Firlough Hydrogen Plant

Groundwater Supply Assessment

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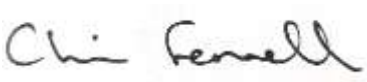	
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Executive Summary

1. Minerex Environmental Limited was commissioned by Mercury Renewables to carry out a groundwater supply assessment for the proposed development of a combined windfarm and hydrogen production plant near Ballina, County Mayo.
2. Eight boreholes were drilled onsite as part of the investigation. Water strikes were noted by the driller in two boreholes (BH6 and BH7) which were subsequently selected for pump testing.
3. A constant rate discharge pumping test commenced on the 11/07/22 and pumping continued until the 03/08/2022 (approximately 546 hours of pumping in total).
4. Sustainable yields of 2.25 l/s (194 m^3/d) and 0.44 l/s (38 m^3/d) have been established for Boreholes 6 and 7, respectively, with a cumulative yield of 232 m^3/d (84,680 m^3/yr) which is consistent with the two boreholes being able to meet the water demand of the plant (annual water budget of 65,021 m^3 or 178 m^3/d).
5. Groundwater abstraction will be reduced through the implementation of rainwater harvesting. Preliminary calculations suggest that an average of 18,275 m^3/yr would be a reasonable estimate from the roofed areas alone. An additional 33,751 m^3/yr could be harvested from the remaining non-roofed area leading to a combined 52,026 m^3/yr from rainwater, accounting for approximately 80% of the entire annual water demand.
6. A reduction in zone of contribution (ZOC) for the boreholes as a result of rainwater harvesting means that the volume of water being abstracted from the system is not greater than the volume of water recharging the aquifer over the landowner property area.
7. While climate change will bring about increased seasonality in rainfall patterns, the impact on groundwater recharge will be varied depending on local geology. Drought conditions would have generally detrimental consequences for groundwater supplies with ZOCs increasing in order to meet the same demand. A 50% safety factor has been used in the calculation of all ZOCs by way of a conservative approach to such changes.
8. Continuous and manual water level measurements taken at a borehole (FW1) supplying a neighbouring dairy farm for the duration of the pumping test and recovery period are consistent with the pumping having little discernible impact on the well.
9. A monitor and mitigate approach is recommended for proximal sensitive receptors (e.g., springs and other abstraction boreholes) to ensure that any potential impacts are minimized.

10. While the hydrochemical signatures of BH6, BH7, FW1 and SW1 all tend towards a calcium-magnesium-bicarbonate type, the pumping wells show a distinct cationic signature to FW1 and SP1 with relatively lower calcium concentrations and higher magnesium concentrations.
11. A strong hydrogen sulphide odour and reducing conditions were observed at BH6 and BH7 with visible limescale forming on equipment during the pumping test.
12. Reductions in flow at local springs (SP1 and SP2) were noted. However, further investigation would be required to ascertain whether this is due to pumping or low rainfall levels.

1. Introduction

Minerex Environmental Limited (MEL) was commissioned by Mercury Renewables (MR) to carry out a groundwater supply assessment for the proposed development of a combined windfarm and hydrogen production plant (Appendix A) near Ballina, County Mayo.

Current estimates indicate that an annual water budget of 65,021 m^3 is required for hydrogen production. Water usage patterns will be dependent on the electricity produced by the windfarm.

The assessment includes the completion of a pumping test on two boreholes located on the proposed site in order to identify their respective sustainable yields. Concurrent monitoring was carried out within a network of observation wells, proximal groundwater springs and a well supplying a local landowner (Appendix B). MEL visited the site on the 11th, 12th and 22nd of July 2022.

Specific work items are as follows:

1. Assess the hydrogeological setting of the site including aquifer extent and properties.
2. Review the borehole logs and drillers notes for the 2 no. proposed production wells.
3. Design and execute pumping tests on 2 no. proposed production wells in order to identify likely sustainable yields. This includes instrumentation of production boreholes with high resolution water level loggers and the development of a manual water level monitoring regime for observation wells and a local spring.
4. Sampling of production boreholes at various stages throughout the pumping tests and accredited laboratory analysis for key hydrochemical and microbiological quality parameters.
5. Assess the potential for rainwater harvesting and its contribution to the overall water demand.
6. Assess the long-term sustainability of the proposed extraction.
7. Assess the potential impact of the proposed abstraction on a neighbouring well supplying a local landowner.
8. Assess the potential impact of the proposed abstraction on other proximal boreholes.
9. Assess how climate change may affect the long-term sustainability of the supply.
10. Make subsequent recommendations for the management of the supply going forward.

2. Hydrogeological setting

Hydrogeological maps pertaining to the site are presented in Appendix C.

2.1 Groundwater Vulnerability & Karst Features

A high groundwater vulnerability classification (H) has been assigned to most of the site. A portion of the site to the south east has been assigned a moderate groundwater vulnerability. An area of extreme groundwater vulnerability borders the site to the west. This is consistent with mapped areas of bedrock outcrop. There are no mapped karst features in proximity to the site (Ref. 1).

2.2 Bedrock

The site is underlain by the Carboniferous Ballina Limestone Formation which is characterised by dark fine-grained limestone & shale. Outcrops are mapped as occurring to the west of the site. A northwest to southeast trending anticlinal axis is mapped to the north of the site (Ref. 1).

2.3 Aquifer Classification

The aquifer associated with the Ballina Limestone Formation is classified as a Locally Important Aquifer (LI), describing bedrock which is moderately productive only in local zones. The mapped areal extent of this aquifer is 102 km^2, extending west and north west to the Moy Estuary and Enniscrone, respectively, and south west to Bonniconlon.

The groundwater body (Code IE_WE_G_0034) status according to the Water Framework Directive Status (2013-2018) is listed as both good and not at risk.

2.4 Overburden

The quaternary sediments underlying much of the site are classed as till derived from limestones (TLs). The corresponding subsoil permeability is classed as moderate. A portion of the site to the south east is classed as cut over raised peat. This correlates with the area of moderate groundwater vulnerability mentioned above. Alluvium overburden is mapped to the south west of the site which is consistent with the mapped stream at this location.

2.5 Groundwater Recharge

Groundwater recharge properties for the site can be derived from the groundwater recharge map provided by the GSI – see Appendix C (Ref. 1). With respect to climatic variables, the map is generated from Met Éireann's 30-year average rainfall and actual evapotranspiration for the period 1971-2000. The effective rainfall (total rainfall – actual evapotranspiration) for the site is mapped as ranging from 710 mm/yr to 722 mm/yr.

The volume of effective rainfall likely to reach groundwater, i.e., recharge, can be estimated from recharge coefficients compiled by the Working Group on Groundwater, which are based on soil drainage, subsoil permeability, vulnerability and aquifer type (Ref. 2). A recharge coefficient of 60% has been applied to the site. Assuming effective rainfall of 710 mm/yr and a recharge coefficient of 60 % yields an average recharge value of 426 mm/yr. However, given the Locally Important classification applied to the aquifer, a recharge cap of 200 mm/yr has been applied due to the limited ability of the bedrock to accept recharge.

2.6 Groundwater Wells

The GSI Groundwater well, borehole and spring locations map was consulted in order to identify other local abstraction points (Ref. 1). The database contains records of boreholes, dug wells, springs, and ground site investigations derived from GSI drilling, fieldwork and surveys, Local Authorities and other state bodies, Private Well Grants, Drillers, Consultants, Group Water Schemes and Academia. The locations of records have different accuracies depending on the source data. It is must be noted that it is not a comprehensive database (Ref. 1).

The closest well to the site is located approximately 1.4km to north. Thee reported borehole details are as follows:

- GSI Name 1131NEW005: 30.5m deep borehole. Yield Class: Poor. Agri & domestic use. Located in proximity to the castle. Locational accuracy: 500m.

There are no other boreholes reported with at least 4 km of the site. However, given the stated poor accuracy of the database and the unregulated nature of private wells a survey would be required to accurately identify wells in the proximity to the site.

2.7 Surface Water & Protected Areas

The site is located in the Moy and Killala Bay catchment, Leaffony sub catchment and the Dooyeaghny or Cloonloughan sub basin. The Dooyeaghny or Cloonloughan stream flows

westwards along the southern boundary of the site. A groundwater spring SP1 rises at the south west corner of the site. This is likely one source of the South Corbally stream which is mapped as rising at the south west boundary of the site flowing westwards before joining the Dooyeaghny or Cloonloughan stream which eventually flows to the Moy (Ref. 3).

The Killala Bay and Moy Estuary are designated as both and Special Areas of Conservation (SAC) and Special Protection Areas (SPA).

3. Boreholes & Pumping Test

3.1 Boreholes

Eight boreholes were drilled onsite as part of the investigation (Table 3.1). Water strikes were noted by the driller in two boreholes (BH6 and BH7). Estimated yields established by the driller for BH6 and BH7 were 9 m^3/hr and 2 m^3/hr, respectively. It is understood that these yields were established from a shorter duration pumping test. An outline map of the site and the locations of the boreholes are presented in Appendix B.

Table 3.1. Borehole data.

BOREHOLE No.	POSITION			Total Depth (mbgl)	Depth to Bedrock (mbgl)	Steel Casing Depth (mbgl)	Water Strike (mbgl)	Estimated Yield (m3/hr)
	ITM (Eastings)	ITM (Northings)	Ground Level (maOD)					
1	529550.720	822677.680	53.930	170	6	6		
2	529570.790	822677.170	53.010	195	6	6		
5	529623.100	822638.070	47.600	152	3	3		
6	529063.073	822788.959	53.819	183	6	6	80	9
7	528933.395	822830.498	47.794	183	4	4	50	2
8	529178.795	822583.564	47.241	152	3	3		
9	529337.182	822691.565	52.575	152	4	4		
11	528984.707	822729.161	46.942	158	3	3		

3.2 Pumping Test Design

Following data presented in Table 3.1., BH6 and BH7 were selected for pump testing in accordance with BS ISO 14686:2003 (Ref. 4). The remaining wells were used as observation wells during pumping. An additional well (FW1), supplying a neighbouring landowner and dairy farm was also monitored for the duration of the pumping test and recovery period to ascertain whether the proposed development would impact on the well.

Pumps were installed in both wells at a depth of 80m by Dullea Drilling. PVC rising mains, gate valves, flow meters and dip tubes were also installed. Instantaneous flows were measured using the bucket and stopwatch method. Outfalls from both rising main were placed a sufficient distance from the boreholes (downgradient and to the south) to ensure no short circuiting of recharge.

High resolution water level loggers were installed in BH6 and FW1 for the duration of the pumping test and recovery period. A manual water level monitoring regime using a Solinst Dip Meter was also implemented for all boreholes (pumping, observation, and FW1)

The constant rate discharge pumping test commenced on the 11/07/22 and pumping continued until the 03/08/2022 (approximately 546 hours of pumping in total). Recovery was monitored for a 3-day period by manual measurement in all boreholes and by the water level logger in FW1 for 1 week.

Spring flow was monitored at SP1, with several flow readings (container and stopwatch) taken from SP2, a concrete reservoir with a hand pump feeding the South Corbally Stream (Appendix C).

3.3 Pumping Test Results

All data, including manual water level measurements and flow readings are presented in Appendix D. Water levels and flow rates from the manual monitoring regime of the pumping wells are presented in Figures 3.1 and 3.2. Continuous water level data from BH6 and FW1 are presented in Figures 3.3 and 3.4. Manual water level readings from all observation wells (including FW1) are presented in Figure 3.5. Rainfall data, taken from a Met Eireann station at Knock Airport (approximately 30 km to the south east) is presented in Figure 3.6.

3.3.1 Borehole 6 (Pumping)

The pump in BH6 ran at full capacity for the duration of the test. At the initial pre-pumping water level (i.e., start of the test) the pumping rate was measured at 3.3 l/s, however, this reduced as drawdown and head both increased. After 24 hours, at a pumping rate of 2.5 l/s the rate of drawdown decreased (drawdown of 45.4m with a water level of 53.5 mbtoc). For the remainder of the test the pumping/dynamic water level remained relatively stable at approximately 56 mbtoc at a pumping rate of 2.25 l/s (194.4 m^3/d), the likely sustainable yield of the well. This is consistent with the continuous water level logger data for BH6 (Figure 3.3).

Note, the slight drop in water levels observed in BH6 after 384 hours of pumping is consistent with an increase in flow from BH7 (as a result of the maintenance of a gate valve – see below), rather than boundary conditions.

3.3.2 Borehole 7 (Pumping)

Pumping at BH7 was interrupted temporarily after approximately 24 hours in order to remove the flow meter as it was causing excess friction loss, possibly due to scaling, that was restricting flow to approximately 0.35 l/s. Once removed, the pump running at full capacity was capable of pumping 0.85 l/s. This pumping rate, however, resulted in rapid drawdown to 75.4 mbtoc hence flow was reduced to 0.44 l/s. After approximately 312 hours of pumping, flow was restricted by gradual scaling of the gate valve. For the remainder of the test the

pumping/dynamic water level remained relatively stable at approximately 73 mbtoc at a pumping rate of 0.44 l/s (38 m^3/d), the likely sustainable yield of the well.

3.3.3 Observation Wells

Drawdown was monitored via manual measurements across the network of observation wells (Figure 3.5). With the exception of BH11, in general, the level of drawdown is consistent with proximity to the pumping wells as would be expected. Over the course of the pumping test, 9.2 m and 4.2 m of drawdown were observed in BH8 and BH9, respectively, with just 1.29 m of drawdown observed at BH5.

Notable variation in BH11 water levels was observed. Given its proximity to BH6 and BH7, it is likely that the drawdown observed is a result of pumping. However, monitoring shows periods of erratic rebound followed by further drawdown. These periods of rebound appear to be correlated with rainfall which is indicative of flashy borehole hydrograph.

A conceptual cross section showing static and dynamic water levels across the monitoring network is presented in Appendix E.

3.3.4 Borehole FW1

There was little discernible impact from the pumping test on FW1 (Figure 3.4 and 3.5). A drawdown of 8 cm was observed between the pre-pumping baseline measurement and the time when the pumping ceased. Continuous water level data were obtained for one week after the pumping ceased. Despite the cessation of pumping, further drawdown (approximately 10cm) was observed in FW1, despite the apparent recovery in the observation wells. It is likely that the drawdown in FW1 is consistent with usage and/or low levels of recharge.

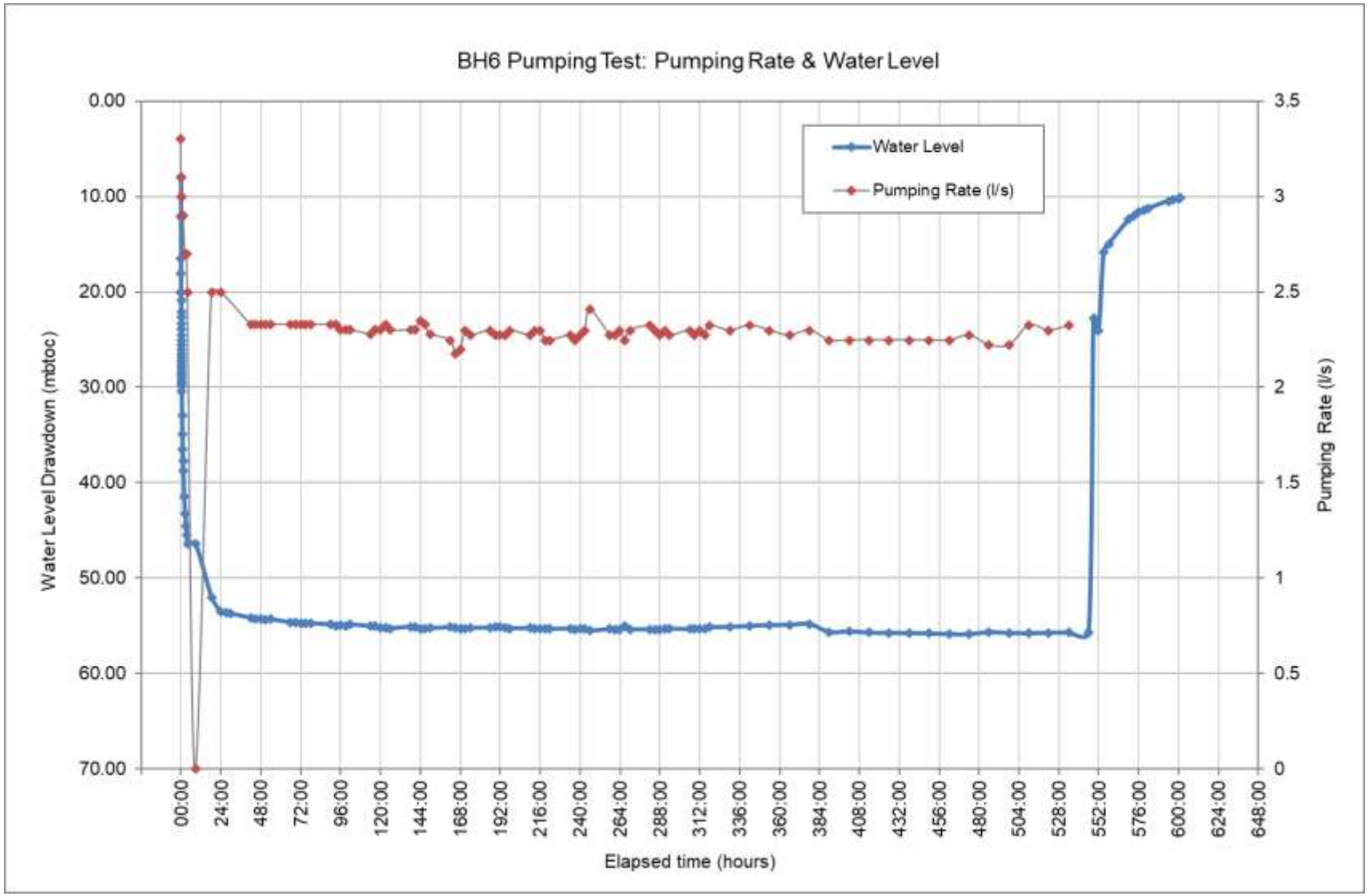

Figure 3.1. Borehole 6 pumping test data

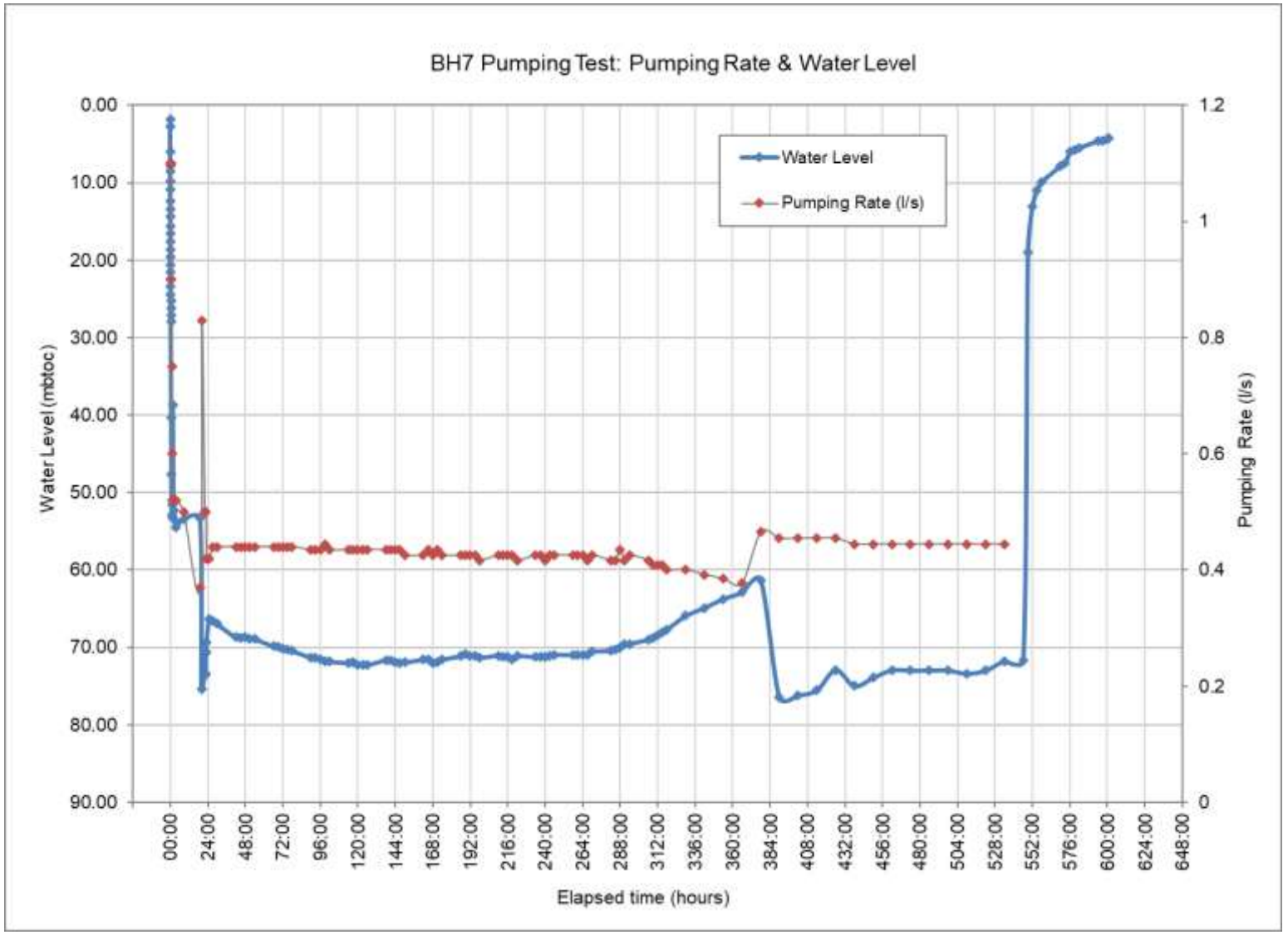

Figure 3.2. Borehole 7 pumping test data

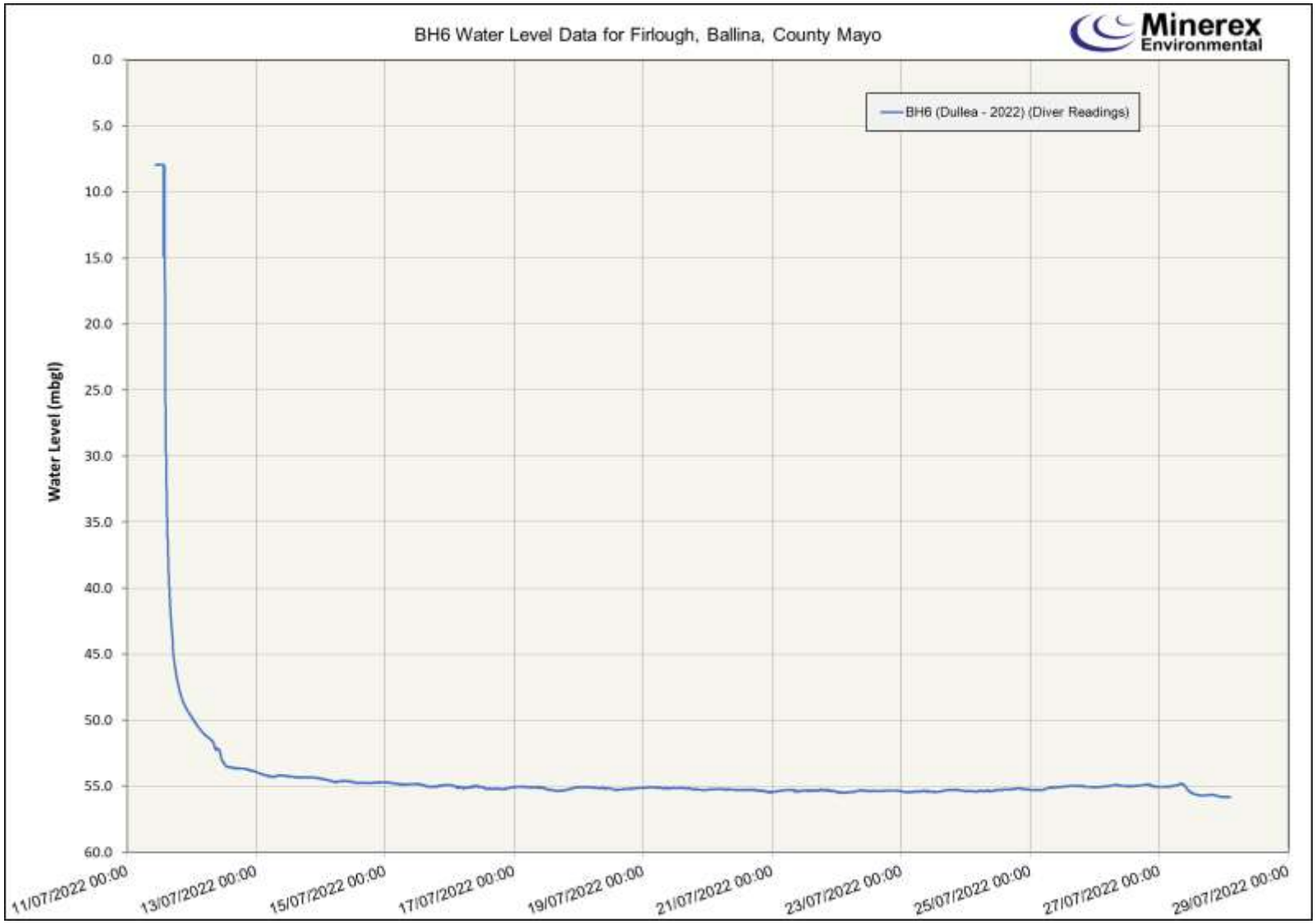

Figure 3.3. Borehole 6 continuous water level logger data.

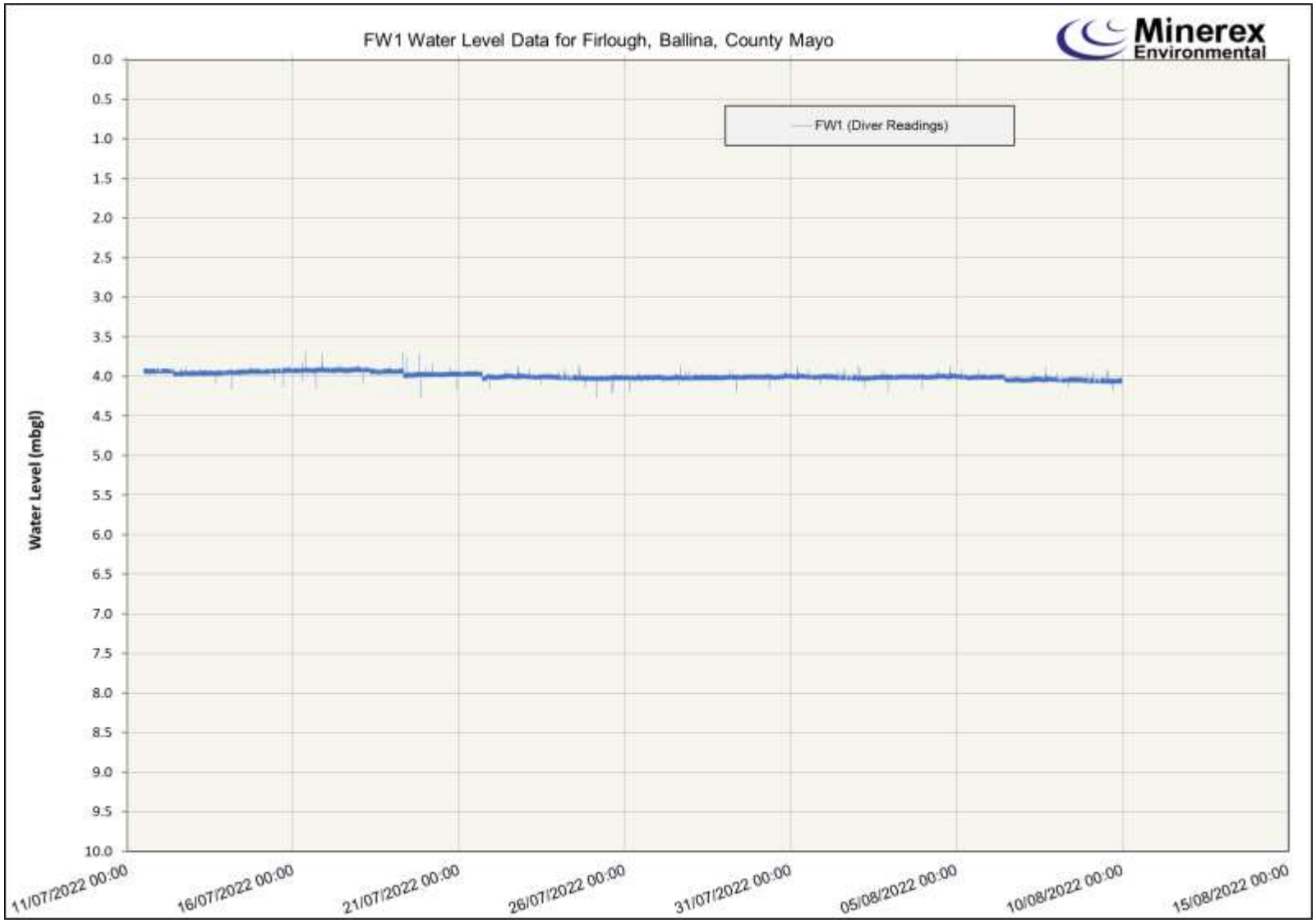

Figure 3.4. Borehole FW1 continuous water level logger data.

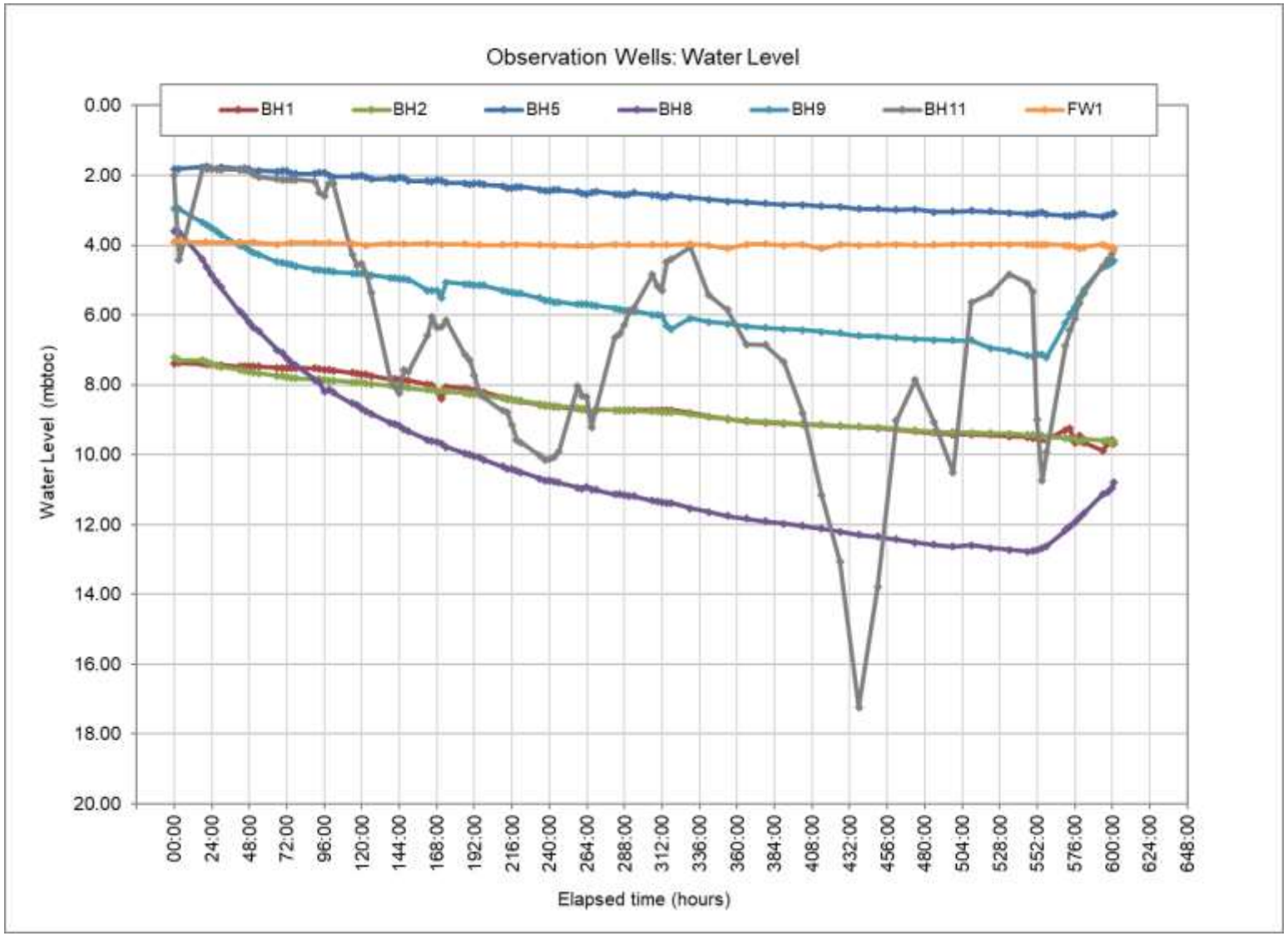

Figure 3.5. Observation well water level data.

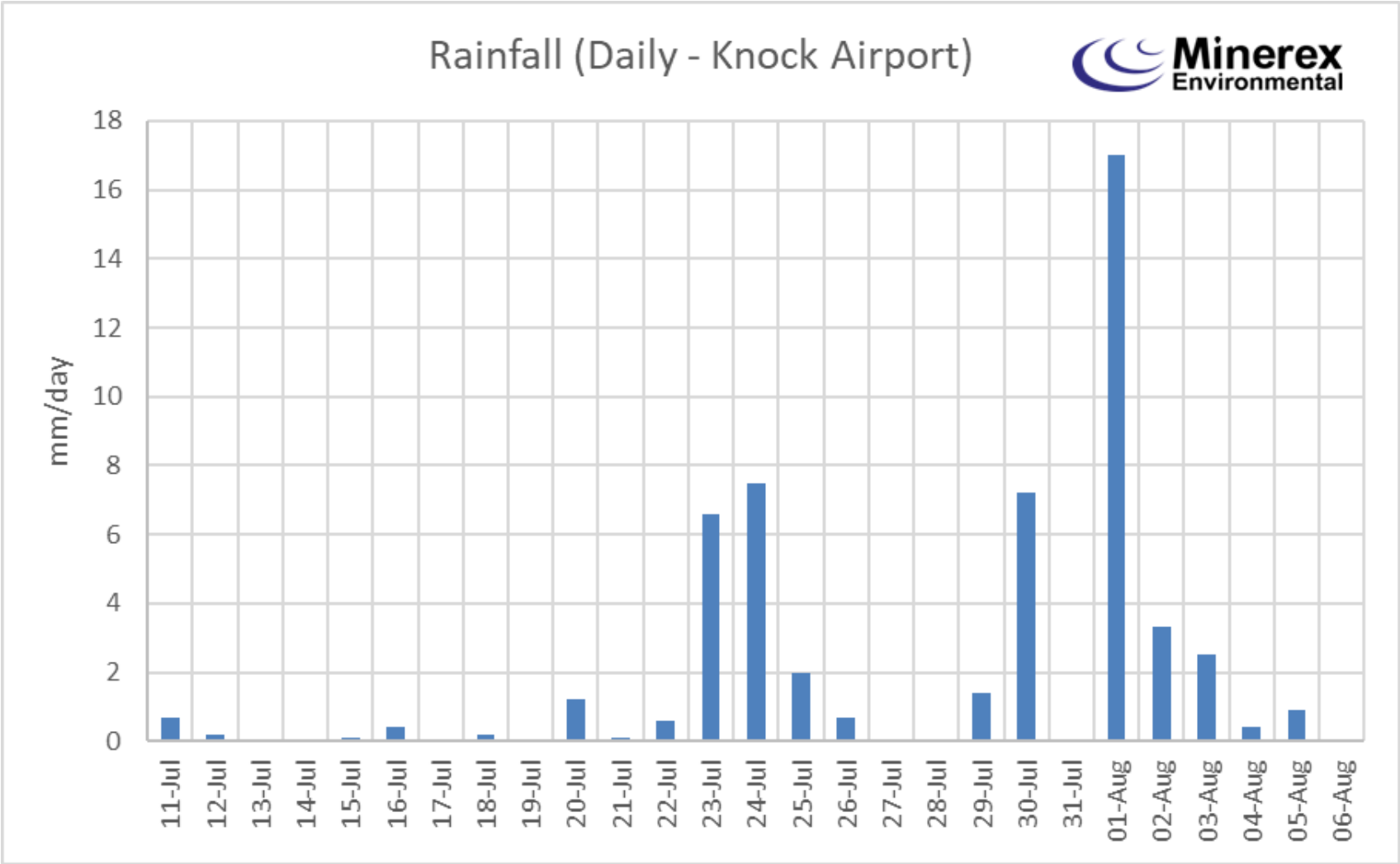

Figure 3.6. Rainfall data from Met Eireann monitoring station at Knock Airport (Ref. 5).

