TECHNICAL NOTE

Project name	Wroughton Closed Landfill		
Title	Summary Controlled Waters Risk Assessment		
Document reference	12248-HYD-XX-XX-TN-GE-1001	**Status / Revision**	S2 P01
Client	The Hills Group Ltd.		
Authors	Matthew Keehn BSc (Hons) CEnv MIEnvSc		
Date	11 August 2022	**Approved**	✓

1. INTRODUCTION

In July 2022, Hydrock Consultants Ltd. (Hydrock) were commissioned by The Hills Group Ltd. (the Client) to prepare a summary Controlled Waters Risk Assessment to support the proposed development of the Wroughton Closed Landfill in Wroughton, near Swindon (the 'site').

The works detailed herein have been undertaken in accordance with Hydrock's fee proposal (email dated 11 July 2022) and the Client's emailed instruction to proceed (dated 12 July 2022).

1.1 Background

The site is located in the large village of Wroughton, near Swindon and comprises:

- a closed landfill in the north (hereafter referred to as the 'Former Landfill Area'); and
- two undeveloped fields in the south (hereafter referred to as the 'Greenfield Area').

A Site Location Plan (Ref: 11229-G016 (Rev C), dated 5 May 2022) is presented in Annex A.

The proposed development is presented on the Proposed Site Layout Plan (Ref: 50467 P1-01 [Rev L], dated 4 February 2022) in Annex A and comprises residential housing, public open space (POS), including a cricket pitch and a pavilion, supporting infrastructure and a new access road off the A4361 Swindon Road to the east.

An extensive enabling works phase comprising significant earthworks will be required to create the development platform, and will involve the excavation, processing and re-use of site-won materials, including both landfill wastes and naturally occurring materials. The re-use of landfill waste materials on land (i.e., 'waste recovery') requires an Environment Agency Deposit for Recovery permit. In support of the permit application, a tiered Controlled Waters Risk Assessment is required to determine the level of risk posed to Controlled Waters from the proposed development works.

1.2 Previous works

Multiple phases of ground investigation, monitoring and risk assessment have historically been completed by Hydrock across the site, including with respect to Controlled Waters. The notable technical reports are below.

1. Hydrock. Surface Water Monitoring. Ref: R/08180/003, dated 6 October 2009.
2. Hydrock. Updated Ground Conditions. Ref: R/11229/003/03 (P03), dated 27 April 2020.
3. Hydrock. Supplementary Ground Investigation. Ref: 02753-HYD-XX-XX-TN-GE-1001 (P02), dated 11 August 2022.

In addition, the Client has undertaken surface water monitoring of the perimeter drains and the outfall on the Former Landfill Area over the period May 2017 to May 2022 (Client provided report presented as Annex B).

The relevant data from the above works have been collated into a single technical note (i.e., this document) for ease and to ensure that the Controlled Waters Risk Assessment is undertaken in broad accordance with the GOV.UK (2021) guidance on Waste Recovery Plans and Deposit for Recovery permits. The full reports listed above should be read in conjunction with this technical note, however, relevant summarises are provided.

1.3 Objectives

The works have been commissioned to support the design of the proposed development, specifically in aid of the proposed materials movement strategy across the site. The objective of the Controlled Waters Risk Assessment is to present the most up to date Ground Model for the site and determine the level of risk posed to Controlled Waters from the proposed development works.

1.4 Regulatory context and guidance

The works presented herein are written in broad accordance with the Environment Agency's (2021) Land Contamination Risk Management, and also the GOV.UK (2021) guidance on Deposit for Recovery permits.

The methods used follow a risk-based approach, the first stage of which is development of the Ground Model for the site with the potential geo-environmental risk initially assessed qualitatively using the 'source-pathway-receptor contaminant linkage' concept (Section 2).

The second stage comprises quantitative risk assessment using the analytical data collected during the multiple phases of investigation and monitoring that have been undertaken. Professional judgement is then used to evaluate the findings of the risk assessments and to provide recommendations for the development (Section 3).

2. GROUND MODEL

2.1 Site description

The site is accessed via a track off Swindon Road to the east. The site is closed off by fencing and a locked gate but it is believed the site is used by the local residents as an informal recreation area for dog walking.

The Former Landfill Area has been built up by the process of landfilling, evident by its raised topography and sloping nature of its northern, western and southern flanks. The centre of the site lies at approximately 113 m above Ordnance Datum (AOD), with the base of the northern and western slopes approximately 104 m AOD.

The Greenfield Area comprises two open fields sloping from 109 m AOD in the east to 104 m AOD in the west.

2.2 Site history

The Former Landfill Area was historically used for the excavation of clay from pits excavated into the underlying natural geology of the Kimmeridge Clay Formation (the 'Kimmeridge Clay'). This was followed by the landfilling of wastes that were deposited into the unlined former clay pits.

Historical documents and records reviewed as part of the historical ground investigations refer to the landfilling of the following types of waste streams within the Former Landfill Area.

- The 'deep pit' in the south eastern corner as filled by 1955-56 with 'clay, rubble, etc.'.
- A central spine filled with 'hardcore' as a haul road.
- To the north of the haul road a 1971 memo records that the then local authority deposited domestic and household refuse on old clay workings and marshland to a thickness of 2.5-2.7m.
- An area south of the haul road and immediately to the west of the deep pit is reported to have been used from 1966 for landfilling of 'excavated muck, general waste, rubble and container waste'.

- Post-1972 landfilling shall be 'of inert materials only and no domestic refuse, industrial waste or toxic materials shall be deposited on the site' and that 'upon completion of tipping operations the whole area shall be covered with a minimum of 0.3 m of topsoil sufficient to sustain plant growth'.
- A waste disposal licence (dated 1977) lists the waste types as (a) 'waste produced in the course of constructing, improving, repairing or demolishing any building or structure provided it does not contain any hazardous quantity or concentration of poisonous, noxious or polluting substance' and (b) 'excavated material in its natural state'. Asbestos was allowed provided it was immediately covered.
- Wiltshire Council archive records indicates that the waste disposal licence was surrendered on 24 February 1993 and 2,000 m^3 of topsoil was required to complete the reprofiling works.
- The GroundSure database report lists a licence (dated 1977) for inert, industrial, household and liquid sludge wastes. The report also records that surrender was actually on 24 February 1994.

The extents and associated dates of the landfilling that has historically been undertaken at the site are summarised on the Extent of Fill (from Aerial Photos) drawing (Ref: 11229-G021, dated 15 December 2014) in Annex A.

The Greenfield Area has been undeveloped open fields since the earliest mapping up to the present day.

2.3 Ground Conditions

The published Solid Geology for the site is the Kimmeridge Clay, which is an over-consolidated claystone sequence with subsidiary limestone or clayey limestone bands. Stress relief and weathering near the surface produce a profile of stiff clay becoming softer closer to the surface. There are no records of significant Superficial Deposits on site or the surrounding area.

Landfilling within the Former Landfill Area was recorded to have occurred at the site from the 1950s through to the late 1980s. Both domestic and commercial waste streams were historically landfilled but the exact nature is likely to be variable in composition and depth with the deepest fill known to be in the former brick pits.

2.3.1 As proven during ground investigation

The collated Ground Models for the Former Landfill Area and Greenfield Area are presented in Table 2.1.

Table 2.1 Summary of ground conditions

Stratum		Depth to top (m bgl) (range)	Depth to base (m bgl) (range)	Thickness (m) (range)	Thickness (m) (average)
Former Landfill Area					
Topsoil		0.0	0.05 - 0.4	0.05 - 0.4	0.2
Capping Layer		0.05 - 0.4	0.3 - 2.4	0.2 - 2.3	0.8
Recent Construction Waste		0.05 - 1.5	0.45 - 6.8	0.8 - 5.6	2.8
Pits Backfill	Landfill Waste	0.15 - 5.5	1.45 - 10	0.55 - 8	3.7
	Reworked Site-Won Material	2.2 - 6.2	3.5 - 7.1	0.6 - 1.5	1.0
Kimmeridge Clay Formation		0.8 - 10.0	3.0 - 13.0	Not proven	Not proven
Greenfield Area					
Topsoil		0.0	0.3	0.3	0.3
Kimmeridge Clay Formation		0.3	3.0 - 3.1	Not proven	Not proven

The interpreted ground conditions encountered across the Former Landfill Area to date are summarised below (from shallowest to deepest).

- Topsoil: comprising brown sandy organic clay encountered to a maximum proven depth of 0.4 m below ground level (bgl).

- **Capping Layer:** a cohesive landfill cap predominantly comprising brown silty clay with occasional brick and concrete encountered to a maximum depth of 2.4 m bgl.
- The more recent waste stream deposited between 1974 and license surrender in the early-1990s.
  - **Recent Construction Waste:** comprising a variable material of brown to grey sandy gravelly clay or clayey gravelly sand, typically with fragments of brick and concrete, occasional metal, plastic and wood, and rare asbestos. Encountered to a maximum proven depth of 6.8 m bgl.
- The oldest waste streams collectively referred to as 'Pits Backfill' (deposited prior to 1974), which can be subdivided.
  - **Landfill Waste:** comprising a variable material of grey-black sandy gravelly clay or clayey gravelly sand, including significant anthropogenic materials (e.g., brick, concrete, ash, metal, plastic, wood, textiles, glass, ceramic and asbestos). Encountered to a maximum proven depth of 10.0 m bgl.
  - **Reworked Site-Won Material:** comprising blue-grey (almost back) silty clay, with occasional gravel of brick and concrete, and pockets of peat. Encountered to a maximum proven depth of 7.1 m bgl.
- **Kimmeridge Clay:** comprising stiff brown grey and yellow silty clay. Encountered to a maximum proven depth of 13.0 m bgl.

The ground conditions across the Greenfield Area are summarised below (from shallowest to deepest).

- **Topsoil:** comprising brown sandy organic clay encountered to a maximum proven depth of 0.3 m bgl.
- **Kimmeridge Clay:** comprising firm to stiff yellowish-brown mottled orange silty clay (moderately weathered) to maximum proven depth of 2.2 m bgl, overlying stiff brown grey and yellow silty clay (slightly weathered / unweathered) to maximum proven depth of 3.1 m bgl.

2.3.2 Site zonation

The distribution of the different deposits identified across the Former Landfill Area is very heterogeneous at the small scale (i.e., of the order of metres) but appears to be similar at the larger scale (i.e., distinct areas of the site). The site has been characterised into three separate zones explaining the spatial distribution and sequence of the ground conditions present on site. These are presented on the Zonation Plan drawing (Ref: 11229-G018 Rev E, dated 10 October 2019) in Annex A. Three distinct areas have been classified, as summarised below.

- **Area A:** Greenfield Area, comprising natural topsoil and subsoil only.
- **Area B:** Recent Construction Waste deposits, comprising (shallowest to deepest):
  - Topsoil, Capping Layer, Recent Construction Waste, and Kimmeridge Clay.
- **Area C:** Landfill Waste, comprising (shallowest to deepest):
  - Topsoil, Capping Layer, Recent Construction Waste, Landfill Waste, Reworked Site-Won Materials, and Kimmeridge Clay.

The distinct Capping Layer has been encountered across the footprint of the Former Landfill Area and is interpreted as being the final cohesive cap. The material is largely free of the significant anthropogenic waste materials (i.e., ash, metal, textiles, glass, asbestos, etc.) that are encountered in the underlying waste deposits.

2.4 Hydrology and hydrogeology

The Kimmeridge Clay is dominated by low permeability clay and the Environment Agency designate the formation as ‘unproductive’ (i.e., there is no classified groundwater body beneath the site). The Kimmeridge Clay has a very low hydraulic conductivity and for all practical purposes is considered impermeable. The nearest recorded groundwater abstraction licences are a domestic supply approximately 1,400 m to the southeast and a public water supply 1,700 m to the south. The site is not within 500 m of a Source Protection Zone.

