very strong, dark grey to green, crystalline, medium to coarse grained DIORITE from 6m to 65m depth. One minor water strike is logged at 8m, with an inflow volume of 100 gals/hr (0.45m^3/hr).

7.121 Broadly the logs reflect strong to very strong diorite with little permeability or porosity, overlain by 1.8m to 6m of overburden / weathered rock / Made Ground. The primary water inflow recorded during the drilling occurred in the interface between Made Ground and Diorite in GW2, likely due to increased permeability in the Made Ground increasing recharge through this material, before it reaches the Diorite bedrock and flows along the top of the hard bedrock, unable to permeate further vertically. The recorded well yield are low, and accord with the well yield class defined for Poor aquifers ("***Poor (P) aquifers would generally have 'moderate' or 'low' well yields - less than 100 m^3/d.***")

Wicklow Groundwater Body

7.122 Ballinclare Quarry is mapped as being located within an area of Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones.

7.123 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.

7.124 The groundwater at the application site is of good status according to the EPA Groundwater Body WFD Status Report for 2016-2021. The overall objective is to protect the water body and the groundwater body overall risk is described as "***At risk of not achieving good status***".

7.125 The Wicklow GWB covers an area of 1,396km^2 and is described as being a 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.

7.126 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.

7.127 In some instances, a greater degree of structural deformation may provide a fracture network which will allows 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).

7.128 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.

7.129 The dominant recharge process within the GWB is diffuse recharge from water percolating through the overlying tills and into the underlying bedrock 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.

7.130 The hydrochemical groundwater signature is a calcium bicarbonate type and is soft to moderately hard (50–250 mg/l $CaCO_3$). Relatively low electrical conductivity values are recorded at 130 – 220 µS/cm during field measurements.

7.131 A WFD Compliance Assessment is included as Appendix 7-N.

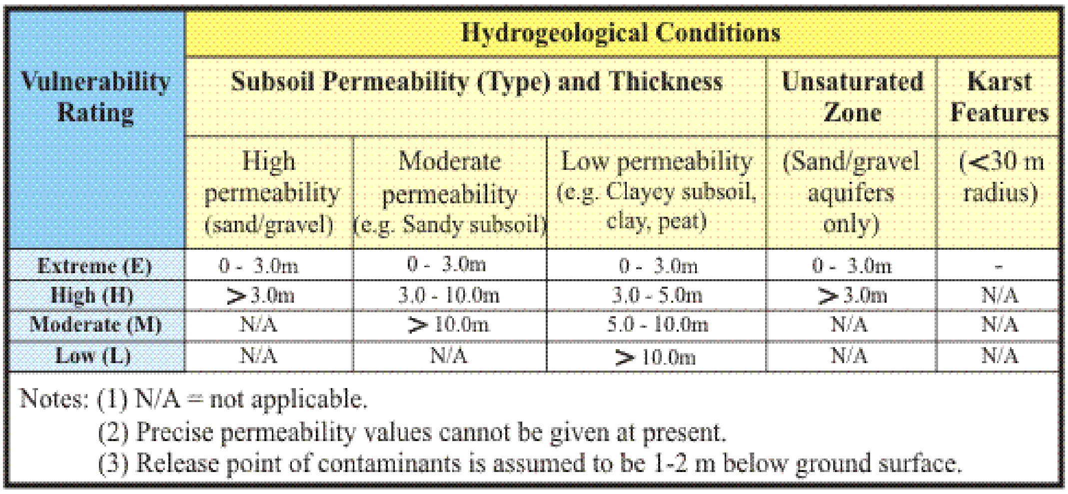
Groundwater Vulnerability

7.132 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).

7.133 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 (note there is no karst at this site given the bedrock type is not limestone)). 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.

7.134 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 clay liner, the inert soil material and restoration surface will be >10m in thickness, refer to Table 7-9 below.

Table 7-9
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.

7.135 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).

7.136 The Wicklow Groundwater Protection Scheme Report[2] notes the following in relation to groundwater vulnerability and potential developments in the Wicklow GWB: A review of the groundwater protection responses for the county notes the following inclusions:

- "Landfills: From a groundwater viewpoint, over 95% of the county is broadly suitable for the construction of landfills. This reflects the absence of regionally important aquifers, and the possibility of engineering landfills to take account of any vulnerability constraints.
- Landspreading of licensable organic wastes: Just over a third of the county is essentially suitable, reflecting the fact that subsoil thicknesses are generally low. An additional proportion, perhaps 30%, is also likely to be suitable, subject to detailed investigation and checking.
- On-site wastewater treatment systems (septic tanks, etc.): Over 95% of the county is essentially suitable for these systems, subject to site permeability testing.

7.137 The key point here is that the Wicklow Groundwater Protection Scheme Report (2003) acknowledges that subject to site specific assessment and engineering design the type of bedrock and aquifers found within County Wicklow are generally suitable for the construction of landfills.

Groundwater Recharge

7.138 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.

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[2] GSI Groundwater Section – Wicklow County Council Groundwater Protection Scheme Main Report (March 2003)

7.139 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.

7.140 However, at Ballinclare Quarry a large portion of potential recharge is rejected because the Diorite bedrock is considered to be a poor aquifer with low permeability and low storativity. Most potential recharge will therefore be rejected and run-off overground to surface water features. Surface water is the dominant hydrological process in the area. Mapping published by the GSI indicates that the maximum recharge capacity (a recharge cap) for the area surrounding the quarry is 100mm/yr.

7.141 As noted previously, extraction activities in the quarry at the ~37mAOD and~ 21.5mAOD (sump) levels required little or no dewatering, and any water pumped was put in storage for use in on site production of concrete and for dust suppression. This observation from the site operation aligns with the recharge cap and the Poor Aquifer classification for the Diorite bedrock recorded at the Site.

Groundwater Abstraction and Wells

7.142 A water supply well is located at the western boundary of the application site, shown in Figure 7-1. While the site was operational, the water from this well supplied the wheelwash and provided 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.

7.143 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 northwest 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 has a reported poor yield of 27m^3/day;
- Borehole number 3217NWW126 is located to the southeast 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 having a poor yield; and,
- Borehole number 3217NWW103 was drilled in 1996 to a depth of 91.4m, with a poor yield class reported at 20m^3/day.

7.144 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. The results of the survey are presented in Table 7-10 below.

7.145 HES completed further wells audits in the area during 2024. Some of the wells surveyed in 2005 were revisited. Additional survey data has been added to Table 7-10. A map of local wells is included on Figure 7-1. In addition, HES have installed groundwater level loggers in 4 No. groundwater wells within the Application site, as well as loggers in 4 No. nearby domestic wells in order to continually monitor water levels. Groundwater levels within these wells range between 43.6-63.4mAOD. The analysis of these available groundwater levels, as well as interrogation of the relevant topography, indicates that a shallow groundwater regimen is the dominant sub surface flow system within the area, whereby rainfall infiltrates through the subsoil layer and is transmitted primarily within this layer. This is evidenced by the response in the groundwater hydrographs to rainfall events (particularly GW2 and GW3), the presence of shallow wells locally (dug wells in subsoils) as well as available data from borehole logs. Only 1 No. well recorded a groundwater strike at depth in the bedrock (small inflow in BH1 at 57mbgl). Groundwater flow directions are defined as following the local topography before discharging as baseflow to nearby surface watercourses. Groundwater flow directions are further described in Para 7.164.

7.146 In general, groundwater levels are relatively stable with minor fluctuations, reflecting the broadly impermeable bedrock aquifer with no significant response to rainfall events (***i.e.*** poor recharge with steady low volume discharge (flow) through aquifer) overlain by a subsoil / bedrock interface aquifer which in some instances responds quickly to rainfall events (refer to Figure 7-7).

Table 7-10
Local Well Survey Data 2005-2024

Well Number	Location	Depth (m)	Water level (m bgl)	Diameter (mm)	Comments
PW1	Ballinclare Quarry	60	6	150	Used to be the Potable water supply, but was abandoned
PW2	Ballinclare Quarry extension	120	-	150	Groundwater ingress <10m bgl. Duty supply for process and dust suppression
PW2a	Ballinclare Quarry extension	122	-	150	Added in 2007, standby process and dust suppression
PW3	Ballinclare quarry	152	Artesian	150	Added in 2007, abandoned
GLDW1	Kilmacurra West	51.8	2.9	150	Steel casing, no PVC
DW1	Carrigmore	122	1.1	150	Steel casing, no PVC
ODW1	Carrigmore	30	1.45	150	Steel casing, no PVC
ODW3	Carrigmore	4	2.85	1000	Gravity fed dug well
DW3	Carrigmore	-	-	-	-
LDDW1	Carrigmore	Unknown	-	150	-
LDDW2	Carrigmore	Unknown	-	150	Not used
DW2	Kilmacurra West	Unknown	-	150	-
ODW2	Carrigmore	92	-	150	Lined and capped. Not accessible to dip.
ODW4	Carrigmore	28	<2.0	150	-
ODW5	Carrigmore	122	<2.0	150	Not used. Steel casing, no PVC
CBDW1	Ballinclare	-	~3-5	150	
KHDW1	Ballinclare	Unknown	<2.0	150	

7.147 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.

7.148 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.

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

Groundwater Levels

7.150 As previously noted, a number of boreholes have been drilled at the application site. Groundwater levels monitored in these boreholes and results are presented in Table 7-11 below.

Table 7-11
Groundwater Level Ranges in monitored wells (mAOD)

Borehole	Depth (m)	2014-2020	2021	2024
GW1	68	54.895-56.040	58.97-60.17	55.575-58.140
GW2	61	50.769-51.144	46.284-50.584	49.784-50.510
GW3	75	54.096-54.196	53.3-55.23	52.997-53.872
BH1	40	37.842-37.892	-	-
PW2A	122	-	-	53.72-54.71
ODW1	30	-	-	46.15-52.61*
ODW3	3	-	-	62.39-62.51
CBDW1	-	-	-	39-84-56.95*
KHDW1	-	-	-	53.61-44.33

* = dynamic (pumping) water levels

7.151 The groundwater levels range between 50.8-58.04mAOD in boreholes GW1-GW3, and at ~37.8mAOD in BH1 during 2014 when it was historically pumped. The groundwater levels show highly localised variations (refer to Figure 7-6). However, a localised groundwater flow is derived from groundwater levels recorded in monitoring and domestic wells near the site and flows broadly towards the Potters River, to the east and southeast of the site, with regional deeper groundwater flow towards the coast to the east. The primary control on groundwater flow direction is the topography and the variability/thickness of subsoils.

7.152 Dataloggers were installed in wells PW2A, GW1, GW2 and GW3 as well as in 4 No local domestic wells (ODW1, ODW3, CBDW1, and KHDW1). These dataloggers recorded water levels over the period between 26th January and – 04th July 2024. In total, over 688 cumulative days of data were collected, consisting of 8,260 data points. A plot of recorded water levels is illustrated as Figure 7-7.

7.153 Groundwater levels in these monitored wells range from ~63.6mAOD at GLDW1, situated southwest of the site, to 44.3mAOD at a monitored domestic well (KHDW1) situated ~2km southeast of the site. A further high groundwater level of 62.47mAOD is recorded in a domestic well (ODW3) on the northern side of the quarry, with groundwater flowing north here towards a further domestic well (ODW1) with a recorded water level of 52.47mAOD.

7.154 The groundwater level data indicates that local groundwater wells to the north, south and west of the site are all hydraulically upgradient, while wells to the east are potentially downgradient, however a watercourse exists (Kilmacurra Stream) which likely acts as a hydraulic boundary separating the quarry from these downgradient receptors.

7.155 Topographically, the catchment area feeding towards the quarry is small. 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 shallow groundwater rather than deep bedrock groundwater. Any groundwater flowing through the upper (fractured) bedrock will eventually discharge into Potters River. A conceptual site model is detailed below at Para 7.160.

Figure 7-6
Monitored Groundwater Levels (Jan-July 2024)

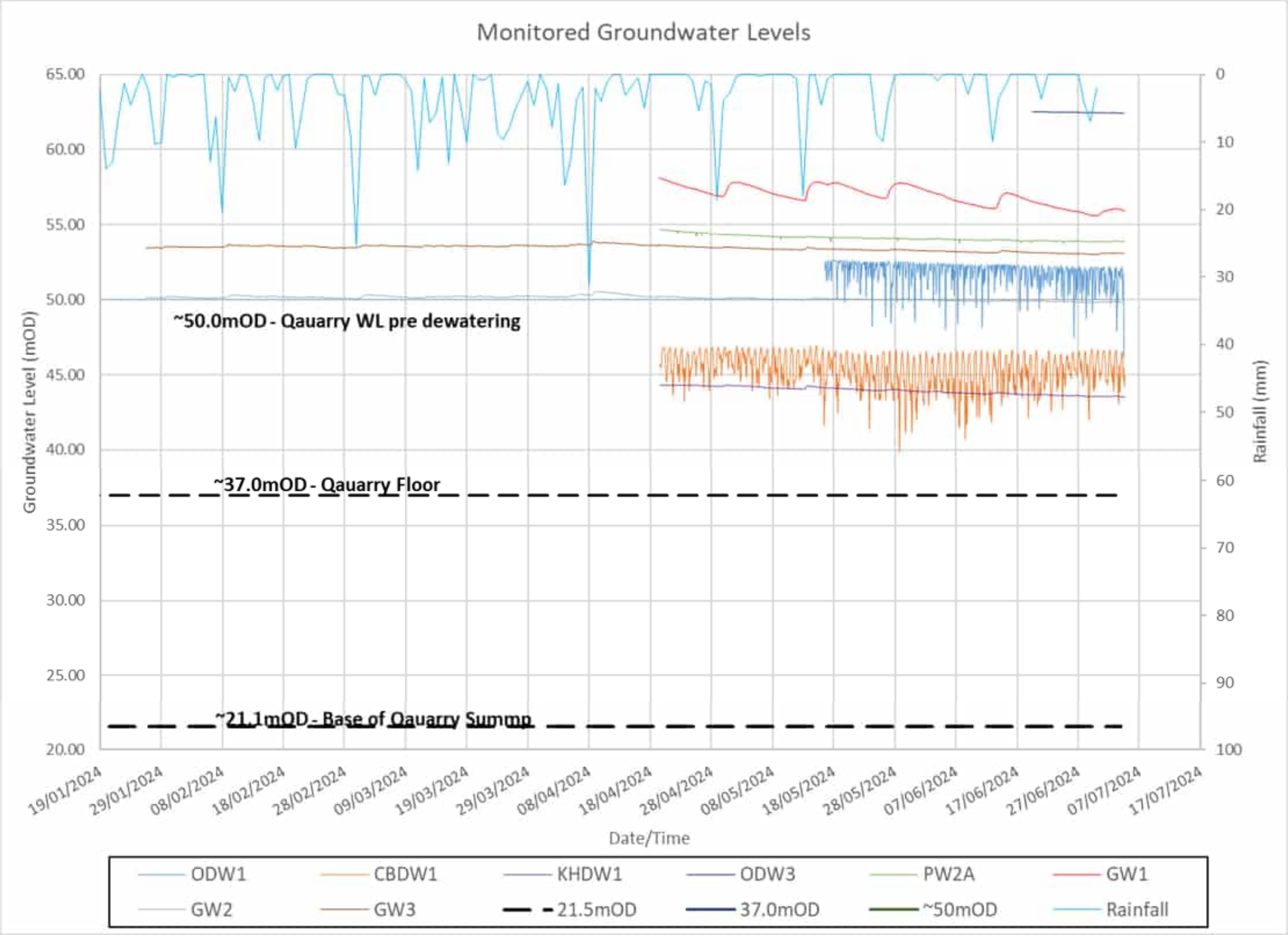
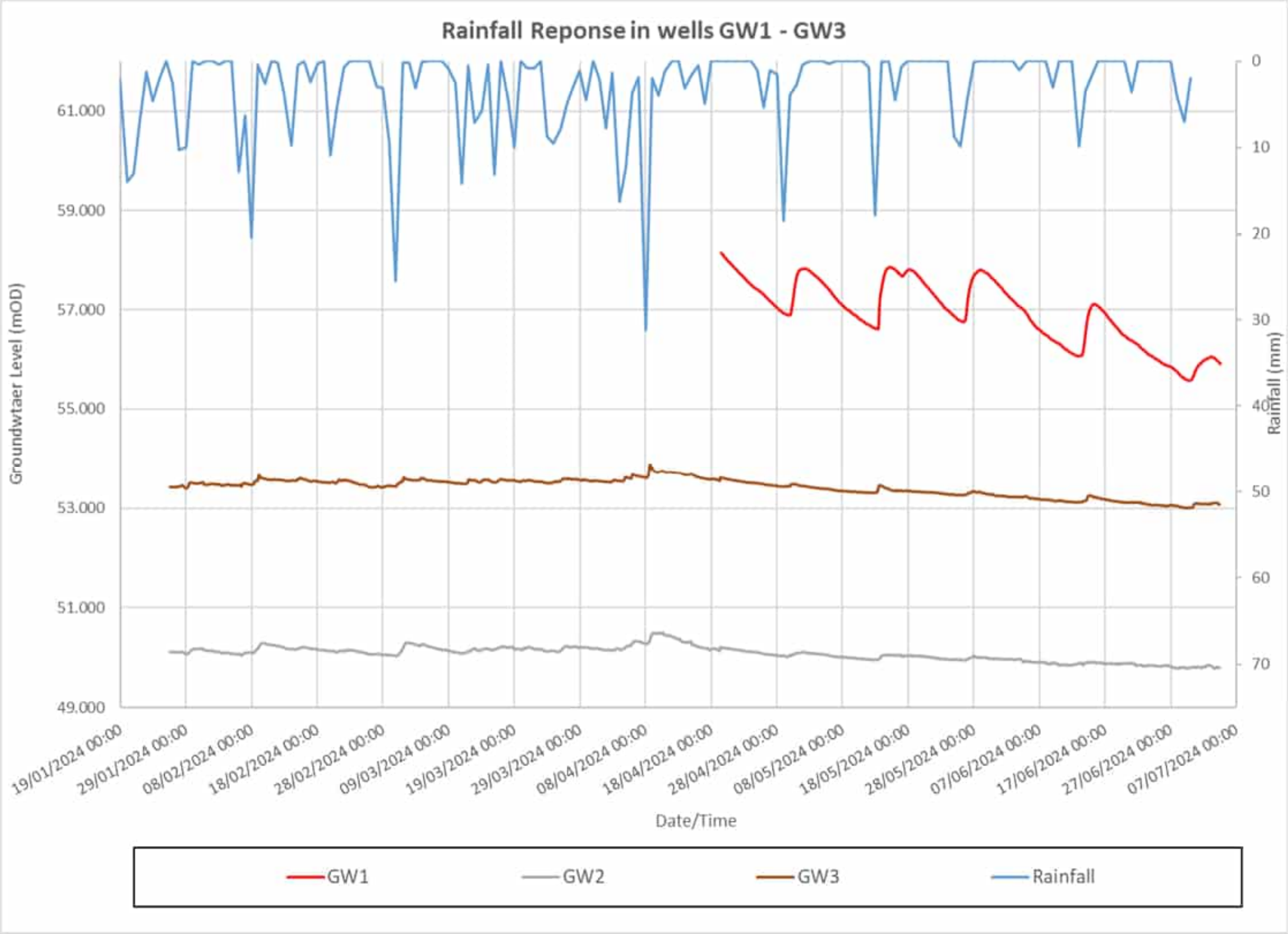


Figure 7-7
Groundwater Level Response in wells GW2 and GW3 (Jan-May 2024)



Groundwater Quality

7.156 Groundwater samples were taken from the three existing monitoring wells boreholes (GW1-GW3) once a month from May to November 2019 (seven samples total). A further 2 No. rounds of groundwater quality sampling were completed on 19th June and 04th July 2024.

7.157 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 366/2016;
- European Communities (Drinking Water) Regulations 2014 Quality. S.I. No 122/2014, and S.I. No. 99/2023 - European Union (Drinking Water) Regulations 2023; and
- EPA Interim Report Towards Setting Guideline Values for The Protection Of Ground Water in Ireland.

7.158 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.

7.159 The results of groundwater quality testing are presented in Appendix 7-F. Average, minimum, and maximum results are presented in Tables 7-12 and 7-13, and indicate the baseline groundwater quality. PAHs and hydrocarbons were also scheduled for analysis for completeness. (PAH = polycyclic aromatic hydrocarbon).

Table 7-12
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
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

		GW1 Avg	GW1 Max	GW1 Min	GW2 Avg	GW2 Max	GW2 Min	GW3 Avg	GW3 Max	GW3 Min
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
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

Exceeds Groundwater Regulations

Exceeds Drinking Water Regulations

Exceeds EPA IGVs

Limit of Detection is higher than regulations

Table 7-13
Groundwater Quality Results 2024

		GW2 (19/06/24)	GW2 (04/07/24)	ODW1 (19/06/24)	ODW1 (04/07/24)	ODW2 (19/06/24)	ODW2 (04/07/24)	LDDW1 (04/07/24)
Conductivity (25°C)	µS/cm	401	456	307	236	243	329	419
pH	pH units	7.3	7.2	7.2	6.9	6.8	6.8	6.2
Total Ammonia (as N)	mg/l	0.384	0.531	0.012	<0.01	<0.01	0.011	<0.01
Ammoniacal Nitrogen (NH3-N)	mg/l	0.464	0.647	0.145	<0.0121	<0.0121	0.0133	<0.0121
Chloride (as Cl-)	mg/l	11.1	11.2	32.3	17	17.4	42.3	25.7
Sulphate (as SO42-)	mg/l	21.3	22.8	10.4	7.96	9.29	10.1	24.6
Fluoride (as Fl-)	mg/l	0.215	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrate (as NO3)	mg/l	<4.43	<4.43	8.54	<4.43	<4.43	7.22	9.83
Nitrite (as NO2)	mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	0.033	<0.03
Orthophosphate (as PO4)	mg/l	0.066	0.07	0.013	0.01	0.013	0.019	0.01
Total coliforms	MPN/100ml	517	78	17	55	4	2	-
E coli	MPN/100ml	5	6	<1	1	<1	0	-
Cyanide (total)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (free)	mg/l	-	<0.001	-	<0.001	-	<0.001	<0.001
Sulphide	mg/l	-	<0.03	-	<0.03	-	<0.03	<0.03
Sodium	mg/l	14.8	198	26.4	116	13.6	34.3	15.8
Total Calcium	mg/l	60.3	46.5	31.8	<1.08	26.8	34.3	28.8
Total Potassium	mg/l	11.3	10.3	2.15	0.728	3.19	2.29	3.69
Total Magnesium	mg/l	12.3	9.6	8.02	<1.11	8.81	8.65	9.51
Aluminium (total)	mg/l	0.0065	0.0054	<0.005	0.0063	<0.005	0.0063	<0.005
Arsenic (total)	mg/l	0.08	0.113	0.08	0.011	0.025	0.09	0.013

		GW2 (19/06/24)	GW2 (04/07/24)	ODW1 (19/06/24)	ODW1 (04/07/24)	ODW2 (19/06/24)	ODW2 (04/07/24)	LDDW1 (04/07/24)
Boron (total	mg/l	<0.21	1.38	<0.21	<0.21	<0.21	<0.21	<0.21
Barium (total)	mg/l	0.078	0.133	<0.0017	<0.0017	0.0057	<0.0017	<0.0017
Cadmium (total)	mg/l	<0.0001	0.000485	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (total)	mg/l	0.00341	0.0018	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (total)	mg/l	<0.003	2.02	<0.003	0.003	0.003	<0.003	<0.003
Iron (total)	mg/l	0.145	0.188	<0.005	<0.005	<0.005	0.012	0.0127
Mercury (total)	mg/l	<0.00003	0.00099	<0.00003	<0.00003	<0.00003	<0.00003	0.000036
Manganese (total)	mg/l	0.382	46.4	0.0067	<0.001	0.00672	0.0332	0.162
Nickel (total)	mg/l	0.006	0.0187	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead (total)	mg/l	<0.00051	0.00992	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051
Antimony (total)	mg/l	0.00026	0.00029	0.00054	0.00069	0.0003	0.00057	0.0008
Selenium (total)	mg/l	<0.0002	0.00022	0.00032	0.00055	0.00036	0.00026	0.0006
Zinc (total)	mg/l	0.0225	0.0465	0.0377	0.00578	0.0342	0.0041	0.0072

Exceeds Groundwater Regulations

Exceeds Drinking Water Regulations

Exceeds EPA IGVs

Limit of Detection is higher than regulations

7.160 **2019 Groundwater Sampling**: 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. This is likely associated with trace metals from the borehole steel casing, as well as sampling error in not filtering the sample in the field for trace metals (standard practise).
- 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.

7.161 **2024 Groundwater Sampling:** Groundwater sampling was carried out on the 29th June 2024 in wells GW2, ODW1 and ODW2 and the 04th July 2024 in wells GW2, ODW1, ODW2 and LDDW1. The groundwater quality testing identified the following parameter ranges:

- The pH values in GW2, ODW1 and ODW2 ranged between 6.8 – 7.2, while the conductivity ranged between 243-401 µS/cm.
- There was 1 no. exceedance of the EPA IGV and Drinking water Guidelines threshold values (0.14 and 0.5 mg/L) for Ammonia in GW2 on 19th June at a reported value of 0.531 mg/L.
- There were 2 no. exceedances of the EPA IGV limit for Orthophosphate (0.03 mg/L) in GW2 on both the 19th June and 04th July 2024 at reported values of 0.07 and 0.066 mg/L respectively.
- There were exceedances of the Drinking Water Regulations guideline values for Total coliforms n wells GW2, ODW1 and ODW2 during both sampling rounds.
- There were detections of E.Coli in GW2 on 19th June and 04th July (both 6 MPN/100ml), as well as in ODW1 on 04th July at 1 MPN/100ml. Neither of these wells are used for potable well supplies.
- There were exceedances of the Drinking Water Regulations limit for Arsenic (0.01mg/L) in each of the 7 no. samples taken during 2024;

- There were minor exceedances of the IGV threshold limits for Sodium, Barium, Boron and Copper in GW2 on 04th July 2024.

7.162 Hydrocarbons were below detection limit in all three boreholes during every sampling round of 2019. There was 1 no. detection of hydrocarbons in GW2 on 04th July 2024 at 0.61 mg/L. Hydrocarbons had been detected during previous sampling from GW2. Remedial works at GW2 are proposed to resolve this issue.

7.163 It is noted that the water pumped from the production borehole (PW1) is not used for potable supply and that bottled drinking water is brought onto the site for consumption as required.

Hydrogeological Conceptual Site Model

7.164 A hydrogeological conceptual site model (CSM) has been derived, based on the information included within borehole geological logs, desk study data and in-situ monitoring of groundwater levels in observation wells. A graphic of the CSM is included as Appendix 7-M. The conceptual site model is described as follows;

- The bedrock geology of the site is dominated by hard, competent, very low permeability Diorite. The Diorite bedrock is classified as a Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones. Recorded local well yields are all low;
- The diorite is overlain by a thin layer (1-6m) of overburden, which is predominantly described as Clay, but includes gravelly / weathered section across the top of the bedrock. This subsoil-bedrock interface layer is much more porous and more permeable than the underlying Diorite bedrock;
- The topography of the site and surrounding area broadly slopes northeast from an elevation of 270mAOD at Westaston Hill, ~2km southwest of the site, to the Potters River at ~50mAOD, situated ~0.35km northeast of the site;
- Rain falls on the surrounding ground and at the site, with greater rainfall on higher elevations (i.e. southwest of the site) and the rain infiltrates through the relatively thin subsoils;
- The rainfall infiltrates through the subsoil and reaches the low permeability bedrock (Diorite). From this point it cannot infiltrate further vertically except in local areas but not everywhere. As a result, the predominant groundwater flow occurs along the top of the bedrock, and this predominant flow follows the gradient of the local topography. Some recharge enters the bedrock through local weathering and fissures. The deeper bedrock flows are localised and relatively short. They do not form regional groundwater flows, and they are not significant in terms of volume;
- Groundwater levels in the area range between 44.3 – 63.6mAOD, with higher elevations recorded towards the west, north and south / southwest of the site. Shallow groundwater flow follows topography and runs along the subsoil-bedrock interface, where that exists.
- The groundwater levels at the site range between 50.8-58.04mAOD, which coincide with the elevation of the subsoil layer, apart from GW1, which displays a higher water level. GW1 showed a consistent higher water level above the level of the flooded quarry, and therefore is potentially disconnected from any local fracture system (although a small inflow is recorded at 57 mbgl). Analysis of the GW1 hydrograph indicates an isolated sump well that fills rapidly after rainfall and slowly drains down until the next rainfall event occurs. The lowest groundwater levels exist towards the east / southeast of the site, the direction in which local groundwater broadly flows;

- The groundwater response to rainfall is relatively quick in most wells (apart from the water level recessions noted in GW1) and similar to that which would be observed in a surface water or shallow groundwater system (refer to Figure 7-7);
- There is a section of ground to the southwest of the site which slopes southwest, at this point groundwater in the subsoils will flow to a drain situated southwest of the site; and,
- On the northern side of the quarry, a large cliff face exists with high ground situated north of the quarry. A high groundwater level of 62.47 mAOD is recorded north of the quarry at ODW3, thus this area is hydraulically upgradient of the quarry.
- The higher groundwater levels recorded in areas surrounding the site (particularly north and south of the site) are most likely due to increased recharge in these areas as thicker subsoils will exist on undisturbed ground. Further north of ODW1 and ODW3, the ground continues sloping northeast and the shallow groundwater will flow northwest towards the Potters River.
- The available data indicates there are two groundwater flows systems locally:
    - The shallow flow which occurs across the top of the bedrock and which is driven by recent rainfall recharge.
    - Deeper, less connected, local flow within fissures and fractures in the Diorite.
    - The shallow flow is the dominant groundwater flow in the area, and this dominant system is also likely the main source of inflow to many of the local groundwater wells.
    - The shallow flow system follows topography, with flow from the west, and to the south, and away from the quarry on higher ground to the north.
    - More broadly, the deeper groundwater flow likely follows the river drainage pathways and flows to the east-southeast.
    - All recorded groundwater levels exist ~15-25m above the level of the base of the quarry, and pumping from this quarry has not affected local water levels from the observed data, demonstrating an isolation between the small amounts of groundwater flowing into the quarry through the diorite bedrock and the wider shallow groundwater system. For the purposes of clarity, the majority of water being pumped from the quarry is from rainfall falling directly on the quarry, not groundwater inflows.

Local Wastewater Treatment

7.165 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 standard septic tank and percolation area or a packaged wastewater treatment system and percolation area.

Designated Areas

7.166 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.

7.167 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 7-14 below.

Table 7-14
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 the discharge from the Site 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

7.168 The following water environment sensitive receptors have been identified in the receiving environment and are assessed for significance and sensitivity in Table 7-15 below:

- Surface Water - Potters River surface water quality;
- Surface Water – downstream DWPA along the Potters River for the Glenealy Water Supply;
- Groundwater - good quality, poorly productive diorite bedrock aquifer; and,
- Groundwater - nearby domestic and agricultural local groundwater wells and the people and farms they supply.

7.169 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 Potters River, they cannot therefore be impacted by any site based activities. There is no hydrological pathway from the Application site to Glenealy Woods pNHA and Deputy's Pass Nature Reserve SAC.

7.170 Of the designated sites indicated in Table 7-14 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 it is located on lands overlying a different aquifer (GWDTE-Buckroney-Brittas Fen) than that which occurs at the Site.

7.171 Potential effects on the Buckroney-Brittas Dunes and Fens SAC are considered below within the Impact Assessment.

Table 7-15
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 moderate quality but at risk of deteriorating. EPA noted unsatisfactory conditions at Kilboy bridge (refer to Q values in Para 7.85).	**Medium - Attribute has a medium quality or value at the local catchment scale only.** The river is very sensitive to any reduction in surface water quality.
2	Surface Water - Potters River	Local significance only. The Potters_010 SWB in the vicinity of the application site is listed as a Drinking Water Protected Area (DWPA) under Article 7 Abstraction for Drinking Water (IE_EA_10P010300).	This DWPA occurs upstream and downstream of the application site discharge and also includes the Kilmacurra Stream. The abstraction from the Potters River is for the Glenealy Public Supply which is reported to have a maximum abstraction volume of 185m^3/day, and the abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.	**High - Attribute has a high quality or value at the local catchment scale.** The river is very sensitive to any reduction in surface water quality.
3	Groundwater - Bedrock aquifer	Local significance only. No regional flowpaths occur.	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.
4	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 are sensitive to changes in local groundwater quality. Proposed activities at the site have the potential to result in a reduction in the groundwater quality.	**Medium-High - Attribute has a medium-high quality or value on a local scale** Boreholes surrounding the site are sensitive to a reduction in groundwater quality,

Site Baseline Summary

7.172 The proposed materials recovery / recycling facility and inert landfill development is located at Ballinclare Quarry, Kilbride, Co. Wicklow. The proposed development comprises the establishment and operation of C&D waste recovery facilities (a soil wash plant and C&D crushing plant) and backfilling of the quarry void through the establishment and operation of an inert lined landfill.

7.173 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.

7.174 The Potters 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. The Potters River flows south before discharging to the Irish Sea ~7km from the site.

7.175 The Potters River discharges to the Irish Sea. At the point at which this river discharges to the sea (near Potters Point), there is an SAC / pNHA mapped, identified as the Buckroney-Brittas Dunes and Fen SAC and pNHA (000729). While these sites are not designated for hydrological / hydrogeological elements, the presence of the Potters River through the designated area means that these sites are carried through to the impact assessment section for further evaluation.

7.176 Surface water quality is broadly good. Contemporary water quality results demonstrate good quality water, with the exception of elevated Arsenic at one sampling location (SW6) during one sampling event.

7.177 The Potters_010 SWB in the vicinity of the application site is listed as a Drinking Water Protected Area (DWPA) under Article 7 Abstraction for Drinking Water (IE_EA_10P010300). The surface water abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.

7.178 The diorite bedrock is classified as a poor aquifer (PI) 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.

7.179 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.

7.180 A site investigation carried out in 2014 comprised 3 No. groundwater monitoring boreholes and 2 No. rotary cored boreholes, which encountered diorite bedrock to 40m below the quarry floor. Previous site investigation drilling was completed in 2005 (TW series wells). Groundwater inflows to the TW series wells were estimated to be less than 5m^3/day, and to be more accurately described as seepages.

7.181 Minor groundwater inflows were encountered at most well locations, with the exception of borehole GW2 where a groundwater strike was encountered at 6m bgl (interface between made ground and bedrock) with a significant groundwater inflow (attributed to localised presence of loose unconsolidated material, refer to Para 7.120). In comparison, boreholes GW1 and GW3 encountered very little groundwater in the diorite bedrock and the groundwater took some time to enter the borehole following drilling.

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

7.183 Recorded groundwater levels range between 50.8-58.04mAOD within the Application site and 44.3-63.6mAOD in the wider area. Groundwater flow primarily occurs in a shallow system within the subsoil and flow directions broadly follow topography. There is limited flow within the underlying diorite bedrock, reflecting its relatively impermeable nature and status as a “Poor Aquifer”.

IMPACT ASSESSMENT

Evaluation Methodology

7.184 The impacts on the local surface water and groundwater environment of the proposed inert soil / C&D waste recovery, recycling and disposal activities at Ballinclare Quarry are assessed in the following section.

7.185 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.

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

7.187 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 Proposed Development. This approach allows effort to be focused on reducing risk where the greatest benefit may result.

7.188 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.

7.189 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.

7.190 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 hydrological and 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 Development

7.191 As described in Section 2, the proposed development at Ballinclare Quarry provides for the establishment and operation of a licensed, integrated material recovery / recycling facility and inert landfill which comprises three key elements

- a soil washing plant to win aggregate from imported soil and stone;
- a construction and demolition (C&D) waste recycling facility to produce aggregate from construction and demolition waste (principally concrete); and
- an inert engineered (i.e. lined) landfill to facilitate backfilling and restoration of the existing quarry void.

7.192 It will provide for the importation, re-use, recovery and/or disposal of by-product materials and inert wastes generated by construction and development projects in Counties Wicklow, Dublin and Wexford as well as the backfilling and long-term restoration of the former quarry to native woodland habitat.

7.193 As part of the proposed development water management systems will be required, and these detailed, which are relevant to the Water Environment Impact Assessment are outlined below.

Proposed Water Management and Treatment Systems

Dewatering of Quarry Void

7.194 To enable the quarry to be re-engineered as an inert landfill, and as previously noted, the quarry void is currently being dewatered, with ponded waters being pumped to an on-site water treatment system and discharged to the Potters River, in line with an existing Local Authority discharge licence (Ref. WPL 116).

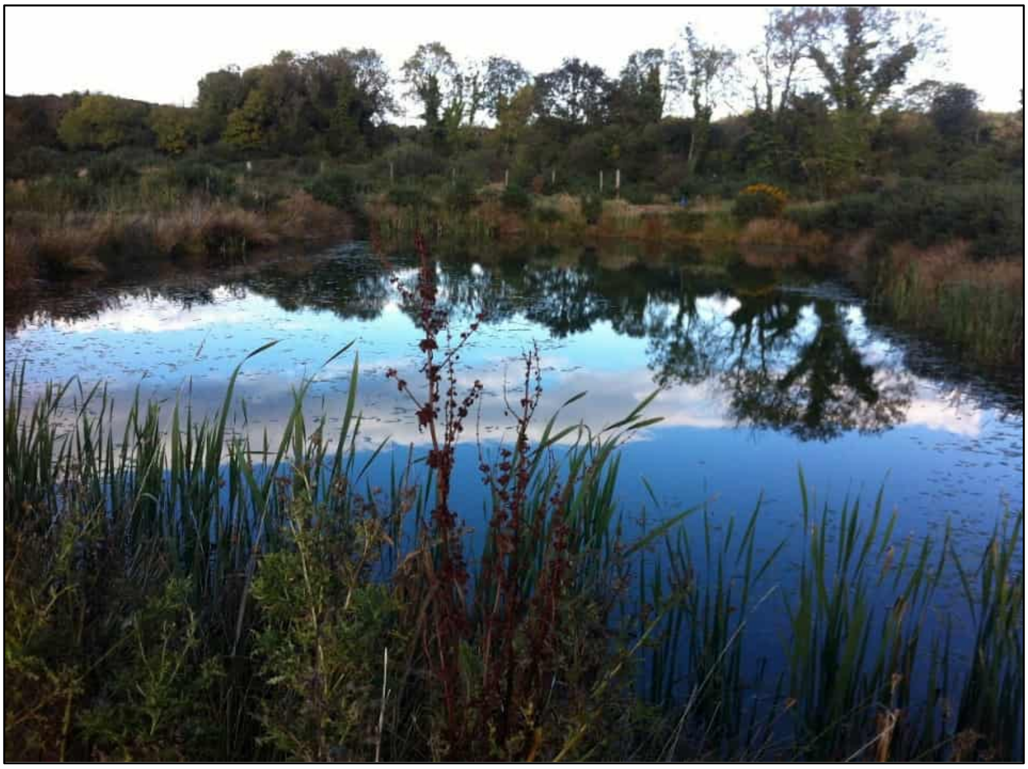
7.195 Due to elevated natural levels of arsenic in the water collecting in the quarry void, the discharge is treated via a bespoke Siltbuster treatment system which assists in the removal of suspended solids from the discharge water. Details of the Siltbuster treatment system are included in Appendix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

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

7.197 In terms of the potential for an increase in the risk of flooding in the Potters River, the quarry discharge is currently limited to 20L/s (72m^3/hr, or 1728m^3/day). This discharge flow is a very small proportion of likely larger flood flows in the Potters River. For example, the estimated 5%ile flow in the Potters River is 1.685m^3/s (1685 L/s), and the addition of the 20L/s from the quarry only accounts for ~1.2% of that river flow. Discharge from the quarry does not have to be continuous, and therefore can be temporarily stopped during extreme flood events. The quarry discharge will not significantly affect downstream flood flows in the Potters River.

Plate 7-1
Existing Lagoon at Ballinclare

Plate 7-2
Existing Final Lagoon at Ballinclare



7.198 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: Runoff Treatment

7.199 There will be on-going generation of runoff from rainfall on the landfill over the operational life of the inert landfill facility at the application site and as a result runoff from the infill area will need to be collected and treated prior to being discharged off-site.

7.200 The Proposed Development includes provision for phased infilling of the quarry void. During Phase 1A, surface water runoff from the infill area will be captured and recirculated (or supplied to soil wash plant). Any excess runoff will be tankered off site for licenced disposal. Surface water runoff from the C&D recovery yard will be captured and supplied to the soil wash plant, while runoff from the soil processing area will be directed towards a sump behind the wash plant for re-use in the washing process. Any excess water in the sump on the quarry floor will be treated prior to discharge.

7.201 Following the capping and restoring oh the Phase 1A area, surface water runoff will be captured by a perimeter toe drain and discharged offsite.

7.202 During the follow-on Phase 1 development, the discharge / runoff from the inert landfilling areas will be collected and treated in a Integrated Constructed Wetland. Runoff from the C&D waste recovery and soil processing area will be supplied to the soil wash plant. Any excess water collecting in the sump on the quarry floor will be treated by the Siltbuster system and settlement ponds prior to discharge.

7.203 During Phase 2 of the development, whereby the land surface will be raised to 80mAOD, the runoff from active inert landfill areas will be collected and treated within the Integrated Constructed Wetland. Runoff from capped landfill areas and the C&D waste recovery facilities will be collected and directed to temporary balancing ponds. Excess water in these balancing ponds will be treated by the Siltbuster system and settlement ponds prior to licensed discharge.

7.204 During Phase 3 of the Proposed Development, the water management system will mimic the Phase 2 operation outlined above.

7.205 Schematic details of the surface water management system to be implemented across the inert landfill area at each phase of development are shown in Figure 2-11 to Figure 2-16.

7.206 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 any lightly impacted / lightly contaminated run-off ('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.

7.207 An initial assessment indicates that there is sufficient spare land available at Ballinclare Quarry 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, thus minimising the amount of leachate generated and requiring treatment.

7.208 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.

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

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

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

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

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

7.210 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 1.06 hectares. Refer to Figures 2-12 to 2-16 and Figure 2-17 in Chapter 2 of this EIAR

Landfill Groundwater Control System

7.211 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.

7.212 Notwithstanding this, a groundwater control system will be installed below the clay layer to ensure it is not damaged by hydrostatic uplift pressures. It is envisaged that the drainage system at the base of the quarry / inert landfill cells will comprise a herringbone system of granular drainage channels and that these would feed groundwater inflows to a collection point at the deeper excavation in the middle of the existing quarry floor which effectively acts as a sump over the initial landfilling stages (Phases 1A to 1C). During Phase 1C of landfilling, riser pipes will be installed at the sump area to facilitate the continued operation of the groundwater collection system which controls uplift pressures beneath the basal liner. Submersible pumps will be placed in these risers and will continually lift and remove any dewatered groundwater collecting in them. Pumping will continue until such time as the overlying inert waste has reached a depth / height where the weight of waste exceeds the maximum uplift pressure from surrounding groundwater. At that point in time, pumping of groundwater is likely to cease and the riser pipe will be decommissioned by backfilling it with bentonite.

7.213 During Phase 2 of the landfill development, the land surface will be raised above the level of the local groundwater table. As such, there will be no further requirement to manage or pump groundwater.

Soil Washing Plant / C&D Facility

7.214 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 or the C&D recovery area to the west of the site access road (other than direct rainfall runoff captured from the roof of the C&D shed). All process water associated with the winning of recycled aggregate from more granular waste soils or from claybound C&D, as well as rainfall runoff from these areas will be re-circulated in a closed loop system at the soil wash plant. 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.

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

Wastewater Management

7.216 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 wastewater treatment system are provided in Appendix 7-K for reference. The existing wastewater system does not have the full capacity for the proposed loading arising when the envisaged maximum numbers of personnel are based on site during the operation of the Proposed Development. Provision is therefore made for excess effluent to be stored in a holding tank, and tankered off site (by a licenced haulier) on a monthly basis. The excess effluent will be transferred to a licenced wastewater treatment plant for off-site treatment and disposal. Details of the sub-surface storage tank are also provided in Appendix 7-K.

Wheelwash

7.217 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. A further wheelwash will be constructed at the proposed aggregate production yard in the south-eastern corner of the application site. Water supplied to these wheelwashes will be recycled in a closed system and topped up with water from the supply well or from the quarry sump / balancing ponds as required. There is no water discharge from the wheelwash systems.

Long-Term (Post Closure) Surface Water Management

7.218 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.

7.219 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.

7.220 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 Potters River.

7.221 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 / attenuation pond along the southeastern boundary (refer to Figure 2-19) that will discharge to an existing stream which flows to the Kilmacurra Stream.

Site Entrance Drainage Collection and Water Management System

7.222 Runoff from the site entrance area and the weighbridge area will be collected and treated in a hydrocarbon interceptor, and it will then pass to the existing storage pond [30m x 15m x 3m = 1,350m^3 volume). Excess water from the storage pond will be pumped (duty and standby pumps will be installed to ensure redundancy) to the main quarry drainage system, where it will either be used for water supply to the soil washing plant or treated and discharged.

Site Water Supply

7.223 Water supply to the site office and welfare facilities will continue to come from well PW2. Water management and water supply to the soil washing plant will operate as described in Paras 7.199 to 7.204 above.

Construction Stage Impacts

7.224 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 C&D waste recovery facilities and new inert landfill, the construction stage is taken to be site preparation which involves any residual dewatering from the quarry sump, the construction of the required infrastructure and site preparation, which is outlined in Chapter 2 of this EIAR.

Direct Impacts

Groundwater

7.225 The groundwater receptors at the site include the underlying poorly productive diorite bedrock aquifer and nearby domestic and agricultural local groundwater supply wells.

7.226 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. Discharge of these to groundwater would cause an **adverse effect.**

Surface Water

7.227 The surface water receptors at the site are the Kilmacurra Stream and the Potters River (including the DWPA IE_EA_10P010300). Direct impacts during the construction stage have the potential to arise from:

- Uncontrolled discharge of water from the flooded quarry sump (over the remainder of the 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 and the DWPA. This would be an **adverse effect.**
- An uncontrolled discharge of water from the flooded quarry sump also 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.**
- Uncontrolled discharge of water from the quarry sump has the potential to create increased Arsenic concentrations in downstream surface water bodies (Potters River). This would be an **adverse effect.**

Indirect Impacts

Designated Sites

7.228 Potential effects on downstream designated sites (i.e. Buckroney-Brittas Dunes and Fen SAC and pNHA (000729) are linked to the potential Construction Stage effects on surface water as outlined above.

7.229 Discharge of poor-quality surface water from the Application site has the potential to affect the water quality in the Potters River, which has the further potential to have secondary adverse effects on the Buckroney-Brittas Dunes and Fen SAC / pNHA. However, the potential consequences for the designated site(s) are limited as the SAC / pNHA is designated primarily for Annex I/II habitats and species associated with a dune environment. The Buckroney Fen (part of the SAC / pNHA), which could be considered more hydrologically dependent, but is not hydrologically connected to the Potters River and is fed by rivers / streams further south of the Potters River. As such, the potential effects from poor quality water in the Potters River are limited.

Operation Stage Impacts

7.230 During the operational stage the dry quarry void will be backfilled and restored using imported soil and stone waste, while C&D materials will be recovered at the proposed recovery facility to win aggregate material. Therefore, discharges that could potentially effect groundwater quality and surface water quality are the principal potential impacts during this stage, primarily from the infilling of the quarry with inert soil and stone material.

Direct Impacts

Groundwater

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

7.232 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 potentially affect groundwater quality in the aquifer, and the groundwater quality of water abstracted from nearby local groundwater wells. This would be an **adverse effect.**
- Impacts on groundwater levels due to pumping / dewatering and infilling of the quarry void (by blocking groundwater flow paths), potentially affecting the supply capacity of nearby local groundwater wells. **This would be an adverse effect.**

7.233 Each of the above impacts is assessed in terms of the character, magnitude, duration, probability and consequence in Table 7-16 below.

Surface Water

7.234 It is noted that the surface water receptor in the vicinity of the site is the Potters River (its water quality and aquatic ecosystem and its use as a DWPA) are very sensitive in terms of surface water quality and flow volumes during flood events.

7.235 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.**

7.236 Each of the above impacts is assessed in terms of the character, magnitude, duration, probability and consequence in Table 7-16 below.

Indirect Impacts

Designated Sites

7.237 Potential effects on downstream designated sites (i.***e.*** Buckroney-Brittas Dunes and Fen SAC and pNHA (000729) are linked to the potential Operational Stage effects on surface water as outlined above, primarily related to suspended solids entrainment in discharge water.

7.238 Discharge of poor quality surface water from the Application site has the potential to affect the water quality in the Potters River, which has the further potential to have secondary adverse effects on the Buckroney-Brittas Dunes and Fen SAC / pNHA. However, the potential consequences for the designated site(s) are limited as the SAC / pNHA is designated primarily for Annex I/II habitats/species associated with a dune environment. The Buckroney Fen (part of the SAC / pNHA), which could be considered more hydrologically dependent, but is not hydrologically connected to the Potters River, and is fed by rivers / streams further south of the Potters River. As such, the potential effects from poor quality water in the Potters River are limited.

Post - Operational Stage Impacts

7.239 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.

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

Direct Impacts

7.241 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 native woodland habitat.

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

7.243 There will be no trade effluent discharge to any surface watercourse 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.

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

Indirect Impacts

7.245 There are no indirect post closure impacts anticipated.

Unplanned Events

7.246 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.

7.247 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.

7.248 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

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

The ‘Do Nothing’ Scenario

7.250 If the proposed waste recovery and landfilling 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.

7.251 Groundwater vulnerability at the site will remain high to extreme as bare rock is exposed.

7.252 In the absence of any site management practices, surface water bodies / groundwater would be vulnerable to impacts from any future human activities within and/or around the quarry.

7.253 In the absence of controlled pumping and discharge (with water treatment and monitoring) from existing quarry void it would fill with rainwater (as it did in the past), and potentially overflow, leading to uncontrolled discharges which would likely contain elevated concentrations of arsenic.

Rating of Identified Potential Impacts and Significance

7.254 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.

7.255 The description of the potential effects and rating for each identified impact is presented in Table 7-16 below.

7.256 The significance of impacts is based on the significance/ sensitivity of the existing environment and the description of identified potential impacts, refer to Table 7-16 below. The significance of Impact is determined from the Classification of the Significance of Impacts in Appendix 7-I.

Table7-16
Direct Impacts: Description and Significance of Effects

	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**
2	Impact on groundwater levels / flowpaths	Potential to affect groundwater levels due to pumping groundwater from quarry floor to completely dewater the quarry.	Small magnitude given the relatively impermeable, unproductive aquifer	Duration of effect during the construction phase would be temporary to short	Unlikely given the underlying hydrogeological regimen at the site and from site data collected to date (no significant effect)	Lowering of water levels in local domestic/agricultural wells	The potential impact on groundwater levels is rated as being Low, based on knowledge of the underlying hydrogeology at the site and the available data from local groundwater wells while pumping is ongoing in the quarry.	**Moderate**
Construction Stage: Surface Water								
3	Impact on **surface water quality** in the Potters River during the final 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 and DWPA. The Glenealy WS abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.	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**
4	Impact on **surface water flow / levels** in the Potters River during the final dewatering phase of the quarry void.	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. The quarry discharge is a low volume (20L/s) and it constitutes only a very small proportion of flood flows. Discharges (pumping) from the quarry can be stopped during extreme flood events.	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, but can be stopped if a significant (out of bank) flood event occurs.	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**

	Potential Impacts	Character	Magnitude	Duration	Probability	Consequences	Description of Impact	Significance of Impact
Construction Stage – Indirect Effects								
5	Impacts on qualifying interests of downstream Designated Sites	Potential to affect surface water quality in the Potters River, thereby potentially affecting the qualifying interests of the downstream SAC (Buckroney-Brittas Dunes and Fen SAC/pNHA), which the Potters River flows through	Extent in the river would be downstream of the discharge point.	Duration of effect would be temporary (duration of construction stage dewatering).	Unlikely effect due to the volume of flow in the Potters River in comparison to any discharge, as well as the lack of hydrological dependency on the qualifying interests of the SAC / pNHA (as the Fen is not hydraulically connected to the Potters River)	Potential effects on vegetation associated with the Dune complex	The potential impact on surface water quality is rated as being Medium based on the character, magnitude, duration and consequence of the identified effects.	**Slight**
Operational Stage – Groundwater								
6	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 – based on observed disconnect between bedrock hydrogeology underlying the quarry and predominance of shallow groundwater flow in lands surrounding the quarry.**
7	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**
8	Impact on groundwater levels / flowpaths	Potential to affect groundwater levels due to pumping groundwater from the quarry floor to maintain groundwater levels below clay liner, and potential to block groundwater flowpaths by filling the quarry void.	Small magnitude given the relatively impermeable, unproductive aquifer. Quarry face indicates very tight bedrock with little or no evidence of fracturing/jointing or faults (along which groundwater might flow).	Duration of effect during the operational phase would be temporary to long term, depending on the rate of fill of the quarry void to the point where hydrostatic uplift pressure is overcome by the imported material.	Unlikely given the underlying hydrogeological regimen at the site and from site data collected to date (no significant effect)	Lowering of water levels / yields in local domestic/agricultural wells.	The potential impact on groundwater levels is rated as being Low, based on knowledge of the underlying hydrogeology at the site.	**Moderate to Slight**
Operational Stage: Surface Water								
9	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 and DWPA. The Glenealy WS abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.	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**

	Potential Impacts	Character	Magnitude	Duration	Probability	Consequences	Description of Impact	Significance of Impact
10	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 and DWPA.	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**
Operational Stage – Indirect Effects								
11	Impacts on qualifying interests of downstream Designated Sites	Potential to affect surface water quality in the Potters River, thereby potentially affecting the qualifying interests of the downstream SAC (Buckroney-Brittas Dunes and Fen SAC / pNHA), which the Potters River flows through	Extent in the river would be downstream of the discharge point.	Duration of effect would be temporary (duration of construction stage dewatering).	Unlikely effect due to the volume of flow in the Potters River in comparison to any discharge, as well as the lack of hydrological dependency on the qualifying interests of the SAC / pNHA (as the Fen is not hydraulically connected to the Potters River)	Potential effects on vegetation associated with the Dune complex	The potential impact on surface water quality is rated as being Medium based on the character, magnitude, duration and consequence of the identified effects.	**Slight**
Post Closure Stage: Surface Water								
12	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 and DWPA. The Glenealy WS abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.	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

7.257 A summary of those impacts which have been identified as having a likely, significant effect is provided below. Only one potential impact has been identified as having a likely, significant effect, specifically:

- 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.

