London Legacy Development Corporation

DECARBONISATION OF DISTRICT HEATING NETWORK

River Water Source Heat Pump - Stage 3

JUNE 2024

CONFIDENTIAL

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River Water Source Heat Pump - Stage 3

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ACRONYMS

Acronym	Meaning
AOD	Above Ordnance Datum (mean sea level)
ASHP	Air Source Heat Pump
BMS	Building Management System
CIBSE	Chartered Institute of Building Services Engineers
CoP	Coefficient of Performance
CP1	CIBSE Code of Practice 1 for Heat Networks
DH	District Heating
DHW	Domestic Hot Water
DNO	Distribution Network Operator
ESCo	Energy Services Company (or equivalent) that is the operator and heat supplier
GWP	Global Warming Potential
HTHW	High Temperature Hot Water
HV	High Voltage
kW	Kilowatt
kWh	Kilowatt-hour
LTHW	Low Temperature Hot Water
LLDC	London Legacy Development Corporation
LV	Low Voltage
M&E	Mechanical and Electrical
MCWS	Mains Cold Water Supply
MEP	Mechanical, electrical and public health systems
MW	Megawatt
MWh	Megawatt-hour
O&M	Operation & Maintenance
PCS	Plant Control System
QEOP	Queen Elizabeth Olympic Park
RIBA	Royal Institute of British Architects
SH	Space Heating
SHC	Simultaneous Heating and Cooling
SLD	Single Line Diagram (Electrical)
VSD	Variable Speed Drive
WSHP	Water Source Heat Pump

1 INTRODUCTION

1.1 BACKGROUND

Bring Energy, through their subsidiary company East London Energy (ELE), have a 40-year Concession Agreement with Stratford City Developments Ltd and the London Legacy Development Corporation (LLDC, previously the Olympic Development Authority) to finance, design, build, operate and maintain district heating and cooling networks for the Queen Elizabeth Olympic Park in east London. This was established for the 2012 Olympic Games and will support legacy developments being built in this area from 2012 to 2053.

The district energy network comprises two purpose-built energy centres, with heat being generated by means of gas fired CHP, biomass boilers and gas boilers. Over 18km of buried pipework is installed to distribute heat to the developments. Energy centre construction began in October 2008 with all major plant items installed by March 2010. The concession agreement provides an area of exclusivity to Bring Energy for the term of the agreement. The concession agreement sets out the terms whereby heating and cooling is supplied to consumers, regulates connection and operational charges and requires carbon savings to be delivered compared to other conventional energy sources. Within this defined area, developments must connect to the district heat network at pre-agreed pricing.

Bring Energy are undertaking a broad assessment of the routes to decarbonisation of the Queen Elizabeth Olympic Park (QEOP) district energy network. As part of this work, during 2023 WSP were commissioned to assess the options for deploying:

- air source heat pumps (ASHP) at the Westford Shopping Centre next to the Stratford City Energy Centre, and
- water source heat pumps (WSHP) and air source heat pumps (ASHP) at Kings Yard.

A report detailing this assessment was issued in July 2023 (report reference 70103370-R004)

These works (being undertaken on behalf of LLDC) follow on from that study and are a further development of the system that will connect the Kings Yard Energy Centre to the River Lea in support of a future WSHP system. It forms the output of a RIBA Stage 3 design process, the first part of which culminated in an earlier report (0143-WSP-XX-XX-RP-ME-0001); this report expands on those works to provide further information and detail.

This report should be read in conjunction with the associated structural, environmental and planning reports produced as part of the same package of work.

1.2 SITE DETAILS

The Kings Yard Energy Centre is located at the west edge of Queen Elizabeth Olympic Park. The site is bounded to the west by the River Lea navigation (Canal); to the north by the Network Rail Stratford to Willesden Junction rail line; to the south by White Post Lane / Carpenters Road and to the east by an electrical substation.

The River Lea is approximately 250m to the east of the Kings Yard site.

An aerial view of the site is shown in Figure 1-1 below.

Figure 1-1 - Kings Yard Energy Centre Aerial View

2 PROJECT BRIEF

The project brief included in the specification for this package of works was as follows.

This report relates to Stage 2 of these works, with the earlier report (0143-WSP-XX-XX-RP-ME-0001) covering Stage 1.

2.1 MAIN PROJECT BRIEF

The project will develop the potential for a River Lea WSHP taking the current concept and developing it to RIBA stage 3 across mechanical, electrical and structural disciplines.

It is expected that the design working closely with EQUANS team will be future proofed to enable the implementation of EQUANS long term vision shown in Figure 4.

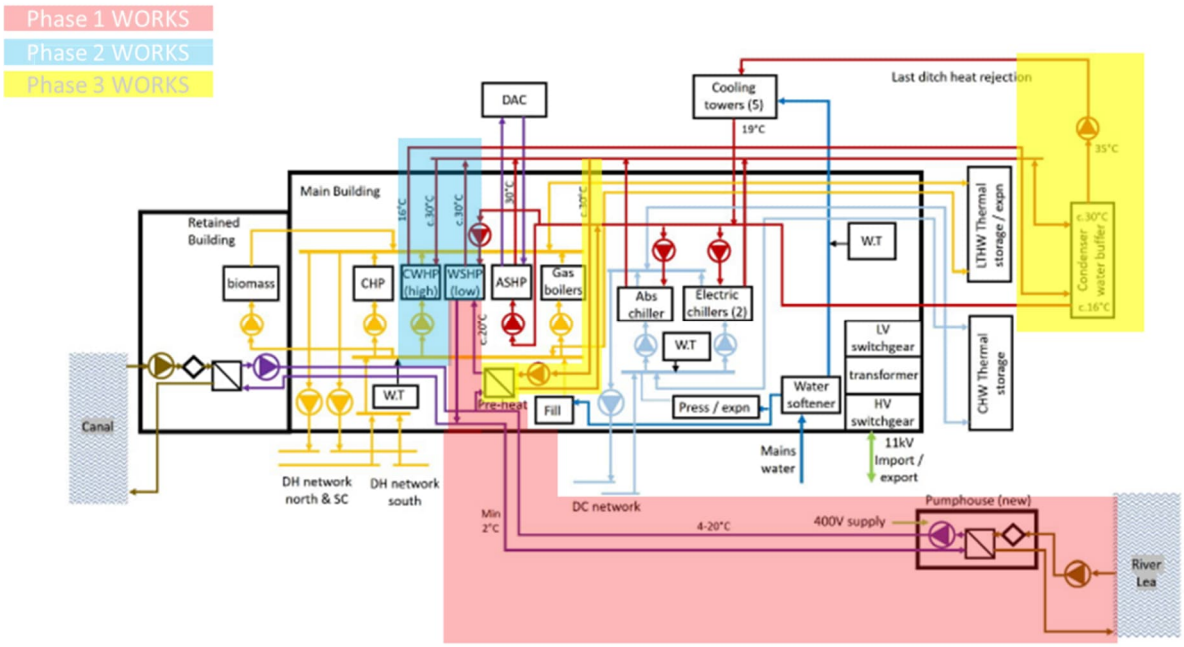


Figure 2-1 - Figure 4: Concept Design of the Long-Term Vision of the King's Yard Energy Centre

[Please note that that the indirect solution coupled to two separate stages of heat pumps shown in Figure 2-1 and included within the brief is no longer being progressed; the proposed system would be direct with a single stage of heat pumps.]

We expect the work to be undertaken in two stages. The two stages of the work are outlined below along with the key activities that the selected service provider is expected to undertake.

Stage 1: Refinement of RIBA stage 2 design and pre-design work

i. *Evaluate the direct connection of the heat pump to the river using an integrated two stage heat pump including locations for the pumphouse considering land ownership;*

ii. *The basis of design is to utilise the same or similar heat pumps identified in the WSP study document or if any other solution(s) are selected that this equipment is clearly identified and detailed data sheets provided.*

iii. *Develop value engineering options to minimise capital and operational cost associated with the pumphouse.*

iv. *Refine design information (peak flow, annual flow rates etc) in support of licence application*

v. *Refine and issue pre-app for EA abstraction and discharge licences.*

vi. *Consider and advise on any pre planning works / engagement requirements prior to RIBA 3 scope.*

vii. *Discussion of pros & cons around direct connection to the river versus indirect*

viii. *Desktop geotechnical investigation/study of earthworks.*

ix. *Liaising with EQUANS and key stakeholders to refine and select final concept design option.*

With regards to point i, the previous work suggested that only a single major manufacturer could supply a WSHP capable of accommodating filtered canal/river water directly. We would want to understand whether additional suppliers could be identified, and ultimately make a decision on whether to shortlist a direct or indirect solution. Currently, a direct solution is seen as preferrable by EQUANS Technical team through the project this should be confirmed.

With regards to point ii, the concept design for a direct connection is shown in Figure 5. The service provider is expected to optimise the design to reduce capital and operational cost. Options could include the use of a submerged abstraction pump (i.e. no additional pump above ground) or relocating the pump above ground to the existing energy centre.

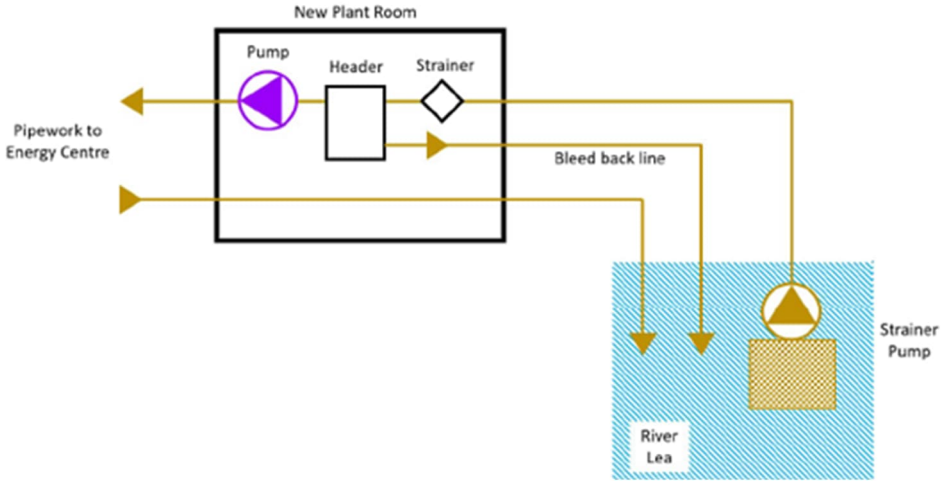


Figure 2-2 - Figure 5: Pumphouse concept design

Stage 2: Water abstraction and discharge system

Develop the concept design of the water abstraction and discharge system to RIBA stage 3, and identify and incorporate value engineering opportunities. It is envisaged that this stage will include the following activities (although some activities may be undertaken in advance of the decision gateway meeting before Stage 1 and Stage 2):

1. *Final equipment selection(s) for WSHP solution to be presented for considered in design for the energy centre works based on the performance requirements and this design.*
2. *Surveys including a bathymetric survey of the river in the selected location and topographic and utility surveys of the riverbank and potential pipe route confirm where pipe work runs.*
3. *Assessment of subsurface infrastructure / utilities located on the riverbank potential pipe route to the energy centre, and available location(s) for infrastructure.*
4. *Stakeholder engagement with for example the Environment Agency and Local Planning Authority (LLDC PPDT)*
5. *Details of the landside infrastructure requirements including for example scale, options for screening, access requirements with a focus on visual impact.*

- *Abstraction and discharge pipework route/s*
- *Liaising with stakeholders to Identify pumphouse location*
- *RIBA stage 3 design of abstraction and discharge system, including controls, mechanical and electrical connections of the pumphouse to the energy centre and the pumphouse equipment*
- *A concept design of the pumphouse with a focus on spatial requirements in advance of a full RIBA stage 3 structural design of pumphouse*

2.2 ADDITIONAL DETAIL

Following on from Stage 1 of these works, WSP were instructed to proceed with the design of a direct type system whilst ensuring that the riverside plant room was to have consideration for space for the equipment required for an indirect solution.

The direct type system was selected because it would result in higher operating efficiency (with associated lower operating cost) and longer operating hours. However, there are some downsides (including the fact that it seems that only one supplier can provide heat pumps that can act in a direct way), which is why the space required for an indirect system has been allowed.

3 SYSTEM DESIGN

3.1 SYSTEM OPERATING CRITERIA

3.1.1 SYSTEM OUTPUT

The 2023 works undertaken for Bring Energy suggested a 6MW maximum system output would be feasible for this system, and the brief for these works requests a maximum system output of the same figure. It should be noted that the schematic and layout drawings completed under the 2023 scheme reflected a 3MW system (as the scheme was presented as an alternative option to the proposed 3MW Canal scheme). As a result, the plant requirements shown are different and more substantial than those required for the previous scheme.

The design detailed in this report is based around the Star Renewables two stage direct ammonia heat pumps as used in the previous study.

3.1.2 SOURCE TEMPERATURE RANGE

As the system is based upon removing heat from the river water, understanding the likely temperature profile is useful for estimating the system coefficient of performance and whether there are any periods during the year when the system may not be able to function as the source temperature is too low.

An estimated temperature profile for the canal is shown below in Table 3.1. This profile has been produced by fitting a sinusoidal curve to the average temperatures of the available data logs, with maximum and minimum profiles being generated to enclose the maximum and minimum temperatures recorded. There are gaps in the recorded data in March, July and August and only one set of recorded data is available, so this information should be treated with caution.

Whilst the lowest canal water temperature listed is 2.9°C, we cannot state with certainty that ice will not form on the river. The systems will be designed and specified so that they are not damaged by ice, but under these conditions they would not operate (in reality, they will stop operating before the river freezes - when unable to extract heat from the water, so at approximately 2-3°C)

Table 3.1 – Canal Monthly Data Profile (°C)

	Average	Minimum	Maximum
Jan	4.1	2.9	10.1
Feb	5.1	3.7	10.9
Mar	8.4	6.5	13.3
Apr	13.4	10.7	17.0
May	18.3	14.9	20.7
Jun	22.2	18.2	23.6
Jul	23.9	19.6	24.9
Aug	22.8	18.8	24.1
Sep	19.4	15.9	21.6
Oct	14.5	11.7	17.9
Nov	9.5	7.4	14.1
Dec	5.7	4.2	11.3

3.2 PEAK FLOW CALCULATIONS

The calculation of the peak flow rate is important for the design of the system, and also the licencing.

The system peak flow requirement will be based around a situation where the maximum system output is provided at the best CoP that could conceivably be encountered. This is because low CoPs result in a higher proportion of the generated heat being due to the electrical energy input into the heat pumps, whereas for better CoPs more of the heat has to be extracted from the river water.

This can be seen in the following table, which uses the CoP data provided by Star Renewables for the previous report and the 6MW system output requested in the project brief.

In addition to the data provided previously, three more operating points have been provided:

- Two system operating points based upon a 30°C source, using estimated data based on information previously provided by Star Renewables.
- A theoretical system with an infinite CoP for context (i.e., the flow rate required if all the heat is extracted from the water).

As previously highlighted, the maximum river water temperature picked up by the data logging was 24.16°C. It would seem reasonable to allow a decent margin over this temperature as the logging available only covers one year. A 30°C figure seems reasonable.

Table 3-2 – Water Flow rates

Heating Flow Temperature, °C	Heating Return temperature, °C	Source inlet temperature, °C	Source Outlet Temperature, °C	CoP	Water Flow rate, kg/s
80	60	5	2	2.95	359.0
80	60	6	3	2.97	359.8
80	60	7	4	3.00	361.8
80	60	8	5	3.05	363.7
80	60	9	6	3.09	366.0
80	60	10.5	7.5	3.14	368.7
80	60	12	9	3.19	371.3
80	60	13.5	10.5	3.25	373.8
80	60	15	12	3.32	376.6
80	70	6	3	2.91	356.6
80	70	10	7	3.04	363.5
80	70	14	11	3.19	370.8
80	70	18	15	3.33	377.0
80	60	30	27	3.87*	402.5*
80	70	30	27	3.74*	397.8*
n/a	n/a	3 degree differential		Infinite	478.4

* - Estimated data

The highest water flow rate for the system therefore looks to be around 400kg/s. This will require further development during Stage 3, but we do not expect this figure to change significantly.

3.3 ABSTRACTION, FILTRATION AND DISCHARGE

Providing a water abstraction and discharge system using the River Lea in this location presents a challenge. The issues to overcome are as follows:

- The water level is substantially below the prevailing ground level, meaning that there is a considerable vertical lift to get the water up to a usable level.
- The riverbed is shallow at the edges and deeper in the middle, which means that extracting at the edge is not practical
- The water level in the river will vary depending on rainfall.

The location of the proposed abstraction / discharge point relative to Kings Yard is shown in Figure 3-1. Detail of the proposed abstraction point is shown in Figure 3-2.