There is no engineered containment of the landfilled materials, nor does the former landfill contain any engineered drainage layer, therefore, a proportion of the rain will infiltrate the cover and become leachate on contact with the underlying waste materials. This is not technically considered to be a 'groundwater' body but instead can be considered as 'perched water' confined within the excavations created by the former clay pits.

The site is bordered to the north and west by drainage ditches, with the ditch along the western boundary known as the Wroughton Ditch. This flows northwards to its confluence with the Wroughton Brook approximately 1,300 m downstream and eventually the River Ray. There are no licensed surface water abstractions within 1,000m of the site.

2.4.1 Perched water flow

Perched water will accumulate within the waste deposits in the former clay pits, mainly from infiltration of rainwater, plus a very small proportion from biodegradation of the relatively low percentage of putrescible material. Significantly, water will not enter the Kimmeridge Clay, but will gradually fill the pore spaces within the waste materials until the water level reaches the lowest lip of the former clay pits from where it will flow out into the surrounding surface water system. This is evidenced by ochreous leachate outbreaks within the drainage ditches that flank the Former Landfill Area.

The perched water levels within the waste deposits indicate a general flow direction towards the northwest. The perched water contours from the monitoring undertaken on 15 February 2018 are presented on the Perched Water (Leachate) Contours drawing (Ref: C11229-GO39, dated 8 October 2019) in Annex A. The perched water flows towards the northwest and seeps out into the drainage ditches, notably along the northern and western perimeters.

2.4.2 Engineered reed bed

Following identification of the ochreous leachate outbreaks in the drainage ditches, Hydrock undertook a Controlled Waters risk assessment using both historical leachate and surface water data, and also additional data from sampling undertaken along the surface water network at locations agreed with Swindon Borough Council (SBC). The findings are presented within the Hydrock Surface Water Monitoring report (Ref: R/08180/003, dated 6 October 2009).

The raw leachate within the Former Landfill Area recorded several exceedances of the Water Quality Targets (WQT) derived for the protection of inland aquatic ecosystems (i.e., Environmental Quality Standards [EQS]), including several heavy metals, ammoniacal nitrogen and chloride. The former landfill operated on the dilute and disperse principle and since the surface water within the perimeter drains only recorded EQS exceedances of iron and ammoniacal nitrogen, the containment provided by the Kimmeridge Clay was considered to be providing a good level of protection to the surface water environment. In addition, the ammoniacal nitrogen exceedances were also consistent with general background concentrations of unknown origin (possibly agricultural). However, since minor pollution of Controlled Waters was occurring, SBC stated that corrective action was required. The construction of an engineered reed bed was recommended (in line with the Environment Agency's stated preference).

The engineered reed bed was constructed in 2012, with subsequent improvements made in 2017 and 2019. The reed bed is detailed on the Brunel Surveys Reed Bed Construction Details drawing (Ref: WR/RB/007A, dated 19 March 2017) in Annex A. The reed bed is maintained by Hills Waste Solutions Ltd. (Hills Waste) in accordance with an environmental permit (Ref: EPR/JP3120XW, determined 25 November 2011) (the 'Discharge Consent').

The surface water within the perimeter drainage ditches flows towards the northwest corner where it is now treated by passing through the engineered reed bed facility prior to flowing off site. Hills Waste undertake

regular monitoring and sampling of the surface water network across the site, including upstream of the reed bed, at the outlet of the reed bed and downstream of the reed bed. The samples are analysed for the contaminants listed within the Discharge Consent and compared against the consented limits. The data have been provided to Hydrock for use in the Controlled Waters risk assessment in Section 3. The original Hills Waste report is provided in Annex B.

3. CONTROLLED WATERS RISK ASSESSMENT

Surface water monitoring data collected post-construction of the engineered reed bed are assessed hereafter. In addition, historical data for the upstream sampling location SW1 are also presented to indicate likely background concentrations. The assessment also considers the impact of the proposed development on the surface water regime across the site. In addition, whilst not explicitly related to the protection of Controlled Waters, potential risks to human health that arise from the identified leachate outbreaks are also considered.

3.1 Exposure model rationale

The pollutant linkage with respect to Controlled Waters is based on the below scenario.

- **Source:** Landfilled waste within the Former Landfill Area, comprising household and construction waste.
- **Pathway:** Leachate outbreaks into the perimeter drains along the western and northern boundaries of the site with elevated concentrations of iron and ammoniacal nitrogen.
- **Receptor:** The Wroughton Ditch, which flows along the western boundary, through an engineered reed bed in the northwest of the site and eventually discharges into the Wroughton Brook then River Ray.

3.2 Water quality targets

Future groundwater abstraction from beneath the site or the surrounding area is considered extremely unlikely due to the impermeable nature and unproductive designation of the Kimmeridge Clay. As the receptor is the Wroughton Ditch, the data are compared against EQS and/or the Discharge Consent limits for the engineered reed bed only. However, Drinking Water Standards are still considered as part of the next step in Section 3.6.

The inland waters EQS for copper, lead, nickel and zinc are based on the bioavailable fraction and so the M-BAT software tool (WFD-UKTAG, dated July 2014) has been used to calculate site-specific Predicted No Effect Concentrations $(PNEC)_{dissolved}$, which have been used as the EQS for comparison against measured dissolved metal concentrations and consider the calculated bioavailable fraction. The calculation of the PNEC has used historical surface water data from the upstream sampling location SW1, however, due to the absence of a dissolved organic carbon concentration (DOC) from this location, an average DOC has been taken from the River Ray (the ultimate receiving water body) using the Environment Agency's online Water Quality Archive. All information used to calculate the PNEC is presented in Annex D.

In some instances, the reporting limit (or detection limit) quoted by the laboratory may be greater than the WQT that it is being assessed against. As the current exercise is an initial screening assessment, further assessment of these elements has not been undertaken.

3.3 Surface water assessment locations

The surface water assessment locations are presented on Figure 3.1 and comprise:

- **SW1:** upstream of Former Landfill Area;
- **SW5 & SW6:** upstream of engineered reed bed;
- **Outlet:** discharge point of engineered reed bed; and
- **SW7 & SW9:** downstream of engineered reed bed.

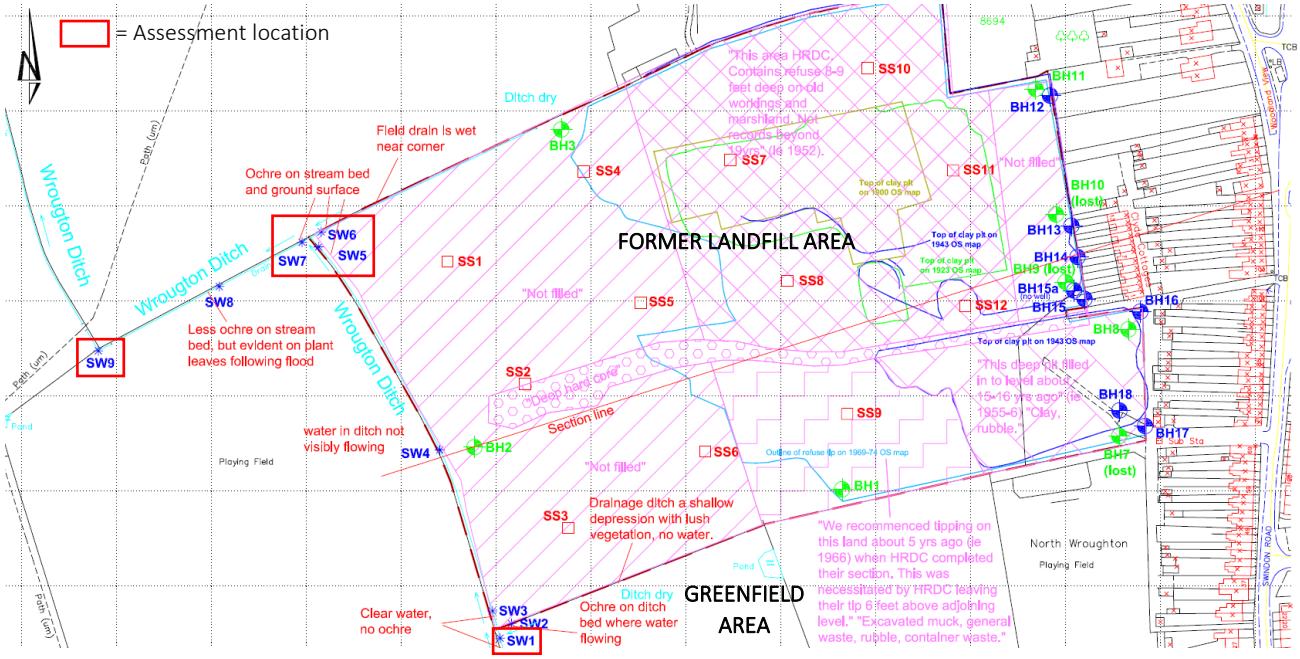


Figure 3.1: Surface water assessment locations (source: historical Hydrock exploratory hole location plan dated 2008)

3.4 Analytical data

The Discharge Consent requires analytical testing for pH, ammonia nitrogen, iron (total) and suspended solids. As the raw leachate from the waste streams within the former landfill has been proven to have elevated metals and chloride in excess of the EQS, the Hills Waste report includes additional data for cadmium, iron (dissolved), lead and chloride. These additional determinands have been compared against EQS for completeness.

3.5 Assessment findings

The results of the screening assessment are presented in Annex D. Several exceedances of the EQS or Discharge Consent values are recorded at locations SW5 and SW6 (i.e., downstream of the western perimeter of the Former Landfill Area but immediately prior to entering the engineered reed bed). Notable exceedances include ammoniacal nitrogen, iron (dissolved) (EQS only), iron (total) and suspended solids. However, following treatment through the reed bed, no exceedances are recorded at the outlet location with the exception of rare suspended solids (4 exceedances out of 19 samples).

The most recent sampling visit in May 2022 was undertaken when there was no flow out of the reed bed outlet, therefore, suspended solids may have been elevated as the depth of water was low and/or solids were yet to fully settle prior to actually discharging from the system (see Hills Waste report for more information). This may also explain the other three historical exceedances that were recorded at similar periods of the calendar year and when flow may have been low/not occurring.

Further downstream of the engineered reed bed, rare exceedances of ammoniacal nitrogen and suspended solids have been recorded at locations SW7 and SW9 pre-2019. However, in 2017 and 2019 maintenance works were undertaken on the reed bed, including increasing the area of reeds (2017) and vegetation clearance/ replacement of some reeds (2019), and no significant exceedances have occurred following these works.

Based on multiple lines of evidence, including the Ground Model (i.e., perched water in an impermeable clay excavation), the raw leachate analytical data and the surface water monitoring data (pre- and post-engineered reed bed), the containment that is being provided by the Kimmeridge Clay followed by the polishing through the

engineered reed bed is providing a good level of protection to the receptor. Provided the reed bed continues operation in accordance with the environmental permit, the risk to Controlled Waters is considered to be low.

3.6 Impact of proposed development

The potential impact of the proposed development works on the surface water regime has also been evaluated.

3.6.1 Earthworks proposals

The proposed earthworks to create the development platform require the raising of ground levels in the Greenfield Area to ensure that the drainage scheme across the site is suitable. The existing earthworks proposals include the cutting of the Capping Layer material from the Former Landfill Area and moving it to raise levels across the Greenfield Area (the cut on the Former Landfill Area will subsequently be replaced with the installation/reinstatement of a clean cover system). The Capping Layer soil has extensively been shown to be free of elevated concentrations of contaminants from a human health and plant life perspective (as reported in the Hydrock Supplementary Ground Investigation note [Ref: 02753-HYD-XX-XX-TN-GE-1001 [P02], dated 11 August 2022]), and leachate testing has now also been undertaken to evaluate the risk to Controlled Waters.