7.258 Although not considered to be potential significant impacts Associated indirect effects on Buckroney-Brittas Dunes and Fen SAC / pNHA are also discussed below in the Residual Impact Assessment (refer to Para 7.301 to 7.311).

7.259 Also, although not considered to be potential significant impacts, we have also provided information on Groundwater Protection in the discussion below (in the Residual Impact Assessment (refer to Para 7.312 to 7.317)), as this was one of the key issues and concerns raised during public consultation at pre-application stage.

MITIGATION MEASURES

7.260 Proposed mitigation measures to reduce the potential impacts associated with the planned development at Ballinclare Quarry 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. The mitigation measures employed are related to all potential effects identified within points 1-12 of Table 7-16 above.

7.261 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.

7.262 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.

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

Construction Stage

7.264 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 (WPL116), or any required revision to the licence resulting from conditions associated with this application;
- 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 other refuelling activities;
- All refuelling will be completed by competent / trained operatives;
- 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

7.265 Water in the quarry void will be pumped to the treatment plant and will then be routed to the settlement / attenuation ponds for further treatment (settlement) prior to discharge at the Potters River. The locations of the existing settlement ponds are shown on Figure 2-1.

7.266 All surface water discharges to the Potters River will comply with the emission limits set by the discharge licence [WPL116] (or those which may supersede them in any waste licence issued by the EPA).

7.267 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

7.268 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.

7.269 The following additional mitigation measures will also be implemented:

Inert Landfill Liner

7.270 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. The proposed clay liner is intended to have the following functions:

- Prevent discharge through the base of the backfilled quarry void.
- Prevent discharge through the sidewalls of the backfilled quarry void.
- Ensure that the wider aquifer and underlying groundwater system and groundwater quality is physically protected by a pathway/flow barrier.

On-site Passive Wetland Treatment System

7.271 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 managed separately to run-off which is not in contact with the imported wastes. Run-off arising in contact with waste bodies will be collected separately and directed for recycling / re-use at the soil wash plant. Any excess run-off in contact with imported waste will be pumped 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.

7.272 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.

7.273 Based on the initial assessment and design, the proposed wetland treatment system at Ballinclare Quarry will comprise the existing approved treatment system in addition to:

(i) A wetland treatment system: comprising the following elements in series:
    a. Anaerobic (biochemical reactor) wetland;
    b. Iron Sequestering Unit (ISU);
    c. Aerobic wetland.
(ii) A leachate reception tank: up to 50m^3, self-bunded storage tank with level controls.
(iii) A pump house: housed in a standard shipping container (6.0m x 2.4m x 2.6m) containing feed, discharge and chemical dosing pumps;
(iv) Off-site discharge via existing ditch / drainage channels to the Ballinclare Stream and the Potters River further downstream.

Testing and Inspection of Imported Material

7.274 All inert soil / C&D waste materials will be transported to the proposed materials recovery / recycling facility and inert landfill at Ballinclare Quarry using heavy goods vehicles (HGVs) comprising a mix of rigid body lorries and articulated trucks. All HGVs importing inert wastes (or by-product) to the facility will be required to pass over the new weighbridge which is to be installed at the northern end of the existing access road into the site.

7.275 On arrival, HGV drivers carrying the waste intake materials will identify themselves to staff at the site / weighbridge office before proceeding to the active backfilling / landfilling area or the C&D waste recovery / recycling facilities (as appropriate). Staff will record the time and date of arrival, the nature, origin and weight of the imported materials (whether waste or by-product / engineering materials), the customer / Client name, the truck licence plate number, any relevant waste collection permit details and any further details which may be required by the EPA waste licence. All records of by-product and waste intake will be maintained on site for tracking and auditing purposes.

7.276 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.

7.277 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 and complies with site acceptance criteria. A site investigation report of other detailing the characterisation testing undertaken and results of testing will be submitted for approval in advance by customers, clients or sub-contractors intending to forward soil and stone materials to the facility. A suitably qualified person shall review the Site Investigation Report and determine if the material is suitable for acceptance. All HGVs transporting waste to the site must hold a valid Waste Collection Permit. Details of the hauliers permit shall be issued in advance. A letter of suitability shall be issued to the source site. Specific conditions if required will be outlined and agreed by the source site. Onsite CCTV cameras at the weighbridge will be fitted with vehicle recognition software to ensure the vehicle is pre-approved and carries a waste collection permit.

7.278 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 which is identified with intermixed non-hazardous / hazardous wastes on foot of a CCTV / visual inspection at the weighbridge will be deemed unacceptable, will be immediately rejected and re-directed off-site to an alternative authorised (i.e. permitted or licensed) waste facility.

7.279 All inert soil and stone imported to the facility will be unloaded (end-tipped) from HGV's at the active landfilling areas. In addition to visual / CCTV inspection at the weighbridge, it will be inspected again by site based personnel at the landfilling area 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 (i.e. permitted or licensed) waste facility.

7.280 Similarly, should any non-inert or non-C&D waste be identified amongst incoming waste consignments at the soil / 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

7.281 If, following its acceptance at the facility, there is any subsequent grounds for concern about the nature of the wastes imported to and/or handled on site, it will be segregated and transferred to the covered waste inspection and quarantine shed for closer inspection and classification testing to establish whether it can be accepted at the facility or not. Suspect waste will be identified on the basis of visual inspection (unusual colour, intermixed wastes etc.) or by smell during waste placement, handling and/or processing / crushing. A detailed record will be kept of all such inspections.

7.282 Should detailed inspection and/or any subsequent testing indicate that the quarantined materials are non-inert or cannot be accepted and used for landfilling or recovery / recycling purposes at the facility, they will be transferred off-site by to another appropriately authorised waste facility.

7.283 It is proposed to designate the former aggregate storage shed at the southern site boundary (at the southern limit of the former concrete / asphalt production area) as the on-site waste inspection and quarantine facility. The shed is roofed, closed on three sides and has a concrete floor, thereby protecting any suspect waste which might be transferred and held there 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).

7.284 Any significant volumes of intermixed non-inert C&D wastes (principally metal, timber, PVC pipes and plastic) inadvertently imported to the facility will be separated out and temporarily stored in skips or covered at the waste recovery area / shed or at the waste quarantine area prior to removal off-site to appropriately authorised waste facility. A representative sample will be taken (in accordance with waste licence requirements) of waste materials accepted at the inert landfill facility and subjected to compliance testing which focuses on key contaminant indicators. This data shall be used to confirm that the accepted soils are inert / acceptable (according to Council Decision 2003/33/EC) and/or comply with approved waste intake acceptance criteria. Compliance testing will be undertaken by the Applicant.

7.285 Only operators and/or haulage firms holding valid current waste collection permits will be engaged to transfer waste streams off-site to other authorised waste disposal or recovery facilities as required.

Surface Water Management (to Protect Downstream Receptors)

7.286 The operational phase of the Proposed Development includes for a phased infilling of the quarry void. During Phase 1A, surface water runoff from the infill area will be captured and recirculated (or supplied to soil wash plant). Any excess runoff will be tankered off site. Surface water runoff from the C&D recovery yard will be captured and supplied to the soil wash plant, while runoff from the soil processing area will be directed towards a sump behind the wash plant for use in the washing process. Any excess water in the sump on the quarry floor will be treated prior to discharge.

7.287 Following the capping and restoring of the Phase 1A area, surface water runoff will be captured by a perimeter toe drain and discharged offsite.

7.288 Before the end of Phase 1A, the construction of the Integrated Constructed Wetland will commence. During that construction phase, excess water from the construction area will be pumped back to the quarry void. In addition, a temporary cutoff drain and double line of silt fencing will be used to ensure separation between the wetland construction area and the Ballinclare stream.

7.289 During the follow on Phase 1 development, the discharge/runoff from the inert landfilling areas will be collected and treated in a Integrated Constructed Wetland. Runoff from the C&D waste recovery and soil processing area will be supplied to the soil wash plant. Any excess water collecting in the sump on the quarry floor will be treated by the Siltbuster system and settlement ponds prior to discharge.

7.290 During Phase 2 of the development, whereby the land surface will be raised to 80mAOD, the runoff from active inert landfill areas will be collected and treated within the Integrated Constructed Wetland. Runoff from capped landfill areas and the C&D waste recovery facilities will be collected and directed to temporary balancing ponds. Excess water in these balancing ponds will be treated by the Siltbuster system and settlement ponds prior to licensed discharge.

7.291 During Phase 3 of the Proposed Development, the water management system will mimic the Phase 2 operation outlined above.

7.292 Surface water quality testing of the discharge from the site will be completed on a quarterly basis (subject to any update of the existing discharge license and/or conditions within the Waste License).

7.293 As such, runoff from the site will be managed during each phase of the proposed infilling, as well as management of surface water from the C&D waste recovery facility, in order to mitigate against any potential effects on downstream watercourses following discharge off-site.

Post – Operational Stage

7.294 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 native woodland habitat.

7.295 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.

7.296 Once the site is backfilled, it will become vegetated and runoff and drainage will either percolate to ground or runoff and drain passively from the site via the wetland area. A small area of the southeastern corner of the site will drain locally to a suitably sized swale /attenuation pond and will discharge following treatment to the Kilmacurra Stream.

7.297 The long-term surface water management regime for the backfilled landform described in Chapter 2 will be established incrementally over time, as landfill and restoration work proceeds. On completion of the quarry backfilling and restoration works, any outstanding long-term site drainage works will be completed.

RESIDUAL IMPACT ASSESSMENT

7.298 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. Detailed proven mitigation measures will be implemented at all stages of the development to ensure protection of downstream surface water quality in the Potters River.

7.299 A WFD Compliance Assessment is included as Appendix 7-N. That assessment concludes that there will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the proposed development. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs are protected from any potential deterioration. Mitigation proposed for the protection of protected areas during the construction, operation and post-operational stages of the proposed development will ensure the qualitative and quantitative status of the receiving ground and surface waters will not be altered by the proposed development and thereby limiting the potential for the proposed development to negatively impact upon any designated site.

7.300 The following additional residual assessment is added with respect to groundwater and Buckroney-Brittas Dunes and Fen SAC / pNHA:

Groundwater Quality and Groundwater Levels / Flows and Potential Effects on Nearby Groundwater Wells

7.301 Potential impacts on local groundwater wells can occur if the imported soil/stone material does not conform to its inert status. Mitigation measures have been outlined above (Testing and Inspection of Imported Material) which will prevent this.

7.302 Local domestic wells have been identified, which are listed above within the Receiving Environment section (Groundwater abstractions and wells). Due to the broadly unproductive hard Diorite bedrock aquifer, impacts on groundwater levels distal to the site will not occur. This is borne out from on-site information in the observation wells (GW1-GW3) and from monitoring in local domestic wells.

7.303 Groundwater will flow within the upper clay / overburden layer as detailed in Para 7.160. Local domestic wells are either upgradient of the site or, where downgradient such as at CBDW1 and KHDW1, there is a surface watercourse (the Ballinameesda Lower [Kilmacurra] stream), which creates a hydraulic boundary between these local domestic wells and the site.

7.304 Local domestic wells also show no significant effect on groundwater levels due to the ongoing pumping / dewatering from the application site at an average pumping rate of 72 m3/hr. There is no response recorded in local wells from that pumping despite a water level change of ~13m at the quarry in recent times.

7.305 In light of the measured groundwater levels and historical observations, it is concluded that no effects on local domestic / agricultural wells will occur as a result of the planed operations and activities at the quarry.

7.306 A clay liner will be installed underlying the waste material being infilled in the quarry. This clay liner will have sufficient low permeability (at least 1x10-7m/s) so as to hydraulically isolate it from the underlying bedrock aquifer.

7.307 Groundwater quality testing will be completed (on a quarterly basis) in wells GW1-GW3 to ensure there is no change in groundwater quality and no effects from the importation and placement of the inert soil and stone material at the lined landfill facility.

7.308 The mitigation measures outlined in relation to waste material will further ensure no impacts occur to local groundwater quality.

7.309 Proven and effective control measures to mitigate any risks to groundwater quality or groundwater levels at the Application site are outlined above. Application of these controls will break the pathway (if any) between the potential source and the receptor.

7.310 Minor hydrocarbon detections were recorded at GW2 and in view of this, in-situ remedial works are proposed at GW2 to remove the minor hydrocarbon issue noted in that monitoring well during groundwater sampling (refer to section on Monitoring below).

7.311 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 (quality and quantity) and/or surface water (quality and quantity).

Potential Effects on Buckroney-Brittas Dunes and Fen SAC / pNHA

7.312 Buckroney-Brittas Dunes and Fen SAC / pNHA is located downstream of the Site and the discharge from the Site to the Potters River. It is also located partially in the same GWB as the Site and partially in the GWDTE-Buckroney-Brittas Dunes GWB.

7.313 Buckroney-Brittas Dunes and Fen SAC / pNHA is located a considerable distance downstream of the proposed site, therefore the potential for site operations to effect groundwater or surface water quality over those distances is negligible. In addition, there are several other factors, such as topography and changes in geology that diminish further any potential effects on groundwater quality or groundwater flows.

7.314 Mitigation for the protection of surface water quality during all phases of the proposed development are outlined above to deal with sediment, hydrocarbons, and dissolved metals.

7.315 There will be no significant change in flow discharging to the Potters River, and therefore flow (or volume) of water will not effect the functioning of the hydrology of the protected habitat.

7.316 The operation of the proposed site will not effect groundwater quality for the reasons outlined above, therefore it will not effect the GWB or the GWDTE waterbody within which Buckroney-Brittas Dunes and Fen SAC/pNHA occurs.

7.317 As a result, there will be no significant potential to effect water quantity or water quality that flows down the Potters River towards Buckroney-Brittas Dunes and Fen SAC / pNHA.

CUMULATIVE IMPACT ASSESSMENT

7.318 Cumulative impacts are those which result from incremental changes caused by other past, present or reasonably foreseeable actions, together with those generated by the proposed development. Therefore, the potential impacts of the proposed development cannot be considered in isolation but must be considered in addition to impacts already arising from existing or planned development.

7.319 Given the nature of the groundwater regime at the Ballinclare site (refer to Para 7.164 for the CSM), and also considering the inert fill and the engineered liner, there is no potential for significant impacts on the groundwater environment from the Application site. Also, there are detailed proposals and mitigation for protection of the surface water environment included in the proposal at Ballinclare Quarry. As a result, the potential for cumulative effects on the Potters River or the downstream water environment are negligible.

7.320 Notwithstanding the above, a review of Wicklow County Council’s online planning portal and An Bord Pleanála case files identifies six prospective development projects within a 5km radius of the application site which have either applied for or have been granted planning permission. Of these one (a sand and gravel pit) is for substitute consent and another (for land raising) is for an extension of time which means that development impacts associated with them are already extant and reflected in baseline environmental surveys.

7.321 Of the remaining projects, one (WCC Planning Ref. 23/60497) is located 2 km south-east of the application site and relates to a land raising project, which envisages importation of a maximum of 24,000 tonnes of soil per annum for a maximum of two years. In light of the limited time duration, the separation distance and the fact that it is will not use the same local roads as the proposed development at Ballinclare Quarry, it is considered that there is no potential for cumulative effects with this project.

7.322 The remaining three projects are all considered either too small in scale or too distant from the application site to generate any potential adverse cumulative effects on the water environment.

7.323 Planning permission for the existing landfill facility at Ballynagran was extended by five years from 2021 to 2026 (by Planning Ref. 20/21). As all environmental impacts associated with the Ballynagran facility are well established, they are deemed to be included or reflected in the findings / measurements obtained by baseline surveys undertaken for the purposes of this environmental impact assessment. These impacts will remain in existence and no further change is likely to arise in the local environment. As such, no cumulative impacts with that development on the water environment need to be assessed or considered.

MONITORING

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

7.325 Protection and monitoring of groundwater quality was a recurring issue raised by 3rd parties during public consultation at pre-planning stage. 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):

- A replacement monitoring well for GW2 will be installed. It will be called GW2A.
- As outlined above monitoring well GW2 will undergo remedial works to remove residual hydrocarbons from that well, and following that remediation, monitoring well GW2 will be decommissioned.
- Groundwater dataloggers will be installed (or will be left in-situ) in monitoring wells GW1, GW2A and GW3, and these will record continuous water level data. Data from these wells will be downloaded and processed / reviewed on a quarterly basis;
- Groundwater quality testing will be undertaken on samples taken from the 3 No. groundwater monitoring wells on a quarterly basis. Laboratory analysis will include the following analytes:
  - pH
  - BOD / COD
  - Ammonia (as N)
  - Nitrate / Nitrite
  - Total Nitrogen
  - Total Dissolved Solids
  - Chloride
  - Asbestos
  - Electrical Conductivity
  - Potassium
  - Sodium
  - Sulphate
  - Total Phosphorous
  - Orthophosphate (as P)
  - Dissolved metals – As, B, Cd, Cu, Pb, Mg, Mn, Ni, Zn & Hg
  - Oils, Fats & Grease
  - Total Petroleum Hydrocarbons
  - Diesel Range Organics / Petrol Range Organics
  - Total Coliforms
  - Faecal Coliforms

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

7.327 In addition, baseline groundwater quality monitoring is proposed at local wells CBDW1, GLDW1, DW2, LDDW1, DW3, ODW1, and ODW2. The selected wells will have groundwater quality sampling undertaken twice prior to works commencing and biannually (every two years) thereafter during the construction and operational phases. If on site monitoring indicates any change in groundwater quality during the operational phase, then the frequency of off-site groundwater quality monitoring can be reviewed and increased.

7.328 The groundwater monitoring regime will remain in place for the life of the proposed landfilling and recovery operations and for a period of 5 years thereafter during the aftercare period (with proposed monitoring in year 1, year 3, and year 5 in the post closure period).

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)**.

Geological Survey of Ireland (March 2003), Wicklow County Council Groundwater Protection Scheme Main Report

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

HYDROLOGY AND HYDROGEOLOGY 7

FIGURES

HYDROLOGY AND HYDROGEOLOGY 7

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. 349/1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84/1995, S.I. No. 352/1998, S.I. No. 93/1999, S.I. No. 450/2000 and S.I. No. 538/2001), S.I. No. 30/2000, the Planning and Development Act, and S.I. 600/2001 Planning and Development Regulations and subsequent Amendments. These instruments implement EU Directive 85/373/EEC and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment;
- The Planning and Development Act, 2000 (as amended);
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- S.I. No 296/2018: S.I. No. 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law;
- The Heritage Act 1995, as amended.

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. 9/2010 European Communities Environmental Objectives (Groundwater) Regulations 2010 and amendments (S.I. No. 389/2011 and S.I. No. 149/2012).
- S.I. No. 272/2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009 and amendment (S.I. No. 327/2012);
- S.I. No. 684/2007 Waste Water Discharge (Authorisation) Regulations, 2007, as amended (S.I. 231/2010);
- S.I. No. 278/2007 European Communities (Drinking Water) (No. 2) Regulations;
- Water Services Acts 2007 and 2012;
- S.I. No. 722/2003 European Communities (Water Policy) Regulations;
- S.I. No. 122/2010 European Communities (Assessment and Management of Flood Risks) Regulations 2010;
- S.I. No. 457/2008 European Communities (Environmental Liability) Regulations which bring into force the European Liability Directive (2004/35/EC);
- S.I. No. 296/2009: The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (as amended by S.I. No. 355/2018);

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- Local Government (Water Pollution) Acts 1977 to 1990;
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- European Communities (Quality of Shellfish Waters) Regulations, 2006 (S.I. No. 268/2006);
- European Union (Drinking Water) Regulations 2014 (S.I. No. 122/2014);
- Bathing Water Quality Regulations, 2008 (S.I. No. 79/2008);
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations, 2010(as amended by S.I. No. 389/2011; S.I. No. 149/2012; S.I. No. 366/2016; the Radiological Protection (Miscellaneous Provisions) Act 2014; and S.I. No. 366/2016); and,
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APPENDIX 7-B
Discharge Licence WPL-116

HYDROLOGY AND HYDROGEOLOGY 7

APPENDIX 7-C
Discharge Licence Impact Assessment on the Potter 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[3].

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

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[3] 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.

directly with the water quality standard (EQS) to determine whether the discharge will cause an exceedance of the EQS value in the receiving waters.

The Mass Balance is calculated as:

$$T = \frac{FC + fc}{F + f}$$ ***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 C-1 below.

Table C-1: 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 **Table C-1**.

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 Paras 7.100 and 7.101 above, and Appendix 7-D below.

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 C-2** below

Table C-2: 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.

Other Discharge Scenarios

The Assimilation Capacity (AC) and Mass Balance (MB) assessment completed above, relates to dewatering of the quarry which is ongoing. This is considered the worst-case scenario.

As the quarry is infilled there will be less exposed bedrock, and progressively more vegetated ground across the site.

For landfilling Phase 1, Phase 2 and Phase 3, excess water which is not recycled at the soil wash plant will be treated in the water treatment plant and/or polished in the proposed integrated constructed wetland and the treatment is expected to improve on the discharge water quality assessed above. As a result, there will be a reduced risk to surface water than that already assessed.

In the post closure scenario, again the risk is further reduced as surface water run-off will not be in contact with imported waste. While the water treatment plant will be decommissioned and removed from the site, at that point in the future, run-off will only be over the restored landform site and will continue to feed passively through the ICW and be polished prior to discharge.

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.

The (AC) and (MB) assessment completed above are worst case, and other discharge scenarios throughout the course of the proposed development will have more treatment, and less risk to downstream surface water receptors.

APPENDIX 7-D
EPA Hydro Tool Ungauged Catchment Report

HYDROLOGY AND HYDROGEOLOGY 7

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

HYDROLOGY AND HYDROGEOLOGY 7

APPENDIX 7-F
Water Quality Analysis Laboratory Reports

HYDROLOGY AND HYDROGEOLOGY 7

APPENDIX 7-G
Rating of Existing Environment Significance / Sensitivity

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 2012)

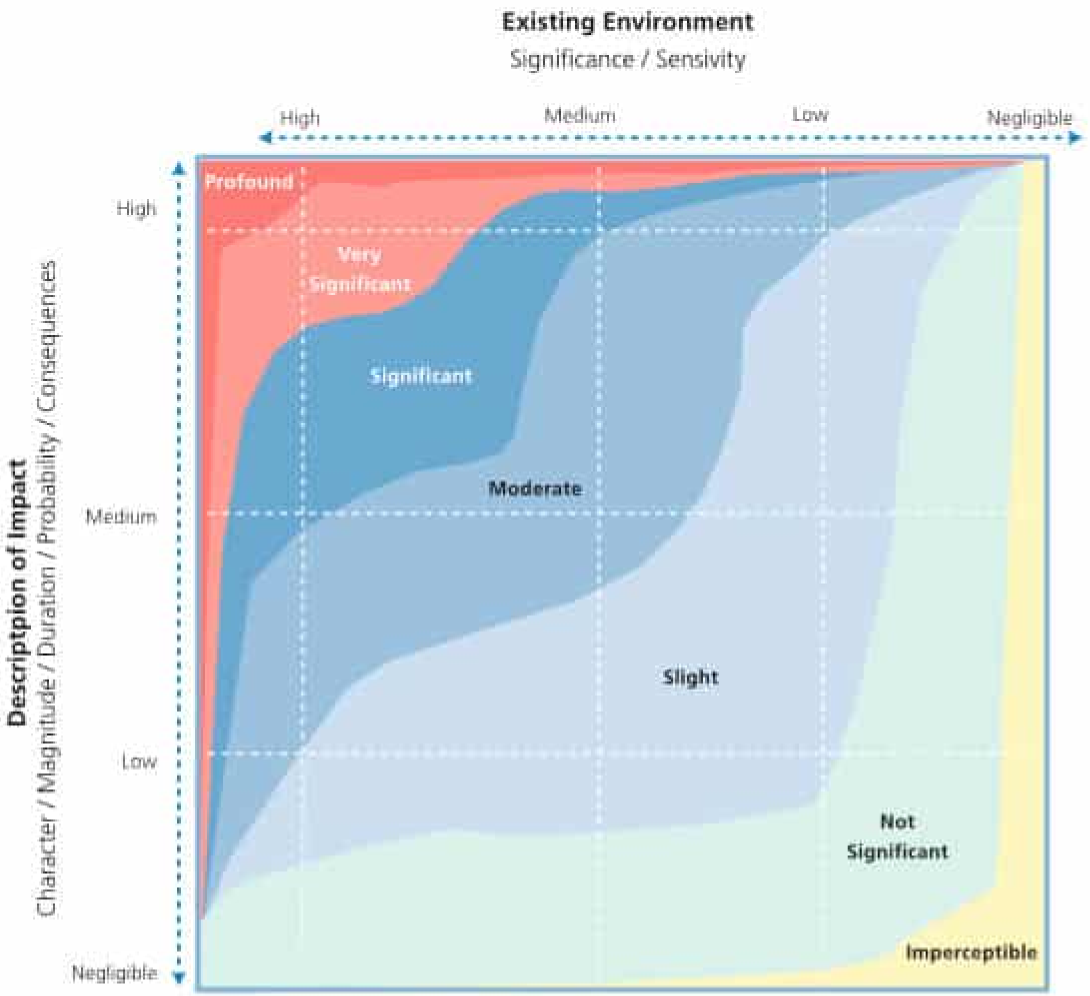
Impact Characteristic	Term	Description
Quality of Effects	Positive Effects	A change which improves the quality of the environment
	Neutral Effects	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative / Adverse Effects	A change 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 Frequency of Effects	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting less than a day
	Temporary Effects	Effects lasting less than a year
	Short-term Effects	Effects lasting one to seven years
	Medium-term Effects	Effects lasting seven to fifteen years
	Long-term Effects	Effects lasting fifteen to sixty years

Impact Characteristic	Term	Description
	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 2022)

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

HYDROLOGY AND HYDROGEOLOGY 7

APPENDIX 7-K
Wastewater Site Characterisation Form

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 operation of a construction and demolition (C&D) waste recovery facilities and the backfilling of an existing hard rock quarry by way of an inert landfill at Ballinclare Quarry, near Kilbride, Co. Wicklow by Kilsaran Concrete Unlimited Company (hereinafter ’Kilsaran’ or ’the Applicant’).

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.

7.3 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 will provide for an integrated waste management facility for inert C&D waste at the application site.

7.4 The inert wastes to be imported and backfilled at the landfill facility 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 for disposal at the landfill facility will comply with the waste acceptance criteria (WAC) for inert landfills set by Council Decision 2003/33/EC.

7.5 As part of the development, 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 basal and side clay liners required for the inert landfill.

7.6 On completion, the inert landfill will be restored to a long-term native woodland habitat, similar to that which existed prior to quarry development, and will include provision for establishment of native oak plantations in defined areas around the site.

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

- Installation and operation of a soil washing plant at the former concrete / asphalt yard to produce construction grade sand and gravel aggregate from imported excess soil and stone. The soil washing plant comprises a loading hopper, a number of soil screens in series with connecting conveyor systems, a primary wastewater treatment tank (thickener), a buffer tank holding sludge and recycled water, an elevated plate press and filter cake discharge area;
- Construction of a close-sided industrial shed (portal frame structure with roof mounted solar panels) at the existing paved area to the west of the access road 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 external paved and hardstanding areas surrounding the C&D waste processing shed for the external handling and storage of both unprocessed and processed C&D wastes;
- Separation of any intermixed solid construction and demolition (C&D) wastes (principally metal, timber, PVC pipes and plastic) prior to its removal off-site to authorised waste disposal or recovery facilities;
- Substantial backfilling of the existing quarry void to a maximum level of 80mOD through disposal of imported inert soil and stone waste and residual fines from the soil washing process and the use of non-waste soil by-product for engineering, capping and/or landscaping purposes

- The progressive restoration of the completed landfill landform to long-term native woodland habitat;
- Continued use of established site infrastructure and services including, site / weighbridge office, staff welfare facilities, surface water run-off and wastewater treatment systems, weighbridge, garage / workshop, wheelwash, hardstand areas, fuel and water storage tanks to service the proposed development;
- Clearance of vegetation and felling of a number of mature trees to facilitate widening of the internal site access road and make provision for off-road queuing of inbound HGVs within the application site boundary;
- Decommissioning of any remaining fixed plant and infrastructure associated with former rock extraction or concrete / asphalt production activities;
- Off-site removal of any waste materials or bulky wastes associated with former quarrying or production activities;
- Installation of a new weighbridge along the inbound lane of the quarry access road;
- Installation of an additional wheelwash facility on the eastern side of the former concrete / asphalt yard;
- Modification / upgrade of existing drainage channel along the site access road, Installation of silt trap and hydrocarbon interceptor to treat run-off and provision of additional pumping capacity to transfer run-off from existing surface water pond at site entrance to quarry sump
- Installation of a silt trap and hydrocarbon interceptor at the proposed C&D waste recovery facility to treat run-off prior to being pumped to the soil wash plant or surface water ponds elsewhere on site.
- Installation of a sub-surface concrete wastewater holding tank;
- Construction and establishment of an on-site (passive) wetland treatment system and any associated drainage infrastructure to treat / polish water collected from the active backfilling / landfilling cells prior to its discharge off-site to the Ballinclare Stream;
- Re-use of an existing storage shed as a dedicated waste inspection and quarantine facility to inspect and store suspect waste consignments as required. Any waste which has been accepted at the facility and which is likely (on basis of visual inspection) or confirmed (on basis of compliance testing) to be non-compliant with waste acceptance criteria for the facility will be temporarily stored at this location pending results of further waste classification testing and a decision as to how and where they should ultimately be disposed of or recovered;
- Re-alignment, upgrading and ongoing maintenance of internal haul routes across the application site;
- Temporary stockpiling of topsoil pending re-use as cover material for final restoration of the inert landfill / backfilled quarry void;
- Implementation of a series of measures to enhance local biodiversity including the retention of habitats and features of biodiversity value (e.g. ponds, buildings), quarry face retention for nesting peregrine falcon, establishment of an artificial sand martin colony, creation of roost space / deployment of bird boxes for bats, creation of habitat / erection of bird nest boxes for breeding / roosting birds and erection of fence along the site perimeter to include access points for mammals.
- Environmental monitoring of noise, dust, surface water and groundwater for the duration of the landfilling and restoration works and C&D waste recovery / recycling activities and for a short period thereafter;
- All ancillary site works, landscaping and perimeter fencing.

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 and 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 / groundwater at the application site are:

- The placement of imported inert soil and stone in the quarry void in terms of the potential effects on groundwater;
- The storage of C&D materials at the site in terms of the potential effects on groundwater and surface water;
- 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 / recycling activities on surface water and groundwater;
- A review and assessment of issues previously raised in the previous Strategic Infrastructure Development (SID) application for a waste management facility at the application site and associated Inspectors Report (Ref. No. ABP-309991-21), specifically related to the water environment; and,
- Where necessary, recommendation(s) of mitigation measures to reduce or eliminate any potential impact(s).

Consultations / Consultees

Previous SID Application (2021)

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 C&D recovery / recycling activities and their impact on local groundwater resources and on the Potters River.

7.14 As the development constituted 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. Specific feedback provided at that time in respect of water related impacts was considered and addressed as appropriate in the EIAR which accompanied the SID application.

Current SID Application (2024)

7.15 A formal consultation exercise was undertaken with statutory consultees and nearby residents / members of the general public in August 2024. Details of these consultations and the feedback obtained therefrom is provided in a separate report submitted in support of this application. Any specific feedback provided in respect of water related impacts has been considered and addressed as appropriate in drafting this Chapter of the EIAR.

7.16 Water related issues raised during public consultation include:

- The proposal will occur below the water table and as a result presents a significant risk relating to groundwater quality, groundwater flow, and local groundwater users (e.g. domestic and farm wells).
- Drainage management and water discharge from the site will cause water quality and contamination impacts within the Potters River, and also to the downstream SAC at Brittas (Buckroney-Brittas Dunes and Fen SAC).
- There is insufficient site investigation and monitoring data to characterise the local hydrogeology and groundwater regime. Not enough borehole data to establish groundwater flow direction.
- Concern that backfilling will decrease available groundwater resources by disrupting groundwater flow patterns, and also effect local groundwater quality.
- Dewatering of the quarry commenced in advance of the determination of the current planning application.
- A detailed baseline monitoring proposal for water wells and groundwater quality and surface water quality should be implemented before the development proceeds.
- The lowest point of the site will be the swale and not the wetland, and water from the swale will discharge, completely untreated, into a dyke and onto the Potters River.

7.17 A review of the Inspectors report from the previous SID application (Ref. No. ABP-309991-21) indicated that the key issues to be resolved related to surface water quality and protection and its relationship to the ecological environment, and that groundwater (while also a very important issue) was not part of the core reason for refusal.

Contributors / Author(s)

7.18 This Chapter of the EIAR was prepared by HES on behalf of SLR and Kilsaran. Hydro-Environmental Services (HES) is a specialist geological, hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and its office is located in Dungarvan, County Waterford.

7.19 HES’ core areas of expertise and experience include quarry hydrogeology and quarry drainage management. The company routinely completes impact assessments for hydrology and hydrogeology for quarries and infill sites, and a large variety of other project types.

7.20 This chapter of the EIAR was prepared by Michael Gill and Adam Keegan.

7.21 Michael Gill PGeo. (BA, BAI, Dip Geol., MSc, MIEI) is a Civil / Environmental Engineer and Hydrogeologist with over 22 years’ environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of quarry extraction and infill projects in Ireland. He has worked on the following quarry infill assessments: Clasheen Pit (Killarney), Garyhesta (Cork), Middleton (Cork), Killarney East, Kilmeague (Kildare), and Kilmessan (Meath).

7.22 Adam Keegan PGeo (BSc, MSc) is a hydrogeologist with five years of experience in the environmental sector in Ireland. Adam has been involved in numerous hydrological and hydrogeological impact assessments, flood risk assessments and hydrogeological monitoring as part of the team at HES. Adam has worked on quarry infill assessments at Brownswood Quarry (Wexford), Clasheen Pit (Kerry) and Killarney East pit (Kerry).

Limitations / Difficulties Encountered

7.23 The assessment of the hydrological and hydrogeological environment is based published data / information, visual observations from various site visits, analyses and interpretation of surface water data and groundwater monitoring borehole data and sampling undertaken in 2019, along with contemporary monitoring and groundwater and surface water sampling completed in 2024.

7.24 While the site has its physical challenges, notably the localised presence of naturally occurring asbestos in bedrock, there were no other significant limitations / difficulties encountered during the preparation of this Chapter of the EIAR.

REGULATORY BACKGROUND

Legislation

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

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

- Environmental Impact Assessment Directive (2011/92/EU);
- 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).
- The management of waste from extractive industries (2006/21/EC); and,
- Environmental Liability Directive (2004/35/EC).

7.27 Other European Directives to which this EIAR Chapter refers are listed in Appendix 7-A. The Irish Government Acts, National Legislation and Regulations which apply to this hydrology and hydrogeology assessment are also listed in Appendix 7-A.

7.28 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:

1. “prevent or limit, as appropriate, the input of pollutants into groundwater and prevent the deterioration of the status of all bodies of groundwater;
2. 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;
3. 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;
4. 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. 722/2003] 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

7.29 Planning Policy and Development Control relating to surface water and groundwater at the application site is governed by the Wicklow County Development Plan 2022-2028.

Guidelines

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

- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);
- Environmental Protection Agency (2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- Environmental Protection Agency (1997): Landfill Manuals - Landfill Operational Practices;
- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on ‘Control of Water Pollution from Linear Construction Projects’ (CIRIA Report No. C648, 2006); and,
- National Roads Authority, 2008. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

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

Technical Standards

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

RECEIVING ENVIRONMENT

Study Area

7.33 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.

7.34 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

7.35 The methodology used in the investigation follows the guidelines and advice notes provided by the Environmental Protection Agency on environmental impact assessments (2022), and with due regard also had to the Institute of Geologists of Ireland’s (IGI) guidelines (2013).

7.36 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, including the previous EIAR and all available 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 monitored and assessed;
- Monitoring of groundwater level at the site, and in monitoring wells and domestic wells surrounding the site;
- Appropriate sampling of groundwater and surface water for baseline characterisation from the site and around and upgradient of the site; and
- Analysis of the all information gathered.

Sources of Information

7.37 The existing reports and EIAR 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;
- Environmental Impact Statement, Ballinclare and Carrigmore Townlands, December 2006; and,
- Environmental Impact Assessment Report (Water Chapter) for Proposed Inert Landfill and C&D waste recovery at Ballinclare, Co Wicklow, 2021.

7.38 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
Elevation	OSi Discovery Series Mapping – sheet 62	1:50,000
Climate	Met Eireann	Digital
Protected Areas, Environmental Pressures	Environmental Protection Agency, National Parks and Wildlife Service	Digital

7.39 A site visit and inspection of the application site was originally undertaken by SLR 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 during 2019 (relating to baseline survey work for the 2021 EIAR).

7.40 HES staff completed walkover surveys and investigative field work on the following dates: 26th January 2024, 08th March 2024, 19th April 2024, 29th May 2024, 19th June 2024, 26th

June 2024, and 04th July 2024. During those site visits, the following site work was undertaken by HES:

- A site walkover was completed, locating existing groundwater monitoring wells;
- Groundwater wells were manually dipped and water levels recorded;
- Diver water level loggers were installed in on-site wells GW1, GW2 and GW3 with electronic logging completed at 15-minute and 2-hour intervals. Dataloggers were also installed in a number of off-site groundwater wells;
- An audit of local domestic and farm groundwater supplies was completed;
- Groundwater sampling was completed in on-site and off-site groundwater wells on 19th June and 04th July 2024; and,
- Surface water sampling was completed on 29th May and 19th June at 5 no. locations (SW1, SW4, SW5, SW6 and SW7) along nearby upstream and downstream watercourses.

Historic Site Investigations

7.41 A detailed description of the available historical site investigation completed within the quarry is provided in the following section as those data provide valuable insights into the hydrogeology (groundwater conditions) at the application site.

White Young Green - 2005

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

- drilling of four trial wells (TW series 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.

7.43 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/day. Historically, after dry summer months, a shortage of process water for the quarrying operation was reported.

7.44 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/day.

7.45 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.

7.46 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 33mAOD to 37mAOD. The quarry floor level across much of the quarry is currently at 37mAOD. The TW series well locations are shown on Figure 7-1.

7.47 All six wells drilled in 2005 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 groundwater inflows or water strikes recorded. Inflows were estimated by WYG to be less than 5m^3/day, and to be more accurately described as seepages.

SLR Geological Investigation - 2014

7.48 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 extend 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).

7.49 The 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 52mAOD	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 55mAOD	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 37mAOD	40m	Ground conditions confirmed from existing quarry floor
BH2	Western area of the existing quarry floor. Existing floor level assumed at 37mAOD	40m	

7.50 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 (GW1, GW2, and GW3) were drilled by Dempsey Drilling and were completed on 10th October 2014. The geological boreholes (BH1 and BH2) were completed by Irish Drilling Ltd on 14th October 2014. All boreholes reached target depths.

7.51 The geological boreholes were drilled on the quarry floor, which at that time was at ~37m AOD. Rotary drilling was undertaken to obtain a 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. The data from the drilling of BH1 and BH2 provides valuable information about the bedrock geology and hydrogeology below the proposed infill area.

7.52 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.

7.53 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 (fill) the borehole following drilling. The groundwater was left to recover overnight. A significant groundwater inflow was encountered at borehole GW2, at approximately 6mbgl, and while this is logged as being associated with a cavity, this is reinterpreted as being a more permeable subsoil strata overlying bedrock (Refer to Para 7.120). The overburden consists of reworked ground. There was no evidence of hydrocarbons at borehole GW3. All boreholes encountered a few metres of overburden overlying competent diorite bedrock.

7.54 The groundwater boreholes (GW1, GW2, and GW3) were installed with 125mm plastic casing. The top sections where overburden was encountered were fitted with plain well casing, and the remainder was fitted with slotted well casing. These installations allowed future groundwater level monitoring and groundwater sampling to be completed.

Potential Soil and Groundwater Contamination

7.55 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 the overburden soils at location GW2.

7.56 Extraction activity at the quarry was suspended 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.

7.57 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

7.58 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.

7.59 When operational, the quarry was worked dry with very little inflow of groundwater reported within the quarry void area. This is a very important point and will be referred to again below with respect to the hydrogeology of the site. A quarry sump (~70,000 m^3 in volume) located on the lowest quarry floor level was used to collect any surface water falling over the void area and any minor inflows of groundwater. During previous quarrying operations, periodic pumping of the water from the quarry sump to on-site storage tanks was carried out. This water was recycled and used in concrete production activities and on-site dust suppression.

7.60 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 the base of the central sump at c.21.5mAOD. The wider quarry floor is at ~37mAOD.

7.61 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 along local roads and areas of commercial forestry.

Rainfall and Climate

7.62 The Standard Average Annual Rainfall (SAAR) at Ballinclare is c. 1,142mm/yr (i.e. at ING 325000, 189000) for the period 1991-2020 (Met Éireann, SAAR database). The monthly average rainfall values (at the same node) for 1991-2020 are shown in Table 7-3 below.

Table 7-3
Average Monthly Rainfall Total (mm) 1991-2020 at Ballinclare

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AAR
112	86	82	80	74	78	70	84	90	128	139	119	1142

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

7.64 Groundwater Recharge maps published by the GSI show an effective rainfall for the Application site of 647mm/yr. Evapotranspiration is therefore 495mm/yr (Evapotranspiration = Rainfall – Effective Rainfall). Met Eireann report potential evapotranspiration as 530.5mm/yr. Potential evaporation will always be higher than the actual value.

7.65 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 and on the recharge capacity of the underlying diorite bedrock, which in general is very low.

7.66 GSI Groundwater Recharge mapping suggests a recharge cap of 100mm/yr for the application site. This is due to the lack of permeability, or ability to accept recharge within the underlying Diorite bedrock.

7.67 Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM's). Projections for the period 2041-2060 (mid-century) are available from Met Eireann (www.met.ie). The data indicates a projected decrease in summer rainfall from 0 to 13% under the medium-low emission range scenario and an increase in the frequency of heavy precipitation events of c.20%. In total the projected annual reduction in rainfall near the site is modelled as c. 10% under the medium-low emission scenario and c. 8% under the high emissions scenario. As stated above the local average long term rainfall data for the site is estimated to be 1,142mm/yr. Under the medium-low emissions scenario this may reduce to c. 1,028mm/yr, while under the high emissions scenario this figure may reduce to c. 1,051mm/yr.

Soils and Geology

Soils and Subsoils

7.68 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.

7.69 Teagasc soil mapping indicates soil cover was thin to absent over the original extraction area. The soils in the western part of the Application site are classified as AminSW, shallow well drained mineral soil, derived from mainly non-calcareous materials. The soils towards the east of the site are classified as AminSP, shallow poorly drained mineral soil, also derived from mainly non-calcareous materials, refer to Figure 6-1.

7.70 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

7.71 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, but none are mapped within the quarry footprint. The bedrock geology beneath the current quarry floor level has been confirmed as diorite to 40m beneath the quarry floor (from borehole drilling at BH1 and BH2). The local bedrock geology is shown on Figure 6-3 and the geology is discussed in detail in Chapter 6 of this EIAR.

7.72 The geology of the site is described based on the following available datasets:

- Desk study data and GSI mapping;
- Historic boreholes described in Paras 7-109 to 7-114
- On site drilling (GW1, GW2, and GW3) described in Paras 7-118 to 7-119
- Observation and mapping of the hundreds of meters of exposed bedrock along the various quarry faces within the quarry.

Surface Water - Hydrology

7.73 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 Potters River catchment (IE_EA_10P010500).

7.74 The Potters River (IE_EA_10P010500) 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 [EPA name: Ballinameesda lower stream (IE_EA_10P010300)] is located c. 200m to the south of the application site and flows in an easterly direction, to its confluence with the Potters River, see Figure 7-2.

7.75 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.

7.76 The Irish Sea is c. 7.5km east of the application site. The Potters River flows southeast for ~7.5km, before discharging to the Irish Sea at Potters Point.

7.77 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 of the quarry.

7.78 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 WFD Status

7.79 The Potters_010 SWB (surface water body) achieved 'Moderate' status in all 3 no. WFD cycles. This SWB is currently deemed to be 'at risk' of failing to meet its WFD objectives. Significant pressures on this SWB include agriculture and forestry. The Potters_020 SWB that lies downstream of the application site achieved 'Good' status in all 3 no. WFD cycles. This SWB is deemed to be 'not at risk' of failing to meet its WFD objectives. No significant pressures have been identified to be impacting this SWB. The Southwestern Irish Sea – Brittas Bay (HA 10) SWB achieved 'High' status in the 2016-2021 WFD cycle. This coastal waterbody is also deemed to be 'Not at risk' and no significant pressures are listed to be impacting this SWB.

7.80 A WFD Compliance Report is attached as Appendix 7-N.

Surface Water Abstractions

7.81 The Potters_010 SWB in the vicinity of the application site is listed as a Drinking Water Protected Area (DWPA) under Article 7 Abstraction for Drinking Water (IE_EA_10P010300). This DWPA occurs upstream and downstream of the application site discharge and also includes the Kilmacurra Stream. The abstraction from the Potters River is for the Glenealy Public Supply which is reported to have a maximum abstraction volume of 185m^3/day. The abstraction point for the Glenealy water supply is from the Barnbawn stream, and this is located ~4km northwest of the Application site.

Surface Water Discharges

7.82 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.

7.83 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.

7.84 The only other Section 4 Discharge Licence for discharge to the Potters River is for the Green Angel Skincare premised (former Tap Restaurant), Licence Ref. No. WPL/96, at Kilbride which lies approximately 2.7km downstream of Ballinclare Quarry.

Surface Water Quality

7.85 The overall status of the Potters River and Kilmacurra Stream is moderate according to the EPA River Waterbody WFD Status Report for 2016-2021. 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 2020. Approximately 500m further downstream, at Kilbride Bridge, a Q rating of 4 (Good) is assigned to the Potters River.

7.86 A Biological Q-value assessment has been completed at 2 No. locations along the Potters River, upstream (MP1) and downstream (MP2) of the off-site discharge from Ballinclare Quarry (refer to Appendix 7-L). Following kick sampling and macroinvertebrate examination, a Q-value of 3-4 is assigned to location MP1 upstream of the discharge point, while a Q-rating of 4 is assigned to location MP2, situated downstream of the discharge point. The locations of monitoring points MP1 and MP2 are shown on Figure 7-2.

7.87 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 (Chapter 5).

7.88 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.

7.89 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. Potters 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.

7.90 WYG took 3 No. surface water samples in May 2007, from a drain upstream of the quarry entrance, at the drain's confluence with Potters Bar downstream of the quarry and from a containment pond at the quarry entrance. 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 the containment pond at the quarry entrance. 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.

7.91 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 situated on the small stream which runs past the quarry, into which the licensed discharge flows. 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. Elevated arsenic concentrations were recorded in the quarry sump water samples taken at that time.

7.92 Further Surface water samples were taken by HES on 29th May 2024 and 19th June 2024 at SW1 and SW4-SW7 (at locations shown in Figure 7-2). Sampling locations are upstream and downstream of Ballinclare Quarry. The results of these analysis demonstrated good quality water across the sampling locations, with no analytes above the relevant environmental quality standard. Suspended solids ranged between <5-7 mg/L, while BOD ranged between <1-1.8 mg/L. The results are also presented in Table 7-5 below.

7.93 In addition to the above-mentioned sampling, surface water quality monitoring has been ongoing since the commencement of discharge from the quarry under WPL-116. Water quality sampling has been completed at locations MP1 and MP2, and daily analysis of discharge water from the quarry has been completed since late 2021. Quarry discharge data are summarised in Table 7-6 while MP1 and MP2 data are summarised in Table 7-7 and Table 7-8 respectively.

7.94 The overall status of the coastal Irish Sea directly east of the site is high according to the EPA Coastal Waterbody WFD Status 2016-2021. 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. It is not at risk of deterioration.

Table 7-4
Surface Water Quality 2019

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	0.5
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
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	5

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
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					
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: S.I. 272 of 2009

Environmental Quality Standard (EQS) blue: S.I. 327 of 2012

*** Field Measurement**

Table 7-5
Surface Water Quality 2024

Parameter	Units	29/05/24					19/06/24					Quality Standards				
		SW1	SW4	SW5	SW6	SW7	SW1	SW4	SW5	SW6	SW7	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
Ammonia (Surface Water)	mg/L as N	0.028	0.018	<0.01	0.01	0.027	0.014	0.015	0.027	0.123	0.021				0.065-0.175	0.5
Arsenic (Dissolved)	ug/L	2.97	0.687	0.455	1.14	2.52	2.65	0.862	0.499	10.7	2.01	25 (AA)	20 (AA)	10	7.5	10
Asbestos Identification*	N/A	-	-	-	-	-	-	-	-	-	-					
BOD (Surface Water) (River)	mg/L	1.1	<1	1.1	<1	1.8	<1	<1	<1	<1	<1	"High status ≤1.3 (mean) or ≤2.2 (95%ile) Good status ≤1.5 (mean) or ≤2.6 (95%ile)"				
Cadmium (Dissolved)	ug/L	<0.1	<01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.45 - 1.5	0.45 - 1.5	5		5
Chloride (Surface Water)	mg/L	-	-	-	-	-	-	-	-	-	-			30	24-187.5	250
Chromium (Surface Water)	ug/L	-	-	-	-	-	-	-	-	-	-	32		30	37.5	50
COD (Surface Water)	mg/L	-	-	-	-	-	-	-	-	-	-					
Conductivity (Surface Water at 20°C)	µS/cm @ 20°C						345*	302.5*	158.9*	355.4*	158*			1000	800 - 1875*	2500
Copper (Dissolved)	ug/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	5 or 30 (AA)	5 (AA)	30		2000
Dissolved Oxygen (mg/l)	mg/L						9.11*	5.41*	10.17*	6.83*	9.79*					
Hardness Total (Surface Water)	mg/L CaCO3	-	-	-	-	-	-	-	-	-	-			200		
Lead (Dissolved)	ug/L	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	<0.51	7.2 (AA)	7.2 (AA)	10	7.5	5
Mercury (Dissolved)	ug/L	-	-	-	-	-	-	-	-	-	-	0.07	0.07	1	0.75	1
Nickel (Dissolved)	ug/L	2.24	1.23	<0.5	0.549	3.47	2.42	1.1	<0.5	1.14	0.657	20 (AA)	20 (AA)	20		20

Parameter	Units	29/05/24					19/06/24					Quality Standards				
		SW1	SW4	SW5	SW6	SW7	SW1	SW4	SW5	SW6	SW7	EQS Inland	EQS other	EPA IGV	GW Regs	DW Regs
Nitrate (Surface Water)	mg/L as N	-	-	-	-	-	-	-	-	-	-			25	37.5	50
Nitrite (Surface Water)	mg/L as N	-	-	-	-	-	-	-	-	-	-			0.1	0.375	0.5
pH (Surface Water)	pH Units	6.7	7.0	7.0	7.0	6.9	6.6	7.0	6.5	6.8	7.1			6.5 - 9.5		6.5 - 9.5
Phosphate (Ortho) Surface Water	mg/L as P	<0.01	<0.01	0.011	<0.01	0.028	<0.01	0.01	0.01	0.022	0.02			0.03		
PRO (>C6-C12)	ug/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1					
Solids (Total Suspended)	mg/L	<5	5	<5	<5	7	<5	<5	<5	5	<5					
Sulphate (Surface Water)	mg/L	-	-	-	-	-	-	-	-	-	-			200	187.5	250
Zinc (Surface Water)	ug/L	1.41	1.2	1.38	2.72	25.3	28.5	25.4	37.3	32.5	32.2			100	75	

Environmental Quality Standard (EQS) green: S.I. 272/2009

Environmental Quality Standard (EQS) blue: S.I. 327/2012

* Field Measurement

Table 7-6
Summary Surface Water Quality at Quarry Discharge 2021 - 2024

Parameter	Units	n	Range	Exceedance of DL ELVs	Exceedance of SW Regs (S.I. 272/2009 as amended)
pH	[H$^+$]	660	6.0-7.9	0	0
BOD	mg/L	653	0.03-6.6	42	achieves Good status on mean and 95%ile
Suspended Solids	mg/L	661	2.0-31	5	2^
Total Ammonia as N	mg/L	659	0.01-1.33	54	Good status on mean
Ortho-P as P	mg/L	657	0-2.08	15	achieves High status on mean and 95%ile
Arsenic (Dissolved)	µg/L	614	0.336-9.429	2	0
Mercury (Dissolved)	µg/L	85	<0.003-0.1	4	2
Nickel (Dissolved)	µg/L	291	0.583-9.65	270	0
Asbestos	MF/L	41	0	0	n/a

Notes: ^ELV = 25mg/L (Salmonid Regs S.I. 293/1988); n = number of data points.