3.3.5 Aquifer & Borehole Properties

Specific Capacity [m3/d/m] gives an indication of how 'good' the yield is with respect to the corresponding drawdown observed. To derive a specific capacity, the discharge rate and drawdown at the end of a period where the rate was relatively constant has been used. The specific capacities for BH6 and BH7 have been calculated as 4.12 m^3/d/m and 0.54 m^3/d/m, respectively.

Groundwater flow through the aquifers is described by the Groundwater Flow Equation – Darcy's Law, which describes a coefficient of hydraulic conductivity (permeability) (K) [m/d], an important aquifer characteristic. However, it is known that hard rock aquifers or fractured rock aquifers, such as those common in Ireland and at the site in question, pose difficulties in characterising and predicting aquifer parameters. The preferred parameter to assess hydraulic properties in hard rock aquifers or fractured rock aquifers is transmissivity, due to its practical importance, availability of data and more reliable values as compared to hydraulic conductivity where data from well pumping tests usually reflect single or a handful of highly permeable factures surrounded by massive blocks of impermeable rock (Ref. 6).

Using the Logan method, based on these specific capacities, bulk transmissivities for BH6 and BH7 would be in the order 5 m^2/day and 0.7 m^2/day, respectively. These transmissivities are in line with published data for other "LI" classed aquifers (Figure 3.7) (Ref. 6). Note, these aquifer properties should be treated as an approximation only. The disparities in specific capacities and transmissivities between BH6 and BH7 and the network of observation wells that were found to be unproductive are consistent with fracture flow.

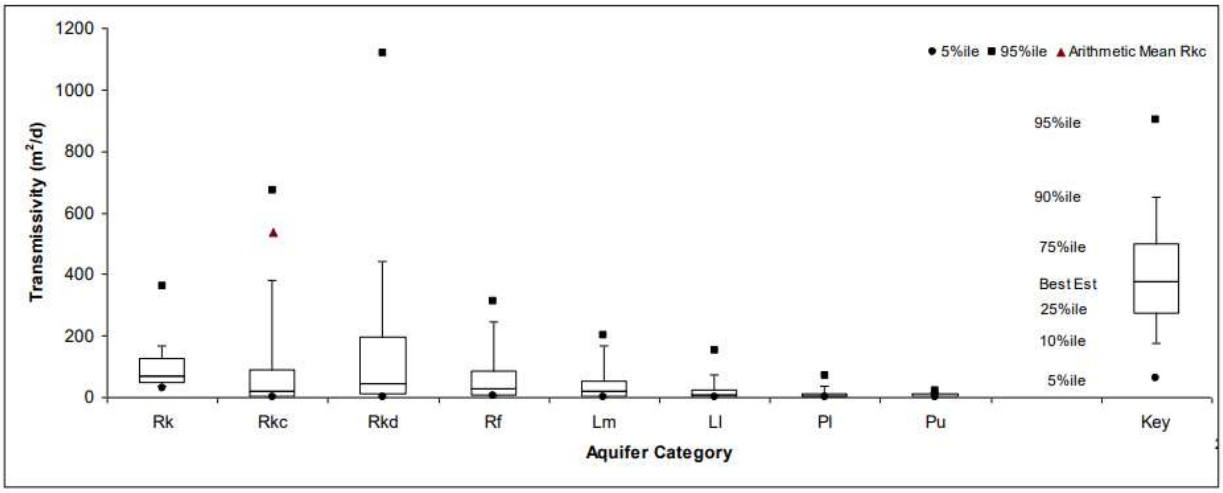

Figure 3.7. Aquifer transmissivity data from Irish Aquifer classes (Ref.6).

3.3.6 Spring (SP1 & SP2)

A notable reduction in water level/flow was observed at SP1 and SP2 (Figures 3.8 and 3.9, respectively). Flow at SP2 was measured at 0.65 l/s before pumping, however, it had reduced to 0.3 l/s after 10 days of continuous pumping. Flow further reduced to 0.06 l/s on the 01/08/22 at 8.00, however, it increased to 0.2 l/s by 20.00 on the same day. This is consistent with a heavy rainfall event (approximately 17mm) (see Figure 3.6).

Flow at SP2 did not increase after the cessation of the pumping test. While flow is apparently somewhat correlated with rainfall, further work would be required to identify the impact of the groundwater abstraction.

Figure 3.8. SP1 on the 11/07/22 i.e., pre-pumping (left) and after 10 days of pumping 22/07/22 (right).

Figure 3.9. SP2 on the 11/07/22 i.e., pre-pumping (left) and after 10 days of pumping 22/07/22 (right).

3.3.7 National Groundwater Levels & Springs Flows

Environmental Protection Agency hydrometric reports for July and August (Ref. 7 and Ref. 8) describe national rainfall, river flows and groundwater levels at the time of the pumping test. For both July and August, all monthly rainfall totals across the country were below their 1981-2010 Long-Term Average (LTA). The report notes that it was the driest August since 1995 at Markree, Co Sligo, located approximately 40 km east of the site.

Correspondingly, average groundwater levels in July decreased at 91% of monitoring wells compared to average levels observed in June (Figure 3.10). In August, groundwater levels were either below normal or particularly low in 84% of monitored wells (Figure 3.11). Several groundwater levels and springs flows monitored by the EPA in August in relative proximity to the site were particularly low.

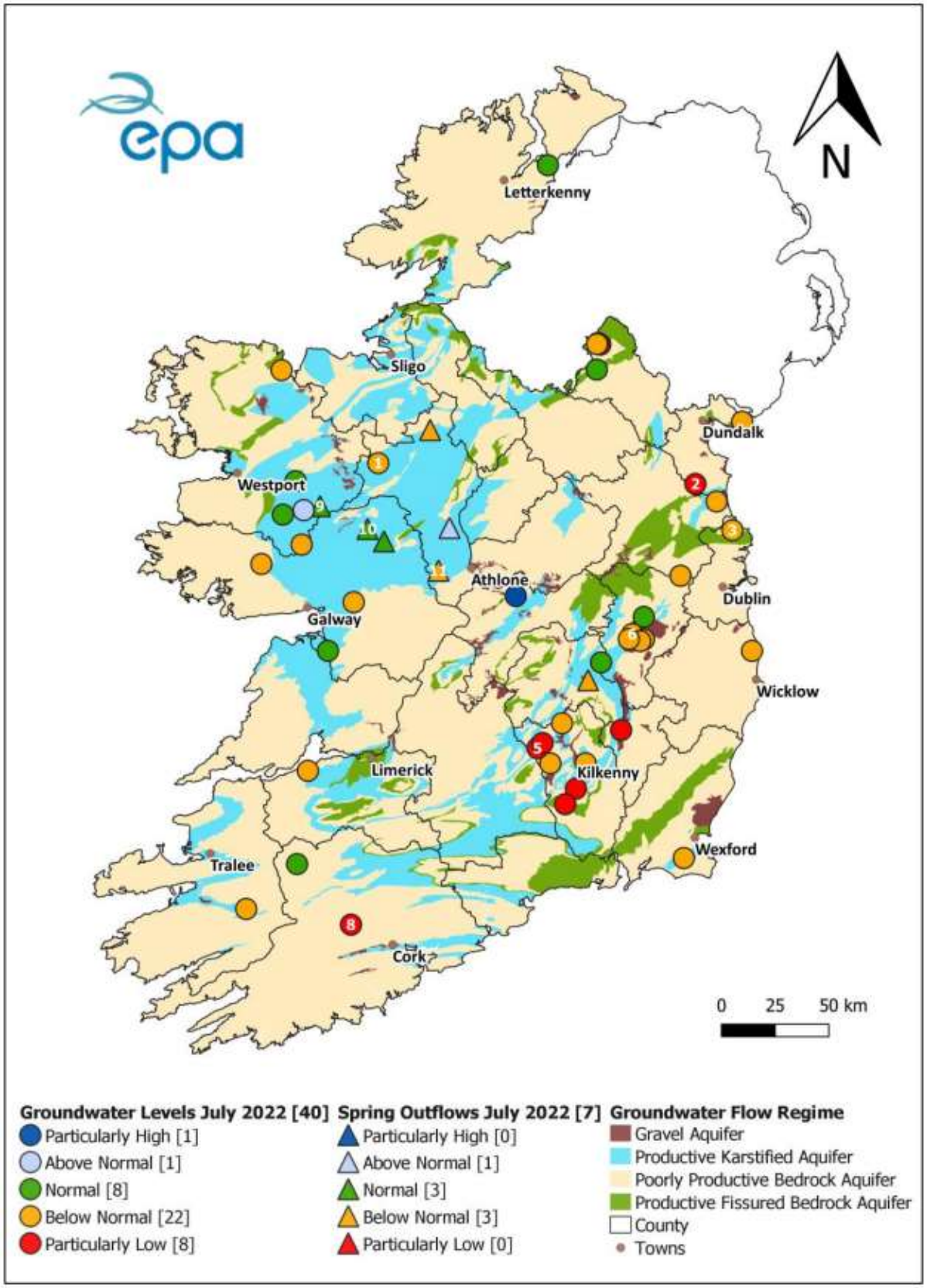

Figure 3.10. EPA national groundwater level and spring flow monitoring report for July 2022 (Ref. 7)

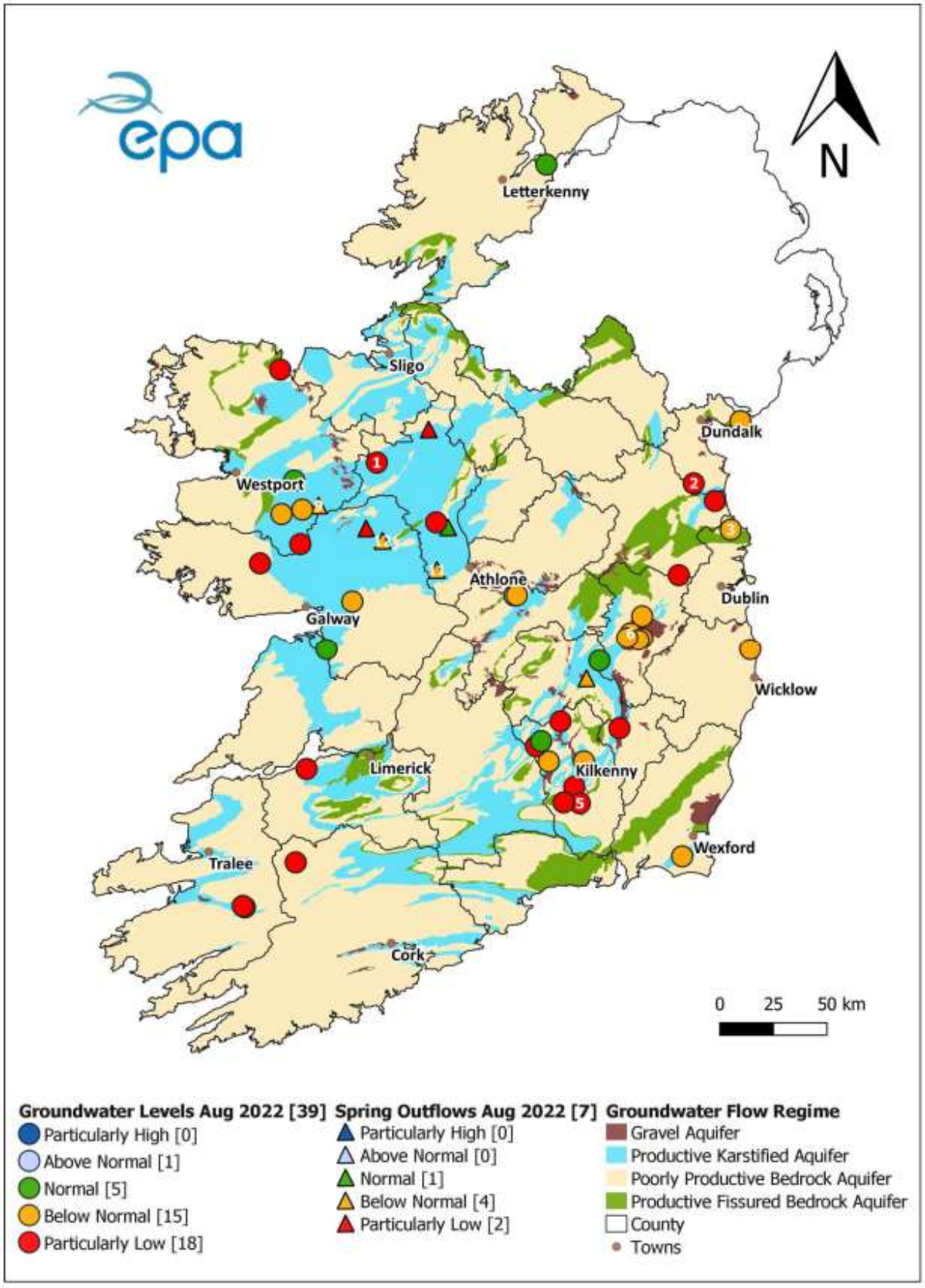

Figure 3.11. EPA national groundwater level and spring flow monitoring report for August 2022 (Ref. 8)

4. Zone of Contribution

4.1 Zone of Contribution

The zone of contribution (ZOC) refers to the area surrounding a pumped well that encompasses all areas or features that supply groundwater recharge to the supply. A water balance calculation can be used to determine the size of the ZOC for the proposed abstractions. A conceptual cross section outlining a ZOC to a borehole is presented in Figure 4.1. Also shown is the concept of zone of influence or the area where drawdown occurs due to pumping.

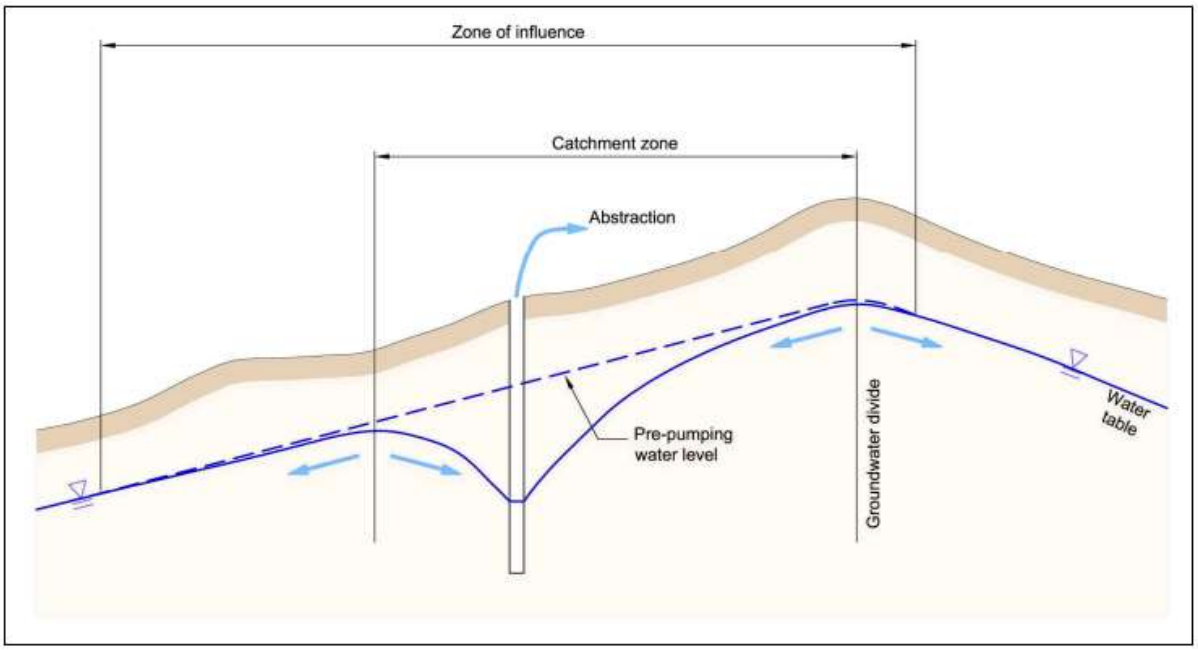

Figure 4.1. Conceptual cross section illustrating the zone of contribution and zone of influence surrounding a borehole (Ref. 9).

Assuming the combined maximum sustainable yields of both wells as 2.69 l/s (approx. 233 m^3/d and see Section 3.3), a simplified water budget based on the following methodology can be used:

$$Q/R = A$$

Q = Annual volume of water abstracted (m^3)

R = Annual average recharge (m)

A = Area of ZOC (m^2)

To allow for errors in the estimation of groundwater flow direction and to allow for an increase in the ZOC in dry weather, a safety margin is incorporated by assuming a higher abstraction rate rather than the estimated rate. Hence, the estimated abstraction rate is increased by 50% to 350 m^3/d, which equates to approximately 127,750 m^3/ year. Dividing this figure by the annual average recharge (0.200 m/year – see Section 2.5), gives an estimated theoretical ZOC or well catchment area of approximately 639,000 m^2. The approximate area of the landowner property (see boundary in Appendix B) is 265,000 m^2.

Current estimates indicate that an annual water budget of 65,021 m^3 is required for hydrogen production, which is less than the proven combined sustainable yield of the wells. Dividing this figure by the annual average recharge (0.2 m/year) gives an estimated theoretical ZOC or well catchment area of approximately 325,000 m^2. If a safety factor of 50% is applied to the required volume (65,021 x 1.5 = 97,532 m^3), the ZOC increases to approximately 488,000 m^2 (see Appendix F). The zone of contribution is likely predominantly to the north of the site if consistent with local topography (Appendix F). In practice, the actual size, shape and orientation of the ZOC will be highly dependent on fracture flow.

Note, it is likely that the ZOC will be notably smaller given the intended use of rainwater harvesting (see Section 5 and Appendix F).

5. Rainwater Harvesting

In order to augment the groundwater supply, rainwater harvesting is to be employed at the facility. A water storage reservoir with a capacity of approximately 12,815 m^3 is proposed for the site.

Preliminary water budget calculations have been developed in order to estimate the potential contribution of rainwater harvesting to the operational water requirements. Long term rainfall data has been obtained from Knock Airport (1997 – 2021) in order to estimate rainfall at the site (see Table 5.1). Average annual rainfall over this period was 1,372 mm/yr, ranging from 1,078 – 1,853 mm/yr. Average monthly rainfall for the same period is presented in Table 5.2.

Table 5.1 Rainfall data from Knock Airport (1997-2021)

Year	Annual Rainfall (mm/yr)
1997	1,262
1998	1,423
1999	1,655
2000	1,371
2001	1,078
2002	1,464
2003	1,089
2004	1,374
2005	1,206
2006	1,342
2007	1,346
2008	1,563
2009	1,437
2010	1,093
2011	1,443
2012	1,368
2013	1,207
2014	1,518
2015	1,853
2016	1,230
2017	1,343
2018	1,307
2019	1,455
2020	1,506
2021	1,365
Average	**1,372**

Table 5.2 Summary statistics for monthly rainfall at Knock Airport (1997-2021).

	Monthly Rainfall (mm/yr)		
	Average	**Max.**	**Min.**
Jan	134	225	26
Feb	113	277	27
Mar	98	182	33
Apr	77	128	21
May	93	179	31
Jun	94	230	38
Jul	110	184	41
Aug	117	208	35
Sep	111	223	19
Oct	131	197	59
Nov	142	302	63
Dec	151	348	54

The footprint of the entire facility, as shown in Appendices A and B, is 64,000 m^2, of which buildings (i.e., roof area) account for 14,800 m^2. Using the long-term values for average, minimum and maximum rainfall presented above, the volume of rainfall landing on the site annually are presented in Table 5.3. Annual average rainfall of 1.372 m/yr over the entire footprint of the facility (64,000 m^2) amounts to 87,808 m^3/yr. Assuming the average rainfall over the roof area of the facility (14,800 m^2) amounts to 20,306 m^3/yr.

Table 5.3 Estimates of the rainfall landing on the facility (no yield coefficient applied).

No Yield Coefficient Applied		**Total Site Area**	**Roofed Area**	**Site Area Not Roofed**
		64,000 m^2	**14,800 m^2**	**49,200 m^2**
Rainfall (Min)	**1.078 m/yr**	68,992 m^3/yr	15,954 m^3/yr	53,038 m^3/yr
Rainfall (Average)	**1.372 m/yr**	87,808 m^3/yr	20,306 m^3/yr	67,502 m^3/yr
Rainfall (Max)	**1.853 m/yr**	118,592 m^3/yr	27,424 m^3/yr	91,168 m^3/yr

While these figures assume 100% of rainfall is captured, a yield or runoff coefficient should be applied to account for losses. The final design of the roof surfaces (e.g., pitch and roofing material) and the makeup of the site (e.g., concrete, paving, asphalt) will dictate the coefficients to be used. The coefficients should also consider potential losses associated with water treatment.

The yield coefficient for pitched roofs with profiled metal sheeting is quoted as 0.9, while for tiled roofs the coefficient is 0.8 (Ref. 10). A yield coefficient of 0.9 applied to the average

annual rainfall falling on the roof area of the site amounts to 18,275 m3/yr (Table 5.4 – see maximum and minimum values also).

Table 5.4 Estimates of the rainfall landing on the roofed areas (yield coefficient applied).

0.9 Yield Coefficient Applied		**Roofed Area**
		14,800 m²
Rainfall (Min)	**1.078 m/yr**	14,359 m^3/yr
Rainfall (Average)	**1.372 m/yr**	18,275 m^3/yr
Rainfall (Max)	**1.853 m/yr**	24,682 m^3/yr

The yield coefficient for concrete or asphalt can range from 0.8 - 0.9, while for grassed areas or permeable paving it will naturally be lower (Ref. 11). A composite coefficient based on the percentage of different types of surfaces over the proposed plant area should be developed.

While further assessment (i.e., development of a composite coefficient) would be required to refine the maximum amount of water obtainable from rainwater harvesting, applying a coefficient of 0.5 to the average rainfall over the remainder of the plant area (67,502 m^3/yr x 0.5) would yield approximately an additional 33,751 m^3/yr.

Note, these figures have been calculated based on average rainfall values and do not account for seasonal variations or variations in intensity. However, using the average monthly rainfall values presented in Table 5.2., the indicative rainfall capture volumes per month are presented in Table 5.5.

The drainage infrastructure and tank sizing should be optimised to ensure the most amount of rainfall can be captured.

Table 5.5. Indicative rainfall capture volumes per month based on average monthly rainfall.

	Average Monthly Rainfall	**Roofed Area** (0.9 runoff coefficient applied)	**Site Area Not Roofed** (0.5 runoff coefficient applied)
	(mm/yr)	**14,800 m^2**	**49,200 m^2**
Jan	**0.134**	1788 m^3/yr	3303 m^3/yr
Feb	**0.113**	1509 m^3/yr	2788 m^3/yr
Mar	**0.098**	1304 m^3/yr	2407 m^3/yr
Apr	**0.077**	1029 m^3/yr	1901 m^3/yr
May	**0.093**	1245 m^3/yr	2299 m^3/yr
Jun	**0.094**	1254 m^3/yr	2315 m^3/yr
Jul	**0.110**	1460 m^3/yr	2696 m^3/yr
Aug	**0.117**	1565 m^3/yr	2890 m^3/yr
Sep	**0.111**	1579 m^3/yr	2732 m^3/yr
Oct	**0.131**	1740 m^3/yr	3213 m^3/yr
Nov	**0.142**	1893 m^3/yr	3495 m^3/yr
Dec	**0.151**	2007 m^3/yr	3706 m^3/yr
Total	**1.372**	**18,272 m^3/yr**	**33,746 m^3/yr**

6. Water Supply: Groundwater & Rainfall

6.1 Water Balance

Current estimates indicate that an annual water budget of 65,021 m^3 is required for hydrogen production. While this corresponds to approximately 178 m^3/d, the water usage patterns will be dependent on the electricity produced by the windfarm. It is proposed to install a water storage reservoir onsite with a capacity of 12,815 m^3 in order to buffer the balance between water supply and usage.

As presented in Section 3, sustainable yields of 2.25 l/s (194 m^3/d) and 0.44 l/s (38 m^3/d) have been established for Boreholes 6 and 7, respectively, with a cumulative yield of 232 m^3/d (84,680 m^3/yr) which is consistent with the two boreholes being able to meet the water demand of the plant.

Groundwater abstraction will be reduced through the implementation of rainwater harvesting. Preliminary calculations using average rainfall values derived from long term historical data suggest that an average of 18,275 m^3/yr would be a reasonable estimate from the roofed areas alone. Applying a runoff coefficient of 0.5 over the remainder of the plant area would yield approximately an additional 33,751 m^3/yr, leading to a combined 52,026 m^3/yr from rainwater, accounting for approximately 80% of the entire annual water demand.

6.2 Updated ZOC

The potential for obtaining a portion of the required water demand from rainfall would significantly reduce groundwater abstraction volumes, consequently reducing the ZOC. The potential balance between rainfall and groundwater contributions and the corresponding ZOC (assuming 0.2 m/yr recharge – see Section 2.5) is presented in Table 6.1.

If half of the required water demand is met by rainwater harvesting then the ZOC for the abstraction boreholes would not be greater than the landowner property area (see Appendix F). This reduction in the ZOC means that the volume of water being abstracted from the system is not greater than the volume of water recharging the aquifer over the landowner property area.

Table 6.1. Relationship between rainfall, groundwater and ZOC area.

Contribution from Rainfall to Total Required Volume	**Remainder Abstracted from Groundwater**	**ZOC Area ($m^{2)}$ (plus 50% safety factor)**
0% (0 m^3)	65,021 m^3	488,000
25% (16,255 m^3)	48,766 m^3	366,000
50% (32,511 m^3)	32,510 m^3	244,000
75% (48,766 m^3)	16,255 m^3	122,000
100% (65,021 m^3)	0 m^3	0

6.3 Contingency Supply

In the event that a supplementary supply of water is required, it is proposed that the facility is connected to the local mains water supply network. This contingency option could be used in the event of prolonged drought conditions.

7. Implications of Climate Change

Consideration must be given to the sustainability of the proposed groundwater abstraction, given its context in a time of climate change and increased climate variability. Changes in climate are likely to have a significant impact surface and groundwaters, however, compared with surface water resources, there has been less research into the potential impacts of climate change on groundwater.

The climate pattern across Ireland is projected to change towards decreasing mean annual and seasonal (spring and summer) rainfall; increasing number of wet (>20 mm/d) and very wet (>30 mm/d) days; increasing mean annual and seasonal temperatures and increasing number of extended dry periods and droughts (Ref. 12).

While significant changes in precipitation are forecasted, due to the heterogeneity of Irish geology complex interactions between subsoil properties, aquifer properties, effective rainfall amount and rainfall timing means that there is not just one type of predicted impact on groundwater systems (Ref. 13). Studies have shown that the impact can be highly variable depending on these climatic and geological variables.

For instance, while the Intergovernmental Panel on Climate Change (IPCC, 2001) suggested that increased winter rainfall was likely to result in increased groundwater recharge. Ref. 13 states that groundwater recharge volumes may not necessarily increase over much of Ireland due to the nature of Irish bedrock aquifers.

Potential scenarios for groundwater recharge as a result of a changing climate, aquifer type and subsoil cover are presented by (Ref. 13). Poorly productive aquifers (such as the aquifer underlying the proposed site which is assigned an LI classification – see Section 2.3) generally have limited ability to (a) accept recharge to the groundwater; (b) transmit the recharge laterally, thereby creating space to accept more recharge. Therefore, greater rainfall amounts in winter will not contribute to greater recharge, since it cannot be accepted by the aquifers. Even current annual rainfall amounts in the west (up to 2000mm) mainly run off, rather than recharge poorly productive aquifers.

In addition to aquifer properties and classification, subsoil permeability influences how quickly effective rainfall can percolate into the subsurface to become groundwater recharge. For instance, in areas overlain by moderate permeability subsoils (such as the proposed site), different rainfall intensity patterns may not result in higher recharge, since the vertical permeability cannot transmit high rainfall down into the subsurface quickly enough.

A study by Ref. 14 carried out a sensitivity analysis to assess how changing meteorological variables (rainfall quantity, its intensity and seasonality) and hydrogeological variables influence groundwater recharge. It was found that increased rainfall, seasonality and intensity would lead to increased recharge in areas underlain by aquifers with good storage and throughput capacity. However, it was found that there would be little effect on recharge to the poorly productive aquifers such as the at the location in question due to the geological setting.

Consequently, catchments that have higher storage capacity are thought to be less vulnerable to climate change impacts than those with lower storage capacity. The storage acts as a 'buffer' against the extreme events i.e., increased storage and recharge to offset summer droughts and higher infiltration capacities to reduce the risk of winter flooding (Ref. 14).

It follows therefore that poorer aquifers are more susceptible to increased seasonality due to the lesser ability to buffer against summer droughts. Under current conditions the late autumn and winter recharge period is critical to sustaining groundwater levels throughout the year. Any significant reductions in storage during this time of the year will increase the risk of severe drought, as the failure of winter or spring precipitation may result in prolonged drought periods where the groundwater system is unable to recover from previous dry spells.

Drought conditions would have generally detrimental consequences for supplies. In areas where recharge decreases, the zones of contribution (ZOCs) to boreholes will increase in order to meet the same demand. It must be noted that due to the uncertainties associated with projected changes in precipitation, projected changes in hydrological response remain subject to a high level of uncertainty. By way of a conservative approach a 50% safety factor has been used in the calculation of all ZOCs in Section 6.

Water quality must also be considered in a changing climate. In certain circumstances, increases in higher rainfall and rainfall intensity may have adverse effects on the groundwater quality. Pulses of contaminants, such as nitrates or pesticides, may pose a problem to groundwater at the beginning of the recharge period following drought periods.

8. Potential Influence on Local Boreholes

The proposed abstraction rates, commitment to rainwater harvesting and the corresponding water balance calculations are consistent with the proposed abstraction being sustainable.

Continuous and manual water level measurements taken at a borehole (FW1) supplying a neighbouring dairy farm for the duration of the pumping test and recovery period are consistent with the pumping having little discernible impact on the well.

The Environment Agency (Ref. 9) provide several Hydrogeological Impact Appraisal (HIA) methodologies to assess the impact of groundwater abstractions on receptors, such as boreholes. The approach centres on the development of a conceptual model that is refined using a tiered approach of investigation.

The guidance, however, notes the challenges for carrying out such assessments in karstic or fractured crystalline aquifers as their properties violate the assumptions built into many models and analytical equations (i.e., that the aquifer is homogenous and isotropic). While the aquifer in question is not classified as karstic, as discussed in Section 3.3.5, flow is likely to be fracture dominated. In such fractured aquifers, hydraulic properties can vary greatly over short distances meaning that two different boreholes (such as BH6 and BH7 and the observation network) can have notably different yields (Ref. 9). While bulk aquifer characteristics can be estimated, the location and typology of the fracture network are difficult to accurately characterise.

Consequently, the Environment Agency suggest a modified HIA method with an emphasis on a monitor and mitigate approach.

The monitor and mitigate approach sets out eight steps as follows:

Step 1: Establish the regional water resource status.
Step 2: Develop a conceptual model for the abstraction and the surrounding area.
Step 3: Identify sensitive sites.
Step 4: Commence preliminary monitoring at those sites.
Step 5: Design and demonstrate effective mitigation measures for the sensitive sites.
Step 6: Specify trigger levels for the mitigation measures.
Step 7: Continue surveillance monitoring at the sensitive sites.
Step 8: If necessary, implement mitigation measures when trigger levels have been passed.

Considerable information has been obtained through this pumping test investigation with a conceptual model presented herein (i.e., Step 1 and Step 2). Further investigation should be

carried out in order to identify sensitive sites (Step 3). At a minimum SP1 And SP2 (Section 3.3.6) should be monitored to obtain baseline flow data. As discussed in Section 2.6, given the unregulated nature of private wells and the absence of a database pertaining to their existence/location, a survey would be required to accurately identify wells in the proximity to the site. This should be targeted towards the area encompassing the ZOC shown in Appendix x.x. If boreholes are identified in this area, they should be targeted for baseline monitoring.

Once all sensitive sites are identified, baseline monitoring should be commenced (Step 4). Potential mitigation measures can then be developed. Such measures need to be informed by the baseline monitoring, but could include the use of a contingency supply, the direct supply of water to a third-party user, to replace or compensate for a groundwater source that has been derogated, or provision of an alternative water supply such as connection to a mains supply (Ref. 9) (Step 5).

Trigger levels (Step 6), which form the link between monitoring and mitigation should then be defined (i.e., at what stage are mitigation measures implemented). Trigger levels could be defined using several different variables, such as water levels in observation or neighbouring boreholes or a variety of statistical approaches based on maximum or minimum water levels.

9. Hydrochemistry

Baseline samples were taken from both FW1 and SP1 before the pumping test commenced (11/07/22). Samples were taken from BH6 and BH7 at the start of the pumping test (also 11/07/22). Further samples were taken from BH6 and BH7 on the 12/07/22. All four sampling locations were sampled again on the 22/07/22 approximately 240 hours after the pumping test had commenced. Field hydrochemistry (pH, electrical conductivity, temperature and redox) was taken at the time of sampling. All samples were tested for a suite of major and minor ions, metals and microbiological indicators.

All sampling results are presented in a hydrochemistry database (Appendix G). All results are screened against pertinent legislative limits Groundwater Regulations (S.I No. 366 of 2016 – Ref. 16). Official laboratory certificates of analysis are presented in Appendix H.

A strong hydrogen sulphide odour was noted from both BH6 and BH7 for the duration of the pumping test. Strongly reducing conditions (eH values ranging from -196 mV to -269 mV) were also noted.

Elevated levels of Ammoniacal nitrogen were apparent in BH6 and BH7 (in excess of the limit set by GW Regs (Ref. 16). Positive detections of both Total Coliforms and *E. coli* were found at both FW1 and SP1. As these microbial indicators were present both pre and during the pumping test their presence is likely not attributable to the pumping activities. Low levels of Total Coliforms were detected in two of the six samples taken from the pumping wells.

Hydrochemical signatures or facies of the four sampling locations both pre-pumping and 240 hours into the pumping test are presented in a trilinear Piper Plot in Figure 9.1. The anionic properties of all four locations are notably similar with a strong bicarbonate signature. The pumping wells show a distinct cationic signature to FW1 and SP1. Both FW1 and SP1 show a strong calcium dominated signature, while BH6 and BH7 show a more mixed signature which is a result of relatively lower calcium concentrations and higher magnesium concentrations. In general, the signatures tend towards a calcium-magnesium-bicarbonate type.

Considerable limescale build up was noted on the ground at the discharge points from both wells. This is consistent with the hydrochemical signature.