Six samples of Capping Layer soils from the Former Landfill Area have been subjected to leachate testing for the contaminants recorded at low-level concentrations within the soil during the recent supplementary ground investigation to understand their leachability. The analytical suite includes heavy metals and polycyclic aromatic hydrocarbons (PAHs). In addition, determinands from the Discharge Consent were also tested, including pH, iron (dissolved only as total cannot be analysed for in a laboratory prepared leachate sample) and ammoniacal nitrogen. The samples were collected from exploratory locations during the recent supplementary investigation (specifically from TP301, TP307, TP311, TP312, TP316 and TP320 to ensure coverage), and the locations are presented on the Exploratory Hole Location Plan (Ref: 02753-HYD-XX-XX-DR-GE-1003 [P02], dated 19 July 2022). The laboratory certificate (both soil and leachate) is presented in Annex C.

The natural ground conditions beneath the Greenfield Area are also impermeable clay of the Kimmeridge Clay, therefore, vertical migration of leachate is considered extremely unlikely (in addition no classified water body is located beneath the site). The anticipated receptor for any leachate is the Wroughton Ditch to the west of the Greenfield Area, and will subsequently flow through the engineered reed bed. The analytical data have been compared against EQS and/or the Discharge Consent limits. The results of the EQS screening assessment are presented in Annex D and the comparison against the Discharge Consent is discussed below, where relevant.

Exceedances of iron (dissolved) and lead were recorded in the Capping Layer leachate from two locations (out of six samples). The lead exceedances are considered to be relatively marginal (8.7 µg/l and 9.3 µg/l against an EQS of 6.98 µg/l). In addition, the upstream surface water location SW1 has historically recorded concentrations of lead above EQS (ranging between 7 µg/l and 18 µg/l) suggesting a potential background/upgradient source.

The iron (dissolved) exceedances are also relatively marginal (1,300 µg/l and 1,400 µg/l against an EQS of 1,000 µg/l). Although iron (total) could not be analysed for, the dissolved iron portion provides an indication of the likely concentration of iron within any future leachate. The dissolved concentrations are all significantly below the Discharge Consent limit for iron (total), which is set at 5 mg/l (i.e., 5,000 µg/l).

Based on multiple lines of evidence, including the number of exceedances (i.e., two out of the six leachate samples), the marginal nature of the exceedances, background concentrations of lead in the Wroughton Ditch and the iron (dissolved) concentrations being significantly below the Discharge Consent limits, the risk to Controlled Waters from placement of the Capping Layer material on the Greenfield Area is considered to be low. This is consistent with the suitability of the material from a human health and plant life perspective as well.

3.6.2 Contact with future site users

The chemical quality of the perched water beneath the Former Landfill Area is not a constraint to the proposed development because it will not normally come into direct contact with future site users. However, a potential exception is the risk of physical contact the with outbreaks that occur along the perimeter drainage ditches.

The risk to the Controlled Waters receptor from the leachate outbreaks is considered to be low (Section 3.5), however, prior to polishing by the engineered reed bed, the outbreaks also contain contaminants in excess of the relevant Drinking Water Standards derived for the protection of human health (namely metals and anions). It is unlikely that any future site users would enter the water or want to drink it since one of the of the main constituents is iron, which has been shown to precipitate as an unsightly ochreous staining on the ground. However, this has historically been raised as a concern by SBC.

Infiltration, perched water flow and raw leachate quality

The proposed development is considered unlikely to significantly alter the perched water flow, but, if anything, infiltration through the Former Landfill Area might be expected to reduce slightly. The residential development area in the east will be partially covered by houses, pavement/road construction and other hard surfaced infrastructure. Typically, 40% of a residential development area will feed into the storm network and not infiltrate to ground (thus reducing the volume of infiltration to ground and through the waste deposits).

In addition, the earthworks proposals include the partial excavation and processing of landfill waste in the east of the Former Landfill Area, and subsequent placement back into the development platform. This will include the removal of deleterious materials and soils with significant visual and olfactory evidence of contamination (as far as reasonably practicable). Some betterment of the raw leachate from the east of the site may be expected.

Storage Basins

The two proposed storage basins in the west of the Greenfield Area will be excavated into the impermeable and unproductive Kimmeridge Clay. Historical ground investigation recorded groundwater strikes at the location of the proposed basins at depths of approximately 102 m AOD. The base of the proposed basins is 104 m AOD, therefore, the risk of groundwater upwelling from the Kimmeridge Clay into the basins is considered to be low.

The proposed storage basins are hydraulically upgradient of the north westerly perched water flow direction. The excavation of the storage basins approximately 0.5 m into the Kimmeridge Clay is unlikely to alter the perched water regime and is unlikely to initiate significant breakouts against the flow direction. However, as the perched water level in the nearest monitoring well (BH108 approximately 30 m to the north) has historically ranged between 104.4 m and 105.3 m AOD, which is above the proposed base of the basins at 104 m AOD, there remains a low risk that perched water could breakout on the slope immediately above the northern-most storage basin. This has also historically been raised as a concern by SBC.

Service Corridors (deep drainage)

Depending on the depth of deep drainage (storm and foul), a potential preferential pathway may exist that allows the flow of perched water along the drainage corridors from the Former Landfill Area and into the Greenfield Area, which could then flow on towards the proposed storage basins in the west of the site.

Development mitigation measures

The potential risk to future site users and the proposed storage basins has been addressed by the proposed construction of cut-off drains along the southern, western and northern perimeters of the Former Landfill Area. The proposed cut-off drains will intercept and prevent breakouts from occurring at surface by channelling them

to the existing engineered reed bed facility in the northwest. The proposed drains are shown on the Cole Easdon Consultants SuDS Maintenance Plan (Ref: 4175/SK503 [Rev C], dated 8 June 2020) in Annex A.

Separately, if deep drainage is constructed beneath the elevation of the perched water, measures such as dams will need to be installed within the deep service corridors to intercept and divert any perched flow before it enters the Greenfield Area.

4. CONCLUSIONS

The conclusions from the various phases of assessment within this technical note are summarised below.

- The Kimmeridge Clay that underlies the site has a very low hydraulic conductivity and for all practical purposes is considered impermeable. The site is not within a Source Protection Zone and the nearest groundwater abstraction is 1,400 m southeast.
- Perched water beneath the Former Landfill Area sits within the hollow left by the historical excavation of clay. The flow direction is towards the northwest and outbreaks occur into the perimeter drainage ditches.
- The Controlled Waters receptor is the Wroughton Ditch along the western boundary of the site and the ditch flows through an engineered reed bed prior to discharge into the wider surface water network. There are no licensed surface water abstractions within 1,000m of the site.
- The surface water monitoring data from the past 5 years (2017 to 2022) indicate that the containment afforded by the Kimmeridge Clay followed by the polishing through the engineered reed bed is providing a good level of protection to the Controlled Waters receptor.
- Provided the engineered reed bed is continually operated in accordance with the environmental permit, the risk to Controlled Waters is considered to remain low.
- The risk of leachate to the Controlled Waters receptor from the proposed placement of Capping Layer soils on the Greenfield Area to facilitate ground level raise is considered to be low, namely:
  - » the exceedances of lead and iron (dissolved) in two out of the six leachate samples are marginal; and
  - » all determinands in the leachate are below the consented limits in the environmental permit.
- The proposed development in the east of the Former Landfill Area may result in a slight reduction in infiltration and betterment of the leachate quality in this area of the site.
- The construction of cut-off drains along the southern, western and northern perimeters of the Former Landfill Area, and also dams in the deep service corridors, will prevent breakouts from occurring at surface by intercepting and channelling the flow to the existing engineered reed bed facility.

Based on the multiple lines of evidence summarised above, following the proposed development of the site, the residual risk to both the Controlled Waters receptor and also to human health through direct contact with leachate outbreaks is considered to be low.

ANNEXES

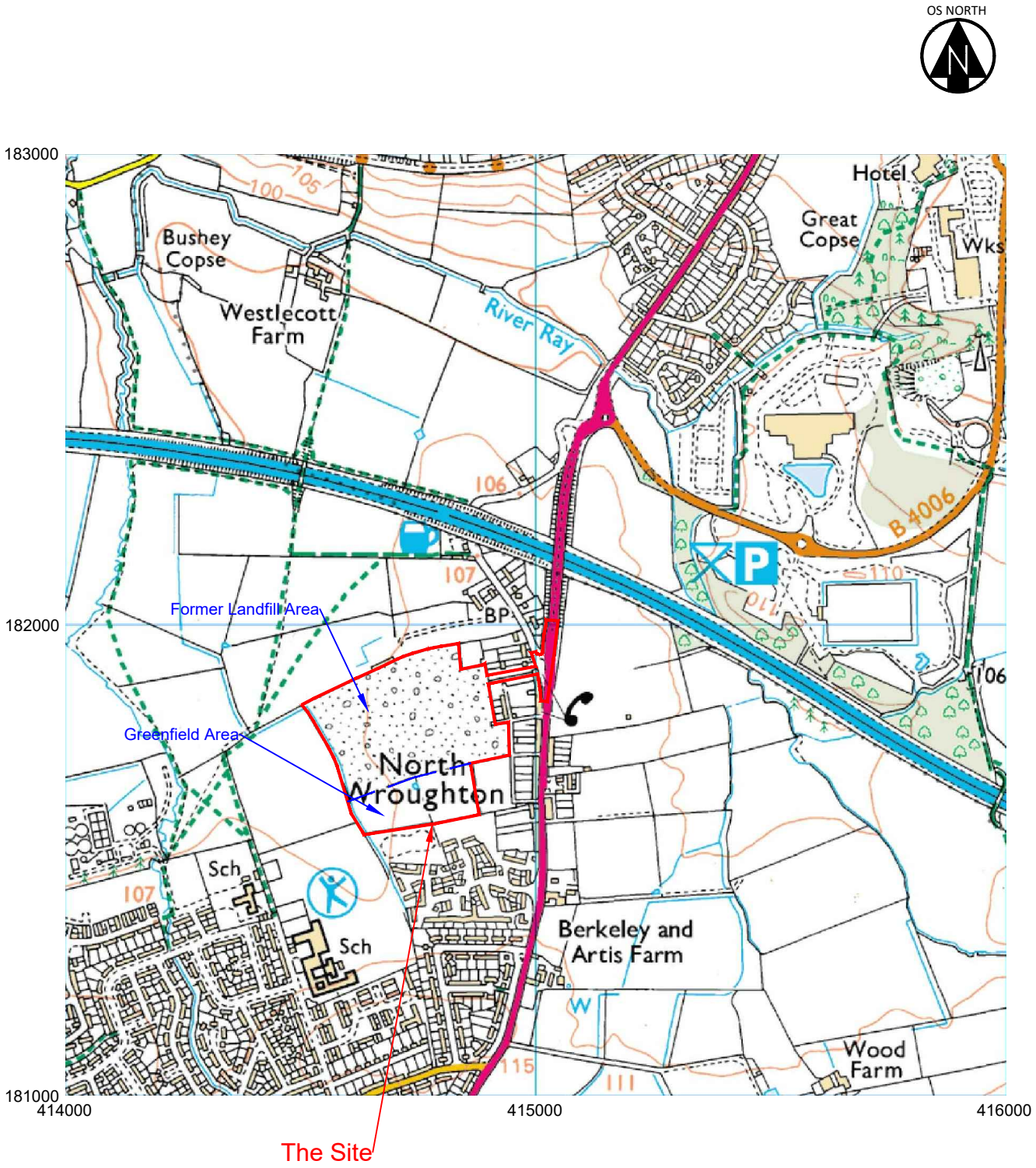
Annex A: Drawings

Annex B: Surface Water Monitoring Report (by Hills Waste)

Annex C: Laboratory Certificates (Capping Layer leachate)

Annex D: Assessment Sheets

Annex A Drawings



Rev	Date	Description	By	Ckd
C	05/05/22	Minor edits	MK	MK
B	18/08/15	Minor edits	KP	KP
A	23/06/11	Initial issue	KP	KP

