



REPORT

Biffa Waste Services Ltd

Eye Landfill, Eastern Extension

Environmental Setting and Installation Design

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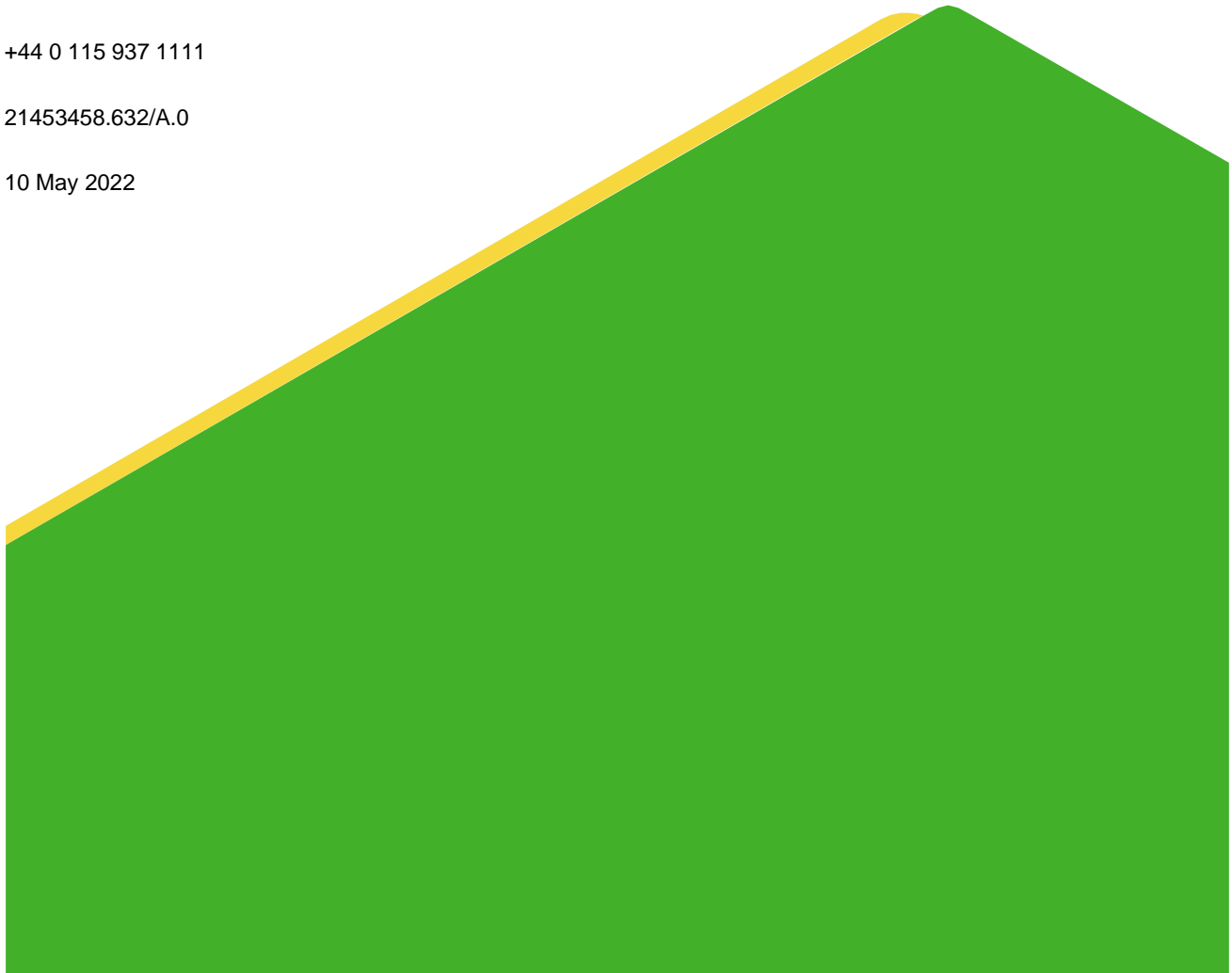
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1.0 INTRODUCTION

1.1 General

This Environmental Setting and Installation Design (ESID) Report has been prepared by Golder, member of WSP in UK (Golder), on behalf of Biffa Waste Services Ltd (Biffa) in support of its Environmental Permit variation application for development of an Eastern Extension at Eye Landfill, Eyebury Road, Eye, Peterborough, Cambridgeshire, PE6 7TH (the 'Site').

1.2 Project Objectives and Description

Biffa would like to extend its existing landfill operations at Eye Landfill by the development of an Eastern Extension and is applying for planning permission and an Environmental Permit variation to:

- 1) Develop parts of Willow Hall Farm Quarry and Inert Landfill as a non-hazardous landfill (to be called the Eastern Extension) for continuous and uninterrupted landfilling operations after the current Southern Extension at Eye Landfill is completed.

Biffa's overall objective is to secure permission for the Eastern Extension to maintain Eye Landfill's long-term role in supporting its waste transfer, recycling and recovery operations, and in providing landfill capacity in the region.

Willow Hall Farm Quarry and Inert Landfill is located immediately to the east of Eye Landfill and is operated by PJ Thory Ltd (Thory). It is an active sand and gravel quarry which is being restored to a low level, flat lying restoration through the progressive importation of inert waste.

Biffa and Thory have agreed the feasibility of Biffa utilising void space at Willow Hall Farm Quarry and Inert Landfill for the disposal of non-hazardous waste and have been working collaboratively to this effect. In doing so, Biffa recognises the need for this application to fully align with a separate application prepared in parallel and submitted by Thory to make the necessary adjustments to its existing scheme for Willow Hall Farm Quarry and Inert Landfill.

Re-development as a non-hazardous waste landfill requires this application to provide a new scheme for the excavation and movement of underlying clay materials, excavation and relocation of inert waste already deposited, and changes to the approved phasing and restoration contours. The new scheme will reduce the overall landfill footprint, bring forward and enhance some areas of restoration including the Green Wheel path, and provide an extension to Biffa's existing Wildlife Corridor.

The Eastern Extension Landfill will be accessed from Eye Landfill and so Biffa is also applying to:

- 2) Replace the existing and now old Site Reception at Eye Landfill with a new Site Reception in an adjacent location. The new Site Reception will be similar and will have car park, office, welfare, weighbridge, wheelwash, car park and leachate storage tank facilities. Biffa will decommission and remove the old facilities.
- 3) Re-route the internal haul road, so it passes from the new Site Reception around the west and north of the existing Recycling Shed by improving an old haul route originally used in the 1980s/1990s and passes along the southern edge of the Central Area.
- 4) Create a new crossing over the Cat's Water Drain at the southeast corner of the Central Area to serve the Eastern Extension; and
- 5) Extend pipework so that infrastructure currently used for the management of leachate and landfill gas can also serve the Eastern Extension.

The proposed development is summarised as follows:

- Ongoing mineral extraction operations at Willow Hall Farm Quarry will continue and be completed by Thory to existing timescales; however, the ongoing restoration by the placement of inert waste would cease subject to approval of Biffa's planning and Environmental Permit variation applications.
- With permissions in place, Biffa proposes to commence preparation works in 2022 and landfilling in April 2023. Preparation works will include the new Site Reception and haul road. It will also include backfilling the southeast corner of Willow Hall Farm Quarry closest to residential properties with clay and completing restoration in advance of landfilling.
- Landfilling would commence in the southwestern corner and move anticlockwise and then progressively northwards. The site would receive some 3.23 Mm³ of waste (pre-settlement, pre-restoration) or 2.43 Mm³ of waste (post-settlement, pre-restoration) over the period from 2023 to 2038 followed by completion of restoration.
- Inert waste already placed by Thory at the north end of its Inert Landfill would be excavated by Biffa and re-deposited in a dedicated inert landfill area between the transmission line and the Cat's Water Drain. Inert waste would be placed to a low-level and restored to surrounding ground level to provide an extension to Biffa's existing Wildlife Corridor.
- Areas to the south of the Green Wheel path would not be filled with waste. Instead, Biffa would excavate Oxford Clay from the base of the quarry and place it, together with sub-soil and top soil, to a low level restoration and return it to agriculture as soon as possible after completion of mineral extraction operations by Thory.

1.3 Environmental Permits

1.3.1 Willow Hall Farm Inert Landfill

Willow Hall Farm Inert Landfill is operated by Thory under Environmental Permit EPR/DB3007TZ for inert landfill, which was issued by the Environment Agency (EA) to TAG Industries Ltd on 4 February 2016 and transferred to Thory on 14 November 2017 (EPR/FB3204MX).

In addition, Thory holds Environmental Permit EPR/EB3091VZ for the discharge of trade effluent composed of quarry void/excavation dewatering, which was issued to TAG Industries Ltd on 10 February 2017 and transferred to Thory on 19 June 2017 (EPR/EB3091VZ/T002).

1.3.2 Eye Landfill Northeastern and Southern Extensions

The Northeastern and Southern Extensions of Eye Landfill are authorised by Environmental Permit EPR/BP/3537PP issued by the EA in 2005. The EP was last varied and consolidated by the EA in May 2018 (Variation V010). Key conditions/considerations are:

- Table S1.1 activities and directly associated activities:
 - AR1. Section 5.2 Part A(1)(a). Landfill for non-hazardous waste and landfill restoration;
 - AR2. Section 5.2 Part A(1)(a). Landfill for hazardous waste i.e. stable non-reactive hazardous waste;
 - AR3. Section 5.4 Part A(1)(a)(i). Storage and treatment of leachate via Miscanthus Beds in a facility with a capacity of >50 tonnes/day;
 - AR4. Treatment and utilisation of landfill gas;
 - AR5. Storage and pre-treatment of leachate;

- AR6. Landfill gas flaring;
 - AR7. Discharge of pre-treated leachate to sewer;
 - AR8. Discharge of site drainage;
 - AR9. Fuel storage;
 - AR10 Storage of raw materials in bulk storage containers;
 - AR11. Production and storage of waste oils;
 - AR12. Not used; and
 - AR13. D10 Deposition into or on to land.
- Table S1.5 Annual waste input limits. The Site is permitted to accept 400,000 tonnes of non-hazardous waste, 204,999 tonnes of inert waste and 20,000 tonnes of asbestos wastes per year up to maximum total 400,000 tonnes per year.

1.4 Pre-Application Consultation

Enhanced Pre-Application Advice was requested by Biffa and provided by the EA in October 2021. A Nature and Heritage Screening Report is provided in **Appendix ESID1** and a Pre-Application Advice letter is provided in **Appendix ESID2**. Key advice provided includes:

- Biffa should apply to vary the permit for Eye Landfill, to extend the landfill, consolidate with the inert landfill permit and surrender appropriate areas.
- A separate application to transfer the Inert Landfill permit (from Thory to Biffa) must be applied for during determination of the above variation in order for the transfer application to be determined just prior to the variation.
- Recommended permitting approach is:
 - Variation application to extend EPR/BP3537PP (Eye Landfill); to vary to consolidate EPR/BP3537PP with EPR/FP3204MX (Inert Landfill) and EPR/EB3091VZ (Discharge Activity); and to surrender the unused area no longer required in the permit;
 - Transfer application for EPR/FP3204MX (Inert Landfill) from Thory to Biffa;
 - Transfer application for EPR/EB3091VZ (Discharge Activity) from Thory to Biffa; and
 - Surrender of EPR/EB3091VZ (Discharge Activity) once the limits have been consolidated into the installations permit.
- Financial Provision will be required for the consolidated site; and
- No Climate Change Risk Assessment is needed.

1.5 ESID Scope

An ESID report for the Northeastern Extension was submitted in March 2004. The Northeastern Extension (~11 ha) was filled with non-hazardous waste between approximately 2005 and 2011 and has been restored to agriculture.

An ESID Report for the Southern Extension was submitted in June 2008. The Southern Extension (~15 ha) is the current operational landfill area for non-hazardous and stable non-reactive hazardous (i.e. asbestos) wastes.

The ESID Report was subsequently amended to vary the location of cells to receive stable non-reactive hazardous waste and for the development of miscanthus beds for the treatment of leachate.

Planning permission for the Southern Extension expired on 31 December 2021 and Biffa had not completed the Site within this timeframe. Consequently, in consultation with Peterborough City Council, Biffa submitted a separate planning application in December 2021 to extend the permission for filling to 31 December 2025 with restoration by 31 December 2027. As such, landfilling continues to take place in the Southern Extension at Eye Landfill whilst the planning application is determined. Within this extended timeframe, Biffa anticipates that it will continue to accept non-hazardous waste until end March 2023 and small amounts of Stable Non-Reactive Hazardous Waste (SNRHW i.e. wastes containing asbestos) until 31 December 2025.

Biffa is therefore making this application for the Eastern Extension to be open and ready for the acceptance of non-hazardous waste in April 2023. The Eastern Extension is located in Willow Hall Farm Quarry which is an area distinct from the Northeastern and Southern Extensions although some infrastructure will be shared. For this variation application, and as required by the EA application form (Part C3, Appendix 4, Question 1), the ESID has been updated to take into account current operations and the proposed Eastern Extension which will be engineered and managed in accordance with the principles already established at the existing Site.

This ESID report therefore updates previous ESID Reports only so far as to reflect the current *operational status* of the Site or where there is considered to be a *material change* to the conceptual model. It is not intended to fully update non-material changes or summarise aspects of engineering, construction quality assurance, environmental monitoring or annual review that are fully considered by the EA elsewhere in accordance with the Permit.

The following drawings are provided in this ESID report:

- Drawing ESID1 – Site Location Plan;
- Drawing ESID2 – Environmental Site Setting;
- Drawing ESID3 – Cultural and Natural Heritage;
- Drawing ESID4A – Site Layout and Waste Deposition;
- Drawing ESID4B – Pre-Settlement Pre-Restoration;
- Drawing ESID5 – Restoration;
- Drawing ESID6A – Installation Plan;
- Drawing ESID6B – Engineering and Containment;
- Drawing ESID7A – Leachate Management Layout;
- Drawing ESID7B – Leachate Management Details;
- Drawing ESID8 – Landfill Gas Management;
- Drawing ESID9A – Regional Geology;
- Drawing ESID10 – Regional Hydrogeology;
- Drawing ESID11 – Local Hydrogeology and Hydrology;
- Drawing ESID12 – Hydrogeological Conceptual Site Model; and
- Drawing ESID13 – Monitoring and Extraction Point Plan.

1.6 Historical Development and Current Site Activities

1.6.1 Eye Landfill

1.6.1.1 Location

Eye Landfill is approximately 1 km southeast of the village of Eye, Peterborough at National Grid Reference TF 235 010 (**Drawing ESID1 - Site Location Plan**). It is operated by Biffa Waste Services Ltd.

1.6.1.2 Historical Development

Eye Landfill has been progressively developed as a quarry for the extraction of sand and gravel with restoration by landfill under a series of planning permissions since 1966. Planning permission P.23.65, dated 19 January 1966, allowed the abstraction of sand and gravel above the water table with restoration at a low level. Subsequent permissions allowed working below the water table (1975), infilling certain areas with inert material (1978) and extraction and restoration by backfilling with controlled waste in certain areas (1981).

Today, Eye Landfill covers a total area of approximately 130 hectares (ha) developed under a range of planning permissions and includes four areas of landfill, as follows:

- The Central Area (~24 ha) was filled with putrescible waste from 1982 to 2000 and has been restored to agriculture.
- The Northern Extension (~7 ha) was filled with non-hazardous waste and with some asbestos between approximately 2000 and 2005 and has been restored to agriculture.
- The Northeastern Extension (~11 ha) was filled with non-hazardous waste between approximately 2005 and 2011 and has been restored to agriculture.
- The Southern Extension (~15 ha) is the current operational landfill area for non-hazardous and stable non-reactive hazardous (i.e. asbestos) wastes.

Eye Landfill also has the following infrastructure and features:

- A Wildlife Corridor to the east of the Southern Extension to mitigate and compensate ecological impacts of its development. The Wildlife Corridor sits astride the path of a high voltage transmission line passing SSW to NNE.
- The Cat's Water Drain is a natural watercourse along the eastern boundary which flows southwards. It is maintained by the District Internal Drainage Board (IDB) and has been canalised adjacent to the Site.
- An 'Archaeological Exclusion Zone' between the Northern and Northeastern Extension Areas.
- 'Clear Water Lagoon' is a large lake located between the Central Area and the Southern Extension.
- The Green Wheel footpath passes west to east, along the northern edge of the Clear Water Lagoon.
- Gas Compound and two Leachate Storage Lagoons.
- Miscanthus Beds for the treatment of leachate.
- Site Reception (including office, two weighbridges, welfare facilities and car park).
- Recycling Shed; and
- Silt Lagoons to the north and northeast of the Site Reception.

1.6.1.3 Access

Vehicular access to Eye Landfill is via the existing 700 m long entrance road from Eyebury Road to the Site Reception. The entrance road connects to Eyebury Road with a T-junction arrangement. The entrance road is surfaced in concrete with signage and traffic calming measures.

1.6.1.4 Site Reception

The current Site Reception comprises:

- Visitor car park, surfaced in sand and gravel, with parking for about ten cars and/or small vans.
- Raised modular buildings to provide office accommodation for weighbridge clerk and Site Manager, and with a meeting room, kitchen, second office, and toilets.
- Two weighbridges (in and out).
- Wheelwash.
- Leachate storage tank and parking bay used for the loading of landfill leachate by road-going tanker to export an appropriately authorised wastewater treatment works.

1.6.1.5 Consented Hours of Operation

The currently consented hours of operation for the Site are as follows:

- 07.00 to 18.00 Monday to Friday;
- 07.00 to 18.00 Saturdays; and
- At no other times or on Sundays, Public Holidays or Bank Holidays.

The above are adhered to, except in emergencies, to maintain safe working and environmental protection (and are notified to the Planning Authority in writing as soon as possible afterwards) or where the Planning Authority has agreed otherwise in writing. Periods of servicing and maintenance of plant and equipment outside the hours above are noted in the Site logbook.

1.6.2 Willow Hall Farm Quarry and Inert Landfill

1.6.2.1 Location

Willow Hall Farm Quarry and Inert Landfill is located to the east of Eye Landfill, on the eastern side of the Cat's Water Drain and to the west of Willow Hall Lane (**Drawing ESID1 - Site Location Plan**).

1.6.2.2 Historical Development

Willow Hall Farm Quarry and Inert Landfill is an active sand and gravel quarry operated by PJ Thory Ltd. The site is being restored to a low level, flat lying restoration through the progressive importation of inert waste.

Pedestrian access to the site can be gained via Willow Hall Lane which runs southwest from the A47 road; however, vehicular routes for the processing and export of mineral and the import of inert waste is via a 3.6 km long haul road and entrance road eastwards to the B1040 North Side road. Planning permissions were obtained as follows.

- 12/01008/MMFUL valid 27 June 2012 for the extraction of sand and gravel with restoration of low-level agriculture using uncontaminated inert waste, continued use of new haul road and crossing of Willow Hall Lane.

- 17/00279/WCMM valid 14 February 2017 for the variation to Conditions 2, 3, 4 and 15 of permission 12/01008/MMFUL to allow mineral extraction and infill operations within 50 m of the Bar Pastures Scheduled Monument.

Thory is systematically extracting mineral and filling with inert waste behind in a continuous operation from north to south. The sand and gravel is a shallow deposit of variable thickness and typically less than 6 to 8 m. It occurs below the top soil and a silty overburden, and overlies clay. To date, the site has progressed as follows:

- 'Restored Area' (north end of site). Sand and gravel has been extracted and the void backfilled with inert waste. Prior to infilling, clay excavated from the base of the quarry has been placed against the sidewalls to provide a geological barrier and to manage groundwater. The Area has been filled, graded and restored to a flat lying low level restoration, about 1 m below surrounding ground level.
- 'Active Filling Area'. Sand and gravel has been extracted, clay placed, and inert waste is currently being deposited. Waste exposed in the tipping face comprises primarily a brown soil-like material.
- 'Active Extraction Area'. Sand and gravel has been extracted down to the top of clay. The haul road for dump trucks passes across this area to the mineral extraction face that extends west to east and defines the southern edge (**Figure ESID1**). All sand and gravel has been removed but all top soil and overburden remains on site in areas already restored, in screening bunds, edge protection bunds, and in stockpiles on the quarry bottom.
- 'Soil Stripping Area'. Topsoil has been stripped in advance of the working face and archaeological survey takes place in accordance with the planning permission (**Figure ESID1**).
- 'Unworked Area' (southern end of the site). The Unworked Area remains in agricultural use for the time being (**Figure ESID2**). The Green Wheel footpath passes across the Unworked Area but in time will be subject to diversion and then reinstatement as a bridleway on its original route, in accordance with the planning permission.

Thory estimates that mineral extraction will be completed at end 2025. Consequently, if Biffa enters the Eastern Extension in April 2023, mineral extraction will have advanced to about the line of the Green Wheel path, and not wholly complete.



Figure ESID1: Working face with Active Extraction Area (left) and Soil Stripping Area (right)



FigureESID2: Unworked Area, looking South

1.7 Installation Details for the Eastern Extension

1.7.1 Topography

1.7.1.1 Surrounding Topography

Willow Hall Farm Quarry and Inert Landfill occupies an area of flat topography. Spot heights provided by the Ordnance Survey on Willow Hall Lane show 4.0 m AOD at the north end of the site and 3.7 m AOD at the southern end.

1.7.1.2 Pre-Existing Topography at Willow Hall Farm Quarry

93 mineral investigation boreholes were drilled by ARC in 1992 and an additional 18 mineral investigation boreholes were drilled in 2011. The 'collar level' (m AOD) of each borehole is recorded. For the 1992 boreholes, there is reasonable confidence that the 'collar level' represents the topographic level at each borehole location, and so the pre-existing topographic survey has been reproduced by Biffa in the design of this development scheme.

1.7.1.3 Mineral Extraction at Willow Hall Farm Quarry

The area of mineral extraction at Willow Hall Farm Quarry is about 41 ha. The recoverable mineral reserve tonnage was identified in the planning application to be 2.25 Mt in accordance with the following information and assumptions:

- Site investigation information was obtained by ARC (1992) and Thory (2011).
- Stand-off distances from the Site boundary to the limit of excavation, include:
 - 50 m from the Bar Pastures Scheduled Ancient Monument (planning permission 12/01008/MMFUL) reduced to 12 m (planning permission 17/00279/WCMM);
 - 16 m from the Cat's Water Drain to accommodate edge protection bunds and 9 m IDB minimum standoff requirement;
 - Minimum 75 m from residential properties;
 - Minimum 10 m from the site boundary to allow access, to ensure the stability of adjacent land and to accommodate edge protection bunds; and
 - 20 m stand-off from electricity pylons to the limit of excavation.
- 1(v):1(h) excavation batters.
- 1.75 tonnes/m³ conversion factor.

Mineral extraction is described by Thory in terms of three phases i.e. Northern, Central and Southern. The boundary between the Central Phase and the Southern Phase occurs, west to east, just north of the Green Wheel footpath, where the base of the sand and gravel changes. Material balance information is summarised in **Table ESID1** adapted from Thory. 'Overburden' (as described by Thory) refers to all soils above the mineral and is quoted as 374,000 m³; however, in this table, it is usefully divided between top soil (0.3 m thick) and subsoil (variable thickness).

Table ESID1: Mineral Reserve Schedule

Phase	Area (ha)	Top Soil (0.3 m thick) (m ³)	Sub Soil (Overburden) (m ³)	Recoverable Mineral (m ³)	Duration of Extraction
Northern	13.76	41,280	86,720	569,142	4 - 5 years
Central	14.33	42,990	86,010	505,714	3.5 - 4.5 years
Southern	12.98	38,940	78,060	213,714	1.5 - 2 years
Total	41.07	123,210	250,790	1,228,570	

1.7.2 Location and Access

1.7.2.1 Entrance and Entrance Road

The existing 700 m long site entrance road from Eyebury Road will continue to be used and will take traffic to the new Site Reception. The entrance road connects to Eyebury Road with a T-junction arrangement. The access junction is purpose-built for the landfill and the parameters and junction radii cater for the swept-path requirements of Heavy Commercial Vehicles (HCVs). The entrance road is surfaced in concrete with signage and traffic calming measures.

On-Site vehicle speeds are monitored and appropriate controlling action is taken. A crawling speed limit is imposed and maintained at all times, aided by traffic calming measures. Signs giving safety information, traffic directions and speed limits have been erected where appropriate and are moved or modified as required.

The access has secure heavy steel gates to prevent non-operational vehicle access to the Site when closed. An identification board will remain situated at the entrance on Eyebury Road displaying the following information:

- Operator's name and address;
- Site name and address;
- Opening hours;
- Environment Agency contact details;
- Emergency out of hours contact details; and
- EP Permit No.

This notice is maintained in good order throughout the operational life of the Site.

1.7.2.2 New Site Reception

The current Site Reception is old, and Biffa will provide a new Site Reception in an adjacent location so that operations can transfer from the old to the new without interruption. The new Site Reception will be located about 50 m north as shown on **Drawing PAS10 – New Site Reception and Haul Road**. It will comprise:

- Visitor car park surfaced in sand and gravel, with parking (2.4 m x 3.0 m) for 17 cars or small vans.
- One above ground weighbridge (for both in and out) with driver walkway (similar to existing).
- Site office, meeting room, kitchen and welfare facilities comprising three side-by-side, joined prefabricated modular buildings (total 10 m x 9 m) with flat roofs, installed on their jack-legs and/or block pads. The toilet and welfare facilities will have a built-in sewage tank (above ground). They will be connected to mains electricity and telephone.

- One Mess Room comprising one prefabricated modular building (total 10 m x 3 m) with flat roof, installed on its jack-legs and/or block pads.
- Wheelwash.

Pre-fabricated modular buildings will be metal clad, and with security grilles over the windows.

The new Site Reception will be re-orientated towards the haul road.

1.7.2.3 Leachate Tank (to be Retained)

The new Site Reception will retain a leachate storage tank and parking bay used for the export of landfill leachate by road going tanker to an appropriately authorised waste water treatment works (see **Figure ESID3**).

The leachate storage tank is located approximately 35 m southeast of the Site Reception buildings and weighbridge. The tank is 54,000 litres volume, free standing, horizontal, 110% open bunded steel tank. The structure is finished in a visually recessive green colour.

The tank is fed with leachate via 40 mm HDPE pipe and the pumps only run when the level in the tank is low enough to accept leachate. They are controlled by a level transducer in the tank and there is a three stage shut off system to the tank to prevent overflow. It has a readout display mounted by the discharge slam shut button in the tanker bay to enable easy checking of levels in the tank. The tank also has a monitoring system installed with the ability to remotely view real time tank and bund levels and to send out high level alarm notifications.

The tank is emptied via a flexible hose with Bauer couplings. The manual valve to this hose is locked to prevent unauthorised access. There is also a slam shut valve on the discharge line operated by a button in the tanker bay which opens the valve for 30 minutes with a flashing green light to indicate it is open. There are two valves on the outlet should one fail and a Bauer blank end is placed on the end of the discharge pipe for extra security. There is also an air inlet valve to allow the hose to be fully emptied at the end of discharge to the tanker.



Figure ESID3: Road Tanker in Loading Bay and Leachate Storage Tank (to be retained)

1.7.2.4 *Re-alignment of Haul Road around Recycling Shed*

With development of the new Site Reception, Biffa proposes to modify the route of the internal haul road to pass through the new Site Reception and then around the northern side of the existing Recycling Shed. It will then pass between the Silt Lagoons to join the 'main spine' of the Site as shown on **Drawing PAS10 – New Site Reception and Haul Road**. This route was previously used during earlier stages of landfill development and is proposed to be re-adopted for the Eastern Extension.

1.7.2.5 *Haul Road crossing the Green Wheel Path*

Landfill traffic on the 'main spine' will cross the Green Wheel path at the existing crossing point. The Health and Safety aspects of this crossing, improvements to crossing infrastructure and operational instructions to drivers will be subject to review by Biffa. Biffa acknowledges that current users of the path may have become accustomed to light vehicle and occasional use by Eye Landfill traffic and will upgrade the existing crossing point to reflect its reversion to daily operational use, including:

- Improved sight lines.
- Consideration of walkers including stiles or 'kissing gates'.
- Consideration of horse riders including raised sight lines, corral fencing, waiting areas back from the crossing, and gates that can be opened and closed without dismount.
- Consideration of cyclists to slow, but not necessarily stop progress.
- Localised surfacing to prevent the raising of dust.
- New signage.

The conceptual design of the new crossing point is shown in **Drawing PAS11 – Green Wheel Path Crossing**. The crossing point will be actively managed by Biffa and the operational procedures and infrastructure will be regularly reviewed.

1.7.2.6 *Haul Road crossing the southern margin of the Central Area*

The proposed haul route will pass west to east across the southern margin of the Central Area. This area was filled in the 1980s and is fully capped and restored. In developing the haul road, Biffa will:

- Maintain a minimum stand-off of 10 m from the fence line.
- Maintain a minimum stand-off of 5 m from all environmental monitoring infrastructure including leachate and gas wells and monitoring boreholes.
- All top soil will be stripped and pushed into a low bund on the southern side of the haul road.
- The haul road will be constructed with minimum 500 m of recycled aggregate materials with reinforcement (e.g. geogrid) as required to provide a trafficable and rut-free surface.
- Pipes/drainage will be provided beneath the haul road to prevent ponding and erosion and to maintain existing surface water flows.

1.7.2.7 *Haul Road crossing the Cat's Water Drain*

At its eastern end, Biffa will route the internal haul road to a new crossing point over the Cat's Water Drain to enable traffic entry to the Eastern Extension at its southwest corner. Conceptual designs for the crossing point are shown in **Drawing PAS12 – Bridge over Cat's Water Drain**. The new crossing will provide:

- Two-way traffic with robust trafficable surface and edge protection;

- Capacity for full highway loading to current standards, excluding abnormal vehicles/loads;
- Design lifespan of the bridge would be approximately 15 years;
- Maintenance of water flow to IDB requirements to prevent flooding upstream, and prevent erosion and scouring of banks; and
- Carriage of pipework for the management of leachate and landfill gas to the Gas Compound and Leachate Tank.

Biffa has commissioned a high-level options appraisal for the new crossing over the Cat's Water Drain, which include:

- Option 1 – Enclosed Structure (Concrete Pipe Culvert);
- Option 2 – Enclosed Structure (Precast Reinforced Concrete Box Culvert); and
- Option 3 – Open Structure (Proprietary Bridge).

The options are described and discussed in a Technical Note provided as **Appendix ESID5**. The selected option will be subject to detailed design and approval of the IDB.

1.7.3 Landfill Classification

The Eastern Extension will be classified as a non-hazardous landfill. Only non-hazardous and inert solid wastes will be deposited. Stable non-reactive hazardous waste will not be accepted.

1.7.4 Installation Boundary

The installation boundary, including the Eastern Extension, is shown on **Drawing ESID2 – Environmental Site Setting**. The boundary includes:

- Northeastern Extension;
- Southern Extension (Cells 1 to 8);
- New Site Reception;
- New haul road alignment including bridge across the Cat's Water drain;
- Eastern Extension (Cells 9 to 18) for non-hazardous waste; and
- Eastern Extension (Cells 19 to 20) for the re-deposit of inert waste.

1.7.5 Security

The purpose of introducing security procedures is to prevent unauthorised waste disposal and safeguard Company property and environmental protection measures. This is achieved by:

- Preventing unauthorized access to the Site;
- Making buildings secure, immobilizing plant out of working hours;
- Utilising alarms, sensor lights or other means to discourage intruders; and
- Prosecuting offenders whenever possible.

Vehicular access to Eye Landfill is via the entrance gate off Eyebury Road. This gate is secure, constructed of heavy steel and is set back from the main road across the entire entrance roadway. The gate will be locked outside operating hours. Vehicular access to Willow Hall Farm Quarry from Willow Hall Lane also has a secure gate, constructed of heavy steel which will be locked outside operating hours.

All other boundaries are bounded screening bunds, dykes, vegetation and/or agricultural fences, which provide a significant degree of security that would be little improved by the addition of further security fences. Thus, the Site is generally secured from unauthorised access

The Gas Utilisation Compound encloses the gas utilisation plant, engines and flare and is secured against trespass for Health and Safety and security reasons with the provision of a nominal 2.4 m high galvanised palisade fence with pedestrian and vehicular access gates. A 1 m wide walkway is also provided around the external perimeter of the compound.

Two leachate holding lagoons are enclosed by post and wire fence with pedestrian access gate.

Management staff make unscheduled visits during hours when the Site is closed to check the Site for unauthorised access. Such visits are recorded in the Site diary.

At least once a week, the Landfill Manager or nominated deputy inspects the entire Site to check the condition of the perimeter and whether there is any evidence of illegal tipping, break-ins or vandalism. Such inspections and findings will be recorded in the Site diary.

Site staff will be instructed that, in the event of finding evidence of unauthorised access and/or vandalism, that the matter must be reported to the Police. If the incident involves unauthorised tipping, the Environment Agency will also be informed as soon as reasonably practicable. Perimeter barriers that are found to be in poor condition will be temporarily repaired immediately, and then permanently repaired within two weeks of inspection.

1.7.6 Land Use

Land uses within 500 m of the Permit Boundary are shown on **Drawing ESID2 - Environmental Site Setting** and summarised in **Table ESID2**, below:

Table ESID2: Land Uses within 500 m of the Permit Boundary

Boundary	Land Use within 500 m
Northern	<ul style="list-style-type: none"> ■ Agricultural Land. ■ Pode Hole Quarry (sand and gravel quarry operated by Aggregate Industries) is (at its closest point) adjacent to the Permit Boundary but also extends northeast to the A47 road. Different parts of the quarry are connected via an internal road that extends under Willow Hall Lane. ■ Bar Pastures Scheduled Ancient Monument and Bar Pasture Farm. ■ Cat's Water Drain extending to the north. ■ Transmission wires extending to the northeast. ■ Willow Hall Lane extending to the northeast.
Eastern	<ul style="list-style-type: none"> ■ Residential and commercial properties including Willow Hall Farm Cottage, Willow Hall, Prior's Farm, Briggs Farm Cottages and Willow Holt. ■ Willow Hall Lane. ■ Green Wheel path extending to the east.

Boundary	Land Use within 500 m
	<ul style="list-style-type: none"> ■ Thory's haul road extending to the east. ■ Biffa's Wildlife Corridor aligned with the transmission wires.
Southern	<ul style="list-style-type: none"> ■ Agricultural land. ■ Cat's Water Drain extending to the south. ■ Counter Drain. ■ Oxney Road. ■ Residential and commercial properties including America Farm, America Farm Cottage, Poplar Farm and Walnut Lodge.
Western	<ul style="list-style-type: none"> ■ Biffa's Central Area, exclusion zone, and Northern Extension. ■ Agricultural land. ■ Restored sand and gravel workings including backfilled areas and surface water features. ■ Green Wheel path extending to the west. ■ Tanholt Farm and Tanholt Cottages.

1.7.7 Identified Potential Receptors

The locations of identified potential receptors, including residential areas, Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar Sites, Sites of Special Scientific Interest (SSSIs) and Scheduled Monument sites identified within 5 km of the Site are presented on **Drawing ESID2 – Environmental Site Setting** and **Drawing ESID3 – Cultural and Natural Heritage**, and include:

Key statutory receptors are as follows:

- Eye Gravel Pit (SSSI) – 2,130 m to N;
- Eye Green (LNR) – 1,710 m to N;
- Dogsthorpe Star Pit (SSSI) – 1,980 m to NW;
- Dogsthorpe Star Pit (LNR) – 1,980 m to NW;
- Nene Washes (SPA) – 2,600 m to S and SE;
- Nene Washes (Ramsar) - 2,600 m to S and SE; and
- Nene Washes (SAC) – 3,200 m to SSE.

Non-statutory receptors are as follows:

- Eyebury Road Pits (CWS) – within Eye Landfill and linked to Biffa's ongoing restoration and ecological management including the Wildlife Corridor, Clear Water Lagoon and silt lagoons.

Cultural heritage features within 1.0 km of the site boundary include:

- Scheduled Monument, Iron Age and Roman settlement at Bar Pastures – 0 m to North.
- Scheduled Monument, Bowl barrow 780 m east of Bar Pasture Farm – 780 m to East.

- Scheduled Monument, Two bowl barrows 940 m south east of Bar Pasture Farm – 1,000 m to East.
- 2 Nr Grade II* Listed buildings at Oxney House – 500 m to NW.
- 4 Nr Grade II Listed buildings at Eyebury Farm – 610 m to WNW.
- 1 Nr Grade II Listed building 69 Eyebury Road – 840 m to NW.
- Grade II Listed building at Willow Hall – 90 m to East.
- Grade II Listed building at Prior's Farmhouse – 95 m to ESE

Bar Pastures Scheduled Ancient Monument (SAM) is located immediately north of Willow Hall Farm Quarry around Bar Pastures Farm. It is part of a settlement of Iron Age and Roman date, with a drove and associated ditches, rectilinear yards and other enclosures, some of which contain the remains of buildings. It is located on a gravel terrace about 1 km west of what was, formerly, the edge of the peat fen. Archaeological features are visible as low earthworks and as buried features within the underlying gravel below the depth of ploughing.

A second SAM comprises two bowl barrows, approximately 800 m east of the site situated on gravel islands along the prehistoric fen edge. These comprise earth mounds with encircling ditches associated with burials. The ditches have been infilled and the deeper remains are protected by Fen deposits.

Bridleway/Footpath Eye 3 runs in an east to west direction across Eye Landfill and across the Application Site. It forms part of the Peterborough Green Wheel - a recreational route around the city with 'spokes' out from the centre.

According to the EA Flood Maps, the Eastern Extension is within Flood Zone 1 i.e. an area of low probability of flooding (less than 1 in 1,000 years). Flood Zones 2 and 3 occur to the south and southwest of the Eastern Extension and include the former sand and gravel workings of the Southern Extension which are now subject to landfilling and restoration. A flood risk assessment was completed in 2008 as part of the permit application for this Southern Extension.

The Site is not located in a Nitrate Vulnerable Zone for Surface Water.

1.7.8 Compliance with Groundwater Protection Guidelines

Current guidance entitled '*The Environment Agency's approach to groundwater protection*', version 1.2 dated February 2018 sets out the EA's landfill location position statement (E1) which states that:

The Environment Agency will normally object to any proposed landfill site in groundwater SPZ1.

For all other proposed landfill site locations, a risk assessment must be conducted based on the nature and quantity of the wastes and the natural setting and properties of the location.

Where this risk assessment demonstrates that active long-term site management is essential to prevent long-term groundwater pollution, the Environment Agency will object to sites:

- *Below the water table* in any strata where the groundwater provides an important contribution to river flow, or other sensitive receptors*
- *Within SPZ2 or 3*
- *On or in a principal aquifer.*

Position Statement E1 uses the terms "important contribution" and "sensitive surface waters", which must be defined by site specific professional hydrogeological judgement. The relevant factors to be considered in "important contribution" and "sensitive" include:

- *proximity of surface water;*

- *directness of the hydraulic connection;*
- *quality and quantity of both the groundwater and the receiving surface water;*
- *the consequences of the potential impact on the surface water quality of any landfill development;*
- *the consequences of the potential impact on the ecology of the surface water due to changes in quality or level from any landfill development.*

For simplicity the general term “water table” has been used in Position Statement E1. When considering a landfill development, this term also applies to a piezometric head within a confining layer, where there is sufficient connectivity to the underlying aquifer to allow water to flow into the landfill void.

Compliance with the guidance (previously RGN3) was fully assessed in the Hydrogeological Risk Assessments for the Northeastern and Southern Extensions and the Permit was issued. This variation application seeks to extend the landfill operations eastwards and therefore beyond what has previously been assessed. Discussion regarding each of the aspects within position statement E1 is presented in the following sub-sections. A HRA for the Eastern Extension has been carried out (Report ref. 21453458.633).

1.7.8.1 Location Below the Water Table in the River Terrace Deposits

The landfill will lie within the Quaternary River Terrace Deposits with Oxford Clay beneath. Prior to quarrying in 2011 more stable water levels of approximately 1.3 to 2.4 m AOD (average of 1.6 m AOD) were measured. The water table in the River Terrace Deposits is variable due to the influence from dewatering within the quarry, reported to range between approximately -3 and 3 m AOD. For the purposes of compliance with the position statement, consideration of whether the groundwater within the sand and gravels provides an important contribution to river flow, or other sensitive receptors is required.

The area lies within the catchment of the River Nene, which is located approximately 2.5 km to the south. Drainage within the area has been heavily modified by manmade drainage channels to lower the natural water levels and drain the area to render it suitable for modern farming practices.

The Cat's Water Drain is a natural watercourse which flows southwards between the existing landfill and the Eastern Extension. It is maintained by the District Internal Drainage Board (IDB) and has been canalised adjacent and downstream of the sites. The channel is approximately 3 m deep and is often dry; however, it is used by the IDB as a drain and is prone to rapid fluctuation in water level. Water within Cat's Water Drain flows southwards then eastwards towards Dog-in-a-Doublet some 3 km southeast of the site where a pumping station operated by the IDB lifts the water up to the adjacent River Nene.

The majority of local fields have drains and ditches around their margins and drainage in the area is generally towards the Cat's Water Drain and the Dog-in-a-Doublet pumping station. It is considered that the base of Cat's Water Drain (approximately 1.6 m AOD) is typically above the water table, and that flow in the drain is ephemeral controlled by discharges up-stream including other quarry workings. It is considered therefore that the drain would be providing recharge to groundwater during these periods, and that groundwater in the sands and gravels does not provide an important contribution to these surface water features.

1.7.8.2 Location in relation to Source Protection Zones

Reference to the EA's website finds that the proposed Eastern Extension does not lie within a source protection zone (SPZ1, 2 or 3) (MAGIC, 2022) and is therefore compliant with this aspect of the position statement.

1.7.8.3 *Location in relation to Aquifer Status*

Both the River Terrace Deposits and the Kellaways Sand are likely to allow the lateral flow of groundwater. The Oxford Clay is unlikely to transmit water at a significant rate and water flow can be expected to be predominantly in a vertical direction.

The River Terrace Deposits are classified as a Secondary A Aquifer (to comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers). The Kellaways Sand present at depth beneath the Oxford Clay are also classified as a Secondary A Aquifer.

Boreholes drilled as a part of the site investigation in 2021 proved the base of the Oxford Clay and found its full thickness to reach between 12.3 and 17.5 m. As is the case for the existing site, the elevation of the piezometric level of groundwater in the Kellaways Sand is likely to lie above the base of the landfill. The elevation of the base of each landfill cell will require designing to ensure that the pressure of water in the Kellaways Sand cannot heave the clay rich materials that will lie between the landfill liner and the Kellaways Sand which could potentially allow free flowing water to enter the landfill void. The potential for basal heave has been assessed by the Stability Risk Assessment (Report reference 21453458.634).

The Eastern Extension therefore does not lie on a principal aquifer and is therefore compliant with this aspect of the position statement.

1.7.8.4 *Summary*

In judgement of the factors relevant to the location policy, it is concluded that the location of the proposed landfill installation should not lead the Environment Agency to reject an application on the grounds of its landfill location position statement (E1).

2.0 SOURCE TERM CHARACTERISATION

2.1 The Development of the Installation

2.1.1 Historical Development

Before the extraction of sand and gravel commenced at Willow Hall Farm Quarry, the Site comprised open fields bounded by the Cat's Water Drain to the west and properties and Willow Hall Lane to the east.

The Site is currently operated as a sand and gravel quarry and landfill for the disposal of inert waste. Thory is systematically extracting mineral and filling with inert waste behind in a continuous operation from north to south. The sand and gravel is a shallow deposit of variable thickness which occurs below the top soil and a silty overburden, and overlies clay.

As described in Section 1.7.1.3 the area of mineral extraction at Willow Hall Farm Quarry is about 41 ha, with an estimated recoverable mineral reserve tonnage of 2.25 Mt.

2.1.2 Layout and Phasing of Landfilling

The layout of the Site and the phasing of waste deposition is presented on **Drawing ESID4 – Site Layout and Waste Deposition**.

The Eastern Extension will be divided into 10 non-hazardous waste cells numbered Cell 9 to Cell 18 as a continuation of those in the Southern Extension. The design principles of the landfill lining system have been established through the development of Cells 1 to 8 in the Southern Extension which have been installed in accordance with Environmental Permit EPR/BP/3537PP/V010. These design principles will continue in the development of Cells 9 to 18.

The Eastern Extension will have two additional cells numbered Cell 19 to Cell 20 specifically to receive inert waste previously deposited by Thory. These will be located to the east of the Cat's Water Drain and to the west of the transmission wires.

The size of each operational cell will be designed to minimise the area open to rainfall whilst maintaining overall operational efficiency. During filling of each cell, effective infiltration into the site should not form free leachate in the base of the cell. A water balance for the Eastern Extension is provided in **Appendix ESID1**.

Once Thory has completed its sand and gravel excavation, Biffa will recover clay beneath to be used as an engineering material in the lining system and also for capping and restoration. A sidewall drainage system will be installed and engineered fill will be placed to provide a stable subgrade for the landfill lining system.

Progressive capping, restoration, and installation of landfill gas and leachate management systems will be carried out as each cell is completed. The existing Gas Compound and Leachate Storage Tank will also be used for the Eastern Extension.

2.1.3 Waste Types and Quantities

The Southern Extension is anticipated to finish for the disposal of non-hazardous waste at end March 2023 and the Eastern Extension will therefore be proposed to open in April 2023. Stable non-reactive hazardous waste (asbestos waste) will continue to be accepted in the Southern Extension until end December 2025 but will not be taken in the Eastern Extension.

The permitted waste list for the Eastern Extension will be the same as that currently approved for the Southern Extension excluding stable non-reactive hazardous waste. Non-hazardous waste is proposed to be accepted at a constant rate of 220,000 tpa for all years, pro rata during the last year. It is expected to have the following breakdown (in terms of waste density):

- General industrial and commercial waste – 110,000 tpa (0.90 t/m³).
- Inert materials and cover materials – 90,000 tpa (1.25 t/m³).
- Contaminated soils – 10,000 tpa (1.50 t/m³).
- Difficult – 10,000 tpa (1.00 t/m³).

Municipal waste input is expected to be zero but may be received during planned and unplanned outages of third party Energy-from-Waste (EfW) plant in the region (up to 10,000 tpa).

Wastes may also be received at the landfill for use in restoration, in accordance with the Environmental Permit (up to 250,000 tpa).

At the above waste inputs, the landfill void space will be consumed at a rate of 211,000 m³/year. Consequently, the Eastern Extension is expected to be operational for a period of about 15 years from April 2023 to about mid-2038.

To reflect these expected waste inputs in the Eastern Extension, it is proposed that the annual waste input limits for the Eastern Extension are listed within the Permit as shown in **Table ESID3**

Table ESID3: Proposed annual waste input limits for the Eastern Extension

Annual waste input limits (tonnes) – Eastern Extension	
Non-hazardous waste*	400,000
Inert waste	204,999
Wastes for restoration**	250,000
Total	874,999

* Including municipal waste only accepted during Energy-from-Waste plant down-time in the region

** Only should a shortfall occur in available material within the Eastern Extension

The site would receive some 3.23 Mm³ of waste (pre-settlement, pre-restoration) or 2.43 Mm³ of waste (post-settlement, pre-restoration) over the period from 2023 to 2038 followed by completion of restoration.

A full list of permitted wastes is presented in the application (Report ref. 21453458.639).

2.1.4 Inert Waste already received by Thory

Inert waste already deposited in Willow Hall Farm Inert Landfill by Thory (estimated to be around 250,000 m³) will be excavated and re-deposited in dedicated areas. In accordance with the Environmental Permit the following waste types have been received at the Site:

- Sands, silts, clays, ceramics, bricks, tiles and construction products.
- Glass, concrete; and
- Soil and stones.

These wastes can be seen today in the working face and, for engineering purposes, the inert waste material can be considered as a soft to firm sandy clay of low to medium plasticity and with varying amounts of sand, gravel, 'clinker' and miscellaneous construction debris. During landfilling by Thory, a considerable amount of mixing is expected to have occurred; consequently, the waste can be expected to be mixed and 'soil-like' and suitable to be moved with regular earth moving plant (excavators and dump trucks).

