

Shannon Technology and Energy Park (STEP) Power Plant

Appendix A6.2: Groundwater and Surface Water 2020 Sampling Report

Shannon LNG Limited



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1. Introduction

1.1 Project Contractual Basis and Personnel Involved

AECOM Ireland Limited (AECOM) is pleased to present this report detailing results of recent baseline groundwater monitoring undertaken at Ralappane, Co. Kerry, Ireland (see Appendix A Figure 1).

The work was undertaken as part of a wider EIAR for planning submission for Shannon LNG in accordance with AECOM Proposal No. PR-452891, dated 12 February 2020.

The AECOM team for 2020 groundwater monitoring comprised the following:

- Project Director : Barry Sheridan, Technical Director
- Project Manager: Niamh O'Connell, Associate
- Field Staff: Kevin Forde, Associate Director/Hydrogeologist
- Field Staff: Gemma O' Connor, Graduate Environmental Scientist

Laboratory analysis of samples was subcontracted to Environmental Laboratory Testing (ELS), Mahon, Cork, Ireland, an AECOM-approved analytical laboratory.

1.2 Background

Shannon LNG intends to submit a planning application to construct a liquified natural gas (LNG) terminal, using an offshore Floating Regasification and Storage Unit (FRSU), and gas-fired power plant at the Proposed Development site. A gas transmission pipeline would connect the LNG terminal to the national gas grid, for which An Bord Pleanala (ABP) have previously granted planning permission.

As part of the associated EIAR submission, one Groundwater Monitoring event was carried out on the 05 and 07 February 2020 to assess baseline conditions of groundwater and surface waters at the site. This follows from previous site investigations completed by Minerex and Arup in 2006 and 2007¹.

A total of 25 groundwater monitoring wells were previously installed in at the wider site location in both the clay till subsoils and bedrock. Well construction details and grid coordinates are given in Appendix B Table 2.

During this monitoring event, depth to groundwater was recorded from all available wells and water quality from selected groundwater wells and surface water locations was assessed.

2. Project Objectives

- To sample surface water and groundwater from ten groundwater monitoring wells within the Proposed Development site
- To assess surface water and groundwater quality at the Proposed Development site in relation to published assessment criteria
- To assess the direction of groundwater flow at the Proposed Development site.

3. Scope of Works

- Measurement of depth to groundwater and total well depth in all accessible monitoring wells across the site
- Groundwater purging and sampling from ten groundwater wells within the Proposed Development site

¹ 2007 Shannon LNG Environmental Impact Statement plus appendices, Arup Consulting Engineers for Shannon LNG Limited, dated September 2007

- Surface water sampling from six locations within the Proposed Development site
- Field testing of unstable water quality parameters (dissolved oxygen (DO), pH, oxidation / reduction potential (ORP), electrical conductivity (EC), temperature) on site
- Laboratory analysis of surface and ground water samples
- Data assessment and reporting.

3.1 Groundwater Sampling and Monitoring

Prior to sampling, the depth to groundwater in all accessible monitoring wells on site was measured using an electronic interface probe. An interface probe is capable of distinguishing between separate aqueous phase and non-aqueous phase layers (NAPLs); NAPLs can be either more or less dense than water.

Well BH10 could not be located and is suspected to have been destroyed or buried since 2007 (Appendix D Photographs 16 and 17).

Multilevel wells BR-1, BR-5, BR11 and BR-X consisted of multilevel installations with three or four separate narrow diameter (<20mm internal diameter) well pipes (Appendix B Table 2) and several of these wells are kinked at ground level, due to disturbance by livestock. Water levels were measured in these multilevel wells were possible using an interface probe. An attempt was made to sample zone P1 in well BR-11 using a narrow diameter bailer, however it was not possible to insert the 19mm bailer to the required depth for sampling, due to limited clearance and friction due to mud within the well pipe.

Dedicated pumping and sampling equipment, consisting of Waterra™ tubing and 25mm inertial foot valves, was installed by AECOM in all 50mm diameter groundwater wells sampled.

Groundwater samples were taken in accordance with AECOM groundwater sampling protocols, using dedicated inertial lift tubing installed into each of the monitoring wells.

The groundwater monitoring wells were purged of approximately three times the volume of standing water in the well to ensure samples were representative of groundwater in the aquifer.

During purging, stable measurements of groundwater quality parameters (DO, pH, ORP, EC and temperature) were recorded using a calibrated water quality meter and flow through cell (where possible).

Samples were collected on site directly into clean, laboratory-supplied sample containers. For ammonia and metal analysis, water samples were collected into laboratory-supplied containers with appropriate acid preservative.

Sample containers were labelled in the field and the sample details were entered onto a chain of custody form. Samples were stored in a chilled cool-box on site and during transit to the contract laboratory.

Groundwater samples collected are outlined in Table 1 below. Groundwater sample locations are shown on Appendix A Figure 2. Photographs of sampling locations are included in Appendix D.

Table 1. Groundwater wells sampled

Well ID	Field readings	Sample collected
BH03	X	X
BH05	X	X
BH12	X	X
BH13	X	X
BH14	X	X
BH18	X	X
BH19	X	X
BH20	X	X

Well ID	Field readings	Sample collected
BR11-P1	No sample	X
BH10	Well not found	Well not found

3.2 Surface water Sampling

Surface water samples were collected by AECOM at six locations, as shown on Appendix A Figure 2. Photographs of sampling locations are included in Appendix D.

Surface water samples were taken directly into clean, laboratory-supplied sample containers in accordance with AECOM surface water sampling protocols. Stable measurements of groundwater quality parameters (DO, pH, oxidation reduction potential (ORP), electrical conductivity (EC) and temperature) were recorded on site using a calibrated water quality meter prior to sampling.

For ammonia and metal analysis, water samples were collected into laboratory-supplied containers with appropriate acid preservatives.

Sample containers were labelled in the field and the sample details were entered onto a chain of custody form. Surface water samples were stored in a chilled cool-box on site and during transit to the contract laboratory.

Surface water samples were collected as outlined in Table 2 below.

Table 2. Surface water locations sampled

Location ID	Field readings	Sample collected
D1 SW	X	X
D3 SW1	X	X
D2 SW1	X	X
D2 SW2	X	X
SP SW4	X	X
D3 SW2	X	X

3.3 Laboratory Analysis

Groundwater and surface water samples were sent for analysis to ELS under standard chain of custody procedures.

Groundwater sampled were analysed by ELS for the following suite of parameters:

- Total petroleum hydrocarbons
- Dissolved metals (iron, manganese, sodium)
- Total organic carbon
- Alkalinity
- Major ions (nitrate, phosphate, chloride and sulphate)
- A sample inventory is provided in Appendix B Table 1.

4. Assessment Guidelines

Preliminary assessment of groundwater field and analytical data was completed by comparing the results with a range of generic groundwater assessment criteria (GAC), specifically Groundwater Threshold Values (GTVs) and the EPA draft Interim Guideline Values (IGVs).

The GTVs are statutory Irish regulatory guidelines which were developed to give effect to the European Union Groundwater Directive. Exceedance of a threshold value triggers further investigation to confirm whether a 'Poor' groundwater chemical status for the groundwater body as a whole is indicated. GTVs

are defined in Irish law in Statutory Instrument No. 366 of 2016, European Union Environmental Objectives (Groundwater) (Amendment) Regulations, 2016.

Draft IGVs were developed by the EPA using a number of existing water quality guidelines in use in Ireland, including existing national environmental quality standards, proposed common indicators for the new groundwater directive, drinking water standards and GSI trigger values.

Legally binding quality objectives for all surface waters and environmental quality standards for pollutants are implemented across EU member states under the European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations, 2019 (Statutory Instrument No. 77 of 2019) Environmental Quality Standards (EQSs).

Under the Drinking Water Regulations ((Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption), the quality of public water supplies is monitored to improve management of public water supplies. The Drinking Water Regulations are implemented in Ireland under Statutory Instrument No. 464 of 2017 – European Union (Drinking Water (Amendment) Regulations 2017.

5. Groundwater Results

5.1 Groundwater Monitoring Field Observations

In- situ water quality parameters for monitoring wells are tabulated in Appendix B Table 3A.

- No evidence of contaminated in the form of sheen or separate phase liquids was observed during groundwater purging and sampling.
- Groundwater pH values recorded ranged from 6.27 (BH13) to 8.75 (BH18), the pH range of groundwater across the site indicates near-neutral pH conditions associated with the sandstone bedrock.
- Temperature ranged from 10.2 °C (BH18) to 11.31 °C (BH14). Temperatures observed are within the normal range for groundwater in Ireland of 10.0 °C to 12.0 °C.
- Electrical conductivity ranged from 204 µS/cm (BH18) to 553 (BH03), indicating freshwater conditions (<1,600 µS/cm).
- Dissolved oxygen ranged from 0.18 mg/L (BH03) to 6.65 mg/L (BH05). Groundwater at the Proposed Development generally contains <5 mg/L DO, with groundwater measurements of >5 mg/L DO considered to be well-oxygenated and < 1 mg/L DO being considered oxygen-depleted. BH03 (0.18 mg/L DO) and BH13 (0.92 mg/L DO) are the only wells sampled which were assessed as being oxygen-depleted.
- Field ORP readings were compensated, as recommended by the instrument manufacturer, to give Eh (redox potential). Adjusted Eh readings ranged from 141.77 mV (BH20) to 369.26 mV (BH18). These Eh values are consistent with the DO readings noted above, indicating moderately-reducing conditions beneath the site.
- No field readings are available for BR-11 as it was not possible to collect groundwater for analysis due to the narrow (<20mm ID) standpipe internal diameter.