Project: Land Off Woodland View, Wroughton

Title: SITE LOCATION PLAN

Client: Hills

Drawing Status: INFORMATION

Job No.: C11229

Drawn	Checked	Scale at A4	Date	Issue Date
KP	KP	1:12,500	23/06/11	05/05/22

Hydrock
Over Court Barns, Over Lane, Almondsbury, Bristol, BS32 4DF.
TEL: 01454 619 533 FAX: 01454 614 125 or visit www.hydrock.com

Drawing No.: 11229-G016

Revision: C

KEY

- Proposed Strategic Landscape
- Retained habitat to support reptile mitigation
- Existing trees to be retained
- Existing trees to be removed
- Proposed trees
- Proposed footpath diversion
- Existing footpath (FP 78)
- Other footpath
- Primary (Spine) Road - Asphalt 6m + 2m footpath on both sides
- Secondary (Residential) Road - Asphalt 5m + 2m footpath
- Adoptable Shared Surface - Block Paving TBA Min 5m + no footpath
- Private Shared Surface - Block Paving TBA Min 4.5m + no footpath
- Affordable Unit

111.35	Finished Floor Level
122.51	Ridge Level

Site Area	= 11.6 Ha approx.
Development Area	= 5.2 Ha approx.
Houses	= 98
Apartments	= 6
TOTAL	= 104

Approx. 21 DPH

LAND OFF WOODLAND VIEW, WROUGHTON

REV.	DATE	AMENDMENTS	DRAWN	CHECKED
K	28.02.22	Amendments to apartment units 46-51	SW	
L	04.04.22	General amendments	SW	

CLIENT: **Hills UK Ltd**

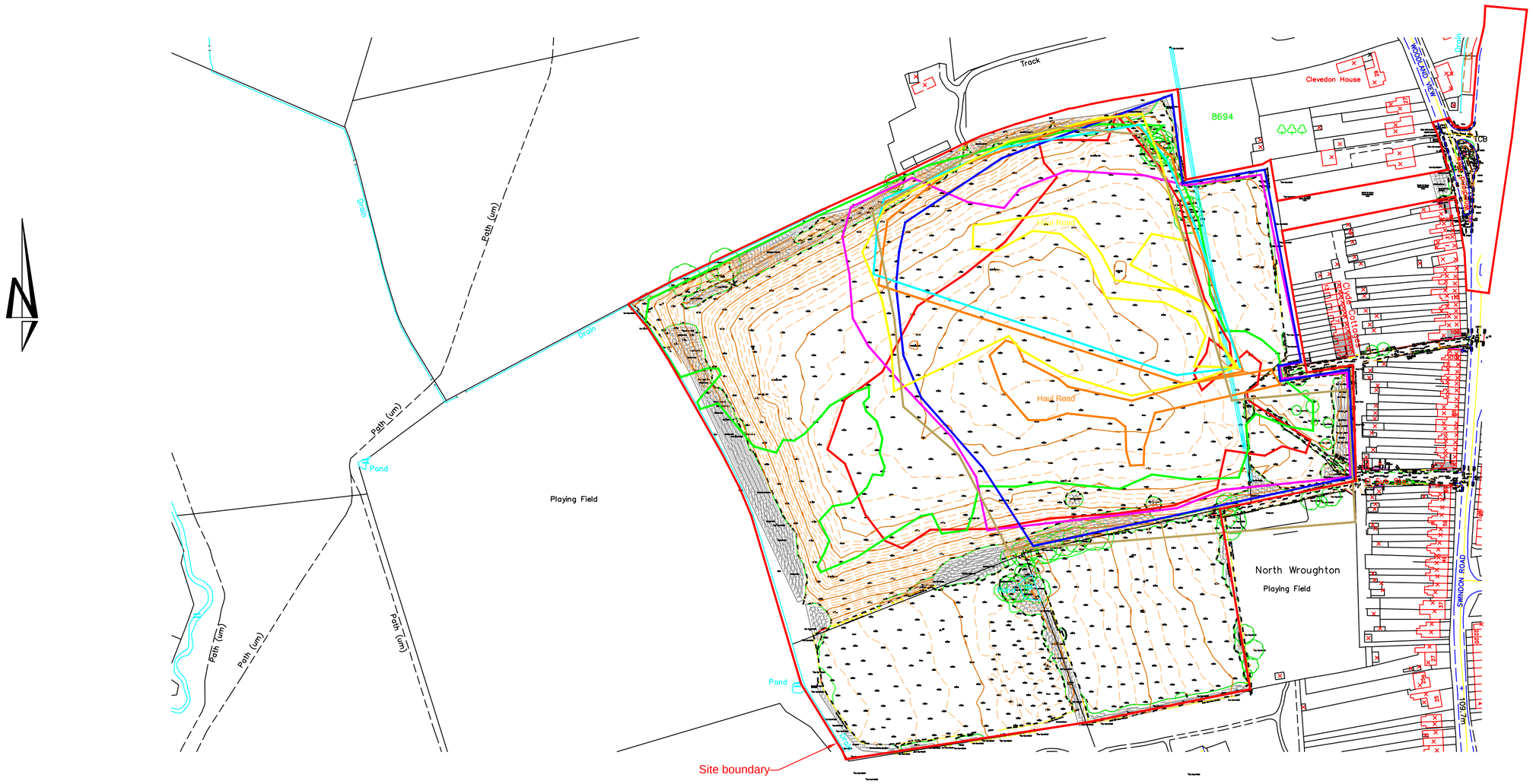
PROJECT: **Land off Woodland View, Wroughton**

DRAWING: **Proposed Site Layout**

DATE: **June 2019**

SCALE: **1:1000**
SIZE: **A1**
JOB NO: **50467**
DWG NO: **P1-01**
REV: **L**

PRO VISION
PLANNING | ARCHITECTURE | URBAN DESIGN
www.pro-vision.co.uk



Fill Legend

1995		Restoration area (no grass)
1989		Extent of builders waste (note skips visible)
1974		Extent of fill
1971		Extent of fill
1968		Extent of fill and haul road shown
1967		Extent of fill
1962		Extent of fill
1958		Extent of fill (pits still open at this time)

Rev	Date	Description	By	Ckd
B	15/12/14	Survey data added	KP	KP
A	14/09/11	Original issue	AJ	KP

Client

Hills

Project

WROUGHTON CLOSED LANDFILL

Title

Extent of Fill
(from Aerial Photos)

Drawing Status

INFORMATION

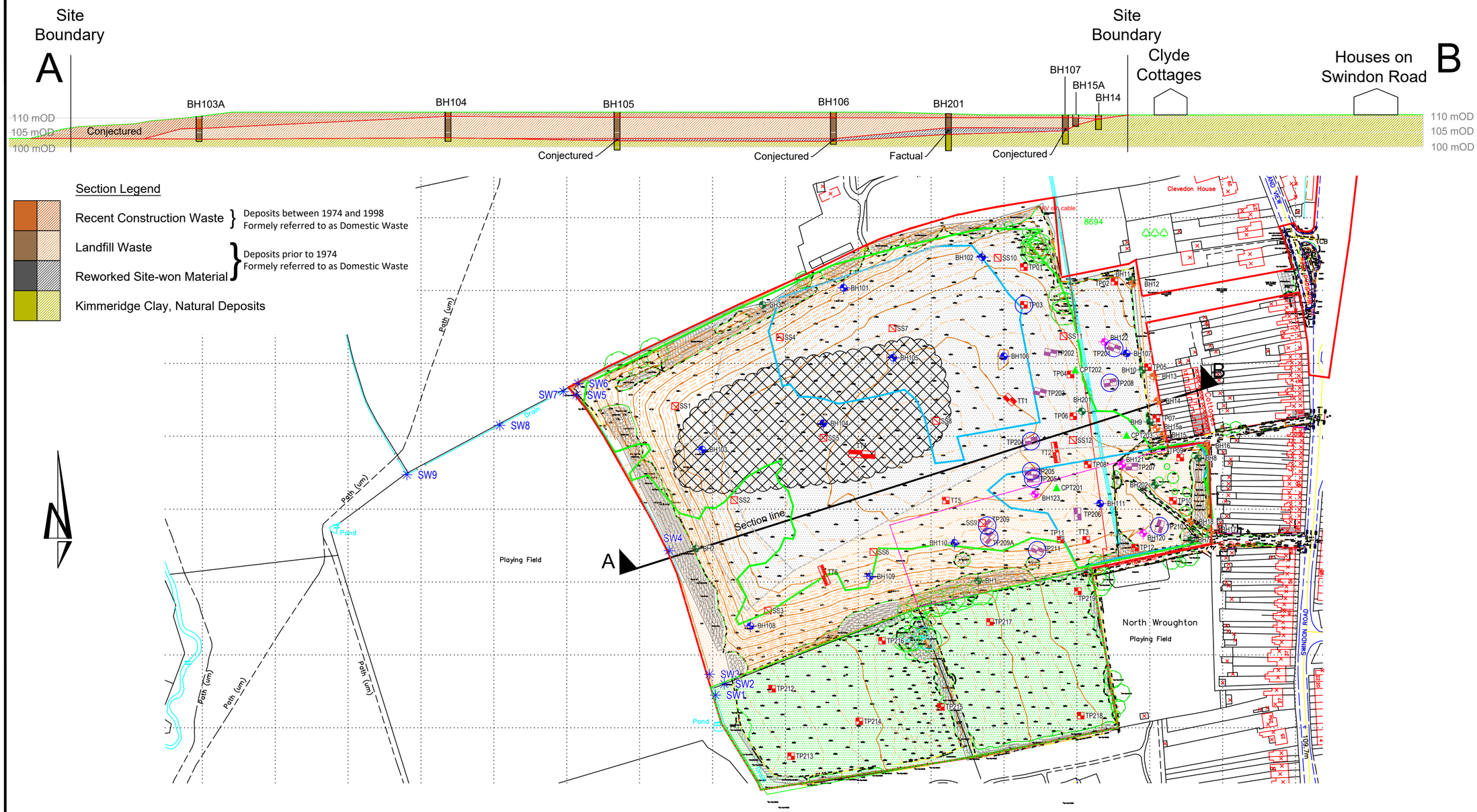
Hydrock
Consultants
Over Court Barns
Over Lane
Almondsbury
Bristol BS32 4DF
TEL: 01454 619 533
FAX: 01454 614 125
E-Mail: bristol@hydrock.com
or visit www.hydrock.com

Job No. C11229

Drawn	Checked	Scale	Date	Issue Date
AJ	KP	1:2,000	14/09/11	15/12/14

Drawing No. 11229-G021

Revision B



Legend

- Site boundary
- BH2 — Pre-existing gas monitoring borehole
- BH13 — Hydrock gas monitoring borehole (June 2008)
- SW4 — Surface water monitoring point (June 2008)
- SS3 — Surface soil sample location (June 2008)
- BH101 — Supplementary Shell & Auger Borehole (July 2011)
- TP01 — Trial pits (Aug 2015)
- TT1 — Trial trenches (Jan 2015)
- BH120 — Hydrock borehole (December 2017)
- BH13 — Hydrock borehole (June 2019)
- TP210 — Trial pit (June 2019)
- CPT203 — Cone Penetration Test (June 2019)

- Maximum extent of clay pits (from historical OS maps & aerial photos)
- Maximum extent of fill (from historical OS maps & aerial photos)
- Site boundary
- Area A: Greenfield
- Area B: Recent Construction Waste
- Area C: Landfill Waste
- Asbestos (visible ACM or fibres) encountered within waste materials of former landfill
- Boreholes with significantly elevated gas readings (8/8/11 & 5/9/11)

BH No.	X	Y
101	414690.0	181902.0
102	414785.0	181923.0
103	414593.0	181791.0
104	414676.0	181809.0
105	414724.0	181854.0
106	414800.0	181855.0
107	414884.0	181857.0
108	414626.0	181670.0
109	414708.0	181704.0
110	414766.0	181727.0
111	414866.0	181754.0
201	414853.5	181817.2
202	414903.5	181766.7