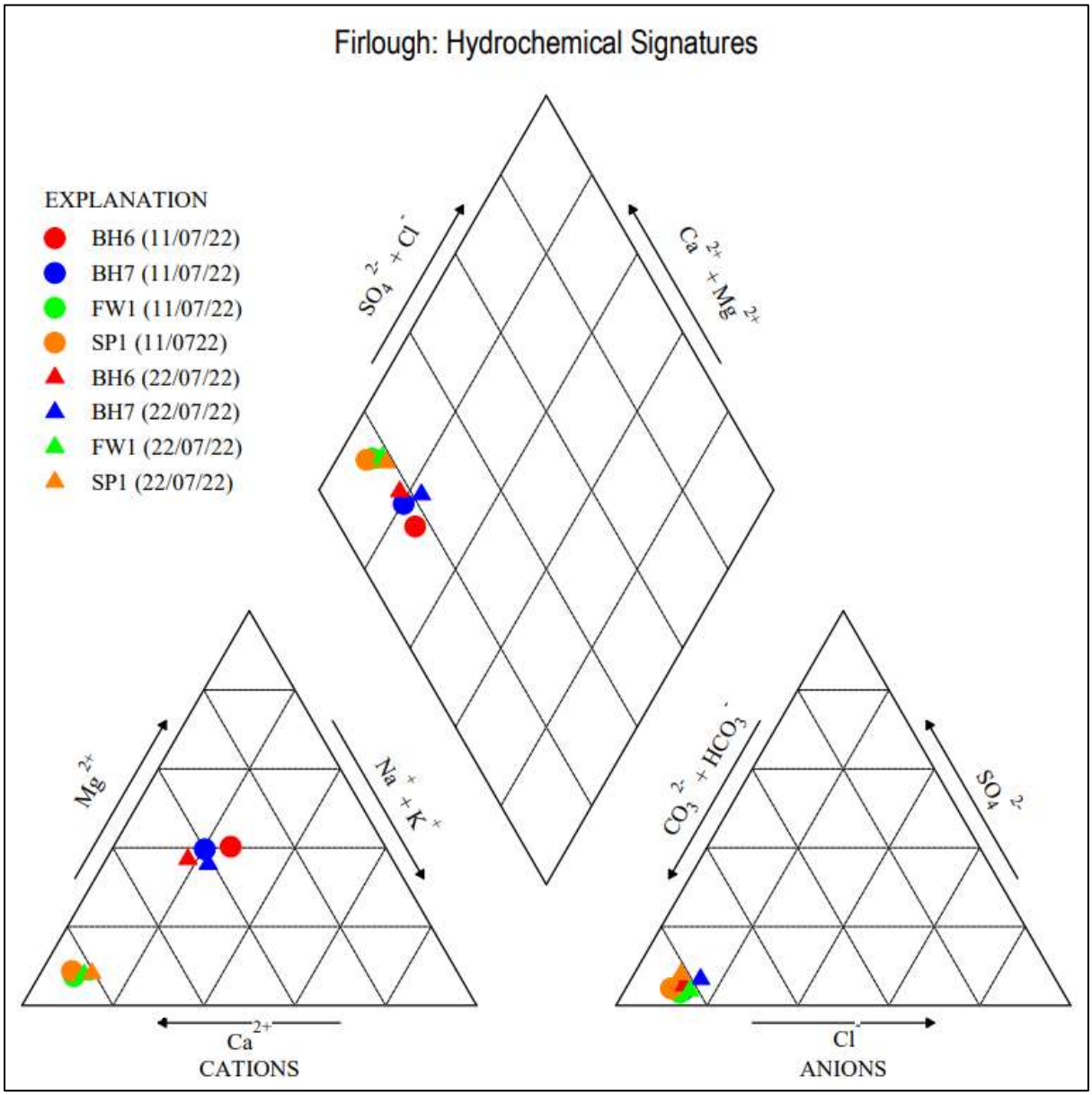

Figure 9.1. Hydrochemical signatures.

10. Summary & Conclusions

1. Minerex Environmental Limited was commissioned by Mercury Renewables to carry out a groundwater supply assessment for the proposed development of a combined windfarm and hydrogen production plant near Ballina, County Mayo.
2. Eight boreholes were drilled onsite as part of the investigation. Water strikes were noted by the driller in two boreholes (BH6 and BH7) which were subsequently selected for pump testing.
3. A constant rate discharge pumping test commenced on the 11/07/22 and pumping continued until the 03/08/2022 (approximately 546 hours of pumping in total).
4. Sustainable yields of 2.25 l/s (194 m^3/d) and 0.44 l/s (38 m^3/d) have been established for Boreholes 6 and 7, respectively, with a cumulative yield of 232 m^3/d (84,680 m^3/yr) which is consistent with the two boreholes being able to meet the water demand of the plant (annual water budget of 65,021 m^3 or 178 m^3/d).
5. Groundwater abstraction will be reduced through the implementation of rainwater harvesting. Preliminary calculations suggest that an average of 18,275 m^3/yr would be a reasonable estimate from the roofed areas alone. An additional 33,751 m^3/yr could be harvested from the remaining non-roofed area leading to a combined 52,026 m^3/yr from rainwater, accounting for approximately 80% of the entire annual water demand.
6. A reduction in zone of contribution (ZOC) for the boreholes as a result of rainwater harvesting means that the volume of water being abstracted from the system is not greater than the volume of water recharging the aquifer over the landowner property area.
7. While climate change will bring about increased seasonality in rainfall patterns, the impact on groundwater recharge will be varied depending on local geology. Drought conditions would have generally detrimental consequences for groundwater supplies with ZOCs increasing in order to meet the same demand. A 50% safety factor has been used in the calculation of all ZOCs by way of a conservative approach to such changes.
8. Continuous and manual water level measurements taken at a borehole (FW1) supplying a neighbouring dairy farm for the duration of the pumping test and recovery period are consistent with the pumping having little discernible impact on the well.
9. A monitor and mitigate approach is recommended for proximal sensitive receptors (e.g., springs and other abstraction boreholes) to ensure that any potential impacts are minimized.
10. While the hydrochemical signatures of BH6, BH7, FW1 and SW1 all tend towards a calcium-magnesium-bicarbonate type, the pumping wells show a distinct cationic

signature to FW1 and SP1 with relatively lower calcium concentrations and higher magnesium concentrations.

11. A strong hydrogen sulphide odour and reducing conditions were observed at BH6 and BH7 with visible limescale forming on equipment during the pumping test.
12. Reductions in flow at local springs (SP1 and SP2) were noted. However, further investigation would be required to ascertain whether this is due to pumping or low rainfall levels.

11. Recommendations

1. WATER DEMAND & BUDGET: A detailed breakdown of water demand (e.g., volume and timing) should be developed to determine detailed water usage.
2. RAINWATER HARVESTING: Rainwater harvesting from roofs and hard standings should be implemented. The plant and associated infrastructure should be designed to maximise potential capture.
3. SUPPLY LIMITATIONS: The sustainable yields established from the pumping test should be considered a maximum yield. A reduction in yield should be allowed for through well losses over time. Allowances should also be made for periods of downtime associated with routine maintenance or pump failure.
4. BACKUP SUPPLY: Additional boreholes could be constructed to augment the supply. The siting of such boreholes should be guided by geophysical surveys with subsequent drilling supervised by a hydrogeologist.
5. BASELINE MONITORING: In accordance with the recommended monitor and mitigate approach proximal sensitive receptors (e.g., springs and other abstraction boreholes) should identified and monitored pre development. This data should be used to identify triggers for targeted mitigation measures.

12. References

No.	Description	Minerex Doc. Ref.
1.	Geological Survey of Ireland (2022) Public Data Viewer Series. Available at: https://www.gsi.ie/en-ie/data-and-maps/Pages/d efault.aspx	
2.	Hunter Williams, N.H., Misstear, B.D., Daly, D and Lee, M (2013) Development of a national groundwater recharge map for the Republic of Ireland. *Journal of Engineering Geology and Hydrogeology*, **46**, 493-506.	
3.	Environmental Protection Agency Map Viewer (2022) Environmental Protection Agency. Available at: https://gis.epa.ie/EPAMaps/	
4.	British Standards (2022) ISO 14686:2003. Hydrometric determinations: Pumping tests for water wells - Considerations and guidelines for design, performance and use.	
5.	Met Eireann (2022) Daily Data. Available at: https://www.met.ie/climate/available-data/daily-data	
6.	Kelly, C., Hunter Williams, T., Misstear, B.M and Motherway, K (2015) Irish Aquifer Properties – A reference manual and guide. Prepared on behalf of the Geological Survey of Ireland and the Environmental Protection Agency.	
7.	Environmental Protection Agency (2022) Monthly Hydrology Bulletin: Edition 027: July 2022	
8.	Environmental Protection Agency (2022) Monthly Hydrology Bulletin: Edition 028: August 2022	
9.	Environment Agency (2007) Hydrogeological impact appraisal for groundwater abstractions. Science Report – SC040020/SR2	F2252
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11.	Ferguson, B. K and Debo, T. N (1990) On-site Stormwater Management: Applications for Landscape and Engineering. Wiley.	
12.	Nolan, P and Flanagan, J (2020) High-resolution Climate Projections for Ireland – A Multimodel Ensemble Approach. Environmental Protection Agency (EPA), Johnstown Castle, Co. Wexford, Ireland	
13.	Hunter-Williams, H and Lee, M (2010) Ireland at risk – Possible implications for groundwater resources of climate change. Groundwater Section,	
14.	Cantoni, E., Misstear, B.D.R and Gill, L (2017) Climate change impacts on groundwater recharge to Irish fractured bedrock aquifers. National Hydrology Conference.	
15.	S.I No. 366 of 2016 - Groundwater Regulations	F2240

13. Appendices

APPENDIX A

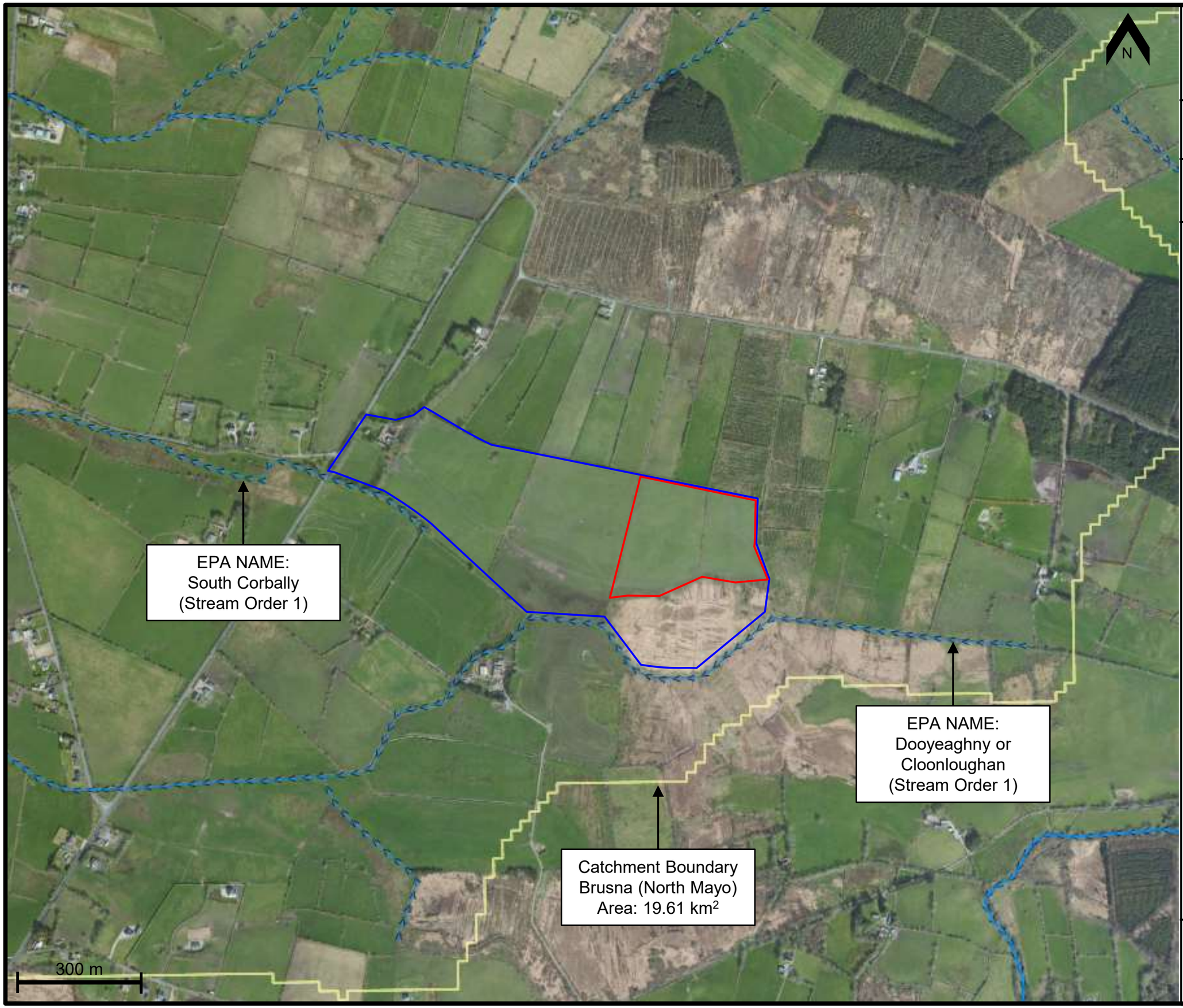
Legend

- Wastewater Storage Tank (1,500m^3)
- Constructed Wetlands (80m^2 & 580m^2)
- Vegetated Swale
- Discharge Route
- Discharge Line
- Discharge Point

Discharge Point

Dooyeaghny or Cloonloughan River

APPENDIX B



Drawing Title
Surface Water Features

Client: Project: 3131
Hydrogen Plant - Co. Sligo

Drawing Ref: 3131-008
Drawn by: CF 25/10/2022

Common Legend

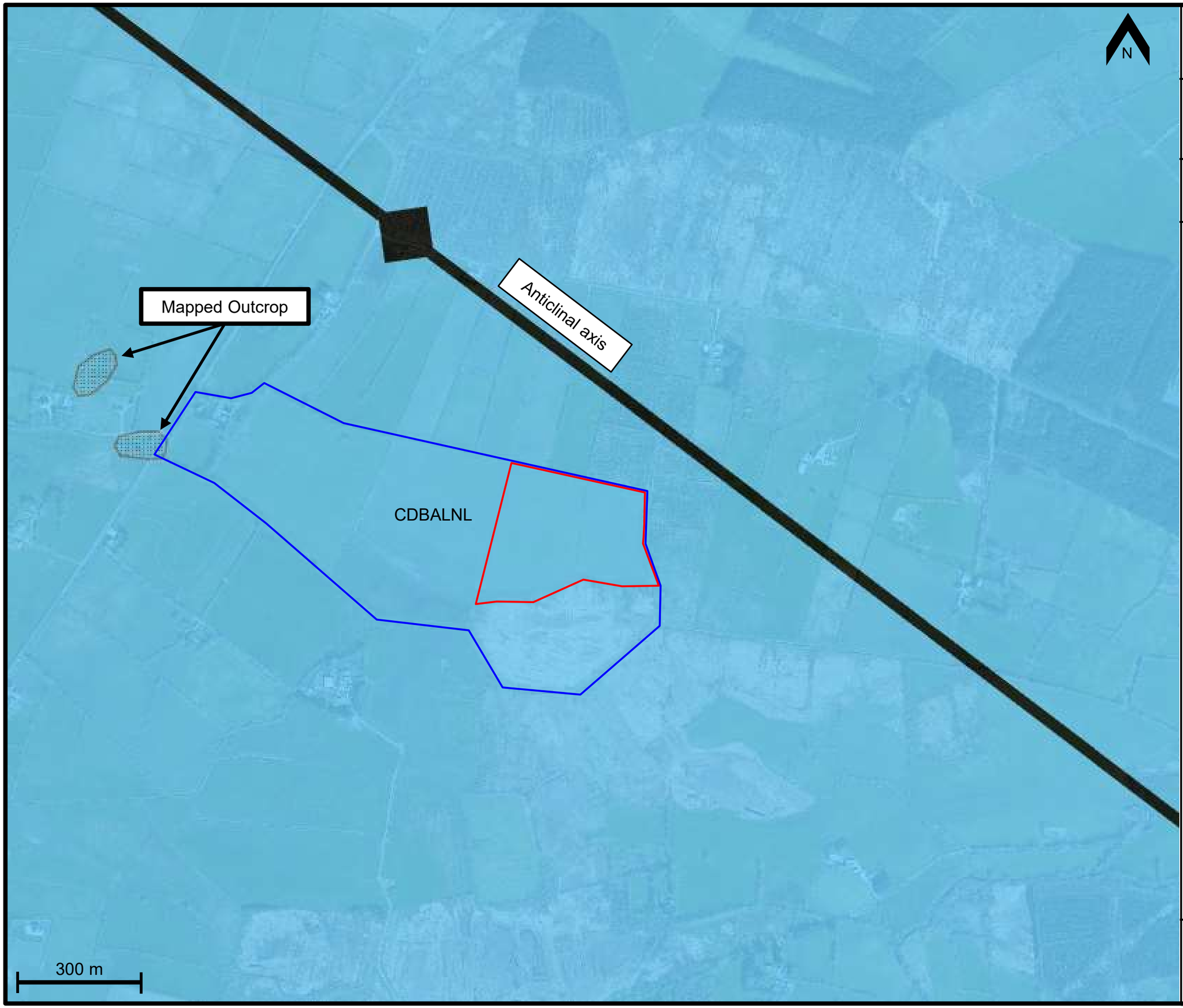
Landowner Property

Proposed hydrogen production facility outline

Source: EPA

Minerex Environmental

APPENDIX C



Drawing Title
Bedrock Geology

Client: Project: 3131
Hydrogen Plant - Co. Sligo

Drawing Ref: 3131-008
Drawn by: CF 25/10/2022

Common Legend

Landowner Property

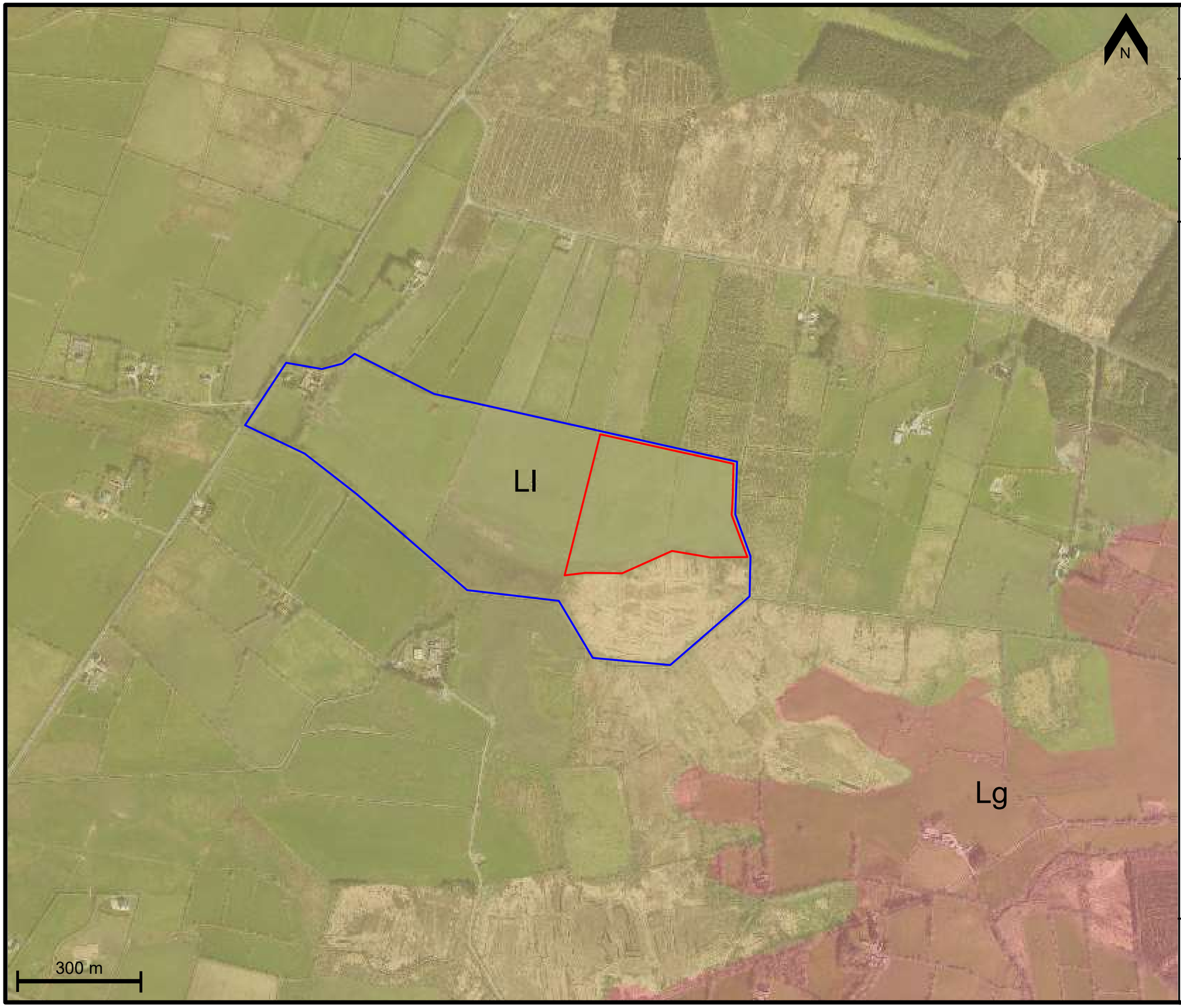
CDBALNL

Ballina Limestone Formation (Lower)
Dark fine-grained limestone and shale.

Proposed hydrogen production facility outline

Source: Geological Survey Ireland

Minerex Environmental



Drawing Title
Aquifer Classification

Client: Project: 3131
Hydrogen Plant - Co. Sligo

Drawing Ref: 3131-008
Drawn by: CF 25/10/2022

Common Legend

Landowner Property

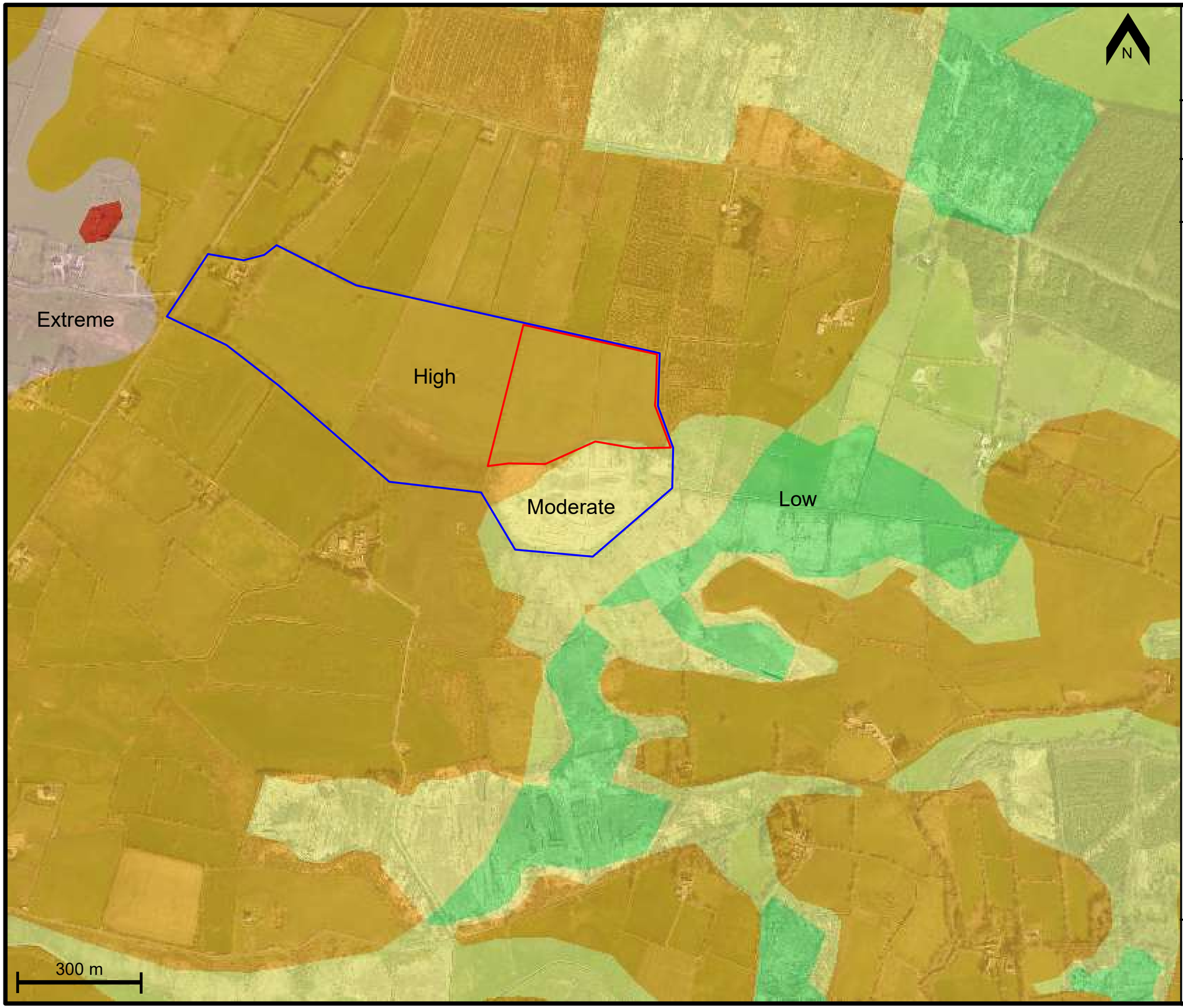
LI — Locally Important Aquifer - *Bedrock which is moderately productive only in local zones*

Lg — Locally Important Gravel Aquifer

Proposed hydrogen production facility outline

Source: Geological Survey Ireland

Minerex Environmental



Drawing Title
Groundwater Vulnerability

Client: Project: 3131
Hydrogen Plant - Co. Sligo

Drawing Ref: 3131-008
Drawn by: CF 25/10/2022

Common Legend

Landowner Property

Proposed hydrogen production facility outline

Source: Geological Survey Ireland

Minerex Environmental

N

300 m

Drawing Title
Groundwater Recharge (mm/yr)

Client: Project: 3131
Hydrogen Plant - Co. Sligo

Drawing Ref: 3131-008
Drawn by: CF 25/10/2022

Common Legend

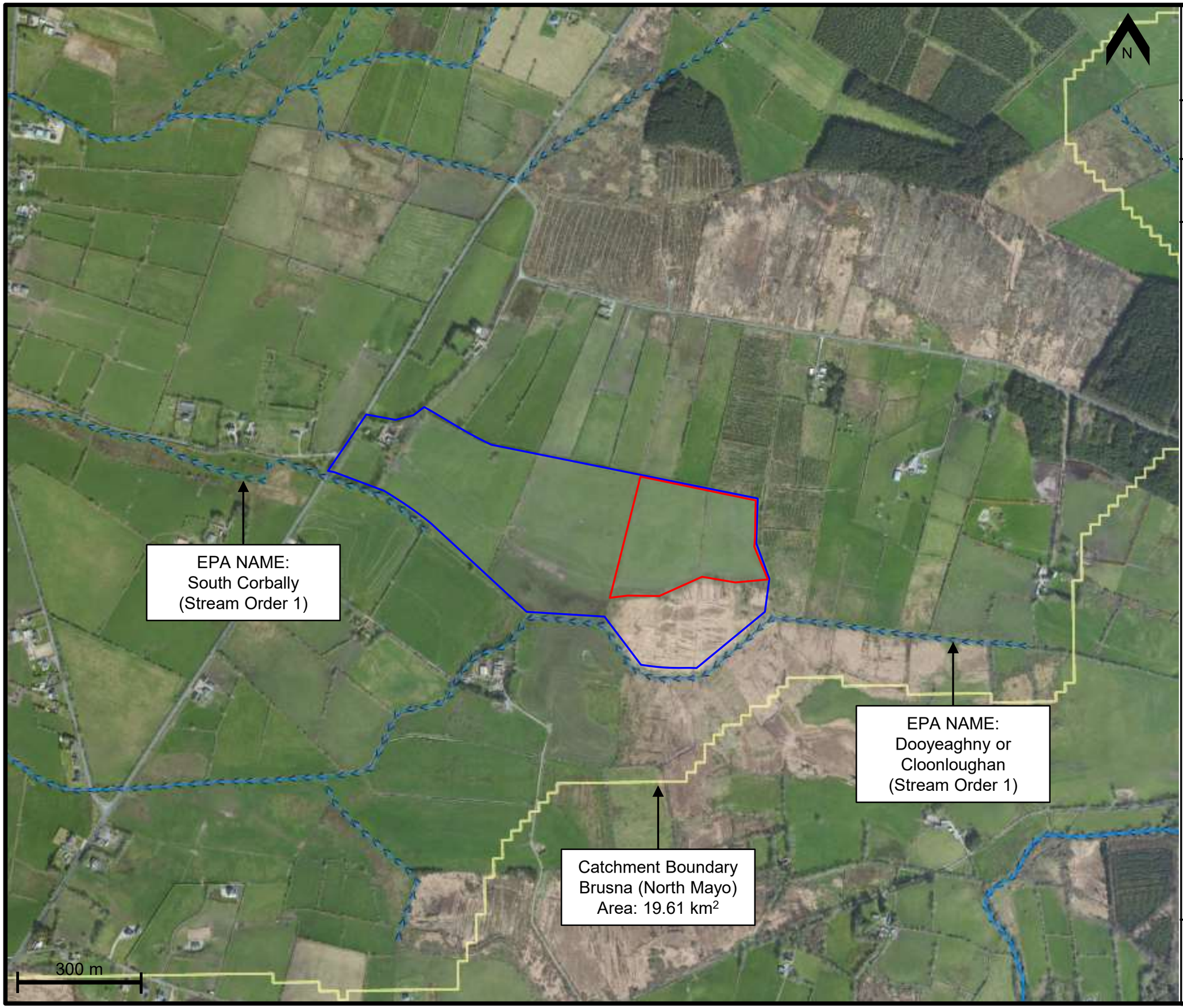
Landowner Property

Proposed hydrogen production facility outline

- >2000 mm
- 1401-2000 mm
- 1001-1400 mm
- 901-1000 mm
- 801-900 mm
- 701-800 mm
- 601-700 mm
- 551-600 mm
- 501-550 mm
- 451-500 mm
- 401-450 mm
- 351-400 mm
- 301-350 mm
- 251-300 mm
- 201-250 mm
- 151-200 mm
- 101-150 mm
- 51-100 mm
- 1-50 mm
- 0 mm

Source: Geological Survey Ireland

Minerex Environmental



Drawing Title
Surface Water Features

Client: Project: 3131
Hydrogen Plant - Co. Sligo

Drawing Ref: 3131-008
Drawn by: CF 25/10/2022

Common Legend

Landowner Property

Proposed hydrogen production facility outline

Source: EPA

Minerex Environmental

APPENDIX D

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
11/07/22 13:40:00	00:00	BH6	Pumping well	7.96	0.00			0.0	H2S	Static water level. Pre-pumping
11/07/22 14:03:00	00:00	BH6	Pumping well	12.10	4.14		3.3	11.9	H2S	**PUMP ON**
11/07/22 14:04:00	00:01	BH6	Pumping well	16.50	8.54			0.0	H2S	
11/07/22 14:05:00	00:02	BH6	Pumping well	18.04	10.08			0.0	H2S	
11/07/22 14:06:00	00:03	BH6	Pumping well	20.00	12.04			0.0	H2S	
11/07/22 14:07:00	00:04	BH6	Pumping well	20.90	12.94			0.0	H2S	
11/07/22 14:08:00	00:05	BH6	Pumping well	22.11	14.15		3.1	11.2	H2S	
11/07/22 14:09:00	00:06	BH6	Pumping well	22.69	14.73			0.0	H2S	
11/07/22 14:10:00	00:07	BH6	Pumping well	23.30	15.34			0.0	H2S	
11/07/22 14:11:00	00:08	BH6	Pumping well	23.88	15.92			0.0	H2S	
11/07/22 14:12:00	00:09	BH6	Pumping well	24.55	16.59			0.0	H2S	
11/07/22 14:13:00	00:10	BH6	Pumping well	25.05	17.09			0.0	H2S	
11/07/22 14:14:00	00:11	BH6	Pumping well	25.56	17.60			0.0	H2S	
11/07/22 14:15:00	00:12	BH6	Pumping well	26.00	18.04			0.0	H2S	
11/07/22 14:16:00	00:13	BH6	Pumping well	26.45	18.49			0.0	H2S	
11/07/22 14:17:00	00:14	BH6	Pumping well	26.88	18.92			0.0	H2S	
11/07/22 14:18:00	00:15	BH6	Pumping well	27.25	19.29		3	10.8	H2S	
11/07/22 14:19:00	00:16	BH6	Pumping well	27.64	19.68			0.0	H2S	
11/07/22 14:20:00	00:17	BH6	Pumping well	27.96	20.00			0.0	H2S	
11/07/22 14:21:00	00:18	BH6	Pumping well	28.37	20.41			0.0	H2S	
11/07/22 14:22:00	00:19	BH6	Pumping well	28.65	20.69		3	10.8	H2S	
11/07/22 14:23:00	00:20	BH6	Pumping well	28.97	21.01			0.0	H2S	
11/07/22 14:24:00	00:21	BH6	Pumping well	29.31	21.35			0.0	H2S	
11/07/22 14:25:00	00:22	BH6	Pumping well	29.56	21.60			0.0	H2S	
11/07/22 14:26:00	00:23	BH6	Pumping well	29.85	21.89			0.0	H2S	
11/07/22 14:29:00	00:26	BH6	Pumping well	30.4	22.44		3	10.8	H2S	
11/07/22 14:40:00	00:37	BH6	Pumping well	32.95	24.99			0.0	H2S	
11/07/22 14:50:00	00:47	BH6	Pumping well	34.89	26.93		2.9	10.4	H2S	
11/07/22 15:03:00	01:00	BH6	Pumping well	36.47	28.51			0.0	H2S	
11/07/22 15:13:00	01:10	BH6	Pumping well	37.70	29.74			0.0	H2S	
11/07/22 15:23:00	01:20	BH6	Pumping well	38.75	30.79		2.9	10.4	H2S	
11/07/22 15:56:00	01:53	BH6	Pumping well	41.43	33.47			0.0	H2S	
11/07/22 16:30:00	02:27	BH6	Pumping well	43.23	35.27		2.7	9.7	H2S	
11/07/22 17:00:00	02:57	BH6	Pumping well	44.49	36.53			0.0	H2S	
11/07/22 17:30:00	03:27	BH6	Pumping well	45.44	37.48		2.7	9.7	H2S	
11/07/22 18:00:00	03:57	BH6	Pumping well	46.39	38.43		2.5	9.0	H2S	
11/07/22 22:45:00	08:42	BH6	Pumping well	46.39	38.43		0	0.0	H2S	
12/07/22 08:30:00	18:27	BH6	Pumping well	52.01	44.05		2.5	9.0	H2S	
12/07/22 14:00:00	23:57	BH6	Pumping well	53.50	45.54		2.5	9.0	H2S	
12/07/22 17:00:00	26:57	BH6	Pumping well	53.64	45.68			0.0	H2S	
12/07/22 20:00:00	29:57	BH6	Pumping well	53.70	45.74			0.0	H2S	
13/07/22 08:00:00	41:57	BH6	Pumping well	54.14	46.18		2.33	8.4	H2S	
13/07/22 11:00:00	44:57	BH6	Pumping well	54.23	46.27		2.33	8.4	H2S	
13/07/22 14:00:00	47:57	BH6	Pumping well	54.30	46.34		2.33	8.4	H2S	
13/07/22 17:00:00	50:57	BH6	Pumping well	54.32	46.36		2.33	8.4	H2S	
13/07/22 20:00:00	53:57	BH6	Pumping well	54.29	46.33		2.33	8.4	H2S	
14/07/22 08:00:00	65:57	BH6	Pumping well	54.61	46.65		2.33	8.4	H2S	
14/07/22 11:00:00	68:57	BH6	Pumping well	54.61	46.65		2.33	8.4	H2S	
14/07/22 14:00:00	71:57	BH6	Pumping well	54.74	46.78		2.33	8.4	H2S	
14/07/22 17:00:00	74:57	BH6	Pumping well	54.74	46.78		2.33	8.4	H2S	
14/07/22 20:00:00	77:57	BH6	Pumping well	54.71	46.75		2.33	8.4	H2S	
15/07/22 08:00:00	89:57	BH6	Pumping well	54.84	46.88		2.33	8.4	H2S	
15/07/22 11:00:00	92:57	BH6	Pumping well	54.98	47.02		2.33	8.4	H2S	
15/07/22 14:00:00	95:57	BH6	Pumping well	54.87	46.91		2.3	8.3	H2S	
15/07/22 17:00:00	98:57	BH6	Pumping well	55.03	47.07		2.3	8.3	H2S	
15/07/22 20:00:00	101:57	BH6	Pumping well	54.84	46.88		2.3	8.3	H2S	
16/07/22 08:00:00	113:57	BH6	Pumping well	55.02	47.06		2.28	8.2	H2S	
16/07/22 11:00:00	116:57	BH6	Pumping well	54.99	47.03		2.3	8.3	H2S	
16/07/22 14:00:00	119:57	BH6	Pumping well	55.19	47.23		2.3	8.3	H2S	
16/07/22 17:00:00	122:57	BH6	Pumping well	55.17	47.21		2.33	8.4	H2S	
16/07/22 20:00:00	125:57	BH6	Pumping well	55.25	47.29		2.3	8.3	H2S	
17/07/22 08:00:00	137:57	BH6	Pumping well	55.06	47.10		2.3	8.3	H2S	
17/07/22 11:00:00	140:57	BH6	Pumping well	55.13	47.17		2.3	8.3	H2S	
17/07/22 14:00:00	143:57	BH6	Pumping well	55.29	47.33		2.35	8.5	H2S	

