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Football Club

Kop Development

Drainage Strategy Report

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WREXHAM ASSOCIATION FOOTBALL CLUB – KOP DEVELOPMENT DRAINAGE STRATEGY REPORT

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1. INTRODUCTION

1.1 Objective

The objective of this report is to provide a description of the foul and surface water drainage strategy to support the Full planning application for the redevelopment of the Kop Stand for 5,500 seats inclusive of 500 capacity hospitality area, new public realm, and associated works at Wrexham Association Football Club.

1.2 Constraints and Limitations

This report has been prepared by Ramboll UK Limited (Ramboll) exclusively for the intended use by Wrexham Association Football Club (WAFC).

The information contained within this report is based on a review of existing information and consultation with interested parties.

Ramboll UK has endeavoured to assess all information provided to them during this appraisal. The report summarises information from several external sources and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon. Ramboll UK has not verified information from third parties, unless otherwise stated in this report.

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1.3 Records Review

The key reports and drawings reviewed as part of this strategy are listed in the table below:

Title	Author	Date
Welsh Water Asset Plan	Welsh Water	15 th September 2021
Drainage and Utility survey – “0921-RAM-001”	Subsite surveys	23 rd September 2021
WRX-AFL-Z4-00-DR-A-20110	AFL	13 th June 2022
WRX-AFL-Z4-01-DR-A-20111	AFL	13 th June 2022
WRX-AFL-Z4-02-DR-A-20112	AFL	13 th June 2022

Table 1 Key Reports and Drawings

2. SITE DESCRIPTION

2.1 Site Location

The existing football ground lies to the northwest of the town centre and adjoins, but is outside, the Masterplan Area of the adopted Wrexham Town Centre Masterplan (2016). It is situated between the railway station and university campus as shown in the figure below.

The KOP stand is located on OS Grid Reference SJ328509 and National Grid Reference 332897m (Northing), 350935m (Easting).

2.2 Site Topography

A topographical survey for the application site has been undertaken by Compass Land Surveys and indicates the lowest part of the existing stand at the pitch edge is around 88.039 rising to 93.580 at the back of the stand. There is a vegetated earth embankment to the rear of the stand falling to approximately 88.260. The remainder of the site within the redline is hardcore at around 88.200 falling towards Crispin Lane which falls generally from south to north.

2.3 Flood Risk Statement

The site is located in an area indicated to be at low risk of fluvial flooding, and given the site is less than 1 ha in area, a full Flood Consequences Assessment is not required. However, provided below is a summary assessment of the flood risk to the site from all sources.



Figure 1 - Caption taken from Natural Resource Wales flood data map

2.3.1 Fluvial and Tidal Flood Risk

The primary resource for reviewing fluvial and tidal flood risk is via the NRW Flood Map for Planning. These classify risks as follows:

- Flood Zone 2 - Areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from rivers in a given year, including the effects of climate change
- Flood Zone 3 – Areas with more than 1% (1 in 1000) chance of flooding from rivers in a given year including the effects of climate change

The site is not shown to be located in a Flood Zone. Therefore, fluvial and tidal flooding is not considered to be a factor at the site. The closest area indicated to be in Flood Zone 2 is located approximately 230m south.

2.3.2 Surface Water Flood Risk

The NRW Flood Map for Planning delineates from pluvial sources into the three following categories:

- Low - *this area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%).*
- Medium - *this area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%).*
- High - *this area has a chance of flooding of greater than 1 in 30 (3.3%).*

The majority of the site is at not shown to be at risk of surface water flooding. There is a small area of Low risk that extends across the northern edge of the pitch this accumulates in the north west corner of the stadium pitch. This does not take account of specific surface water drainage measures. The risk of surface water flooding is therefore considered to be low.

2.3.3 Groundwater

Wrexham County Borough Council's Local Flood Risk Management Plan has identified no records of past groundwater flooding within the County Borough. The Dee Preliminary Flood Risk Assessment also confirms since 2011 there have been no recorded events of groundwater flooding within the Dee River Basin District. Therefore the risk of groundwater flooding is considered to be low.

2.3.4 Historic Flooding

According to the NRW Flood Map for Planning the site has not experienced historic flooding. The closest record of a historic flood is 7.5km south-east adjacent to the River Dee.

2.3.5 Risk from Reservoirs, Canal and Other Artificial Sources

The NRW online mapping suggests that the site is not located in an area at risk of flooding from reservoirs, canals or other artificial sources. Therefore, the risk of flooding from these sources is considered to be low.

2.3.6 Summary

The main risk to the site in terms of future flood risk is from extreme rainfall events causing overland flow and surface water flooding. This will be managed via the surface water drainage strategy summarised in this report.

2.4 Infiltration

Infiltration testing has been undertaken in accordance with BRE digest 365, the test results have confirmed that infiltration is a viable solution to managing the surface water from the development. Table 2 below details the soakaway test results which can be found in Appendix 8. Figure 2 below

shows local borehole data that identifies that the strata comprise of “compact to dense coarse brown sand with small to large gravel”. The results are similar to the values indicated in table 25.1 from the Ciria SuDS Manual shown below in figure 3.

Table 2 - Soakaway test results

Reference	Infiltration rate (m/sec)
TP01 – Test 1	7.3×10^{-4}
TP01 – Test 2	4.7×10^{-4}
TP01 – Test 3	4.0×10^{-4}
TP02 – Test 1	1.4×10^{-3}
TP02 – Test 2	5.2×10^{-4}
TP03 – Test 3	4.2×10^{-4}

Description of Strata	Legend	Depth	Thick- ness	Sample		SPT 'N' Value	Water levels and General Remarks
				Type	Depth		
ASH AND SOIL AND BRICK FILL		0.30	0.30				
COMPACT TO DENSE COARSE BROWN SAND WITH SMALL TO LARGE GRAVEL				SPT	0.91	13	
				SPT	1.83	26	
				SPT	2.74	39	
		3.66	3.36				B.H. DRY

Figure 2 – Bore hole data available on site taken 200m to the south of site

TABLE 25.1 Typical infiltration coefficients based on soil texture (after Bettess, 1996)			
Soil type/texture	ISO 14688-1 description (after Blake, 2010)	Typical infiltration coefficients (m/s)	
Good infiltration media			
• gravel	Sandy GRAVEL	$3 \times 10^{-4} - 3 \times 10^{-2}$	
• sand	Slightly silty slightly clayey SAND	$1 \times 10^{-3} - 5 \times 10^{-3}$	
• loamy sand	Silty slightly clayey SAND	$1 \times 10^{-4} - 3 \times 10^{-5}$	
• sandy loam	Silty clayey SAND	$1 \times 10^{-7} - 1 \times 10^{-5}$	
Poor infiltration media			
• loam	Very silty clayey SAND	$1 \times 10^{-7} - 5 \times 10^{-6}$	
• silt loam	Very sandy clayey SILT	$1 \times 10^{-7} - 1 \times 10^{-5}$	
• chalk (structureless)	N/A	$3 \times 10^{-8} - 3 \times 10^{-6}$	
• sandy clay loam	Very clayey silty SAND	$3 \times 10^{-10} - 3 \times 10^{-7}$	
Very poor infiltration media			
• silty clay loam	—	$1 \times 10^{-8} - 1 \times 10^{-6}$	
• clay	Can be any texture of soil described above	$< 3 \times 10^{-8}$	
• till		$3 \times 10^{-9} - 3 \times 10^{-6}$	
Other			
• rock* (note mass infiltration capacity will depend on the type of rock and the extent and nature of discontinuities and any infill)	N/A	$3 \times 10^{-9} - 3 \times 10^{-5}$	

Figure 3 - Typical Infiltration Coefficients (CIRIA SuDS Manual, 2015)

2.5 Existing Site Drainage

2.5.1 Public Assets

The provided Welsh Water asset map is shown in figure 6.1. The Welsh Water sewer records indicate that a 150mm diameter foul water public sewer which currently serves part of the Racecourse Ground and the Turf Hotel crosses the south west of the site. This is indicated as a foul water sewer on the asset information but the lack of surface water infrastructure in the area could mean that this is actually a combined sewer. The records also indicate a 225mm diameter public combined sewer is located within Crispin Lane.



Figure 6.1: Extract from Welsh Water sewer record

2.5.2 Private Drainage

Topographical survey information and a site walkover confirms that the existing stand roof collects rainwater from the front and rear of the stand via above ground pipework. The pipework routes the collected surface water to the rear of the stand, it is currently not clear where this connects to below ground but is believed to be a historic soakaway. The front of the existing Kop stand is managed by several small localised soakaways.



Figure 6.2: Roof positive drainage system

The surface water drainage to the concrete area between the pitch and the front of the stand is collected via gullies and below ground pipework but the final discharge location is unknown.

There appears to be no current positive drainage systems to the vegetated earth embankment or existing hardcore areas although part of these areas used to be a car showroom and industrial buildings and therefore would have had drainage networks associated with these.

Existing drainage and topographical information can be found in Appendix 1.

2.6 Existing Surface Water Run-Off

The proposed redline boundary area is 0.642ha of which

- 0.216ha – roof and some concrete hardstanding areas
- 0.202ha – existing hardcore area
- 0.224ha – existing green

Brownfield calculations using the Wallingford Procedure have been produced at this time until further survey has been undertaken to understand the actual drainage networks serving the Application Site.

Using the area of existing hardstanding and stand roof peak runoff rates have been calculated as indicated in Table 2.1.

Table 2.3: Peak Storm Runoff

Return Period	Peak Runoff Rate (l/s)
M1-5	51.37 l/s
M2-5	65.46 l/s
M30-5	118.2 l/s
M100-5	148.3 l/s
Based on site area = 0.216 ha	

Greenfield runoff rates have also been calculated for the full redline boundary of the site.

Table 2.2: Greenfield

Return Period	Peak Runoff Rate (l/s)
M1-5	1.1 l/s
M2-5	1.2 l/s
M30-5	2.6 l/s
M100-5	3.5 l/s
Based on site area = 0.642 ha	

3. DESIGN STANDARDS AND CRITERIA

3.1 Design Standards and Criteria

The proposed surface water and foul water drainage networks will be designed and installed to achieve self-cleaning velocity. Flows will generally be kept above 0.75 m/s to avoid erosion of the internal pipe surface, respectively, within the pipelines to ensure that self-cleaning velocities are achieved. This is subject to the condition, location, and level of the existing off-site drainage.

To give a long design life, with minimum embodied energy, the buried pipework will generally be:

- Externally: Vitrified clay and concrete, where possible; and
- Cast iron when laid below or cast within or through foundations or building structures.