Figure 3-1 – Kings Yard Energy Centre and Abstraction/Discharge Points

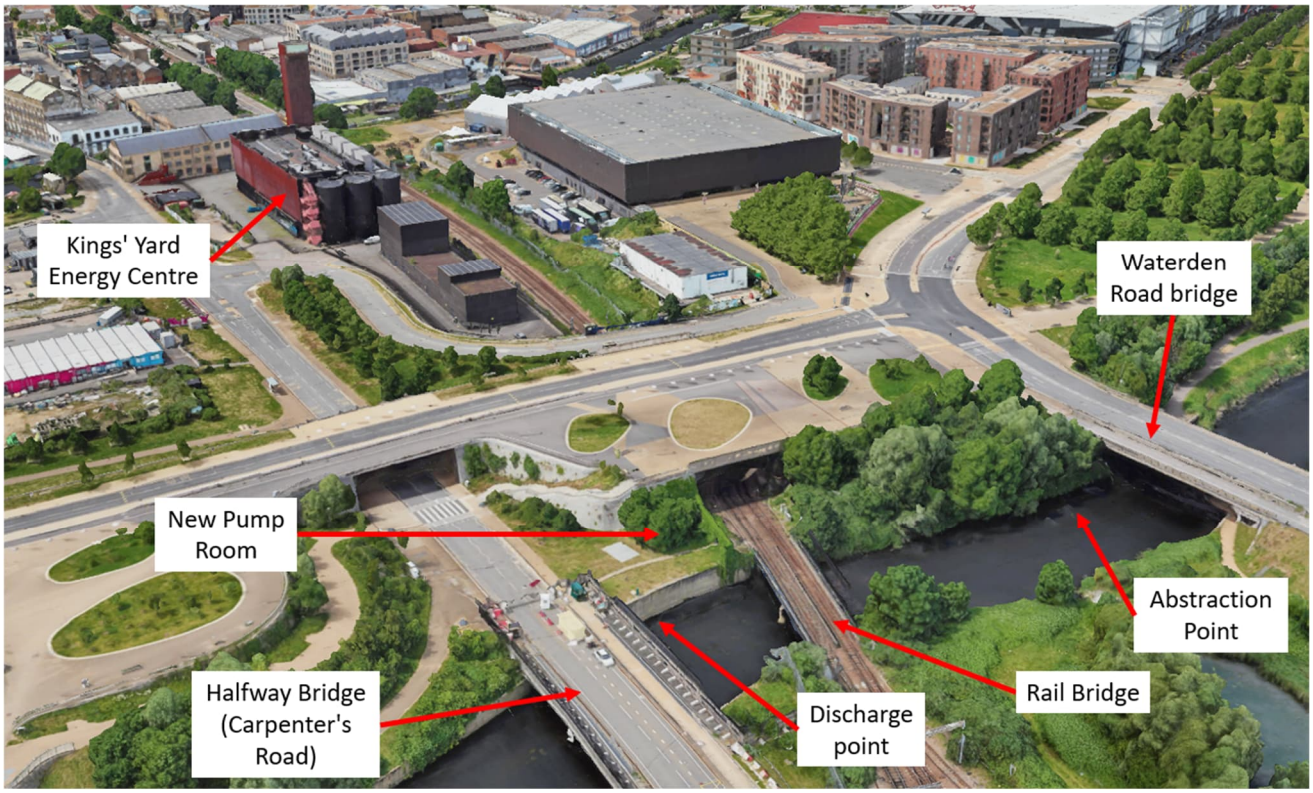
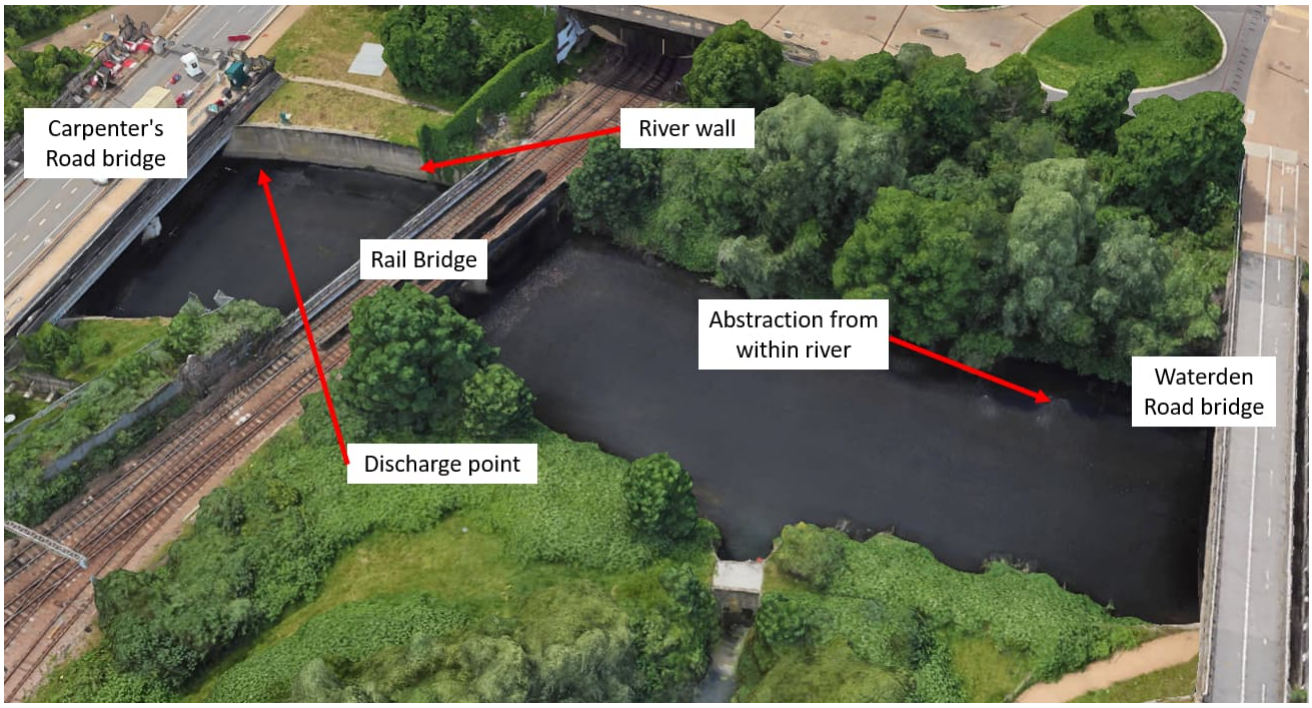


Figure 3-2 – River Abstraction/Discharge Points



A key concern with open loop water systems that require a vertical lift is ensuring that air locks do not occur within the pipework as a result of the water draining out of the system when it is off. Air locks can prevent the system restarting and can be quite difficult to clear. As a result, it is WSP's preference to locate the system pumps so that they have permanently flooded suction rather than relying on priming systems. This results in positive pressures throughout the pipe network as soon as it rises above the source water level and aids air displacement.

In order to achieve this arrangement in this case, the river water pumps would need to be located within the river.

The proposed arrangement would be as follows:

- Intake to be via multiple stainless steel self-cleaning basket strainers fitted with submersible pumps and a continuous backwashing system. These would be Environment Agency Eel Regulation compliant. They would be fitted with a woven steel mesh that will remove any objects down to 2mm. The strainers would be fitted to a sliding frame system that allows them to be withdrawn from the river vertically for maintenance. A jetty would be fitted over the strainer pumps to protect them from damage and bridge the gap between the river wall and the pumps. This jetty would be fitted with access hatches so that the strainer pumps can be pulled vertically upwards through the jetty. The jetty would also be designed so that boats can moor alongside it so that the total mooring area is increased. Similar pontoons are currently positioned downstream of the proposed location.
- Plastic (PE or ABS) pipework from the intake filters along the river bed/wall to a plant room located at ground level.

- Discharge pipework extending from the plant room to a point where re-entrainment back into the intake is avoided. Discharge will be via an open-ended pipe with the end in a permanently submerged location (with the selected depth ensuring that it remains submerged year-round). The open end will be fitted with a screen and would also be surrounded by a fender to prevent damage from boats.

The plantroom would contain:

- Multiple backflushing strainers filtering to 250µm, c/w dedicated backflushing pumps
- Cyclone filters filtering down below 75µm
- Header tank acting as an intake point for pumps that will supply to the Energy Centre, with a bleed back pipe going back to the river so that the river pumps and the second set of pumps do not act in series.
- Pumps (c/w associated inverters) which supply from the header to the Energy Centre and back to the discharge point.
- Control panel.
- Power distribution board.

The pipework between the plant room and the Energy Centre would be plastic to minimise the risk of fouling. Due to this length of pipe being part of an open loop, it would be advantageous to include cleaning points within the pipe run.

The mechanical design arrangements of the system are shown in the following drawings:

- 0143-WSP-XX-XX-DR-ME-0101 Kings Yard – Abstraction and Discharge Layout
- 0143-WSP-XX-XX-DR-ME-0102 Kings Yard – Abstraction and Discharge Details
- 0143-WSP-XX-XX-DR-ME-0103 Kings Yard - Abstraction and Discharge – Energy Centre Layout
- 0143-WSP-XX-XX-DR-ME-0901 Kings Yard – Abstraction and Discharge Schematic

These drawings should be read in conjunction with previous drawing 70103370-M100, which gives the wider context for the system and how it would be integrated into the Energy Centre.

The section shown on drawing 0143-WSP-XX-XX-DR-ME- 0102 is based upon the information provided by the bathymetric survey.

The proposed pipework route from the intake strainer pumps to the new pump room requires the pipework to pass underneath a railway bridge. Network Rail would only need to give permission for this to be installed if it affected the operation of the railway or required affixing something to Network Rail assets, neither of which are proposed. However, it would be beneficial to let Network Rail know what is proposed when the design is complete so that they are aware of it next time they survey the bridge.

3.4 NEW PLANT ROOM

A suitably sized plant room in the location used under the previous works and a nominal pipework route between the new plant room and the Energy Centre is shown on drawing 0143-WSP-XX-XX-DR-ME-0101.

The plant room has been sized for the proposed direct system. However, the area shown for the break tank would be sufficient to turn the system into an indirect system if required, which the tank being replaced by heat exchangers and other more minor modifications being undertaken.

The load placed on the ground by the plant room needs to not cause issues with the river wall. The plant room has been shown as far back from the river as possible to minimise the additional load on the river wall. Please refer to the accompanying Structural Engineering report for further information.

Figure 3-3 – New Pump Room

3.4.1 EXISTING SERVICES IN THIS AREA

LLDC have provided an existing utility drawing (LC810-TAM-UCW-U-DGA-0001 rev P02, dated 12/01/2018). This has been used to generate drawing 0143-WSP-XX-XX-DR-UT-0101 which accompanies this report and shows the services likely to be encountered both in the area of the new plant room and on the route to the Energy Centre. This drawing should however be used with caution as it is based on record information which WSP cannot verify. A survey of the relevant areas

has been discussed with Bring Energy, who will procure it at a later date to provide the additional detail required to set the required depth for the proposed pipework.

There are several existing services around the proposed location, which are as follows.

Foul Drainage

The utilities drawing shows two buried foul drainage runs through the area. Both are shown on Thames Water utilities drawings dating from 2012.

The following information is known about the two foul drains:

- the one on the west is the Olympic Park Primary Foul Drain – this is a 1200mm drain running at about 13m below ground level according to Arup drawing OPS-OAP-ZZ-PSP-DR-D-1-JR1-0001. This runs under several roads, the river and the railway. Access from ground level to this drain will be unworkable due to it being impractical to excavate to this depth without significant implications on the surrounding area so an easement is unlikely to be required. However, any foundations will need to ensure that no damage is caused to the drain.
- The one on the east is shown running through the bridge over Stansted Mill Stream at Carpenter's Road Lock, indicating that it is unlikely to be that far below ground level. This is shown on Atkins drawing UNN-ATK-PWD-UCW-DR-U-5-D1-0514 as being a Sludge Main Diversion. The size is currently unknown.

WSP contacted Thames Water to clarify their requirements in respect of both pipes. They have responded that the usual procedure for building over or within 3m of a sewer would be to apply for a build over agreement. For sewers over 375mm this may require an asset protection impact study which has a cost of £1300 or more and may take up to 28 days to receive from application. An additional legal fee of £550 may also apply.

Surface Water Drainage

There are some significant source water drainage systems in this area. Surface water drains from Carpenters Road and Marshgate Lane to a large concrete tank, and then on into the River.

3.5 SERVICES ROUTING TO ENERGY CENTRE

3.5.1 PIPEWORK ROUTE

The pipework runs from the new plant room, down Marshgate Lane under the Carpenters Road Bridge (bridge L03B). This is shown on drawings 0143-WSP-XX-XX-DR-ME-0101 and 0103.

This location and route will require further development to co-ordinate it with the existing utilities and various structures. The future utilities survey will help with this task.

3.5.2 EXISTING UTILITIES

As well as the previously mentioned drawing 0143-WSP-XX-XX-DR-UT-0101, drawing 0143-WSP-XX-XX-DR-ME-0103 has been produced to cover the Energy Centre end of the system. This drawing incorporates information from the as-built utilities drawings 8516-UEG-KYD-UG-CO-GA-

1001 and 1002. Again, this drawing should be used with caution as it is based on record information which WSP cannot verify.

A survey of the relevant areas has also been procured to provide additional detail.

Based upon the information available, services of note along the nominal pipework route include the following. Additional information is provided in Appendix E.

HV Electrics

3 No HV cables run from the National Grid Substation down Clarnico Lane, under Bridge L03B and over the Carpenters Road bridge. One of these is marked as 132kV; the others are not identified but are likely to be 11kV. The 132kV cable runs on the south side of Carpenters Road; the two others on the north side.

LV Electrics

There are two LV cables running most of the way along the route; one on the south side of Carpenters Road and the other on the north side. These serve street lighting and infrastructure.

Gas

Intermediate pressure pipework of an unknown size is shown running over the Carpenters Road bridge to a governor on the Kings Yard site via two connections (ones sized at 250mm and the other at 150mm).

Low pressure pipework owned by Cadent is shown running to the west of the Marshgate Lane road embankment to Carpenters Road and past Kings Yard. This is a 355mm PE main in Carpenters Road and 315mm PE main running north from Carpenters Road parallel to the Marshgate Lane road embankment. It is shown as running at a nominal depth of 700mm below ground level on the information provided by Cadent.

District Heating

2 No. 400mm district heating pipes run from Kings Yard to Carpenters Road at the Clarnico Lane junction. They run in the pavement on the south side of Carpenters Road and then to the south on the west side of Marshgate Lane.

Surface Water Drainage

There are extensive surface water drainage provisions all along Carpenters Road, most of which runs to the large submerged tank near the proposed Plant Room site. These include all lines marked as SW (Surface water), CD (Combined Drain), CK (Combined Kerb Drain) FD (Filter Drain), SG (Surface Gulley), and LD (Linear Drain).

Foul Drainage

In addition to the two pipes crossing Carpenters Road near the river bridge, there are various foul drains on Carpenters Road on the west side of Marshgate Lane. These are marked FW on the drawings.

Water

Two water main pipes run the length of Carpenters Road from the Kings Yard end to the Carpenters Road bridge and run over the north side of the bridge.

There are also non potable water supplies (for irrigation) in several places along Carpenters Road (marked NPW).

Communications

Communications systems owned by EU Networks, Neos Networks and Zayo Group can be found in Carpenters Road and Clarnico Lane.

Other Items

It should be noted that there is a Radiological Deposit Cell underneath the road on the south approach to bridge L03B. This is covered by Atkins report 87216/TR/053. We are not intending that pipework should be installed near this cell.

3.5.3 ALTERNATIVE OPTIONS

3.5.3.1 Alternative Pipework Route

As outlined above, the nominal pipework route has an abundance of significant services running along the same route, and this may make it difficult or impossible to adopt this course for the pipework.

An alternative route would be for the pipework to exit the plant room on the west side, run up the gabion wall, across underneath the pavement area and road (this appears to be made ground so this should be possible), down the gabion wall towards Clarnico Road and around the edge of the National Grid compound.

This route seems to present less risk in terms of existing services. However, there are other concerns:

- There are significant changes in height along the route; this is not ideal for an open loop system as it makes airlocks more likely
- This route is likely to require more bends in the pipework, increasing the risk of silt deposits in the system
- The Clarnico Road area is to be developed in future under the Sweetwater scheme, and this has an impact on the viability of the route.
- The route passes through an area where the London Borough of Hackney own the freehold (although LLDC have a leasehold). Please refer to section 6.1 for further information.

Figure 3-4 shows an excerpt from a planning drawing submitted for the Sweetwater scheme. This shows the scheme extending right up to the railway and National Grid fence lines. Running the pipework via this route would therefore have an impact on the proposed scheme. It may be possible for the pipework to run down the gabion wall close to Carpenters Road and then run down Carpenters Road, but this perhaps does not present that much of an advantage over the nominal route.

Figure 3-4 - Excerpt from drawing EWS2-S-LUC-04-XX-DG-L-90401

3.5.3.2 Alternative Plant Room Location

A secondary plant room location would be to the north of the railway line. This has advantages in terms of being less congested with utilities and there being more available area. However:

- The area is heavily sloped and covered in trees
- Access for plant installation/maintenance will be more difficult
- The pipework routing would need to be as per the alternative route listed above
- Rather than being owned by LLDC, the area is on a long term lease to LLDC from the London Borough of Hackney (see 6.1 below)

3.6 FILTRATION SYSTEMS

Three levels of filtration are to be provided, which are as follows.

3.6.1 INTAKE STRAINER BASKETS

Five stainless steel self-cleaning basket strainers fitted with submersible pumps would be installed in the river, mounted on a framing system.

The design is based around Rotorflush units on an N+1 basis.

The units are Environment Agency Eel Regulation compliant. They would be fitted with a woven steel mesh that will remove any objects down to 2mm. The strainers would be fitted to a sliding frame system that allows them to be withdrawn vertically for maintenance. The intake strainers will be fitted at a depth that ensures that they are always fully immersed. They will be fitted with an integral backflushing system, with the units constantly backflushing to prevent debris build up.

The pumps fitted to the baskets are to be fully submersible units designed to deal with the debris as least as big as that which might come through the 2mm screen. The materials used in their construction will generally be graphite or chromium cast iron suitable for an abrasive environment. They will be electrically connected to the main body of the strainer basket which will be fitted with sacrificial anodes to protect them from corrosion. The pumps will be three phase and supplied complete with the submersible cable.

The river water pump control will be variable flow and will ensure that a differential of 3-4K is maintained between the intake and discharge in order to minimise pumping energy whilst ensuring that the temperature differential between the intake and discharge does not exceed 5K. Under normal operation all the units would be used, with individual units being manually isolated when undergoing maintenance. Refer to section 3.14.5 for further details of the controls.

Figure 3-5- Rotorflush RF800LW Based Strainer Pump Unit

The connection from the pump to the pipework running up the river wall could either be an auto coupling type connection (which is self-sealing when the strainer is in position and unlocks when it is raised; they are also known as duckfoot connections) or a flexible connection. The connection from the backflushing system to the intake strainer would normally be flexible.

A jetty would be fitted over the strainer pumps to protect them from damage and bridge the gap between the river wall and the pumps. This would be fitted with access hatches so that the strainer pumps can be pulled vertically upwards for maintenance. It would also be designed so that boats can moor alongside it so that the total mooring area is increased. Similar pontoons are currently positioned downstream of the proposed location; it is anticipated that the new jetty would be of a similar design.

Figure 3-6- Existing Pontoons

Plastic (PE or ABS) pipework will extend from the intake filters to a plant room located at ground level. This pipework will be submerged in the river for most of the route and held in place with concrete weights.

Within the plant room, the intake pipes connect to a common header serving the fine filters.

3.6.2 FINE FILTERS

Three fine grade filters will be provided, with each unit capable of dealing with 50% of the peak flow rate (N+1). The design is based around Dango & Dinenthal units. Under normal operation each unit will be operating. The units are fitted with mesh filtering down to 250µm. The filters will undertake an intermittent backwash when the pressure differential across the units exceeds a predetermined maximum (an alternative would be to base the backflush on a fixed operating time). The backwash discharge from these filters will be combined and piped back to the river.

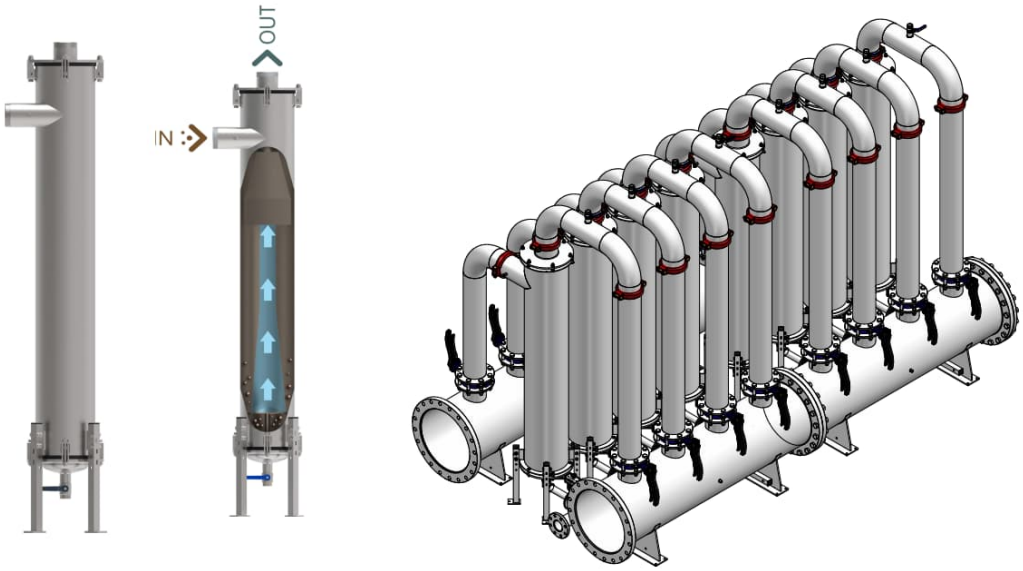
The filters will rely on being provided with a pressure of around 2 bar at the inlet in order to backflush correctly. The controls system will ensure that this is generated (using the dedicated pumps and a pressure sensor located on the backflushing supply) whenever backflushing needs to occur. A filter control panel will be provided by the filter manufacturer and will be interfaced with the controls system to that the status can be monitored on the head end.

Figure 3-7- D&D DDF400 Filter

3.6.3 CYCLONE SEPARATORS

After the fine filters, 8 No. cyclone separators will be provided to filter down to 75 microns (some smaller particles will also be removed). These units have no moving parts and will further reduce the level of debris in the water before it is passed on to the secondary system running to the Energy Centre.

Figure 3-8- JMF Twisterfil Cyclone Filters



The cyclone filters are intended to reduce the silt carried into the tank an onwards into the pipework supplying the Energy Centre.

carryover in the system and further reduce the silt dropping out in the header tank and in the pipework as part of direct connection mitigation. This will help reduce erosion of the system pipework and also reduce maintenance costs.