The inert waste will be systematically excavated after removal of the overlying top soil and subsoil. It will be worked at an extraction face in a similar fashion to the extraction of sand and gravel.

After being brought by dump truck to Cells 19 and 20, each load will be pushed out by a dozer into thin layers (typically 0.25 to 0.4 m thick) prior to being compacted by a roller. The waste will be built up in horizontal layers to maximise stability and reduce settlement.

2.1.5 Leachate Quality

The Site has been, and will continue to be, developed under a non-hazardous landfill classification. Since the Eastern Extension is not yet constructed but will accept the same waste stream as the existing Site, leachate quality data from the Southern Extension, collected in accordance with the Permit, is considered to be representative of the proposed quality of leachate in the Eastern Extension. The Hydrogeological Risk Assessment (Report ref. 21453458.633) draws upon data from the Southern Extension for the period 2016 to 2021.

Although it is anticipated that the leachate quality in the Eastern Extension will be broadly in line with the existing Southern Extension, waste streams and current source terms could change in the future with the implementation of waste pre-treatment and the diversion of biodegradable waste from landfill. A reduction in putrescible waste would also lead to a reduction in the ammonium concentration. Therefore, regular monitoring of leachate with a full suite of analysis including Hazardous substances will allow the definition of a site-specific source term in the future.

2.1.6 Hydrogeological Risk Screening

Groundwater is present within the River Terrace Deposits and the Kellaways Sand which underlies the Oxford Clay. There is no evidence that this groundwater is permanently unsuitable for use although it is noted that groundwater quality within the Kellaways Sand is of poor quality, with concentrations of chloride and ammoniacal nitrogen typically over four and three times, respectively, their UK DWS.

The waste deposited at the site contains leachable substances. Water being exposed to the waste has the potential to become contaminated and to form landfill leachate. Groundwater receptors are present within and close to the site, and therefore it is considered necessary to minimise the generation of, and control and collect, landfill leachate.

The HRA for the Eastern Extension (Report ref. 21453458.633) seeks to establish compliance with Schedule 10 and Schedule 22 of the Environmental Permitting Regulations (2016) and follows current Environment Agency guidance. This approach is to ensure that the proposed development will not create a significant risk of an impact upon groundwater in contravention of the Groundwater Directive.

2.2 Installation Engineering

2.2.1 Groundwater Management System

Shallow groundwater is present in the River Terrace Deposits and currently discharges into the quarry from the lower parts of the quarry face from where it is pumped to the surface water lagoon in the northwest corner. Water is pumped from the lagoon to the Cat's Water Drain in accordance with the Environmental Permit EPR/EB3091VZ (Discharge Activity)

Groundwater will continue to be managed and back-drains installed behind the exterior lining system of Cells 9 to 20 so that groundwater will drain into the undeveloped parts of the quarry from where it will be pumped to the surface water lagoon for discharge to the Cat's Water Drain. A back-drain is not required along the full height engineered bund.

Groundwater management and discharge is required whilst the Site is under landfill development. Once landfilling is sufficiently completed, no further management of groundwater will be required and water levels will re-bound to their natural level to provide hydraulic containment of the Site.

The back drains placed behind the side slopes will conform to a specification contained within a Construction Quality Assurance (CQA) Plan submitted to the EA prior to construction in accordance with the Environmental Permit. Design and CQA procedures for engineering the back drain are defined within the CQA Plan. A CQA Validation Report, which presents the final *as built* construction and engineered details of the back drain for each cell, is submitted to the EA after construction.

2.2.2 Basal and Sidewall Lining System

2.2.2.1 General

In broad terms, 1.0 m of engineered clay with a maximum permeability of 1×10^{-9} m/s (non-hazardous waste) or 1×10^{-7} m/s (inert waste) will be placed across the base and side slopes of all landfill cells. This engineered clay will be variously termed 'geological barrier' and 'artificially sealing layer' in accordance with requirements. The design and construction details for the installation are shown in **Drawing ESID6A – Installation Plan Layout** and **Drawing ESID6B – Engineering and Containment**.

The design principles of the lining system have been established through the development of the previous Northeastern and Southern Extensions. The Eastern Extension will be engineered and managed in accordance with the design principles already established at the Site. The lining system for each Cell will conform to a specification contained within a Construction Quality Assurance (CQA) Plan submitted to the EA prior to construction in accordance with the Environmental Permit. Cell design and CQA procedures for engineering the lining system are defined within the CQA Plan. A CQA Validation Report, which presents the final *as built* construction and engineered details of each cell, is submitted to the EA after construction.

2.2.2.2 Design for Non-Hazardous Waste Cells

In-situ clay beneath the Site provides a natural geological barrier for the basal and lower sidewall lining system of the non-hazardous waste cells. The full thickness of the Oxford Clay has been proven in site investigation boreholes and the minimum required to maintain an appropriate Factor of Safety against basal heave will always remain between the base of the Site and the top of the underlying Kellaways Sand.

The artificial sealing layer over the base and lower sidewalls of the Site will be provided by the placement of 1.0 m of engineered clay with a maximum permeability of 1×10^{-9} m/s.

The geological barrier over the upper sidewalls of the Site will be artificially established and provided by the placement of 0.5 m of engineered clay with a maximum permeability of 1×10^{-9} m/s.

The artificial sealing layer over the upper sidewalls of the Site will be provided by the placement of 0.5 m of engineered clay with a maximum permeability of 1×10^{-9} m/s.

If necessary, some use of on-Site clay may be substituted by fully welded geomembrane or geosynthetic clay liner (GCL) with approval of the EA in accordance with the Environmental Permit.

Each cell will be hydraulically separated from adjacent cells by an intercell bund. The bund will be a minimum of 2.0 m high and 2.0 m wide at its crest.

2.2.2.3 Design for Inert Waste Cells

In-situ clay beneath the Site provides a natural geological barrier for the basal and lower sidewall lining system of the inert waste cells. The full thickness of the Oxford Clay has been proven in site investigation boreholes and the minimum required to maintain an appropriate Factor of Safety against basal heave will always remain between the base of the Site and the top of the underlying Kellaways Sand.

The geological barrier over the upper sidewalls of the Site will be artificially established and provided by the placement of 1.0 m of engineered clay with a maximum permeability of 1×10^{-7} m/s. An artificial sealing layer is not required for the disposal of inert waste.

Inert waste Cells 19 and 20 will be hydraulically separated from non-hazardous waste Cells 9, 10, 13 and 18 by a full height engineered bund placed along the line of the transmission wires and between the pylon 'islands'. The top of the bund will be 1 m below surrounding ground level and will anchor the capping systems of the cells for non-hazardous waste. The bund will be 5 m wide at its crest.

2.2.3 Site Investigation Boreholes

Should any site investigation boreholes remain within the footprint of the Eastern Extension following Thory's quarrying activities that could provide pathways beneath the site, they will be decommissioned at the time of construction of each cell by filling the borehole installation with a bentonite/cement grout. The grout will be placed over the full remaining height of the borehole and, if necessary, will be tremmied to the base of the hole (this may be required if deeper boreholes installed in the Kellaways Sand are identified).

The work will be undertaken in the presence of a CQA Engineer who will provide records of the amount of grout filled into each hole and the grout level (depth) within the hole as decommissioning proceeds. The decommissioning methodology will be presented within a CQA Plan submitted to the Environment Agency prior to construction. Installation and Construction Quality Assurance procedures for decommissioning will be defined within the CQA Plan.

2.2.4 Leachate Management

2.2.4.1 General

Leachate will be managed in Cells 9 to 18. The principles of leachate management have been established at the Southern Extension and are controlled through the Environmental Permit.

For protection of the groundwater environment and in accordance with the Environmental Permit, the Site will be hydraulically contained such that the level of leachate in the base of each cell is maintained at a level lower than the surrounding groundwater level. Cells 9 to 18 will have infrastructure installed to manage leachate. Leachate may also be re-applied to the waste mass to aid degradation.

Leachate is not required to be managed in inert waste Cells 19 and 20.

2.2.4.2 Leachate Collection and Removal System

A leachate collection and removal system will be installed in each Cell 9 to 18. The leachate drainage system for the Eastern Extension will comprise a drainage blanket with drainage pipes. The minimum gradient of the base of each cell will be 1% towards the sump. The drainage blanket may typically comprise aggregate, recycled aggregate, shredded tyres, or baled tyres and shall extend over the base of each cell adopting the same practice as the Southern Extension.

Each cell will have HDPE leachate drainage pipes within the drainage blanket in general accordance with **Drawing ESID7A – Leachate Management Layout** and **Drawing ESID7B – Leachate Management Details** to encourage efficient drainage of leachate heads across the base of each cell to the leachate collection well. The pipe diameter will be a minimum of 120 mm nominal internal diameter for branches and 160 mm nominal internal diameter for main runs.

The Eastern Extension Landfill will be hydraulically separated from its immediate surroundings by the engineered lining system and leachate levels across the base will be managed in accordance with the Environmental Permit i.e. Cells 9 to 18 will be hydraulically separated from each other by lined bunds, approximately 2 m high and from Cells 19 and 20 by a full height bund. The use of the inter-cell bunds will ensure that surface water collecting in non-operational sections of the Eastern Extension will remain uncontaminated by leachate. In addition, the bunds would assist in the control, containment and collection of leachate generated by landfilling operations.

The leachate drainage system will conform to the specification contained within a CQA Plan submitted to the EA prior to construction. Installation and construction quality assurance procedures for the leachate drainage system will be defined within the CQA Plan.

2.2.5 Capping System

2.2.5.1 General

To reduce the amount of precipitation that can infiltrate the waste, a low permeability cap will be constructed as waste deposition in each cell is completed to pre-settlement levels. The principles of engineered capping and restoration have been established at the Site and are controlled through the Environmental Permit. They will continue in the development of Cells 9 to 18 in the Eastern Extension and are described below. A sealing layer is not required for inert Cells 19 and 20.

2.2.5.2 Regulation Layer

Prior to the placement of the regulation layer the waste will be thoroughly compacted and smoothed so that sharp objects do not protrude excessively and the thickness of the regulation layer may be controlled. A nominal 200 mm layer of sand, clay, or similar inert waste material will be laid over the waste in Cells 9 to 18 as a regulation layer. The regulation layer will be spread and compacted over the waste and will be smooth and free from debris, roots, angular or sharp gravel, boulders or any materials considered to be capable of causing damage to the sealing layer.

2.2.5.3 Sealing Layer

The capping sealing layer will be provided over the waste by placement of:

- 1.0 m of engineered clay with a maximum permeability of 1×10^{-9} m/s; or
- Fully welded flexible membrane liner (FML).

The capping liner will be joined to the basal liner around the edges of the landfill to provide complete containment of the waste (**Drawing ESID6B – Engineering and Containment**).

If clay is used, this will comprise Oxford Clay from the base of the site (or if supply becomes limited, Geosynthetic Clay Liner (GCL)). FML and GCL are both manufactured products frequently used in environmental containment applications and particularly at landfill sites across the UK. A GCL consists of two layers of geotextile material sandwiching a layer of low-permeability sodium bentonite clay. The materials are normally needle-punched together into a lining material capable of resisting high shear forces.

Each area is prepared to receive a FML or GCL by rolling smooth and made free of unsuitable materials. The material is delivered to site on a roll which is carried upon a spreader bar by a 360-degree excavator and carefully unrolled into position to form a panel. Each roll is overlapped and/or heat sealed with adjacent panels according to manufacturer's instructions. The placement of geomembrane is done in a similar fashion.

The capping system for each Cell will conform to a specification contained within a Construction Quality Assurance (CQA) Plan submitted to the EA prior to construction in accordance with the Environmental Permit. Cell design and CQA procedures for engineering the lining system are defined within the CQA Plan. A CQA Validation Report, which presents the final *as built* construction and engineered details of each cell, is submitted to the EA after construction

2.2.5.4 Drainage Layer

The drainage layer for each cell will comprise a minimum 500 mm thick layer of free draining overburden material retained for use at the Site (**Drawing ESID6B – Engineering and Containment**). Where appropriate, geocomposite drainage materials will be laid around the lower parts of the restored slope within the drainage layer to minimise erosion of the sands above the drainage ditches.

2.2.5.5 *Restoration Materials*

Restoration cover soils (over burden material) and top soils will be placed over the drainage layer to achieve a minimum total thickness above the sealing layer of 1.0 m (**Drawing ESID6B – Engineering and Containment**).

The soils will comprise overburden materials and top soils stripped from the site prior to quarry operations and retained in existing stockpiles and bunds for use at the Site, to achieve the standard required for restoration to agriculture. In any areas where it is intended to plant shrubs, trees or hedge rows on the cap, soil thickness will be locally increased.

The placement of restoration soils will keep pace with the installation of capping liner. Vehicles will not be allowed to track over the capping liner until a minimum thickness of cover soils is placed each day. Vehicles can then work upon these soils. Any areas of capping liner that become damaged will be replaced.

The restoration soils will be delivered by dump truck and gently placed by excavator and then a dozer under supervision. Typically, the restoration soils will be placed in two or three layers to 0.7 m thickness followed by one layer of top soil to 0.3 m thickness.

The final cap will be placed within 12 months of cell completion of filling to pre-settlement restoration levels and installation of gas management systems.

2.2.6 *Restoration and Aftercare*

2.2.6.1 *Surrounding Topography and Restoration Contours*

The topography of the surrounding area and the proposed post-settlement post-restoration contours are shown on **Drawing ESID5 – Restoration**. Willow Hall Farm Quarry and Landfill is currently to be filled and restored to a flat lying low level restoration about 1 m below surrounding ground levels. Non-hazardous landfill development will require a domed restoration profile to release the void space, reduce infiltration and to assist in the management of surface water and landfill gas. Acceptability in landscape and restoration terms is influenced by landscape and visual aspects, ecological mitigation and enhancement, maximum gradients to be achieved, and by the presence of overhead transmission lines.

The pre-settlement pre-restoration contours required to achieve the post-settlement contours in the Eastern Extension are shown on **Drawing ESID4B – Pre-Settlement, Pre-Restoration** assuming a settlement allowance of 25%.

2.2.6.2 *After-Use*

The progressive capping and restoration of the non-hazardous waste Cells 9 to 18 will produce a gently undulating landform that will be returned to agricultural use.

The filling and restoration of inert waste Cells 19 and 20 will produce a low-lying flat landform (at surrounding ground level) that will provide an extension to the existing Wildlife Corridor. Biffa will enhance the appearance and nature conservation value of the area by the introduction of:

- Native trees/woodland;
- Native woodland edge scrub;
- Marginal wildflower meadow seeding;
- Wildflower meadow seeding; and
- Shallow water courses and seasonal ponds (clay lined).

The proposed restoration plan is shown on **Drawing ESID5 – Restoration**.

2.2.7 Fuel and Oil Storage

The following procedures apply to the storage of fuel and chemicals used on the Eastern Extension:

- All above-ground container(s) for bulk liquids e.g. gas oil, will be of sound construction and sited within a bund or secondary container. The floor and bund wall, or the secondary containment, will be constructed of a material that is impervious and chemically resistant to the material(s) stored. A bund or secondary container will be capable of containing at least 110% of the volume of the container(s);
- All pipes, gauges and valves will be enclosed within the bund wall or secondary containment so that, should a spillage occur, it is contained. Where applicable, all pipes and valves will be securely locked at the end of each working day;
- Any liquid accumulating within the bund or secondary containment will be removed and disposed of at a suitably authorised facility when the depth of the liquid reaches 0.1 m. A record of any removal is to be made in the site diary;
- Any chemicals that are used on site will be stored in secure compounds or buildings. These compounds or buildings will be locked at the end of each working day;
- Any spillage of materials will be cleaned by means of sand/saw dust spreading procedures; and
- All accidental spillages and leaks will be recorded and steps taken to identify the cause and prevent further occurrence.

An oil 'soak-up' kit will be kept at the site comprising absorbent matting and granules and an absorbent boom for the protection of water courses. After use, all contaminated material will be placed in a skip or container prior to disposal at a suitably authorised facility.

All above ground tanks, storage containers and pipework will be inspected at least once per week to identify any evidence of damage or leakages and check the level of liquid accumulating within the bunds. Any leaks identified shall be repaired at least temporarily such that pollution is prevented as soon as possible on the same day that the issue is identified. If a short-term repair is not possible the vessel shall be drained until such time as a permanent repair is completed.

2.3 Leachate Management and Monitoring Infrastructure

2.3.1 Leachate Generation

The decomposition of waste within any landfill is a complex process with microbiological, physical and chemical processes acting simultaneously to break down the waste. Leachate is formed by the decay and release of moisture and contaminants from the waste coupled with the percolation of infiltrating water (from rainfall) through the waste mass.

The volume of leachate produced within any landfill is primarily based upon the rate of infiltration to the Site and the approximate surface area of the individual landfill cells. When the site is active, it can be conservatively assumed that all effective rainfall infiltrates through the waste to produce leachate, i.e. 167 mm per year (effective rainfall). Leachate volumes generated from effective rainfall are estimated within the Water Balance in **Appendix ESID1**. In temporary capped areas the infiltration is assumed to reduce to 150 mm per year, and when cells have been permanently capped, the effective rainfall is assumed to be 50 mm per year.

2.3.2 Leachate Management

2.3.2.1 Leachate Extraction

Leachate extraction within the non-hazardous landfill at the Eastern Extension will follow the procedures applied at the Southern Extension. As such it will take place from the leachate sumps in the bottom of each cell, as

shown on **Drawing ESID7A – Leachate Management Layout**, by means of a vertical or side slope leachate extraction well extending to the surface of the landfill. The wells accommodate automatic pumping equipment (eductors or submersible pumps) to extract leachate (**Drawing 7B – Leachate Management Details**).

Leachate will be extracted from the cells for re-circulation and/or treatment and disposal to maintain the level of leachate within each cell in accordance with the Permit. The wells will be hydraulically connected to the leachate drainage system to optimise leachate control.

2.3.2.2 Leachate Recirculation

During the early stages of waste infilling each cell, and when required, leachate may be re-circulated after abstraction from the leachate extraction wells. The leachate will be returned to the waste mass to control the leachate level on the basal liner (by increasing evaporative loss and fully utilising the absorptive capacity of the waste) and to accelerate the stabilisation of the waste mass. The maximum permitted leachate level will, however, be subject to that specified in the Environmental Permit, based on HRA.

Prior to completion of infilling of wastes to final levels in individual areas, leachate may be re-circulated back into the waste mass by either pumping below the working face using temporary pipework or vacuum tanker, prior to covering with new wastes. Alternatively, pipework will be introduced into shallow trenches excavated into recently placed wastes, filled with selected hardcore.

To minimise odour from these operations, leachate will not be spray irrigated onto areas of the Site, and shallow trenches (once backfilled with hardcore) will be covered over with suitable material to suppress odour from the recirculation trench. Pipework will be introduced into these trenches before leachate is pumped in, and the discharge will be monitored to ensure that it does not give rise to unacceptable odour. Should unacceptable odour arise, or the trench become saturated, the discharge will be discontinued and moved to an alternative discharge point. Where trenches become a source of odour, these will be abandoned, and the entry covered over to prevent further odour. Use of trenches will be rotated to obtain a uniform distribution of wetting and prevent saturation at individual locations.

After completion of each cell, a leachate re-circulation system will be installed, as required, beneath the cap. This will allow the re-introduction of leachate abstracted from the extraction wells back into the waste mass to accelerate the stabilisation of the waste mass.

The leachate re-circulation system will comprise an entry point through the cap in each cell. The system will spread the leachate back over the waste through a system of perforated HDPE pipes below the low permeability sealing liner.

The system will comprise pipework forming a herringbone drainage system, placed in 0.5 m wide by 0.5 m deep trenches excavated into the waste at the surface of the landfill. Trenches will be backfilled with selected hardcore and aggregate which is free draining.

2.3.2.3 Leachate Disposal

Excess leachate that cannot be re-circulated will be removed from the low point in the basal drainage system, by means of a leachate extraction well which will extend up to the surface. Leachate will be extracted from the cells to maintain leachate heads within each cell below the leachate head compliance level. Leachate will be transferred by surface pipework from the abstraction wells to the leachate holding tank at the Site Reception for removal by road tanker to an appropriately authorised water treatment works.

2.3.2.4 Leachate Management Aftercare

All the components of the leachate extraction systems below the landfill cap will be left in the waste. All headworks, pipework, manifold chambers etc. above the capping system will be removed as part of the

decommissioning. Leachate management systems will be decommissioned and dismantled at the end of the Aftercare Period when risk assessment has identified that these do not need to continue.

2.3.3 Leachate Monitoring

2.3.3.1 Monitoring Infrastructure

Two leachate monitoring points per cell will be installed to allow monitoring of leachate levels remote to the leachate abstraction point. The locations of proposed leachate monitoring wells are shown on **Drawing ESID7A – Leachate Management Layout**

One of the monitoring wells will comprise an up-slope riser, installed prior to waste infilling. The second monitoring well will comprise a vertical well and will be retrospectively fitted (drilled) over a target concrete pad upon completion of each cell.

The use of upslope riser and vertical monitoring wells will be subject to amendment and confirmation submitted to the Agency for approval prior to construction in the form of a Construction Quality Assurance (CQA) Plan.

2.3.3.2 Leachate Levels

The Eastern Extension is to be operated on the principles of hydraulic containment. In accordance with the findings of the HRA (Report ref. 21453458.633) the leachate level within each cell will be maintained below 1.4 m above the base of the cell.

Leachate will be monitored from one leachate collection point and two remote monitoring points located within each cell in accordance with the Site's Leachate Management and Monitoring Plan (Report ref. 21453458.641).

As the site operates under the principle of hydraulic containment, compliance limits for leachate head have been set and an action plan to be implemented following a breach of the compliance limits has been implemented, as described in the Leachate Management and Monitoring Plan.

2.3.3.3 Leachate Quality

As the Eastern Extension is not yet constructed recent leachate quality data from the Southern Extension, collected in accordance with the permit, has been presented and used for assessment of the Eastern Extension within the HRA (Report ref. 21453458.633).

Regular monitoring of leachate with a full suite of analysis including Hazardous substances will allow the definition of a site-specific source term in the future. The proposed monitoring regime for leachate is presented in the HRA (Report ref. 21453458.633) and the Leachate Management and Monitoring Plan (Report ref. 21453458.641).

2.4 Landfill Gas Management and Monitoring System

2.4.1 Landfill Gas Generation

Landfill gas is a by-product generated from the decomposition of biodegradable components of non-hazardous waste. The major constituents of landfill gas are methane (CH₄) and carbon dioxide (CO₂) although other gases are also found as minor constituents such as carbon monoxide (CO) and hydrogen sulphide (H₂S). The Landfill Gas Generation and Risk Assessment (Report ref. 21453458.635) details the modelled landfill gas generation for the lifetime of the Eastern Extension.

2.4.2 Landfill Gas Management

Landfill gas will be managed, collected and utilised in accordance with the Environmental Permit and in accordance with the Landfill Gas Management Plan (Report ref. 21453458.643). The landfill gas management infrastructure is shown on **Drawing ESID8 – Landfill Gas Management**.

2.4.2.1 Gas Extraction System

An active gas extraction system comprising gas extraction wells at approximately 40 m centres will be progressively installed across Cells 9 to 18 in the Eastern Extension to ensure that landfill gas is drawn back towards the centre of the landfill and away from the side slope liner and will be commenced within 12 months of the completion of each cell to pre-settlement, pre-restoration levels or at the earliest opportunity in the event that elevated gas levels are detected.

Landfill gas wells will be connected by a system of carrier pipes, valves, manifolds and condensate knock-out pots to a large diameter ring or branch main, that will divert gas to the crossing point over the Cat's Water Drain. From there, landfill gas from the Eastern Extension will connect with the existing gas collection system for Eye Landfill:

- Gas is collected from gas wells, generally at 40 m spacing, across the Central, Northern and Northeastern Extensions. These areas are now restored and the gas collection pipework is mostly buried; and
- Gas extraction wells and pipework are currently being progressively installed in the Southern Extension.

All gas wells will be taken up through the low permeability sealing layer and finished above or below final ground level, as required. The sealing layer will be installed against each well in a water-tight seal.

All connecting pipework will be surface laid or buried within the restoration soil profile immediately on top of the low permeability sealing layer, as required.

All gas will be piped to the existing Gas Utilisation Plant (GUP).

Landfill gases will be monitored and actively controlled and managed across the Eastern Extension throughout its operational life and during its post closure and Aftercare Period.

By definition, landfill gas will not be generated within areas of inert landfill such that gas will not need to be collected from Cells 19 and 20.

2.4.2.2 Gas Utilisation Plant

The principles of landfill gas management and utilisation have been established at Eye Landfill and are controlled through the Environmental Permit.

Landfill gas extracted from the waste using the active gas extraction system will be disposed of by means of combustion either within a flare or in engines (for the generation of electricity and export to the National Grid) in the existing GUP. The flare is required to manage the gas flow in the event that the generator engines are not operational or excess gas is produced above the operating capacity of the generators.

The GUP is located on the internal haul road, south of the Clear Water Lagoon and the Green Wheel footpath as shown on **Drawing ESID2 – Environmental Site Setting**. It is approximately 30 m x 40 m with a hardcore base and concrete pads and has the following infrastructure:

- Two engines and one flare;
- Continental blower;
- Compressor house;
- LV room;
- Two transformers;
- Two 5,000 litre oil tanks (clean and dirty);
- Wheelie bins for oily rags and filters;

- 2.2 m palisade security fence with razor wire and CCTV security (two cameras), lockable gates and lighting.

Landfill gas from the Eastern Extension will be directed to the GUP in a new carrier main along the haul road and will pass into compression and treatment equipment where remaining moisture is removed; and the gas treated to a condition suitable to pass into the generating equipment. The gas will be converted into electricity and the electrical power generated will be fed via a step-up transformer and sub-station into the local electricity supply network. The substation is located west of the former Cemex site, remote from the GUP.

The GUP serves the whole of Eye landfill and will also serve the Eastern Extension. The flare and gas engine provision will be reviewed and updated as necessary as gas production volumes fluctuate during the life of the Southern Extension. The plant is fully instrumented and remote monitoring facilities are provided via a telemetry link. The plant will run for 24 hours a day. During normal operating conditions, there will be regular visits to the plant and landfill for monitoring, adjustments and maintenance.

All control and protection features are designed to be fail-safe and plant will automatically shut down in any emergency situation whereupon gas will be flared. Where the amount of gas produced by the landfill site is greater than the gas required to run the plant at maximum capacity, the excess gas will be automatically flared. Service personnel will be available on a 24-hour call out basis.

2.4.3 Landfill Gas Monitoring

2.4.3.1 Gas Monitoring Infrastructure

The vertical leachate monitoring wells within the Eastern Extension will also be used to determine in-waste gas concentrations, and for active extraction when required. To enable monitoring, a port will be installed on the side of the well to allow suitable access for monitoring equipment. Monitoring will commence from the date of installation of the leachate monitoring well and landfill gas extraction wells within the cell.

As the volume and quality of gas decreases with time after site closure and gas collection ceases, in-waste landfill gas concentrations will be monitored in a limited number of wells or in the leachate monitoring wells to be identified and agreed with the Environment Agency.

Monitoring of landfill gas concentrations outside of the Eastern Extension is proposed in landfill gas monitoring boreholes around the perimeter of the Site. The proposed indicative locations of the monitoring boreholes are indicated on **Drawing ESID13 – Monitoring and Extraction Point Plan**.

New external landfill gas boreholes will be installed to the top of the Oxford Clay. Wells will be drilled to a nominal diameter of 150 mm. Landfill gas wells will comprise a 50 mm inside diameter PVC or HDPE casing, perforated throughout its length except for the top metre. The casing will be surrounded with a filter wrap to prevent ingress of fines and will be surrounded with a 6 to 10 mm gravel pack, except for the top metre which will be fitted with a bentonite seal. End caps will be fitted to the base of the well casing and the top of the casing will be fitted with a removable cap, fitted with a gas tap. A secure lockable headwork will be fitted over the top of the well and concreted into position.

2.5 Surface Water Management

2.5.1 Surface Water Management System

The landform slopes in the final restoration have been designed to shed surface water to the perimeter of the Site. Surface water run-off from areas of non-hazardous landfill will be collected by marginal and perimeter drains to discharge to the Cat's Water Drain. The drains will be installed progressively as each phase of restoration is completed, i.e. as each cell is capped or area of inert waste is completed, the requisite ditches shall be constructed. Ditches will be lined where constructed above waste, and unlined where constructed into virgin ground or over restoration backfill material. The unlined sections of the ditches will provide significant soakaway capacity.

Flow will be directed to feed and sustain surface water ponds, ditches and swales created within the extension to the Wildlife Corridor and along the restored corridor either side of the Green Wheel path.

2.5.2 Surface Water Monitoring

Surface water quality will be monitored in accordance with the Environmental Permit. Surface water monitoring locations and schedule are proposed within the HRA (Report ref. 21453458.633) and the Surface Water Management and Monitoring Plan (Report ref. 21453458.642) and shown on **Drawing ESID13 – Monitoring Point and Extraction Point Plan**.

2.6 Construction Quality Assurance of Engineered Management Systems

A suitably experienced CQA engineer, managed by a suitably qualified and experienced Chartered Engineer or Engineering Geologist, will be present during all construction works to ensure compliance with the CQA requirements. The works themselves will be undertaken under the control of suitably qualified and experienced personnel.

The detailed design of the engineered liner, leachate drainage, capping, and surface water management systems will be submitted to the EA for approval prior to their construction in the form of a CQA plan. The CQA plan will include detailed CQA procedures that will be undertaken during construction to ensure compliance with the specification and design. These procedures will include on-Site inspection, field testing, and laboratory testing.

The CQA Engineer will produce a report summarising the construction activities carried out during the works, detailing the Engineer's daily logs and the results of inspections carried out as part of the CQA programme. This report will include the as-built drawings.

2.7 Post Closure Controls

On completion of the last phase of restoration, the Site will enter post period as follows:

- Closure Date – the *date* at which active waste disposal operations stop (i.e. the 'gate shuts').
- Post-Operational Period - the *period* between the Operational Period and the Aftercare Period;
- Definitely Closed Date - the *date* at which the EA agrees that the site can enter the Aftercare Period;
- Aftercare Period - the *period* between Definitely Closed Date and permit Surrender Date; and
- Surrender Date - the *date* at which EA accepts that the site no longer presents a risk to the environment and the Permit is handed back.

During the Post-Operational period, environmental monitoring will continue in accordance with the Permit and during the Aftercare Period, environmental monitoring will continue in accordance with a Closure Plan.

Some infrastructure may be dismantled soon after completion of active landfilling operations e.g. offices. The landfill gas utilisation plant will be decommissioned after the Gas Cessation Year i.e. the last year that landfill gas will be available in sufficient quantity and quality to continue to utilise the gas for the generation of electricity. The flare will be decommissioned after the End of Flaring Date i.e. the last year that landfill gas will be available in sufficient quantity and quality to continue to flare. Leachate management systems will be decommissioned and dismantled after Permit Surrender, or when a Surrender Report and risk assessment has identified that these do not need to continue.

A method statement for the decommissioning of the landfill gas extraction system, the landfill gas utilisation plant, leachate treatment systems, leachate extraction systems and any repair of penetrations through the landfill cap will be submitted to the Agency for approval prior to the works being carried out.

At this stage, it is envisaged that all the components of the gas and leachate extraction systems below the landfill cap will be left in the waste. All headworks, pipework, manifold chambers etc. above the capping system will be removed, as required, as part of the decommissioning such that they do not interfere with the Restoration Plan.

Wells within the waste are subject to damage due to waste settlement and all infrastructure will have a finite operational life due to material decay or attack by external processes. Irrespective of this, all infrastructure which is required during the post closure period to prevent a significant adverse impact upon the environment will be maintained and replaced as necessary.

3.0 PATHWAYS AND RECEPTOR TERM CHARACTERISATION

3.1 Climate

The Site is located within the East Anglian Fenland Region, which is a flat low-lying area on the eastern side of England. The Anglian Region has a low average rainfall when compared with the rest of the UK.

Total long-term rainfall and potential evapotranspiration for the region are reported in the Ministry of Agriculture, Fisheries and Food Technical Bulletin 35 for the period 1941 to 1970 (MAFF, 1976). The site lies within Area 28, for which rainfall is reported as being 574 mm per year.

This is in broad agreement with average annual rainfall for the nearest river gauge station at Wansford, which is 641 mm/yr (for the period 2004 to 2017).

Effective rainfall is the amount of rainfall available for infiltration and run off after evapotranspiration losses have been taken into account and any soil moisture deficit satisfied. A soil moisture deficit evolves as a result of an excess of evapotranspiration over rainfall.

The effective rainfall for active and restored landfill was calculated using ERAIN software incorporating an assumed root constant of 0 mm for bare soil and 56 mm for grassland. The initial soil moisture deficit was set at 0 mm for January as starting month for the calculation.

The average annual effective rainfall calculated was approximately 116 mm and 167 mm for grassland and bare ground, respectively.

Wind rose data has been obtained from Wittering monitoring station located approximately 20 km to the west of the Site. The wind rose data, as shown on **Drawing ESID2 – Environmental Site Setting** indicates that the prevalent wind direction is from the southwest.

3.2 Geology

3.2.1 Site Investigations

The Site has been the subject of numerous Site Investigations for both the excavation of mineral reserve and the subsequent landfill development. 93 mineral investigation boreholes were drilled by ARC in 1992 and an additional 18 mineral investigation boreholes were drilled by Thory in 2011 (BH11/01 to BH11/12 and BHP11/01 to BHP11/06).

As the elevation of the base of the Oxford Clay was not subject to the site investigation carried out in 1992 or 2011, five further site investigation/monitoring boreholes were installed by Biffa in February and March 2021. The works comprised the drilling of five boreholes (BH21-01 to BH21-05) to depths of between 21.3 and 27.2 m bgl including a minimum of 3 m into the Kellaways Formation.

Borehole logs relevant to the Eastern Extension from the 2011 and 2021 site investigations are presented in **Appendix ESID4**.

3.2.2 Regional Geology

The British Geological Survey Sheet 158 for Peterborough and BGS online Geindex indicates that the Eastern Extension is underlain by Quaternary River Terrace deposits which overlie the Jurassic Oxford Clay Formation and Kellaways Sand. The regional geological setting is presented on **Drawing ESID9 – Regional Geology** and the geological succession is summarised in **Table ESID3** below.

Table ESID4: Summary of Regional Geology

Age	Formation	Description	Approximate Thickness (m)
Quaternary	River Terrace Deposits	Sand and gravel with some silt	Variable
Jurassic	Oxford Clay	Olive grey fossiliferous, bituminous shale and blocky mudstone	63 – 76 m
	Kellaways Sand	Grey clayey silt and mud	1.9 – 6.4 m
	Kellaways Clay	Grey fissile mudstone	1.4 – 5.8 m
	Cornbrash	Fine grained shell-detrital limestone	1.2 – 4.3 m
	Blisworth Clay	Grey/Green mudstone with thin limestone	3.0 – 6.0 m
	Blisworth Limestone	Shell-detrital to micritic limestone with marl and mudstone	1.9 – 5.1 m

3.2.3 Local Geology

Mineral extraction takes place from the underlying Quaternary River Terrace Deposits. There are, in turn, underlain by the Oxford Clay and Kellaways Sand. The geological succession beneath the Site is summarized in the following sections.

3.2.3.1 River Terrace Deposits.

Site investigation information obtained in 1992 and 2011 shows that the mineral extraction area is underlain by:

- c. 0.3 m top soil;
- c. 0.6 m to c. 2 m of sandy, gravelly, clay subsoil ('overburden'); and
- c. 0.8 m to c. 6.3 m of sand and gravel ('mineral') (average c. 3.9 m).

Borehole data from site investigation boreholes drilled in 1992 and 2011 has been used to infer the base of sand and gravel. Assuming a generalized surface elevation of 4.0 m AOD, then:

- The base of the sand and gravel is c. 6 to 7 m bgl in the current Restored Area, Active Filling Area, Active Extraction Area and Soil Stripping Area. The thickest sand and gravel so far encountered appears to be at the western end of the current working face.
- With time, mineral extraction will proceed southwards into the current Unworked Area and the base of the sand and gravel is expected to rise to 4 to 6 m bgl. Further south, towards the Green Wheel path and beyond, the base of the sand and gravel rises further to c. 2.5 to 4 m bgl.
- No mineral extraction is proposed in the far southwest corner of the Site where it is too thin or absent.

Findings from the 2021 site investigation are broadly consistent with the 1992 and 2011 site investigations, with approximately 0.3 m to 0.4 m of top soil, underlain by 0.4 m to 1 m of overburden, and 1.1 m to 5.5 m of sand and gravel beneath. A summary of the geology encountered during the investigation in May 2021 are summarised in **Table ESID7**.

Table ESID5: Summary of Site Investigation 2021

Drill ID	BEDS Name	BEDS Code	Location	Ground Level (m AOD)	Total Drill Depth (m bgl)	Top Soil (m)	Overburden (m)	River Terrace Deposits (m)	Oxford Clay ² (m)	Kellaways Sand ² Confirmed (m)
BH21-01	BH46	91002460	NE corner	3.12	26.40	0.40	1.00	5.10	14.90	2.60
BH21-02	BH49	91002490	NW corner	2.20	22.40	N/A ¹	N/A ¹	5.50 ¹	12.30	1.80
BH21-03	BH51	91002510	SW corner	3.95	21.30	0.30	0.90	2.90	14.20	2.70
BH21-04	BH52	91002520	SE corner	3.77	23.00	0.30	0.70	1.10	17.30	>3.60
BH21-05	BH53	91002530	Middle of E side	3.49	27.20	0.40	0.40	5.40	17.50	>3.50

¹ Due to restricted access around the northwest perimeter of the Site, BH21-02 was drilled within a man-made bund at the perimeter of the quarry. The natural topsoil and sub-soil would have therefore been removed when constructed and at surface some of the observed gravel represents reworked material.

² Interface between the Oxford Clay and Kellaways Sand difficult to determine exactly partly due to the similarity between the composition of layers within both units (silty or sandy with siltstone and mudstone bands).

³ See Sections 3.3 and 3.4.

3.2.3.2 Oxford Clay.

The Oxford Clay is a well-consolidated, calcareous clay which may be silty or sandy with thin cemented siltstone or mudstone bands.

The Oxford Clay has been proven by seventeen boreholes. It is typically described as stiff, very closely fissured dark grey clay with frequent disseminated shell fragments. It dips gently from west to east and varies in elevation from (-1.37) m AOD in the west to 0.32 m AOD in the east.

The elevation of the base of the Oxford Clay was not subject to the site investigation carried out in 1992 or 2011. The full thickness of the Oxford Clay was proven in all five boreholes drilled during the 2021 investigation, and ranged from between 12.3 and 17.5 m.

3.2.3.3 Kellaways Sand

Below the Oxford Clay is the Kellaways Sand which consists dominantly of silty sands clayey silts with siltstone and mudstone. The strata are underlain by the Cornbrash and Blisworth Limestone.

During the 2021 site investigation, the interface between the Oxford Clay and Kellaway Sand was difficult to determine exactly due to the drilling method used (cable percussive) and the similarity between the composition of layer within both units (silty or sandy with siltstone and mudstone bands). Three boreholes proved the full thickness of the Kellaways Sand, between 1.8 and 2.7 m. The other two boreholes were terminated at 3.5 and 3.6 m into the Kellaways Sand.

3.3 Man-Made Subsurface Pathways

With the exception of boreholes that are currently located within and around the Eastern Extension, there are no known man-made subsurface pathways present within the footprint or immediate vicinity of the site.

3.4 Hydrology

3.4.1 Local Hydrological Setting

The local hydrological setting is illustrated on **Drawing ESID11 – Local Hydrogeology and Hydrology**.

The area lies within the catchment of the River Nene, which is located approximately 2.5 km to the south. Drainage within the area has been heavily modified by manmade drainage channels to lower the natural water levels and drain the area to render it suitable for modern farming practices.

The Cat's Water Drain is a natural watercourse which flows southwards between the two sites. It is maintained by the District Internal Drainage Board (IDB) and has been canalised adjacent and downstream of the sites. The channel is approximately 3 m deep and is often dry; however, it is used by the IDB as a drain and is prone to rapid fluctuation in water level. The base of the drain had been surveyed as being 1.63 m AOD adjacent to the landfill. Water within Cat's Water Drain flows southwards then eastwards towards Dog-in-a-Doublet some 3 km southeast of the site where a pumping station operated by the IDB lifts the water up to the adjacent River Nene.

The majority of local fields have drains and ditches around their margins and drainage in the area is generally towards the Dog-in-a-Doublet pumping station.

There are a number of ponds within Eye Landfill including the Clear Water Lagoon, silt lagoons associated with Cemex's operation and ponds created within the Wildlife Corridor. There is one settlement pond adjacent to the Cat's Water Drain associated with dewatering of Willow Hall Farm Quarry.

3.4.2 Flood Risk and Indicative Flood Plains

The Eastern Extension Landfill lies within Flood Zone 1, indicating that the area has a less than 1 in 1,000 annual probability of river or sea flooding. There is a small area to the south of the Green Wheel Footpath, outside of both the Quarry excavation and landfilling areas, but within the planning boundary, which lies within Flood Zones 2 and 3 (**Drawing ESID10 - Regional Hydrogeology and Hydrology**).

A summary of the potential sources of Flooding is presented in **Table ESID5**.

Table ESID6: Potential Sources of Flooding

Type of Flooding	Further Consideration Required?	Comments
Fluvial	Yes	<p>The Permit boundary for the Eastern Extension non-hazardous and inert landfill lies within Flood Zone 1.</p> <p>A small proportion of the southwest corner of the planning boundary of Willow Hall Farm Quarry lies within Flood Zone 2 and 3⁽¹⁾ flood plain of the River Nene. The River Nene is classed as a 'Main River' and as such is subject to maintenance, improvement or construction work by the EA to manage flood risk, including flood defences.</p> <p>Based on Envirocheck flood mapping, which takes account of flood defences, this area is at 'medium' risk⁽²⁾ of flooding from rivers or seas. However, given the Quarry itself does not encroach upon the 'Medium' flood risk zone, and there are no plans for development of this area, the fluvial flood risk posed to the Quarry and Eastern Extension itself can be classed as 'Very Low'.</p>
Tidal	No	The Site is not located near any tidal influences.
Impounded Water Bodies	No	There are no public surface water sewers, reservoirs or canals identified in the immediate vicinity of site which might cause a risk of flooding. A number of surface water ponds are located on the Eye Landfill to the west of the Site, however, as these are managed by Biffa, flood risk from them is negligible.
Groundwater	Yes	<p>Envirocheck flood maps indicate that the majority of the Eastern extension is at a 'Low' risk of flooding, with parts in the northeast and southwest at a 'Moderate' risk of flooding.</p> <p>The excavated void within the Site is at risk from groundwater flooding as its base elevation is below ground water levels. However underlying soils of the wider area consist of sand and gravel which allows for good Site drainage above the water table.</p> <p>To reduce groundwater flood risk during operations, and to facilitate the working of sand and gravel in the Eastern Extension, groundwater removal is required and is already carried out under existing permissions. It is planned to continue to drain groundwater to undeveloped parts of the Eastern Extension before pumping it to a nearby surface water lagoon for discharge to the Cat's Water Drain. A back drain will be installed behind the sidewall lining system and will reduce the potential risk posed by groundwater flooding. The risk is therefore deemed to be 'Low'.</p>

Type of Flooding	Further Consideration Required?	Comments
Pluvial	Yes	<p>Based on Envirocheck pluvial flood maps, the majority of the Site is classed as 'Very Low' risk, however in places there are small areas of 'Low' and 'Medium' flood risk. This is most notable towards the northeast of the Site, adjacent to Willow Hall Lane.</p> <p>The maps indicate that surface water is the Site's only flood source, and it is only projected to impact the Site during events with return periods greater than 200 years. During such times pluvial flooding will occur in small areas with maximum depths between 0.1 m and 0.3 m. During a 1 in 1000 year event, surface water will cover a slightly larger area, but depths will still remain between 0.1 m and 0.3 m.</p> <p>Surface water management plans are already in place to deal with excess surface water, which therefore significantly reduce the pluvial flood risks associated with the Site. There is a need to ensure that any existing pluvial flood post-development of the Eastern Extension Site are appropriately managed as part of the proposed site restoration plan. With measures in place the risk is deemed to be 'Very Low'.</p>
<p>(1) Flood Zone 2 (Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 100 and 1 in 1,000 annual probability of flooding i.e. between 1% AEP to 0.1% AEP).</p> <p>Flood Zone 3 (Land having a 1 in 100 or greater annual probability of flooding i.e. 1% AEP or greater)</p> <p>(2) Annual probability of flooding of between 1 in 30 and 1 in 100 years.</p>		

3.4.3 Surface Water Quality

As part of the on-going monitoring and management of the surface water environment at Eye Landfill, Biffa regularly monitors water quality in a number of locations around the site, **Drawing ESID11 – Local Hydrogeology and Hydrology**. They also monitors surface water under its Environmental Permit for Willow Hall Quarry and Inert Landfill.

Data collected in accordance with these existing permits, has been presented and used for assessment of the Eastern Extension within the HRA (Report ref. 21453458.633).

The proposed monitoring regime for surface water quality is presented in the HRA (Report ref. 21453458.633) and the Surface Water Management and Monitoring Plan (Report ref. 21453458.642).

3.4.4 Surface Water Abstractions

Publicly available information regarding current surface water abstractions within a 5 km radius of the Site has been obtained from the Environment Agency (data received by Golder on 7 July 2021) and Peterborough City Council (email received by Golder on 2 July 2021). Details of licensed abstractions provided by the Environment Agency are presented in Table ESID7.

