Padeswood Test Pumping Report

Prepared for Hanson UK Ltd

March 2023

CONFIDENTIAL

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Revision History

Revision	Details	Prepared by	Checked by	Approved by	Issue Date
REV01	Issue to NRW	JH	PH	PH	31/03/2023
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Contents

Figures

Tables

Appendices

1 INTRODUCTION

1.1 Background

Hanson UK Ltd ("Hanson") is developing a Carbon Capture & Storage (CCS) scheme at Padeswood Cement Works ("the Cement Works"). The scheme requires approximately 150m^3/hour, 3,600m^3/day, 1.3Mm^3/year of water for evaporative cooling. The Cement Works currently has two water supply boreholes targeting the Sherwood Sandstone aquifer at Kinnerton ("the Kinnerton boreholes"), located approximately 4.5km to the east. The location of the Cement Works and the Kinnerton Boreholes are shown on Figure 1.

Hanson hold two abstraction licences (Ref: 24/67/9/0137 and 24/67/9/0126) authorising them to abstract up to 60m^3/hour, 1,500m^3/day, 136,500m^3/year from the Kinnerton boreholes. Hanson would like to increase the volumes to supply the CCS scheme with enough water for evaporative cooling, in addition to some water for the cement works.

The Cement Works and the Kinnerton boreholes fall within the Dee catchment and water abstraction is regulated by Natural Resources Wales (NRW). Discussions with NRW, including a pre-application (Ref. WPCC12286 & WPCC12287) confirmed that up to 3.1Ml/day of water is available for consumptive abstraction within the Chester Block Groundwater Management Unit.

Following the submission of a Water Features Survey (WFS) (Envireau Water, 2022), Groundwater Investigation Consents (GIC) Ref. WA/067/0009/0001 and WA/067/0009/0002 were issued by Natural Resources Waters (NRW) in December 2022, authorising a test pumping programme to be undertaken on the two boreholes.

1.2 Scope of Work

Envireau Water was appointed by Hanson to design and oversee test pumping at the Kinnerton Boreholes, analyse the test pumping data to determine the sustainability of the proposed abstraction, and produce a test pumping report to support an application to NRW to increase the abstraction licence.

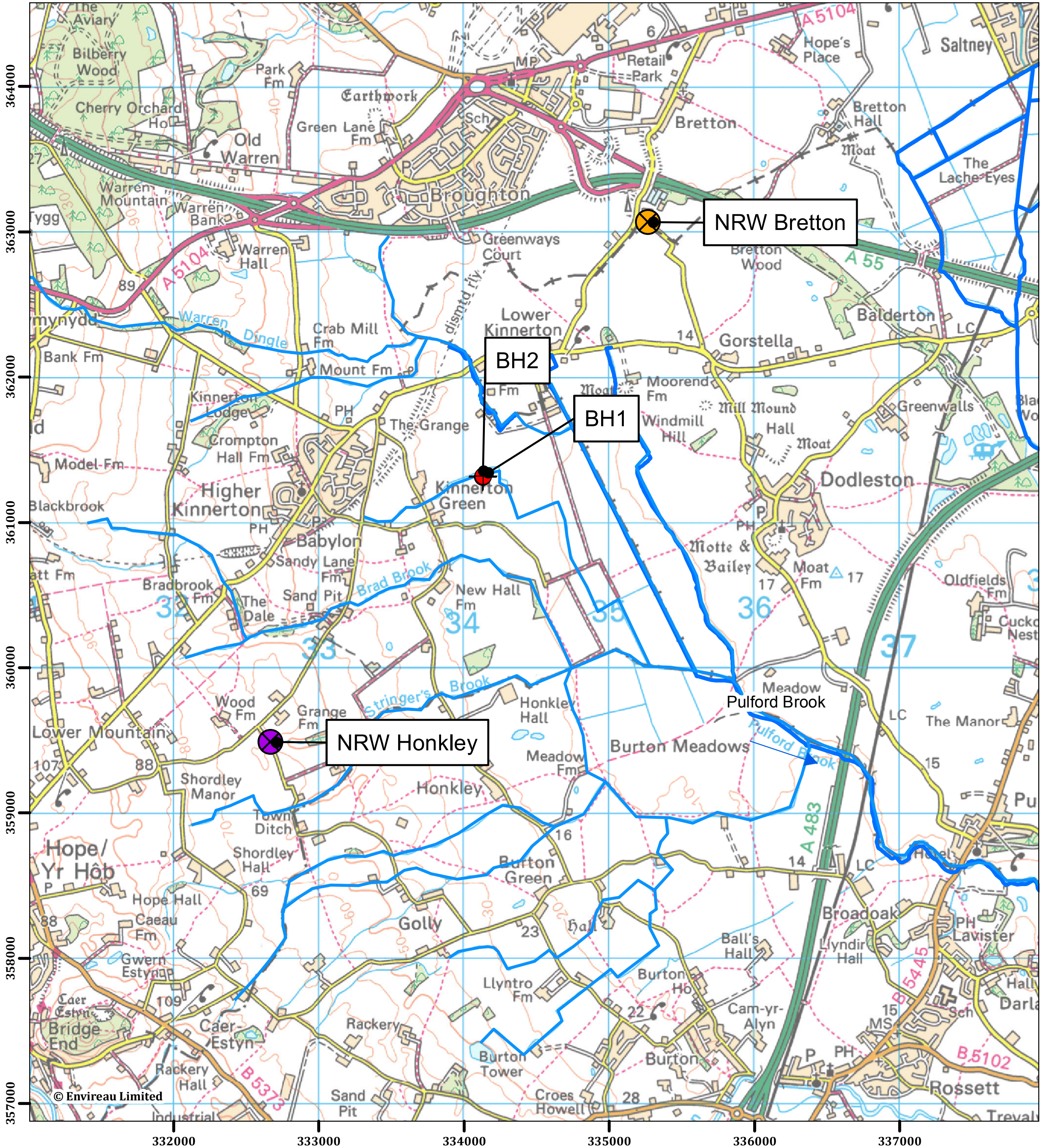
This report presents the findings from the groundwater investigation and includes:

- A review of the site setting, borehole construction details for the Kinnerton Boreholes, and details of the other boreholes used as monitoring points during the groundwater investigation;
- Presentation of a hydrogeological conceptual model based on a thorough understanding of the local hydrogeology gained through literature review and local hydrogeological investigations;
- A description of the groundwater investigation carried out, including interpretation and analysis of test pumping data, and validation of the conceptual model.
- An assessment of the hydrogeological impacts resulting from the proposed abstraction and the implications for abstraction licensing.

The above information is presented in this report to support an application to NRW to vary the two existing abstraction licences to authorise abstraction from the Kinnerton Boreholes at 165m^3/hr, 3,960m^3/day and 1,445,400m^3/year.