3.6.4 DISCHARGE POINT

The discharge back to the river will be via an open-ended pipe below the waterline. A fender will be provided around the pipework to prevent damage by boats or other watercraft. An actuated valve on the discharge line at the point that it exits the plant room is to be controlled so that it opens and closes in sequence with the river water pumps to prevent the possibility of water falling out of the system when it is not operating and airlocks forming. A simple open/close valve will be used for this purpose; as both ends of the system are fully submerged and pumps operate under pressure, it will remain fully flooded. The open end will be fitted with a screen and may also be surrounded by a fender to prevent damage from boats.

3.6.5 METERING

The river water system will be subject to certain conditions for abstraction and discharge. The most important function of the controls system will be that these terms should not be breached (and this must be able to be demonstrated), whilst also minimising energy use and maintaining the correct heating system conditions.

Flow and temperature monitoring will be fitted to the open loop system to allow the data required by the Environment Agency to be collected. Flow meters and their installation shall be MCERTS certified and approved by the Environment Agency.

3.7 FINE FILTER BACKFLUSHING PUMPS

The fine filters backwash to remove debris only when required rather than continuously. They require a minimum of 2 bar at the inlet to undertake backflushing at a volume of 21l/s. Dedicated run and standby pumps for fine filter backflushing are to be provided, with each capable of delivering the required flow and pressure by itself.

3.8 HEADER TANK

The header tank within the new plant room forms a break between the lifting system located in the river and the pump set pumping the water to the heat pumps in the Energy Centre. The system will need to be configured and operate in a way that ensures that there is always sufficient water in the tank to serve the flow to the Energy Centre and the demand being placed on the Heat Pumps. The size of the tank is therefore a function of the operating relationship between the pumps in the two systems. The tank is sized to be able to store 60 seconds worth of full system flow.

Whilst the three levels of filtration will remove any debris that might be a problem for the heat pump heat exchangers, it is to be expected that some silt may get as far as the tank. The tank therefore needs to have straightforward maintenance access to allow this to be removed, and a drain to allow any water in the tank to be drained before maintenance takes place.

As the aim will be for the river strainer pump flow to match or very slightly exceed the secondary pump set, there is a need for a bleed-back line to discharge water back to the river – this is effectively an overflow.

Based upon these requirements, it is intended that the tank will be either a sectional GRP, HDPE or stainless steel tank. It will be fitted with access hatches for cleaning. Internal baffles will be fitted to encourage silt to settle in specific readily accessible areas and prevent swirling inside the tank that might affect the intake for the secondary pumps.

3.9 SECONDARY PUMPS

The secondary pumps supply water from the break tank to the Energy Centre and will need to be rated to deliver the design flow and pressure. Given the water being used is from the river, construction is likely to be stainless steel (grade 1.4401 or similar) with seals and impellers suitable for dealing with fine silt. It is expected that they would be long coupled horizontal units so that motors can be replaced without draining the system down.

Given the size of the pumps and motors, it may be beneficial to provide a lifting beam across the pumps to allow replacement parts/pumps to be moved around within the plant room.

3.10 PIPEWORK

3.10.1 PIPE SIZING

The size of the system pipework is affected by:

- The maximum system flowrate
- The maximum acceptable pressure drop
- The wish to keep the system velocity high enough to maintain self-cleaning where possible.

As outlined previously in this report, the maximum system flow rate looks to be around 400kg/s.

Due to the likelihood of silt and other very small debris being drawing into the system, velocities should be kept reasonably high to try to prevent this silt settling within the pipework. BSRIA BG29 2021 suggests that debris smaller than 5mm can be flushed out of larger size (e.g. 300mm) pipework by velocities exceeding 1.4 m/s. Therefore, the maximum flow rate should meet or exceed this velocity to ensure that the system spends at least some of the time in this range.

It is desirable for systems of this type to keep pressure drops below 200Pa/m. In practice, this pressure drop relates to a system velocity between 2 and 3m/s for the pipework sizes and materials being considered.

Based on these criteria, the pipework between Energy Centre and the pumping station is expected to take the form of 1 No. 560mm pipe in each direction (flow and return). This would result in a maximum velocity of 2.441m/s and pressure drop of 130Pa/m.

3.10.2 PIPEWORK INSTALLATION

Installations will be carried out using pipework manufactured from polyethylene of grade PE 100. All pipework and fittings used shall be SDR11 and rated at PN16 or higher. All pipework shall be coloured black. All pipework and fittings shall be from the same manufacturer to ensure compatibility.

All pipework and fittings shall be manufactured in compliance with BS EN 12201.

Pipework shall be jointed using the approved butt or socket fusion welding procedure carried out by suitably trained competent personnel and in accordance with the pipework manufacturers approved installation method. All welds are to be undertaken the correct clamping method to ensure roundness and full depth insertion into fittings. No threaded fittings are to be used.

All welding that be carried out in accordance with BS EN 13067:2020. Plastics Welding Personnel. Qualification of Welders - Thermoplastics welded assemblies.

Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the Quality Control records.

All fittings shall be suitable for use as pressure conduits and nominal burst values of three and one-half times the pressure rating of the pipe.

The butt fusion procedures shall be in accordance with the manufacturer approved method. The fusion equipment operator shall receive training using the recommended procedure. The Contractor shall be responsible to verify that the fusion equipment is in good operating condition and that the operator has been trained within the past twelve months. Fusion beads shall not be removed.

The supplier of the pipe and fittings shall provide a qualified butt fusion technician for the training of the contractor's personnel.

The pipework installed as part of this system does not need to be insulated. Under low temperature conditions, the ground temperature will tend to be higher than the river water which will be beneficial. For the sections from the intake strainers to the break header tank, all the pipework above the waterline will drain down under low temperature conditions to prevent damage through freezing.

3.10.3 PIPEWORK CLEANING

As a direct system, there is a risk that debris will be drawn into the pipework. The system where this poses the biggest problem is the pipework between the new plant room and the Energy Centre. As far as possible, the quantity of debris should be minimised, prevented from settling and methods for removing it should be developed.

The following elements of the design address this risk:

- Three grades of filtration (2mm, 250µm and 75µm) upstream of the pipework
- Header tank acting as settling tank for the water in advance of being pumped into the pipework
- Pipework sized to ensure that the velocity is kept up to prevent settling
- Flushing connections provided at either end of the pipework (c/w flushing bypasses) to allow it to be flushed out or for ice pigging to occur; a further point may be added in the middle of the system depending on further development/routing at Stage 4.

There are also advantages to minimising the number of bends in the system; this will be considered as part of the final pipework routing.

3.11 ELECTRICAL

WSP have identified that with liaison between the appointed Contractor and the local District Network Operator (DNO), who is UK Power Network (UKPN) in this area, that a new final joint can be connected onto the existing passing HV main that is currently installed. An application has been completed and submitted to UKPN and shared with LLDC. A responding budget letter covering works and costs has been received back from UKPN (16/04/24, ref 8600031172 / QID 3000049765); this has been shared by WSP and is included as Appendix I.

This would require a point of connection being made onto the existing Supply Cable Feeder Group from Kings Yard Main Substation and a 500kVA supply provided to a new 800kVA package sub-station, as provided by UKPN and installed adjacent to the proposed new plantroom.

This new packaged sub-station would be connected into the local HV main.

All civil works within the site boundary, including the sub-station base and any supporting structures where applicable, and the excavation/reinstatement of cable trenches would be carried out by the appointed Contractor. UKPN would then terminate directly the new customer supplied submain cable(s) from the new sub-station (800A/630A MCCB) transformer switchgear and into the new utility meter adjacent to the LV Panelboard inside the new plantroom.

NB: For further details on policy and connection from UKPN, refer to UKPN document eds-08-2100-lv-customer-supplies.

The new LV panelboard that will serve all the mechanical plant and associated equipment will be a 400V, 630A Triple Pole & Neutral MCCB type board, with local metering at the main panelboard. This has been sized based on the loads provided within the Mechanical Schedules found in Appendix D – Equipment Schedules at the end of this report.

New multi-core SWA cables will be installed by UKPN from the transformer to the utility meter adjacent to the LV panelboard. These cables will be buried direct in the ground before entering a dedicated in-ground ducting network that passes into the plantroom. The cable(s) will then rise onto a ladder rack containment or tray system and route to UKPN's MCCB cubicle. Single core cables installed within lidded trunking will connect from the UKPN MCCB cubicle to the new LV panelboard.

The new incoming ducting will be a minimum of 125mm internal wall diameter LV uPVC rigid ducts (no. of ducts and final size requirement tbc with the UKPN). The appointed Contractor is to liaise with UKPN to determine the required spacing and works required for the new supply. Most DNO's require any services that are to be buried to be in line with NJUG6 requirements. This can be clarified with UKPN. This will also rely upon a Section 50 licence being gained for the cables. This will ensure that there is a record of the cables as a 3rd party asset on public highway. We understand that this procedure is already being undertaken for other items like security infrastructure. A Section 50 licence may well also be required for the river water pipework. Tower Hamlets will also need to be kept informed of the design proposals.

The arrangement of the new incoming supply cable(s) is shown on drawings 0143-WSP-XX-XX-DR-EE-0901 and -0902.

As an alternative option, a supply from the Kings Yard Energy Centre can only be considered further once additional details about the electrical switchgear characteristics have been determined; for example, the type and size and spare capacity of the existing load centre that would supply this element of works. These works would fall within the much larger electrical reconfiguration works required to support the two 3MW heat pumps and is outside of the scope of this report but was discussed during the 2023 works (see section 5.7 of report 7010337-R004).

3.11.1 CONTAINMENT

New proprietary containment will be installed within the new plantroom in the form of Medium Duty Return Flange (MDRF) perforated cable tray with supplementary lidded trunking, basket, and tray to deliver the local lighting, small power (& data if required), fire alarm and any ancillary services required.

The containment is to be sized as indicated on the containment layout and will be appropriate for the service it is serving as well as having a built-in spare capacity of 20% as minimum for potential future works.

All containment including, conduits will be hot-dipped galvanized in finish.

3.11.2 SMALL POWER

Small power systems in the form of either metal clad twin switched socket outlets or Masterseal IP rated sockets will be installed within the plantroom space.

Local 3-phase rotary isolators are to be installed to suit the requirements of the mechanical plant and equipment. Power supplies that are located outside of the new plantroom, e.g. adjacent to the strainer pumps on a pontoon along the riverbank, are to be appropriately IP rated (IP68) and enclosed within a weatherproof enclosure, unless termination allows for a direct connection. These external pump supplies will be routed in parallel with the main water pipework in the riverbed via a ducted system that is appropriately sealed at both ends.

Refer to WSP drawing 0143-WSP-XX-XX-DR-EE-0901 for additional details.

Single phase/3-phase commando sockets are to be provided in line with the details shown in the mechanical equipment schedule.

Switched and unswitched fused connection units may also be required for low-load extract fans and other items as the design develops.

The electrical installation will be installed in line with the latest amendment of the 18th edition IET wiring regulations.

RCD/RCBO overcurrent protection is to be provided to the power installation where applicable.

Wiring is to be carried out in 6491B singles cabling with radials and rings to be wired at a size of no less than 4.0mm² unless stated otherwise on DB schedules or layouts / schematics.

Communications

A new communications line/data service will be provided to the new plantroom from one of the local network providers in the area. These are EU Networks, Neos Networks and Zayo Group, and the existing services can be found in Carpenters Road and Clarnico Lane. A new communications system for mechanical plant and equipment, including the BMS controls system, can be installed to monitor and maintain the systems.

The network Specialist will provide an externally graded Optical Multi-mode fibre cable to a local data hub located within the new plantroom. This cable should be either OM3 or OM4 graded due to the potential long route to the required site location, however it will be down to the network Specialist to determine the type and size of the cable required for this site to achieve a working and compliant communications system.

3.11.3 LIGHTING AND EMERGENCY LIGHTING

A new lighting system is to be installed to meet the requirements of the relevant IET 18th edition wiring regulations and is to adhere to the guidance provided in the specific CIBSE Lighting Guides and SLL code for lighting.

Surface mounted linear IP rated luminaires are to be installed to the new plantroom with separate standalone lights for the emergency systems.

Final exit illumination in the form of maintained exit signage is to be provide above any perimeter/exit doors from the plantroom space.

An emergency lighting system is to be installed to meet the requirements outlined in BS5266 and the lighting levels to suit the guidance as provided in the CIBSE Lighting guides.

RCD/RCBO overcurrent protection is to be provided to the lighting installation where applicable.

Wiring is to be carried out in 6491B singles cabling with radials wired at a size of 2.5mm^2.

Local emergency key switching will be provided adjacent to the distribution board within the new plantroom space for testing.

3.11.4 FIRE ALARM

A new fire alarm and detection system with category 'P' coverage, is to be provided to the plantroom (Liaison with the Building Control Officer will determine exact requirements). A stand-alone system in the form of a 2-loop panel will be installed on the wall space adjacent to the main entrance doors. This will be confirmed by the fire strategy.

The new fire alarm system will be in the form of combined smoke/heat detector sounders with VADS (Visual Aid Device), final exit manual call points/ break glass units and any interfaces required for the mechanical plant and equipment.

3.11.5 ANCILLIARY SERVICES

A new externally/internally mounted CCTV system and Security Alarm system with local PIR sensors and sounder devices, will be installed to provide suitable coverage and security to the new plantroom. This system will be linked to the clients preferred local head-end/master station (externally located) or if preferred can be via an Alert Response Centre (ARC). This is sometimes known as a BT Openreach Redcare System where raised alarms can be monitored, and action taken where required.

Approved Specialist Contractors will be appointed to carry out a supply, install and detailed design for the required works.

A BMS control panel is to be provided locally within the plantroom space. The size and type will be confirmed by the mechanical team as the design progresses through to RIBA stage 4.

3.11.6 LIGHTNING PROTECTION

A Lightning protection system will be provided as required by the risk assessments carried out in accordance with BS EN 62305. Risk assessment to be carried out by the specialist contractor.

The lightning protection system will be provided in accordance with BS EN 62305 by the specialist taking into consideration buried services to prevent detrimental influence, ground conditions to obtain suitable earth measurements.

All metallic roof terminals for ventilation, man safe system, metal drainage, etc. will be bonded to the system.

The lightning protection system is to utilise the building fabric (steel structure if applicable) as part of the installation with additional tape connections being installed as required. For steel framed

elements the steel columns will be utilised as down conductors, linked to the air termination at high level and to the ground earth pit terminations at low level.

Where earth terminal pits are provided, located around the perimeter of the building they shall be complete with an accessible disconnection test joint within the pit. The final 2m of down conductor will be mechanically protected.

Surge protection devices (SPD) will be provided at the origin of the supply installed within the panelboard/distribution board to comply with the requirements of BS7671 18th edition.

3.11.7 EARTHING AND BONDING

All new mechanical plant and equipment and the associated electrical installations are to be appropriately earthed and bonded to the plantroom structural steel work. Any separate CPCs are to be connected to an earth referencing bar adjacent to the main LV panel board and externally wall mounted and clearly labelled.

3.12 RESILIENCE

System resilience is generally based upon meeting an N+1 requirement.

- It is proposed to use 5No. Rotorflush intake strainer pumps (4 will cover the whole duty).
- 3 No. fine filters have been shown; 2 will cover the whole duty.
- 2 No. backflushing pumps have been shown; 1 will cover the whole duty.
- 8 No. cyclone filters have been shown; 7 will cover the whole duty.
- 3 No. pumps serving the circuit from the new pump room to the Energy Centre. 2 will cover the whole duty.

3.13 PLANT ROOM ENVIRONMENT

Any source water plant room is likely to be quite a moist and cold space due to the nature of the activities. It can also contain chemicals for cleaning the systems which can be detrimental to both the plant and occupants.

Ventilation needs to be provided to the space in order to prevent the build-up of high humidities and corrosive/harmful gases from system cleaning. A small extract fan will be provided on this basis.

Equipment installed in the pump room shall be rated for marine use and resistant to corrosion in damp environments.

Floor drains will need to be provided so that water used during cleaning or water ejected from the system during venting can be safely disposed. The floor should be installed to fall towards the drains. Thes drains will discharge to the nearby surface water systems which discharge to the river. Signage will be provided within the pump room to state that the drains shall not be used for the discharge of chemicals. Unless the system is changed over to an indirect version, then the only situation that will require these drains is draining the river water in the system when conducting maintenance.

No chemicals are anticipated to be required as part of a direct system. However, if the system was changed to be come indirect, it would be expected that cleaning chemicals would be used to clean the heat exchangers (these commonly include caustic and phosphate-based cleaners). These are commonly combined and heated in a Clean in Place (CiP) system which heats them up and pumps them through the heat exchangers. CiP systems require an electrical supply; this has been included in the design. Once cleaning is complete, the chemicals would be taken offsite and neutralised for disposal.

The plant room floor shall be waterproofed to prevent damage from water and cleaning chemicals.

Control panels shall be positioned well away from any pipework and well clear of the floor to prevent risk of damage from water.

3.14 CONTROL STRATEGY

3.14.1 INTRODUCTION

The system will be subject to certain conditions for abstraction and discharge. The most important function of the controls system is that these terms should not be breached, whilst also minimising energy use and maintaining the correct operating conditions for the Heat Pumps.

3.14.2 EQUIPMENT

A local control panel will be provided within the new pump room, interfaced with the existing Kings Yard controls system and configured as part of the future heat pump system installation.

Sensors and control valves will be suitable for a seawater environment.

Flow metering shall be via internally lined electromagnetic meters suitable for the source water environment. The meters shall not have any internal obstructions to water flow.

Flow meters shall be MCERTS certified and approved by the Environment Agency, meeting the accuracy standards set out in the MCERTS documentation. The installation will also be MCERTS certified.

Flow meters shall output the flow rate and total flow volume to the controls system to allow the required abstraction data logs to be generated.

3.14.3 SYSTEM ENABLE/DISABLE

The system is to be enabled and disabled as part of the wider Heat Pump system. The master enable for the systems will come from a central heat demand, and withdrawing this demand will disable the system.

3.14.4 LEAK DETECTION

Leak detection will be undertaken using the three flow meters; no specific water leak detection (i.e. copper electrode system) will be installed. The three flow meters are as follows:

Table 3-3 – Water Flow rates

Reference	Function
WM1	River Water Main Flow
WM2	River Water Bleed Back Line
WM3	River Water Main Return

The controls system will compare the intake figure measured by WM1 with the combined discharge figure (WM2+WM3), with a suitable margin of error; the margin may depend on the meters used but would be expected to be 10% or less.

This will allow large leaks within the system between the new pump room and the energy centre to be discovered. Smaller leaks, or leaks between the strainer pumps and the new pump room would not be detected by this method.

3.14.5 PUMP AND SYSTEM FLOW CONTROL

The control of both the strainer pumps and secondary pumps will be variable flow and will ensure that a maximum differential of 4°C is maintained between the intake and discharge in order to minimise pumping energy whilst ensuring that the temperature differential between the intake and discharge does not exceed 5°C.

Exceptions to this 4°C rule resulting in smaller temperature differentials are:

- when the source water pump that is running reaches minimum flow, or
- when the discharge temperature when in heating mode drops towards 0°C, in which case the pump/pumps shall ramp up to maintain the discharge above freezing at all times, or
- when the discharge temperature when cooling rises towards the licenced maximum, in which case the pump/pumps shall ramp up to maintain the discharge below this maximum at all times.

The system is designed to be able to run at full flow/load at a 3°C temperature differential. If the differential reduces below 3°C, then the capacity will reduce accordingly. This should only ever occur when running at part load, so it is not a problem.

In the event of the river water discharge temperature dropping to 0°C, the system shall be temporarily disabled, and a fault displayed. The system shall only be able to be re-enabled manually via the controls system head end.

The intake strainer pumps as specified are capable of exceeding the maximum flow that is required (and will be licenced) so the operation and speed control will need to be configured during commissioning to ensure that the licence is not breached under any circumstances.