Table 7-7
Summary Surface Water Quality at MP1 2021 - 2024

Parameter	Units	n	Range	Exceedance of SW Regs (S.I. 272/2009 as amended)
pH	[H$^+$]	656	6.0-8.05	0
BOD	mg/L	634	0.1-8.0	achieves Good status on mean
Suspended Solids	mg/L	648	2-135	18^
Total Ammonia as N	mg/L	659	<0.01-4.49	Does not achieve Good status on mean
Ortho-P as P	mg/L	654	<0.01-4.89	achieves Good status on mean and High status on 95%ile
Arsenic (Dissolved)	µg/L	628	0.02-4.731	0
Mercury (Dissolved)	µg/L	82	<0.03-0.1	4
Nickel (Dissolved)	µg/L	297	0.4-6.669	0
Asbestos	MF/L	37	0	n/a

Notes: ^ELV = 25mg/L (Salmonid Regs S.I. 293/1988); n = number of data points.

Table 7-8
Summary Surface Water Quality at MP2 2021 - 2024

Parameter	Units	n	Range	Exceedance of SW Regs (S.I. 272/2009 as amended)
pH	[H+]	656	6.0-8.97	0
BOD	mg/L	636	0.2-32.5	achieves Good status on the mean
Suspended Solids	mg/L	648	2-208	44+
Total Ammonia as N	mg/L	649	<0.01-3.56	Does not achieve Good status on mean or 95%ile
Ortho-P as P	mg/L	647	<0.01-0.27	achieves High status on mean, and Good status on 95%ile
Arsenic (Dissolved)	µg/L	625	0.01-3.998	0
Mercury (Dissolved)	µg/L	87	<0.03-0.1	3
Nickel (Dissolved)	µg/L	296	0.4-5.237	0
Asbestos	MF/L	41	0	n/a

Notes: ^ELV = 25mg/L (Salmonid Regs S.I. 293/1988); n = number of data points. + As noted in the Q reports in Appendix 7-K, there are observed sedimentation issues upstream of the bridge at MP2 and this issue is not related to the quarry discharge.

7.95 **2019 Surface Water Data**: The water quality results from sample locations SW1-SW7 were compared against quality thresholds set out in the Surface Water Regulations (S.I. 272/2009 and S.I. 327/2012). 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 S.I. 9/2010 (GW Regs) and Drinking Water Regulations (S.I. 99/2023, DW Regs). The following exceedances were noted:

- At SW1, zinc concentrations exceed threshold values in SW S.I. 272/2009 EQS Other Surface Waters (MACs) on 26/03/19.
- At SW3B, BOD exceeds both the good and high-quality standard (S.I. 272/2009) on 26th March 2019.
- At SW4, BOD exceeds both the good and high-quality standard (S.I. 272/2009) on 26th March 2019.
- The recorded concentrations at the quarry sump:
  - exceeds the environmental quality standards for arsenic on both 05th and 26th March 2019;
  - exceeds EPA IGV criteria for orthophosphate on 05th and 26th March 2019;
  - exceeds EPA IGV criteria for potassium on 05th March (not tested for on 26/03/19); and,
  - exceeds Drinking Water limits for antimony on 05th March 2019 (not tested for on 26/03/19).

7.96 **2024 Surface Water Data**: The water quality results from sample locations SW1-SW7 were compared against quality thresholds set out in the Surface Water Regulations (S.I. 272/2009 and S.I. 327/2012). 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 S.I. 9/2010 (GW Regs) and Drinking Water Regulations (S.I. 99/2023, DW Regs). The following exceedances were noted:

- The BOD value recorded at SW7 on 29th May 2024 (1.8 mg/L), exceeds both the Good and High limits for surface waters (S.I. 272/2009) of 1.3 and 1.5 mg/L respectively, however the mean BOD recorded at SW7 is below both the Good and High mean limits (2.2 and 2.8 mg/L respectively).

- The recorded Arsenic value at SW6 (10.6 µg/L) on 19th June 2024 exceeds the Drinking Water Guideline threshold value of 10 µg/L. This concentration does not exceed the Surface Water guideline values (25 µg/L).
- There were no further exceedances of water quality limits from the samples taken from SW1 and SW1-SW7 on 29th May and 19th June 2024.

7.97 An asbestos identification was carried out on the surface water and quarry sump samples in 2019, and no asbestos was reported.

7.98 **Discharge Licence Monitoring Data**: The water quality results from sample locations MP1 and MP2 were compared against environmental quality standards set out in the Surface Water Regulations (S.I. 272/2009 and S.I. 327/2012). The results from the quarry discharge were also compared with these standards, as well as the water quality criteria stipulated in the quarry Discharge Licence (WPL-116). As noted above, the results are summarised in Table 7-6 (Quarry Discharge), Table 7-7 (MP1), and Table 7-8 (MP2). The following is noted form the data:

- There is a significant quantity of analyses for each parameter. As a result, there is a high confidence level in the interpretation of the data.
- The variation of pH at all monitoring points is comparable. All data meets the EQS thresholds.
- The range of BOD values recorded at the quarry discharge is lower than at MP1 and MP2, although data from all locations indicate Good status water quality is achieved for BOD.
- The range of TSS values recorded at the MP2 are higher than the quarry discharge and higher than those recorded at MP1, and the range recorded at MP1 is higher than the quarry discharge. Background TSS variations recorded in the Potters River are higher than what is being discharged from the quarry.
- The range of Ammonia concentrations recorded at the quarry discharge is lower than at MP1 and MP2. Data from the quarry discharge would meet Good status water quality requirements, but data from MP1 and MP2 would not. Background ammonia variations recorded in the Potters River are higher than what is being discharged from the quarry.
- The range of Ortho-P concentrations recorded at MP2 is lower than both MP1 and the quarry discharge, and would achieve Good/High status at MP2 (downstream) on mean/95%ile analysis. Data from the quarry discharge has a lower range than MP1. Data from the quarry discharge would meet Good status water quality requirements. Background ortho-P variations recorded in the Potters River at MP1 are higher than what is being discharged from the quarry, but downstream concentrations of Ortho-P recorded at MP2 are much lower than at MP1.
- Except for Mercury, all other dissolved metals concentrations are lower than the Surface Water Regulation EQSs (S.I. 272/2009 as amended) at all monitoring points. The Mercury exceedances occur at the detection limit value (0.1µg/L), but with the absence of the "<" sign. These may be a laboratory reporting error and should be <0.1µg/L (i.e. the detection limit of the analysis).
- It is noted that there were 2 (of 614 data points) exceedances of the Arsenic Discharge Licence ELV (2 samples had Arsenic concentrations >7µg/L (but all results were less than the MAC-EQS of 20 µg/L stated in S.I. 272/2009).
- There were 270 (of 291 data points) exceedances of the Nickel Discharge Licence ELV (270 samples had Nickel concentrations of >3.22µg/L (but based on all data for 2022, 2023, and 2024 the annual average (AA) value is less than the AA-EQS of

20 µg/L stated in S.I. 272/2009) (AA of Nickel for 2022: 5.3 µg/L (n = 26); AA for Nickel for 2023: 4.8 µg/L (n = 235); AA for Nickel for 2024: 3.9 µg/L (n = 28)).

- Monthly biological Q Value sampling has been carried out at MP1 and MP2 since December 2022 (refer to Appendix 7-L). Upstream and downstream Q Values have been recorded as fluctuating between Q 3-4 and Q4. JKW Environmental conclude that "*Based on the conducted kick sampling and using a direct comparison of samples taken upstream and downstream from December 2022 to June 2024 it can be concluded that discharges from dewatering at Ballinclare Quarry have not had any notable adverse impact on the aquatic ecosystem of the Potters River.*"
- As such, all available data indicates that the ongoing discharge from the quarry has not had a notable adverse impact on water quality or the aquatic ecosystem of the Potters River.

7.99 There has been no detection of asbestos in any of the monitoring at MP1 (41 samples), MP2 (37 samples) and the quarry discharge (41 samples).

Surface Water Flows

7.100 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 5%ile flow at c. 1.685m^3/s and the 95%ile lower flow is estimated at 0.057m^3/s, refer to Appendix 7-D.

7.101 There are no flow monitoring stations on the Potters 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 Potters and Kilmacurra Stream.

Flooding

7.102 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.

7.103 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.

7.104 National Indicative Fluvial Mapping (NIFM) River Flood Extents (Present Day) flood mapping are also available for review (www.floodmaps.ie). These show flood zones along the Potters River downstream of the site.

7.105 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.

7.106 The quarry discharge is currently limited to 20L/s (72m^3/hr, or 1728m^3/day). This discharge flow is a very small proportion of likely larger flood flows in the Potters River. For example, the estimated 5%ile flow in the Potters River is 1.685m^3/s (1685 L/s), and the addition of the

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

20L/s from the quarry only accounts for ~1.2% of that river flow. Notwithstanding this, discharge (pumping) from the quarry can be turned off during extreme flood events.

Quarry Water Management

7.107 Currently, rainfall across the application site mostly drains toward the quarry void, with a smaller quantity slowly infiltrating to ground and it recharges the shallow overburden where permeability occurs, with some further limited recharge to the underlying bedrock also likely occurring. During storm events, surface water runoff across most of the site will drain to the quarry floor / void (it being the lowest point within the site), while some runoff from the western end of the site will flow towards the discharge drain at the western boundary of the site.

7.108 The existing quarry void is currently being dewatered. Water is being treated and discharged at the north of the site into the Ballinclare Stream (a small tributary of Potters River).

7.109 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.

7.110 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).

Groundwater – Hydrogeology

7.111 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 ~ -3mAOD (in BH1 and BH2).

7.112 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 (PI) which is generally unproductive except in local zones, refer to Figure 7-3.

7.113 Proven well yields for on-site boreholes were low (see Para 7.120 below), and water was mainly derived from the shallow interface between the base of the overburden and any upper weathered bedrock that existed / exists across the site. Deeper water strikes recorded were of limited inflow and were generally referred to as seepages.

7.114 Logging of bedrock BH1 and BH2 indicates generally high Total Core Recovery (%), high Solid Core Recovery (%), low Fracture index (%), and variable, but generally high Rock Quality Designation.

7.115 Fault gouge is recorded in BH2 (@ ~1-2mAOD, i.e. well below the base of the sump which has its deepest elevation at 21.5mAOD). The fault gouge implies that even where structural weakness occurs it is infilled with clay material that would impede deeper groundwater flow within the Diorite.

7.116 In BH1, the RQD and Fault Index increase and decrease respectively at 19.1m (18.8mAOD) and at 26.6m (11.3mAOD). These areas do not correlate with any change in lithology and may be related to some minor deeper faulting, however they are not significant and occur at depth below the base of the existing quarry.

7.117 As noted above, previous operation of the quarry to the ~37mAOD and~ 21.5mAOD (sump) floor levels required little or no dewatering, and any water pumped was put in storage for use in on- site production of concrete and for dust suppression.

7.118 From the Wicklow Groundwater Protection Report, there is little hydrogeological information on the Diorites, however they are likened to the hydrogeological characteristics of the Granites, due to their lithological similarity. Information on the Granites (as a proxy for the Diorite) includes the following:

- No primary permeability, a porosity normally less than 1%, and any pores present are generally small and unconnected (Davis & De Wiest, 1966). Permeability in the granites has developed through fracturing and weathering, which is generally restricted to the top 100m below ground (Daly, E.P. 1994).
- Permeability tests by De Buisonje (1977) and Van Engelen (1980) in weathered granite indicated values of 10-100 m/d but in the underlying fresh granite values of 1-3 m/d were obtained.
- The weathered zone may commonly be up to 15 m thick, and is overlain by a variable thickness of Quaternary deposits. Porosity of completely weathered granite can be up to 15%, giving significant groundwater storage and a permeability comparable with that of gravel. The permeability of un-weathered granite is in the order of 0.01-1 m/day.

7.119 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.

Site Investigation Data

7.120 Borehole logs are available for 3 No. groundwater wells at the Application site (GW1-GW3). A summary of the borehole logs is as follows:

- Borehole GW1 – WEATHERED BEDROCK encountered between 0-1.8m, overlying competent DIORITE from 1.8m to 68m depth. One minor water strike is noted at 57m, with a very small inflow volume of 20 gals/hr (0.09m^3/hr). No major or minor fractures are noted in the borehole log.
- Borehole GW2 – MADE GROUND recorded from 0m to -6m. A cavity is recorded from 6m to 7m in the interface between the Made Ground and the underlying diorite, with a significant water inflow of 2000 gals/hr (9 m^3/hr) in this section. This is considered a misinterpretation of soft made ground overlying the competent Diorite at 7m. The water strike in this section (6m-7m) is interpreted as reflecting groundwater in loose unconsolidated material, perched on top of the impermeable diorite bedrock at 7m. There is no geological reason that a cavity should occur in this type of formation (no karstification is possible). Strong to very strong, dark grey to green, crystalline, medium to coarse grained DIORITE is logged from 7m to 61m depth with no fractures or water strikes recorded.
- Borehole GW3 – Boulder clay is logged from 0m to 6m, overlying strong to very strong, dark grey to green, crystalline, medium to coarse grained DIORITE from 6m to 65m depth. One minor water strike is logged at 8m, with an inflow volume of 100 gals/hr (0.45m^3/hr).

7.121 Broadly the logs reflect strong to very strong diorite with little permeability or porosity, overlain by 1.8m to 6m of overburden / weathered rock / Made Ground. The primary water inflow recorded during the drilling occurred in the interface between Made Ground and Diorite in GW2, likely due to increased permeability in the Made Ground increasing recharge through this material, before it reaches the Diorite bedrock and flows along the top of the hard bedrock, unable to permeate further vertically. The recorded well yield are low, and accord with the well yield class defined for Poor aquifers ("*Poor (P) aquifers would generally have 'moderate' or 'low' well yields - less than 100 m^3/d.*")

Wicklow Groundwater Body

7.122 Ballinclare Quarry is mapped as being located within an area of Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones.

7.123 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.

7.124 The groundwater at the application site is of good status according to the EPA Groundwater Body WFD Status Report for 2016-2021. The overall objective is to protect the water body and the groundwater body overall risk is described as "*At risk of not achieving good status*".

7.125 The Wicklow GWB covers an area of 1,396km^2 and is described as being a 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.

7.126 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.

7.127 In some instances, a greater degree of structural deformation may provide a fracture network which will allows 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).

7.128 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.

7.129 The dominant recharge process within the GWB is diffuse recharge from water percolating through the overlying tills and into the underlying bedrock 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.

7.130 The hydrochemical groundwater signature is a calcium bicarbonate type and is soft to moderately hard (50–250 mg/l $CaCO_3$). Relatively low electrical conductivity values are recorded at 130 – 220 µS/cm during field measurements.

7.131 A WFD Compliance Assessment is included as Appendix 7-N.

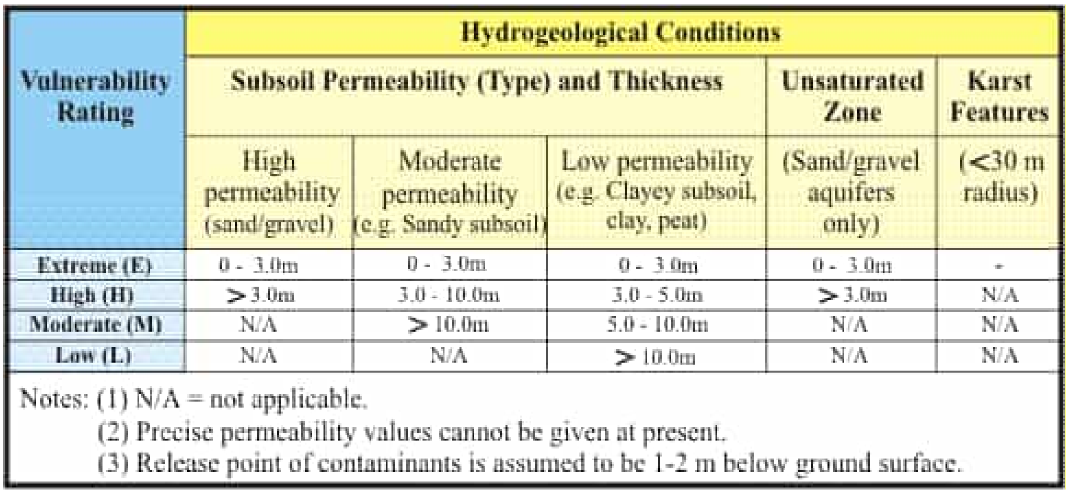
Groundwater Vulnerability

7.132 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).

7.133 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 (note there is no karst at this site given the bedrock type is not limestone)). 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.

7.134 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 clay liner, the inert soil material and restoration surface will be >10m in thickness, refer to Table 7-9 below.

Table 7-9
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.

7.135 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).

7.136 The Wicklow Groundwater Protection Scheme Report[2] notes the following in relation to groundwater vulnerability and potential developments in the Wicklow GWB: A review of the groundwater protection responses for the county notes the following inclusions:

- "Landfills: From a groundwater viewpoint, over 95% of the county is broadly suitable for the construction of landfills. This reflects the absence of regionally important aquifers, and the possibility of engineering landfills to take account of any vulnerability constraints.
- Landspreading of licensable organic wastes: Just over a third of the county is essentially suitable, reflecting the fact that subsoil thicknesses are generally low. An additional proportion, perhaps 30%, is also likely to be suitable, subject to detailed investigation and checking.
- On-site wastewater treatment systems (septic tanks, etc.): Over 95% of the county is essentially suitable for these systems, subject to site permeability testing.

7.137 The key point here is that the Wicklow Groundwater Protection Scheme Report (2003) acknowledges that subject to site specific assessment and engineering design the type of bedrock and aquifers found within County Wicklow are generally suitable for the construction of landfills.

Groundwater Recharge

7.138 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.

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[2] GSI Groundwater Section – Wicklow County Council Groundwater Protection Scheme Main Report (March 2003)

7.139 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.

7.140 However, at Ballinclare Quarry a large portion of potential recharge is rejected because the Diorite bedrock is considered to be a poor aquifer with low permeability and low storativity. Most potential recharge will therefore be rejected and run-off overground to surface water features. Surface water is the dominant hydrological process in the area. Mapping published by the GSI indicates that the maximum recharge capacity (a recharge cap) for the area surrounding the quarry is 100mm/yr.

7.141 As noted previously, extraction activities in the quarry at the ~37mAOD and~ 21.5mAOD (sump) levels required little or no dewatering, and any water pumped was put in storage for use in on site production of concrete and for dust suppression. This observation from the site operation aligns with the recharge cap and the Poor Aquifer classification for the Diorite bedrock recorded at the Site.

Groundwater Abstraction and Wells

7.142 A water supply well is located at the western boundary of the application site, shown in Figure 7-1. While the site was operational, the water from this well supplied the wheelwash and provided 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.

7.143 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 northwest 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 has a reported poor yield of 27m^3/day;
- Borehole number 3217NWW126 is located to the southeast 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 having a poor yield; and,
- Borehole number 3217NWW103 was drilled in 1996 to a depth of 91.4m, with a poor yield class reported at 20m^3/day.

7.144 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. The results of the survey are presented in Table 7-10 below.

7.145 HES completed further wells audits in the area during 2024. Some of the wells surveyed in 2005 were revisited. Additional survey data has been added to Table 7-10. A map of local wells is included on Figure 7-1. In addition, HES have installed groundwater level loggers in 4 No. groundwater wells within the Application site, as well as loggers in 4 No. nearby domestic wells in order to continually monitor water levels. Groundwater levels within these wells range between 43.6-63.4mAOD. The analysis of these available groundwater levels, as well as interrogation of the relevant topography, indicates that a shallow groundwater regimen is the dominant sub surface flow system within the area, whereby rainfall infiltrates through the subsoil layer and is transmitted primarily within this layer. This is evidenced by the response in the groundwater hydrographs to rainfall events (particularly GW2 and GW3), the presence of shallow wells locally (dug wells in subsoils) as well as available data from borehole logs. Only 1 No. well recorded a groundwater strike at depth in the bedrock (small inflow in BH1 at 57mbgl). Groundwater flow directions are defined as following the local topography before discharging as baseflow to nearby surface watercourses. Groundwater flow directions are further described in Para 7.164.

7.146 In general, groundwater levels are relatively stable with minor fluctuations, reflecting the broadly impermeable bedrock aquifer with no significant response to rainfall events (*i.e.* poor recharge with steady low volume discharge (flow) through aquifer) overlain by a subsoil / bedrock interface aquifer which in some instances responds quickly to rainfall events (refer to Figure 7-7).

Table 7-10
Local Well Survey Data 2005-2024

Well Number	Location	Depth (m)	Water level (m bgl)	Diameter (mm)	Comments
PW1	Ballinclare Quarry	60	6	150	Used to be the Potable water supply, but was abandoned
PW2	Ballinclare Quarry extension	120	-	150	Groundwater ingress <10m bgl. Duty supply for process and dust suppression
PW2a	Ballinclare Quarry extension	122	-	150	Added in 2007, standby process and dust suppression
PW3	Ballinclare quarry	152	Artesian	150	Added in 2007, abandoned
GLDW1	Kilmacurra West	51.8	2.9	150	Steel casing, no PVC
DW1	Carrigmore	122	1.1	150	Steel casing, no PVC
ODW1	Carrigmore	30	1.45	150	Steel casing, no PVC
ODW3	Carrigmore	4	2.85	1000	Gravity fed dug well
DW3	Carrigmore	-	-	-	-
LDDW1	Carrigmore	Unknown	-	150	-
LDDW2	Carrigmore	Unknown	-	150	Not used
DW2	Kilmacurra West	Unknown	-	150	-
ODW2	Carrigmore	92	-	150	Lined and capped. Not accessible to dip.
ODW4	Carrigmore	28	<2.0	150	-
ODW5	Carrigmore	122	<2.0	150	Not used. Steel casing, no PVC
CBDW1	Ballinclare	-	~3-5	150	
KHDW1	Ballinclare	Unknown	<2.0	150	

7.147 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.

7.148 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.

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

Groundwater Levels

7.150 As previously noted, a number of boreholes have been drilled at the application site. Groundwater levels monitored in these boreholes and results are presented in Table 7-11 below.

Table 7-11
Groundwater Level Ranges in monitored wells (mAOD)

Borehole	Depth (m)	2014-2020	2021	2024
GW1	68	54.895-56.040	58.97-60.17	55.575-58.140
GW2	61	50.769-51.144	46.284-50.584	49.784-50.510
GW3	75	54.096-54.196	53.3-55.23	52.997-53.872
BH1	40	37.842-37.892	-	-
PW2A	122	-	-	53.72-54.71
ODW1	30	-	-	46.15-52.61*
ODW3	3	-	-	62.39-62.51
CBDW1	-	-	-	39-84-56.95*
KHDW1	-	-	-	53.61-44.33

* = dynamic (pumping) water levels

7.151 The groundwater levels range between 50.8-58.04mAOD in boreholes GW1-GW3, and at ~37.8mAOD in BH1 during 2014 when it was historically pumped. The groundwater levels show highly localised variations (refer to Figure 7-6). However, a localised groundwater flow is derived from groundwater levels recorded in monitoring and domestic wells near the site and flows broadly towards the Potters River, to the east and southeast of the site, with regional deeper groundwater flow towards the coast to the east. The primary control on groundwater flow direction is the topography and the variability/thickness of subsoils.

7.152 Dataloggers were installed in wells PW2A, GW1, GW2 and GW3 as well as in 4 No local domestic wells (ODW1, ODW3, CBDW1, and KHDW1). These dataloggers recorded water levels over the period between 26th January and – 04th July 2024. In total, over 688 cumulative days of data were collected, consisting of 8,260 data points. A plot of recorded water levels is illustrated as Figure 7-7.

7.153 Groundwater levels in these monitored wells range from ~63.6mAOD at GLDW1, situated southwest of the site, to 44.3mAOD at a monitored domestic well (KHDW1) situated ~2km southeast of the site. A further high groundwater level of 62.47mAOD is recorded in a domestic well (ODW3) on the northern side of the quarry, with groundwater flowing north here towards a further domestic well (ODW1) with a recorded water level of 52.47mAOD.

7.154 The groundwater level data indicates that local groundwater wells to the north, south and west of the site are all hydraulically upgradient, while wells to the east are potentially downgradient, however a watercourse exists (Kilmacurra Stream) which likely acts as a hydraulic boundary separating the quarry from these downgradient receptors.

7.155 Topographically, the catchment area feeding towards the quarry is small. 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 shallow groundwater rather than deep bedrock groundwater. Any groundwater flowing through the upper (fractured) bedrock will eventually discharge into Potters River. A conceptual site model is detailed below at Para 7.160.

Figure 7-6
Monitored Groundwater Levels (Jan-July 2024)

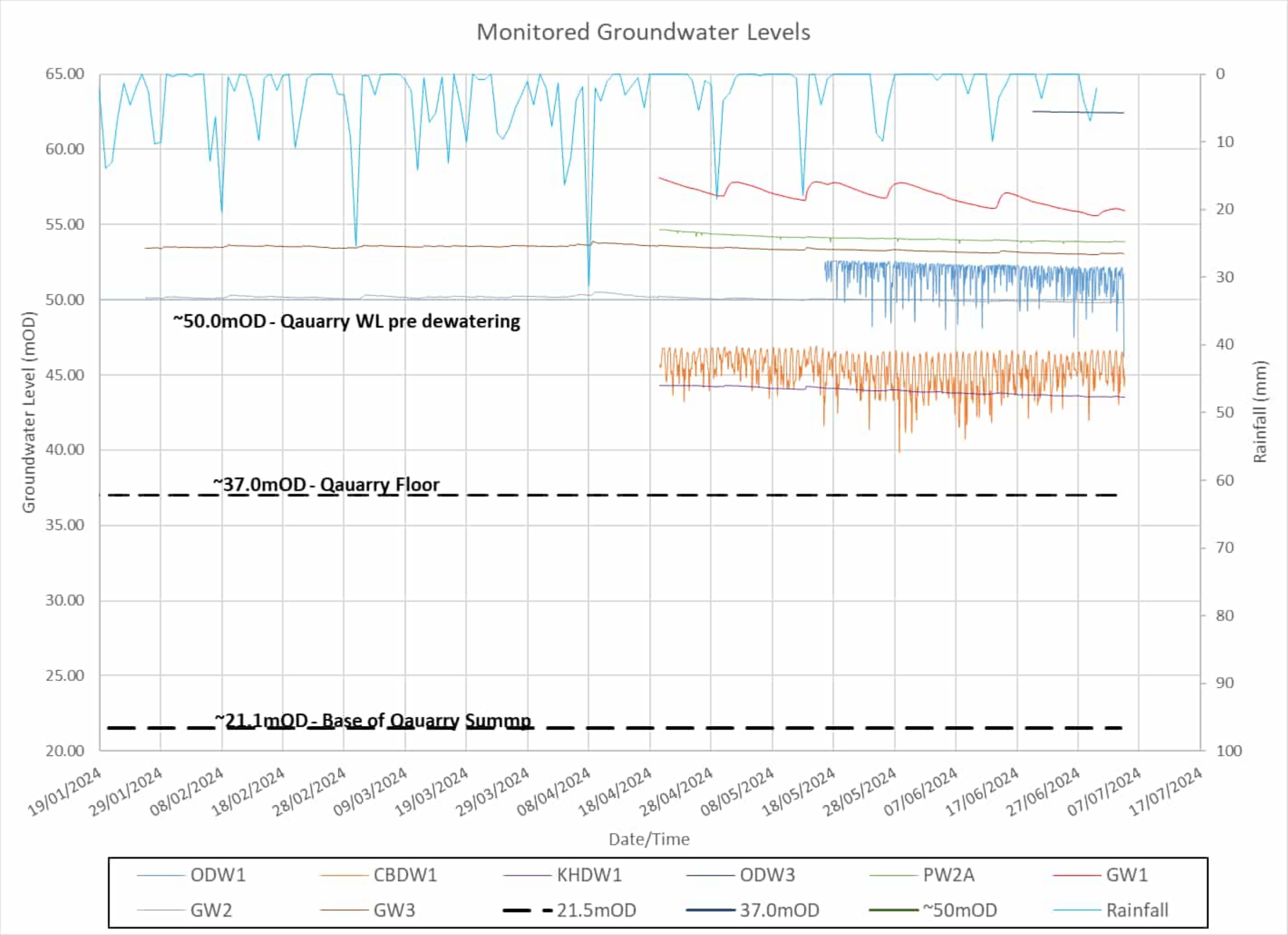
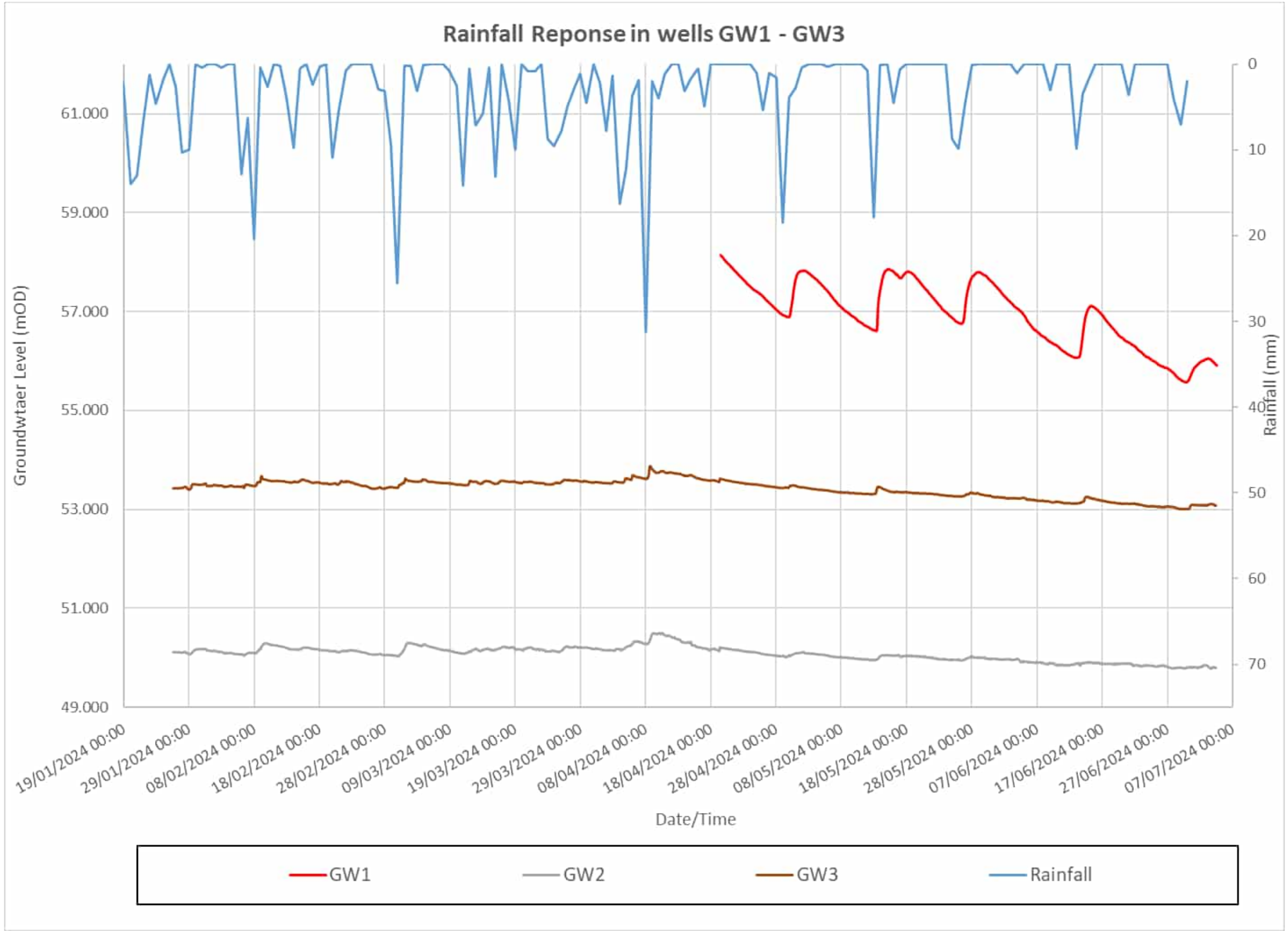


Figure 7-7
Groundwater Level Response in wells GW2 and GW3 (Jan-May 2024)



Groundwater Quality

7.156 Groundwater samples were taken from the three existing monitoring wells boreholes (GW1-GW3) once a month from May to November 2019 (seven samples total). A further 2 No. rounds of groundwater quality sampling were completed on 19th June and 04th July 2024.

7.157 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 366/2016;
- European Communities (Drinking Water) Regulations 2014 Quality. S.I. No 122/2014, and S.I. No. 99/2023 - European Union (Drinking Water) Regulations 2023; and
- EPA Interim Report Towards Setting Guideline Values for The Protection Of Ground Water in Ireland.

7.158 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.

7.159 The results of groundwater quality testing are presented in Appendix 7-F. Average, minimum, and maximum results are presented in Tables 7-12 and 7-13, and indicate the baseline groundwater quality. PAHs and hydrocarbons were also scheduled for analysis for completeness. (PAH = polycyclic aromatic hydrocarbon).

Table 7-12
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
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

		GW1 Avg	GW1 Max	GW1 Min	GW2 Avg	GW2 Max	GW2 Min	GW3 Avg	GW3 Max	GW3 Min
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
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

Exceeds Groundwater Regulations

Exceeds Drinking Water Regulations

Exceeds EPA IGVs

Limit of Detection is higher than regulations

Table 7-13
Groundwater Quality Results 2024

		GW2 (19/06/24)	GW2 (04/07/24)	ODW1 (19/06/24)	ODW1 (04/07/24)	ODW2 (19/06/24)	ODW2 (04/07/24)	LDDW1 (04/07/24)
Conductivity (25°C)	µS/cm	401	456	307	236	243	329	419
pH	pH units	7.3	7.2	7.2	6.9	6.8	6.8	6.2
Total Ammonia (as N)	mg/l	0.384	0.531	0.012	<0.01	<0.01	0.011	<0.01
Ammoniacal Nitrogen (NH3-N)	mg/l	0.464	0.647	0.145	<0.0121	<0.0121	0.0133	<0.0121
Chloride (as Cl-)	mg/l	11.1	11.2	32.3	17	17.4	42.3	25.7
Sulphate (as SO42-)	mg/l	21.3	22.8	10.4	7.96	9.29	10.1	24.6
Fluoride (as Fl-)	mg/l	0.215	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrate (as NO3)	mg/l	<4.43	<4.43	8.54	<4.43	<4.43	7.22	9.83
Nitrite (as NO2)	mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	0.033	<0.03
Orthophosphate (as PO4)	mg/l	0.066	0.07	0.013	0.01	0.013	0.019	0.01
Total coliforms	MPN/100ml	517	78	17	55	4	2	-
E coli	MPN/100ml	5	6	<1	1	<1	0	-
Cyanide (total)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (free)	mg/l	-	<0.001	-	<0.001	-	<0.001	<0.001
Sulphide	mg/l	-	<0.03	-	<0.03	-	<0.03	<0.03
Sodium	mg/l	14.8	198	26.4	116	13.6	34.3	15.8
Total Calcium	mg/l	60.3	46.5	31.8	<1.08	26.8	34.3	28.8
Total Potassium	mg/l	11.3	10.3	2.15	0.728	3.19	2.29	3.69
Total Magnesium	mg/l	12.3	9.6	8.02	<1.11	8.81	8.65	9.51
Aluminium (total)	mg/l	0.0065	0.0054	<0.005	0.0063	<0.005	0.0063	<0.005
Arsenic (total)	mg/l	0.08	0.113	0.08	0.011	0.025	0.09	0.013

		GW2 (19/06/24)	GW2 (04/07/24)	ODW1 (19/06/24)	ODW1 (04/07/24)	ODW2 (19/06/24)	ODW2 (04/07/24)	LDDW1 (04/07/24)
Boron (total	mg/l	<0.21	1.38	<0.21	<0.21	<0.21	<0.21	<0.21
Barium (total)	mg/l	0.078	0.133	<0.0017	<0.0017	0.0057	<0.0017	<0.0017
Cadmium (total)	mg/l	<0.0001	0.000485	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (total)	mg/l	0.00341	0.0018	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (total)	mg/l	<0.003	2.02	<0.003	0.003	0.003	<0.003	<0.003
Iron (total)	mg/l	0.145	0.188	<0.005	<0.005	<0.005	0.012	0.0127
Mercury (total)	mg/l	<0.00003	0.00099	<0.00003	<0.00003	<0.00003	<0.00003	0.000036
Manganese (total)	mg/l	0.382	46.4	0.0067	<0.001	0.00672	0.0332	0.162
Nickel (total)	mg/l	0.006	0.0187	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead (total)	mg/l	<0.00051	0.00992	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051
Antimony (total)	mg/l	0.00026	0.00029	0.00054	0.00069	0.0003	0.00057	0.0008
Selenium (total)	mg/l	<0.0002	0.00022	0.00032	0.00055	0.00036	0.00026	0.0006
Zinc (total)	mg/l	0.0225	0.0465	0.0377	0.00578	0.0342	0.0041	0.0072

Exceeds Groundwater Regulations

Exceeds Drinking Water Regulations

Exceeds EPA IGVs

Limit of Detection is higher than regulations

7.160 **2019 Groundwater Sampling**: 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. This is likely associated with trace metals from the borehole steel casing, as well as sampling error in not filtering the sample in the field for trace metals (standard practise).
- 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.

7.161 **2024 Groundwater Sampling:** Groundwater sampling was carried out on the 29th June 2024 in wells GW2, ODW1 and ODW2 and the 04th July 2024 in wells GW2, ODW1, ODW2 and LDDW1. The groundwater quality testing identified the following parameter ranges:

- The pH values in GW2, ODW1 and ODW2 ranged between 6.8 – 7.2, while the conductivity ranged between 243-401 µS/cm.
- There was 1 no. exceedance of the EPA IGV and Drinking water Guidelines threshold values (0.14 and 0.5 mg/L) for Ammonia in GW2 on 19th June at a reported value of 0.531 mg/L.
- There were 2 no. exceedances of the EPA IGV limit for Orthophosphate (0.03 mg/L) in GW2 on both the 19th June and 04th July 2024 at reported values of 0.07 and 0.066 mg/L respectively.
- There were exceedances of the Drinking Water Regulations guideline values for Total coliforms n wells GW2, ODW1 and ODW2 during both sampling rounds.
- There were detections of E.Coli in GW2 on 19th June and 04th July (both 6 MPN/100ml), as well as in ODW1 on 04th July at 1 MPN/100ml. Neither of these wells are used for potable well supplies.
- There were exceedances of the Drinking Water Regulations limit for Arsenic (0.01mg/L) in each of the 7 no. samples taken during 2024;

- There were minor exceedances of the IGV threshold limits for Sodium, Barium, Boron and Copper in GW2 on 04th July 2024.

7.162 Hydrocarbons were below detection limit in all three boreholes during every sampling round of 2019. There was 1 no. detection of hydrocarbons in GW2 on 04th July 2024 at 0.61 mg/L. Hydrocarbons had been detected during previous sampling from GW2. Remedial works at GW2 are proposed to resolve this issue.

7.163 It is noted that the water pumped from the production borehole (PW1) is not used for potable supply and that bottled drinking water is brought onto the site for consumption as required.

Hydrogeological Conceptual Site Model

7.164 A hydrogeological conceptual site model (CSM) has been derived, based on the information included within borehole geological logs, desk study data and in-situ monitoring of groundwater levels in observation wells. A graphic of the CSM is included as Appendix 7-M. The conceptual site model is described as follows;

- The bedrock geology of the site is dominated by hard, competent, very low permeability Diorite. The Diorite bedrock is classified as a Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones. Recorded local well yields are all low;
- The diorite is overlain by a thin layer (1-6m) of overburden, which is predominantly described as Clay, but includes gravelly / weathered section across the top of the bedrock. This subsoil-bedrock interface layer is much more porous and more permeable than the underlying Diorite bedrock;
- The topography of the site and surrounding area broadly slopes northeast from an elevation of 270mAOD at Westaston Hill, ~2km southwest of the site, to the Potters River at ~50mAOD, situated ~0.35km northeast of the site;
- Rain falls on the surrounding ground and at the site, with greater rainfall on higher elevations (i.e. southwest of the site) and the rain infiltrates through the relatively thin subsoils;
- The rainfall infiltrates through the subsoil and reaches the low permeability bedrock (Diorite). From this point it cannot infiltrate further vertically except in local areas but not everywhere. As a result, the predominant groundwater flow occurs along the top of the bedrock, and this predominant flow follows the gradient of the local topography. Some recharge enters the bedrock through local weathering and fissures. The deeper bedrock flows are localised and relatively short. They do not form regional groundwater flows, and they are not significant in terms of volume;
- Groundwater levels in the area range between 44.3 – 63.6mAOD, with higher elevations recorded towards the west, north and south / southwest of the site. Shallow groundwater flow follows topography and runs along the subsoil-bedrock interface, where that exists.
- The groundwater levels at the site range between 50.8-58.04mAOD, which coincide with the elevation of the subsoil layer, apart from GW1, which displays a higher water level. GW1 showed a consistent higher water level above the level of the flooded quarry, and therefore is potentially disconnected from any local fracture system (although a small inflow is recorded at 57 mbgl). Analysis of the GW1 hydrograph indicates an isolated sump well that fills rapidly after rainfall and slowly drains down until the next rainfall event occurs. The lowest groundwater levels exist towards the east / southeast of the site, the direction in which local groundwater broadly flows;

- The groundwater response to rainfall is relatively quick in most wells (apart from the water level recessions noted in GW1) and similar to that which would be observed in a surface water or shallow groundwater system (refer to Figure 7-7);
- There is a section of ground to the southwest of the site which slopes southwest, at this point groundwater in the subsoils will flow to a drain situated southwest of the site; and,
- On the northern side of the quarry, a large cliff face exists with high ground situated north of the quarry. A high groundwater level of 62.47 mAOD is recorded north of the quarry at ODW3, thus this area is hydraulically upgradient of the quarry.
- The higher groundwater levels recorded in areas surrounding the site (particularly north and south of the site) are most likely due to increased recharge in these areas as thicker subsoils will exist on undisturbed ground. Further north of ODW1 and ODW3, the ground continues sloping northeast and the shallow groundwater will flow northwest towards the Potters River.
- The available data indicates there are two groundwater flows systems locally:
  - The shallow flow which occurs across the top of the bedrock and which is driven by recent rainfall recharge.
  - Deeper, less connected, local flow within fissures and fractures in the Diorite.
  - The shallow flow is the dominant groundwater flow in the area, and this dominant system is also likely the main source of inflow to many of the local groundwater wells.
  - The shallow flow system follows topography, with flow from the west, and to the south, and away from the quarry on higher ground to the north.
  - More broadly, the deeper groundwater flow likely follows the river drainage pathways and flows to the east-southeast.
  - All recorded groundwater levels exist ~15-25m above the level of the base of the quarry, and pumping from this quarry has not affected local water levels from the observed data, demonstrating an isolation between the small amounts of groundwater flowing into the quarry through the diorite bedrock and the wider shallow groundwater system. For the purposes of clarity, the majority of water being pumped from the quarry is from rainfall falling directly on the quarry, not groundwater inflows.

Local Wastewater Treatment

7.165 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 standard septic tank and percolation area or a packaged wastewater treatment system and percolation area.

Designated Areas

7.166 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.

7.167 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 7-14 below.

Table 7-14
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 the discharge from the Site 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

7.168 The following water environment sensitive receptors have been identified in the receiving environment and are assessed for significance and sensitivity in Table 7-15 below:

- Surface Water - Potters River surface water quality;
- Surface Water – downstream DWPA along the Potters River for the Glenealy Water Supply;
- Groundwater - good quality, poorly productive diorite bedrock aquifer; and,
- Groundwater - nearby domestic and agricultural local groundwater wells and the people and farms they supply.

7.169 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 Potters River, they cannot therefore be impacted by any site based activities. There is no hydrological pathway from the Application site to Glenealy Woods pNHA and Deputy's Pass Nature Reserve SAC.

7.170 Of the designated sites indicated in Table 7-14 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 it is located on lands overlying a different aquifer (GWDTE-Buckroney-Brittas Fen) than that which occurs at the Site.

7.171 Potential effects on the Buckroney-Brittas Dunes and Fens SAC are considered below within the Impact Assessment.

Table 7-15
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 moderate quality but at risk of deteriorating. EPA noted unsatisfactory conditions at Kilboy bridge (refer to Q values in Para 7.85).	**Medium - Attribute has a medium quality or value at the local catchment scale only.** The river is very sensitive to any reduction in surface water quality.
2	Surface Water - Potters River	Local significance only. The Potters_010 SWB in the vicinity of the application site is listed as a Drinking Water Protected Area (DWPA) under Article 7 Abstraction for Drinking Water (IE_EA_10P010300).	This DWPA occurs upstream and downstream of the application site discharge and also includes the Kilmacurra Stream. The abstraction from the Potters River is for the Glenealy Public Supply which is reported to have a maximum abstraction volume of 185m^3/day, and the abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.	**High - Attribute has a high quality or value at the local catchment scale.** The river is very sensitive to any reduction in surface water quality.
3	Groundwater - Bedrock aquifer	Local significance only. No regional flowpaths occur.	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.
4	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 are sensitive to changes in local groundwater quality. Proposed activities at the site have the potential to result in a reduction in the groundwater quality.	**Medium-High - Attribute has a medium-high quality or value on a local scale** Boreholes surrounding the site are sensitive to a reduction in groundwater quality,

Site Baseline Summary

7.172 The proposed materials recovery / recycling facility and inert landfill development is located at Ballinclare Quarry, Kilbride, Co. Wicklow. The proposed development comprises the establishment and operation of C&D waste recovery facilities (a soil wash plant and C&D crushing plant) and backfilling of the quarry void through the establishment and operation of an inert lined landfill.

7.173 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.

7.174 The Potters 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. The Potters River flows south before discharging to the Irish Sea ~7km from the site.

7.175 The Potters River discharges to the Irish Sea. At the point at which this river discharges to the sea (near Potters Point), there is an SAC / pNHA mapped, identified as the Buckroney-Brittas Dunes and Fen SAC and pNHA (000729). While these sites are not designated for hydrological / hydrogeological elements, the presence of the Potters River through the designated area means that these sites are carried through to the impact assessment section for further evaluation.

7.176 Surface water quality is broadly good. Contemporary water quality results demonstrate good quality water, with the exception of elevated Arsenic at one sampling location (SW6) during one sampling event.

7.177 The Potters_010 SWB in the vicinity of the application site is listed as a Drinking Water Protected Area (DWPA) under Article 7 Abstraction for Drinking Water (IE_EA_10P010300). The surface water abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.

7.178 The diorite bedrock is classified as a poor aquifer (PI) 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.

7.179 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.

7.180 A site investigation carried out in 2014 comprised 3 No. groundwater monitoring boreholes and 2 No. rotary cored boreholes, which encountered diorite bedrock to 40m below the quarry floor. Previous site investigation drilling was completed in 2005 (TW series wells). Groundwater inflows to the TW series wells were estimated to be less than 5m^3/day, and to be more accurately described as seepages.

7.181 Minor groundwater inflows were encountered at most well locations, with the exception of borehole GW2 where a groundwater strike was encountered at 6m bgl (interface between made ground and bedrock) with a significant groundwater inflow (attributed to localised presence of loose unconsolidated material, refer to Para 7.120). In comparison, boreholes GW1 and GW3 encountered very little groundwater in the diorite bedrock and the groundwater took some time to enter the borehole following drilling.

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

7.183 Recorded groundwater levels range between 50.8-58.04mAOD within the Application site and 44.3-63.6mAOD in the wider area. Groundwater flow primarily occurs in a shallow system within the subsoil and flow directions broadly follow topography. There is limited flow within the underlying diorite bedrock, reflecting its relatively impermeable nature and status as a “Poor Aquifer”.

IMPACT ASSESSMENT

Evaluation Methodology

7.184 The impacts on the local surface water and groundwater environment of the proposed inert soil / C&D waste recovery, recycling and disposal activities at Ballinclare Quarry are assessed in the following section.

7.185 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.

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

7.187 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 Proposed Development. This approach allows effort to be focused on reducing risk where the greatest benefit may result.

7.188 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.

7.189 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.

7.190 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 hydrological and 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 Development

7.191 As described in Section 2, the proposed development at Ballinclare Quarry provides for the establishment and operation of a licensed, integrated material recovery / recycling facility and inert landfill which comprises three key elements

- a soil washing plant to win aggregate from imported soil and stone;
- a construction and demolition (C&D) waste recycling facility to produce aggregate from construction and demolition waste (principally concrete); and
- an inert engineered (i.e. lined) landfill to facilitate backfilling and restoration of the existing quarry void.

7.192 It will provide for the importation, re-use, recovery and/or disposal of by-product materials and inert wastes generated by construction and development projects in Counties Wicklow, Dublin and Wexford as well as the backfilling and long-term restoration of the former quarry to native woodland habitat.

7.193 As part of the proposed development water management systems will be required, and these detailed, which are relevant to the Water Environment Impact Assessment are outlined below.

Proposed Water Management and Treatment Systems

Dewatering of Quarry Void

7.194 To enable the quarry to be re-engineered as an inert landfill, and as previously noted, the quarry void is currently being dewatered, with ponded waters being pumped to an on-site water treatment system and discharged to the Potters River, in line with an existing Local Authority discharge licence (Ref. WPL 116).

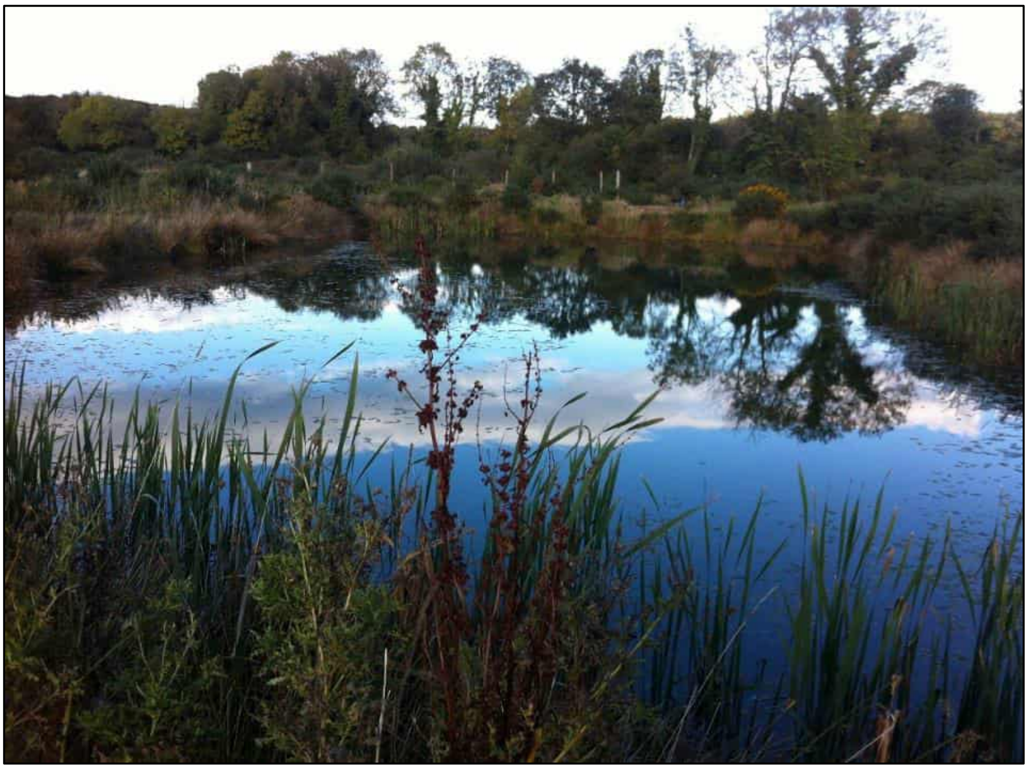
7.195 Due to elevated natural levels of arsenic in the water collecting in the quarry void, the discharge is treated via a bespoke Siltbuster treatment system which assists in the removal of suspended solids from the discharge water. Details of the Siltbuster treatment system are included in Appendix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

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

7.197 In terms of the potential for an increase in the risk of flooding in the Potters River, the quarry discharge is currently limited to 20L/s (72m^3/hr, or 1728m^3/day). This discharge flow is a very small proportion of likely larger flood flows in the Potters River. For example, the estimated 5%ile flow in the Potters River is 1.685m^3/s (1685 L/s), and the addition of the 20L/s from the quarry only accounts for ~1.2% of that river flow. Discharge from the quarry does not have to be continuous, and therefore can be temporarily stopped during extreme flood events. The quarry discharge will not significantly affect downstream flood flows in the Potters River.

Plate 7-1
Existing Lagoon at Ballinclare

Plate 7-2
Existing Final Lagoon at Ballinclare



7.198 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: Runoff Treatment

7.199 There will be on-going generation of runoff from rainfall on the landfill over the operational life of the inert landfill facility at the application site and as a result runoff from the infill area will need to be collected and treated prior to being discharged off-site.

7.200 The Proposed Development includes provision for phased infilling of the quarry void. During Phase 1A, surface water runoff from the infill area will be captured and recirculated (or supplied to soil wash plant). Any excess runoff will be tankered off site for licenced disposal. Surface water runoff from the C&D recovery yard will be captured and supplied to the soil wash plant, while runoff from the soil processing area will be directed towards a sump behind the wash plant for re-use in the washing process. Any excess water in the sump on the quarry floor will be treated prior to discharge.