Table ESID7: Licensed Surface Water Abstractions

Licence No.	Orig. Effective Date	Name	Secondary Description	Point Name	Max Annual Quantity	Max Daily Quantity
5/32/11/*S/0053A	01/03/1966	Coles	General Agriculture	Drain At Buke Horn Farm	4546	364
5/32/11/*S/0059	26/03/1966	Northlands Farm (Thorney) Limited	General Agriculture	Drains Near Northey Farm	60000	3000
5/32/11/*S/0061	01/04/1977	J R Fisher & Son	General Agriculture	Gores Drain A - B - C Counter Drain D - E	27277	1527
5/32/11/*S/0081	01/08/1973	P J Lee And Sons Limited	General Agriculture	Levitts Drove Drain At Thorney	62000	5000
5/32/11/*S/0086	01/01/1977	T E Darby & Sons	General Agriculture	Field Drains Adj South Drn "G - L", Impounded Farm Ditches & Brick Reservoir, South Drain & Adj Field Drns "C - D", South Main Drain, Unnamed Farm Dyke "M - Z", Carr Dyke Newborough	40915	4696
5/32/11/*S/0094	01/05/1980	The Whitebread Charity	General Agriculture	Un-Named Drain "F-G"	16000	1250
5/32/11/*S/0097	01/06/1983	G E Green Ltd	General Agriculture	Internal Farm Drains	27000	3000
5/32/11/*S/0098	01/10/1983	James Sutton Farming Co Ltd	General Agriculture	New Ten Foot Drain, Thorney River	18000	1100
5/32/11/*S/0100	01/10/1983	Heading	General Agriculture	Butchers Drain, Farm Drain, North Counter Drain, The New Ten Foot Drain	20000	900
5/32/11/*S/0102	01/05/1984	Skeels	General Agriculture	Drain In Newborough, Drain Near Bull Bridge Farm, Drain Near Pranks Farm, Green Drain, Hundreds Drain, Middle Drain, Newborough Main Drain, Turves Drain	24000	1580
5/32/11/*S/0105	01/10/1984	Griffin & Speed Farm Ltd	General Agriculture	Hemmetts Drain, Ten Foot Drain	30000	2000
5/32/11/*S/0106	01/04/1985	Bradshaw	General Agriculture	Newborough Main Drain, Side Drain In Newborough Fen	12000	2000
5/32/11/*S/0107	01/04/1985	I J & D J White	General Agriculture	Internal Farm Drain Near Middle Level Drain, Middle Drain, Near Counter Drain, Newborough Main Drain	20000	2000
5/32/11/*S/0109	01/05/1985	Belmont Farms	General Agriculture	Middle Drain Newborough Fen, Drain At Newborough Fen	35000	1300
5/32/11/*S/0114	01/07/1986	Cave	General Agriculture	Farm Drain "H", Farm Drains "F-G", Highland Drain "I", Middle Drain "A", Middle Drain "C-D", Newborough Main Drain "B"	17000	4000

Licence No.	Orig. Effective Date	Name	Secondary Description	Point Name	Max Annual Quantity	Max Daily Quantity
5/32/11/*S/0116	02/03/1987	Hunt- Pain	General Agriculture	Middle Drove Drain - "C To D"	86500	1250
5/32/11/*S/0117	01/03/1987	Harris	General Agriculture	Freshwater Drain, Lords Drain, Middle Drain	23000	1200
5/32/11/*S/0118	01/03/1987	Godfrey	General Agriculture	Watercourse At Newborough 4,7,8,9,11,12	36000	1200
5/32/11/*S/0120/A	08/03/2014	Northlands Farm (Thorney) Limited	General Agriculture	Gores Drain "28-29-30", Thorney River "1-2", Un-named Drain 3-8.	27000	1718
5/32/11/*S/0122	01/02/1988	Bradshaw	General Agriculture	Un-Named Drain, Newborough	4500	1000
5/32/11/*S/0132	31/12/1992	Bradshaw	General Agriculture	South Main Drain, Trib South Main Drain, Newborough	27272	2020
5/32/11/*S/0144/R01	01/11/2017	N Woodroffe & Sons	General Agriculture	Highland Drain At Thorney, Hundreds Drain At Thorney, Newborough Main Drain, Highland Drain At Thorney, Newborough Main Drain	55000	3000
5/32/11/*S/0147/R01	01/04/2018	RSPB	General Agriculture	Moretons Leam in Whittlesey	100000	7500
5/32/11/*S/0154/R01	01/04/2017	P J Lee And Sons Limited	General Agriculture	New Ten Foot Drain, Levitts Drove Drain	195500	5184
5/32/11/*S/0159/R02	01/04/2020	Stevenson	General Agriculture	Middle Drain , Thorney	27600	1500
5/32/11/*S/0160/R02	19/12/2019	Stevenson	General Agriculture	Drain At Thorney - To Reservoir	180000	4392
5/32/11/*S/0163	09/10/2006	Jennings	Other Environmental Improvements	Gravel Dyke at Whittlesey, Moretons Leam at Whittlesey	27216	7776
5/32/11/*S/0165	09/10/2006	Jennings	Non-Remedial River/Wetland Support	River Nene at Whittlesey	26957	7776
5/32/11/*S/0167	05/09/2005	Jennings	Other Environmental Improvements	Un-named IDB Drain - Whittlesey	12000	7776
5/32/11/*S/0169/R01	19/05/2020	J & A Woodroffe Farms Limited	General Agriculture	Highland Drain, Newborough Main Drain	33000	700
6/33/53/*S/0005	01/06/1967	Chapelbridge Farms	General Agriculture	Unnamed Drains Near Drysides	22727	818
6/33/53/*S/0479	01/04/1989	Aggreserves Ltd	General Agriculture	Drain at Reach, Kings Dike at Canter's Doles Farm	471092	4185.2
6/33/53/*S/0619/R01	01/03/2020	Philip Bradshaw (Farming)	General Agriculture	Un-named Drain in Whittlesey IDB	145000	5476
6/33/53/*S/0652	28/01/1998	Chapelbridge Farms	General Agriculture	Bevills Leam at Whittlesey, Drain at Drysides, Drain at Whittlesey, King's Dyke at Drysides	162272	6800

Licence No.	Orig. Effective Date	Name	Secondary Description	Point Name	Max Annual Quantity	Max Daily Quantity
6/33/53/*S/0664	15/12/1998	Crowson	General Agriculture	Drain at Bird's Hundred, Drains at Whittlesey, Whittlesey IDB (24)	32000	2400
6/33/53/*S/0775	18/10/2005	A G Andrew & Son	General Agriculture	Drain 1 at Blackbush	25000	2184
6/33/53/*S/0784/R01	13/05/2019	Crowson	General Agriculture	Drain at Whittlesey	13636	1454
6/33/53/*S/0811	22/10/2008	Star Pit Partners	General Agriculture	Kings Dyke	842220	18000
AN/032/0011/004	02/09/2010	North Level District Internal Drainage Board	Remedial River/Wetland Support	PT-1 River Nene at Whittlesey Cams, PT-2 River Nene at Whittlesey, PT-3 Tidal River Nene at Whittlesey	290000	20715
AN/032/0011/012	09/07/2012	Band	General Agriculture	Un-named Drain at Whittlesey "A"	2728	727
AN/032/0011/032	29/03/2017	Kingsland Farms	General Agriculture	Un-named Drain at Whittlesey "A-B"	10908	727
AN/032/0011/033	21/08/2017	G R & P Easton	General Agriculture	Moreton's Leam at Bassenhally Farm, Whittlesey	6168	1308
AN/032/0011/034	29/05/2018	C Horrell Ltd	General Agriculture	Reaches 2-11 Un-Named Drain, North Level Main Drain, Inland Water Unnamed Drain Thorney 'Reach 1', Drains in the Drysides IDB	50000	4020
AN/033/0053/006	15/01/2010	Chapelbridge Farms	General Agriculture	Kings dyke Near Drysides	38800	1786
AN/033/0053/020	01/03/2011	Stevenson	General Agriculture	Drain at Whittlesey – Single Point	63500	3000
AN/033/0053/050	18/07/2012	Chapelbridge Farms	General Agriculture	Kings Dyke, Unnamed Drain near Kings Dyke	48300	2000
AN/033/0053/087	25/04/2019	Crowson	General Agriculture	Drain at Whittlesey	21637	1189

No private surface water abstractions were identified by Peterborough City Council within 5km of the Site.

3.5 Hydrogeology

The regional hydrogeological setting of the Site is shown on **Drawing ESID10 – Regional Hydrogeology and Hydrology**.

3.5.1 Aquifer Characteristics

3.5.1.1 Source Protection Zones

Source Protection Zones (SPZs) have been defined by the EA for groundwater sources (wells, boreholes and springs) used for public drinking water supply. The SPZs provide an indication of the risk to groundwater supplies that may result from potentially polluting activities and accidental releases of pollutants. Generally, the closer the activity or release is to a groundwater source the greater the risk. Four SPZs have been defined; Zone I or Inner Protection Zone, Zone II or Outer Protection Zone, Zone 3 or the total catchment of the borehole, and a Zone of Special Interest. The site does not fall within any defined SPZ.

3.5.1.2 Groundwater Vulnerability

The EA outlines a classification scheme to determine the vulnerability of groundwater to contamination. The classification is based upon a number of variables including the nature of the overlying soil cover, the presence and nature of drift deposits, the nature of the strata, and the thickness of the unsaturated zone. Groundwater vulnerability maps may be accessed online (MAGIC, 2021), and the groundwater vulnerability of the area surrounding the site is illustrated on **Drawing ESID10 - Regional Hydrogeology and Hydrology**.

The near surface River Terrace Deposits and the Kellaways Sand are the principal water bearing strata at the Site. They are separated by the low permeability Oxford Clay which is an aquitard (i.e. does not transmit water at a significant rate).

The groundwater in the area is principally contained in the River Terrace Deposits and in the Kellaways Sand. The River Terrace Deposits are classified a Secondary A Aquifer (comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers), and the Kellaways Sand is also a Secondary A Aquifer.

3.5.1.3 Relevant Hydrogeological Parameters

No laboratory or field-testing results for the River Terrace Deposits are available for the Site. Previous HRA reports indicate an average hydraulic conductivity value of 47 m/d¹.

The Oxford Clay beneath the Site is an aquitard, limiting the downward migration of contaminants from the landfill into the deeper aquifer. The expected hydraulic conductivity of the Oxford Clay at the site is 1×10^{-10} m/s. The Oxford Clay therefore represents a natural geological barrier.

No laboratory or field testing of the Kellaways Sand has been completed at the Site. However, the Aquifer Properties Manual² has been consulted to provide an indication of the properties of the aquifer at the Site. It reports that hydraulic conductivity values range from 3.1×10^{-6} to 6.8×10^{-3} m²/d. Porosity is reported to range from 4.3% to 37.6%, with an average from 22 samples of 26.9%.

3.5.2 Groundwater Abstractions

Publicly available information regarding current groundwater and surface water abstractions within a 5 km radius of the Site has been obtained from the Environment Agency (data received by Golder 7 July 2021) and Peterborough Council (email received by Golder 2 July 2021). Details of licensed abstractions provided by the Environment Agency are presented in Table ESID8.

Table ESID8: Licensed Groundwater Abstractions

Licence No.	Orig. Effective Date	Name	Description	Point Name	Max Annual Quantity	Max Daily Quantity
5/32/11/*G/0087	01/03/1993	Diane Elizabeth Band	General Agriculture - Spray Irrigation - Direct	Gravel Pit "A" at Decoy Farm	13636	727
5/32/11/*G/0091	01/05/1979	Chapman	General Agriculture - Spray Irrigation - Direct	Two Bores At Flag Fen Farm	50000	650

¹ Hafren Water, 2015. *Hydrogeological Risk Assessment*, ref. 1941/HRA, v. 1.1.

² British Geological Survey, 2000. *The Physical Properties of Minor Aquifers in England and Wales*.

Licence No.	Orig. Effective Date	Name	Description	Point Name	Max Annual Quantity	Max Daily Quantity
6/33/53/*G/0357	01/04/1985	McCain Foods (GB) Ltd	Food and Drink – Boiler Feed, Evaporative Cooling and Process Water	Claypit Nr Whittlesey	504000	1440
AN/032/0011/001/R01	01/04/2017	Aggregate Industries Uk Ltd	Extractive - Dust Suppression, General Washing/Process Washing, Mineral Washing, Mineral Products Process Water	Catchpit At Thorney, Peterborough	1170281	4283
AN/032/0011/035	29/05/2018	C Horrell Ltd	General Agriculture Spray Irrigation - Storage	Nene Sands and Gravels At Thorney	50000	4020
AN/032/0011/037	28/09/2018	Landlogical Thorney Limited	Mineral Products Dewatering	Pasture House Farm	1892160	5184
AN/032/0011/044	31/01/2020	Aggregate Industries Uk Ltd	Mineral Products Dewatering	Bar Pastures Quarry [Extention To Pode Hole Quarry]	-	-

One private groundwater abstraction was identified by Peterborough City Council within 5 km of the Site, a borehole at Chase Farm, Bridge Hill Road, Newborough, Peterborough, PE6 7SA (NGR 519584, 304179).

3.5.2.1 Long-Term Change

The site is located in an area of extensive mineral extraction, and these may have resulted in lowering of the water level in the drift deposits overlying the Oxford Clay (i.e. the sand and gravel). Water levels are likely to rebound, especially in the immediate vicinity of the Site; however, increased water levels in the River Terrace Deposits will increase the extent to which the Site is hydraulically contained, and therefore this is considered to reduce the risks posed by the landfill in the long-term.

3.5.3 Groundwater Levels and Flow

3.5.3.1 Water Levels

Thory has carried out groundwater level monitoring within its shallow boreholes installed within the River Terrace Deposits since 2011 (BHP11/01 to BHP11/06). Following installation of the deeper boreholes within the Kellaways Sand by Biffa in 2021 (BH21-01 to BH21-06), Biffa has collected groundwater level measurements within these boreholes, as well as further measurements from Thory's shallow boreholes.

The water levels measured by Thory during the period 2016 to 2021, and by Biffa in 2021, have been presented and used for assessment of the Eastern Extension within the HRA (Report ref. 21453458.633).

3.5.3.2 *Flow in the River Terrace Deposits*

Groundwater flow beneath and around the Site is predominantly in the River Terrace Deposits and the deeper Kellaways Sand. Local groundwater flow within the River Terrace Deposits is thought to be currently radially inwards towards the Eastern Extension. However, this represents a transient condition established by the dewatering operations in the Eastern Extension and by quarrying and landfilling operations elsewhere at the Site. When the drainage system is no longer utilised upon completion of waste emplacement, groundwater levels will rise to their natural level groundwater levels. It is believed that the natural flow direction is in a north/westerly direction, based upon pre-quarrying groundwater levels from 2011.

3.5.3.3 *Flow in the Oxford Clay*

The Oxford Clay serves as an aquitard, preventing the downwards migration of contaminants into the Kellaways Sands, and confines groundwater in the Kellaways Sand.

Any flow within the saturated Oxford Clay will be very small with an in situ permeability of less than 1×10^{-9} m/s.

3.5.3.4 *Flow in the Kellaways Sand*

Groundwater levels in the Kellaways Sand are typically above the top of the Oxford Clay which indicate that the Kellaways Sand is a confined aquifer recharged at a distance from the site. This also indicates that there is a limited potential for groundwater to flow through the Oxford Clay.

3.5.4 **Groundwater Quality**

Thory has been carrying out groundwater quality monitoring at Willow Hall Quarry and Inert Landfill in accordance with their permit since 2011, in boreholes installed within the River Terrace Deposits (BHP11/01 to BHP11/06). Following installation of the deeper boreholes by Biffa in 2021 (BH21-01 to BH21-06), Biffa undertook three monitoring rounds to collect baseline water quality information from these boreholes, as well as a more comprehensive suite of analysis from the Thory boreholes. **Drawing ESID11 – Local Hydrogeology and Hydrology** shows the groundwater monitoring points in the vicinity of the Eastern Extension.

Data collected by Thory for the period 2016 to 2021, and collected by Biffa in 2021, has been presented and used for assessment of the Eastern Extension within the HRA (Report ref. 21453458.633).

The proposed monitoring regime for groundwater quality is presented in the HRA (Report ref. 21453458.633) and the Groundwater Management and Monitoring Plan (Report ref. 21453458.640) and will be carried out in accordance with the Permit.

3.5.5 **Off-Site Landfill Gas Monitoring**

Landfill Gas Monitoring will be undertaken at around the perimeter of the Eastern Extension as shown on **Drawing ESID8 – Landfill Gas Management**.

3.6 **Receptors and Compliance Points**

The sources, pathways, and receptors that have been identified within this report are shown on **Drawing ESID2 – Environmental Site Setting**.

3.6.1 **Groundwater**

The specific receptors that are considered in the HRA are:

- The groundwater beneath and adjacent to the site; and
- Groundwater abstraction boreholes.

The Eastern Extension will operate on the principle of hydraulic containment i.e. leachate elevations are below external groundwater elevations in the Kellaways Sand and River Terrace Deposits (once rebound occurs following cessation of groundwater management). As such the inward hydraulic gradient will not support advective flow of leachate from the Site unless the leachate levels rise above the groundwater levels. Diffusion of contaminants through the clay liner will be the only mechanism for contaminants to be transported through the clay lining system. Therefore, under normal operational procedures, these cells will pose negligible risk to groundwater quality.

The compliance points are as follows:

- For Hazardous Substances, the receptor point will be the edge of the sidewall liner in contact with the groundwater in the River Terrace Deposits above the Oxford Clay, and the base of the Oxford Clay above the Kellaways Sand; and
- For Non-Hazardous Substances, the primary receptor point will be the downstream boundary of the Site within the River Terrace Deposits and Kellaways Sand. Surface streams, most notably the Cat's Water Drain will form secondary receptors.

The Hydrogeological Conceptual Site Model is shown in **Drawing ESID12 - Hydrogeological Conceptual Site Model**.

3.6.2 Surface Water

The specific surface water receptors that are considered in the HRA are:

- Cat's Water Drain; and
- Surface water drains.

3.6.3 Landfill Gas

The specific receptors that are considered in the Section D Landfill Gas Generation and Risk Assessment are:

- Global atmosphere;
- Eyebury Farm;
- America Farm Cottage;
- Poplar Farm Cottage;
- Walnut Lodge;
- Briggs Farm Cottages;
- Willow Holt;
- Willow Hall Farm Cottage;
- Eyebury Cottages;
- New Residential Property;
- Tanholt Farm;
- Oxney Grange;
- Bar Pasture Farm; and
- America Farm Commercial Estate.

3.6.4 Amenity (Nuisance and Health)

The specific receptors that are considered in the Section E Amenity Risk Assessment are:

- Tanholt Farm and Tanholt Cottages;
- Eyebury Farm and Eyebury Cottages;
- Oxney Grange;
- America Farm Cottage and America Farm;
- Willow Hall and Willow Hall Farm Cottage;
- Poplar Farm Cottage and Walnut Lodge;
- Willow Holt, Brigg's Farm Cottages and Prior's Farm;
- Bar Pasture Farm
- Green Wheel Cycle Path;
- Eyebury Road;
- Agricultural Land;
- Silt Lagoon and Clear Water Lagoon;
- Dogsthorpe Star pit, Eye gravel pit;
- Nene Washes; and
- Cat's Water Drain.

3.6.5 Habitats

There are three Habitat Sites within 5 km of Eye Landfill. These include:

- The Nene Washes. This is a SPA, SAC, Ramsar and SSSI site and lies at a distance of approximately 2.4 km to the south of the Site;
- Eye Gravel Pit. This is a SSSI and lies at a distance of approximately 2.1 km to the northwest of the Site; and
- Dogsthorpe Star Pit. This is a SSSI and lies at approximately 2.7 km to the west of the Site.

The effect of the landfill on these Habitat Sites is detailed in Section F Habitats Risk Assessment.

4.0 SITE REPORT

4.1 Site Details

Name of Applicant:

- Biffa Waste Services Ltd

Activity Address:

- Eye Landfill, Eyebury Road, Eye, Peterborough, Cambridgeshire, PE6 7TH

National Grid Reference:

- TF 2328701453

Document Reference and dates for Site Condition Report at permit application and surrender:

- A Site Condition Report was prepared for Willow Hall Farm Quarry and Inert Landfill which will become the Eastern Extension, as part of Thory's EP application (GP Planning Ltd, 2015). A copy of this, and the HRA that it references are included as Appendix 13 of this variation application.

Document references for site plans (including location and boundaries):

- Environmental Setting and Installation Design Report including drawings (ref. 21453458.632).

4.2 Condition of the Land at Permit Issue

Environmental Setting including:

- Geology – see Section 3.3, above;
- Surface Waters – see Section 3.5, above; and
- Hydrogeology – see Section 3.6, above.

Pollution history including:

- Pollution incidents that may have affected land – see Section 2.1, above;
- Historical land-uses and associated contaminants – see Section 1.6, above;
- Any visual/olfactory evidence of existing contamination – see Section 1.6; and
- Evidence of damage to pollution prevention measures – not applicable.

Evidence of historical contamination, for example historical site investigation assessment, remediation and verification reports:

- None.

Baseline soil and groundwater reference data:

- Sections 3.3, 3.5 and 3.6 above, plus environmental monitoring and reporting undertaken in accordance with the Permit.

4.3 Permitted Activities

4.3.1 Permitted Activities

See Section 1.3 above.

4.3.2 Non-Permitted Activities

None.

4.3.3 Documents

The activity layout of the Eastern Extension is described in the Environmental Setting and Installation Design Report including drawings (ref. 21453458.632).

As part of the current variation application, quantitative risk assessments are presented for hydrogeology, stability and landfill gas, and qualitative risk assessments have been carried out for nuisance and health.

4.4 Changes to the Activity

Enhanced Pre-Application Advice was requested by Biffa and provided by the EA in October 2021. Biffa is applying to vary the permit for Eye Landfill to extend the non-hazardous landfill, consolidate with the inert landfill permit and surrender appropriate areas.

A separate application to transfer the Inert Landfill permit (from Thory to Biffa) will be applied for during determination of the above variation in order for the transfer application to be determined just prior to the variation.

The EA's recommended permitting approach is:

- This variation application is submitted to extend EPR/BP3537PP (Eye Landfill); to vary to consolidate EPR/BP3537PP with EPR/FP3204MX (Inert Landfill) and EPR/EB3091VZ (Discharge Activity); and to surrender the unused area no longer required in the permit;
- Transfer application for EPR/FP3204MX (Inert Landfill) from Thory to Biffa;
- Transfer application for EPR/EB3091VZ (Discharge Activity) from Thory to Biffa; and
- Surrender of EPR/EB3091VZ (Discharge Activity) once the limits have been consolidated into the installations permit.

The activity boundary for EPR/FP3204MX (Thory Inert Landfill) is shown on **Drawing ESID2 – Environmental Site Setting**.

The proposed activity boundary for EPR/BP3537PP (Biffa Eye Landfill, Northeastern Extension, Southern Extension and proposed Eastern Extension) is shown on **Drawing ESID2 – Environmental Site Setting**.

This variation application will also consolidate EPR/EB3091VZ (Discharge Activity) into EPR/BP3537PP (Eye Landfill).

No 'dangerous substances' not identified in the Application Site Condition Report have been used or produced as a result of the permitted activities.

4.5 Measures taken to protect Land

Measures to protect land have been undertaken in accordance with EPR/FP3204MX (Thory Inert Landfill)

4.6 Pollution Incidents

No pollution incidents that may have had an impact on land have been identified to date.

4.7 Soil, Gas and Water Quality Monitoring

Soil, gas and water quality monitoring has been undertaken in accordance with EPR/FP3204MX (Thory Inert Landfill).

4.8 Decommissioning and Removal of Pollution Risk

The area to the south of the Green Wheel path is subject to partial surrender in this application. This area was in agricultural use at the outset, remains in agricultural use, and is otherwise undisturbed to date. No plant machinery, equipment or activities that are sources of pollution risk have been introduced into this area during the lifetime of the Permit.

No mineral extraction has taken place south of the Green Wheel Path. Thory will continue mineral extraction operations in accordance with existing planning permission. The Area will be restored with natural Oxford Clay, overburden and top soil materials in accordance with the planning permission.

No landfilling for inert waste has taken place south of the Green Wheel Path.

4.9 Reference Data and Remediation

Environmental monitoring undertaken in accordance with EPR/FP3204MX (Thory Inert Landfill) indicates that there has been no deterioration of the land south of the Green Wheel path. The land is considered to be in a satisfactory state.

4.10 Statement of Site Condition

The area to the south of the Green Wheel path is subject to partial surrender in this application. Using the information provided above, Biffa confirms that:

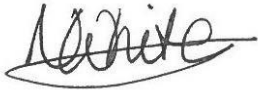
- This area was in agricultural use at the outset, remains in agricultural use, and is otherwise undisturbed to date. The permitted activity (Inert Landfilling) did not commence in this area;
- No plant machinery, equipment or activities that are sources of pollution risk have been introduced into this area during the lifetime of the Permit; and
- With reference to this Site Condition Report, the land is considered to be in a satisfactory condition.

5.0 REFERENCES

- 1) <https://www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/>
- 2) MAFF, 1976. *Technical Bulletin 35*, s.l.: Ministry of Agriculture, Fisheries and Food.
- 3) MAGIC, 2021. *Magic Map Application*. [Online] Available at: magic.defra.gov.uk [Accessed 2021].

Signature Page

Golder, member of WSP UK Ltd



Nicola White
Project Manager



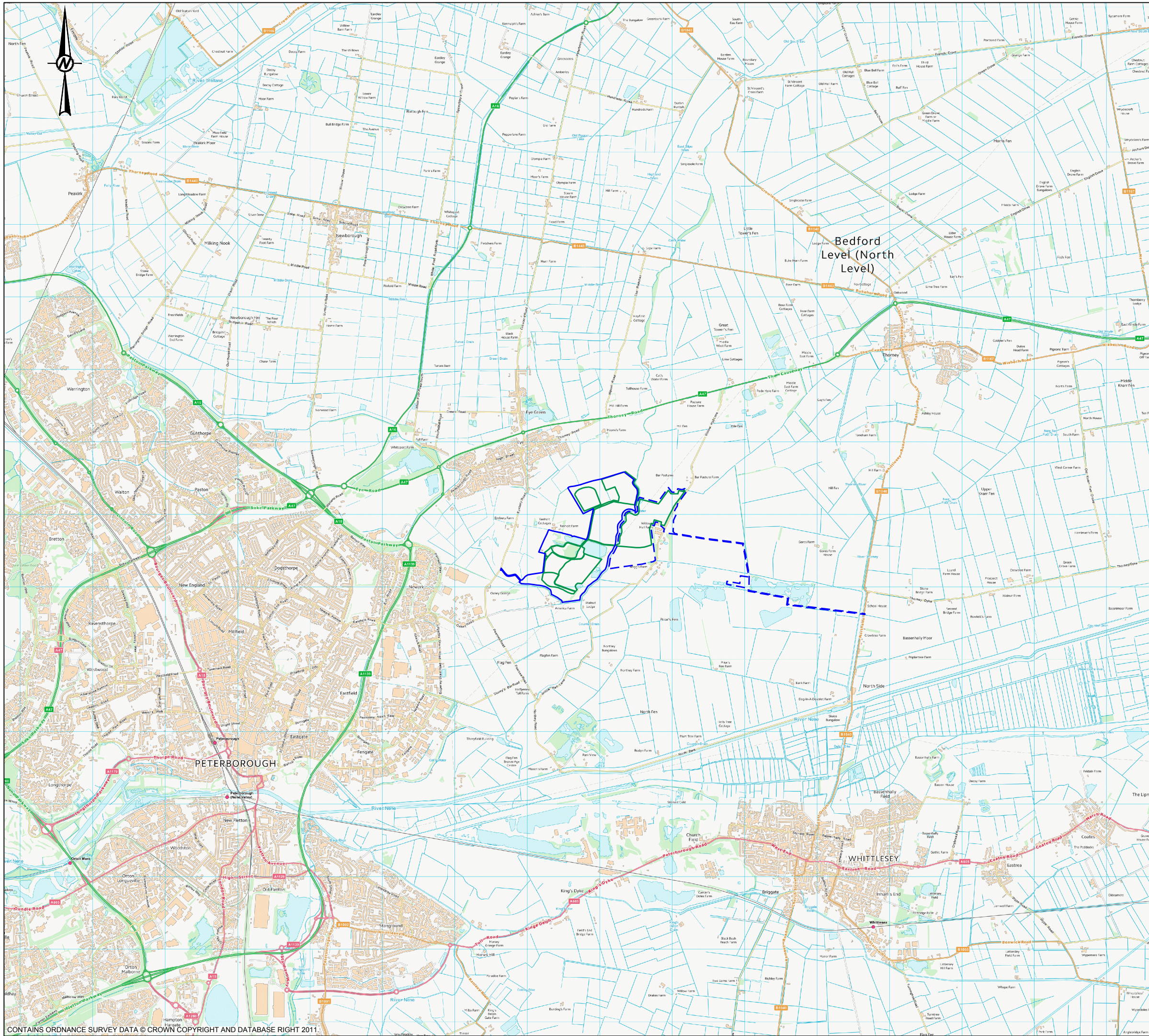
Chris McDonald
Project Director

IC/CM/NW/ab

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At WSP House, 70 Chancery Lane, London, WC2A 1AF
VAT No. 905054942

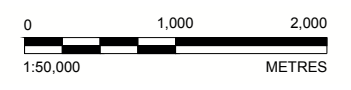
DRAWINGS

Drawing ESID 1 to 13



KEY MAP (N.T.S.)

- LEGEND**
- EYE LANDFILL LAND UNDER APPLICANT'S CONTROL
 - - - - - PLANNING PERMISSION BOUNDARY, WILLOW HALL FARM QUARRY AND INERT LANDFILL
 - PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY EPR/BP3537PP/V011

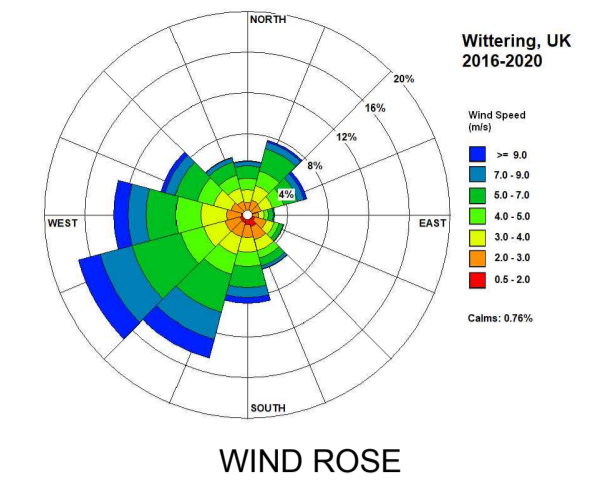
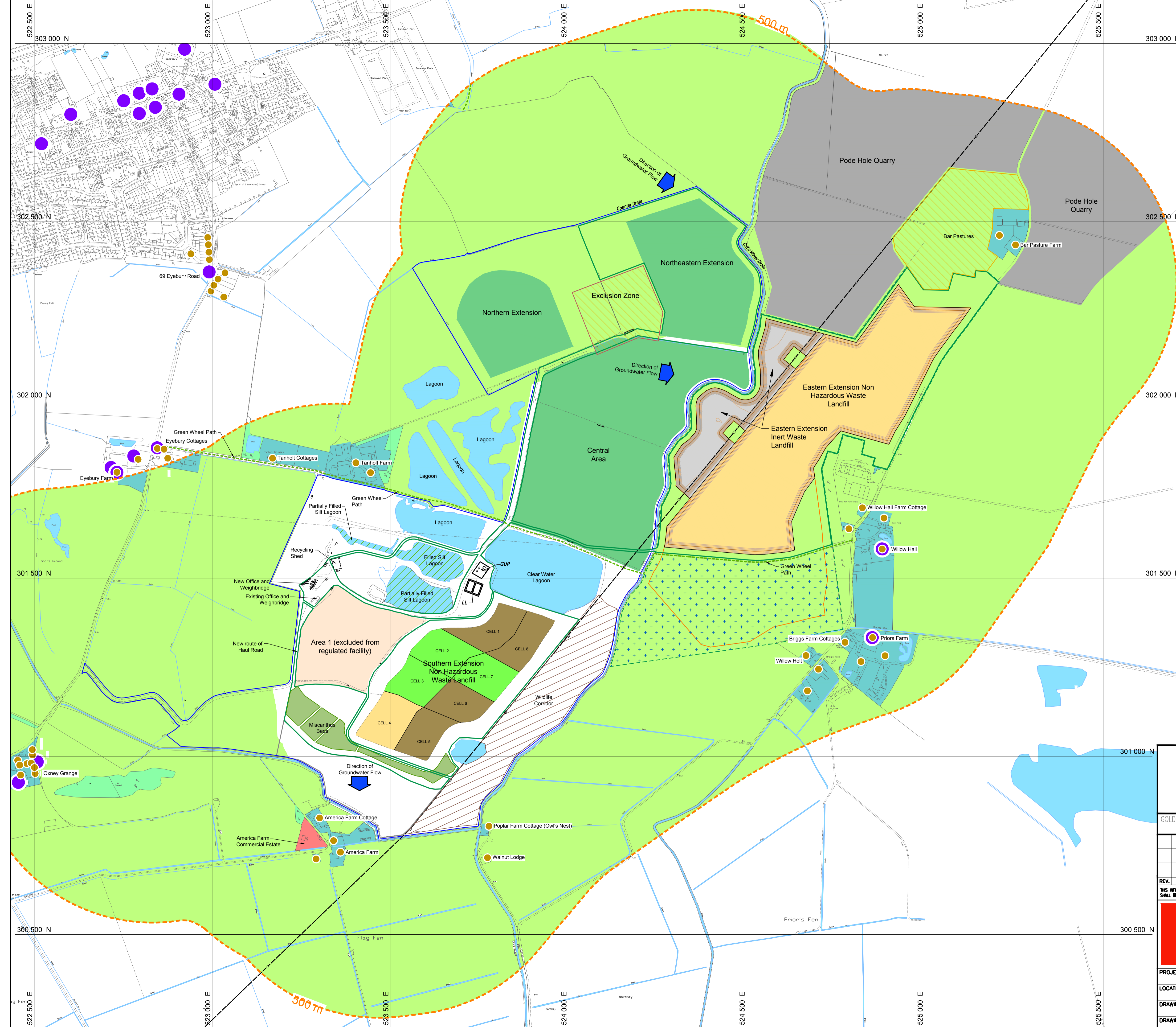


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 Mob: 01921 386021
 E-mail: phil.mumford@biffa.co.uk

PROJECT	Eye Eastern Extension	DRAWN	E.C.S.
LOCATION	Eye Landfill, Peterborough	DATE	25/02/2022
DRAWING TITLE	Site Location Plan	SCALE(S)	1:50,000
DRAWING No.	ESID1	COMPUTER REF.	E5237800



Note:
1. ALL LEVELS RELATIVE TO NEWLYN ORDANCE DATUM.

Reference:
1. Site survey provided by A&B Surveys, drawing ref.APA2003, dated January 2003, manually amended to east from Ordnance Survey Opendata.

- Key:**
- Eye Landfill Land Under Applicant's Control
 - Proposed Biffa Environmental Permit Boundary EPR/BP3537PP/V011
 - THORY EPR/FB3204MX
 - Area Excluded From Regulated Facilities
 - Pylons and Overhead Electricity Transmission Wires
 - Wildlife Corridor
 - 500 m Offset From Biffa EPR/BP3537PP/V011
 - Partial Surrender From EPR/FB3204MX (Inert Landfill)
 - Mineral Excavation Boundary

- Sources:**
- Closed Landfill (Various Permits)
 - Filled and Capped Landfill Cell
 - Operational Landfill Cell (Awaiting Completion)
 - Operational Cell
 - GUP (Gas Utilisation Plant)
 - LL (Leachate Storage Lagoon for Miscanthus Beds)

- Receptors:**
- Residential Property
 - Commercial/Industrial Property
 - Farmland (Arable or Livestock)
 - Quarry
 - Footpath, Track or Bridleway
 - Scheduled Ancient Monument
 - Listed Buildings

- Pathways:**
- Watercourses and Drains
 - Groundwater Flow



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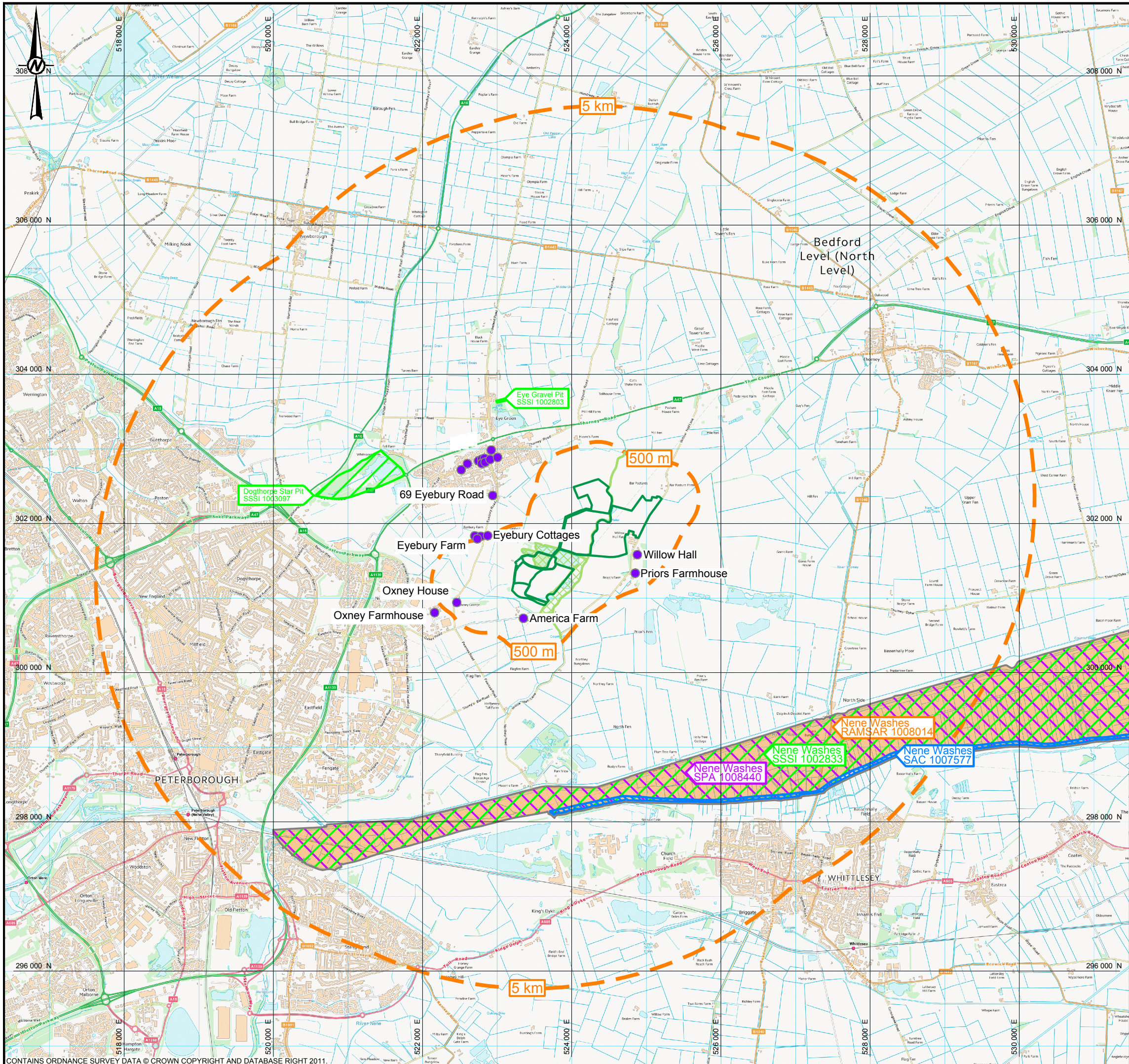


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PROJECT	Eye Eastern Extension	DRAWN	ECS
LOCATION	Eye Landfill, Peterborough	DATE	25/02/2022
DRAWING TITLE	Environmental Site Setting	SCALE(S)	1:5,000
DRAWING No.	ESID2	COMPUTER REF.	E5237900



- Key:**
- PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY EPR/BP3537PP/V011
 - - - 500 m OFFSET FROM BIFFA EPR/BP3537PP/V011
 - CULTURAL HERITAGE: LISTED BUILDINGS (0.5 km)
 - CULTURAL HERITAGE: BOUNDARY OF SSSI, SPA AND RAMSAR
 - CULTURAL HERITAGE : SCHEDULED MONUMENTS (5 km)
 - ▨ Nene Washes SSSI 1002833
 - ▨ Nene Washes SPA 1008440
 - ▨ Nene Washes SAC 1007577
 - ▨ Nene Washes RAMSAR 1008014
 - ▨ RAMSAR
 - ▨ COUNTY WILDLIFE SITES (0.5 km)



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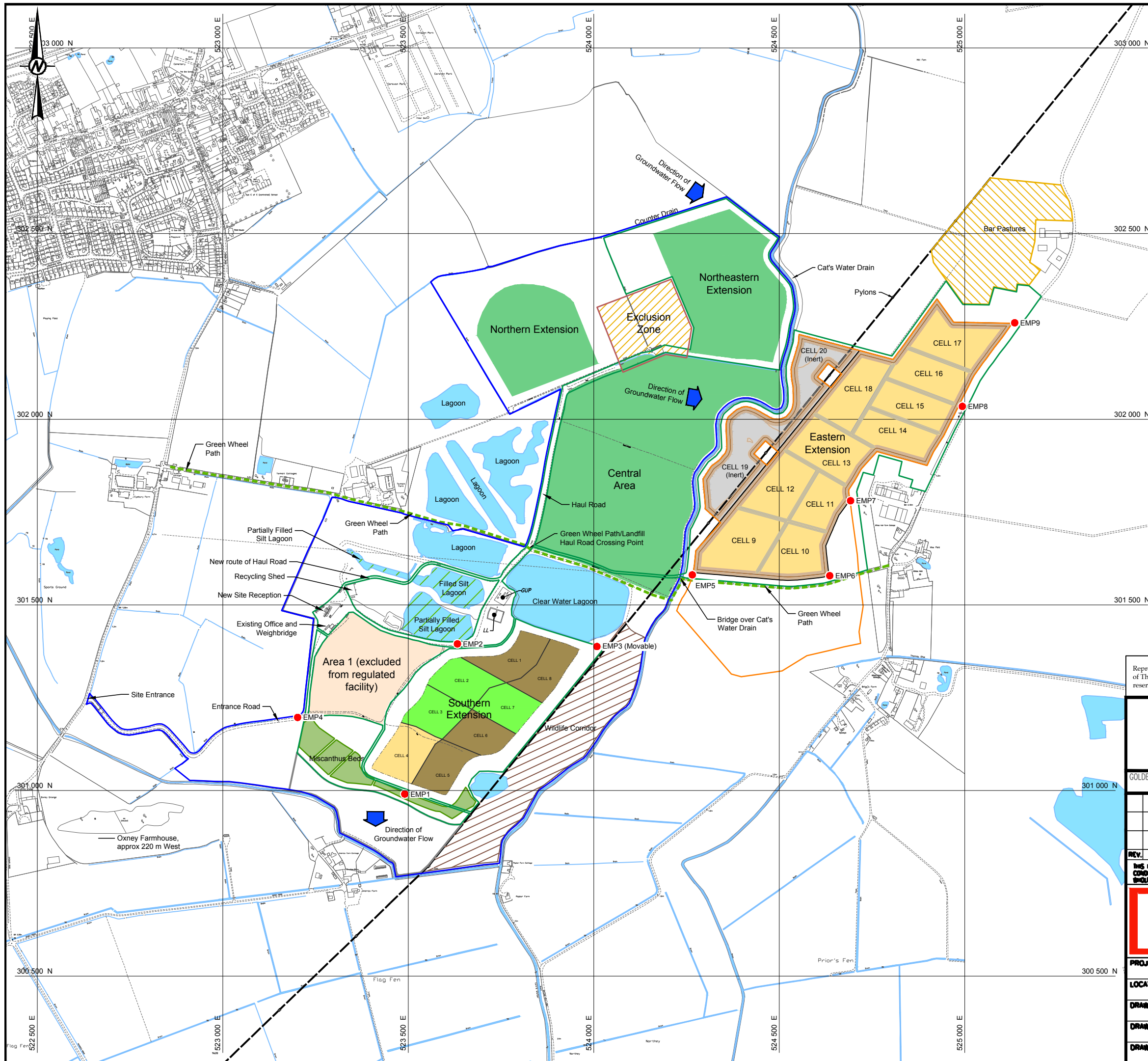


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PROJECT	Eye Eastern Extension
LOCATION	Eye Landfill, Peterborough
DRAWING TITLE	Cultural and Natural Heritage
DRAWING No.	ES103
COMPUTER REF.	E5238000
DRAWN	ECS
DATE	25/02/2022
SCALE(S)	1:50,000



- Note:**
- All levels relative to Newlyn Ordnance Datum.
 - EMP1 South of the Site
 - EMP2 Northwest of the Site
 - EMP3 A non fixed location on the Site boundary which is downwind of the prevailing wind direction of the operational area at the time of sampling
 - EMP4 Entrance from Highway
 - EMP5 Southwest of the Site adjacent to Cat's Water Drain and Green Wheel Path
 - EMP6 Southeast of the Site adjacent to Green Wheel Path
 - EMP7 East of the Site adjacent to Willow Hall Lane
 - EMP8 East of the Site adjacent to Willow Hall Lane
 - EMP9 Northeast of the Site adjacent to Willow Hall Lane

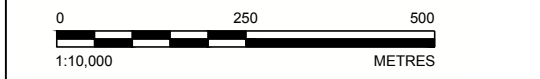
Reference:
1. Site survey provided by A&B Surveys, drawing ref.APA2003, dated January 2003, manually amended to east from Ordnance Survey Opendata.

- Key:**
- EYE LANDFILL LAND UNDER APPLICANT'S CONTROL
 - PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY EPR/BP3537PP/V011
 - AREA EXCLUDED FROM REGULATED FACILITIES
 - PYLONS AND OVERHEAD ELECTRICITY TRANSMISSION WIRES
 - WILDLIFE CORRIDOR
 - ENVIRONMENTAL MONITORING POINT
 - MINERAL EXTRACTION BOUNDARY

- Sources:**
- CLOSED LANDFILL (VARIOUS PERMITS)
 - FILLED AND CAPPED LANDFILL CELL
 - OPERATIONAL LANDFILL CELL (AWAITING COMPLETION)
 - OPERATIONAL CELL
 - GUP (GAS UTILISATION PLANT)
 - LL (LEACHATE STORAGE LAGOON FOR MISCANTHUS BEDS)

- Receptors:**
- FOOTPATH, TRACK OR BRIDLEWAY
 - SCHEDULED ANCIENT MONUMENTS

- Pathways:**
- WATERCOURSES AND DRAINS
 - GROUNDWATER FLOW



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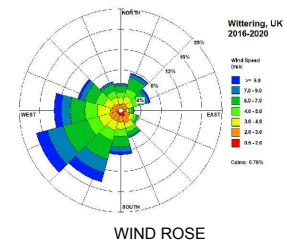
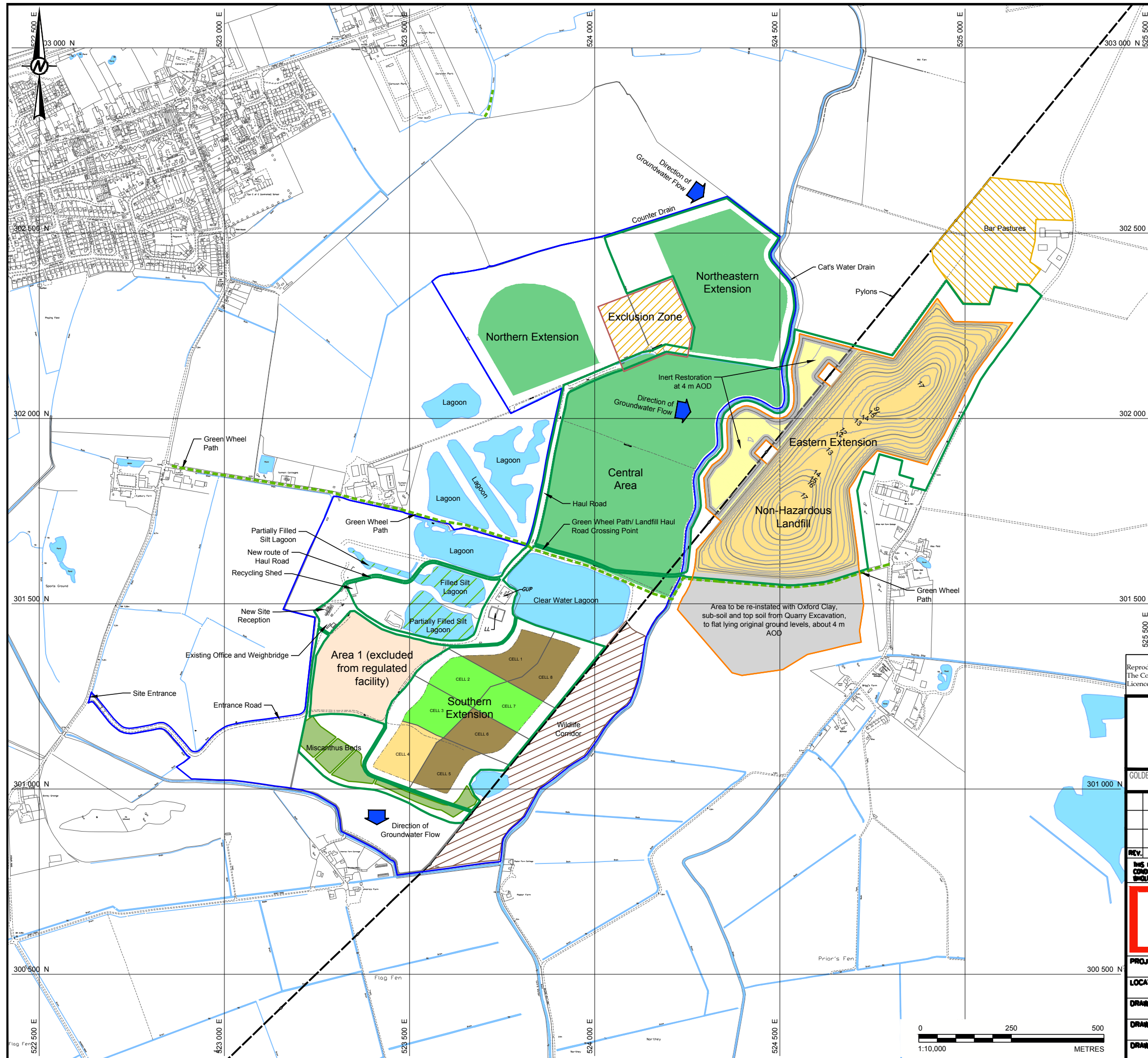
PROJECT Eye Eastern Extension

LOCATION Eye Landfill, Peterborough

DRAWING TITLE Site Layout and Waste Deposition

DRAWING No. ESID4A **COMPUTER REF.** E5238100

DRAWN ECS **DATE** 25/02/2022 **SCALE(S)** 1:10,000



Note:
 1. ALL LEVELS RELATIVE TO NEWLYN ORDNANCE DATUM.
 2. EASTERN EXTENSION INERT LANDFILL RESTORED TO FLAT LYING SURROUNDING GROUND LEVELS (-4m).