5.2 Groundwater Flow Gradient

Depth to groundwater measurements from all wells dipped on 05 and 07 February 2020 are presented in Appendix B Table 2. Depth to groundwater ranged from 0.062 meters (BR23) below top of casing (m btc) to 5.608 m btc at an unmarked well (referred to as BR-X P1).

Depth to groundwater readings were converted to equivalent groundwater elevations relative to Ordnance Datum using elevation data from the Minerex 2007 study. Groundwater elevations ranged from 6.098 maOD (BR-6) to 18.143 maOD (BH18).

A groundwater contour map is presented in Appendix A Figure 3. Several of the wells were omitted from the groundwater contour map due to absence of reliable well elevation information, either due to

omission from previous reporting (2 zones in well BR-X) or significant damage to well installations (generally caused by cattle) (well BH-13).

The inferred groundwater flow direction in the southern and western portions of the Proposed Development site is generally to the west or northwest towards Ballylongford Bay and the Lower Shannon Estuary, with an estimated hydraulic gradient of 0.020 (between wells BH05 and BR-6) and 0.014 (between wells BR1 and BR5).

To the east of BH05, the estimated hydraulic gradient between BH05 and BH12 is locally steeper, at 0.072, and between BH18 to BH19 is 0.167, indicating groundwater flow towards the north, discharging to the Lower Shannon Estuary.

5.3 Groundwater Monitoring Analytical Results

Complete groundwater analytical results for the site are tabulated in Appendix B Tables 4, 5 and 6, with laboratory reports in Appendix C.

5.3.1 TPH

TPH was reported above the adopted GAC in groundwater from monitoring wells BH19, BH20 and BR11. TPH was detected at 93 µg/L (BH19), 419 µg/L (BH20) and 229 µg/L (BR11) exceeding the IGV of 10 µg/L and GTV of 7.5 µg/L.

Diesel range organics (C10-C40 carbon chain band) were detected in excess of the IGV of 10 µg/L in 4 of 9 wells, at a concentration of 70 µg/L in BH05, 90 µg/L BH19, 390 µg/L in BH20 and 210 µg/L in BR11.

The hydrocarbons reported in wells BH19, BH20 and BR11 were all predominantly in the chain length range C10 to C20, suggesting a kerosene/diesel-type source.

While the site setting is considered to be undeveloped agricultural land with limited potential for sources of hydrocarbon contamination, the detection of petroleum hydrocarbons in three wells in the middle distillate range indicates fuel-related impacts. A review of available online information highlighted the presence of houses and farmyards upgradient (south and east) of the site and a vehicle repair facility ('Prendiville Agri Parts'), located approximately 650 meters south of wells BR19, BR20 and BR05 and <500 meters to the south east of BR-11.²

5.3.2 Metals

5.3.2.1 Sodium

Sodium was detected from all wells sampled above the laboratory Minimum Detection Limit (MDL), but was below IGV of 150 mg/L and DWS of 200 mg/L in all wells.

5.3.2.2 Iron

Iron was reported above the MDL of 0.02 mg/L in monitoring wells BH03, BH05, BH12, BH13, BH14, BH20 and BR-11. IGV and Drinking Water Standards of 0.2 mg/L for dissolved iron were exceeded in BH20 and BR-11, at 1.70 mg/L and 0.55 mg/L, respectively. There is no GTV defined for iron in groundwater.

5.3.2.3 Manganese

Manganese was detected above the MDL in all wells sampled. IGV and drinking water standards (0.05 mg/L) were exceeded in BH03 (1.30 mg/L), BH12 (0.07 mg/L), BH13 (0.9 mg/L), BH14 (0.08 mg/L), BH19 (0.11 mg/L), BH20 (3.70 mg/L) and BR-11 (0.73 mg/L).

Detections of elevated dissolved iron and manganese in solution can indicate reducing (anaerobic) conditions in groundwater. Elevated concentrations dissolved iron and manganese are widely observed in groundwater from the site and indicate moderately reducing conditions.

² <https://www.google.com/maps/@52.5768966,-9.440425,1698m/data=!3m1!1e3> (27 June 2020)

5.3.3 Miscellaneous

Nitrate (as NO₃) was detected above MDL in all monitoring wells sampled. Concentrations ranged from 2.5 mg/L (BH03) to 37 mg/L (BH14). The IGTV of 25 mg/L for nitrate was exceeded in two wells; BH05 (27 mg/L) and BH14 (37 mg/L), however nitrate concentrations in all wells at the Proposed Development site were below both the GTV (37.5 mg/L) and DWS (50 mg/L).

Phosphate (as PO₄) exceeded both the IGTV (0.03 mg/L) and GTV (0.035 mg/L) in all wells other than BH13 and BH20, in which phosphate was not detected above the MDL. Reported phosphate concentrations ranged from 0.05 mg/L (BH18) to 0.30 mg/L (BH05).

Chloride was detected in all wells monitored ranging from 17 mg/L (BH18) and 190 mg/L (BH20). Chloride results for all monitoring wells exceeded the IGTV of 30 mg/L, with the exception of BH18 (17 mg/L) and BR-11 (22 mg/L), reflecting the site's coastal setting. The chloride GTV of 187.5 mg/L was exceeded in BH20 at 190 mg/L.

Sulphate was detected in groundwater from all wells other than BH18, which was below the laboratory MDL. Concentrations of sulphate in groundwater ranged from 4.2 mg/L (BH19) to 480 mg/L (BH20). Both the sulphate IGTV of 200 mg/L and GTV of 187.5 mg/L were exceeded in groundwater from BH20.

Total alkalinity (measured as CaCO₃) ranged between 445 mg/L (BH13 mg/L) and 716 mg/L (BH03). There are no appropriate groundwater guideline acceptance criteria for total alkalinity. However, the concentrations observed are higher than the reported median alkalinity of 227 mg/L observed in Irish groundwaters underlain by sandstone bedrock.³

Total Organic Carbon reported in groundwater ranged from 1.13 mg/L (BH03) to 6.18 mg/L (BH14). There are no relevant guideline criteria in Ireland for TOC in groundwater.

6. Surface Water Results

6.1 Surface Water Field Observations

Field-measured surface water quality measurements are presented in Appendix B Table 3B.

No evidence of potential contamination was observed on site at any of the six surface water sampling locations.

Dissolved oxygen in surface water samples ranged from 0.78 mg/L (D2 SW2) to 11.21 mg/L (D3 SW2). The lowest dissolved oxygen was recorded at sample locations D2 SW2 (0.78 mg/L), which had a low flow, and in ponded water collected at spring SP SW4 (2.67 mg/L). Oxygen-saturated surface water contains approximately 10 mg/L DO.

Low flow and standing water may contribute to reduced mixing of surface waters, leading to stagnant conditions, reducing dissolved oxygen concentrations and anaerobic conditions.

Redox potential measured was in line with dissolved oxygen concentrations, ranging from 234 mV (D2 SW2) to 302 mV (D2 SW1), this indicates low aerobic conditions are present within surface watercourses at the site.

pH measurements at surface water sampling locations ranged from 7.59 (D2 SW2) to 7.93 (D3 SW2), which are within the allowable pH range of 6 – 9 under S.I. No. 77/2019 - European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019.

Measured electrical conductivity in surface water samples ranged from 230 µS/cm (D3 SW2) to 378 µS/cm (D1 SW), indicative of freshwater conditions (<2,600 µS/cm)

Temperature measurements in surface water were in the range 5.29 °C to 9.82 °C.

³ Chapter 5- Groundwater, 2008, Water Quality in Ireland 2004-2006, Environmental Protection Agency, accessed 25 June 2020 : <https://www.epa.ie/pubs/reports/water/waterqua/waterrep/#d.en.45665>

6.2 Surface Water Monitoring Analytical Data

6.2.1 TPH

TPH was detected in one surface water sampling location only (D1 SW) at 90 µg/L (predominantly in the carbon chain length range C₁₀-C₂₀, indicating kerosene/diesel-type hydrocarbons). There are currently no recommended surface water EQS for TPH or other fuel hydrocarbon parameters provided under S.I. No. 77/2019.

6.2.2 Metals

6.2.2.1 Sodium

Sodium was detected from all surface water samples above the MDL but below the DWS of 200 mg/L. Concentrations ranged from 22 mg/L (D1 SW) to 59 mg/L (SP SW4). There is no EQS defined for sodium.

6.2.2.2 Iron

Iron was detected above the MDL of 0.02 mg/L in all surface water samples. The DWS of 0.2 mg/L was exceeded in all samples collected and ranged from 0.24 mg/L (D2 SW1) to 5.60 mg/L (SP SW4). There is no EQS defined for iron.

6.2.2.3 Manganese

Manganese was detected above the MDL in all surface water samples and exceeded the DWS of 0.05 mg/L in all samples with the exception of D2 SW1 (0.02 mg/L). Concentrations ranged from 0.02 mg/L (D2 SW1) to 0.56 mg/L (D1 SW). There is no EQS defined for manganese.

6.2.3 Miscellaneous

Nitrate (as NO₃) was detected above MDL in all surface water samples, with the exception of SP SW4. Nitrate concentrations ranged from 2.40 mg/L (D3 SW2) to 16 mg/L (D1 SW). Samples D3 SW1, D2 SW1, D2 SW2 and D3 SW2 exceeded the lower threshold of the EQS (0.75 mg/L), while D1 SW exceeded the upper threshold (11.51 mg/L).