Rev	Date	Description	By	Ckd
E	10/10/19	Supplementary GI added	EP	PLA
D	06/01/16	Trial pits added	KP	KP
C	15/01/15	Trial trenches added	KP	KP
B	15/12/14	Survey data added	KP	KP
A	14/09/11	Original issue	AJ	KP

Client

Hills

Project

WROUGHTON CLOSED LANDFILL

Title

Zonation Plan

Drawing Status

INFORMATION

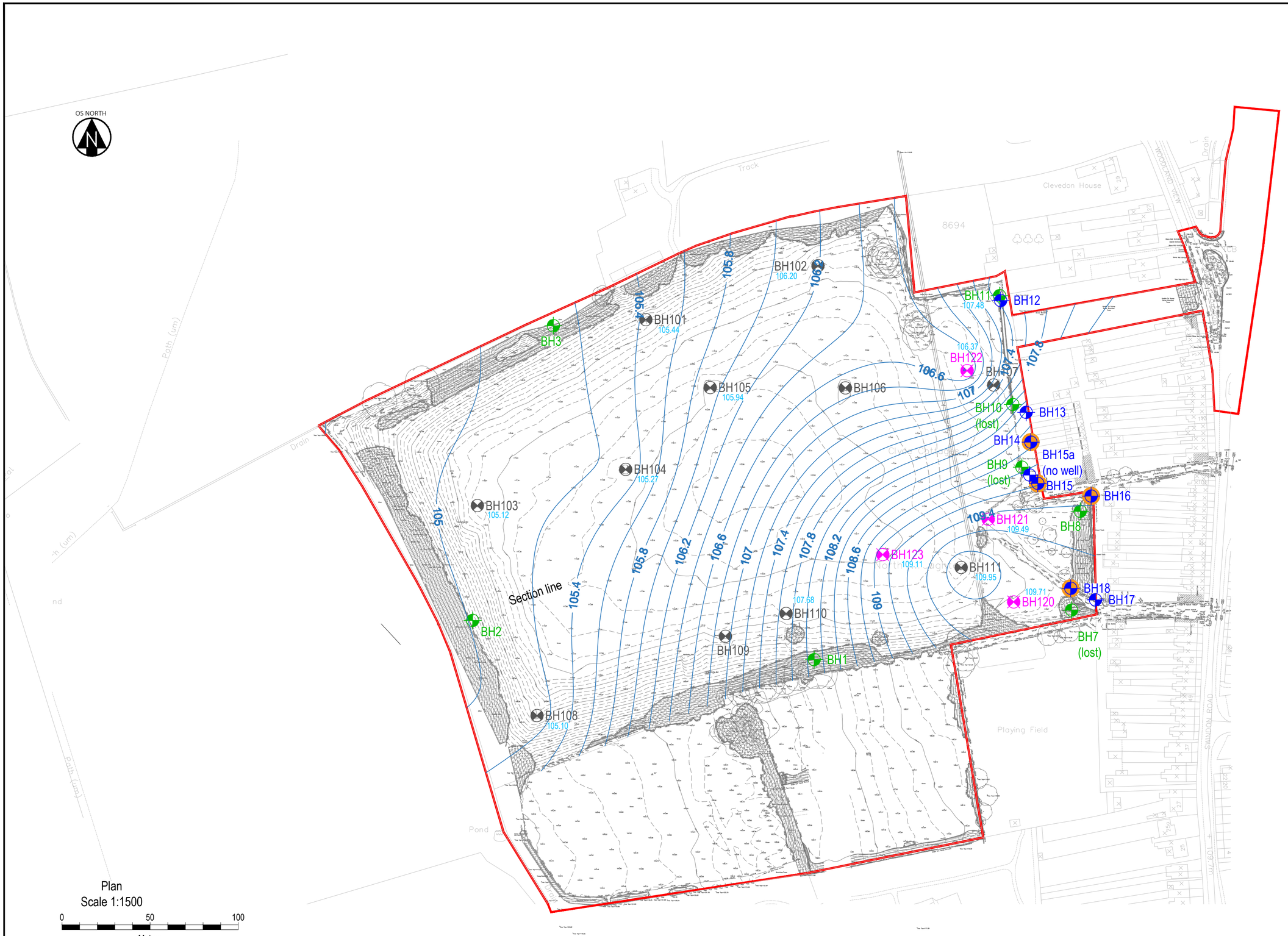
Hydrock Consultants
Over Court Barns
Over Lane
Almondsbury
Bristol BS32 4DF
TEL: 01454 619 533
FAX: 01454 614 125
E-Mail: bristol@hydrock.com
or visit www.hydrock.com

Job No. C11229

Drawn	Checked	Plan=1:2,000 Section = 1:1,000	Date	Issue Date
EP	PLA		14/09/11	10/10/19

Drawing No. 11229-G018

Revision E



KEY

	Site boundary
BH2	Pre-existing gas monitoring borehole
BH13	Hydrock gas monitoring borehole (June 2008)
BH101	Supplementary Shell & Auger Borehole (July 2011)
BH120	Hydrock borehole (December 2017)
BH13	Hydrock borehole where observed groundwater level is below base of waste/made ground (February 2018)
100.00	Groundwater level at monitoring location (mAOD)

REV.						
B	SECOND ISSUE					
	MK	08/10/19	RH	08/10/19	RH	08/10/19
A	FIRST ISSUE					
	AT	27/02/18	SN	27/02/18	JF	27/02/18
	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

Hydrock
Over Court Barns
Over Lane
Almondsbury, Bristol BS32 4DF
TEL: 01454 619 533
FAX: 01454 614 125
E-Mail: bristol@hydrock.com
or visit www.hydrock.com

CLIENT

HILLS GROUP

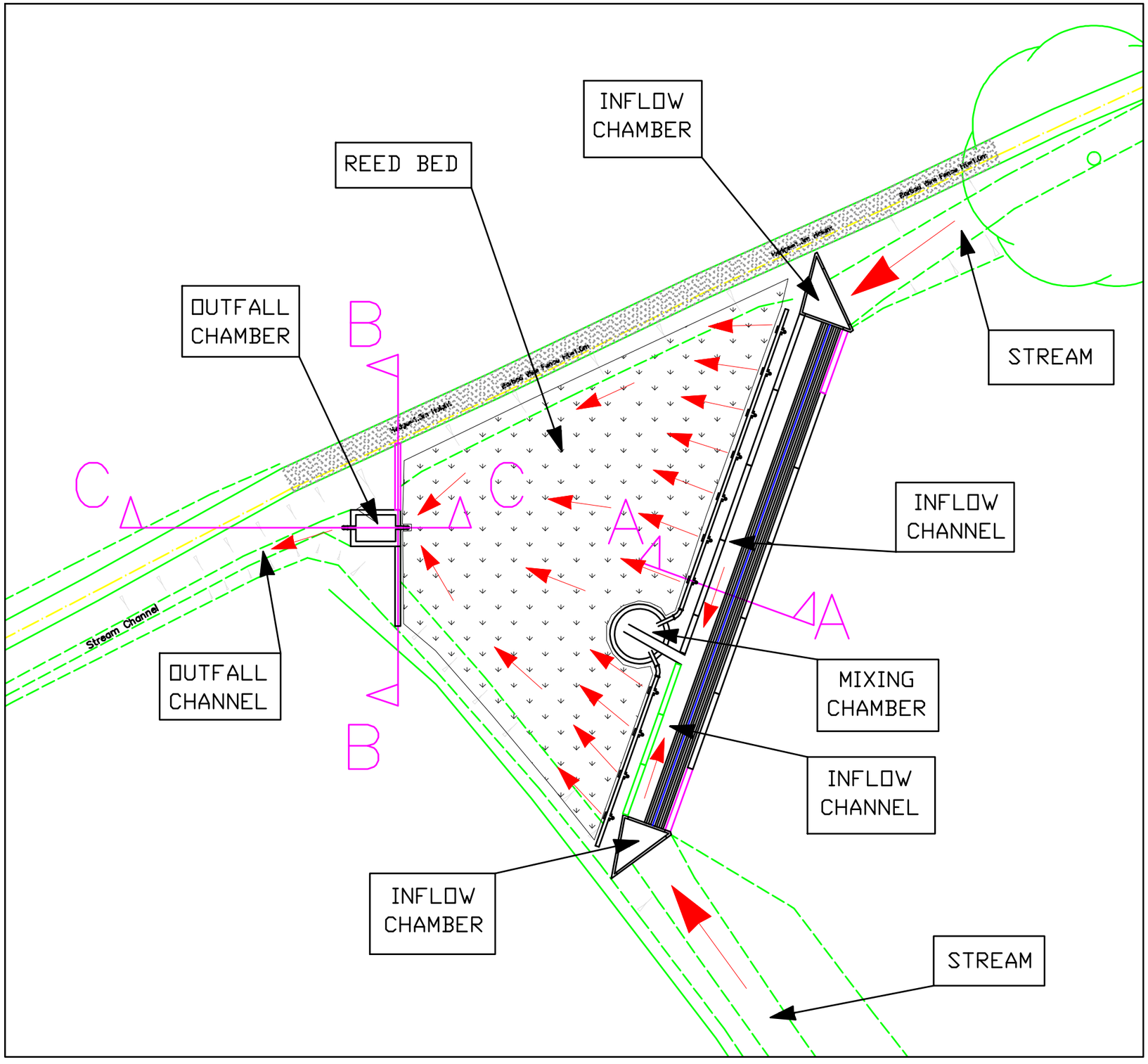
PROJECT

WROUGHTON CLOSED LANDFILL

TITLE

PERCHED WATER (LEACHATE) CONTOURS
mAOD - 15/02/18

HYDROCK PROJECT NO.	SCALE @ A2
C11229	AS SHOWN
PURPOSE OF ISSUE: SUITABLE FOR INFORMATION	STATUS: S2
DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER): 11229-G039	REVISION: B



Brunel Surveys Ltd

Unit 59, Shrivenham Hundred Business Park
Watchfield, Swindon, Wiltshire, SN6 8TZ
Tel : (01793) 784700 Fax : (01793) 784664
Web : www.brunelsurveys.com

Client

Hills
Minerals & Waste

Ailsbury Court, High Street,
Marlborough, Wilts. SN8 1AA

Job Title

WROUGHTON
LANDFILL SITE

REED BED/
SETTLEMENT POND

CONSTRUCTION DETAILS

Scale 1:200 (A3)

Date 19/03/17

Surveyed by SP/SMC

Drg. No. **WR/RB/007A**

OS NORTH

Trees & hedgerows

Trees & hedgerows

Site Access

KEY

- Site boundary
- BH2 — Pre-existing gas monitoring borehole
- BH13 — Hydrock gas monitoring borehole (June 2008)
- SW4 — Surface water monitoring point (June 2008)
- SS3 — Surface soil sample location (June 2008)
- BH101 — Supplementary Shell & Auger Borehole (July 2011)
- TP01 — Trial pits (Aug 2015)
- TT1 — Trial trenches (Jan 2015)
- BH120 — Hydrock borehole (December 2017)
- BH13 — Hydrock borehole (June 2019)
- TP210 — Trial pit (June 2019)
- CPT203 — Cone Penetration Test (June 2019)
- TP318 — Trial Pit (June 2022)

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.

2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.

3. This drawing has been based on the following drawings and information: Cole Easdon Consultants - Drawing No: 3429/300/01 May 2019

REV.						
P2	SECOND ISSUE - INCLUDING JUNE 2022 LOCATIONS					
	EP	19/07/22	MH	19/07/22	MK	19/07/22
P1	FIRST ISSUE					
	AT	06/09/19	MK	06/09/19	RH	06/09/19
	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

Hydrock
Over Court Barns
Over Lane
Almondsbury, Bristol BS32 4DF
TEL: 01454 619 533
FAX: 01454 614 125
E-Mail: bristol@hydrock.com
or visit www.hydrock.com

CLIENT

THE HILLS GROUP

PROJECT

WROUGHTON CLOSED LANDFILL

TITLE

EXPLORATORY HOLE LOCTION PLAN

HYDROCK PROJECT NO.	SCALE @ A2
C-02753-C	1:1000
PURPOSE OF ISSUE: SUITABLE FOR INFORMATION	STATUS: S2
DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER): 02753-HYD-XX-XX-DR-G-1003	REVISION: P2

Perimeter ditches maintained by Hills

Existing Reed bed area to be maintained by Hills

DITCH

Cut-off Trench (0.6m wide x 1m deep) to collect potential leachate / perched groundwater. Trench to feed into the existing Reed bed system. To be maintained by Hills.