Reference:
 1. Site survey provided by A&B Surveys, drawing ref.APA2003, dated January 2003, manually amended to east from Ordnance Survey Opendata.

- Key:**
- EYE LANDFILL LAND UNDER APPLICANT'S CONTROL
 - PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY EPR/BF3537PPV011
 - AREA EXCLUDED FROM REGULATED FACILITIES
 - PYLONS AND OVERHEAD ELECTRICITY TRANSMISSION WIRES
 - WILDLIFE CORRIDOR
 - PRE-SETTLEMENT, PRE-RESTORATION CONTOURS
 - MINERAL EXTRACTION BOUNDARY

- Sources:**
- CLOSED LANDFILL (VARIOUS PERMITS)
 - FILLED AND CAPPED LANDFILL CELL
 - OPERATIONAL LANDFILL CELL (AWAITING COMPLETION)
 - OPERATIONAL CELL
 - GAS UTILISATION PLANT
 - LEACHATE STORAGE LAGOON FOR MISCANTHUS BEDS

- Receptors:**
- FOOTPATH, TRACK OR BRIDLEWAY
 - SCHEDULED ANCIENT MONUMENTS

- Pathways:**
- WATERCOURSES AND DRAINS
 - GROUNDWATER FLOW

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












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PROJECT	Eye Eastern Extension		
LOCATION	Eye Landfill, Peterborough		
DRAWING TITLE	Pre-Settlement Pre-Restoration		
DRAWING No.	ESID4B	COMPUTER REF.	E5238200
DRAWN	ECS	DATE	25/02/2022
		SCALE(S)	1:10,000





Legend

-  Eastern Extension Application Boundary
-  Extraction Boundary (As approved)
-  The Green Wheel Recreational Route (Reinstated on its current alignment)
-  Diverted Cycleway (Retained as Permissive Path)
-  Scheduled Monument (Iron Age and Roman settlement at Bar Pastures)
-  Grade II Listed Buildings
-  Overhead Electricity Transmission Line (No tree planting within 10m)
-  Existing Trees/Woodland
-  Proposed Native Trees/Woodland (Refer Planting Mix NW)
-  Proposed Native Woodland Edge/Scrub (Refer Planting Mix NS)
-  Proposed Native Hedgerow (Refer Planting Mix NH)
-  Proposed Water Course/Seasonal Ponds (Clay lined)
-  Proposed Marginal Wildflower Seeding (Refer Seed Mix WF1)
-  Proposed Wildflower Meadow Seeding (Refer Wildflower Seed Mix WF2)
-  Proposed Post Settlement Contours (1.0m intervals)
-  Proposed Agricultural Land (3 Fields) (Agricultural seed mix sown on to 300 mm top-soil over 700 subsoil)
-  Proposed Stock-Proof Fence
-  Proposed Field Gate
-  Proposed Wildlife Corridor alongside Cats Water

REFERENCE(S)
 BASE MAP TAKEN FROM DRaw PDF REF 008-035-L01, REV 00, DATED 13 JANUARY 2022.



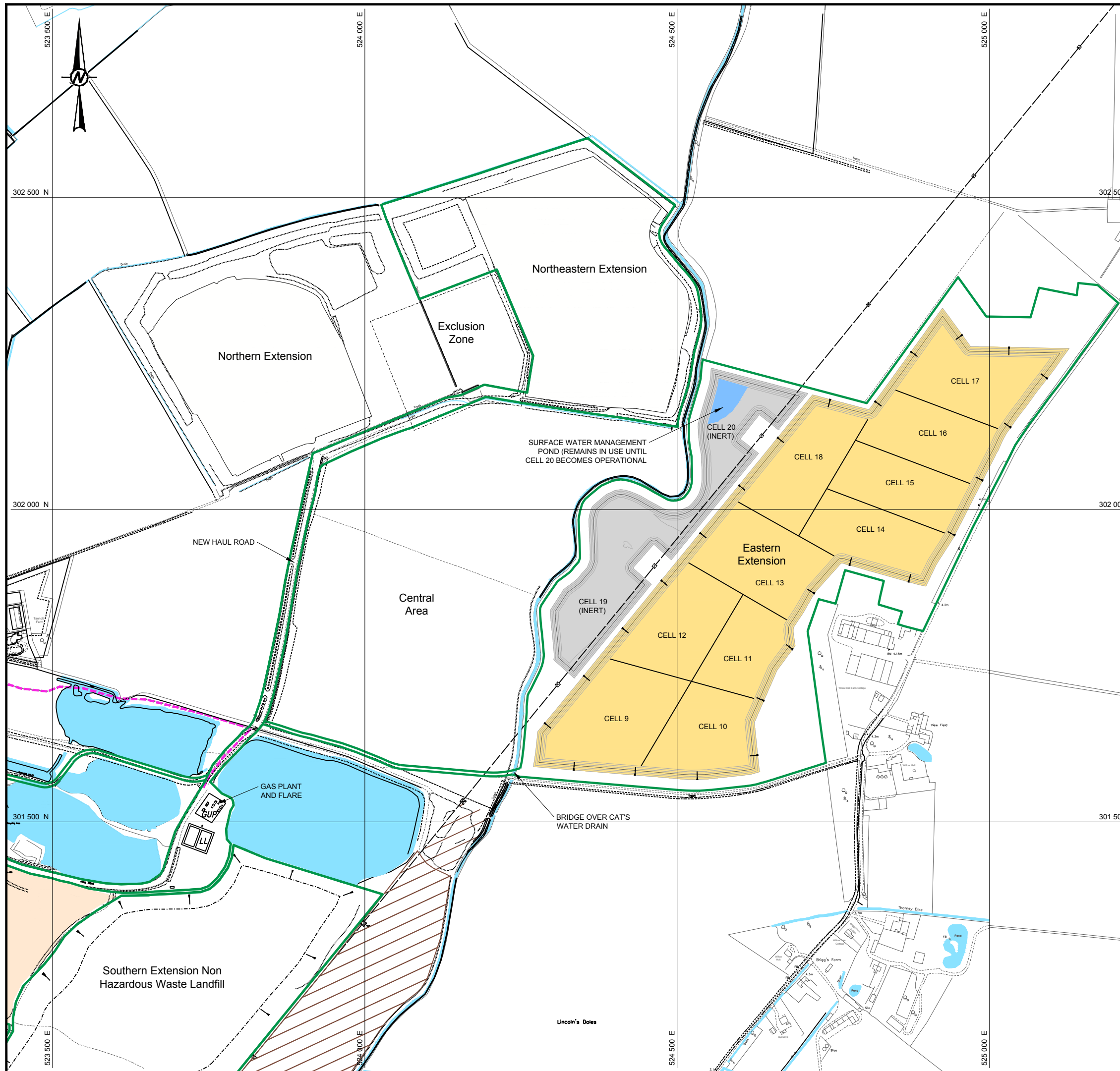
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PROJECT	Eye Eastern Extension	DRAWN	E.C.S.
LOCATION	Eye Landfill, Peterborough	DATE	25/02/2022
DRAWING TITLE	Restoration	SCALE(S)	1:20,000
DRAWING No.	ESID5	COMPUTER REF.	E5238300



KEY	
	PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY EPR/BP3537PP/V011
	CONTAINMENT AREA SIDE LINER
	WILDLIFE CORRIDOR
	BREAK OF SLOPE
	GAS UTILISATION PLANT
	LEACHATE STORAGE LAGOON FOR MISCANTHUS BEDS



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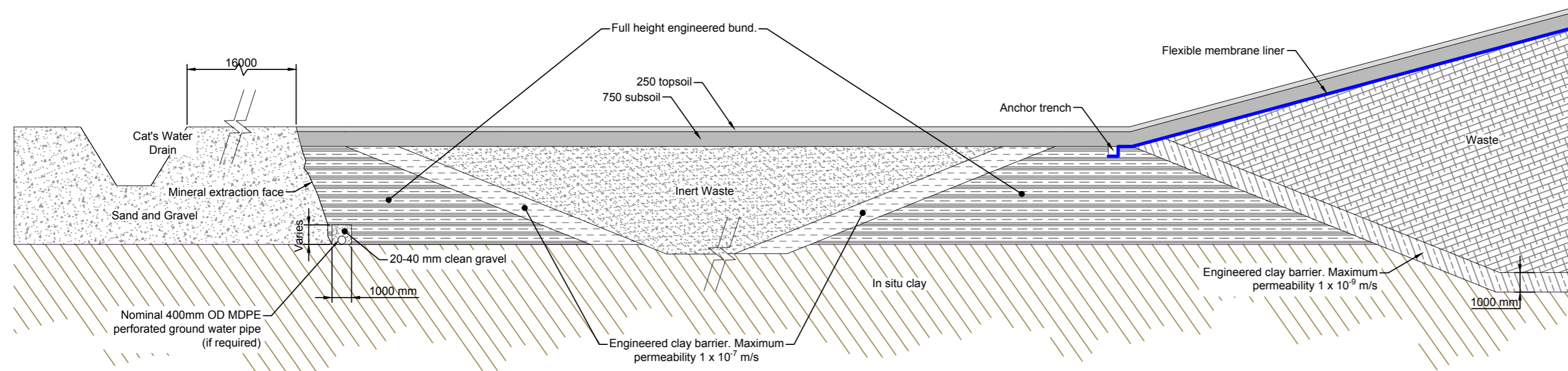
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 Mob: 01921 386021
 E-mail: phil.mumford@biffa.co.uk

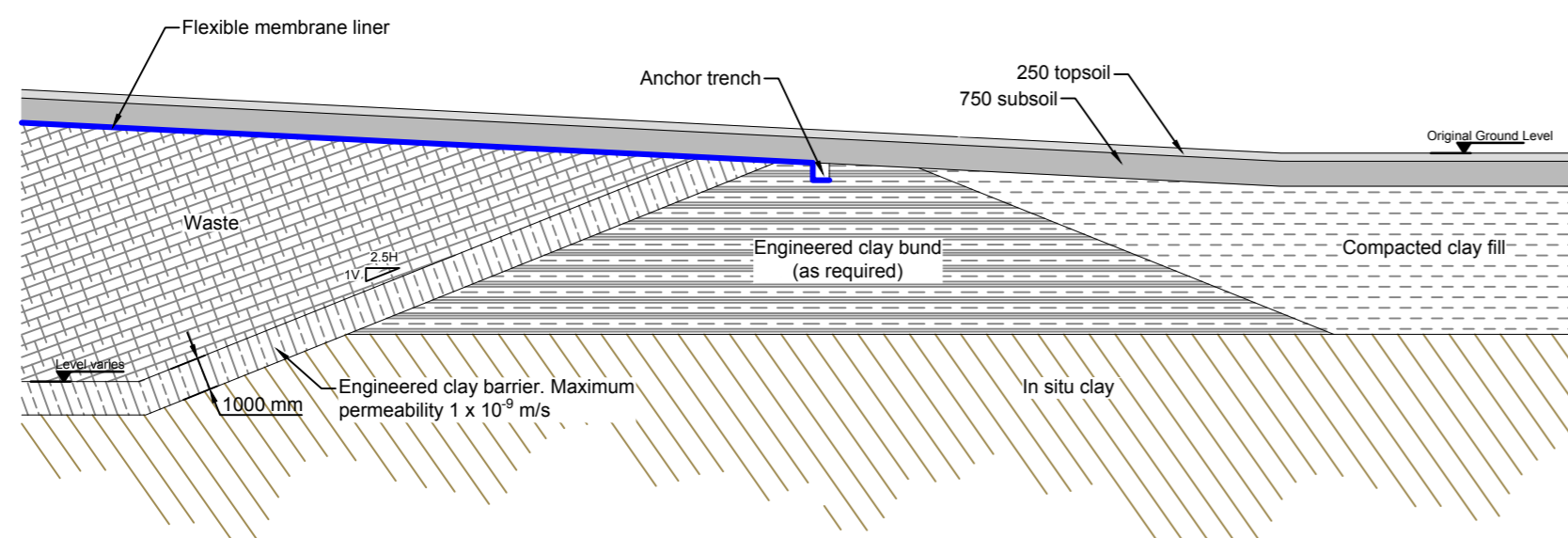
PROJECT	Eye Eastern Extension		
LOCATION	Eye Landfill, Peterborough		
DRAWING TITLE	Installation Plan Layout		
DRAWING No.	ESID6A	COMPUTER REF.	E5238400
DRAWN	ECS	DATE	25/02/2022
		SCALE(S)	1:6,000

NOTE(S)

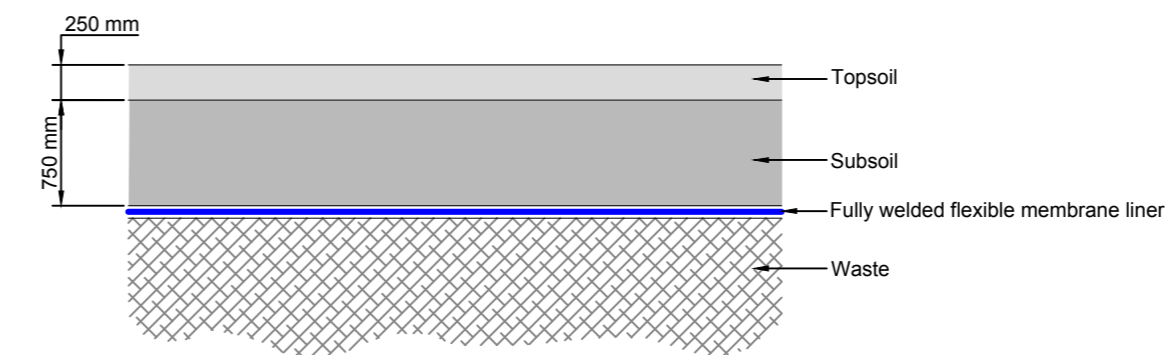
1. All dimensions shown are in millimetres unless otherwise stated.



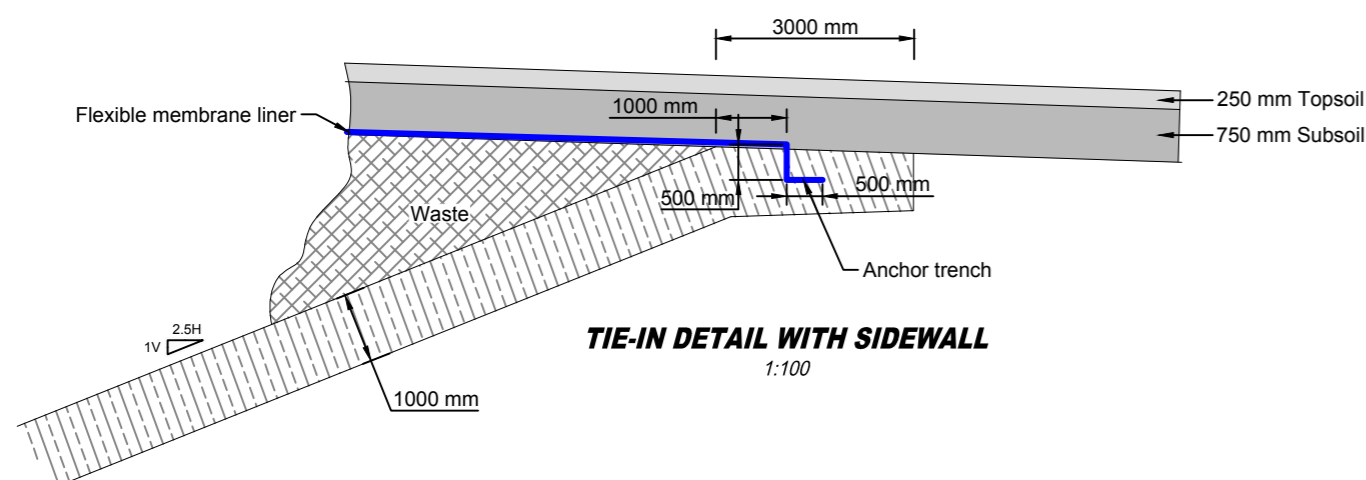
**GENERAL CROSS SECTION THROUGH SIDE SLOPES
(ADJACENT TO CAT'S WATER DRAIN)**
1:200



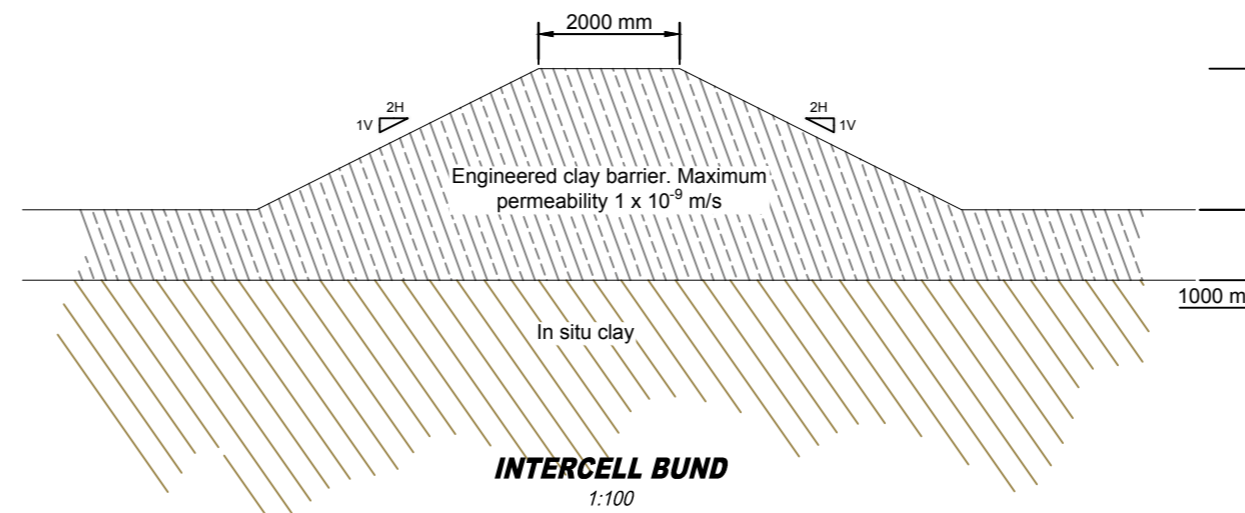
**GENERAL CROSS SECTION THROUGH SIDE SLOPES
(ADJACENT TO BAR PASTURES, WILLOW HALL AND GREEN WHEEL PATH)**
1:200



TYPICAL SECTION THROUGH CAP (FML)
1:50



TIE-IN DETAIL WITH SIDEWALL
1:100



INTERCELL BUND
1:100

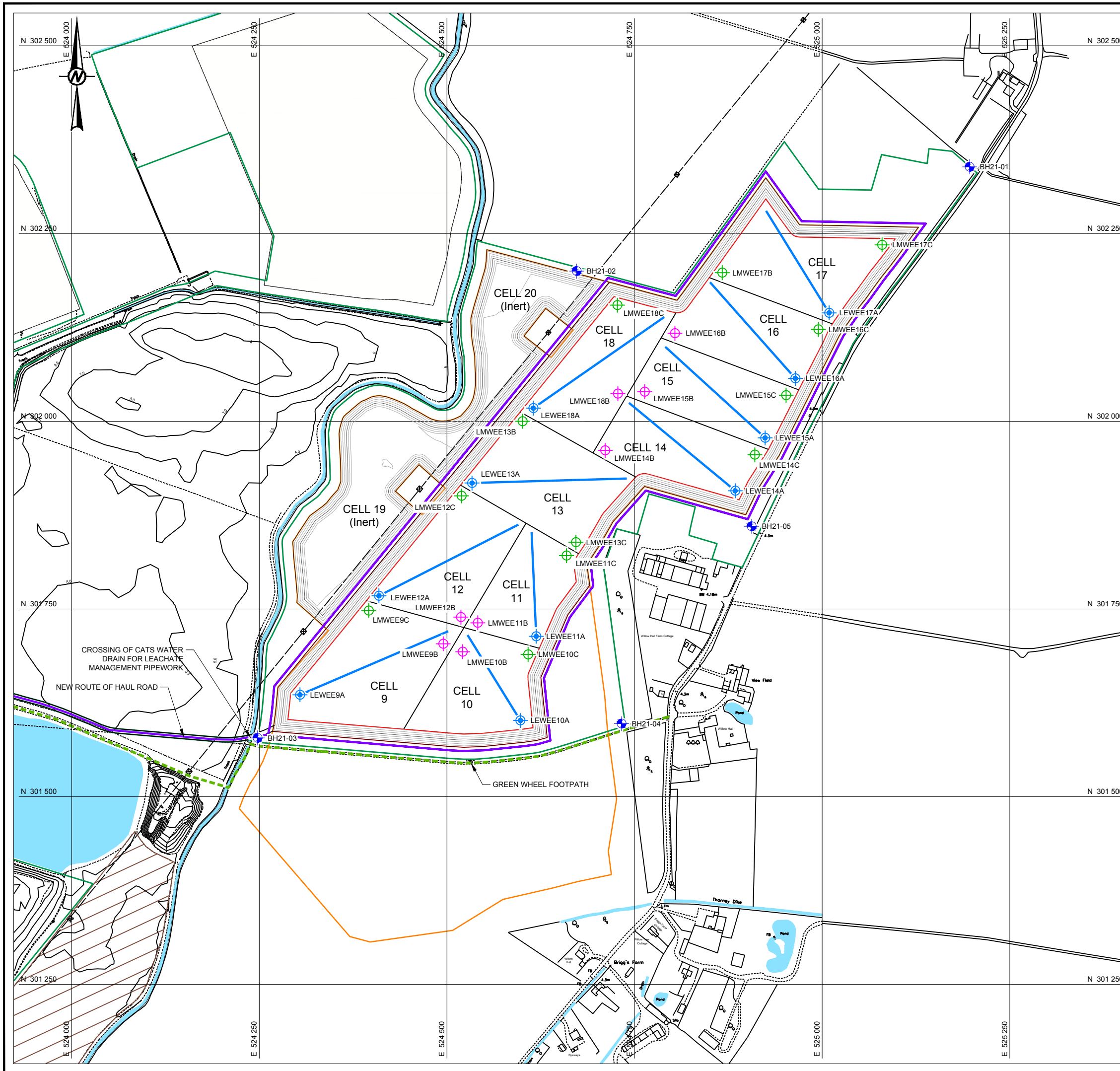
wsp GOLDER

GOLDER FILE REF 1403-PA-0016 ENGINEER NW REVIEWED BY CMcD

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 Biiffa Waste Services Ltd
 Redhill Landfill Site
 Cormongers Lane,
 Nutfield, Redhill
 RH11 4ER
 Tel: 01737 765042
 Mob: 07921 338021
 E-mail: phil.mumford@biiffa.co.uk

PROJECT	Eye Eastern Extension		
LOCATION	Eye Landfill, Peterborough		
DRAWING TITLE	Engineering and Containment		
DRAWING No.	ESID6B	COMPUTER REF.	E5238500
DRAWN	ECS	DATE	25/02/2022
		SCALE(S)	As Shown

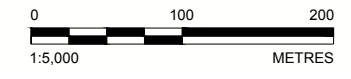


LEGEND

- PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY (EPR/BP3537PPV011)
- MINERAL EXTRACTION BOUNDARY
- GAS EXTRACTION RING MAIN
- ◆ LEACHATE EXTRACTION WELL, EASTERN EXTENSION (UPSLOPE RISER)
- ◆ LEACHATE MONITORING WELL, EASTERN EXTENSION (UPSLOPE RISER)
- ◆ LEACHATE MONITORING WELL, EASTERN EXTENSION (VERTICAL)
- ◆ SITE INVESTIGATION BOREHOLE (2021)

Name	BEDS Description and Code
BH21-01	BH46 – 91002460
BH21-02	BH49 – 91002490
BH21-03	BH51 – 91002510
BH21-04	BH52 – 91002520
BH21-05	BH53 – 91002530

NOTE(S)
 1. EACH CELL SHOULD HAVE AN ABSTRACTION POINT AND 2 MONITORING POINTS. INDICATIVE POSITIONS SHOWN ONLY. EXACT LOCATION TO BE CONFIRMED IN CELL SPECIFIC CQA PLAN.



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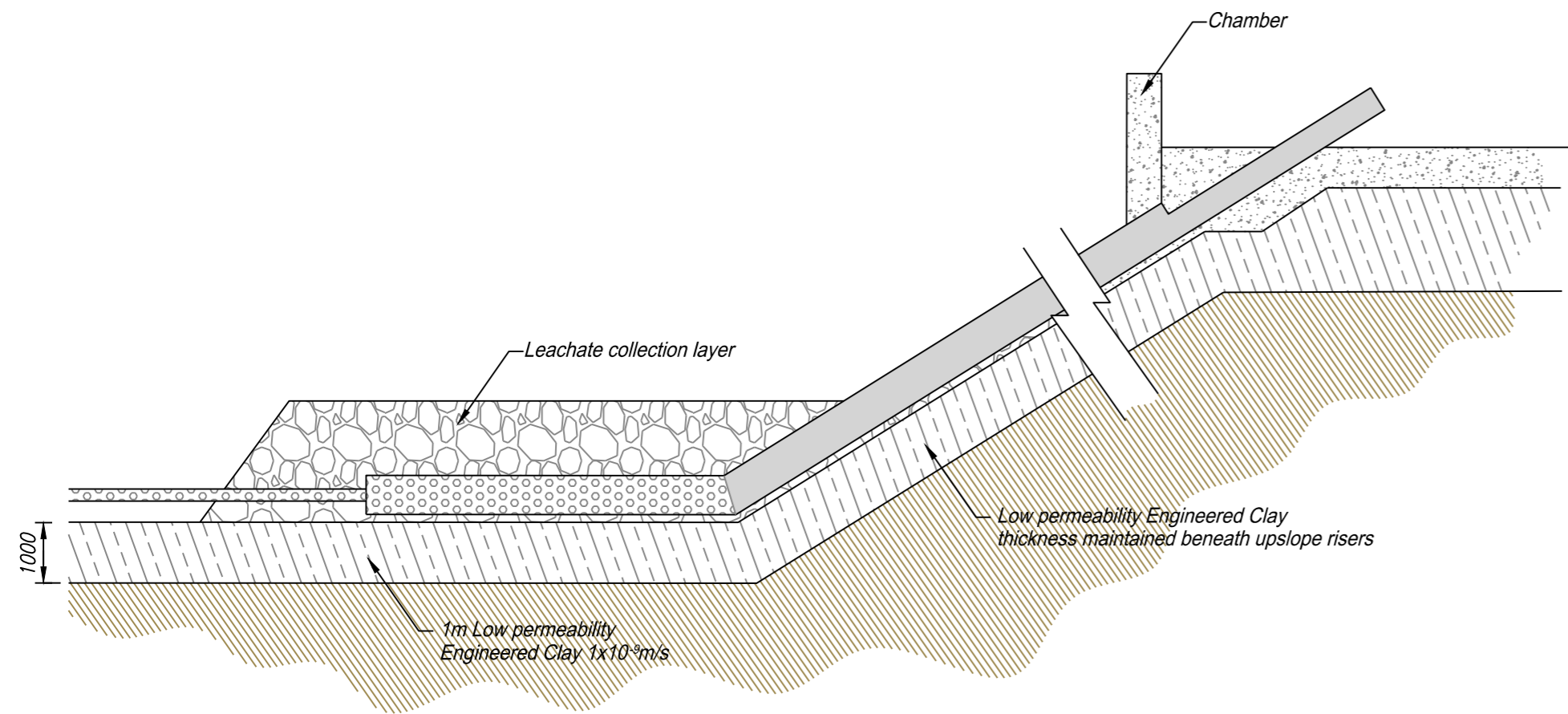


GOLDER FILE REF	1403-PA-0008	ENGINEER	NW	REVIEWED BY	CMcD
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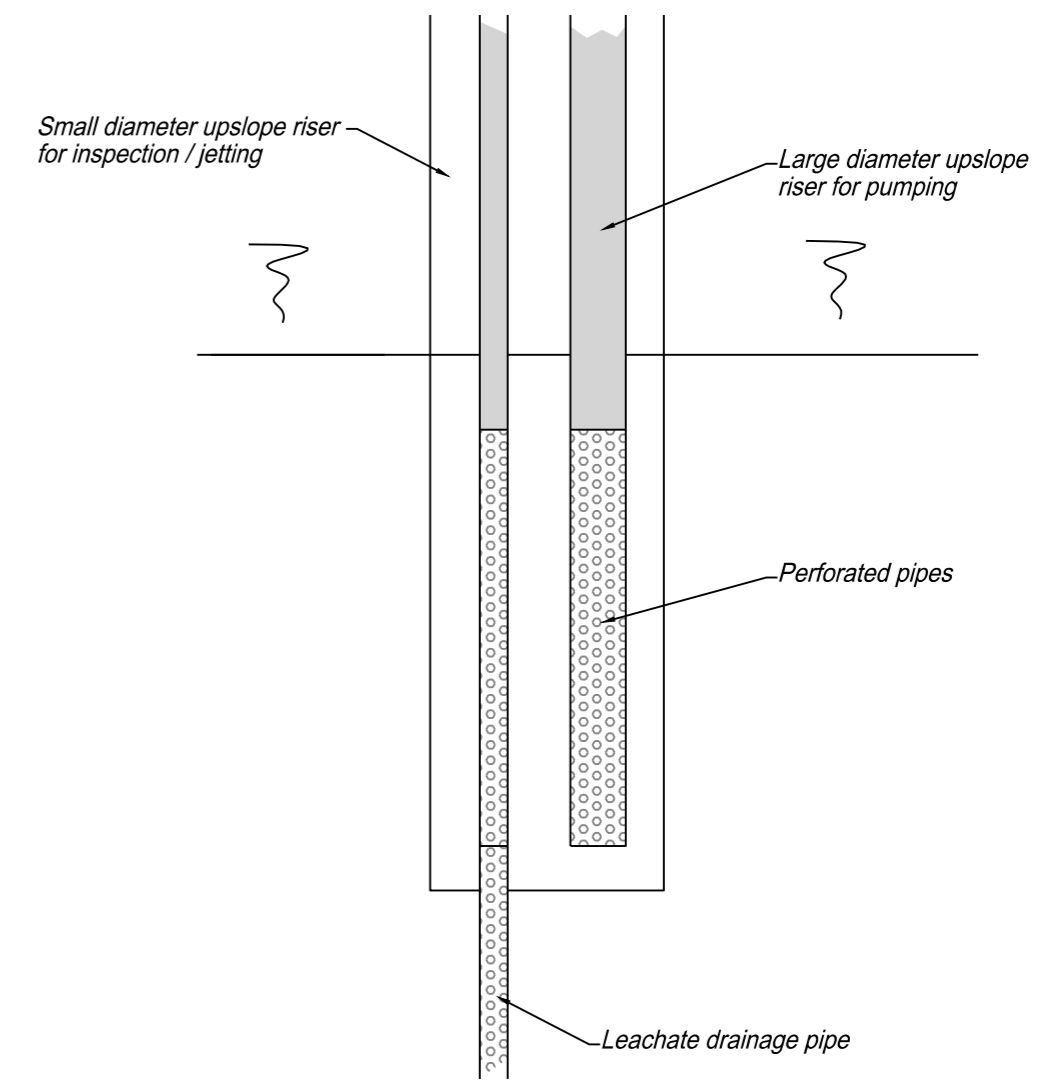
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Biffa
 Biffa Waste Services Ltd
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 Cormanorgate Lane,
 Nutfield, Redhill
 RH1 4ER
 Tel: 01737 765042
 Mob: 07921 366021
 E-mail: phil.mumford@biffa.co.uk

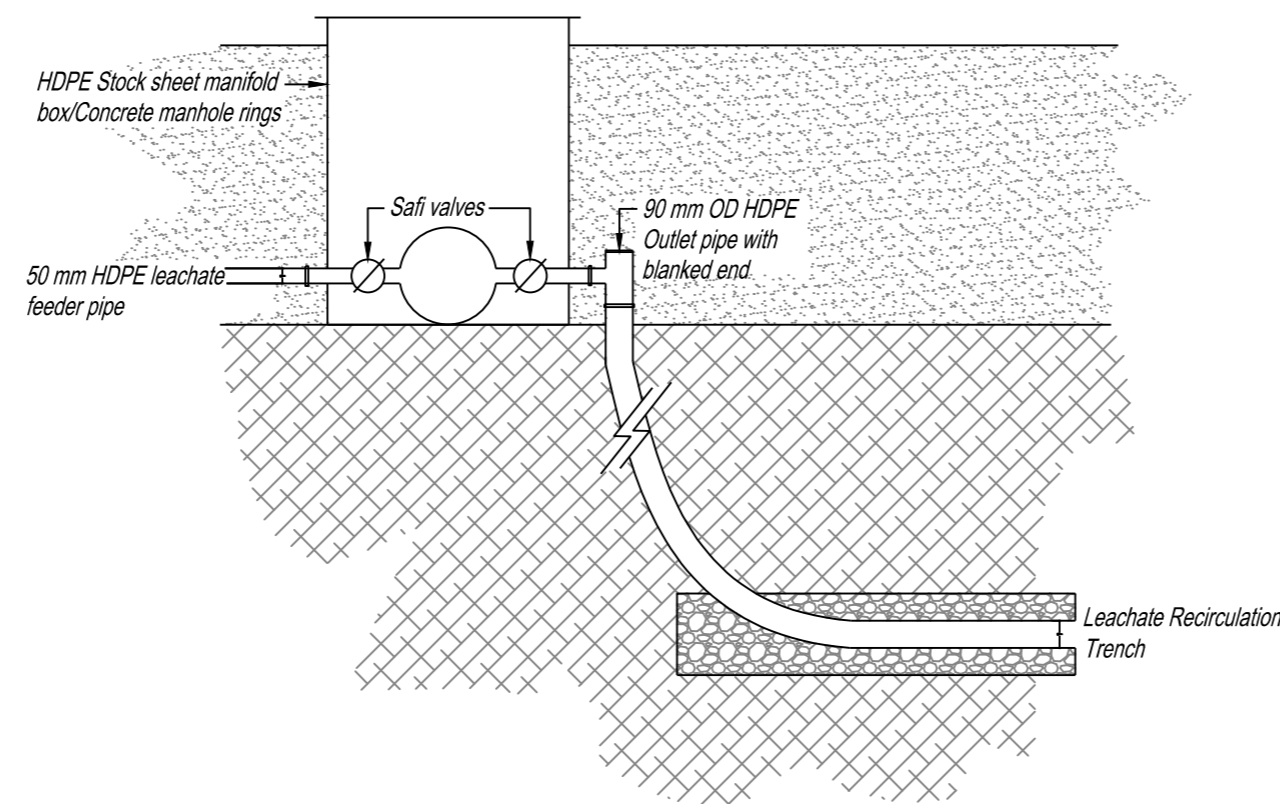
PROJECT	Eye Eastern Extension		
LOCATION	Eye Landfill, Peterborough		
DRAWING TITLE	Leachate Management Layout		
DRAWING No.	ESID7A	COMPUTER REF.	E5238600
DRAWN	ECS	DATE	16/03/2022
		SCALE(S)	1:5,000



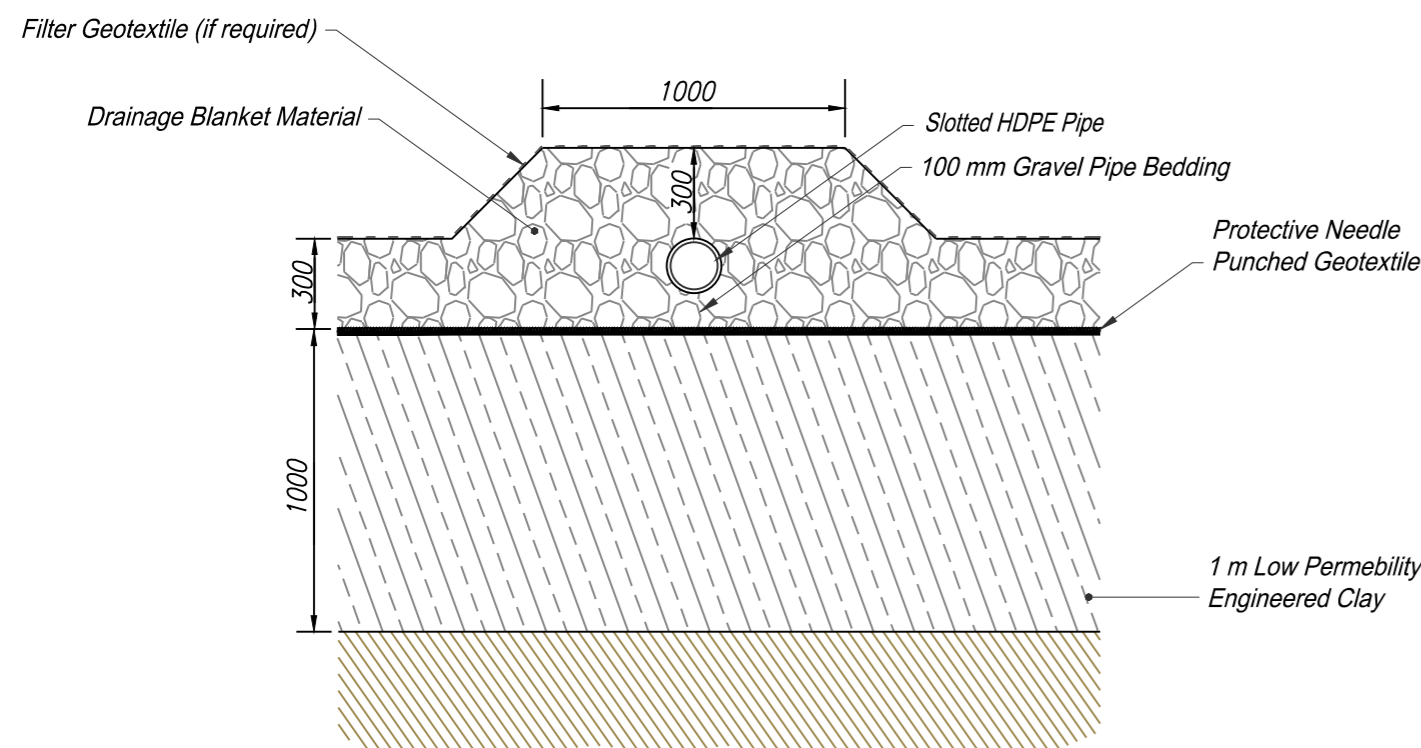
TYPICAL CROSS SECTION THROUGH LEACHATE COLLECTION SUMP
1:100



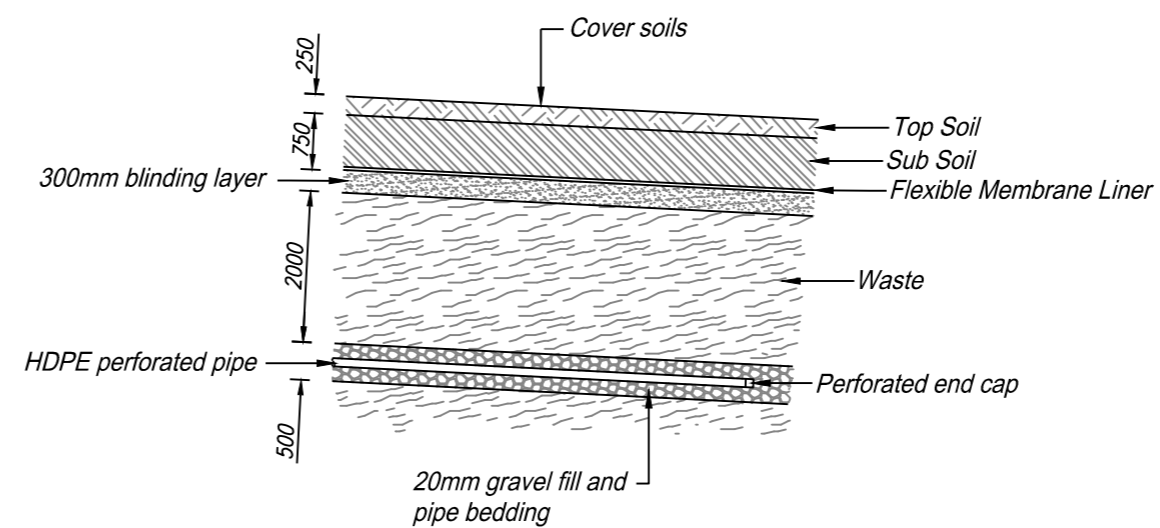
TYPICAL PLAN OF LEACHATE COLLECTION SUMP
NTS



TYPICAL LEACHATE RECIRCULATION SUMP
NTS



LEACHATE DRAINAGE PIPE DETAIL
1:25

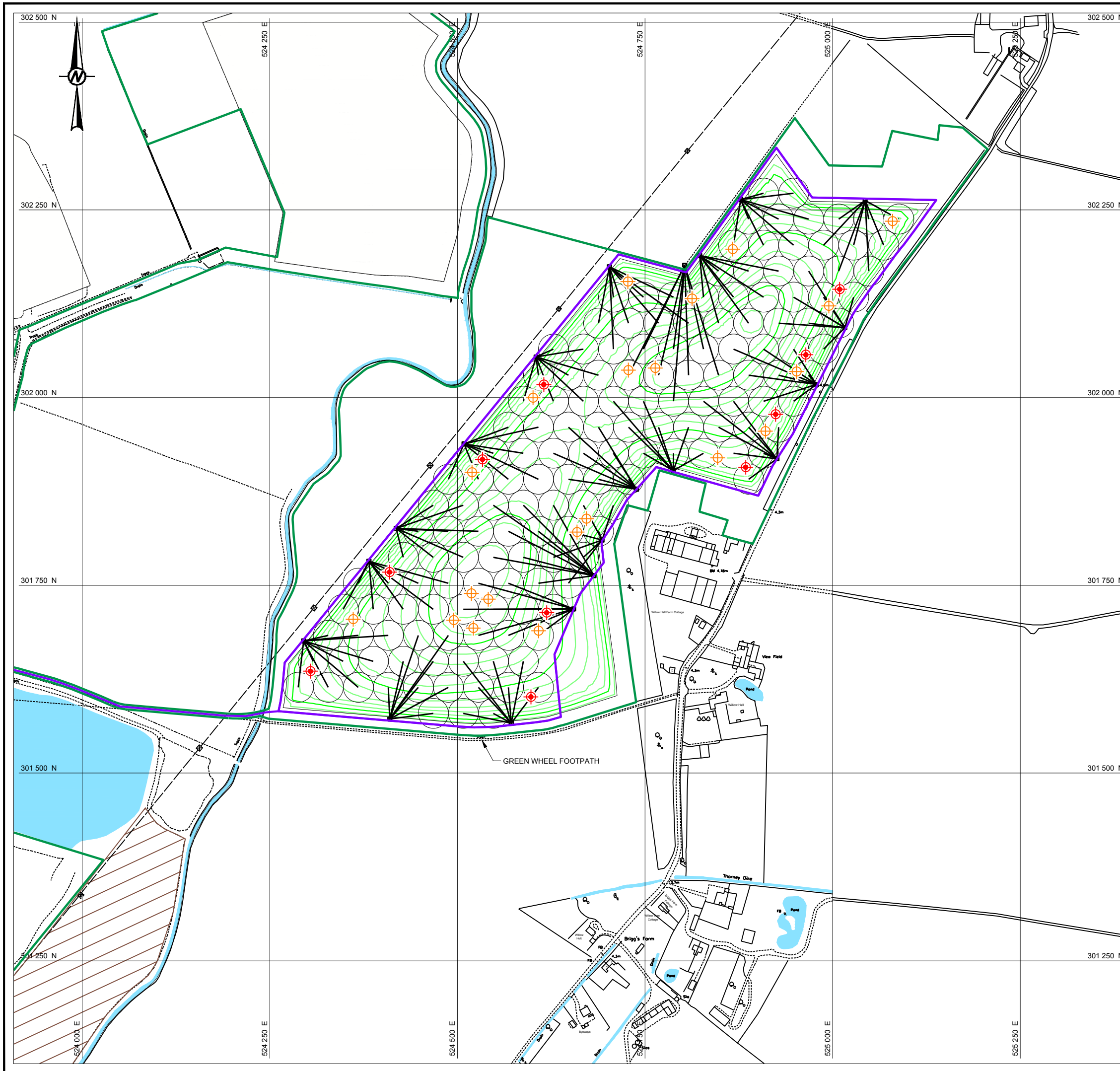


TYPICAL SECTION THROUGH LEACHATE RECIRCULATION DRAIN
1:100

Note:

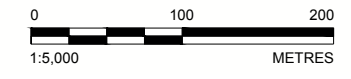
1. ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. THE DRAINAGE BLANKET MAY COMPRISE AGGREGATE, RECYCLED AGGREGATE, SHREDDED TYRES, OR BAILED TYRES.
3. LEACHATE COLLECTION MEDIUM WILL BE EITHER 300mm OF CLEAN GRAVEL >20mm <75mm, OR PAS 108 TYRE BALES.
4. ALL PIPEWORK WILL BE SURROUNDED BY GRAVEL.

WSP GOLDER			
GOLDER FILE REF	1403-PA-0009	ENGINEER	NW
		REVIEWED BY	CMcD
REV.	DATE	DRAWN	DESCRIPTION
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Biiffa		Biffa Waste Services Ltd Redhill Landfill Site Cormongers Lane, Nutfield, Redhill RH1 4ER Tel: 01737 765042 Mob: 07921 386021 E-mail phil.mumford@biffa.co.uk	
PROJECT	Eye Eastern Extension	DRAWN	ECS
LOCATION	Eye Landfill, Peterborough	DATE	25/02/2022
DRAWING TITLE	Leachate Management Details	SCALE(S)	As Shown
DRAWING No.	ESID7B	COMPUTER REF.	E5238700



- LEGEND**
- PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY EPR/BP3537PP/V011
 - GAS EXTRACTION RING MAIN
 - GAS WELL (INDICATIVE WITH 20 m RADIUS OF INFLUENCE)
 - GAS MANIFOLD AND PIPES FROM GAS WELLS
 - LEACHATE EXTRACTION WELL
 - LEACHATE MONITORING WELL
 - PRE-SETTLEMENT, PRE-RESTORATION CONTOURS

NOTE(S)
 1. GAS WELL AND PIPE LOCATIONS ARE INDICATIVE ONLY.