Chambers will generally be either (subject to availability of space):

- Polypropylene inspection chambers (if less than 1.2m to invert level), or
- Pre-cast manholes (if deeper than 1.2m to invert and in areas subject to vehicle over-run).
- In-situ concrete manholes.
- Non-entry polypropylene inspection chamber will be used, where required, up to a depth of 3.0m.

Pipe diameters will generally be as follows:

- Foul water drainage – DN150, DN225 and DN300 to minimise the risk of blockage.

The development will be drained by dedicated and fully segregated surface and foul water systems designed in accordance with the following documents (where appropriate);

- Building Regulations - Approved Document Part H;
- BS EN 12056: Parts 1-5: Gravity Drainage Systems Inside Buildings;
- BS EN 752: Drain and Sewer Systems outside buildings;
- Sustainable Drainage Systems - Design manual for England and Wales (CIRIA C753);
- Sewers Sector Guidance 2019;
- SAB guidance criteria;
- Planning Policy Wales Edition 11;

3.2 Planning Policy

Planning Policy Wales Edition 11 February 2021 sets out the land use policies of the Welsh Government, Section 6.6 specifically is in relation to Water and Flood Risk and supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. TAN 15: Development and Flood Risk should be referred to for policy advice on development and flood risk.

Section 6.6.17 of the policy states that all new developments of more than one dwelling or where the area exceeds more than 100m² requires, alongside the planning process, approval from the SuDS Approval Body (SAB) before construction can commence.

The provision of SuDS must be considered as an integral part of the design of the new development and considered at the earliest possible stage when formulating the new proposals. The development proposals should incorporate the design for surface water management, based on principles which work with nature to facilitate the natural functioning of the water cycle. Designing for multiple benefits and green infrastructure should be secured wherever possible. The Interim Code of Practice

for Sustainable Drainage Systems 2004 gives guidance on the implementation of SuDS in new developments.

4. CONSULTATIONS

Initial consultations have been undertaken with Welsh Water (Dwr Cymru) and the SAB approval body for Wrexham County Borough Council with regards to discharge of proposed foul and surface water flows from the site and the use of SuDs on the site.

4.1 Wrexham County Borough Council – Sustainable Urban Drainage Approving Body (SAB)

A site meeting was attended by Lisa Sawyer (Ramboll) and Carole Wright & Kevin Edwards (Wrexham SAB officers), the proposed scheme was discussed along with SuDS implementation in accordance with relative guidance. Notes taken at the time of the meeting detailed that the scheme / SAB application should include;

- Water recycling as landscaping options appear to be limited.
- Green SuDS which gives other benefits than just water storage, eg biodiversity benefits from implementing a green roof with storage (not just a blue roof) and / or raingardens, swales adjacent to the hardstanding areas which included a complete water treatment train for all water collection.
- Infiltration testing results to prove whether this is possible within the design.

A preapplication SAB submission was made to Wrexham County Borough Council on 08.06.2022 and at the time of writing no response has been received. The preapplication response has been provided in Appendix 9.

Ramboll are also engaged with Wrexham County Borough Council regarding the phosphates permit and are working to assist in finding a suitable solution.

4.2 Dwr Cymru Welsh Water

Initial consultation via a pre-development enquiry was submitted with Welsh Water in regard to connection of foul drainage and possible surface water drainage to the public sewer network.

As part of the works a sewer diversion of the public sewer which is currently within the application site has been progressed under a Section 185 Agreement.

The response is shown within Appendix 05 and highlights that there is sufficient capacity within the network to receive the calculated flows, however it indicates that Five Fords Waste Water Treatment Works (WWTW) has a phosphate permit that needs to be discussed with the local planning authority.

5. PROPOSED FOUL WATER DRAINAGE STRATEGY

5.1 Introduction

The following calculations have been based on work in progress Stage 2 architectural and MEP design layouts / information to provide a preliminary assessment of the likely foul drainage flow rates originating from the proposed development.

The existing stand is currently condemned and unused with the proposed stand to provide seating for up to 5500 fans.

At this stage, the calculations are based on a number of assumptions and estimates and therefore may be subject to further refinement as the wider infrastructure and architectural design is developed through Concept and Technical Design.

5.2 Methodology

Due to the nature of the proposed stand the peak foul flow rate will only occur for a short period of time on match days. Therefore, a four-hour peak period will be utilised for the calculations. All below ground drainage will be designed to sustain a self-cleansing velocity during quitter periods.

At this stage, above ground flow calculations have not been undertaken / finalised so flow rates are subject to change.

To assess the foul flow calculations the population & expected probability rates as outlined within BS EN 752 & BS EN 12056 will be calculated and will be compared to gain an understanding of the flow rate.

5.2.1 Probability Method

The number of appliances below are as per AFL Architects layout dated 13/06/2022. Number of stacks within kitchens have been assumed, along with floor gullies assumed within plant spaces. For these calculations 'System II: Single discharge stack system with small bore discharge branch pipes' will be utilised, and a frequency factor of 1.0 will be utilised which is used for 'Congested use, e.g., in toilets and/or showers open to public'.

The breakdown of the appliances are as follows:

- Ground floor (level 0):
 - 89 WC's (1.8 DU): 160.2 DU
 - 67 Wash hand basins (0.3 DU): 20.1 DU
 - 67 Urinals (0.5 DU): 33.5 DU
 - 3 FG's (assumed) (1.5 DU): 4.5 DU
- Level 1:
 - 13 WC's (1.8 DU): 23.4 DU
 - 13 Wash hand basins (0.3 DU): 3.9 DU
 - 4 Urinals (0.5 DU): 2.0 DU
 - 1 Shower (0.6 DU): 0.6 DU
- Level 2:
 - 14 WC's (1.8 DU): 25.2 DU
 - 13 Wash hand basins (0.3 DU): 3.9 DU
 - 10 Urinals (0.5 DU): 5.0 DU
 - 4 FG's (assumed) (1.5 DU): 6.0 DU
 - 4 Sinks (assumed) (0.8 DU): 3.2 DU
 - 2 Dishwashers (assumed) (0.8 DU): 1.6 DU

Peak foul flow, Q_{ww} can be calculated as follows:

$$Q_{ww} = k\sqrt{\sum DU}$$

Therefore,

$$Q_{ww} = 1.0 * \sqrt{293.1} = \mathbf{17.12 \text{ l/s}}$$
 (Average flow 2.85 l/s)

Note, this value is based upon assumptions made at stage 2 and may increase / decrease dependent on any design changes at detailed design.

5.2.2 Population Method

The expected population for the development will vary due to the nature of the development. However, for the purpose of these calculations the maximum capacity of the stand will be utilised as this would generate the highest flow.

AFL Architects have produced a capacity schedule, and this will be utilised at this stage. The capacity schedule states a total capacity of 5500. Note this does not include staff, so for the purpose of these calculations a value of 5550 will be used to provide an allowance for the total occupation during a match event.

To establish the expected flow per person 'Flows & Loads 4' will be utilised to determine the most suitable scenario. The most applicable activity would be 'Local community sports club, e.g. squash, rugby & football' which gives a base flow of 40 litres per person per day. Applying this value to the 5550 expected capacity of the stand, a total foul flow volume can be calculated.

Therefore;

$$U = 5550 \times 40 \text{ l/p/d} = \mathbf{222,000 \text{ litres}}$$

As mentioned previously, a four-hour duration for an event is being utilised for a peak value for the foul flows. The peak foul flow, Q_{pop} can be calculated as follows:

$$Q_{pop} = \frac{U \text{ (in litres)}}{t \text{ (in seconds)}} \text{ l/s}$$

Therefore,

$$Q_{pop} = \frac{222000 \text{ l}}{4 \times 60 \times 60 \text{ s}} = \mathbf{15.42 \text{ l/s}}$$

5.3 Summary of foul water flows

For planning, a flow rate of **16 l/s** will be assumed as the peak flow rate from the proposed stand redevelopment as this is an approximation of the median from the two calculated peak flow rates.

As assessment & survey of the existing public sewer that currently drains the Wrexham AFC stadium & nearby establishments. Sewer records indicate that this sewer is 150mm in diameter, should this be the case the capacity of this sewer is likely to be approximately for a peak flow of **14 l/s**. To accept the flow from the proposed stand extension, there are two options that must be considered:

- Upgrade works to the existing public sewer to allow for additional flow.

- Provision of an offline storage solution to store effluent flow during peak times (match days).

The latter is likely to be required. Further calculations will be required once further information on the public sewer / allowable flow rates are available. When this information is available further calculations will be carried out and further liaison with Welsh Water to fully understand the requirement for offline storage.

5.4 Nitrate Neutrality

The Kop Development team are currently engaged with Wrexham County Borough Council, considering options for managing and mitigating any risk of additional phosphates to the foul water network that may be encountered from the Kop Stand development. These options will be explored further with information and detail provided as the mitigation measures are develop.

6. PROPOSED SURFACE WATER DRAINAGE STRATEGY

6.1 SuDS Strategy & Hierarchy

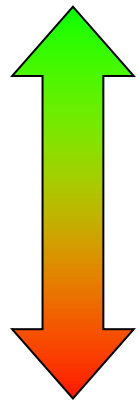
Sustainable Drainage Systems (SuDS) generally mimic the natural drainage patterns of the undeveloped site, allowing where possible, infiltration into the ground, improving water quality and controlling outflow rates from the development.

The proposed surface water drainage system has been designed to incorporate the current SuDS principles and approaches. The following hierarchy for managing surface water has been considered:

- Water Reuse
- Living Roofs
- Basins and Ponds
- Infiltration Devices
- Permeable Surfaces
- Tank Systems

More desirable

Less desirable



6.1.1 Water Reuse

The use of rainwater harvesting for greywater use within the building would decrease the volume and rate of surface water runoff from the building. This would reduce the roof runoff in low return period events; however, it cannot be considered to reduce peak flows off-site since the drainage strategy has to assume that the rainwater tank is full and therefore overflowing. Rainwater harvesting is also not deemed economical for this type of development due to the peaks and troughs in usage therefore is unlikely to be used within this scheme.

6.1.2 Living Roofs

Planted roof areas which provide a degree of rainfall storage and attenuation for small return period storms although the attenuation volumes for the site will have to assume the green roof is fully saturated. Well, maintained green/brown roofs are able to decrease the volume of surface water runoff by up to 40% in low return period storms. A green roof could be incorporated with the blue roof but will increase the weight on the structure and could possibly require additional maintenance than a blue roof alone.