System Start and Operation

When the system is enabled:

1. The intake strainer pumps will start and run up to deliver 50% of design flow (using the flow meter).
2. The header tank will be allowed to fill to a specific capacity (to be determined at commissioning and will be a function of the startup time of the secondary pumps)
3. The shutoff valve on the lead heat pump will be opened.
4. The secondary pumps will start and run up to deliver 50% of design flow (using the flow meter).
5. The lead heat pump will be enabled.
6. Once the heat pump is up to load, the secondary pumps will throttle back to maintain a 4-degree differential between the temperature at the strainer pump intake and the discharge point.
7. The intake strainer pumps will then be controlled to maintain the header tank at 75% full.

If a second heat pump is called for:

1. The intake strainer pumps will run up to deliver 100% of design flow.
2. The shutoff valve on the second heat pump will be opened.
3. The secondary pumps will run up to deliver 100% of design flow.
4. The second heat pump will be enabled.
5. Once the heat pump is up to load, the secondary pumps will throttle back to maintain a 4-degree differential between the temperature at the strainer pump intake and the discharge point.
6. The intake strainer pumps will then be controlled to maintain the header tank at 75% full.

If the second heat pump is disabled:

1. The second heat pump will be disabled.
2. The shutoff valve on the second heat pump will be closed.

The secondary pumps will continue to throttle to maintain a 4-degree differential between the temperature at the strainer pump intake and the discharge point, and the intake strainer pumps will continue to control to maintain the header tank at 75% full.

If the system is being turned off:

1. The lead heat pump will be disabled.
2. The secondary pumps will be disabled.
3. The intake strainer pumps will be disabled.

4. The lead heat pump shutoff valve will be closed.

The secondary pumps will not be able to be enabled without the strainer pumps operating. The secondary pump flow rate will always be less than or equal to the strainer pump flow rate; control of the relationship between the two would be tested during commissioning.

When the system is turned off and the external temperature is low, a drain valve near the strainer pumps will open and water will be allowed to drain back through the pipework from the pump room to the intake strainer pumps. This ensures that this section of pipework will not freeze when the system is turned off.

An actuated valve on the discharge line is to be controlled so that it opens and closes in sequence with the secondary water pumps to prevent the possibility of water falling out of the system when it is not operating and airlocks forming.

There is likely to be some ability to finesse the relationship between the intake strainer pumps and the secondary pumps during commissioning and seasonal commissioning, so that there is a minimal amount of water overflow from the header tank back to the river when starting the system or changing the number of heat pumps operating. This will involve setting up a relationship between the control of the two pump sets that means that the control of the intake strainer pumps is not based purely on tank levels but is also based upon the flow being delivered by the secondary pumps. Minimising the overflow volume will help reduce ongoing costs, both in terms of pump energy and licenced water volume charges.

3.14.6 FINE FILTERS

The fine filters will be provided with a filter control panel supplied by the filter manufacturer; this will control the filter operation based upon signals from the main control systems.

The fine filters backwash to remove debris only when required rather than continuously. They require a minimum of 2 bar at the inlet to undertake backflushing at a volume of 21l/s.

Dedicated pumps for fine filter backflushing are to be provided. They are provided on run/standby basis.

In the event of a filter reaching the intake/discharge pressure differential that indicated that backflushing is required:

3. The main two port valve to that filter will close.
4. The backflushing two port valve will open.
5. One of the two backflushing pumps will start (the lead pump will change each time a backflushing event occurs)
6. The controls system will signal the filter panel to commence the backwashing cycle.
7. Once it receives a signal that the backwashing cycle is complete (circa 20 seconds) the backflushing pump will turn off

8. The backflushing two port valve will close.
9. The main two port valve to that filter will open.

During this process, the other two filters will remain in use ensuring that the full design flow can be delivered.

The controls system should operate in conjunction with the backwashing strainer pumps to ensure that the system abstraction/discharge rate does not breach the licence figure due to a drop in system resistance during the backwashing process. The controls system head end should display that backwashing is taking place when it occurs.

3.14.7 MONITORING

The Environment Agency licensing will require the operation of the system to be monitored to ensure that it can be demonstrated that it operates within the terms of the licence. To meet the requirements, the following will need to be continuously logged and displayed on the controls system head end:

- Intake temperature, °C
- Discharge temperature, °C
- Intake to Discharge temperature differential, °C
- Instantaneous flow rate, l/s (via electromagnetic flow meters)
- Hourly flow volume, m3/h (for the last 60 minutes)
- Daily flow volume (over any 24-hour period)
- Yearly flow volume (1st April to 31st March)

This data shall be logged and stored on a rolling 7-year basis per EA requirements and shall be easily displayed via a button on the control system page taking the user to the logs. This is so that it can be displayed if the Environment Agency conducts an unannounced inspection of the system.

Two weeks before it is required, an alarm shall be displayed each year informing the user that the annual total water flow data needs to be sent to the Environment Agency before the deadline imposed on the licence.

In the event of the intake to discharge temperature difference, maximum discharge temperature, abstraction volumes for the hour or day being within a user configurable percentage of the maximum for those criteria, the heat pump output will be temporarily limited in an effort to stop the system passing the licence requirements.

In the event of the flow rate, intake to discharge temperature difference, maximum discharge temperature, abstraction volumes for the hour or day exceeding the licence figures a fault will be logged.

4 ANNUAL FLOW CALCULATIONS

Understanding the annual water flow rate is a requirement for the licencing. This is derived from the annual energy extraction from the water source, and the temperature differential across the source.

The previous works at the site put the required output of the water source heat pump systems at 29,422MWh/annum.

Using a fixed source temperature differential of 3K, this would be 5,596,900m^3/annum.

Using a fixed source temperature differential of 4K would put the annual volume at 4,196,700m^3/annum.

5 PLUME MODELLING

As part of the previous works, WSP completed basic plume modelling for the river system and prepared a report issued separately.[1] This modelling has been revisited to improve the accuracy and level of confidence in the design and an updated report has been prepared and should be reviewed alongside this report.

Modelling must be undertaken for several design and licencing reasons:

- To ensure that water that is discharged from the heat pump system is not entrained back into the intake.
- To ensure that the temperature dispersion at the discharge point meets the requirements set out by the Environment Agency.
- To review the possibility of the plume creating a temperature barrier to wildlife within the body of water that might prevent them from passing through the area.

Several assumptions were made during the previous modelling which have been revisited and amended during this stage. These assumptions included:

- The profile of the riverbed – this was estimated based on a site visit.
- The depth of the river – this was estimated based on a site visit.
- The river flow rate (this was based on minimal EA data logging)

The results of the bathymetric survey have provided the information for the first two elements. The bathymetric survey is included in Appendix H.

[1] 70103370-R003-WPA Plume Modelling Report

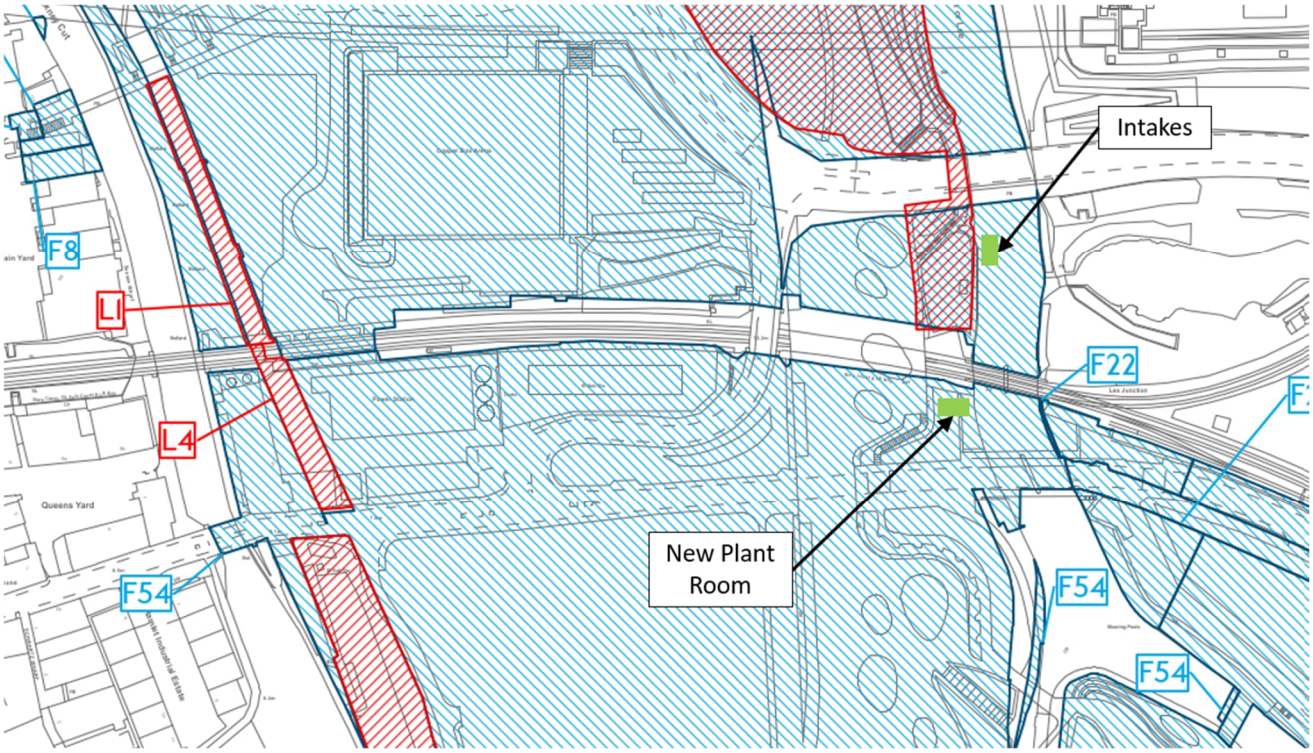
6 LAND AND RIVER OWNERSHIP

Ownership and administration of the land and river drives the design of the system, as discussed in the previous report. This section of the report expands on the information previously provided.

6.1 LAND OWNERSHIP

The Land Registry Titles drawing revision P03 (13/07/2018) has been annotated and is included as Figure 6-1. This shows areas where LLDC have the freehold in blue and areas where they have a leasehold from the London Borough of Hackney in red. As can be seen from the drawing, most (if not all) of the works will take place within LLDC freehold areas. Some works may be required within (and access will be required through) the red area, referred to as North Parklands on the previously mentioned drawing. Please refer to the separate Planning Appraisal report for further information.

Figure 6-1 - Annotated Land Registry Drawing

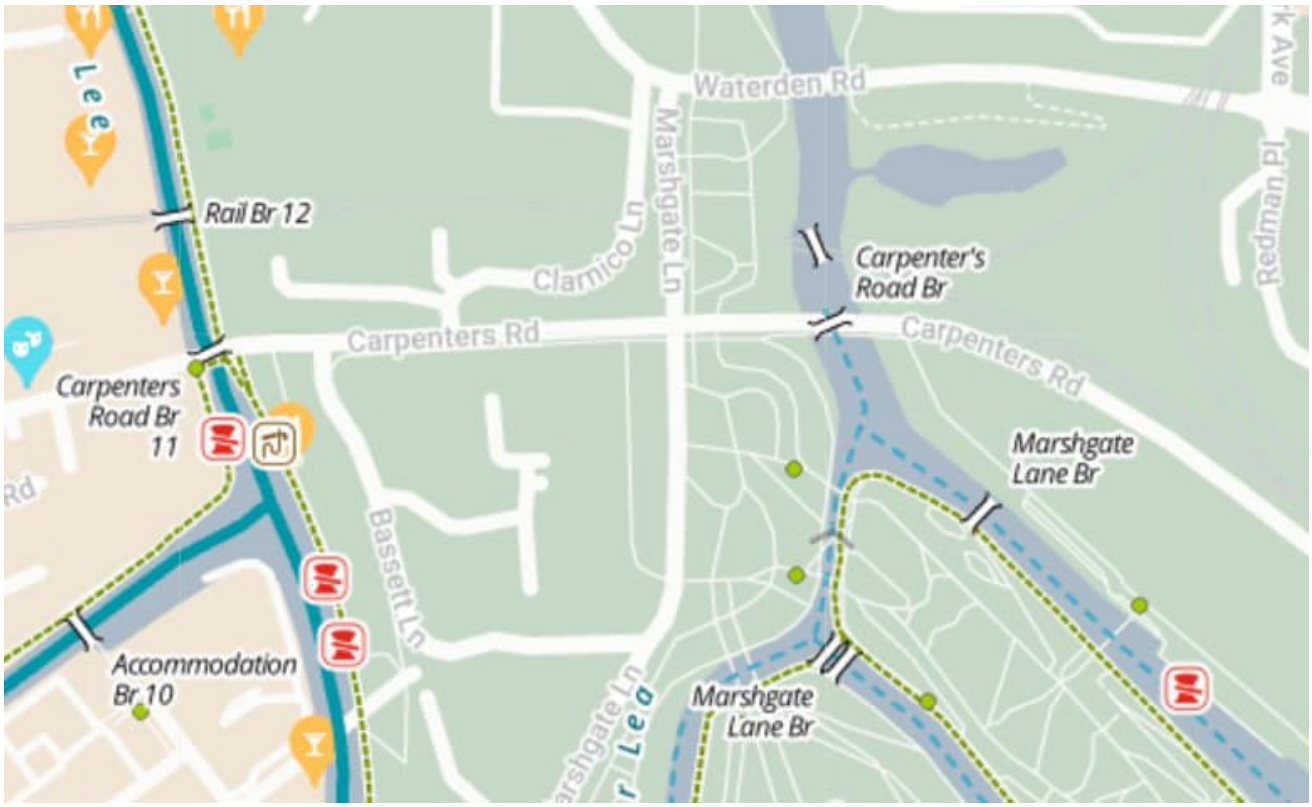


6.2 RIVER OWNERSHIP/NAVIGATION RIGHTS

Figure 6-2 shows the ownership of the river, with the blue dotted lines showing the sections that are the responsibility of the Canal and River Trust. The river north of Carpenters Bridge is not the responsibility of the Canal and River Trust. This is significant, because the costs for operating a system outside the Canal and River Trust area will be much lower as only the EA annual fees would be due.

It is however probable that the Canal and River Trust are responsible for the navigation along this section of the river, so will need to be informed of the works and approve the installation.

Figure 6-2 River Ownership



© Google/Canal and River Trust

7 VALUE ENGINEERING

7.1 CAPITAL COST

The system being developed is a direct system. When compared to the previously proposed indirect system, a direct system will have a lower plant capital cost. This is due to:

- Removing the heat exchangers and requirement for heat exchanger cleaning systems – replacement equipment is a significantly cheaper header tank.
- Smaller plant room required (for like for like capacity system)

Other options for reducing the cost include:

- Reducing the intake to discharge distance differential (this is dependent on the flow modelling)
- Providing the plant rooms as prefabricated enclosures placed on to concrete slabs

7.2 OPERATIONAL COST

The proposed system is relatively straightforward, and minimising the operating cost can be ensured by undertaking the following:

- Careful final selection of the pumps and pumps staging to ensure that they operate efficiently across the operating range.
- Effective commissioning and testing of the completed system

8 DRAFT PROJECT PROGRAMME

A draft project programme is included in Appendix F.

This is indicative of a realistic programme from the start of April 2024 to completion of the system.

It excludes the works relating to the heat pumps which are outside of the scope of this work.

9 LICENCING AND ONGOING COSTS

9.1 LICENCING

The licencing for the system will consist of two elements:

- Water Resources (Abstraction) Licence
- Environmental Permitting Licence (for discharge)

WSP normally recommend that the licencing is undertaken in two phases.

9.1.1 PRE-APP

Whilst it is not compulsory, submitting a pre-app has three main functions:

- It enables the design team to talk to the Environment Agency about the project.
- It finalises the list of information required for the final submission.
- It establishes some confidence about the likelihood of the final submission being successful.

The pre-app is charged in two phases:

- A charge for submitting the pre-app
- A charge for works undertaken by the Environment Agency in support of their response – they will provide a quote for these works before they are undertaken. For previous projects this has been between £1000-2000.

The pre-app has now been submitted: the submission is included in Appendix A. It includes:

- Form WR328 - Application for a water resources licence – part A
- Form WR330 - Application for a water resources abstraction licence – part B
- Maps showing the extent of the site and the intake/discharge locations
- Drawings showing how the system will be configured.

The EA pre-app reference is NPS/WR/041077.

9.1.2 FINAL APPLICATION

The final application will require the following to be submitted, in addition to the documents submitted under the pre-app:

- Form WR332 – Application for a water resources abstraction licence – part C
- Form WR390 - Charging for a Water Resources application – part E.
- Application for an environmental permit – Part F1

The EA are likely to request several studies to be undertaken in their response to the pre-app, including:

- Desktop environmental screening study
- Flow Modelling

The cost for the final application is likely to be in the order of £20,000; this is however only a rough estimate at this stage. This requires further discussion with the Environment Agency to establish the exact figure.

9.2 ONGOING COSTS

Both the Water Resources (Abstraction) Licence and Environmental Permitting Licence (Discharge) have an annual cost that relates to the amount of water put through the system. This is likely to be in the order of £5000 per annum. This requires further discussion with the Environment Agency.

.

Appendix A

PRE-APP

Appendix B

DESIGN RISK ASSESSMENT

T446: Design Risk Management Schedule

Project No	70120143	Project Name	Queen Elizabeth Olympic Park Heat Pump

Guidance Notes *(see guidance notes page for more details)*

Design risk management should be an integral part of the overall design development and designers should think of it in terms of considering constructability, maintainability, etc. Designers only need to document their consideration of risks in this simple risk management schedule format. There is no requirement for quantative design risk assessments to be carried out/documented and these should be avoided

** Risks should be considered in a logical sequence relating to the location/operational environment, constructability/installability, operability (normal/emergency), maintainability (inc routine cleaning, replacement, etc.), and alteration/decommissioning/dismantling/demolition, and should be categorised against those headings,*

CIRIA guidance documents C755, C756, C686, C607, etc. provide a useful checklist and detailed guidance on the identification of risks to be considered during design and how those risks might be addressed - see detailed guidance notes for more details

§ Significant residual risks are those which are unusual, not obvious, difficult to manage, or where critical design assumptions apply. The documentation by designers of residual risks that cover well-known and understood hazards should be avoided.