7.201 Following the capping and restoring oh the Phase 1A area, surface water runoff will be captured by a perimeter toe drain and discharged offsite.

7.202 During the follow-on Phase 1 development, the discharge / runoff from the inert landfilling areas will be collected and treated in a Integrated Constructed Wetland. Runoff from the C&D waste recovery and soil processing area will be supplied to the soil wash plant. Any excess water collecting in the sump on the quarry floor will be treated by the Siltbuster system and settlement ponds prior to discharge.

7.203 During Phase 2 of the development, whereby the land surface will be raised to 80mAOD, the runoff from active inert landfill areas will be collected and treated within the Integrated Constructed Wetland. Runoff from capped landfill areas and the C&D waste recovery facilities will be collected and directed to temporary balancing ponds. Excess water in these balancing ponds will be treated by the Siltbuster system and settlement ponds prior to licensed discharge.

7.204 During Phase 3 of the Proposed Development, the water management system will mimic the Phase 2 operation outlined above.

7.205 Schematic details of the surface water management system to be implemented across the inert landfill area at each phase of development are shown in Figure 2-11 to Figure 2-16.

7.206 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 any lightly impacted / lightly contaminated run-off ('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.

7.207 An initial assessment indicates that there is sufficient spare land available at Ballinclare Quarry 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, thus minimising the amount of leachate generated and requiring treatment.

7.208 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.

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

(i) A wetland treatment system: comprising the following elements in series:
    a. Anaerobic (biochemical reactor) wetland;
    b. Iron Sequestering Unit (ISU);
    c. Aerobic wetland.
(ii) A leachate reception tank: up to 50m^3, self-bunded storage tank with level controls.
(iii) A pump house: housed in a standard shipping container (6.0m x 2.4m x 2.6m) containing feed, discharge and chemical dosing pumps;
(iv) Off-site discharge via existing ditch / drainage channels to the Ballinclare Stream and the Potters River further downstream.

7.210 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 1.06 hectares. Refer to Figures 2-12 to 2-16 and Figure 2-17 in Chapter 2 of this EIAR

Landfill Groundwater Control System

7.211 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.

7.212 Notwithstanding this, a groundwater control system will be installed below the clay layer to ensure it is not damaged by hydrostatic uplift pressures. It is envisaged that the drainage system at the base of the quarry / inert landfill cells will comprise a herringbone system of granular drainage channels and that these would feed groundwater inflows to a collection point at the deeper excavation in the middle of the existing quarry floor which effectively acts as a sump over the initial landfilling stages (Phases 1A to 1C). During Phase 1C of landfilling, riser pipes will be installed at the sump area to facilitate the continued operation of the groundwater collection system which controls uplift pressures beneath the basal liner. Submersible pumps will be placed in these risers and will continually lift and remove any dewatered groundwater collecting in them. Pumping will continue until such time as the overlying inert waste has reached a depth / height where the weight of waste exceeds the maximum uplift pressure from surrounding groundwater. At that point in time, pumping of groundwater is likely to cease and the riser pipe will be decommissioned by backfilling it with bentonite.

7.213 During Phase 2 of the landfill development, the land surface will be raised above the level of the local groundwater table. As such, there will be no further requirement to manage or pump groundwater.

Soil Washing Plant / C&D Facility

7.214 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 or the C&D recovery area to the west of the site access road (other than direct rainfall runoff captured from the roof of the C&D shed). All process water associated with the winning of recycled aggregate from more granular waste soils or from claybound C&D, as well as rainfall runoff from these areas will be re-circulated in a closed loop system at the soil wash plant. 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.

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

Wastewater Management

7.216 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 wastewater treatment system are provided in Appendix 7-K for reference. The existing wastewater system does not have the full capacity for the proposed loading arising when the envisaged maximum numbers of personnel are based on site during the operation of the Proposed Development. Provision is therefore made for excess effluent to be stored in a holding tank, and tankered off site (by a licenced haulier) on a monthly basis. The excess effluent will be transferred to a licenced wastewater treatment plant for off-site treatment and disposal. Details of the sub-surface storage tank are also provided in Appendix 7-K.

Wheelwash

7.217 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. A further wheelwash will be constructed at the proposed aggregate production yard in the south-eastern corner of the application site. Water supplied to these wheelwashes will be recycled in a closed system and topped up with water from the supply well or from the quarry sump / balancing ponds as required. There is no water discharge from the wheelwash systems.

Long-Term (Post Closure) Surface Water Management

7.218 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.

7.219 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.

7.220 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 Potters River.

7.221 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 / attenuation pond along the southeastern boundary (refer to Figure 2-19) that will discharge to an existing stream which flows to the Kilmacurra Stream.

Site Entrance Drainage Collection and Water Management System

7.222 Runoff from the site entrance area and the weighbridge area will be collected and treated in a hydrocarbon interceptor, and it will then pass to the existing storage pond [30m x 15m x 3m = 1,350m^3 volume). Excess water from the storage pond will be pumped (duty and standby pumps will be installed to ensure redundancy) to the main quarry drainage system, where it will either be used for water supply to the soil washing plant or treated and discharged.

Site Water Supply

7.223 Water supply to the site office and welfare facilities will continue to come from well PW2. Water management and water supply to the soil washing plant will operate as described in Paras 7.199 to 7.204 above.

Construction Stage Impacts

7.224 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 C&D waste recovery facilities and new inert landfill, the construction stage is taken to be site preparation which involves any residual dewatering from the quarry sump, the construction of the required infrastructure and site preparation, which is outlined in Chapter 2 of this EIAR.

Direct Impacts

Groundwater

7.225 The groundwater receptors at the site include the underlying poorly productive diorite bedrock aquifer and nearby domestic and agricultural local groundwater supply wells.

7.226 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. Discharge of these to groundwater would cause an **adverse effect.**

Surface Water

7.227 The surface water receptors at the site are the Kilmacurra Stream and the Potters River (including the DWPA IE_EA_10P010300). Direct impacts during the construction stage have the potential to arise from:

- Uncontrolled discharge of water from the flooded quarry sump (over the remainder of the 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 and the DWPA. This would be an **adverse effect.**
- An uncontrolled discharge of water from the flooded quarry sump also 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.**
- Uncontrolled discharge of water from the quarry sump has the potential to create increased Arsenic concentrations in downstream surface water bodies (Potters River). This would be an **adverse effect.**

Indirect Impacts

Designated Sites

7.228 Potential effects on downstream designated sites (i.e. Buckroney-Brittas Dunes and Fen SAC and pNHA (000729) are linked to the potential Construction Stage effects on surface water as outlined above.

7.229 Discharge of poor-quality surface water from the Application site has the potential to affect the water quality in the Potters River, which has the further potential to have secondary adverse effects on the Buckroney-Brittas Dunes and Fen SAC / pNHA. However, the potential consequences for the designated site(s) are limited as the SAC / pNHA is designated primarily for Annex I/II habitats and species associated with a dune environment. The Buckroney Fen (part of the SAC / pNHA), which could be considered more hydrologically dependent, but is not hydrologically connected to the Potters River and is fed by rivers / streams further south of the Potters River. As such, the potential effects from poor quality water in the Potters River are limited.

Operation Stage Impacts

7.230 During the operational stage the dry quarry void will be backfilled and restored using imported soil and stone waste, while C&D materials will be recovered at the proposed recovery facility to win aggregate material. Therefore, discharges that could potentially effect groundwater quality and surface water quality are the principal potential impacts during this stage, primarily from the infilling of the quarry with inert soil and stone material.

Direct Impacts

Groundwater

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

7.232 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 potentially affect groundwater quality in the aquifer, and the groundwater quality of water abstracted from nearby local groundwater wells. This would be an **adverse effect.**
- Impacts on groundwater levels due to pumping / dewatering and infilling of the quarry void (by blocking groundwater flow paths), potentially affecting the supply capacity of nearby local groundwater wells. **This would be an adverse effect.**

7.233 Each of the above impacts is assessed in terms of the character, magnitude, duration, probability and consequence in Table 7-16 below.

Surface Water

7.234 It is noted that the surface water receptor in the vicinity of the site is the Potters River (its water quality and aquatic ecosystem and its use as a DWPA) are very sensitive in terms of surface water quality and flow volumes during flood events.

7.235 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.**

7.236 Each of the above impacts is assessed in terms of the character, magnitude, duration, probability and consequence in Table 7-16 below.

Indirect Impacts

Designated Sites

7.237 Potential effects on downstream designated sites (i.*e.* Buckroney-Brittas Dunes and Fen SAC and pNHA (000729) are linked to the potential Operational Stage effects on surface water as outlined above, primarily related to suspended solids entrainment in discharge water.

7.238 Discharge of poor quality surface water from the Application site has the potential to affect the water quality in the Potters River, which has the further potential to have secondary adverse effects on the Buckroney-Brittas Dunes and Fen SAC / pNHA. However, the potential consequences for the designated site(s) are limited as the SAC / pNHA is designated primarily for Annex I/II habitats/species associated with a dune environment. The Buckroney Fen (part of the SAC / pNHA), which could be considered more hydrologically dependent, but is not hydrologically connected to the Potters River, and is fed by rivers / streams further south of the Potters River. As such, the potential effects from poor quality water in the Potters River are limited.

Post - Operational Stage Impacts

7.239 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.

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

Direct Impacts

7.241 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 native woodland habitat.

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

7.243 There will be no trade effluent discharge to any surface watercourse 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.

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

Indirect Impacts

7.245 There are no indirect post closure impacts anticipated.

Unplanned Events

7.246 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.

7.247 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.

7.248 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

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

The ‘Do Nothing’ Scenario

7.250 If the proposed waste recovery and landfilling 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.

7.251 Groundwater vulnerability at the site will remain high to extreme as bare rock is exposed.

7.252 In the absence of any site management practices, surface water bodies / groundwater would be vulnerable to impacts from any future human activities within and/or around the quarry.

7.253 In the absence of controlled pumping and discharge (with water treatment and monitoring) from existing quarry void it would fill with rainwater (as it did in the past), and potentially overflow, leading to uncontrolled discharges which would likely contain elevated concentrations of arsenic.

Rating of Identified Potential Impacts and Significance

7.254 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.

7.255 The description of the potential effects and rating for each identified impact is presented in Table 7-16 below.

7.256 The significance of impacts is based on the significance/ sensitivity of the existing environment and the description of identified potential impacts, refer to Table 7-16 below. The significance of Impact is determined from the Classification of the Significance of Impacts in Appendix 7-I.

Table7-16
Direct Impacts: Description and Significance of Effects

	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**
2	Impact on groundwater levels / flowpaths	Potential to affect groundwater levels due to pumping groundwater from quarry floor to completely dewater the quarry.	Small magnitude given the relatively impermeable, unproductive aquifer	Duration of effect during the construction phase would be temporary to short	Unlikely given the underlying hydrogeological regimen at the site and from site data collected to date (no significant effect)	Lowering of water levels in local domestic/agricultural wells	The potential impact on groundwater levels is rated as being Low, based on knowledge of the underlying hydrogeology at the site and the available data from local groundwater wells while pumping is ongoing in the quarry.	**Moderate**
Construction Stage: Surface Water								
3	Impact on **surface water quality** in the Potters River during the final 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 and DWPA. The Glenealy WS abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.	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**
4	Impact on **surface water flow / levels** in the Potters River during the final dewatering phase of the quarry void.	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. The quarry discharge is a low volume (20L/s) and it constitutes only a very small proportion of flood flows. Discharges (pumping) from the quarry can be stopped during extreme flood events.	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, but can be stopped if a significant (out of bank) flood event occurs.	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**

	Potential Impacts	Character	Magnitude	Duration	Probability	Consequences	Description of Impact	Significance of Impact
Construction Stage – Indirect Effects								
5	Impacts on qualifying interests of downstream Designated Sites	Potential to affect surface water quality in the Potters River, thereby potentially affecting the qualifying interests of the downstream SAC (Buckroney-Brittas Dunes and Fen SAC/pNHA), which the Potters River flows through	Extent in the river would be downstream of the discharge point.	Duration of effect would be temporary (duration of construction stage dewatering).	Unlikely effect due to the volume of flow in the Potters River in comparison to any discharge, as well as the lack of hydrological dependency on the qualifying interests of the SAC / pNHA (as the Fen is not hydraulically connected to the Potters River)	Potential effects on vegetation associated with the Dune complex	The potential impact on surface water quality is rated as being Medium based on the character, magnitude, duration and consequence of the identified effects.	**Slight**
Operational Stage – Groundwater								
6	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 – based on observed disconnect between bedrock hydrogeology underlying the quarry and predominance of shallow groundwater flow in lands surrounding the quarry.**
7	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**
8	Impact on groundwater levels / flowpaths	Potential to affect groundwater levels due to pumping groundwater from the quarry floor to maintain groundwater levels below clay liner, and potential to block groundwater flowpaths by filling the quarry void.	Small magnitude given the relatively impermeable, unproductive aquifer. Quarry face indicates very tight bedrock with little or no evidence of fracturing/jointing or faults (along which groundwater might flow).	Duration of effect during the operational phase would be temporary to long term, depending on the rate of fill of the quarry void to the point where hydrostatic uplift pressure is overcome by the imported material.	Unlikely given the underlying hydrogeological regimen at the site and from site data collected to date (no significant effect)	Lowering of water levels / yields in local domestic/agricultural wells.	The potential impact on groundwater levels is rated as being Low, based on knowledge of the underlying hydrogeology at the site.	**Moderate to Slight**
Operational Stage: Surface Water								
9	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 and DWPA. The Glenealy WS abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.	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**

	Potential Impacts	Character	Magnitude	Duration	Probability	Consequences	Description of Impact	Significance of Impact
10	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 and DWPA.	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**
Operational Stage – Indirect Effects								
11	Impacts on qualifying interests of downstream Designated Sites	Potential to affect surface water quality in the Potters River, thereby potentially affecting the qualifying interests of the downstream SAC (Buckroney-Brittas Dunes and Fen SAC / pNHA), which the Potters River flows through	Extent in the river would be downstream of the discharge point.	Duration of effect would be temporary (duration of construction stage dewatering).	Unlikely effect due to the volume of flow in the Potters River in comparison to any discharge, as well as the lack of hydrological dependency on the qualifying interests of the SAC / pNHA (as the Fen is not hydraulically connected to the Potters River)	Potential effects on vegetation associated with the Dune complex	The potential impact on surface water quality is rated as being Medium based on the character, magnitude, duration and consequence of the identified effects.	**Slight**
Post Closure Stage: Surface Water								
12	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 and DWPA. The Glenealy WS abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.	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

7.257 A summary of those impacts which have been identified as having a likely, significant effect is provided below. Only one potential impact has been identified as having a likely, significant effect, specifically:

- 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.

7.258 Although not considered to be potential significant impacts Associated indirect effects on Buckroney-Brittas Dunes and Fen SAC / pNHA are also discussed below in the Residual Impact Assessment (refer to Para 7.301 to 7.311).

7.259 Also, although not considered to be potential significant impacts, we have also provided information on Groundwater Protection in the discussion below (in the Residual Impact Assessment (refer to Para 7.312 to 7.317)), as this was one of the key issues and concerns raised during public consultation at pre-application stage.

MITIGATION MEASURES

7.260 Proposed mitigation measures to reduce the potential impacts associated with the planned development at Ballinclare Quarry 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. The mitigation measures employed are related to all potential effects identified within points 1-12 of Table 7-16 above.

7.261 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.

7.262 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.

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

Construction Stage

7.264 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 (WPL116), or any required revision to the licence resulting from conditions associated with this application;
- 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 other refuelling activities;
- All refuelling will be completed by competent / trained operatives;
- 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

7.265 Water in the quarry void will be pumped to the treatment plant and will then be routed to the settlement / attenuation ponds for further treatment (settlement) prior to discharge at the Potters River. The locations of the existing settlement ponds are shown on Figure 2-1.

7.266 All surface water discharges to the Potters River will comply with the emission limits set by the discharge licence [WPL116] (or those which may supersede them in any waste licence issued by the EPA).

7.267 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

7.268 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.

7.269 The following additional mitigation measures will also be implemented:

Inert Landfill Liner

7.270 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. The proposed clay liner is intended to have the following functions:

- Prevent discharge through the base of the backfilled quarry void.
- Prevent discharge through the sidewalls of the backfilled quarry void.
- Ensure that the wider aquifer and underlying groundwater system and groundwater quality is physically protected by a pathway/flow barrier.

On-site Passive Wetland Treatment System

7.271 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 managed separately to run-off which is not in contact with the imported wastes. Run-off arising in contact with waste bodies will be collected separately and directed for recycling / re-use at the soil wash plant. Any excess run-off in contact with imported waste will be pumped 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.

7.272 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.

7.273 Based on the initial assessment and design, the proposed wetland treatment system at Ballinclare Quarry will comprise the existing approved treatment system in addition to:

(i) A wetland treatment system: comprising the following elements in series:
  a. Anaerobic (biochemical reactor) wetland;
  b. Iron Sequestering Unit (ISU);
  c. Aerobic wetland.
(ii) A leachate reception tank: up to $50m^3$, self-bunded storage tank with level controls.
(iii) A pump house: housed in a standard shipping container (6.0m x 2.4m x 2.6m) containing feed, discharge and chemical dosing pumps;
(iv) Off-site discharge via existing ditch / drainage channels to the Ballinclare Stream and the Potters River further downstream.

Testing and Inspection of Imported Material

7.274 All inert soil / C&D waste materials will be transported to the proposed materials recovery / recycling facility and inert landfill at Ballinclare Quarry using heavy goods vehicles (HGVs) comprising a mix of rigid body lorries and articulated trucks. All HGVs importing inert wastes (or by-product) to the facility will be required to pass over the new weighbridge which is to be installed at the northern end of the existing access road into the site.

7.275 On arrival, HGV drivers carrying the waste intake materials will identify themselves to staff at the site / weighbridge office before proceeding to the active backfilling / landfilling area or the C&D waste recovery / recycling facilities (as appropriate). Staff will record the time and date of arrival, the nature, origin and weight of the imported materials (whether waste or by-product / engineering materials), the customer / Client name, the truck licence plate number, any relevant waste collection permit details and any further details which may be required by the EPA waste licence. All records of by-product and waste intake will be maintained on site for tracking and auditing purposes.

7.276 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.

7.277 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 and complies with site acceptance criteria. A site investigation report of other detailing the characterisation testing undertaken and results of testing will be submitted for approval in advance by customers, clients or sub-contractors intending to forward soil and stone materials to the facility. A suitably qualified person shall review the Site Investigation Report and determine if the material is suitable for acceptance. All HGVs transporting waste to the site must hold a valid Waste Collection Permit. Details of the hauliers permit shall be issued in advance. A letter of suitability shall be issued to the source site. Specific conditions if required will be outlined and agreed by the source site. Onsite CCTV cameras at the weighbridge will be fitted with vehicle recognition software to ensure the vehicle is pre-approved and carries a waste collection permit.

7.278 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 which is identified with intermixed non-hazardous / hazardous wastes on foot of a CCTV / visual inspection at the weighbridge will be deemed unacceptable, will be immediately rejected and re-directed off-site to an alternative authorised (i.e. permitted or licensed) waste facility.

7.279 All inert soil and stone imported to the facility will be unloaded (end-tipped) from HGV’s at the active landfilling areas. In addition to visual / CCTV inspection at the weighbridge, it will be inspected again by site based personnel at the landfilling area 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 (i.e. permitted or licensed) waste facility.

7.280 Similarly, should any non-inert or non-C&D waste be identified amongst incoming waste consignments at the soil / 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

7.281 If, following its acceptance at the facility, there is any subsequent grounds for concern about the nature of the wastes imported to and/or handled on site, it will be segregated and transferred to the covered waste inspection and quarantine shed for closer inspection and classification testing to establish whether it can be accepted at the facility or not. Suspect waste will be identified on the basis of visual inspection (unusual colour, intermixed wastes etc.) or by smell during waste placement, handling and/or processing / crushing. A detailed record will be kept of all such inspections.

7.282 Should detailed inspection and/or any subsequent testing indicate that the quarantined materials are non-inert or cannot be accepted and used for landfilling or recovery / recycling purposes at the facility, they will be transferred off-site by to another appropriately authorised waste facility.

7.283 It is proposed to designate the former aggregate storage shed at the southern site boundary (at the southern limit of the former concrete / asphalt production area) as the on-site waste inspection and quarantine facility. The shed is roofed, closed on three sides and has a concrete floor, thereby protecting any suspect waste which might be transferred and held there 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).

7.284 Any significant volumes of intermixed non-inert C&D wastes (principally metal, timber, PVC pipes and plastic) inadvertently imported to the facility will be separated out and temporarily stored in skips or covered at the waste recovery area / shed or at the waste quarantine area prior to removal off-site to appropriately authorised waste facility. A representative sample will be taken (in accordance with waste licence requirements) of waste materials accepted at the inert landfill facility and subjected to compliance testing which focuses on key contaminant indicators. This data shall be used to confirm that the accepted soils are inert / acceptable (according to Council Decision 2003/33/EC) and/or comply with approved waste intake acceptance criteria. Compliance testing will be undertaken by the Applicant.

7.285 Only operators and/or haulage firms holding valid current waste collection permits will be engaged to transfer waste streams off-site to other authorised waste disposal or recovery facilities as required.

Surface Water Management (to Protect Downstream Receptors)

7.286 The operational phase of the Proposed Development includes for a phased infilling of the quarry void. During Phase 1A, surface water runoff from the infill area will be captured and recirculated (or supplied to soil wash plant). Any excess runoff will be tankered off site. Surface water runoff from the C&D recovery yard will be captured and supplied to the soil wash plant, while runoff from the soil processing area will be directed towards a sump behind the wash plant for use in the washing process. Any excess water in the sump on the quarry floor will be treated prior to discharge.

7.287 Following the capping and restoring of the Phase 1A area, surface water runoff will be captured by a perimeter toe drain and discharged offsite.

7.288 Before the end of Phase 1A, the construction of the Integrated Constructed Wetland will commence. During that construction phase, excess water from the construction area will be pumped back to the quarry void. In addition, a temporary cutoff drain and double line of silt fencing will be used to ensure separation between the wetland construction area and the Ballinclare stream.

7.289 During the follow on Phase 1 development, the discharge/runoff from the inert landfilling areas will be collected and treated in a Integrated Constructed Wetland. Runoff from the C&D waste recovery and soil processing area will be supplied to the soil wash plant. Any excess water collecting in the sump on the quarry floor will be treated by the Siltbuster system and settlement ponds prior to discharge.

7.290 During Phase 2 of the development, whereby the land surface will be raised to 80mAOD, the runoff from active inert landfill areas will be collected and treated within the Integrated Constructed Wetland. Runoff from capped landfill areas and the C&D waste recovery facilities will be collected and directed to temporary balancing ponds. Excess water in these balancing ponds will be treated by the Siltbuster system and settlement ponds prior to licensed discharge.

7.291 During Phase 3 of the Proposed Development, the water management system will mimic the Phase 2 operation outlined above.

7.292 Surface water quality testing of the discharge from the site will be completed on a quarterly basis (subject to any update of the existing discharge license and/or conditions within the Waste License).

7.293 As such, runoff from the site will be managed during each phase of the proposed infilling, as well as management of surface water from the C&D waste recovery facility, in order to mitigate against any potential effects on downstream watercourses following discharge off-site.

Post – Operational Stage

7.294 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 native woodland habitat.

7.295 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.

7.296 Once the site is backfilled, it will become vegetated and runoff and drainage will either percolate to ground or runoff and drain passively from the site via the wetland area. A small area of the southeastern corner of the site will drain locally to a suitably sized swale /attenuation pond and will discharge following treatment to the Kilmacurra Stream.

7.297 The long-term surface water management regime for the backfilled landform described in Chapter 2 will be established incrementally over time, as landfill and restoration work proceeds. On completion of the quarry backfilling and restoration works, any outstanding long-term site drainage works will be completed.

RESIDUAL IMPACT ASSESSMENT

7.298 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. Detailed proven mitigation measures will be implemented at all stages of the development to ensure protection of downstream surface water quality in the Potters River.

7.299 A WFD Compliance Assessment is included as Appendix 7-N. That assessment concludes that there will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the proposed development. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs are protected from any potential deterioration. Mitigation proposed for the protection of protected areas during the construction, operation and post-operational stages of the proposed development will ensure the qualitative and quantitative status of the receiving ground and surface waters will not be altered by the proposed development and thereby limiting the potential for the proposed development to negatively impact upon any designated site.

7.300 The following additional residual assessment is added with respect to groundwater and Buckroney-Brittas Dunes and Fen SAC / pNHA:

Groundwater Quality and Groundwater Levels / Flows and Potential Effects on Nearby Groundwater Wells

7.301 Potential impacts on local groundwater wells can occur if the imported soil/stone material does not conform to its inert status. Mitigation measures have been outlined above (Testing and Inspection of Imported Material) which will prevent this.

7.302 Local domestic wells have been identified, which are listed above within the Receiving Environment section (Groundwater abstractions and wells). Due to the broadly unproductive hard Diorite bedrock aquifer, impacts on groundwater levels distal to the site will not occur. This is borne out from on-site information in the observation wells (GW1-GW3) and from monitoring in local domestic wells.

7.303 Groundwater will flow within the upper clay / overburden layer as detailed in Para 7.160. Local domestic wells are either upgradient of the site or, where downgradient such as at CBDW1 and KHDW1, there is a surface watercourse (the Ballinameesda Lower [Kilmacurra] stream), which creates a hydraulic boundary between these local domestic wells and the site.

7.304 Local domestic wells also show no significant effect on groundwater levels due to the ongoing pumping / dewatering from the application site at an average pumping rate of 72 m3/hr. There is no response recorded in local wells from that pumping despite a water level change of ~13m at the quarry in recent times.

7.305 In light of the measured groundwater levels and historical observations, it is concluded that no effects on local domestic / agricultural wells will occur as a result of the planed operations and activities at the quarry.

7.306 A clay liner will be installed underlying the waste material being infilled in the quarry. This clay liner will have sufficient low permeability (at least 1x10-7m/s) so as to hydraulically isolate it from the underlying bedrock aquifer.

7.307 Groundwater quality testing will be completed (on a quarterly basis) in wells GW1-GW3 to ensure there is no change in groundwater quality and no effects from the importation and placement of the inert soil and stone material at the lined landfill facility.

7.308 The mitigation measures outlined in relation to waste material will further ensure no impacts occur to local groundwater quality.

7.309 Proven and effective control measures to mitigate any risks to groundwater quality or groundwater levels at the Application site are outlined above. Application of these controls will break the pathway (if any) between the potential source and the receptor.

7.310 Minor hydrocarbon detections were recorded at GW2 and in view of this, in-situ remedial works are proposed at GW2 to remove the minor hydrocarbon issue noted in that monitoring well during groundwater sampling (refer to section on Monitoring below).

7.311 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 (quality and quantity) and/or surface water (quality and quantity).

Potential Effects on Buckroney-Brittas Dunes and Fen SAC / pNHA

7.312 Buckroney-Brittas Dunes and Fen SAC / pNHA is located downstream of the Site and the discharge from the Site to the Potters River. It is also located partially in the same GWB as the Site and partially in the GWDTE-Buckroney-Brittas Dunes GWB.

7.313 Buckroney-Brittas Dunes and Fen SAC / pNHA is located a considerable distance downstream of the proposed site, therefore the potential for site operations to effect groundwater or surface water quality over those distances is negligible. In addition, there are several other factors, such as topography and changes in geology that diminish further any potential effects on groundwater quality or groundwater flows.

7.314 Mitigation for the protection of surface water quality during all phases of the proposed development are outlined above to deal with sediment, hydrocarbons, and dissolved metals.

7.315 There will be no significant change in flow discharging to the Potters River, and therefore flow (or volume) of water will not effect the functioning of the hydrology of the protected habitat.

7.316 The operation of the proposed site will not effect groundwater quality for the reasons outlined above, therefore it will not effect the GWB or the GWDTE waterbody within which Buckroney-Brittas Dunes and Fen SAC/pNHA occurs.

7.317 As a result, there will be no significant potential to effect water quantity or water quality that flows down the Potters River towards Buckroney-Brittas Dunes and Fen SAC / pNHA.

CUMULATIVE IMPACT ASSESSMENT

7.318 Cumulative impacts are those which result from incremental changes caused by other past, present or reasonably foreseeable actions, together with those generated by the proposed development. Therefore, the potential impacts of the proposed development cannot be considered in isolation but must be considered in addition to impacts already arising from existing or planned development.

7.319 Given the nature of the groundwater regime at the Ballinclare site (refer to Para 7.164 for the CSM), and also considering the inert fill and the engineered liner, there is no potential for significant impacts on the groundwater environment from the Application site. Also, there are detailed proposals and mitigation for protection of the surface water environment included in the proposal at Ballinclare Quarry. As a result, the potential for cumulative effects on the Potters River or the downstream water environment are negligible.

7.320 Notwithstanding the above, a review of Wicklow County Council’s online planning portal and An Bord Pleanála case files identifies six prospective development projects within a 5km radius of the application site which have either applied for or have been granted planning permission. Of these one (a sand and gravel pit) is for substitute consent and another (for land raising) is for an extension of time which means that development impacts associated with them are already extant and reflected in baseline environmental surveys.

7.321 Of the remaining projects, one (WCC Planning Ref. 23/60497) is located 2 km south-east of the application site and relates to a land raising project, which envisages importation of a maximum of 24,000 tonnes of soil per annum for a maximum of two years. In light of the limited time duration, the separation distance and the fact that it is will not use the same local roads as the proposed development at Ballinclare Quarry, it is considered that there is no potential for cumulative effects with this project.

7.322 The remaining three projects are all considered either too small in scale or too distant from the application site to generate any potential adverse cumulative effects on the water environment.

7.323 Planning permission for the existing landfill facility at Ballynagran was extended by five years from 2021 to 2026 (by Planning Ref. 20/21). As all environmental impacts associated with the Ballynagran facility are well established, they are deemed to be included or reflected in the findings / measurements obtained by baseline surveys undertaken for the purposes of this environmental impact assessment. These impacts will remain in existence and no further change is likely to arise in the local environment. As such, no cumulative impacts with that development on the water environment need to be assessed or considered.

Monitoring

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

7.325 Protection and monitoring of groundwater quality was a recurring issue raised by 3rd parties during public consultation at pre-planning stage. 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):

- A replacement monitoring well for GW2 will be installed. It will be called GW2A.
- As outlined above monitoring well GW2 will undergo remedial works to remove residual hydrocarbons from that well, and following that remediation, monitoring well GW2 will be decommissioned.
- Groundwater dataloggers will be installed (or will be left in-situ) in monitoring wells GW1, GW2A and GW3, and these will record continuous water level data. Data from these wells will be downloaded and processed / reviewed on a quarterly basis;
- Groundwater quality testing will be undertaken on samples taken from the 3 No. groundwater monitoring wells on a quarterly basis. Laboratory analysis will include the following analytes:
    - pH
    - BOD / COD
    - Ammonia (as N)
    - Nitrate / Nitrite
    - Total Nitrogen
    - Total Dissolved Solids
    - Chloride
    - Asbestos
    - Electrical Conductivity
    - Potassium
    - Sodium
    - Sulphate
    - Total Phosphorous
    - Orthophosphate (as P)
    - Dissolved metals – As, B, Cd, Cu, Pb, Mg, Mn, Ni, Zn & Hg
    - Oils, Fats & Grease
    - Total Petroleum Hydrocarbons
    - Diesel Range Organics / Petrol Range Organics
    - Total Coliforms
    - Faecal Coliforms

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

7.327 In addition, baseline groundwater quality monitoring is proposed at local wells CBDW1, GLDW1, DW2, LDDW1, DW3, ODW1, and ODW2. The selected wells will have groundwater quality sampling undertaken twice prior to works commencing and biannually (every two years) thereafter during the construction and operational phases. If on site monitoring indicates any change in groundwater quality during the operational phase, then the frequency of off-site groundwater quality monitoring can be reviewed and increased.

7.328 The groundwater monitoring regime will remain in place for the life of the proposed landfilling and recovery operations and for a period of 5 years thereafter during the aftercare period (with proposed monitoring in year 1, year 3, and year 5 in the post closure period).

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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)**.

Geological Survey of Ireland (March 2003), Wicklow County Council Groundwater Protection Scheme Main Report

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

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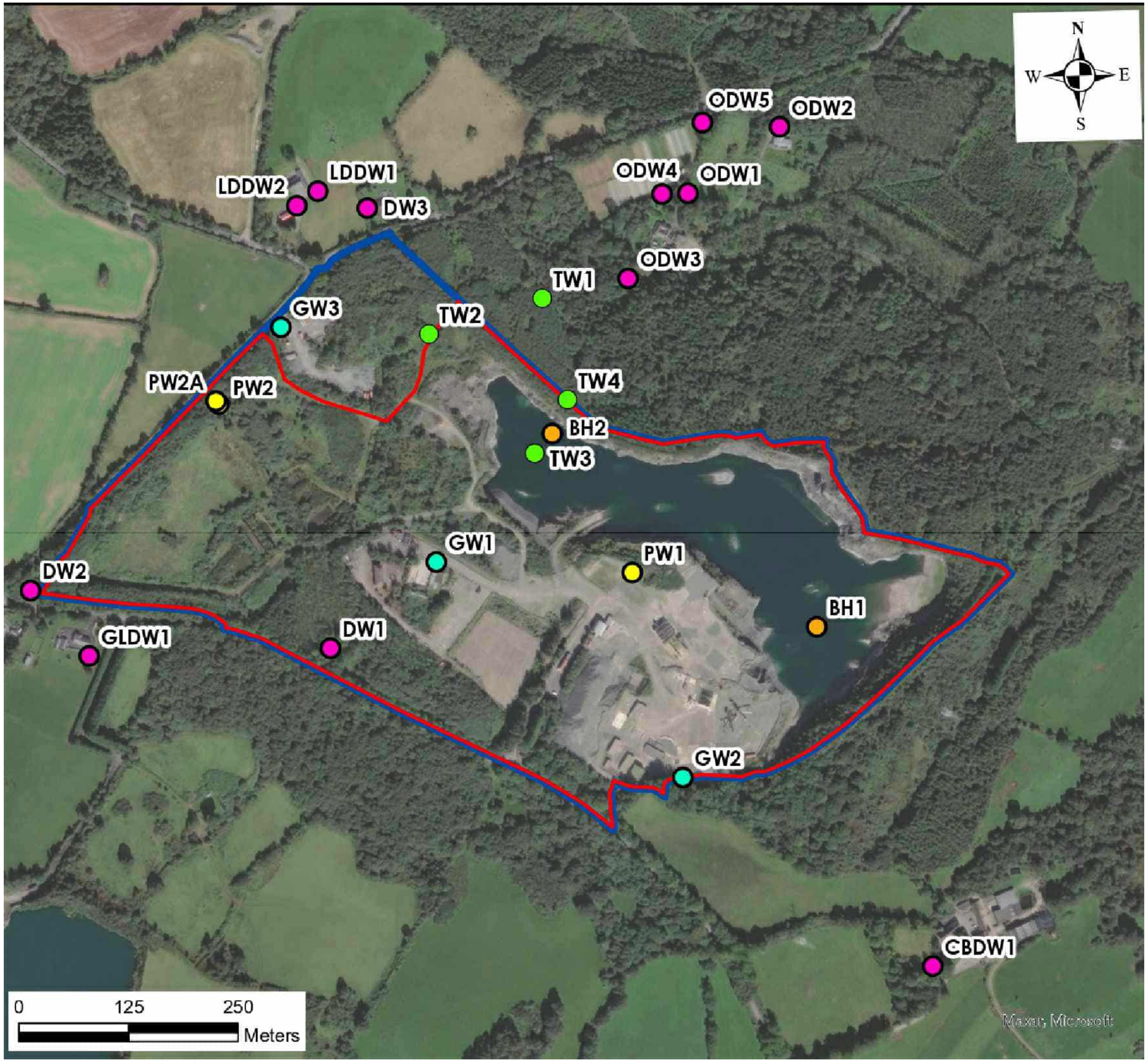
01/11/2024



Notes:

1. DRAWING PROVIDED BY HYDRO ENVIRONMENTAL SERVICES.

Legend:

▭	Site Boundary
▭	Landholding
●	Boreholes [Coreholes]
●	Domestic Wells
●	Monitorig Wells
●	Water Supply Wells
●	TW Wells

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Project
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Drawing Title
BOREHOLE LOCATION MAP

Scale	SLR Project No.
1:5,000 @ A3	065366.00001

Designed	Drawn	Checked	Authorised
GA	GA	MG	MG
Date 10/24	Date 10/24	Date 10/24	Date 10/24

Drawing Number
FIGURE 7-1

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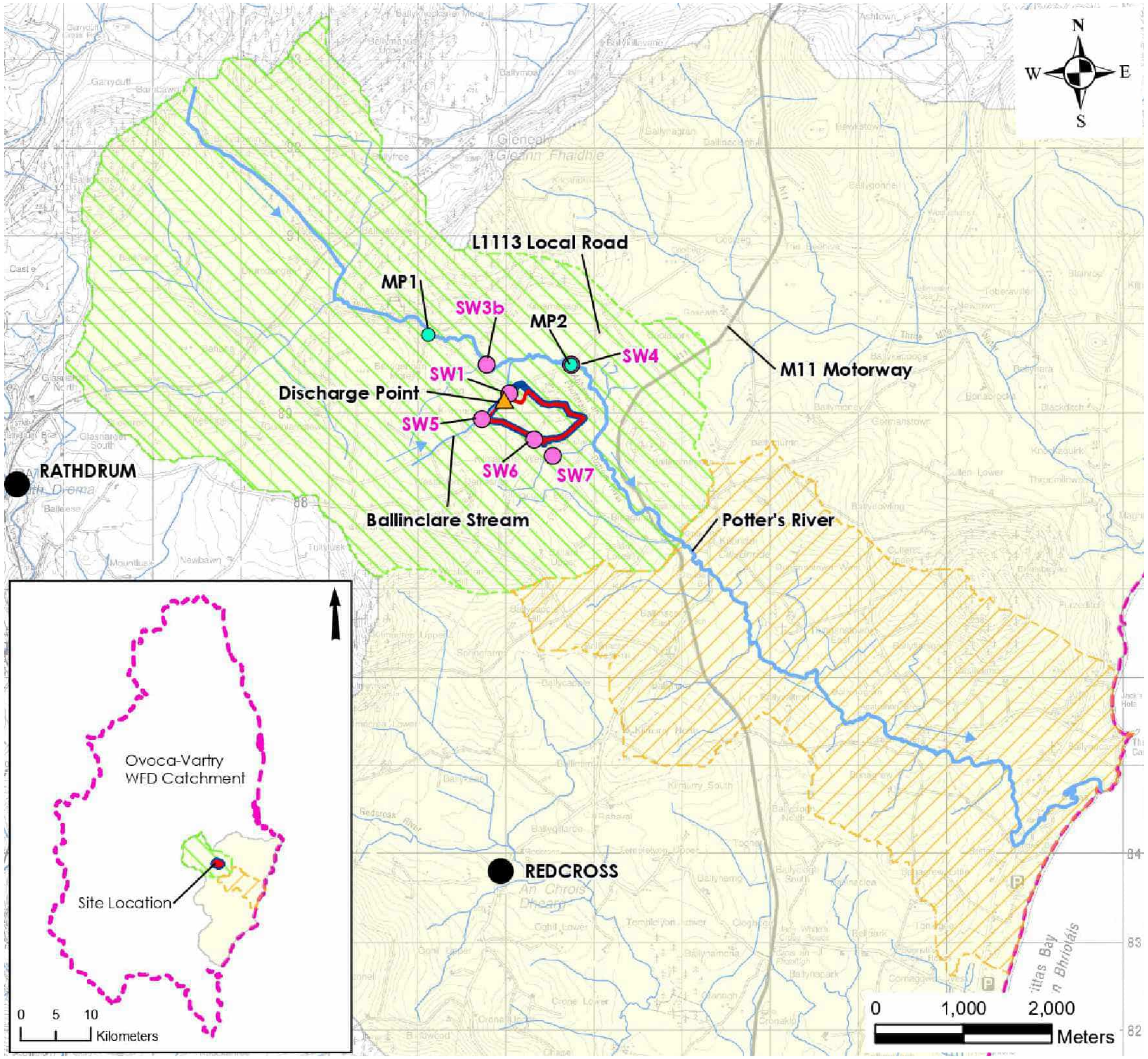
1

CYAL50316488



Notes:

1. DRAWING PROVIDED BY HYDRO ENVIRONMENTAL SERVICES.

Legend:

- 🟥 Site Boundary
- 🟦 Landholding
- — Watercourses
- WFD River Sub-Basins
  - ▨ POTTER'S_010
  - ▨ POTTER'S_020
- WFD Subcatchments
  - 🟨 Redcross_SC_010
- WFD Catchments
  - ▭ Ovoca-Vartry
- ● Surface Water Sample Location
- ▲ Discharge Point
- ● Q_sampling locations

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Drawing Title
SITE LOCATION AND SURFACE WATER
FEATURE MAP

Scale		SLR Project No.	
1:50,000 @ A3		065366.00001	
Designed	**Drawn**	**Checked**	**Authorised**
GA	GA	MG	MG
Date	Date	Date	Date
10/24	10/24	10/24	10/24

Drawing Number
FIGURE 7-2

Rev.
1

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01/11/2024

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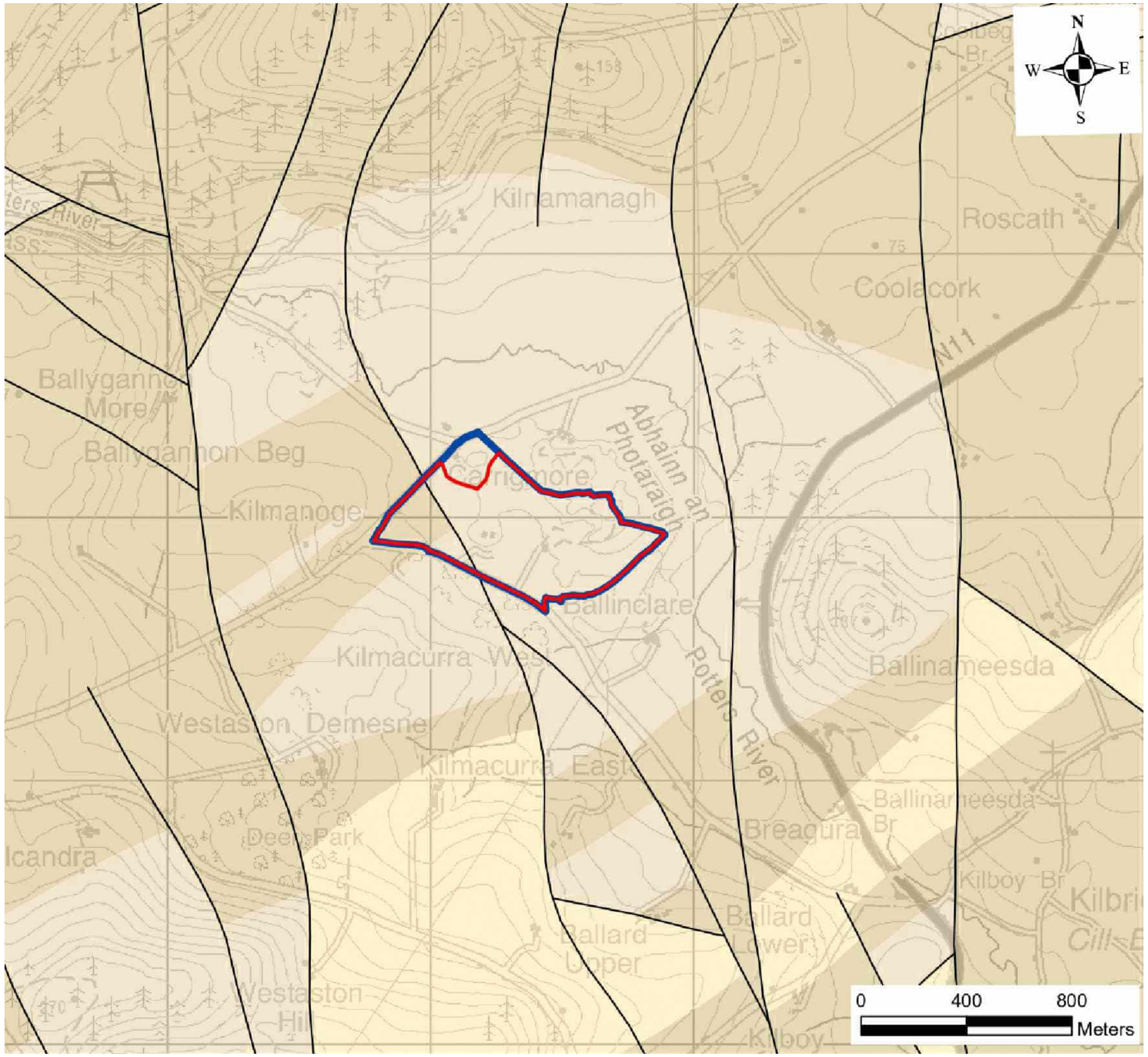

Notes:

1. DRAWING PROVIDED BY HYDRO ENVIRONMENTAL SERVICES.

Legend:

🟥 Site Boundary
🟦 Landholding
▨ LI - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
▨ PI - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
▨ Pu - Poor Aquifer - Bedrock which is Generally Unproductive
— Mapped Faults

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Drawing Title
BEDROCK AQUIFER MAP

Scale	SLR Project No.		
1:20,000 @ A3	065366.00001		
Designed GA	Drawn GA	Checked MG	Authorised MG
Date 10/24	Date 10/24	Date 10/24	Date 10/24

Drawing Number
FIGURE 7-3

Rev.
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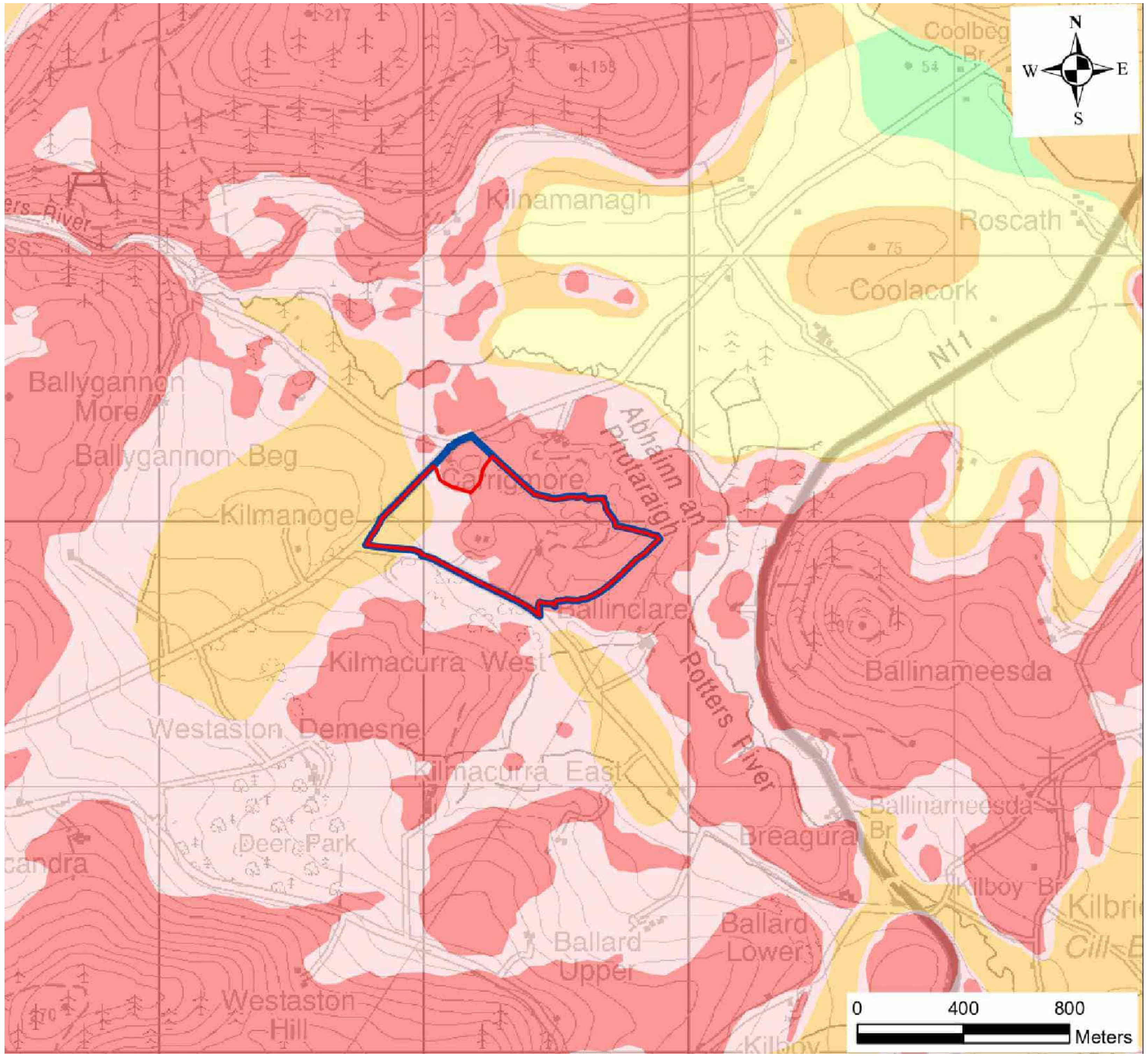
Notes:

1. DRAWING PROVIDED BY HYDRO ENVIRONMENTAL SERVICES.



Legend:

▭	Site Boundary
▭	Landholding

Groundwater Vulnerability

🟥	Rock at or near Surface or Karst
▨	Extreme
🟧	High
🟨	Moderate
🟩	Low

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Drawing Title
GROUNDWATER VULNERABILITY MAP

Scale		SLR Project No.	
1:20,000 @ A3		065366.00001	
Designed	Drawn	Checked	Authorised
GA	GA	MG	MG
Date	Date	Date	Date
10/24	10/24	10/24	10/24

Drawing Number
FIGURE 7-4

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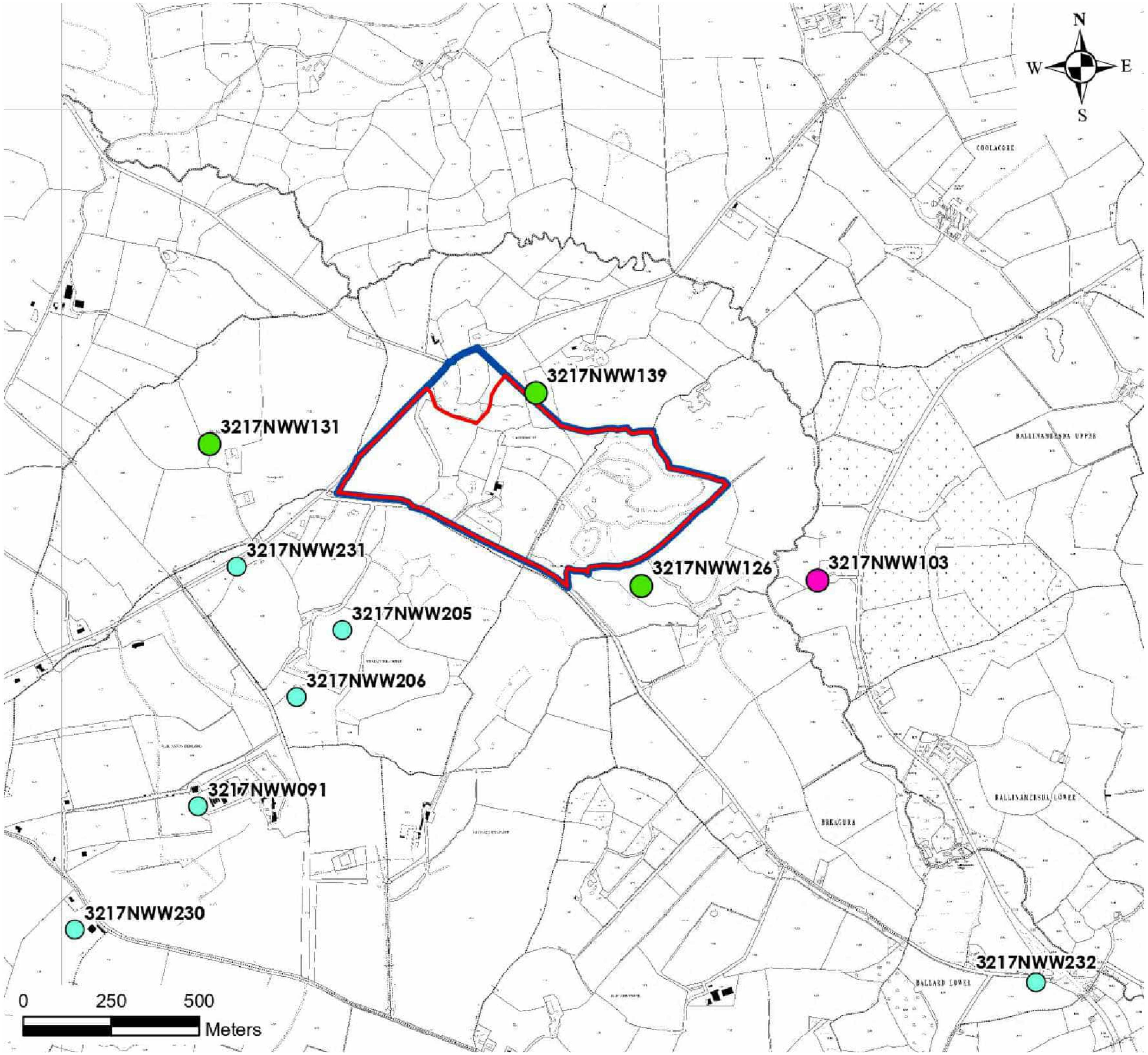

Notes:

1. DRAWING PROVIDED BY HYDRO ENVIRONMENTAL SERVICES.

Legend:

🟥 Site Boundary
🟦 Landholding
GSI Groundwater Wells
Accuracy
● to within 50m
● to within 100m
● to within 1km

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Drawing Title
GSI GROUNDWATER WELLS MAP

Scale	SLR Project No.
1:12,500 @ A3	065366.00001

Designed	Drawn	Checked	Authorised
GA	GA	MG	MG
Date 10/24	Date 10/24	Date 10/24	Date 10/24

Drawing Number	Rev.
FIGURE 7-5	1

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APPENDIX 7-A
Guidelines and Legislation

HYDROLOGY AND HYDROGEOLOGY 7

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. 349/1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84/1995, S.I. No. 352/1998, S.I. No. 93/1999, S.I. No. 450/2000 and S.I. No. 538/2001), S.I. No. 30/2000, the Planning and Development Act, and S.I. 600/2001 Planning and Development Regulations and subsequent Amendments. These instruments implement EU Directive 85/373/EEC and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment;
- The Planning and Development Act, 2000 (as amended);
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- S.I. No 296/2018: S.I. No. 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law;
- The Heritage Act 1995, as amended.