6.1.3 Basins and Ponds

Basins and ponds are not considered viable due to the limited external space on the proposed development site.

6.1.4 Infiltration Devices

Infiltration testing has confirmed that infiltration is a viable solution to managing surface water collected from site. Infiltration systems are to be further than 5m from any existing or proposed

substructure. Infiltration soakaway tanks have been designed as a method of managing surface water from the development.

6.1.5 Permeable Surfaces

Permeable paving is considered for the external hard-landscaping areas. Permeable paving with below-ground sub-base attenuation can be used to help manage surface water run-off. In addition to storm-water attenuation, permeable paving also provides pollution control.

6.1.6 Geocellular Tank Systems

These have the advantage of having a high void ratio allowing it to attenuate large volumes. The use of a tank solution or large oversized pipework could be considered beneath the external circulation areas and could be incorporated with conveyance if connections are shallow to prevent pumping.

6.2 Proposed Surface Water Drainage Strategy

The proposed surface water drainage system for the Applications Site shall be designed to adhere to the following criteria:

- No surcharging of pipework during storms up to a 1:2-year annual probability
- No flooding to occur on suit during storms up to a 1:30-year annual probability
- No flooding of third-party land or buildings during storms up to a 1:100-year annual probability + 40% increased allowance for climate change.

It is acceptable to allow car parks or areas of soft landscaping to flood during 1:100-year annual probability events providing that it does not impact safe access/egress to the development for emergency services, emergency escape routes or impact third-parties.

Ground/Infiltration

Infiltration testing in accordance with BRE Digest 365 has been undertaken which has confirmed that the infiltration rates are suitable for an infiltration led strategy to manage surface water. The test results can be found in Appendix 8 and for the purpose of the design the infiltration rate will be set at 5.2×10^{-4} m/s.

Since positive infiltration testing results have been received the surface water design has been updated during the detailed design to include infiltration and remove the requirement for any discharge into the sewer. This approach has been discussed as part of the SAB preapplication process.

Surface Water Sewer or Combined Sewer

There are no surface water sewers located in the vicinity of the site according to the available survey information. There is a combined public sewer located in the south of the site that discharges towards the south. This is the location that Welsh Water identified as having capacity for the development and that should be used as the outfall location for the development.

In accordance with Building Regulations Part H, it is proposed that foul and surface water drainage systems will be kept separate up until the point of discharge into the public sewer network.

Details of the preliminary drainage strategy can be found within Appendix 6. Infiltration testing has been carried out (post planning design), the design has been updated to reflect a drainage strategy which uses infiltration to manage surface water.

The surface water drainage strategy has been designed to incorporate the below SuDS features;

- Green Roofs
- Permeable paving
- Geocellular soakaway tank

The infiltration rate that will be used for the purpose of the design is 5.2×10^{-4} m/s.

An SAB preapplication was submitted to Wrexham County Borough Council based on this methodology and this report has been updated to reflect the revised detailed surface water design incorporating infiltration.

The surface water will be collected on the roof through the implementation of a green / blue roof which will provide biodiversity benefits as well as assisting in managing the flows from the roof at source. Rainwater harvesting will also be implemented within the design.

Surface water collected from the external areas will be treated through the implementation of a light liquid separator and silt traps before discharging via a geocellular soakaway.

6.2.1 Pollution Control and Water Quality

Water quality treatment is provided to the surface water run-off through the following methods as detailed in the CIRIA 753 SuDS manual (CIRIA, 2015):

- Filtration and settlement - removal of silt or suspended solids (with associated pollutants).
- Biodegradation – chemical dissolution of organic contaminants such as oil, petrol and diesel by bacteria, fungi, or other biological means within the pavement layers.
- Adsorption – adhesion of contaminant particles to sand and gravel material surfaces within the pavement build-up. Dependent on factors such as aggregate type, structure, texture, and moisture content.

In line with CIRIA C753 The SuDS Manual Section 26.7 the land uses for the development and corresponding pollution hazard indices are shown in the table below:

Land Use	Pollution Hazard Level	Total Solids	Suspended Solids	Metals	Hydrocarbons
Roof	Low	0.3		0.2	0.05
Non-residential car parking and low traffic access road	Low	0.5		0.4	0.4

Table 6 - Pollution Hazard Indices (reproduced from CIRIA C753 Table 26.2)

The pollution hazard for the site is low, due to the site boundary comprising of the roof and a small area of external finishes. The sustainable drainage systems proposed satisfy the requirement to mitigate pollutants given the higher pollution mitigation indexes as shown in the below table:

Land Use	Total Suspended Solids	Metals	Hydrocarbons
Green Roof	0.8	0.8	0.8
Permeable Paving	0.7	0.6	0.7
Light Liquid Separator	NA	NA	NA

Table 7 - SuDS Mitigation Indices (reproduced from CIRIA C753 Table 26.4)

7. SITE & PROJECT CONSTRAINTS

The table below details the site-specific constraints which have been evaluated in order to determine the most appropriate drainage solution. Where elements are yet to be fully considered, this is noted alongside any additional comments. If the constraints lead to a specific risk, this have been highlighted and transferred to the Risk Register within Section 7.

Site / Project Constraints	Potential Impact on Development	Considered in Current Drainage Strategy	Comments
Sensitive environmental receptors	Restrictions on foul and surface water discharge location and quality; inclusion of additional polishing techniques such as separators, reed beds etc.	Yes/No	Discharge is to local utility sewerage systems. Connection into Welsh Water combined sewer proposed.
Presence of contamination	Restricts the use of infiltration for surface water disposal	Yes/No	Ground investigation survey to be carried out to identify any sources of contamination.
Presence of shallow aquifers	Restricts the use of infiltration for surface water disposal	Yes/No	Not identified in desk study.
Presence of nearby watercourses	Restrictions on discharging water quality	Yes/No	Foul and surface water to connect into the existing Welsh Water combined sewer.
Flood zone / flood relief areas	Limitations on SUDS systems that can be used (retention of attenuation capacity during flood events)	Yes/No	Development site is in Flood Zone A taken from the Natural Resource Wales Flood Risk Map.
Infiltrations rates (at required location/depth)	Applicability of infiltration devices for surface water disposal; size of infiltration devices	Yes/No	Infiltration rates recently received that identify that an infiltration lead strategy is feasible. Strategy to be taken forward at the next design stage and during discussions with the SAB via preapplication meetings.
Groundwater level	Restricts infiltration potential; authorities may prevent discharge from potential sources of pollution, i.e. paved areas. Pumping in excavations.	Yes/No	To be confirmed following ground investigation and ground water monitoring, not identified during infiltration testing.
Buried obstructions	May require localised removal within drainage locations or drainage to be re-routed around obstruction	Yes/No	Following demolition of the existing stand any existing obstructions to be surveyed and where applicable grubbed out and removed.
Foul water discharge point locations and invert levels	May require pumping; restrictions on pipe routing (shortest length); additional protection to shallow drains.	Yes/No	Proposed site levels to be confirmed and drainage strategy reviewed. Proposed foul water discharge to be via gravity where applicable into existing Welsh Water infrastructure. Pumping only to be considered if gravity connections are not viable.
Surface water discharge point locations and invert levels	May require pumping; restrictions on pipe routing (shortest length); additional protection to shallow drains.	Yes/No	Proposed site levels to be confirmed and drainage strategy reviewed. Proposed foul water discharge to be via gravity where applicable into existing Welsh Water infrastructure. Pumping only to be considered if gravity connections are not viable.
Availability of foul water infrastructure nearby	May require ‘self-sufficiency’ i.e. packaged treatment units, reed beds etc.	Yes/No	Existing drainage outfall systems to be utilised for disposal to utility sewerage systems. WW confirmed capacity for foul water.
Off-site drainage infrastructure capacity	Upgrading of water company assets; use of flow restrictors; additional storage/attenuation	Yes/No	Existing drainage outfall systems to be utilised for disposal to utility sewerage systems. WW contacted to assess available capacity in public sewer. WW advised that capacity for the foul water is available, the surface water discharge will be reduced so assumed acceptable.
Allowable discharging flow rates	Impacts on volume of attenuation required	Yes/No	The drainage strategy requires SAB approval, a SAB preapplication will be submitted prior to the planning submission. Infiltration testing was carried out on the 13 th July 2022 in accordance with BRE Digest 365. The results indicated that the soils encountered beneath the site were found to be predominantly sand with an infiltration rate of 1.872m/hr. Given the infiltration test results from the test, it is considered that the use of soakaways is suitable for this site and taken forward for detailed design.
Allowable discharging flow volumes	Allowable impermeable area/volume of long-term attenuation	Yes/No	The drainage strategy requires SAB approval, a SAB preapplication will be submitted prior to the planning submission.
Specific authority requirements	Limits SUDS systems / materials specifications that can be used	Yes/No	The drainage strategy requires SAB approval, a SAB preapplication will be submitted prior to the planning submission.
Easements for services, rivers, critical infrastructure	Reduces available space; restricts drainage element locations	Yes/No	Diversions and abandonment considered.
BREAAM credit requirement	Enhanced restriction of surface water discharge requiring additional controls and increased attenuation	Yes/No	Not considered at this stage, design in accordance with requirements from SAB officer.
Available external area (space for SUDS)	Limits SUDS systems that can be used (low land take)	Yes/No	Surface water drainage strategy proposals to integrate SuDS features, i.e. rain gardens, porous paving, and below ground attenuation tanks as well as rain water harvesting into the design.
Land use (appropriateness for open water)	Limits SUDS systems that can be used (health and safety)	Yes/No	Not considered due to nature of project and pedestrian access.
Traffic level type/volume	Pervious paving foundation thickness	Yes/No	Infrequent use by traffic; i.e. pedestrian access with emergency vehicles / maintenance vehicles only. This to be checked against pavement design and frost heave requirements at later design stage.
Construction phasing	Position of attenuation; pipe routing; temporary oversizing of elements due to temporary retention of buildings	Yes/No	Not considered at this stage.
Construction hoarding lines/access routes	Position of attenuation, SuDS, pipe routing	Yes/No	Not considered at this stage.
Future development (i.e. extensions)	Oversizing of elements to provide additional capacity	Yes/No	No further expansion is considered.