Phosphate (as PO₄) was reported above the MDL for all surface water samples. Concentrations ranged from 0.02 mg/L (D3 SW2) to 0.15 mg/L (SP SW4). Surface water from D1 SW (0.12 mg/L), D2 SW2 (0.13 mg/L) and SP SW4 (0.15 mg/L) exceeded the higher threshold EQS for freshwater of 0.11 mg/L. Chloride was detected above MDL in all surface water samples. Concentrations ranged from 33 mg/L (D3 SW2) to 100 mg/L (SP SW4). There are currently no defined EQS for chloride in surface water. Chloride was not detected above Drinking Water Standards in any surface water samples collected.

Sulphate was detected above the MDL in all surface water samples other than SP SW4. Concentrations ranged from 8.40 mg/L (D2 SW2) to 14 mg/L (D1 SW). There are no defined EQS for sulphate in surface waters. All detected sulphate concentrations in surface water were less than the DWS (250 mg/L).

Total alkalinity in all surface water samples ranged from 81 mg/L (D3 SW1) and 523 mg/L (D2 SW2). Total organic carbon ranged from 2.79 mg/L (D1 SW) and 60.28 mg/L (SP SW4). There are no appropriate surface water GAC for either total alkalinity and total organic carbon.

7. Conceptual Site Model

Currently there are no sources of contamination on site with the exception of potential impact from agricultural practices.

In relation to the detections of low levels of hydrocarbons in certain groundwater and surface water samples, the only potential sources in the vicinity of the Proposed Development are considered to be domestic/agricultural oil storage, possible vehicle maintenance activities to the south of the site boundary or run-off from the Coast Road to the Ralappane (D1) Stream.

Potential contamination source, pathway, receptor (SPR) linkages at the Proposed Development are outlined below (not all are active).

POTENTIAL SPR LINKAGES (not all are active)

Sources	Pathways	Receptors
S1 Agricultural practices, fuel storage, road run-off	Human/Animal Health	R1 - Human Health
	P1 - Inhalation of vapours P2 - Ingestion of surface water P2 - Ingestion of groundwater	R2 - Livestock
	Controlled Waters	R3 - Lower Shannon Estuary
	P4 - Lateral migration of potential contaminants through the bedrock aquifer	R4 - Ralappane Stream waterbody
	P5 - Lateral migration of potential contaminants through the bedrock aquifer	

8. Summary and Conclusion

AECOM undertook a groundwater and surface water monitoring event at the proposed Shannon LNG site location on 05 and 07 of February 2020.

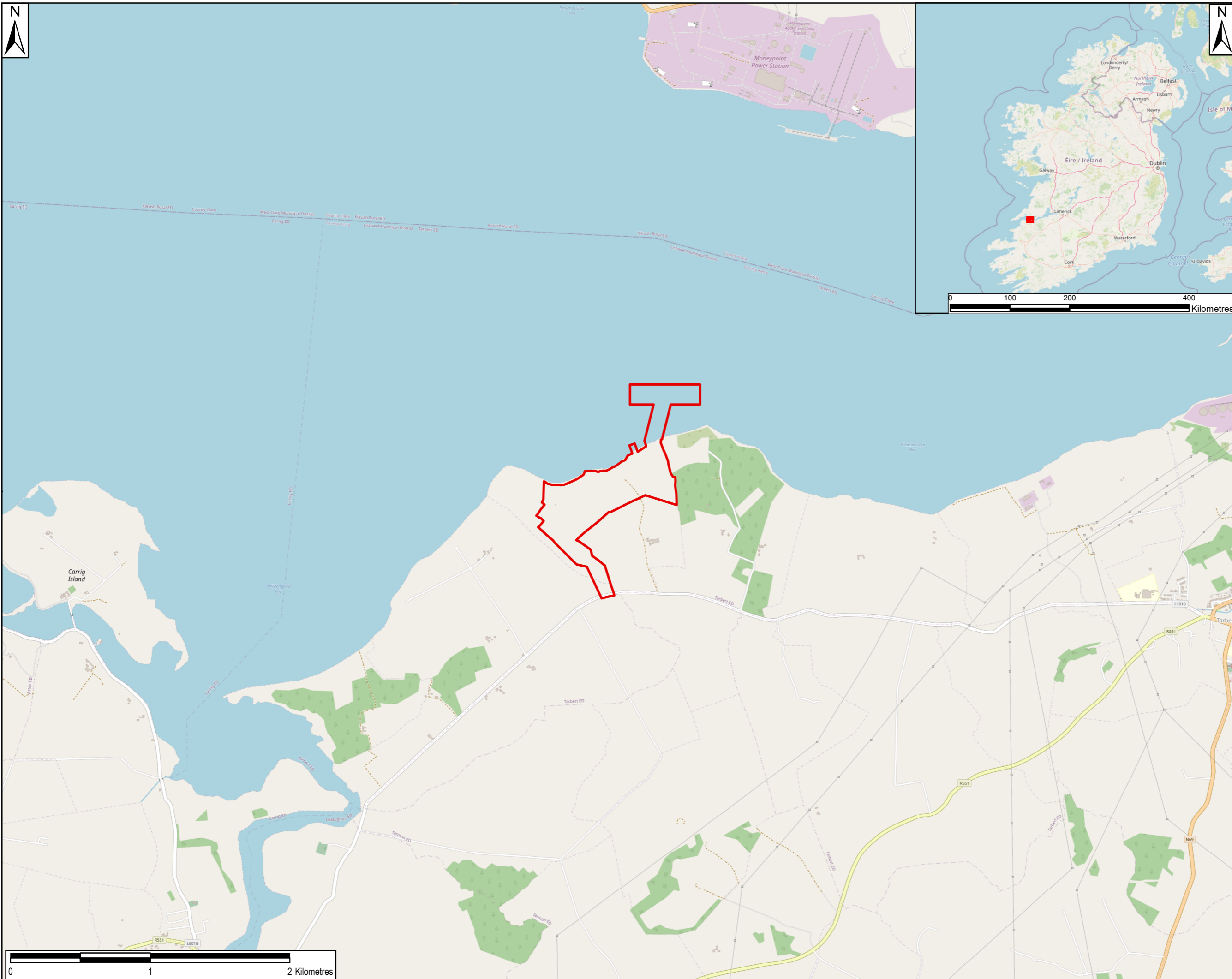
Nine groundwater and six surface water locations were sampled for a range of inorganic parameters and total petroleum hydrocarbons.

From field observations and analysis of the groundwater and surface water samples collected, the following conclusions can be drawn:

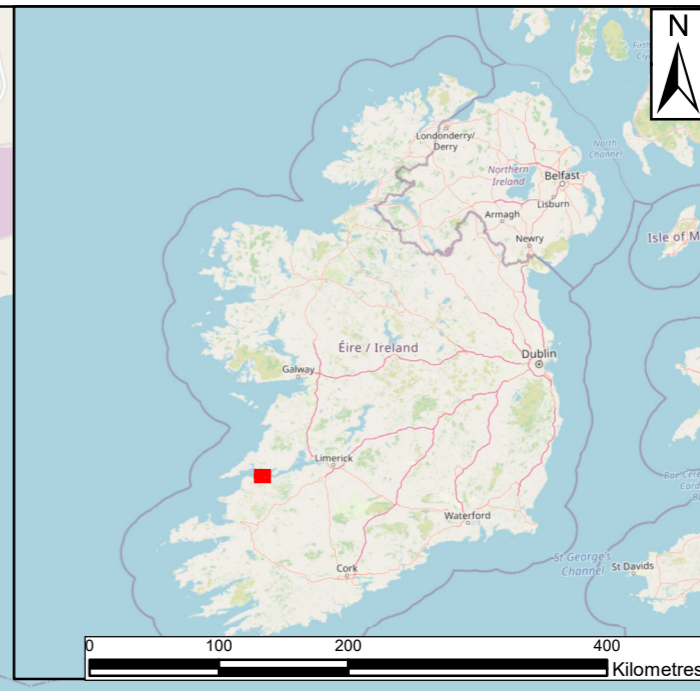
- Groundwater pH beneath the site is near-neutral, ranging from 6.27 (BH13) to 8.75 (BR-1).
- EC ranged from 204 $\mu\text{S}/\text{cm}$ (BR-1) to 553 $\mu\text{S}/\text{cm}$ (BH03) and indicative of typical groundwater conditions from non-carbonate bedrock, such as the shale and sandstone bedrock at the site.
- Groundwater temperature values (10.2 °C – 11.31 °C) were consistent with the normal range for groundwater in Ireland of 10.0 °C to 12.0 °C.
- Field readings of ORP, DO and laboratory results for dissolved manganese and iron indicate that groundwater conditions across the site are undersaturated with respect to oxygen (moderately reducing), with the lowest groundwater dissolved oxygen measurements corresponding with wells in which elevated TPH was reported.
- The low groundwater EC indicates minimal ingress of sea water beneath the site, this is also indicated by the low sodium and chloride results in groundwater.
- TPH was detected in wells BH05, BH19, BH20 and BR11, with the nearest potential source of fuel hydrocarbons being either domestic/agricultural use to the south (upgradient) of the site or a vehicle maintenance facility to the south of the site.
- The inferred groundwater flow direction in the western side of the site (west of BH05) is consistently to the west towards the discharge point of the Ballylongford waterbody to the Lower Shannon Estuary whereas east of BH05 ground water appears to flow north to the coastline, following the general topography.
- Surface water was found to have relatively low dissolved oxygen and low redox potential.
- TPH was detected at one surface water sampling location in the south of the site at 90 $\mu\text{g}/\text{L}$, and could be related either to road runoff to the stream or off-site domestic/agricultural/commercial activity in the vicinity.