Figure 1: Site Location and Setting

Padeswood, Flintshire



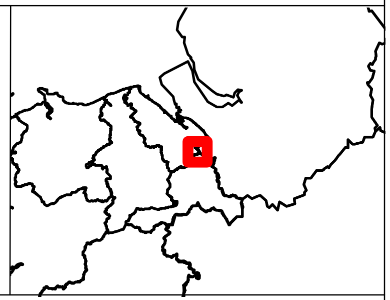
Kinnerton Abstraction Boreholes

- BH1 Licence Ref. 24/67/9/0137
- BH2 Licence Ref. 24/67/9/0126

Monitoring Locations

- NRW Bretton
- NRW Honkley
- Watercourses

Notes:



0 410 820 1,230 1,640 Meters

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29 March 2023

NGR: 334,484 E / 360,728 N

Project No. 3490192

Client: Hanson UK Ltd

Drawn by: JH

Ref: Site Setting

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2 BASELINE SETTING

2.1 Site Location and Description

2.1.1 The Kinnerton Boreholes

The Kinnerton boreholes are located at Kinnerton Green, 0.4km east of Higher Kinnerton, Flintshire (SJ34123 61316), at an elevation of approximately 20mAOD. The surrounding area is predominantly farmland and rural dwellings, with residential areas to the west in Higher Kinnerton. The boreholes are located approximately 500m southwest of the Welsh/English Border. The Site Location is shown on Figure 1.

The summary details of the two boreholes are presented in Table 1 below.

Table 1 Kinnerton Boreholes

Hanson Ref.	BGS Ref.*	Abstraction Licence	National Grid Reference	Year	Depth (m)	Diameter (mm)	Water Level	Geology	Target Aquifer
Borehole 1	SJ36SW11	24/67/9/0137	SJ 34123 61316	1945	106	203	Artesian	47m of glacial Till overlying Kinnerton Sandstone Formation	Sherwood Sandstone
Borehole 2	SJ36SW12	24/67/9/0126		1948	152	533	Artesian	41m of glacial Till overlying Kinnerton Sandstone Formation	

**the BGS references are incorrectly located, however they refer to these boreholes* (Envireau Water, 2022)

Both boreholes are constructed to target the Kinnerton Sandstone Formation, part of the Permo-Triassic Sherwood Sandstone Group. A geophysical survey was carried out on BH2 in July 2022 (Envireau Water, 2022), which showed that BH2 was cased to a depth of 42.5mbgl, beneath which the borehole is 'open hole'. The main inflow horizons in BH2 occurs between 45 and 105mbgl.

A schematic showing the construction of the Kinnerton Boreholes is presented in Figure 2.

2.1.2 Abstraction Licence

The two abstraction licences held by Hanson for the Kinnerton Boreholes (Ref: 24/67/9/0137 and 24/67/9/0126) were originally issued in 1968, and re-issued in July 2012. The licences have no end date.

The abstraction licences allow abstraction of 60m^3/hour, 1,500m^3/day, 136,500m^3/year from either of the two boreholes for the purpose of Manufacture of Cement – process and cooling.

2.1.3 Water Use

Hanson currently pump the water to the Cement Works where it is used in the process of making cement. The CCS scheme will use 150m^3/hour of water for evaporative cooling. The CCS has been designed to use air cooling where possible to minimise the amount of water usage. The manufacture of cement will use the remaining 15m^3/hour.

The proposed increase is to provide water for evaporative cooling at the proposed CCS plant. Both processes are consumptive and there will be no discharge of the abstracted water.

2.1.4 Nearby Abstractors

The following abstractors were identified within 4km of the Kinnerton Boreholes as part of a WFS (Envireau Water, 2022):

- Public Water supply boreholes operated by Dŵr Cymru Welsh Water (DCWW) at Gorstella and Bretton, 2.5km to the northeast. These boreholes target the Permo-Triassic Sherwood Sandstone Group, the same formation as the Kinnerton Boreholes.
- An agricultural borehole at Shordley Hall Farm, located 3.3km southwest of the Kinnerton Boreholes. This borehole targets the Millstone Grit Group, which is a different formation to the Kinnerton Boreholes.

Historically there were a number of private water supplies in the Kinnerton area. The WFS confirmed that these were abandoned in the 1950's / 1960's following the introduction of mains water to the local area.

2.2 Hydrology

The River Dee forms the regional, hydrological base. The Dee rises in the mountains of Snowdonia and flows north westward towards Wrexham before flowing north towards Chester and discharging into Liverpool Bay via the Dee estuary. The Dee is tidal downstream of Chester Weir and has been canalised. The Dee is located approximately 7km northeast of the Kinnerton Boreholes, at its closest point.

The closest surface water feature to the Kinnerton Boreholes is an unnamed tributary of Pulford Brook, which is located 50m north of the boreholes. The tributary forms part of a network of field drains that flow south-eastward, discharging to Pulford Brook and eventually into the River Dee, approximately 7km southeast of the Kinnerton Boreholes. These features are shown on Figure 1.

2.3 Geology

The geological setting at the Site and surrounding area has been characterised using information from BGS 1:50,000 scale map sheet 108 (Flint) (British Geological Survey, 1999), the online BGS GeoIndex mapping tool (British Geological Survey, 2022), BGS borehole records, the BGS Lexicon of Named Rock Units (British Geological Survey, 2020), and information from a geophysical survey of Borehole 2 in July 2022.

2.3.1 Regional Geology

The regional geological setting is indicated on Figure 3 and Figure 4. Much of the region is overlain by superficial deposits. Glacial Till dominates the superficial coverage, with zones of glaciofluvial sand and gravels and glaciolacustrine clay and silt deposits in the vicinity of the River Alyn, and the River Dee and its tributaries.

The bedrock geology of the region dips towards the east and is extensively faulted. There are two major N-S faults in the region, the Hawarden Fault in the east, and the Great Ewloe Fault in the west.

To the east of the Hawarden Fault (where the Kinnerton Boreholes are located), the Permo-Triassic Kinnerton Sandstone Formation is underlain by the Salop Formation (formerly the Erbistock Formation) and the Etruria Formation (formerly the Ruabon Marl Formation) of the Warwickshire Group (formerly the Red Measures) which is underlain by the Carboniferous Pennine Coal Measures Group.

In the region local to Penyffordd, the Hawarden Fault and Great Ewloe Fault have created a fault bound block with the Carboniferous Millstone Grit Group as the uppermost bedrock. In this region, the geology is complex but typically the Gwespyr Sandstone Formation is underlain by the Bowland Shale Formation (formerly the Holywell Shales Formation), which is in turn underlain by the Cefn-y-Fedw Sandstone Formation.

To the west of the Great Ewloe Fault, the Gwespyr Sandstone Formation is overlain by the Pennine Coal Measures Group.