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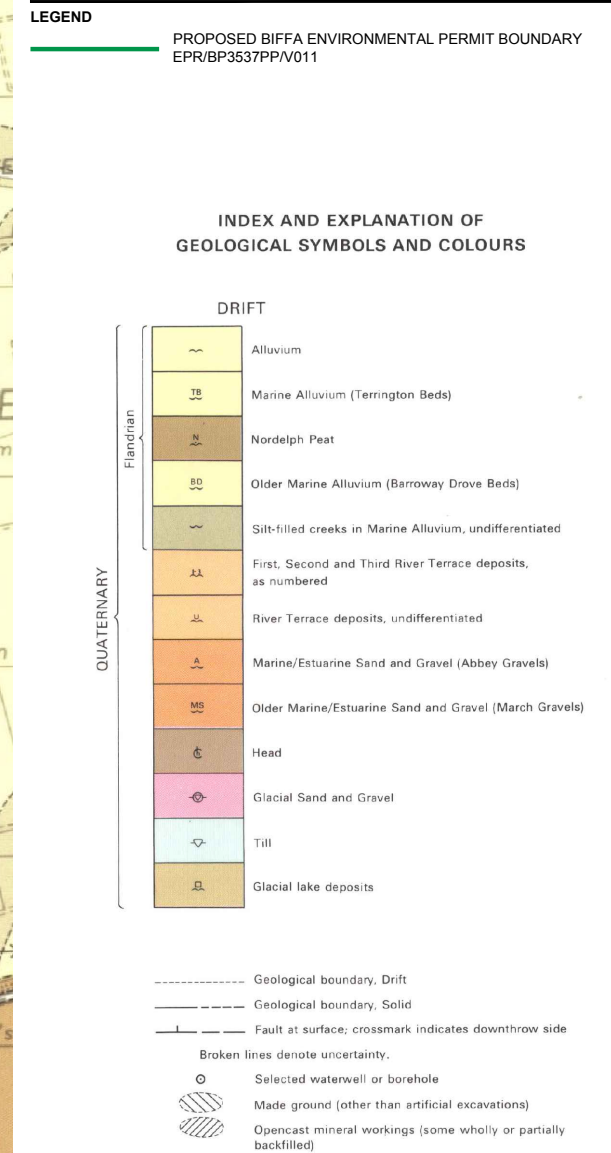
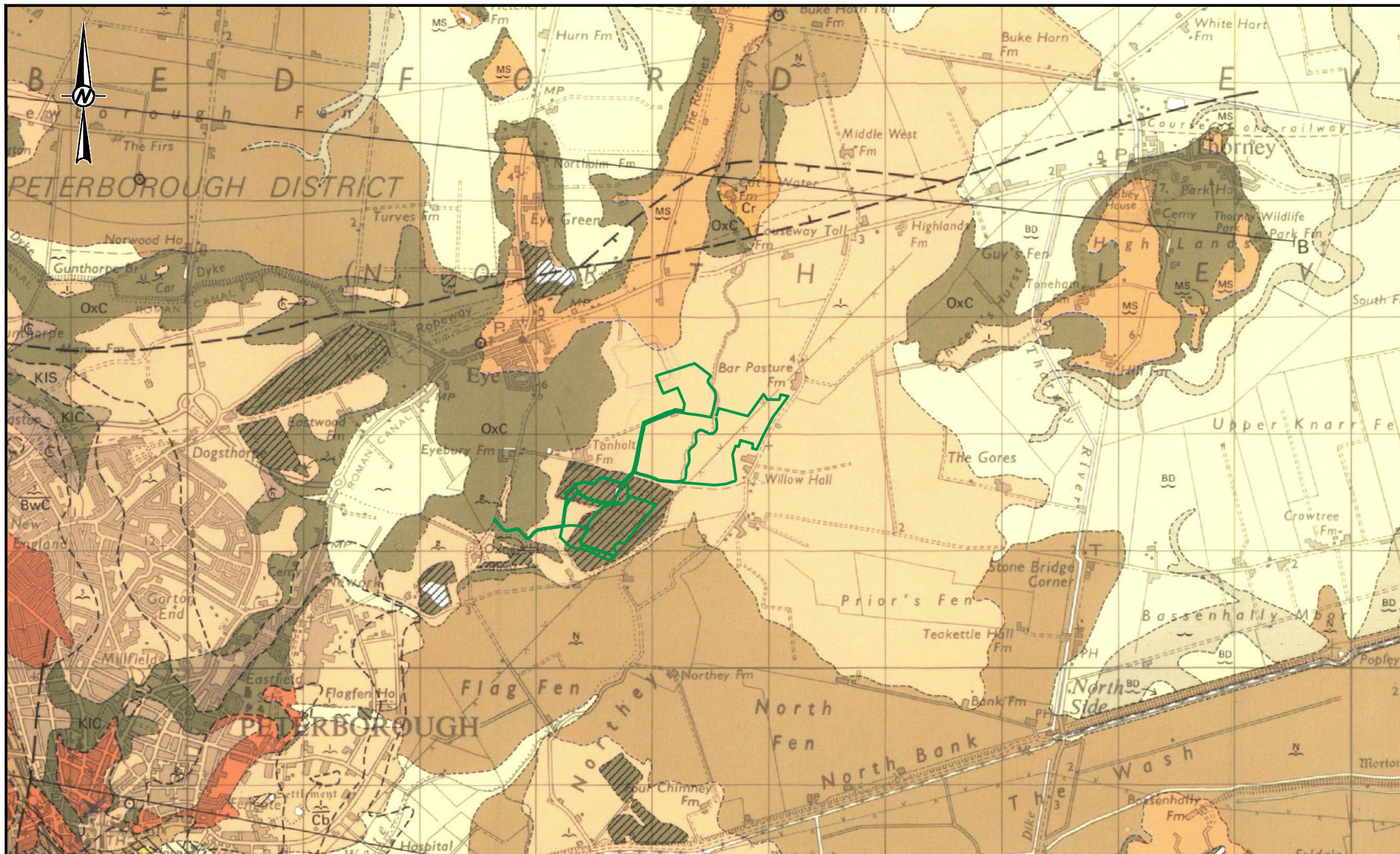


GOLDER FILE REF 1403-PA-0012 ENGINEER NW REVIEWED BY CMcD

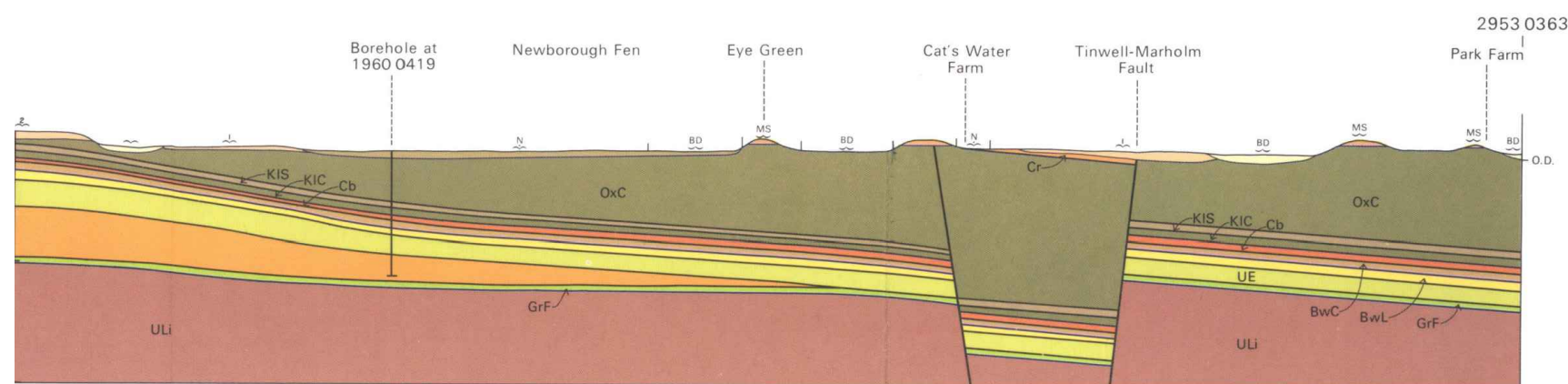
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Biffa Waste Services Ltd
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 Cormanogates Lane,
 Nutfield, Redhill
 RH1 4ER
 Tel: 01737 765042
 Mob: 07921 366021
 E-mail: phil.mumford@biffa.co.uk

PROJECT		Eye Eastern Extension	
LOCATION		Eye Landfill, Peterborough	
DRAWING TITLE		Landfill Gas Management	
DRAWING No.	ESID8	COMPUTER REF.	E5238800
DRAWN	ECS	DATE	25/02/2022
		SCALE(S)	1:5,000



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(Note: Flandrian deposits have not been subdivided on the sections)

Horizontal Scale 1:50 000

Vertical Exaggeration x20

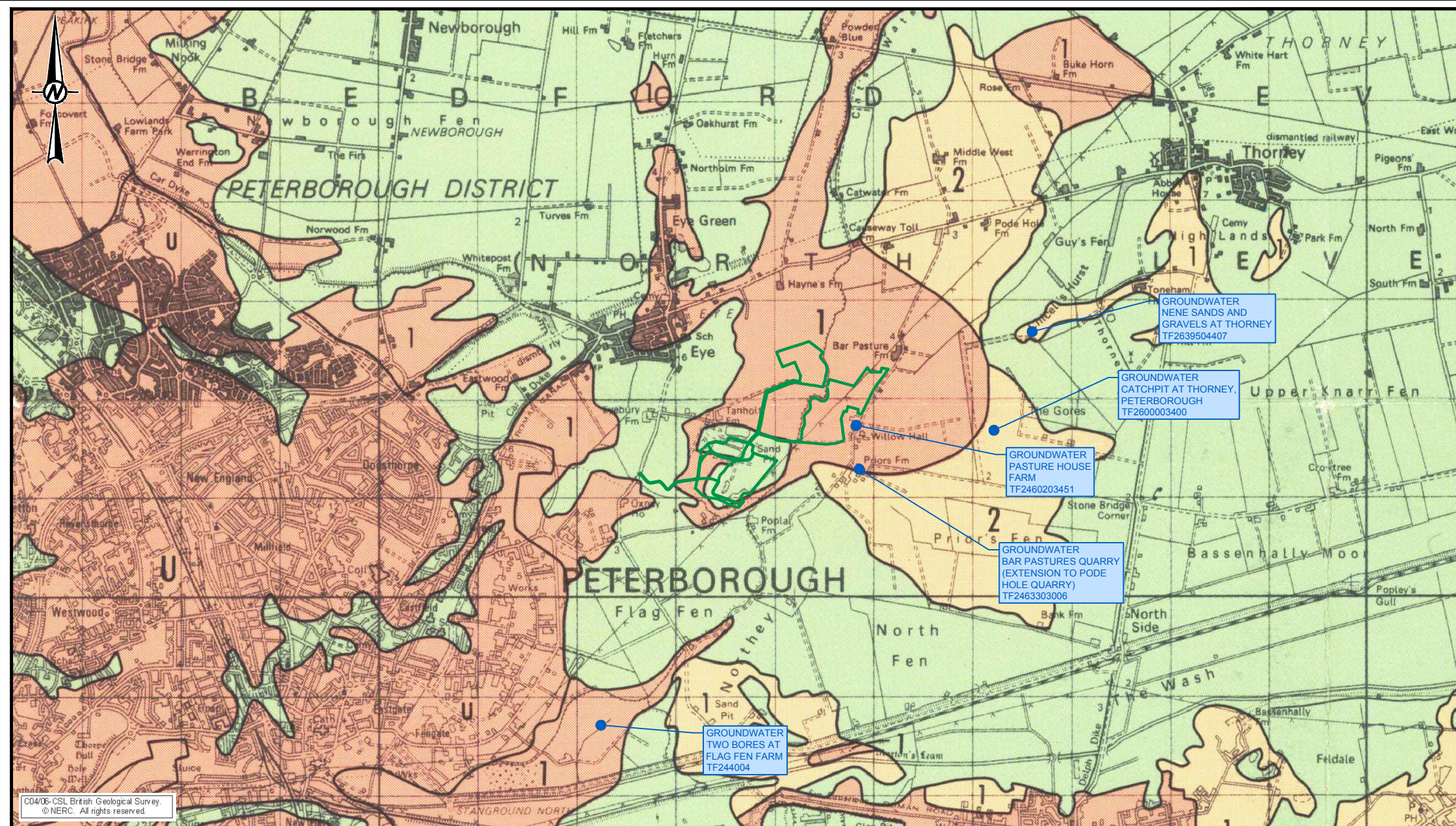
wsp GOLDER

GOLDER FILE REF 1403-PA-0013 ENGINEER NW REVIEWED BY CMCD

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PROJECT Eye Eastern Extension
 LOCATION Eye Landfill, Peterborough
 DRAWING TITLE Regional Geology
 DRAWING No. ESID9 COMPUTER REF. E5238900
 DRAWN ECS DATE 25/02/2022 SCALE(S) Not to Scale



LEGEND

PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY
EPR/BP3537PP/V011

GROUNDWATER GRAVEL PIT "A" AT DECOY FARM
TL29009822

LICENSED ABSTRACTION BOREHOLES

VULNERABILITY CLASSES

Major Aquifer (Highly Permeable)	High (H) 1, 2, 3, U*
Now principal aquifer / Minor Aquifer (Variably Permeable)	Intermediate (I) 1, 2
Now secondary aquifer (Negligibly Permeable)	Low

Soil Classes

High (H) 1, 2, 3, U*
Intermediate (I) 1, 2
Low

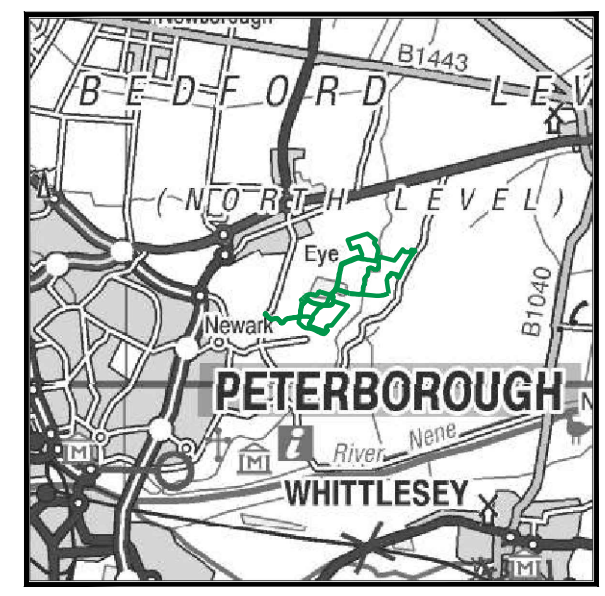
* - Because soil information for urban areas is less reliable and based on fewer observations than in rural areas, the worst case is assumed and such land is classified as high leaching potential (HU) until proved otherwise.

All maps involve a compromise between the representation of natural complexity and ease of interpretation of the map. Such compromises place limitations on the resolution and precision of map information. In this case, the variety of soils, geological strata and potential contaminants that have to be covered is wide, and the classification used is, of necessity, generalised. Individual sites and circumstances will always require further and more detailed assessments to determine the specific impact on groundwater resources. The maps only represent conditions at the surface and therefore where the soil and/or underlying formations have been disturbed or removed, for example during mineral extraction, the vulnerability class may have been changed. Hence, where there is evidence of disturbance there will be a need to determine groundwater vulnerability using site-specific data.

Map prepared by Cartographic Department, Soil Survey and Land Research Centre, Cranfield University, Silsoe, Bedford, MK45 4DT

© National Rivers Authority 1994

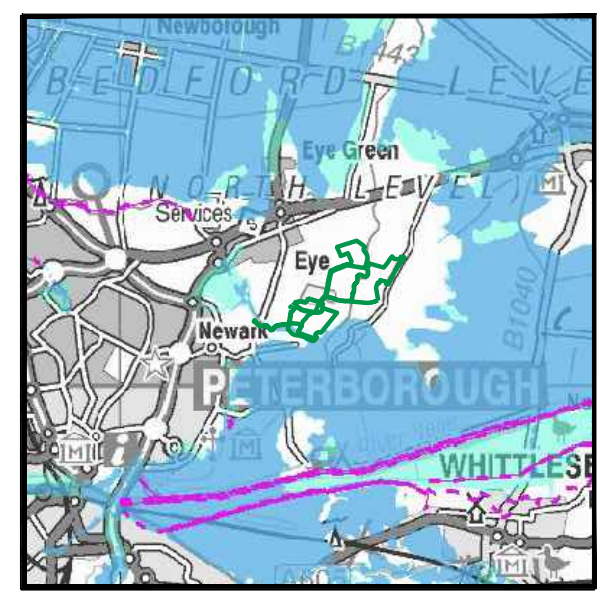
GROUNDWATER VULNERABILITY & LICENSED ABSTRACTIONS



Source Protection

- Inner Zone
- Outer Zone
- Total Catchment
- Special Interest

GROUNDWATER SOURCE PROTECTION



Indicative Floodplain

- River
- Sea

LOCAL FLOODPLAIN

wsp GOLDER

GOLDER FILE REF 1403-PA-0014 | ENGINEER NW | REVIEWED BY CMcD

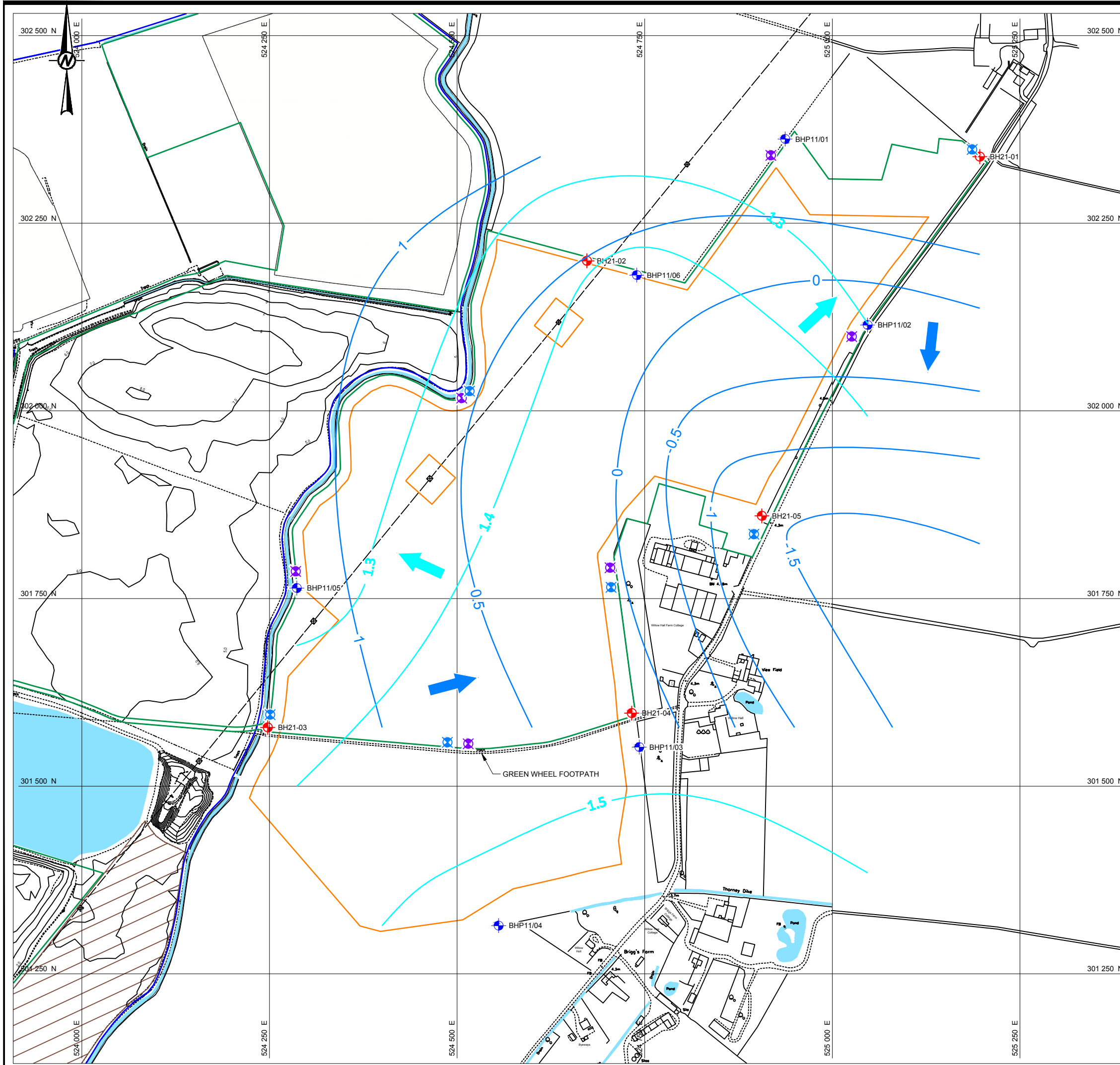
REV.	DATE	DRAWN	DESCRIPTION

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Biffa

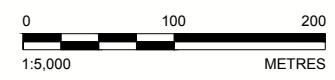
Biffa Waste Services Ltd
Ridhill Landfill Site
Cormongers Lane,
Nuffield, Redhill
RH1 4ER
Tel: 01737 763042
Mob: 01921 386021
E-mail: phil.mumford@biffa.co.uk

PROJECT Eye Eastern Extension
LOCATION Eye Landfill, Peterborough
DRAWING TITLE Regional Hydrogeology
DRAWING No. ESID10 | COMPUTER REF. E5239000
DRAWN ECS | DATE 25/02/2022 | SCALE(S) Not to Scale



- LEGEND**
- PROPOSED BIFFA ENVIRONMENTAL PERMIT BOUNDARY EPR/BP3537PP/V011
 - MINERAL EXTRACTION BOUNDARY
 - GROUNDWATER LEVEL - RIVER TERRACE DEPOSITS (2011)
 - GROUNDWATER LEVEL - KELLEWAY SANDS (2021)
 - + EXISTING MONITORING BOREHOLE (SAND AND GRAVEL)
 - + EXISTING MONITORING BOREHOLE (KELLEWAY SANDS)
 - + PROPOSED MONITORING POINT (RIVER TERRACE DEPOSITS)
 - + PROPOSED MONITORING POINT (KELLEWAY SAND)
 - GROUNDWATER FLOW DIRECTION (2011)
 - GROUNDWATER FLOW DIRECTION (2021)

NAME	BEDS DESCRIPTION AND CODE
BH21-01	BH46 - 91002460
BHP 11/01	BH47 - 91002470
BHP 11/06	BH48 - 91002480
BH21-02	BH49 - 91002490
BHP 11/05	BH50 - 91002500
BH21-03	BH51 - 91002510
BHP 11/04	BH55 - 91002550
BHP 11/03	BH56 - 91002560
BH21-04	BH52 - 91002520
BH21-05	BH53 - 91002530
BHP 11/02	BH54 - 91002540



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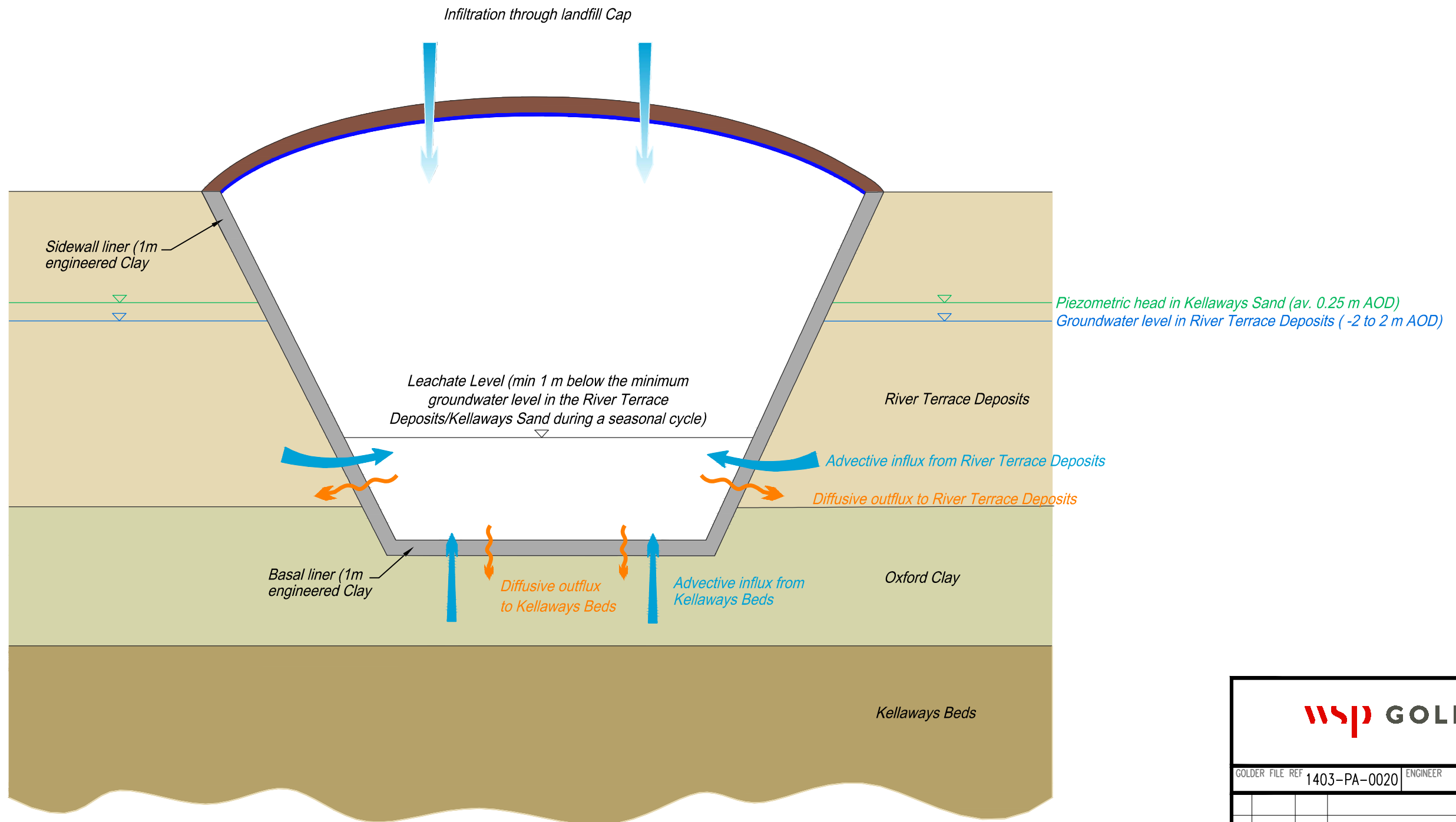


GOLDER FILE REF 1403-PA-0015 | ENGINEER NW | REVIEWED BY CMCD

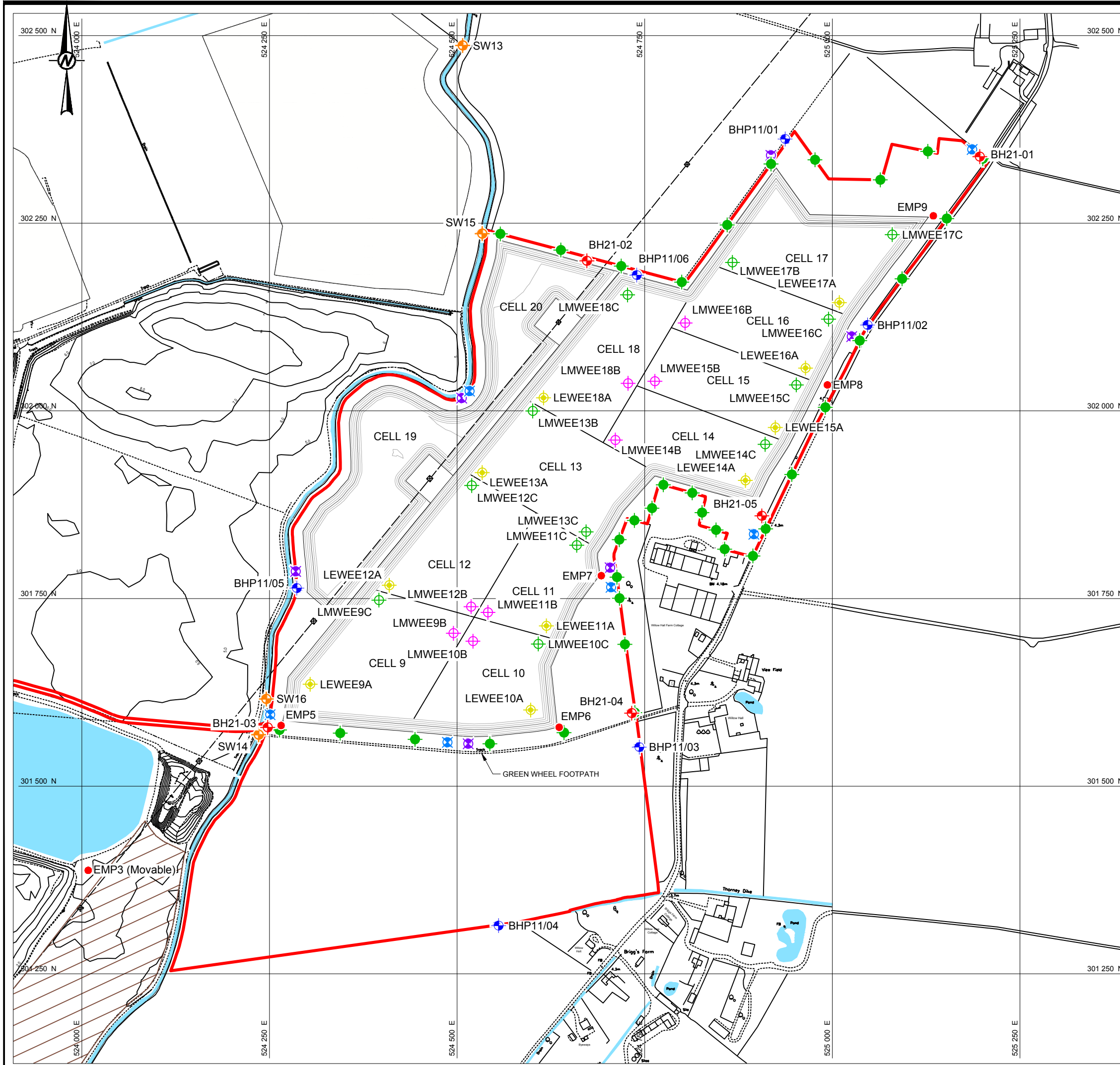
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Biffa Waste Services Ltd
Redhill Landfill Site
Cormongers Lane,
Nutfield, Redhill
RH11 4ER
Tel: 01737 765042
Mob: 07921 386021
E-mail phil.mumford@biffa.co.uk

PROJECT	Eye Eastern Extension		
LOCATION	Eye Landfill, Peterborough		
DRAWING TITLE	Local Hydrogeology and Hydrology		
DRAWING No.	ESID11	COMPUTER REF.	E5239100
DRAWN	ECS	DATE	25/02/2022
		SCALE(S)	1:5,000



wsp GOLDER			
GOLDER FILE REF 1403-PA-0020		ENGINEER NW	REVIEWED BY CMcD
REV.	DATE	DRAWN	DESCRIPTION
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Biffa		Biffa Waste Services Ltd Redhill Landfill Site Gormongate Lane, Nutfield, Redhill RH1 4ER Tel: 01737 765042 Mob: 07921 366021 E-mail: phil.mumford@biffa.co.uk	
PROJECT Eye Eastern Extension			
LOCATION Eye Landfill, Peterborough			
DRAWING TITLE Hydrogeological Conceptual Site Model (Normal Operating Conditions)			
DRAWING No. ESID12		COMPUTER REF. E5239200	
DRAWN ECS	DATE 25/02/2022	SCALE(S) Not to Scale	



- LEGEND**
- PLANNING APPLICATION BOUNDARY
 - ◆ EXISTING GROUNDWATER MONITORING BOREHOLE (SAND AND GRAVEL)
 - ◆ EXISTING GROUNDWATER MONITORING BOREHOLE (KELLAWAYS SANDS)
 - ◆ SURFACE WATER MONITORING POINT
 - PROPOSED GROUNDWATER MONITORING POINT (RIVER TERRACE DEPOSITS)
 - PROPOSED GROUNDWATER MONITORING POINT (KELLAWAYS SAND)
 - ◆ PROPOSED PERIMETER GAS MONITORING POINT
 - ◆ LEACHATE EXTRACTION WELL EASTERN EXTENSION (UPSLOPE RISER)
 - ⊕ LEACHATE MONITORING WELL EASTERN EXTENSION (UPSLOPE RISER)
 - ◆ LEACHATE MONITORING WELL EASTERN EXTENSION (VERTICAL)
 - ENVIRONMENTAL MONITORING POINT

NAME	BEDS DESCRIPTION AND CODE
BH21-01	BH46 - 91002460
BHP11/01	BH47 - 91002470
BHP11/06	BH48 - 91002480
BH21-02	BH49 - 91002490
BHP11/05	BH50 - 91002500
BH21-03	BH51 - 91002510
BHP11/04	BH55 - 91002550
BHP11/03	BH56 - 91002560
BH21-04	BH52 - 91002520
BH21-05	BH53 - 91002530
BHP11/02	BH54 - 91002540

NOTE(S)
 1. INDICATIVE POSITIONS SHOWN ONLY. EXACT LOCATIONS TO BE CONFIRMED IN CELL SPECIFIC CQA PLAN.



GOLDER FILE REF 1403-PA-0021 | ENGINEER EMCA | REVIEWED BY CMcD

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PROJECT	Eye Eastern Extension		
LOCATION	Eye Landfill, Peterborough		
DRAWING TITLE	Monitoring and Extraction Point Plan		
DRAWING No.	ESID13	COMPUTER REF.	E5239300
DRAWN	TS	DATE	06/04/2022
		SCALE(S)	1:5,000

APPENDIX ESID1

**Nature and Heritage
Conservation Screening Report**

Nature and Heritage Conservation

Screening Report: Bespoke Installation

Reference	EPR/BP3537PP/V011
NGR	TF 24084 01588
Buffer (m)	1100m
Date report produced	23/09/2021
Number of maps enclosed	8

The nature conservation sites identified in the table below must be considered in your application.

Nature and heritage conservation sites	Screening distance (km)	Further information
Special Areas of Conservation (cSAC or SAC)	10	Joint Nature Conservation Committee
Orton Pit		
Nene Washes		
Special Protection Area (pSPA or SPA)	10	Joint Nature Conservation Committee
Nene Washes		
Ramsar	10	Joint Nature Conservation Committee
Nene Washes		
Sites of Special Scientific Interest (SSSI)	2	Natural England
Dogsthorpe Star Pit		
Eye Gravel Pit		
Nene Washes		
	2	Natural England



Local Nature Reserve (LNR)

Dogsthorpe Star Pit

Eye Green

Local Wildlife Sites (LWS) 2

[Appropriate Local Record Centre \(LRC\)](#)

Thorney Dike

[Appropriate Wildlife Trust](#)

**Adderley and Storey's Bar
Road Drains**

Cat's Water Drain

Eye Green Gravel Pit

Eyebury Road Pits

Little Wood

Northey Gravel Pit

Protected Species

Screening distance (m)

Further Information

Water Vole

up to 500m

[Natural England](#)

Protected Species Code 2

[Appropriate Local Record Centre \(LRC\)](#)

Environment Agency. Dial 03708 506 506
for your local Fisheries and Biodiversity
team

Protected Habitats

Screening distance (m)

Further Information

Fens

up to 500m

[Natural England](#)

**Coastal and Floodplain
Grazing Marsh**

Unfortunately we cannot provide you with the details of all protected species. This is because we either have not been given permission by the owner of the species data, or they have asked us not to identify the species as they are vulnerable. In these instances you must contact the relevant organisation listed above. A small administration charge may be incurred for this service.

Where protected species are present, a licence may be required from Natural England or the Welsh Government to handle the species or undertake the proposed works.

customer service line
03708 506 506

incident hotline
0800 80 70 60

floodline
0845 988 1188

www.environment-agency.gov.uk

The relevant Local Records Centre must be contacted for information on the features within local wildlife sites. A small administration charge may also be incurred for this service.

Please note we have screened this application for protected and priority sites, habitats and species for which we have information. It is however your responsibility to comply with all environmental and planning legislation, this information does not imply that no other checks or permissions will be required.

Please note the nature and heritage screening we have conducted as part of this report is subject to change as it is based on data we hold at the time it is generated. We cannot guarantee there will be no changes to our screening data between the date of this report and the submission of the permit application, which could result in the return of an application or requesting further information.

customer service line
03708 506 506


incident hotline
0800 80 70 60

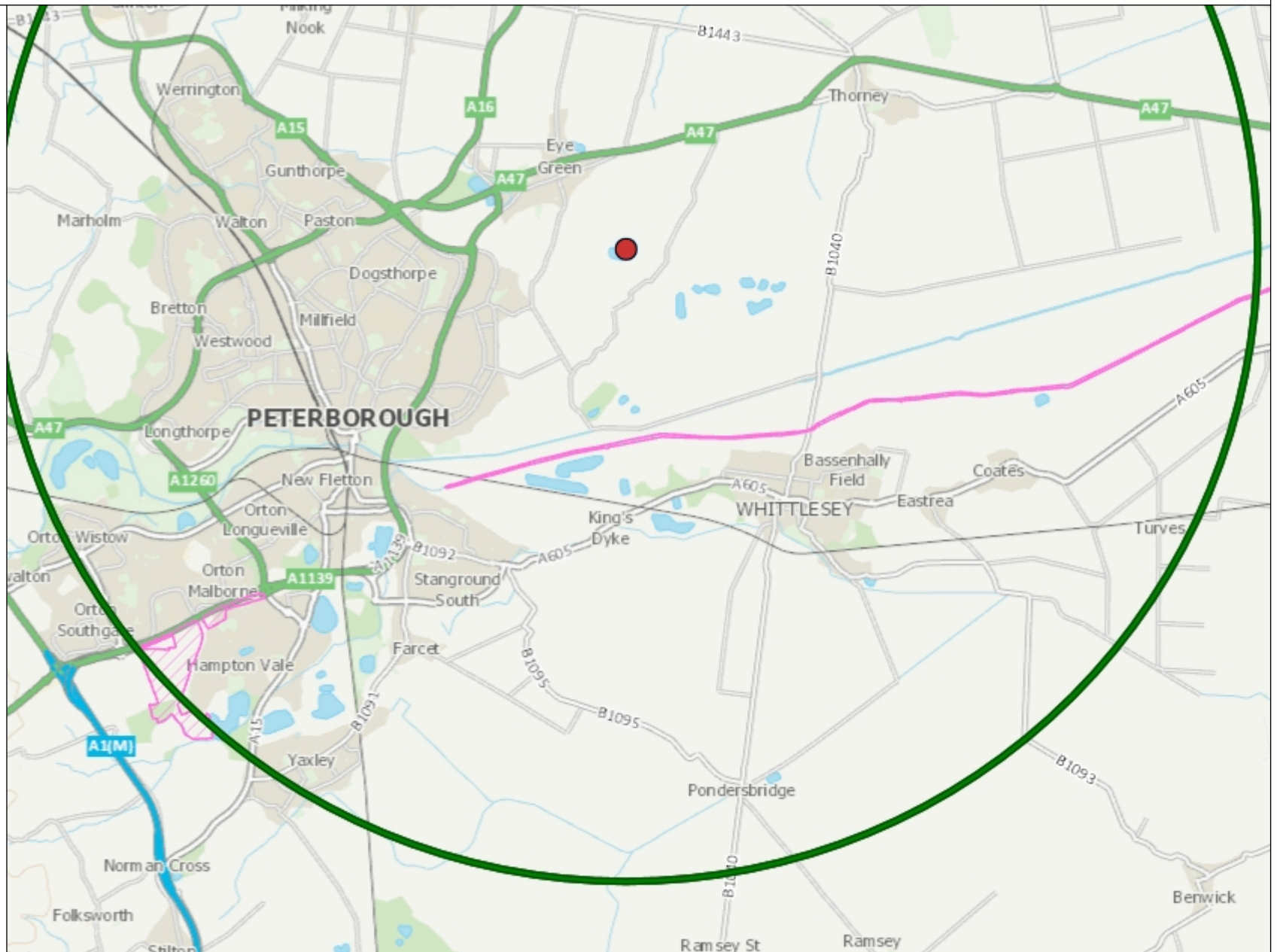
floodline
0845 988 1188

www.environment-agency.gov.uk

Special Areas of Conservation

Legend

 SAC (England)



1: 100,000


0 2,500

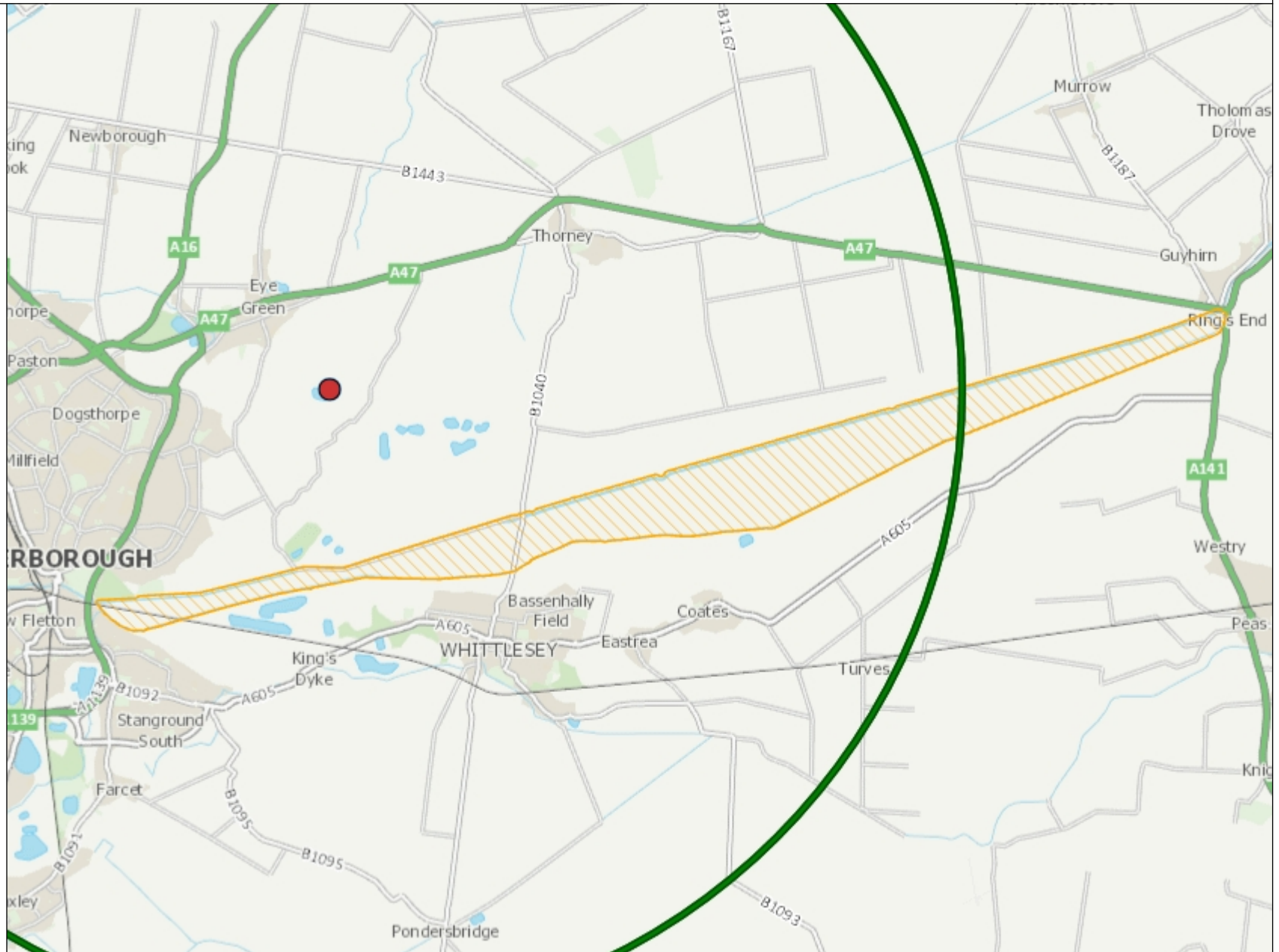
Metres



Special Protection Areas

Legend

 SPA (England)



1: 100,000


0 2,500

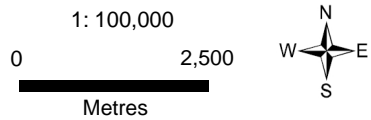
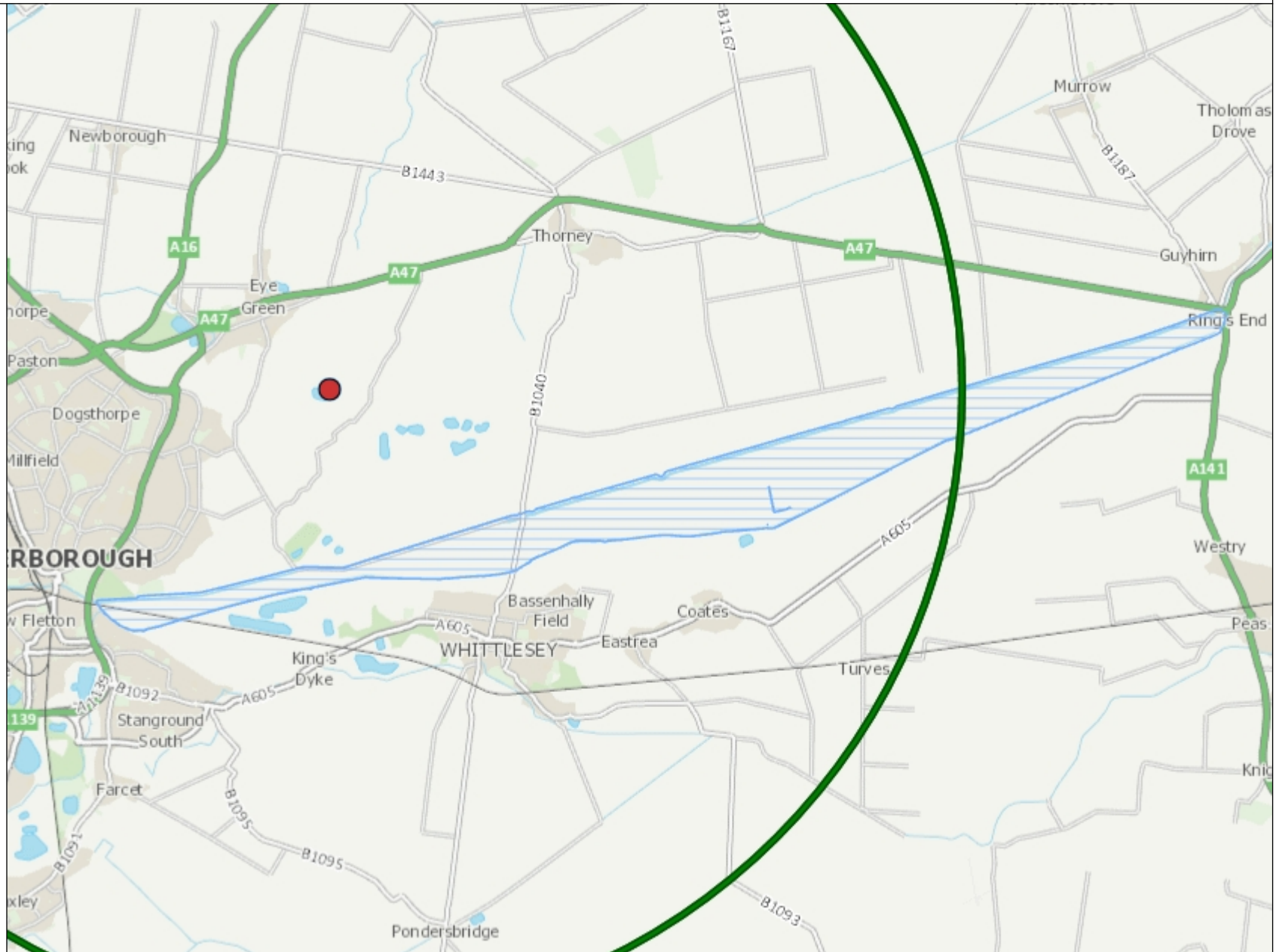
Metres