Sports pitch to incorporate its own subsurface drainage arrangements, with a connection into the perimeter filter trench.

Permeable paving to be maintained by property owners

Shallow swale/landscaped depression to accept highway flooding. To be maintained by Private Management Company as part of site's wider landscape management

Highway drain and highway gullies to be adopted by Swindon Borough Council

Existing public foul sewer system maintained by Thames Water

Cellular units for affordable units be maintained by housing association

Sports pitch drainage and cellular units to be maintained by th cricket club

Perimeter ditches maintained by Hills

Cut-off Trench (0.6m wide x 2.0m deep) to collect potential leachate / perched groundwater. Trench to feed into the existing Reed bed system. To be maintained by Hills.

Proposed storm and foul water networks including foul water rising main to be adopted by Thames Water

FW Pumping Station to be adopted by Thames Water

Controlled outfall into the existing ditch

Pond

Storage Basins, pipes and headwalls to be maintained by a Private Management Company as appointed by Hills.

Drain

Scale 1:1000

0 20m 40m 60m 80m 100m

KEY

	SITE BOUNDARY
	TANKED PERMEABLE BLOCK PAVED DRIVEWAYS
	STORM WATER SEWER & MANHOLE
	FOUL WATER SEWER & MANHOLE
	HIGHWAY DRAIN, MANHOLE & PIPE DETAILS
	HIGHWAY GULLY & CONNECTION
	CUT OFF DRAIN & INSPECTION CHAMBER
	FLOOD FLOW ROUTE
FFL 110.60	PROPOSED FLOOR LEVEL
	OVERLAND FLOW SWALE

No.	By	Date	Revision Details
C	AJM	08.06.20	Scale bar added as requested in SBC letter dated 02.06.20.
B	LS	06.11.19	Updated to new layout

Client

Hills

COLE EASDON CONSULTANTS
YORK HOUSE
EDISON PARK
DORCAN WAY
SWINDON
WILTSHIRE
SN3 3RB
Tel : 01793 619965
Web Site www.ColeEasdon.com
E-mail cec@ColeEasdon.com

Client
Hills UK Limited

Job Title
Land off Woodland View,
Wroughton,
Swindon

Drawing Title
SuDS Maintenance Plan

Issued for Planning

Designed by:	Drawn by:	Checked by:
NP	NP	RB

Date	Scale
Sept 2015	1:1000 (A2)

Drg. No.	Rev.
4175/SK503	C

Annex B Surface Water Monitoring Report (by Hills Waste)

Wroughton Closed Landfill and Reed Bed

Background

The Reed bed in installed in the far corner of the Wroughton Landfill in approx. 2012. This followed some concerns about a leachate leak form the site.

The Reed bed was constructed following an agreed discharge consent from the EA duly made on 25th November 2011 ref EPR/JP3120XW which specified the following limits

Variable	Limit
Suspended Solids	35 mg/l
pH	6-9
Ammoniacal Nitrogen	10mg/l
Iron (Total)	5mg/l
Visible oil and Grease	None
Flow	9.9 m3/day
	1.14 l/s

The system is set up to run two surface water ditches either side of the landfill which merge at the reed bed to allow for treatment before being discharged.

A monitoring scheme was set up to analyse the treatment with points entering the reed bed (SW5 and SW6) the outlet of the discharge and points upstream. However, this was for internal processes as the environment Agency send their own officers to sample as part of their discharge consent monitoring.

Upgrade to reed bed 2017

Following some high results for Iron in samples taken in August and October 2016 the upgrade of the reed bed was investigated and was completed in October 2017. The design moved from a basic reed bed area and settlement tank systems to a reed bed system that filled the entirety of the area. This also included a gravel ream to drop out iron solids prior to the reed bed inlet.

Monitoring continued at an increased frequency following the commissioning and then returned to quarterly. Where possible the EA notify Hills when they are due to visit, and we aim to complete a mirrored sample for our own records.

Additional work in 2019

The reeds on one side of the bed had not properly taken and although performance hadn't been affected, reeds were replaced by JPR Environmental in April 2019 along with some tree and hedge cutting to allow sufficient light through. Also, some clearance of the ditch after the outlet was completed to allow better drainage and less back flow.

Results for the past 5 years are shown below and show that performance has been maintained a good levels. The only occasion for potential breach was for suspended solids but this was for a sample taken when not discharging and averages show this is normally below the limit.

Date	Ammoniacal Nitrogen (mg/l)	Iron (Total) (mg/l)	pH (pH units)	Solids (Suspended) (mg/l)
Max	6.9	2.7	8.0	100
Min	0.6	0.0	7.4	4.00
Average	2.5	1.1	7.7	28.01
Limit	10	5	6-9	35

For information the EA will only take a sample when they visit, and the reed bed is discharging.

Sample Point	Data Source	Discharging sample	Date	Ammoniacal Nitrogen (mg/l)	Chloride (mg/l)	Alkalinity as CaCO3 (mg/l)	Cadmium (Dissolved) (ug/l)	Iron (Dissolved) (mg/l)	Iron (Dissolved) (ug/l)	Iron (Total) (mg/l)	Iron (Total) (ug/l)	Lead (Dissolved) (ug/l)	pH (pH units)	Solids (Suspended) (mg/l)
Wroughton Outlet 1	ACS		30/05/2017	0.98	19.7			< 2.00		2.09			7.5	4
Wroughton Outlet 1	SAL		23/01/2018	0.58	27.47			0.03	27.34	0.79	790.72		7.7	<10
Wroughton Outlet 1	SAL		19/02/2018	1.31	32.10	493	<0.02	0.02	18.11	<0.03	<25	0.65	7.9	27
Wroughton Outlet 1	SAL		05/03/2018	0.73	37.47			0.03	32.60	0.45	454.37		7.63	<10
Wroughton Outlet 1	SAL		10/04/2018	2.36	27.76			0.04	44.79	1.22	1215.18		7.53	<10
Wroughton Outlet 1	SAL		29/05/2018	5.84	39.75			0.06	57.33	1.6	1603.34		7.41	55
Wroughton Outlet 1	SAL		19/06/2018	6.94	42.37			0.11	112.61	2.74	2739.45		7.45	34
Wroughton Outlet 1	SAL		30/01/2019	0.72	46.91			0.04	39.41	0.64	635.90		7.75	10
Wroughton Outlet 1	SAL		15/04/2019	3.30	39.28	489	<0.02	0.03	28.79	1.62	1623.52	<0.3	7.66	74
Wroughton Outlet 1	SAL		25/06/2019	0.67	10.79			0.34	340.76	0.79	787.26		7.54	11
Wroughton Outlet 1	ALS		29/10/2019	1.87	24.9			0.0551	55.1	0.682	682		7.78	<2
Wroughton Outlet 1	ALS		26/11/2019	1.83	25.3			0.0472	47.2	1.53	1530		7.81	6.6
Wroughton Outlet 1	ALS		15/01/2020	0.639	15.2			0.109	109	0.872	872		7.74	7.5
Wroughton Outlet 1	ALS		15/03/2021	2.82	23.4			0.0326	32.6	1.24	1240		7.86	5.7
Wroughton Outlet 1	ALS		07/04/2021	6.57	31.2			0.976	976	0.989	989		7.61	5.4
Wroughton Outlet 1	TerraTek		29/06/2021	3.6	20.2			<0.00	<1	0	2		7.5	18
Wroughton Outlet 1	TerraTek		26/10/2021	1.3	26.8			<0.01	<10	0	1		8	38
Wroughton Outlet 1	TerraTek	Yes	28/02/2022	2.1	28.6			<0.00	<1	<0.00	<1		7.8	24
Wroughton Outlet 1	Chemtest	NO	06/05/2022	7.8	41	810	< 0.08	0.03	25	0.75	750	< 0.50	7.4	100
			Max	7.80	46.91	810	0	0.976	976	2.74	2739.45	0.65	8	100
			Min	0.58	10.79	489	0.00	0.02	18.11	0.00	1.00	0.65	7.40	4.00
			Average	2.73	29.48	597		0.13	129.78	1.06	994.73	0.65	7.66	28.01
			Limit	**10**						**5**	**5000**		**6-9**	**35**

Annex C Laboratory Certificates (Capping Layer leachate)

4041

Matthew Keehn
Hydrock Consultants Ltd
Over Court Barns
Over Lane
Bristol
BS32 4DF

t: 01454 619533
f: 01454 614125
e: Group Bristol cc engineer

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 22-71525

Replaces Analytical Report Number: 22-71525, issue no. 2
Additional analysis undertaken.

Project / Site name:	Wroughton Landfill	**Samples received on:**	30/06/2022
Your job number:	2753	**Samples instructed on/ Analysis started on:**	15/07/2022
Your order number:	PO18290	**Analysis completed by:**	03/08/2022
Report Issue Number:	3	**Report issued on:**	03/08/2022
Samples Analysed:	6 leachate samples		

Martyna Langer

Signed:

Martyna Langer
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

UKAS TESTING
4041

Analytical i2 Environmental Science

Analytical Report Number: 22-71525
Project / Site name: Wroughton Landfill

Your Order No: PO18290

Lab Sample Number				2351141	2351142	2351143	2351144	2351145
Sample Reference				TP301	TP307	TP311	TP312	TP316
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.60	0.50	0.50	0.25
Date Sampled				27/06/2022	27/06/2022	28/06/2022	28/06/2022	04/07/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH (automated)	pH Units	N/A	ISO 17025	6.8	6.8	7.2	7.2	6.8
Ammoniacal Nitrogen as N	µg/l	15	NONE	< 15	< 15	< 15	< 15	< 15
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total PAH								
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Heavy Metals / Metalloids								
Arsenic (dissolved)	µg/l	1	ISO 17025	1.7	2.6	2.2	1.8	3.9
Beryllium (dissolved)	µg/l	0.2	ISO 17025	1.4	1.5	1.5	1.4	1.5
Boron (dissolved)	µg/l	10	ISO 17025	22	20	34	36	20
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chromium (III)	µg/l	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.8	1.6	1.2	2	4.2
Copper (dissolved)	µg/l	0.7	ISO 17025	8.2	11	5	6.7	20
Iron (dissolved)	mg/l	0.004	ISO 17025	0.021	0.81	0.019	0.3	1.3
Lead (dissolved)	µg/l	1	ISO 17025	5.4	6.8	5.6	4.4	8.7
Nickel (dissolved)	µg/l	0.3	ISO 17025	1.4	2.8	1.9	2.7	4.6
Vanadium (dissolved)	µg/l	1.7	ISO 17025	15	15	13	14	18
Zinc (dissolved)	µg/l	0.4	ISO 17025	5.3	13	13	11	20

U/S = Unsuitable Sample I/S = Insufficient Sample

UKAS TESTING
4041

Analytical i2 Environmental Science

Analytical Report Number: 22-71525
Project / Site name: Wroughton Landfill

Your Order No: PO18290

Lab Sample Number				2351146
Sample Reference				TP320
Sample Number				None Supplied
Depth (m)				0.25
Date Sampled				04/07/2022
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
General Inorganics				
pH (automated)	pH Units	N/A	ISO 17025	6.9
Ammoniacal Nitrogen as N	µg/l	15	NONE	< 15
Speciated PAHs				
Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01
Total PAH				
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2
Heavy Metals / Metalloids				
Arsenic (dissolved)	µg/l	1	ISO 17025	2.2
Beryllium (dissolved)	µg/l	0.2	ISO 17025	1.6
Boron (dissolved)	µg/l	10	ISO 17025	22
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0
Chromium (III)	µg/l	5	NONE	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	3.9
Copper (dissolved)	µg/l	0.7	ISO 17025	26
Iron (dissolved)	mg/l	0.004	ISO 17025	1.4
Lead (dissolved)	µg/l	1	ISO 17025	9.3
Nickel (dissolved)	µg/l	0.3	ISO 17025	5.3
Vanadium (dissolved)	µg/l	1.7	ISO 17025	15
Zinc (dissolved)	µg/l	0.4	ISO 17025	17