2.3.2 Local Geology

The geology encountered by the Kinnerton Boreholes comprises between 41 - 47m of Glacial Till above the Permo-Triassic Kinnerton Sandstone Formation. The boreholes penetrate the top 60m of sandstone bedrock, with neither borehole proving the full thickness of the sandstone. A review of geological mapping and BGS data suggests the sandstone is up to 200m thick locally. The boreholes are located very close to mapped faults within the sandstone bedrock and the geological map suggests that, locally, the bedrock strata may dip at a shallow angle to the south.

The Hawarden Fault is located 1km west of the Site. The fault marks the boundary between the Kinnerton Sandstone Formation and the Carboniferous age Millstone Grit Group.

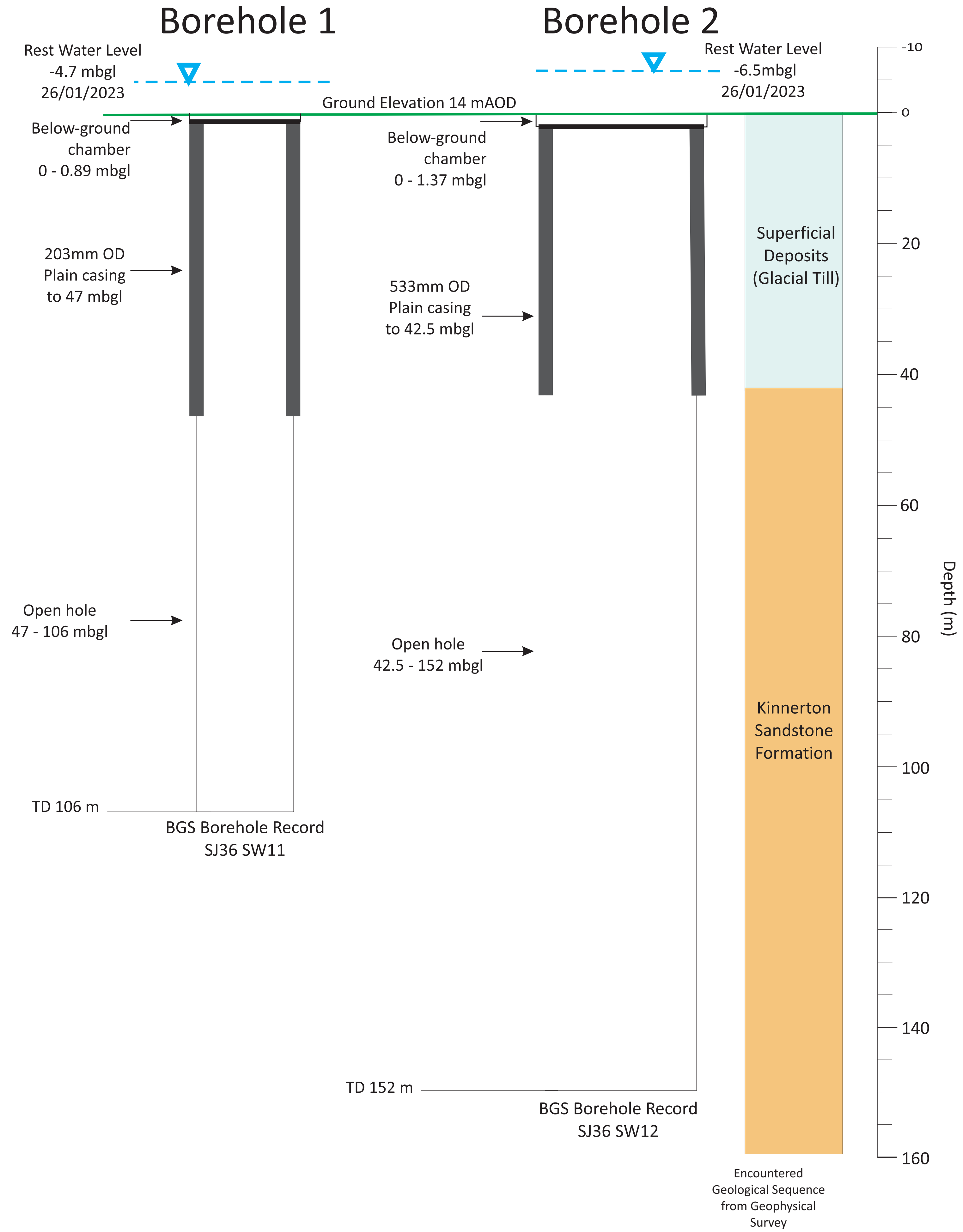

Figure 2: As-Built Borehole Construction - Borehole 1 and Borehole 2

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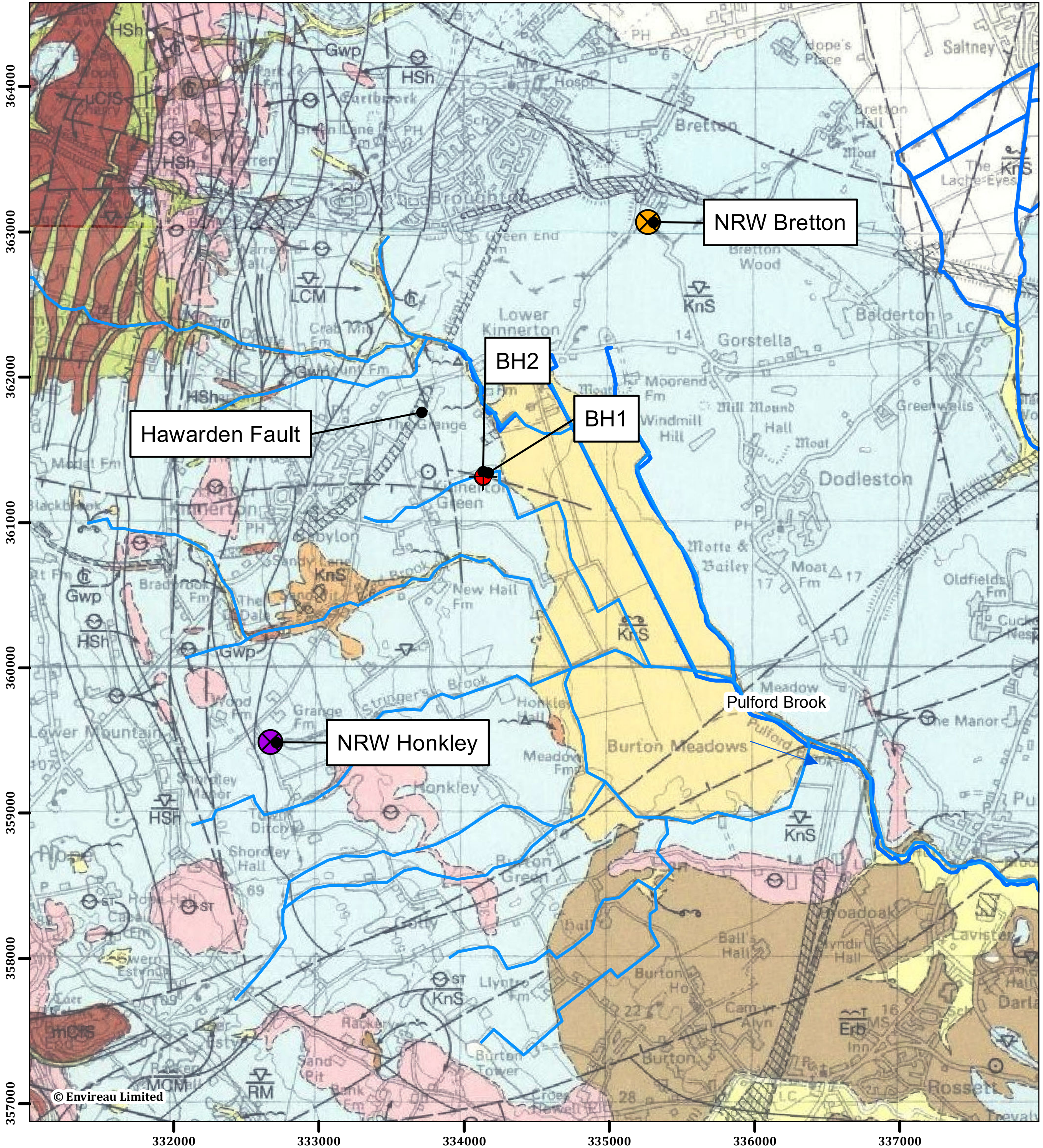