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
17/07/22 17:00:00	146:57	BH6	Pumping well	55.30	47.34		2.33	8.4	H2S	
17/07/22 20:00:00	149:57	BH6	Pumping well	55.23	47.27		2.28	8.2	H2S	
18/07/22 08:00:00	161:57	BH6	Pumping well	55.13	47.17		2.25	8.1	H2S	
18/07/22 11:00:00	164:57	BH6	Pumping well	55.16	47.20		2.17	7.8	H2S	
18/07/22 14:00:00	167:57	BH6	Pumping well	55.29	47.33		2.20	7.9	H2S	
18/07/22 17:00:00	170:57	BH6	Pumping well	55.24	47.28		2.30	8.3	H2S	
18/07/22 20:00:00	173:57	BH6	Pumping well	55.21	47.25		2.27	8.2	H2S	
19/07/22 08:00:00	185:57	BH6	Pumping well	55.16	47.20		2.30	8.3	H2S	
19/07/22 11:00:00	188:57	BH6	Pumping well	55.13	47.17		2.27	8.2	H2S	
19/07/22 14:00:00	191:57	BH6	Pumping well	55.13	47.17		2.27	8.2	H2S	
19/07/22 17:00:00	194:57	BH6	Pumping well	55.16	47.20		2.27	8.2	H2S	
19/07/22 20:00:00	197:57	BH6	Pumping well	55.24	47.28		2.30	8.3	H2S	
20/07/22 08:00:00	209:57	BH6	Pumping well	55.22	47.26		2.27	8.2	H2S	
20/07/22 11:00:00	212:57	BH6	Pumping well	55.27	47.31		2.30	8.3	H2S	
20/07/22 14:00:00	215:57	BH6	Pumping well	55.27	47.31		2.30	8.3	H2S	
20/07/22 17:00:00	218:57	BH6	Pumping well	55.30	47.34		2.25	8.1	H2S	
20/07/22 20:00:00	221:57	BH6	Pumping well	55.30	47.34		2.25	8.1	H2S	
21/07/22 08:00:00	233:57	BH6	Pumping well	55.29	47.33		2.273	8.2	H2S	
21/07/22 11:00:00	236:57	BH6	Pumping well	55.38	47.42		2.247	8.1	H2S	
21/07/22 14:00:00	239:57	BH6	Pumping well	55.31	47.35		2.273	8.2	H2S	
21/07/22 17:00:00	242:57	BH6	Pumping well	55.33	47.37		2.299	8.3	H2S	
21/07/22 20:00:00	245:57	BH6	Pumping well	55.51	47.55		2.41	8.7	H2S	
22/07/22 08:00:00	257:57	BH6	Pumping well	55.31	47.35		2.27	8.2	H2S	
22/07/22 11:00:00	260:57	BH6	Pumping well	55.37	47.41		2.27	8.2	H2S	
22/07/22 14:00:00	263:57	BH6	Pumping well	55.35	47.39		2.30	8.3	H2S	
22/07/22 17:00:00	266:57	BH6	Pumping well	55.05	47.09		2.25	8.1	H2S	
22/07/22 20:00:00	269:57	BH6	Pumping well	55.34	47.38		2.30	8.3	H2S	
23/07/22 08:00:00	281:57	BH6	Pumping well	55.35	47.39		2.33	8.4	H2S	
23/07/22 11:00:00	284:57	BH6	Pumping well	55.40	47.44		2.30	8.3	H2S	
23/07/22 14:00:00	287:57	BH6	Pumping well	55.41	47.45		2.27	8.2	H2S	
23/07/22 17:00:00	290:57	BH6	Pumping well	55.30	47.34		2.30	8.3	H2S	
23/07/22 20:00:00	293:57	BH6	Pumping well	55.28	47.32		2.27	8.2	H2S	
24/07/22 08:00:00	305:57	BH6	Pumping well	55.33	47.37		2.30	8.3	H2S	
24/07/22 11:00:00	308:57	BH6	Pumping well	55.32	47.36		2.27	8.2	H2S	
24/07/22 14:00:00	311:57	BH6	Pumping well	55.29	47.33		2.30	8.3	H2S	
24/07/22 17:00:00	314:57	BH6	Pumping well	55.25	47.29		2.27	8.2	H2S	
24/07/22 20:00:00	317:57	BH6	Pumping well	55.14	47.18		2.33	8.4	No odour	
25/07/22 08:00:00	329:57	BH6	Pumping well	55.10	47.14		2.30	8.3	H2S	
25/07/22 20:00:00	341:57	BH6	Pumping well	55.00	47.04		2.33	8.4	H2S	
26/07/22 08:00:00	353:57	BH6	Pumping well	54.90	46.94		2.30	8.3	H2S	
26/07/22 20:00:00	365:57	BH6	Pumping well	54.89	46.93		2.27	8.2	H2S	
27/07/22 08:00:00	377:57	BH6	Pumping well	54.79	46.83		2.30	8.3	H2S	
27/07/22 20:00:00	389:57	BH6	Pumping well	55.64	47.68		2.25	8.1	H2S	
28/07/22 08:00:00	401:57	BH6	Pumping well	55.56	47.60		2.25	8.1	H2S	
28/07/22 20:00:00	413:57	BH6	Pumping well	55.70	47.74		2.25	8.1	H2S	
29/07/22 08:00:00	425:57	BH6	Pumping well	55.73	47.77		2.25	8.1	H2S	
29/07/22 20:00:00	437:57	BH6	Pumping well	55.74	47.78		2.25	8.1	H2S	
30/07/22 08:00:00	449:57	BH6	Pumping well	55.79	47.83		2.25	8.1	H2S	
30/07/22 20:00:00	461:57	BH6	Pumping well	55.85	47.89		2.25	8.1	H2S	
31/07/22 08:00:00	473:57	BH6	Pumping well	55.87	47.91		2.27	8.2	H2S	
31/07/22 20:00:00	485:57	BH6	Pumping well	55.65	47.69		2.22	8.0	H2S	
01/08/22 08:00:00	497:57	BH6	Pumping well	55.74	47.78		2.22	8.0	H2S	
01/08/22 20:00:00	509:57	BH6	Pumping well	55.77	47.81		2.33	8.4	H2S	
02/08/22 08:00:00	521:57	BH6	Pumping well	55.72	47.76		2.30	8.3	H2S	
02/08/22 20:00:00	533:57	BH6	Pumping well	55.68	47.72		2.33	8.4	H2S	
03/08/22 08:00:00	545:57	BH6	Pumping well	55.70	47.74					Pumping stopped
03/08/22 11:00:00	548:57	BH6	Pumping well	22.76	14.80					
03/08/22 14:00:00	551:57	BH6	Pumping well	24.09	16.13					
03/08/22 17:00:00	554:57	BH6	Pumping well	15.86	7.90					
03/08/22 20:00:00	557:57	BH6	Pumping well	14.99	7.03					
04/08/22 08:00:00	569:57	BH6	Pumping well	12.42	4.46					
04/08/22 11:00:00	572:57	BH6	Pumping well	12.02	4.06					
04/08/22 14:00:00	575:57	BH6	Pumping well	11.67	3.71					
04/08/22 17:00:00	578:57	BH6	Pumping well	11.42	3.46					
04/08/22 20:00:00	581:57	BH6	Pumping well	11.22	3.26					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
05/08/22 08:00:00	593:57	BH6	Pumping well	10.47	2.51					
05/08/22 11:00:00	596:57	BH6	Pumping well	10.37	2.41					
05/08/22 14:00:00	599:57	BH6	Pumping well	10.21	2.25					
05/08/22 15:00:00	600:57	BH6	Pumping well	10.10	2.14					
11/07/22 13:40:00	00:00	BH7	Pumping well	1.77	0.00			0.0	H2S	Static water level. Pre pumping & pre
11/07/22 14:03:00	00:00	BH7	Pumping well	2.75	0.98		1.1	4.0	H2S	**PUMP ON**
11/07/22 14:04:00	00:01	BH7	Pumping well	6.00	4.23			0.0	H2S	
11/07/22 14:05:00	00:02	BH7	Pumping well	7.80	6.03			0.0	H2S	
11/07/22 14:06:00	00:03	BH7	Pumping well	8.54	6.77			0.0	H2S	
11/07/22 14:07:00	00:04	BH7	Pumping well	9.87	8.10			0.0	H2S	
11/07/22 14:08:00	00:05	BH7	Pumping well	10.87	9.10			0.0	H2S	
11/07/22 14:09:00	00:06	BH7	Pumping well	12.32	10.55			0.0	H2S	
11/07/22 14:10:00	00:07	BH7	Pumping well	13.40	11.63			0.0	H2S	
11/07/22 14:11:00	00:08	BH7	Pumping well	14.36	12.59			0.0	H2S	
11/07/22 14:12:00	00:09	BH7	Pumping well	15.62	13.85			0.0	H2S	
11/07/22 14:13:00	00:10	BH7	Pumping well	16.54	14.77			0.0	H2S	
11/07/22 14:14:00	00:11	BH7	Pumping well	17.60	15.83			0.0	H2S	
11/07/22 14:15:00	00:12	BH7	Pumping well	18.60	16.83			0.0	H2S	
11/07/22 14:16:00	00:13	BH7	Pumping well	19.60	17.83		1.1	4.0	H2S	
11/07/22 14:17:00	00:14	BH7	Pumping well	20.62	18.85			0.0	H2S	
11/07/22 14:18:00	00:15	BH7	Pumping well	21.56	19.79			0.0	H2S	
11/07/22 14:19:00	00:16	BH7	Pumping well	22.51	20.74			0.0	H2S	
11/07/22 14:20:00	00:17	BH7	Pumping well	23.42	21.65			0.0	H2S	
11/07/22 14:21:00	00:18	BH7	Pumping well	24.44	22.67			0.0	H2S	
11/07/22 14:22:00	00:19	BH7	Pumping well	25.23	23.46			0.0	H2S	
11/07/22 14:23:00	00:20	BH7	Pumping well	26.14	24.37			0.0	H2S	
11/07/22 14:24:00	00:21	BH7	Pumping well	27.16	25.39			0.0	H2S	
11/07/22 14:25:00	00:22	BH7	Pumping well	27.90	26.13		1.1	4.0	H2S	
11/07/22 14:45:00	00:42	BH7	Pumping well	40.31	38.54			0.0	H2S	
11/07/22 14:55:00	00:52	BH7	Pumping well	47.70	45.93		0.9	3.2	H2S	
11/07/22 15:05:00	01:02	BH7	Pumping well	51.54	49.77		0.75	2.7	H2S	
11/07/22 15:15:00	01:12	BH7	Pumping well	52.82	51.05		0.6	2.2	H2S	
11/07/22 15:30:00	01:27	BH7	Pumping well	53.26	51.49		0.52	1.9	H2S	
11/07/22 15:45:00	01:42	BH7	Pumping well	38.75	36.98		0.52	1.9	H2S	
11/07/22 16:15:00	02:12	BH7	Pumping well	52.33	50.56			0.0	H2S	
11/07/22 17:15:00	03:12	BH7	Pumping well	53.67	51.90		0.52	1.9	H2S	
11/07/22 17:45:00	03:42	BH7	Pumping well	54.51	52.74		0.52	1.9	H2S	
11/07/22 22:30:00	08:27	BH7	Pumping well	53.39	51.62		0.5	1.8	H2S	
12/07/22 09:10:00	19:07	BH7	Pumping well	53.33	51.56		0.37	1.3	H2S	
12/07/22 10:10:00	20:07	BH7	Pumping well	75.41	73.64		0.83	3.0	H2S	Flow meter removed as it was restricting flow
12/07/22 12:00:00	21:57	BH7	Pumping well	73.35	71.58		0.5	1.8	H2S	
12/07/22 12:15:00	22:12	BH7	Pumping well	73.40	71.63		0.5	1.8	H2S	
12/07/22 12:30:00	22:27	BH7	Pumping well	73.44	71.67		0.5	1.8	H2S	
12/07/22 12:45:00	22:42	BH7	Pumping well	73.48	71.71		0.5	1.8	H2S	
12/07/22 13:00:00	22:57	BH7	Pumping well	70.68	68.91		0.42	1.5	H2S	
12/07/22 13:20:00	23:17	BH7	Pumping well	69.30	67.53		0.42	1.5	H2S	
12/07/22 15:00:00	24:57	BH7	Pumping well	66.35	64.58		0.42	1.5	H2S	
12/07/22 17:00:00	26:57	BH7	Pumping well	66.60	64.83		0.44	1.6	H2S	
12/07/22 20:00:00	29:57	BH7	Pumping well	66.96	65.19		0.44	1.6	H2S	
13/07/22 08:00:00	41:57	BH7	Pumping well	68.70	66.93		0.44	1.6	H2S	
13/07/22 11:00:00	44:57	BH7	Pumping well	68.78	67.01		0.44	1.6	H2S	
13/07/22 14:00:00	47:57	BH7	Pumping well	68.61	66.84		0.44	1.6	H2S	
13/07/22 17:00:00	50:57	BH7	Pumping well	68.85	67.08		0.44	1.6	H2S	
13/07/22 20:00:00	53:57	BH7	Pumping well	68.90	67.13		0.44	1.6	H2S	
14/07/22 08:00:00	65:57	BH7	Pumping well	69.82	68.05		0.44	1.6	H2S	
14/07/22 11:00:00	68:57	BH7	Pumping well	69.92	68.15		0.44	1.6	H2S	
14/07/22 14:00:00	71:57	BH7	Pumping well	70.20	68.43		0.44	1.6	H2S	
14/07/22 17:00:00	74:57	BH7	Pumping well	70.31	68.54		0.44	1.6	H2S	
14/07/22 20:00:00	77:57	BH7	Pumping well	70.43	68.66		0.44	1.6	H2S	
15/07/22 08:00:00	89:57	BH7	Pumping well	71.28	69.51		0.43	1.6	H2S	
15/07/22 11:00:00	92:57	BH7	Pumping well	71.33	69.56		0.43	1.6	H2S	
15/07/22 14:00:00	95:57	BH7	Pumping well	71.52	69.75		0.43	1.6	H2S	
15/07/22 17:00:00	98:57	BH7	Pumping well	71.83	70.06		0.44	1.6	H2S	
15/07/22 20:00:00	101:57	BH7	Pumping well	71.83	70.06		0.43	1.6	H2S	
16/07/22 08:00:00	113:57	BH7	Pumping well	71.98	70.21		0.43	1.6	H2S	

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
16/07/22 11:00:00	116:57	BH7	Pumping well	71.91	70.14		0.43	1.6	H2S	
16/07/22 14:00:00	119:57	BH7	Pumping well	72.20	70.43		0.43	1.6	H2S	
16/07/22 17:00:00	122:57	BH7	Pumping well	72.25	70.48		0.43	1.6	H2S	
16/07/22 20:00:00	125:57	BH7	Pumping well	72.29	70.52		0.43	1.6	H2S	
17/07/22 08:00:00	137:57	BH7	Pumping well	71.61	69.84		0.43	1.6	H2S	
17/07/22 11:00:00	140:57	BH7	Pumping well	71.72	69.95		0.43	1.6	H2S	
17/07/22 14:00:00	143:57	BH7	Pumping well	71.94	70.17		0.43	1.6	H2S	
17/07/22 17:00:00	146:57	BH7	Pumping well	71.98	70.21		0.43	1.6	H2S	
17/07/22 20:00:00	149:57	BH7	Pumping well	71.93	70.16		0.43	1.5	H2S	
18/07/22 08:00:00	161:57	BH7	Pumping well	71.57	69.80		0.43	1.5	H2S	
18/07/22 11:00:00	164:57	BH7	Pumping well	71.60	69.83		0.43	1.6	H2S	
18/07/22 14:00:00	167:57	BH7	Pumping well	72.07	70.30		0.43	1.5	H2S	
18/07/22 17:00:00	170:57	BH7	Pumping well	71.90	70.13		0.43	1.6	H2S	
18/07/22 20:00:00	173:57	BH7	Pumping well	71.55	69.78		0.43	1.5	H2S	
19/07/22 08:00:00	185:57	BH7	Pumping well	71.12	69.35		0.43	1.5	H2S	
19/07/22 11:00:00	188:57	BH7	Pumping well	70.90	69.13		0.43	1.5	H2S	
19/07/22 14:00:00	191:57	BH7	Pumping well	71.11	69.34		0.43	1.5	H2S	
19/07/22 17:00:00	194:57	BH7	Pumping well	71.14	69.37		0.43	1.5	H2S	
19/07/22 20:00:00	197:57	BH7	Pumping well	71.32	69.55		0.42	1.5	H2S	
20/07/22 08:00:00	209:57	BH7	Pumping well	71.04	69.27		0.43	1.5	H2S	
20/07/22 11:00:00	212:57	BH7	Pumping well	71.25	69.48		0.43	1.5	H2S	
20/07/22 14:00:00	215:57	BH7	Pumping well	71.20	69.43		0.43	1.5	H2S	
20/07/22 17:00:00	218:57	BH7	Pumping well	71.50	69.73		0.43	1.5	H2S	
20/07/22 20:00:00	221:57	BH7	Pumping well	71.06	69.29		0.42	1.5	H2S	
21/07/22 08:00:00	233:57	BH7	Pumping well	71.23	69.46		0.43	1.5	H2S	
21/07/22 11:00:00	236:57	BH7	Pumping well	71.22	69.45		0.43	1.5	H2S	
21/07/22 14:00:00	239:57	BH7	Pumping well	71.18	69.41		0.42	1.5	H2S	
21/07/22 17:00:00	242:57	BH7	Pumping well	71.08	69.31		0.43	1.5	H2S	
21/07/22 20:00:00	245:57	BH7	Pumping well	70.92	69.15		0.43	1.5	H2S	
22/07/22 08:00:00	257:57	BH7	Pumping well	70.97	69.20		0.43	1.5	H2S	
22/07/22 11:00:00	260:57	BH7	Pumping well	70.93	69.16		0.43	1.5	H2S	
22/07/22 14:00:00	263:57	BH7	Pumping well	70.92	69.15		0.43	1.5	H2S	
22/07/22 17:00:00	266:57	BH7	Pumping well	70.93	69.16		0.42	1.5	H2S	
22/07/22 20:00:00	269:57	BH7	Pumping well	70.53	68.76		0.43	1.5	H2S	
23/07/22 08:00:00	281:57	BH7	Pumping well	70.43	68.66		0.42	1.5	H2S	
23/07/22 11:00:00	284:57	BH7	Pumping well	70.33	68.56		0.42	1.5	H2S	
23/07/22 14:00:00	287:57	BH7	Pumping well	69.99	68.22		0.43	1.6	H2S	
23/07/22 17:00:00	290:57	BH7	Pumping well	69.58	67.81		0.42	1.5	H2S	
23/07/22 20:00:00	293:57	BH7	Pumping well	69.52	67.75		0.43	1.5	H2S	
24/07/22 08:00:00	305:57	BH7	Pumping well	68.98	67.21		0.42	1.5	H2S	
24/07/22 11:00:00	308:57	BH7	Pumping well	68.78	67.01		0.41	1.5	H2S	
24/07/22 14:00:00	311:57	BH7	Pumping well	68.41	66.64		0.41	1.5	H2S	
24/07/22 17:00:00	314:57	BH7	Pumping well	68.10	66.33		0.41	1.5	H2S	
24/07/22 20:00:00	317:57	BH7	Pumping well	67.67	65.90		0.40	1.4	No odour	
25/07/22 08:00:00	329:57	BH7	Pumping well	65.92	64.15		0.40	1.4	H2S	
25/07/22 20:00:00	341:57	BH7	Pumping well	64.88	63.11		0.39	1.4	H2S	
26/07/22 08:00:00	353:57	BH7	Pumping well	63.73	61.96		0.38	1.4	H2S	
26/07/22 20:00:00	365:57	BH7	Pumping well	62.88	61.11		0.38	1.4	H2S	
27/07/22 08:00:00	377:57	BH7	Pumping well	61.30	59.53		0.47	1.7	H2S	
27/07/22 20:00:00	389:57	BH7	Pumping well	76.44	74.67		0.45	1.6	H2S	
28/07/22 08:00:00	401:57	BH7	Pumping well	76.17	74.40		0.45	1.6	H2S	
28/07/22 20:00:00	413:57	BH7	Pumping well	75.50	73.73		0.45	1.6	H2S	
29/07/22 08:00:00	425:57	BH7	Pumping well	72.89	71.12		0.45	1.6	H2S	
29/07/22 20:00:00	437:57	BH7	Pumping well	74.97	73.20		0.44	1.6	H2S	
30/07/22 08:00:00	449:57	BH7	Pumping well	73.90	72.13		0.44	1.6	H2S	
30/07/22 20:00:00	461:57	BH7	Pumping well	72.92	71.15		0.44	1.6	H2S	
31/07/22 08:00:00	473:57	BH7	Pumping well	72.97	71.20		0.44	1.6	H2S	
31/07/22 20:00:00	485:57	BH7	Pumping well	72.94	71.17		0.44	1.6	H2S	
01/08/22 08:00:00	497:57	BH7	Pumping well	72.96	71.19		0.44	1.6	H2S	
01/08/22 20:00:00	509:57	BH7	Pumping well	73.36	71.59		0.44	1.6	H2S	
02/08/22 08:00:00	521:57	BH7	Pumping well	72.96	71.19		0.44	1.6	H2S	
02/08/22 20:00:00	533:57	BH7	Pumping well	71.75	69.98		0.44	1.6	H2S	
03/08/22 08:00:00	545:57	BH7	Pumping well	71.67	69.90					Pumping stopped
03/08/22 11:00:00	548:57	BH7	Pumping well	18.97	17.20					
03/08/22 14:00:00	551:57	BH7	Pumping well	13.01	11.24					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
03/08/22 17:00:00	554:57	BH7	Pumping well	11.01	9.24					
03/08/22 20:00:00	557:57	BH7	Pumping well	9.90	8.13					
04/08/22 08:00:00	569:57	BH7	Pumping well	7.85	6.08					
04/08/22 11:00:00	572:57	BH7	Pumping well	7.44	5.67					
04/08/22 14:00:00	575:57	BH7	Pumping well	5.98	4.21					
04/08/22 17:00:00	578:57	BH7	Pumping well	5.70	3.93					
04/08/22 20:00:00	581:57	BH7	Pumping well	5.50	3.73					
05/08/22 08:00:00	593:57	BH7	Pumping well	4.64	2.87					
05/08/22 11:00:00	596:57	BH7	Pumping well	4.54	2.77					
05/08/22 14:00:00	599:57	BH7	Pumping well	4.37	2.60					
05/08/22 15:00:00	600:57	BH7	Pumping well	4.26	2.49					
11/07/22 13:00:00	00:00	BH1	Observation	7.38	0.00					Static water level. Pre-pumping
11/07/22 16:00:00	03:00	BH1	Observation	7.37	-0.01					
12/07/22 08:00:00	17:57	BH1	Observation	7.40	0.02					
12/07/22 11:00:00	20:57	BH1	Observation	7.41	0.03					
12/07/22 14:00:00	23:57	BH1	Observation	7.42	0.04					
12/07/22 17:00:00	26:57	BH1	Observation	7.44	0.06					
12/07/22 20:00:00	29:57	BH1	Observation	7.44	0.06					
13/07/22 08:00:00	41:57	BH1	Observation	7.47	0.09					
13/07/22 11:00:00	44:57	BH1	Observation	7.48	0.10					
13/07/22 14:00:00	47:57	BH1	Observation	7.48	0.10					
13/07/22 17:00:00	50:57	BH1	Observation	7.48	0.10					
13/07/22 20:00:00	53:57	BH1	Observation	7.47	0.09					
14/07/22 08:00:00	65:57	BH1	Observation	7.51	0.13					
14/07/22 11:00:00	68:57	BH1	Observation	7.51	0.13					
14/07/22 14:00:00	71:57	BH1	Observation	7.52	0.14					
14/07/22 17:00:00	74:57	BH1	Observation	7.52	0.14					
14/07/22 20:00:00	77:57	BH1	Observation	7.51	0.13					
15/07/22 08:00:00	89:57	BH1	Observation	7.53	0.15					
15/07/22 11:00:00	92:57	BH1	Observation	7.54	0.16					
15/07/22 14:00:00	95:57	BH1	Observation	7.56	0.18					
15/07/22 17:00:00	98:57	BH1	Observation	7.57	0.19					
15/07/22 20:00:00	101:57	BH1	Observation	7.59	0.21					
16/07/22 08:00:00	113:57	BH1	Observation	7.66	0.28					
16/07/22 11:00:00	116:57	BH1	Observation	7.67	0.29					
16/07/22 14:00:00	119:57	BH1	Observation	7.69	0.31					
16/07/22 17:00:00	122:57	BH1	Observation	7.71	0.33					
16/07/22 20:00:00	125:57	BH1	Observation	7.74	0.36					
17/07/22 08:00:00	137:57	BH1	Observation	7.84	0.46					
17/07/22 11:00:00	140:57	BH1	Observation	7.84	0.46					
17/07/22 14:00:00	143:57	BH1	Observation	7.86	0.48					
17/07/22 17:00:00	146:57	BH1	Observation	7.86	0.48					
17/07/22 20:00:00	149:57	BH1	Observation	7.88	0.50					
18/07/22 08:00:00	161:57	BH1	Observation	7.99	0.61					
18/07/22 11:00:00	164:57	BH1	Observation	8.00	0.62					
18/07/22 14:00:00	167:57	BH1	Observation	8.20	0.82					
18/07/22 17:00:00	170:57	BH1	Observation	8.40	1.02					
18/07/22 20:00:00	173:57	BH1	Observation	8.06	0.68					
19/07/22 08:00:00	185:57	BH1	Observation	8.10	0.72					
19/07/22 11:00:00	188:57	BH1	Observation	8.13	0.75					
19/07/22 14:00:00	191:57	BH1	Observation	8.16	0.78					
19/07/22 17:00:00	194:57	BH1	Observation	8.18	0.80					
19/07/22 20:00:00	197:57	BH1	Observation	8.21	0.83					
20/07/22 08:00:00	209:57	BH1	Observation	8.36	0.98					
20/07/22 11:00:00	212:57	BH1	Observation	8.39	1.01					
20/07/22 14:00:00	215:57	BH1	Observation	8.42	1.04					
20/07/22 17:00:00	218:57	BH1	Observation	8.44	1.06					
20/07/22 20:00:00	221:57	BH1	Observation	8.48	1.10					
21/07/22 08:00:00	233:57	BH1	Observation	8.57	1.19					
21/07/22 11:00:00	236:57	BH1	Observation	8.59	1.21					
21/07/22 14:00:00	239:57	BH1	Observation	8.60	1.22					
21/07/22 17:00:00	242:57	BH1	Observation	8.62	1.24					
21/07/22 20:00:00	245:57	BH1	Observation	8.64	1.26					
22/07/22 08:00:00	257:57	BH1	Observation	8.69	1.31					
22/07/22 11:00:00	260:57	BH1	Observation	8.70	1.32					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
22/07/22 14:00:00	263:57	BH1	Observation	8.70	1.32					
22/07/22 17:00:00	266:57	BH1	Observation	8.92	1.54					
22/07/22 20:00:00	269:57	BH1	Observation	8.72	1.34					
23/07/22 08:00:00	281:57	BH1	Observation	8.73	1.35					
23/07/22 11:00:00	284:57	BH1	Observation	8.72	1.34					
23/07/22 14:00:00	287:57	BH1	Observation	8.72	1.34					
23/07/22 17:00:00	290:57	BH1	Observation	8.72	1.34					
23/07/22 20:00:00	293:57	BH1	Observation	8.73	1.35					
24/07/22 08:00:00	305:57	BH1	Observation	8.73	1.35					
24/07/22 11:00:00	308:57	BH1	Observation	8.72	1.34					
24/07/22 14:00:00	311:57	BH1	Observation	8.72	1.34					
24/07/22 17:00:00	314:57	BH1	Observation	8.73	1.35					
24/07/22 20:00:00	317:57	BH1	Observation	8.73	1.35					
25/07/22 08:00:00	329:57	BH1	Observation	8.80	1.42					
25/07/22 20:00:00	341:57	BH1	Observation	8.90	1.52					
26/07/22 08:00:00	353:57	BH1	Observation	8.98	1.60					
26/07/22 20:00:00	365:57	BH1	Observation	9.05	1.67					
27/07/22 08:00:00	377:57	BH1	Observation	9.08	1.70					
27/07/22 20:00:00	389:57	BH1	Observation	9.11	1.73					
28/07/22 08:00:00	401:57	BH1	Observation	9.12	1.74					
28/07/22 20:00:00	413:57	BH1	Observation	9.15	1.77					
29/07/22 08:00:00	425:57	BH1	Observation	9.18	1.80					
29/07/22 20:00:00	437:57	BH1	Observation	9.20	1.82					
30/07/22 08:00:00	449:57	BH1	Observation	9.24	1.86					
30/07/22 20:00:00	461:57	BH1	Observation	9.28	1.90					
31/07/22 08:00:00	473:57	BH1	Observation	9.33	1.95					
31/07/22 20:00:00	485:57	BH1	Observation	9.38	2.00					
01/08/22 08:00:00	497:57	BH1	Observation	9.42	2.04					
01/08/22 20:00:00	509:57	BH1	Observation	9.42	2.04					
02/08/22 08:00:00	521:57	BH1	Observation	9.43	2.05					
02/08/22 20:00:00	533:57	BH1	Observation	9.47	2.09					
03/08/22 08:00:00	545:57	BH1	Observation	9.50	2.12					Pumping stopped
03/08/22 11:00:00	548:57	BH1	Observation	9.52	2.14					
03/08/22 14:00:00	551:57	BH1	Observation	9.53	2.15					
03/08/22 17:00:00	554:57	BH1	Observation	9.55	2.17					
03/08/22 20:00:00	557:57	BH1	Observation	9.57	2.19					
04/08/22 08:00:00	569:57	BH1	Observation	9.29	1.91					
04/08/22 11:00:00	572:57	BH1	Observation	9.25	1.87					
04/08/22 14:00:00	575:57	BH1	Observation	9.67	2.29					
04/08/22 17:00:00	578:57	BH1	Observation	9.45	2.07					
04/08/22 20:00:00	581:57	BH1	Observation	9.65	2.27					
05/08/22 08:00:00	593:57	BH1	Observation	9.88	2.50					
05/08/22 11:00:00	596:57	BH1	Observation	9.69	2.31					
05/08/22 14:00:00	599:57	BH1	Observation	9.59	2.21					
05/08/22 15:00:00	600:57	BH1	Observation	9.69	2.31					
11/07/22 13:00:00	00:00	BH2	Observation	7.20	0.00					Static water level. Pre-pumping
11/07/22 16:00:00	03:00	BH2	Observation	7.30	0.10					
12/07/22 08:00:00	17:57	BH2	Observation	7.30	0.10					
12/07/22 11:00:00	20:57	BH2	Observation	7.35	0.15					
12/07/22 14:00:00	23:57	BH2	Observation	7.40	0.20					
12/07/22 17:00:00	26:57	BH2	Observation	7.45	0.25					
12/07/22 20:00:00	29:57	BH2	Observation	7.49	0.29					
13/07/22 08:00:00	41:57	BH2	Observation	7.56	0.36					
13/07/22 11:00:00	44:57	BH2	Observation	7.60	0.40					
13/07/22 14:00:00	47:57	BH2	Observation	7.62	0.42					
13/07/22 17:00:00	50:57	BH2	Observation	7.65	0.45					
13/07/22 20:00:00	53:57	BH2	Observation	7.67	0.47					
14/07/22 08:00:00	65:57	BH2	Observation	7.74	0.54					
14/07/22 11:00:00	68:57	BH2	Observation	7.75	0.55					
14/07/22 14:00:00	71:57	BH2	Observation	7.77	0.57					
14/07/22 17:00:00	74:57	BH2	Observation	7.79	0.59					
14/07/22 20:00:00	77:57	BH2	Observation	7.81	0.61					
15/07/22 08:00:00	89:57	BH2	Observation	7.85	0.65					
15/07/22 11:00:00	92:57	BH2	Observation	7.84	0.64					
15/07/22 14:00:00	95:57	BH2	Observation	7.85	0.65					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
15/07/22 17:00:00	98:57	BH2	Observation	7.87	0.67					
15/07/22 20:00:00	101:57	BH2	Observation	7.88	0.68					
16/07/22 08:00:00	113:57	BH2	Observation	7.92	0.72					
16/07/22 11:00:00	116:57	BH2	Observation	7.92	0.72					
16/07/22 14:00:00	119:57	BH2	Observation	7.94	0.74					
16/07/22 17:00:00	122:57	BH2	Observation	7.96	0.76					
16/07/22 20:00:00	125:57	BH2	Observation	7.98	0.78					
17/07/22 08:00:00	137:57	BH2	Observation	8.02	0.82					
17/07/22 11:00:00	140:57	BH2	Observation	8.04	0.84					
17/07/22 14:00:00	143:57	BH2	Observation	8.05	0.85					
17/07/22 17:00:00	146:57	BH2	Observation	8.06	0.86					
17/07/22 20:00:00	149:57	BH2	Observation	8.09	0.89					
18/07/22 08:00:00	161:57	BH2	Observation	8.14	0.94					
18/07/22 11:00:00	164:57	BH2	Observation	8.15	0.95					
18/07/22 14:00:00	167:57	BH2	Observation	8.18	0.98					
18/07/22 17:00:00	170:57	BH2	Observation	8.17	0.97					
18/07/22 20:00:00	173:57	BH2	Observation	8.19	0.99					
19/07/22 08:00:00	185:57	BH2	Observation	8.24	1.04					
19/07/22 11:00:00	188:57	BH2	Observation	8.26	1.06					
19/07/22 14:00:00	191:57	BH2	Observation	8.27	1.07					
19/07/22 17:00:00	194:57	BH2	Observation	8.28	1.08					
19/07/22 20:00:00	197:57	BH2	Observation	8.30	1.10					
20/07/22 08:00:00	209:57	BH2	Observation	8.38	1.18					
20/07/22 11:00:00	212:57	BH2	Observation	8.41	1.21					
20/07/22 14:00:00	215:57	BH2	Observation	8.43	1.23					
20/07/22 17:00:00	218:57	BH2	Observation	8.44	1.24					
20/07/22 20:00:00	221:57	BH2	Observation	8.46	1.26					
21/07/22 08:00:00	233:57	BH2	Observation	8.55	1.35					
21/07/22 11:00:00	236:57	BH2	Observation	8.57	1.37					
21/07/22 14:00:00	239:57	BH2	Observation	8.59	1.39					
21/07/22 17:00:00	242:57	BH2	Observation	8.60	1.40					
21/07/22 20:00:00	245:57	BH2	Observation	8.62	1.42					
22/07/22 08:00:00	257:57	BH2	Observation	8.65	1.45					
22/07/22 11:00:00	260:57	BH2	Observation	8.69	1.49					
22/07/22 14:00:00	263:57	BH2	Observation	8.65	1.45					
22/07/22 17:00:00	266:57	BH2	Observation	8.79	1.59					
22/07/22 20:00:00	269:57	BH2	Observation	8.69	1.49					
23/07/22 08:00:00	281:57	BH2	Observation	8.72	1.52					
23/07/22 11:00:00	284:57	BH2	Observation	8.73	1.53					
23/07/22 14:00:00	287:57	BH2	Observation	8.73	1.53					
23/07/22 17:00:00	290:57	BH2	Observation	8.74	1.54					
23/07/22 20:00:00	293:57	BH2	Observation	8.74	1.54					
24/07/22 08:00:00	305:57	BH2	Observation	8.76	1.56					
24/07/22 11:00:00	308:57	BH2	Observation	8.76	1.56					
24/07/22 14:00:00	311:57	BH2	Observation	8.78	1.58					
24/07/22 17:00:00	314:57	BH2	Observation	8.78	1.58					
24/07/22 20:00:00	317:57	BH2	Observation	8.78	1.58					
25/07/22 08:00:00	329:57	BH2	Observation	8.84	1.64					
25/07/22 20:00:00	341:57	BH2	Observation	8.92	1.72					
26/07/22 08:00:00	353:57	BH2	Observation	8.97	1.77					
26/07/22 20:00:00	365:57	BH2	Observation	9.02	1.82					
27/07/22 08:00:00	377:57	BH2	Observation	9.06	1.86					
27/07/22 20:00:00	389:57	BH2	Observation	9.09	1.89					
28/07/22 08:00:00	401:57	BH2	Observation	9.14	1.94					
28/07/22 20:00:00	413:57	BH2	Observation	9.14	1.94					
29/07/22 08:00:00	425:57	BH2	Observation	9.17	1.97					
29/07/22 20:00:00	437:57	BH2	Observation	9.20	2.00					
30/07/22 08:00:00	449:57	BH2	Observation	9.22	2.02					
30/07/22 20:00:00	461:57	BH2	Observation	9.26	2.06					
31/07/22 08:00:00	473:57	BH2	Observation	9.30	2.10					
31/07/22 20:00:00	485:57	BH2	Observation	9.34	2.14					
01/08/22 08:00:00	497:57	BH2	Observation	9.36	2.16					
01/08/22 20:00:00	509:57	BH2	Observation	9.37	2.17					
02/08/22 08:00:00	521:57	BH2	Observation	9.38	2.18					
02/08/22 20:00:00	533:57	BH2	Observation	9.40	2.20					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
03/08/22 08:00:00	545:57	BH2	Observation	9.44	2.24					Pumping stopped
03/08/22 11:00:00	548:57	BH2	Observation	9.43	2.23					
03/08/22 14:00:00	551:57	BH2	Observation	9.45	2.25					
03/08/22 17:00:00	554:57	BH2	Observation	9.46	2.26					
03/08/22 20:00:00	557:57	BH2	Observation	9.50	2.30					
04/08/22 08:00:00	569:57	BH2	Observation	9.53	2.33					
04/08/22 11:00:00	572:57	BH2	Observation	9.54	2.34					
04/08/22 14:00:00	575:57	BH2	Observation	9.54	2.34					
04/08/22 17:00:00	578:57	BH2	Observation	9.64	2.44					
04/08/22 20:00:00	581:57	BH2	Observation	9.55	2.35					
05/08/22 08:00:00	593:57	BH2	Observation	9.60	2.40					
05/08/22 11:00:00	596:57	BH2	Observation	9.58	2.38					
05/08/22 14:00:00	599:57	BH2	Observation	9.68	2.48					
05/08/22 15:00:00	600:57	BH2	Observation	9.60	2.40					
11/07/22 13:00:00	00:00	BH5	Observation	1.81	0.00					Static water level. Pre-pumping
11/07/22 16:00:00	03:00	BH5	Observation	1.81	0.00					
12/07/22 08:00:00	17:57	BH5	Observation	1.76	-0.05					
12/07/22 11:00:00	20:57	BH5	Observation	1.75	-0.06					
12/07/22 14:00:00	23:57	BH5	Observation	1.79	-0.02					
12/07/22 17:00:00	26:57	BH5	Observation	1.83	0.02					
12/07/22 20:00:00	29:57	BH5	Observation	1.76	-0.05					
13/07/22 08:00:00	41:57	BH5	Observation	1.81	0.00					
13/07/22 11:00:00	44:57	BH5	Observation	1.80	-0.01					
13/07/22 14:00:00	47:57	BH5	Observation	1.83	0.02					
13/07/22 17:00:00	50:57	BH5	Observation	1.89	0.08					
13/07/22 20:00:00	53:57	BH5	Observation	1.86	0.05					
14/07/22 08:00:00	65:57	BH5	Observation	1.89	0.08					
14/07/22 11:00:00	68:57	BH5	Observation	1.86	0.05					
14/07/22 14:00:00	71:57	BH5	Observation	1.87	0.06					
14/07/22 17:00:00	74:57	BH5	Observation	1.95	0.14					
14/07/22 20:00:00	77:57	BH5	Observation	1.95	0.14					
15/07/22 08:00:00	89:57	BH5	Observation	1.95	0.14					
15/07/22 11:00:00	92:57	BH5	Observation	1.93	0.12					
15/07/22 14:00:00	95:57	BH5	Observation	1.92	0.11					
15/07/22 17:00:00	98:57	BH5	Observation	2.00	0.19					
15/07/22 20:00:00	101:57	BH5	Observation	2.04	0.23					
16/07/22 08:00:00	113:57	BH5	Observation	2.03	0.22					
16/07/22 11:00:00	116:57	BH5	Observation	2.02	0.21					
16/07/22 14:00:00	119:57	BH5	Observation	1.99	0.18					
16/07/22 17:00:00	122:57	BH5	Observation	2.04	0.23					
16/07/22 20:00:00	125:57	BH5	Observation	2.11	0.30					
17/07/22 08:00:00	137:57	BH5	Observation	2.09	0.28					
17/07/22 11:00:00	140:57	BH5	Observation	2.11	0.30					
17/07/22 14:00:00	143:57	BH5	Observation	2.06	0.25					
17/07/22 17:00:00	146:57	BH5	Observation	2.08	0.27					
17/07/22 20:00:00	149:57	BH5	Observation	2.16	0.35					
18/07/22 08:00:00	161:57	BH5	Observation	2.16	0.35					
18/07/22 11:00:00	164:57	BH5	Observation	2.19	0.38					
18/07/22 14:00:00	167:57	BH5	Observation	2.14	0.33					
18/07/22 17:00:00	170:57	BH5	Observation	2.15	0.34					
18/07/22 20:00:00	173:57	BH5	Observation	2.21	0.40					
19/07/22 08:00:00	185:57	BH5	Observation	2.22	0.41					
19/07/22 11:00:00	188:57	BH5	Observation	2.27	0.46					
19/07/22 14:00:00	191:57	BH5	Observation	2.24	0.43					
19/07/22 17:00:00	194:57	BH5	Observation	2.22	0.41					
19/07/22 20:00:00	197:57	BH5	Observation	2.26	0.45					
20/07/22 08:00:00	209:57	BH5	Observation	2.31	0.50					
20/07/22 11:00:00	212:57	BH5	Observation	2.36	0.55					
20/07/22 14:00:00	215:57	BH5	Observation	2.36	0.55					
20/07/22 17:00:00	218:57	BH5	Observation	2.33	0.52					
20/07/22 20:00:00	221:57	BH5	Observation	2.33	0.52					
21/07/22 08:00:00	233:57	BH5	Observation	2.41	0.60					
21/07/22 11:00:00	236:57	BH5	Observation	2.45	0.64					
21/07/22 14:00:00	239:57	BH5	Observation	2.45	0.64					
21/07/22 17:00:00	242:57	BH5	Observation	2.41	0.60					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
21/07/22 20:00:00	245:57	BH5	Observation	2.42	0.61					
22/07/22 08:00:00	257:57	BH5	Observation	2.47	0.66					
22/07/22 11:00:00	260:57	BH5	Observation	2.51	0.70					
22/07/22 14:00:00	263:57	BH5	Observation	2.53	0.72					
22/07/22 17:00:00	266:57	BH5	Observation	2.50	0.69					
22/07/22 20:00:00	269:57	BH5	Observation	2.46	0.65					
23/07/22 08:00:00	281:57	BH5	Observation	2.53	0.72					
23/07/22 11:00:00	284:57	BH5	Observation	2.55	0.74					
23/07/22 14:00:00	287:57	BH5	Observation	2.57	0.76					
23/07/22 17:00:00	290:57	BH5	Observation	2.55	0.74					
23/07/22 20:00:00	293:57	BH5	Observation	2.50	0.69					
24/07/22 08:00:00	305:57	BH5	Observation	2.56	0.75					
24/07/22 11:00:00	308:57	BH5	Observation	2.57	0.76					
24/07/22 14:00:00	311:57	BH5	Observation	2.61	0.80					
24/07/22 17:00:00	314:57	BH5	Observation	2.61	0.80					
24/07/22 20:00:00	317:57	BH5	Observation	2.58	0.77					
25/07/22 08:00:00	329:57	BH5	Observation	2.64	0.83					
25/07/22 20:00:00	341:57	BH5	Observation	2.69	0.88					
26/07/22 08:00:00	353:57	BH5	Observation	2.74	0.93					
26/07/22 20:00:00	365:57	BH5	Observation	2.77	0.96					
27/07/22 08:00:00	377:57	BH5	Observation	2.81	1.00					
27/07/22 20:00:00	389:57	BH5	Observation	2.84	1.03					
28/07/22 08:00:00	401:57	BH5	Observation	2.84	1.03					
28/07/22 20:00:00	413:57	BH5	Observation	2.88	1.07					
29/07/22 08:00:00	425:57	BH5	Observation	2.90	1.09					
29/07/22 20:00:00	437:57	BH5	Observation	2.96	1.15					
30/07/22 08:00:00	449:57	BH5	Observation	2.96	1.15					
30/07/22 20:00:00	461:57	BH5	Observation	2.99	1.18					
31/07/22 08:00:00	473:57	BH5	Observation	2.98	1.17					
31/07/22 20:00:00	485:57	BH5	Observation	3.05	1.24					
01/08/22 08:00:00	497:57	BH5	Observation	3.04	1.23					
01/08/22 20:00:00	509:57	BH5	Observation	3.01	1.20					
02/08/22 08:00:00	521:57	BH5	Observation	3.04	1.23					
02/08/22 20:00:00	533:57	BH5	Observation	3.08	1.27					
03/08/22 08:00:00	545:57	BH5	Observation	3.10	1.29					Pumping stopped
03/08/22 11:00:00	548:57	BH5	Observation	3.11	1.30					
03/08/22 14:00:00	551:57	BH5	Observation	3.08	1.27					
03/08/22 17:00:00	554:57	BH5	Observation	3.07	1.26					
03/08/22 20:00:00	557:57	BH5	Observation	3.12	1.31					
04/08/22 08:00:00	569:57	BH5	Observation	3.15	1.34					
04/08/22 11:00:00	572:57	BH5	Observation	3.15	1.34					
04/08/22 14:00:00	575:57	BH5	Observation	3.16	1.35					
04/08/22 17:00:00	578:57	BH5	Observation	3.10	1.29					
04/08/22 20:00:00	581:57	BH5	Observation	3.12	1.31					
05/08/22 08:00:00	593:57	BH5	Observation	3.18	1.37					
05/08/22 11:00:00	596:57	BH5	Observation	3.14	1.33					
05/08/22 14:00:00	599:57	BH5	Observation	3.12	1.31					
05/08/22 15:00:00	600:57	BH5	Observation	3.08	1.27					
11/07/22 13:00:00	00:00	BH8	Observation	3.61	0.00					Static water level. Pre-pumping
11/07/22 16:00:00	03:00	BH8	Observation	3.62	0.01					
12/07/22 08:00:00	17:57	BH8	Observation	4.40	0.79					
12/07/22 11:00:00	20:57	BH8	Observation	4.64	1.03					
12/07/22 14:00:00	23:57	BH8	Observation	4.84	1.23					
12/07/22 17:00:00	26:57	BH8	Observation	5.04	1.43					
12/07/22 20:00:00	29:57	BH8	Observation	5.20	1.59					
13/07/22 08:00:00	41:57	BH8	Observation	5.90	2.29					
13/07/22 11:00:00	44:57	BH8	Observation	6.03	2.42					
13/07/22 14:00:00	47:57	BH8	Observation	6.21	2.60					
13/07/22 17:00:00	50:57	BH8	Observation	6.35	2.74					
13/07/22 20:00:00	53:57	BH8	Observation	6.45	2.84					
14/07/22 08:00:00	65:57	BH8	Observation	7.00	3.39					
14/07/22 11:00:00	68:57	BH8	Observation	7.09	3.48					
14/07/22 14:00:00	71:57	BH8	Observation	7.23	3.62					
14/07/22 17:00:00	74:57	BH8	Observation	7.37	3.76					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
14/07/22 20:00:00	77:57	BH8	Observation	7.45	3.84					
15/07/22 08:00:00	89:57	BH8	Observation	7.85	4.24					
15/07/22 11:00:00	92:57	BH8	Observation	7.92	4.31					
15/07/22 14:00:00	95:57	BH8	Observation	8.20	4.59					
15/07/22 17:00:00	98:57	BH8	Observation	8.14	4.53					
15/07/22 20:00:00	101:57	BH8	Observation	8.22	4.61					
16/07/22 08:00:00	113:57	BH8	Observation	8.53	4.92					
16/07/22 11:00:00	116:57	BH8	Observation	8.58	4.97					
16/07/22 14:00:00	119:57	BH8	Observation	8.68	5.07					
16/07/22 17:00:00	122:57	BH8	Observation	8.75	5.14					
16/07/22 20:00:00	125:57	BH8	Observation	8.83	5.22					
17/07/22 08:00:00	137:57	BH8	Observation	9.08	5.47					
17/07/22 11:00:00	140:57	BH8	Observation	9.13	5.52					
17/07/22 14:00:00	143:57	BH8	Observation	9.18	5.57					
17/07/22 17:00:00	146:57	BH8	Observation	9.26	5.65					
17/07/22 20:00:00	149:57	BH8	Observation	9.33	5.72					
18/07/22 08:00:00	161:57	BH8	Observation	9.58	5.97					
18/07/22 11:00:00	164:57	BH8	Observation	9.60	5.99					
18/07/22 14:00:00	167:57	BH8	Observation	9.64	6.03					
18/07/22 17:00:00	170:57	BH8	Observation	9.68	6.07					
18/07/22 20:00:00	173:57	BH8	Observation	9.78	6.17					
19/07/22 08:00:00	185:57	BH8	Observation	9.96	6.35					
19/07/22 11:00:00	188:57	BH8	Observation	10.00	6.39					
19/07/22 14:00:00	191:57	BH8	Observation	10.04	6.43					
19/07/22 17:00:00	194:57	BH8	Observation	10.08	6.47					
19/07/22 20:00:00	197:57	BH8	Observation	10.14	6.53					
20/07/22 08:00:00	209:57	BH8	Observation	10.34	6.73					
20/07/22 11:00:00	212:57	BH8	Observation	10.40	6.79					
20/07/22 14:00:00	215:57	BH8	Observation	10.42	6.81					
20/07/22 17:00:00	218:57	BH8	Observation	10.46	6.85					
20/07/22 20:00:00	221:57	BH8	Observation	10.50	6.89					
21/07/22 08:00:00	233:57	BH8	Observation	10.69	7.08					
21/07/22 11:00:00	236:57	BH8	Observation	10.73	7.12					
21/07/22 14:00:00	239:57	BH8	Observation	10.74	7.13					
21/07/22 17:00:00	242:57	BH8	Observation	10.77	7.16					
21/07/22 20:00:00	245:57	BH8	Observation	10.80	7.19					
22/07/22 08:00:00	257:57	BH8	Observation	10.94	7.33					
22/07/22 11:00:00	260:57	BH8	Observation	10.97	7.36					
22/07/22 14:00:00	263:57	BH8	Observation	10.92	7.31					
22/07/22 17:00:00	266:57	BH8	Observation	10.99	7.38					
22/07/22 20:00:00	269:57	BH8	Observation	11.01	7.40					
23/07/22 08:00:00	281:57	BH8	Observation	11.13	7.52					
23/07/22 11:00:00	284:57	BH8	Observation	11.14	7.53					
23/07/22 14:00:00	287:57	BH8	Observation	11.16	7.55					
23/07/22 17:00:00	290:57	BH8	Observation	11.18	7.57					
23/07/22 20:00:00	293:57	BH8	Observation	11.19	7.58					
24/07/22 08:00:00	305:57	BH8	Observation	11.32	7.71					
24/07/22 11:00:00	308:57	BH8	Observation	11.34	7.73					
24/07/22 14:00:00	311:57	BH8	Observation	11.37	7.76					
24/07/22 17:00:00	314:57	BH8	Observation	11.38	7.77					
24/07/22 20:00:00	317:57	BH8	Observation	11.38	7.77					
25/07/22 08:00:00	329:57	BH8	Observation	11.53	7.92					
25/07/22 20:00:00	341:57	BH8	Observation	11.64	8.03					
26/07/22 08:00:00	353:57	BH8	Observation	11.76	8.15					
26/07/22 20:00:00	365:57	BH8	Observation	11.83	8.22					
27/07/22 08:00:00	377:57	BH8	Observation	11.91	8.30					
27/07/22 20:00:00	389:57	BH8	Observation	11.97	8.36					
28/07/22 08:00:00	401:57	BH8	Observation	12.04	8.43					
28/07/22 20:00:00	413:57	BH8	Observation	12.12	8.51					
29/07/22 08:00:00	425:57	BH8	Observation	12.20	8.59					
29/07/22 20:00:00	437:57	BH8	Observation	12.29	8.68					
30/07/22 08:00:00	449:57	BH8	Observation	12.35	8.74					
30/07/22 20:00:00	461:57	BH8	Observation	12.43	8.82					
31/07/22 08:00:00	473:57	BH8	Observation	12.52	8.91					
31/07/22 20:00:00	485:57	BH8	Observation	12.58	8.97					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
01/08/22 08:00:00	497:57	BH8	Observation	12.63	9.02					
01/08/22 20:00:00	509:57	BH8	Observation	12.59	8.98					
02/08/22 08:00:00	521:57	BH8	Observation	12.67	9.06					
02/08/22 20:00:00	533:57	BH8	Observation	12.72	9.11					
03/08/22 08:00:00	545:57	BH8	Observation	12.77	9.16					Pumping stopped
03/08/22 11:00:00	548:57	BH8	Observation	12.76	9.15					
03/08/22 14:00:00	551:57	BH8	Observation	12.73	9.12					
03/08/22 17:00:00	554:57	BH8	Observation	12.68	9.07					
03/08/22 20:00:00	557:57	BH8	Observation	12.62	9.01					
04/08/22 08:00:00	569:57	BH8	Observation	12.17	8.56					
04/08/22 11:00:00	572:57	BH8	Observation	12.06	8.45					
04/08/22 14:00:00	575:57	BH8	Observation	11.92	8.31					
04/08/22 17:00:00	578:57	BH8	Observation	11.80	8.19					
04/08/22 20:00:00	581:57	BH8	Observation	11.68	8.07					
05/08/22 08:00:00	593:57	BH8	Observation	11.13	7.52					
05/08/22 11:00:00	596:57	BH8	Observation	11.07	7.46					
05/08/22 14:00:00	599:57	BH8	Observation	10.94	7.33					
05/08/22 15:00:00	600:57	BH8	Observation	10.80	7.19					
11/07/22 13:00:00	00:00	BH9	Observation	2.96	0.00					Static water level. Pre-pumping
11/07/22 16:00:00	03:00	BH9	Observation	2.96	0.00					
12/07/22 08:00:00	17:57	BH9	Observation	3.35	0.39					
12/07/22 11:00:00	20:57	BH9	Observation	3.42	0.46					
12/07/22 14:00:00	23:57	BH9	Observation	3.49	0.53					
12/07/22 17:00:00	26:57	BH9	Observation	3.59	0.63					
12/07/22 20:00:00	29:57	BH9	Observation	3.70	0.74					
13/07/22 08:00:00	41:57	BH9	Observation	4.01	1.05					
13/07/22 11:00:00	44:57	BH9	Observation	4.05	1.09					
13/07/22 14:00:00	47:57	BH9	Observation	4.13	1.17					
13/07/22 17:00:00	50:57	BH9	Observation	4.21	1.25					
13/07/22 20:00:00	53:57	BH9	Observation	4.26	1.30					
14/07/22 08:00:00	65:57	BH9	Observation	4.48	1.52					
14/07/22 11:00:00	68:57	BH9	Observation	4.51	1.55					
14/07/22 14:00:00	71:57	BH9	Observation	4.53	1.57					
14/07/22 17:00:00	74:57	BH9	Observation	4.56	1.60					
14/07/22 20:00:00	77:57	BH9	Observation	4.60	1.64					
15/07/22 08:00:00	89:57	BH9	Observation	4.70	1.74					
15/07/22 11:00:00	92:57	BH9	Observation	4.70	1.74					
15/07/22 14:00:00	95:57	BH9	Observation	4.73	1.77					
15/07/22 17:00:00	98:57	BH9	Observation	4.74	1.78					
15/07/22 20:00:00	101:57	BH9	Observation	4.76	1.80					
16/07/22 08:00:00	113:57	BH9	Observation	4.80	1.84					
16/07/22 11:00:00	116:57	BH9	Observation	4.81	1.85					
16/07/22 14:00:00	119:57	BH9	Observation	4.82	1.86					
16/07/22 17:00:00	122:57	BH9	Observation	4.84	1.88					
16/07/22 20:00:00	125:57	BH9	Observation	4.86	1.90					
17/07/22 08:00:00	137:57	BH9	Observation	4.93	1.97					
17/07/22 11:00:00	140:57	BH9	Observation	4.95	1.99					
17/07/22 14:00:00	143:57	BH9	Observation	4.96	2.00					
17/07/22 17:00:00	146:57	BH9	Observation	4.97	2.01					
17/07/22 20:00:00	149:57	BH9	Observation	4.99	2.03					
18/07/22 08:00:00	161:57	BH9	Observation	5.30	2.34					
18/07/22 11:00:00	164:57	BH9	Observation	5.30	2.34					
18/07/22 14:00:00	167:57	BH9	Observation	5.30	2.34					
18/07/22 17:00:00	170:57	BH9	Observation	5.50	2.54					
18/07/22 20:00:00	173:57	BH9	Observation	5.06	2.10					
19/07/22 08:00:00	185:57	BH9	Observation	5.11	2.15					
19/07/22 11:00:00	188:57	BH9	Observation	5.12	2.16					
19/07/22 14:00:00	191:57	BH9	Observation	5.14	2.18					
19/07/22 17:00:00	194:57	BH9	Observation	5.15	2.19					
19/07/22 20:00:00	197:57	BH9	Observation	5.15	2.19					
20/07/22 08:00:00	209:57	BH9	Observation	5.29	2.33					
20/07/22 11:00:00	212:57	BH9	Observation	5.33	2.37					
20/07/22 14:00:00	215:57	BH9	Observation	5.35	2.39					
20/07/22 17:00:00	218:57	BH9	Observation	5.37	2.41					
20/07/22 20:00:00	221:57	BH9	Observation	5.38	2.42					