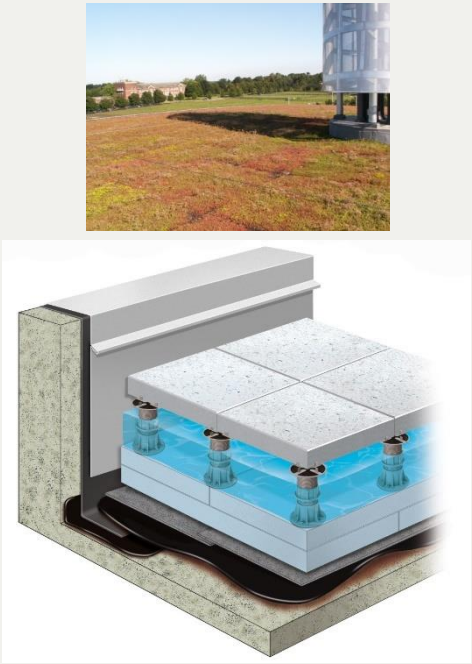
Need for new outlets / headwalls to watercourses	Additional correspondence (fees) with authorities; construction of headwall to approved standards; issues relating to banks/bed (scour)	Yes /No	Foul and surface water to connect into the existing Welsh Water combined sewer.
Abnormal foul water discharge requirements (i.e. laboratories)	Separate laboratory waste; chemically and temperature resistant pipework; inclusion of sample chambers; inclusion of grease separators.	Yes/ No	Not applicable, domestic foul wastewater discharge only.
Retained trees	Limitation in excavation location/depth to prevent root damage.	Yes/ No	Not applicable
Maintenance requirements	Required maintenance regime is not acceptable to client requiring amendments to proposed drainage scheme.	Yes/ No	Maintenance of SuDS & drainage system is required to be undertaken by the maintenance team. O&M in accordance with the CIRIA SuDS Manual.

8. SURFACE WATER DRAINAGE OPTIONS (SUDS MATRIX)

The use of sustainable drainage systems (SuDS) is mandatory for new surface water drainage systems within the UK. SuDS can be used as source control (interception of surface water), conveyance, storage/attenuation (porous/permeable paving with perforated pipes and soakaways) and discharge dependent on various site conditions using vortex flow control devices. The table below describes many of the SuDS approaches that are available and explains their advantages, disadvantages and appropriateness for use on the proposed development site.

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for use at site?
Retention	Balancing pond		Provides both storm water attenuation and treatment. Runoff from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation.	Good removal of pollutants can be used where groundwater is vulnerable, good community acceptability, high ecological, and amenity benefits.	No reduction in runoff volume, land take may limit use in high density sites.	No – Special considerations prevent this from being implemented.
	Subsurface storage		Oversized pipes, tank systems and modular geocellular systems that can be used to create a below ground storage structure.	Modular and flexible, dual usage (infiltration/storage, high void ratios, can be installed beneath trafficked and soft landscaped areas.	No water quality treatment unless paired with petrol interceptor,	Yes – This will be considered in the drainage design.
	Shallow wetland Extended detention wetland Pond wetland Pocket wetland Submerged gravel wetland Wetland channel		Wetlands provide stormwater attenuation and treatment. They comprise shallow ponds and marshy areas, covered in aquatic vegetation. Wetlands detain flows for an extended period to allow sediments to settle and to remove contaminants They can provide significant ecological benefits.	Good pollutant removal and if lined can be used where groundwater is vulnerable. Good community acceptability, ecological and amenity benefits.	Land take is high, requires baseflow, little reduction in runoff volume, not suitable for steep sites.	No – Special considerations prevent this from being implemented.
Infiltration	Infiltration trench Infiltration basin Soakaway		Surface water runoff can be discharged directly to ground for infiltration by soakaways, basins, or trenches. A prerequisite is that both groundwater and ground conditions are appropriate to receive the quality and quantity of water generated.	Reduces the volume of runoff, effective at pollutant removal, contributes to groundwater recharge, simple and cost-effective, easy performance observation.	Requires appropriate pre-treatment, basins require a large flat area, offset from foundations.	Infiltration test results identify that infiltration is a viable solution to managing surface water on site.

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for use at site?
	Surface sand filter Sub-surface sand filter Perimeter sand filter		Structures designed to treat surface water runoff through filtration using a sand bed filter medium. The filters can be designed with or without infiltration. Temporary storage of runoff is achieved through ponding above the filter layer. They are used where particularly high pollutant removal is required.	Flexibility of design, efficient in removing pollutants, suitable for retrofits and in tightly constrained urban locations.	Not for high sediment content, detention times can support algae growth, minimum hydraulic head of 1.2m required, possible odor problems, high capital and maintenance cost.	Infiltration test results identify that infiltration is a viable solution to managing surface water on site.
	Bioretention / filter swale		Vegetated strips of land designed to accept runoff as overland sheet flow between a hard-surfaced area and a receiving system.	Landscaping features, effective in removing pollutants, flexible layout to fit into landscape, suited for highly impervious areas, good retrofit capability, effective pre-treatment option	Requires landscaping and management, large land requirement, not suitable for steep sites, no significant attenuation or reduction of flows.	Infiltration test results identify that infiltration is a viable solution to managing surface water on site.
	Filter trench / drain		Shallow excavations filled with rubble or stone that create temporary subsurface storage for filtration of storm water runoff.	Hydraulic benefits achieved with filter trenches, trenches can be incorporated into site landscaping and fit well beside roads and car parks.	High clogging potential without effective pre-treatment, limited to small catchments, high cost of replacing filter material.	Yes - This will be considered in the drainage design.
Detention	Detention basin		Surface storage basins that provide flow control through attenuation. Normally dry and in certain situations the land may also function as a recreational facility.	Cater for a wide range of rainfall events, can be used where groundwater is vulnerable, potential for dual land use, easy to maintain.	Land take, little reduction in runoff volume, detention depths constrained by levels.	No – Special considerations prevent this from being implemented.
	Enhanced dry swale		Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate.	Incorporate into landscaping, good removal of pollutants, reduces runoff rates and volumes, low cost.	Not suitable for steep areas, significant land take, not suitable in areas with roadside parking.	Yes - This will be considered in the drainage design.
	Enhanced wet swale					
Conveyance	Conveyance swales		Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in runoff volume via plant uptake and infiltration.	Potential trip/wheel hazard, disabled access issues.	No – Due to the site nature with a lot of football the trip hazard element would cause a potential issue.
	Rills					

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for use at site?
Source control	Green / Brown roof / Blue roof		Multi-layered system that covers the roof of a building with vegetation cover / landscaping / blue roof over a drainage layer. Designed to intercept and retain precipitation, reducing the volume of runoff and attenuating peak flows.	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep / sloped roofs, maintenance of roof vegetation.	Yes - This will be considered in the drainage design.
	Rainwater harvesting		Uses rainwater coming from roofs to supply toilets, washing machines and irrigation systems. Harvested rainwater is stored underground and is substituted for potable water mains supply, reducing both site discharge and water consumption.	Can provide source control of storm water runoff, reduces demand on mains water.	Use is dependent on demand requirements, contributing surface area, and seasonal rainfall characteristics	Yes - This will be considered in the drainage design.
	Rain Garden		Vegetated strips of land designed to accept runoff as overland sheet flow between a hard-surfaced area and a receiving system.	Landscaping features, effective in removing pollutants, flexible layout to fit into landscape, suited for highly impervious areas, good retrofit capability, effective pre-treatment option. Can be orientated to take roof drainage.	Requires landscaping and management, large land requirement, not suitable for steep sites, no significant attenuation or reduction of flows.	Yes - This will be considered in the drainage design.

9. OPERATION AND MAINTENANCE PLAN

Maintenance requirements are the responsibility of the Wrexham Association Football Club maintenance team. The below tables summarise the maintenance requirements of the proposed drainage features. For further details on the below ground drainage operation and maintenance please refer to the Operation and Maintenance Manual reference “WRX-RAM-XX-XX-RP-C-00003”.

Table 9 - Manholes, catchpits, and inspection chambers maintenance summary.

Action	Details	Frequency
Monitoring and Inspection /Testing	Check condition of inlets, outlets, vents, overflows, flow controls, covers and chambers	Monthly for the first three months following commission; Six-monthly thereafter or 48 hours after major storm event
	Inspect all manholes and catch-pit sumps for any sediment, trash, debris, and any other pollutants	Monthly for the first three months following commission; Six-monthly thereafter or 48 hours after major storm event
Regular Maintenance	Repair inlets, outlets, vents, overflows, flow controls, covers and chambers	Monthly for the first three months following commission; Six-monthly thereafter or 48 hours after major storm event
	Remove sediment, trash, debris and any other pollutants from manholes and catchpit sumps to ensure correct performance	Monthly for the first three months following commission; Six-monthly thereafter or 48 hours after major storm event
Occasional Maintenance	Replace covers and frames as necessary	As required
	Repair exposed concrete and surfacing as necessary	As required
Remediation	Replace malfunctioning parts or structures.	As required

Table 10 - Pipes maintenance summary.

Action	Details	Frequency
Monitoring and Inspection /Testing	Initial water test to be done prior to CCTV survey	Once, upon completion of development
	Initial inspection should be provided as post construction CCTV survey	Once, upon completion of development
	Inspect for evidence of poor operation via water level in chambers. If required, take remedial action	Monthly for the first three months following commission; Three-monthly thereafter or 48 hours after major storm event
Occasional Maintenance	Check and remove large vegetation growth near pipe runs	Six-monthly
	Rod through poorly performing runs as initial remediation.	As required
Remediation	If continued poor performance, jet and CCTV survey poorly performing runs.	As required
	Seek advice as to remediation techniques suitable for the type of performance issue and location	As required, if above does not improve performance

Table 11 - Permeable paving maintenance summary.

Action	Details	Frequency
Monitoring and Inspection / Testing	Initial inspection	Monthly for the first three months following commission;
	Inspect for evidence of poor operation and/or weed growth- if required, take remedial action	Three-monthly or 48 hours after major storm event
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over entire surface)	Once a year after autumn leaf fall, or reduced frequency as required, based on site specific observations of clogging. Attention to be paid to areas where water runs onto permeable surface from adjacent impermeable areas as this area is the most likely to collect the most sediment.
Occasional Maintenance	Stabilise and mow contributory adjacent areas	As required
	Removal or management of weeds using glyphosate applied directly onto weeds	Annually or as required
	Remediate any landscaping, which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
Remediation	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users. Replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years, or as required (if infiltration is reduced due to clogging)

10. CONCLUSION AND NEXT STEPS

Below are the key points summarising the drainage strategy design proposals.