Figure 3: Superficial Deposits

Padeswood, Flintshire

Kinnerton Abstraction Boreholes

- BH1 Licence Ref. 24/67/9/0137
- BH2 Licence Ref. 24/67/9/0126

Monitoring Locations

- NRW Bretton
- NRW Honkley
- Watercourses

Linear Features

- Fault

** For bedrock geology key, see Figure 4*

Superficial Deposits

ARTIFICIAL DEPOSITS

- Made Ground on original ground surface
- Infilled Ground, former excavations which are either wholly or partially backfilled

DRIFT

QUATERNARY : PLEISTOCENE AND HOLOCENE

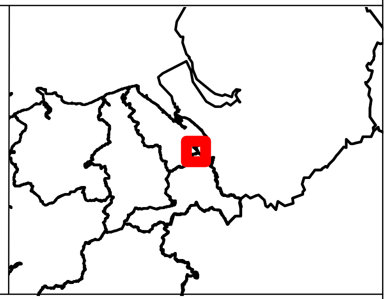
Postglacial Deposits

- Foundered Strata
- Landslip
- Blown Sand
- Tufa
- Peat
- Marine Deposits, undifferentiated, organic-rich clay, silt, sand and gravel
- Raised Marine Deposits, storm beach sand and gravel
- Lacustrine Deposits, organic-rich clay and silt
- Alluvium, gravels,sands and silty clays
- River Terrace Deposits, undifferentiated, sand and gravel
- Alluvial Fan Deposits, sand and gravel
- Older Alluvial Fan Deposits, sand and gravel
- Scree, angular gravel
- Head, gravelly and sandy clay

Glacial Deposits

- Glaciolacustrine deposits, silts and clays
- Glaciofluvial Ice Contact Deposits, sand and gravel
- Glaciofluvial Sheet and Glaciolacustrine Delta Deposits, sand and gravel
- Glaciofluvial Deposits undifferentiated, sand and gravel
- Till, stoney clay

Notes:



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Ref: Superficial Deposits

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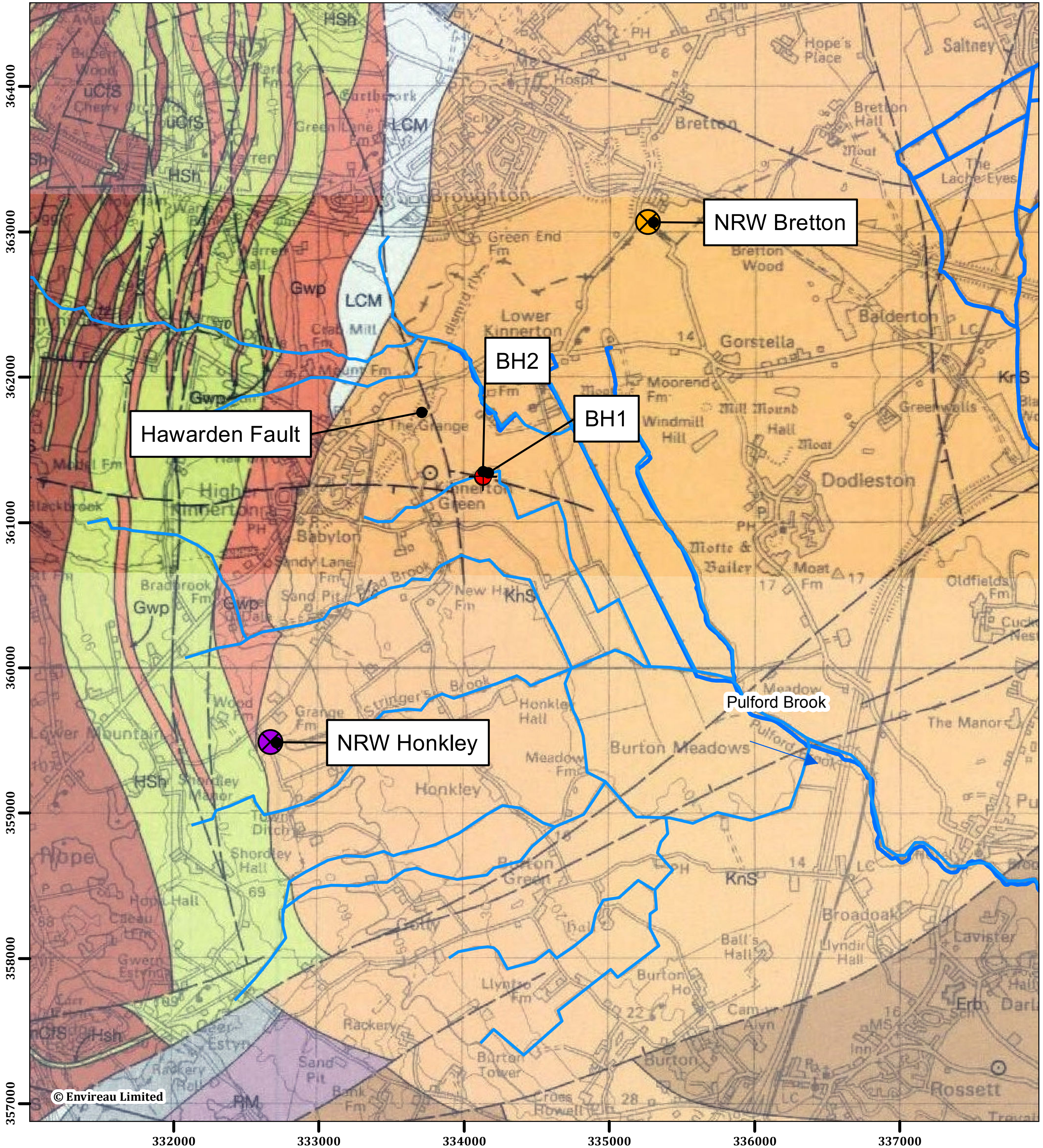
Figure 4: Bedrock Geology