Appendix A Figures

File Name: Z:\UK\MEDBL\Jobs\PR-482591_Shannon_LNG_Consultancy_Servic900_CAD_GIS\920_GISE\AR\GIS02_Maps\Water\Figure 6.1 Site Location and Outline of Proposed Development.mxd



LEGEND
— Development Boundary



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 Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA
 Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Purpose of Issue: **FINAL**

Client: **CONFIDENTIAL**

Project Title: **SHANNON TECHNOLOGY AND ENERGY PARK**

Drawing Title: **SITE LOCATION AND OUTLINE OF PROPOSED DEVELOPMENT**

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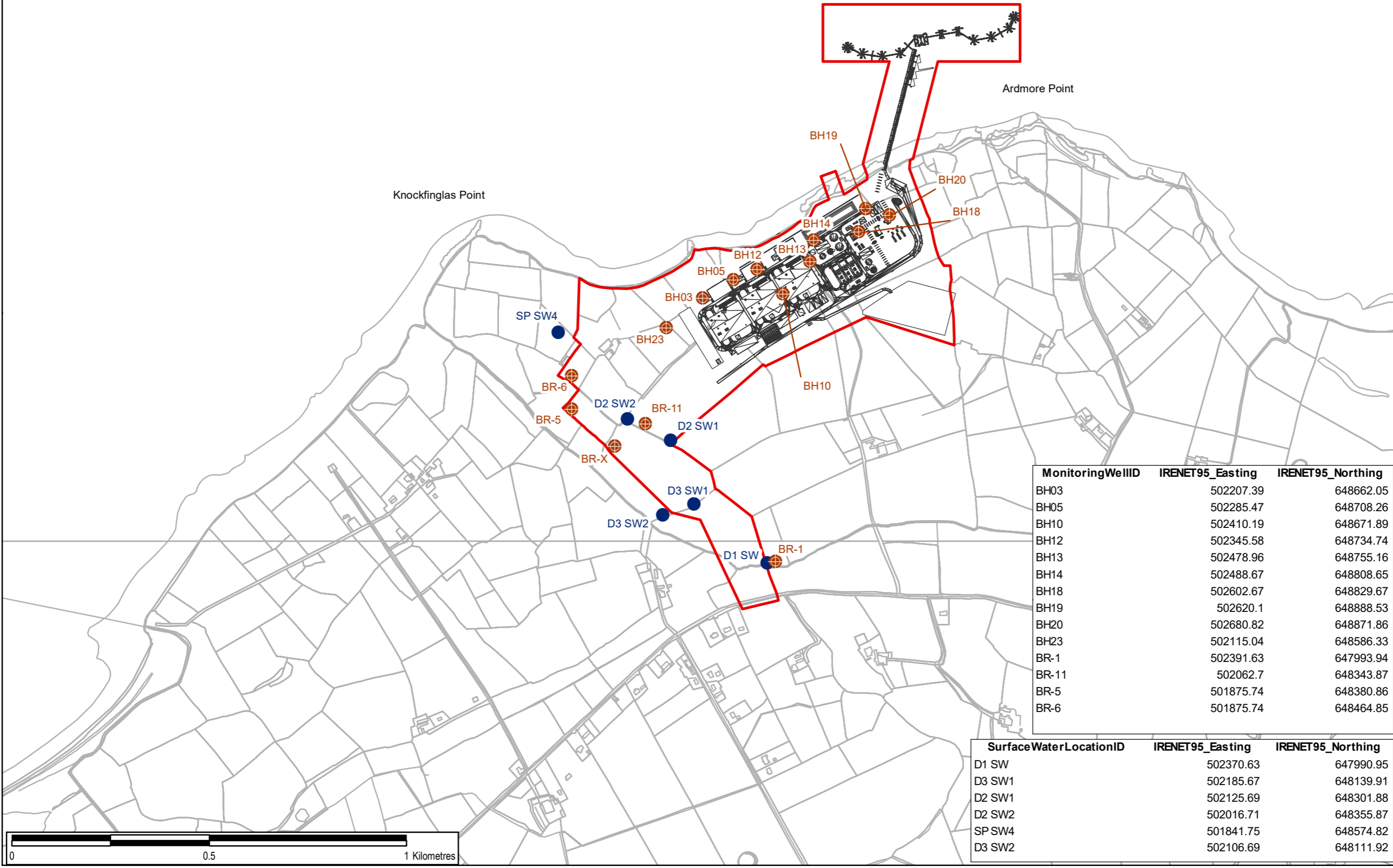
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 A96 T927, Ireland
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Drawing No: **FIGURE 1** Rev: **0**



File Name: Z:\UK\IEDBL\Jobs\PR-452981_Shannon_LNG_Consultancy_Servic900_CAD_GIS\920_GIS\EIAR\GIS02_Maps\Water\Figure 6.3 Well and Surface Water Sampling Locations on the Proposed Development (February 2020 Sampling Event).mxd



LEGEND

- Development Boundary
- Site Layout
- ⊕ Well locations
- Surface water locations

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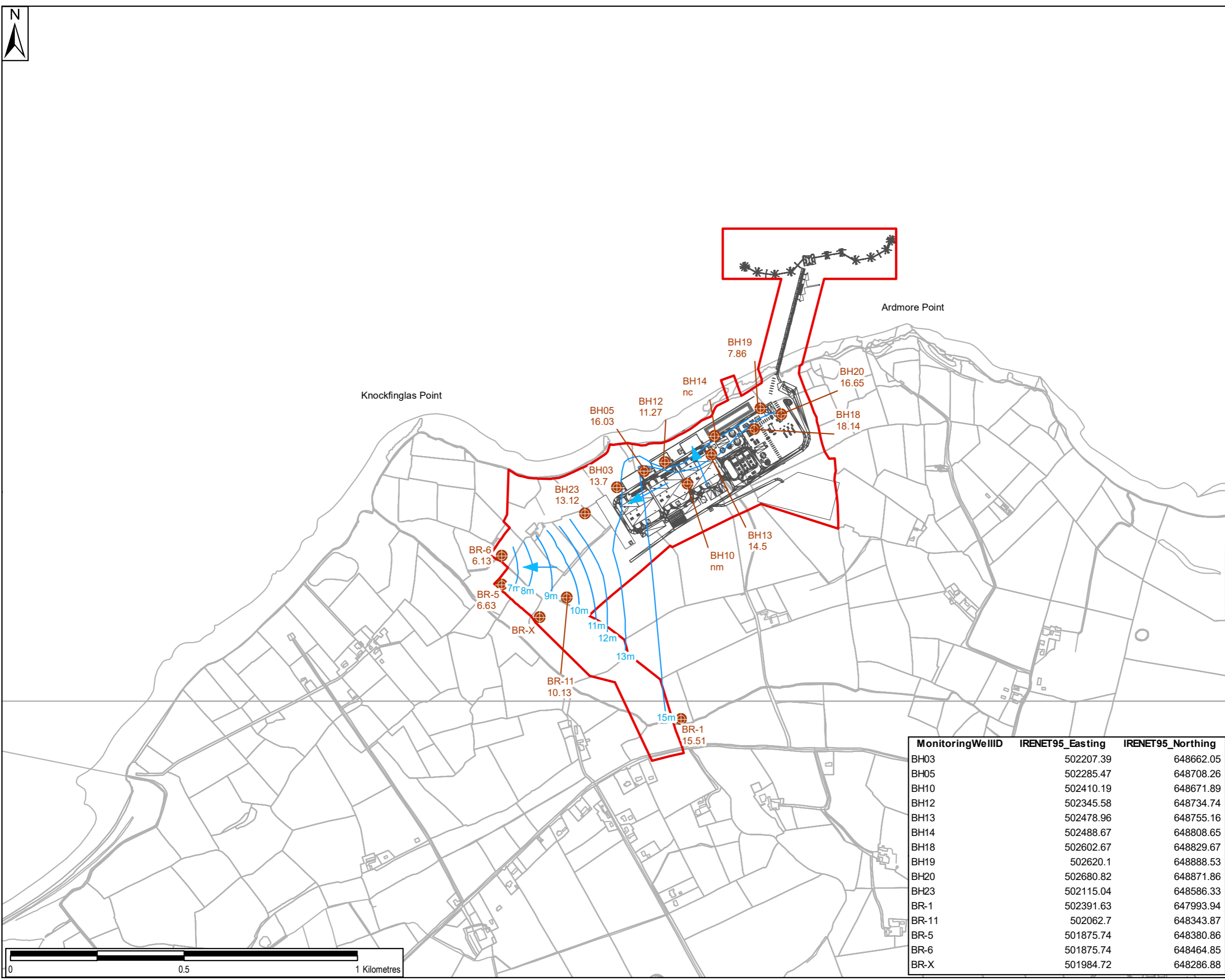
Drawing No: **FIGURE 2** Rev: **0**

MonitoringWellID	IRENET95_Easting	IRENET95_Northing
BH03	502207.39	648662.05
BH05	502285.47	648708.26
BH10	502410.19	648671.89
BH12	502345.58	648734.74
BH13	502478.96	648755.16
BH14	502488.67	648808.65
BH18	502602.67	648829.67
BH19	502620.1	648888.53
BH20	502680.82	648871.86
BH23	502115.04	648586.33
BR-1	502391.63	647993.94
BR-11	502062.7	648343.87
BR-5	501875.74	648380.86
BR-6	501875.74	648464.85

SurfaceWaterLocationID	IRENET95_Easting	IRENET95_Northing
D1 SW	502370.63	647990.95
D3 SW1	502185.67	648139.91
D2 SW1	502125.69	648301.88
D2 SW2	502016.71	648355.87
SP SW4	501841.75	648574.82
D3 SW2	502106.69	648111.92