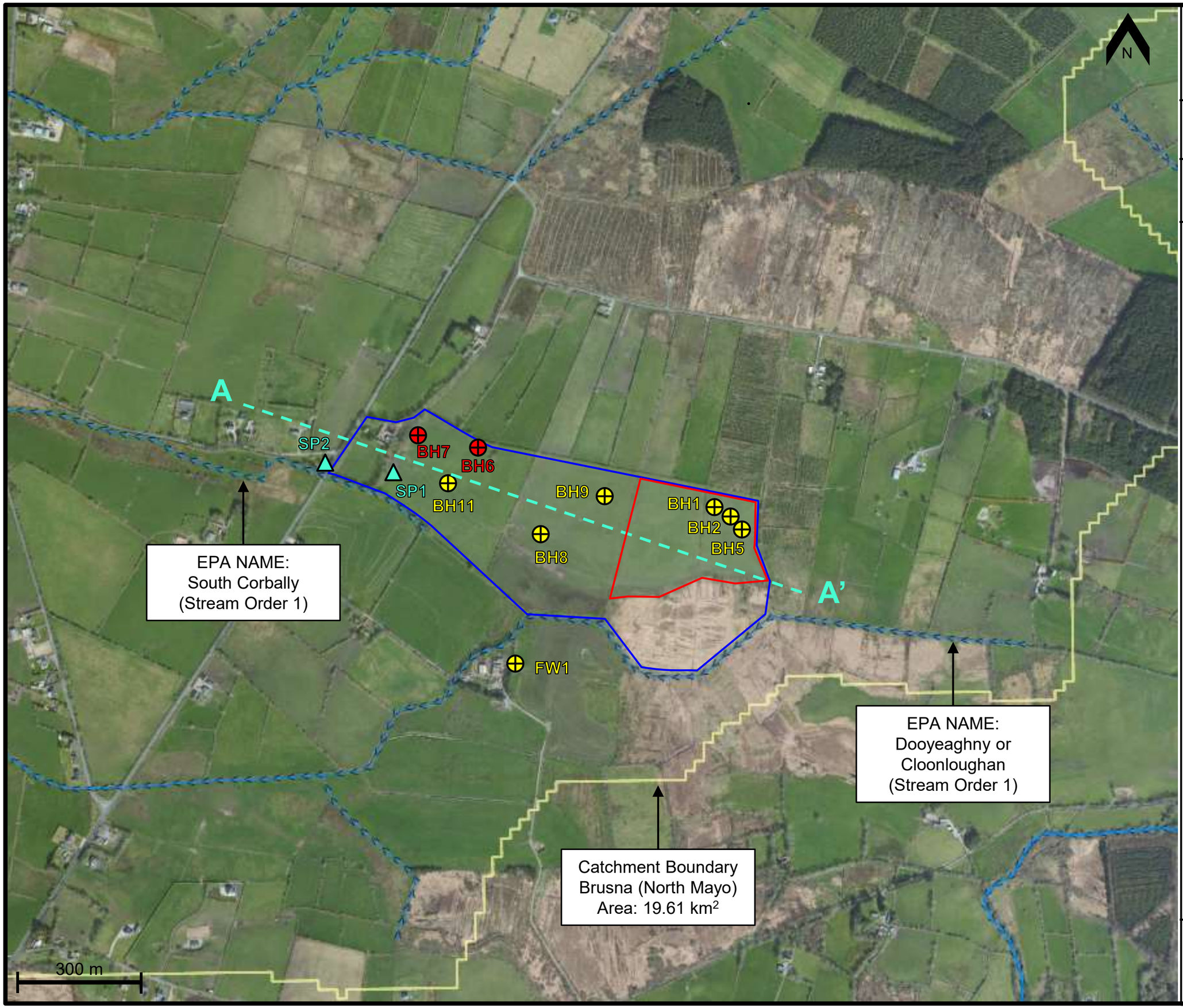
Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
21/07/22 08:00:00	233:57	BH9	Observation	5.51	2.55					
21/07/22 11:00:00	236:57	BH9	Observation	5.58	2.62					
21/07/22 14:00:00	239:57	BH9	Observation	5.59	2.63					
21/07/22 17:00:00	242:57	BH9	Observation	5.63	2.67					
21/07/22 20:00:00	245:57	BH9	Observation	5.63	2.67					
22/07/22 08:00:00	257:57	BH9	Observation	5.70	2.74					
22/07/22 11:00:00	260:57	BH9	Observation	5.70	2.74					
22/07/22 14:00:00	263:57	BH9	Observation	5.68	2.72					
22/07/22 17:00:00	266:57	BH9	Observation	5.72	2.76					
22/07/22 20:00:00	269:57	BH9	Observation	5.73	2.77					
23/07/22 08:00:00	281:57	BH9	Observation	5.81	2.85					
23/07/22 11:00:00	284:57	BH9	Observation	5.84	2.88					
23/07/22 14:00:00	287:57	BH9	Observation	5.86	2.90					
23/07/22 17:00:00	290:57	BH9	Observation	5.87	2.91					
23/07/22 20:00:00	293:57	BH9	Observation	5.89	2.93					
24/07/22 08:00:00	305:57	BH9	Observation	5.99	3.03					
24/07/22 11:00:00	308:57	BH9	Observation	6.00	3.04					
24/07/22 14:00:00	311:57	BH9	Observation	6.02	3.06					
24/07/22 17:00:00	314:57	BH9	Observation	6.30	3.34					
24/07/22 20:00:00	317:57	BH9	Observation	6.40	3.44					
25/07/22 08:00:00	329:57	BH9	Observation	6.09	3.13					
25/07/22 20:00:00	341:57	BH9	Observation	6.20	3.24					
26/07/22 08:00:00	353:57	BH9	Observation	6.25	3.29					
26/07/22 20:00:00	365:57	BH9	Observation	6.33	3.37					
27/07/22 08:00:00	377:57	BH9	Observation	6.37	3.41					
27/07/22 20:00:00	389:57	BH9	Observation	6.40	3.44					
28/07/22 08:00:00	401:57	BH9	Observation	6.43	3.47					
28/07/22 20:00:00	413:57	BH9	Observation	6.48	3.52					
29/07/22 08:00:00	425:57	BH9	Observation	6.52	3.56					
29/07/22 20:00:00	437:57	BH9	Observation	6.60	3.64					
30/07/22 08:00:00	449:57	BH9	Observation	6.61	3.65					
30/07/22 20:00:00	461:57	BH9	Observation	6.65	3.69					
31/07/22 08:00:00	473:57	BH9	Observation	6.69	3.73					
31/07/22 20:00:00	485:57	BH9	Observation	6.71	3.75					
01/08/22 08:00:00	497:57	BH9	Observation	6.72	3.76					
01/08/22 20:00:00	509:57	BH9	Observation	6.72	3.76					
02/08/22 08:00:00	521:57	BH9	Observation	6.95	3.99					
02/08/22 20:00:00	533:57	BH9	Observation	7.02	4.06					
03/08/22 08:00:00	545:57	BH9	Observation	7.16	4.20					Pumping stopped
03/08/22 11:00:00	548:57	BH9	Observation	7.18	4.22					
03/08/22 14:00:00	551:57	BH9	Observation	7.12	4.16					
03/08/22 17:00:00	554:57	BH9	Observation	7.13	4.17					
03/08/22 20:00:00	557:57	BH9	Observation	7.20	4.24					
04/08/22 08:00:00	569:57	BH9	Observation	6.23	3.27					
04/08/22 11:00:00	572:57	BH9	Observation	5.98	3.02					
04/08/22 14:00:00	575:57	BH9	Observation	5.76	2.80					
04/08/22 17:00:00	578:57	BH9	Observation	5.51	2.55					
04/08/22 20:00:00	581:57	BH9	Observation	5.27	2.31					
05/08/22 08:00:00	593:57	BH9	Observation	4.63	1.67					
05/08/22 11:00:00	596:57	BH9	Observation	4.58	1.62					
05/08/22 14:00:00	599:57	BH9	Observation	4.51	1.55					
05/08/22 15:00:00	600:57	BH9	Observation	4.44	1.48					
11/07/22 13:00:00	00:00	BH11	Observation	2.00	0.00					Static water level. Pre-pumping
11/07/22 16:00:00	03:00	BH11	Observation	4.43	2.43					
12/07/22 08:00:00	17:57	BH11	Observation	1.82	-0.18					
12/07/22 11:00:00	20:57	BH11	Observation	1.82	-0.18					
12/07/22 14:00:00	23:57	BH11	Observation	1.82	-0.18					
12/07/22 17:00:00	26:57	BH11	Observation	1.83	-0.17					
12/07/22 20:00:00	29:57	BH11	Observation	1.84	-0.16					
13/07/22 08:00:00	41:57	BH11	Observation	1.84	-0.16					
13/07/22 11:00:00	44:57	BH11	Observation	1.85	-0.15					
13/07/22 14:00:00	47:57	BH11	Observation	1.88	-0.12					
13/07/22 17:00:00	50:57	BH11	Observation	1.97	-0.03					
13/07/22 20:00:00	53:57	BH11	Observation	2.04	0.04					
14/07/22 08:00:00	65:57	BH11	Observation	2.11	0.11					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
14/07/22 11:00:00	68:57	BH11	Observation	2.12	0.12					
14/07/22 14:00:00	71:57	BH11	Observation	2.12	0.12					
14/07/22 17:00:00	74:57	BH11	Observation	2.12	0.12					
14/07/22 20:00:00	77:57	BH11	Observation	2.12	0.12					
15/07/22 08:00:00	89:57	BH11	Observation	2.18	0.18					
15/07/22 11:00:00	92:57	BH11	Observation	2.49	0.49					
15/07/22 14:00:00	95:57	BH11	Observation	2.59	0.59					
15/07/22 17:00:00	98:57	BH11	Observation	2.22	0.22					
15/07/22 20:00:00	101:57	BH11	Observation	2.23	0.23					
16/07/22 08:00:00	113:57	BH11	Observation	4.27	2.27					
16/07/22 11:00:00	116:57	BH11	Observation	4.57	2.57					
16/07/22 14:00:00	119:57	BH11	Observation	4.53	2.53					
16/07/22 17:00:00	122:57	BH11	Observation	4.81	2.81					
16/07/22 20:00:00	125:57	BH11	Observation	5.35	3.35					
17/07/22 08:00:00	137:57	BH11	Observation	7.79	5.79					
17/07/22 11:00:00	140:57	BH11	Observation	8.05	6.05					
17/07/22 14:00:00	143:57	BH11	Observation	8.24	6.24					
17/07/22 17:00:00	146:57	BH11	Observation	7.58	5.58					
17/07/22 20:00:00	149:57	BH11	Observation	7.62	5.62					
18/07/22 08:00:00	161:57	BH11	Observation	6.58	4.58					
18/07/22 11:00:00	164:57	BH11	Observation	6.06	4.06					
18/07/22 14:00:00	167:57	BH11	Observation	6.36	4.36					
18/07/22 17:00:00	170:57	BH11	Observation	6.34	4.34					
18/07/22 20:00:00	173:57	BH11	Observation	6.16	4.16					
19/07/22 08:00:00	185:57	BH11	Observation	7.13	5.13					
19/07/22 11:00:00	188:57	BH11	Observation	7.30	5.30					
19/07/22 14:00:00	191:57	BH11	Observation	7.72	5.72					
19/07/22 17:00:00	194:57	BH11	Observation	8.20	6.20					
19/07/22 20:00:00	197:57	BH11	Observation	8.35	6.35					
20/07/22 08:00:00	209:57	BH11	Observation	8.74	6.74					
20/07/22 11:00:00	212:57	BH11	Observation	8.77	6.77					
20/07/22 14:00:00	215:57	BH11	Observation	9.15	7.15					
20/07/22 17:00:00	218:57	BH11	Observation	9.57	7.57					
20/07/22 20:00:00	221:57	BH11	Observation	9.65	7.65					
21/07/22 08:00:00	233:57	BH11	Observation	10.03	8.03					
21/07/22 11:00:00	236:57	BH11	Observation	10.14	8.14					
21/07/22 14:00:00	239:57	BH11	Observation	10.12	8.12					
21/07/22 17:00:00	242:57	BH11	Observation	10.08	8.08					
21/07/22 20:00:00	245:57	BH11	Observation	9.91	7.91					
22/07/22 08:00:00	257:57	BH11	Observation	8.03	6.03					
22/07/22 11:00:00	260:57	BH11	Observation	8.31	6.31					
22/07/22 14:00:00	263:57	BH11	Observation	8.34	6.34					
22/07/22 17:00:00	266:57	BH11	Observation	9.23	7.23					
22/07/22 20:00:00	269:57	BH11	Observation	8.70	6.70					
23/07/22 08:00:00	281:57	BH11	Observation	6.64	4.64					
23/07/22 11:00:00	284:57	BH11	Observation	6.54	4.54					
23/07/22 14:00:00	287:57	BH11	Observation	6.27	4.27					
23/07/22 17:00:00	290:57	BH11	Observation	5.92	3.92					
23/07/22 20:00:00	293:57	BH11	Observation	5.80	3.80					
24/07/22 08:00:00	305:57	BH11	Observation	4.85	2.85					
24/07/22 11:00:00	308:57	BH11	Observation	5.17	3.17					
24/07/22 14:00:00	311:57	BH11	Observation	5.30	3.30					
24/07/22 17:00:00	314:57	BH11	Observation	4.47	2.47					
24/07/22 20:00:00	317:57	BH11	Observation	4.40	2.40					
25/07/22 08:00:00	329:57	BH11	Observation	4.06	2.06					
25/07/22 20:00:00	341:57	BH11	Observation	5.42	3.42					
26/07/22 08:00:00	353:57	BH11	Observation	5.85	3.85					
26/07/22 20:00:00	365:57	BH11	Observation	6.84	4.84					
27/07/22 08:00:00	377:57	BH11	Observation	6.85	4.85					
27/07/22 20:00:00	389:57	BH11	Observation	7.34	5.34					
28/07/22 08:00:00	401:57	BH11	Observation	8.80	6.80					
28/07/22 20:00:00	413:57	BH11	Observation	11.16	9.16					
29/07/22 08:00:00	425:57	BH11	Observation	13.06	11.06					
29/07/22 20:00:00	437:57	BH11	Observation	17.23	15.23					
30/07/22 08:00:00	449:57	BH11	Observation	13.79	11.79					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
30/07/22 20:00:00	461:57	BH11	Observation	9.02	7.02					
31/07/22 08:00:00	473:57	BH11	Observation	7.86	5.86					
31/07/22 20:00:00	485:57	BH11	Observation	9.07	7.07					
01/08/22 08:00:00	497:57	BH11	Observation	10.50	8.50					
01/08/22 20:00:00	509:57	BH11	Observation	5.64	3.64					
02/08/22 08:00:00	521:57	BH11	Observation	5.39	3.39					
02/08/22 20:00:00	533:57	BH11	Observation	4.83	2.83					
03/08/22 08:00:00	545:57	BH11	Observation	5.09	3.09					Pumping stopped
03/08/22 11:00:00	548:57	BH11	Observation	5.34	3.34					
03/08/22 14:00:00	551:57	BH11	Observation	8.98	6.98					
03/08/22 17:00:00	554:57	BH11	Observation	10.75	8.75					
03/08/22 20:00:00	557:57	BH11	Observation	9.92	7.92					
04/08/22 08:00:00	569:57	BH11	Observation	6.87	4.87					
04/08/22 11:00:00	572:57	BH11	Observation	6.44	4.44					
04/08/22 14:00:00	575:57	BH11	Observation	6.10	4.10					
04/08/22 17:00:00	578:57	BH11	Observation	5.65	3.65					
04/08/22 20:00:00	581:57	BH11	Observation	5.37	3.37					
05/08/22 08:00:00	593:57	BH11	Observation	4.60	2.60					
05/08/22 11:00:00	596:57	BH11	Observation	4.43	2.43					
05/08/22 14:00:00	599:57	BH11	Observation	4.25	2.25					
05/08/22 15:00:00	600:57	BH11	Observation	4.11	2.11					
11/07/22 12:20:00	00:00	FW1	Observation	3.90	0.00					Static water level. Pre-pumping
12/07/22 09:20:00	20:20	FW1	Observation	3.91	0.01					
13/07/22 08:00:00	41:57	FW1	Observation	3.91	0.01					
13/07/22 17:00:00	50:57	FW1	Observation	3.91	0.01					
14/07/22 08:00:00	65:57	FW1	Observation	3.98	0.08					
14/07/22 17:00:00	74:57	FW1	Observation	3.93	0.03					
15/07/22 08:00:00	89:57	FW1	Observation	3.93	0.03					
15/07/22 17:00:00	98:57	FW1	Observation	3.94	0.04					
16/07/22 08:00:00	113:57	FW1	Observation	3.96	0.06					
16/07/22 17:00:00	122:57	FW1	Observation	4.00	0.10					
17/07/22 08:00:00	137:57	FW1	Observation	3.96	0.06					
17/07/22 17:00:00	146:57	FW1	Observation	3.97	0.07					
18/07/22 08:00:00	161:57	FW1	Observation	3.96	0.06					
18/07/22 17:00:00	170:57	FW1	Observation	3.98	0.08					
19/07/22 08:00:00	185:57	FW1	Observation	3.97	0.07					
19/07/22 17:00:00	194:57	FW1	Observation	3.99	0.09					
20/07/22 08:00:00	209:57	FW1	Observation	3.99	0.09					
20/07/22 17:00:00	218:57	FW1	Observation	3.98	0.08					
21/07/22 08:00:00	233:57	FW1	Observation	3.99	0.09					
21/07/22 17:00:00	242:57	FW1	Observation	4.00	0.10					
22/07/22 08:00:00	257:57	FW1	Observation	4.02	0.12					
22/07/22 17:00:00	266:57	FW1	Observation	4.02	0.12					
23/07/22 08:00:00	281:57	FW1	Observation	3.98	0.08					
23/07/22 17:00:00	290:57	FW1	Observation	3.99	0.09					
24/07/22 08:00:00	305:57	FW1	Observation	3.99	0.09					
24/07/22 17:00:00	314:57	FW1	Observation	3.99	0.09					
25/07/22 08:00:00	329:57	FW1	Observation	3.97	0.07					
25/07/22 20:00:00	341:57	FW1	Observation	4.00	0.10					
26/07/22 08:00:00	353:57	FW1	Observation	4.10	0.20					
26/07/22 20:00:00	365:57	FW1	Observation	3.98	0.08					
27/07/22 08:00:00	377:57	FW1	Observation	3.97	0.07					
27/07/22 20:00:00	389:57	FW1	Observation	4.01	0.11					
28/07/22 08:00:00	401:57	FW1	Observation	3.98	0.08					
28/07/22 20:00:00	413:57	FW1	Observation	4.10	0.20					
29/07/22 08:00:00	425:57	FW1	Observation	3.98	0.08					
29/07/22 20:00:00	437:57	FW1	Observation	4.00	0.10					
30/07/22 08:00:00	449:57	FW1	Observation	3.99	0.09					
30/07/22 20:00:00	461:57	FW1	Observation	3.98	0.08					
31/07/22 08:00:00	473:57	FW1	Observation	3.99	0.09					
31/07/22 20:00:00	485:57	FW1	Observation	3.99	0.09					
01/08/22 08:00:00	497:57	FW1	Observation	3.98	0.08					
01/08/22 20:00:00	509:57	FW1	Observation	3.98	0.08					
02/08/22 08:00:00	521:57	FW1	Observation	3.98	0.08					
02/08/22 20:00:00	533:57	FW1	Observation	3.98	0.08					