Ref	Risk Category* & Phase where appropriate, *e.g. location/environment, construction, operation, maintenance, alteration/demolition*	Work Element/Location (where appropriate)	Hazard or Risk Issue Identified	Risk Management Owner	Design ERIc Action Required (*e.g. hazard elimination/risk mitigation action, information to be provided to others)*	Significant Temporary Works Requirements/Management Arrangements and/or any Special Erection/Installation Sequences or Requirements	Design Action Status/Final Resolution Notes (*e.g. traceability of ERIc action, communication of significant residual risk, critical design criteria, etc.*)	Significant Residual Risk§	Date Logged/ Reviewed	Raised By
001	Construction	Excavation	Route and condition of buried LV and HV electrical cables unknown therefore significant risk of electrocution during any excavation work prior to cables being located and their condition has been assessed	Building Services Engineer	Advise client on need for detailed services survey including the careful hand digging of trial holes to inspect cable condition Add warning note to relevant drawings		Suitable warning note being added on relevant drawings. Survey to be arranged.	Yes	23/01/2024	DRH
002	Construction	Excavation	Route and condition of buried gas pipework unknown therefore significant risk of gas leak during any excavation work prior to pipes being located and their condition has been assessed	Building Services Engineer	Advise client on need for detailed services survey including the careful hand digging of trial holes to inspect gas pipe condition Add warning note to relevant drawings		Suitable warning note being added on relevant drawings. Survey to be arranged.	Yes	23/01/2024	DRH
003	Construction	Excavation	Route and condition of district heating, water, drainage and communications	Building Services Engineer	Advise client on need for detailed services survey including the careful hand digging of trial holes. Add warning note to relevant drawings		Suitable warning note being added on relevant drawings. Survey to be arranged.	Yes	23/01/2024	DRH
004	Construction	All Electrical Plant	Risk of electric shock during works.	Main Contractor	Contractor to provide RAMS and design to provide adequate working space.			Yes	23/01/2024	DRH
005	Location, Construction, Maintenance, Demolition.	All	Site Traffic - Congested and confined nature of the site access and circulation areas has potential for injury from collision between vehicles/vehicles and vehicles/pedestrians.	Project Manager/Contractor	Construction plan to investigate options for minimising site traffic and consequent problems as wells as constraints to be dealt with by the contractor.		Clear notice to be given to tenderers of the constraints to be imposed so that due allowance can be made.	Yes	23/01/2024	DRH
006	Location/Environment	MEP Plant & Services Distribution	Works located close to water and as such external works will often require personnel to work close to water.	All	For any works requiring external access near the river the way of working shall be considered so it is designed in a way as to minimise extent of work and enable it to be completed as safe as possible. For the works which must be undertaken the contractor shall undertake a full risk review and ensure suitable access systems, training, equipment and processes are in place.		Contractor to prepare, monitor and review risk assessment. Suggest experience of working over water and management of this is considered part of contractor competency review.	Yes	23/01/2024	DRH
007	Construction/maintenance	MEP Plant & Services Distribution	Risk of falls from height while working near edge of river	MEP designer / Main Contractor	River edge to be provided with suitable barriers to prevent access along with temporary and permanent floors / platforms as necessary	River edge to be provided with suitable barriers to prevent access along with temporary and permanent floors / platforms as necessary	Access and maintenance requirements to be incorporated in stage 4 documentation. Main contractor to employ safe systems of work whilst riser services and platforms / floors are installed.	No	23/01/2024	DRH

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Issue 3.1

Appendix C

DESIGN RISK REGISTER

T440: Project Risk Management Tool

Risk ID	Date Identified	Identified By	Category	Risk or Opportunity?	Technical Discipline	Risk Description (Describe Cost, Programme & Quality Impacts)	Initial Impact	Initial Probability	Initial Rating	Response (Mitigation and/or Contingency)	Risk Owner	Review Date	Residual Impact	Residual Probability	Residual Rating	Status	Review Comments
1	23/01/2024	D Hemmings	Environmental	Risk	MEP	Delays in Environment Agency responding to licence pre-app and engaging with project. Lack of advice from EA as a result	Moderate	Probable	Medium	Make client aware. Make assumptions and make them clear in output.	WSP	08/04/2024	Moderate	Probable	Medium	Pending	Pre-app issued to EA 20/03/2024 - logged in their systems with refernce NPS/WR/041077.
2	23/01/2024	D Hemmings	Technical	Risk	MEP	Insufficient depth for Rotorflush intake screens to be installed and operate continuously, resulting in screen design changing or intake system design changing.	High	Unlikely	Medium	Bathymetric survey undertaken; sufficient depth looks to be available. Would benefit from more confidence around river water levels.	WSP	08/04/2024	High	Unlikely	Medium	Pending	
3	23/01/2024	D Hemmings	Technical	Risk	MEP	No viable route for pipework down Carpenters Road - alternative route has to be selected	High	Possible	Medium	Undertake utility survey	LLDC	08/04/2024	High	Possible	Medium	Pending	Utility survey to follow at next stage.
4	20/03/2024	C Mungall	Technical	Risk	Structural	New Pump Plant Room location may overlap existing services.	Moderate	Possible	Medium	Undertake utility survey - move pump plant room slighlty to optimise.	LLDC	08/04/2024	High	Possible	Medium	Pending	Utility survey to follow at next stage.
5	20/03/2024	C Mungall	General	Risk	Structural	Damage from flooding	Moderate	Possible	Medium	Flood risk assessment provided by LLDC reviewed. No risk.	WSP	08/04/2024	Very Low	Very Unlikely	Low	Closed	
6	20/03/2024	C Mungall	Construction	Risk	Structural	Ground conditions need to be confirmed	Moderate	Possible	Medium	Undertake ground investigation at next stage	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
7	20/03/2024	C Mungall	Construction	Risk	Structural	Presence of ground gas and ground water needs to be investigated.	Moderate	Possible	Medium	Undertake ground investigation at next stage	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
8	20/03/2024	C Mungall	Construction	Risk	Structural	Presence of UXO unknown.	Moderate	Possible	Medium	Either obtain existing UXO survey or undertake survey at next stage.	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
9	20/03/2024	C Mungall	Construction	Risk	Structural	Pile design for jetty unknown.	Moderate	Probable	Medium	Obtain specialist advice from geotechnical engineer at next stage.	WSP	08/04/2024	Moderate	Probable	Medium	Pending	
10	20/03/2024	C Mungall	Construction	Risk	Structural	The loading classification of the cover to the surface water chamber must be established prior to any loads being applied, and trafficking the cover should be avoided if it cannot be proven to have sufficient capacity.	Moderate	Possible	Medium	Until this is established, it should be assumed that construction traffic cannot drive over this area.	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
11	20/03/2024	C Mungall	Construction	Risk	Structural	The river edge is currently an unprotected edge	Moderate	Probable	Medium	Consideration will need to be given to providing edge protection during any construction activities in this area.Inform contractor in documentation (this was included in stage 3 report)	WSP	08/04/2024	Moderate	Unlikely	Low	Pending	
12	20/03/2024	C Mungall	Construction	Risk	Structural	Temporary stability of the structure: the buildings have been designed based on the permanent condition only; the Contractor will have to make an assessment of the temporary stability of the buildings based on his specialist construction knowledge and intended construction sequence.	Moderate	Possible	Medium	Inform contractor in documentation (this was included in stage 3 report)	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
13	20/03/2024	C Mungall	Construction	Risk	Structural	Unidentified buried services. The information provided to date provide a good level of information about buried services, but some services may not have been accurately located: the Contractor should be aware of this risk and plan to undertake the works accordingly.	Moderate	Possible	Medium	Inform contractor in documentation (this was included in stage 3 report)	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
14	20/03/2024	C Mungall	Construction	Risk	Structural	There is existing drainage that cuts through the site. Damage to the drainage must be avoided during excavation and piling works.	Moderate	Possible	Medium	Inform contractor in documentation (this was included in stage 3 report)	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
15	20/03/2024	C Mungall	Construction	Risk	Structural	Stability of excavations – there is potential for the sides of excavations to be unstable. This is to be verified by completion of a site-specific ground investigation.	Moderate	Possible	Medium	Inform contractor in documentation (this was included in stage 3 report)	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
16	20/03/2024	C Mungall	Construction	Risk	Structural	The use of manual equipment to break down pile-heads. This activity has a number of implications for operatives who undertake this work on a regular basis,	Moderate	Possible	Medium	To safeguard the health of site operatives, the use of manual breaking equipment is prohibited. Inform contractor in documentation (this was included in stage 3 report)	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
17	20/03/2024	C Mungall	Construction	Risk	Structural	The identified presence of ground contaminants. It is understood that the ground has been previously remediated.	Moderate	Possible	Medium	Specialist advice will be required to determine whether the proposed works will invalidate the previous remediation strategy resulting in an alternative strategy being required. The Contractor should become familiar with previous and proposed remediation details and be aware of the presence of identified contaminants Reference should be made to previous reports and to the ground investigation for details.	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
18	20/03/2024	C Mungall	Technical	Risk	Structural	All loads are subject to review following the appointment of an architect and development of the specification of the building fabric.	Moderate	Probable	Medium	Review at next stage.	WSP	08/04/2024	Moderate	Probable	Medium	Pending	
19	20/03/2024	C Mungall	Health & Safety - Design	Risk	Structural	Risk of damage to existing structures.	Moderate	Possible	Medium	On site surveys will be required to verify that existing structures are in accordance with the existing information provided. Any differences may require the proposed plant room to be reconfigured or relocated to ensure that existing structures are not adversely affected by the works.	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
20	27/03/2024	D Hemmings	Programme	Risk	Fire Engineering	Fire design outstanding	Moderate	Possible	Medium	Fire engineer needs to be appointed at the next stage. Could result in redesign works.	LLDC	08/04/2024	Moderate	Possible	Medium	Pending	
21	27/03/2024	D Hemmings	Programme	Risk	Architect	Architectural design outstanding.	Moderate	Probable	Medium	Architect needs to be appointed at next stage. Likely to result in minor redesign works.	LLDC	08/04/2024	Moderate	Probable	Medium	Pending	
22	27/03/2024	D Hemmings	Project Capital Cost	Risk	Quantity Surveyor	QS not appointed.	Moderate	Possible	Medium	QS needs to be appointed at next stage.	LLDC	08/04/2024	Moderate	Possible	Medium	Pending	
23	27/03/2024	D Hemmings	Environmental	Risk	Acoutics	Acoustic advice required.	Moderate	Possible	Medium	Acoustician needs to be appointed at next stage.	LLDC	08/04/2024	Moderate	Possible	Medium	Pending	
24	27/03/2024	D Hemmings	Technical	Risk	MEP	Insufficient local HV infrastructure to support new systems	Moderate	Possible	Medium	Discuss with DNO. Alternative would be to take private wire supply from Kings Yard as part of rework to support heat pumps.	WSP	08/04/2024	Low	Possible	Low	Pending	
25	27/03/2024	D Hemmings	Technical	Risk	All	Design of energy centre systems outside the scope of these works, but not as advanced as this package. Energy centre works need to be brought to same standard to fullly ratify design of water systems. Could result in redesign.	Moderate	Possible	Medium	To be developed at next stage.	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
26	27/03/2024	M Stocks	Approval	Risk	Planning	Authority changes from LLDC to Tower Hamlets in June 2024.	Moderate	Possible	Medium	Pre-application engagement with LLDC prior to June 2024	WSP	08/04/2024	Moderate	Possible	Medium	Pending	
27	27/03/2024	M Stocks	Environmental	Risk	Planning	Site location within the MOL, SINC and Local Open Space pose planning constraints. Mitigation works likely to be required.	Moderate	Possible	Medium	Engage with planners on pre-app basis.Contact EA for advice.	WSP	08/04/2024	Moderate	Possible	Medium	Pending	

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Issue 3.4

Appendix D

EQUIPMENT SCHEDULES

Mechanical Schedules

Schedule Title:	M01 Pipework	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02
Specification Reference:					

Service	Material	Pipe Finish / Grade	Size mm	Operating Temp °C	Operating Pressure PN Bar	Pipe standards	Jointing type and standard	Comments
River Water	ABS	-	All	0-30	6	BS EN 12201	Fusion, WIS 4-32-08	

Notes

1 This schedule shall be read in-conjunction with the specification and drawings

2 The installer shall ensure all materials used in water supplies are approved to Water Authority requirements

Mechanical Schedules

Schedule Title:	M02 Intake Strainer Pumps	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02
Specification Reference:					

Reference		SP1/2/3/4/5
Number of units		5
Type		Self-Cleaning Basket Strainers - continuous backflushing
Location		River Lea
System/purpose		River Water Intake
Eel Regulation compliant		Yes
Construction		
Pump		
Pump type		Submersible
Casing		Grey cast iron
Impellers		Graphite cast iron
Shaft		1.4028 stainless steel
Seal type		Double - silicon carbide
Drive type		Direct
Dry Weight	kg	390
Strainer		
Type		Woven Steel Mesh
Mesh material		1.4401 (316)
General construction material		1.4401 (316)
Mesh size		2mm
Maximum dimensions	mm	To suit EA requirements
Filter screen area	cm^2	
Dry Weight	kg	
Connections		
Discharge	mm	250
Vent/Breather	mm	75
Performance		
Minimum temp	°C	0
Maximum temp	°C	30
Minimum Flow	kg/s	To match minimum backflushing requriement
Maximum Flow	kg/s	100.60
Pressure head	kPa	55.00
Max sound power level	dBA	
Motor		
Motor type		Dry-type submersible induction motor
Maximum motor speed	rpm	1440.00
Motor rating	kW	22.00
Full load current	amps	45.70
Starting current	amps	256.80
Speed control		Inverter
Electrical		
Supply – Voltage	volts	400
Supply – Phase	ph	3
Supply – Hz	Hz	50
Method of start		Soft start
Auto-changeover		Yes

Notes

1 This schedule shall be read in conjunction with the specification and drawings
2 Units to be fitted with sacrificial anodes
3 Selection based on Rotorflush

Mechanical Schedules

Schedule Title:	M03 Fine Grade Filter	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02
Specification Reference:					

Reference			FF1/2/3
Number of units			3
Type			Automatic backflushing
Location			New Pumproom
System/purpose			River Water Intake
Construction			
Filter housing material			Epoxy coated cast iron
Mesh type			Slotted sieve
Mesh material			1.4435 (316L)
Mesh size			250µm
Maximum dimensions		mm	915 x 1457 x 1800
Dry Weight		kg	200
Connections			
Intake		mm	400
Discharge		mm	400
Backflushing discharge		mm	100
Performance			
Minimum temp		°C	0
Maximum temp		°C	30
Minimum Design Flow		kg/s	-
Normal Design Flow		kg/s	134.2
Maximum Design Flow		kg/s	201.3
Backflushing Flow		kg/s	21.4
Pressure reqd for backflushing		kPa	200
Full flow diff. pressure (clean)		kPa	<10
Full flow diff. pressure (dirty)		kPa	<11.6
Electrical			
Supply	Voltage	volts	400
	Phase	ph	3
	Frequency	Hz	50
Controls			
Backwash control system			Yes
Differential press. Output to BMS			4-20mA
Backwash valve control			Electric
Common fault indication			Yes
Enable signal			Yes
Backwashing signal			Yes
External start of backwashing			Yes
Accessories			
Differential pressure gauge			Yes

Notes

1 This schedule shall be read in conjunction with the specification and drawings
2 Selection based on Dango & Dinenthal DDF DN400

Mechanical Schedules

Schedule Title:	M04 Cyclone Filters	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02
Specification Reference:					

Reference		**CF01-08**
Number of units		8
Type		Hydrocyclonic Separator
Location		New Pumproom
System/purpose		River Water Intake Filtration
Construction		
Filter housing material		Stainless Steel
Filter Type		Centrifugal
Filter Efficiency		99% for particles >75µm
Maximum dimensions	mm	2316Hx507Dia
Dry Weight	kg	105
Connections		
Intake	mm	150
Discharge	mm	150
Performance		
Minimum temp	°C	0
Maximum temp	°C	60
Minimum Design Flow	kg/s	26.4
Normal Design Flow	kg/s	50.3
Maximum Design Flow	kg/s	52.8
Full flow diff. pressure (clean)	kPa	<50
Full flow diff. pressure (dirty)	kPa	<50

Notes

1 This schedule shall be read in conjunction with the specification and drawings
2 Selection based on JMF Twisterfil 150

Mechanical Schedules

Schedule Title:	M05 Pumps	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02
Specification Reference:					

Pump reference			P1/P2/P3	BFP1/2
Number off		No	3	2
Location			New plant room	New plant room
System			RWHP Supply	Fine Filter Backflush
Fluid			River Water	River Water
Fluid temperature		°C	0-30	0-30
Resilience			Run/Run/Standby	Run/Standby
Operation			Variable Flow	Fixed Flow
Construction/material				
Pump type			Inline, singles	Inline, singles
Casing				
Impellers				
Shaft				
Seal type				
Drive type			Direct	Direct
Inlet connection		mm		
Outlet connection		mm		
Dry Weight		kg		
Performance				
Flow rate		kg/s	201.30	21.40
Pressure head		kPa	275	200 at filters
Max sound power level		dBA		
Motor				
Motor type				
Maximum motor speed		rpm		
Motor rating		kW	90	7.5
Full load current		amps		
Starting current		amps		
Speed control			Inverter	Inverter
Electrical				
Supply	Voltage	volts	400	400
	Phase	ph	3	3
	Hz	Hz	50	50
Method of start			Soft start	Soft start
Auto-changeover			Yes	Yes
Other				
Inertia base			Yes	Yes
Resilient mounts			Yes	Yes

Notes

1 This schedule shall be read in-conjunction with the specification and drawings
2 Where the final layout based on the installation drawings and equipment selection associated with the system varies from the tender documents the installer shall responsible for calculating the final pump resistances.
3 Locate pumps with adequate space for safe maintenace
4 Pump connections shall be isolated for vibration by line size flexible connections
5 High efficiency motors shall be supplied
6 Select pump at or near most effiecient part of performance curve for duty required. Advise CA of potential spare capacity of selected pump prior to ordering
7 A 15mm drain cock shall be provided on each pump suction
8 Fit safety guards around all exposed revolving parts and comply with relevant standards
9 Unless otherwise indicated motors shall have power factors at full load running conditions that are equivalent or better than that required by the supply authority
10 Pumps shall be installed with isolation valves to allow removal
11 Ensure the pipelines do not stress the pump casing

Mechanical Schedules

Schedule Title:	M06 Header Tank	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02
Specification Reference:					

Tank reference		**HT1**
Number off	No	1
Location		New Pump room
System		RWHP
Capacity (nominal)	litres	27000
Capacity (nominal)	litres	24000
Length	m	3
Width	m	3
Height	m	3
Class (BS EN 13280)		
Construction/material		
Material		GRP
Flanged		Yes
Plate size		1000x1000
Compartments	No	
Insulation material		N/A
Insulation thickness	mm	N/A
Tank supports		
Connections		
Inlet	mm	560
Outlet	mm	560
Overflow	mm	560
Drain	mm	
Accessories		
Internal ladder		N
External ladder		Y
Tank cover		Y
Water level indicators		Y
BMS content indication		Y
Manhole access		Y
Screened air inlet		Y
Temperature probes		Y
Raised valve box		N

Notes

1 This schedule shall be read in-conjunction with the specification and drawings
2 Tanks and connections shall comply with:
  a) Water Supply Regulations
  b) CIBSE TM13 Minimising risk of legionnaires' disease
  c) HSE L8
  d) BS EN 806
  e) BS EN 13280
3 Tanks shall be stored in accordance with manufacturer's recommendations
4 Sectional tanks shall be erected and tested by the manufacturer
5 Ladders shall comply with BS 4211
6 Tanks and cisterns shall be in accordance with BS EN 13280
7 Leakage tests shall be ubdertaken on all tanks and cisterns
8 Water level indicators shall be provided for each compartment and WRAS approved
9 For tanks 1000 litres and above lids/covers shall be two piece
10 Manhole access shall be a minimum 600mm diameter or side dimension

Mechanical Schedules

Schedule Title:	M06 Flow Meters	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02
Specification Reference:					

Reference	Function	Quantity	Line size	Flow Rate	Output	Comments
WM1	River Water Main Flow	1	560	402kg/s	MBus	
WM2	River Water Bleed Back Line	1	560	402kg/s	MBus	
WM3	River Water Main Return	1	560	402kg/s	MBus	

Notes

1 Meters to be composed of a flow meter and a digital integrator c/w display and output back to the controls system
2 Meters to have MBus output to BMS
3 Meters to be a heat meter compliant with Environment Agency requriements, i.e.
- compliance with the relevant requirements set out in Annex I to the 2004 Measuring Instruments Directive (MID) (2004/22/EC), and
- compliance with the specific requirements listed in Annex MI-004 of the MID, and
- fall within accuracy Class 2 as defined in Annex MI-00470

4 Meters to be internally lined electromagnetic type suitable for river water environment.

Mechanical Schedules

Schedule Title:	M08 Power	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02
Specification Reference:					

PANEL REF: MCC		**LOCATION:** New Pump Room	
River Water Pump 1	SP1	up to 28kW/3ph	Run/Run/Run/Run/Standby
River Water Pump 2	SP2	up to 28kW/3ph	
River Water Pump 3	SP3	up to 28kW/3ph	
River Water Pump 4	SP4	up to 28kW/3ph	
River Water Pump 5	SP5	up to 28kW/3ph	
Fine Filter 1	FF1	up to 1kW/3ph	Run/Run/Standby
Fine Filter 2	FF2	up to 1kW/3ph	
Fine Filter 3	FF3	up to 1kW/3ph	
Secondary Pump 1	P01	up to 90kW/3ph	Run/Run/Standby
Secondary Pump 2	P02	up to 90kW/3ph	
Secondary Pump 3	P03	up to 90kW/3ph	
Backflushing Pump 1	BFP1	up to 7.5kW/3ph	Run/Standby
Backflushing Pump 2	BFP2	up to 7.5kW/3ph	
Ventilation fan	EF1	up to 0.2kW/1ph	
Provision for cleaning systems		up to 12kW/3ph	Commando Socket