RAMSAR Sites


Legend

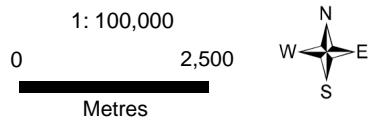
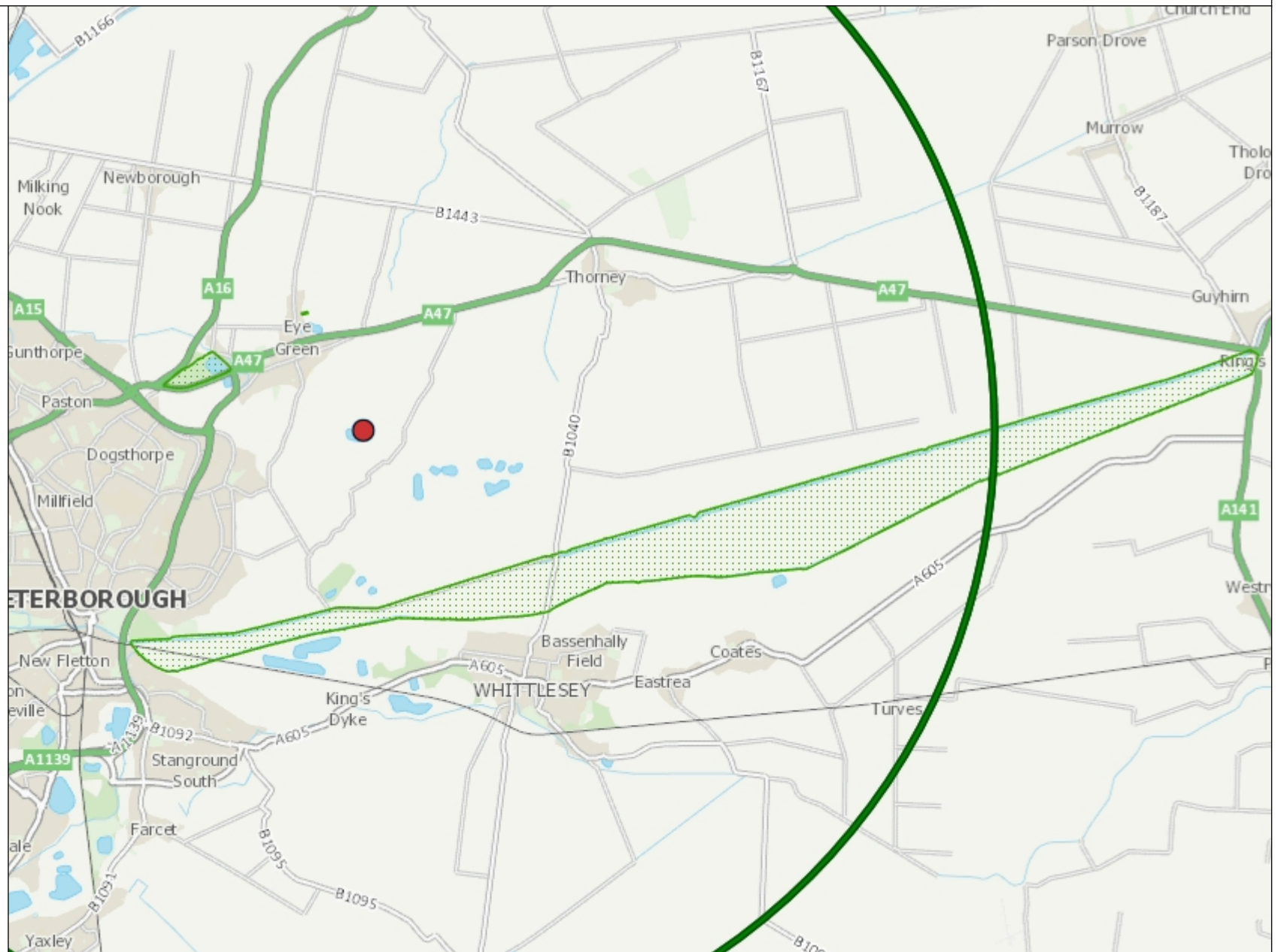
 Ramsar (England)



Sites of Special Scientific Interest

Legend


 SSSI (England)

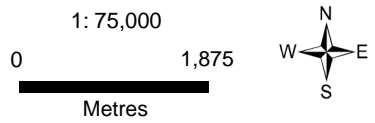
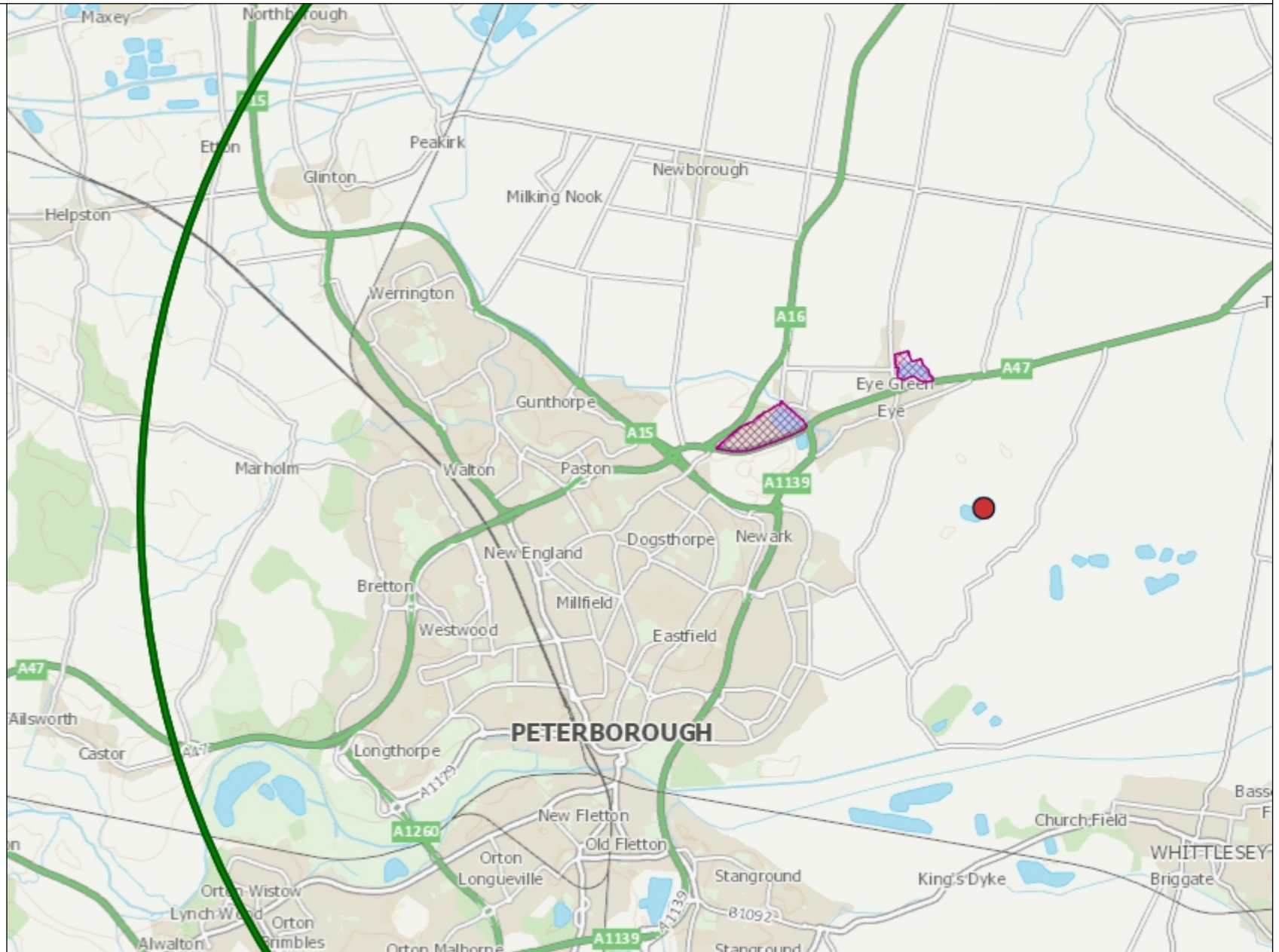


Local Nature Reserve



Legend

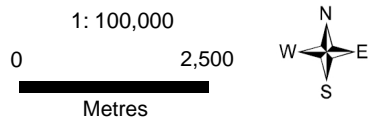
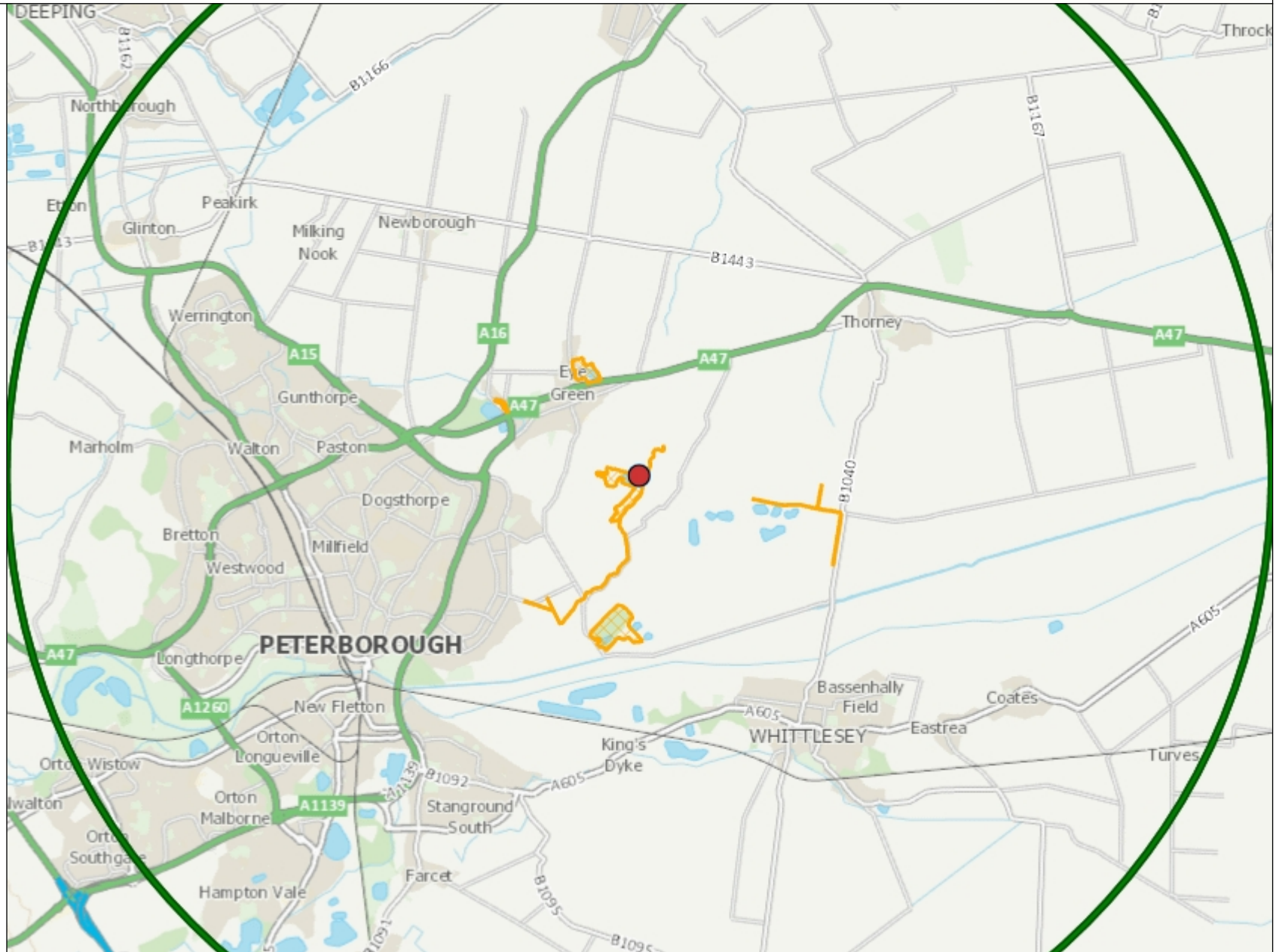
 LNR (England)



Local Wildlife Sites


Legend

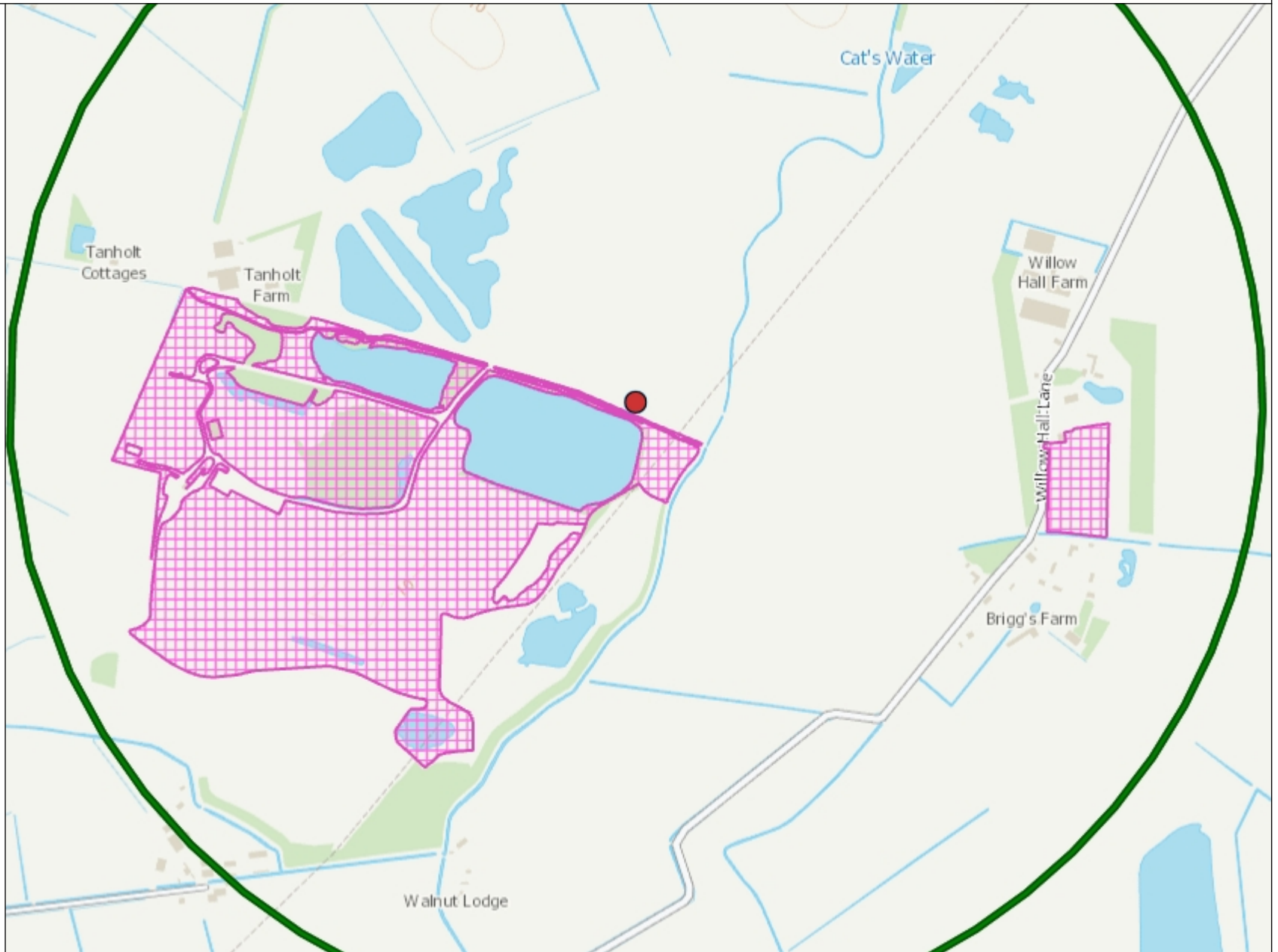
 Local Wildlife Sites



Protected Habitats

Legend




-  Protected Habitats screened for En Permits

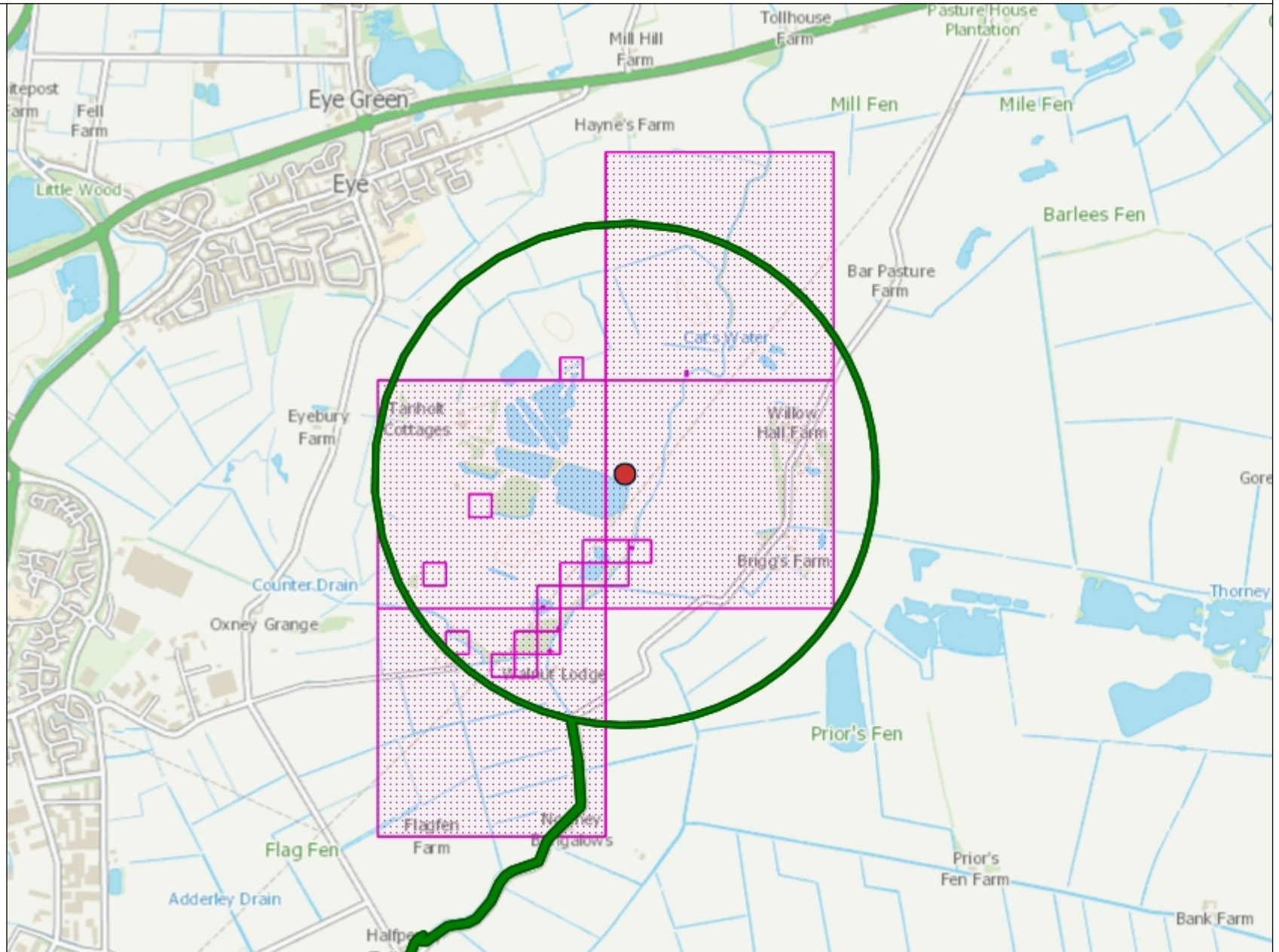


Protected Species

Legend

Protected species screened for Env Permits - complete set

-  Protected species, non fish
-  Protected fish
-  Protected fish migratory route



1: 25,000



APPENDIX ESID2

**Environment Agency Pre-
Application Response Letter**

Mr Chris McDonald / Mrs Nicola White
Biffa Waste Services Limited
Coronation Road
Cressex
High Wycombe
Buckinghamshire
HP12 3TZ

Our Ref: EA/EPR/BP3537PP/V011

Date: 01 October 2021

Dear Chris and Nicola,

Pre application advice – Enhanced Service

I am pleased to provide you with an enhance level of pre application advice to Biffa Waste Services Limited. In regards to a multifaceted application under the reference EPR/BP3537PP/V011 – Eye North Eastern Landfill relating to this permitted site and the following permits EPR/FB3204MX/T001 – Willow Hall Quarry and Landfill (EAWML 402485) and EPR/EB3091VZ/T002 – Willow Hall Farm Quarry (water discharge permit).

Following your pre-application request dated 03/08/2021 and the pre application meeting held on 22/09/2021 via MS Teams I have summarised our discussions and answered the questions raised during the pre-application. Meeting attendees include Neil Sumner (Biffa Waste Services Limited- Permitting Manager), Richard Hill (Biffa Waste Services Limited - Eye Landfill Site Manager), Duncan Wright (Biffa Waste Services Limited - Regional Manager (South)), Bethany Smith (Environment Agency – Permitting Officer), Kim Mynard (Environment Agency – Area Regulatory Officer), Nicola White (Golder Associates), Chris McDonald (Golder Associates), Izzy Creed (Golder Associates – Intern).

As part of our basic pre-application advice I have also provided details of the forms that should be completed for your application and how much it will cost. I have included this standard advice within your response, the time taken to provide this has not been charged for.

Background to the initiative

Golder provided some background for the site and an overview of the proposed plans for Eye Landfill. The current area includes two permitted landfills. To the west is Eye North Eastern Landfill (Eye Landfill) a non-hazardous landfill operated by Biffa Waste Services Limited (Biffa) reference EPR/BP3537PP. To the east is Willow Hall Quarry and Landfill an inert landfill operated by P. J. Thory Limited reference EPR/FB3204MX (EAWML 402485). There is also a water discharge consent associated with the inert landfill which is permitted under reference EPR/EB3091VZ.

P. J. Thory are currently excavating the land within the Willow Hall Quarry inert landfill permit boundary but do not intend to fill the void. Biffa plan to extend Eye Landfill to include the Willow Hall Quarry inert landfill permit area and use it for the disposal of non-hazardous waste. P. J. Thory

intend to complete their excavation work by 2025, however, Biffa plan to begin landfill engineering work in this area in 2023.

Golder presented an overview of conceptual designs for the extension area. The site is to be divided into non-hazardous cells. There are currently two inert landfill cells in the Willow Hall Quarry area which have been infilled by P. J. Thory. Biffa intend to excavate these two cells and to redistribute the waste to the west of the extended area in order to ensure the ground is stable - as there are electrical pylons in this location. Then the remaining void in the extension will be used for the deposit of non-hazardous waste. To the south of the extension area the excavation will only extend 2 – 4 meters - Biffa intend to restore this section of land using clay to extend the wildlife corridor which already exists, as well as including a footpath. Biffa plan to surrender this area of land to the south.

Approach to a multifaceted application

Golder outlined their preferred permitting route - which would be to transfer P. J. Thory’s inert landfill permit to Biffa and consolidate it with Biffa’s permit for Eye Landfill. This variation would include the extension of the non-hazardous landfill where the area has previously been permitted as an inert landfill. The variation application will also include proposals for surrendering some unused areas, thereby reducing the permit boundary. The water discharge activity permitted under EPR/EB3091VZ would also be transferred from P. J. Thory to Biffa.

The pre application meeting discussed the principle of applying to transfer the inert landfill permit to Biffa, vary to extend the non-hazardous landfill, vary to consolidate the permits, and surrender part of the permitted area. Biffa requested clarification on the permitting process, order and timescales for submission of the applications. We have summarised the questions raised during the pre-application and have provided a response with our advice.

Queries Raised	Environment Agency Advice
What is the appropriate permitting approach for this multi-faceted application	After discussions internally it has been determined the best approach for this specific application is the following: Biffa should apply to vary the permit for Eye Landfill extend the landfill, consolidate with the inert landfill permit and surrender appropriate areas. We will then be able to begin work on this application. However, the transfer for the inert landfill permit must be applied for during determination of the above variation in order for the transfer application to be determined just prior to the variation. If the Willow Hall Quarry inert permit is not transferred to Biffa, then Biffa’s variation also cannot be issued.
How far in the future can a future dated transfer be issued	We do not have a set rule for how far ahead a future dated transfer can be issued. However, given the nature of a transfer we have to be satisfied that the transfer can go ahead. So generally the longer the time period from our decision until the transfer takes effect - the greater the risk to the environment. We are not able to advise on exact timescale and would only be able to provide comment if an anticipated timeframe was provided to us. However, if the above permitting route is used this will not be of concern.

Would the option of a multi-operator facility be appropriate	This would not be an appropriate option for this site. To classify as a multi-operator facility the two activities must be technically connected.
Recommended permitting process approach	<p>Submit the following applications:</p> <ul style="list-style-type: none"> • Variation application to extend EPR/BP3537PP (Eye Landfill); to vary to consolidate EPR/BP3537PP with EPR/FP3204MX and EPR/EB3091VZ; and to surrender the unused area no longer required in the permit. • Transfer application for EPR/FP3204MX (inert landfill) – to Biffa • Transfer application for EPR/EB3091VZ (discharge activity) – to Biffa • Surrender of EPR/EB3091VZ (discharge activity) once the limits have been consolidated into the installations permit
Financial Provisions required for each application	<p>If the above approach is taken:</p> <ul style="list-style-type: none"> • An expenditure plan for the entire consolidated site must be provided to support the variation • The obligations for Financial Provisions must be agreed upon before the transfer of the inert landfill permit. The obligations of the previous permit holder (P.J. Thory Limited) will not be relinquished until the new obligations are in place <p>If the inert landfill is transferred before we agree financial provision obligations for the variation then financial provisions for the inert landfill must be provided as part of the transfer application.</p>
Surrender of part of the inert landfill permitted area	<p>In order to surrender this area of land, the Environment Agency’s Area Regulatory Team must agree the type of surrender. If the land can be confirmed as unused, i.e. no activities have taken place, then a standard fee of £770 will be required.</p> <p>Biffa’s intentions of restoring the area using clay is acceptable if this is virgin material, however, if the area is to be restored using waste an EPR permit would be required.</p>
Excavation of inert landfill cells and redistribution into different location	Ensure appropriate risk assessments, and operating techniques are included in the variation application. The waste must be within a permitted area engineered in accordance with the landfill directive. If there is any treatment of the waste - Biffa will also need to apply for the - appropriate treatment activities.
Is there a requirement for Climate Change Risk Assessment	No requirement for a Climate Change Risk Assessment, currently this is only applicable to New Bespoke Permits.

Requirement for abstraction licence for collection and discharge of water from back drain behind side slope lining system	<p>We cannot confirm if an Abstraction Licence is required as this is under a different regime. However, the discharge associated would be required to be assessed as part of the variation application and this discharge would be included in the consolidated permit.</p> <p>If you require pre application advice regarding abstraction licences please complete forms WR328 (part A) and WR330 (part B). Form WR328 has a box to tick to say it's a pre-application: Water abstraction: application for a water resources licence - GOV.UK (www.gov.uk)</p> <p>The charging scheme states 15 hours of free pre application advice is available prior to pre-application charging Environment Agency Scheme of Abstraction Charges 2020/21 (publishing.service.gov.uk)</p>
Nature and heritage conservation screening	The conservation screening and maps will be included in this pre application response email. This has been completed for the planned consolidated site.
Forms and Application Fee required once agreed permitting route	Forms required and application fees for the recommended permitting route are listed below.

We would like to note that if P. J. Thory do not intend to continue carrying out the EPR activity of inert landfilling on their site - we would be able to consider the transfer of the inert landfill to Biffa while P. J. Thory continue the excavation work. However, once the permit is transferred it would be Biffa's responsibility as operator to ensure the permit conditions of the inert permit EPR/FP3204MX are complied with.

Application Forms/ Supporting Information:

Provide all supporting information requested in these forms. If sections are not applicable to your permit please indicate this rather than leaving a section blank.

Variation and Consolidation of permits:

Part A:

<https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-a-about-you>

Part E2:

<https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-e2-surrender-application>

Part C2:

<https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-c2-varying-a-bespoke-permit>

Part C3:

<https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-c3-varying-a-bespoke-installation-permit>

Part F:

<https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-f1-opra-charges-declarations>

Please provide supporting documents with the multifaceted variation application, the following should be considered to determine if they are appropriate for the application:

- Non-Technical Summary
- Environmental Risk Assessment
- Site Plan (including a separate plan to highlight which area is being surrendered)
- Environmental Setting and Installation Design Report
- Hydrogeological Risk Assessment
- Stability Risk Assessment
- Landfill Gas Risk Assessment
- Waste Acceptance Criteria
- Waste Acceptance Procedures
- Financial Provisions
- Pest Management Plan
- Odour Management Plan
- Noise Management Plan
- Dust Management Plan
- Habitats Risk Assessment
- Evidence of technical competence

Transfer Installation permit:

Form A:

<https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-a-about-you>

Form D2:

<https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-d2-application-for-transfer>

Form F1:

<https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-f1-opra-charges-declarations>

Transfer Water Discharge permit:

Form D1:

<https://www.gov.uk/government/publications/notification-for-an-environmental-permit-part-d1-notification-of-transfer>

This form should be sent to the EA using the following email address, there is no charge for transferring this type of permit, PSC-WaterQuality@environment-agency.gov.uk

Surrender Water Discharge permit:

Part A:

<https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-a-about-you>

Part E1:

<https://www.gov.uk/government/publications/notification-for-an-environmental-permit-part-e1-notification-of-surrender>

These forms should be sent to the EA using the following email address, there is no charge for surrendering this type of permit, PSC-WaterQuality@environment-agency.gov.uk

Nature and Heritage Conservation Screening

The conservation screening report is attached to the pre application response email. The screening results highlight Nature and Heritage Conservation sites which are within the relevant screening distances to the new consolidated site. You will be required to submit a risk assessment of the impact of your proposal on these receptors.

Application Fee

The baseline charges are listed in the Table of Charges, The Environment Agency (Environmental Permitting) (England) Charging Scheme 2019.

[The Environment Agency \(Environmental Permitting\) \(England\) Charging Scheme - Consolidated versions including all amendments up to and including April 2019 \(publishing.service.gov.uk\)](#)

[Environmental permitting charges guidance - GOV.UK \(www.gov.uk\)](#)

Variation and Consolidation of permits:

Ref.	Activity	Cost
1.17.1	Section 5.2 – landfill for non-hazardous waste with a separate cell for stable non-hazardous waste, asbestos or gypsum; including assessment of odour management plan (<i>substantial variation</i>)	£20,637
1.17.7	Landfill for inert waste (<i>normal variation – consolidation fee</i>)	£6,602
Part 2 9.(7)(b)	Surrender of unused land	£770
The application charge may also need any of the following plans or assessments in addition to the charges shown above		
1.19.2	Habitats Assessment	£779
1.19.4	Pest Management Plan	£1,241
1.19.5	Emissions management plan	£1,241
1.19.7	Noise Management Plan	£1,246
1.19.9	Dust and bio-aerosol management plan	£620

Transfer Installation permit:

Ref.	Activity	Cost
1.17.7	Landfill for inert waste (<i>transfer</i>)	£5,561

Transfer Water Discharge permit:

Ref.	Activity	Cost
There is no charge for transferring this type of permit		

Surrender Water Discharge permit:

Ref.	Activity	Cost
There is no charge for surrendering this type of permit		

The advice given is based on the information you have provided, and does not constitute a formal response or decision of the Environment Agency with regard to future permit applications. Any views or opinions expressed are without prejudice to the Environment Agency's formal consideration of any application. Please note that any application is subject to a full technical check during duly making and determination, and additional information may be required based on your detailed submission and site specific requirements.

When you're ready to submit your application please quote the above reference number.

Your completed application can be sent via email to psc@environment-agency.gov.uk

Or by post to
Permitting Support Centre
Quadrant 2
99 Parkway Avenue
Sheffield
S9 4WF

A complete application must contain the following information;

Declaration	Please ensure the declaration section is completed by each relevant person. For a limited company, this must be a director/company secretary as listed on Companies House.
Site plan	Site plan must be clearly marked with the full site boundary.
Payment	Please note your application will not be processed until we receive the full payment.

We look forward to working with you on this project.

If you have any questions please find my contact details below.

Yours sincerely,

Bethany Smith
Permitting Officer – Installations
National Permitting Service

Mobile: 07341796370

Email: Bethany.Smith@environment-agency.gov.uk

APPENDIX ESID3

Water Balance

1.0 INTRODUCTION

Water balance calculations for the Eastern Extension of Eye Landfill, have been used to determine the cell size and compare the quantities of water entering and leaving the waste mass during landfilling of each cell. Any imbalance between water input and water output will lead to a change in the quantity of liquid held in the waste mass as leachate.

Water is present in the current landfill as either free leachate or absorbed onto or into solid waste materials. The same leachate forms are expected to be encountered in the planned Eastern Extension. The amount held in each form depends on the storage characteristics of the waste. This varies depending on the type, source, and age of the waste.

The water balance calculations are based on the standard water balance equation for any hydrologic system, where the rate of inflow of water minus the rate of outflow of water is equal to the rate of change of the quantity of water stored within the system. In its application to a landfill system, this equation is rearranged and combined with assumptions about the volume and storage characteristics of the waste. The volume of free leachate can be calculated using the following equation:

$$V_L = V_{(in)} - AW$$

Where $V_{(in)}$ equals the volume of water entering the landfill system (m^3), V_L equals the volume of free leachate in the landfill system (m^3), A equals the absorptive capacity of the waste ($m^3/tonne$), and W equals the waste input during the specified period (tonne).

The size of each cell will ensure that no free leachate is generated during the filling of each cell, i.e. the results of the above equation are negative and some absorptive capacity remains in the waste.

Water may enter the landfill as a result of effective rainfall, surface run-on, groundwater discharge, and, where permitted by the Environment Agency, leachate recirculation. Water can leave the landfill by evaporation, transpiration, surface run-off, surface seepage or springs, groundwater recharge, and leachate removal.

2.0 COMPONENTS OF THE WATER BALANCE FOR EASTERN EXTENSION

2.1 Effective rainfall

Effective rainfall is commonly the major input to the water balance. It is defined as the amount of rainfall available for infiltration after run-off and evapotranspiration losses have been taken into account and any soil moisture deficit has been satisfied. A soil moisture deficit evolves because of an excess of evapotranspiration over rainfall.

The effective rainfall to open waste at the Eastern Extension is conservatively estimated to be 167 mm per year (calculated in Section 3.1 of the ESID report), the same as for the currently operating site. For water balance calculation purposes, all the effective rainfall in active landfill phases is assumed to infiltrate into the waste.

2.2 Surface water run-on and run-off

Surface water that enters the Eastern Extension and the current site by run-on and leaves the site by run-off will be prevented as much as possible from entering the waste mass or leaving the site by a series of interception ditches and sumps within the landfilled areas of the site. The effect of surface water management has been ignored for the purposes of the water balance calculations, and surface water run-on and run-off are therefore not included in the inputs and outputs of the water balance calculations.

2.3 Groundwater inflow

The Eastern Extension will be situated in a shallow void that remains after sands and gravels are extracted. The upper sideslopes of the site will comprise sands and gravels while the lower sideslopes and base will comprise Oxford Clay.

Low permeability base and sidewall linings will be constructed in all the cells and will comprise recompacted Oxford Clay sourced from the site. The basal and sidewall lining of each cell will be a minimum of 1.0 m thick and will have a maximum permeability of 1.0×10^{-9} m/s.

As the Eastern Extension will be operated on the principal of hydraulic containment, similarly to the currently operating site, groundwater ingress into the landfill is anticipated to be occurring in areas where the elevation of the groundwater external to the site is greater than the elevation of the leachate within in the site. However, during construction and filling of the site, a back drain will be installed adjacent to the outer edge of the sidewall lining, therefore preventing the ingress of groundwater into the waste. As such, groundwater ingress has been ignored for the purposes of the water balance calculation.

2.4 Leachate recirculation

Leachate recirculation may take place at the site, as permitted by the Environment Agency, during filling in order to utilise the available absorptive capacity of the waste efficiently. As the cells have been designed to ensure free leachate does not generate while a cell is active.

2.5 Storage characteristics

As water percolates down through the Eastern Extension, it may be absorbed by the porous components of the waste. Waste at field capacity is defined as the maximum amount of moisture that can be held by the waste against the pull of gravity. The absorptive capacity is defined as the maximum amount of water that can be taken up by the waste to take it from its initial moisture content to field capacity.

A review of literature was carried out to determine an appropriate value for the absorptive capacity of refuse (References 1 to 12). Based on the findings of this review, a value of 0.05 m³/tonne was considered a reasonably cautious estimate for the absorptive capacity of the waste that is to be deposited, and this value is judged applicable to the Eastern Extension water balance calculations.

2.6 Waste input and phasing

Landfilling at the Eastern Extension will be undertaken in a phased manner in order to optimise the use of minerals and available void space. The size of each cell will be determined based on the findings of the water balance calculation to ensure that no free leachate generates within each cell during filling of that cell, i.e. the result of the equation presented previously is negative.

3.0 WATER BALANCE METHODOLOGY AND SUMMARY OF RESULTS

The water balance calculations have been undertaken using an Excel spreadsheet and a summary of the results is presented in Table 1. They indicate that free leachate will not be produced during landfilling of each cell, assuming:

- Groundwater ingress into the site during filling of each cell is zero;
- Effective rainfall is 167 mm per year;
- The absorptive capacity of the waste is 0.05 m³/tonne;
- The waste input rate to the site is 112,000 tonnes per year; and
- The waste has a density of 1.0 m³/tonne.

Table 1: Summary of Water Balance

Cell	Plan Area	Total Void Space [^]	Time to Fill Cell	Total Water Input During Filling	Total Water Output (Absorptive Capacity) During Filling	Free Leachate Volume
	(m ²)	(m ³)	(years)	(m ³)	(m ³)	(m ³)
Cell 9	24002	332307	1.6	6313	16615	-10303
Cell 10	31083	430343	2.0	10587	21517	-10930
Cell 11	22333	309200	1.5	5465	15460	-9995
Cell 12	16357	226462	1.1	2932	11323	-8391
Cell 13	26452	366227	1.7	7667	18311	-10644
Cell 14	21039	291284	1.4	4850	14564	-9714
Cell 15	19064	263940	1.3	3982	13197	-9215
Cell 16	20678	286286	1.4	4685	14314	-9629
Cell 17	27825	385236	1.8	8484	19262	-10778
Cell 18	24774	342995	1.6	6725	17150	-10424

[^] Estimated using total landfill void space and plan area for each cell

4.0 REFERENCES FOR APPENDIX ESID1

- 1) Oweis, I.S. and Khera, R.P., 1990. Geotechnology of waste management. Butterworths.
- 2) North West Waste Disposal Officers, November 1991. Leachate Management Report.
- 3) Cambell, D.J.V., 1982. Absorptive capacity of refuse – Harwell research. Proceedings Harwell Landfill Symposium on Landfill Leachate, pp10.
- 4) Stegmann, R. 1982. Absorptive capacity of refuse – West German research. Proceedings 2nd Harwell Waste Management Symposium on Landfill Leachate, May 12pp.
- 5) Blakey, N.C. and Craft, D.G., 1986. Infiltration and absorption of waster by domestic wastes in landfills – leachate volume changes with time. Proceedings 6th Harwell Waste Management Symposium on Landfill Water Management, June 5-18.
- 6) Department of the Environment, 1986. Landfilling of wastes. Waste Management Paper No.26, HMSO, London. 206pp.
- 7) Department of the Environment, 1995. Landfill Design, Construction and Operational Practice. Waste Management Paper No.26B, HMSO, London.
- 8) Beaven, RP and Powrie, 1995. W “Hydrogeological and geotechnical properties of refuse using a large scale compression cell”. Proceedings Sardinia '95. Fifth International Landfill Symposium.
- 9) Maier, T.B., 1998, Analysis procedures for design of leachate recirculation systems. Proc. 3rd Annual SWANA Landfill Symposium, Palm Beach Gardens, Florida.
- 10) GeoSyntec and Todd, D.K. 1995. Geotechnical Waste Characterisation. Report for a landfill in southern California.
- 11) McBean, E.A., Rovers, F.A. and Farquhar, G.J., 1995. Solid waste landfill engineering and design. Prentice Hall PTR, Englewood Cliffs, New Jersey.
- 12) Canziani, R and Cossu, R., 1989. Landfill hydrology and leachate production. Sanitary landfilling: process, technology and environmental impact. Harcourt Brace Jovanovich, New York, pp185-212.

APPENDIX ESID4

Borehole Logs



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-01

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.12

Date Started : 22/02/2021 Completed : 24/02/2021

Co-ordinates : E 525196.47
N 302338.78

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								0.40	MADE GROUND: Dark brown slightly organic slightly sandy slightly gravelly SILT. Gravel is subangular fine to coarse chert. (TOPSOIL).
								1.00	Light orangish brown sandy slightly gravelly SILT. Gravel is subangular fine to coarse chert. (SUBSOIL).
								1.40	
								5.10	at 3.80 m - band of firm grey brown silt.
								6.50	at 5.90 m - firm grey clay band.
								-3.38	Stiff grey fissile CLAY with high fossil content and rare gravel. (OXFORD CLAY).

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. 50mm well installed with a response zone between 21.50 and 24.50 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-01

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.12

Date Started : 22/02/2021 Completed : 24/02/2021

Co-ordinates : E 525196.47
N 302338.78

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(14.90)	Stiff grey fissile CLAY with high fossil content and rare gravel. (OXFORD CLAY).

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. 50mm well installed with a response zone between 21.50 and 24.50 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-01

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.12

Date Started : 22/02/2021 Completed : 24/02/2021

Co-ordinates : E 525196.47
N 302338.78

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
						-18.28		21.40	Stiff grey fissile CLAY with high fossil content and rare gravel. (OXFORD CLAY).
						-20.88		(2.60)	Stiff light to dark grey dry slightly sandy to sandy SILT with strong cemented bands approx 10-30mm thick. Some lighter laminations of fine sand. Sand is fine. Rare gravel. (KELLAWAYS SAND). at 21.80 m becoming very stiff. Slow drilling progress.
						-20.88		24.00	Stiff to very stiff dark bluish grey CLAY. (KELLAWAYS CLAY). at 24.20 m - Possible seepage.
						-23.28		(2.40)	26.40

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. 50mm well installed with a response zone between 21.50 and 24.50 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-02

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 2.20

Date Started : 02/03/2021

Completed : 04/03/2021

Co-ordinates : E 524672.9

Logged by : A. Cutts

N 302199.976

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
		1.20		S			(5.50)	Brown sandy subangular to rounded, fine to coarse GRAVEL. (RIVER TERRACE GRAVELS).	
		2.00		S					
		5.00		S					
					-3.30				
		6.00		S					
		7.00		S					

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. Borehole located within a sand and gravel quarry, overburden and part of sand and gravel have been extracted.
4. 50mm well installed with a response zone between 17.50 and 20.50 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-02

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 2.20

Date Started : 02/03/2021

Completed : 04/03/2021

Co-ordinates : E 524672.9

N 302199.976

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(12.30)	Stiff grey fissile CLAY with high fossil content and rare gravel. (OXFORD CLAY).
						-15.60		17.80	Stiff light to dark grey dry slightly sandy to sandy SILT with strong cemented bands approx 10-30mm thick. Some lighter laminations of fine sand. Sand is fine. Rare gravel. (KELLAWAYS SAND).
								(1.80)	
						-17.40		19.60	Stiff to very stiff dark bluish grey CLAY. (KELLAWAYS CLAY).

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. Borehole located within a sand and gravel quarry, overburden and part of sand and gravel have been extracted.
4. 50mm well installed with a response zone between 17.50 and 20.50 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-02

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Date Started : 02/03/2021 Completed : 04/03/2021

Logged by : A. Cutts

Ground Level (mAOD) : 2.20

Co-ordinates : E 524672.9
N 302199.976

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(2.80)	Stiff to very stiff dark bluish grey CLAY. (KELLAWAYS CLAY).
						-20.20		22.40	End of Hole at 22.40m

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. Borehole located within a sand and gravel quarry, overburden and part of sand and gravel have been extracted.
4. 50mm well installed with a response zone between 17.50 and 20.50 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-03

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Date Started : 26/02/2021

Completed : 02/03/2021

Logged by : A. Cutts

Ground Level (mAOD) : 3.95

Co-ordinates : E 524247.76
N 301578.237

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								0.30	MADE GROUND: Dark brown slightly organic slightly sandy slightly gravelly SILT. Gravel is subangular fine to coarse chert. (TOPSOIL).
								(0.90)	Light orangish brown sandy slightly gravelly SILT. Gravel is subangular fine to coarse chert. (SUBSOIL).
		1.20				2.75		1.20	
								(2.90)	Brown sandy fine to coarse GRAVEL. (RIVER TERRACE GRAVELS).
						-0.15		4.10	Stiff grey fissile CLAY with high fossil content and rare gravel. (OXFORD CLAY).
		5.00							
		6.00							

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. 50mm well installed with a response zone between 18.30 and 21.30 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-03

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.95

Date Started : 26/02/2021 Completed : 02/03/2021

Co-ordinates : E 524247.76
N 301578.237

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(14.20)	Stiff grey fissile CLAY with high fossil content and rare gravel. (OXFORD CLAY).
						-14.35		18.30	
								(2.70)	Stiff light to dark grey dry slightly sandy to sandy SILT with strong cemented bands approx 10-30mm thick. Some lighter laminations of fine sand. Sand is fine. Rare gravel. (KELLAWAYS SAND).

Remarks :

- Borehole scanned with CAT & Genny prior to excavation.
- Hand dug inspection pit to 1.20 m.
- 50mm well installed with a response zone between 18.30 and 21.30 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-03

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.95

Date Started : 26/02/2021 Completed : 02/03/2021

Co-ordinates : E 524247.76
N 301578.237

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
						-17.05		21.00	Stiff light to dark grey dry slightly sandy to sandy SILT with strong cemented bands approx 10-30mm thick. Some lighter laminations of fine sand. Sand is fine. Rare gravel. (KELLAWAYS SAND).
						-17.35		21.30	Stiff to very stiff dark bluish grey CLAY. (KELLAWAYS CLAY).
									End of Hole at 21.30m

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. 50mm well installed with a response zone between 18.30 and 21.30 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-04

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.77

Date Started : 24/02/2021

Completed : 25/02/2021

Co-ordinates : E 524732.66

N 301597.244

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
						3.47		0.30	MADE GROUND: Dark brown slightly organic slightly sandy slightly gravelly SILT. Gravel is subangular fine to coarse chert. (TOPSOIL).
						2.77		(0.70) 1.00	Light orangish brown sandy slightly gravelly SILT. Gravel is subangular fine to coarse chert. (SUBSOIL).
						1.67		(1.10) 2.10	Brown sandy subangular to rounded, fine to coarse GRAVEL. (RIVER TERRACE GRAVELS).
									Stiff grey CLAY. High fossil content rare fine rounded gravel. (OXFORD CLAY).

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. 50mm well installed with a response zone between 20.00 and 23.00 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-04

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.77

Date Started : 24/02/2021 Completed : 25/02/2021

Co-ordinates : E 524732.66
N 301597.244

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(17.30)	Stiff grey CLAY. High fossil content rare fine rounded gravel. (OXFORD CLAY).
						-15.63		19.40	Stiff light to dark grey dry slightly sandy to sandy SILT with strong cemented bands approx 10-30mm thick. Some lighter laminations of fine sand. Sand is fine. Rare gravel. Slow drilling progression. (KELLAWAY SANDS).

Remarks :

- Borehole scanned with CAT & Genny prior to excavation.
- Hand dug inspection pit to 1.20 m.
- 50mm well installed with a response zone between 20.00 and 23.00 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-04

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.77

Date Started : 24/02/2021 Completed : 25/02/2021

Co-ordinates : E 524732.66
N 301597.244

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
↓								(3.60)	Stiff light to dark grey dry slightly sandy to sandy SILT with strong cemented bands approx 10-30mm thick. Some lighter laminations of fine sand. Sand is fine. Rare gravel. Slow drilling progression. (KELLAWAY SANDS).
						-19.23		23.00	End of Hole at 23.00m

Remarks :

- Borehole scanned with CAT & Genny prior to excavation.
- Hand dug inspection pit to 1.20 m.
- 50mm well installed with a response zone between 20.00 and 23.00 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-05

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.49

Date Started : 05/03/2021

Completed : 09/03/2021

Co-ordinates : E 524906.03

Logged by : A. Cutts

N 301860.094

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD					
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description		
								3.09		(0.40) 0.40	MADE GROUND: Dark brown slightly organic slightly sandy slightly gravelly SILT. Gravel is subangular fine to coarse chert. (TOPSOIL).
								2.69		(0.40) 0.80	Light orangish brown sandy slightly gravelly SILT. Gravel is subangular fine to coarse chert. (SUBSOIL).
										(5.40)	Brown sandy subangular to rounded, fine to coarse GRAVEL. (RIVER TERRACE GRAVELS).
								-2.71		6.20	Stiff grey fissile CLAY with high fossil content and rare gravel. (OXFORD CLAY).