Date & Time		Monitoring point		Water level, yield, & wellhead hydrochemist						Comments
				Water levels			Flow Rate		Odour	
24hr (day-month-year hour:minute:second)	Elapsed time (Hours:Minutes)	ID	Point status (pumping or observation)	Water levels (mbTOC)	Drawdown (m)	Residual drawdown (m)	Flow (l/s)	Flow (m^3/h)		
03/08/22 08:00:00	545:57	FW1	Observation	3.98	0.08					Pumping stopped
03/08/22 11:00:00	548:57	FW1	Observation	3.98	0.08					
03/08/22 14:00:00	551:57	FW1	Observation	3.98	0.08					
03/08/22 17:00:00	554:57	FW1	Observation	3.98	0.08					
03/08/22 20:00:00	557:57	FW1	Observation	3.98	0.08					
04/08/22 08:00:00	569:57	FW1	Observation	4.01	0.11					
04/08/22 11:00:00	572:57	FW1	Observation	4.00	0.10					
04/08/22 14:00:00	575:57	FW1	Observation	4.04	0.14					
04/08/22 17:00:00	578:57	FW1	Observation	4.10	0.20					
04/08/22 20:00:00	581:57	FW1	Observation	4.06	0.16					
05/08/22 08:00:00	593:57	FW1	Observation	3.98	0.08					
05/08/22 11:00:00	596:57	FW1	Observation	4.03	0.13					
05/08/22 14:00:00	599:57	FW1	Observation	4.07	0.17					
05/08/22 15:00:00	600:57	FW1	Observation	4.10	0.20					

APPENDIX E



Drawing Title
Surface Water Features

Client: Project: 3131
Hydrogen Plant - Co. Sligo

Drawing Ref: 3131-008
Drawn by: CF 18/07/2022

Common Legend

- Landowner Property
- Pumping well
- Observation well
- Spring
- Proposed hydrogen production facility outline

Source: EPA

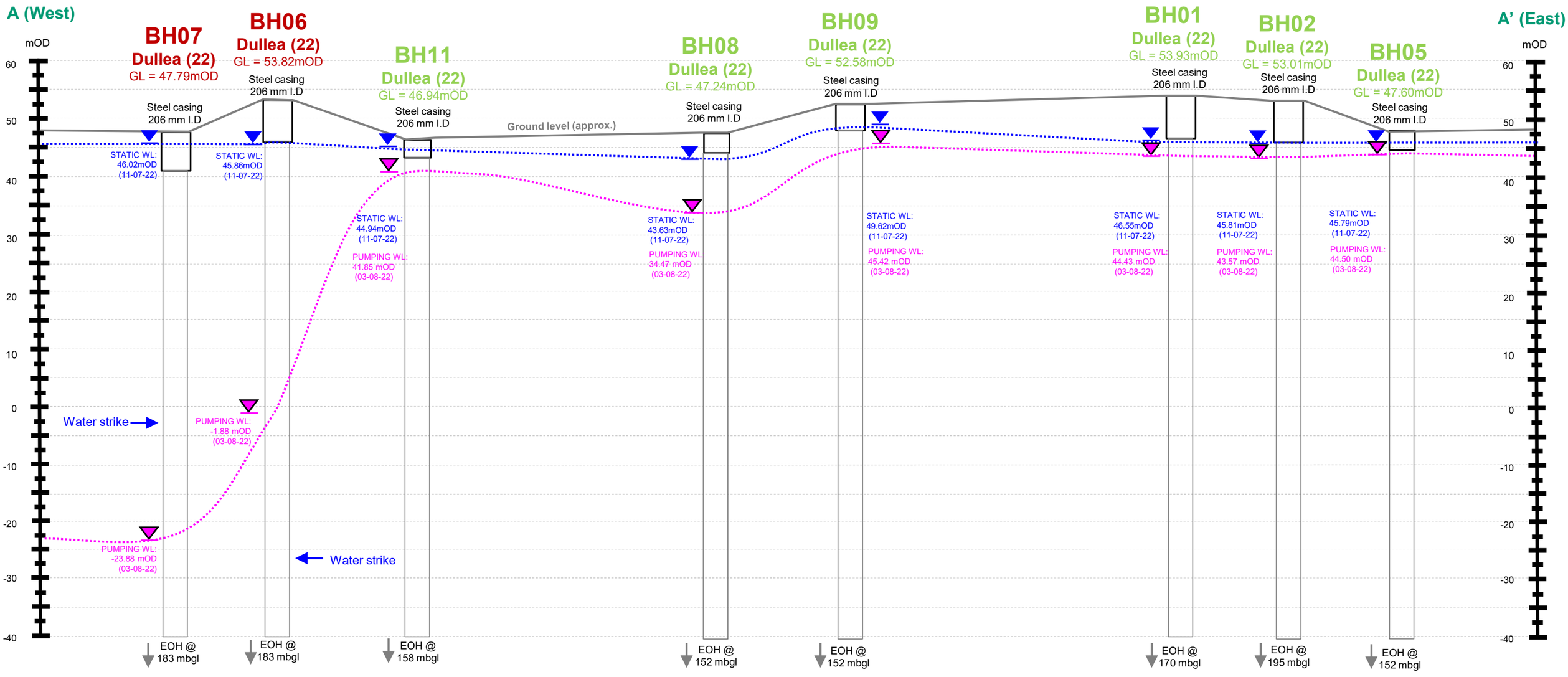
Minerex Environmental

Mercury Renewables at Bonniconlon, Mayo

Conceptual Cross Section

Minerex Environmental

Minerex Drawing Ref: 3131-008. Drawn by: CF 02/09/2022



APPENDIX F

WHITEWATER
Caring about water since 1932

Whitewater House, Boghall Road,
Bray, Co. Wicklow, A98
Ireland.

Tel: +353 (0)1 276 8468
Fax: +353 (0)1 276 8476
Email: info@whitewatercare.com
Web: www.whitewatercare.com

INSPECTION SERVICE AGREEMENT

CLIENT: Killeen Castle Golf Services Ltd

PLANT TYPE/SERIAL NO: Water Purification System

LOCATION: Dundrum

AGREEMENT NUMBER: SC1938/22

PREVENTATIVE MAINTENANCE CONTRACT

This contract allows for ***4*** maintenance service visits per annum to the specified equipment here within this contract. The work covered in this type of contract is described in detail on the attached specification sheets.
The current operating status of each piece of equipment will be compared against figures from previous service contract results and a report will be issued to the client and a copy kept for our records.

Contract Benefits:

- Better security of purified water supply (quality and quantity). Potential breakdown problems identified and rectified.

- Priority breakdown service. In the case of a breakdown, holders of Preventative Maintenance Contracts will receive visit priority. Access to twenty-four hour Emergency Service hotline (086 8214804). 24 hour on-call service response 24/7 (365 days). On site within 2 hour when possible. Advice to clinical engineers and/or plumbers/fitters by phone as required.

- **Preventative Maintenance Contracts provide holders of these contracts with ongoing system condition information/documentation to comply with validation compliance with Pharmacopoeial or other strict standards.**

- Changes in raw mains feed water quality identified. Significant changes in the quality of site water supply will be recognised early and actions recommended if necessary.

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Services Include:

Summary of Plant Components and Description of Service Work
The plant consists of the following main parts

Equipment	Maintenance Carried Out
Booster Pumps	Check output pressure and flow rate.
	Check automatic changeover.
	Check for leaks.
Water Softeners	Check for pressure drop.
	Clean and grease main and pilot pistons.
	Check regeneration operation.
	Check Salt Tank level.
	Check for leaks.
Carbon Filters	Check for pressure drop.
	Clean and grease main and pilot pistons.
	Check backwash operation.
	Repack carbon annually.
	Check for leaks.
Nest Filters	Replace Filters.
	Check for leaks.
RO Unit	Change RO pre-filter.
	Clean RO membranes.
	Replace PSU 15A fuse annually
	Re-balance flows and pressures
Pressure Gauges	Check all gauges and record pressure drops.
Log Sheets	Complete pre-treatment and RO unit log sheets.

Whitewater Maintenance Procedure:

A. The Maintenance Procedure:

Is designed to cover every main item of equipment in the system, unless excluded, and to test all interlocks and alarm procedures where possible and practical. However, this will exclude any procedures which will infringe the sterility of any sections of the system that have a microbiological specification.

B. Analytical Tests:

Raw Water and various inter-stage water samples will be tested using standard test kits. These results are used to confirm the correct chemical operation of plant items and also confirm the feed water quality to key items is within the design specification. (These tests give results to an accuracy in parts per million. High sensitivity instrumental chemical analysis can be supplied at extra cost if required.)

C. Actions:

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Any minor faults that are found or minor adjustments that are required will be carried out if possible and the changes will be recorded. Any work required that cannot be carried out will be noted and recommendations will be given in final report.

D. Report:

It is Whitewater's policy to provide signed soft copy service reports on completion of all repair & maintenance procedures to designated technical departments after each visit to site. Each of our service engineers is equipped with the latest reporting technology, for field service engineers for real time reporting to customers. It manages our field staff/scheduling on-screen from the office – accurate/real time job reporting, quickens response times for follow up.

Inspection/Service Contract:

1. Check quality of water supply to be treated and check for any change in quality which may affect plant performance.
2. Check on treated water quality and salt usage.
3. Check on filter bed and resin quality. Filter bed quality are checked when there is a reason to suspect there may be a problem i.e. poor quality, high pressure drop, etc. Where a recharge is required for no obvious reason we would then arrange tests to establish cause.
4. All mechanical and electrical components are checked for wear and tear, with particular emphasis on seals, glands and controls.
5. The data on your plant will be recorded on our CRM data base to maintain a complete service record of each individual plant at your site.
6. One weeks' notice to be given prior to service visit.
7. Any operational problems are checked out with your staff.
8. After the service visit, recommendations with regards to the plant will be made if required.
9. Perform Sanitisation and Chemical Cleaning Schedule.
10. Resetting of the softener, carbon bed and filters to winter and summer times.
11. **Instrument Calibrations** There is no calibration included in the scope of this contact.
12. **Working Hours & Rates:**
    The amount of time required to service a particular part of the installation may vary from time to time. No extra charge will be made if extra time is required to conduct normal maintenance, however, should a service visit be prolonged by factors outside the control of Whitewater , this additional time will be invoiced at the rates quoted for additional works.
    Normal working hours of work are defined to be 08:30 to 17:00 Monday to Friday, excluding Bank and Public Holidays.

Unless specified to the contrary, all hours worked outside of these hours are subject to the following overtime rates and may be charged in addition.

13. Warranties and Guarantees:

Whitewater warrants that it executes it services with due skill and care and in the event that a service has not been performed to an acceptable standard the work will be repeated free of charge. These remedies are Whitewater's sole liability with respect to this contract.

14. Site Requirements

During a service visit, it is necessary that the Whitewater service engineer has full access to the equipment and all utility services to this equipment. All service visits will be scheduled in advance for the period of the Contract and every effort will be made to work around our Client's requirements. Re-arrangement of scheduled visits by the Client should be advised in writing to Whitewater offices at least two (2) weeks in advance.

Although our engineers carry a comprehensive set of tools, items such as access platforms may be requested of the customer.

15. Safety

Work Permits must be made available by the Client, If not available Whitewater will only commence work when the client has pre-signed the Whitewater work permit on service report sheet. Site Induction Training if required will be to the clients account.
Whitewater engineers are Safe Pass certified and have had additional training in accordance with the Whitewater site safety booklet. Whitewater Engineers are also trained on all aspects of Safety in servicing this type of equipment.

16. Call Out Provision in Contract

It has been our experience that customer accounts departments prefer all unplanned or call out work to be accompanied by a purchase order. Since unplanned outages and emergency call outs usually occur at the most inconvenient times we recommend that you make provision for call outs in this service agreement by adding a preagreed provision for call out services.
In the event this is not used up the balance will be credited back at the end of the agreement period. In the event that the provision is exceeded we will advise you and suggest an upgrade on the same basis, as it is always best to be prepared in advance for the unexpected.
If the pre-agreed provision is not taken up at the outset of the service contract we will request a purchase order for each call out, but you will still benefit from the discounted rates and response level you have engaged.

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Contract Exclusions:

The contracts excludes the following unless specified otherwise:

- Filters, Membranes and Parts

Contract Inclusions:

The contract includes the following unless specified otherwise

Qty		Unit Price (EUR)	Total (EUR)
4	Service Visits	1045.00	4180.00

Consumables required but not included in contract:

2	V360 Piston Service Kit - When required	769.00	1538.00
1	CCS14x Maintenance Kit - req at visit 2	375.00	375.00
4	Electrode (50005256) - 1 required at each visit	88.00	352.00
1	Kit, Valve/Diaph. SD-S-PVC/V/C-1 - when req	171.00	171.00
1	Diaphragm Valve Kit for DME8 (Chlorine) - When required	221.00	221.00
2	Foot Valve FV-NL-G5	151.00	302.00
2	9M DME Injector PVDF - req at visit 2 & 4	124.00	248.00

Total cost of contract per annum **EUR 4180.00**

Price per visit **EUR 1045.00**

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AGREEMENT

This Agreement is made this day **18/07/2022** between Whitewater and:

Killeen Castle Golf Services Ltd

Hereinafter called the client.

That for a charge of **EUR 1045.00 per visit**, a Whitewater Service Engineer will visit the above mentioned site ***4* times a year times a year** to service, examine, and where necessary, adjust the systems and also make any recommendations pertinent to ensure that the plants are maintained and in good working order. This contract will run for 12 consecutive months commencing 1st of month in which PO is given.

This Agreement only covers the work as previously stated, any additional work or dismantling necessary to repair the plant will be charged at the current service rates as well as spare parts used. Where additional work is necessary, an estimate for spare parts will be forwarded to the client for his approval.

This Agreement **SC1938/22** may be terminated by either party, giving sixty days' notice in writing. Title to Goods/Services shall not pass to the Buyer but shall be retained by the Seller until the contract price has been paid to the seller in full by the buyer

Order Number: _____ (Please issue an order number to cover above)

SIGNED:

_____

FOR AND ON BEHALF OF:
Whitewater
Whitewater House
Boghall Road
Bray
Co Wicklow

SIGNED:

28/09/2022.

FOR AND ON BEHALF OF:-
Killeen Castle Golf Services Ltd
Usher House
Main Street
Dundrum
Dublin 14

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General Terms and Conditions - R.S White (Water Treatment) Ltd, T/A Whitewater

R.S White (Water Treatment) Ltd, T/A Whitewater and also Whitewater Service hereafter named Whitewater.
Whitewater quotations are valid from the date of issue. Quotations are for the sole use of the addressee, to be treated as commercially sensitive. We reserve the right to withdraw a quotation which has been passed to you by a third party.

PRICES:
Prices quoted are current net prices & are subject to VAT at the appropriate rate. Prices quoted are valid for the validity period. However, imported items are subject to variation due to international currency rates changing during that period.

TERMS OF PAYMENT:
30 days from invoice after each visit

VALIDITY:
Our offer is open for acceptance 30 days from date of quotation.

WARRANTY:
The purification system will be covered by 12 months parts and labour from date of commissioning or 18 months from date of delivery whichever is sooner, subject to the following provisions:

A The water system has been installed by or in accordance with instructions given by Whitewater.
B The water system has been operated in accordance with Whitewater operating and maintenance instructions.
C The nature of the input water used as our design basis or other governing data to the water system has not changed in comparison by a significant amount.

There has been no exchange or modification of the water system or the parts there of after installation without agreement with Whitewater. Supplies of regenerant chemicals and consumable items of the specified quality have been maintained and used in accordance with Whitewater instructions.
The plant has not been misused or damaged by external force.

RETENTION OF TITLE CLAUSE, ALL MONIES CLAUSE:
Title to goods/services shall not pass to the buyer but shall be retained by the seller until the contract price has been paid to the seller in full by the buyer.

The Customer shall permit the employees or agents of the Company to enter the Customer's premises to repossess goods subject to this retention of title. In the event of the goods being at the premises of a third party by the direction of the Customer then the Customer shall, if required by the Company, remove the goods and return them to the Company immediately.

FORCE MAJEURE:
The Company shall be under no liability if it is prevented from, or delayed in, carrying out the whole or any part of the contract for any cause beyond its control.

DELIVERY:
working weeks ex works from receipt of official order & full instructions enabling us to proceed uninterrupted with manufacture. We will deem that all goods as delivered when signed for on the buyer's behalf at advised delivery address.

BASES AND DRAINS:
We have assumed that appropriate bases will be provided for the units, which will be +/- 6 mm over the whole area. We also assume appropriate drains will be provided.

INSTALLATION:

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Where included for the priced separately, we assume that normal site services are available for our Technicians, including use of power, water & telephone facilities. Installation excludes all electrical works
Commissioning will take place immediately after installation. A responsible person must be available during this period for instruction on operation of the plant. Immediately after commissioning the operation of the plant becomes the purchaser's responsibility.

CLAIMS:

The Customer shall have no claim for shortage or defects.
Unless:

1. The Customer inspects the goods and a written complaint specifying the shortage or defect is made to the Company within 10 days of delivery of the goods (in the case of shortage, or visible defects) or as soon as possible after the discovery of the defect (if it was not visible at the time of delivery); and
2. The Company is given an opportunity to inspect the goods and investigate any complaint before any use is made of the goods.
3. Notwithstanding the periods provided in condition 1 for making claims, the Company will not accept liability for notifying carriers of, nor will it have any liability to the Purchaser for, any claim for shortage or defect, or for any loss, damage, delay in transit or mis-delivery, unless the Customer puts the Company in a position to be able to comply with the claims procedures under the carrier's conditions current at the commencement of transit.

The Company shall not be liable for any claim for loss or damage in finished work containing the Company's products due to fair wear and tear, misuse or failure to comply with the Company's Product Literature.

TERMINATION POINTS:

Terminations as specified.

TERMS & CONDITIONS FOR SERVICE:

Where the date &/or time for works to be carried out is agreed by the Company with the Customer, then the Company shall use its best endeavours to ensure that the operative shall attend on the date & at the time agreed. However, the Company accepts no liability in respect of the non-attendance or late attendance on site of the operative/engineer or for the late or non-delivery of materials.

Where the Company agrees to carry out works on installations of inferior quality or over ten years old at that date no warranty is given in respect of such works & the Company accepts no liability in respect of the effectiveness of such works or otherwise.

We shall supply the Works to You in accordance with the Order in all material respects.

We shall have the right to make any changes to the Works which are necessary to comply with any applicable laws and/or safety requirements, or which do not materially affect the nature or quality of the Works, and We shall notify You in any such event.

The Works will be supplied in a good and workmanlike manner using all reasonable care and skill.

If we consider that Additional Works are required or recommended, we shall advise you as soon as possible and if we are in a position to undertake such Additional Works, We will provide you with an estimate of the time required to complete such Additional Works and the associated costs.

If we discover that there are issues which prevent us from completing the Works we will notify you and you shall have the option to either:

1. End the Contract
2. Suspend the Contract until such time as such issues are rectified. If such issues are not rectified within 6 months either party may terminate the Contract.

The Company shall not be liable for any delay or for the consequences of any delay in performing any of its obligations if such delay is due to any cause whatsoever beyond its reasonable control & the Company shall be entitled to a reasonable extension of the time for performing such obligations.

The Company shall only be liable for rectifying works completed by the Company & shall not be held responsible for ensuing damage or claims resulting from this or other work overlooked or subsequently requested & not undertaken at that time. These

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terms & conditions & all contracts awarded between the Company & Customer shall be governed & construed in accordance with Irish law & shall be subject to the exclusive jurisdiction of Ireland.

For out of hours servicing, the engineer has the discretion to supply whatever parts are deemed necessary for essential maintenance.

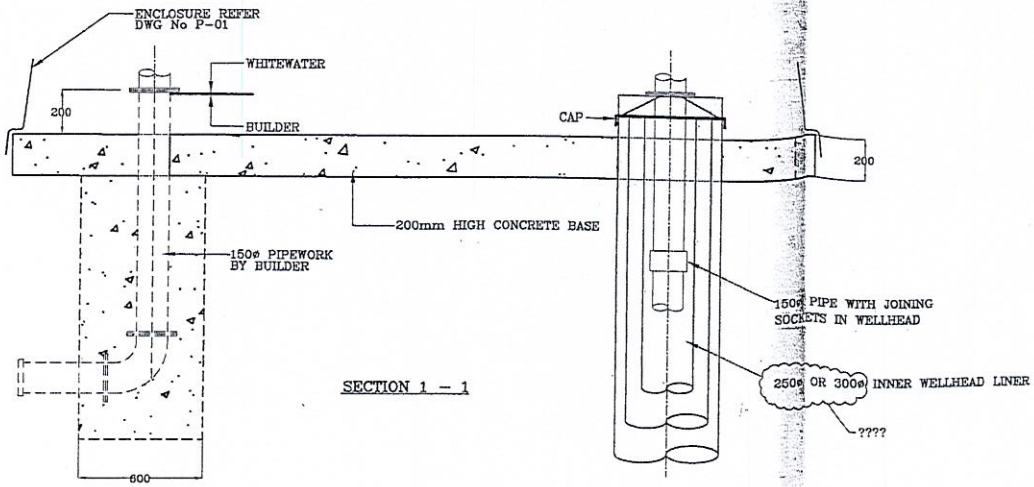
Service Rates:

Will be agreed in advance and are based on time (including travelling time) and agreed mileage charge.
The Agreement and these Terms and Conditions (including any non-contractual matters and obligations arising therefrom or associated therewith) shall be governed by, and construed in accordance with, the laws of Ireland.

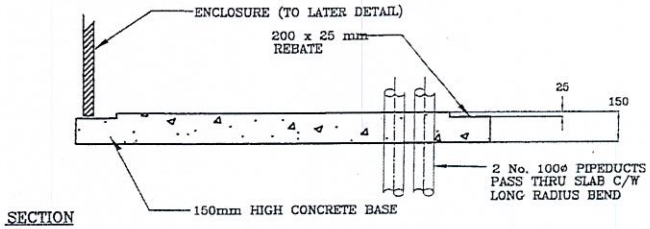
EXCLUSIONS:

We exclude any items not specifically listed. For your information these would mainly be:

A. Installation and offloading. Demurrage charges incurred by delays in off-loading, cranage on site, site erection and installation. All electrical works
B. Storage area or facilities for plant delivered to site.
C. Any civil engineering or building works required on site.
D. All safety notices or hand railing associated with the plant except that listed in the specification.
E. Supply and installation of pipe work outside the limits of our equipment including drains, etc. for disposal of effluent or regeneration chemicals or rinse water
F. Raw water, regenerant chemicals required for testing, commissioning or subsequent operation of the plant.
G. Lagging of any equipment or pipe work supplied by Whitewater.
H. Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS).
I. Distribution Loop.
J. Electrical installation materials and labour.
K. Labelling apart from valve and instrumentation.
L. Local electrical isolators to our equipment.
M. Removal of existing equipment.
N. Third party inspection.
O. Any water analysis.



SECTION 1 – 1



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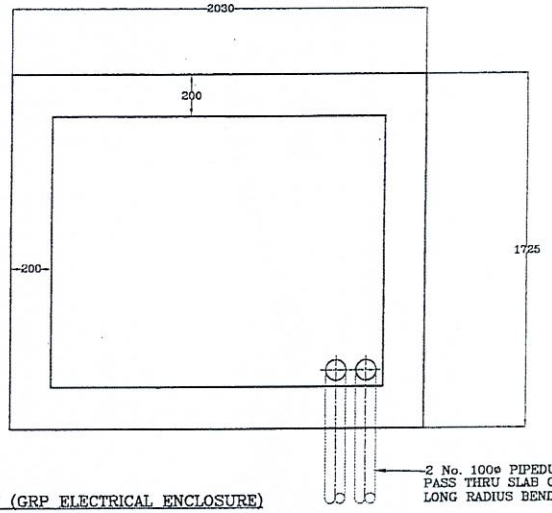
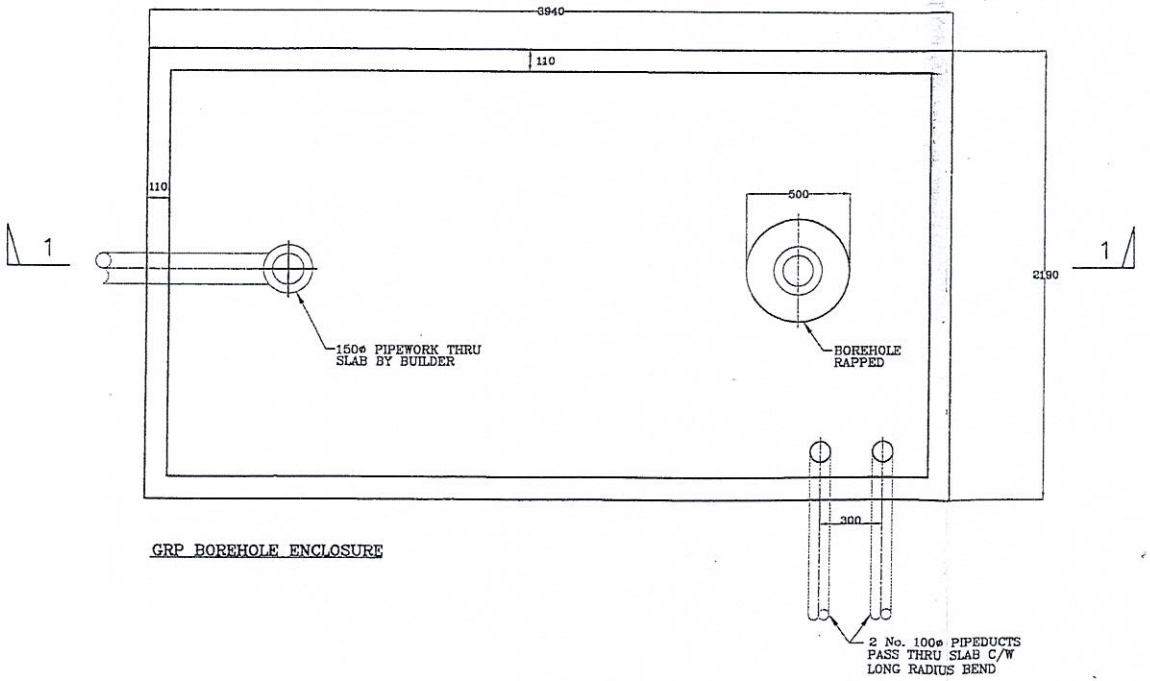


PLAN (GRP ELECTRICAL ENCLOSURE)



GRP BOREHOLE ENCLOSURE

Revision	Date	Description	Drn. By	Chk'd
1	16.03.06	PIPEWORK DETAILS ADDED	P.T.	R.M
0	08.03.06	ISSUED FOR COMMENTS	P.T.	R.M

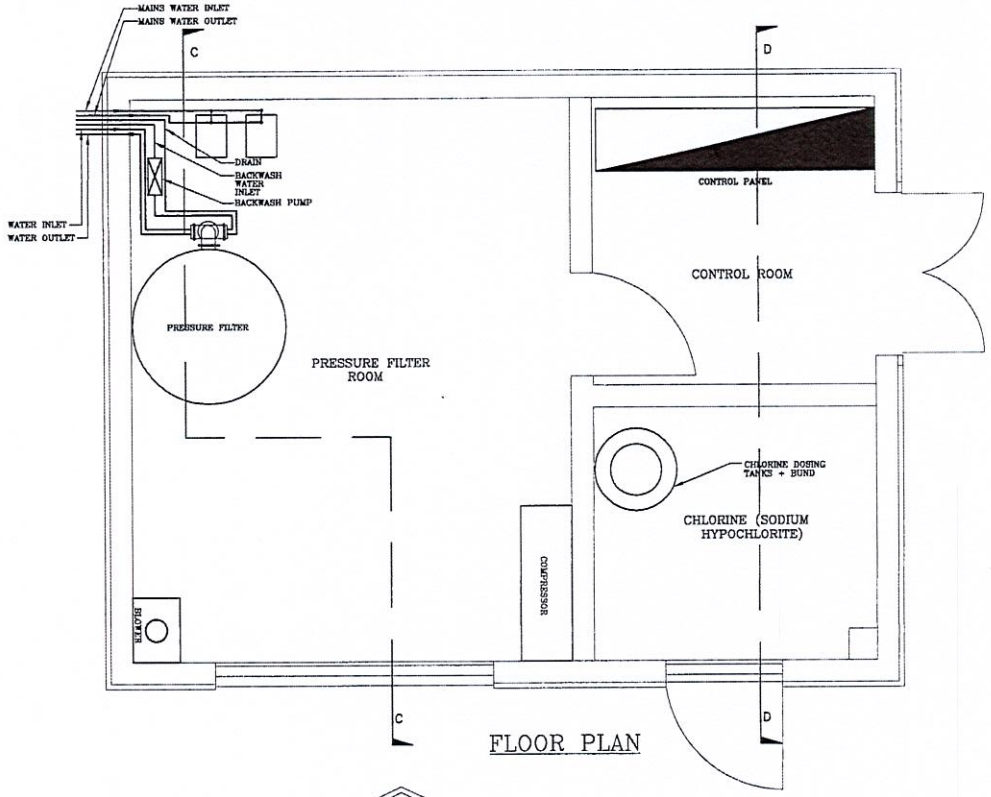
PROJECT: KILLEEN CASTLE CO.MEATH

CONSULTANT: PH McCARTHY & PARTNERS

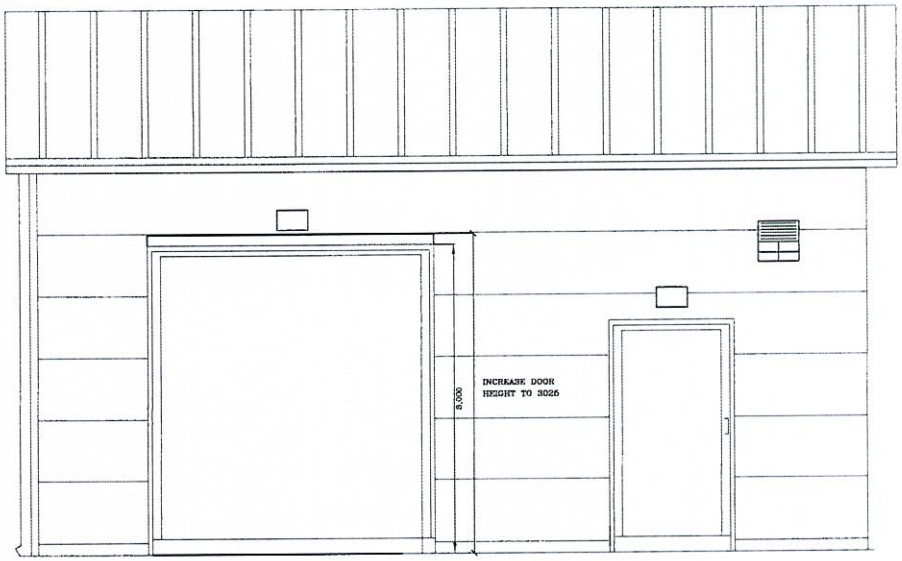
WHITEWATER
quality in purity
Unit 732, Hillcrest Industrial Park, Blackrock, Co. Dublin.
Telephone: 353-1-2945500
Fax No: 353-1-2945506
Email: info@whitewaterireland.ie

TITLE: TANK ENCLOSURE BASE DETAILS

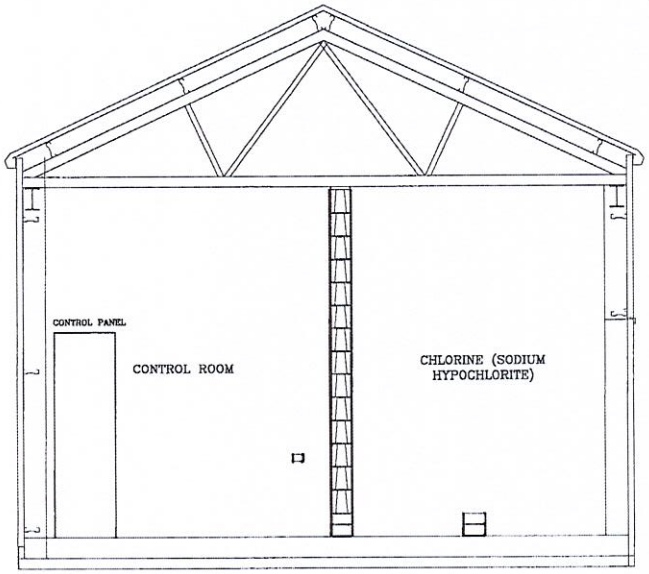
DRN.	CKD.	JOB No.	DRG No.
DATE MAR'06		8803	BW/01
SCALE 1:25 @ A3			FILENAME 8803-BW01