Notes

1 This schedule shall be read in conjunction with the specification and drawings

Mechanical Schedules

Schedule Title:	M09 BMS Points	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02
Specification Reference:					

Reference	Item	Device	AI	DI	AO	DO	Pulse	Notes
River Pumping Station Control Panel - Energy Centre								
Note - the systems listed below relate only to the river water systems. Additional controls systems will be required for the Heat Pumps and other associated systems.								
River Water System								
	Flow From Pumping Station Temperature Sensor	Water Temp Sensor	✓					
	Flow To Pumping Station Temperature Sensor	Water Temp Sensor	✓					
	WSHP1 DPS	DPS	✓					
	WSHP1 Flow Temperature Sensor	Water Temp Sensor	✓					
	WSHP1 Return Temperature Sensor	Water Temp Sensor	✓					
	WSHP1 2 Port Valve	Actuator			✓			
	WSHP2 DPS	DPS	✓					
	WSHP2 Flow Temperature Sensor	Water Temp Sensor	✓					
	WSHP2 Return Temperature Sensor	Water Temp Sensor	✓					
	WSHP2 2 Port Valve	Actuator			✓			
River Pumping Station Control Panel - New Pumping Station								
General Systems								
	Fire Alarm Interface with BMS Test Override			✓				
	Heat Pump System Enable			✓				
	External Temperature Sensor	Ext Temp Sensor		✓				
			✓					
River Water System								
SP1	SP1 Inverter speed control	Inverter			✓			
	SP1 Fault			✓				
	SP1 VSD Status		✓					
SP2	SP2 Inverter speed control	Inverter			✓			
	SP2 Fault			✓				
	SP2 VSD Status		✓					
SP3	SP3 Inverter speed control	Inverter			✓			
	SP3 Fault			✓				
	SP3 VSD Status		✓					
SP4	SP4 Inverter speed control	Inverter			✓			
	SP4 Fault			✓				
	SP4 VSD Status		✓					
SP5	SP5 Inverter speed control	Inverter			✓			
	SP5 Fault			✓				
	SP5 VSD Status		✓					

Mechanical Schedules

Schedule Title:	M09 BMS Points	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02

Specification Reference:

	System Drain Valve	Actuator			✓			
WM1	River Water Intake Flow Meter	Flow Meter						MBus Interface
	River Water Inlet Temperature Sensor	Water Temp Sensor	✓					Note 3
	Fine Filter Backflushing Intake Pressure Sensor	Pressure Sensor	✓					
	Fine Filter 1 Main Intake 2 Port Valve	Actuator			✓			
	Fine Filter 1 Backflushing Intake 2 Port Valve	Actuator			✓			
FF1	FIne Filter Enable	Interface						
	Fine Filter Fault							
	Fine Filter Backflushing							
	Fine Filter 1 Discharge 2 Port Valve	Actuator			✓			
	Fine Filter 2 Main Intake 2 Port Valve	Actuator			✓			
	Fine Filter 2 Backflushing Intake 2 Port Valve	Actuator			✓			
FF2	FIne Filter Enable	Interface						
	Fine Filter Fault							
	Fine Filter Backflushing							
	Fine Filter 2 Discharge 2 Port Valve	Actuator			✓			
	Fine Filter 3 Main Intake 2 Port Valve	Actuator			✓			
	Fine Filter 3 Backflushing Intake 2 Port Valve	Actuator			✓			
FF3	FIne Filter Enable	Interface						
	Fine Filter Fault							
	Fine Filter Backflushing							
	Fine Filter 3 Discharge 2 Port Valve	Actuator			✓			
P1	P1 Inverter speed control	Inverter			✓			
	P1 Fault			✓				
	P1 VSD Status		✓					
P2	P2 Inverter speed control	Inverter			✓			
	P2 Fault			✓				
	P2 VSD Status		✓					
P3	P3 Inverter speed control	Inverter			✓			
	P3 Fault			✓				
	P3 VSD Status		✓					
BFP1	BFP1 Inverter speed control	Inverter			✓			
	BFP1 Fault			✓				
	BFP1 VSD Status		✓					
BFP2	BFP2 Inverter speed control	Inverter			✓			
	BFP2 Fault			✓				
	BFP2 VSD Status		✓					
	Header Tank Level Sensor 1	Level Sensor		✓				

Mechanical Schedules

Schedule Title:	M09 BMS Points	Workstage:	RIBA Stage 3	Date:	28/03/2024
Schedule Reference:		Checked By:	DRH	Prepared By:	FE
Project Title:	QEOP River Water Heat Pump	Issue Status:	Draft Issue	WSP Office:	Bristol
Project Number:	70120143			Revision:	P02

Specification Reference:

	Header Tank Level Sensor 2	Level Sensor		✓				
	Header Tank Level Sensor 3	Level Sensor		✓				
	Header Tank Level Sensor 4	Level Sensor		✓				
	Flow to Energy Centre Temperature Sensor	Water Temp Sensor	✓					
	Flow to Energy Centre Temperature Sensor	Water Temp Sensor	✓					
	Main Discharge 2 Port Valve	Actuator			✓			
WM3	River Water Main Discharge Flow Meter	Flow Meter						MBus Interface
	River Water Main Discharge Temperature Sensor	Water Temp Sensor	✓					Note 3
WM2	Bleed Back Line Flow Meter	Flow Meter						MBus Interface
	Bleed Back Line Temperature Sensor	Water Temp Sensor	✓					Note 3

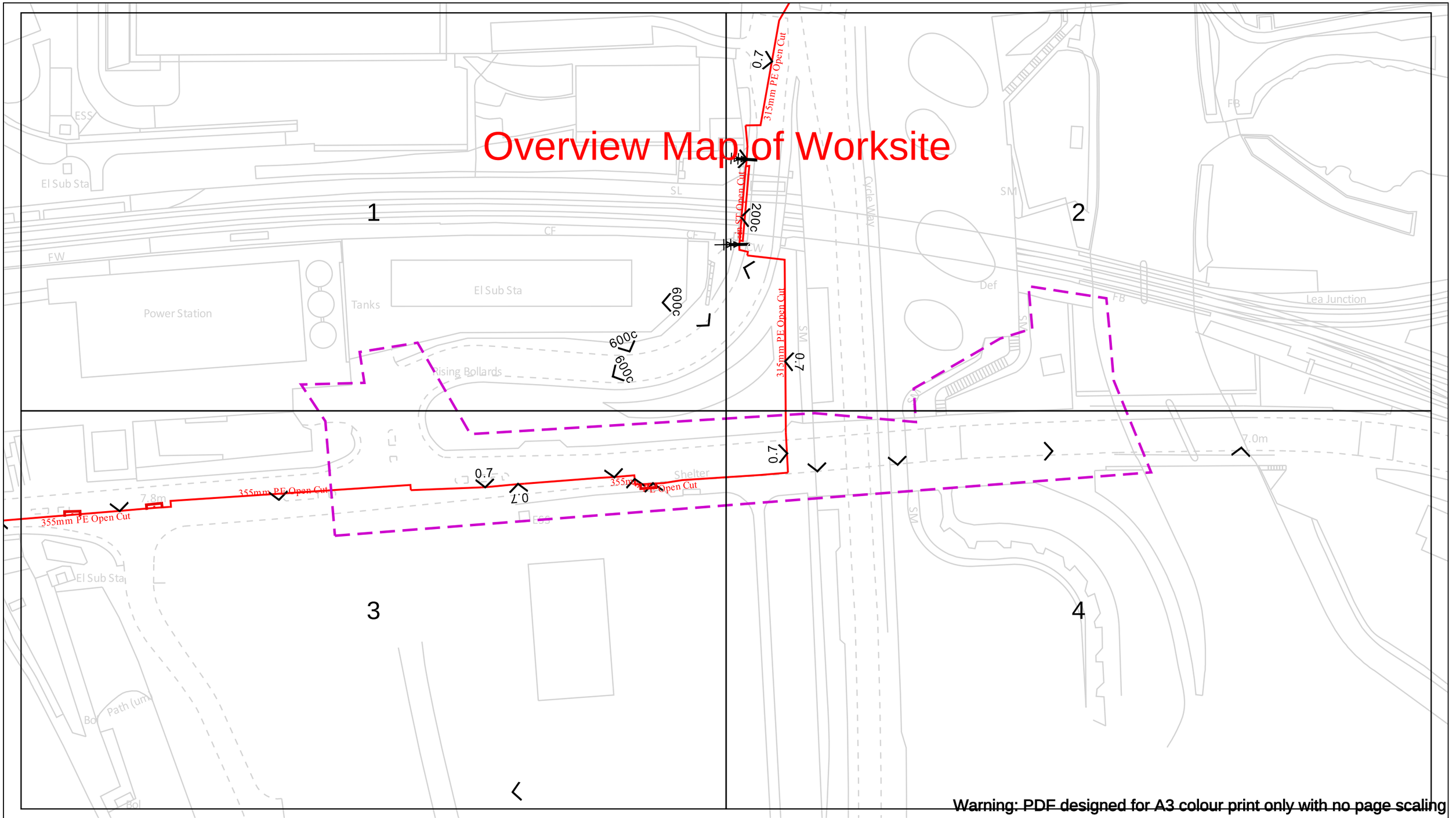
Notes

1 This schedule shall be read in-conjunction with the specification and drawings
2 Suitable control points shall be provided to meet the design intent. The above list is to be considered a minimum.
3 River Water temperature sensors to have a minimum accuracy of ±0.1°C to allow correct control of the system and suitable logging for EA purposes.
4 River Water sensors to be suitable for saline environment.

Appendix E

UTILITIES SUPPLIER MAPS

Overview Map of Worksite



Warning: PDF designed for A3 colour print only with no page scaling

Date Requested: 19/02/2024
Job Reference: 32503651
Site Location: 537602 184552
Requested by:
Mr David Hemmings
Your Scheme/Reference:
QEOP RWHP

Scale: 1:1025 (When plotted at A3)

View extent: 200m, 115m

IMPORTANT NOTICES

This plan shows these pipes owned by Cadent Gas Limited in its role as a Licensed Gas Transporter (GT). Gas pipes owned by other GT's or otherwise privately owned may be present in this area. Information with regards to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections etc. are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Cadent Gas Limited or their agents, servants or contractors for any errors or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue.

In case of an emergency call 0800 111 999

Dig Sites

Area: Line:

LP Mains
MP Mains
IP Mains
LHP Mains

Valve
Depth of cover
Syphon

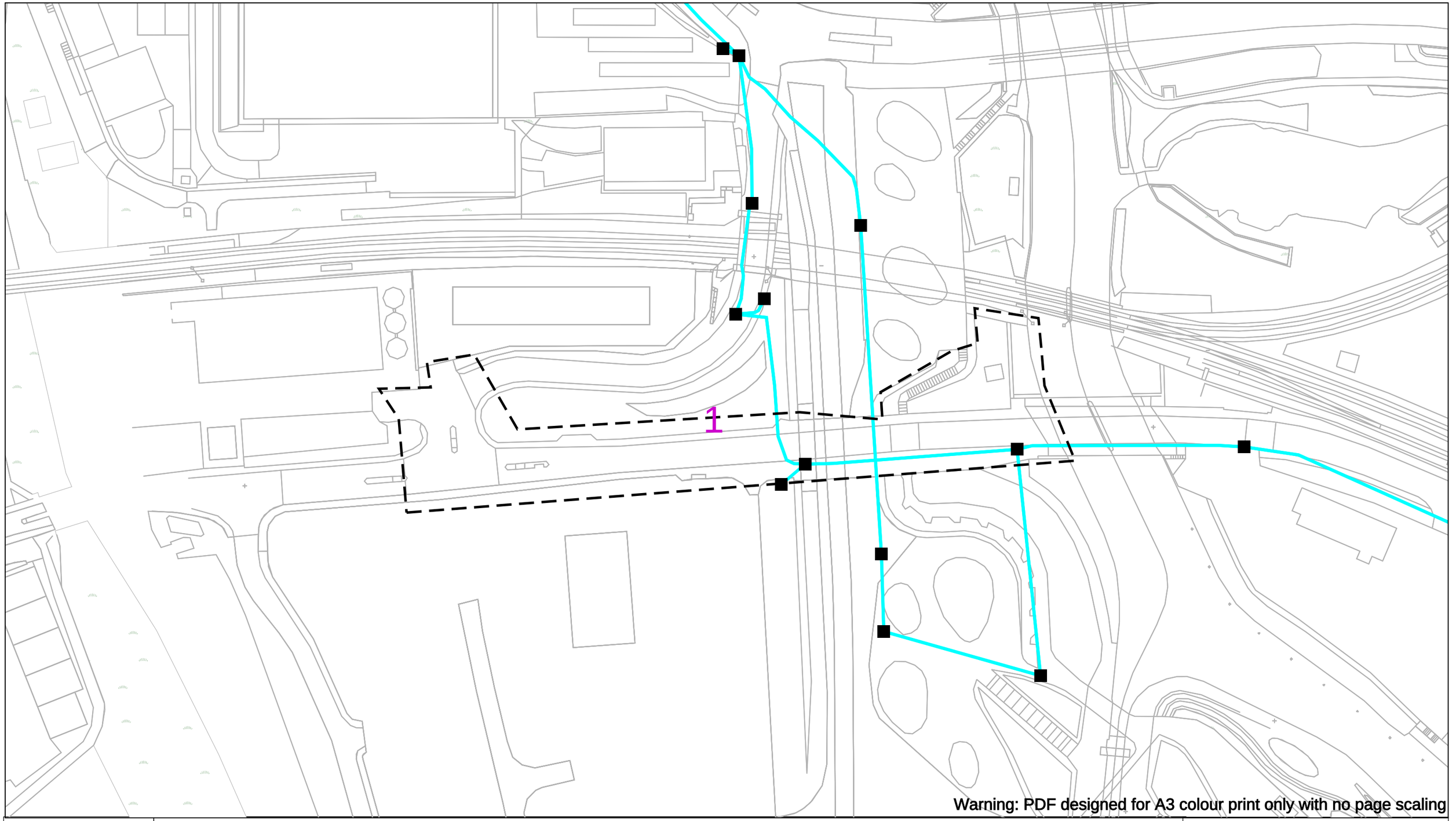
Diameter Change
Material Change
Out of Standard Service

Where an out-of-standard service is present please contact plant protection 0800 688 588 for further information.
Out-of-standard service symbology may be used to indicate one or more of the following:

- Identification of shallow services
- Identification of dual services
- Recording of non-perpendicular services

A perpendicular service/connection is laid in a straight line from the entry point at the property to the connection at the main – this includes a pipe that has a perpendicular connection and is not straight but does not deviate more than 1m off centre line.

Cadent
Your Gas Network



Warning: PDF designed for A3 colour print only with no page scaling

Contact us:

planprotection@eunetworks.com

Date Requested: 19/02/2024
Job Reference: 32503651
Site Location: 537602 184552
Requested by:
Mr David Hemmings
Your Scheme/Reference: QEOP RWHP

Scale: 1:1250 (When plotted at A3)

100m

Dig Sites Line: Area:

Key

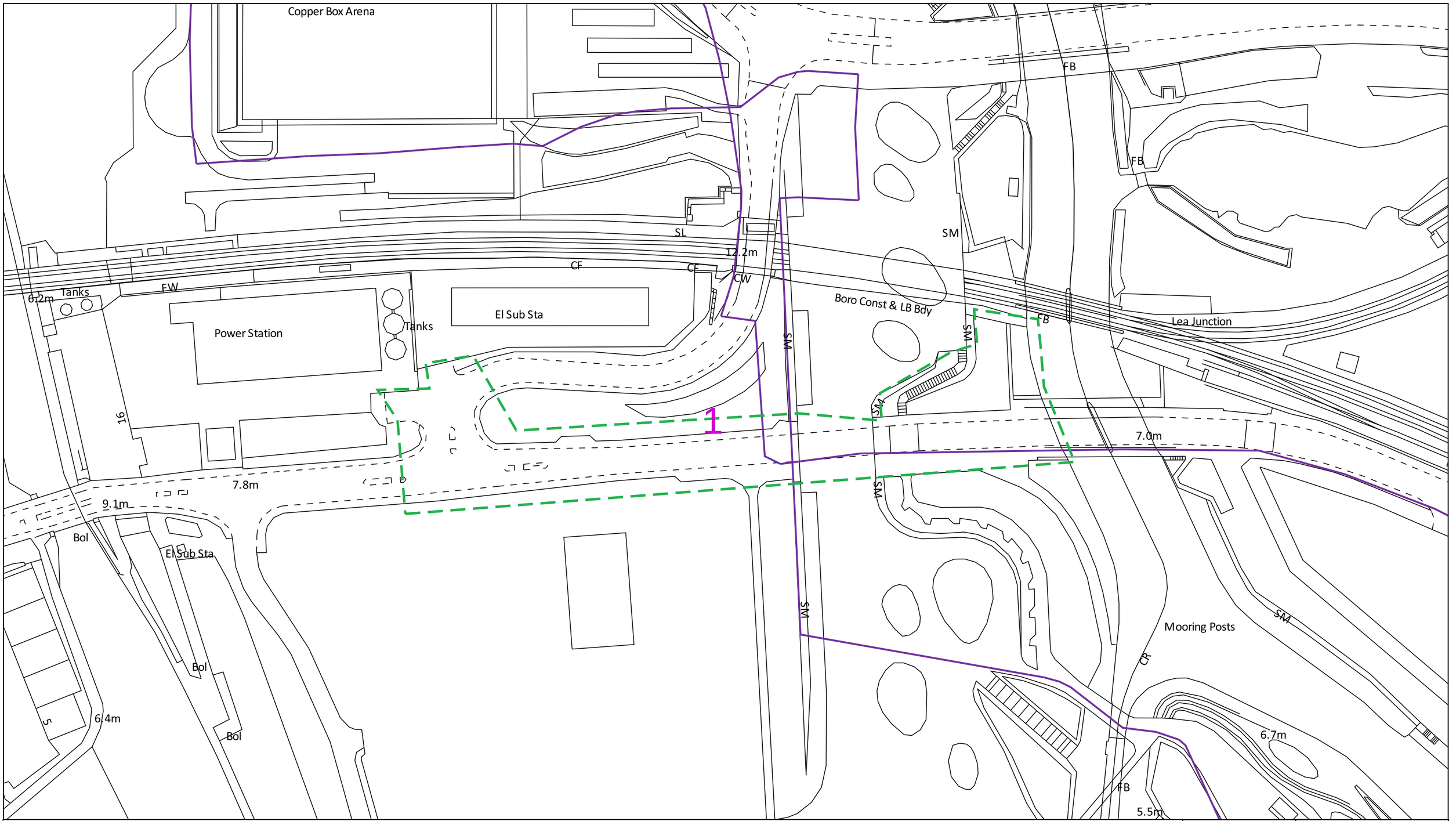
Duct | Long Haul (LHN) Duct | Chamber Location

IMPORTANT WARNING

The information supplied is given in good faith as a guide to locating underground apparatus. Its accuracy cannot be guaranteed, nor does it include comprehensive information about the existence or location of service pipes or cables to individual premises. The responsibility for locating and avoiding damage to apparatus on site shall be that of the persons proposing to excavate in the street shall be liable to the apparatus owner and any third party who may be affected in any way for any loss or damage caused by their failure to do so.

IF IN DOUBT PLEASE ASK! PHONE: 07896 087585

eunetworks



0 100 m

Dig Sites Area: Line:

The quality and accuracy of any print will depend on your printer, your computer and its print settings. Measurements scaled from this plan may not match measurements between the same points on the ground.