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. 9/2010 European Communities Environmental Objectives (Groundwater) Regulations 2010 and amendments (S.I. No. 389/2011 and S.I. No. 149/2012).
- S.I. No. 272/2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009 and amendment (S.I. No. 327/2012);
- S.I. No. 684/2007 Waste Water Discharge (Authorisation) Regulations, 2007, as amended (S.I. 231/2010);
- S.I. No. 278/2007 European Communities (Drinking Water) (No. 2) Regulations;
- Water Services Acts 2007 and 2012;
- S.I. No. 722/2003 European Communities (Water Policy) Regulations;
- S.I. No. 122/2010 European Communities (Assessment and Management of Flood Risks) Regulations 2010;
- S.I. No. 457/2008 European Communities (Environmental Liability) Regulations which bring into force the European Liability Directive (2004/35/EC);
- S.I. No. 296/2009: The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (as amended by S.I. No. 355/2018);

- European Union (Planning and Development) (Environmental Impact Assessment) (No. 2) Regulations 2018 (S.I. No. 404/2018);
- Local Government (Water Pollution) Acts 1977 to 1990;
- European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293/1988);
- European Communities (Quality of Shellfish Waters) Regulations, 2006 (S.I. No. 268/2006);
- European Union (Drinking Water) Regulations 2014 (S.I. No. 122/2014);
- Bathing Water Quality Regulations, 2008 (S.I. No. 79/2008);
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations, 2010(as amended by S.I. No. 389/2011; S.I. No. 149/2012; S.I. No. 366/2016; the Radiological Protection (Miscellaneous Provisions) Act 2014; and S.I. No. 366/2016); and,
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 (S.I. No. 610/2010).

Guidelines

- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.
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HYDROLOGY AND HYDROGEOLOGY 7

APPENDIX 7-B
Discharge Licence WPL-116

HYDROLOGY AND HYDROGEOLOGY 7

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 OBr

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

HYDROLOGY AND HYDROGEOLOGY 7

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[3].

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

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[3] 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.

directly with the water quality standard (EQS) to determine whether the discharge will cause an exceedance of the EQS value in the receiving waters.

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 C-1 below.

Table C-1: 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 **Table C-1**.

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 Paras 7.100 and 7.101 above, and Appendix 7-D below.

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 C-2** below

Table C-2: 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.

Other Discharge Scenarios

The Assimilation Capacity (AC) and Mass Balance (MB) assessment completed above, relates to dewatering of the quarry which is ongoing. This is considered the worst-case scenario.

As the quarry is infilled there will be less exposed bedrock, and progressively more vegetated ground across the site.

For landfilling Phase 1, Phase 2 and Phase 3, excess water which is not recycled at the soil wash plant will be treated in the water treatment plant and/or polished in the proposed integrated constructed wetland and the treatment is expected to improve on the discharge water quality assessed above. As a result, there will be a reduced risk to surface water than that already assessed.

In the post closure scenario, again the risk is further reduced as surface water run-off will not be in contact with imported waste. While the water treatment plant will be decommissioned and removed from the site, at that point in the future, run-off will only be over the restored landform site and will continue to feed passively through the ICW and be polished prior to discharge.

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.

The (AC) and (MB) assessment completed above are worst case, and other discharge scenarios throughout the course of the proposed development will have more treatment, and less risk to downstream surface water receptors.

APPENDIX 7-D
EPA Hydro Tool Ungauged Catchment Report

River Name	Potter's(10_1122)
XY Location	326015,188593 (ING)

River Segment Map

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

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 km^2);
- 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/

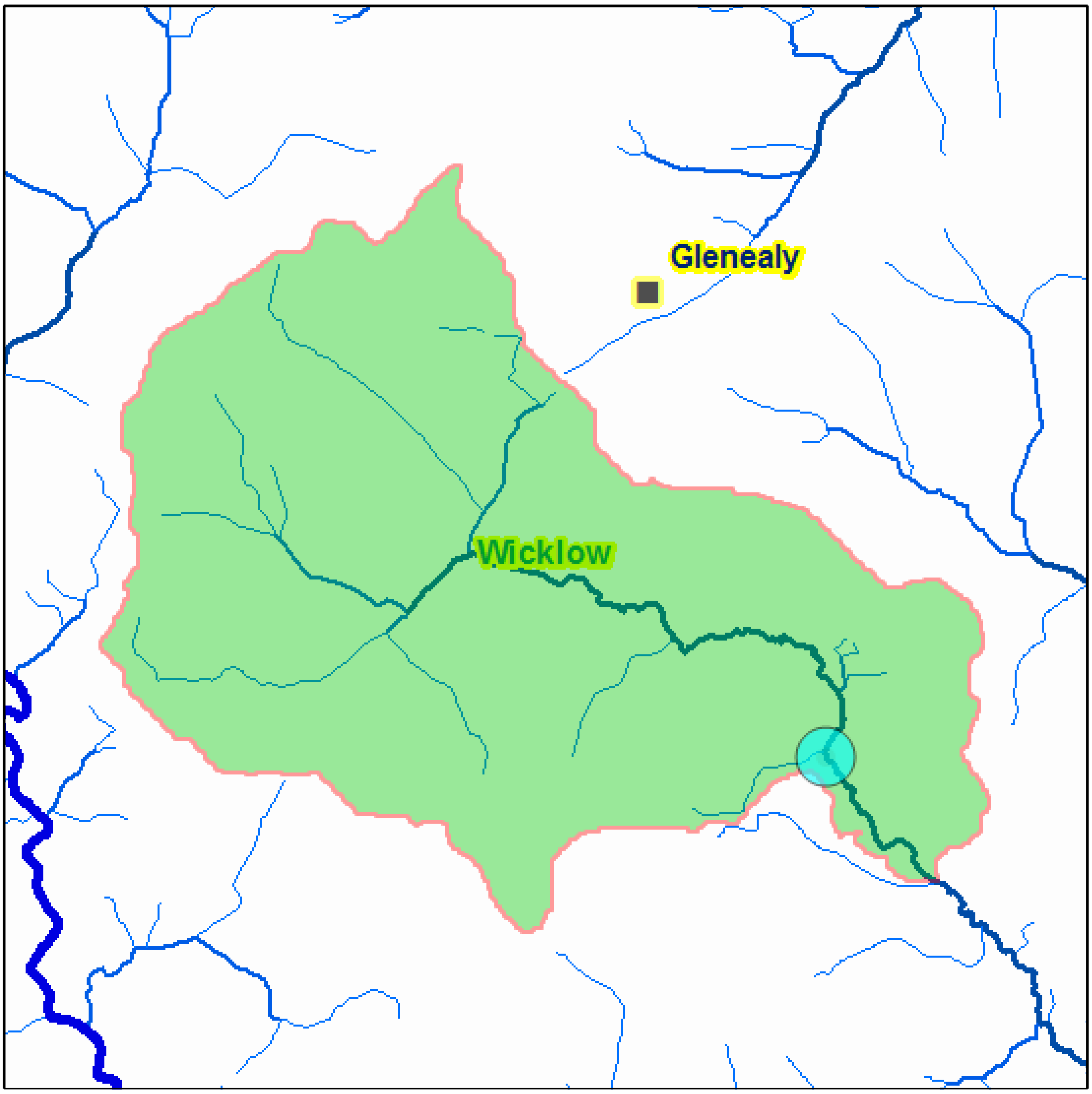
The data produced by the model for specific stations should be compared to the data contained in this file of DWF and long term 95percentile flows.

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.

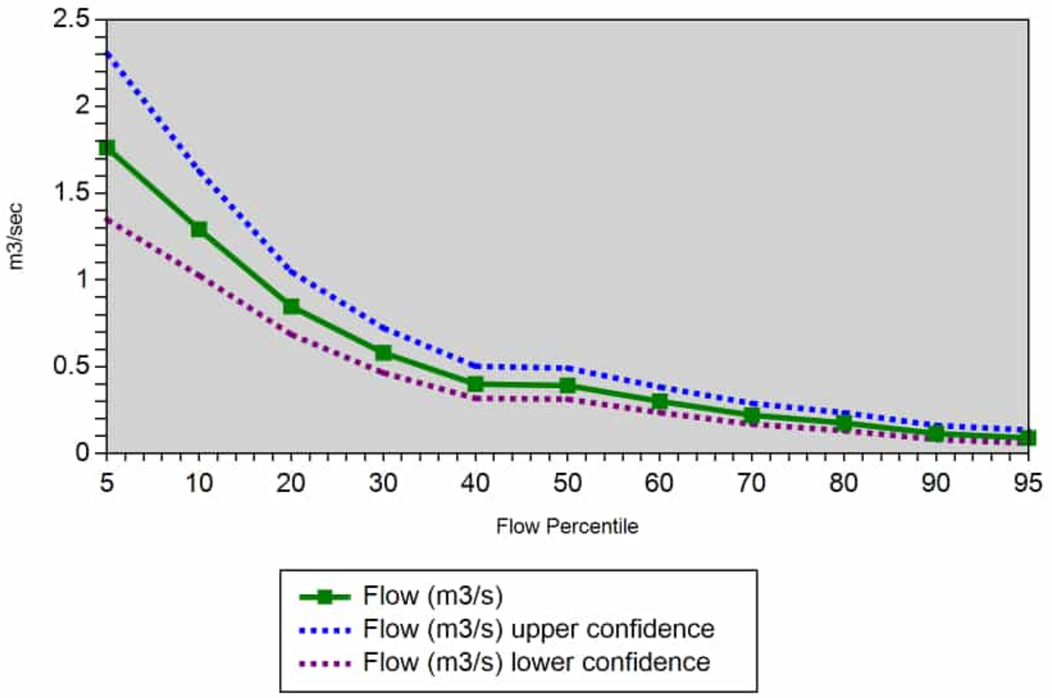
Estimation of Flow Duration Curve for Ungauged Catchment

River Name	Potter's(10_1122)
XY Location	326015,188593 (ING)

Nested Catchment Map



Flow Duration Curve (Flow in m3/sec)



%ile	flow(m3/sec)	upper 95% confidence limit m3/sec	lower 95% confidence limit m3/sec
5	1.763	2.306	1.348
10	1.292	1.628	1.026
20	0.848	1.048	0.686
30	0.58	0.723	0.465
40	0.4	0.503	0.318
50	0.392	0.492	0.313
60	0.301	0.383	0.236
70	0.221	0.289	0.169
80	0.176	0.235	0.132
90	0.115	0.162	0.081
95	0.09	0.135	0.06

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.

Catchment Descriptors		
General		
Descriptor	**Unit**	**Value**
Area	sq km	24.9
Average Annual Rainfall (61-90)	mm/yr	1049
Stream Length	km	25.9
Drainage Density	Channel length (km)/catchment area (sqkm)	1
Slope	Percent Slope	10.3
FARL	Index (range 0:1)	1

Soil	
Code	**% of Catchment**
Poorly Drained	12.6
Well Drained	83.9
Alluvmin	3.1
Peat	0
Water	0
Made	0.4

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.

Subsoil Permeability

Code	Explanation	% of Catchment
H	High	0.3
M	Moderate	11
L	Low	13.9
ML	Moderate/Low	0
NA	No Subsoil/Bare Rock	74.8

Aquifer

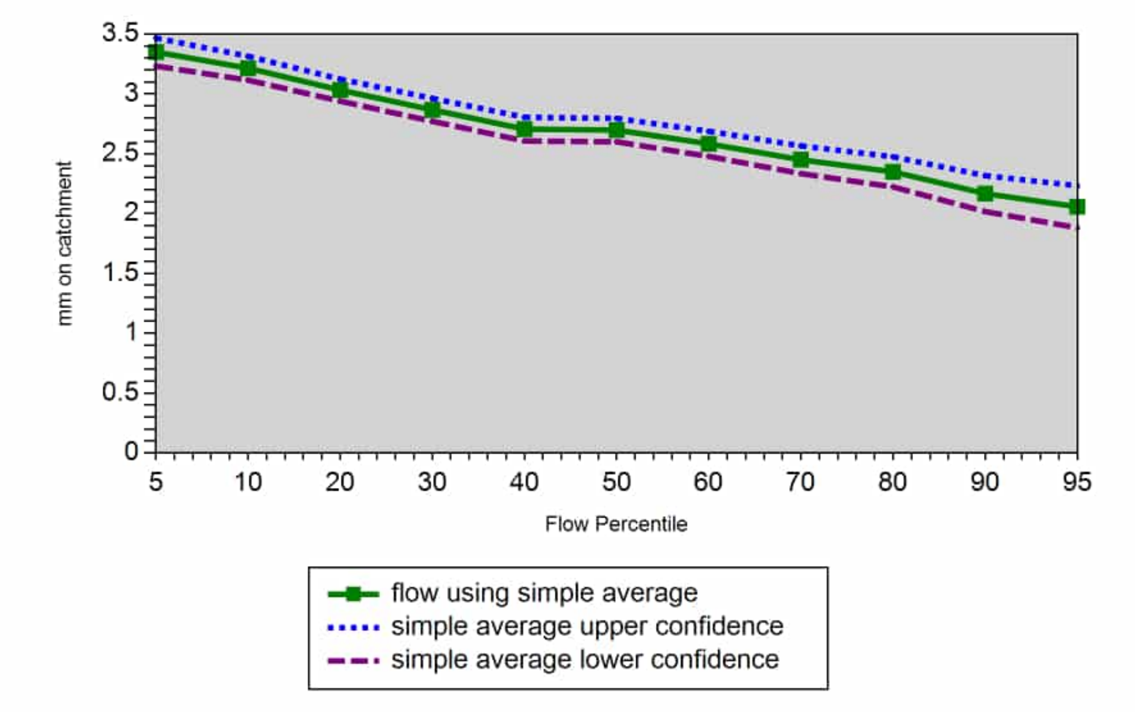
Code	Explanation	% of Catchment
LG_RG	LG:Locally important sand-gravel aquifer RG: Regionally important sand-gravel aquifer	0
LL	Locally important aquifer which is moderately productive only in local zones	63.1
LM_RF	LM: Locally important aquifer which is generally moderately productive RF: Regionally 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	36.9
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	16003
60	18005	19001	16003
70	18005	19001	16003
80	25038	18005	19001
90	25038	18005	19001
95	25038	18005	19001

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.

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	2.698	2.796	2.6
60	2.583	2.688	2.478
70	2.45	2.566	2.334
80	2.349	2.475	2.223
90	2.167	2.317	2.017
95	2.057	2.233	1.881

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.

HYDROLOGY AND HYDROGEOLOGY 7

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

SLR Consulting Ireland

Unit 7, Dundrum Business Park, Windy Arbour, Dublin 14, Ireland.
Tel. + 353 1 2964667 Fax. + 353 1 2964676
www.slrconsulting.com

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
					WEATHERED ROCK (WEATHERED ROCKHEAD) Weathered Rock
	1.80	59.15			DIORITE Diorite

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

Continued next sheet

Remarks:

SLR Consulting Ireland
Unit 7, Dundrum Business Park, Windy Arbour, Dublin 14, Ireland.
Tel. + 353 1 2964667 Fax. + 353 1 2964676
www.slrconsulting.com

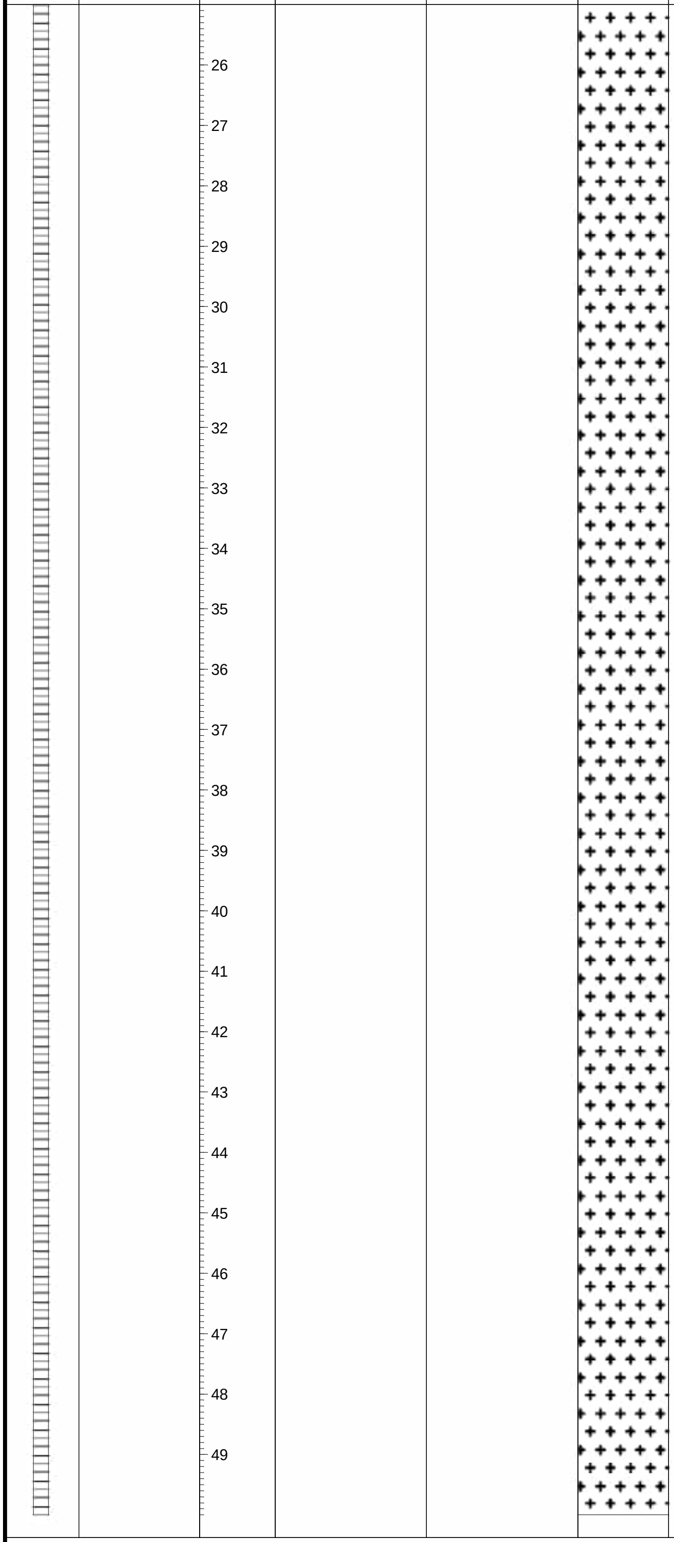
Well No.
GW1
Sheet 2 of 3

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
						DIORITE



Continued next sheet

Remarks:

SLR Consulting Ireland

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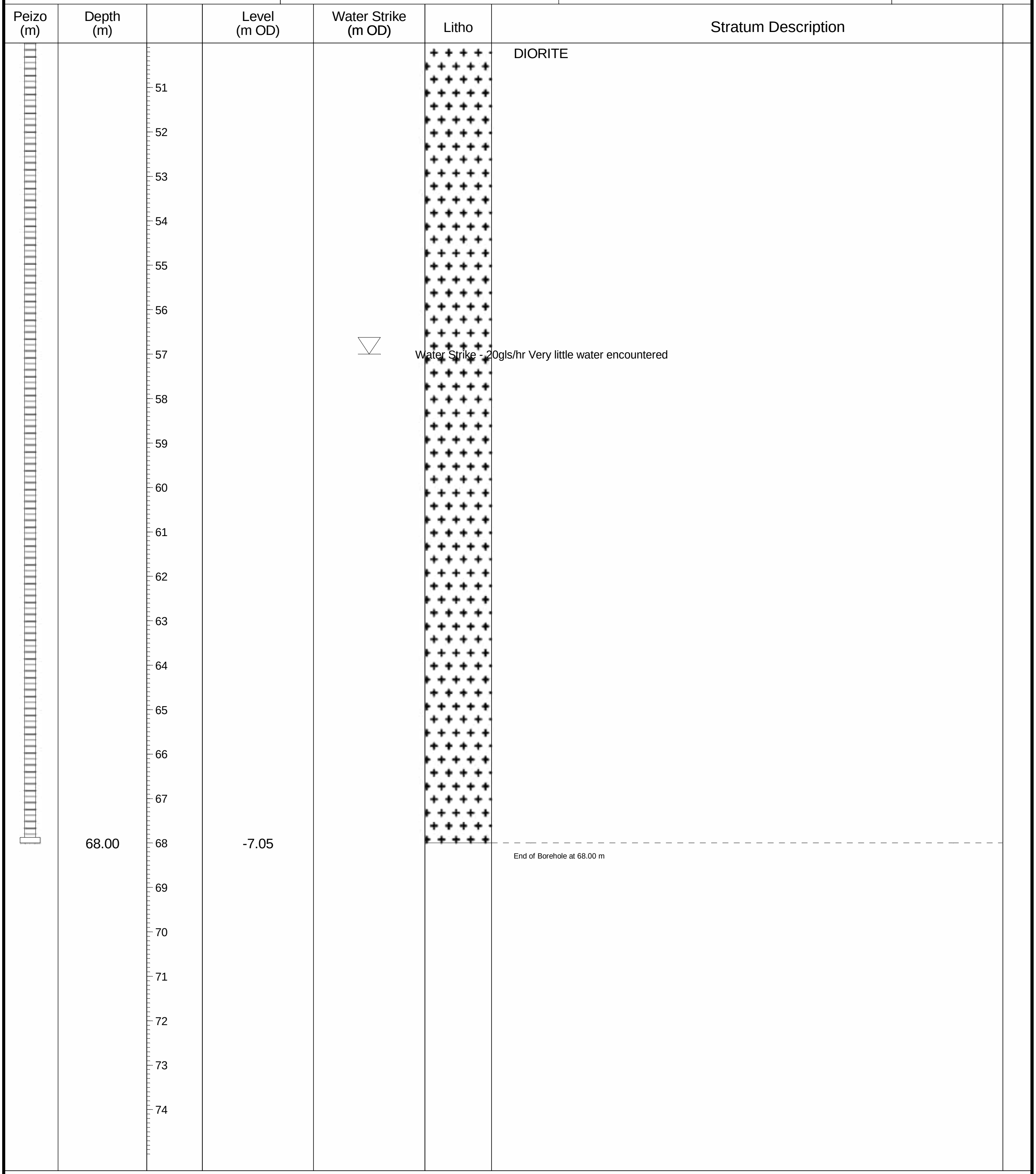
Well No.
GW1
Sheet 3 of 3

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



Remarks:

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Unit 7, Dundrum Business Park, Windy Arbour, Dublin 14, Ireland.
Tel. + 353 1 2964667 Fax. + 353 1 2964676
www.slrconsulting.com

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
		1 2 3 4 5			▨	(MADE GROUND) MADE GROUND - Reworked ground with a slight hydrocarbon odour
	6.00	6	45.89	▽		Water Strike - 2000gls/hr CAVITY Cavity
	7.00	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	44.89		+ + + +	DIORITE Strong to very strong, dark grey to green, crystalline, medium to coarse grained DIORITE

Continued next sheet

Remarks:

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www.slrconsulting.com

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
						DIORITE
		26				
		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

Remarks:

SLR Consulting Ireland

Unit 7, Dundrum Business Park, Windy Arbour, Dublin 14, Ireland.
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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
		51				
		52				
		53				
		54				
		55				
		56				
		57				
		58				
		59				
		60				
	61.00	61	-9.11			End of Borehole at 61.00 m
		62				
		63				
		64				
		65				
		66				
		67				
		68				
		69				
		70				
		71				
		72				
		73				
		74				

Remarks:

SLR Consulting Ireland
Unit 7, Dundrum Business Park, Windy Arbour, Dublin 14, Ireland.
Tel. + 353 1 2964667 Fax. + 353 1 2964676
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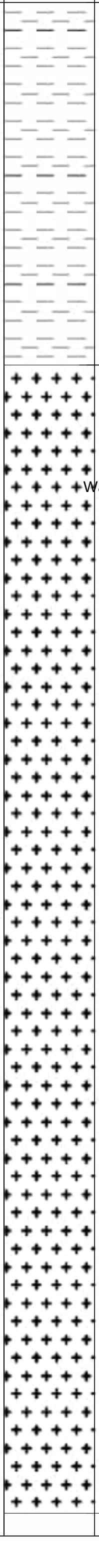
Well No.
GW3
Sheet 1 of 3

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
		1 2 3 4 5				OVERBURDEN (BOULDER CLAY) Overburden comprising clay and weathered rock
	6.00	6	49.44			DIORITE Strong to very strong, dark grey to green, crystalline, medium to coarse grained DIORITE
		7 8		▽		Water Strike - 100gls/hr
		9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24				



Continued next sheet

Remarks:

SLR Consulting Ireland

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Tel. + 353 1 2964667 Fax. + 353 1 2964676
www.slrconsulting.com

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 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49			+ + + +	DIORITE

Continued next sheet

Remarks:

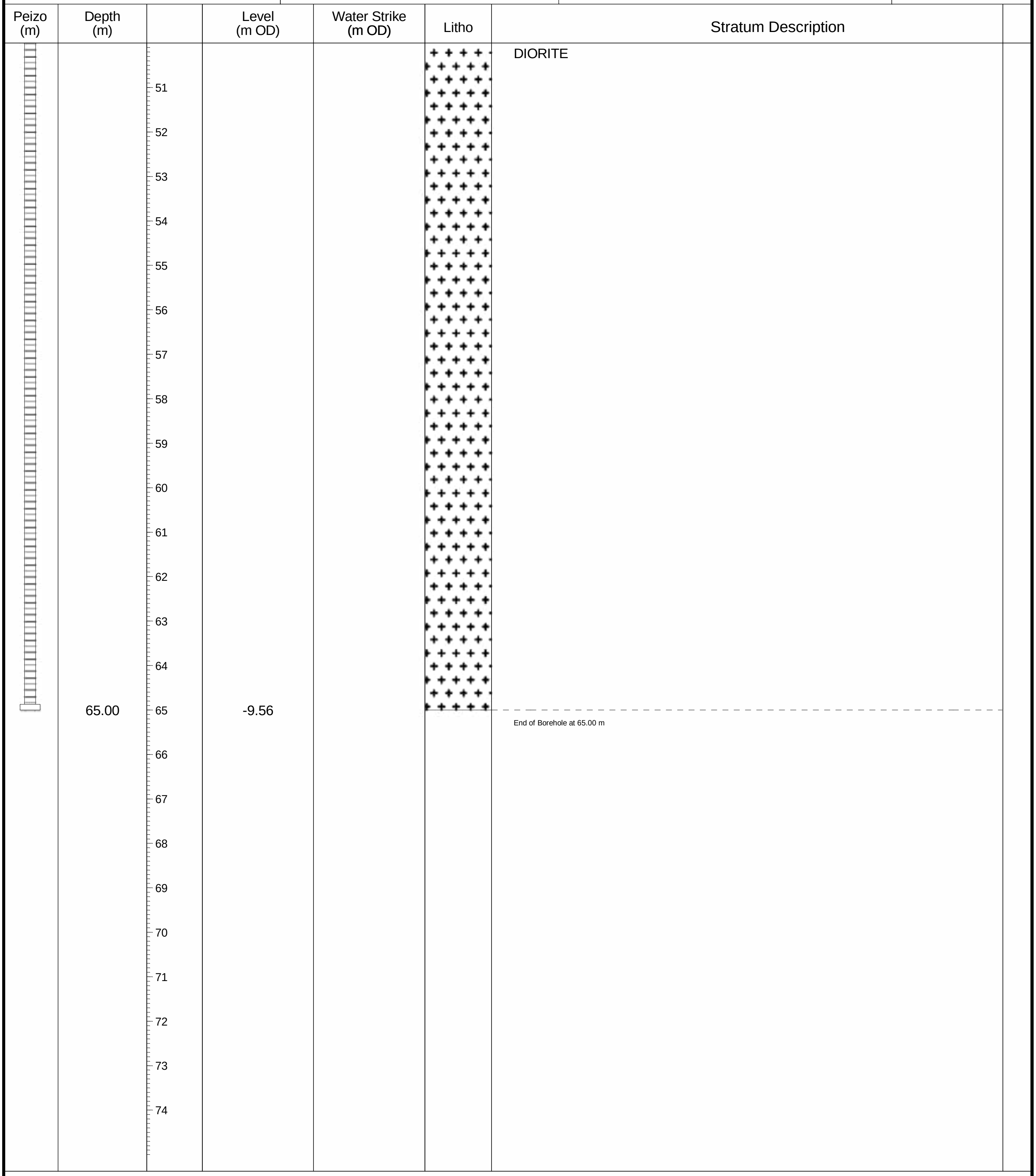
SLR Consulting Ireland
Unit 7, Dundrum Business Park, Windy Arbour, Dublin 14, Ireland.
Tel. + 353 1 2964667 Fax. + 353 1 2964676
www.slrconsulting.com

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	65	-9.56			End of Borehole at 65.00 m

Remarks:

HYDROLOGY AND HYDROGEOLOGY 7

APPENDIX 7-F
Water Quality Analysis Laboratory Reports

Eurofins Environment Testing Ireland
Hoffman Park, Inchera
Cork
T45 PC80
Ireland
T: 0818 252526
Web: www.eurofins.ie
Email: ASTsupport@etuki.eurofins.com

ISO 17025
INAB ACCREDITED
TESTING
DETAILED IN SCOPE REG NO.138T

Client:	**Hydro-Environmental Services** **22** **Lower Main Street** **Dungarvan** **Co. Waterford.** **Waterford** **IRELAND**	*Certificate Code:* *Page Number:* *PO reference:*	**AR-24-M3-013196-01** **Page 1 of 10**

Certificate of Analysis

Sample number	966-2024-00014851	Received on	30/05/2024
		Analysis started on	30/05/2024
Your sample reference	Ballinclare SW1		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Suspended Solids [M3002]								
Suspended Solids		31/05/24 10:09	EW013	5		<5	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		31/05/24 10:01	EW046	15		185	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		30/05/24 17:05	EW175	0.01		<0.01	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		30/05/24 17:05	EW175	0.01		0.0280	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		30/05/24 17:06	Ew001R	1		1.10	mg/l	C6
pH (Robotic Method) [M3051]								
pH		30/05/24 15:42 [7D]	EW152R	4		6.7		
Arsenic - Dissolved [M3159]								
Arsenic		10/06/24 15:28	EW188			2.97	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		10/06/24 15:28	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		10/06/24 15:28	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		10/06/24 15:28	EW188	5		97.6	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		10/06/24 15:28	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								

Signed: ______________________________ 10/06/2024

Aoife De Barra - Organics & Instrumentation Team Lead

NOTES

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6. The sampling date was not communicated; this may impact the validity of the results unless provided.

7A. This test was conducted outside of recommended best practice holding time; this may impact the accreditation status/validity of the result. The result will still be technically sound in terms of the method and associated quality controls
7B. No time of sampling was supplied, a default time of 00:00:00 will be assumed for holding time calculations unless provided. This may impact the validity of the results.
7D. The sample was received close to or outside of the recommended best practice holding time; this may impact the accreditation status of the result.

8. This notification is based on the numerical result for the test without consideration of the uncertainty of measurement of the result, unless otherwise agreed in writing. Uncertainty of measurement has been calculated for all INAB accredited tests and is available upon request.
9. Report is issued as per our standard T&C of sale.

Client: **Hydro-Environmental Services**
22
Lower Main Street
Dungarvan
Co. Waterford.
Waterford
IRELAND

Certificate Code: **AR-24-M3-013196-01**
Page Number: **Page 2 of 10**
PO reference:

Sample number	966-2024-00014851	Received on	30/05/2024
		Analysis started on	30/05/2024
Your sample reference	Ballinclare SW1		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Magnesium (Mg)		10/06/24 15:28	EW188	1.11		8.55	mg/l	C6
Manganese - Dissolved [M3175]								
Manganese (Mn)		10/06/24 15:28	EW188			17.2	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		10/06/24 15:28	EW188			2.24	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		10/06/24 15:28	EW188	1		1.41	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C21-C40	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C6-C10	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	30/05/24 14:17		10		<10	µg/l	YA

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T
YA: Accredited (External Subcontractor)

Signed: AdeBarra 10/06/2024

Aoife De Barra - Organics & Instrumentation Team Lead

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7D. The sample was received close to or outside of the recommended best practice holding time; this may impact the accreditation status of the result.
8. This notification is based on the numerical result for the test without consideration of the uncertainty of measurement of the result, unless otherwise agreed in writing. Uncertainty of measurement has been calculated for all INAB accredited tests and is available upon request.
9. Report is issued as per our standard T&C of sale.

Client: **Hydro-Environmental Services**
22
Lower Main Street
Dungarvan
Co. Waterford.
Waterford
IRELAND

Sample number	966-2024-00014852	Received on	30/05/2024
		Analysis started on	30/05/2024
Your sample reference	Ballinclare SW4		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Suspended Solids [M3002]								
Suspended Solids		31/05/24 10:09	EW013	5		5.00	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		31/05/24 10:01	EW046	15		121	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		30/05/24 17:05	EW175	0.01		<0.01	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		30/05/24 17:05	EW175	0.01		0.0180	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		30/05/24 17:06	Ew001R	1		<1	mg/l	
pH (Robotic Method) [M3051]								
pH		30/05/24 15:42 [7D]	EW152R	4		7.0		
Arsenic - Dissolved [M3159]								
Arsenic		10/06/24 15:28	EW188			0.687	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		10/06/24 15:28	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		10/06/24 15:28	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		10/06/24 15:28	EW188	5		109	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		10/06/24 15:28	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		10/06/24 15:28	EW188	1.11		7.04	mg/l	C6
Manganese - Dissolved [M3175]								

Signed: 10/06/2024

Aoife De Barra - Organics & Instrumentation Team Lead

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9. Report is issued as per our standard T&C of sale.

Sample number	966-2024-00014852	Received on	30/05/2024
		Analysis started on	30/05/2024
Your sample reference	Ballinclare SW4		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Manganese (Mn)		10/06/24 15:28	EW188			45.2	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		10/06/24 15:28	EW188			1.23	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		10/06/24 15:28	EW188	1		1.20	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C21-C40	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C6-C10	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	30/05/24 14:17		10		<10	µg/l	YA

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T
YA: Accredited (External Subcontractor)

Signed: ADeBarra 10/06/2024

Aoife De Barra - Organics & Instrumentation Team Lead

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9. Report is issued as per our standard T&C of sale.

Client: **Hydro-Environmental Services**
22
Lower Main Street
Dungarvan
Co. Waterford.
Waterford
IRELAND

Certificate Code: **AR-24-M3-013196-01**
Page Number: **Page 5 of 10**
PO reference:

Sample number	966-2024-00014853	Received on Analysis started on	30/05/2024 30/05/2024
Your sample reference	Ballinclare SW5		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Suspended Solids [M3002]								
Suspended Solids		31/05/24 10:09	EW013	5		<5	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		31/05/24 10:01	EW046	15		918	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		30/05/24 17:05	EW175	0.01		0.0110	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		30/05/24 17:05	EW175	0.01		<0.01	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		30/05/24 17:06	Ew001R	1		1.10	mg/l	C6
pH (Robotic Method) [M3051]								
pH		30/05/24 15:42 [7D]	EW152R	4		7.0		
Arsenic - Dissolved [M3159]								
Arsenic		10/06/24 15:28	EW188			0.455	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		10/06/24 15:28	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		10/06/24 15:28	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		10/06/24 15:28	EW188	5		11.7	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		10/06/24 15:28	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		10/06/24 15:28	EW188	1.11		7.14	mg/l	C6
Manganese - Dissolved [M3175]								

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Aoife De Barra - Organics & Instrumentation Team Lead

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Certificate Code: **AR-24-M3-013196-01**
Page Number: **Page 6 of 10**
PO reference:

Sample number	966-2024-00014853	Received on	30/05/2024
		Analysis started on	30/05/2024
Your sample reference	Ballinclare SW5		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Manganese (Mn)		10/06/24 15:28	EW188			1.90	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		10/06/24 15:28	EW188			<0.5	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		10/06/24 15:28	EW188	1		1.38	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C21-C40	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C6-C10	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	30/05/24 14:17		10		<10	µg/l	YA

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T
YA: Accredited (External Subcontractor)

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Aoife De Barra - Organics & Instrumentation Team Lead

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Certificate Code: **AR-24-M3-013196-01**
Page Number: **Page 7 of 10**
PO reference:

Sample number	966-2024-00014854	Received on Analysis started on	30/05/2024 30/05/2024
Your sample reference	Ballinclare SW6		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB[5]	Analysis Started	Method	LOQ[3]	SPEC[2]	Result	Units	ACCRED[4]
Suspended Solids [M3002]								
Suspended Solids		31/05/24 10:08	EW013	5		<5	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		31/05/24 10:01	EW046	15		102	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		30/05/24 17:05	EW175	0.01		<0.01	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		30/05/24 17:05	EW175	0.01		0.0100	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		30/05/24 17:06	Ew001R	1		<1	mg/l	
pH (Robotic Method) [M3051]								
pH		30/05/24 15:42[7D]	EW152R	4		7.0		
Arsenic - Dissolved [M3159]								
Arsenic		10/06/24 15:28	EW188			1.14	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		10/06/24 15:28	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		10/06/24 15:28	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		10/06/24 15:28	EW188	5		128	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		10/06/24 15:28	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		10/06/24 15:28	EW188	1.11		8.90	mg/l	C6
Manganese - Dissolved [M3175]								

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Certificate Code: **AR-24-M3-013196-01**
Page Number: **Page 8 of 10**
PO reference:

Sample number	966-2024-00014854	Received on	30/05/2024
		Analysis started on	30/05/2024
Your sample reference	Ballinclare SW6		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Manganese (Mn)		10/06/24 15:28	EW188			44.3	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		10/06/24 15:28	EW188			0.549	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		10/06/24 15:28	EW188	1		2.72	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C21-C40	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C6-C10	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	30/05/24 14:17		10		<10	µg/l	YA

[4] Accreditiation Information

C6: ISO/IEC 17025:2017 INAB 138-T
YA: Accredited (External Subcontractor)

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Certificate Code: **AR-24-M3-013196-01**

PO reference:

Sample number	966-2024-00014855	Received on	30/05/2024
		Analysis started on	30/05/2024
Your sample reference	Ballinclare SW7		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Suspended Solids [M3002]								
Suspended Solids		31/05/24 10:09	EW013	5		7.00	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		31/05/24 10:01	EW046	15		132	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		30/05/24 17:05	EW175	0.01		0.0280	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		30/05/24 17:05	EW175	0.01		0.0270	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		30/05/24 17:06	Ew001R	1		1.80	mg/l	C6
pH (Robotic Method) [M3051]								
pH		30/05/24 15:42 [7D]	EW152R	4		6.9		
Arsenic - Dissolved [M3159]								
Arsenic		10/06/24 15:28	EW188			2.52	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		10/06/24 15:28	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		10/06/24 15:28	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		10/06/24 15:28	EW188	5		150	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		10/06/24 15:28	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		10/06/24 15:28	EW188	1.11		7.24	mg/l	C6
Manganese - Dissolved [M3175]								

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Aoife De Barra - Organics & Instrumentation Team Lead

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Page Number: **Page 10 of 10**
PO reference:

Sample number	966-2024-00014855	Received on	30/05/2024
		Analysis started on	30/05/2024
Your sample reference	Ballinclare SW7		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	29/05/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Manganese (Mn)		10/06/24 15:28	EW188			41.1	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		10/06/24 15:28	EW188			3.47	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		10/06/24 15:28	EW188	1		25.3	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C21-C40	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH >C6-C10	*	30/05/24 14:17		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	30/05/24 14:17		10		<10	µg/l	YA

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T
YA: Accredited (External Subcontractor)

Signed: 10/06/2024

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Certificate Code: **AR-24-M3-015522-01**
Page Number: **Page 13 of 22**
PO reference: **P1330-3**

Sample number	966-2024-00017087	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 SW1		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Suspended Solids [M3002]								
Suspended Solids		21/06/24 10:41	EW013	5		<5	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		21/06/24 10:24	EW046	15		233	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		20/06/24 17:48	EW175	0.01		<0.01	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		20/06/24 17:48	EW175	0.01		0.0140	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		21/06/24 09:08	Ew001R	1		<1	mg/l	
pH (Robotic Method) [M3051]								
pH		20/06/24 18:26 [7D]	EW152R	4		6.6		
Arsenic - Dissolved [M3159]								
Arsenic		26/06/24 13:47	EW188			2.65	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		26/06/24 13:47	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		26/06/24 13:47	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		26/06/24 13:47	EW188	5		47.4	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		26/06/24 13:47	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		26/06/24 13:47	EW188	1.11		8.97	mg/l	C6
Manganese - Dissolved [M3175]								

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Niamh Ward - Senior Laboratory Analyst

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Certificate Code: **AR-24-M3-015522-01**
Page Number: **Page 14 of 22**
PO reference: **P1330-3**

Sample number	966-2024-00017087	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 SW1		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Manganese (Mn)		26/06/24 13:47	EW188			9.63	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		26/06/24 13:47	EW188			2.42	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		26/06/24 13:47	EW188	1		28.5	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C21-C40	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C6-C10	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	21/06/24 13:56		10		<10	µg/l	

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

Signed: 04/07/2024

Niamh Ward - Senior Laboratory Analyst

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Sample number	966-2024-00017088	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 SW4		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Suspended Solids [M3002]								
Suspended Solids		21/06/24 10:35	EW013	5		<5	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		21/06/24 10:24	EW046	15		122	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		20/06/24 17:48	EW175	0.01		0.0100	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		20/06/24 17:48	EW175	0.01		0.0150	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		21/06/24 09:08	Ew001R	1		<1	mg/l	
pH (Robotic Method) [M3051]								
pH		20/06/24 18:26 [7D]	EW152R	4		7.0		
Arsenic - Dissolved [M3159]								
Arsenic		26/06/24 13:47	EW188			0.862	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		26/06/24 13:47	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		26/06/24 13:47	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		26/06/24 13:47	EW188	5		88.8	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		26/06/24 13:47	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		26/06/24 13:47	EW188	1.11		7.59	mg/l	C6
Manganese - Dissolved [M3175]								

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Sample number	966-2024-00017088	Received on Analysis started on	20/06/2024 20/06/2024
Your sample reference	P1330-3 SW4		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code **Analyte**	**SUB [5]**	**Analysis Started**	**Method**	**LOQ [3]**	**SPEC [2]**	**Result**	**Units**	**ACCRED [4]**
Manganese (Mn)		26/06/24 13:47	EW188			24.6	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		26/06/24 13:47	EW188			1.10	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		26/06/24 13:47	EW188	1		25.4	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C21-C40	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C6-C10	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	21/06/24 13:56		10		<10	µg/l	

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Certificate Code: **AR-24-M3-015522-01**
Page Number: **Page 17 of 22**
PO reference: **P1330-3**

Sample number	966-2024-00017089	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 SW5		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Suspended Solids [M3002]								
Suspended Solids		21/06/24 10:42	EW013	5		<5	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		21/06/24 10:24	EW046	15		119	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		20/06/24 17:48	EW175	0.01		0.0100	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		20/06/24 17:48	EW175	0.01		0.0270	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		21/06/24 09:08	Ew001R	1		<1	mg/l	
pH (Robotic Method) [M3051]								
pH		20/06/24 18:26 [7D]	EW152R	4		6.5		
Arsenic - Dissolved [M3159]								
Arsenic		26/06/24 13:47	EW188			0.499	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		26/06/24 13:47	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		26/06/24 13:47	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		26/06/24 13:47	EW188	5		8.11	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		26/06/24 13:47	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		26/06/24 13:47	EW188	1.11		7.19	mg/l	C6
Manganese - Dissolved [M3175]								

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PO reference: **P1330-3**

Sample number	966-2024-00017089	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 SW5		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Manganese (Mn)		26/06/24 13:47	EW188			2.54	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		26/06/24 13:47	EW188			<0.5	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		26/06/24 13:47	EW188	1		37.3	µg/l	C6

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Certificate Code: **AR-24-M3-015522-01**
Page Number: **Page 19 of 22**
PO reference: **P1330-3**

Sample number	966-2024-00017090	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 SW6		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Suspended Solids [M3002]								
Suspended Solids		21/06/24 10:35	EW013	5		5.00	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		21/06/24 10:24	EW046	15		252	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		20/06/24 17:48	EW175	0.01		0.0220	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		20/06/24 17:48	EW175	0.01		0.123	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		21/06/24 09:08	Ew001R	1		<1	mg/l	
pH (Robotic Method) [M3051]								
pH		20/06/24 18:26 [7D]	EW152R	4		6.8		
Arsenic - Dissolved [M3159]								
Arsenic		26/06/24 13:47	EW188			10.7	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		26/06/24 13:47	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		26/06/24 13:47	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		26/06/24 13:47	EW188	5		139	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		26/06/24 13:47	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		26/06/24 13:47	EW188	1.11		15.6	mg/l	C6
Manganese - Dissolved [M3175]								

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Certificate Code: **AR-24-M3-015522-01**

PO reference: **P1330-3**

Sample number	966-2024-00017090	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 SW6		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Manganese (Mn)		26/06/24 13:47	EW188			445	µg/l	
Nickel - Dissolved [M3178]								
Nickel (Ni)		26/06/24 13:47	EW188			1.14	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		26/06/24 13:47	EW188	1		32.5	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C21-C40	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C6-C10	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	21/06/24 13:56		10		<10	µg/l	

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Certificate Code: **AR-24-M3-015522-01**
Page Number: **Page 21 of 22**
PO reference: **P1330-3**

Sample number	966-2024-00017091	Received on Analysis started on	20/06/2024 20/06/2024
Your sample reference	P1330-3 SW7		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Suspended Solids [M3002]								
Suspended Solids		21/06/24 10:35	EW013	5		<5	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		21/06/24 10:24	EW046	15		117	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		20/06/24 17:48	EW175	0.01		0.0200	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		20/06/24 17:48	EW175	0.01		0.0210	mg/l	C6
Biochemical Oxygen Demand (BOD) Robotic Method [M304E]								
Biochemical oxygen demand (BOD) 5d by Robotic Method		21/06/24 09:25	Ew001R	1		<1	mg/l	
pH (Robotic Method) [M3051]								
pH		20/06/24 18:26 [7D]	EW152R	4		7.1		
Arsenic - Dissolved [M3159]								
Arsenic		26/06/24 13:47	EW188			2.01	µg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		26/06/24 13:47	EW188			<0.1	µg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		26/06/24 13:47	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		26/06/24 13:47	EW188	5		73.6	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		26/06/24 13:47	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		26/06/24 13:47	EW188	1.11		7.10	mg/l	C6
Manganese - Dissolved [M3175]								

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Certificate Code: **AR-24-M3-015522-01**
Page Number: **Page 22 of 22**
PO reference: **P1330-3**

Sample number	966-2024-00017091	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 SW7		
Sample Matrix	Surface water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Manganese (Mn)		26/06/24 13:47	EW188			29.6	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		26/06/24 13:47	EW188			0.657	µg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		26/06/24 13:47	EW188	1		32.2	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C21-C40	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C6-C10	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	21/06/24 13:56		10		<10	µg/l	

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Web: www.eurofins.ie
Email: ASTsupport@etuki.eurofins.com

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Certificate Code: **PR-24-M3-000318-01**
Page Number: **Page 1 of 12**
PO reference: **P1330-3**

Preliminary Certificate of Analysis

This is a preliminary Certificate of Analysis and cannot be fully verified until all results have been validated

Sample number	966-2024-00017084	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 GW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code **Analyte**	**SUB[5]**	**Analysis Started**	**Method**	**LOQ[3]**	**SPEC[2]**	**Result**	**Units**	**ACCRED[4]**
Phenols (10) and Cresols (3) [F6536]								
2,3/3,5-Dimethylphenol + 4-Ethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
2,4-Dimethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
2,5-Dimethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
2,6-Dimethylphenol	*	21/06/24 14:22		0.03		<0.03	µg/l	
3,4-Dimethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
Cresols (sum)	*	21/06/24 14:22		0.8		<0.8	µg/l	
m-Cresol	*	21/06/24 14:22		0.3		<0.3	µg/l	
m-Ethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
o-Cresol	*	21/06/24 14:22		0.3		<0.3	µg/l	
o-Ethylphenol	*	21/06/24 14:22		0.03		<0.03	µg/l	
p-Cresol	*	21/06/24 14:22		0.2		<0.2	µg/l	
Phenol	*	21/06/24 14:22		0.2		<0.2	µg/l	
Thymol	*	21/06/24 14:22		0.01		<0.01	µg/l	
Cyanides total [FF01Q]								
Cyanides total	*	21/06/24 14:22		1		<1	µg/l	
Dissolved Oxygen [M3005]								
Dissolved oxygen		21/06/24 09:17 [7D]	EW043	1		8.25	mg/l	
Total Nitrogen [M3007]								
Total Nitrogen		21/06/24 11:05	EW140	1		<1	mg/l	C6
Sulphate mg/L - Gallery [M300N]								

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Waterford
IRELAND

Certificate Code: **PR-24-M3-000318-01**
Page Number: **Page 2 of 12**
PO reference: **P1330-3**

Sample number	966-2024-00017084	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 GW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Sulphate mg/L - Gallery		20/06/24 17:48	EW175	1		21.3	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		20/06/24 17:48	EW175	0.01		0.0660	mg/l	C6
Fluoride mg/L - Gallery [M300Q]								
Fluoride mg/L - Gallery		20/06/24 17:48	EW175	0.2		0.215	mg/l	C6
Chloride mg/L - Gallery [M300S]								
Chloride mg/L - Gallery		20/06/24 17:48	EW175	5		11.1	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		20/06/24 17:48	EW175	0.01		0.384	mg/l	C6
Nitrite (as N) - Gallery [M3016]								
Nitrite (as N) - Gallery		20/06/24 17:48	EW175	0.01		<0.01	mg/l	C6
Nitrate (as N) - Gallery [M301A]								
Nitrate (as N) - Gallery		20/06/24 17:48	EW175	1		<1	mg/l	C6
Temperature (Site) [M3036]								
Temperature		04/07/24 16:26	Site Test			Not Provided	°C	
Total Phosphorus-TP [M3045]								
Total Phosphorus-TP		24/06/24 10:04	EW146	0.02		0.0800	mg/l	C6
pH (Robotic Method) [M3051]								
pH		20/06/24 18:26 [7D]	EW152R	4		7.3		
Conductivity at 20°C (Robotic Method) [M3052]								
Conductivity at 20°C		20/06/24 18:26	EW152R	5		401	µS/cm	C6
Boron - Dissolved [M3163]								
Boron (B)		26/06/24 13:47	EW188	0.21		<0.21	mg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		26/06/24 13:47	EW188			<0.1	µg/l	C6

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Certificate Code: **PR-24-M3-000318-01**
Page Number: **Page 3 of 12**
PO reference: **P1330-3**

Sample number	966-2024-00017084	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 GW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code **Analyte**	**SUB** 5	**Analysis Started**	**Method**	**LOQ** 3	**SPEC** 2	**Result**	**Units**	**ACCRED** 4
Calcium - Dissolved [M3165]								
Calcium (Ca)		26/06/24 13:47	EW188	1.08		60.3	mg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		26/06/24 13:47	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		26/06/24 13:47	EW188	5		145	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		26/06/24 13:47	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		26/06/24 13:47	EW188	1.11		12.3	mg/l	C6
Manganese - Dissolved [M3175]								
Manganese (Mn)		26/06/24 13:47	EW188			382	µg/l	
Mercury - Dissolved [M3176]								
Mercury		26/06/24 13:47	EW188	0.03		<0.03	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		26/06/24 13:47	EW188			5.98	µg/l	C6
Potassium - Dissolved [M3180]								
Potassium (K)		26/06/24 13:47	EW188	0.15		11.3	mg/l	C6
Sodium - Dissolved [M3184]								
Sodium (Na)		26/06/24 13:47	EW188	1.5		14.8	mg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		26/06/24 13:47	EW188	1		22.5	µg/l	C6
Aluminium - Trace [M3234]								
Aluminium		26/08/24 15:17	EW188	5		6.47	µg/l	C6
Antimony - Trace [M3235]								
Antimony		26/08/24 15:17	EW188	0.1		0.259	µg/l	C6

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Certificate Code: **PR-24-M3-000318-01**

PO reference: **P1330-3**

Sample number	966-2024-00017084	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 GW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	10:30		