Padeswood, Flintshire



Kinnerton Abstraction Boreholes

- BH1 Licence Ref. 24/67/9/0137
- BH2 Licence Ref. 24/67/9/0126

Monitoring Locations

- NRW Bretton
- NRW Honkley
- Watercourses

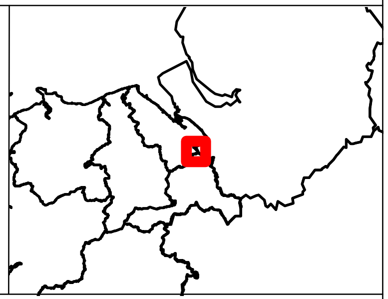
Bedrock Geology

Sherwood Sandstone Group	KnS	Kinnerton Sandstone Formation
Warickshire Group	Erb	Salop Formation *(formerly Erbistock Formation)*
	RM	Etruria Formation *(formerly Ruabon Marl Formation)*
Coal Measures	MCM	Middle Coal Measures
	Ho	Hollin Rock
	LCM	Lower Coal Measures
Millstone Grit Group	Gwp	Gwespyr Sandstone Formation
	Hsh	Bowland Shale Formation *(formerly Holywell Shales Formation)*
	CfS	Cefn-y-Fewd Sandstone Formation
		Namurian - Dinantian

Linear Features

- Fault

Notes:



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Drawn by: JH

Ref: Bedrock Geology

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2.4 Hydrogeology

The hydrogeological setting of the Site and surrounding area has been characterised based on the underlying geology and using information from the Environment Agency's Major Aquifers in England and Wales (NERC & Environment Agency, 2000) and Minor Aquifers in England and Wales (NERC & Environment Agency, 2000); together with historical data for the boreholes held by Hanson and information from a geophysical survey of BH 2 in July 2022 (Envireau Water, 2022).

In this case, the hydrogeology is dominated by the Kinnerton Sandstone Formation of the Permo-Triassic Sherwood Sandstone Group, which is designated as a Principal Aquifer (Department for Environment, Food and Rural Affairs, 2021). The Sherwood Sandstone is an important aquifer in north-east Wales and is used for public water supply and a variety of private uses.

2.4.1 Recharge and Flow

Flow through the Sherwood Sandstone is highly dependent on depth. In the upper portion of the aquifer, the sandstone is often heavily fractured resulting in fracture flow being the dominant flow mechanism. At depth, fractures are more rare and intergranular flow is more important. The geophysical survey of Borehole 2 confirms that the majority of inflow to the borehole occurs between 45 and 105m below ground level (bgl) and fissuring in the sandstone bedrock is a key flow mechanism.

Groundwater flow within the sandstone is primarily northwards, towards the sea. Recharge to the aquifer occurs on higher ground to the south, via downwards leakage where the superficial deposits are thinner. There are some small areas where the sandstone outcrops and recharge can occur via direct infiltration, for example to the southwest of the Kinnerton Boreholes. Faulting within the sandstone bedrock, as at Kinnerton, is likely to provide preferential flow and recharge pathways. The Hawarden Fault, which is located 1km west of the boreholes, marks the edge of the Sherwood Sandstone and acts a no-flow boundary.

The Kinnerton Boreholes are located on the western extent of the Sherwood Sandstone aquifer. At Kinnerton, the sandstone is overlain by more than 40m of low permeability glacial Till, which acts as a confining layer and provides hydraulic separation between surface water and groundwater systems. The Kinnerton Boreholes are artesian, with an observed pressure head of approximately 10m above ground level (30m AOD), which demonstrates the very low permeability of the superficial deposits.

2.4.2 Aquifer Properties

The Kinnerton Sandstone Formation falls within the description of the Permo-Triassic sandstones in Cheshire and South Lancashire (NERC & Environment Agency, 2000).

The hydraulic conductivity of the Sherwood Sandstone is largely controlled by the regional fracture connectivity. In regions where fractures are highly connected, the hydraulic conductivity will be high, and in regions with little fracture connectivity, the hydraulic conductivity will be low.

BGS hydraulic conductivity data for the sandstone ranges from 3.7×10^{-5} to 10m/d, with an interquartile range of 0.13 to 1.8m/d, a median of 0.8m/d and a geometric mean of 0.4m/d. BGS porosity data for the sandstone ranges from 13 to 32%, with an interquartile range of 23 to 27%, a median of 26%, and an arithmetic mean of 25%.

Transmissivity data obtained from 147 tests carried out on boreholes in the Sherwood Sandstone in the Cheshire region range from 0.9 – 4,900m^2/day, with an interquartile range of 120 to 530m^2/day, a median of 250m^2/day and a geometric mean of 220m^2/day. Fracture flow is a significant contributor to the higher values.

2.4.3 Aquifer Yield

The Sherwood Sandstone is a highly productive aquifer, with proven yields from boreholes commonly around 25 l/s. Again, fractures play a significant role in the yield of boreholes.

Specific capacity records at 29 sites in Cheshire and South Lancashire range from 6.8 to 1,500 m^3/d/m, with an interquartile range of 37 to 220 m^3/d/m. The median is 68 m^3/d/m and the geometric mean is 98 m^3/d/m. Specific capacity data show a general increase with transmissivity.

The Kinnerton Boreholes are licensed for a maximum hourly abstraction of 60m^3/hr but historical test pumping data from Hanson shows that the individual boreholes could deliver up to 150m^3/hr. Higher rates of abstraction could be achieved through pumping both boreholes. The impacts of pumping will comprise a reduction in groundwater levels locally but, in this hydrogeological setting, will not impact local resource availability and groundwater flow. BGS data from the Kinnerton Boreholes demonstrate a proven yield of approximately 75m^3/hr, 1,800 m^3/d, with a specific capacity of 115 m^3/d/m, which is consistent with the baseline data (Envireau Water, 2022).

BGS data suggests that the Welsh Water boreholes targeting the Permo-Triassic sandstones at Bretton/Gorstella, 2.5km to the northeast are less productive than the Kinnerton Boreholes, with a specific capacity of approximately 40 m^3/d/m. The difference may be attributed to geological faulting, and local differences in fracturing within the sandstone bedrock.

2.4.4 Groundwater Level

BGS data from the Kinnerton Boreholes shows that the groundwater level is artesian, with an estimated rest water level of 9m agl (Envireau Water, 2022). This equates to approximately 29m AOD.