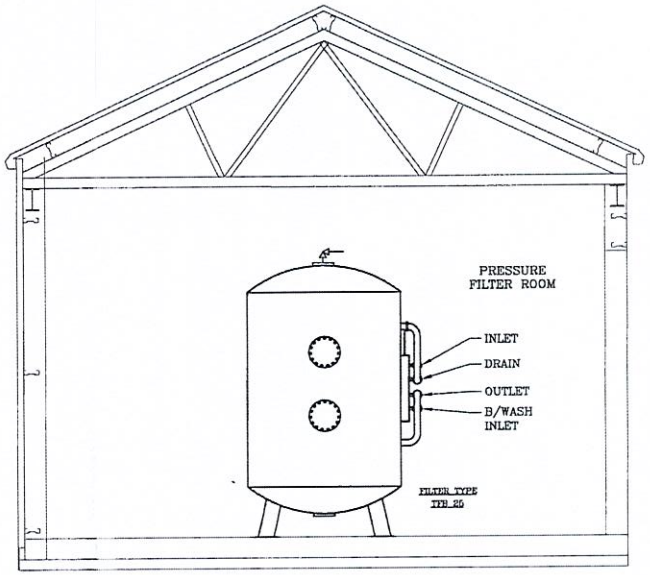
FLOOR PLAN



NORTH WEST ELEVATION



SECTION D–D



SECTION C–C

Revision	Date	Description	Drn. By	Chk'd
0	18.03.06	ISSUED FOR APPROVAL	N.W	P.M

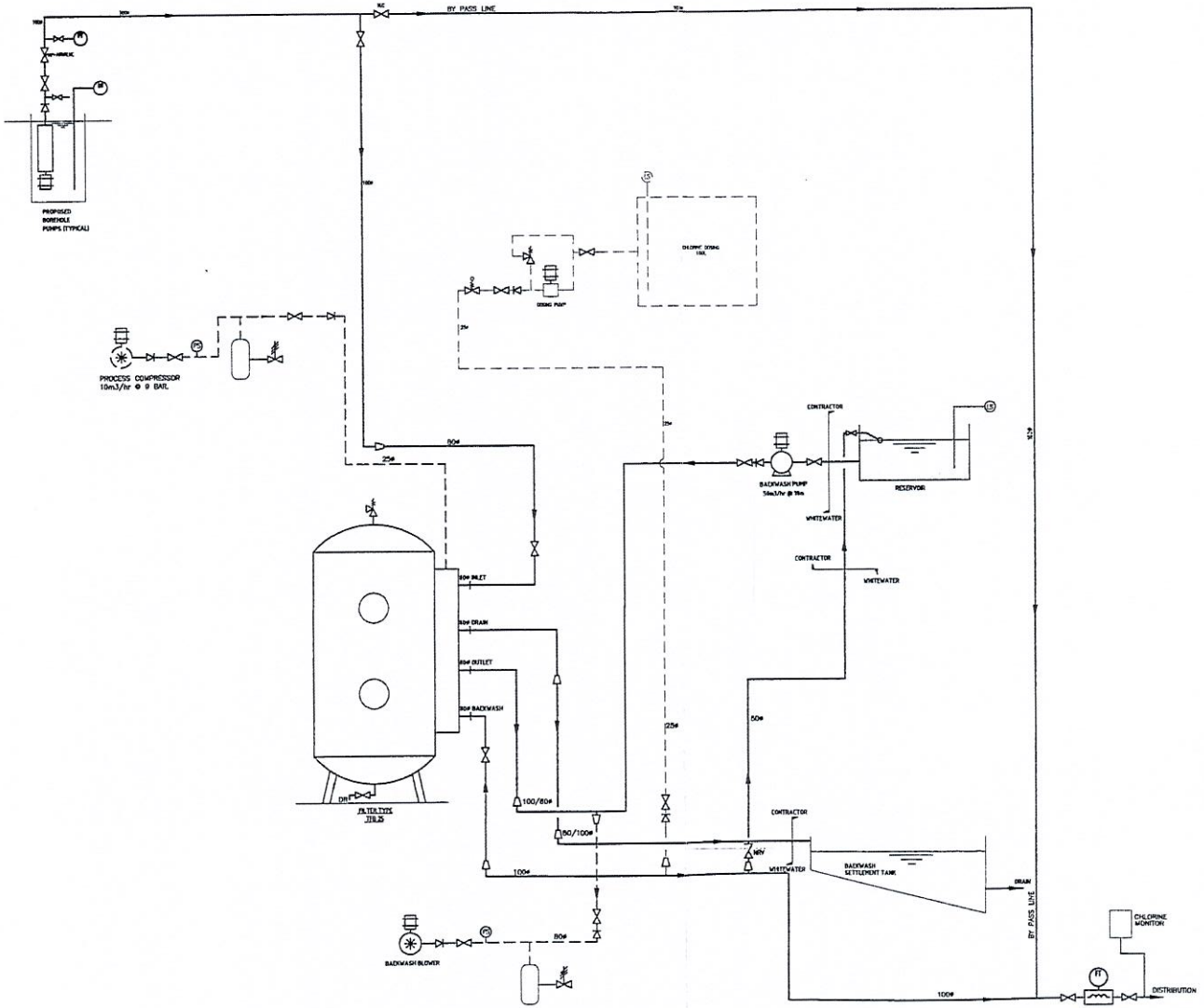
PROJECT: KILLEEN CASTLE CO.MEATH

CONSULTANT: PH McCARTHY & PARTNERS

WHITEWATER
quality in purity
Unit T32, Stillorgan Industrial Park, Blackrock, Co. Dublin.
Telephone: 353-1-2940300
Fax No.: 353-1-2940306
Email: info@whitewaterireland.ie

TITLE: FLOOR PLAN + SECTION

DRN.	CKD.	JOB No.	DRG No.
DATE: MARCH '06		8803	M-02
SCALE: 1:50 @ A3			FILENAME: 8803M02



VALVES

- GATE VALVE
- CHECK (NON RETURN) VALVE
- ANGLE VALVE
- PRESSURE RELIEF VALVE
- LOCKING VALVE
- AIR LINE

VALVE ACTUATING METHOD

- MOTORISED

Revision	Date	Description	Drn. By	Chk'd
3	17.02.06	RE-ISSUED PER CLIENTS COMMENTS	N.W	R.M
2	16.02.06	RE-ISSUED PER CLIENTS COMMENTS	N.W	R.M
1	16.02.06	REVISED PER CLIENTS COMMENTS	N.W	R.M
0	15.02.06	ISSUED FOR APPROVAL	N.W	R.M

PROJECT: KILLEEN CASTLE CO.MEATH

CONSULTANT: PH McCARTHY & PARTNERS

WHITEWATER
quality in purity
Unit 722, Lilliput Industrial Park, Blackrock, Co. Dublin.
Telephone: 353-1-2940100
Fax No.: 353-1-2940106
Email: info@whitewaterireland.ie

TITLE: PIPING & INSTRUMENTATION DIAGRAM

DRN. N.W	CKD. R.M	JOB No. 8803	DRG No. M03
DATE FEB'06			
SCALE N.T.S @ A3			FILENAME 8803-M03

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Bray, Co. Wicklow, A98 E097,
Ireland.
Tel: +353 (0) 1 276 8468
Fax: +353 (0) 1 276 8476
Email: info@whitewatercare.com
Web: www.whitewatercare.com

Technical Service Report – VIS16065

Reason for visit:	Contract: SC1938/22- Contract Item: Water Purification System - 2 of 4
Engineer Name:	Jason Beers
Secondary Engineer Name:	
Department:	Plant Room
Address:	Usher House
Site Contact	Darren Curley
Order No:	Darren Curley
Date:	02/02/2023
Company Name:	Killeen Castle Golf Services Ltd
Plant Type:	Water Purification System
Serial No:	N/A
Next Service Due:	10/05/2023

Time & Travel:

Start Date:	02/02/2023
End Date:	02/02/2023
Total Hours on Site:	
Travel Time:	

Initial Water Analysis:

	Raw	Treated
T Hardness	427.5	nil
P.H.	7.49	7.49
Conductivity	682	682
Iron	N/A	N/A
Chlorine	From borewell nil	On recirc 0.68 to site 0.66
CO^2	N/A	N/A
Manganese	N/A	N/A
Temperature	11.0	11.0
Silt Density Index	N/A	N/A

Initial System Flow Rates:

Equipments	Maintenance Carried Out	
Plant Inspection	Inspect plant with Client and identify any ongoing problems/Complete Hardness, Chlorine, Conductivity and pH Test on feed water. Redo tests post service. Inspect all Mechanical and Electrical operation. Repair or replace faulty or scheduled parts as per job card. ALL filter cartridges to be replaced unless client requests otherwise. (Note on signed report if filter cartridges have not been replaced)	Yes
Raw Water Tank	Check ballcock and inlet valve operation./Check level controls./Check for leaks.	N/A
Booster Pumps	Check output pressure and flow rate/Check for leaks/Check automatic changeover.	Yes
Multimedia Filters	Check for pressure drop/Clean and grease main and pilot pistons/Check backwash operation/Check for leaks.	YES
Organic Scavengers	Check for pressure drop/Clean and grease main and pilot pistons/Check regeneration operation/Check Salt Tank level/Check for leaks.	N/A
Water Softeners	Check for pressure drop/Clean and grease main and pilot pistons/Check backwash operation/Check for leaks	Yes
UV Units	Check countdown timer. UV lamp changed annually/Check for leaks.	Yes
Carbon Filters	Check for pressure drop/Clean and grease main and pilot pistons/Check backwash operation/Check for leaks/Repack carbon annually	N/A
Chlorine Analyser	Check reagent levels. Refill as necessary/Cross check chlorine reading and recalibrate annually/Check for leaks	yes
Nest Filters	Replace Filters/Check for leaks.	N/A
RO Unit	Change RO pre-filter.	N/A
	Clean RO membranes.	N/A
	Re-balance flows and pressures	N/A
	Replace PSU 15A fuse annually	N/A
Pressure Gauges	Check all gauges and record pressure drops.	N/A
Log Sheets	Complete pre-treatment and RO unit log sheets.	N/A
Safety Checks	Ensure work permits are obtained and method statements are reviewed and signed off.Complete a site walk through, check for slips, trips and obstacles, assess for any potential hazards prior to commencing any works. Any potential hazards need reported and removed before work commences.	Yes

Report:

Carried out routine service on plant
Checked chlorine dosing pumps and injection lines ok
Checked chlorine levels on recirculation and to site line against readings on site controllers and had to carry out a calibration as readings badly out.
Checked and backwashed water softeners and Checked operation/cycles ok
Sample points on water softener outlet not working and also sample point that feeds the recirculation chlorine analyser badly leaking and will need replaced.
Left all plant back online

Final Water Analysis:

	Raw	Treated
T Hardness	427.5	nil
P.H.	7.49	7.49
Conductivity	682	682
Iron	n/a	n/a
Chlorine	Nil	Recirc 0.68 to site 0.66
CO^2	n/a	n/a
Manganese	n/a	n/a
Temperature	11.0	11.0
Silt Density Index	N/a	N/a

Final System Flow Rates:

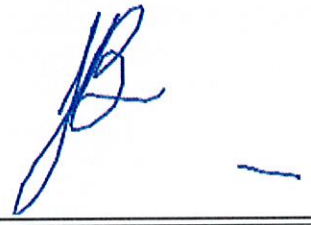
Final Checks Before Leaving Site:	
Check all valves/power supplies and confirm that system is in full operational mode	Yes
Clean down plant and leave area in tidy and safe condition	Yes
Complete Service Report indicating any action that may be required. Include serial number of units. Consult with client in regard to any recommendations and to sign completed Service Report.	Yes
Fill relevant service labels and attached to equipment or panel.	Yes
Investigate and replace clients stock as necessary where required.	N/A

Recommendations:

2x softener sample points (on outlet pipework)
1x sample point that feeds chlorine analyser
(Details sent in email)
Recommend a full service kits for the water softener siata heads as they have never been carried out piston/spacers etc
(Details sent in email)

Consumables & Parts Used/Issued:

Qty	Code	Description	Location	SO Number
1	95730924	9M DME Injector PVDF	Stock	
1	71076921	CCS14x Maintenance Kit	Used from Client Stock	
1	CCY14-F	Electrode (50005256)	Stock	

Engineer Signature	Customer Signature
	Site Contact Darren Curley

Initial System Flow Rates:

N/A

Equipments	Maintenance Carried Out	
Plant Inspection	Inspect plant with Client and identify any ongoing problems/Complete Hardness, Chlorine, Conductivity and pH Test on feed water. Redo tests post service. Inspect all Mechanical and Electrical operation. Repair or replace faulty or scheduled parts as per job card. ALL filter cartridges to be replaced unless client requests otherwise. (Note on signed report if filter cartridges have not been replaced)	Yes
Raw Water Tank	Check ballcock and inlet valve operation./Check level controls./Check for leaks.	Yes
Booster Pumps	Check output pressure and flow rate/Check for leaks/Check automatic changeover.	N/A
Multimedia Filters	Check for pressure drop/Clean and grease main and pilot pistons/Check backwash operation/Check for leaks.	n/a
Organic Scavengers	Check for pressure drop/Clean and grease main and pilot pistons/Check regeneration operation/Check Salt Tank level/Check for leaks.	n/a
Water Softeners	Check for pressure drop/Clean and grease main and pilot pistons/Check backwash operation/Check for leaks	serviced
UV Units	Check countdown timer. UV lamp changed annually/Check for leaks.	n/a
Carbon Filters	Check for pressure drop/Clean and grease main and pilot pistons/Check backwash operation/Check for leaks/Repack carbon annually	n/a
Chlorine Analyser	Check reagent levels. Refill as necessary/Cross check chlorine reading and recalibrate annually/Check for leaks	Serviced
Nest Filters	Replace Filters/Check for leaks.	Yes
RO Unit	Change RO pre-filter.	N/A
	Clean RO membranes.	N/A
	Re-balance flows and pressures	Yes
	Replace PSU 15A fuse annually	No
Pressure Gauges	Check all gauges and record pressure drops.	Yes
Log Sheets	Complete pre-treatment and RO unit log sheets.	N/A
Safety Checks	Ensure work permits are obtained and method statements are reviewed and signed off.Complete a site walk through, check for slips, trips and obstacles, assess for any potential hazards prior to commencing any works. Any potential hazards need reported and removed before work commences.	Yes

Report:

Routine service visit carried out. No faults reported prior to visit other than a few small leaks. These are now fixed. Replace 3 x sample taps and check for operation. Check quality output <0.05ppm hardness. Replace electrode x 2 and calibrate cells x 2. Clean flow chambers. On the chlorine tank replace foot valve and test after purging air. An acid clean will need to be done next service on the flow Chambers. Fix leak at high level sample valve. Reduce compressor pressure from 5bar to 3.5bar. Over pressure is causing blow off on Siata valve and possible damage to valve head pistons. (Photo in e mail). System ready for use. Area remains clean and tidy, all waste removed for disposal.

Final Water Analysis:

	Raw	Treated
T Hardness	340 ppm	<0.05 ppm
P.H.	7.3	7.3
Conductivity	n/a	N/A
Iron	n/a	N/A
Chlorine	0.16	n/d
CO^2	n/a	N/A
Manganese	n/a	N/A
Temperature	18°C	18 °C
Silt Density Index	N/a	N/A

Final System Flow Rates:

N/A

Final Checks Before Leaving Site:	
Check all valves/power supplies and confirm that system is in full operational mode	Yes
Clean down plant and leave area in tidy and safe condition	Yes
Complete Service Report indicating any action that may be required. Include serial number of units. Consult with client in regard to any recommendations and to sign completed Service Report.	Yes
Fill relevant service labels and attached to equipment or panel.	Yes
Investigate and replace clients stock as necessary where required.	Yes

Recommendations:

Recommend 3 service kits next visit for the chlorine pumps.
1 x Grundfos DME 8
2 x Grundfos DDA 7.5

Recommend brine tank cleaned due to heavy fouling.

Consumables & Parts Used/Issued:

Qty	Code	Description	Location	SO Number
2	CCY14-F	Electrode (50005256)		
1	98070953	Foot Valve FV-NL-G5		
2	71076921	CCS14x Maintenance Kit		
3	FIT010	Fittings		SO-00015040

Engineer Signature	Customer Signature

RMC	

Notes:

APPENDIX G

Exceedance of Limit									
NS: Not Sampled									
COMPOUND NAME	**COMPOUND CLASS**	**GROUNDWATER REGULATIONS** S.I. No. 9 of 2010	**INTERIM GUIDELINE VALUES** (IGV's) (EPA 2004)	**SAMPLING DATE**	**UNITS**	**BH6**	**BH7**	**FW1**	**SP**
Alkalinity, Total as CaCO3	Inorganics			11/07/2022	mg/l	465	470	440	395
Alkalinity, Total as CaCO3	Inorganics			12/07/2022	mg/l	470	450	NS	NS
Alkalinity, Total as CaCO3	Inorganics			22/07/2022	mg/l	441	464	430	381
Ammoniacal Nitrogen as N (low level)	Inorganics	0.065 - 0.175		11/07/2022	mg/l	0.345	0.3	0.0351	0.0189
Ammoniacal Nitrogen as N (low level)	Inorganics	0.065 - 0.175		12/07/2022	mg/l	0.299	0.313	NS	NS
Ammoniacal Nitrogen as N (low level)	Inorganics	0.065 - 0.175		22/07/2022	mg/l	0.279	0.303	0.0411	0.0437
Apparent Colour	Inorganics			11/07/2022	mg/l Pt/Co	6.9	6.1	14.2	17.2
Apparent Colour	Inorganics			12/07/2022	mg/l Pt/Co	9.7	29.6	NS	NS
Apparent Colour	Inorganics			22/07/2022	mg/l Pt/Co	19.5	70	19.8	36.1
BOD, unfiltered	Inorganics			11/07/2022	mg/l	<10	2	<1	<1
BOD, unfiltered	Inorganics			12/07/2022	mg/l	2.17	22	NS	NS
BOD, unfiltered	Inorganics			22/07/2022	mg/l	<1	7.11	<1	<1
Chloride	Inorganics	24-187.50	30	11/07/2022	mg/l	33.9	34.6	31	21.8
Chloride	Inorganics	24-187.50	30	12/07/2022	mg/l	30.4	50	NS	NS
Chloride	Inorganics	24-187.50	30	22/07/2022	mg/l	31.8	43.3	35.9	23.1
COD, unfiltered	Inorganics			11/07/2022	mg/l	<7	<7	<7	13.7
COD, unfiltered	Inorganics			12/07/2022	mg/l	8.48	<7	NS	NS
COD, unfiltered	Inorganics			22/07/2022	mg/l	<7	<7	<7	10.6
Electrical Conductivity	Inorganics			11/07/2022	uS/cm	877	913	857	755
Electrical Conductivity	Inorganics			12/07/2022	uS/cm	899	947	NS	NS
Electrical Conductivity	Inorganics			22/07/2022	uS/cm	863	933	901	773
Nitrate as N	Inorganics	8.50	5.7	11/07/2022	mg/l	<0.07	<0.07	0.579	0.746
Nitrate as N	Inorganics	8.50	5.7	12/07/2022	mg/l	0.296	<0.07	NS	NS
Nitrate as N	Inorganics	8.50	5.7	22/07/2022	mg/l	<0.07	<0.07	1.34	0.347
Nitrite as NO2	Inorganics	0.375	0.10	11/07/2022	mg/l	<0.05	<0.05	<0.05	<0.05
Nitrite as NO2	Inorganics	0.375	0.10	12/07/2022	mg/l	<0.05	<0.05	NS	NS
Nitrite as NO2	Inorganics	0.375	0.10	22/07/2022	mg/l	<0.05	<0.05	<0.05	<0.05
pH	Inorganics		>6.5 <9.5	11/07/2022	pH	7.15	6.99	6.48	6.74
pH	Inorganics		>6.5 <9.5	12/07/2022	pH	7.15	7.06	NS	NS
pH	Inorganics		>6.5 <9.5	22/07/2022	pH	6.87	6.91	6.61	6.81
Phosphate (Ortho as P)	Inorganics	0.035	0.03	11/07/2022	mg/l	<0.02	<0.02	<0.02	<0.02
Phosphate (Ortho as P)	Inorganics	0.035	0.03	12/07/2022	mg/l	<0.02	<0.02	NS	NS
Phosphate (Ortho as P)	Inorganics	0.035	0.03	22/07/2022	mg/l	<0.02	<0.02	<0.02	<0.02
Redox (eH)	Inorganics			11/07/2022	mV	-218	-219	136	168
Redox (eH)	Inorganics			12/07/2022	mV	-196	-218	NS	NS
Redox (eH)	Inorganics			22/07/2022	mV	-243	-269	129	145
Sulphate	Inorganics	187.50	200	11/07/2022	mg/l	13.6	14.7	10.7	12.7
Sulphate	Inorganics	187.50	200	12/07/2022	mg/l	28.7	23.1	NS	NS
Sulphate	Inorganics	187.50	200	22/07/2022	mg/l	17.5	25.5	12.5	23.7
Suspended solids, Total	Inorganics			11/07/2022	mg/l	<2	<2	<2	3.05
Suspended solids, Total	Inorganics			12/07/2022	mg/l	<2	3.4	NS	NS
Suspended solids, Total	Inorganics			22/07/2022	mg/l	<2	<2	<2	13.7
Temperature	Inorganics			11/07/2022	oC	13.9	13	13.7	13.1
Temperature	Inorganics			12/07/2022	oC	13.2	13	NS	NS
Temperature	Inorganics			22/07/2022	oC	12.8	12.7	15.2	16
True Colour	Inorganics			11/07/2022	mg/l Pt/Co	<1	<1	9.9	14.3
True Colour	Inorganics			12/07/2022	mg/l Pt/Co	1	<1	NS	NS
True Colour	Inorganics			22/07/2022	mg/l Pt/Co	<1	1.7	11	15.9
Aluminium (diss.filt)	Metals		200	11/07/2022	µg/l	<10	<10	<10	<10
Aluminium (diss.filt)	Metals		200	12/07/2022	µg/l	<10	<10	NS	NS
Aluminium (diss.filt)	Metals		200	22/07/2022	µg/l	<10	<10	<10	<10
Aluminium (tot.unfilt)	Metals			11/07/2022	µg/l	<10	18.2	<10	74.8
Aluminium (tot.unfilt)	Metals			12/07/2022	µg/l	10.7	<10	NS	NS
Aluminium (tot.unfilt)	Metals			22/07/2022	µg/l	<10	<10	<10	27.3
Arsenic (diss.filt)	Metals	7.50	10	11/07/2022	µg/l	<0.5	<0.5	<0.5	<0.5
Arsenic (diss.filt)	Metals	7.50	10	12/07/2022	µg/l	<0.5	<0.5	NS	NS
Arsenic (diss.filt)	Metals	7.50	10	22/07/2022	µg/l	<0.5	<0.5	<0.5	<0.5
Arsenic (tot.unfilt)	Metals			11/07/2022	µg/l	<2	<2	<2	<2
Arsenic (tot.unfilt)	Metals			12/07/2022	µg/l	<2	<2	NS	NS
Arsenic (tot.unfilt)	Metals			22/07/2022	µg/l	<2	<2	<2	<2
Barium (diss.filt)	Metals			11/07/2022	µg/l	68.7	83.4	67.6	28.7
Barium (diss.filt)	Metals			12/07/2022	µg/l	70	84.6	NS	NS
Barium (diss.filt)	Metals			22/07/2022	µg/l	81	92	67.6	24.6
Barium (tot.unfilt)	Metals		100	11/07/2022	µg/l	68.4	84.8	72.1	29.4
Barium (tot.unfilt)	Metals		100	12/07/2022	µg/l	70.5	83.9	NS	NS
Barium (tot.unfilt)	Metals		100	22/07/2022	µg/l	83.8	90.1	70.8	25
Cadmium (diss.filt)	Metals			11/07/2022	µg/l	<0.08	<0.08	0.311	0.11
Cadmium (diss.filt)	Metals			12/07/2022	µg/l	<0.08	<0.08	NS	NS
Cadmium (diss.filt)	Metals			22/07/2022	µg/l	<0.08	<0.08	0.257	0.132
Cadmium (tot.unfilt)	Metals		5	11/07/2022	µg/l	<0.5	<0.5	<0.5	<0.5

Exceedance of Limit									
NS: Not Sampled									
COMPOUND NAME	**COMPOUND CLASS**	**GROUNDWATER REGULATIONS** S.I. No. 9 of 2010	**INTERIM GUIDELINE VALUES** (IGV's) (EPA 2004)	**SAMPLING DATE**	**UNITS**	**BH6**	**BH7**	**FW1**	**SP**
Cadmium (tot.unfilt)	Metals		5	12/07/2022	µg/l	<0.5	<0.5	NS	NS
Cadmium (tot.unfilt)	Metals		5	22/07/2022	µg/l	<0.5	<0.5	<0.5	<0.5
Chromium (diss.filt)	Metals	37.500	30	11/07/2022	µg/l	<1	<1	<1	<1
Chromium (diss.filt)	Metals	37.500	30	12/07/2022	µg/l	5.83	9.07	NS	NS
Chromium (diss.filt)	Metals	37.500	30	22/07/2022	µg/l	<1	<1	<1	<1
Chromium (tot.unfilt)	Metals			11/07/2022	µg/l	<3	<3	<3	<3
Chromium (tot.unfilt)	Metals			12/07/2022	µg/l	7.26	10.7	NS	NS
Chromium (tot.unfilt)	Metals			22/07/2022	µg/l	<3	<3	<3	<3
Copper (diss.filt)	Metals		30	11/07/2022	µg/l	<0.3	<0.3	20.8	0.92
Copper (diss.filt)	Metals		30	12/07/2022	µg/l	0.585	<0.3	NS	NS
Copper (diss.filt)	Metals		30	22/07/2022	µg/l	0.398	<0.3	23.9	1.45
Copper (tot.unfilt)	Metals		30	11/07/2022	µg/l	<1	<1	23.9	1.91
Copper (tot.unfilt)	Metals		30	12/07/2022	µg/l	1.35	<1	NS	NS
Copper (tot.unfilt)	Metals		30	22/07/2022	µg/l	<1	<1	31	1.4
Hardness, Total as CaCO3 unfiltered	Metals			11/07/2022	mg/l	385	409	504	427
Hardness, Total as CaCO3 unfiltered	Metals			12/07/2022	mg/l	405	400	NS	NS
Hardness, Total as CaCO3 unfiltered	Metals			22/07/2022	mg/l	392	366	439	387
Iron (Dis.Filt)	Metals		0.2	11/07/2022	mg/l	<0.019	<0.019	<0.019	0.0272
Iron (Dis.Filt)	Metals		0.2	12/07/2022	mg/l	<0.019	<0.019	NS	NS
Iron (Dis.Filt)	Metals		0.2	22/07/2022	mg/l	<0.019	<0.019	<0.019	<0.019
Iron (Tot. Unfilt.)	Metals		0.2	11/07/2022	mg/l	<0.024	0.041	0.0434	0.582
Iron (Tot. Unfilt.)	Metals		0.2	12/07/2022	mg/l	<0.024	<0.024	NS	NS
Iron (Tot. Unfilt.)	Metals		0.2	22/07/2022	mg/l	<0.024	<0.024	<0.024	0.131
Lead (diss.filt)	Metals	7.50	10	11/07/2022	µg/l	<0.2	<0.2	0.4	<0.2
Lead (diss.filt)	Metals	7.50	10	12/07/2022	µg/l	<0.2	<0.2	NS	NS
Lead (diss.filt)	Metals	7.50	10	22/07/2022	µg/l	0.595	<0.2	0.536	<0.2
Lead (tot.unfilt)	Metals		10	11/07/2022	µg/l	<1	<1	<1	<1
Lead (tot.unfilt)	Metals		10	12/07/2022	µg/l	<1	<1	NS	NS
Lead (tot.unfilt)	Metals		10	22/07/2022	µg/l	<1	<1	<1	<1
Calcium (Dis.Filt)	Metals			11/07/2022	mg/l	60.2	72.6	166	147
Calcium (Dis.Filt)	Metals			12/07/2022	mg/l	76.2	77.7	NS	NS
Calcium (Dis.Filt)	Metals			22/07/2022	mg/l	83.3	79	156	144
Calcium (Tot. Unfilt.)	Metals		200	11/07/2022	mg/l	70.4	81.9	183	154
Calcium (Tot. Unfilt.)	Metals		200	12/07/2022	mg/l	84	83.8	NS	NS
Calcium (Tot. Unfilt.)	Metals		200	22/07/2022	mg/l	87.7	79.5	160	143
Magnesium (Dis.Filt)	Metals			11/07/2022	mg/l	43.2	43.6	8.73	9.16
Magnesium (Dis.Filt)	Metals			12/07/2022	mg/l	43.6	41.4	NS	NS
Magnesium (Dis.Filt)	Metals			22/07/2022	mg/l	41.6	41.7	8.97	8.85
Magnesium (Tot. Unfilt.)	Metals			11/07/2022	mg/l	48.4	49.7	11.3	10.1
Magnesium (Tot. Unfilt.)	Metals			12/07/2022	mg/l	47.4	46.3	NS	NS
Magnesium (Tot. Unfilt.)	Metals			22/07/2022	mg/l	41.8	40.6	9.47	8.78
Manganese (diss.filt)	Metals		50.00	11/07/2022	µg/l	<3	3.02	31.8	<3
Manganese (diss.filt)	Metals		50.00	12/07/2022	µg/l	<3	<3	NS	NS
Manganese (diss.filt)	Metals		50.00	22/07/2022	µg/l	5.33	3.85	26.2	4.19
Manganese (tot.unfilt)	Metals		50.00	11/07/2022	µg/l	2.47	2.65	37.7	6.05
Manganese (tot.unfilt)	Metals		50.00	12/07/2022	µg/l	3.27	2.99	NS	NS
Manganese (tot.unfilt)	Metals		50.00	22/07/2022	µg/l	4.33	3.79	28.1	5.32
Mercury (diss.filt)	Metals	0.75		11/07/2022	µg/l	<0.01	<0.01	<0.01	<0.01
Mercury (diss.filt)	Metals	0.75		12/07/2022	µg/l	<0.01	<0.01	NS	NS
Mercury (diss.filt)	Metals	0.75		22/07/2022	µg/l	<0.01	<0.01	<0.01	<0.01
Mercury (tot.unfilt)	Metals			11/07/2022	µg/l	<0.02	<0.02	<0.02	<0.02
Mercury (tot.unfilt)	Metals			12/07/2022	µg/l	<0.02	<0.02	NS	NS
Mercury (tot.unfilt)	Metals			22/07/2022	µg/l	<0.02	<0.02	<0.02	<0.02
Nickel (diss.filt)	Metals			11/07/2022	µg/l	<0.4	<0.4	7.71	0.911
Nickel (diss.filt)	Metals			12/07/2022	µg/l	<0.4	<0.4	NS	NS
Nickel (diss.filt)	Metals			22/07/2022	µg/l	<0.4	<0.4	9.23	4.06
Nickel (tot.unfilt)	Metals			11/07/2022	µg/l	<1	<1	10.2	3.81
Nickel (tot.unfilt)	Metals			12/07/2022	µg/l	<1	<1	NS	NS
Nickel (tot.unfilt)	Metals			22/07/2022	µg/l	<1	<1	9.56	4.47
Potassium (Dis.Filt)	Metals		5	11/07/2022	mg/l	3.76	3.34	6.40	2.31
Potassium (Dis.Filt)	Metals		5	12/07/2022	mg/l	3.45	3.39	NS	NS
Potassium (Dis.Filt)	Metals		5	22/07/2022	mg/l	2.86	3.13	8.62	3.01
Potassium (Tot. Unfilt.)	Metals		5	11/07/2022	mg/l	4.25	3.83	7.9	2.45
Potassium (Tot. Unfilt.)	Metals		5	12/07/2022	mg/l	3.89	3.87	NS	NS
Potassium (Tot. Unfilt.)	Metals		5	22/07/2022	mg/l	2.89	3.12	9.51	2.9
Selenium (diss.filt)	Metals			11/07/2022	µg/l	<1	<1	<1	<1
Selenium (diss.filt)	Metals			12/07/2022	µg/l	<1	<1	NS	NS
Selenium (diss.filt)	Metals			22/07/2022	µg/l	<1	<1	<1	<1
Selenium (tot.unfilt)	Metals			11/07/2022	µg/l	<1	<1	<1	<1
Selenium (tot.unfilt)	Metals			12/07/2022	µg/l	<1	<1	NS	NS
Selenium (tot.unfilt)	Metals			22/07/2022	µg/l	<1	<1	<1	<1

Exceedance of Limit									
NS: Not Sampled									
COMPOUND NAME	**COMPOUND CLASS**	**GROUNDWATER REGULATIONS** S.I. No. 9 of 2010	**INTERIM GUIDELINE VALUES** (IGV's) (EPA 2004)	**SAMPLING DATE**	**UNITS**	**BH6**	**BH7**	**FW1**	**SP**
Sodium (Dis.Filt)	Metals			11/07/2022	mg/l	50.3	40.7	13.6	11.9
Sodium (Dis.Filt)	Metals			12/07/2022	mg/l	41.4	57.8	NS	NS
Sodium (Dis.Filt)	Metals			22/07/2022	mg/l	36.5	49	16.2	21.4
Sodium (Tot. Unfilt.)	Metals		150	11/07/2022	mg/l	55.4	45.1	16.9	12.3
Sodium (Tot. Unfilt.)	Metals		150	12/07/2022	mg/l	44.7	63.5	NS	NS
Sodium (Tot. Unfilt.)	Metals		150	22/07/2022	mg/l	37.6	53.1	16.4	20.3
Zinc (diss.filt)	Metals	75.00	100	11/07/2022	µg/l	1.39	1.02	16.9	2.52
Zinc (diss.filt)	Metals	75.00	100	12/07/2022	µg/l	<1	<1	NS	NS
Zinc (diss.filt)	Metals	75.00	100	22/07/2022	µg/l	1.54	1.1	25.7	3.77
Zinc (tot.unfilt)	Metals			11/07/2022	µg/l	<5	<5	18.2	7.32
Zinc (tot.unfilt)	Metals			12/07/2022	µg/l	<5	<5	NS	NS
Zinc (tot.unfilt)	Metals			22/07/2022	µg/l	<5	<5	17.6	<5
Coliforms, Total	Microbiological		0	11/07/2022	MPN/100ml	<1	<1	18.5	>2420
Coliforms, Total	Microbiological		0	12/07/2022	MPN/100ml	13.4	<1	NS	NS
Coliforms, Total	Microbiological		0	22/07/2022	MPN/100ml	<1	4.1	18.9	>2420
Escherichia Coli	Microbiological		0	11/07/2022	MPN/100ml	<1	<1	4.1	44.1
Escherichia Coli	Microbiological		0	12/07/2022	MPN/100ml	1	<1	NS	NS
Escherichia Coli	Microbiological		0	22/07/2022	MPN/100ml	<1	<1	5.2	69.1

APPENDIX H

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528777
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Minerex Environmental
Taney hall
Eglinton Terrace
Dundrum
Dublin
Dublin 14

Attention: Chris Fennell

CERTIFICATE OF ANALYSIS

Date of report Generation:	05 August 2022
Customer:	Minerex Environmental
Sample Delivery Group (SDG):	220714-59
Your Reference:	3131-028-COC1
Location:	Firlough - Ballina
Report No:	656846
Order Number:	

This report has been revised and directly supersedes 656495 in its entirety.

We received 6 samples on Thursday July 14, 2022 and 6 of these samples were scheduled for analysis which was completed on Friday August 05, 2022. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.