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. 50mm well installed with a response zone between 23.70 and 26.70 m bGL.

Checked By:

Scale 1:50

GAUK-CP-PID
April 2006



GOLDER

Client :

Biffa Waste Services Ltd

Hole No.

BH21-05

Site : Willow Hall Farm Quarry

Project : Eye Landfill Eastern Extension

Project No : 20140759

Equipment & Methods : Dando 2000MKII

Contractor : CCGI

Ground Level (mAOD) : 3.49

Date Started : 05/03/2021 Completed : 09/03/2021

Co-ordinates : E 524906.03
N 301860.094

Logged by : A. Cutts

WATER/ PROGRESS	INSTALLATION /BACKFILL	SAMPLES				STRATA RECORD			
		Sample Top (m)	Sample Base (m)	Sample Type	PID (ppm)	Level (mAOD)	Legend	Depth (Thickness) m	Description
						-20.21		23.70	Stiff grey fissile CLAY with high fossil content and rare gravel. (OXFORD CLAY).
								(3.50)	Stiff light to dark grey dry slightly sandy to sandy SILT with strong cemented bands approx 10-30mm thick. Some lighter laminations of fine sand. Sand is fine. Rare gravel. (KELLAWAYS SAND).
						-23.71		27.20	
									End of Hole at 27.20m

Remarks :

1. Borehole scanned with CAT & Genny prior to excavation.
2. Hand dug inspection pit to 1.20 m.
3. 50mm well installed with a response zone between 23.70 and 26.70 m bGL.

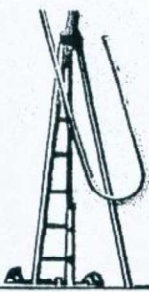
Checked By:

Scale 1:50

GAUK-CP PID
April 2006

APPENDIX WH/EIA/A1

Borehole logs



PIEZOMETER INSTALLATION
BHS + FINAL TOTAL

TONY BEDFORD

Site Investigation Drilling Specialist

11 Marconi Drive, Yaxley
Peterborough PE7 3ZR
Tel: (01733) 242866
Fax: (01733) 242496
Mobile: 07860 514387

Project <u>WILLOW HALL FARM THORNEY</u>										Driller <u>J. DAVEY</u>		
Client <u>PSTHORY LTD</u>										Invoice Certificate <u>023178</u>		
Worked on by <u>MR. M. PRITCHARD</u> <u>17-2-11</u>										Date <u>20 MARCH 2011</u>		
Borehole	P11 01	P11 02	P11 03	P11 04	P11 05	P11 06				Total Meter BHS	GENERAL SURVEY BHS	FINAL TOTAL FOOT INVOICE
Transport Equipment											1 no	1 no
Erect & Dismantle	1	1	1	1	1	1				6	12 no	18 no
Boring GL to 10M	7.8	6.6	3.1	3.5	2.1	7				36.01	60.5m	96.6m
Boring 10 to 20M	-	-	-	-	-	-				-		
Boring 20 to 30M	-	-	-	-	-	-				-		
Boring 30 to 40M	-	-	-	-	-	-				-		
Chiselling Hours	-	-	✓	-	-	-				-		
Standing Time	-	-	-	-	-	-				-		
U4's Samples	1	-	-	-	1	-				2 no	1	3 no
U4's Samples	-	-	-	-	-	-				-		
SPT's/CPT Samples	-	-	-	-	-	-				-		
SPT's/CPT Samples	-	-	-	-	-	-				-		
Bulk Samples	4	-	-	-	6	-				10 no	22 no	32 no
Disturbed Samples	2	-	-	-	1	-				3 no	2 no	5 no
Water Samples	-	-	-	-	-	-				-		
Standpipe Tube	6.7	6.1	2.4	2.7	7.6	6.5				32m	-	32m
Starter Pit	0.75	0.75	0.75	0.75	0.75	0.75				4.5	9	13.5m
Covers	1	1	1	1	1	1				6 no	-	6 no
Day Works	-	-	-	-	-	-				-		
Gravel Pack	6.1	4.9	2.1	1.8	6.4	5.7				27m	-	27m
BENONITE	1.4	1.5	0.7	1.4	1.5	1.1				6.6m	-	6.6m
GEORAP	3	2	1.0	1.0	2	2				11m		11m
CASBUNK	1	1	1	1	1	1				6 no		6 no
										Total Ex VAT £	VAT £	Total £

STANDPIPE INSTALLATION

SITE *WILLOW HALL FARM*

DATE *2-3-11*

DRILLER *K DAUGH*

BOREHOLE No. *P1101*

T. BEDFORD

Site Investigation Drilling Specialist

11 Marconi Drive
Yaxley

Peterborough
PE7 3ZR

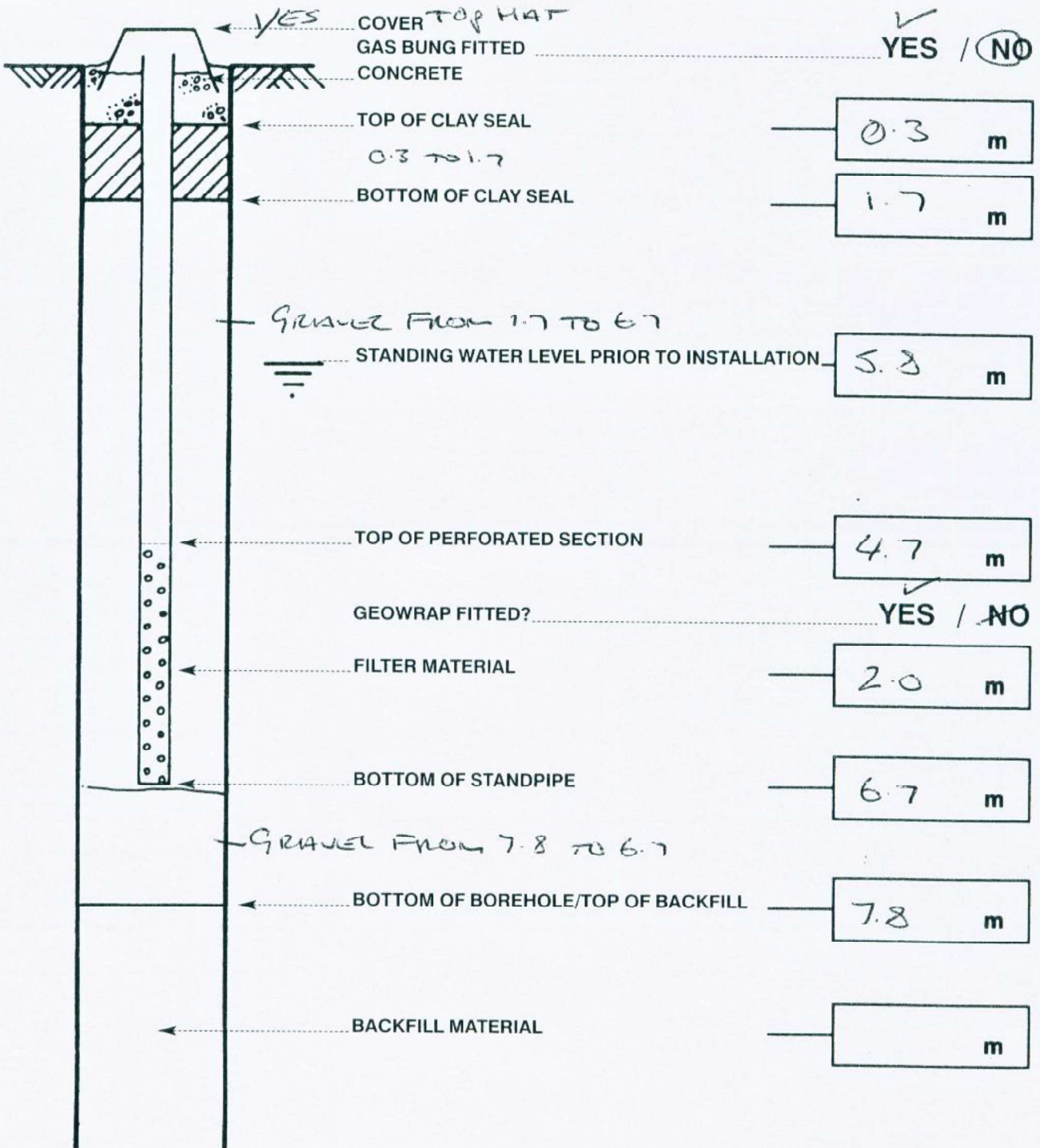
Tel: (01733) 242866

Fax: (01733) 242496

VAT No: 396/0636/26

tony.bedford@tesco.net

www.tbedforddrilling.co.uk



DRILLERS COMMENTS: _____



Site Investigation Drilling Specialist
 11 Marconi Drive, Yaxley, Peterborough PE7 3ZR
 Tel: 01733 242866 Fax: 01733 242496 Mobile: 07860 514387

M T W Th F S Su 9 3 1

WILLOW HALL FARM

P1103

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES

U4

PENETRATION TESTS

SPT SPT

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
CL	1.4	BLACK TOP SOIL
		FILL
1.4	2.0	BLACK GRAVELLY BRICK
		STONE-FILL
2.0	2.3	BROWN VERY SANDY
		GRAVELLY CLAY
2.3	6.1	BROWN SAND & GRAVEL
6.1	6.6	SANDY CLAY

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

NOTE

NOTE

NOTE

BULK SAMPLES

no.	from	to
B 1		
B 2		
B 3		
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	2.9		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			DRY
water level at finish of boring			6.4
water level when casing removed			2.1

CHISEL OR PIT

Borehole complete	Yes	No
Depth of borehole cased	6.5	
Piezometer / Standpipe?	depth	6.1

from	CL
to	1.2
hours	3

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2
to	2.9
litres	155 ACCONS

driller K DAVEN

STANDPIPE INSTALLATION

T. BEDFORD

Site Investigation Drilling Specialist

11 Marconi Drive
Yaxley

Peterborough
PE7 3ZR

Tel: (01733) 242866

Fax: (01733) 242496

VAT No: 396/0636/26

tony.bedford@tesco.net

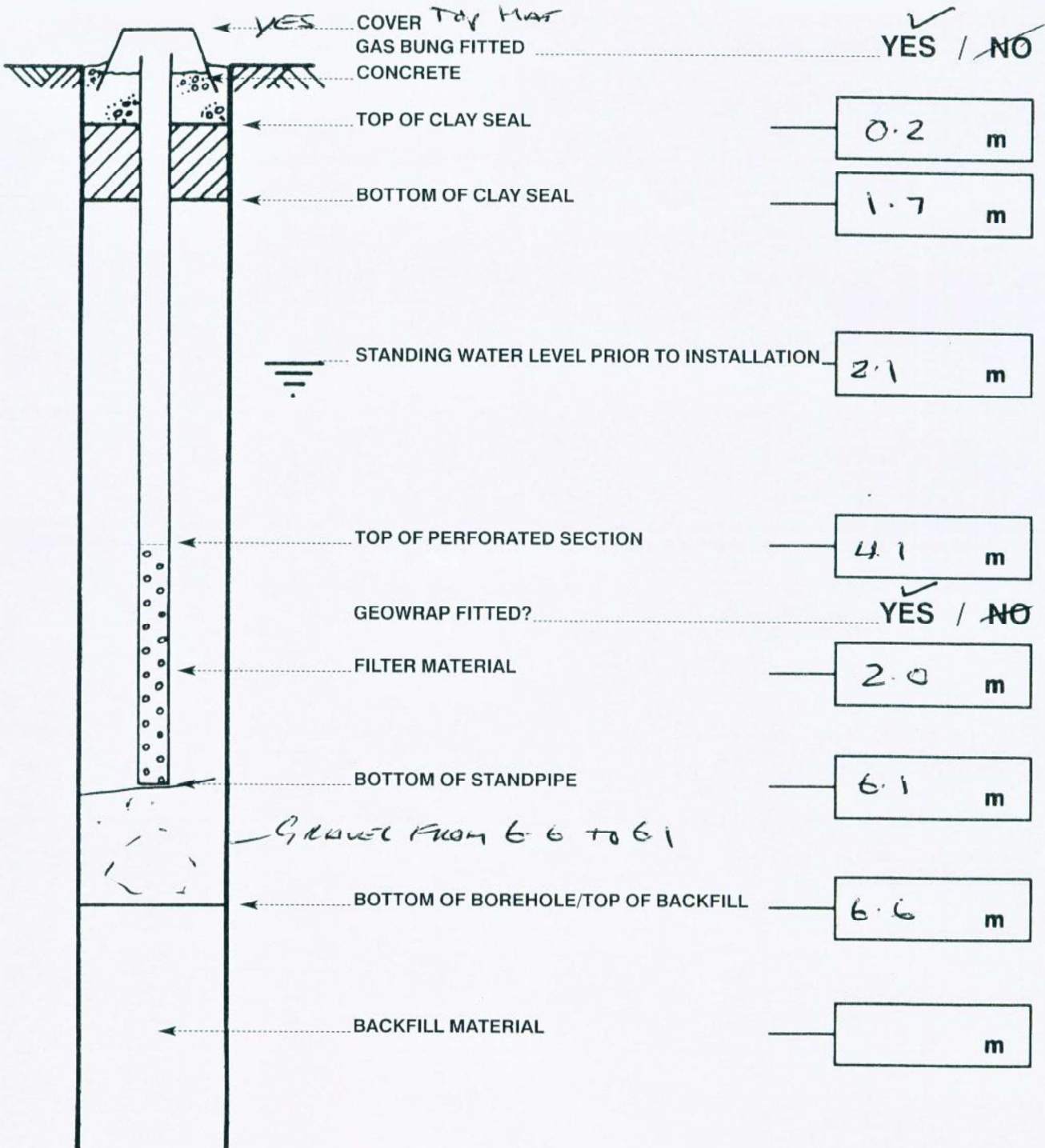
www.tbedforddrilling.co.uk

SITE WILCOX HALL FARM

DATE 9-3-11

DRILLER ICIDAVE

BOREHOLE No 1102



DRILLERS COMMENTS: _____



IONT BEDFORD

Site Investigation Drilling Specialist
 11 Marconi Drive, Yaxley, Peterborough PE7 3ZR
 Tel: 01733 242866 Fax: 01733 242496 Mobile: 07860 514387

(M) T W Th F S Su 7 3 11

SITE NAME, ADDRESS, JOB NUMBER

BOREHOLE NO.

WILLOW HALL FARM

P1103

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
9c	0.2	DARK BROWN GRAVELLY CLAY TOP SOIL
0.2	0.4	BROWN GRAVELLY SANDS CLAY WITH BROWN SAND STONES
0.4	2.4	BROWN SAND & GRAVEL
2.4	2.6	BROWN CLAY
2.6	3.1	GREY CLAY

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1		
B 2		
B 3		
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	2.2		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			DEL
water level at finish of boring			DEL
water level when casing removed			2.2

CHISEL OR PIT

Borehole complete	Yes	No
Depth of borehole cased	3.0	
Piezometer <u>Standpipe?</u>	depth	2.4

from	9c
to	1.2
hours	3/4

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2
to	2.2
litres	159 gallons

driller KIDNEY

STANDPIPE INSTALLATION

T. BEDFORD

Site Investigation Drilling Specialist

11 Marconi Drive
Yaxley

Peterborough
PE7 3ZR

Tel: (01733) 242866

Fax: (01733) 242496

VAT No: 396/0636/26

tony.bedford@tesco.net

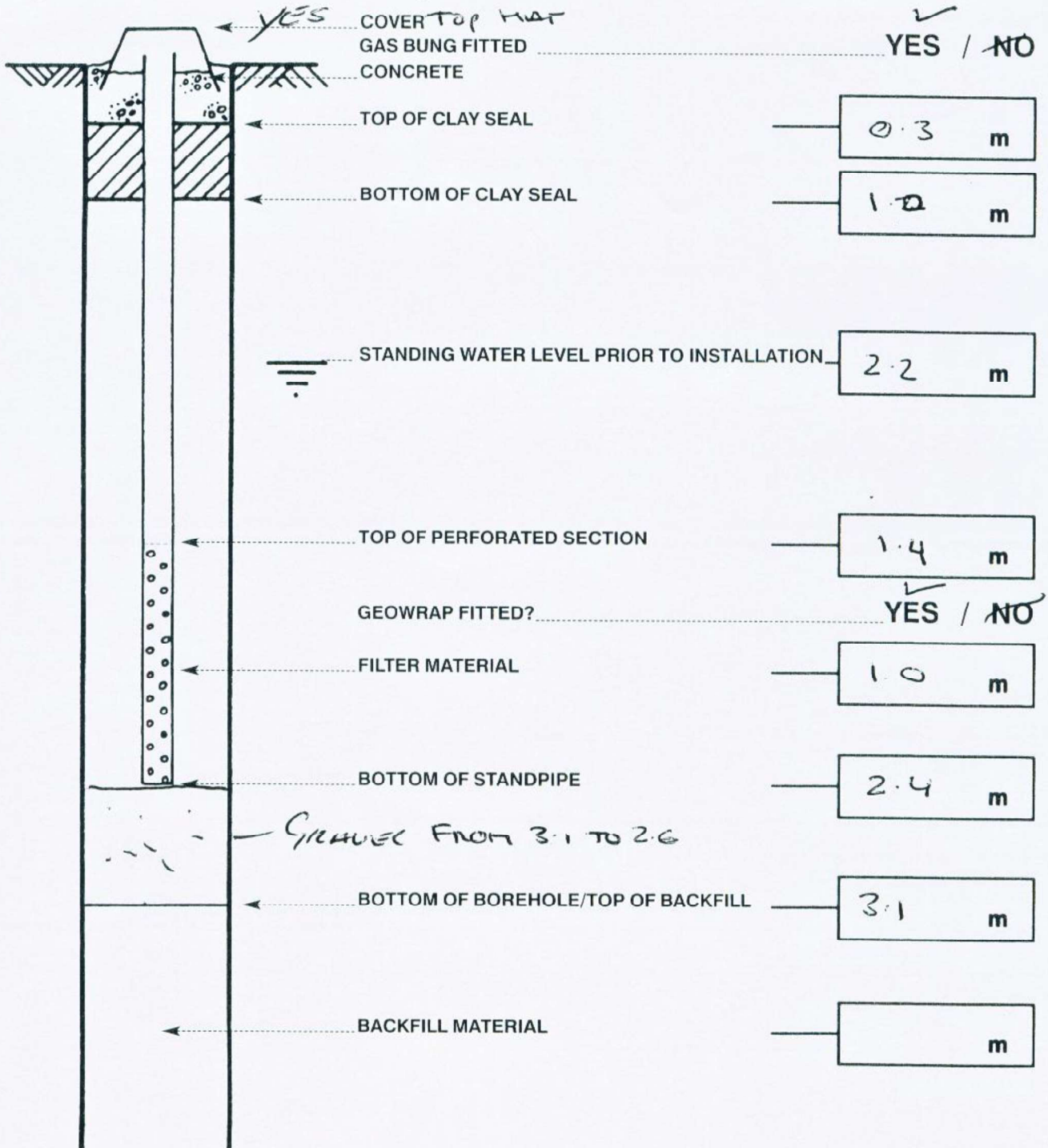
www.tbedforddrilling.co.uk

SITE WILLOW HALL FARM

DATE 7-3-11

DRILLER K Dauby

BOREHOLE No. P11/03



DRILLERS COMMENTS: _____

STANDPIPE INSTALLATION

SITE WILLOW HALL FARM

DATE 8-3-11

DRILLER K DAVEN

BOREHOLE No. P1104

T. BEDFORD

Site Investigation Drilling Specialist

11 Marconi Drive

Yaxley

Peterborough

PE7 3ZR

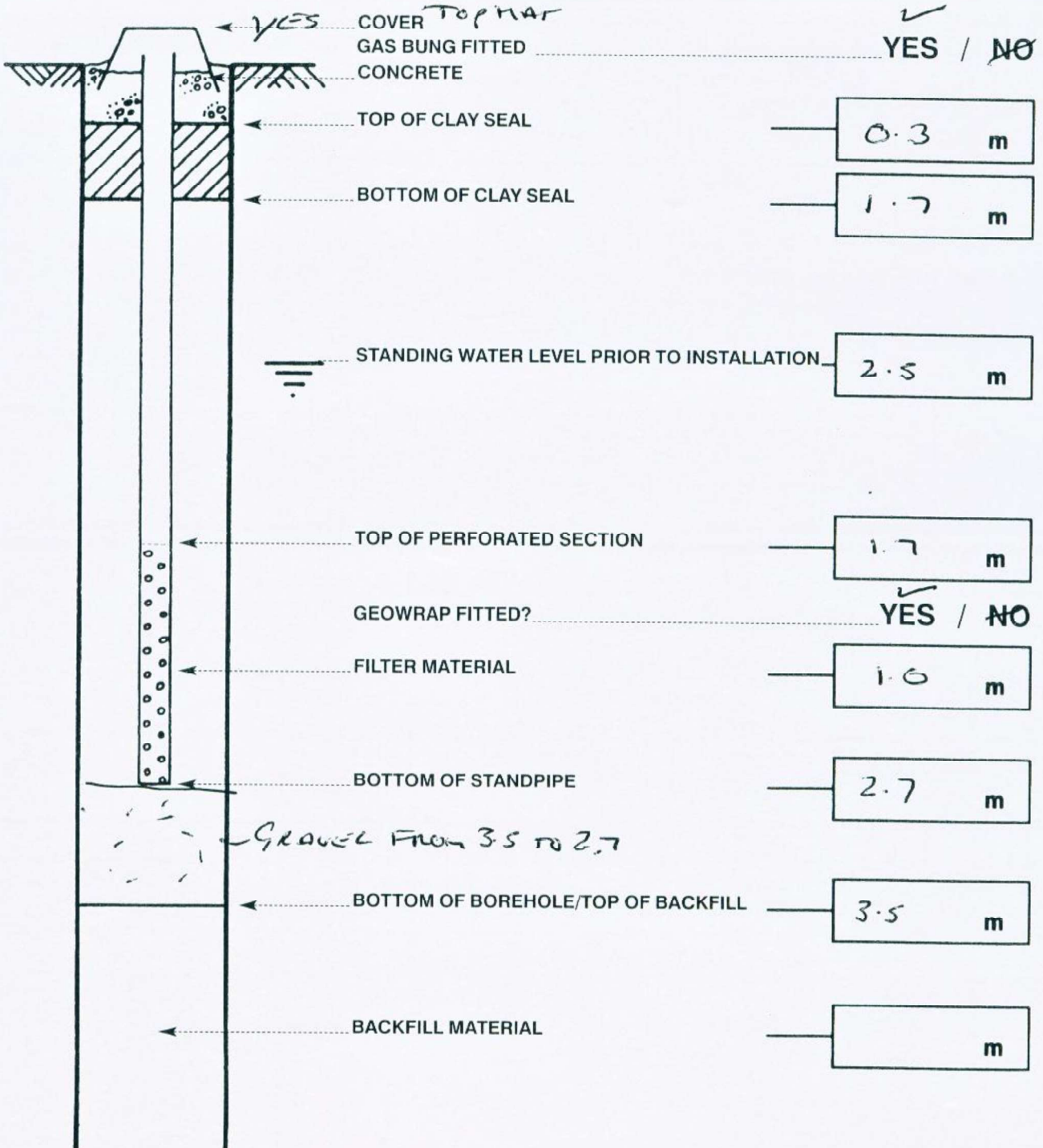
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VAT No: 396/0636/26

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DRILLERS COMMENTS: _____



IONT BEDFORD

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(M) T W Th F S Su 7 4 11

WILLOW HALL FARM

PI105

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT W C

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
9L	0.4	DARK BROWN GRAVELLY CLAYE TOP SOIL
0.4	0.9	BROWN GRAVELLY VERY SANDY CLAY
0.9	1.4	BROWN & GREY SILTY SANDY CLAY
1.4	7.6	BROWN SAND - GRAVEL
7.6	8.1	GREY CLAY

no.	depth
D 1	8.1
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1	7.7	0.9	100
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1	1.5	2.0
B 2	2.5	3.0
B 3	3.5	4.0
B 4	4.5	5.0
B 5	5.5	6.0
B 6	6.5	7.0
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	3.7		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			DBL
water level at finish of boring			7.6
water level when casing removed			3.9

CHISEL OR PIT

Borehole complete	Yes	No	from	9L
Depth of borehole cased	7.6		to	1.2
Piezometer / standpipe?	depth	7.6	hours	3/4

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.4		
to	3.7		
litres	25	GALLONS	

driller **KIDAUEN**

STANDPIPE INSTALLATION

SITE *WILLOW HALL FARM*

DATE *7-4-11*

DRILLER *K DRAUGH*

BOREHOLE No. *P1105*

T. BEDFORD

Site Investigation Drilling Specialist

11 Marconi Drive

Yaxley

Peterborough

PE7 3ZR

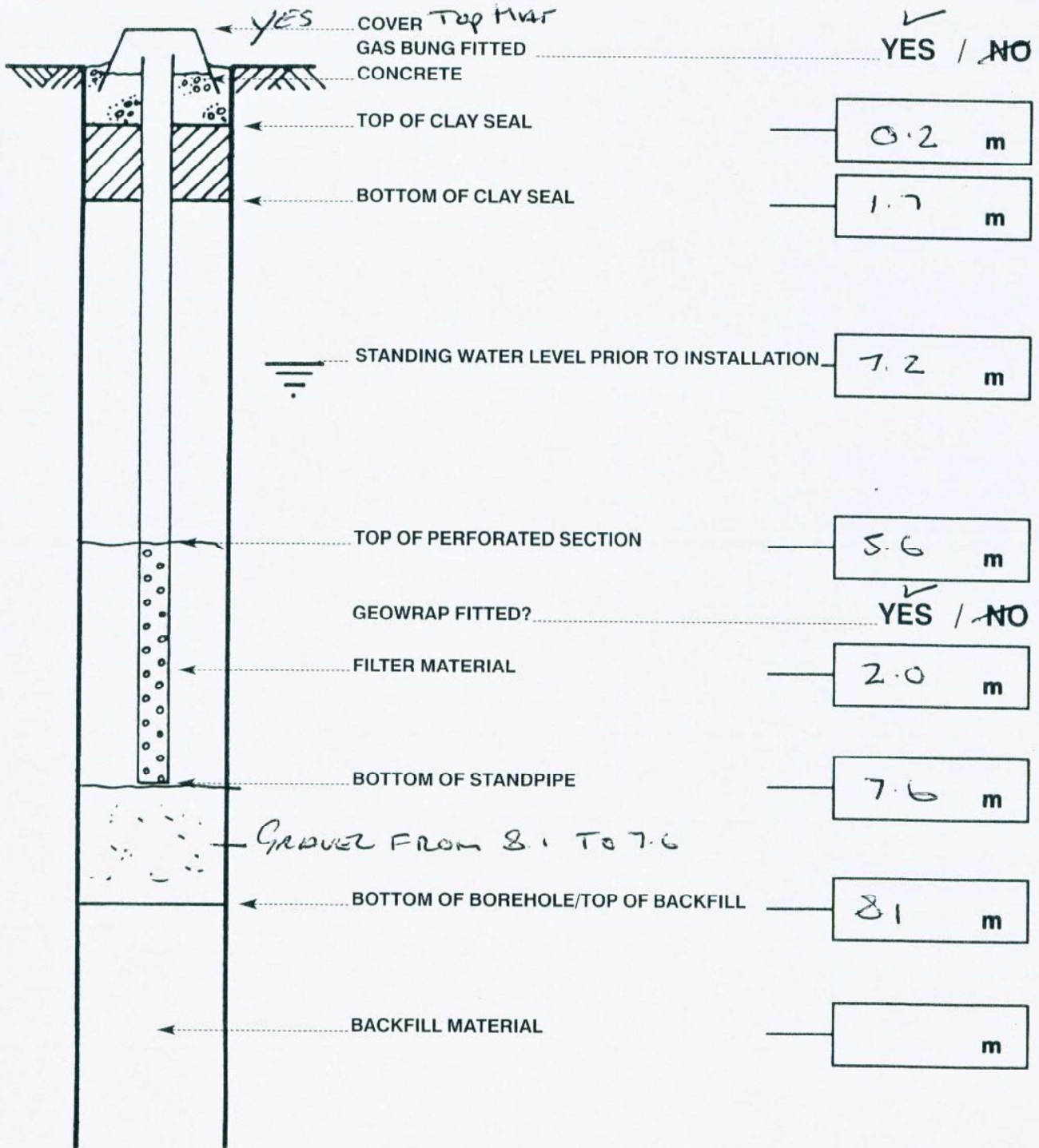
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VAT No: 396/0636/26

tony.bedford@tesco.net

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DRILLERS COMMENTS: _____

TONY BEDFORD

Site Investigation Drilling Specialist

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Tel: 01733 242866 Fax: 01733 242496 Mobile: 07860 514387

SITE NAME, ADDRESS, JOB NUMBER

BOREHOLE NO.

M T W **Th** F S Su 3 3 11

WILLOW HALL FARM

P106

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
9.6	0.4	DARK BROWN GRAVELLY CLAYE TOP SOIL
0.4	0.8	BROWN GRAVELLY VERY SANDY CLAY
0.8	6.5	BROWN SAND & GRAVEL
6.5	7.0	GREY CLAY

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1		
B 2		
B 3		
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	2.4		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			DRY
water level at finish of boring			6.7
water level when casing removed			0.8

CHISEL OR PIT

Borehole complete	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Depth of borehole cased	6.5	
Piezometer / Standpipe?	depth	6.5

from	9.6
to	0.2
hours	3/4

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2
to	2.4
litres	154 ACCONS

driller K DAUGH



STANDPIPE INSTALLATION

SITE *WILLOW HALL FARM*

DATE *3-3-11*

DRILLER *K DAVEY*

BOREHOLE No. *P1106*

T. BEDFORD

Site Investigation Drilling Specialist

11 Marconi Drive

Yaxley

Peterborough

PE7 3ZR

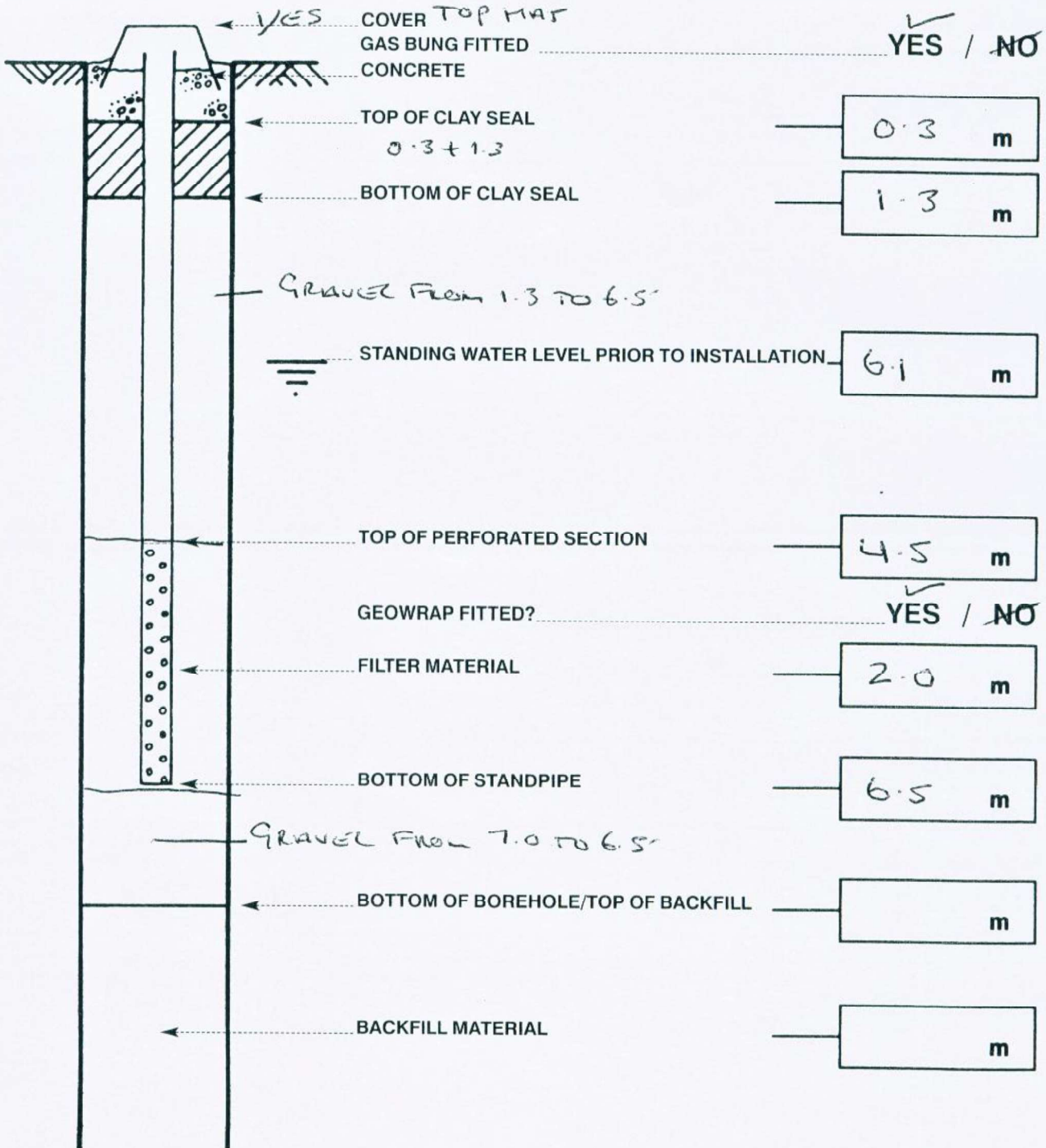
Tel: (01733) 242866

Fax: (01733) 242496

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DRILLERS COMMENTS: _____



GRAND SURVEY
RHS ONLY

TONY BEDFORD

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Mobile: 07860 514387

Project <u>WILLOW HALL FARM THORNEY</u>												Driller <u>KOALBY</u>	
Client <u>PSTHOPE LTD WORK ORDER NO. 17-2-11</u> <u>MR. M. BRITCHARD POTWALL</u>												Invoice Certificate	
												Date <u>2ND MARCH 2011</u>	
Borehole	<u>11 01</u>	<u>11 02</u>	<u>11 04</u>	<u>11 09</u>	<u>11 10</u>	<u>11 11</u>	<u>11 12</u>	<u>11 03</u>	<u>11 06</u>	<u>11 07</u>	Total <u>1105</u>	Rate <u>1108</u>	Amount <u>THIS SHEET</u>
Transport Equipment	1												1 no
Erect & Dismantle	1	1	1	1	1	1	1	1	1	1	7	1	12 no
Boring GL to 10M	7	6	4	5	7	6	7	2	5	3	2.5	4	60.5m
Boring 10 to 20M	-	-	-	-	-	-	-	-	-	-	-	-	
Boring 20 to 30M	-	-	-	-	-	-	-	-	-	-	-	-	
Boring 30 to 40M	-	-	-	-	-	-	-	-	-	-	-	-	
Chiselling Hours	-	-	-	-	-	-	-	-	-	-	-	-	
Standing Time	-	-	-	-	-	-	-	-	-	-	-	-	
U4's Samples	-	-	-	-	-	-	-	-	-	-	-	-	
U4's Samples	-	-	-	-	4	-	-	-	-	-	-	-	1 no
SPT's/CPT Samples	-	-	-	-	-	-	-	-	-	-	-	-	
SPT's/CPT Samples	-	-	-	-	-	-	-	-	-	-	-	-	
Bulk Samples	5	-	-	3	-	-	6	5	2	-	1	-	22 no
Disturbed Samples	2	-	-	-	-	-	-	-	-	-	2	-	
Water Samples	-	-	-	-	-	-	-	-	-	-	-	-	
Standpipe Tube	-	-	-	-	-	-	-	-	-	-	-	-	
Starter Pit	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	9 HR
Covers	-	-	-	-	-	-	-	-	-	-	-	-	
Day Works	1	-	-	-	-	-	-	-	-	-	-	-	
Gravel Pack	-	-	-	-	-	-	-	-	-	-	-	-	
											Total Ex VAT	VAT	Total
											£	£	£

TONT BEDFORD

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M T W Th F S Su 2 3 11

SITE NAME, ADDRESS, JOB NUMBER

WILLOW HALL FARM

BOREHOLE NO.

1101

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT W C

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
96	0.4	DARK BROWN GRAVELS CLAYE TOP SOIL
0.4	0.7	BROWN GRAVELS, VERY SANDY CLAY
0.7	3.7	BROWN SAND & GRAVEL
3.7	3.9	GREY SAND, SILTY CLAY
3.9	5.9	BROWN SAND & GRAVEL
5.9	7.0	GREY CLAY WITH SILTS
1 HOUR SETTING OUT BOREHOLES		

no.	depth
D 1	5.9
D 2	7.0
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1	1.0	1.5
B 2	2.0	2.5
B 3	3.0	3.5
B 4	4.0	4.5
B 5	5.0	5.5
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	2.7		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			DRY
water level at finish of boring			6.4
water level when casing removed			1.2

CHISEL OR PIT

Borehole complete	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Depth of borehole cased	6.0	
Piezometer / Standpipe?	depth	NO

from	96
to	1.2
hours	3/4

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2		
to	2.7		
litres	1594 LITRES		

driller / DAUGH



TONT BEDFORD

Site Investigation Drilling Specialist
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GROUND CONDITIONS ENCOUNTERED

M T W **Th** F S Su 3 3 11

SITE NAME, ADDRESS, JOB NUMBER

WILKOC HALL FARM

BOREHOLE NO.

1102

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT W C

from	to	consistency or density / colour / type
9.6	0.6	DARK BROWN GRAVELY CLAYE TOP SOIL
0.6	1.0	BROWN GRAVELY VERY SANDY CLAY
1.0	5.5	BROWN SAND & GRAVEL
5.5	6.0	GREY CLAY

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1		
B 2		
B 3		
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	2.5		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			2.4
water level at finish of boring			5.7
water level when casing removed			3.8

Borehole complete	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Depth of borehole cased	5.5	
Piezometer / Standpipe?	depth	no

CHISEL OR PIT

from	9.6
to	1.2
hours	3/4

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2		
to	2.5		
litres	20 GALLONS		

driller K. DAVEN





PORT BLOTORDE

Site Investigation Drilling Specialist
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M T W Th **F** S Su 4 3 11

WILLOW HALL FARM

11/09

DISTURBED SAMPLES U4 C

UNDISTURBED SAMPLES U4 W

PENETRATION TESTS

SPT SPT W C

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
GL	0.2	DARK BROWN GRAVELLY CLAY TOP SOIL
0.2	0.5	BROWN & BLACK GRAVELLY VERY SANDY CLAY
0.5	3.7	BROWN SAND & GRAVEL
3.7	4.2	BROWN CLAY
4.2	5.0	GREY CLAY

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	none
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8		100	
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1	1.0	1.5
B 2	2.0	2.5
B 3	3.0	3.5
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	2.3		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			DRY
water level at finish of boring			4.7
water level when casing removed			2.2

CHISEL OR PIT

Borehole complete	Yes	No
Depth of borehole cased	4.0	
Piezometer / Standpipe?	depth	NO

from	GL
to	1.2
hours	3/4

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2		
to	2.3		
litres	155	ALLOW	

driller K DAUGH

IONY BEDFORD

Site Investigation Drilling Specialist
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M T W Th **F** S Su 4 3 11

SITE NAME, ADDRESS, JOB NUMBER

WILLOW HALL FARM

BOREROLE NO.

1118

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS U4

SPT U4

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
0.6	0.6	DARK BROWN GRAVELLY CLAY TOP SOIL
0.6	0.2	BROWN GRAVELLY VERY SANDY CLAY
0.2	6.4	BROWN SAND & GRAVEL
6.4	7.0	GREEN CLAY

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1	6.5	0.5	100
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1		
B 2		
B 3		
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	3.3		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			
water level at finish of boring			
water level when casing removed			

CHISEL OR PIT

Borehole complete	Yes	No
Depth of borehole cased	6.5	
Piezometer / Standpipe?	depth	NO

from	9.1
to	1.2
hours	3/4

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2	
to	3.3	
litres	15 Gallons	

driller K. DAVEN



IONT BEDFORD

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M T W Th F S Su 3 3 11

SITE NAME, ADDRESS, JOB NUMBER

WILLOW HALL FARM

BORING NO.

11 11

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT W C

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
0.1	0.5	DARK BROWN GRAVELY CLAYE TOP SOIL
0.5	1.5	BROWN GRAVELY VERY SANDY CLAY
1.5	5.5	BROWN SAND + GRAVEL
5.5	6.0	CLAY

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1		
B 2		
B 3		
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	2.6	2.7	
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			DRY
water level at finish of boring			5.1
water level when casing removed			0.9

CHISEL OR PIT

Borehole complete	<input checked="" type="radio"/> Yes	<input type="radio"/> No	from	0.1
Depth of borehole cased	5.5		to	1.2
Piezometer / Standpipe?	depth	NO	hours	3

DETAILS OF WATER ADDED

from			
to			
litres			

DRILLERS COMMENTS

driller K DAUG



IONY BEDFORD

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M T W **Th** F S Su 3 3 11

WILLOW MALL FARM

11/12

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT W C

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
9.1	0.6	DARK BROWN GRAVEL
		CLAYE TOP SOIL
0.6	0.9	BROWN GRAVELLY VERY SANDY CLAY
0.9	6.7	BROWN SAND + GRAVEL
6.7	7.2	Grey Clay

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S / C 1						
S / C 2						
S / C 3						
S / C 4						
S / C 5						
S / C 6						
S / C 7						
S / C 8						
S / C 9						
S / C 10						
S / C 11						
S / C 12						
S / C 13						
S / C 14						
S / C 15						

BULK SAMPLES

no.	from	to
B 1	1.0	1.5
B 2	2.0	2.5
B 3	3.0	3.5
B 4	4.0	4.5
B 5	5.0	5.5
B 6	6.0	6.5
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	2.7		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			Dry
water level at finish of boring			6.9
water level when casing removed			0.9

CHISEL OR PIT

Borehole complete	Yes	No
Depth of borehole cased	7.0	
Piezometer / Standpipe?	depth	no

from	9.1
to	1.2
hours	3/4

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2
to	2.7
litres	15 GALONS

driller K Dacey





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M P W Th F S Su 8 3 11

WILLOW HALL FARM

1103

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
96	0.4	DARK BROWN GRAVELLY CLAY, TOP SOIL
0.4	0.7	BROWN GRAVELLY VERY SANDY CLAY
0.7	1.0	BROWN SILTY SAND
1.0	3.2	BROWN SAND & GRAVEL
3.2	4.2	GRAY & BROWN SAND, GRAVELLY CLAY
4.2	5.2	BROWN SAND - GRAVEL
5.2	6.5	GRAY CLAY

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

CHISEL OR PIT PIT

Borehole complete	<u>Yes</u>	No
Depth of borehole cased	6.0	
Piezometer / Standpipe?	depth	<u>NO</u>

from	96
to	1.2
hours	$\frac{3}{4}$

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2	
to	2.4	
litres	20 SACKS	

DISTURBED SAMPLES U4

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

UNDISTURBED SAMPLES U4

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

BULK SAMPLES

no.	from	to
B 1	1.0	1.5
B 2	2.0	2.5
B 3	3.0	3.5
B 4	4.0	4.5
B 5	5.0	5.5
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

PENETRATION TESTS

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	2.4		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			Dry
water level at finish of boring			6.4
water level when casing removed			1.1

driller KIDAWA



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M T W Th F S Su 8 3 11

WILLOW HALL FARM

1106

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT W C

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
9.6	0.4	DARK BROWN GRAVELLY CLAYE TOP SOIL
0.4	0.8	BROWN GRAVELLY CLAY
0.8	2.2	BROWN SAND & GRAVEL
2.2	2.4	BROWN CLAY
2.4	3.0	Grey CLAY

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1	1.0	1.5
B 2	2.0	2.2
B 3		
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	1.9		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			Dry
water level at finish of boring			Dry
water level when casing removed			2.9

CHISEL OR PIT

Borehole complete	Yes	No
Depth of borehole cased	2.5	
Piezometer / Standpipe?	depth	NO

from	9.6
to	1.2
hours	3/4

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from			
to			
litres			

driller K Dacey

TONY BEDFORD

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M T W Th F S Su 8 3 11

SITE NAME, ADDRESS, JOB NUMBER

WILLOW HALL FARM

BOREHOLE NO.

107

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT

GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type	no.	depth
0.1	0.2	DARK BROWN GRAVELLY CLAY TOP SOIL	D 1	
			D 2	
			D 3	
0.2	0.7	BROWN GRAVELLY CLAY	D 4	
			D 5	
0.7	1.7	BROWN SAND & GRAVEL	D 6	
			D 7	
1.7	1.9	BROWN CLAY	D 8	
			D 9	
1.9	2.3	GREY CLAY	D 10	
			D 11	
			D 12	
			D 13	
			D 14	
			D 15	
			D 16	
			D 17	
			D 18	
			D 19	
			D 20	

no.	depth	length	blows
U 1			
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S / C 1						
S / C 2						
S / C 3						
S / C 4						
S / C 5						
S / C 6						
S / C 7						
S / C 8						
S / C 9						
S / C 10						
S / C 11						
S / C 12						
S / C 13						
S / C 14						
S / C 15						

BULK SAMPLES

no.	from	to
B 1		
B 2		
B 3		
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	1.5		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			DRY
water level at finish of boring			DEL
water level when casing removed			1.7

CHISEL OR PID

Borehole complete	Yes	No	from	9.6	
Depth of borehole cased	2.0		to	1.2	
Piezometer / Standpipe?	depth	no	hours	3	

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from			
to			
litres			

driller K Davis



TONT BEDFORD

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GROUND CONDITIONS ENCOUNTERED

from	to	consistency or density / colour / type
0.1	0.3	DARK BROWN GRAVELLY CLAY - TOP SOIL
0.3	1.0	BROWN VERY GRAVELLY SANDY CLAY
1.0	1.5	BROWN SAND & GRAVEL
1.5	2.0	BROWN CLAY
2.0	2.5	GREY CLAY

M T W Th F S Su 8 3 11

WILLOW HALL FARM

1105

DISTURBED SAMPLES U4

UNDISTURBED SAMPLES U4

PENETRATION TESTS

SPT SPT

no.	depth
D 1	
D 2	
D 3	
D 4	
D 5	
D 6	
D 7	
D 8	
D 9	
D 10	
D 11	
D 12	
D 13	
D 14	
D 15	
D 16	
D 17	
D 18	
D 19	
D 20	

no.	depth	length	blows
U 1	2.0	0.5	70
U 2			
U 3			
U 4			
U 5			
U 6			
U 7			
U 8			
U 9			
U 10			
U 11			
U 12			
U 13			
U 14			
U 15			

type/no	depth	150	75	75	75	75
S/C 1						
S/C 2						
S/C 3						
S/C 4						
S/C 5						
S/C 6						
S/C 7						
S/C 8						
S/C 9						
S/C 10						
S/C 11						
S/C 12						
S/C 13						
S/C 14						
S/C 15						

BULK SAMPLES

no.	from	to
B 1	1.0	1.5
B 2		
B 3		
B 4		
B 5		
B 6		
B 7		
B 8		
B 9		
B 10		
B 11		

DETAILS OF GROUNDWATER ENCOUNTERED

depth struck	1.7		
casing depth			
inflow rate			
rose to			
sealed out at			
sample no.	w	w	w
sample depth			
water level at start of boring			D24
water level at finish of boring			D24
water level when casing removed			1.7

CHISEL OR PIT

Borehole complete	Yes	No
Depth of borehole cased	2.0	
Piezometer / Standpipe?	depth	00

from	0.1	
to	1.2	
hours	3	

DRILLERS COMMENTS

DETAILS OF WATER ADDED

from	1.2	
to	1.7	
litres	209	ACCENS

driller K Dacey



APPENDIX ESID5

**New Crossing over Cat's Water
Drain - Options Appraisal**

EYE EASTERN EXTENSIONS

CAT'S WATER DRAIN OPTION APPRAISAL

IDENTIFICATION TABLE

Client/Project owner	Golder Associates
Project	Eye Eastern Extensions
Title of Document	Cat's Water Drain Option Appraisal
Type of Document	Technical Note
Date	01/02/2022
Reference number	GB01T22E16-TN-001

APPROVAL

Version	Name		Position	Date	Modifications
1	Author	A. Din	Graduate Engineer	25/01/2022	
	Checked by	W. Smyth	Bridges Team Leader	01/02/2022	
	Approved by	W. Smyth	Bridges Team Leader	01/02/2022	

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1. PROJECT OVERVIEW

1.1 Background

SYSTRA Ltd has been appointed by Golder Associates on behalf of Biffa Waste Services Ltd to carry out a high level option appraisal for a new crossing over the Cat’s Water Drain which sits within the Eye Landfill site. Due to the extension of the Eye Landfill site, the client will require a new crossing to support the access route to a gas compound and leachate tanks. The client has stated the design must meet 3 key requirements.