2.5 Hydrogeological Conceptual Model

The hydrogeological conceptual model can be summarised as follows:

- The Kinnerton Boreholes target the Kinnerton Sandstone Formation, which is part of the Sherwood Sandstone Group, and is at least 200m thick at the Site.
- The Sherwood Sandstone Group is overlain ~47m of low permeability superficial deposits, which acts as a confining layer and provides hydraulic separation between groundwater in the sandstone bedrock and surface water features.

- Groundwater flow is predominantly to the north. Flow occurs as intergranular and fracture flow. At the Kinnerton Boreholes fissuring within the sandstone is a key flow mechanism.
- Recharge to the sandstone aquifer occurs where the formation outcrops, via infiltration through superficial deposits where they thin, and via fault induced pathways.
- Groundwater levels at the Kinnerton Boreholes are artesian.
- Historic test pumping data shows the Kinnerton Boreholes are capable of delivering at least $150m^3$/hr.

3 GROUNDWATER INVESTIGATIONS

3.1 Test Pumping Programme

A test pumping programme was caried out in accordance with the GICs (Ref. WA/067/0009/0001 and WA/067/0009/0002) to determine the maximum yield from the Kinnerton Boreholes and the longer-term impact and sustainability of abstraction. Table 2 summarises the details of the full test pumping programme.

Table 2 Test Pumping Programme

Event	Date/Period	Duration	Description
Start of groundwater level monitoring	12/12/2022 – 26/01/2023	46 days	Dataloggers installed at BH1 and BH2 recorded operational pumping.
Step Test & Recovery	26/01/2023	1 day	5 steps at rates of 117.1 m^3/hr, 136.7 m^3/hr, 159.1 m^3/hr, 175.4 m^3/hr, 168.63 m^3/hr. Steps 1 to 4 used BH2 only, step 5 included BH1. Maximum drawdown of 55.15m during the fifth step. Recovery to 68% within 30 minutes
Groundwater level monitoring	26/01/2023 – 30/01/2023	-	Groundwater level recorded by dataloggers in BH1 and BH2.
CRT	30/01/2023 – 03/02/2023	4 days	BH1 and BH2 pumped at a constant rate of 184 m^3/hr. Maximum drawdown of 49.48 m observed on 03/02/23
Recovery	03/02/2023 – 10/02/2023	7 Days	Recovery to 99% within 7 days.

3.2 Monitoring Locations

Monitoring locations during test pumping are shown on Figure 1 and summary details are provided in Table 3. A field verification exercise by Envireau Water showed that the DCWW boreholes at Bretton and Gorstella were not accessible for monitoring. Alternative locations were agreed with NRW. These included two NRW observation boreholes at the DWCC Bretton Treatment works and at Honkley. Both observation boreholes target the Kinnerton Sandstone.

Table 3 Test Pumping Monitoring Locations

Location	National Grid Reference	Monitoring Horizon	Borehole Depth (m)	Approx. Distance from Kinnerton Boreholes (km)
Borehole 1	SJ 34123 61316	Kinnerton Sandstone	106	0
Borehole 2	SJ 34123 61316	Kinnerton Sandstone	152	0
NRW Honkley	SJ 32669 59488	Kinnerton Sandstone	100	2.0
NRW Bretton	SJ 35267 63067	Kinnerton Sandstone	171	2.3

3.3 Summary of Data Collected

Water level data was collected at all monitoring locations using pressure transducers with automatic dataloggers installed in the boreholes, supplemented with manual readings.

Abstraction data was collected manually from flow meters installed on the discharge lines from BH 1 and BH 2.

3.4 Discharge During Testing

The water abstracted during the test pumping exercise was discharged to the unnamed tributary located north of the Kinnerton Boreholes (Figure 1). A small volume of water was also supplied to the cement works to maintain operations. There was no recirculation of water back into the aquifer.

4 ANALYSIS OF TEST PUMPING DATA

4.1 Hydrographs

A hydrograph showing the groundwater level data collected at all monitoring points for the duration of the monitoring period is presented in Figure 5. Hydrographs showing the groundwater level data collected during the Step Test and CRT at the Kinnerton Boreholes are presented on Figure 6 and Figure 7. Individual hydrographs showing the water level across the monitoring period for each monitoring location are presented in Appendix A.

4.2 Step Test

The step test was carried out on BH2 on 26/01/2023 and a hydrograph is presented as Figure 6. The first four steps were carried out with BH2 pumping alone. In the fifth step, BH1 was also pumped. A maximum drawdown of 55m was observed during Step 5 at a flow rate of 209m^3/hr (from both BH1 and BH2).

Analysis of the step test (see Appendix A) indicates that BH2 is capable of delivering between 160m^3/hr – 180m^3/hr, and at this rate approximately 37% of the drawdown in the borehole is due to well losses. This means the aquifer drawdown is much lower than reflected by the observed water level in the borehole.

BH1, which is a much smaller diameter than BH2, is capable of yielding up to ~50m^3/hr. This rate is controlled by the size of the pump that can be physically installed in the borehole and does not reflect the maximum possible yield.

4.3 Constant Rate Test (CRT)

The CRT commenced on 30/01/2023 for a period of 4 days at an average abstraction of 164m^3/hr. During the CRT water was abstracted from both BH1 and BH2. A hydrograph is presented on Figure 7. The water level reached a steady state on the second day of the test. The observed drawdown in BH2 at the end of the CRT was 49.48m, not accounting for well losses. The observed drawdown in BH1 at the end of the CRT was 46.72m. After the cessation of pumping, the water level recovered to 80% in BH2 and 85% in BH1 within 4.5 hours. Full recovery was reached by 10/02/23.

No drawdown was observed in the observation boreholes at Bretton and Honkley, showing that the abstraction had no impact at that distance. The hydrographs of the observation boreholes are shown on Figure 5.

The data shows that the boreholes can sustain a rate of 164m^3/hr, without dewatering the sandstone aquifer or impacting nearby abstractors.