File Name: Z:\UK\MEDBL\Jobs\PR-482591_Shannon_LNG_Consultancy_Servic900_CAD_GIS\920_GIS\SEAR\GIS02_Maps\Water\Figure 6.4_Site_Location_and_Outline_of_Proposed_Development.mxd



LEGEND

- Development Boundary
- Groundwater contours
- Site Layout
- Well locations

Copyright:
Service Layer Credits:

Purpose of Issue: **FINAL**

Client: **CONFIDENTIAL**

Project Title: **SHANNON TECHNOLOGY AND ENERGY PARK**

Drawing Title: **SITE LOCATION AND OUTLINE OF PROPOSED DEVELOPMENT**

Drawn: BS	Chk'd: DG	App'd: KF	Date: 14/07/2021
-----------	-----------	-----------	------------------

AECOM Internal Project No: PR-482591 Scale at A3: 1:10,000

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aecom.com



Drawing No: **FIGURE 3** Rev: **0**

Monitoring Well ID	IRENET95_Easting	IRENET95_Northing
BH03	502207.39	648662.05
BH05	502285.47	648708.26
BH10	502410.19	648671.89
BH12	502345.58	648734.74
BH13	502478.96	648755.16
BH14	502488.67	648808.65
BH18	502602.67	648829.67
BH19	502620.1	648888.53
BH20	502680.82	648871.86
BH23	502115.04	648586.33
BR-1	502391.63	647993.94
BR-11	502062.7	648343.87
BR-5	501875.74	648380.86
BR-6	501875.74	648464.85
BR-X	501984.72	648286.88

Appendix B Tables

**Table 1 - Sample Inventory 2020
 Shannon LNG**

Monitoring Location	Depth to Groundwater	Sample Schedule								
		Field WQM	TPH	Iron, Manganese, Sodium	Nitrate	Phosphate	Chloride	Sulphate	Total Alkalinity	Total Organic Carbon
Groundwater										
BH03	x	X	X	X	X	X	X	X	X	X
BH05	x	X	X	X	X	X	X	X	X	X
BH10	X	X	X	X	X	X	X	X	X	X
BH12	X	X	X	X	X	X	X	X	X	X
BH13	X	X	X	X	X	X	X	X	X	X
BH14	X	X	X	X	X	X	X	X	X	X
BH18	X	X	X	X	X	X	X	X	X	X
BH19	X	X	X	X	X	X	X	X	X	X
BH20	X	X	X	X	X	X	X	X	X	X
BR11	X	X	X	X	X	X	X	X	X	X
Surface Water										
S1 SW	na	X	X	X	X	X	X	X	X	X
D3 SW1	na	X	X	X	X	X	X	X	X	X
D2 SW1	na	X	X	X	X	X	X	X	X	X
D2 SW2	na	X	X	X	X	X	X	X	X	X
SP SW4	na	X	X	X	X	X	X	X	X	X
D3 SW2	na	X	X	X	X	X	X	X	X	X

Field WQM (water quality measurement): pH, electrical conductivity, dissolved oxygen, redox potential and temperature

TPH: total petroleum hydrocarbons

X: indicates measurement taken/analysis scheduled

na: not applicable

Table 2 - Groundwater Well Information

Monitoring Well ID	Zone (BR-series piezometer nests only)	Date of 2020 sampling/ measurement	Easting ITM/RENET95	Northing ITM/RENET95	Total Depth Measured (m bct)	Top of Screen (m bct)	Base of Screen (m bct)	Standpipe internal Diameter (mm)	Screen Section Geology	Top of Casing elevation 2007 m aOD (Malin)
BH03		07 February 2020	502207.39	648662.05	7.62	2.0	7.5	50	Overburden (Till) / Bedrock (Sandstone)	17.01
BH05		07 February 2020	502285.47	648708.26	9.38	2.0	9.5	50	Bedrock (Siltstone/Mudstone)	18.19
BH10		07 February 2020	502410.19	648671.89	-	0.0	4.4	50	Overburden (Till)	20.21
BH12		07 February 2020	502345.58	648734.74	5.96	1.0	5.5	50	Overburden (Till) / Bedrock (Sandstone)	13.44
BH13		07 February 2020	502478.96	648755.16	9.46	1.0	9	50	Overburden (Till) / Bedrock (Sandstone)	17.17
BH14		07 February 2020	502488.67	648808.65	7.27	1.0	6	50	Overburden (Till) / Bedrock (Sandstone)	13.46
BH18		07 February 2020	502602.67	648829.67	10.17	1.0	10	50	Bedrock (Sandstone)	19.25
BH19		07 February 2020	502620.1	648888.535	21.32	1.0	7	50	Overburden (Till) / Bedrock (Sandstone)	13.12
BH20		07 February 2020	502680.82	648871.86	3.62	0.0	0.8	50	Overburden (Till)	17.98
BH23	-	07 February 2020	502115.04	648586.33	6.823	5.0	7.5	50	Overburden (Till) / Bedrock (Siltstone/Mudstone)	13.18
BR-1	PH1	05 February 2020	502207.39	647993.94	1	0.5	1	20	Overburden (Lower Till)	16.4
BR-1	P1	05 February 2020	502207.39	647993.94	10.01	8	9.9	20	Bedrock (Sandstone)	16.34
BR-1	P2	05 February 2020	502207.39	647993.94	6.51	5.4	6.4	20	Bedrock (Sandstone)	16.21
BR-1	P3	05 February 2020	502207.39	647993.94	4.58	2.4	4.4	20	Bedrock (Sandstone)	16.36
BR-11	PH1	05 February 2020	502062.7	648343.87	1.79	0.74	1.84	20	Overburden (Upper Till)	10.61
BR-11	P1	05 February 2020	502062.7	648343.87	6.39	6.48	7.48	20	Bedrock (Siltstone)	10.85
BR-11	P2	05 February 2020	502062.7	648343.87	5.49	4.65	5.65	20	Bedrock (Siltstone)	10.83
BR-11	P3	05 February 2020	502062.7	648343.87	3.76	2.69	3.69	20	Overburden (Upper Till) / Bedrock (Siltstone)	10.66
BR-5	PH1	05 February 2020	501875.74	648380.86	2.76	0.5	2.7	20	Overburden (Lower Till)	6.72
BR-5	P1	05 February 2020	501875.74	648380.86	7.25	6	7	20	Bedrock (Siltstone/Mudstone)	6.98
BR-5	P2	05 February 2020	501875.74	648380.86	5.34	3.3	5.3	20	Overburden (Lower Till) / Bedrock (Siltstone/Mudstone)	6.92
BR-6	PH1	05 February 2020	501875.74	648464.85	2.34	0.5	2.8	20	Overburden (Upper Till/Lower Till)	6.79
BR-6	P1	05 February 2020	501875.74	648464.85	11.38	10	11	20	Bedrock (Sandstone/Siltstone)	6.91
BR-6	P2	05 February 2020	501875.74	648464.85	9.62	6.7	9.2	20	Overburden (Lower Till) / Bedrock (Sandstone/Siltstone)	6.85
BR-6	P3	05 February 2020	501875.74	648464.85	6.06	3.9	5.9	20	Overburden (Lower Till)	6.76
BR-X	P1	05 February 2020	501972.00	648273.00	14.79	-	-	20	Not Known	No survey data
BR-X	P2	05 February 2020	501972.00	648273.00	10.07	-	-	20	Not Known	No survey data

NOTES:
Well Screen information taken from previous site investigation reports (MEL, 2007, Arup, 2006)