Test Code **Analyte**	**SUB** [5]	**Analysis Started**	**Method**	**LOQ** [3]	**SPEC** [2]	**Result**	**Units**	**ACCRED** [4]
Arsenic - Trace [M3236]								
Arsenic		26/08/24 15:17		0.2		79.9	µg/l	
Barium - Trace [M3237]								
Barium		26/08/24 15:17		1.77		77.7	µg/l	C6
Chromium - Trace [M3242]								
Chromium (Cr)		26/06/24 13:47		1		3.41	µg/l	C6
Selenium - Trace [M3255]								
Selenium (Se)		26/08/24 15:17		0.2		<0.2	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C21-C40	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C6-C10	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	21/06/24 13:56		10		<10	µg/l	
Coliforms [XD002]								
Coliforms	*	20/06/24 17:09				517	cfu/100 ml	
Escherichia coli, confirmed [XD005]								
Escherichia coli, confirmed	*	20/06/24 17:09				5	cfu/100 ml	

Results to follow:

Cyanides free [F1518]
Sulphide [M3009]

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Certificate Code: PR-24-M3-000318-01
Page Number: Page 5 of 12
PO reference: P1330-3

Sample number	966-2024-00017085	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 ODW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	12:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Phenols (10) and Cresols (3) [F6536]								
2,3/3,5-Dimethylphenol + 4-Ethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
2,4-Dimethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
2,5-Dimethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
2,6-Dimethylphenol	*	21/06/24 14:22		0.03		<0.03	µg/l	
3,4-Dimethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
Cresols (sum)	*	21/06/24 14:22		0.8		<0.8	µg/l	
m-Cresol	*	21/06/24 14:22		0.3		<0.3	µg/l	
m-Ethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
o-Cresol	*	21/06/24 14:22		0.3		<0.3	µg/l	
o-Ethylphenol	*	21/06/24 14:22		0.03		<0.03	µg/l	
p-Cresol	*	21/06/24 14:22		0.2		<0.2	µg/l	
Phenol	*	21/06/24 14:22		0.2		<0.2	µg/l	
Thymol	*	21/06/24 14:22		0.01		<0.01	µg/l	
Cyanides total [FF01Q]								
Cyanides total	*	21/06/24 14:22		1		<1	µg/l	
Dissolved Oxygen [M3005]								
Dissolved oxygen		21/06/24 09:19 [7D]	EW043	1		8.64	mg/l	
Total Nitrogen [M3007]								
Total Nitrogen		21/06/24 11:05	EW140	1		1.13	mg/l	C6
Sulphate mg/L - Gallery [M300N]								
Sulphate mg/L - Gallery		20/06/24 17:48	EW175	1		10.4	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		20/06/24 17:48	EW175	0.01		0.0130	mg/l	C6

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		Analysis started on	20/06/2024
Your sample reference	P1330-3 ODW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	12:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Fluoride mg/L - Gallery [M300Q]								
Fluoride mg/L - Gallery		20/06/24 17:48	EW175	0.2		<0.2	mg/l	
Chloride mg/L - Gallery [M300S]								
Chloride mg/L - Gallery		20/06/24 17:48	EW175	5		32.3	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		20/06/24 17:48	EW175	0.01		0.0120	mg/l	C6
Nitrite (as N) - Gallery [M3016]								
Nitrite (as N) - Gallery		20/06/24 17:48	EW175	0.01		<0.01	mg/l	C6
Nitrate (as N) - Gallery [M301A]								
Nitrate (as N) - Gallery		20/06/24 17:48	EW175	1		1.93	mg/l	C6
Temperature (Site) [M3036]								
Temperature		04/07/24 16:27	Site Test			Not Provided	°C	
Total Phosphorus-TP [M3045]								
Total Phosphorus-TP		24/06/24 10:04	EW146	0.02		<0.02	mg/l	
pH (Robotic Method) [M3051]								
pH		20/06/24 18:26 [7D]	EW152R	4		7.2		
Conductivity at 20°C (Robotic Method) [M3052]								
Conductivity at 20°C		20/06/24 18:26	EW152R	5		307	µS/cm	C6
Boron - Dissolved [M3163]								
Boron (B)		26/06/24 13:47	EW188	0.21		<0.21	mg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		26/06/24 13:47	EW188			<0.1	µg/l	C6
Calcium - Dissolved [M3165]								
Calcium (Ca)		26/06/24 13:47	EW188	1.08		31.8	mg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		26/06/24 13:47	EW188	0.003		<0.003	mg/l	C6

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Certificate Code: **PR-24-M3-000318-01**
Page Number: **Page 7 of 12**
PO reference: **P1330-3**

Sample number	966-2024-00017085	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 ODW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	12:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Iron - Dissolved [M3172]								
Iron (Fe)		26/06/24 13:47	EW188	5		<5	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		26/06/24 13:47	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		26/06/24 13:47	EW188	1.11		8.02	mg/l	C6
Manganese - Dissolved [M3175]								
Manganese (Mn)		26/06/24 13:47	EW188			6.67	µg/l	C6
Mercury - Dissolved [M3176]								
Mercury		26/06/24 13:47	EW188	0.03		<0.03	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		26/06/24 13:47	EW188			<0.5	µg/l	C6
Potassium - Dissolved [M3180]								
Potassium (K)		26/06/24 13:47	EW188	0.15		2.15	mg/l	C6
Sodium - Dissolved [M3184]								
Sodium (Na)		26/06/24 13:47	EW188	1.5		26.4	mg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		26/06/24 13:47	EW188	1		37.7	µg/l	C6
Aluminium - Trace [M3234]								
Aluminium		26/08/24 15:20	EW188	5		<5	µg/l	C6
Antimony - Trace [M3235]								
Antimony		26/08/24 15:20	EW188	0.1		0.542	µg/l	C6
Arsenic - Trace [M3236]								
Arsenic		26/08/24 15:20		0.2		79.1	µg/l	
Barium - Trace [M3237]								
Barium		26/08/24 15:20		1.77		<1.77	µg/l	C6

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Certificate Code: **PR-24-M3-000318-01**
Page Number: **Page 8 of 12**
PO reference: **P1330-3**

Sample number	966-2024-00017085	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 ODW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	12:30		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Chromium - Trace [M3242]								
Chromium (Cr)		26/06/24 13:47		1		<1	µg/l	C6
Selenium - Trace [M3255]								
Selenium (Se)		26/08/24 15:20		0.2		0.317	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C21-C40	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH >C6-C10	*	21/06/24 13:56		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	21/06/24 13:56		10		<10	µg/l	
Coliforms [XD002]								
Coliforms	*	20/06/24 17:09				17	cfu/100 ml	
Escherichia coli, confirmed [XD005]								
Escherichia coli, confirmed	*	20/06/24 17:09				<1	cfu/100 ml	

Results to follow:

Cyanides free [F1518]
Sulphide [M3009]

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Certificate Code: **PR-24-M3-000318-01**
Page Number: **Page 9 of 12**
PO reference: **P1330-3**

Sample number	966-2024-00017086	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 ODW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	12:50		

Test Code **Analyte**	**SUB** [5]	**Analysis Started**	**Method**	**LOQ** [3]	**SPEC** [2]	**Result**	**Units**	**ACCRED** [4]
Phenols (10) and Cresols (3) [F6536]								
2,3/3,5-Dimethylphenol + 4-Ethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
2,4-Dimethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
2,5-Dimethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
2,6-Dimethylphenol	*	21/06/24 14:22		0.03		<0.03	µg/l	
3,4-Dimethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
Cresols (sum)	*	21/06/24 14:22		0.8		<0.8	µg/l	
m-Cresol	*	21/06/24 14:22		0.3		<0.3	µg/l	
m-Ethylphenol	*	21/06/24 14:22		0.02		<0.02	µg/l	
o-Cresol	*	21/06/24 14:22		0.3		<0.3	µg/l	
o-Ethylphenol	*	21/06/24 14:22		0.03		<0.03	µg/l	
p-Cresol	*	21/06/24 14:22		0.2		<0.2	µg/l	
Phenol	*	21/06/24 14:22		0.2		<0.2	µg/l	
Thymol	*	21/06/24 14:22		0.01		<0.01	µg/l	
Cyanides total [FF01Q]								
Cyanides total	*	21/06/24 14:22		1		<1	µg/l	
Dissolved Oxygen [M3005]								
Dissolved oxygen		21/06/24 09:20 [7D]	EW043	1		9.21	mg/l	
Total Nitrogen [M3007]								
Total Nitrogen		21/06/24 11:21	EW140	1		<1	mg/l	C6
Sulphate mg/L - Gallery [M300N]								
Sulphate mg/L - Gallery		20/06/24 17:48	EW175	1		9.29	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		20/06/24 17:48	EW175	0.01		0.0130	mg/l	C6

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Certificate Code: **PR-24-M3-000318-01**
Page Number: **Page 10 of 12**
PO reference: **P1330-3**

Sample number	966-2024-00017086	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 ODW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	12:50		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Fluoride mg/L - Gallery [M300Q]								
Fluoride mg/L - Gallery		20/06/24 17:48	EW175	0.2		<0.2	mg/l	
Chloride mg/L - Gallery [M300S]								
Chloride mg/L - Gallery		20/06/24 17:48	EW175	5		17.4	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		20/06/24 17:48	EW175	0.01		<0.01	mg/l	C6
Nitrite (as N) - Gallery [M3016]								
Nitrite (as N) - Gallery		20/06/24 17:48	EW175	0.01		<0.01	mg/l	C6
Nitrate (as N) - Gallery [M301A]								
Nitrate (as N) - Gallery		20/06/24 17:48	EW175	1		<1	mg/l	C6
Temperature (Site) [M3036]								
Temperature		04/07/24 16:27	Site Test			Not Provided	°C	
Total Phosphorus-TP [M3045]								
Total Phosphorus-TP		24/06/24 10:04	EW146	0.02		<0.02	mg/l	
pH (Robotic Method) [M3051]								
pH		20/06/24 18:26 [7D]	EW152R	4		6.8		
Conductivity at 20°C (Robotic Method) [M3052]								
Conductivity at 20°C		20/06/24 18:26	EW152R	5		243	µS/cm	C6
Boron - Dissolved [M3163]								
Boron (B)		26/06/24 13:47	EW188	0.21		<0.21	mg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		26/06/24 13:47	EW188			<0.1	µg/l	C6
Calcium - Dissolved [M3165]								
Calcium (Ca)		26/06/24 13:47	EW188	1.08		26.8	mg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		26/06/24 13:47	EW188	0.003		0.00300	mg/l	C6

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Certificate Code: **PR-24-M3-000318-01**
Page Number: **Page 11 of 12**
PO reference: **P1330-3**

Sample number	966-2024-00017086	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 ODW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	12:50		

Test Code **Analyte**	**SUB** [5]	**Analysis Started**	**Method**	**LOQ** [3]	**SPEC** [2]	**Result**	**Units**	**ACCRED** [4]
Iron - Dissolved [M3172]								
Iron (Fe)		26/06/24 13:47	EW188	5		<5	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		26/06/24 13:47	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		26/06/24 13:47	EW188	1.11		8.81	mg/l	C6
Manganese - Dissolved [M3175]								
Manganese (Mn)		26/06/24 13:47	EW188			6.72	µg/l	C6
Mercury - Dissolved [M3176]								
Mercury		26/06/24 13:47	EW188	0.03		<0.03	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		26/06/24 13:47	EW188			<0.5	µg/l	C6
Potassium - Dissolved [M3180]								
Potassium (K)		26/06/24 13:47	EW188	0.15		3.19	mg/l	C6
Sodium - Dissolved [M3184]								
Sodium (Na)		26/06/24 13:47	EW188	1.5		13.6	mg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		26/06/24 13:47	EW188	1		34.2	µg/l	C6
Aluminium - Trace [M3234]								
Aluminium		26/08/24 15:20	EW188	5		<5	µg/l	C6
Antimony - Trace [M3235]								
Antimony		26/08/24 15:20	EW188	0.1		0.304	µg/l	C6
Arsenic - Trace [M3236]								
Arsenic		26/08/24 15:20		0.2		25.6	µg/l	C6
Barium - Trace [M3237]								
Barium		26/08/24 15:20		1.77		5.70	µg/l	C6

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Page Number: **Page 12 of 12**
PO reference: **P1330-3**

Sample number	966-2024-00017086	Received on	20/06/2024
		Analysis started on	20/06/2024
Your sample reference	P1330-3 ODW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	19/06/2024
Time Sampled	12:50		

Test Code **Analyte**	**SUB[5]**	**Analysis Started**	**Method**	**LOQ[3]**	**SPEC[2]**	**Result**	**Units**	**ACCRED[4]**
Chromium - Trace [M3242]								
Chromium (Cr)		26/06/24 13:47		1		<1	µg/l	C6
Selenium - Trace [M3255]								
Selenium (Se)		26/08/24 15:20		0.2		0.362	µg/l	C6
Coliforms [XD002]								
Coliforms	*	20/06/24 17:09				4	cfu/100 ml	
Escherichia coli, confirmed [XD005]								
Escherichia coli, confirmed	*	20/06/24 17:09				<1	cfu/100 ml	

Results to follow:

Cyanides free [F1518]
Sulphide [M3009]

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Certificate Code: **PR-24-M3-000317-01**
Page Number: **Page 1 of 15**
PO reference:

Preliminary Certificate of Analysis

This is a preliminary Certificate of Analysis and cannot be fully verified until all results have been validated

Sample number	966-2024-00018618	Received on	05/07/2024
		Analysis started on	05/07/2024
Your sample reference	P1330-3-GW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	14:00		

Test Code Analyte	SUB[5]	Analysis Started	Method	LOQ[3]	SPEC[2]	Result	Units	ACCRED[4]
Phenols (10) and Cresols (3) [F6536]								
2,3/3,5-Dimethylphenol + 4-Ethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
2,4-Dimethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
2,5-Dimethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
2,6-Dimethylphenol	*	05/07/24 14:04		0.03		<0.03	µg/l	
3,4-Dimethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
Cresols (sum)	*	05/07/24 14:04		0.8		<0.8	µg/l	
m-Cresol	*	05/07/24 14:04		0.3		<0.3	µg/l	
m-Ethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
o-Cresol	*	05/07/24 14:04		0.3		<0.3	µg/l	
o-Ethylphenol	*	05/07/24 14:04		0.03		<0.03	µg/l	
p-Cresol	*	05/07/24 14:04		0.2		<0.2	µg/l	
Phenol	*	05/07/24 14:04		0.2		<0.2	µg/l	
Thymol	*	05/07/24 14:04		0.01		<0.01	µg/l	
Cyanides total [FF01Q]								
Cyanides total	*	05/07/24 14:04		1		<1	µg/l	
Dissolved Oxygen [M3005]								
Dissolved oxygen		05/07/24 13:37 [7D]	EW043	1		6.78	mg/l	
Total Nitrogen [M3007]								
Total Nitrogen		08/07/24 12:31	EW140	1		<1	mg/l	C6
Sulphide [M3009]								

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Certificate Code: **PR-24-M3-000317-01**
Page Number: **Page 2 of 15**
PO reference:

Sample number	966-2024-00018618	Received on	05/07/2024
		Analysis started on	05/07/2024
Your sample reference	P1330-3-GW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Sulphide		26/08/24 13:03	EW024	0.03		<0.03	mg/l	
Sulphate mg/L - Gallery [M300N]								
Sulphate mg/L - Gallery		05/07/24 13:19	EW175	1		22.8	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		05/07/24 13:19	EW175	0.01		0.0700	mg/l	C6
Fluoride mg/L - Gallery [M300Q]								
Fluoride mg/L - Gallery		05/07/24 13:19	EW175	0.2		<0.2	mg/l	
Chloride mg/L - Gallery [M300S]								
Chloride mg/L - Gallery		05/07/24 13:19	EW175	5		11.2	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		05/07/24 13:19	EW175	0.01		0.531	mg/l	
Nitrite (as N) - Gallery [M3016]								
Nitrite (as N) - Gallery		05/07/24 13:19	EW175	0.01		<0.01	mg/l	C6
Nitrate (as N) - Gallery [M301A]								
Nitrate (as N) - Gallery		05/07/24 13:19	EW175	1		<1	mg/l	C6
Temperature (Site) [M3036]								
Temperature		05/07/24 15:32	Site Test			Not Provided	°C	
Total Phosphorus-TP [M3045]								
Total Phosphorus-TP		09/07/24 09:19	EW146	0.02		0.0800	mg/l	C6
pH (Robotic Method) [M3051]								
pH		05/07/24 13:37 [7D]	EW152R	4		7.2		
Conductivity at 20°C (Robotic Method) [M3052]								
Conductivity at 20°C		05/07/24 13:37	EW152R	5		456	µS/cm	C6
Boron - Dissolved [M3163]								
Boron (B)		24/07/24 10:53	EW188	0.21		1.38	mg/l	C6

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Certificate Code: **PR-24-M3-000317-01**
Page Number: **Page 3 of 15**
PO reference:

Sample number	966-2024-00018618	Received on	05/07/2024
		Analysis started on	05/07/2024
Your sample reference	P1330-3-GW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		24/07/24 10:53	EW188			4.85	µg/l	C6
Calcium - Dissolved [M3165]								
Calcium (Ca)		24/07/24 10:53	EW188	1.08		46.5	mg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		24/07/24 10:53	EW188	0.003		2.02	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		24/07/24 10:53	EW188	5		188	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		24/07/24 10:53	EW188	0.51		9.92	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		24/07/24 10:53	EW188	1.11		9.60	mg/l	C6
Manganese - Dissolved [M3175]								
Manganese (Mn)		24/07/24 10:53	EW188			46400	µg/l	
Mercury - Dissolved [M3176]								
Mercury		24/07/24 10:53	EW188	0.03		0.991	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		24/07/24 10:53	EW188			18.7	µg/l	C6
Potassium - Dissolved [M3180]								
Potassium (K)		24/07/24 10:53	EW188	0.15		10.3	mg/l	C6
Sodium - Dissolved [M3184]								
Sodium (Na)		24/07/24 10:53	EW188	1.5		198	mg/l	
Zinc - Dissolved [M3194]								
Zinc (Zn)		24/07/24 10:53	EW188	1		46.5	µg/l	C6
Aluminium - Trace [M3234]								
Aluminium		26/08/24 12:40	EW188	5		5.39	µg/l	C6

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Page Number: **Page 4 of 15**
PO reference:

Sample number	966-2024-00018618	Received on	05/07/2024
		Analysis started on	05/07/2024
Your sample reference	P1330-3-GW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	14:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Antimony - Trace [M3235]								
Antimony		26/08/24 12:40	EW188	0.1		0.294	µg/l	C6
Arsenic - Trace [M3236]								
Arsenic		26/08/24 12:40		0.2		113	µg/l	
Barium - Trace [M3237]								
Barium		26/08/24 12:40		1.77		133	µg/l	C6
Chromium - Trace [M3242]								
Chromium (Cr)		11/07/24 17:01		1		1.18	µg/l	C6
Selenium - Trace [M3255]								
Selenium (Se)		26/08/24 12:40		0.2		0.220	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	05/07/24 14:27		0.1		450	µg/l	
TPH >C21-C40	*	05/07/24 14:27		0.1		130	µg/l	
TPH >C6-C10	*	05/07/24 14:27		0.1		20	µg/l	
TPH Total >C6-C40	*	05/07/24 14:27		10		610	µg/l	
Coliforms [XD002]								
Coliforms	*	05/07/24 11:58				78	cfu/100 ml	
Escherichia coli, confirmed [XD005]								
Escherichia coli, confirmed	*	05/07/24 11:58				6	cfu/100 ml	

Results to follow:

Cyanides free [F1518]

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Certificate Code: **PR-24-M3-000317-01**

PO reference:

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		Analysis started on	05/07/2024
Your sample reference	P1330-3-ODW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	12:45		

Test Code Analyte	SUB 5	Analysis Started	Method	LOQ 3	SPEC 2	Result	Units	ACCRED 4
Phenols (10) and Cresols (3) [F6536]								
2,3/3,5-Dimethylphenol + 4-Ethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
2,4-Dimethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
2,5-Dimethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
2,6-Dimethylphenol	*	05/07/24 14:04		0.03		<0.03	µg/l	
3,4-Dimethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
Cresols (sum)	*	05/07/24 14:04		0.8		<0.8	µg/l	
m-Cresol	*	05/07/24 14:04		0.3		<0.3	µg/l	
m-Ethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
o-Cresol	*	05/07/24 14:04		0.3		<0.3	µg/l	
o-Ethylphenol	*	05/07/24 14:04		0.03		<0.03	µg/l	
p-Cresol	*	05/07/24 14:04		0.2		<0.2	µg/l	
Phenol	*	05/07/24 14:04		0.2		<0.2	µg/l	
Thymol	*	05/07/24 14:04		0.01		<0.01	µg/l	
Cyanides total [FF01Q]								
Cyanides total	*	05/07/24 14:04		1		<1	µg/l	
Dissolved Oxygen [M3005]								
Dissolved oxygen		05/07/24 13:37 7D	EW043	1		9.65	mg/l	
Total Nitrogen [M3007]								
Total Nitrogen		08/07/24 12:31	EW140	1		<1	mg/l	C6
Sulphide [M3009]								
Sulphide		26/08/24 13:04	EW024	0.03		<0.03	mg/l	
Sulphate mg/L - Gallery [M300N]								
Sulphate mg/L - Gallery		05/07/24 13:19	EW175	1		7.96	mg/l	C6

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Certificate Code: **PR-24-M3-000317-01**

PO reference:

Sample number	966-2024-00018619	Received on	05/07/2024
		Analysis started on	05/07/2024
Your sample reference	P1330-3-ODW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	12:45		

Test Code **Analyte**	**SUB** [5]	**Analysis Started**	**Method**	**LOQ** [3]	**SPEC** [2]	**Result**	**Units**	**ACCRED** [4]
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		05/07/24 13:19	EW175	0.01		0.0100	mg/l	C6
Fluoride mg/L - Gallery [M300Q]								
Fluoride mg/L - Gallery		05/07/24 13:19	EW175	0.2		<0.2	mg/l	
Chloride mg/L - Gallery [M300S]								
Chloride mg/L - Gallery		05/07/24 13:19	EW175	5		17.0	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		05/07/24 13:19	EW175	0.01		<0.01	mg/l	C6
Nitrite (as N) - Gallery [M3016]								
Nitrite (as N) - Gallery		05/07/24 13:19	EW175	0.01		<0.01	mg/l	C6
Nitrate (as N) - Gallery [M301A]								
Nitrate (as N) - Gallery		05/07/24 13:19	EW175	1		<1	mg/l	C6
Temperature (Site) [M3036]								
Temperature		05/07/24 15:32	Site Test			Not Provided	°C	
Total Phosphorus-TP [M3045]								
Total Phosphorus-TP		09/07/24 14:17	EW146	0.02		<0.02	mg/l	
pH (Robotic Method) [M3051]								
pH		05/07/24 13:37 [7D]	EW152R	4		6.9		
Conductivity at 20°C (Robotic Method) [M3052]								
Conductivity at 20°C		05/07/24 13:37	EW152R	5		236	µS/cm	C6
Boron - Dissolved [M3163]								
Boron (B)		11/07/24 17:01	EW188	0.21		<0.21	mg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		11/07/24 17:01	EW188			<0.1	µg/l	C6
Calcium - Dissolved [M3165]								

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Certificate Code: **PR-24-M3-000317-01**
Page Number: **Page 7 of 15**
PO reference:

Sample number	966-2024-00018619	Received on Analysis started on	05/07/2024 05/07/2024
Your sample reference	P1330-3-ODW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	12:45		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Calcium (Ca)		11/07/24 17:01	EW188	1.08		<1.08	mg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		11/07/24 17:01	EW188	0.003		0.00300	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		11/07/24 17:01	EW188	5		<5	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		11/07/24 17:01	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		11/07/24 17:01	EW188	1.11		<1.11	mg/l	C6
Manganese - Dissolved [M3175]								
Manganese (Mn)		11/07/24 17:01	EW188			<1	µg/l	C6
Mercury - Dissolved [M3176]								
Mercury		11/07/24 17:01	EW188	0.03		<0.03	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		11/07/24 17:01	EW188			<0.5	µg/l	C6
Potassium - Dissolved [M3180]								
Potassium (K)		11/07/24 17:01	EW188	0.15		0.728	mg/l	C6
Sodium - Dissolved [M3184]								
Sodium (Na)		11/07/24 17:01	EW188	1.5		116	mg/l	
Zinc - Dissolved [M3194]								
Zinc (Zn)		11/07/24 17:01	EW188	1		5.78	µg/l	C6
Aluminium - Trace [M3234]								
Aluminium		26/08/24 12:42	EW188	5		6.36	µg/l	C6
Antimony - Trace [M3235]								
Antimony		26/08/24 12:42	EW188	0.1		0.697	µg/l	C6

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Your sample reference	P1330-3-ODW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	12:45		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Arsenic - Trace [M3236]								
Arsenic		26/08/24 12:42		0.2		11.2	µg/l	C6
Barium - Trace [M3237]								
Barium		26/08/24 12:42		1.77		<1.77	µg/l	C6
Chromium - Trace [M3242]								
Chromium (Cr)		11/07/24 17:01		1		<1	µg/l	C6
Selenium - Trace [M3255]								
Selenium (Se)		26/08/24 12:42		0.2		0.553	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	05/07/24 14:27		0.1		<0.1	µg/l	
TPH >C21-C40	*	05/07/24 14:27		0.1		<0.1	µg/l	
TPH >C6-C10	*	05/07/24 14:27		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	05/07/24 14:27		10		<10	µg/l	
Coliforms [XD002]								
Coliforms	*	05/07/24 11:58				55	cfu/100 ml	
Escherichia coli, confirmed [XD005]								
Escherichia coli, confirmed	*	05/07/24 11:58				1	cfu/100 ml	

Results to follow:

Cyanides free [F1518]

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Sample number	966-2024-00018620	Received on	05/07/2024
		Analysis started on	05/07/2024
Your sample reference	P1330-3-ODW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	13:15		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Phenols (10) and Cresols (3) [F6536]								
2,3/3,5-Dimethylphenol + 4-Ethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
2,4-Dimethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
2,5-Dimethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
2,6-Dimethylphenol	*	05/07/24 14:04		0.03		<0.03	µg/l	
3,4-Dimethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
Cresols (sum)	*	05/07/24 14:04		0.8		<0.8	µg/l	
m-Cresol	*	05/07/24 14:04		0.3		<0.3	µg/l	
m-Ethylphenol	*	05/07/24 14:04		0.02		<0.02	µg/l	
o-Cresol	*	05/07/24 14:04		0.3		<0.3	µg/l	
o-Ethylphenol	*	05/07/24 14:04		0.03		<0.03	µg/l	
p-Cresol	*	05/07/24 14:04		0.2		<0.2	µg/l	
Phenol	*	05/07/24 14:04		0.2		<0.2	µg/l	
Thymol	*	05/07/24 14:04		0.01		<0.01	µg/l	
Cyanides total [FF01Q]								
Cyanides total	*	05/07/24 14:04		1		<1	µg/l	
Dissolved Oxygen [M3005]								
Dissolved oxygen		05/07/24 13:37 [7D]	EW043	1		6.32	mg/l	
Total Nitrogen [M3007]								
Total Nitrogen		08/07/24 12:31	EW140	1		1.11	mg/l	C6
Sulphide [M3009]								
Sulphide		26/08/24 13:05	EW024	0.03		<0.03	mg/l	
Sulphate mg/L - Gallery [M300N]								
Sulphate mg/L - Gallery		05/07/24 13:19	EW175	1		10.1	mg/l	C6

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Certificate Code: **PR-24-M3-000317-01**
Page Number: **Page 10 of 15**
PO reference:

Sample number	966-2024-00018620	Received on	05/07/2024
		Analysis started on	05/07/2024
Your sample reference	P1330-3-ODW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	13:15		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		05/07/24 13:19	EW175	0.01		0.0190	mg/l	C6
Fluoride mg/L - Gallery [M300Q]								
Fluoride mg/L - Gallery		05/07/24 13:19	EW175	0.2		<0.2	mg/l	
Chloride mg/L - Gallery [M300S]								
Chloride mg/L - Gallery		05/07/24 13:19	EW175	5		42.3	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		05/07/24 13:19	EW175	0.01		0.0110	mg/l	C6
Nitrite (as N) - Gallery [M3016]								
Nitrite (as N) - Gallery		05/07/24 13:19	EW175	0.01		0.0110	mg/l	C6
Nitrate (as N) - Gallery [M301A]								
Nitrate (as N) - Gallery		05/07/24 13:19	EW175	1		1.63	mg/l	C6
Temperature (Site) [M3036]								
Temperature		05/07/24 15:32	Site Test			Not Provided	°C	
Total Phosphorus-TP [M3045]								
Total Phosphorus-TP		09/07/24 09:19	EW146	0.02		<0.02	mg/l	
pH (Robotic Method) [M3051]								
pH		05/07/24 13:37 [7D]	EW152R	4		6.8		
Conductivity at 20°C (Robotic Method) [M3052]								
Conductivity at 20°C		05/07/24 13:37	EW152R	5		329	µS/cm	C6
Boron - Dissolved [M3163]								
Boron (B)		11/07/24 17:01	EW188	0.21		<0.21	mg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		11/07/24 17:01	EW188			<0.1	µg/l	C6
Calcium - Dissolved [M3165]								

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Page Number: **Page 11 of 15**
PO reference:

Sample number	966-2024-00018620	Received on Analysis started on	05/07/2024 05/07/2024
Your sample reference	P1330-3-ODW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	13:15		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Calcium (Ca)		11/07/24 17:01	EW188	1.08		34.3	mg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		11/07/24 17:01	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		11/07/24 17:01	EW188	5		12.0	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		11/07/24 17:01	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		11/07/24 17:01	EW188	1.11		8.65	mg/l	C6
Manganese - Dissolved [M3175]								
Manganese (Mn)		11/07/24 17:01	EW188			33.2	µg/l	C6
Mercury - Dissolved [M3176]								
Mercury		11/07/24 17:01	EW188	0.03		<0.03	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		11/07/24 17:01	EW188			<0.5	µg/l	C6
Potassium - Dissolved [M3180]								
Potassium (K)		11/07/24 17:01	EW188	0.15		2.29	mg/l	C6
Sodium - Dissolved [M3184]								
Sodium (Na)		11/07/24 17:01	EW188	1.5		34.3	mg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		11/07/24 17:01	EW188	1		4.17	µg/l	C6
Aluminium - Trace [M3234]								
Aluminium		26/08/24 12:43	EW188	5		6.28	µg/l	C6
Antimony - Trace [M3235]								
Antimony		26/08/24 12:43	EW188	0.1		0.576	µg/l	C6

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Page Number: **Page 12 of 15**
PO reference:

Sample number	966-2024-00018620	Received on	05/07/2024
		Analysis started on	05/07/2024
Your sample reference	P1330-3-ODW2		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	13:15		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Arsenic - Trace [M3236]								
Arsenic		26/08/24 12:43		0.2		90.1	µg/l	
Barium - Trace [M3237]								
Barium		26/08/24 12:43		1.77		<1.77	µg/l	C6
Chromium - Trace [M3242]								
Chromium (Cr)		11/07/24 17:01		1		<1	µg/l	C6
Selenium - Trace [M3255]								
Selenium (Se)		26/08/24 12:43		0.2		0.260	µg/l	C6
TPH 3 Band (C6-10-21-40) in water [M502B]								
TPH >C10-C21	*	05/07/24 14:27		0.1		<0.1	µg/l	
TPH >C21-C40	*	05/07/24 14:27		0.1		<0.1	µg/l	
TPH >C6-C10	*	05/07/24 14:27		0.1		<0.1	µg/l	
TPH Total >C6-C40	*	05/07/24 14:27		10		<10	µg/l	
Coliforms [XD002]								
Coliforms	*	05/07/24 11:58				2	cfu/100 ml	
Escherichia coli, confirmed [XD005]								
Escherichia coli, confirmed	*	05/07/24 11:58				0	cfu/100 ml	

Results to follow:

Cyanides free [F1518]

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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Certificate Code: **PR-24-M3-000317-01**
Page Number: **Page 13 of 15**
PO reference:

Sample number	966-2024-00018621	Received on	05/07/2024
		Analysis started on	05/07/2024
Your sample reference	P1330-3-LDDW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	12:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Cyanides total [FF01Q]								
Cyanides total	*	05/07/24 14:04		1		<1	µg/l	
Dissolved Oxygen [M3005]								
Dissolved oxygen		05/07/24 13:37 [7D]	EW043	1		8.49	mg/l	
Total Nitrogen [M3007]								
Total Nitrogen		08/07/24 12:31	EW140	1		1.71	mg/l	C6
Sulphide [M3009]								
Sulphide		26/08/24 13:05	EW024	0.03		<0.03	mg/l	
Sulphate mg/L - Gallery [M300N]								
Sulphate mg/L - Gallery		05/07/24 13:19	EW175	1		24.6	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		05/07/24 13:19	EW175	0.01		0.0100	mg/l	C6
Fluoride mg/L - Gallery [M300Q]								
Fluoride mg/L - Gallery		05/07/24 13:19	EW175	0.2		<0.2	mg/l	
Chloride mg/L - Gallery [M300S]								
Chloride mg/L - Gallery		05/07/24 13:19	EW175	5		25.7	mg/l	C6
Ammonia as N - Gallery [M300Z]								
Ammonia as N - Gallery		05/07/24 13:19	EW175	0.01		<0.01	mg/l	C6
Nitrite (as N) - Gallery [M3016]								
Nitrite (as N) - Gallery		05/07/24 13:19	EW175	0.01		<0.01	mg/l	C6
Nitrate (as N) - Gallery [M301A]								
Nitrate (as N) - Gallery		05/07/24 13:19	EW175	1		2.22	mg/l	C6
Temperature (Site) [M3036]								
Temperature		05/07/24 15:32	Site Test			Not Provided	°C	
Total Phosphorus-TP [M3045]								

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Page Number: **Page 14 of 15**
PO reference:

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		Analysis started on	05/07/2024
Your sample reference	P1330-3-LDDW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	12:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Total Phosphorus-TP		09/07/24 09:19	EW146	0.02		<0.02	mg/l	
pH (Robotic Method) [M3051]								
pH		05/07/24 13:37 [7D]	EW152R	4		6.2		
Conductivity at 20°C (Robotic Method) [M3052]								
Conductivity at 20°C		05/07/24 13:37	EW152R	5		419	µS/cm	C6
Boron - Dissolved [M3163]								
Boron (B)		11/07/24 17:01	EW188	0.21		<0.21	mg/l	C6
Cadmium - Dissolved [M3164]								
Cadmium (Cd)		11/07/24 17:01	EW188			<0.1	µg/l	C6
Calcium - Dissolved [M3165]								
Calcium (Ca)		11/07/24 17:01	EW188	1.08		28.8	mg/l	C6
Copper - Dissolved [M3168]								
Copper (Cu)		11/07/24 17:01	EW188	0.003		<0.003	mg/l	C6
Iron - Dissolved [M3172]								
Iron (Fe)		11/07/24 17:01	EW188	5		12.7	µg/l	C6
Lead - Dissolved [M3173]								
Lead (Pb)		11/07/24 17:01	EW188	0.51		<0.51	µg/l	C6
Magnesium - Dissolved [M3174]								
Magnesium (Mg)		11/07/24 17:01	EW188	1.11		9.51	mg/l	C6
Manganese - Dissolved [M3175]								
Manganese (Mn)		11/07/24 17:01	EW188			162	µg/l	C6
Mercury - Dissolved [M3176]								
Mercury		11/07/24 17:01	EW188	0.03		0.0360	µg/l	C6
Nickel - Dissolved [M3178]								
Nickel (Ni)		11/07/24 17:01	EW188			<0.5	µg/l	C6

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Page Number: **Page 15 of 15**
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		Analysis started on	05/07/2024
Your sample reference	P1330-3-LDDW1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/07/2024
Time Sampled	12:00		

Test Code Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Potassium - Dissolved [M3180]								
Potassium (K)		11/07/24 17:01	EW188	0.15		3.69	mg/l	C6
Sodium - Dissolved [M3184]								
Sodium (Na)		11/07/24 17:01	EW188	1.5		15.8	mg/l	C6
Zinc - Dissolved [M3194]								
Zinc (Zn)		11/07/24 17:01	EW188	1		7.19	µg/l	C6
Aluminium - Trace [M3234]								
Aluminium		26/08/24 12:44	EW188	5		<5	µg/l	C6
Antimony - Trace [M3235]								
Antimony		26/08/24 12:44	EW188	0.1		0.803	µg/l	C6
Arsenic - Trace [M3236]								
Arsenic		26/08/24 12:44		0.2		12.7	µg/l	C6
Barium - Trace [M3237]								
Barium		26/08/24 12:44		1.77		<1.77	µg/l	C6
Chromium - Trace [M3242]								
Chromium (Cr)		11/07/24 17:01		1		<1	µg/l	C6
Selenium - Trace [M3255]								
Selenium (Se)		26/08/24 12:44		0.2		0.631	µg/l	C6

Results to follow:

Cyanides free [F1518]

[4] **Accreditiation Information**

C6: ISO/IEC 17025:2017 INAB 138-T

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HYDROLOGY AND HYDROGEOLOGY 7

APPENDIX 7-G
Rating of Existing Environment Significance / Sensitivity

HYDROLOGY AND HYDROGEOLOGY 7

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.

HYDROLOGY AND HYDROGEOLOGY 7

APPENDIX 7-H
Descriptions of Effects (EPA, May 2022)

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 Frequency of Effects	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting less than a day
	Temporary Effects	Effects lasting less than a year
	Short-term Effects	Effects lasting one to seven years
	Medium-term Effects	Effects lasting seven to fifteen years
	Long-term Effects	Effects lasting fifteen to sixty years

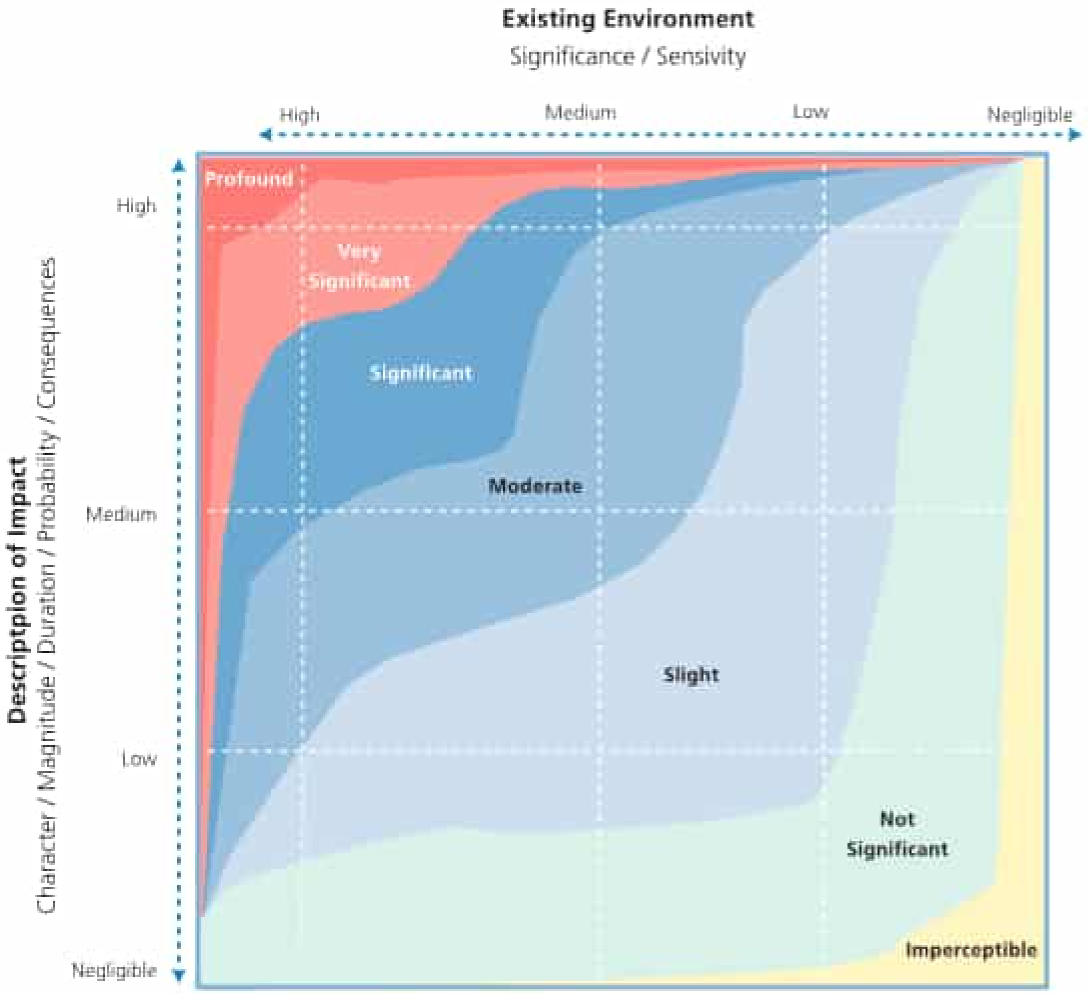
Impact Characteristic	Term	Description
	Permanent Effects	Effects lasting over sixty years
	Reversible Effects	Effects that can be undone, for example through remediation or restoration
	Frequency of Effects	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – 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 2022)

HYDROLOGY AND HYDROGEOLOGY 7

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.

Equipment hire Cost

Hire of temporary 2 stream arsenic removal plant as describe above	£3,500 per week or part thereof
Optional hire of filter press to dewater the sludge	£950 per week or part thereof
Delivery and collection	TBC dependent upon site location and vehicle type
Plant setup and commissioning Over a 5 day period	£3,500 + engineer transportation, sustenance & accommodation

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.

Our Standard Terms and Conditions of Hire & Sales are as follows:

I. All Costs are in Pounds Sterling and exclude VAT

II. Proforma Invoice on all new accounts and those which have been dormant for 6 months or more, covering:
    - Hires:- delivery, collection, installation costs and first months hire
    - Purchases:- 40% of purchase cost

III. Costs are valid for 30 days from 13th March, 2017.

IV. Hire terms are standard Construction Plant Hire Association Conditions, Latest Edition

V. Sale Terms are Siltbuster Standard Conditions of Sale (Available on request)

VI. Invoices are raised Monthly and Payment terms are strictly 30 days from date of invoice.

VII. No other terms and conditions are accepted, including those purported to apply under any purchase or confirmation order placed by the Client.

VIII. Client is responsible for the operation/maintenance of the equipment whilst on hire and ensuring the treated water is discharged/disposed of in accordance with the relevant legislation. The client is also responsible for any site specific operational permits/authorisations/consents required and Health and Safety issues relating to the storage and use of chemicals on site.

IX. All hired units are to be visually cleaned of all settled sludge & oil residues before return. Units returned containing sludge and or oil residues will incur a cleaning cost plus any waste disposal fees (charged at cost) and the unit will remain on hire whilst the waste is tested to determine an appropriate disposal method in accordance with the relevant statutory regulations.

X. Transport Costs for Delivery & Collection are as Quoted above. Collection Charge may vary if individual units from multiple unit deliveries are off-hired and collected separately.

Dr Richard Coulton

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Tel: 01600 772256 Fax: 01600 775312
E-mail: enquires@siltbuster.com
Web: www.siltbuster.com

SE14027-KD-02
12th April, 2017

Michael Gill
Hydro Environmental Services

By Email: michael@hydroenvironmental.ie

Arsenic Removal from Quarry Water
Ireland

Dear Michael,

Further to our previous conversations regarding the treatment of waters with elevated concentrations of dissolved Arsenic at your quarry project site, please find below a summary of results following the treatment process outlined in SE14027-01 on the 3No. samples which were sent to our Monmouth facility.

As received

Sample ID	pH	TSS Mg/l	Total Arsenic Mg/l	Dissolved Arsenic mg/l
Sample A	8.4	3.2	1.5	1.5
Sample B	8.41	1.4	1.5	1.5
Sample C	8.39	0.6	1.5	1.5

The waters were then dosed with the outlined chemicals using the below molar ratios and then provided with a retention time of circa 45 minutes.

Water Treatment Chemicals	**Ratio**	
Hydrogen Peroxide at a molar ratio of	10 :1	
	H_2O_2	As
Iron at a molar ratio of	20 : 1	
	Fe	As

Treated water Quality

Sample ID	pH	TSS Mg/l	Total Arsenic Mg/l	Dissolved Arsenic mg/l
Sample A	6.81	1	0.005	<0.005
Sample B	6.82	3	0.01	<0.005
Sample C	6.81	3	0.02	<0.005

Our Standard Terms and Conditions of Hire & Sales are as follows:

I. All Costs are in Pounds Sterling and exclude VAT
II. Proforma Invoice on all new accounts and those which have been dormant for 6 months or more, covering:
    - Hires:- delivery, collection, installation costs and first months hire
    - Purchases:- 40% of purchase cost
III. Costs are valid for 30 days from 12th April, 2017.
IV. Hire terms are standard Construction Plant Hire Association Conditions, Latest Edition
V. Sale Terms are Siltbuster Standard Conditions of Sale (Available on request)
VI. Invoices are raised Monthly and Payment terms are strictly 30 days from date of invoice.
VII. No other terms and conditions are accepted, including those purported to apply under any purchase or confirmation order placed by the Client.
VIII. Client is responsible for the operation/maintenance of the equipment whilst on hire and ensuring the treated water is discharged/disposed of in accordance with the relevant legislation. The client is also responsible for any site specific operational permits/authorisations/consents required and Health and Safety issues relating to the storage and use of chemicals on site.
IX. All hired units are to be visually cleaned of all settled sludge & oil residues before return. Units returned containing sludge and or oil residues will incur a cleaning cost plus any waste disposal fees (charged at cost) and the unit will remain on hire whilst the waste is tested to determine an appropriate disposal method in accordance with the relevant statutory regulations.
X. Transport Costs for Delivery & Collection are as Quoted above. Collection Charge may vary if individual units from multiple unit deliveries are off-hired and collected separately.

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.

Clear Form

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: $R2^{1}$

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		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			Structureless			
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]

1. Septic tank system (septic tank and percolation area) No

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

Discharge Route

Discharge to Ground Water

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)

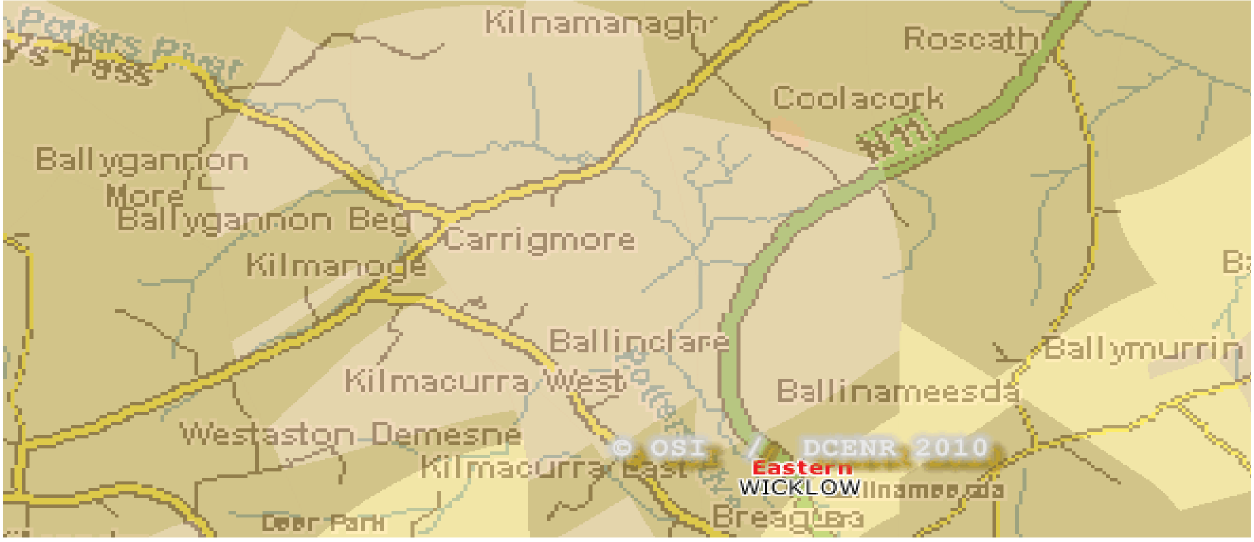
Date of Report: 30/10/2014

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

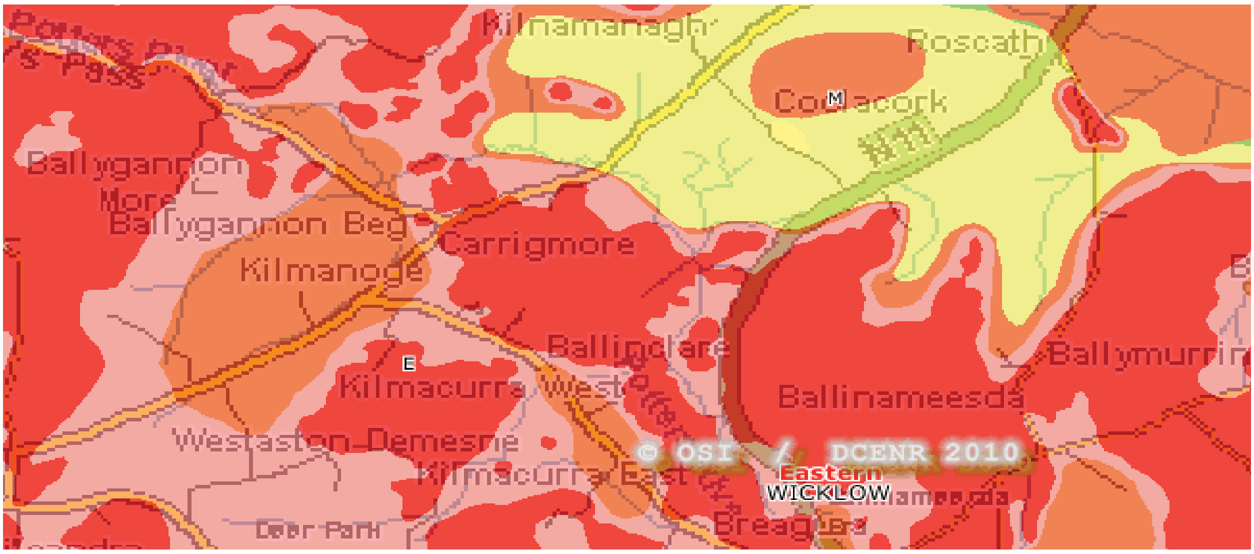
Indemnity Insurance Number: BOEU01PI901

Signature:

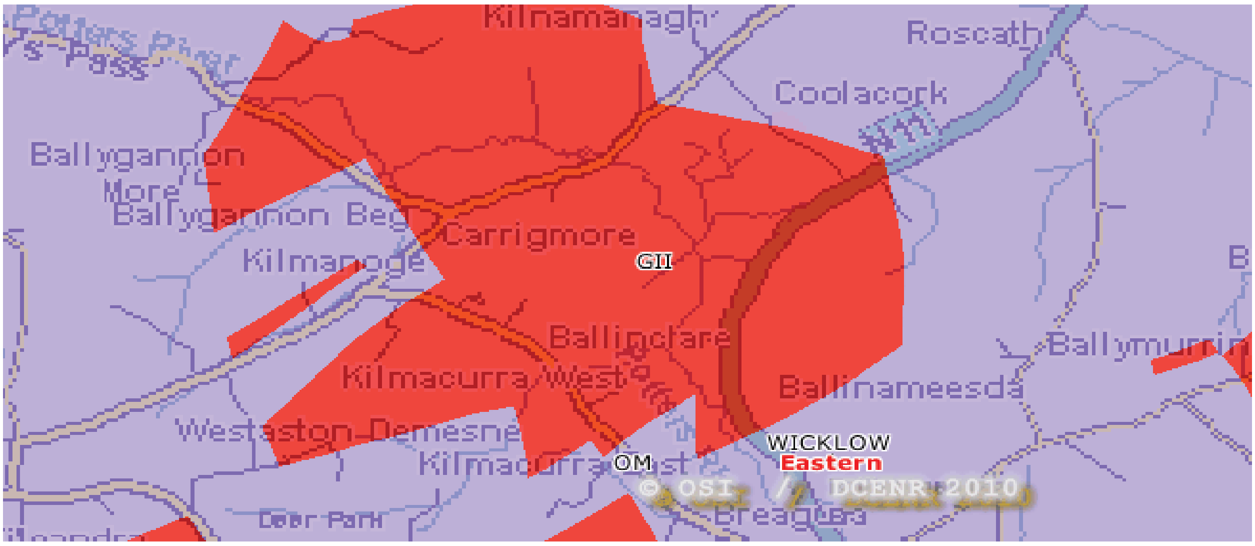
Maps - Aquifer, Vulnerability, Bedrock



Aquifer is PI

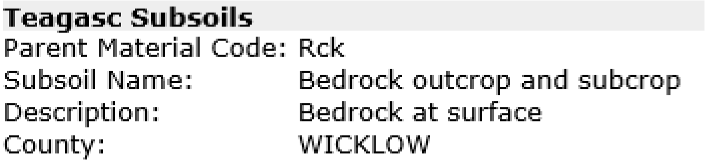


Vulnerability is Extreme



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	Planning applicant*	Specifier details
Dr. Eugene Bolton Clonfert maynooth Co. Kildare * Address is the site address	Mr. Kilsaran Concrete Ballinclare Quarry Wicklow Co. Wicklow	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

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.

Our customers range from homeowners to major commercial, municipal and utility clients, united in seeking cost-effective solutions based on environmentally sound principles. Anua exists to serve both our customers and the natural environment.