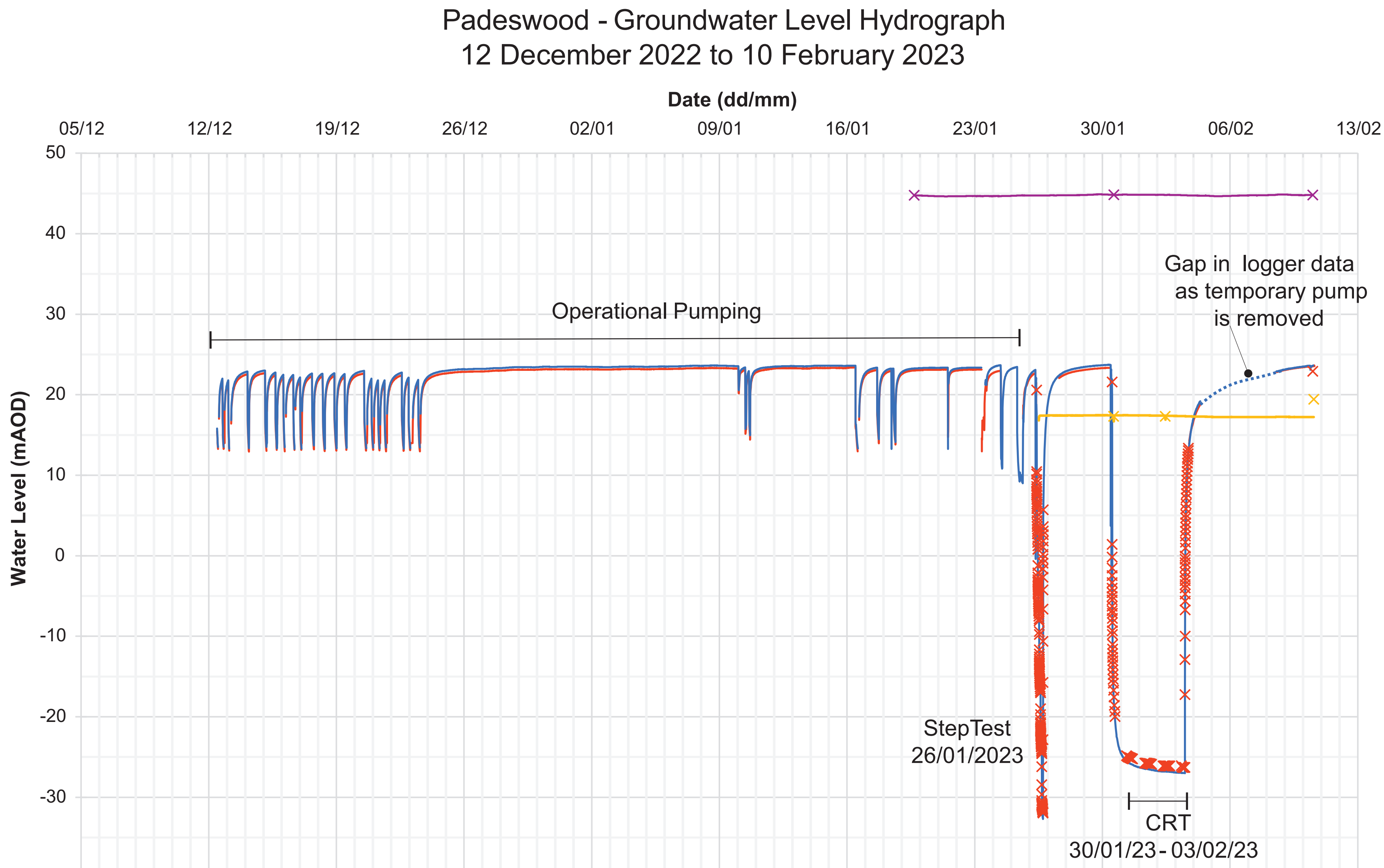

Figure 5: Groundwater Hydrograph - Monitoring Period

BH2 Manual Water Level (mAOD)
BH2 Logged Water Level (mAOD)
BH1 Logged Water Level (mAOD)
NRW Bretton OBH Logged Water Level (mAOD)
NRW Bretton OBH Manual Water Level (mAOD)
NRW Honkley OBH Logged Water Level (mAOD)
NRW Honkley Manual Water Level (mAOD)

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Client: Hanson UK Ltd.
Ref: Fig - Mon Hydrograph
Drawn by: JH

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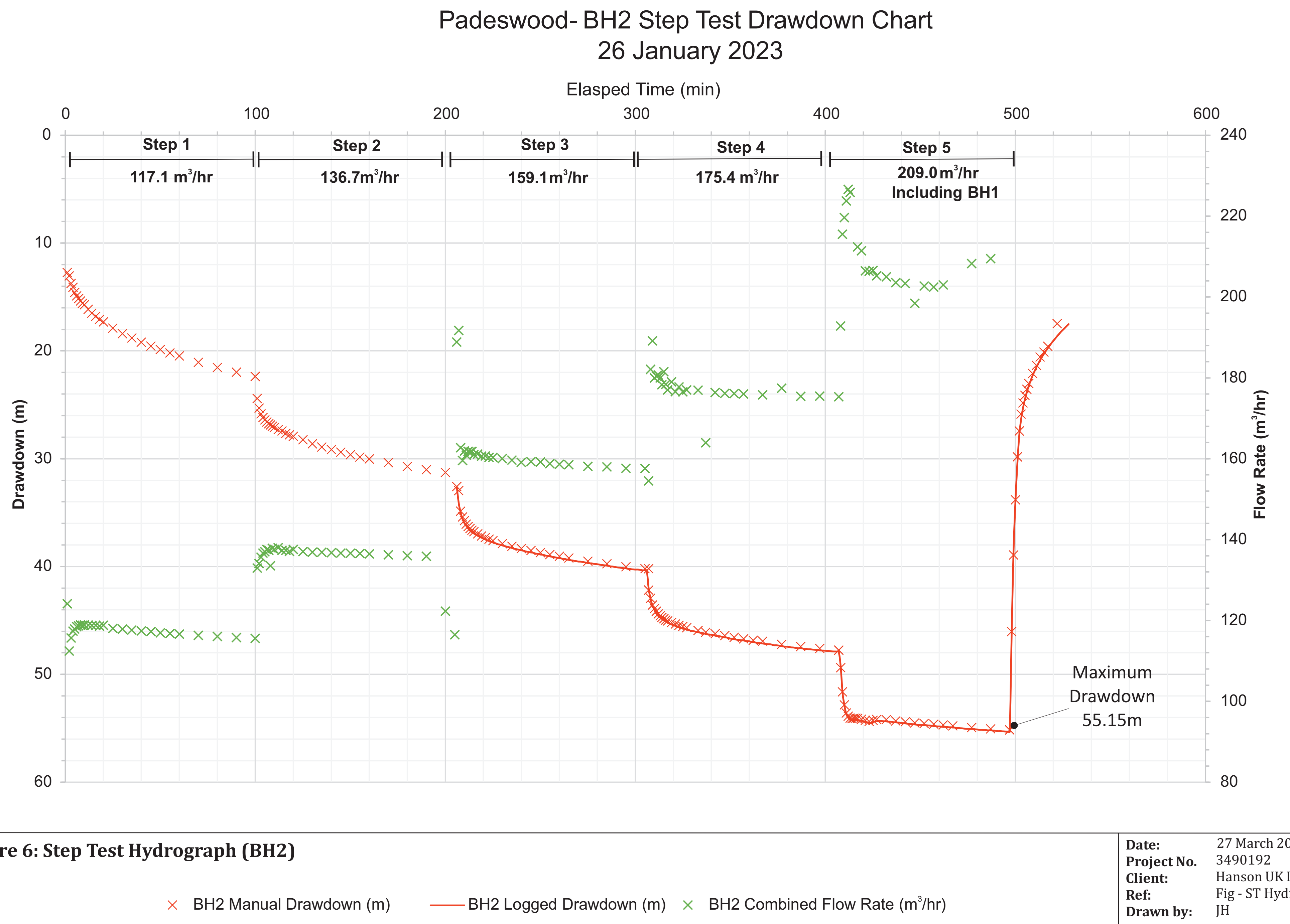