1. The surface water runoff generated from the proposed site is managed using the following appropriate SuDS techniques:
 - Permeable paving
 - Green Roofs
 - Geocellular soakaway
2. The site is located within Flood Zone 1 and as such, has a low probability of flooding. According to the Natural Resource Wales flood map. A Flood Risk Assessment is not required if the development is in Flood Zone 1 and is:
 - Smaller than one hectare;
 - Is not affected by sources of flooding other than rivers and the sea.
3. Surface water drainage has been designed up to the 1 in 100-year storm event with an allowance of 40% for climate change. This ensures that the peak rate of storm water leaving the developed site is controlled and accounted for within the design.
4. Infiltration test results can be found in Appendix 8 and for the purpose of the design the infiltration rate will be set at 5.2×10^{-4} m/s. Infiltration testing was carried out in accordance with BRE Digest 365.
5. The foul water discharge from the proposed development will be managed via a gravity drainage connection into the Welsh Water public sewer located to the south of the development.
6. A predevelopment enquiry has been submitted to Welsh Water to confirm there is available capacity within the network. Formal approval to connect will be made at a more detailed design stage.
7. Consultation with Welsh Water and Wrexham County Borough Council acting as the Lead Local Flood Authority (LLFA) / SAB to receive formal approval for the overarching principles of the proposed drainage strategy including discharge rates, surface water attenuation volumes and any additional requirements, is to be undertaken.

APPENDIX 1

SITE LOCATION PLAN

NOTES
All dimensions and levels to be checked on site
Any discrepancies are to be reported to the Architect before any work commences
This drawing shall not be scaled to ascertain any dimensions, work to figured dimensions only
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P5	13.06.22	WR	WIP Issue
P4	20.05.22	WR	Boundaries Updated
P3	16.05.22	WR	Site Boundaries Added
P2	13.05.22	WR	WIP ISSUE
P1	08.04.2022	WR	First Issue - Floodlight positions added for coordination purposes

rev no.	rev date	rev by	description
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project

KOP Redevelopment

location

Racecourse Stadium

Employer

client



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key plan



drawing title

Proposed Site Plan

AFL job number	scale @ A1	drawn VR	checked NT
211509	1 : 500	rev date	13.06.22

dwg purpose	status	rev
INFORMATION	S2	P5

bim project origin zone level type role 5-digit no.
211509-AFL-ZZ-ZZ-DR-A-00101

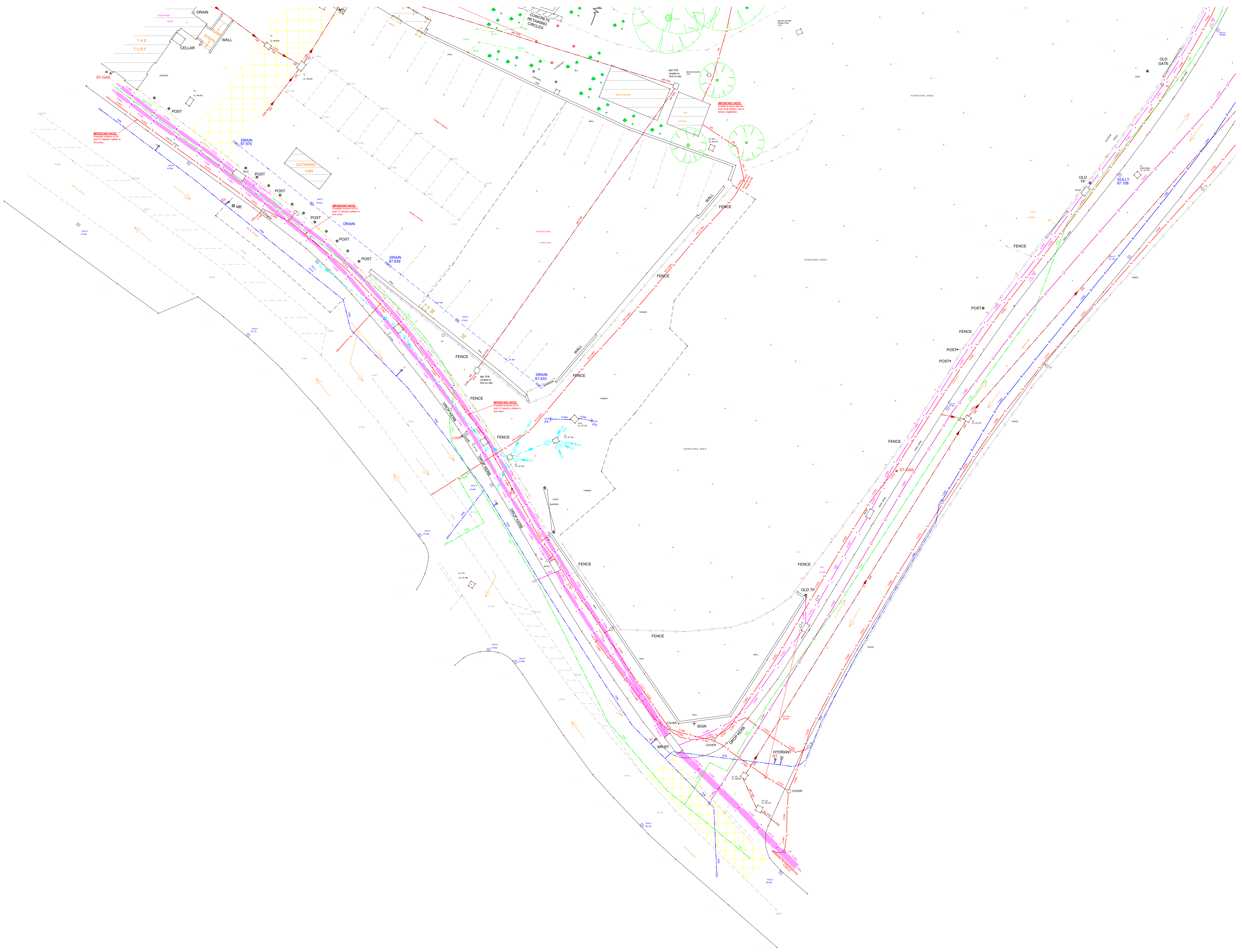
KEY

OTHER LAND IN CLUB OWNERSHIP

PLANNING APPLICATION BOUNDARY

APPENDIX 2

TOPOGRAPHIC & UTILITY SURVEY



NOTES

SURVEY CO-ORDINATE SCHEDULE

STATION	EASTING	NORTHING	STATION	EASTING	NORTHING	HEIGHT
VERTICAL DATUM: X						
HEIGHT ESTABLISHED VIA TRIMBLE VRS NOW NETWORK COMMERCIAL RTK GPS CORRECTION SERVICE						
LOCAL SCALE FACTOR: X						

LAND SURVEY INFORMATION

GRID: X
VERTICAL DATUM: X
HEIGHT ESTABLISHED VIA TRIMBLE VRS NOW NETWORK COMMERCIAL RTK GPS CORRECTION SERVICE
LOCAL SCALE FACTOR: X

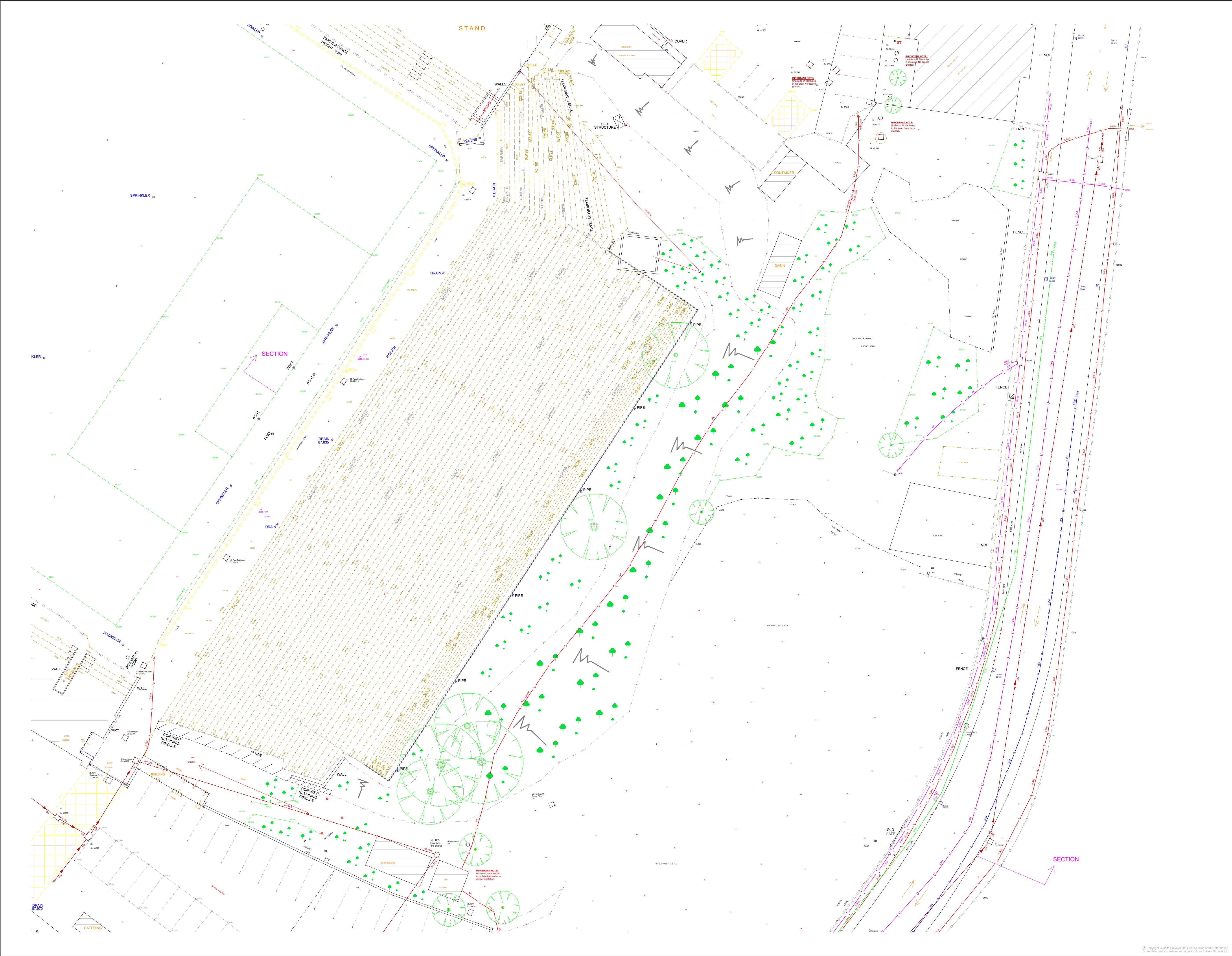
Electromagnetic and/or Ground Penetrating Radar techniques have been used to locate/map underground utilities and features on this drawing. Subsite Surveys Ltd has made every endeavour to make sure that the information contained within this drawing is accurate and of the highest quality. Subsite Surveys Ltd has used any record drawings provided by the client or by the Statutory Utility Providers, at the client's request, at the time of the survey. Any information taken from these drawings (e.g. pipe size and position) is not guaranteed. Historic record information is often incomplete and inaccurate and cannot be relied upon.