Across a broad range of sectors in countries around the world, our customers trust us to deliver the best sustainable solutions, backed by superior customer service. That is why we work with our clients throughout every project to achieve the best possible result, one that will build both our reputations.

Anua enjoys the benefit of the support of a highly respected parent company with over 20 years experience in developing sustainable clean air and clean water solutions. As part of this wider organisation, we adhere to their world-class standards and values for both the technology we provide and the service we give our customers.

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.

Customised for Customers

Customers need a partner – and products – they can trust. Like nature itself, Anua must be adaptable and responsive to change. That means developing the solutions that best suit each individual project.

For Anua staff, understanding their customers' world is their business. That depth of understanding is matched by the depth of our customer support and focus. We work with clients to design solutions that are technically superior and cost-effective.

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

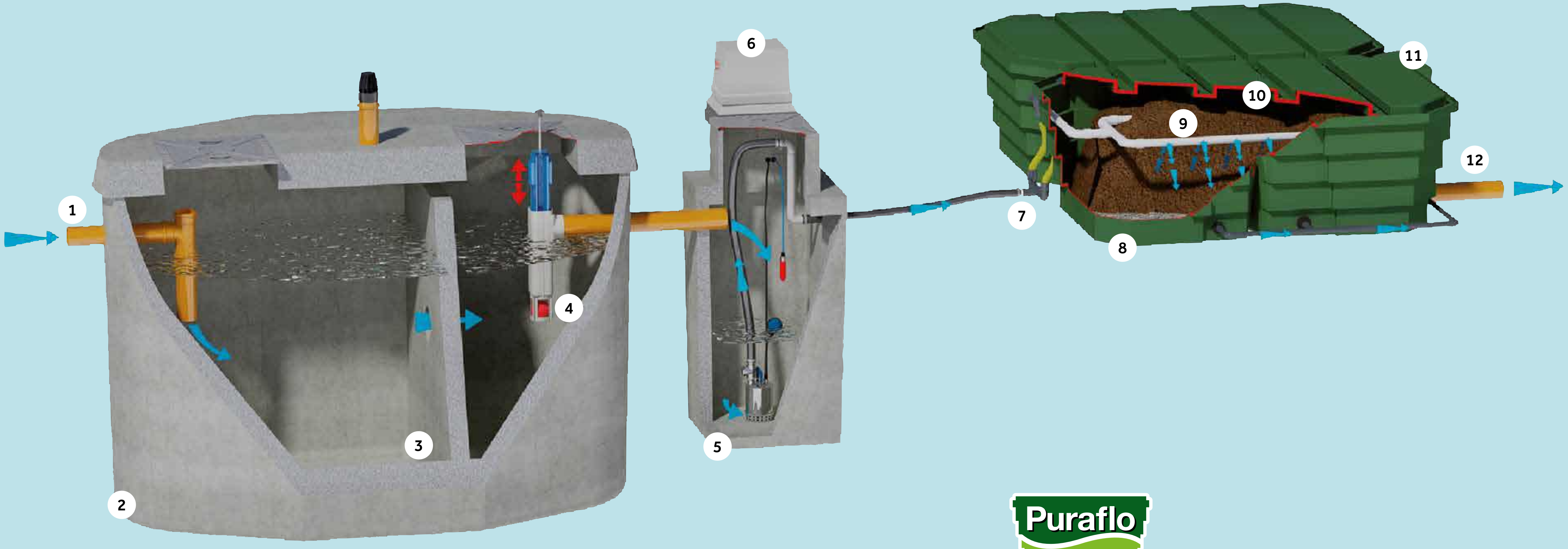
The Puraflo Residential System is an advanced sustainable technology for the treatment of wastewater in domestic homes.

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.

Free pre-planning and site reports

Free no obligation quotations

Nationwide maintenance call-out service

Expert customer support

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

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.

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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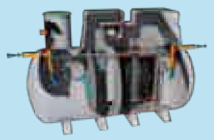
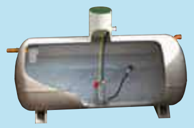
Renew



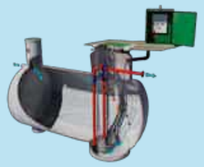
Wastewater Treatment

Recover



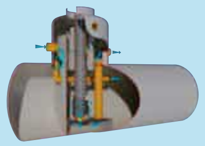
Rainwater Harvesting

Re-direct



Pumps

Recycle

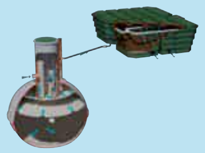


SUDS

Rarefy

Odour Abatement

Retain



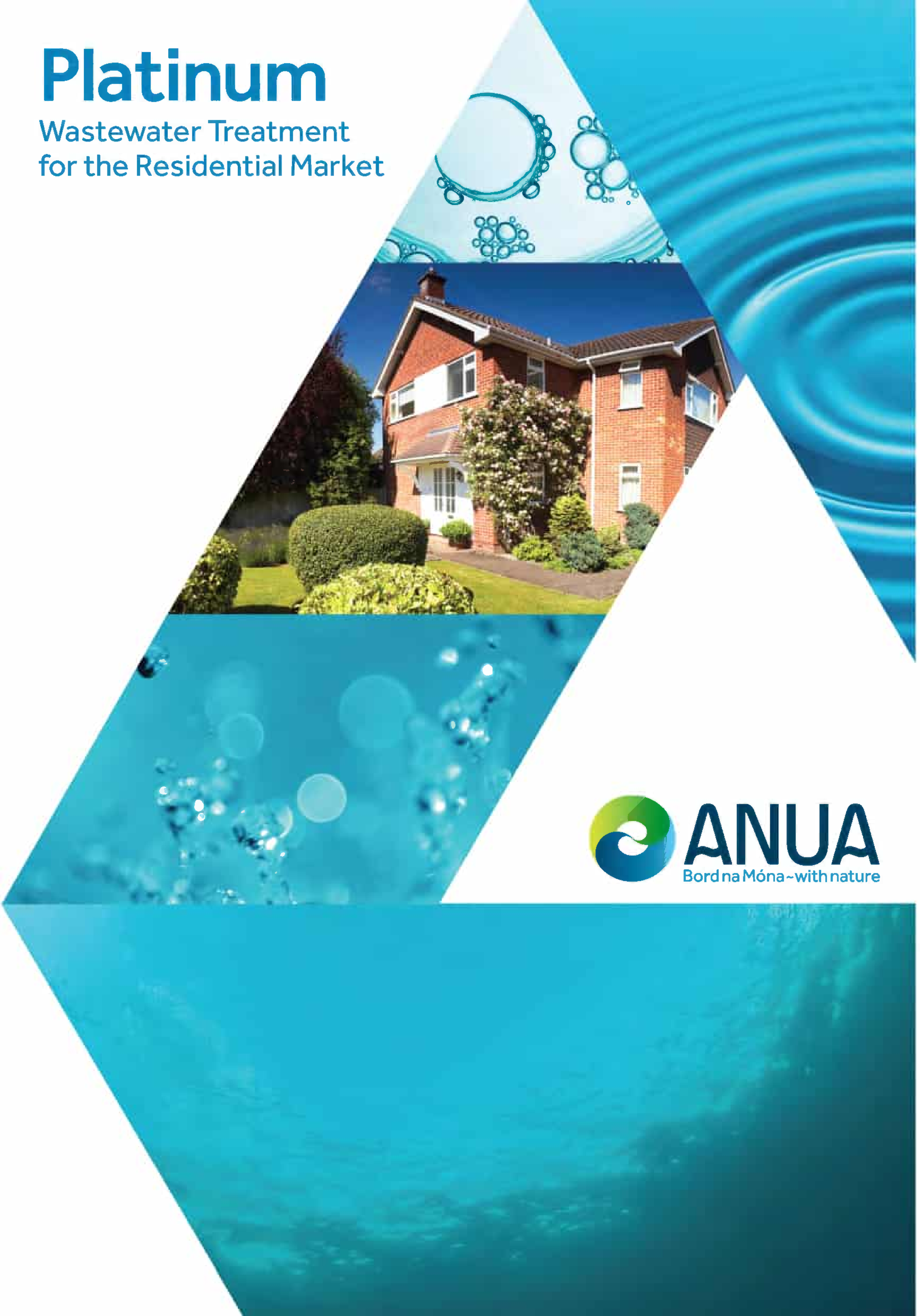
Holding Tanks

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.

Paper made from trees matured in sustainable, well managed forests and is certified to FSC standards

Platinum

Wastewater Treatment for the Residential Market



ANUA
Bord na Móna ~ with nature

Technology That Serves Customers and the Environment

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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	

PIA
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	m^3/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.

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.

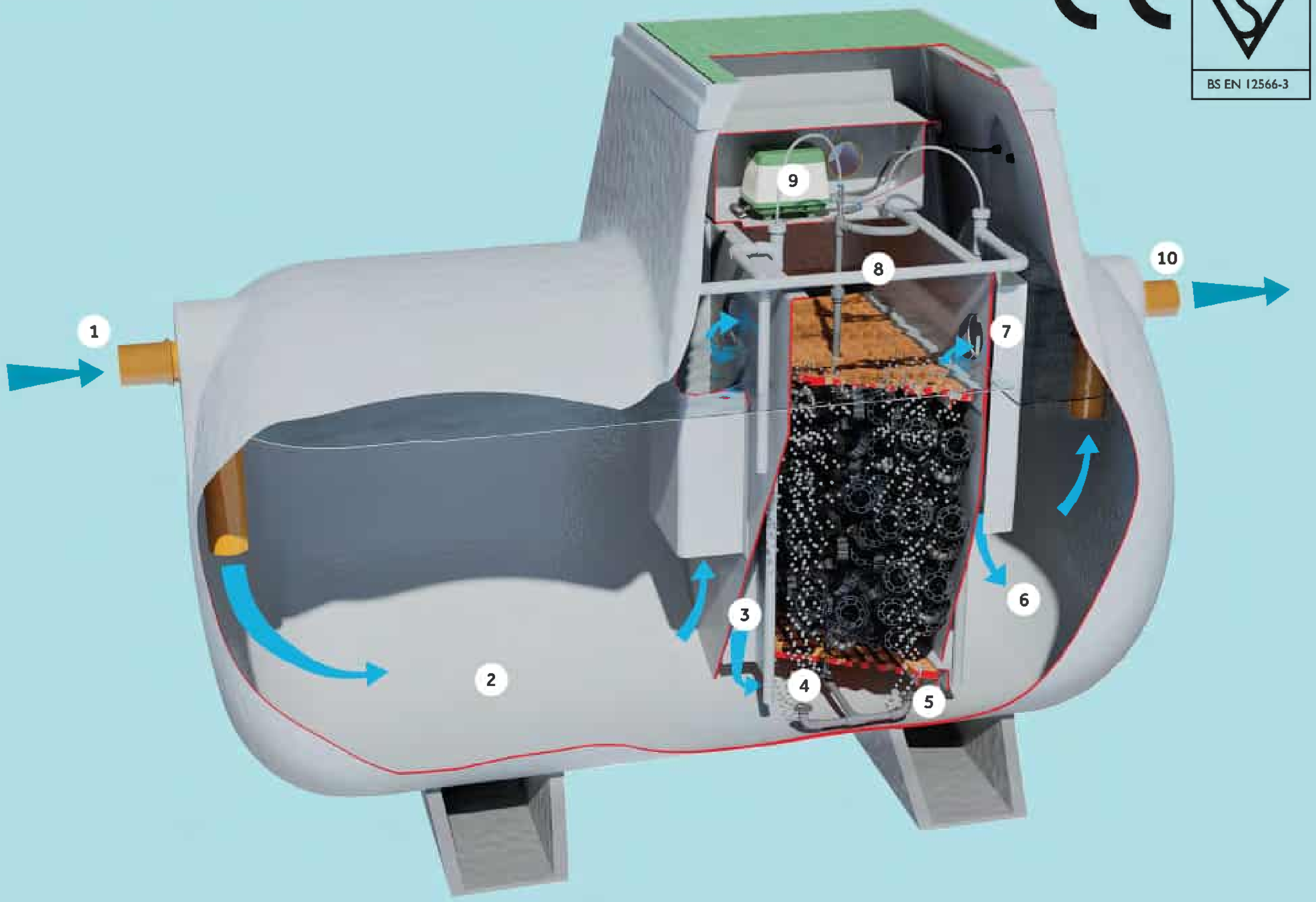
Stage Two: Submerged Aerated Filtration - Biological Treatment

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.

BS EN 12566-3



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)	230v 1ph	230v 1ph	230v 1ph
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.

QMS ISO 9001 REGISTERED FIRM
QMS ISO 14001 REGISTERED FIRM
SAFEcontractor APPROVED
riba product selector
ENGINEERS IRELAND cpd ACCREDITED EMPLOYER

BRITISH WATER expertise worldwide
IRISH WATER Treatment Association
NSAI Agrément
CE
BS EN 12566-3
UVDB empowered by Achilles

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.

Free pre-planning and site reports

Free no obligation quotations

Nationwide maintenance call-out service

Expert customer support

The Anua Guarantee

Every Platinum 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

Simple Installation, Minimum Maintenance

While the Platinum 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.

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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e usainfo@anuainternational.com

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

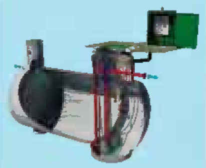
Renew

Wastewater Treatment

Recover

Rainwater Harvesting

Re-direct

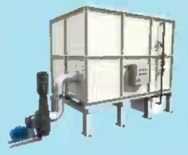


Pumps

Recycle

SUDS

Rarefy



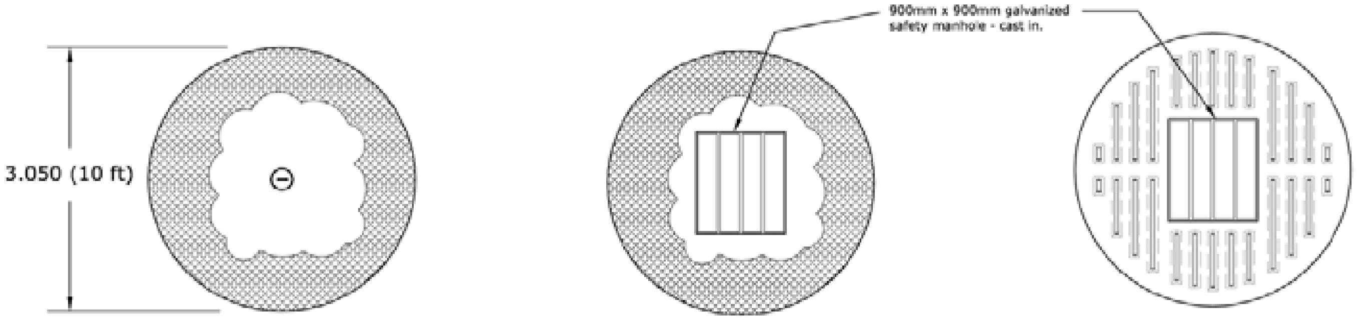
Odour Abatement

Retain

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.

2500 GALLON (11.36 cubic metre) TANK

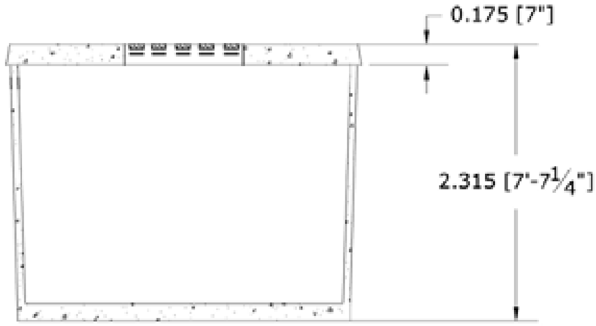


Lid with 9" pot

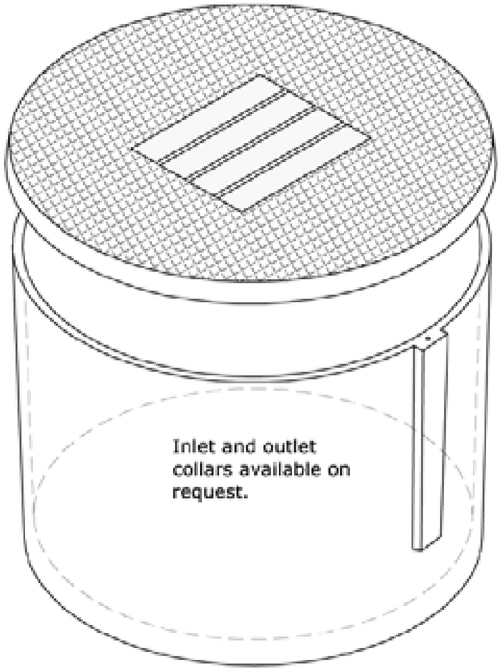
Lid with Standard Safety Manhole

Lid with Slatted Cover with Standard Safety Manhole

Lid Plan Options



SECTION



3D VIEW

1. Select lid suitable to your application.
2. Select inlet and outlets location if desired, mark location and size of these on the drawing.
3. Fill out the farm order confirmation with drawings and post it to out office.

Tanks require a level, well compacted base of CI 804, thickness of which will depend on site conditions typically 150mm thick (1/2ft).

Lorry must be able to reverse to the edge of the excavation.

Tank is then installed by a crane at the rear of the lorry.

After installation we recommend filling the tank with water to prevent flotation until backfilling is complete (only in high water table areas).

Site with a high water table may require a hoop of concrete with rebar at the base of the tank to prevent flotation.

Tank should be backfilled with material free of boulders and large stones.

Weight of base 5.5 Te   Weight of Lid 2.85 Te

Solid lids can carry 5.8 Te wheel load

Slatted lids can carry 4 Te wheel load

HYDROLOGY AND HYDROGEOLOGY 7

APPENDIX 7-L
Q Rating Assessment Report

Kilsaran

Biological Q Value Assessment

Ballinclare Quarry

Co. Wicklow

Prepared for:

Kilsaran

Piercetown

Co. Meath

Prepared by:

JKW Environmental

Easkey

Co. Sligo

June 2024

Client: Kilsaran

Biological Q Value Assessment

Document Stage	Document Version	Prepared by	Approved by
Final	1	Katie Neary BSc(Hons)	Jamie Wood

STATEMENT OF AUTHORITY

This report is written Katie Neary. She is a Senior Ecologist with JKW Environmental. Katie has completed an honours B.Sc.. in Environmental Science. She is an Associate member of the Institution of Environmental Sciences (IES). She regularly carries out reporting on Ecological Impact Assessment and to inform Natura Impact Assessments / Appropriate Assessments carried out by statutory authorities. Furthermore, she has several years' experience in habitat surveys, mammal surveys, bird and bat surveys for a number of large infrastructure schemes, commercial and residential projects. Katie is an experienced Ecological Clerk of Works (ECoW).

This report was reviewed by Jamie Wood. Jamie holds a Degree in Environmental Science and a Masters Degree in Environmental Management, Health and Safety. Jamie is a full member of the Institute of Environmental Science and the Association of Ecological and Environmental Clerk of Works. Jamie is also Chartered with the Society for the Environment holding the postnominal C.Env. Over the past 20 years, working as an Environmental / Ecological Consultant, Jamie has gained extensive experience in a range of ecological surveys and assessment techniques including bird surveys, bat surveys and Ecological Clerk of Works.

Kilsaran – Ballinclare
Biological Q Value Assessment – Potter’s River

Contents

1. Introduction

Kilsaran are required to carry out a Biological Q Value Assessment of the Potter's River north of the Ballinclare site monthly to assess potential impacts of dewatering activities at the site. JKW Environmental have been commissioned by Kilsaran to conduct this assessment.

Sampling was carried out at upstream and downstream locations which were selected by Kilsaran, taking into account safe and available access, and agreed upon by Wicklow County Council. Sampling was carried out on the 19th June 2024.

The locations of each monitoring point surveyed are provided in Figure 2.1. Biological water quality was assessed through kick-sampling each of these monitoring points. Macroinvertebrate samples were converted to Q-ratings as per Toner et al. (2005)[1] . The applied Q ratings followed the EPA water quality classes and Water Framework Directive status categories. All riverine samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute sample, as per ISO standards for water quality sampling (ISO 10870:2012). Large cobble was also washed at each site where present. The results of the surveys at all sites are provided below.

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2. Methodology

The Biological Water Quality Assessment took place in accordance with Biological monitoring based on Q- Value assessments which conforms to prescribed EPA methodology on Biological Assessments laid out in the Water Framework Directive.

Treated dewatering discharge from the Ballinclare site flows under gravity along a channel to the outflow point located along the Ballinclare stream. The Ballinclare steam joins with the Potter's River approximately 400m downstream of the discharge point. Two sampling locations situated on the Potter's River were sampled as part of this assessment; one sampling location upstream of the site discharge point and one downstream of the discharge point. The assessment will measure any changes in aquatic ecology downstream of the point at which site outflow enters the river system.

The assessment will determine if there has been any discernible deterioration in water quality downstream of the development when compared to upstream water quality.

Certain organisms which have a sensitivity or a tolerance to physio-chemical changes in their aquatic environment can be used as water quality indicators. The assessment comprised of: kick sampling at each monitoring location, followed by an examination of macroinvertebrates collected during sampling. The relative abundance of key groups of macroinvertebrates was assessed to determine a water quality 'Q' value at each monitoring location. This system divides macroinvertebrates into five indicator groups based on their sensitivity to pollution. The groups range from Group A, the sensitive forms, Group B the less sensitive forms, Group C, the tolerant forms, Group D, the very tolerant forms and Group E, the most tolerant forms.

Other relevant factors such as the intensity of algal and/or weed development, water turbidity, bottom siltation, substratum, water depth and dissolved oxygen content were also taken into account during the assessment procedure.

The relationship between community composition and water quality are as follows.

Table 2.1: Relationship between community composition and water quality.

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

Prescribed methodology outlines a number of relative abundance level approaches. Abundance levels can be determined with reference to one or more of the tables below.

Table 2.2: Abundance categories and relationships to percentage frequency of occurrence

Abundance Category	**Approximate percentage frequency of occurrence**
Absent	No specimens
Present	1 or 2 individuals
Scare/few	<1% of total fauna
Small numbers	<5%
Fair numbers	5-10%
Common	10-20%
Numerous	25-50%
Dominant	50-75%
Excessive	>75%

Table 2.3: Macroinvertebrates grouped according to their sensitivity to organic pollution ((McGarrigle et al., 2002).

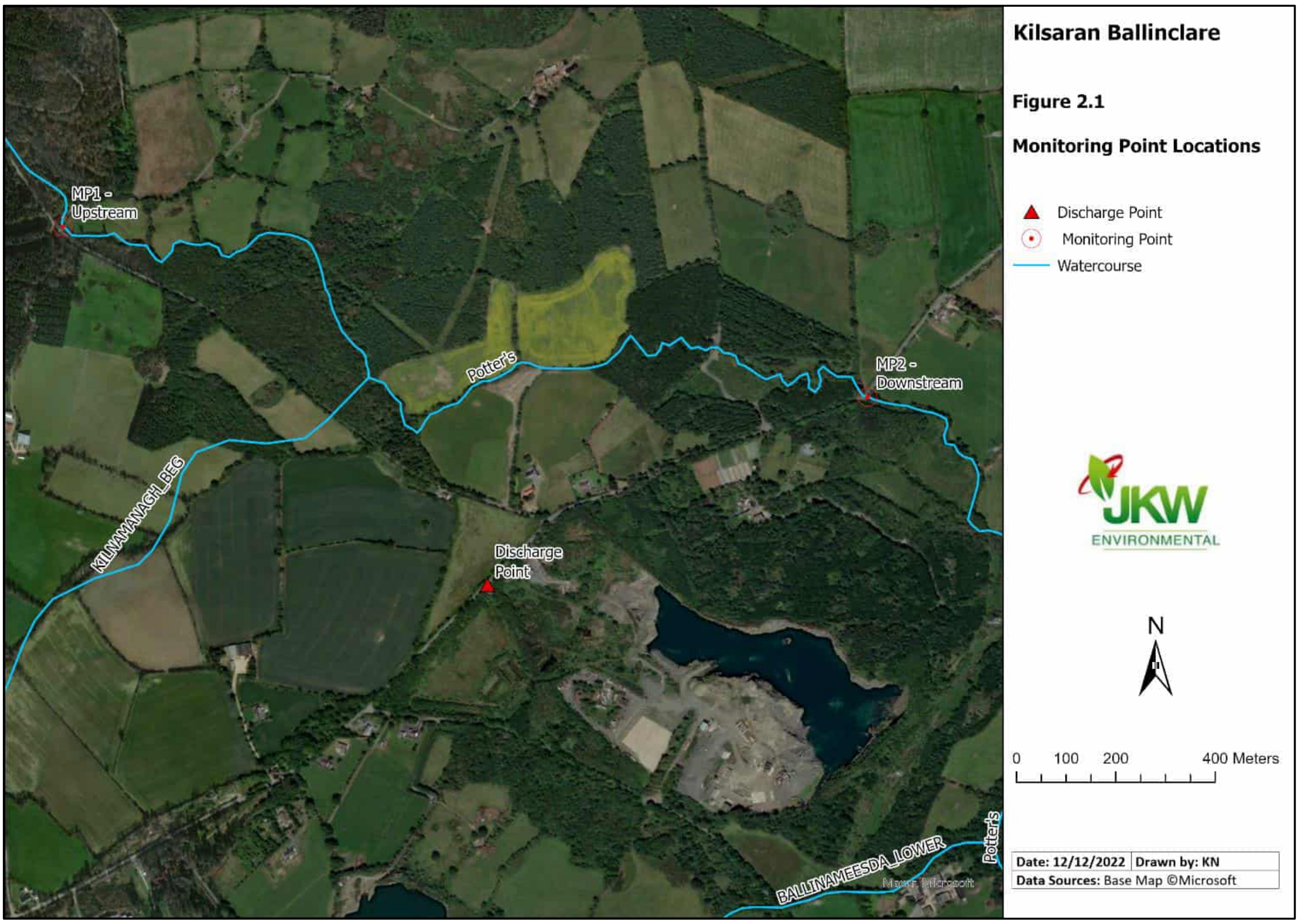
Macroinvertebrates grouped according to their sensitivity to organic pollution					
TAXA	**Group A**	**Group B**	**Group C**	**Group D**	**Group E**
	Sensitive	*Less Sensitive*	*Tolerant*	*Very Tolerant*	*Most Tolerant*
Plecoptera	All except *Leuctra* spp.	*Leuctra* spp.			
Ephemeroptera	Heptageniidae Siphlonuriidae *Ephemera dancia*	Baetidae (excl. *Baetis rhondani*) Leptophlebidae	*Baetis rhodani* Caenidae Ephemerellidae		
Trichoptera		Cased spp.	Uncased spp.		
Odonata		All taxa			
Megaloptera				Sialidae	
Hemiptera		*Aphelocheirus aestivalis*	All except *A. aestivalis*		
Coleoptera			Coleoptera		
Diptera			Chironomidae (excl. *Chironomus* spp.) Simuliidae Tipulidae		*Chironomus* spp. *Eristalis* sp.
Hydracarina			Hydracarina		
Crustacea			*Gammarus* spp. *Austropotamobius pallipes*	*Asellus* spp. *Crangonyx* spp.	
Gastropoda			Gatropoda (excl. *Lymnaea peregra* & *Physa* sp.)	*Lymnaea peregra* *Physa* sp.	
Lamellibranchiata	*Margaritifera margaritifera*		*Anodonata* spp.	Sphaeriidae	
Hirudinea			*Piscicola* sp.	All except *Piscicola* sp.	
Oligochaeta					Tubificidae
Platyhelminths			All		

Table 2.4: Macroinvertebrates and other environmental parameters grouped according to their sensitivity to organic pollution (McGarrigle et al., 2002).

Biological Assessment of Water Quality in Eroding Reaches (Riffles & Glides) of Rivers and Streams*						
Biotic Indices (Q Values) and typical associated macroinvertebrate community structure						
Macroinvertebrate Faunal Groups	**Q5**	**Q4**	**Q3-4**	**Q3**	**Q2**	**Q1**
Group A	At least 3 taxa well represented	At least 1 taxon in reasonable numbers	At least 1 taxon Few - Common	Absent	Absent	Absent
Group B	Few to Numerous	Few to Numerous	Few/Absent to Numerous	Few/Absent	Absent	Absent
Group C	Few	Common to Numerous Baetis rhondani often abundant Others: never Excessive	Common to Excessive (usually Dominant or Excessive)	Dominant to Excessive	Few or Absent	Absent
Group D	Few or Absent	Few or Absent	Few/Absent to Common	Few/Absent to Common	Dominant to Excessive	Few/Absent
Group E	Few or Absent	Few or Absent	Few or Absent	Few or Absent	Few/Absent to Common	Dominant
Additional Qualifying Criteria						
Cladophora spp. Abundance	Trace only or None	Moderate growths (if present)	May be Abundant to Excessive growths	May be Excessive growths	Few or Absent	None
Macrophytes (Typical abundance)	Normal growths or absent	Enhanced growths	May be Luxuriant growths	May be Excessive growth	Absent to Abundant	Present/ Absent
Slime Growths (Sewage Fungus)	Never	Never	Trace or None	May be Abundant	May be Abundant	None
Dissolved Oxygen Saturation	Close to 100% at all times	80% - 120%	Fluctuates from <80% to >120%	Very unstable. Potential fish-kills	Low (but >20%)	Very low, sometimes zero
Substratum Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic
Note occurrence/abundance of groups in above table refers to some but not necessarily all of the constituents of the group. The Additional Qualifying Criteria apply in virtually all circumstances. Single specimens may be ignored. Seasonal and other relevant factors (i.e., drought, floods) must be taken into account. *Mactoinvertebrate criteria do not apply to rivers with mud, bedrock or sand substrata, very sluggish or torrential flow, head-water or high altitude streams and those affected by significant ground water input, excessive calcification, drainage, canalisation, culverting, marked shading etc.						

2.1 Sampling Locations

The discharge point is located along the Ballinclare stream. The downstream monitoring point (MP2) is located at the confluence of the Ballinclare stream and the Potter’s River, c. 685m downstream from the discharge point. The upstream monitoring point (MP1) is located along Potter’s River. The location of MP1 was chosen to facilitate the assessment of any potential impacts on water quality within Potter’s River. MP1 is located c. 1.8km upstream of Potter’s bridge and MP2. Figure 2.1 shows the location of MP1, MP2 and the discharge point.



3. Results

3.1 MP1

The Q rating assigned to MP1 was **Q4**. It was assigned this value as two taxon of Group A macroinvertebrates were present. Two Group B taxon were common. Group C macroinvertebrates were dominant in terms of the diversity of taxa, however, were present in small numbers; Group E macroinvertebrates were present. The water was clear and there was a moderate flow. The substrate was comprised of bedrock, boulders, gravel and fine gravel. Siltation was low. A significant amount of clearance of vegetation was evident at the upstream location.

Table 3.1 – Macroinvertebrates recorded at MP1

Indicator Group	**Taxon**	**Dominance**
Group A - Sensitive	Heptageniidae	Common
	Plecoptera	Common
Group B - Less Sensitive	Trichoptera (cased spp.)	Common
	Baetidae	Fair numbers
Group C - Tolerant	Trichoptera (uncased spp.)	Fair numbers
	Piscicola sp.	Fair numbers
	Gammarus spp.	Present
	Coleoptera	Fair numbers
	Planorbidae	Present
Group E - Most Tolerant	*Chironomus* spp.	*Scare/few*

Figure 3.1 – MP1 (Upstream)

3.2 MP2

The Q rating assigned to MP2 was **Q4.** It was assigned this value as two Group A taxon were present in fair numbers and Group B macroinvertebrates were common; Group C macroinvertebrates were dominant in terms of the diversity of taxa present in fair to small numbers; Group E macroinvertebrates were present. The water was clear and there was a high flow. The substrate was comprised of bedrock, boulders and fine gravel. Siltation is increasing upstream and downstream of the bridge. This monitoring location was downstream of an area of access for livestock to the river. There is a large build-up of debris at the bridge causing turbidity and fast velocity. Sampling was only possible at the river edges.

Macroinvertebrates present in the sample collected at this location are shown in the table below.

Table 3.2 – Macroinvertebrates recorded at MP2

Indicator Group	Taxon	Dominance
Group A - Sensitive	Heptageniidae	Common
	Plecoptera	Common
Group B - Less Sensitive	Trichoptera (cased)	Common
	Baetidae	Common
Group C - Tolerant	Coleoptera	Small numbers
	Trichoptera (uncased spp.)	Small numbers
	Gammarus spp.	Present
	Piscicola sp.	Scarce/few
Group E - Most Tolerant	*Chironomus* spp.	Small numbers

Figure 3.2 – MP2 (Downstream)

4. Conclusion

Based on the groups present and their relative abundance a Q Value rating of Q4 'Good' water quality was assigned to MP1. MP2 was classified as Q4 'Good' water quality as per Water Framework Directive.

Monthly biological Q Value sampling has been carried out at MP1 and MP2 since December 2022. No sampling was carried out in October 2023 due to weather conditions and high flows at both monitoring points. Upstream and downstream Q Values have been recorded as fluctuating between Q 3-4 and Q4.

Based on the conducted kick sampling and using a direct comparison of samples taken upstream and downstream from December 2022 to June 2024 it can be concluded that discharges from dewatering at Ballinclare Quarry have not had any notable adverse impact on the aquatic ecosystem of the Potter's River.

There is significant build up of debris at bridge located at MP2. Structures are present on the upstream side of the bridge and have recently become blocked with a large amount of debris. This is creating a large pool at the bridge and flooding into adjacent land. A large amount of fine sediments has built up in this area. The obstructions are creating a high velocity as the water passes through the bridge. The debris build up and accumulation of sediments could have an impact on water quality at MP2 in the future. It should be noted that the build up of debris and sediment up-stream of MP2 is not connected to dewatering works at Ballinclare quarry.

Kilsaran

Biological Q Value Assessment

Ballinclare Quarry

Co. Wicklow

Prepared for:

Kilsaran

Piercetown

Co. Meath

Prepared by:

JKW Environmental

Easkey

Co. Sligo

July 2024

Client: Kilsaran

Biological Q Value Assessment

Document Stage	Document Version	Prepared by	Approved by
Final	1	Katie Neary BSc(Hons)	Jamie Wood

STATEMENT OF AUTHORITY

This report is written Katie Neary. She is a Senior Ecologist with JKW Environmental. Katie has completed an honours B.Sc.. in Environmental Science. She is an Associate member of the Institution of Environmental Sciences (IES). She regularly carries out reporting on Ecological Impact Assessment and to inform Natura Impact Assessments / Appropriate Assessments carried out by statutory authorities. Furthermore, she has several years' experience in habitat surveys, mammal surveys, bird and bat surveys for a number of large infrastructure schemes, commercial and residential projects. Katie is an experienced Ecological Clerk of Works (ECoW).

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Kilsaran – Ballinclare
Biological Q Value Assessment – Potter's River

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Table 2.3: Macroinvertebrates grouped according to their sensitivity to organic pollution ((McGarrigle et al., 2002).

Macroinvertebrates grouped according to their sensitivity to organic pollution					
TAXA	**Group A**	**Group B**	**Group C**	**Group D**	**Group E**
	Sensitive	*Less Sensitive*	*Tolerant*	*Very Tolerant*	*Most Tolerant*
Plecoptera	All except L*euctra* spp.	*Leuctra* spp.			
Ephemeroptera	Heptageniidae Siphlonuriidae *Ephemera dancia*	Baetidae (excl. *Baetis rhondani*) Leptophlebidae	*Baetis rhodani* Caenidae Ephemerellidae		
Trichoptera		Cased spp.	Uncased spp.		
Odonata		All taxa			
Megaloptera				Sialidae	
Hemiptera		*Aphelocheirus aestivalis*	All except *A. aestivalis*		
Coleoptera			Coleoptera		
Diptera			Chironomidae (excl. *Chironomus* spp.) Simuliidae Tipulidae		*Chironomus* spp. *Eristalis* sp.
Hydracarina			Hydracarina		
Crustacea			*Gammarus* spp. *Austropotamobius pallipes*	*Asellus* spp. *Crangonyx* spp.	
Gastropoda			Gatropoda (excl. *Lymnaea peregra* & *Physa* sp.)	*Lymnaea peregra* *Physa* sp.	
Lamellibranchiata	*Margaritifera margaritifera*		*Anodonata* spp.	Sphaeriidae	
Hirudinea			*Piscicola* sp.	All except *Piscicola* sp.	
Oligochaeta					Tubificidae
Platyhelminths			All		

Table 2.4: Macroinvertebrates and other environmental parameters grouped according to their sensitivity to organic pollution (McGarrigle et al., 2002).

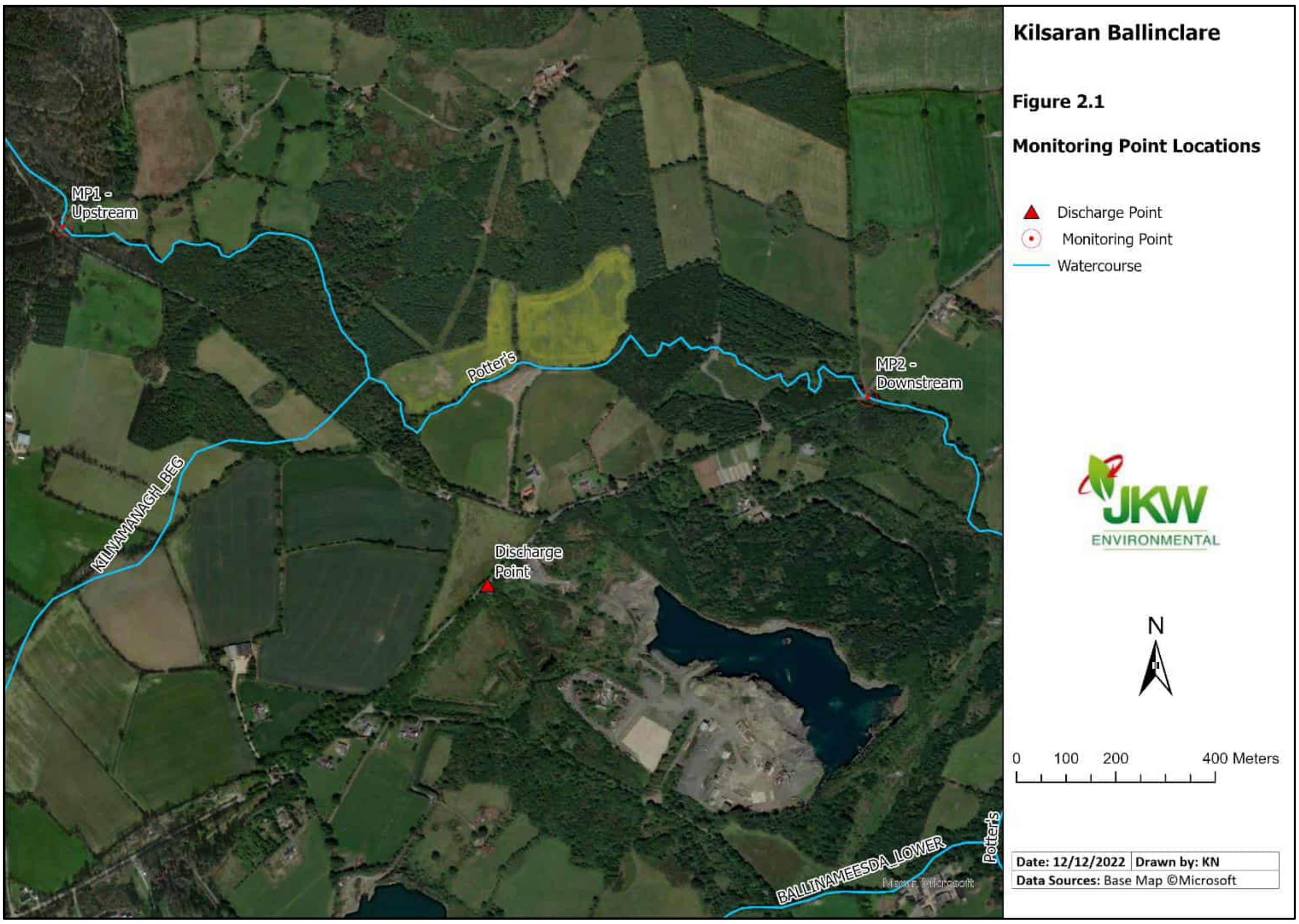
Biological Assessment of Water Quality in Eroding Reaches (Riffles & Glides) of Rivers and Streams*						
Biotic Indices (Q Values) and typical associated macroinvertebrate community structure						
Macroinvertebrate Faunal Groups	**Q5**	**Q4**	**Q3-4**	**Q3**	**Q2**	**Q1**
Group A	At least 3 taxa well represented	At least 1 taxon in reasonable numbers	At least 1 taxon Few - Common	Absent	Absent	Absent
Group B	Few to Numerous	Few to Numerous	Few/Absent to Numerous	Few/Absent	Absent	Absent
Group C	Few	Common to Numerous Baetis rhondani often abundant Others: never Excessive	Common to Excessive (usually Dominant or Excessive)	Dominant to Excessive	Few or Absent	Absent
Group D	Few or Absent	Few or Absent	Few/Absent to Common	Few/Absent to Common	Dominant to Excessive	Few/Absent
Group E	Few or Absent	Few or Absent	Few or Absent	Few or Absent	Few/Absent to Common	Dominant
Additional Qualifying Criteria						
Cladophora spp. Abundance	Trace only or None	Moderate growths (if present)	May be Abundant to Excessive growths	May be Excessive growths	Few or Absent	None
Macrophytes (Typical abundance)	Normal growths or absent	Enhanced growths	May be Luxuriant growths	May be Excessive growth	Absent to Abundant	Present/ Absent
Slime Growths (Sewage Fungus)	Never	Never	Trace or None	May be Abundant	May be Abundant	None
Dissolved Oxygen Saturation	Close to 100% at all times	80% - 120%	Fluctuates from <80% to >120%	Very unstable. Potential fish-kills	Low (but >20%)	Very low, sometimes zero
Substratum Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic

Note occurrence/abundance of groups in above table refers to some but not necessarily all of the constituents of the group. The Additional Qualifying Criteria apply in virtually all circumstances. Single specimens may be ignored. Seasonal and other relevant factors (i.e., drought, floods) must be taken into account.

*Mactoinvertebrate criteria do not apply to rivers with mud, bedrock or sand substrata, very sluggish or torrential flow, head-water or high altitude streams and those affected by significant ground water input, excessive calcification, drainage, canalisation, culverting, marked shading etc.

2.1 Sampling Locations

The discharge point is located along the Ballinclare stream. The downstream monitoring point (MP2) is located at the confluence of the Ballinclare stream and the Potter's River, c. 685m downstream from the discharge point. The upstream monitoring point (MP1) is located along Potter's River. The location of MP1 was chosen to facilitate the assessment of any potential impacts on water quality within Potter's River. MP1 is located c. 1.8km upstream of Potter's bridge and MP2. Figure 2.1 shows the location of MP1, MP2 and the discharge point.



3. Results

3.1 MP1

The Q rating assigned to MP1 was **Q4**. It was assigned this value as two taxon of Group A macroinvertebrates were present. Two Group B taxon were common. Group C macroinvertebrates were dominant in terms of the diversity of taxa, however, were present in small numbers; Group E macroinvertebrates were present. The water was clear and there was a moderate flow. The substrate was comprised of bedrock, boulders, gravel and fine gravel. Siltation was low. A significant amount of clearance of vegetation was evident at the upstream location.

Table 3.1 – Macroinvertebrates recorded at MP1

Indicator Group	**Taxon**	**Dominance**
Group A - Sensitive	Heptageniidae	Common
	Plecoptera	Common
Group B - Less Sensitive	Trichoptera (cased spp.)	Fair numbers
	Baetidae	Fair numbers
Group C - Tolerant	Trichoptera (uncased spp.)	Fair numbers
	Piscicola sp.	Fair numbers
	Gammarus spp.	Present
	Coleoptera	Fair numbers
	Planorbidae	Present
Group E - Most Tolerant	*Chironomus* spp.	*Scare/few*

Figure 3.1 – MP1 (Upstream)

3.2 MP2

The Q rating assigned to MP2 was **Q3-4.** It was assigned this value as two Group A taxon were present in fair numbers and Group B macroinvertebrates were common; Group C macroinvertebrates were dominant in terms of the diversity of taxa present in fair to small numbers; Group E macroinvertebrates were present in small numbers. The water was clear and there was a high flow. The substrate was comprised of bedrock, boulders and fine gravel. Siltation is increasing upstream and downstream of the bridge. This monitoring location was downstream of an area of access for livestock to the river. There is a large build-up of debris at the bridge causing turbidity and fast velocity. Sampling was only possible at the river edges.

Macroinvertebrates present in the sample collected at this location are shown in the table below.

Table 3.2 – Macroinvertebrates recorded at MP2

Indicator Group	Taxon	Dominance
Group A - Sensitive	Heptageniidae	Common
	Plecoptera	Common
Group B - Less Sensitive	Trichoptera (cased)	Small numbers
	Baetidae	Common
Group C - Tolerant	Coleoptera	Small numbers
	Trichoptera (uncased spp.)	Common
	Gammarus spp.	Scarce/few
	Piscicola sp.	Scarce/few
Group E - Most Tolerant	*Chironomus* spp.	Small numbers
	Tubificidae	Scarce/few

Figure 3.2 – MP2 (Downstream)

4. Conclusion

Based on the groups present and their relative abundance a Q Value rating of Q4 ‘Good’ water quality was assigned to MP1. MP2 was classified as Q3-4 ‘Moderate’ water quality as per Water Framework Directive.

Monthly biological Q Value sampling has been carried out at MP1 and MP2 since December 2022. No sampling was carried out in October 2023 due to weather conditions and high flows at both monitoring points. Upstream and downstream Q Values have been recorded as fluctuating between Q 3-4 and Q4.

Based on the conducted kick sampling and using a direct comparison of samples taken upstream and downstream from December 2022 to July 2024 it can be concluded that discharges from dewatering at Ballinclare Quarry have not had any notable adverse impact on the aquatic ecosystem of the Potter’s River.

There is significant build up of debris at bridge located at MP2. Structures are present on the upstream side of the bridge and have recently become blocked with a large amount of debris. This is creating a large pool at the bridge and flooding into adjacent land. A large amount of fine sediments has built up in this area. The obstructions are creating a high velocity as the water passes through the bridge. The debris build up and accumulation of sediments could have an impact on water quality at MP2 in the future. It should be noted that the build up of debris and sediment up-stream of MP2 is not connected to dewatering works at Ballinclare quarry.

Kilsaran

Biological Q Value Assessment

Ballinclare Quarry

Co. Wicklow

Prepared for:

Kilsaran

Piercetown

Co. Meath

Prepared by:

JKW Environmental

Easkey

Co. Sligo

August 2024

Client: Kilsaran

Biological Q Value Assessment

Document Stage	Document Version	Prepared by	Approved by
Final	1	Katie Neary BSc(Hons)	Jamie Wood

STATEMENT OF AUTHORITY

This report is written Katie Neary. She is a Senior Ecologist with JKW Environmental. Katie has completed an honours B.Sc.. in Environmental Science. She is an Associate member of the Institution of Environmental Sciences (IES). She regularly carries out reporting on Ecological Impact Assessment and to inform Natura Impact Assessments / Appropriate Assessments carried out by statutory authorities. Furthermore, she has several years' experience in habitat surveys, mammal surveys, bird and bat surveys for a number of large infrastructure schemes, commercial and residential projects. Katie is an experienced Ecological Clerk of Works (ECoW).

This report was reviewed by Jamie Wood. Jamie holds a Degree in Environmental Science and a Masters Degree in Environmental Management, Health and Safety. Jamie is a full member of the Institute of Environmental Science and the Association of Ecological and Environmental Clerk of Works. Jamie is also Chartered with the Society for the Environment holding the postnominal C.Env. Over the past 20 years, working as an Environmental / Ecological Consultant, Jamie has gained extensive experience in a range of ecological surveys and assessment techniques including bird surveys, bat surveys and Ecological Clerk of Works.

Kilsaran – Ballinclare
Biological Q Value Assessment – Potter's River

Contents

1. Introduction

Kilsaran are required to carry out a Biological Q Value Assessment of the Potter's River north of the Ballinclare site monthly to assess potential impacts of dewatering activities at the site. JKW Environmental have been commissioned by Kilsaran to conduct this assessment.

Sampling was carried out at upstream and downstream locations which were selected by Kilsaran, taking into account safe and available access, and agreed upon by Wicklow County Council. Sampling was carried out on the 19th August 2024.

The locations of each monitoring point surveyed are provided in Figure 2.1. Biological water quality was assessed through kick-sampling each of these monitoring points. Macroinvertebrate samples were converted to Q-ratings as per Toner et al. (2005)[1] . The applied Q ratings followed the EPA water quality classes and Water Framework Directive status categories. All riverine samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute sample, as per ISO standards for water quality sampling (ISO 10870:2012). Large cobble was also washed at each site where present. The results of the surveys at all sites are provided below.

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[1] Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C.,. & MacGarthaigh, M. (2005). Water quality in Ireland. Environmental Protection Agency, Co. Wexford, Ireland.

2. Methodology

The Biological Water Quality Assessment took place in accordance with Biological monitoring based on Q- Value assessments which conforms to prescribed EPA methodology on Biological Assessments laid out in the Water Framework Directive.

Treated dewatering discharge from the Ballinclare site flows under gravity along a channel to the outflow point located along the Ballinclare stream. The Ballinclare steam joins with the Potter's River approximately 400m downstream of the discharge point. Two sampling locations situated on the Potter's River were sampled as part of this assessment; one sampling location upstream of the site discharge point and one downstream of the discharge point. The assessment will measure any changes in aquatic ecology downstream of the point at which site outflow enters the river system.

The assessment will determine if there has been any discernible deterioration in water quality downstream of the development when compared to upstream water quality.

Certain organisms which have a sensitivity or a tolerance to physio-chemical changes in their aquatic environment can be used as water quality indicators. The assessment comprised of: kick sampling at each monitoring location, followed by an examination of macroinvertebrates collected during sampling. The relative abundance of key groups of macroinvertebrates was assessed to determine a water quality 'Q' value at each monitoring location. This system divides macroinvertebrates into five indicator groups based on their sensitivity to pollution. The groups range from Group A, the sensitive forms, Group B the less sensitive forms, Group C, the tolerant forms, Group D, the very tolerant forms and Group E, the most tolerant forms.

Other relevant factors such as the intensity of algal and/or weed development, water turbidity, bottom siltation, substratum, water depth and dissolved oxygen content were also taken into account during the assessment procedure.

The relationship between community composition and water quality are as follows.

Table 2.1: Relationship between community composition and water quality.

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

Prescribed methodology outlines a number of relative abundance level approaches. Abundance levels can be determined with reference to one or more of the tables below.

Table 2.2: Abundance categories and relationships to percentage frequency of occurrence

Abundance Category	Approximate percentage frequency of occurrence
Absent	No specimens
Present	1 or 2 individuals
Scare/few	<1% of total fauna
Small numbers	<5%
Fair numbers	5-10%
Common	10-20%
Numerous	25-50%
Dominant	50-75%
Excessive	>75%

Table 2.3: Macroinvertebrates grouped according to their sensitivity to organic pollution ((McGarrigle et al., 2002).