Figure 6: Step Test Hydrograph (BH2)

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Ref:	Fig - ST Hydrograph
Drawn by:	JH

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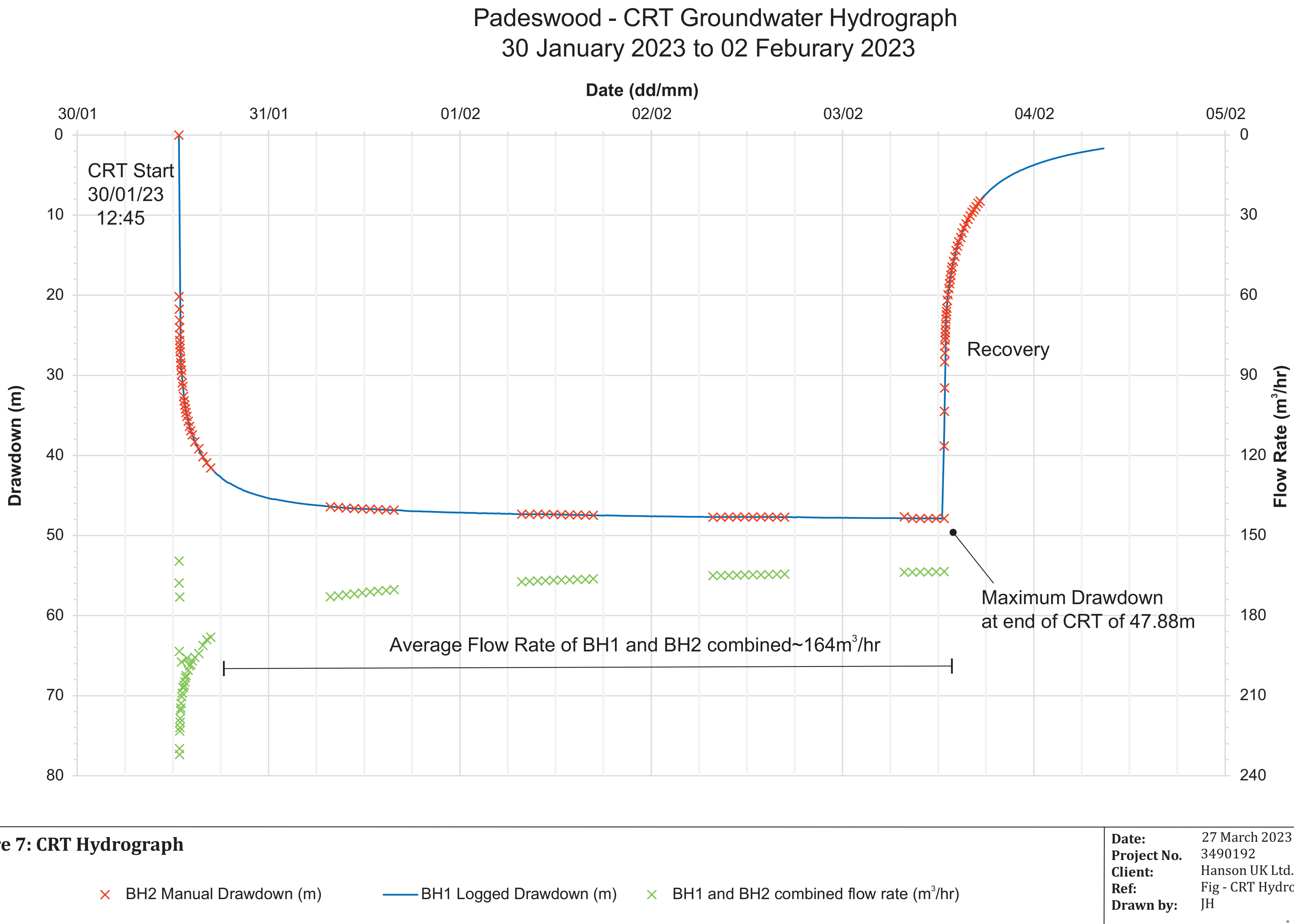

Figure 7: CRT Hydrograph

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Client: Hanson UK Ltd.
Ref: Fig - CRT Hydrograph
Drawn by: JH

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4.4 Aquifer Properties

The data collected during the CRT has been analysed using standard analytical techniques to calculate values for aquifer transmissivity. As all the observed drawdown is in the pumping wells, no storage values have been calculated. Data from the NRW observation boreholes at Bretton and Honkley have not been analysed due to showing no observable drawdown. The complete data analysis is presented in Appendix A.

Table 4 Aquifer Properties

Borehole	Analysis	Transmissivity (m^2/day)
BH1	Cooper Jacob	120.1
BH1	Theis Recovery	60.0
BH2	Cooper Jacob	70.6
BH2	Theis Recovery	80.0
Geometric Mean		*79.9*

The results in Table 4 are towards the lower end of the ranges presented in literature (Section 2.4).

5 DISCUSSION AND IMPACT ASSESSMENT

Hanson are applying for a variation to their existing abstraction licences (Ref: 24/67/9/0137 and 24/67/9/0126) to increase abstraction to 165m^3/hr, 3,960m^3/day and 1,445,400m^3/year from the Kinnerton Boreholes. This will supply the extra water requirement for the cooling processes of a CCS scheme at their Castle Cement works. The proposed increase in abstraction is from the Kinnerton Sandstone.

Test pumping exercises carried out on the Kinnerton Boreholes have shown that the Kinnerton Boreholes are capable of supporting a combined abstraction of 164m^3/day, without any observable impact to two observation boreholes located over 2km to the NE and SW of the Kinnerton Boreholes. The increase in abstraction will not impact the DCWW boreholes at Bretton or Gorstella.

The Kinnerton Boreholes are disconnected from the surface by ~47m of low permeability superficial deposits. There is no hydraulic connection between the Sherwood Sandstone aquifer and surface water features at this location. The increase in abstraction will not impact local water resources.

Discussions with NRW confirmed that up to 3.1Ml/d (3,100m^3/day) of water is available to be licensed for new consumptive abstraction within the Chester Block Groundwater Management Unit. The proposed increase to the abstraction volumes from the Kinnerton Boreholes is an additional 2,460m^3/day of water above the current licenced volume, and within the limit of water that is available for new consumptive abstraction.

On this basis, the existing abstraction licences for the Kinnerton Boreholes should be varied as follows:

- An increase in the licenced abstraction volume to 165m^3/hr, 3,960m^3/day and 1,445,400m^3/year from the two boreholes.
- A change in the usage of the abstracted water to include evaporative cooling at the CCS scheme.

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APPENDICES

Appendix A Electronic Appendix