**Table 3A - Groundwater Field Measurements
Shannon LNG**

Monitoring Well ID	Zone (BR-series piezometer nests only)	Date of 2020 sampling/ measurement	Depth to Groundwater (m bct)	Groundwater Elevation (m aOD)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	pH	Electrical Conductivity (µS/cm)	Temperature (°C)	Sampled	Waters Inertial Pump installed?	Comments
BH03		07 February 2020	3.31	13.700	0.18	291	7.51	553	11.09	Yes	Yes	Light Brown, light brown suspended solids, light to moderate turbidity. NEC
BH05		07 February 2020	2.156	16.034	6.65	311	7.11	432	10.8	Yes	Yes	Light Brown, light brown suspended solids, light to moderate turbidity. NEC
BH10		07 February 2020	-	-	-	-	-	-	-	No	No	Could not locate using GPS coordinates - well suspected to have been destroyed
BH12		07 February 2020	2.174	11.266	3.07	300	6.95	374	10.62	Yes	Yes	Light Brown, light brown suspended solids, moderate turbidity. NEC
BH13		07 February 2020	2.674	14.496	0.92	306	6.27	279	10.2	Yes	Yes	Light Brown, light brown suspended solids, moderate turbidity. NEC
BH14		07 February 2020	3.95	9.510	1.05	226	7.36	334	11.31	Yes	Yes	Orange/ brown, moderate / heavy turbidity, black suspended solids (sand grains). NEC Headworks are offset relative to borehole and standpipe has broken off below ground level.
BH18		07 February 2020	1.107	18.143	1.16	369	8.75	204	10.2	Yes	Yes	Light brown, brown suspended solids, low turbidity, white scum. NEC.
BH19		07 February 2020	5.264	7.856	2.96	242	6.44	235	11.22	Yes	Yes	Light cloudy brown, light to moderate turbidity, brown suspended solids. NEC Headworks missing, damaged standpipe extends above ground level. Well significantly deeper than recorded in 2007 report, well backfill has washed out below screened section.
BH20		07 February 2020	1.33	16.650	-	142	7.26	424	11.04	Yes	Yes	Very cloudy grey/ brown, sand grains?, very high turbidity. NEC. Well purged dry, left to recharge- therefore live readings taken. Well significantly deeper than recorded in 2007 report.
BH23		07 February 2020	0.062	13.118	-	-	-	-	-	No	No	Water level only. Significant standing water within well headworks, but standpipe water level is above casing water level
BR-1	PH1	05 February 2020	-	-	-	-	-	-	-	No	No	Dry
BR-1	P1	05 February 2020	0.83	15.510	-	-	-	-	-	No	No	Water level only
BR-1	P2	05 February 2020	0.865	15.345	-	-	-	-	-	No	No	Water level only
BR-1	P3	05 February 2020	0.692	15.668	-	-	-	-	-	No	No	Water level only
BR-11	PH1	05 February 2020	0.546	10.064	-	-	-	-	-	No	No	Water level only
BR-11	P1	05 February 2020	0.724	10.126	-	-	-	-	-	No	No	Well Headworks tilted and piezometers bent/sinked. Not possible to get narrow bailers more than 2 m down the well, had to take grab sample of standing water. No field readings.
BR-11	P2	05 February 2020	0.693	10.137	-	-	-	-	-	No	No	Water level only
BR-11	P3	05 February 2020	0.575	10.085	-	-	-	-	-	No	No	Water level only
BR-5	PH1	05 February 2020	0.474	6.246	-	-	-	-	-	No	No	Water level only
BR-5	P1	05 February 2020	0.347	6.633	-	-	-	-	-	No	No	Water level only
BR-5	P2	05 February 2020	0.563	6.357	-	-	-	-	-	No	No	Water level only
BR-6	PH1	05 February 2020	0.361	6.429	-	-	-	-	-	No	No	Water level only
BR-6	P1	05 February 2020	0.777	6.133	-	-	-	-	-	No	No	Water level only
BR-6	P2	05 February 2020	0.752	6.098	-	-	-	-	-	No	No	Water level only
BR-6	P3	05 February 2020	0.503	6.257	-	-	-	-	-	No	No	Water level only
BR-X	P1	05 February 2020	5.608	-	-	-	-	-	-	No	No	Water level only. Well not marked in 2007 Minerex study - 2 piezometers in single bore with upright steel headworks. Construction materials consistent with Minerex BR series wells.
BR-X	P2	05 February 2020	5.4	-	-	-	-	-	-	No	No	Water level only. Well not marked in 2007 Minerex study - 2 piezometers in single bore with upright steel headworks. Construction materials consistent with Minerex BR series wells.

NOTES:

mg/L: milligrams per litre
 µS/cm: micro siemens per centimetre
 mV: millivolts
 °C: degrees Celsius
 ORP: Oxidation-reduction potential
 Note: Eh readings adjusted as recommended by instrument manufacturer
 - not measured
 NEC no evidence of contamination

**Table 3B - Surface water Field Measurements
 Shannon LNG**

Location ID	Date	Dissolved Oxygen (mg/L)	Redox Potential (mV)	pH	Electrical Conductivity (µS/cm)	Temperature (°C)	Comments	Easting	Northing
D1 SW	05 February 2020	7.23	271	7.63	378	9.82	Drainage Ditch. No staff gauge	502370.63	647990.95
D3 SW1	05 February 2020	9.74	252	7.88	260	8.97	Clear, suspended solids of organic debris, low flow, NEC	502185.67	648139.91
D2 SW1	05 February 2020	11.11	302	7.86	290	8.47	Clear, occasional organic suspended solids, moderate flow, NEC	502125.69	648301.88
D2 SW2	05 February 2020	0.78	234	7.59	281	8	Clear, clear/ yellow, low flow, NEC	502016.71	648355.87
SP SW4	05 February 2020	2.67	248	7.84	359	5.29	Standing water, yellow/brown, organic material, NEC	501841.75	648574.82
D3 SW2	05 February 2020	11.21	276	7.93	230	8.35	Clear, low-moderate flow, NEC	502106.69	648111.92

NOTES:

mg/L: milligrams per litre

mS/cm: micro siemens per centimetre

mV: millivolts

°C: degrees Celsius

ORP: Oxidation-reduction potential

Note: Eh readings adjusted as recommended by instrument manufacturer

- not measured

NEC no evidence of contamination

**Table 4 - Total Petroleum Hydrocarbons (µg/L)
 Shannon LNG**

Screening Criteria	Determinands		
	TPH	DRO	GRO
	C8-C40	C10-C40	C8-C10
	µg/L		
MDL	10	10	10
EQS	-	-	-
IGV	<u>10</u>	<u>10</u>	<u>10</u>
GTV	7.50	nv	nv
Sample ID			
Groundwater			
BH03	<10	<10	<10
BH05	<10	<u>70</u>	<10
BH12	<10	<10	<10
BH13	<10	<10	<10
BH14	<10	<10	<10
BH18	<10	<10	<10
BH19	<u>90</u>	<u>90</u>	<10
BH20	<u>420</u>	<u>390</u>	<10
BR11	<u>230</u>	<u>210</u>	<10
Surface water			
D1 SW	90	80	<10
D3 SW1	<10	<10	<10
D2 SW1	<10	<10	<10
D2 SW2	<10	<10	<10
SP SW4	<10	<10	<10
D3 SW2	<10	<10	<10

NOTES:

- TPH Total Petroleum Hydrocarbon
- DRO Diesel Range Organics
- EPH Extractable Petroleum Hydrocarbon
- GRO Gas Range Organics
- µg/L micrograms/Litre
- MDL Minimum Detection Limit
- < Below Detection Limit
- No Criteria Provided
- EQS Environmental Quality Standard- Europea
 Environmental Objectives (Surface Wa
- XXXX** Exceeds Groundwater Threshold Value
- XXXX Exceeds Interim Guideline Value

**Table 5 - Metals (mg/L)
 Shannon LNG**

Screening Criteria	Determinands		
	Iron	Manganese	Sodium
	mg/L	mg/L	mg/L
MDL	0.02	0.001	0.5
EQS	-	-	-
IGV	<u>0.2</u>	<u>0.05</u>	150
DWS	0.20	0.05	200
GTV	-	-	-
Sample ID			
Groundwater			
BH03	0.07	<u>1.30</u>	51
BH05	0.05	0.01	34
BH12	0.12	<u>0.07</u>	26
BH13	0.07	<u>0.90</u>	30
BH14	0.08	<u>0.08</u>	34
BH18	<0.02	0.03	24
BH19	<0.02	<u>0.11</u>	24
BH20	<u>1.70</u>	<u>3.70</u>	25
BR-11	<u>0.55</u>	<u>0.73</u>	29
Surface water			
D1 SW	<u>1.60</u>	<u>0.56</u>	22
D3 SW1	<u>0.73</u>	<u>0.09</u>	24
D2 SW1	0.24	0.02	25
D2 SW2	<u>0.48</u>	<u>0.07</u>	25
SP SW4	<u>5.60</u>	<u>0.18</u>	59
D3 SW2	<u>0.31</u>	<u>0.06</u>	23

NOTES:

- mg/L milligrams/Litre
- No Criteria Provided
- MDL Minimum Detection Limit
- < Less than Laboratory Detection Limit
- EQS Environmental Quality Standard- European Union
 Environmental Objectives (Surface Waters)

XXXX Exceeds Interim Guideline Value

XXXX Exceeds Drinking Water Guideline

**Table 6 - Miscellaneous
Shannon LNG**

Screening Criteria	Determinands							
	Nitrate-N	Nitrate as NO ₃	Phosphate -PO ₄	Phosphate -PO ₄	Chloride	Sulphate	Total Alkalinity as CaCO ₃	Total Organic Carbon
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	coastal	coastal	river	coastal				
MDL	0.15	0.66	0.015	0.015	1	1	10	0.25
EQS	0.17-2.6	0.75-11.51	<0.08-0.11	<0.08-0.18				
IGV	<u>5.6</u>	<u>25</u>	<u>0.03</u>	<u>0.03</u>	<u>30</u>	<u>200</u>	NAC	-
DWS	11.30	50.00	-	-	250.00	250.00	-	-
GTV	8.50	37.5	0.035	0.035	187.5	187.5	-	-
Sample ID								
Groundwater								
BH03	0.56	2.5	<u>0.25</u>		<u>120</u>	56	716	1.13
BH05	<u>6.10</u>	<u>27</u>	<u>0.30</u>		<u>56</u>	26	635	2.22
BH12	2.80	12	<u>0.07</u>		<u>34</u>	11	677	1.49
BH13	1.60	7.2	<0.015		<u>44</u>	19	445	4.01
BH14	<u>8.40</u>	<u>37</u>	<u>0.12</u>		<u>54</u>	21	580	6.18
BH18	2.10	9.1	<u>0.05</u>		17	<1	494	2.9
BH19	0.73	3.3	<u>0.16</u>		<u>37</u>	4.2	501	2.6
BH20	5.10	22	<0.015		<u>190</u>	<u>480</u>	616	2.39
BR-11	0.91	4.1	<u>0.07</u>		22	6.5	622	3.87
Surface water								
D1 SW	3.70	16	0.12		36	14		2.79
D3 SW1	1.20	5.3	0.06		33	11	81	3.98
D2 SW1	0.59	2.6	0.05		40	8.8	86	6.06
D2 SW2	1.20	5.2	0.13		40	8.4	523	6.09
SP SW4	<0.15	<0.66	0.15		100	<1	264	60.28
D3 SW2	0.54	2.4	0.02		33	11	432	4.4

mg/L

milligrams/Litre

-

No Criteria Provided

Blank cell indicates no result

MDL

Minimum Detection Limit

<

Less than Laboratory Detection Limit

NAC

No Abnormal Change

EQS

Environmental Quality Standard- European Union Environmental Objectives (Surface Waters)