Date Requested: 19/02/2024
Job Reference: 32503651
Site Location: 537602 184552

Requested by:
Mr David Hemmings
Your Scheme/Reference: QEOP RWHP

Scale: 1:1250 (When plotted at A3)

Neos Network Underground Route

Emergency Number: 0345 305 3337

Registered Office:

Inveralmond House,
200 Dunkeld Road,
Perth, PH1 3AQ

Zayo Group UK Ltd
4th Floor Harmsworth House
13-15 Bouverie Street
London, EC4Y 8DP

JSM Group Ltd
Sterling House
Mutton Lane, Potters Bar
Hertfordshre, EN6 3AR
T: 01992 655 919
zayoplantenquiries@jsmgroup.com

Legend

- Zayo Duct
- Zayo Chamber
- Enquiry Area

Date requested: 19 Feb 2024
Requested by: Mr David Hemmings
Company: WSP
Job reference: 32503651
Your reference: QEOP RWHP

Scale on A3 paper: 1:1250

Warning: PDF designed for colour print only with no page scaling. This Information is given as a guide only and its accuracy cannot be guaranteed.

N

Protecting Lives, Cables & Pipes

In Emergency Only and if Zayo Plant or Cables damaged call: 0800 169 1646

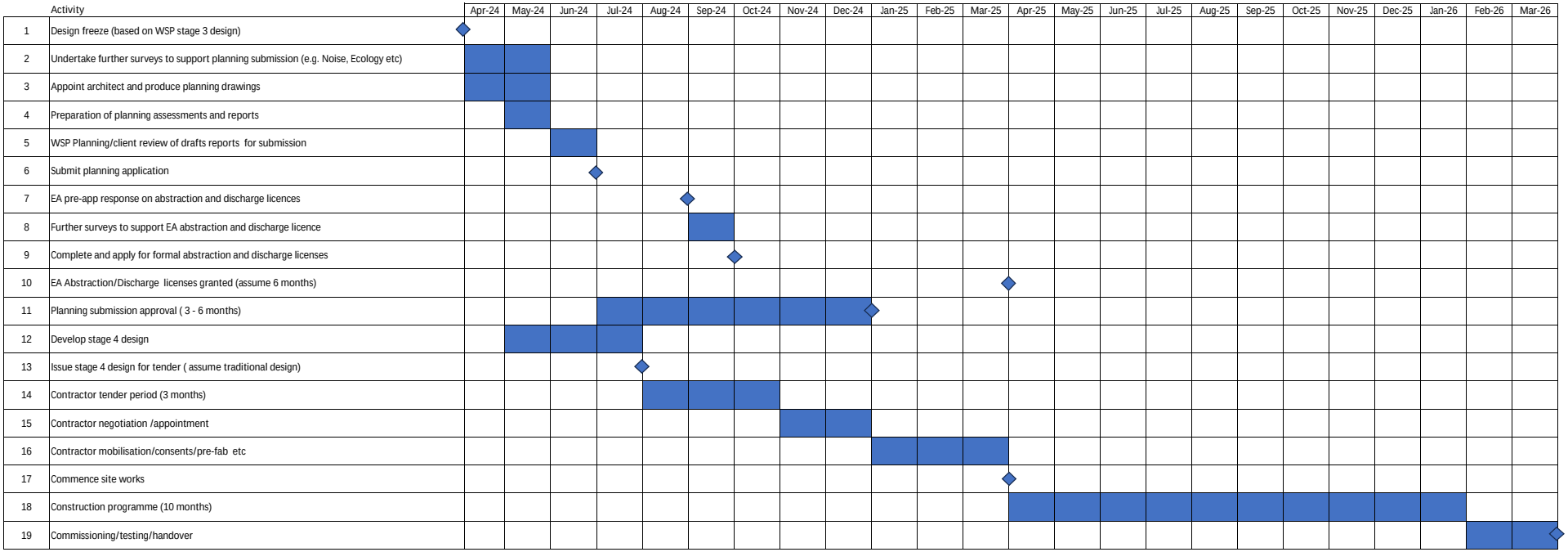
Tile No: 1

Appendix F

DRAFT PROJECT PROGRAMME

QEOP Water Source Heat Pump - Draft Overall Project Programme

Note - this excludes the works related to the heat pumps, which are outside the scope of this work package.



	Activity	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26
1	Design freeze (based on WSP stage 3 design)	◆																							
2	Undertake further surveys to support planning submission (e.g. Noise, Ecology etc)																								
3	Appoint architect and produce planning drawings																								
4	Preparation of planning assessments and reports																								
5	WSP Planning/client review of drafts reports for submission																								
6	Submit planning application			◆																					
7	EA pre-app response on abstraction and discharge licences					◆																			
8	Further surveys to support EA abstraction and discharge licence																								
9	Complete and apply for formal abstraction and discharge licenses						◆																		
10	EA Abstraction/Discharge licenses granted (assume 6 months)												◆												
11	Planning submission approval (3 - 6 months)										◆														
12	Develop stage 4 design																								
13	Issue stage 4 design for tender (assume traditional design)				◆																				
14	Contractor tender period (3 months)																								
15	Contractor negotiation /appointment																								
16	Contractor mobilisation/consents/pre-fab etc																								
17	Commence site works												◆												
18	Construction programme (10 months)																								
19	Commissioning/testing/handover																								◆

Appendix G

COST ESTIMATE

Queen Elizabeth Olympic Park - River Water Heat Pump

Rough Order of Cost Estimate

Assembled by WSP - to be replaced by works undertaken by Quantity Surveyor at next stage.
WSP are not Quantity Surveyors - no guarantee is given on the costs listed below.

Intake Strainer Pumps	£	287,500.00
Jetty and associated civil works	£	150,000.00
Pipework to Pump Room	£	80,000.00

Pump Room Building	£	200,000.00
Pipework in Pump room and plant install	£	60,000.00
Intake Flow Meter	£	6,000.00
Fine Filters	£	197,500.00
Backflushing Pumps	£	20,000.00
Cyclone Filters	£	85,000.00
Header Tank	£	20,000.00
Secondary Pumps	£	120,000.00
Bleed Back Flow Meter	£	6,000.00
Controls	£	8,000.00
Extract Fan	£	1,000.00
Transformer	£	165,000.00
Electrical Works	£	250,000.00

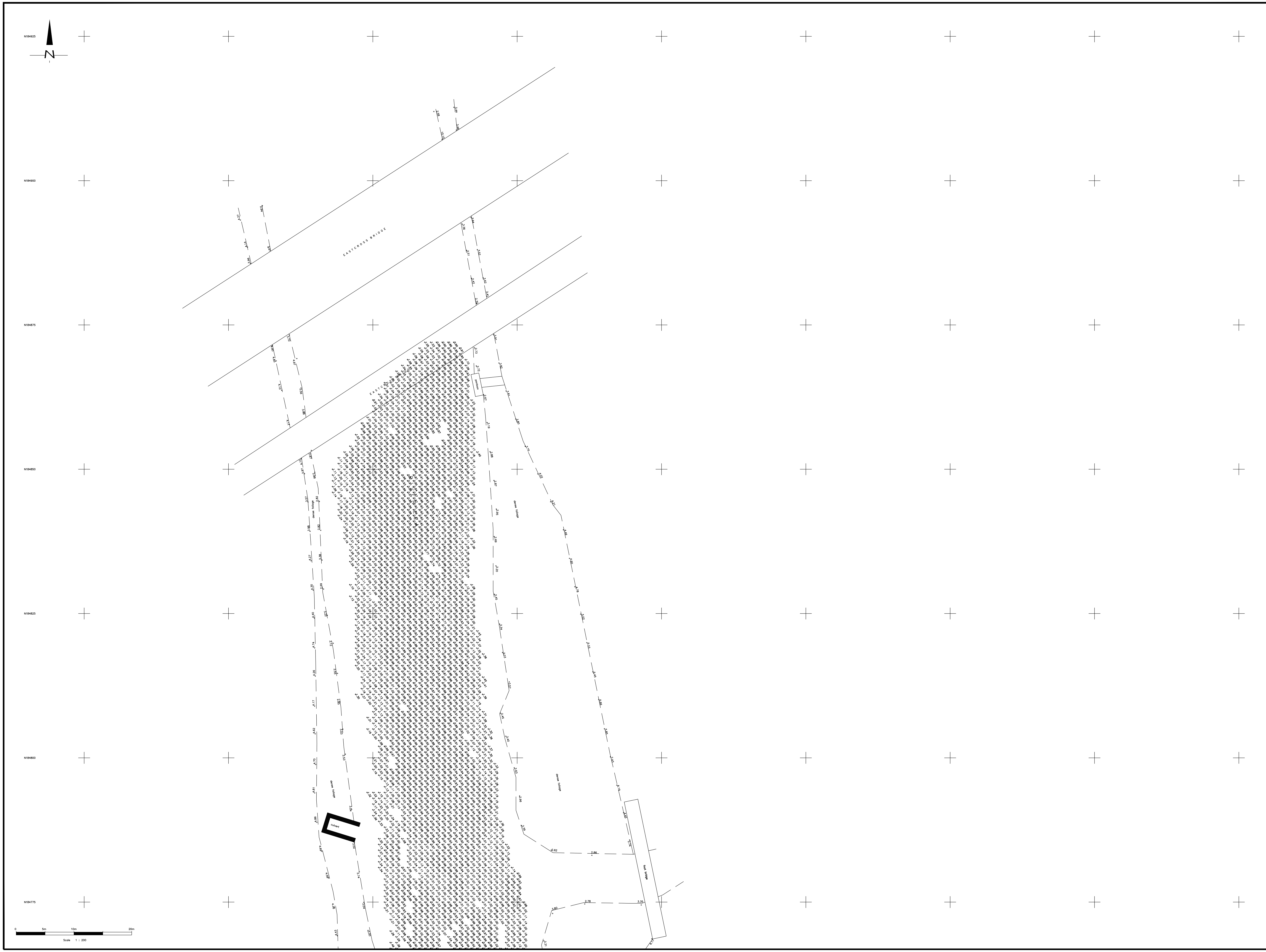
F&R Pipework to Energy Centre	£	500,000.00
Civils in connection	£	100,000.00
Return Flow Meter	£	6,000.00

Total Construction Costs, excl. On-Costs	£	2,262,000.00

Main Contractors Preliminaries @ 20.00%	£	452,400.00
Main Contractors Overheads & Profits @ 5.00%	£	113,100.00
Total Construction Cost, Incl. On-Costs	£	2,827,500.00

Appendix H

BATHYMETRIC SURVEY



Trees/Tree Abbreviations

ASH	Ash	LP	London Plane
BAY	Bay	MAP	Maple
BEE	Beech	OAK	Oak
CB	Copper Beech	POP	Poplar
CED	Cedar	RM	Red Maple
CHE	Cherry	RW	Redwood
CON	Conifer	SB	Silver Birch
EUC	Eucalyptus	SER	Service Tree
FR	Fruit	SP	Scots Pine
HAW	Hawthorn	SYC	Sycamore
HAZ	Hazel	WAL	Walnut
HC	Horse Chestnut	WILL	Willow
HOL	Holly	WP	Weeping Willow
LAB	Laburnum	YEW	Yew
LAU	Laurel	**MB	Multiple stems/trunks Overall dia. shown
LI	Lime		

Tree Dimensions (average) Spread/Trunk Dia/Height

Trees denoted with "approx" have been surveyed by remote methods and therefore their positions & dimensions cannot be guaranteed.

Abbreviations

AV	Air Valve	LP	Lamp Post
BL	Bollard	M	Meter
BM	Bench Mark	MH	Manhole Cover
BP	Boundary Point	MK	Marker
BT	BT Cover	MS	Milestone
CATV	Cable Television Cover	RG	Ridge Level
CAB	Cabinet	RS	Road Sign
CL	Cover Level	rwp	Rain Water Pipe
EP	Electric Power Pole	SC	Stop Cock
EV	Eaves Level	Str	Strainer
FH	Fire Hydrant	SV	Stop Valve
FL	Floor Level	svp	Soil Vent Pipe
FP	Fence Post	TH	Threshold Level
G	Gully	TL	Traffic Light
GP	Gate Post	TP	Telephone Pole
GV	Gas Valve	UTL	Unable To Lift
IC	Inspection Chamber	VP	Vent Pipe
IL	Invert Level	WM	Water Meter
KO	Kerb Outlet	WO	Wash Out

Linetypes

Bank (top/bottom)
Building
Drop kerb
Electric
Fence
Foliage
FWS (Estimated Size From Surface)
Hedge
Kerb
Pipe
SWS (Estimated Size From Surface)
Telephone
Track/Path
Tree Canopy
Verge
Water line
Wall

Bore Hole — Double Gates
Trial Pit — Single Gate
Station Control — Manhole

Tree Dimensions (average) Spread/Trunk Dia/Height

SWS
SouthWestSurveys

Tel: 01454 501683
Mobile: 07595946495
www.southwestsurveys.co.uk
info@southwestsurveys.co.uk
28 Rudgeway Park
Rudgeway
Bristol
South Glos
BS35 3RU

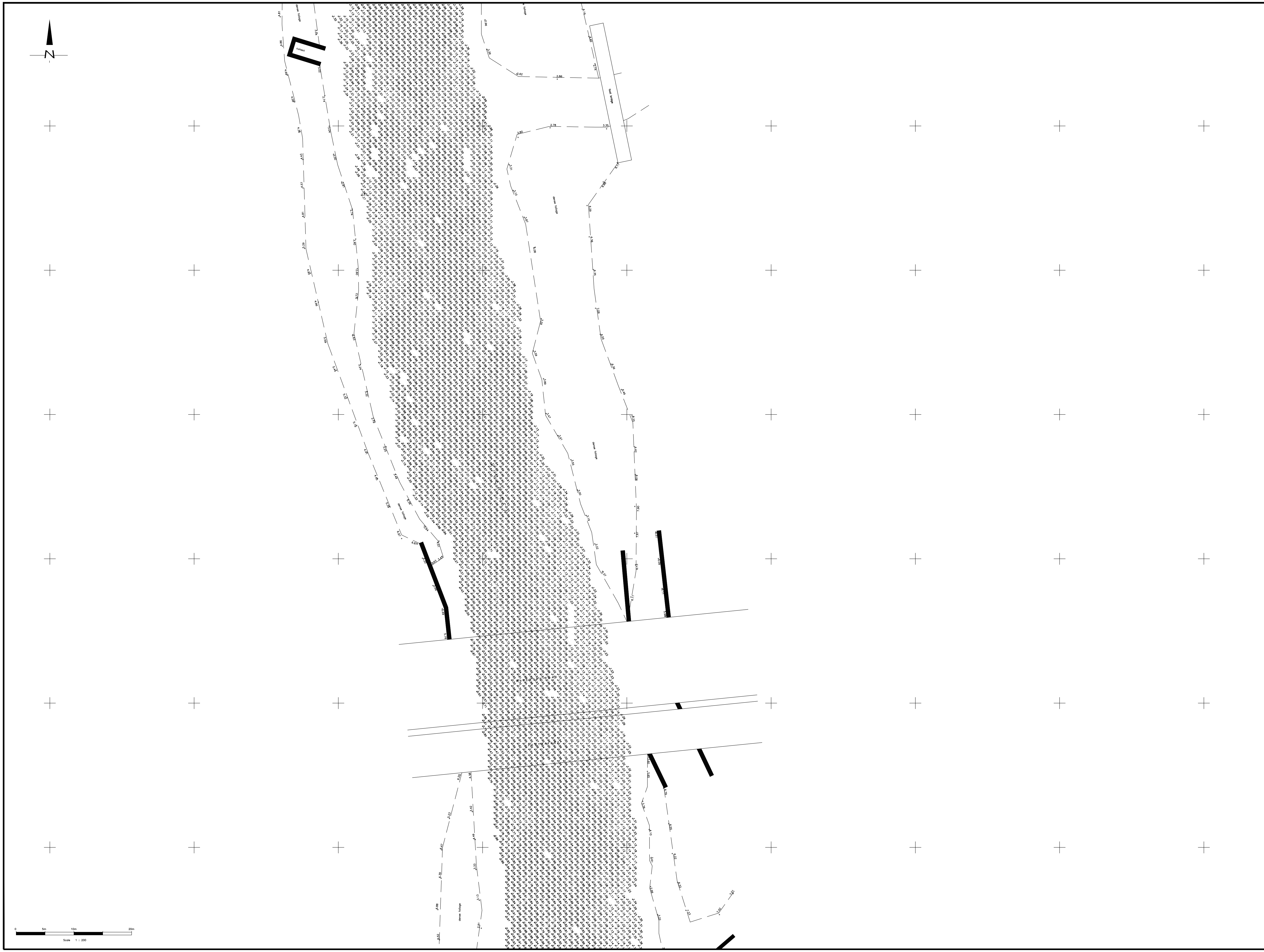
Drawing Title:
Topographic survey (sheet 1)

Project Name:
Olympic Park
London, E20 2AA

Client:
n/a
Agent:
WSP

Site Level Datum	Grid Orientation
ODN Height	OSGB36
Date: 19th March 2024	Scale: 1:200 @ A0

Surveyed By	Drawn By	Sheet ID	Rev
RP TW	TW	SWS012448topo	rev



Trees/Tree Abbreviations

ASH	Ash	LP	London Plane
BAY	Bay	MAP	Maple
BEE	Beech	OAK	Oak
CB	Copper Beech	POP	Poplar
CED	Cedar	RM	Red Maple
CHE	Cherry	RW	Redwood
CON	Conifer	SB	Silver Birch
EUC	Eucalyptus	SER	Service Tree
FR	Fruit	SP	Scots Pine
HAW	Hawthorn	SYC	Sycamore
HAZ	Hazel	WAL	Walnut
HC	Horse Chestnut	WILL	Willow
HOL	Holly	WP	Weeping Willow
LAB	Laburnum	YEW	Yew
LAU	Laurel	**MB	Multiple stems/trunks Overall dia. shown
LI	Lime		

Tree Dimensions (average) Spread/Trunk Dia/Height

Trees denoted with "approx" have been surveyed by remote methods and therefore their positions & dimensions cannot be guaranteed.