Approved By:

Sonia McWhan

Operations Manager

1291

CERTIFICATE OF ANALYSIS

SDG: 220714-59 **Report Number:** 656846 **Superseded Report:** 656495
Client Ref.: 3131-028-COC1 **Location:** Firlough - Ballina

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
26586215	3131-BH6A-COC1		0.00 - 0.00	11/07/2022
26586224	3131-BH7A-COC1		0.00 - 0.00	11/07/2022
26586236	3131-BH6B-COC1		0.00 - 0.00	12/07/2022
26586245	3131-BH7B-COC1		0.00 - 0.00	12/07/2022
26586254	3131-FW1A-COC1		0.00 - 0.00	11/07/2022
26586264	3131-SP1A-COC1		0.00 - 0.00	11/07/2022

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG: 220714-59 **Report Number:** 656846 **Superseded Report:** 656495

Client Ref.: 3131-028-COC1 **Location:** Firlough - Ballina

Results Legend

X Test

N No Determination Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	26586215						26586224						26586236						26586245	
			Customer Sample Reference	3131-BH6A-COC1						3131-BH7A-COC1						3131-BH6B-COC1						3131-BH7B-COC1	
			AGS Reference																				
			Depth (m)	0.00 - 0.00						0.00 - 0.00						0.00 - 0.00						0.00 - 0.00	
			Container	1000ml glass bottle (ALE220)	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)	NaOH (ALE245)	1000ml glass bottle (ALE220)	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)	NaOH (ALE245)	1000ml glass bottle (ALE220)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)	NaOH (ALE245)	1000ml glass bottle (ALE220)	H2SO4 (ALE244)
			Sample Type	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
Alkalinity as CaCO3	All	NDPs: 0 Tests: 6			X						X					X					X		
Ammonium Low	All	NDPs: 0 Tests: 6				X						X					X						X
Anions by Kone (w)	All	NDPs: 0 Tests: 6			X						X					X					X		
BOD True Total	All	NDPs: 0 Tests: 6			X						X					X					X		
COD Unfiltered	All	NDPs: 0 Tests: 6			X						X					X					X		
Coliforms (W)	All	NDPs: 0 Tests: 6			X						X					X					X		
Colour Test	All	NDPs: 0 Tests: 6			X						X					X					X		
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 6				X						X					X						
Mercury Dissolved	All	NDPs: 0 Tests: 6				X						X					X						
Mercury Unfiltered	All	NDPs: 0 Tests: 6					X						X						X				
Nitrite by Kone (w)	All	NDPs: 0 Tests: 6						X						X						X			
Phosphate by Kone (w)	All	NDPs: 0 Tests: 6			X						X					X					X		
Suspended Solids	All	NDPs: 0 Tests: 6	X						X						X					X			
Total Metals by ICP-MS	All	NDPs: 0 Tests: 6					X						X						X				

26586264	3131-SP1A-COC1		0.00 - 0.00	NaOH (ALE245)	GW											X			
				HNO3 Unfiltered (ALE204)	GW										X				X
				HNO3 Filtered (ALE204)	GW								X	X					
				H2SO4 (ALE244)	GW		X												
				500ml Plastic (ALE208)	GW	X		X	X	X	X	X					X		
				1000ml glass bottle (ALE220)	GW													X	
26586254	3131-FW1A-COC1		0.00 - 0.00	NaOH (ALE245)	GW											X			
				HNO3 Unfiltered (ALE204)	GW										X				X
				HNO3 Filtered (ALE204)	GW								X	X					
				H2SO4 (ALE244)	GW		X												
				500ml Plastic (ALE208)	GW	X		X	X	X	X	X					X		
				1000ml glass bottle (ALE220)	GW													X	
26586245	3131-BH7B-COC1		0.00 - 0.00	NaOH (ALE245)	GW											X			
				HNO3 Unfiltered (ALE204)	GW										X				X
				HNO3 Filtered (ALE204)	GW								X	X					

Validated

CERTIFICATE OF ANALYSIS

SDG: 220714-59 **Report Number:** 656846 **Superseded Report:** 656495

Client Ref.: 3131-028-COC1 **Location:** Firlough - Ballina

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	3131-BH6A-COC1	3131-BH7A-COC1	3131-BH6B-COC1	3131-BH7B-COC1	3131-FW1A-COC1	3131-SP1A-COC1
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)
			Date Sampled	11/07/2022	11/07/2022	12/07/2022	12/07/2022	11/07/2022	11/07/2022
			Sample Time	00:00	00:00	00:00	00:00	00:00	00:00
			Date Received	14/07/2022	14/07/2022	14/07/2022	14/07/2022	14/07/2022	14/07/2022
			SDG Ref	220714-59	220714-59	220714-59	220714-59	220714-59	220714-59
			Lab Sample No.(s)	26586215	26586224	26586236	26586245	26586254	26586264
			AGS Reference						
Escherichia Coli (W)*	MPN/100ml	SUB		<1	<1	1	<1	4.1	44.1
Coliforms, Total*	MPN/100ml	SUB		<1	<1	13.4	<1	18.5	>2420
Suspended solids, Total	<2 mg/l	TM022		<2 #	<2 #	<2 #	3.4 #	<2 #	3.05 #
Alkalinity, Total as CaCO3	<2 mg/l	TM043		465 #	470 #	470 #	450 #	440 #	395 #
BOD, unfiltered	<1 mg/l	TM045		<10 #	2 #	2.17 #	22 #	<1 #	<1 #
Ammoniacal Nitrogen as N (low level)	<0.01 mg/l	TM099		0.345 #	0.3 #	0.299 #	0.313 #	0.0351 #	0.0189 #
COD, unfiltered	<7 mg/l	TM107		<7 #	<7 #	8.48 #	<7 #	<7 #	13.7 #
Aluminium (diss.filt)	<10 µg/l	TM152		<10 #	<10 #	<10 #	<10 #	<10 #	<10 #
Aluminium (tot.unfilt)	<10 µg/l	TM152		<10 #	18.2 #	10.7 #	<10 #	<10 #	74.8 #
Arsenic (diss.filt)	<0.5 µg/l	TM152		<0.5 #	<0.5 #	<0.5 #	<0.5 #	<0.5 #	<0.5 #
Arsenic (tot.unfilt)	<2 µg/l	TM152		<2 #	<2 #	<2 #	<2 #	<2 #	<2 #
Barium (diss.filt)	<0.2 µg/l	TM152		68.7 #	83.4 #	70 #	84.6 #	67.6 #	28.7 #
Barium (tot.unfilt)	<0.5 µg/l	TM152		68.4 #	84.8 #	70.5 #	83.9 #	72.1 #	29.4 #
Cadmium (diss.filt)	<0.08 µg/l	TM152		<0.08 #	<0.08 #	<0.08 #	<0.08 #	0.311 #	0.11 #
Cadmium (tot.unfilt)	<0.5 µg/l	TM152		<0.5 #	<0.5 #	<0.5 #	<0.5 #	<0.5 #	<0.5 #
Chromium (tot.unfilt)	<3 µg/l	TM152		<3 #	<3 #	7.26 #	10.7 #	<3 #	<3 #
Chromium (diss.filt)	<1 µg/l	TM152		<1 #	<1 #	5.83 #	9.07 #	<1 #	<1 #
Copper (tot.unfilt)	<1 µg/l	TM152		<1 #	<1 #	1.35 #	<1 #	23.9 #	1.91 #
Lead (tot.unfilt)	<1 µg/l	TM152		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Copper (diss.filt)	<0.3 µg/l	TM152		<0.3 #	<0.3 #	0.585 #	<0.3 #	20.8 #	0.92 #
Manganese (tot.unfilt)	<1 µg/l	TM152		2.47 #	2.65 #	3.27 #	2.99 #	37.7 #	6.05 #
Lead (diss.filt)	<0.2 µg/l	TM152		<0.2 #	<0.2 #	<0.2 #	<0.2 #	0.4 #	<0.2 #
Nickel (tot.unfilt)	<1 µg/l	TM152		<1 #	<1 #	<1 #	<1 #	10.2 #	3.81 #
Manganese (diss.filt)	<3 µg/l	TM152		<3 #	3.02 #	<3 #	<3 #	31.8 #	<3 #
Selenium (tot.unfilt)	<1 µg/l	TM152		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Nickel (diss.filt)	<0.4 µg/l	TM152		<0.4 #	<0.4 #	<0.4 #	<0.4 #	7.71 #	0.911 #
Selenium (diss.filt)	<1 µg/l	TM152		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc (tot.unfilt)	<5 µg/l	TM152		<5 #	<5 #	<5 #	<5 #	18.2 #	7.32 #
Zinc (diss.filt)	<1 µg/l	TM152		1.39 #	1.02 #	<1 #	<1 #	16.9 #	2.52 #
Sodium (Dis.Filt)	<0.076 mg/l	TM152		50.3 #	40.7 #	41.4 #	57.8 #	13.6 #	11.9 #
Magnesium (Dis.Filt)	<0.036 mg/l	TM152		43.2 #	43.6 #	43.6 #	41.4 #	8.73 #	9.16 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152		3.76 #	3.34 #	3.45 #	3.39 #	6.4 #	2.31 #
Calcium (Dis.Filt)	<0.2 mg/l	TM152		60.2 #	72.6 #	76.2 #	77.7 #	166 #	147 #

Validated

CERTIFICATE OF ANALYSIS

SDG: 220714-59 **Report Number:** 656846 **Superseded Report:** 656495

Client Ref.: 3131-028-COC1 **Location:** Firlough - Ballina

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	3131-BH6A-COC1	3131-BH7A-COC1	3131-BH6B-COC1	3131-BH7B-COC1	3131-FW1A-COC1	3131-SP1A-COC1
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)
			Date Sampled	11/07/2022	11/07/2022	12/07/2022	12/07/2022	11/07/2022	11/07/2022
			Sample Time	00:00	00:00	00:00	00:00	00:00	00:00
			Date Received	14/07/2022	14/07/2022	14/07/2022	14/07/2022	14/07/2022	14/07/2022
			SDG Ref	220714-59	220714-59	220714-59	220714-59	220714-59	220714-59
			Lab Sample No.(s)	26586215	26586224	26586236	26586245	26586254	26586264
			AGS Reference						
Iron (Dis.Filt)	<0.019 mg/l	TM152		<0.019 #	<0.019 #	<0.019 #	<0.019 #	<0.019 #	0.0272 #
Sodium (Tot. Unfilt.)	<0.047 mg/l	TM152		55.4 #	45.1 #	44.7 #	63.5 #	16.9 #	12.3 #
Magnesium (Tot. Unfilt.)	<0.05 mg/l	TM152		48.4 #	49.7 #	47.4 #	46.3 #	11.3 #	10.1 #
Potassium (Tot. Unfilt.)	<0.2 mg/l	TM152		4.25 #	3.83 #	3.89 #	3.87 #	7.9 #	2.45 #
Calcium (Tot. Unfilt.)	<0.057 mg/l	TM152		74 #	81.9 #	84 #	83.8 #	183 #	154 #
Iron (Tot. Unfilt.)	<0.024 mg/l	TM152		<0.024 #	0.041 #	<0.024 #	<0.024 #	0.0434 #	0.582 #
Hardness, Total as CaCO3 unfiltered	<0.35 mg/l	TM152		385	409	405	400	504	427
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #
Mercury (tot.unfilt)	<0.02 µg/l	TM183		<0.02 #	<0.02 #	<0.02 #	<0.02 #	<0.02 #	<0.02 #
Nitrite as NO2	<0.05 mg/l	TM184		<0.05 #	<0.05 #	<0.05 #	<0.05 #	<0.05 #	<0.05 #
Sulphate	<2 mg/l	TM184		13.6 #	14.7 #	28.7 #	23.1 #	10.7 #	12.7 #
Chloride	<2 mg/l	TM184		33.9 #	34.6 #	30.4 #	50 #	31 #	21.8 #
Phosphate (Ortho as P)	<0.02 mg/l	TM184		<0.02 #	<0.02 #	<0.02 #	<0.02 #	<0.02 #	<0.02 #
Nitrate as N	<0.07 mg/l	TM184		<0.07	<0.07	0.296	<0.07	0.579	0.746
Apparent Colour	<1 mg/l Pt/Co	TM261		6.9	6.1	9.7	29.6	14.2	17.2
True Colour	<1 mg/l Pt/Co	TM261		<1	<1	1	<1	9.9	14.3

Table of Results - Appendix

Method No	Reference	Description
SUB		Subcontracted Test
TM022	Method 2540D, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part120 1981;BS EN 872	Determination of total suspended solids in waters
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM152	ISO 17294-2:2016 Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS)	Analysis of Aqueous Samples by ICP-MS
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM261	Colour and Turbidity of Waters, Methods for the Examination of Waters and Associated Materials, HMSO, 1981, ISBN 0 11 7519553.	Determination of True and Apparent Colour by Spectrophotometry

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM).

CERTIFICATE OF ANALYSIS

SDG: 220714-59 **Report Number:** 656846 **Superseded Report:** 656495
Client Ref.: 3131-028-COC1 **Location:** Firlough - Ballina

Test Completion Dates

Lab Sample No(s)	26586215	26586224	26586236	26586245	26586254	26586264
Customer Sample Ref.	3131-BH6A-COC1	3131-BH7A-COC1	3131-BH6B-COC1	3131-BH7B-COC1	3131-FW1A-COC1	3131-SP1A-COC1
AGS Ref.						
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Alkalinity as CaCO3	21-Jul-2022	21-Jul-2022	21-Jul-2022	21-Jul-2022	21-Jul-2022	21-Jul-2022
Ammonium Low	19-Jul-2022	19-Jul-2022	19-Jul-2022	19-Jul-2022	19-Jul-2022	19-Jul-2022
Anions by Kone (w)	19-Jul-2022	19-Jul-2022	19-Jul-2022	19-Jul-2022	19-Jul-2022	19-Jul-2022
BOD True Total	19-Jul-2022	19-Jul-2022	20-Jul-2022	19-Jul-2022	19-Jul-2022	19-Jul-2022
COD Unfiltered	20-Jul-2022	20-Jul-2022	20-Jul-2022	20-Jul-2022	20-Jul-2022	20-Jul-2022
Coliforms (W)	18-Jul-2022	18-Jul-2022	18-Jul-2022	18-Jul-2022	18-Jul-2022	18-Jul-2022
Colour Test	16-Jul-2022	16-Jul-2022	16-Jul-2022	16-Jul-2022	16-Jul-2022	16-Jul-2022
Dissolved Metals by ICP-MS	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022	05-Aug-2022
Mercury Dissolved	18-Jul-2022	18-Jul-2022	18-Jul-2022	18-Jul-2022	18-Jul-2022	18-Jul-2022
Mercury Unfiltered	18-Jul-2022	18-Jul-2022	18-Jul-2022	18-Jul-2022	18-Jul-2022	19-Jul-2022
Nitrite by Kone (w)	14-Jul-2022	14-Jul-2022	14-Jul-2022	14-Jul-2022	14-Jul-2022	14-Jul-2022
Phosphate by Kone (w)	14-Jul-2022	14-Jul-2022	14-Jul-2022	14-Jul-2022	14-Jul-2022	14-Jul-2022
Suspended Solids	20-Jul-2022	20-Jul-2022	20-Jul-2022	20-Jul-2022	20-Jul-2022	20-Jul-2022
Total Metals by ICP-MS	21-Jul-2022	21-Jul-2022	21-Jul-2022	21-Jul-2022	21-Jul-2022	19-Jul-2022

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Customer

Customer Services

ALS Life Sciences
Hawarden Business Park
Manor Lane
Hawarden, Deeside
UK
CH5 3US

Certificate Of Analysis

Job Number: 22-26302
Issue Number: 1
Report Date: 14 July 2022

Site: Not Applicable
PO Number: Not Supplied
Date Samples Received: 13/07/2022

Please find attached the results for the samples received at our laboratory on 13/07/2022.

Should you have any queries regarding the report or require any further services, we would be happy to discuss your requirements. For additional information about the company please log-on to our website at the above address.

Thank you for choosing City Analysts Limited. We look forward to assisting you again.

Authorised By: Louise Morrow **Authorised Date:** 14 July 2022

Louise Morrow

Notes are not INAB accredited

Results relate only to the items tested.
Information on methods of analysis and uncertainty of measurement is available on request.
Any opinions or interpretations indicated are outside the scope of our INAB accreditation.

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Manor Lane
Hawarden, Deeside
UK
CH5 3US

Report Reference: 22-26302

Report Version: 1

Site: Not Applicable

Sample Description: 3131 - BH6A

Sample Type: Ground

Lab Reference Number: 661337

Date of Sampling: 13/07/2022

Date Sample Received: 13/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201#	13/07/2022	Coliforms	< 1.0	MPN/100ml	-
D/D1201#	13/07/2022	E.coli	< 1.0	MPN/100ml	-

Comments

The sampling time has not been communicated; time taken for analysis cannot be assessed.

= INAB Accredited, U = UKAS Accredited, * = Subcontracted

Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
NAC & ATC - No abnormal change and acceptable to customers.
TVC - Total viable count
Site D = Analysed at City Analysts Dublin. Site S = Analysed at City Analysts Shannon

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Hawarden, Deeside
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CH5 3US

Report Reference: 22-26302

Report Version: 1

Site: Not Applicable

Sample Description: 3131 - BH7A

Sample Type: Ground

Lab Reference Number: 661338

Date of Sampling: 13/07/2022

Date Sample Received: 13/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201#	13/07/2022	Coliforms	< 1.0	MPN/100ml	-
D/D1201#	13/07/2022	E.coli	< 1.0	MPN/100ml	-

Comments

The sampling time has not been communicated; time taken for analysis cannot be assessed.

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
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CH5 3US

Report Reference: 22-26302

Report Version: 1

Site: Not Applicable

Sample Description: 3131 - SP1A

Sample Type: Ground

Lab Reference Number: 661339

Date of Sampling: 13/07/2022

Date Sample Received: 13/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201#	13/07/2022	Coliforms	> 2419.6	MPN/100ml	-
D/D1201#	13/07/2022	E.coli	44.1	MPN/100ml	-

Comments

The sampling time has not been communicated; time taken for analysis cannot be assessed.

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
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Report Reference: 22-26302

Report Version: 1

Site: Not Applicable

Sample Description: 3131 - FW1A

Sample Type: Ground

Lab Reference Number: 661340

Date of Sampling: 13/07/2022

Date Sample Received: 13/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201#	13/07/2022	Coliforms	18.5	MPN/100ml	-
D/D1201#	13/07/2022	E.coli	4.1	MPN/100ml	-

Comments

The sampling time has not been communicated; time taken for analysis cannot be assessed.

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
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Report Reference: 22-26302

Report Version: 1

Site: Not Applicable

Sample Description: 3131 - BH6B

Sample Type: Ground

Lab Reference Number: 661341

Date of Sampling: 13/07/2022

Date Sample Received: 13/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201#	13/07/2022	Coliforms	13.4	MPN/100ml	-
D/D1201#	13/07/2022	E.coli	1.0	MPN/100ml	-

Comments

The sampling time has not been communicated; time taken for analysis cannot be assessed.

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
NAC & ATC - No abnormal change and acceptable to customers.
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Report Reference: 22-26302

Report Version: 1

Site: Not Applicable

Sample Description: 3131 - BH7B

Sample Type: Ground

Lab Reference Number: 661342

Date of Sampling: 13/07/2022

Date Sample Received: 13/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201#	13/07/2022	Coliforms	< 1.0	MPN/100ml	-
D/D1201#	13/07/2022	E.coli	< 1.0	MPN/100ml	-

Comments

The sampling time has not been communicated; time taken for analysis cannot be assessed.

= INAB Accredited, U = UKAS Accredited, * = Subcontracted

Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
NAC & ATC - No abnormal change and acceptable to customers.
TVC - Total viable count
Site D = Analysed at City Analysts Dublin. Site S = Analysed at City Analysts Shannon

Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials andd soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

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Website: www.alsenvironmental.co.uk

Minerex Environmental
Taney hall
Eglinton Terrace
Dundrum
Dublin
Dublin 14

Attention: Chris Fennell

CERTIFICATE OF ANALYSIS

Date of report Generation:	03 August 2022
Customer:	Minerex Environmental
Sample Delivery Group (SDG):	220726-47
Your Reference:	3131-028-COC2
Location:	Firlough - Ballina
Report No:	656540
Order Number:	

This report has been revised and directly supersedes 656112 in its entirety.

We received 4 samples on Tuesday July 26, 2022 and 4 of these samples were scheduled for analysis which was completed on Tuesday August 02, 2022. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.

Approved By:

Sonia McWhan
Operations Manager

CERTIFICATE OF ANALYSIS

SDG: 220726-47 **Report Number:** 656540 **Superseded Report:** 656112
Client Ref.: 3131-028-COC2 **Location:** Firlough - Ballina

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
26638322	3131-BH6C-COC1		0.00 - 0.00	22/07/2022
26638331	3131-BH7C-COC1		0.00 - 0.00	22/07/2022
26638340	3131-FW1B-COC1		0.00 - 0.00	22/07/2022
26638349	3131-SP1B-COC1		0.00 - 0.00	22/07/2022

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG: 220726-47 **Report Number:** 656540 **Superseded Report:** 656112
Client Ref.: 3131-028-COC2 **Location:** Firlough - Ballina

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	26638322					26638331					26638340					26638349				
			Customer Sample Reference	3131-BH6C-COC1					3131-BH7C-COC1					3131-FW1B-COC1					3131-SP1B-COC1				
			AGS Reference																				
			Depth (m)	0.00 - 0.00					0.00 - 0.00					0.00 - 0.00					0.00 - 0.00				
			Container	1000ml glass bottle (ALE220)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)	NaOH (ALE245)	1000ml glass bottle (ALE220)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)	NaOH (ALE245)	1000ml glass bottle (ALE220)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)	NaOH (ALE245)	1000ml glass bottle (ALE220)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	HNO3 Unfiltered (ALE204)
			Sample Type	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
Alkalinity as CaCO3	All	NDPs: 0 Tests: 4		X					X					X					X				
Ammonium Low	All	NDPs: 0 Tests: 4			X					X					X					X			
Anions by Kone (w)	All	NDPs: 0 Tests: 4		X					X					X					X				
BOD True Total	All	NDPs: 0 Tests: 4		X					X					X					X				
COD Unfiltered	All	NDPs: 0 Tests: 4		X					X					X					X				
Coliforms (W)	All	NDPs: 0 Tests: 4		X					X					X					X				
Colour Test	All	NDPs: 0 Tests: 4		X					X					X					X				
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 4				X					X					X						X	
Mercury Dissolved	All	NDPs: 0 Tests: 4				X					X					X						X	
Mercury Unfiltered	All	NDPs: 0 Tests: 4					X					X					X						X
Nitrite by Kone (w)	All	NDPs: 0 Tests: 4						X					X					X					
Phosphate by Kone (w)	All	NDPs: 0 Tests: 4		X					X					X					X				
Suspended Solids	All	NDPs: 0 Tests: 4		X					X					X					X				
Total Metals by ICP-MS	All	NDPs: 0 Tests: 4					X					X					X						X

26638349	3131-SP1B-COC1		0.00 - 0.00	NaOH (ALE245)	GW
X					

CERTIFICATE OF ANALYSIS

SDG: 220726-47 **Report Number:** 656540 **Superseded Report:** 656112
Client Ref.: 3131-028-COC2 **Location:** Firlough - Ballina

Results Legend
- # ISO17025 accredited.
- M mCERTS accredited.
- aq Aqueous / settled sample.
- diss.filt Dissolved / filtered sample.
- tot.unfilt Total / unfiltered sample.
- * Subcontracted - refer to subcontractor report for accreditation status.
- ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
- (F) Trigger breach confirmed
- 1-4+§@ Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	3131-BH6C-COC1	3131-BH7C-COC1	3131-FW1B-COC1	3131-SP1B-COC1		
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00		
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)		
			Date Sampled	22/07/2022	22/07/2022	22/07/2022	22/07/2022		
			Sample Time	00:00	00:00	00:00	00:00		
			Date Received	26/07/2022	26/07/2022	26/07/2022	26/07/2022		
			SDG Ref	220726-47	220726-47	220726-47	220726-47		
			Lab Sample No.(s)	26638322	26638331	26638340	26638349		
			AGS Reference						
Escherichia Coli (W)*	MPN/100ml	SUB		<1	<1	5.2	69.1		
Coliforms, Total*	MPN/100ml	SUB		<1	4.1	18.9	>2420		
Suspended solids, Total	<2 mg/l	TM022		<2 #	<2 #	<2 #	13.7 #		
Alkalinity, Total as CaCO3	<2 mg/l	TM043		441 #	464 #	430 #	381 #		
BOD, unfiltered	<1 mg/l	TM045		<1 @ #	7.11 @ #	<1 @ #	<1 @ #		
Ammoniacal Nitrogen as N (low level)	<0.01 mg/l	TM099		0.279 #	0.303 #	0.0411 #	0.0437 #		
COD, unfiltered	<7 mg/l	TM107		<7 #	<7 #	<7 #	10.6 #		
Aluminium (diss.filt)	<10 µg/l	TM152		<10 #	<10 #	<10 #	<10 #		
Aluminium (tot.unfilt)	<10 µg/l	TM152		<10 #	<10 #	<10 #	27.3 #		
Arsenic (diss.filt)	<0.5 µg/l	TM152		<0.5 #	<0.5 #	<0.5 #	<0.5 #		
Arsenic (tot.unfilt)	<2 µg/l	TM152		<2 #	<2 #	<2 #	<2 #		
Barium (diss.filt)	<0.2 µg/l	TM152		81 #	92 #	67.6 #	24.6 #		
Barium (tot.unfilt)	<0.5 µg/l	TM152		83.8 #	90.1 #	70.8 #	25 #		
Cadmium (diss.filt)	<0.08 µg/l	TM152		<0.08 #	<0.08 #	0.257 #	0.132 #		
Cadmium (tot.unfilt)	<0.5 µg/l	TM152		<0.5 #	<0.5 #	<0.5 #	<0.5 #		
Chromium (tot.unfilt)	<3 µg/l	TM152		<3 #	<3 #	<3 #	<3 #		
Chromium (diss.filt)	<1 µg/l	TM152		<1 #	<1 #	<1 #	<1 #		
Copper (tot.unfilt)	<1 µg/l	TM152		<1 #	<1 #	31 #	1.4 #		
Lead (tot.unfilt)	<1 µg/l	TM152		<1 #	<1 #	<1 #	<1 #		
Copper (diss.filt)	<0.3 µg/l	TM152		0.398 #	<0.3 #	23.9 #	1.45 #		
Manganese (tot.unfilt)	<1 µg/l	TM152		4.33 #	3.79 #	28.1 #	5.32 #		
Lead (diss.filt)	<0.2 µg/l	TM152		0.595 #	<0.2 #	0.536 #	<0.2 #		
Nickel (tot.unfilt)	<1 µg/l	TM152		<1 #	<1 #	9.56 #	4.47 #		
Manganese (diss.filt)	<3 µg/l	TM152		5.33 #	3.85 #	26.2 #	4.19 #		
Selenium (tot.unfilt)	<1 µg/l	TM152		<1 #	<1 #	<1 #	<1 #		
Nickel (diss.filt)	<0.4 µg/l	TM152		<0.4 #	<0.4 #	9.23 #	4.06 #		
Selenium (diss.filt)	<1 µg/l	TM152		<1 #	<1 #	<1 #	<1 #		
Zinc (tot.unfilt)	<5 µg/l	TM152		<5 #	<5 #	17.6 #	<5 #		
Zinc (diss.filt)	<1 µg/l	TM152		1.54 #	1.1 #	25.7 #	3.77 #		
Sodium (Dis.Filt)	<0.076 mg/l	TM152		36.5 #	49 #	16.2 #	21.4 #		
Magnesium (Dis.Filt)	<0.036 mg/l	TM152		41.6 #	41.7 #	8.97 #	8.85 #		
Potassium (Dis.Filt)	<0.2 mg/l	TM152		2.86 #	3.13 #	8.62 #	3.01 #		
Calcium (Dis.Filt)	<0.2 mg/l	TM152		83.3 #	79 #	156 #	144 #		

CERTIFICATE OF ANALYSIS

SDG: 220726-47 **Report Number:** 656540 **Superseded Report:** 656112
Client Ref.: 3131-028-COC2 **Location:** Firlough - Ballina

Results Legend
- # ISO17025 accredited.
- M mCERTS accredited.
- aq Aqueous / settled sample.
- diss.filt Dissolved / filtered sample.
- tot.unfilt Total / unfiltered sample.
- * Subcontracted - refer to subcontractor report for accreditation status.
- ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
- (F) Trigger breach confirmed
- 1-4+§@ Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	3131-BH6C-COC1	3131-BH7C-COC1	3131-FW1B-COC1	3131-SP1B-COC1		
			Depth (m)	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00		
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)		
			Date Sampled	22/07/2022	22/07/2022	22/07/2022	22/07/2022		
			Sample Time	00:00	00:00	00:00	00:00		
			Date Received	26/07/2022	26/07/2022	26/07/2022	26/07/2022		
			SDG Ref	220726-47	220726-47	220726-47	220726-47		
			Lab Sample No.(s)	26638322	26638331	26638340	26638349		
			AGS Reference						
Iron (Dis.Filt)	<0.019 mg/l	TM152		<0.019 #	<0.019 #	<0.019 #	<0.019 #		
Sodium (Tot. Unfilt.)	<0.047 mg/l	TM152		37.6 #	53.1 #	16.4 #	20.3 #		
Magnesium (Tot. Unfilt.)	<0.05 mg/l	TM152		41.8 #	40.6 #	9.47 #	8.78 #		
Potassium (Tot. Unfilt.)	<0.2 mg/l	TM152		2.89 #	3.12 #	9.51 #	2.9 #		
Calcium (Tot. Unfilt.)	<0.057 mg/l	TM152		87.7 #	79.5 #	160 #	143 #		
Iron (Tot. Unfilt.)	<0.024 mg/l	TM152		<0.024 #	<0.024 #	<0.024 #	0.131 #		
Hardness, Total as CaCO3 unfiltered	<0.35 mg/l	TM152		392	366	439	387		
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #	<0.01 #	<0.01 #		
Mercury (tot.unfilt)	<0.02 µg/l	TM183		<0.02 #	<0.02 #	<0.02 #	<0.02 #		
Nitrite as NO2	<0.05 mg/l	TM184		<0.05 #	<0.05 #	<0.05 #	<0.05 #		
Sulphate	<2 mg/l	TM184		17.5 #	25.5 #	12.5 #	23.7 #		
Chloride	<2 mg/l	TM184		31.8 #	43.3 #	35.9 #	23.1 #		
Phosphate (Ortho as P)	<0.02 mg/l	TM184		<0.02 #	<0.02 #	<0.02 #	<0.02 #		
Nitrate as N	<0.07 mg/l	TM184		<0.07	<0.07	1.34	0.347		
Apparent Colour	<1 mg/l Pt/Co	TM261		19.5	70	19.8	36.1		
True Colour	<1 mg/l Pt/Co	TM261		<1	1.7	11	15.9		

Table of Results - Appendix

Method No	Reference	Description
SUB		Subcontracted Test
TM022	Method 2540D, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part120 1981;BS EN 872	Determination of total suspended solids in waters
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) Filtered by Oxygen Meter on liquids
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit
TM152	ISO 17294-2:2016 Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS)	Analysis of Aqueous Samples by ICP-MS
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM261	Colour and Turbidity of Waters, Methods for the Examination of Waters and Associated Materials, HMSO, 1981, ISBN 0 11 7519553.	Determination of True and Apparent Colour by Spectrophotometry

NA = not applicable.
Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM).

Test Completion Dates

Lab Sample No(s)	26638322	26638331	26638340	26638349
Customer Sample Ref.	3131-BH6C-COC1	3131-BH7C-COC1	3131-FW1B-COC1	3131-SP1B-COC1
AGS Ref.				
Depth	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00	0.00 - 0.00
Type	Ground Water	Ground Water	Ground Water	Ground Water
Alkalinity as CaCO3	27-Jul-2022	27-Jul-2022	29-Jul-2022	27-Jul-2022
Ammonium Low	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022
Anions by Kone (w)	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022
BOD True Total	02-Aug-2022	02-Aug-2022	02-Aug-2022	02-Aug-2022
COD Unfiltered	01-Aug-2022	02-Aug-2022	01-Aug-2022	02-Aug-2022
Coliforms (W)	29-Jul-2022	29-Jul-2022	29-Jul-2022	29-Jul-2022
Colour Test	27-Jul-2022	27-Jul-2022	28-Jul-2022	27-Jul-2022
Dissolved Metals by ICP-MS	28-Jul-2022	28-Jul-2022	28-Jul-2022	28-Jul-2022
Mercury Dissolved	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022
Mercury Unfiltered	29-Jul-2022	29-Jul-2022	29-Jul-2022	29-Jul-2022
Nitrite by Kone (w)	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022
Phosphate by Kone (w)	27-Jul-2022	27-Jul-2022	27-Jul-2022	27-Jul-2022
Suspended Solids	29-Jul-2022	29-Jul-2022	29-Jul-2022	29-Jul-2022
Total Metals by ICP-MS	01-Aug-2022	01-Aug-2022	28-Jul-2022	01-Aug-2022

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Customer

Customer Services

ALS Life Sciences
Hawarden Business Park
Manor Lane
Hawarden, Deeside
UK
CH5 3US

Certificate Of Analysis

Job Number: 22-26985
Issue Number: 1
Report Date: 29 July 2022

Site: Minerex
PO Number: Not Supplied
Date Samples Received: 25/07/2022

Please find attached the results for the samples received at our laboratory on 25/07/2022.

Should you have any queries regarding the report or require any further services, we would be happy to discuss your requirements. For additional information about the company please log-on to our website at the above address.

Thank you for choosing City Analysts Limited. We look forward to assisting you again.

Authorised By: Aoife de Barra **Authorised Date:** 29 July 2022

Notes are not INAB accredited

Results relate only to the items tested.
Information on methods of analysis and uncertainty of measurement is available on request.
Any opinions or interpretations indicated are outside the scope of our INAB accreditation.

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Certificate Of Analysis

Customer

Customer Services

ALS Life Sciences
Hawarden Business Park
Manor Lane
Hawarden, Deeside
UK
CH5 3US

Report Reference: 22-26985

Report Version: 1

Site: Minerex

Sample Description: 3131-BH6C

Sample Type: Ground

Lab Reference Number: 663201

Date of Sampling: 22/07/2022

Date Sample Received: 25/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201	25/07/2022	Coliforms	< 1.0	MPN/100ml	-
D/D1201	25/07/2022	E.coli	< 1.0	MPN/100ml	-

Comments

Sampling date has been provided but is outside the recommended timeframe on receipt

The sampling time has not been communicated; time taken for analysis cannot be assessed.

Deviations from the standard testing conditions observed. Coli and E.coli Results are reported outside the specifications of the accredited method.

= INAB Accredited, U = UKAS Accredited, * = Subcontracted

Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
NAC & ATC - No abnormal change and acceptable to customers.
TVC - Total viable count
Site D = Analysed at City Analysts Dublin. Site S = Analysed at City Analysts Shannon

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Certificate Of Analysis

Customer

Customer Services

ALS Life Sciences
Hawarden Business Park
Manor Lane
Hawarden, Deeside
UK
CH5 3US

Report Reference: 22-26985

Report Version: 1

Site: Minerex

Sample Description: 3131-BH7C

Sample Type: Ground

Lab Reference Number: 663202

Date of Sampling: 22/07/2022

Date Sample Received: 25/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201	25/07/2022	Coliforms	4.1	MPN/100ml	-
D/D1201	25/07/2022	E.coli	< 1.0	MPN/100ml	-

Comments

Sampling date has been provided but is outside the recommended timeframe on receipt

The sampling time has not been communicated; time taken for analysis cannot be assessed.

Deviations from the standard testing conditions observed. Coli and E.coli Results are reported outside the specifications of the accredited method.

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Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
NAC & ATC - No abnormal change and acceptable to customers.
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Certificate Of Analysis

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Customer Services

ALS Life Sciences
Hawarden Business Park
Manor Lane
Hawarden, Deeside
UK
CH5 3US

Report Reference: 22-26985

Report Version: 1

Site: Minerex

Sample Description: 3131-SP1B

Sample Type: Ground

Lab Reference Number: 663203

Date of Sampling: 22/07/2022

Date Sample Received: 25/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201	25/07/2022	Coliforms	> 2419.6	MPN/100ml	-
D/D1201	25/07/2022	E.coli	69.1	MPN/100ml	-

Comments

Sampling date has been provided but is outside the recommended timeframe on receipt

The sampling time has not been communicated; time taken for analysis cannot be assessed.

Deviations from the standard testing conditions observed. Coli and E.coli Results are reported outside the specifications of the accredited method.

= INAB Accredited, U = UKAS Accredited, * = Subcontracted

Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
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NAC & ATC - No abnormal change and acceptable to customers.
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UK
CH5 3US

Report Reference: 22-26985

Report Version: 1

Site: Minerex

Sample Description: 3131-FW1B

Sample Type: Ground

Lab Reference Number: 663204

Date of Sampling: 22/07/2022

Date Sample Received: 25/07/2022

Site / Method Ref.	Analysis Start Date	Parameter	Result	Units	PV Value (Drinking Water Only)
D/D1201	25/07/2022	Coliforms	18.9	MPN/100ml	-
D/D1201	25/07/2022	E.coli	5.2	MPN/100ml	-

Comments

Sampling date has been provided but is outside the recommended timeframe on receipt

The sampling time has not been communicated; time taken for analysis cannot be assessed.

Deviations from the standard testing conditions observed. Coli and E.coli Results are reported outside the specifications of the accredited method.

= INAB Accredited, U = UKAS Accredited, * = Subcontracted

Note:
PV Value is the parametric value, taken from European Communities, (Drinking Water) Regulations, 2014. S.I. No. 122 of 2014 and relates only to drinking water samples.
For queries on results, please contact us within two weeks of the report date to ensure that we can accommodate your query as samples cannot be stored indefinitely.
NAC & ATC - No abnormal change and acceptable to customers.
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Site D = Analysed at City Analysts Dublin. Site S = Analysed at City Analysts Shannon

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials andd soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.