Subsite Surveys Ltd is not liable for any topographical survey that has not been undertaken by us. Any inaccuracies relating to topographical plans/development plans/Drainage Survey data that we have to control over is the liability of the customer. Where quoted, depth information of underground services/features is stated. Depths are generally within +/- 10% accurate, but cannot be guaranteed. Any depths shown are drains are usually to invert (base of drainage channel) unless otherwise stated.

The completeness of any underground survey cannot be 100% guaranteed and the results from these types of surveys are not infallible. If the location or depth of services/features is of particular importance to a project then it is strongly advised that discussions are held with Subsite Surveys Ltd regarding any possible limitations or anomalies. It is also strongly advised that trial excavations should be undertaken to confirm survey results. We cannot be held responsible for any inaccuracies beyond those that could be reasonably expected by a competent company.

ABBREVIATIONS (Land & Utilities)

AV	ADVERSE NOISE	AV	ADVERSE NOISE	AV	ADVERSE NOISE
BA	BUILDING AREA	BA	BUILDING AREA	BA	BUILDING AREA
BE	BENCH MARK	BE	BENCH MARK	BE	BENCH MARK
BL	BUILDING LINE	BL	BUILDING LINE	BL	BUILDING LINE
BR	BUILDING AREA	BR	BUILDING AREA	BR	BUILDING AREA
CA	CABLE	CA	CABLE	CA	CABLE
CB	CABLE	CB	CABLE	CB	CABLE
CC	CABLE	CC	CABLE	CC	CABLE
CD	CABLE	CD	CABLE	CD	CABLE
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IT	CABLE	IT	CABLE	IT	CABLE
IU	CABLE	IU	CABLE	IU	CABLE
IV	CABLE	IV	CABLE	IV	CABLE
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MY	CABLE	MY	CABLE	MY	CABLE
MZ	CABLE	MZ	CABLE	MZ	CABLE
NA	CABLE	NA	CABLE	NA	CABLE
NB	CABLE	NB			



NOTES

SURVEY CO-ORDINATE SCHEDULE

STATION	EASTING	NORTHING	ELEVATION	STATION	EASTING	NORTHING	ELEVATION
1	440000	610000	100.00	2	440000	610000	100.00

LAND SURVEY INFORMATION

GRID: X
VERTICAL DATUM: X
HEIGHT ESTABLISHED VIA TRIMBLE VRS NOW NETWORK
COMMERCIAL RTK GPS CORRECTION SERVICE
LOCAL SCALE FACTOR: X

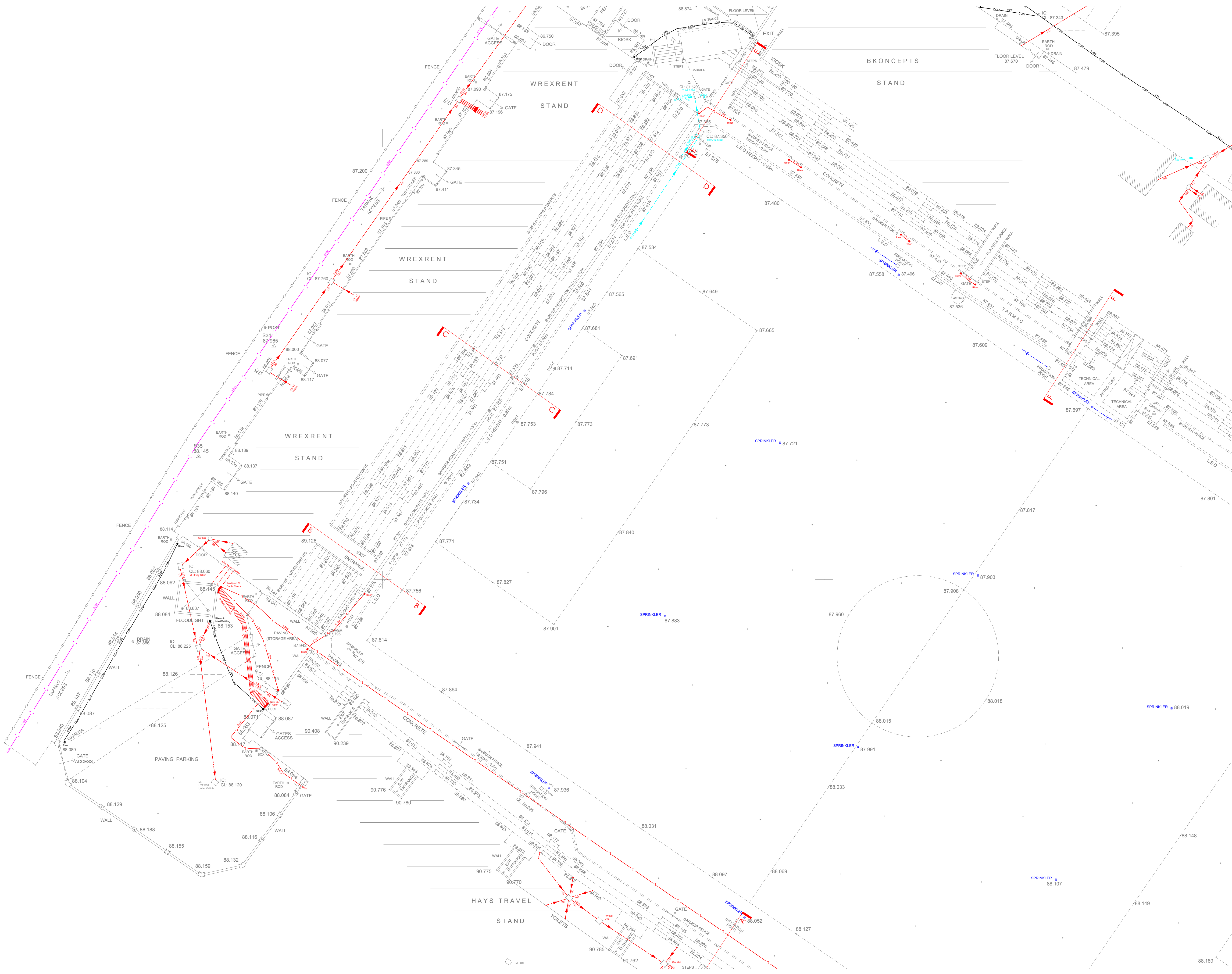
Electromagnetic and/or Ground Penetrating Radar techniques have been used to locate/identify underground utilities and features on this drawing. Subsite Surveys Ltd has made every endeavour to make sure that the information contained within this drawing is accurate and of the highest quality. Subsite Surveys Ltd has used any record drawings provided by the client or by the Statutory Utility Providers, at the client's request, at the time of the survey. Any information taken from these drawings (e.g. pipe size and position) is not guaranteed. Historic record information is often incomplete and inaccurate and cannot be relied upon.

Subsite Surveys Ltd is not liable for any topographical survey that has not been undertaken by us. Any inaccuracies relating to topographical plans/development plans/Ordinance Survey data that we have to control over is the liability of the customer. Where quoted, depth information of underground services/features is stated. Depths are generally within +/-10% accurate, but cannot be guaranteed. Any depths shown are drains are usually to invert (base of drainage channel) unless otherwise stated.

The completeness of any underground survey cannot be 100% guaranteed and the results from these types of surveys are not infallible. If the location or depth of services/features is of particular importance to a project then it is strongly advised that discussions are held with Subsite Surveys Ltd regarding any possible limitations or anomalies. It is also strongly advised that trial excavations should be undertaken to confirm survey results. We cannot be held responsible for any inaccuracies beyond those that could be reasonably expected by a competent company.

ABBREVIATIONS (Land & Utilities)

AV	ASBESTOS	AV	ASBESTOS	AV	ASBESTOS
BA	BARRIER	BA	BARRIER	BA	BARRIER
BE	BENCH MARK	BE	BENCH MARK	BE	BENCH MARK
BL	BUILDING	BL	BUILDING	BL	BUILDING
BR	BURIED	BR	BURIED	BR	BURIED
BU	BURIED	BU	BURIED	BU	BURIED
CA	CABLE	CA	CABLE	CA	CABLE
CB	CABLE	CB	CABLE	CB	CABLE
CC	CABLE	CC	CABLE	CC	CABLE
CD	CABLE	CD	CABLE	CD	CABLE
CE	CABLE	CE	CABLE	CE	CABLE
CF	CABLE	CF	CABLE	CF	CABLE
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CO	CABLE	CO	CABLE	CO	CABLE
CP	CABLE	CP	CABLE	CP	CABLE
CQ	CABLE	CQ	CABLE	CQ	CABLE
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EJ	CABLE	EJ	CABLE	EJ	CABLE
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EL	CABLE	EL	CABLE	EL	CABLE
EM	CABLE	EM	CABLE	EM	CABLE
EN	CABLE	EN	CABLE	EN	CABLE
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MT	CABLE	MT	CABLE	MT	CABLE
MU	CABLE	MU	CABLE	MU	CABLE
MV	CABLE	MV	CABLE	MV	CABLE
MW	CABLE	MW	CABLE	MW	CABLE
MX	CABLE	MX	CABLE	MX	CABLE
MY	CABLE	MY	CABLE	MY	CABLE
MZ	CABLE	MZ	CABLE	MZ	CABLE