- The crossing must sustain two-way traffic with robust trafficable surface and edge protection.
- Maintain water flow to Internal Drainage Board (IDB) regulations to prevent flooding upstream and prevent erosion and scouring of banks.
- Be used as a key route to supply pipework for the management of leachate and landfill gas to the gas compound and leachate tank.

This Technical Note investigates various options that are considered suitable for this new crossing.

1.2 Location

Golder Associates have provided SYSTRA Ltd with a location plan detailing the proposed access route and location of the new crossing. This crossing will be positioned in the south eastern side of the facility crossing over the Cat’s Water Drain and will provide access to the eastern extension of the landfill site. This is indicated by the figure below where the proposed route is in orange and the proposed location of the crossing is highlighted by the red box. Also marked on the diagram is the “green wheel” footpath located south of the proposed route/crossing.



Figure 1:1: Location plan and photo provided by Golder Associates.

2. CONSTRAINTS

In order to determine the feasibility of the proposed options, it is essential to identify the possible constraints that could affect the proposed solution. These constraints are summarised as follows:

Ground Conditions

Golder Associates have provided Systra Ltd with data from borehole BH21-03 which is located close to the proposed crossing location. In addition, standard penetration tests (SPT) have also been carried out at various depths. When analysing the borehole logs, it was found that the topsoil consisted of a sandy gravelly silt of approximate 0.30m depth. This was followed by 0.9m thick gravelly silt subsoil. Beneath these layers, is a 17.1m thick stiff clay.

Environmental/Ecological

The current ‘Haul Road’ drawing indicates there is a large wildlife corridor located on the south-eastern side of the site. While this is not located nearby to the proposed crossing location, it must be noted that a full survey was not conducted and as such, further mitigation measures may be required at a later stage.

Flood Risk

At the time of completing this study, a Flood Risk Assessment relating to the proposed site has not been completed. As a result, dimensions in the proposed designs are assumed and will need to be agreed by the local IDB.

Services

From the currently available information, it is unknown as to whether there are underground services located within close proximity of the new crossing. Based on the supplied photographs, there appear to be no overhead services. It is noted that the proposed crossing has to accommodate supply pipework for the management of leachate and landfill gas to the gas compound and leachate tank. The extent of this pipework is unknown at present and the proposed solutions may need to be verified for compliance once this information is available.

Other Crossings

At the proposed location, there is a crossing for the “green wheel” footpath. This will have an impact on the specific location of the proposed crossing. It is unknown if the existing crossing is solid infill or has a pipe through it providing continuity of drainage run. For the purposes of this Technical Note, we have assumed that the new crossing cannot be a solid embankment and that it must provide a means of waterflow below it.

3. BRIDGE OPTIONS

There are two types of structures that are suitable for this crossing; an enclosed structure and an open structure. For this feasibility study, two enclosed structures and one open structure will be investigated. Each option proposed will aim to meet all 3 of the key requirements listed in Section 1.1.

The overall width of the bridge is determined by the carriageway cross section. The client has requested two-way traffic and since heavy vehicles will be trafficked across the bridge, a carriageway width of approximately 7-8m will be used.

The relative merits of each option are discussed below and sketch drawings are included in Appendix A. It should be noted that, in the absence of any dimensional or level information, all drawings are indicative.

3.1 Option 1 – Enclosed Structure (Concrete pipe culvert)

The first design considered is a pipe culvert. This option essentially replicates the temporary crossing Biffa used at the central to north eastern extension. However, to ensure longer-term durability, a pre-cast concrete pipe encased in concrete will be used to provide maximum protection. Currently, a 1000mm diameter pipe has been assumed as this replicates the previous crossing, however, this may need to be adjusted to maintain waterflow to IDB regulations. Alternatively, two pipes side-by-side could be used to provide greater flow capacity.

An engineering fill will then be backfilled over the concrete to the road level. To prevent the spill and erosion of this backfill, a headwall and wing walls will be constructed at the inlet and outlet ends of the pipe. As these elements are expensive, it has been decided to lengthen the pipe such that the dimensions of the headwall and wing wall are reduced (*See Option 1 drawing in Appendix A*).

To ensure a robust trafficable surface, a 7m wide flexible road pavement or rigid concrete pavement could be used as required by the Client. Lastly, as a low-cost solution, pre-cast concrete road barriers will be installed at either side of the carriageway providing sufficient edge protection. These barriers will be approximately 0.5m in width and would require the total width of this bridge to be around 9.0m.

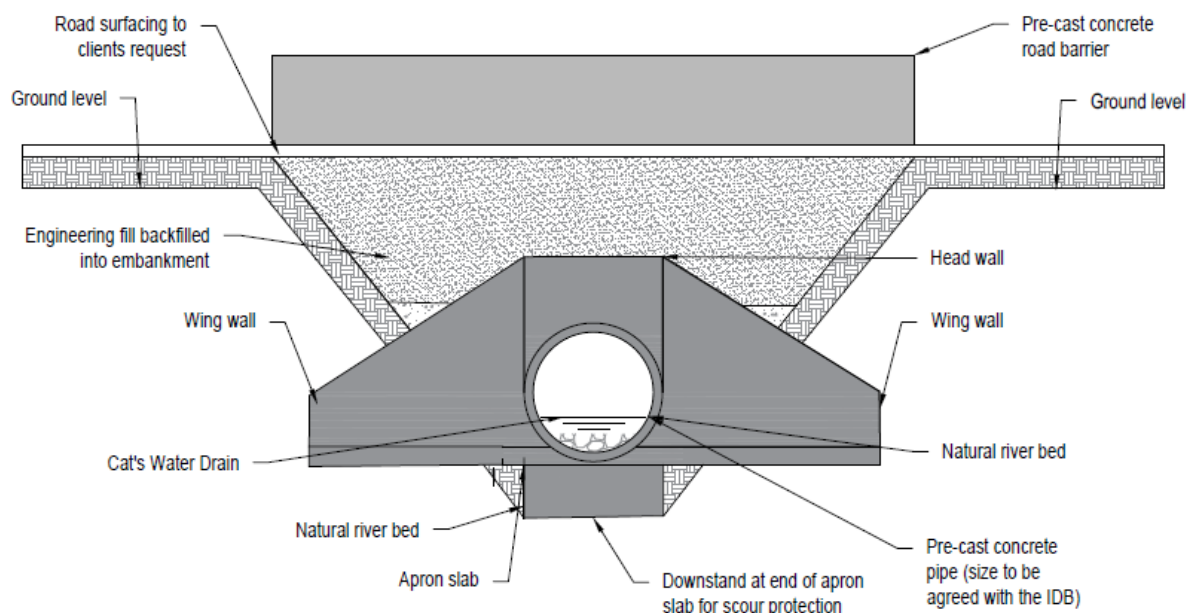


Figure 3:1: Proposed pipe culvert section

Advantages

- Minimal maintenance;
- Easy to construct;
- Factory quality manufacture with engineering tolerances;
- Low cost; and
- Should have sufficient depth of fill cover to accommodate required leachate and gas pipes.

Disadvantages

- Disruptive to the riverbed resulting in possible environmental/ecological impacts;
- Can be prone to sedimentation;
- Long length of enclosed structure required which hinders migration of aquatic species and wildlife along the riverbanks/watercourse;
- Restrictive headroom making inspections/maintenance difficult;
- Wing walls, head wall and apron slab required; and
- A road pavement will have to be constructed over the crossing.

3.2 Option 2 – Enclosed Structure (Precast Reinforced Concrete Box Culvert)

Option B considers utilising a box culvert. This form of construction consists of several precast concrete box segments laid end to end on a granular foundation layer. A typical box would be 2m in length and up to 2m in width. Depending on dimensions, the bottom of the verge may have to be widened.

Similar to Option A, an engineering fill will be used to backfill over the structure and a headwall and wingwalls will be required to prevent the spill of the backfill. Furthermore, the same surfacing and road barrier details will be used.

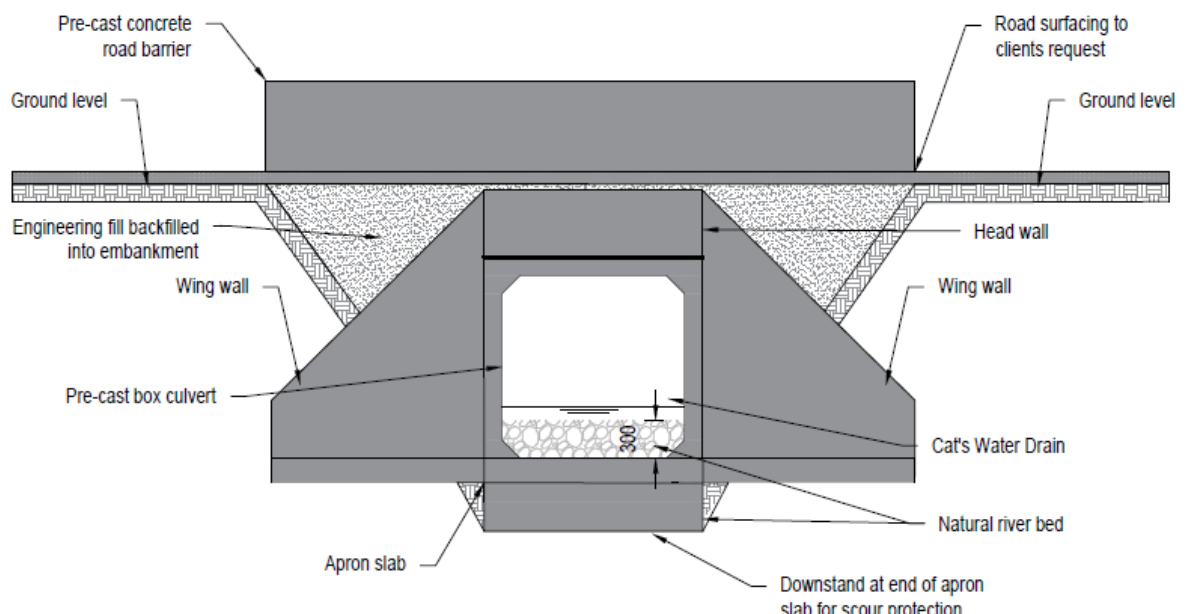


Figure 3:2: Proposed box culvert section

Advantages

- Greater channel area and therefore flow capacity compared to Option A, which could be beneficial in the event of a flood;
- Low maintenance;
- Factory quality manufacture with engineering tolerances;
- Low cost; and
- Should have sufficient depth of fill cover to accommodate required leachate and gas pipes.

Disadvantages

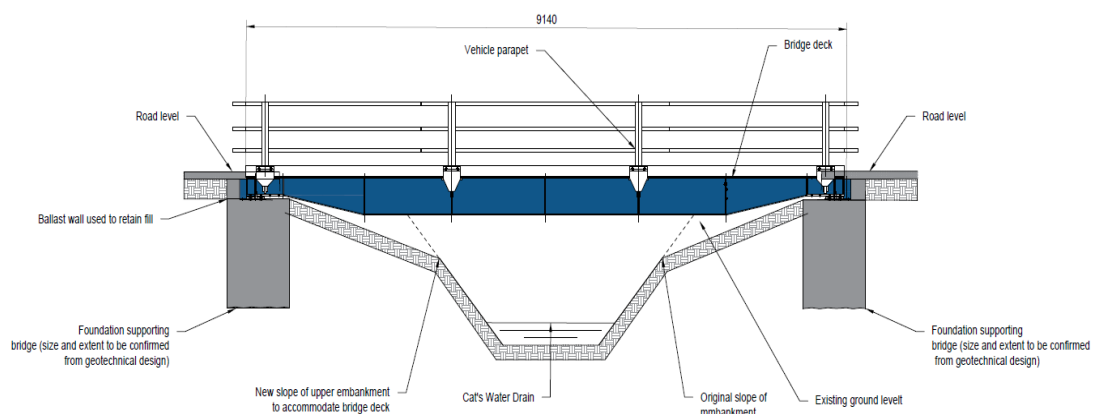
- Disruptive to the riverbed resulting in possible environmental/ecological impacts;
- Restrictive headroom making inspections/maintenance difficult;
- Can be prone to sedimentation;
- A road pavement will have to be constructed over the crossing;
- Long length of enclosed structure required which hinders migration of aquatic species and wildlife along the riverbanks/watercourse; and
- Wing walls, head wall and apron slab required.

3.3 Option 3 – Open Structure (Proprietary Bridge)

This option utilises a single spanning proprietary steel bridge such as the *Quickbridge* system by Mabey. As this is an open structure, the client will not have to worry about ensuring water flows meet IDB regulations. This structure arrives fully assembled, with an anti-skid surface, edge barriers, and is designed to accept full highway loading, including articulated lorries and tipper vehicles.

This bridge is available in a variety of span lengths and widths. From an initial observation, based on the supplied photographs, a 9m span could be used to provide a reasonable location of the abutments away from the watercourse. However, a topographical survey would be required to confirm this length. It must be noted, using a 9m span bridge would require the embankment to be widened locally to accommodate the bridge deck (as shown in the sketch below). A suitable foundation arrangement would be constructed insitu to support the bridge deck. This type and extent of the foundation would be determined as part a geotechnical design, although for illustrative purpose, we have shown a mass concrete trench fill foundation in the sketch below.

For this design to sustain two-way traffic, 4 bridge units would be used giving a road width of 6.85m and an overall width of 7.625m.



Eastern Eye Extensions

Feasibility Study Cat's Water Drain Option Appraisal

Draft V 1

GB01T22TBC-TN-001

01/07/2022

Figure 3:3: Proposed proprietary bridge section

Advantages

- Greater channel area of all options, maximising ability to cope with extreme flood events;
- Less impact on the watercourse environment;
- Easy to manufacture, transport, and lift into place which reduces site work;
- Programme advantages of Quick construction/installation time; and
- A road pavement will not have to be constructed over the crossing.

Disadvantages

- Structural form is not the most aesthetically pleasing;
- The exposed steel super structure will require maintenance which will influence the whole life costing;
- May be difficult to accommodate the required leachate and gas pipes within the deck;
- Likely to be the most expensive solution, although would depend on the duration of hire. Buying direct may be an option which would give the client an opportunity to re-use the bridge for future short term projects (design life of structure is normally 60 years); and
- Foundations required to support the structure.

4. CONCLUSION

This Technical Note is a high level option appraisal of the proposed crossing over the Cat's Water Drain. This study has identified three viable options: a pipe culvert, box culvert and a single spanning steel bridge. For each option, a short description detailing how each design would meet the key requirements has been included along with the advantages and disadvantages

Based on our findings, it is recommended that either Option 1 or Option 2 is taken forward to detailed design. This assumes that either of these options is acceptable to the IDB. If an open structure clear of the riverbed is preferred by the IDB then Option 3 would be suitable.

It should be noted that this Technical Note is based on limited topographical and geotechnical information and further survey and intrusive investigation will have to be undertaken to confirm the final design. In addition, a flood risk assessment should be carried out to demonstrate that the proposed crossing can convey the associated flow.

APPENDIX A - OPTIONS DRAWINGS

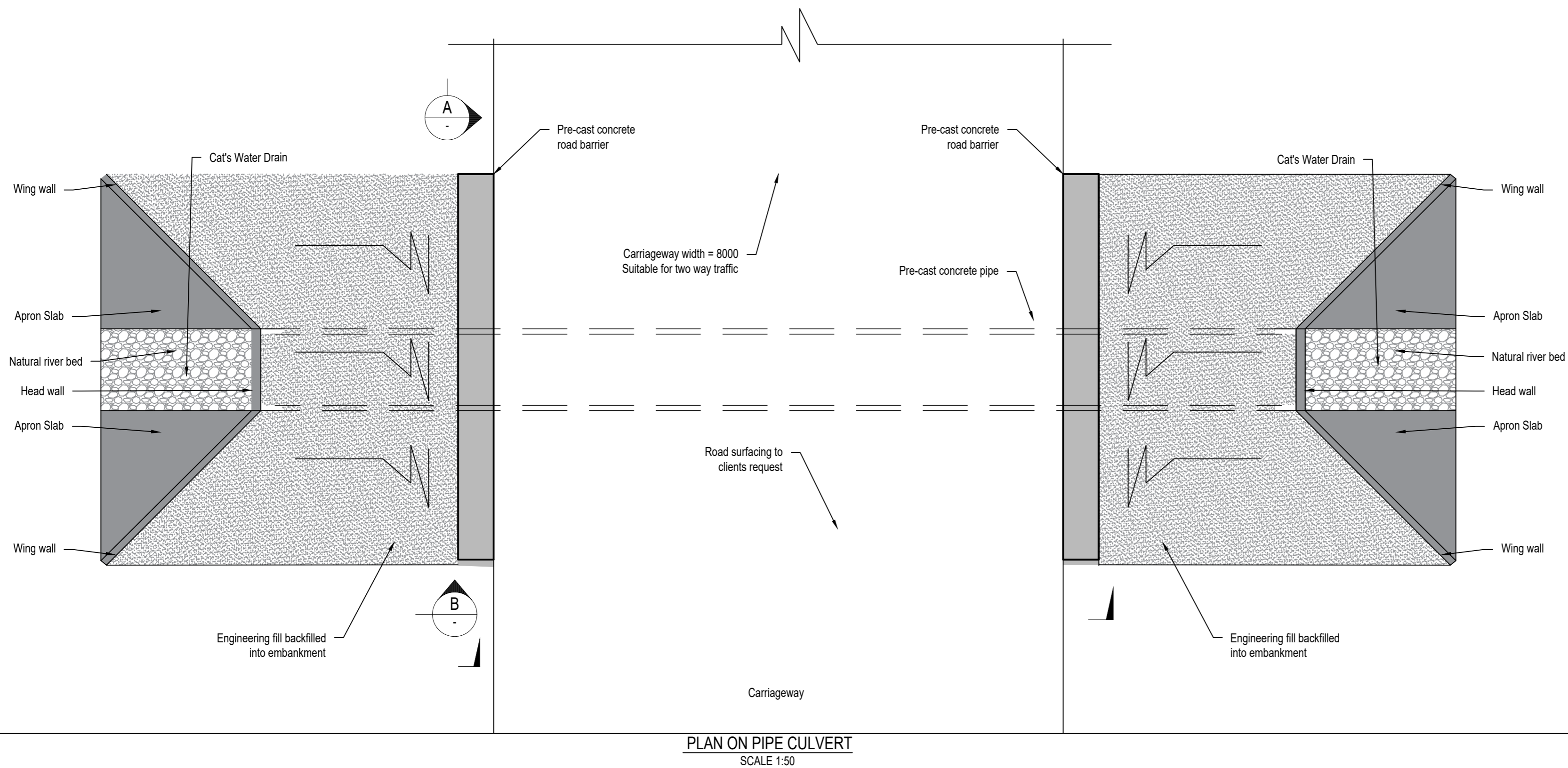
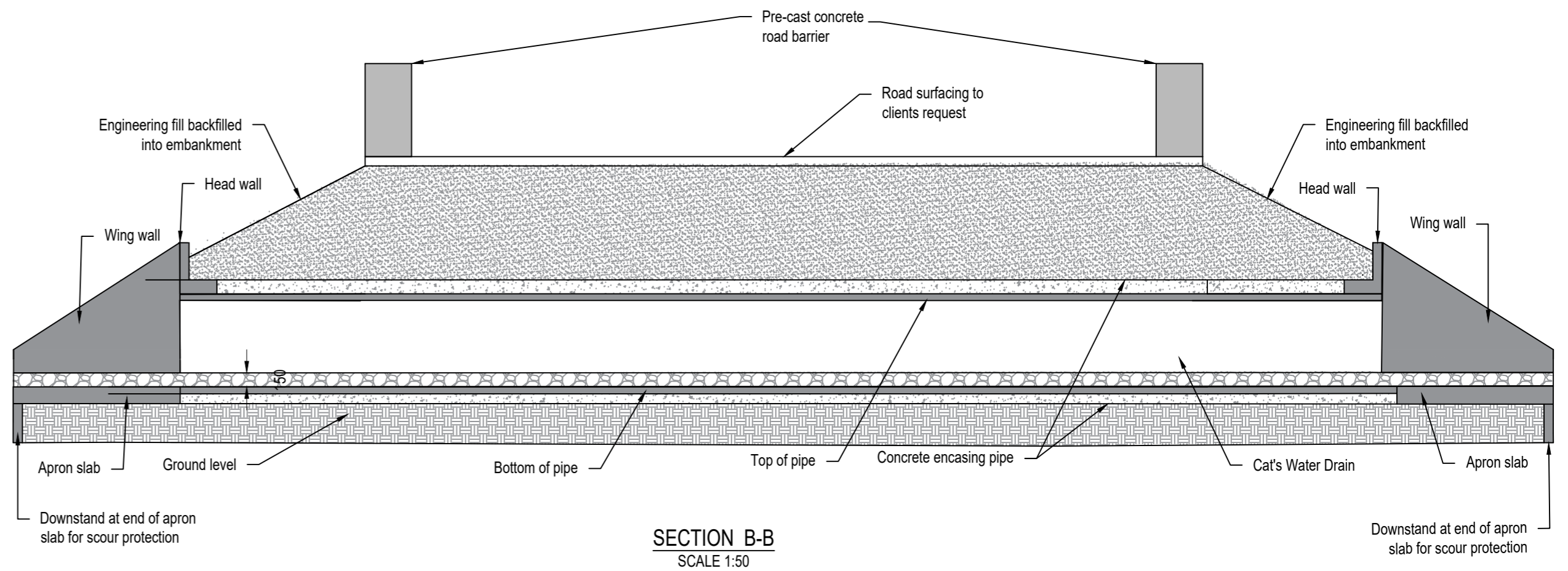
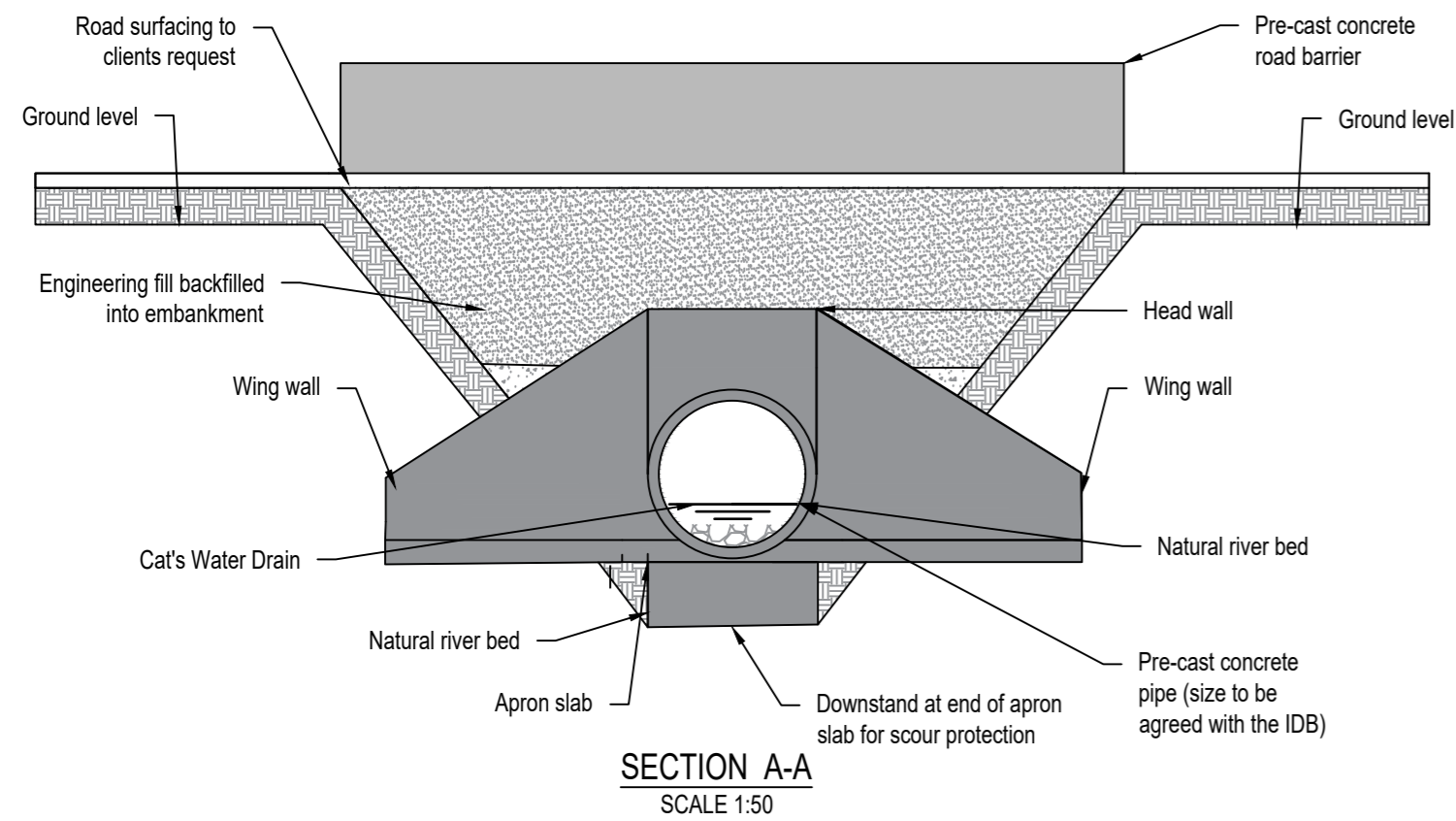
Eastern Eye Extensions



Feasibility Study Cat's Water Drain Option Appraisal

Draft V.1

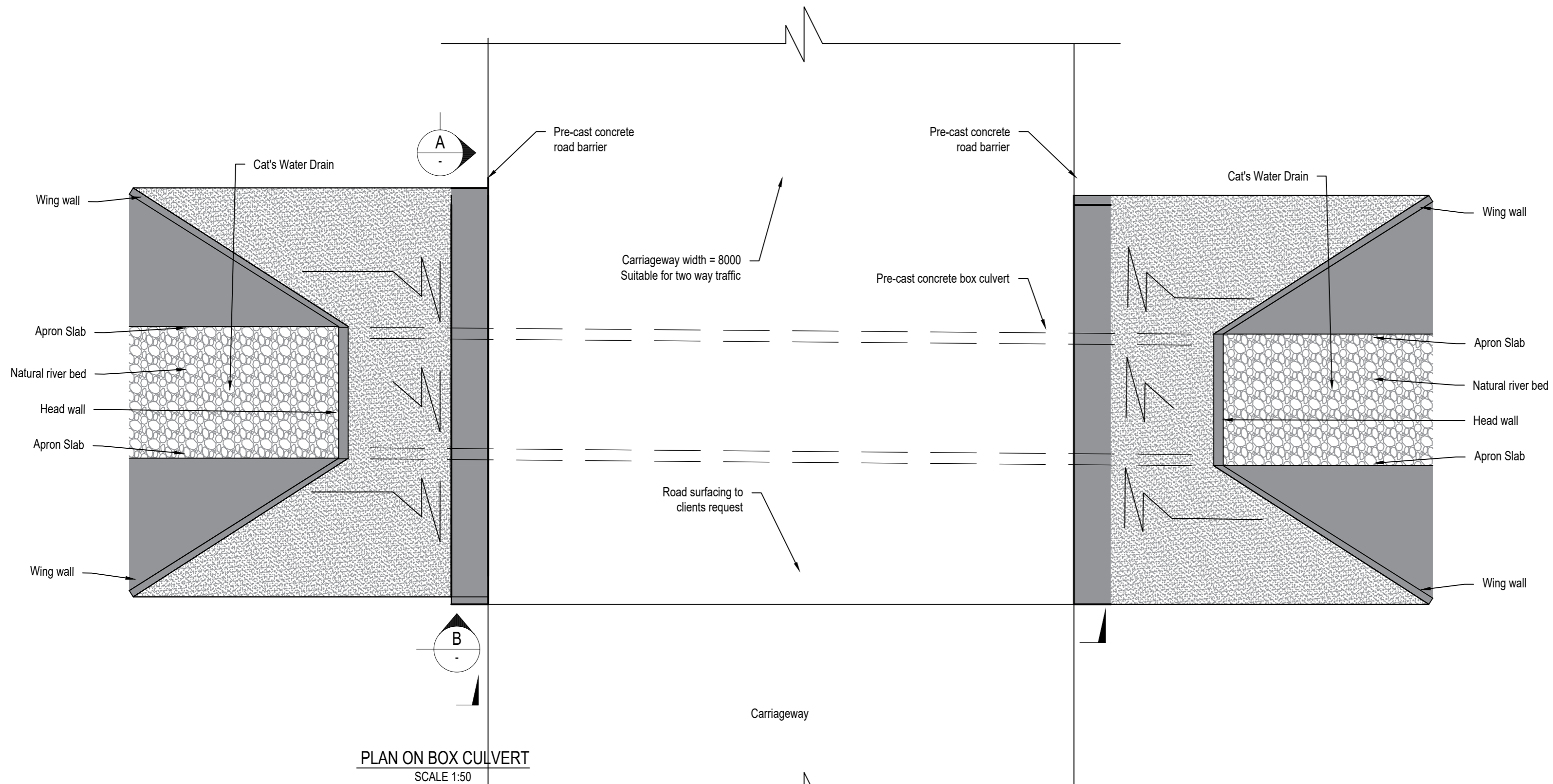
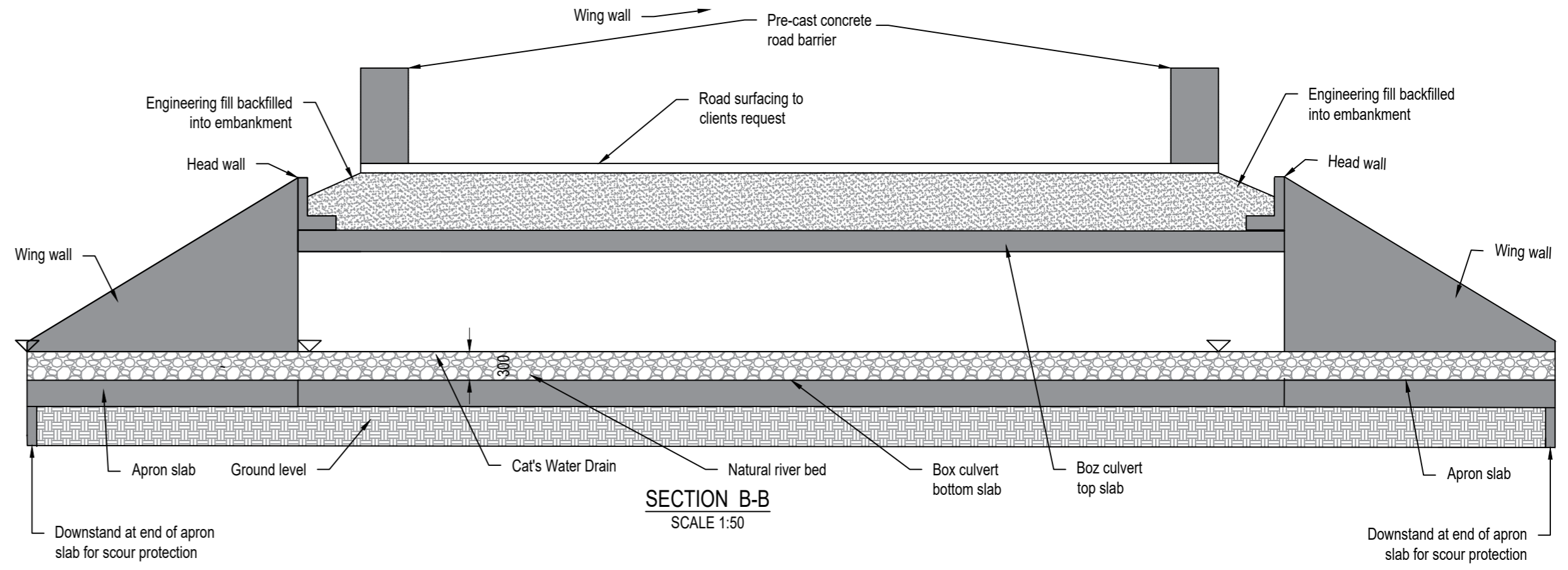
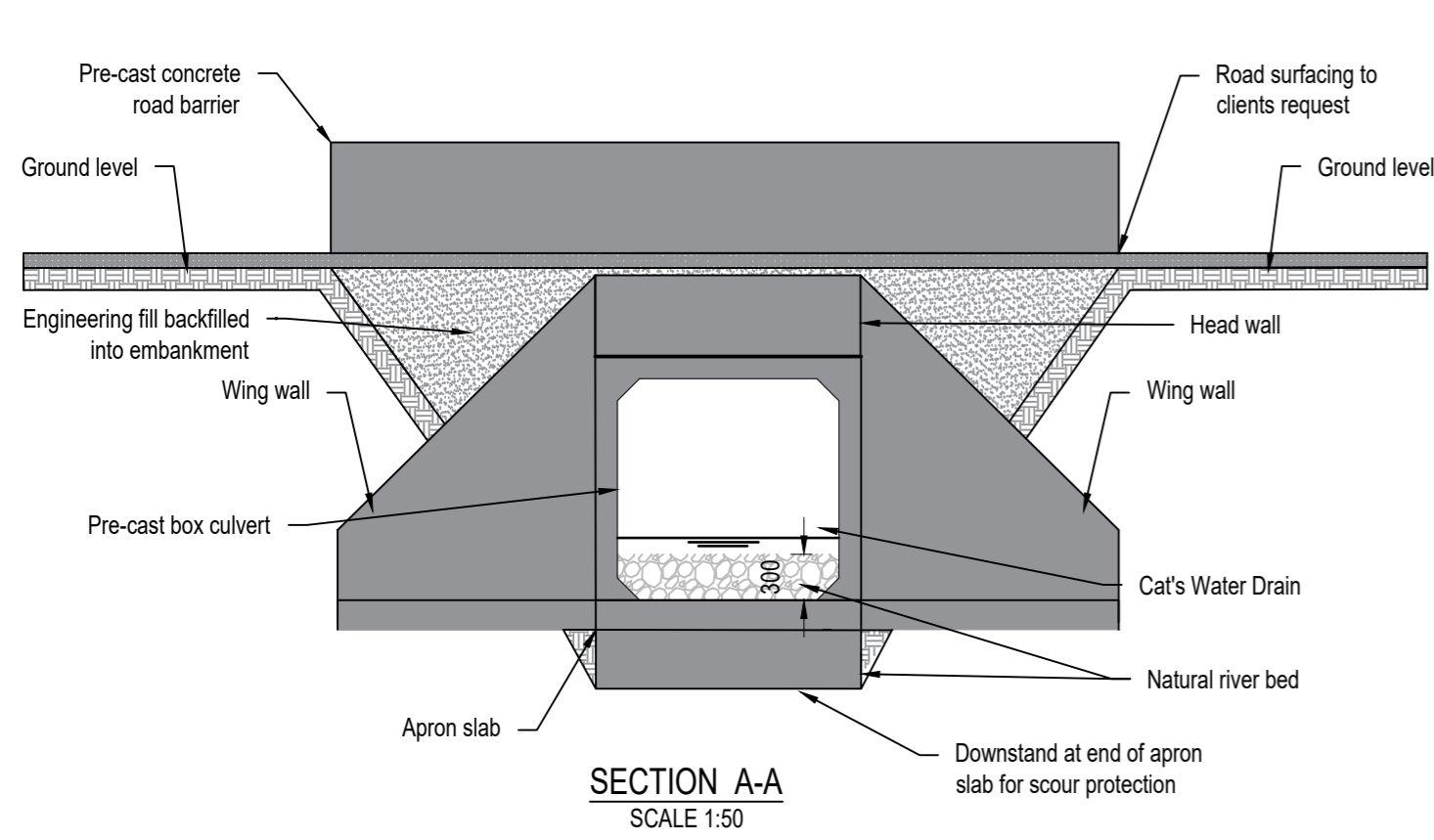
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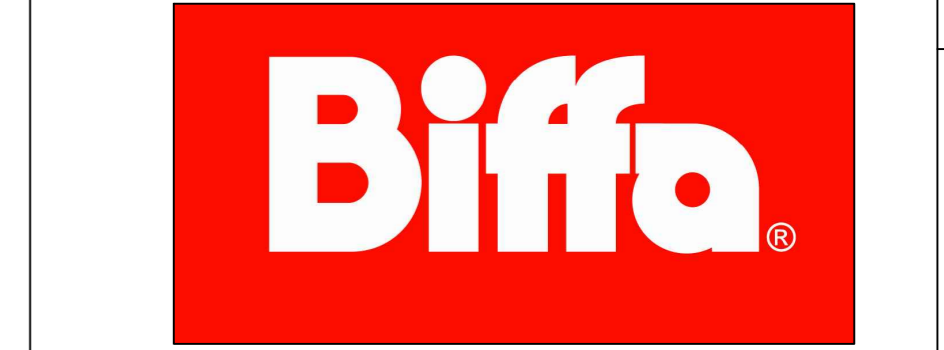
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For Information					Suit Code
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CHECKED	WUS			DATE	01/02/2022
APPROVED	WUS			DATE	01/02/2022
Eastern Eye Extension Project Cat's Water Crossing Feasibility Study Proposed Crossing Option 1 Enclosed Structure - Precast Concrete Pipe Culvert					
SCALES			SURVEY GRID		
Scale 1:50			Survey Grid		
DRAWING NUMBER					REVISION
/SK01					P01

DO NOT SCALE



P01	01/02/22	FIRST ISSUE	AD	WUS	WUS
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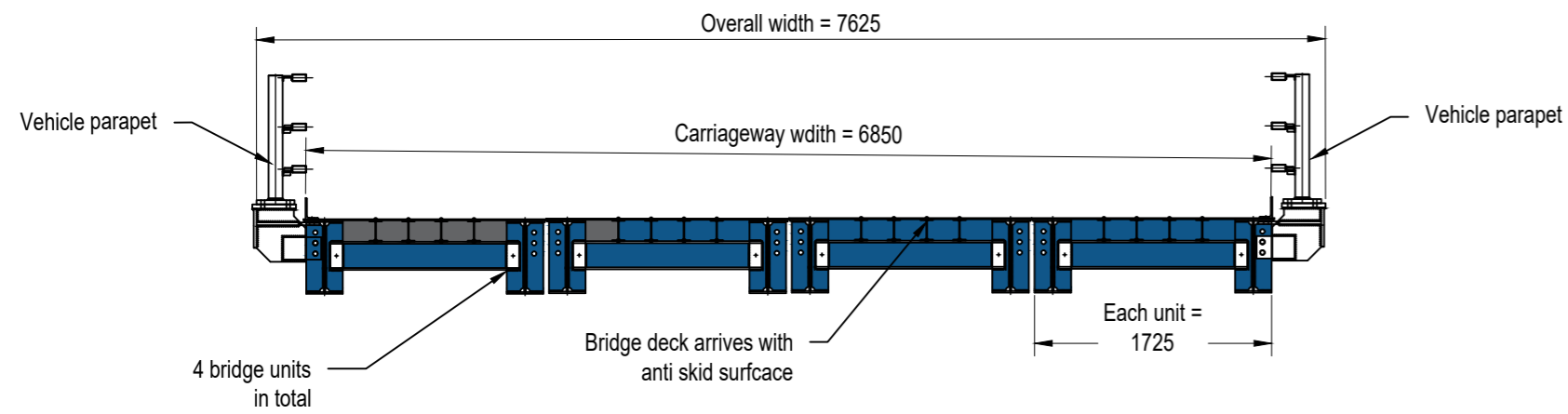


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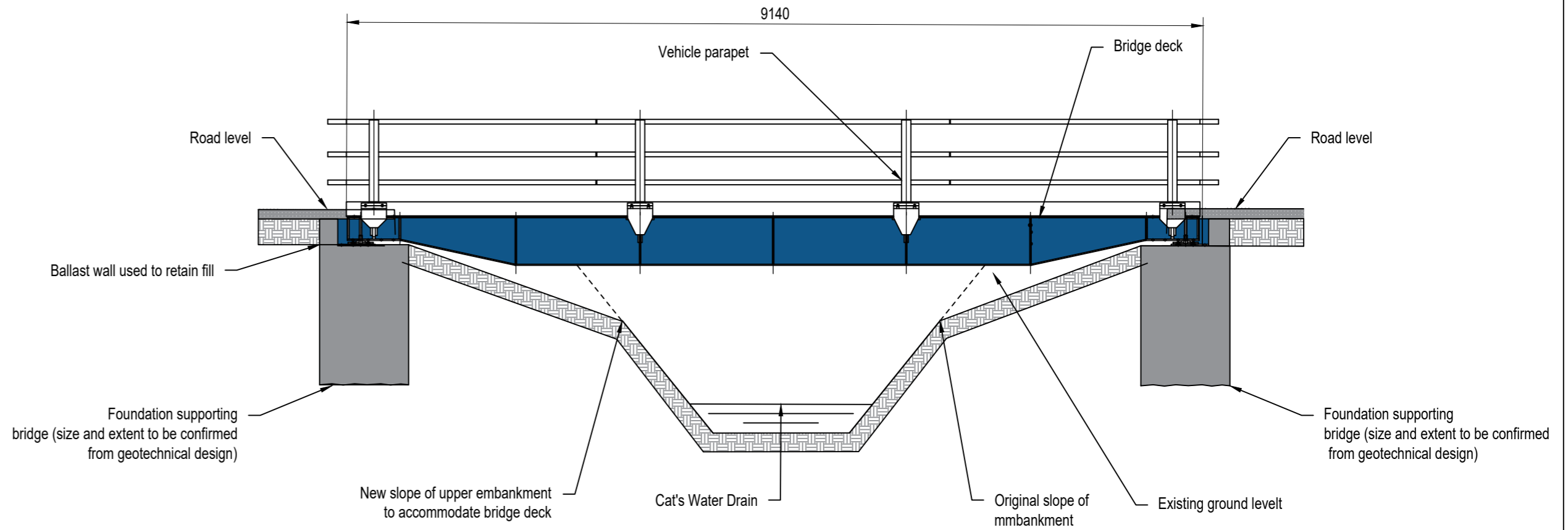
Eastern Eye Extension Project
Cat's Water Crossing
Feasibility Study
Proposed Crossing Option 2
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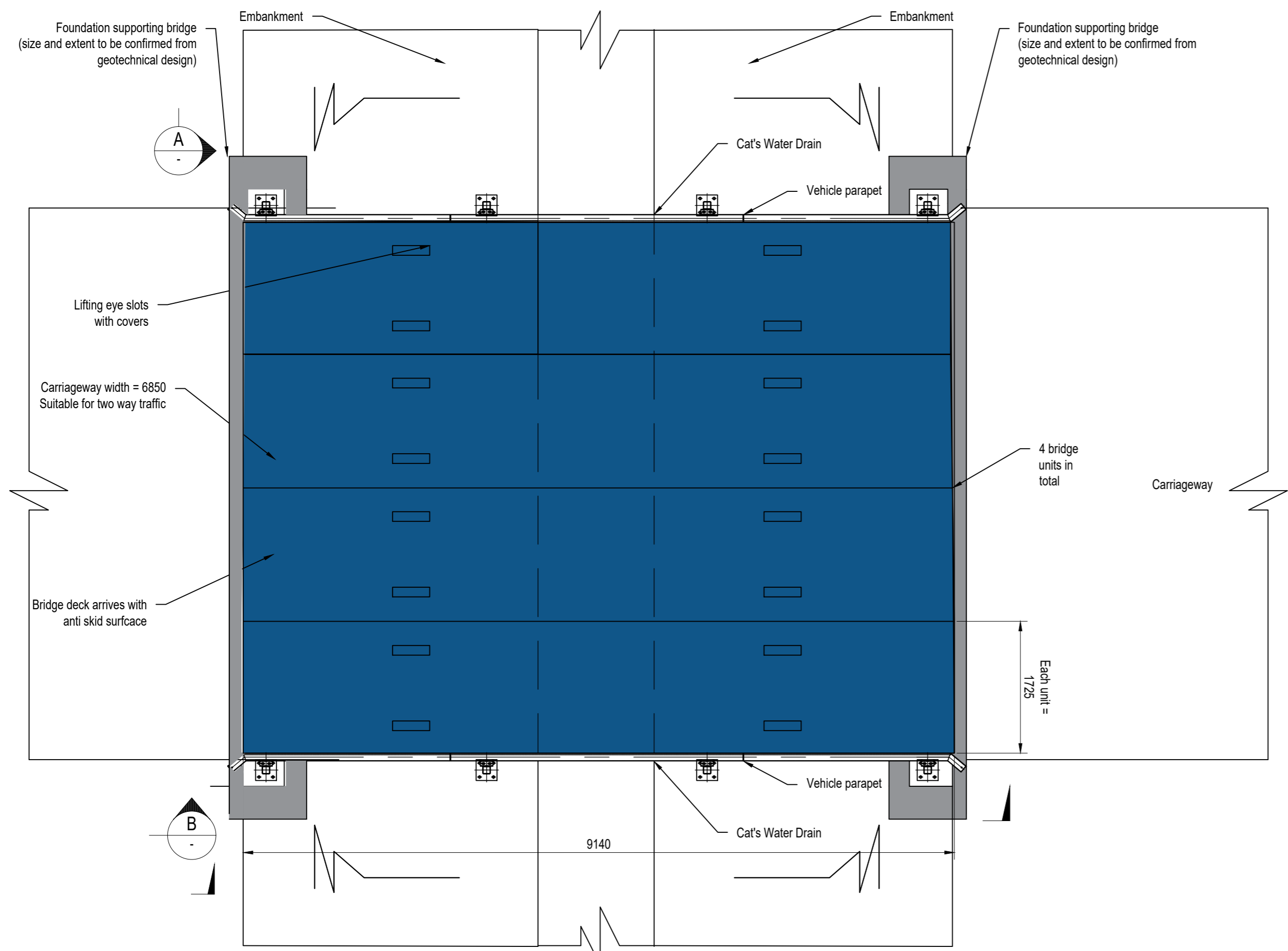
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SECTION A-A
SCALE 1:50



SECTION B-B
SCALE 1:50



PLAN ON PROPRIETARY BRIDGE
SCALE 1:50

P01	01/02/22	FIRST ISSUE	AD	WUS	WUS
REV.	DATE	DESCRIPTIONS OF REVISION	DES	CHKD	APPR



SECURITY CLASSIFICATION			security_class		
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APPROVED	WUS	DATE	01/02/2022		

Eastern Eye Extension Project
Cat's Water Drain Crossing
Feasibility Study
Proposed Crossing Option 3
Open Structure - Proprietary Bridge

SCALES	SURVEY GRID	REVISION
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DRAWING NUMBER	/SK03	

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