U/S = Unsuitable Sample I/S = Insufficient Sample

4041

Analytical Report Number : 22-71525
Project / Site name: Wroughton Landfill

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
Ammoniacal Nitrogen as N in leachate	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	NONE
Cr (III) in leachate	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Annex D Assessment Sheets

12248 WROUGHTON CLOSED LANDFILL
SURFACE WATER MONITORING DATA

Hydrock

Sample Point ID	Relative Location	Date	pH	Alkalinity as CaCO3 (mg/l)*	Ammoniacal Nitrogen (mg/l)	Chloride (mg/l)	Cadmium (Dissolved) (ug/l)	Iron (Dissolved) (ug/l)	Iron (Total) (mg/l)	Lead (Dissolved) (ug/l)	Solids (Suspended) (mg/l)
		EQS>>	**6-9**			**250**	**0.25**	**1,000**		**6.98****	
		Discharge Consent>>	**6-9**	-	**10**	-	-	-	**5**	-	**35**
SW1	Wroughton Ditch upstream of Former Landfill Area	29 July 2008	7.40	181	0.18	-	<0.5	<50	0.42	5	-
		21 August 2008	7.60	288	<0.04	-	<0.5	60	0.74	6	-
		03 September 2008	8.40	334	<0.04	-	0.6	<50	3.63	11	-
		21 October 2008	7.80	213	0.07	-	<0.3	80	0.27	6	-
		25 November 2008	7.50	298	0.04	-	0.8	50	1.40	<2	-
		09 December 2008	7.80	280	0.05	-	0.8	40	0.54	13	-
		27 January 2009	7.90	299	0.04	-	<0.3	<30	0.25	<2	-
		16 February 2009	7.90	276	0.04	-	<0.3	30	0.24	7	-
		23 March 2009	8.50	315	0.08	-	0.8	<30	6.29	13	-
		28 April 2009	7.60	239	0.06	-	0.7	50	0.13	11	-
		21 May 2009	7.90	273	<0.04	-	0.5	<30	0.79	12	-
		11 June 2009	7.80	200	0.07	-	1.2	80	0.25	<2	-
		20 July 2009	7.50	220	<0.04	-	0.6	<30	4.69	18	-
SW5	Wroughton Ditch upstream of engineered reed bed	30 May 2017	7.60	-	0.11	15.8	-	-	2.25	-	4
		23 January 2018	7.70	-	0.07	27.2	-	52	1.82	-	<10
		19 February 2018	7.95	359	0.16	37.0	<0.02	25	<0.03	0.65	<10
		05 March 2018	7.64	-	0.06	36.9	-	44	0.18	-	<10
		10 April 2018	7.71	-	0.09	23.9	-	82	0.32	-	<10
		29 May 2018	7.28	-	7.64	40.6	-	12	6.60	-	54
		19 June 2018	7.28	-	8.34	43.5	-	3,244	9.08	-	173
		30 January 2019	7.78	-	0.05	35.6	-	38	0.29	-	<10
		15 April 2019	7.85	457	0.09	36.7	0.04	26	0.19	<0.3	<10
		25 June 2019	7.52	-	0.11	11.0	-	251	0.65	-	10
		15 January 2020	7.69	-	<0.2	13.2	-	141	0.60	-	3.95
		28 October 2020	7.57	-	1.59	18.0	-	242	0.72	-	<2
		07 December 2020	7.50	-	7.77	37.9	-	117	1.94	-	5.55
		15 March 2021	7.57	-	7.10	32.5	-	62	2.69	-	14.2
		07 April 2021	7.55	-	9.46	32.4	-	1,970	2.06	-	6.95
		29 June 2021	7.40	-	13.70	37.0	-	<1	<0.001	-	26
		26 October 2021	8.00	-	0.50	23.8	-	3	0.01	-	<4
		28 February 2022	7.60	-	10.40	37.8	-	<1	<0.001	-	124
		06 May 2022	7.40	830	1.00	44.0	< 0.08	19	0.47	< 0.50	80
SW6	Northern ditch upstream of engineered reed bed	30 May 2017	7.30	-	12.40	37.2	-	-	<2	-	140
		19 June 2017	7.40	827	16.00	45.0	<0.02	-	-	2.00	130
		23 January 2018	7.50	-	2.93	34.6	-	15	0.70	-	12
		19 February 2018	7.74	779	4.82	40.8	<0.02	89	0.16	0.39	75
		05 March 2018	7.50	-	3.74	39.6	-	7	3.09	-	<10
		10 April 2018	7.57	-	1.92	30.5	-	40	2.55	-	<10
		29 May 2018	7.28	-	7.70	40.6	-	7	6.79	-	106
		19 June 2018	7.25	-	9.93	43.7	-	30	3.34	-	17
		30 January 2019	7.61	-	8.41	46.7	-	35	13.56	-	69
		15 April 2019	7.41	585	6.99	43.3	0.02	16	6.51	<0.3	21
		25 June 2019	7.52	-	4.94	30.4	-	179	12.08	-	38
		15 January 2020	7.70	-	3.94	35.6	-	245	8.38	-	17.4
		29 June 2021	7.30	-	13.80	37.3	-	<1	<0.001	-	48
		26 October 2021	7.70	-	11.00	45.3	-	2	0.01	-	210
		28 February 2022	7.60	-	10.90	39.0	-	<1	<0.001	-	32
		06 May 2022	7.40	900	10.00	39.0	< 0.08	23	4.70	< 0.50	140
Outlet (Reed Bed)	Engineered reed bed discharge point	30 May 2017	7.50	-	0.98	19.7	-	-	2.09	-	4
		23 January 2018	7.70	-	0.58	27.5	-	27	0.79	-	<10
		19 February 2018	7.90	493	1.31	32.1	<0.02	18	<0.03	0.65	27
		05 March 2018	7.63	-	0.73	37.5	-	33	0.45	-	<10
		10 April 2018	7.53	-	2.36	27.8	-	45	1.22	-	<10
		29 May 2018	7.41	-	5.84	39.7	-	57	1.60	-	55
		19 June 2018	7.45	-	6.94	42.4	-	113	2.74	-	34
		30 January 2019	7.75	-	0.72	46.9	-	39	0.64	-	10
		15 April 2019	7.66	489	3.30	39.3	<0.02	29	1.62	<0.3	74
		25 June 2019	7.54	-	0.67	10.8	-	341	0.79	-	11
		29 October 2019	7.78	-	1.87	24.9	-	55	0.68	-	<2
		26 November 2019	7.81	-	1.83	25.3	-	47	1.53	-	6.6
		15 January 2020	7.74	-	0.64	15.2	-	109	0.87	-	7.5
		15 March 2021	7.86	-	2.82	23.4	-	33	1.24	-	5.65
		07 April 2021	7.61	-	6.57	31.2	-	976	0.99	-	5.4
		29 June 2021	7.50	-	3.60	20.2	-	<1	0.00	-	18
		26 October 2021	8.00	-	1.30	26.8	-	<10	0.00	-	38
		28 February 2022	7.80	-	2.10	28.6	-	<1	<0.001	-	24
		06 May 2022	7.40	810	7.80	41.0	< 0.08	25	0.75	< 0.50	100
SW7	Wroughton Ditch downstream of engineered reed bed	30 May 2017	7.40	-	2.40	19.8	-	-	<2	-	43
		19 June 2017	7.50	832	12.00	45.0	<0.02	-	-	1.70	100
		23 January 2018	7.70		0.57	27.7		25	0.71		<10
		19 February 2018	7.98	498	1.30	32.6	<0.02	18	<0.03	0.64	<10
		05 March 2018	7.61	-	0.58	37.2	-	23	0.56	-	<10
		10 April 2018	7.59	-	1.78	27.1	-	50	1.43	-	10
		29 May 2018	7.40	-	5.67	39.5	-	59	2.18	-	46
		19 June 2018	7.45	-	6.61	43.1	-	141	3.13	-	24
		30 January 2019	7.66	-	0.78	46.4	-	49	0.73	-	13
		15 April 2019	7.58	501	3.28	39.4	<0.02	25	1.57	1.75	79
		15 January 2020	7.85	-	0.53	14.3	-	108	0.87	-	6.2
		26 August 2020	7.70	-	2.07	17.2	-	85	0.62	-	5.15
		28 October 2020	7.68	-	0.90	16.7	-	124	0.76	-	4.15
		07 December 2020	7.58	-	1.47	23.7	-	110	0.62	-	4.24
		15 March 2021	7.76	-	2.10	22.9	-	39	0.92	-	3.8
		07 April 2021	7.56	-	6.50	31.0	-	1,160	1.40	-	8.85
		29 June 2021	7.70	-	2.90	18.7	-	<1	0.00	-	<4
		26 October 2021	7.80	-	2.70	30.1	-	2	0.01	-	<4
		28 February 2022	7.80	-	3.10	29.6	-	<1	<0.001	-	<4
		06 May 2022	7.50	800	6.50	40.0	< 0.08	32	0.68	< 0.50	33

12248 WROUGHTON CLOSED LANDFILL
SURFACE WATER MONITORING DATA

Hydrock

Sample Point ID	Relative Location	Date	pH	Alkalinity as CaCO3 (mg/l)*	Ammoniacal Nitrogen (mg/l)	Chloride (mg/l)	Cadmium (Dissolved) (ug/l)	Iron (Dissolved) (ug/l)	Iron (Total) (mg/l)	Lead (Dissolved) (ug/l)	Solids (Suspended) (mg/l)
		EQS>>	**6-9**			**250**	**0.25**	**1,000**		**6.98****	
		Discharge Consent>>	**6-9**	-	**10**	-	-	-	**5**	-	**35**
SW9	Wroughton Ditch downstream of engineered reed bed	30 May 2017	7.60	-	0.31	24.2	-	-	<2	-	45
		19 June 2017	7.80	338	1.20	33.0	<0.02	-	-	1.30	<10
		23 January 2018	7.60	-	0.21	26.1	-	17	0.28	-	<10
		19 February 2018	7.84	344	0.21	31.5	<0.02	13	0.17	0.65	11
		05 March 2018	7.60	-	0.29	34.1	-	42	0.24	-	<10
		10 April 2018	7.66	-	0.99	26.9	-	71	0.63	-	<10
		29 May 2018	7.33	-	0.52	34.5	-	11	0.08	-	<10
		19 June 2018	7.47	-	0.72	38.1	-	53	0.29	-	<10
		15 April 2019	7.94	321	0.11	33.1	<0.02	9	0.02	<0.3	<10
		15 January 2020	7.88	-	0.28	14.1	-	68	0.72	-	6.3
		26 August 2020	7.65	-	<0.2	23.3	-	<19	0.04	-	<2
		28 October 2020	7.66	-	1.15	16.9	-	117	1.02	-	5.95
		07 December 2020	7.50	-	<0.2	18.8	-	31	0.12	-	<2
		15 March 2021	7.88	-	2.29	22.7	-	33	0.91	-	3.4
		07 April 2021	7.64	-	6.39	31.1	-	1,050	1.23	-	7
		29 June 2021	7.60	-	3.00	18.8	-	<1	0.01	-	8
		26 October 2021	7.80	-	2.70	30.0	-	5	0.01	-	24
		28 February 2022	7.70	-	0.10	23.5	-	<1	<0.001	-	<4
		06 May 2022	7.70	430	0.69	29.0	< 0.08	8	0.06	< 0.50	20

Notes

*	Cadmium EQS is dependent on hardness $CaCO_3$
**	EQS for lead is based on bioaccessible fraction (see supporting M-BAT information).
1.23	Exceedance of EQS
1.23	Exceedance of Discharge Consent

SW1 data are taken from the historical Hydrock Surface Water Monitoring report (Ref: R/08180/003, dated 6 October 2009). Data are shown as upstream location for completeness.
All other data are taken from the Hills Waste Solutions Ltd. Report on surface water monitoring of the Wroughton Closed Landfill (issued May 2022).