NOTES

SURVEY CO-ORDINATE SCHEDULE

STATION	EASTING	NORTHING	HEIGHT
1	87.496	87.479	87.479
2	87.496	87.479	87.479
3	87.496	87.479	87.479
4	87.496	87.479	87.479
5	87.496	87.479	87.479
6	87.496	87.479	87.479
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14	87.496	87.479	87.479
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16	87.496	87.479	87.479
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19	87.496	87.479	87.479
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21	87.496	87.479	87.479
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24	87.496	87.479	87.479
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26	87.496	87.479	87.479
27	87.496	87.479	87.479
28	87.496	87.479	87.479
29	87.496	87.479	87.479
30	87.496	87.479	87.479
31	87.496	87.479	87.479
32	87.496	87.479	87.479
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35	87.496	87.479	87.479
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37	87.496	87.479	87.479
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40	87.496	87.479	87.479
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71	87.496	87.479	87.479
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73	87.496	87.479	87.479
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84	87.496	87.479	87.479
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88	87.496	87.479	87.479
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91	87.496	87.479	87.479
92	87.496	87.479	87.479
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94	87.496	87.479	87.479
95	87.496	87.479	87.479
96	87.496	87.479	87.479
97	87.496	87.479	87.479
98	87.496	87.479	87.479
99	87.496	87.479	87.479
100	87.496	87.479	87.479

LAND SURVEY INFORMATION

GRID: X
VERTICAL DATUM: X
HEIGHT ESTABLISHED VIA TRIMBLE VRS NOW NETWORK
COMMERCIAL RTK GPS CORRECTION SERVICE
LOCAL SCALE FACTOR: X

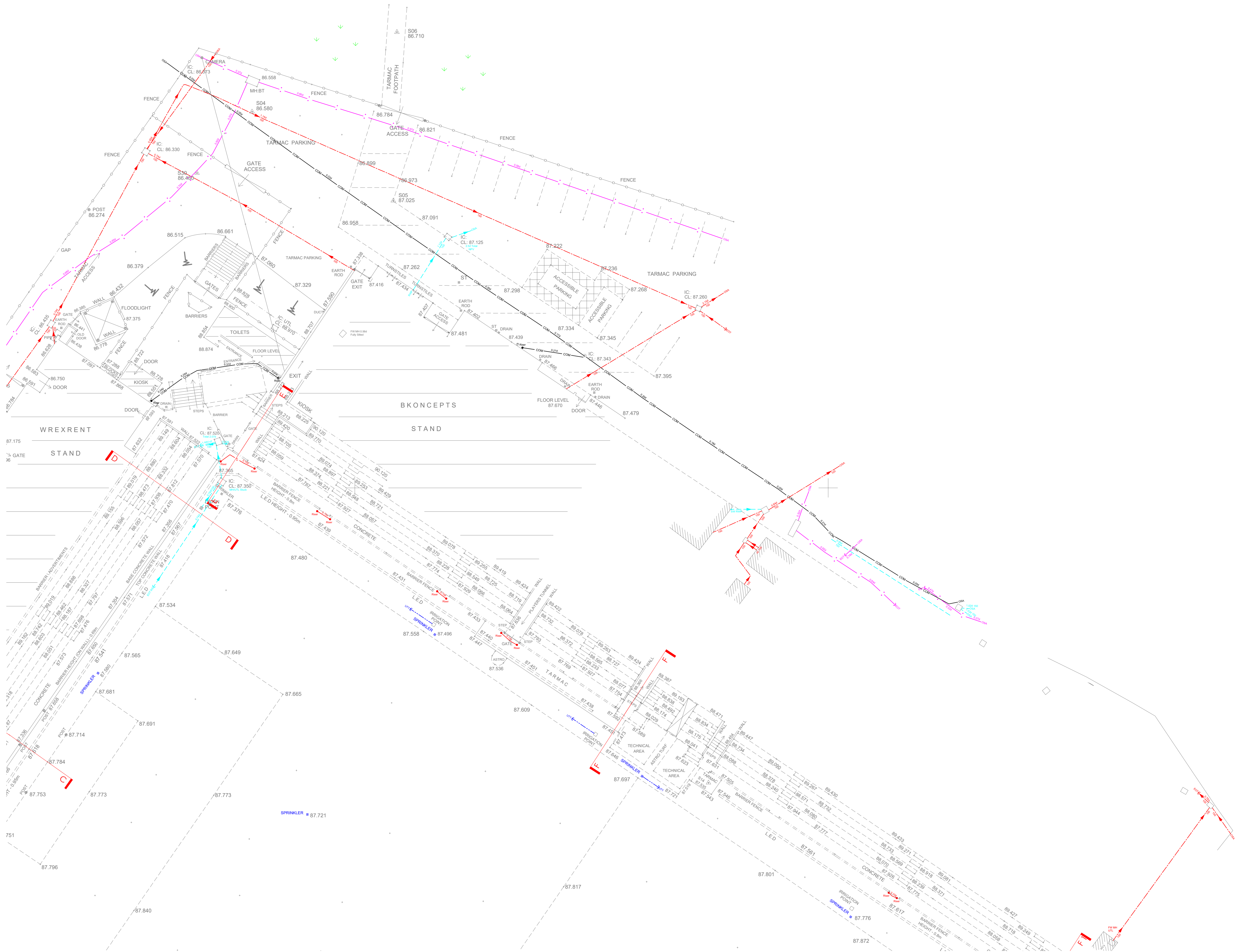
Electromagnetic and/or Ground Penetrating Radar techniques have been used to locate/map underground utilities and features on this drawing. Subsite Surveys Ltd has made every endeavour to make sure that the information contained within this drawing is accurate and of the highest quality. Subsite Surveys Ltd has used any record drawings provided by the client or by the Statutory Utility Providers, at the client's request, at the time of the survey. Any information taken from these drawings (e.g. pipe size and position) is not guaranteed. Historic record information is often incomplete and inaccurate and cannot be relied upon.

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ABBREVIATIONS (Land & Utilities)

AA	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AB	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AC	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AD	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AE	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AF	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AG	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AH	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AI	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AJ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AK	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AL	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AM	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AN	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AO	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AP	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AQ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AR	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AS	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AT	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AV	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AW	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AX	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AY	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
AZ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
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BC	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
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BE	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BF	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BG	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BH	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BI	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BJ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
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BO	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BP	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BQ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BR	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BS	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BT	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BV	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BW	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BX	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BY	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
BZ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CA	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CB	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
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CH	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CI	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CJ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CK	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CL	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CM	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CN	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CO	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CP	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CQ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CR	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CS	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CT	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CV	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CW	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CX	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CY	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
CZ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DA	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DB	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DC	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DD	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DE	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DF	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DG	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
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DI	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
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DK	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
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DR	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DS	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DT	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DV	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DW	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DX	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DY	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
DZ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
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EB	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EC	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
ED	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EE	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EF	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EG	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EH	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EI	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EJ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EK	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EL	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EM	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EN	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EO	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EP	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EQ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
ER	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
ES	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
ET	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EV	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EW	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EX	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EY	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
EZ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FA	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FB	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FC	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FD	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FE	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FF	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FG	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FH	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FI	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FJ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FK	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FL	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FM	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FN	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FO	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FP	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FQ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FR	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FS	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FT	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FV	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FW	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FX	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FY	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
FZ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GA	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GB	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GC	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GD	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GE	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GF	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GH	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GI	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GJ	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GK	ADDITIONAL	AD	ADDITIONAL	AD	ADDITIONAL
GL	ADDITIONAL	AD			