XXXX

Exceeds Groundwater Threshold Value

XXXX

Exceeds Interm Guideline Value

XXXX

Exceeds Environmental Quality Standards

Appendix C Laboratory Report



ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

ENVIRONMENTAL LABORATORY SERVICES

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Contact Name	Brendan McCarthy	Report Number	175067 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175067/001
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	BH03	Date of Report	20/02/2020
		Sample Type	Ground Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		0.56	mg/l N	INAB	
	Nitrate as NO ₃ (Calc)		EW175	0.66		2.5	mg/l NO ₃	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.083	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO ₄ (Calc)		EW175	0.015		0.254	mg/l PO ₄	INAB	
	Chloride mg/L		EW175	1.0		120	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		56	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<100	µg/L	INAB	
	<i>Analyst QC Comment :LOQ raised due to nature of sample matrix.</i>								
	EPH->C8 to <C40		EO063	0.01		<0.1	mg/L	INAB	
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.05	mg/L	INAB	
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.05	mg/L	INAB	
	EPH >C20 - <C40 (Motor Oil Range)		EO063	0.01		<0.05	mg/L	INAB	
Metals-Dissolved									
	Iron-Dissolved		EW188	20		70	ug/L	INAB	
	Manganese-Dissolved		EW188	1.0		1300	ug/L	INAB	
	Sodium-Dissolved		EW188	0.5		50.6	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		716	mg/L CaCO ₃	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		1.13	mg/L	INAB	

Signed :

Rachel Walsh-Technical Manager

20/02/2020

NOTES

- 1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
- 2.SPEC= Allowable limit or parametric value
- 3.OOS=Result which is outside specification highlighted as OOS-A
- 4.LOQ=Limit of Quantification or lowest value that can be reported
- 5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
- 6."*" Indicates sub-contract test
- 7.Where the date of sampling has not been provided,sample stability times cannot be assessed. It is therefore possible that the results provided may be compromised



ENVIRONMENTAL LABORATORY SERVICES
EXCELLENCE THROUGH ACCREDITATION

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Contact Name	Brendan McCarthy	Report Number	175067 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175067/002
		Date of Receipt	11/02/2020
		Date Started	11/02/2020
Tel No		Received or Collected	Courier
Customer PO	COR/2961/GOC (PR-452891)	Date of Report	20/02/2020
Project No.	QN010003	Sample Type	Ground Waters
Customer Ref	BH05	Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		6.1	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		27	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.099	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.302	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		56	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		26	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<100	µg/L	INAB	
	<i>Analyst QC Comment :LOQ raised due to nature of sample matrix.</i>								
	EPH->C8 to <C40		EO063	0.01		<0.1	mg/L	INAB	
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.05	mg/L		
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		0.07	mg/L		
	EPH >C20 - <C40 (Motor Oil Range)		EO063	0.01		<0.05	mg/L		
Metals-Dissolved									
	Iron-Dissolved		EW188	20		52	ug/L	INAB	
	Manganese-Dissolved		EW188	1.0		14	ug/L	INAB	
	Sodium-Dissolved		EW188	0.5		34.2	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		635	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		2.22	mg/L	INAB	

Signed :

Rachel Walsh-Technical Manager

20/02/2020

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Contact Name	Brendan McCarthy	Report Number	175067 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175067/003
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	BH12	Date of Report	20/02/2020
		Sample Type	Ground Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		2.8	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		12	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.022	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.068	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		34	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		11	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<100	µg/L	INAB	
	<i>Analyst QC Comment :LOQ raised due to nature of sample matrix.</i>								
	EPH->C8 to <C40		EO063	0.01		<0.1	mg/L	INAB	
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.05	mg/L	INAB	
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.05	mg/L	INAB	
	EPH >C20 - <C40 (Motor Oil Range)		EO063	0.01		<0.05	mg/L	INAB	
Metals-Dissolved									
	Iron-Dissolved		EW188	20		120	ug/L	INAB	
	Manganese-Dissolved		EW188	1.0		74	ug/L	INAB	
	Sodium-Dissolved		EW188	0.5		26.2	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		677	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		1.49	mg/L	INAB	

Signed :

20/02/2020

Rachel Walsh-Technical Manager

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Contact Name	Brendan McCarthy	Report Number	175067 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175067/004
		Date of Receipt	11/02/2020
		Date Started	11/02/2020
Tel No		Received or Collected	Courier
Customer PO	COR/2961/GOC (PR-452891)	Date of Report	20/02/2020
Project No.	QN010003	Sample Type	Ground Waters
Customer Ref	BH13	Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		1.6	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		7.2	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		<0.005	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		<0.015	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		44	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		19	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<20	µg/L	INAB	
	<i>Analyst QC Comment :LOQ raised due to nature of sample matrix.</i>								
	EPH->C8 to <C40		EO063	0.01		<0.02	mg/L	INAB	
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - <C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
Metals-Dissolved									
	Iron-Dissolved		EW188	20		70	ug/L	INAB	
	Manganese-Dissolved		EW188	1.0		900	ug/L		
	Sodium-Dissolved		EW188	0.5		30.2	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		445	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		4.01	mg/L	INAB	

Signed :  _____ 20/02/2020
Rachel Walsh-Technical Manager

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Contact Name	Brendan McCarthy	Report Number	175067 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175067/005
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	BH14	Date of Report	20/02/2020
		Sample Type	Ground Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		8.4	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		37	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.039	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.119	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		54	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		21	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<50	µg/L	INAB	
	<i>Analyst QC Comment :LOQ raised due to nature of sample matrix.</i>								
	EPH->C8 to <C40		EO063	0.01		<0.05	mg/L	INAB	
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.025	mg/L	INAB	
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.025	mg/L	INAB	
	EPH >C20 - <C40 (Motor Oil Range)		EO063	0.01		<0.025	mg/L	INAB	
Metals-Dissolved									
	Iron-Dissolved		EW188	20		84	ug/L	INAB	
	Manganese-Dissolved		EW188	1.0		78	ug/L	INAB	
	Sodium-Dissolved		EW188	0.5		34.4	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		580	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		6.18	mg/L	INAB	

Signed :

Rachel Walsh-Technical Manager

20/02/2020

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Contact Name	Brendan McCarthy	Report Number	175067 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175067/006
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	BH18	Date of Report	20/02/2020
		Sample Type	Ground Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		2.1	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		9.1	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.016	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.050	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		17	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		<1.0	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L	INAB	
	EPH->C8 to <C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - <C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
Metals-Dissolved									
	Iron-Dissolved		EW188	20		<20	ug/L	INAB	
	Manganese-Dissolved		EW188	1.0		28	ug/L	INAB	
	Sodium-Dissolved		EW188	0.5		24.4	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		494	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		2.90	mg/L	INAB	

Signed : 

Rachel Walsh-Technical Manager

20/02/2020

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Contact Name	Brendan McCarthy	Report Number	175067 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175067/007
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	BH19	Date of Report	20/02/2020
		Sample Type	Ground Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		0.73	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		3.3	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.052	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.159	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		37	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		4.2	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40 (Calc ug/l)		EO063	10		93	µg/L	INAB	
	EPH->C8 to <C40		EO063	0.01		0.09	mg/L	INAB	
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		0.08	mg/L		
	EPH >C20 - <C40 (Motor Oil Range)		EO063	0.01		0.01	mg/L		
Metals-Dissolved									
	Iron-Dissolved		EW188	20		<20	ug/L	INAB	
	Manganese-Dissolved		EW188	1.0		110	ug/L		
	Sodium-Dissolved		EW188	0.5		23.9	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		501	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		2.60	mg/L	INAB	

Signed : 

20/02/2020

Rachel Walsh-Technical Manager

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Contact Name	Brendan McCarthy	Report Number	175067 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175067/008
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	BH20	Date of Report	20/02/2020
		Sample Type	Ground Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		5.1	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		22	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		<0.005	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		<0.015	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		190	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		480	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40 (Calc ug/l)		EO063	10		419	µg/L	INAB	
	EPH->C8 to <C40		EO063	0.01		0.42	mg/L	INAB	
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.025	mg/L		
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		0.39	mg/L		
	EPH >C20 - <C40 (Motor Oil Range)		EO063	0.01		<0.05	mg/L		
Metals-Dissolved									
	Iron-Dissolved		EW188	20		1700	ug/L		
	Manganese-Dissolved		EW188	1.0		3700	ug/L		
	Sodium-Dissolved		EW188	0.5		25.4	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		616	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		2.39	mg/L	INAB	

Signed :

Rachel Walsh-Technical Manager

20/02/2020

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Contact Name	Brendan McCarthy	Report Number	175067 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175067/009
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	BR11	Date of Report	20/02/2020
		Sample Type	Ground Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		0.91	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		4.1	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.024	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.073	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		22	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		6.5	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40 (Calc ug/l)		EO063	10		229	µg/L	INAB	
	EPH->C8 to <C40		EO063	0.01		0.23	mg/L	INAB	
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.025	mg/L		
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		0.21	mg/L		
	EPH >C20 - <C40 (Motor Oil Range)		EO063	0.01		<0.025	mg/L		
Metals-Dissolved									
	Iron-Dissolved		EW188	20		550	ug/L		
	Manganese-Dissolved		EW188	1.0		730	ug/L		
	Sodium-Dissolved		EW188	0.5		29.4	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		622	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		3.87	mg/L	INAB	

Signed :