Abbreviations

AV	Air Valve	LP	Lamp Post
BL	Bollard	M	Meter
BM	Bench Mark	MH	Manhole Cover
BP	Boundary Point	MK	Marker
BT	BT Cover	MS	Milestone
CATV	Cable Television Cover	RG	Ridge Level
CAB	Cabinet	RS	Road Sign
CL	Cover Level	rwp	Rain Water Pipe
EP	Electric Power Pole	SC	Stop Cock
EV	Eaves Level	Str	Strainer
FH	Fire Hydrant	SV	Stop Valve
FL	Floor Level	svp	Soil Vent Pipe
FP	Fence Post	TH	Threshold Level
G	Gully	TL	Traffic Light
GP	Gate Post	TP	Telephone Pole
GV	Gas Valve	UTL	Unable To Lift
IC	Inspection Chamber	VP	Vent Pipe
IL	Invert Level	WM	Water Meter
KO	Kerb Outlet	WO	Wash Out

Linetypes

Bank (top/bottom)
Building
Drop kerb
Electric
Fence
Foliage
FWS (Estimated Size From Surface)
Hedge
Kerb
Pipe
SWS (Estimated Size From Surface)
Telephone
Track/Path
Tree Canopy
Verge
Water line
Wall

Bore Hole
Trial Pit
Station Control
Double Gates
Single Gate
Manhole

Tree Dimensions (average) Spread/Trunk Dia/Height

SWS
SouthWestSurveys

Tel: 01454 501683
Mobile: 07595946495
www.southwestsurveys.co.uk
info@southwestsurveys.co.uk

28 Rudgeway Park
Rudgeway
Bristol
South Glos
BS35 3RU

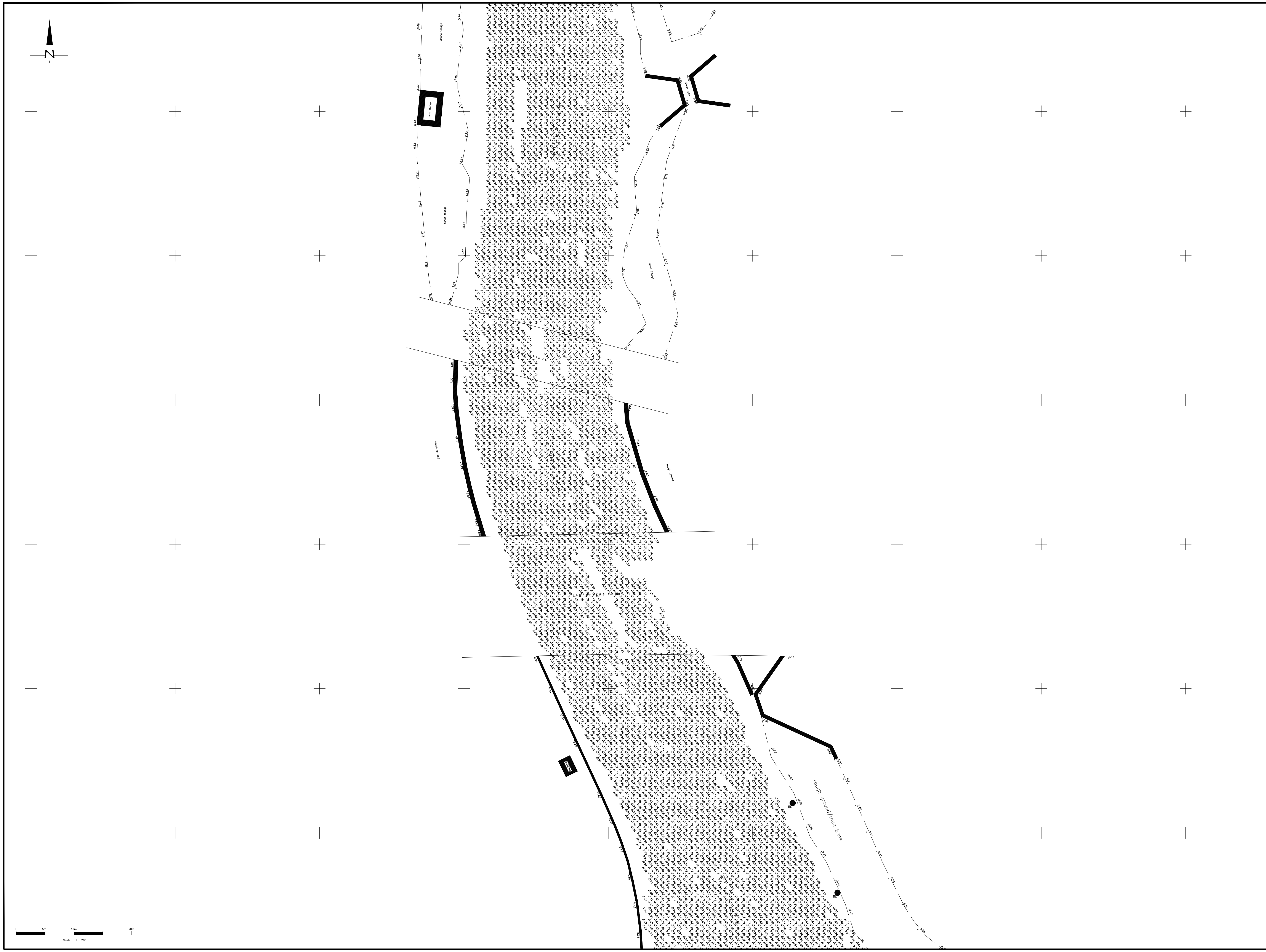
Drawing Title:
Topographic survey (sheet 2)

Project Name:
Olympic Park
London, E20 2AA

Client:
n/a
Agent:
WSP

Site Level Datum: ODN Height	Grid Orientation: OSGB36
Date: 19th March 2024	Scale: 1:200 @ A0

Surveyed By	Drawn By	Sheet ID	Rev
RP TW	TW	SWS012448topo	rev



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BEE	Beech	OAK	Oak
CB	Copper Beech	POP	Poplar
CED	Cedar	RM	Red Maple
CHE	Cherry	RW	Redwood
CON	Conifer	SB	Silver Birch
EUC	Eucalyptus	SER	Service Tree
FR	Fruit	SP	Scots Pine
HAW	Hawthorn	SYC	Sycamore
HAZ	Hazel	WAL	Walnut
HC	Horse Chestnut	WILL	Willow
HOL	Holly	WP	Weeping Willow
LAB	Laburnum	YEW	Yew
LAU	Laurel	**MB	Multiple stems/trunks Overall dia. shown
LI	Lime		

Tree Dimensions (average)
Spread/Trunk Dia/Height

Trees denoted with "approx" have been surveyed by remote methods and therefore their positions & dimensions cannot be guaranteed.

Abbreviations

AV	Air Valve	LP	Lamp Post
BL	Bollard	M	Meter
BM	Bench Mark	MH	Manhole Cover
BP	Boundary Point	MK	Marker
BT	BT Cover	MS	Milestone
CATV	Cable Television Cover	RG	Ridge Level
CAB	Cabinet	RS	Road Sign
CL	Cover Level	rwp	Rain Water Pipe
EP	Electric Power Pole	SC	Stop Cock
EV	Eaves Level	Str	Strainer
FH	Fire Hydrant	SV	Stop Valve
FL	Floor Level	svp	Soil Vent Pipe
FP	Fence Post	TH	Threshold Level
G	Gully	TL	Traffic Light
GP	Gate Post	TP	Telephone Pole
GV	Gas Valve	UTL	Unable To Lift
IC	Inspection Chamber	VP	Vent Pipe
IL	Invert Level	WM	Water Meter
KO	Kerb Outlet	WO	Wash Out

Linetypes

Bank (top/bottom)
Building
Drop kerb
Electric
Fence
Foliage
FWS (Estimated Size From Surface)
Hedge
Kerb
Pipe
SWS (Estimated Size From Surface)
Telephone
Track/Path
Tree Canopy
Verge
Water line
Wall

Bore Hole
Trial Pit
Station Control
Double Gates
Single Gate
Manhole

Tree Dimensions (average)
Spread/Trunk Dia/Height

SWS
SouthWestSurveys

Tel: 01454 501683
Mobile: 07595946495
www.southwestsurveys.co.uk
info@southwestsurveys.co.uk

28 Rudgeway Park
Rudgeway
Bristol
South Glos
BS35 3RU

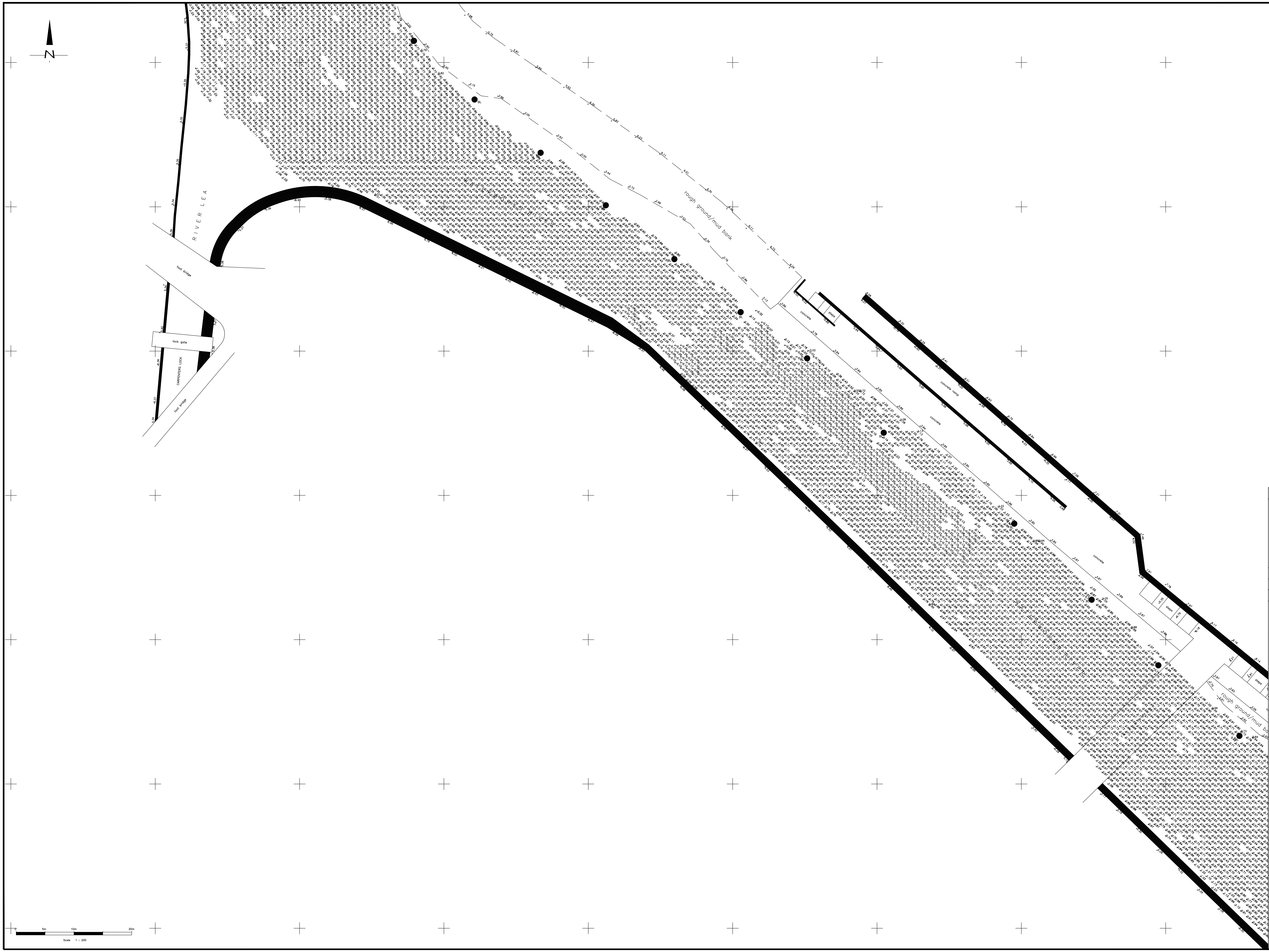
Drawing Title:
Topographic survey (sheet 3)

Project Name:
Olympic Park
London, E20 2AA

Client:
n/a
Agent:
WSP

Site Level Datum	Grid Orientation
ODN Height	OSGB36
Date: 19th March 2024	Scale: 1:200 @ A0

Surveyed By	Drawn By	Sheet ID	Rev
RP TW	TW	SWS012448topo	rev



Trees/Tree Abbreviations

ASH	Ash	LP	London Plane
BAY	Bay	MAP	Maple
BEE	Beech	OAK	Oak
CB	Copper Beech	POP	Poplar
CED	Cedar	RM	Red Maple
CHE	Cherry	RW	Redwood
CON	Conifer	SB	Silver Birch
EUC	Eucalyptus	SER	Service Tree
FR	Fruit	SP	Scots Pine
HAW	Hawthorn	SYC	Sycamore
HAZ	Hazel	WAL	Walnut
HC	Horse Chestnut	WILL	Willow
HOL	Holly	WP	Weeping Willow
LAB	Laburnum	YEW	Yew
LAU	Laurel	**MB	Multiple stems/trunks Overall dia. shown
LI	Lime		

Tree Dimensions (average)
Spread/Trunk Dia/Height

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28 Rudgeway Park
Rudgeway
Bristol
South Glos
BS35 3RU

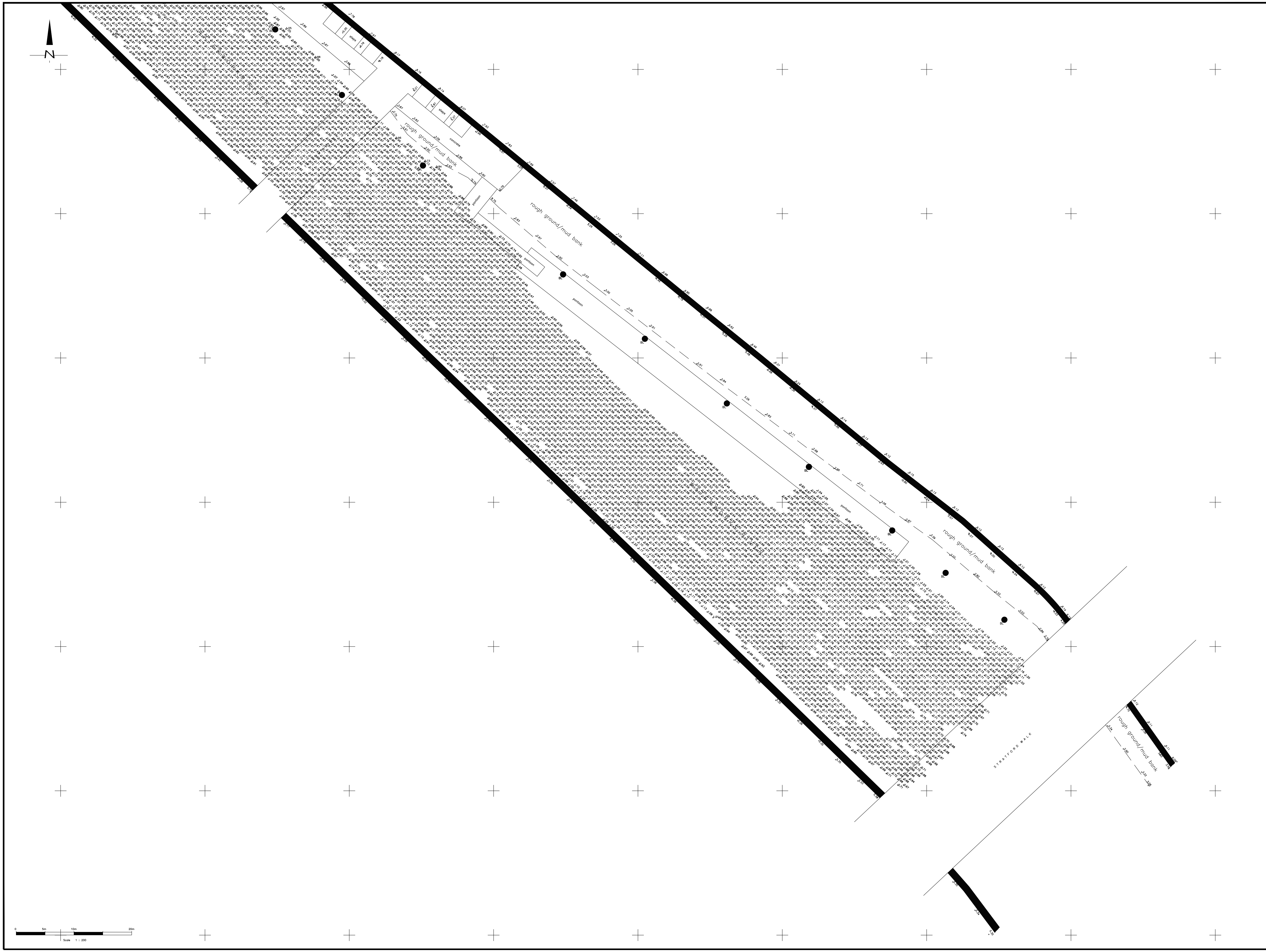
Drawing Title:
Topographic survey (sheet 4)

Project Name:
Olympic Park
London, E20 2AA

Client:
n/a
Agent:
WSP

Site Level Datum: ODN Height	Grid Orientation: OSGB36
Date: 19th March 2024	Scale: 1:200 @ A0

Surveyed By	Drawn By	Sheet ID	Rev
RP TW	TW	SWS012448topo	rev



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Spread/Trunk Dia/Height

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Tree Dimensions (average)
Spread/Trunk Dia/Height

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28 Rudgeway Park
Rudgeway
Bristol
South Glos
BS35 3RU

Drawing Title:
Topographic survey (sheet 5)

Project Name:
Olympic Park
London, E20 2AA

Client:
n/a
Agent:
WSP

Site Level Datum	Grid Orientation
ODN Height	OSGB36
Date: 19th March 2024	Scale: 1:200 @ A0

Surveyed By	Drawn By	Sheet ID	Rev
RP TW	TW	SWS012448topo	rev

Appendix I

UKPN QUOTE

Registered Office
Newington House
237 Southwark Bridge Road
London SE1 6NP

Company:
UK Power Networks
(Operations) Limited

Registered in England and Wales No: 3870728

Mr. Mike Evans
London Legacy Development Corporation
Level 9
5, Endeavor Square
Stratford
E20 1JN

Date: 16 April 2024

Our Ref: 8600031172 / QID 3000049765

Dear Mike,

Site Address: Carpenters Rd, London, E20 1JY.

Budget estimate

I am writing to you on behalf of London Power Networks plc the licensed distributor of electricity for the above address trading as and referred to in this Quote as “UK Power Networks”. Thank you for your recent enquiry regarding the above premises.

I am pleased to be able to provide you with a budget estimate for the Works.

It is important to note that this budget estimate is intended as a guide only. It may have been prepared without carrying out a site visit or system studies. No enquiry has been made as to the availability of consents or the existence of any ground conditions that may affect the ground works and only a cursory assessment of any Reinforcement costs that may be applicable has been undertaken. A detailed evaluation of any potential Reinforcement costs, including the applicability of the High-Cost Project Threshold and associated Cost Apportionment Factor will be undertaken upon receipt of a formal application for a Connection Offer. This Budget Estimate is not an offer to provide the connection and nor does it reserve any capacity on UK Power Networks’ electricity distribution system.

Description of work included:

The Budget estimate to provide 500kVA supply is £160,000.00 (excluding VAT), if the point of connection is made onto the existing SC Feeder Group from Kings Yard Main Substation.

The works for the Budget Estimate includes:

- Establishing 1 x 800kVA package substation.
- Final joint onto existing passing HV main.

Assumptions

This budget estimate is based on the following assumptions:

- The most appropriate Point of Connection (POC) is as described above.
- A viable cable route exists along the route we have assumed between the Point of Connection (POC) and your site.
- In cases where the Point of Connection (POC) is to be at High Voltage, that a substation can be located on your premises at or close to the position we have assumed

- Where electric cables are to be installed in private land UK Power Networks will require an easement in perpetuity for its electric lines and in the case of electrical plant the freehold interest in the substation site, on UK Power Networks terms, without charge and before any work commences.

- You will carry out, at no charge to UK Power Networks, all the civil works within the site boundary, including substation bases, substation buildings where applicable and the excavation/reinstatement of cable trenches

- Unless stated in your application, all loads are assumed to be of a resistive nature. Should you intend to install equipment that may cause disturbances on UK Power Networks' electricity distribution system (e.g. motors; welders; etc.) this may affect the estimate considerably

- All UK Power Networks' work is to be carried out as a continuous programme of work that can be completed substantially within 12 months from the acceptance of the Quote.

Please note that if any of the assumptions prove to be incorrect, this may have a significant impact on the price in any subsequent Quote. You should note also that UK Power Networks' formal Quote may vary considerably from the budget estimate. If you place reliance upon the budget estimate for budgeting or other planning purposes, you do so at your own risk.

If you would like to proceed

If you would like to proceed to a formal offer of connection then you must apply for a Quote. Please refer to our website click here to complete application process.

To help us progress any future enquiry as quickly as possible please quote the UK Power Networks Reference Number from this letter on all correspondence.

Any Questions?

If you have any questions about your budget estimate or need more information, please do not hesitate to contact me. The best time to call is between the hours of 9am and 4pm, Monday to Friday. If the person you need to speak to is unavailable or engaged on another call when you ring, you may like to leave a message or call back later.

Yours sincerely

Shahina Akthar

Mobile: 07783846702

Email: Shahina.Akthar@ukpowernetworks.co.uk

To download your free safety leaflets and resources visit
UK Power Networks - Safety Page

Kings Orchard
1 Queen Street
Bristol
BS2 0HQ

wsp.com