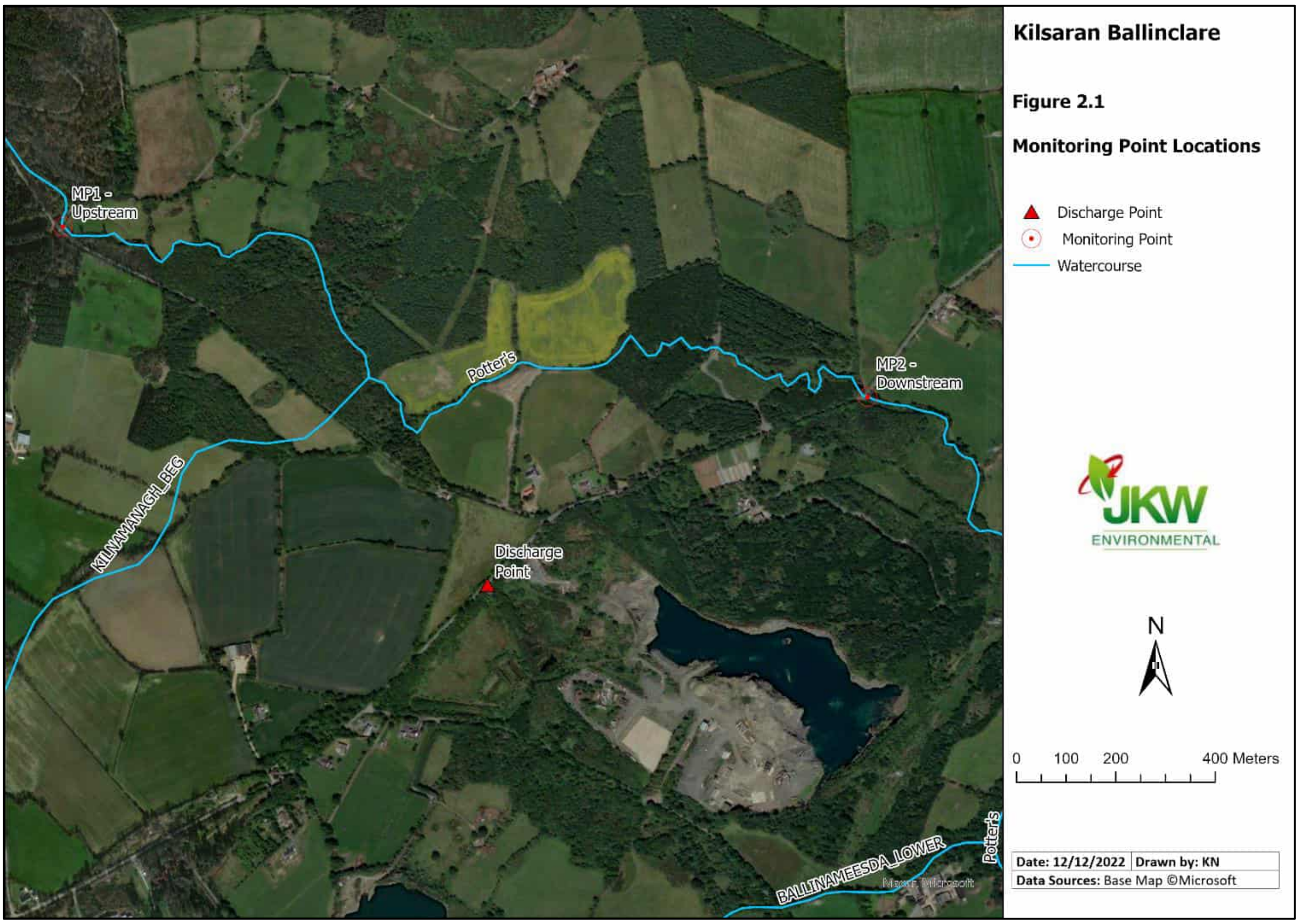
Macroinvertebrates grouped according to their sensitivity to organic pollution					
TAXA	**Group A**	**Group B**	**Group C**	**Group D**	**Group E**
	Sensitive	*Less Sensitive*	*Tolerant*	*Very Tolerant*	*Most Tolerant*
Plecoptera	All except L*euctra* spp.	*Leuctra* spp.			
Ephemeroptera	Heptageniidae Siphlonuriidae *Ephemera dancia*	Baetidae (excl. *Baetis rhondani*) Leptophlebidae	*Baetis rhodani* Caenidae Ephemerellidae		
Trichoptera		Cased spp.	Uncased spp.		
Odonata		All taxa			
Megaloptera				Sialidae	
Hemiptera		*Aphelocheirus aestivalis*	All except *A. aestivalis*		
Coleoptera			Coleoptera		
Diptera			Chironomidae (excl. *Chironomus* spp.) Simuliidae Tipulidae		*Chironomus* spp. *Eristalis* sp.
Hydracarina			Hydracarina		
Crustacea			*Gammarus* spp. *Austropotamobius pallipes*	*Asellus* spp. *Crangonyx* spp.	
Gastropoda			Gatropoda (excl. *Lymnaea peregra* & *Physa* sp.)	*Lymnaea peregra* *Physa* sp.	
Lamellibranchiata	*Margaritifera margaritifera*		*Anodonata* spp.	Sphaeriidae	
Hirudinea			*Piscicola* sp.	All except *Piscicola* sp.	
Oligochaeta					Tubificidae
Platyhelminths			All		

Table 2.4: Macroinvertebrates and other environmental parameters grouped according to their sensitivity to organic pollution (McGarrigle et al., 2002).

Biological Assessment of Water Quality in Eroding Reaches (Riffles & Glides) of Rivers and Streams*						
Biotic Indices (Q Values) and typical associated macroinvertebrate community structure						
Macroinvertebrate Faunal Groups	**Q5**	**Q4**	**Q3-4**	**Q3**	**Q2**	**Q1**
Group A	At least 3 taxa well represented	At least 1 taxon in reasonable numbers	At least 1 taxon Few - Common	Absent	Absent	Absent
Group B	Few to Numerous	Few to Numerous	Few/Absent to Numerous	Few/Absent	Absent	Absent
Group C	Few	Common to Numerous Baetis rhondani often abundant Others: never Excessive	Common to Excessive (usually Dominant or Excessive)	Dominant to Excessive	Few or Absent	Absent
Group D	Few or Absent	Few or Absent	Few/Absent to Common	Few/Absent to Common	Dominant to Excessive	Few/Absent
Group E	Few or Absent	Few or Absent	Few or Absent	Few or Absent	Few/Absent to Common	Dominant
Additional Qualifying Criteria						
Cladophora spp. Abundance	Trace only or None	Moderate growths (if present)	May be Abundant to Excessive growths	May be Excessive growths	Few or Absent	None
Macrophytes (Typical abundance)	Normal growths or absent	Enhanced growths	May be Luxuriant growths	May be Excessive growth	Absent to Abundant	Present/ Absent
Slime Growths (Sewage Fungus)	Never	Never	Trace or None	May be Abundant	May be Abundant	None
Dissolved Oxygen Saturation	Close to 100% at all times	80% - 120%	Fluctuates from <80% to >120%	Very unstable. Potential fish-kills	Low (but >20%)	Very low, sometimes zero
Substratum Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic
Note occurrence/abundance of groups in above table refers to some but not necessarily all of the constituents of the group. The Additional Qualifying Criteria apply in virtually all circumstances. Single specimens may be ignored. Seasonal and other relevant factors (i.e., drought, floods) must be taken into account. *Mactoinvertebrate criteria do not apply to rivers with mud, bedrock or sand substrata, very sluggish or torrential flow, head-water or high altitude streams and those affected by significant ground water input, excessive calcification, drainage, canalisation, culverting, marked shading etc.						

2.1 Sampling Locations

The discharge point is located along the Ballinclare stream. The downstream monitoring point (MP2) is located at the confluence of the Ballinclare stream and the Potter's River, c. 685m downstream from the discharge point. The upstream monitoring point (MP1) is located along Potter's River. The location of MP1 was chosen to facilitate the assessment of any potential impacts on water quality within Potter's River. MP1 is located c. 1.8km upstream of Potter's bridge and MP2. Figure 2.1 shows the location of MP1, MP2 and the discharge point.



3. Results

3.1 MP1

The Q rating assigned to MP1 was **Q4**. It was assigned this value as two taxon of Group A macroinvertebrates were present. Two Group B taxon was present. Group C macroinvertebrates were dominant in terms of the diversity of taxa; Group E macroinvertebrates were present. The water was clear and there was a moderate flow. The substrate was comprised of bedrock, boulders, gravel and fine gravel. Siltation was low. A significant amount of clearance of vegetation was evident at the upstream location.

Table 3.1 – Macroinvertebrates recorded at MP1

Indicator Group	Taxon	Dominance
Group A - Sensitive	Heptageniidae	Fair numbers
	Plecoptera	Fair numbers
Group B - Less Sensitive	Trichoptera (cased spp.)	Fair numbers
	Odonata	Present
Group C - Tolerant	Trichoptera (uncased spp.)	Fair numbers
	Baetis rhodani	Scarce/few
	Simuliidae	Present
	Piscicola sp.	Fair numbers
	Gammarus spp.	Present
	Coleoptera	Fair numbers
Group E - Most Tolerant	*Chironomus* spp.	Fair numbers

Figure 3.1 – MP1 (Upstream)

3.2 MP2

The Q rating assigned to MP2 was **Q4.** It was assigned this value as two Group A taxon were present in fair numbers and Group B macroinvertebrates were present; Group C macroinvertebrates were dominant in terms of the diversity of taxa present in fair to small numbers; Group E macroinvertebrates were present in small numbers. The water was clear and there was a high flow. The substrate was comprised of bedrock, boulders and fine gravel. Siltation is increasing upstream and downstream of the bridge. This monitoring location was downstream of an area of access for livestock to the river. There is a large build-up of debris at the bridge causing turbidity and fast velocity.

Macroinvertebrates present in the sample collected at this location are shown in the table below.

Table 3.2 – Macroinvertebrates recorded at MP2

Indicator Group	**Taxon**	**Dominance**
Group A - Sensitive	Heptageniidae	Common
	Plecoptera	Common
Group B - Less Sensitive	Trichoptera (cased)	Present
	Baetidae	Fair numbers
Group C - Tolerant	Coleoptera	Small numbers
	Trichoptera (uncased spp.)	Common
	Gammarus spp.	Scarce/few
	Piscicola sp.	Scarce/few
Group E - Most Tolerant	*Chironomus* spp.	Small numbers
	Tubificidae	Scarce/few

Figure 3.2 – MP2 (Downstream)

4. Conclusion

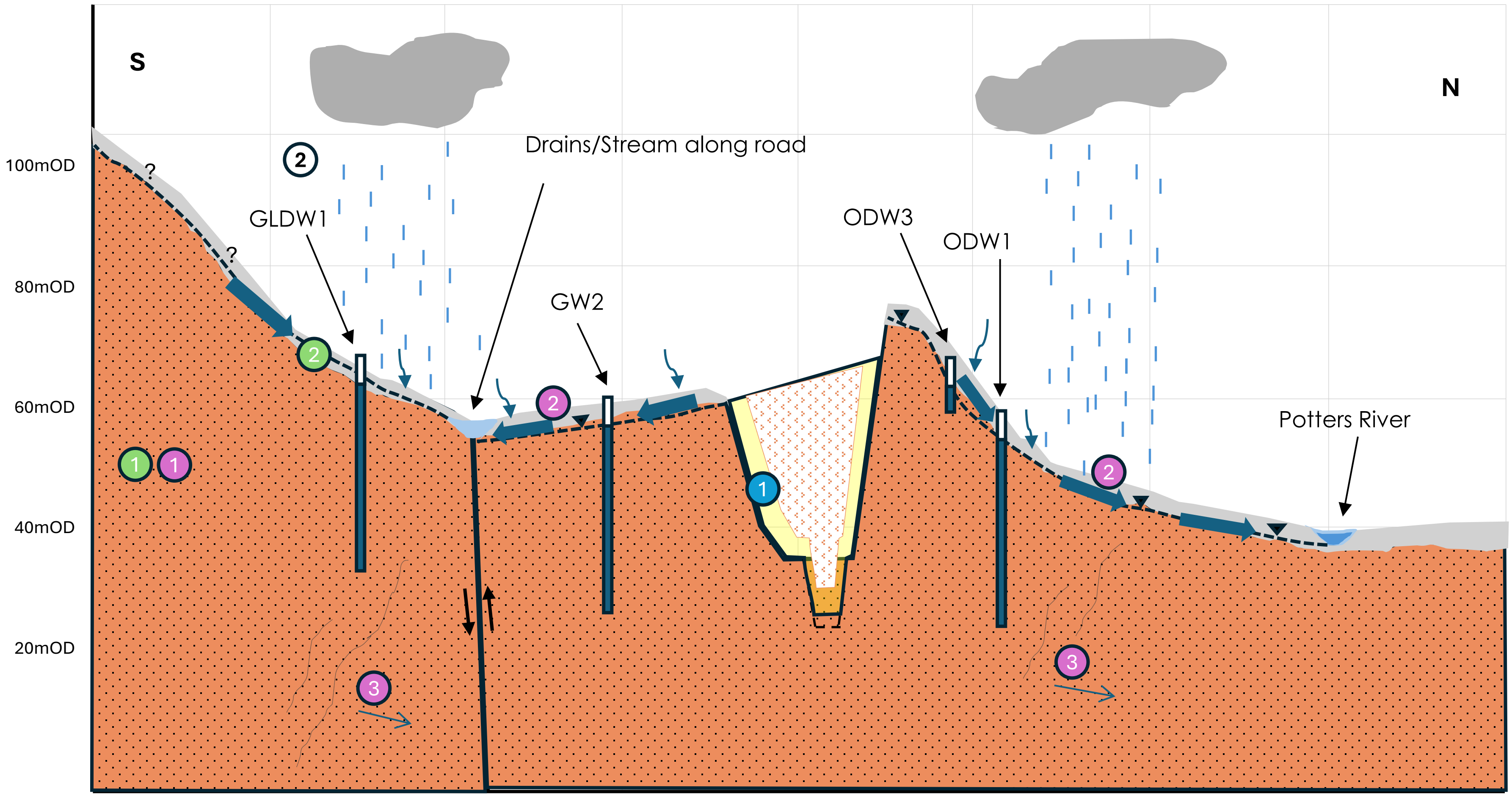
Based on the groups present and their relative abundance a Q Value rating of Q4 'Good' water quality was assigned to MP1. MP2 was classified as Q4 'Good' water quality as per Water Framework Directive.

Monthly biological Q Value sampling has been carried out at MP1 and MP2 since December 2022. No sampling was carried out in October 2023 due to weather conditions and high flows at both monitoring points. Upstream and downstream Q Values have been recorded as fluctuating between Q 3-4 and Q4.

Based on the conducted kick sampling and using a direct comparison of samples taken upstream and downstream from December 2022 to August 2024 it can be concluded that discharges from dewatering at Ballinclare Quarry have not had any notable adverse impact on the aquatic ecosystem of the Potter's River.

There is significant build up of debris at bridge located at MP2. Structures are present on the upstream side of the bridge and have recently become blocked with a large amount of debris. This is creating a large pool at the bridge and flooding into adjacent land. A large amount of fine sediments has built up in this area. The obstructions are creating a high velocity as the water passes through the bridge. The debris build up and accumulation of sediments could have an impact on water quality at MP2 in the future. It should be noted that the build up of debris and sediment up-stream of MP2 is not connected to dewatering works at Ballinclare quarry.

APPENDIX 7-M
Hydrogeological Conceptual Site Model



Geological Legend

- ▦ Overburden – Primarily Clay
- 🟧 Diorite Bedrock
- ⁄ Mapped bedrock geological fault
- ▼ Groundwater Level
- ➡ Shallow groundwater flow (majority of rainfall)
- → Inferred deeper groundwater flow (small volumes)
- ⊔ Outline of approx. quarry sump

Drawing notes:

1. A Conceptual Site Model (CSM) is a graphical representation of the known elements of site geology and hydrogeology, and it can include groundwater flowpaths and sensitive receptors.
2. The drawing depicted here is a simplification of the hydrogeological system.
3. The CSM is based on all available data.

CSM Geological Notes:

*This cross-section is a simplification of the local geology.

① The local geology comprises Hard, competent, low permeability Diorite bedrock, overlain by thin clay/gravel subsoil. The thickness of the subsoil is variable, but can be up to 6m. 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, but none are mapped within the quarry footprint. The bedrock geology beneath the current quarry floor level has been confirmed as diorite to 40m beneath the quarry floor (from borehole drilling at BH1 and BH2). The diorite has been affected by regional deformation and veining and fault gouge associated with the deformation is observed in the quarry faces.

② Bedrock subcrop/outcrop occurs over much of the northern and eastern area and that the southwestern area of the site is underlain by till derived from lower Palaeozoic sandstone and shale.

CSM Hydrogeological Notes:

*This cross-section is a simplification of a very complex hydrogeological area. Not all local wells are shown.

① The Diorite bedrock is classified as a Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones. Recorded local well yields are all low.

② The subsoil-bedrock interface layer is much more porous and more permeable than the underlying Diorite bedrock. Rainfall infiltrates through the subsoil, reaches the subsoil/bedrock interface and moves as shallow groundwater flow, laterally along the top of bedrock. The shallow flow is the dominant groundwater flow in the area and is controlled by topography. This dominant system is also likely the main source of inflow to many of the local groundwater wells.

③ Deeper, less connected, local flow within fissures and fractures in the Diorite bedrock. Fault gouges may inhibit groundwater flow.

CSM Notes Regarding Local Groundwater Wells

① The proposed fill material will be inert, and the quarry will be lined with low permeability clay.

The dominant shallow groundwater flow system will not be effected by the proposed infill.

Any deeper groundwater flow is local, and is likely associated with fissures and fractures, with the main water source coming from local recharge from the shallow subsoil-bedrock rinterface, rather than regional groundwater flow systems.

APPENDIX 7-N
WFD Compliance Assessment

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WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT
BALLINCLARE QUARRY, KILBRIDE,
CO. WICKLOW

FINAL REPORT

Prepared for:

KILSARAN CONCRETE UNLIMITED COMPANY

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

Document Title:	**WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT BALLINCLARE QUARRY, KILBRIDE, CO. WICKLOW**
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Author:	**MICHAEL GILL** **ADAM KEEGAN** **NITESH DALAL**
Signed:	Michael Gill **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

Disclaimer:
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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by Kilsaran Concrete Unlimited Company (hereineafter 'Kilsaran' or 'the Applicant') to complete a Water Framework Directive (WFD) Compliance Assessment for the proposed operation of a construction and demolition (C&D) waste recovery facilities and the backfilling of an existing hard rock quarry by way of an inert fill at Ballinclare Quarry, near Kilbride, Co. Wicklow (the 'application site').

The application site is located in the townlands of Ballinclare and Carrigmore in Co. Wicklow, approximately 1.8km northwest of the village of Kilbride. The application site can be accessed be accessed via the M11 Motorway and L1113 Local Road and via the R772 Regional Road and L1157 Local Road.

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. 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 will provide for an integrated waste management facility for inert C&D waste at the application site.

The purpose of this WFD Compliance Assessment is to determine if any specific components or activities associated with the proposed development will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status. This assessment will determine the water bodies with the potential to be impacted, describe the proposed mitigation measures if such water bodies are identified and define any residual potential impacts.

This WFD Compliance Assessment is intended to supplement the assessment completed in Chapter 7 of the EIAR submitted as part of the SID application.

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types including quarries.

This WFD assessment was prepared by Michael Gill, Adam Keegan and Nitesh Dalal.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 22 years' environmental consultancy experience in Ireland. 22 years' environmental consultancy experience in Ireland. Michael has a degree in Civil and Environmental Engineering, a MSc in Engineering hydrology from TCD and a MSc in Applied Hydrogeology from Newcastle University. Michael has completed numerous (60+) hydrological and hydrogeological assessments relating to bedrock quarries and sand and gravel pits. Recent examples include Ardfert quarry in County Kerry and Middleton Quarry in County Cork.

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1.3 WATER FRAMEWORK DIRECTIVE

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("**WFD**"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003).

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. RBMPs include identifying river basin districts, water bodies, protected areas and any pressures or risks, monitoring and setting environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021.

The Water Action Plan 2024 is Ireland's 3rd RBMP and its objectives have been integrated into the design of this application, and include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027; and,
- Ensure waters in protected areas meet requirements;
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge for the third cycle.

Our understanding of these objectives is that water bodies, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed.

2. WATERBODY IDENTIFICATION AND CLASSIFICATION

2.1 INTRODUCTION

This section identifies those Surface Waterbodies (SWBs) and Groundwater Bodies (GWBs) with potential to be affected by the proposed development and reviews any available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

Regionally, the application site is located within the Ovoca-Vartry WFD Catchment within Hydrometric Area 10 and the Recross River sub-catchment (Redcross_SC_010). More locally, the application site is located in the Potters_010 WFD river sub-basin.

The closest mapped watercourse to the application site is the Kilmacurra Stream (EPA name: Ballinameesda lower stream) which is located c. 200m to the south of the application site. This stream forms part of the Potter's_010 SWB. This stream flows in an easterly direction before it confluences with the Potter's River which is located to the north and east (c. 350m) of the application site.

The Potter's River continues to flow to the southeast before the Potter's_020 SWB discharges into the Southwestern Irish Sea – Brittas Bay coastal waterbody c. 7.5km southeast of the application site at Potters Point.

There is an existing discharge licence (WPL-116) for the application site which provides for the discharges of treated water to the Potter's River (Potter's_010 SWB).

A local hydrology map is shown below as **Figure A**.

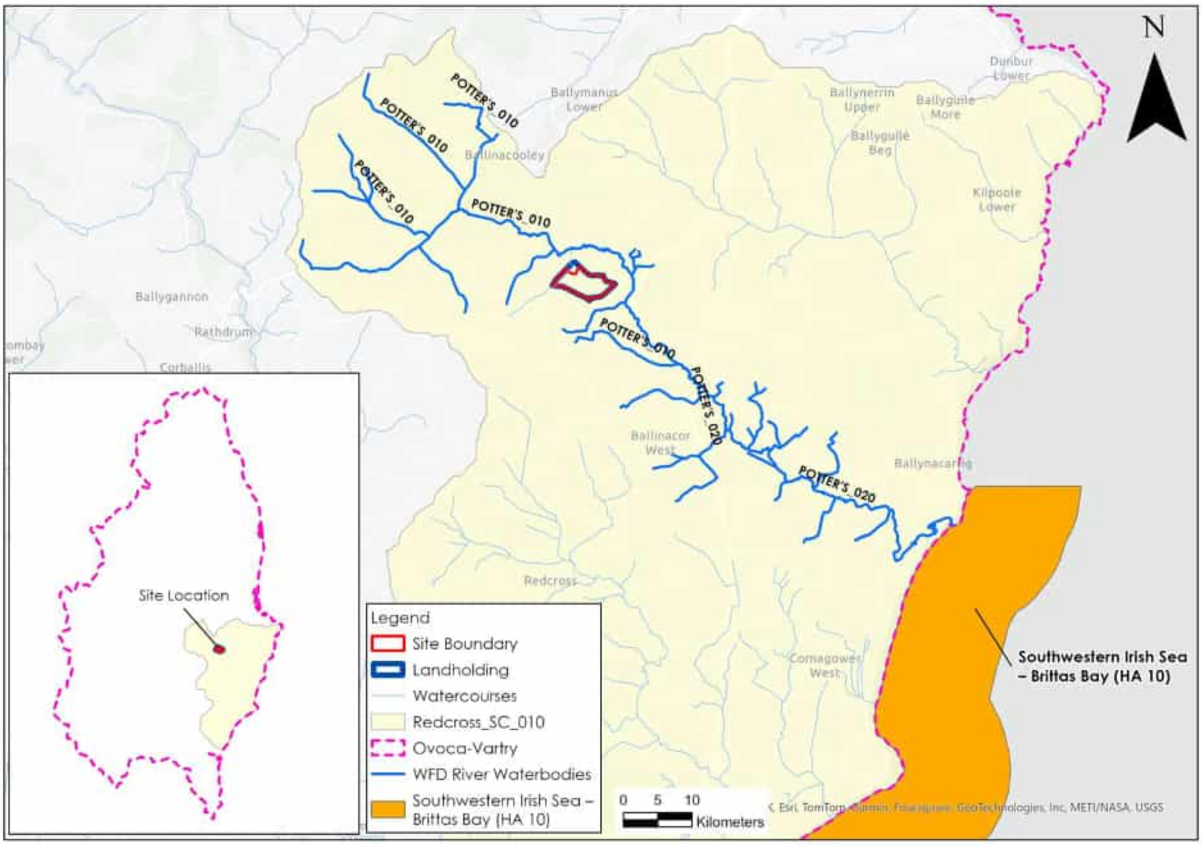

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for SWBs downstream of the application site are shown in **Table A**. The overall status of SWBs is based on the ecological, chemical and quantitative status of each SWB.

Local SWB status information is available from (www.catchments.ie).

The Potter's_010 SWB achieved 'Moderate' status in all 3 no. WFD cycles. This SWB is currently deemed to be 'at risk' of failing to meet its WFD objectives. Significant pressures on this SWB include agriculture and forestry.

The Potter's_020 SWB that lies downstream of the application site achieved 'Good' status in all 3 no. WFD cycles. This SWB is deemed to be 'not at risk' of failing to meet its WFD objectives. No significant pressures have been identified to be impacting this SWB.

The Southwestern Irish Sea – Brittas Bay (HA 10) SWB achieved 'High' status in the 2016-2021 WFD cycle. This coastal waterbody is also deemed to be 'Not at risk' and no significant pressures are listed to be impacting this SWB.

The SWB status for the 2016-2021 WFD cycle are shown on **Figure B.**

Table A: Summary WFD Information for Surface Water Bodies

SWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (3rd Cycle)	3rd Cycle Pressures
Potter's_010	Moderate	Moderate	Moderate	At risk	Agriculture, Forestry, Hydromorphology, Mines and Quarries and Other
Potter's_020	Good	Good	Good	Not at risk	None
Southwestern Irish Sea – Brittas Bay (HA 10)	Unassigned	High	High	Not at risk	None

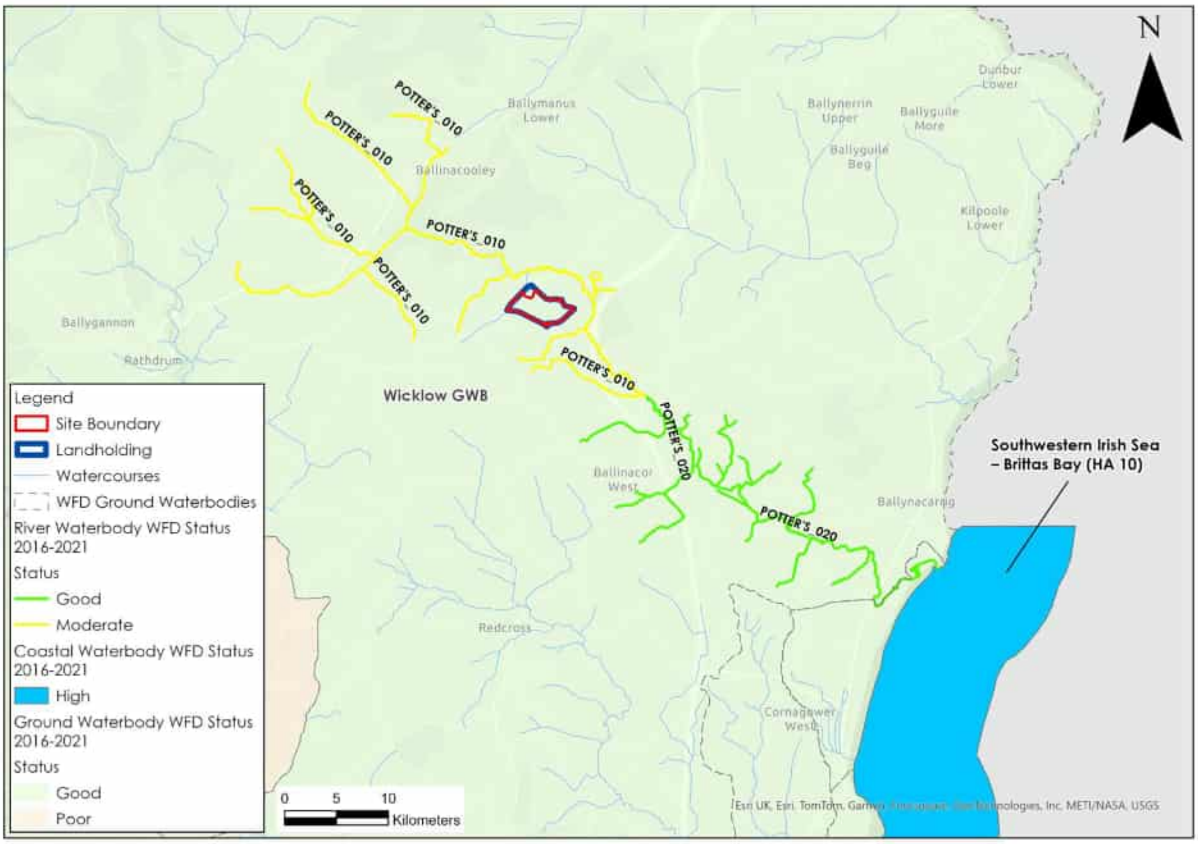

Figure B: WFD Surface Waterbody Status (2016-2021)

2.4 GROUNDWATER BODY IDENTIFICATION

The application site is underlain by diorite bedrock, identified as the Carrigmore Diorite. Bedrock aquifer maps published on the GSI website (www.gsi.ie) provide a detailed classification of bedrock aquifer types and indicate that the diorite bedrock is classified as a Poor Aquifer (PI) - bedrock which is generally unproductive except in local zones.

The application site is located within the Wicklow GWB (IE_EA_G_076).

2.5 GROUNDWATER BODY CLASSIFICATION

The Wicklow GWB achieved 'Good' status in all 3 no. WFD cycles. This GWB has been deemed to be 'At risk' of failing to meet its WFD objectives. Agriculture and unknown anthropogenic pressures have been identified as significant pressures on this GWB (refer to **Table B**).

The GWB status for the 2016-2021 WFD cycle is shown on **Figure B** above.

Table B: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (2013-2018)	Pressures
Wicklow	Good	Good	Good	At risk	Unknown & Agriculture

2.6 PROTECTED AREA IDENTIFICATION

The WFD requires that activities are also in compliance with other relevant legislation, as considered below.

The potential effect of the proposed development on nature conservation designations, bathing waters, nutrient sensitive areas (NSAs), shellfish areas and drinking water protected area's (DWPAs) are also included as part of the WFD Compliance Assessment.

2.6.1 Nature Conservation Designations

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

The closest designated site to the application site is the Glenealy Woods pNHA (001756). This pNHA is located ~1.1km to the northwest and upstream of the application site. This pNHA is located within the same GWB as the application site but is underlain by a different aquifer.

Deputy's Pass Nature Reserve SAC (000717) is located ~1.6km to the northwest and upstream of the application site. This SAC is located within the same GWB as the application site but is underlain by a different aquifer.

The Buckroney-Brittas Dunes and Fen SAC/pNHA (000729) is located ~7.5km to the southeast and downstream of the application site. This SAC is hydrologically connected to the application site. The SAC/pNHA is partially underlain by the Wicklow GWB and partially underlain by the GWDTE-Buckroney-Britta Dunes GWB. The SAC/pNHA is underlain by a different aquifer than the application site.

Other designated site within 10km of the application site include:

- Vale of Clara (Rathdrum Wood) SAC and pNHA (000733) located ~6.5km in the west
- Magherabeg Dunes SAC and pNHA (001766) located ~7.5km in the east
- Murrough SPA (004186, SAC (002249), and pNHA (000730) located ~8km in the north
- Devil's Glen pNHA (000718) located ~8.5km in the north
- Wicklow Head SPA (004127) and pNHA (000734) located ~9.5 km in the east
- Wicklow Reef SAC (002274) located ~9.5km in the east

2.6.2 Bathing Waters

Bathing waters are those designated under the Bathing Water Directive (76/160/EEC) or the later revised Bathing Water Directive (2006/7/EC).

The Brittas Bay North bathing waterbody (IEEABWC140_0000_0300) lies 7.3km downstream of the application site, and the Potters River discharges into this bathing water.

2.6.3 Nutrient Sensitive Areas

Nutrient Sensitive Areas (NSA) comprise Nitrate Vulnerable Zones and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under the Urban Wastewater Treatment Directive (UWWTD)(91/271/EEC). Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

There are no NSAs in the vicinity or downstream of the application site.

2.6.4 Shellfish Waters

The Shellfish Waters Directive (2006/113/EC) aims to protect or improve shellfish waters in order to support shellfish life and growth.

There are no designated shellfish protected areas within the vicinity or downstream of the application site.

2.6.5 Drinking Water

The Potter's_010 SWB in the vicinity of the application site is listed as a Drinking Water Protected Area (DWPA) under Article 7 Abstraction for Drinking Water (IE_EA_10P010300). This DWPA lies downstream of the application site and includes the Kilmacurra Stream. The abstraction from the Potter's River is for the Glenealy Public Supply which is reported to have a maximum abstraction volume of 185m^3/day. The Glenealy WS abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 3 no. SWBs (2 no. river waterbodies and 1 no. coastal waterbody) that are located in the vicinity or downstream of the application site. In addition, the application site is underlain by the Wicklow GWB. Furthermore, there are protected areas located in the vicinity and downstream of the application site.

3.1 SURFACE WATER BODIES

With consideration for the proposed development, it is considered that the Potter's_010 SWB will be included in the WFD Compliance Assessment as the application site is located within this WFD river sub-basin. The Potter's_020 SWB will also be included in the WFD Compliance Assessment as it lies downstream of the Potter's_010 SWB and in close proximity to the application site. Therefore, an assessment is required to consider the potential effects of the proposed development on these SWBs.

The Southwestern Irish Sea – Brittas Bay (HA 10) SWB will not be included in WFD Compliance Assessment due to the large volumes of water within this coastal waterbody, the saline nature of these waters and the distance between the application site and this SWB (c.7.5km straight line distance). Therefore, there is no potential for the proposed development to impact the status of this SWB.

3.2 GROUNDWATER BODIES

The Wicklow GWB has been screened in due to its location directly underlying the application site. The proposed development must not in any way result in a deterioration in the status of this GWB and/or prevent it from meeting the characteristics required for good status in the future.

3.3 PROTECTED AREAS

The <u>Glenealy Woods pNHA</u> and <u>Deputy's Pass Nature Reserve SAC</u> 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 Potters River, they cannot therefore be impacted by any site based activities. There is no hydrological pathway from the application site to Glenealy Woods pNHA and Deputy's Pass Nature Reserve SAC.

The only designated site which is hydrologically connected to the application site is the <u>Buckroney-Brittas Dunes and Fen SAC/pNHA</u>. This designated site is located downstream of the surface water discharge from the application site to the Potters River. Therefore, an assessment is required to consider the effects of the proposed development on the SAC/pNHA.

In addition, there are several other designated sites within 10km of the application site. These sites will not be included in the assessment due to their distant locations from the site and the lack of any hydrological connection. These screened out designated sites include:

- Vale of Clara (Rathdrum Wood) SAC and pNHA (000733)
- Magherabeg Dunes SAC and pNHA (001766)
- Murrough SPA (004186, SAC (002249), and pNHA (000730)
- Devil's Glen pNHA (000718)
- Wicklow Head SPA (004127) and pNHA (000734)
- Wicklow Reef SAC (002274)

The designated bathing waters at Brittas Bay North are located downstream of the Potters River and are located in the Southwestern Irish Sea – Brittas Bay (HA 10) coastal waterbody. This coastal waterbody has been screened out due to the large volumes of saline water within this SWB and its distant location from the applications site. Therefore, the designated bathing waters at Brittas Bay are also screened out of the WFD Compliance Assessment.

The Potters_010 DWPA has been included in the WFD Compliance Assessment due to its location directly downstream of the application site.

3.4 WFD SCREENING SUMMARY

A summary of WFD Screening discussed above is shown in **Table C**.

Table C: Screening of WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	River	Potter's_010	**Yes**	The Potter's_010 SWB will be brought through to the WFD Compliance Assessment as the application site is located within this WFD river sub-basin. The application site currently discharges to the Potter's River. Therefore, an assessment is required to consider the potential effects of the proposed development on this SWB.
	River	Potter's_020	**Yes**	The Potter's_020 SWB is located downstream and in close proximity to the application site. Therefore, an assessment is required to consider the potential effects of the proposed development on this SWB.
	Coastal	Southwestern Irish Sea – Brittas Bay (HA 10)	No	The Southwestern Irish Sea – Brittas Bay (HA 10) SWB has been screened out due to the large volumes of saline water within the SWB and the distance (c. 7.5km straight line distance) between the application site and this SWB. Therefore, the proposed development has no potential to impact the status of this SWB.
Ground water Body	Groundwater	Wicklow GWB	**Yes**	The application site directly overlies the Wicklow GWB. An assessment is required to consider potential impacts of the proposed development on this GWB.
Protected Areas	Designated Sites	Glenealy Woods pNHA	No	The Glenealy Woods pNHA is located c. 1km northwest of the application site. This pNHA is located at higher ground, in a different bedrock aquifer and upstream of the discharge to the Potters River. Therefore, this pNHA cannot be impacted by any activities at the application site.
		Deputy's Pass Nature Reserve SAC	No	The Deputy's Pass Nature Reserve SAC is located c. 1.6km northwest of the application site. This SAC is located at higher ground, in a different bedrock aquifer and upstream of the discharge to the Potters River. Therefore, this SAC cannot be impacted by any activities at the application site.
		Vale of Clara (Rathdrum Wood) SAC/pNHA	No	The Vale of Clara (Rathdrum Wood) SAC/pNHA has been screened out due to its distant location from the application site (6.5km), the lack of any hydrological connection and given the fact that it is underlain by a different bedrock aquifer. The proposed development has no potential to impact this SAC/pNHA.
		Magherabeg Dunes SAC/pNHA	No	The Magherabeg Dunes SAC/pNHA has been screened out due to its distant location from the application site (7.5km), the lack of any hydrological connection and given the fact that it is underlain by a different bedrock aquifer. The proposed development has no potential to impact this SAC/pNHA.
		Buckroney-Brittas Dunes and Fen SAC/pNHA	**Yes**	The Buckroney-Brittas Dunes and Fen SAC/pNHA is located downstream of the application site and the discharge to the Potters River. Therefore, an assessment is required to consider potential impacts of the proposed development on this SAC/pNHA.
		Murrough SAC/pNHA	No	The Murrough SAC/pNHA has been screened out due to its distant location from the application site (8km), the lack of any hydrological connection and given the

				fact that it is underlain by a different bedrock aquifer. The proposed development has no potential to impact this SAC/pNHA.
		Devil's Glen pNHA	No	The Devil's Glen pNHA has been screened out due to its distant location from the application site (8.5km), the lack of any hydrological connection and given the fact that it is underlain by a different bedrock aquifer. The proposed development has no potential to impact this pNHA.
		Wicklow Head SPA	No	The Wicklow Head SPA has been screened out due to its distant location from the application site (9.5km), the lack of any hydrological connection and given the fact that it is underlain by a different bedrock aquifer. The proposed development has no potential to impact this SPA.
		Wicklow Reef SAC	No	The Wicklow Reef SAC has been screened out due to tis distant location from the application site (9.5km) and the lack of any hydrological/hydrogeological connection. The proposed development has no potential to impact this SAC.
	Drinking Water	Potter's_010	**Yes**	The Potter's_010 DWPA will be included for further assessment as this DWPA is located in close proximity to the application site and is downstream of the discharge location. Therefore, an assessment is required to consider the impacts of the proposed development on the Potter's_010 DWPA.
	Designated Bathing Waters	Brittas Bay North	No	The Brittas Bay North designated bathing waters are screened out of further assessment due to their location with the coastal waterbody which has been screened out due to the large volumes of saline water and its distance from the application site. The proposed development has no potential to impact these designated bathing waters.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSED DEVELOPMENT DETAILS

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.

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 will provide for an integrated waste management facility for inert C&D waste at the application site.

The inert wastes to be imported and backfilled at the landfill facility 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 for disposal at the landfill facility will comply with the waste acceptance criteria (WAC) for inert landfills set by Council Decision 2003/33/EC.

As part of the development, 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 basal and side clay liners required for the inert landfill.

On completion, the inert landfill will be restored to a long-term native woodland habitat, similar to that which existed prior to quarry development, and will include provision for establishment of native oak plantations in defined areas around the site.

Full details of the proposed development are provided in Chapter 2 of the EIAR.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Stage (Unmitigated)

In the context of the proposed C&D waste recovery facilities and new inert landfill, the construction stage is taken to be site preparation which involves any residual dewatering from the quarry sump, the construction of the required infrastructure and site preparation, which is outlined in Chapter 2 of the EIAR.

4.2.1.1 Potential Effects on Surface Water Quality/Quantity

The main potential for effects on downstream SWBs related to the uncontrolled discharge of water from the flooded quarry sump and the potential release of fuels and other petroleum-based products. Any uncontrolled release of discharge waters has the potential to impact downstream surface water quality due to increased arsenic concentrations (due to arsenic concentration in groundwater) or petroleum hydrocarbons (from any leaks/spills of fuels/soil at the application site).

Any uncontrolled release of water from the quarry sump also has the potential to impact the quantitative status of downstream SWBs (i.e. flow volumes). However, any discharge volumes are likely to be small in comparison with flow volumes in the Potter's River.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction stage of the proposed development in the unmitigated scenario are outlined in **Table D**.

Table D: Potential Effects on Surface Water Quality/Quantity during Construction Stage (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Potter's_010	IE_EA_10P010300	Moderate	Poor
Potter's_020	IE_EA_10P010500	Good	Good

4.2.1.2 Potential Effects on Groundwater Quality/Quantity

The potential impacts on groundwater receptors during the construction stage relate to the accidental leaking of fuels and other petroleum-based products (lubricating oil, greases, etc.) from plant and machinery, or the storage of such materials, which has the potential to impact on groundwater quality aquifer. Discharge of these to groundwater would cause an adverse effect.

However, the potential for these activities to alter the qualitative status of the overall Wicklow GWB which spans an area of 1,396km^2 is limited.

There will be no significant effects on groundwater levels during the construction stage. Any effects in groundwater levels due to pumping of groundwater from the quarry floor to completely dewater the quarry will be temporary and short. Furthermore, effects on groundwater levels are unlikely due to the low permeability of the aquifer at the site. Therefore, there will be no effects on the quantitative status of the underlying GWB.

A summary of potential status change to GWBs arising from potential groundwater quality impacts during the construction stage of the proposed development in the unmitigated scenario are outlined in **Table E**.

Table E: Potential Effects on Groundwater Quality / Quantity during the Construction Stage (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Wicklow GWB	IE_EA_G_076	Good	Good

4.2.1.3 Potential Effects on Protected Areas

Potential effects on surface water quality in the Potters's River will impact the Potter's_010 DWPA due to its close proximity to the application site. The potential effects would relate to the uncontrolled discharge from the quarry sump. The effects would be diluted due to the small volume of any discharge in comparison with the flow volumes in the Potter's River.

Any effects on the downstream Buckroney-Brittas Dunes and Fen SAC/pNHA are unlikely due to the volume of flow in the Potters River in comparison to any discharge volumes, as well as the lack of hydrological dependency of the qualifying interests of the SAC/pNHA. We note that the fen is not hydrologically connected with the Potter's River.

4.2.2 Operational Stage (Unmitigated)

During the operational stage the dry quarry void will be backfilled and restored using imported soil and stone waste, while C&D materials will be recovered at the proposed recovery facility to win aggregate material.

4.2.2.1 Potential Effects on Groundwater Quantity/Quality

Direct impacts on groundwater quality during the operational stage may rise from:

- The accidental leakage of fuels and other petroleum-based products from plant and machinery; and,
- The release of contaminants from the imported soil and C&D materials.

This would have the potential to impact groundwater quality in the underlying bedrock aquifer. However, as stated previously, the potential for these activities to alter the qualitative status of the overall Wicklow GWB which spans an area of 1,396km^2 is limited.

In relation to groundwater levels, pumping/dewatering and infilling of the quarry void (i.e. blocking of groundwater flowpaths) has the potential to impact groundwater levels. However, no significant effects will occur due to the impermeable and unproductive nature of the underlying aquifer.

A summary of potential status change to GWBs arising from potential groundwater quality impacts during the operational stage of the proposed development in the unmitigated scenario are outlined in **Table F**.

Table F: Potential Effects on Groundwater Quality/Quantity during the Operational Stage (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Wicklow GWB	IE_EA_G_076	Good	Good

4.2.2.2 Potential Effects on Surface Water Quality/Quantity

Potential effects 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; and,
- Any suspended solids in the discharge have the potential to impact on surface water quality.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the operational stage of the proposed development in the unmitigated scenario are outlined in **Table G**.

Table G: Potential Effects on Surface Water Quality/Quantity during Operational Stage (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Potter's_010	IE_EA_10P010300	Moderate	Poor
Potter's_020	IE_EA_10P010500	Good	Good

4.2.2.3 Potential Effects on Protected Areas

Discharge of poor quality surface water from the application site has the potential to affect the water quality in the Potters River, which has the further potential to have negative effects on the Buckroney-Brittas Dunes and Fen SAC/pNHA. However, the potential consequences for the designated site(s) are limited as the SAC/pNHA is designated primarily for Annex I/II habitats/species associated with a dune environment. The Buckroney Fen (part of the SAC / pNHA), which could be considered more hydrologically dependent, but is not hydrologically connected to the Potters River, and is fed by rivers / streams further south of the Potters River. As such, the potential effects from poor quality water in the Potters River are limited.

Discharge of poor quality surface water from the application site also has the potential to negatively affect the Potter's_010 DWPA.

4.3 MITIGATION MEASURES

In order to mitigate against the potential negative effects on surface and groundwater quality, quantity and flow patterns, mitigation measures will be implemented during the proposed development. These are outlined below.

4.3.1 Construction Stage

The following measures will be implemented at the application site to prevent leaks and/or spills, these are <u>mitigation by prevention</u>:

- The discharge water to the Potters River will comply with the conditions in the discharge licence (WPL116); or any required revision to the licence resulting from conditions associated with this application;
- The discharge water will be treated in a water treatment plant and will pass through the settlement lagoons / attenuation pond at the application 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 a 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 proposed development 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 application 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 proposed development 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 proposed development site to further reduce the likelihood and significance of collisions and the possibility of a fuel leak from such a collision.

4.3.1.1 Water Management Systems

- During the construction stage, water in the quarry void will be pumped to the treatment plant (Siltbuster) and will then be routed 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;
- All surface water discharges to the Potters River will comply with the emission limits set by the discharge licence [WPL116] (or those which may supersede them in any waste licence issued by the EPA); and,
- The volume of water discharged from the application 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.

4.3.2 Operational Stage

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.

The following additional mitigation measures will also be implemented:

4.3.2.1 Inert Landfill Liner

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).

4.3.2.2 Water Management

During Phase 1A and Phase 1, the rainfall/runoff from the operational infill area will be captured and recirculated (or supplied to soil wash plant). Any excess runoff will be tankered off site. Surface water runoff from the C&D recovery yard will be captured and supplied to the soil wash plant, while runoff from the soil processing area will be directed towards a sump behind the wash plant for use in the washing process. Any excess water in the sump on the quarry floor will be treated prior to discharge. Following the capping and restoring oh the Phase 1A area, surface water runoff will be captured by a perimeter toe drain and discharged offsite.

4.3.2.3 On-site Passive Wetland Treatment System

Following the capping and restoring oh the Phase 1A area, surface water runoff (which will not be in contact with any infill material, will be captured by a perimeter toe drain and discharged offsite.

During the follow-on Phase 1 development, the discharge / runoff from the inert landfilling areas will be collected and treated via an Integrated Constructed Wetland (ICW). Runoff from the C&D waste recovery and soil processing area will be supplied to the soil wash plant. Any excess water collecting in the sump on the quarry floor will be treated by the Siltbuster system and settlement ponds prior to discharge.

During Phase 2 of the development, whereby the land surface will be raised to 80mAOD, the runoff from active inert landfill areas will be collected and treated within the Integrated Constructed Wetland. Runoff from capped landfill areas and the C&D waste recovery facilities will be collected and directed to temporary balancing ponds. Excess water in these balancing ponds will be treated by the Siltbuster system and settlement ponds prior to licensed discharge.

During Phase 3 of the Proposed Development, the water management system will mimic the Phase 2 operation outlined above.

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 any lightly impacted / lightly contaminated run-off ('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.

An initial assessment indicates that there is sufficient spare land available at Ballinclare Quarry 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, thus minimising the amount of leachate generated and requiring treatment.

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.

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

- A wetland treatment system: comprising the following elements in series:
  - Anaerobic (biochemical reactor) wetland;
  - Iron Sequestering Unit (ISU);
  - Aerobic wetland.
- A leachate reception tank: up to 50m3, self-bunded storage tank with level controls.
- A pump house: housed in a standard shipping container (6.0m x 2.4m x 2.6m) containing feed, discharge and chemical dosing pumps;
- Off-site discharge via existing ditch / drainage channels to the Ballinclare Stream and the Potters River further downstream.

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 1.06 hectares.

4.3.2.4 Testing and Inspection of Imported Material

- 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;
- Waste shall be accepted from customers only after initial waste profiling and waste characterisation off-site. Characterisation testing will be undertaken in advance by customers, clients or sub-contractors forwarding soil and stone backfill materials to the application site;
- 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 of 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;

- 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 (i.e. permitted or licensed) waste facility; and,
- 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.

4.3.2.5 Waste Quarantine and Compliance Testing

- 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;
- 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); and,
- 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.

4.3.2.6 Surface Water Management (to Protect Downstream SWBs)

- The operational stage of the Proposed Development includes for a phased infilling of the quarry void. During Phase 1A, surface water runoff from the infill area will be captured and recirculated (or supplied to soil wash plant). Any excess runoff will be tankered off site. Surface water runoff from the C&D recovery yard will be captured and supplied to the soil wash plant, while runoff from the soil processing area will be directed towards a sump behind the wash plant for use in the washing process. Any excess water in the sump on the quarry floor will be treated prior to discharge;
- Following the capping and restoring of the Phase 1A area, surface water runoff will be captured by a perimeter toe drain and discharged offsite;
- Before the end of Phase 1A, the construction of the Integrated Constructed Wetland will commence. During that construction stage, excess water from the construction area will be pumped back to the quarry void. In addition, a temporary cutoff drain and double line of silt fencing will be used to ensure separation between the wetland construction area and the Ballinclare stream;
- During the follow on Phase 1 development, the discharge/runoff from the inert landfilling areas will be collected and treated in an Integrated Constructed Wetland. Runoff from the C&D waste recovery and soil processing area will be supplied to the soil wash plant. Any excess water collecting in the sump on the quarry floor will be treated by the Siltbuster system and settlement ponds prior to discharge;
- During Phase 2 of the development, whereby the land surface will be raised to 80mOD, the runoff from active inert landfill areas will be collected and treated within the Integrated Constructed Wetland. Runoff from capped landfill areas and the C&D waste recovery facilities will be collected and directed to temporary balancing

ponds. Excess water in these balancing ponds will be treated by the Siltbuster system and settlement ponds prior to licensed discharge;

- During Phase 3 of the Proposed Development, the water management system will mimic the Phase 2 operation outlined above;
- Surface water quality testing of the discharge from the site will be completed on a quarterly basis (subject to any update of the existing discharge license and/or conditions within the Waste License); and,
- As such, runoff from the site will be managed during each stage of the proposed infilling, as well as management of surface water from the C&D waste recovery facility, in order to mitigate against any potential effects on downstream watercourses following discharge off-site.

4.4 POST-OPERATIONAL STAGE – LIKELY SIGNIFICANT EFFECTS AND MITIGATION MEASURES

No significant post-operational stage effects will occur following the full restoration or during the aftercare period.

A restoration scheme has been prepared for the application site and will be implemented in phases with the final restoration. 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 native woodland habitat.

During the post-operational stage dewatering of the site will cease and groundwater will be allowed to rise to its natural level. There will be no discharge to surface waters. Natural surface water run-off from the restored site will be directed via site drains to local watercourses.

The proposed mitigation measures detailed for the construction and operational stages will also be implemented during the post-operational stage while site infrastructure is being decommissioning and whilst the final landscaping works are being completed. Appropriate seasonal timing of site restoration works will reduce the potential for soil erosion. Once the site is backfilled, it will be vegetated and runoff and drainage will either percolate to ground or runoff and drain from the site via the wetland area.

4.5 POTENTIAL EFFECTS WITH THE IMPLEMENTATION OF MITIGATION MEASURES

In all instances, the mitigation measures described above are sufficient to meet the WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in **Table H** below.

With regards to protected areas, mitigation measures for the protection of surface water quality during all stages of the proposed development are prescribed to deal with sediment, hydrocarbons and dissolved metals. The implementation of these mitigation measures will ensure that the proposed development will cause any adverse surface water quality effects on the Potters River. Therefore, the proposed development will not impact the status of downstream protected areas including the Potter's_010 DWPA and the Buckroney-Brittas Dunes and Fen SAC/pNHA. There will be no residual effect on downstream protected areas.
The Glenealy WS abstraction point is upstream of the Application site, ~4km to the northwest at Barnbawn.

Table H: Summary of WFD Status for Unmitigated and Mitigated Scenarios

SWB	WFD Code	Current Status	Assessed Potential Status Change - Unmitigated	Assessed Status with Mitigation Measures

Surface Waterbodies				
Potter's_010	IE_EA_10P010300	Moderate	Poor	Moderate
Potter's_020	IE_EA_10P010500	Good	Good	Good
Groundwater Bodies				
Wicklow GWB	IE_SW_G_082	Good	Good	Good

5. CONCLUSION

WFD status for SWBs (Surface Water Bodies) and GWBs (Groundwater Bodies) hydraulically linked to the application site are defined in **Section 2** above.

The proposed development comprises of the restoration of a bedrock quarry using inert soil and stone material which will be used to infill the existing quarry void and eventually restore the site it its historical ground level.

During the construction stage of the proposed development, construction activities will take place which could result in temporary effects on surface water quality through the uncontrolled discharge of water from the quarry and on groundwater quality through potential spills/leaks of oils/fuels. Due to the nature of the hydrological and hydrogeological environment, in addition to the mitigation measures prescribed for the protection of surface and groundwater quality, the qualitative and quantitative status of the receiving waters will not be altered during the construction stage of the proposed development.

During the operational stage of the quarry infilling, mitigation measures have been prescribed for the protection of surface water quality through surface water drainage measures, pollution control systems and other preventative measures. The proposed surface water drainage plan (which includes a siltbuster system, integrated constructed wetland and attenuation within the quarry sump) will ensure that there is no direct/untreated or unattenuated discharge from the application site to nearby surface waters. Furthermore, mitigation measures have been prescribed for the protection of groundwater quality, primarily through the use of the clay liner within the infill area and by ensuring that the imported material is inert through inspection and testing of the imported material. Therefore, the qualitative and quantitative status of the receiving waters will not be altered during the operational stage of the proposed development.

There is also mitigation proposed to protect surface and groundwater quality during the post-operational stage. These mitigation measures will ensure the status of the receiving waters will not be altered by the proposed development during the post-operational stage.

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the proposed development. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs are protected from any potential deterioration.

Mitigation proposed for the protection of protected areas during the construction, operation and post-operational stages of the proposed development will ensure the qualitative and quantitative status of the receiving ground and surface waters will not be altered by the proposed development and thereby limiting the potential for the proposed development to negatively impact upon any designated site.

As such, the proposed development:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve ‘Good’ surface water/groundwater status;
- does not jeopardise the attainment of 'Good’ surface water/groundwater chemical status;
- does not jeopardise the attainment of ‘Good’ surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;

- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC) (Note that a full list of legislation complied with in relation to hydrology and hydrogeology is included in paragraph 7.26 of EIAR Chapter 7).

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