Rachel Walsh-Technical Manager

20/02/2020

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email: info@elsltd.com



Contact Name	Brendan McCarthy	Report Number	175068 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175068/001
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	D1 SW	Date of Report	21/02/2020
		Sample Type	Surface Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		3.7	mg/l N	INAB	
	Nitrate as NO ₃ (Calc)		EW175	0.66		16	mg/l NO ₃	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.039	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO ₄ (Calc)		EW175	0.015		0.121	mg/l PO ₄	INAB	
	Chloride mg/L		EW175	1.0		36	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		14	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		0.08	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		0.09	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		88	µg/L		
Metals-Trace									
	Iron		EW188	20		1600	ug/L		
	Manganese		EW188	1.0		560	ug/L		
	Sodium		EW188	0.5		21.7	mg/L	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		2.79	mg/L	INAB	

Signed :

21/02/2020

Rachel Walsh-Technical Manager

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4.LOQ=Limit of Quantification or lowest value that can be reported

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6."*" Indicates sub-contract test



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Contact Name	Brendan McCarthy	Report Number	175068 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175068/002
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	D3 SW1	Date of Report	21/02/2020
		Sample Type	Surface Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		1.2	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		5.3	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.019	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.058	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		33	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		11	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
Metals-Trace									
	Iron		EW188	20		730	ug/L		
	Manganese		EW188	1.0		88	ug/L	INAB	
	Sodium		EW188	0.5		23.8	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		81	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		3.98	mg/L	INAB	

Signed : 

Rachel Walsh-Technical Manager

21/02/2020

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Contact Name	Brendan McCarthy	Report Number	175068 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175068/003
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	D2 SW1	Date of Report	21/02/2020
		Sample Type	Surface Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		0.59	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		2.6	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.015	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.045	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		40	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		8.8	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
Metals-Trace									
	Iron		EW188	20		240	ug/L	INAB	
	Manganese		EW188	1.0		22	ug/L	INAB	
	Sodium		EW188	0.5		25.0	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		86	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		6.06	mg/L	INAB	

Signed :

Rachel Walsh-Technical Manager

21/02/2020

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Contact Name	Brendan McCarthy	Report Number	175068 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175068/004
		Date of Receipt	11/02/2020
		Date Started	11/02/2020
Tel No		Received or Collected	Courier
Customer PO	COR/2961/GOC (PR-452891)	Date of Report	21/02/2020
Project No.	QN010003	Sample Type	Surface Waters
Customer Ref	D2 SW2	Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		1.2	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		5.2	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.041	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.127	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		40	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		8.4	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
Metals-Trace									
	Iron		EW188	20		480	ug/L	INAB	
	Manganese		EW188	1.0		65	ug/L	INAB	
	Sodium		EW188	0.5		25.0	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		523	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		6.09	mg/L	INAB	

Signed : 

Rachel Walsh-Technical Manager

21/02/2020

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Contact Name	Brendan McCarthy	Report Number	175068 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175068/005
Tel No		Date of Receipt	11/02/2020
Customer PO	COR/2961/GOC (PR-452891)	Date Started	11/02/2020
Project No.	QN010003	Received or Collected	Courier
Customer Ref	SP SW4	Date of Report	21/02/2020
		Sample Type	Surface Waters
		Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		<0.15	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		<0.66	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.049	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.149	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		100	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		<1.0	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
Metals-Trace									
	Iron		EW188	20		5600	ug/L		
	Manganese		EW188	1.0		180	ug/L	INAB	
	Sodium		EW188	0.5		58.9	mg/L		
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		264	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		60.28	mg/L	INAB	

Signed :

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21/02/2020

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Contact Name	Brendan McCarthy	Report Number	175068 - 1
Address	Aecom Ireland Limited 24 Lower Hatch Street, Dublin 2	Sample Number	175068/006
		Date of Receipt	11/02/2020
		Date Started	11/02/2020
Tel No		Received or Collected	Courier
Customer PO	COR/2961/GOC (PR-452891)	Date of Report	21/02/2020
Project No.	QN010003	Sample Type	Surface Waters
Customer Ref	D3 SW2	Condition on receipt	Satisfactory

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Gallery Plus-Suite A									
	Nitrate as N		EW175	0.15		0.54	mg/l N	INAB	
	Nitrate as NO3 (Calc)		EW175	0.66		2.4	mg/l NO3	INAB	
	Phosphate (Ortho/MRP) as P		EW175	0.005		0.007	mg/l P	INAB	
	Phosphate (Ortho/MRP) as PO4 (Calc)		EW175	0.015		0.021	mg/l PO4	INAB	
	Chloride mg/L		EW175	1.0		33	mg/L	INAB	
	Sulphate mg/L		EW175	1.0		11	mg/L	INAB	
GCFID-(LVI) EPH C8 to C40 (Mineral Oil C8-C40)									
	EPH-C8 to C40		EO063	0.01		<0.01	mg/L	INAB	
	EPH-C8 to C40 (Calc ug/l)		EO063	10		<10	µg/L		
	EPH >C10 - C20 (Diesel Range)		EO063	0.01		<0.01	mg/L		
	EPH >C20 - C40 (Motor Oil Range)		EO063	0.01		<0.01	mg/L		
	EPH >C8 - C10 (Petrol Range)		EO063	0.01		<0.01	mg/L		
Metals-Trace									
	Iron		EW188	20		310	ug/L	INAB	
	Manganese		EW188	1.0		56	ug/L	INAB	
	Sodium		EW188	0.5		22.5	mg/L	INAB	
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		432	mg/L CaCO3	INAB	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		4.40	mg/L	INAB	

Signed :

Rachel Walsh-Technical Manager

21/02/2020

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Appendix D Photographic Log



**APPENDIX D -
PHOTOGRAPHIC LOG**

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

1

Date: 05

February 2020

Description:

Looking north along old trackway on better-drained, higher ground in south of the Proposed Development (approximate route of access road), with the valley of the Ralappane Stream (D1 Stream) in mid-ground and Shannon Estuary in background





PHOTOGRAPHIC LOG

Client Name:
New Fortress Energy

Site Location:
Shannon LNG Site

Project Number:
PR-452891

Photo No.
2

Date: 05
February 2020

Description:

Locations of multilevel well BR-11 and surface water sample D2 SW1 – note poorly-drained land in base of D2 stream valley.





PHOTOGRAPHIC LOG

Client Name:
New Fortress Energy

Site Location:
Shannon LNG Site

Project Number:
PR-452891

Photo No.
3

Date: 05
February 2020

Description:

Locations of multilevel well BR-11 and surface water sample D2 SW2 – D2 stream follows hedgerow on left of photograph.





PHOTOGRAPHIC LOG

Client Name:
New Fortress Energy

Site Location:
Shannon LNG Site

Project Number:
PR-452891

Photo No.
4

Date: 05
February 2020

Description:

Location D2 SW2 – note concrete culvert under field gate on left upstream of sampling location





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

5

Date: 05

February 2020

Description:

Location D3-SW1 – field drain adjacent to field boundary





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

6

Date: 05

February 2020

Description:

Location of spring SP SW4 – note ponded water, algae and organic matter (fallen leaves) in the water





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

7

Date: 05

February 2020

Description:

Location D3-SW2 at gap in field boundary





PHOTOGRAPHIC LOG

Client Name:
New Fortress Energy

Site Location:
Shannon LNG Site

Project Number:
PR-452891

Photo No.
8

Date: 05
February 2020

Description:

D1-SW1 and adjacent wetland area – photograph taken from location of well BR-1





PHOTOGRAPHIC LOG

Client Name:
New Fortress Energy

Site Location:
Shannon LNG Site

Project Number:
PR-452891

Photo No.
9

Date: 05
February 2020

Description:
D1-SW1





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

10

Date: 05

February 2020

Description:

Multi-level well BR-1





PHOTOGRAPHIC LOG

Client Name:
New Fortress Energy

Site Location:
Shannon LNG Site

Project Number:
PR-452891

Photo No.
11

Date: 05
February 2020

Description:
Multi-level well BR-1
– 3x 25mm well piezometers





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

12

Date: 05

February 2020

Description:

Well BH06





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

13

Date: 05

February 2020

Description:

Multilevel well BR-X (not reported in MEL, 2007 report)





PHOTOGRAPHIC LOG

Client Name:
New Fortress Energy

Site Location:
Shannon LNG Site

Project Number:
PR-452891

Photo No.
14

Date: 07
February 2020

Description:
Well BH03





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

15

Date: 07

February 2020

Description:

BH05, BH12, BH13 and BH14 – looking east across proposed location of LNG Terminal and Power Plant





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

16

Date: 05

February 2020

Description:

Field in which BH10 (not found) was located – note poor drainage and reed growth





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

17

Date: 05

February 2020

Description:

Field in which BH10 (not found) was located – note poor drainage and reed growth – BH05 in background





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

18

Date: 07

February 2020

Description:

BH12 – note poorly drained area which is a short stream flowing north to the coastline





PHOTOGRAPHIC LOG

Client Name:
New Fortress Energy

Site Location:
Shannon LNG Site

Project Number:
PR-452891

Photo No.
19

Date: 07
February 2020

Description:

BH13 (upright well cover missing and found nearby) and BH14





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

20

Date: 07

February 2020

Description:

BH14 – note – steel upright well cover and concrete base partly offset from well bore – likely due to livestock activity





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

21

Date: 07

February 2020

Description:

BH19 (steel upright well cover missing)





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

22

Date: 07

February 2020

Description:

BH20





PHOTOGRAPHIC LOG

Client Name:

New Fortress Energy

Site Location:

Shannon LNG Site

Project Number:

PR-452891

Photo No.

23

Date: 07

February 2020

Description:

BH23