Summary of Remedial Targets Methodology Screening

Hydrock

Hydrock Scenario: Scenario B - EQS (inland)
RTM Level: RTM Level 1 - Soil Zone Assessment - leachate samples
Water body receptor(s): Surface water (Wroughton Ditch)
Secondary receptor(s):
Data set: Leachate from Capping Layer
Client: The Hills Group Ltd.
Site: Wroughton Closed Landfill
Job no: 12248
Test Certificates(s): 22-71525
Dataset Capping Layer

PNEC calculated (inland EQS)

2013/39/EU Annex I
P = priority substance
PH = priority hazardous substances.
WFD Designation (2015 Directions)
OP = Other substance identical to previous legislation
SP = Specific Pollutant
JAGDAG Hazardous Substances Determination (UK)
H Hazardous substance
NP Non-hazardous pollutant
(blank) Not included in assessment

CAS / AGS Number	Chemicals of Potential Concern (concentrations in µg/l)	WFD Designation	Hazardous Substance Status	Summary of Sample Data						Value Being Compared to Target = Maximum Value	Water Quality Target (Exceeded if Red		No. Samples Exceeding Water Quality Target		No. Samples above LoD Exceeding Water		Notes
				No. of Samples	No. of Samples > LoD	Limit of Detection	Minimum Value	Maximum Value	95-%ile Value			Inland Waters EQS		Inland Waters EQS		Inland Waters EQS	
7440-38-2	Arsenic (As) (dissolved)	SP	**H**	6	6	1	1.7	3.9	3.575	3.9		50		0		0	
7440-42-8	Boron (B) (dissolved)		NP	6	6	10	20	36	35.5	36		2000		0		0	
18540-29-9	Chromium (VI) (Cr) (dissolved)	SP	**H**	6	0	5	<5	<5	<5	<5		3.4		6		0	
16065-83-1	Chromium (III) (Cr) (dissolved)	SP		6	0	5	<5	<5	<5	<5		4.7		6		0	
7440-47-3	Chromium (Cr) (total) (dissolved)			6	6	0.4	1.2	4.2	4.125	4.2		n/a					
7440-50-8	Copper (Cu) (dissolved)	SP	NP	6	6	0.7	5	26	24.5	26		26.28		0		0	Bioavailable EQS (inland)
7439-89-6	Iron (Fe) (dissolved)	SP		6	6	4	19	1400	1375	1400		1000		2		2	
7440-02-0	Nickel (Ni) (dissolved)	***P***	NP	6	6	0.3	1.4	5.3	5.125	5.3		17.11		0		0	Bioavailable EQS (inland)
7439-92-1	Lead (Pb) (dissolved)	***P***	**H**	6	6	1	4.4	9.3	9.15	9.3		6.98		2		2	Bioavailable EQS (inland)
7440-62-2	Vanadium (V) (dissolved)			6	6	1.7	13	18	17.25	18		60		0		0	EQS (inland) dependent on hardness of receiving surface water environment
7440-66-6	Zinc (Zn) (dissolved)	SP	NP	6	6	0.4	5.3	20	19.25	20		31.34		0		0	Bioavailable EQS (inland) + ambient background concentration (ABC)
P1238	Ammoniacal Nitrogen (as N)		NP	6	0	15	<15	<15	<15	<15		300		0		0	
P1134	pH (min.) (su)			6	6	0	6.8	7.2	7.2	7.2		6		0		0	
P1134	pH (max.) (su)			6	6	0	6.8	7.2	7.2	7.2		9		0		0	
120-12-7	Anthracene	***PH***	**H**	6	0	0.01	<0.01	<0.01	<0.01	<0.01		0.1		0		0	
50-32-8	Benzo(a)pyrene	***PH***	H	6	0	0.01	<0.01	<0.01	<0.01	<0.01		0.00017		6		0	Benzo(a)pyrene EQS used as marker substance for the group of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene & indeno (1,2,3-cd)pyrene
206-44-0	Fluoranthene	***P***	**H**	6	0	0.01	<0.01	<0.01	<0.01	<0.01		0.0063		6		0	
91-20-3	Naphthalene	P	NP	6	0	0.01	<0.01	<0.01	<0.01	<0.01		2		0		0	
GRP01	PAHs = sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene	***P***	**H**	6	0	0.04	<0.04	<0.04	<0.04	<0.04		n/a					

Remedial Targets Methodology Data Table

Hydrock

Hydrock Scenario: Scenario B - EQS (inland)

RTM Level: RTM Level 1 - Soil Zone Assessment - leachate samples

Water body receptor(s): Surface water (Wroughton Ditch)

Secondary receptor(s):

Data set: Leachate from Capping Layer

Client: The Hills Group Ltd.

Site: Wroughton Closed Landfill

Job no: 12248

Test Certificates(s): 22-71525

Dataset Capping Layer

PNEC calculated (inland EQS)

123* Exceeds solubility value

<1 Grey text and "<" sign if value <= LoD

Red fill if value > Inland Waters EQS

Surface Water Representative Hardness as mg/l $CaCO_3$ 360

CAS / AGS Number	Chemical of Potential Concern (µg/l)	WFD Designation	Hazardous Substance Status	Solubility Limit (µg/l)	No. of samples	Limit of Detection		Inland Waters EQS	TP301 @ 0.4m	TP307 @ 0.6m	TP311 @ 0.5m	TP312 @ 0.5m	TP316 @ 0.25m	TP320 @ 0.25m
	Strata / Zone								Capping Layer	Capping Layer	Capping Layer	Capping Layer	Capping Layer	Capping Layer
	Date sampled:								27/06/2022	27/06/2022	28/06/2022	28/06/2022	04/07/2022	04/07/2022
7440-38-2	Arsenic (As) (dissolved)	SP	H		6	1		50	1.7	2.6	2.2	1.8	3.9	2.2
7440-42-8	Boron (B) (dissolved)		NP		6	10		2000	22	20	34	36	20	22
18540-29-9	Chromium (VI) (Cr) (dissolved)	SP	H		6	5		3.4	<5	<5	<5	<5	<5	<5
16065-83-1	Chromium (III) (Cr) (dissolved)	SP			6	5		4.7	<5	<5	<5	<5	<5	<5
7440-47-3	Chromium (Cr) (total) (dissolved)				6	0.4		n/a	1.8	1.6	1.2	2	4.2	3.9
7440-50-8	Copper (Cu) (dissolved)	SP	NP		6	0.7		26.28	8.2	11	5	6.7	20	26
7439-89-6	Iron (Fe) (dissolved)	SP			6	4		1000	21	810	19	300	1300	1400
7440-02-0	Nickel (Ni) (dissolved)	P	NP		6	0.3		17.11	1.4	2.8	1.9	2.7	4.6	5.3
7439-92-1	Lead (Pb) (dissolved)	P	H		6	1		6.98	5.4	6.8	5.6	4.4	8.7	9.3
7440-62-2	Vanadium (V) (dissolved)				6	1.7		60	15	15	13	14	18	15
7440-66-6	Zinc (Zn) (dissolved)	SP	NP		6	0.4		31.34	5.3	13	13	11	20	17
P1238	Ammnoniacal Nitrogen (as N)		NP		6	15		300	<15	<15	<15	<15	<15	<15
P1134	pH (min.) (su)				6	0		6	6.8	6.8	7.2	7.2	6.8	6.9
P1134	pH (max.) (su)				6	0		9	6.8	6.8	7.2	7.2	6.8	6.9
120-12-7	Anthracene	PH	H	56	6	0.01		0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
50-32-8	Benzo(a)pyrene	PH	H	3.8	6	0.01		0.00017	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
206-44-0	Fluoranthene	P	H	230	6	0.01		0.0063	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
91-20-3	Naphthalene	P	NP	19000	6	0.01		2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
GRP01	PAHs = sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene	P	H		6	0.04		n/a	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04

Summary of Remedial Targets Methodology

Notes to Remedial Targets Methodology Table(s)

1 Substances labelled P are defined in 2013/39/EU Annex I as priority substances in the field of water policy and those labelled PH as priority hazardous substances. Substances labelled H are hazardous as defined by JADDAG

2 EQS for inland waters applies to freshwater rivers, lakes etc. EQS for other waters refers to marine and transitional (eg estuarine) waters.

3 Inland waters EQS for Cd, V and fluoride depend on water hardness (mg/l as $CaCO_3$). Where applicable, water hardness is measured, otherwise it has been estimated by reference to the map at http://dwi.defra.gov.uk/consumers/advice-leaflets/hardness_map.pdf. If hardness cannot be determined, a worst case is assumed by setting it to 10mg/l.

4 EQS for inland waters for Cu, Mn, Ni, Pb and Zn are based on bioaccessible fraction. In addition, the EQS for Zn is in excess of the ambient background concentration (ABC). EQS for other waters for Cu is a function of DOC and that for Zn is in excess of ABC. These details have been taken into account in this assessment (see report text for details) by calculating site-specific $PNEC_{bioavailable}$ and comparing these with the dissolved concentrations.

INPUT DATA										RESULTS (Copper)				RESULTS (Zinc)				RESULTS (Ni)			
ID	Location	Waterbody	Date	Measured Cu Concentration (dissolved) (µg l^{-1})	Measured Zn Concentration (dissolved) (µg l^{-1})	Measured Ni Concentration (dissolved) (µg l^{-1})	pH	DOC	Ca	Site-specific PNEC Dissolved Copper (µg l^{-1})	BioF	Bioavailable Copper Concentration (µg l^{-1})	Risk Characterisation Ratio	Site-specific PNEC Dissolved Zinc (µg l^{-1})	BioF	Bioavailable Zinc Concentration (µg l^{-1})	Risk Characterisation Ratio	Site-specific PNEC Dissolved Nickel (µg l^{-1})	BioF	Bioavailable Nickel Concentration (µg l^{-1})	Risk Characterisation Ratio
1	SW1	Wroughton Ditch (Ray for DOC & Ca)	2008-2009	5.29	17.57	3.33	7.5	5.82	123	26.28	0.04	0.20	0.20	29.34	0.37	6.53	0.60	17.11	0.23	0.78	0.19

INPUT DATA						RESULTS (Pb)			
ID	Location	Waterbody	Date	Measured Pb Concentration (dissolved) (µg l^{-1})	DOC	Site Specific PNEC Dissolved Pb (µg l^{-1})	BioF	Available Pb (µg l^{-1})	Risk Characterisation Ratio
1	SW1	Wroughton Dit	2008-2009	8.07	5.82	6.98	0.17	1.39	1.16

Date	Calcium (mg/l)	Dissolved Organic Carbon (mg/l)
23-Apr-14	132	4.62
30-May-14	119	9.24
18-Jun-14	133	3.92
21-Jul-14	114	3.96
22-Aug-14	97	3.89
12-Sep-14	129	2.45
12-Nov-14	84	13.30
18-Nov-14	128	-
16-Dec-14	142	6.77
30-Dec-14	130	4.43
20-Jan-15	132	6.23
18-Feb-15	131	6.31
30-Mar-15	137	4.79
27-May-15	131	3.41
29-Jun-15	132	3.06
29-Jul-15	127	3.53
20-Aug-15	86	4.69
15-Sep-15	99	4.23
27-Oct-15	135	4.39
25-Nov-15	130	9.03
9-Dec-15	134	7.16
27-Jan-16	108	13.70
12-Feb-16	132	7.00
21-Mar-16	133	3.86
Average>>	**123**	**5.82**

Notes:

Data are taken from the Environment Agency Water Quality Archive for the River Ray. Available: link