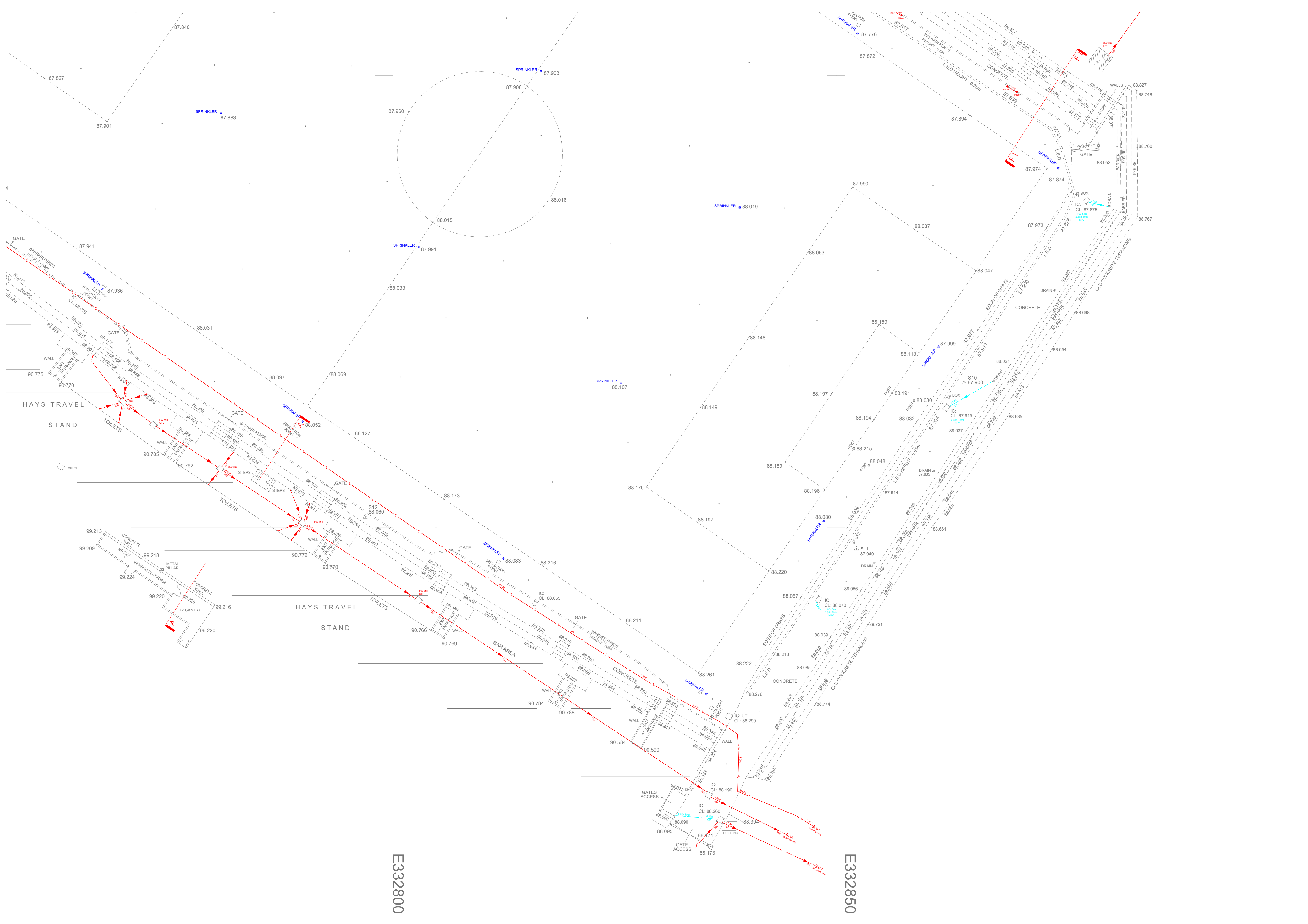
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ABBREVIATIONS (Land & Utilities)			
AV	ASBESTOS	CL	CL
BA	BANK	CM	COMMON
BE	BED	CO	CONCRETE
BL	BLOCK	CS	CORROSION
BR	BROOK	CT	CUT
BU	BURIAL	CU	CULVERT
CA	CABLE	DA	DRAINAGE
CB	CABLE	DE	DEVELOPMENT
CC	CABLE	DI	DRAINAGE
CD	CABLE	DO	DOOR
CE	CABLE	DP	DRAINAGE
CF	CABLE	DS	DRAINAGE
CG	CABLE	DT	DRAINAGE
CH	CABLE	DU	DRAINAGE
CI	CABLE	EV	ELECTRICITY
CJ	CABLE	FA	FENCE
CK	CABLE	FB	FENCE
CL	CABLE	FC	FENCE
CM	CABLE	FD	FENCE
CN	CABLE	FE	FENCE
CO	CABLE	FF	FENCE
CP	CABLE	FG	FENCE
CQ	CABLE	FH	FENCE
CR	CABLE	FI	FENCE
CS	CABLE	FJ	FENCE
CT	CABLE	FK	FENCE
CU	CABLE	FL	FENCE
CV	CABLE	FM	FENCE
CW	CABLE	FN	FENCE
CX	CABLE	FO	FENCE
CY	CABLE	FP	FENCE
CZ	CABLE	FQ	FENCE
DA	DRAINAGE	FR	FENCE
DB	DRAINAGE	FS	FENCE
DC	DRAINAGE	FT	FENCE
DD	DRAINAGE	FU	FENCE
DE	DRAINAGE	FV	FENCE
DF	DRAINAGE	FW	FENCE
DG	DRAINAGE	FX	FENCE
DH	DRAINAGE	FY	FENCE
DI	DRAINAGE	FZ	FENCE
DJ	DRAINAGE	GA	GATE
DK	DRAINAGE	GB	GATE
DL	DRAINAGE	GC	GATE
DM	DRAINAGE	GD	GATE
DN	DRAINAGE	GE	GATE
DO	DRAINAGE	GF	GATE
DP	DRAINAGE	GG	GATE
DQ	DRAINAGE	GH	GATE
DR	DRAINAGE	GI	GATE
DS	DRAINAGE	GJ	GATE
DT	DRAINAGE	GK	GATE
DU	DRAINAGE	GL	GATE
DV	DRAINAGE	GM	GATE
DW	DRAINAGE	GN	GATE
DX	DRAINAGE	GO	GATE
DY	DRAINAGE	GP	GATE
DZ	DRAINAGE	GQ	GATE
EA	EARTH	GR	GATE
EB	EARTH	GS	GATE
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EF	EARTH	GW	GATE
EG	EARTH	GX	GATE
EH	EARTH	GY	GATE
EI	EARTH	GZ	GATE
EJ	EARTH	HA	HEATING
EK	EARTH	HB	HEATING
EL	EARTH	HC	HEATING
EM	EARTH	HD	HEATING
EN	EARTH	HE	HEATING
EO	EARTH	HF	HEATING
EP	EARTH	HG	HEATING
EQ	EARTH	HH	HEATING
ER	EARTH	HI	HEATING
ES	EARTH	HJ	HEATING
ET	EARTH	HK	HEATING
EU	EARTH	HL	HEATING
EV	EARTH	HM	HEATING
EW	EARTH	HN	HEATING
EX	EARTH	HO	HEATING
EY	EARTH	HP	HEATING
EZ	EARTH	HQ	HEATING
FA	FENCE	HR	HEATING
FB	FENCE	HS	HEATING
FC	FENCE	HT	HEATING
FD	FENCE	HU	HEATING
FE	FENCE	HV	HEATING
FF	FENCE	HW	HEATING
FG	FENCE	HX	HEATING
FH	FENCE	HY	HEATING
FI	FENCE	HZ	HEATING
FJ	FENCE	IA	IRIGATION
FK	FENCE	IB	IRIGATION
FL	FENCE	IC	IRIGATION
FM	FENCE	ID	IRIGATION
FN	FENCE	IE	IRIGATION
FO	FENCE	IF	IRIGATION
FP	FENCE	IG	IRIGATION
FQ	FENCE	IH	IRIGATION
FR	FENCE	II	IRIGATION
FS	FENCE	IJ	IRIGATION
FT	FENCE	IK	IRIGATION
FU	FENCE	IL	IRIGATION
FV	FENCE	IM	IRIGATION
FW	FENCE	IN	IRIGATION
FX	FENCE	IO	IRIGATION
FY	FENCE	IP	IRIGATION
FZ	FENCE	IQ	IRIGATION
GA	GATE	IR	IRIGATION
GB	GATE	IS	IRIGATION
GC	GATE	IT	IRIGATION
GD	GATE	IU	IRIGATION
GE	GATE	IV	IRIGATION
GF	GATE	IW	IRIGATION
GG	GATE	IX	IRIGATION
GH	GATE	IY	IRIGATION
GI	GATE	IZ	IRIGATION
GJ	GATE	JA	JUNCTION
GK	GATE	JB	JUNCTION
GL	GATE	JC	JUNCTION
GM	GATE	JD	JUNCTION
GN	GATE	JE	JUNCTION
GO	GATE	JF	JUNCTION
GP	GATE	JG	JUNCTION
GQ	GATE	JH	JUNCTION
GR	GATE	JI	JUNCTION
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GW	GATE	JN	JUNCTION
GX	GATE	JO	JUNCTION
GY	GATE	JP	JUNCTION
GZ	GATE	JQ	JUNCTION
HA	HEATING	JR	JUNCTION
HB	HEATING	JS	JUNCTION
HC	HEATING	JT	JUNCTION
HD	HEATING	JU	JUNCTION
HE	HEATING	JV	JUNCTION
HF	HEATING	JW	JUNCTION
HG	HEATING	JX	JUNCTION
HH	HEATING	JY	JUNCTION
HI	HEATING	JZ	JUNCTION
HJ	HEATING	KA	KIOSK
HK	HEATING	KB	KIOSK
HL	HEATING	KC	KIOSK
HM	HEATING	KD	KIOSK
HN	HEATING	KE	KIOSK
HO	HEATING	KF	KIOSK
HP	HEATING	KG	KIOSK
HQ	HEATING	KH	KIOSK
HR	HEATING	KI	KIOSK
HS	HEATING	KJ	KIOSK
HT	HEATING	KL	KIOSK
HU	HEATING	KM	KIOSK
HV	HEATING	KN	KIOSK
HW	HEATING	KO	KIOSK
HX	HEATING	KP	KIOSK
HY	HEATING	KQ	KIOSK
HZ	HEATING	KR	KIOSK
IA	IRIGATION	KS	KIOSK
IB	IRIGATION	KT	KIOSK
IC	IRIGATION	KU	KIOSK
ID	IRIGATION	KV	KIOSK
IE	IRIGATION	KW	KIOSK
IF	IRIGATION	KX	KIOSK
IG	IRIGATION	KY	KIOSK
IH	IRIGATION	KZ	KIOSK
II	IRIGATION	LA	LAND
IJ	IRIGATION	LB	LAND
IK	IRIGATION	LC	LAND
IL	IRIGATION	LD	LAND
IM	IRIGATION	LE	LAND
IN	IRIGATION	LF	LAND
IO	IRIGATION	LG	LAND
IP	IRIGATION	LH	LAND
IQ	IRIGATION	LI	LAND
IR	IRIGATION	LJ	LAND
IS	IRIGATION	LK	LAND
IT	IRIGATION	LL	LAND
IU	IRIGATION	LM	LAND
IV	IRIGATION	LN	LAND
IW	IRIGATION	LO	LAND
IX	IRIGATION	LP	LAND
IY	IRIGATION	LQ	LAND
IZ	IRIGATION	LR	LAND
JA	JUNCTION	LS	LAND
JB	JUNCTION	LT	LAND
JC	JUNCTION	LU	LAND
JD	JUNCTION	LV	LAND
JE	JUNCTION	LW	LAND
JF	JUNCTION	LX	LAND
JG	JUNCTION	LY	LAND
JH	JUNCTION	LZ	LAND
JI	JUNCTION	MA	MAINTENANCE
JK	JUNCTION	MB	MAINTENANCE
JL	JUNCTION	MC	MAINTENANCE
JM	JUNCTION	MD	MAINTENANCE
JN	JUNCTION	ME	MAINTENANCE
JO	JUNCTION	MF	MAINTENANCE
JP	JUNCTION	MG	MAINTENANCE
JQ	JUNCTION	MH	MAINTENANCE
JR	JUNCTION	MI	MAINTENANCE
JS	JUNCTION	MJ	MAINTENANCE
JT	JUNCTION	MK	MAINTENANCE
KU	KIOSK	ML	MAINTENANCE
KV	KIOSK	MM	MAINTENANCE
KW	KIOSK	MN	MAINTENANCE
KX	KIOSK	MO	MAINTENANCE
KY	KIOSK	MP	MAINTENANCE
KZ	KIOSK	MQ	MAINTENANCE
LA	LAND	MR	MAINTENANCE
LB	LAND	MS	MAINTENANCE
LC	LAND	MT	MAINTENANCE
LD	LAND	MU	MAINTENANCE
LE	LAND	MV	MAINTENANCE
LF	LAND	MW	MAINTENANCE
LG	LAND	MX	MAINTENANCE
LH	LAND	MY	MAINTENANCE
LI	LAND	MZ	MAINTENANCE
LJ	LAND	NA	NAME
LK	LAND	NB	NAME
LL	LAND	NC	NAME
LM	LAND	ND	NAME
LN	LAND	NE	NAME
LO	LAND	NF	NAME
LP	LAND	NG	NAME
LQ	LAND	NH	NAME
LR	LAND	NI	NAME
LS	LAND	NJ	NAME
LT	LAND	NK	NAME
LU	LAND	NL	NAME
LV	LAND	NM	NAME
LW	LAND	NO	NAME
LX	LAND	NP	NAME
LY	LAND	NQ	NAME
LZ	LAND	NR	NAME
MA	MAINTENANCE	NS	NAME
MB	MAINTENANCE	NT	NAME
MC	MAINTENANCE	NU	NAME
MD	MAINTENANCE	NV	NAME
ME	MAINTENANCE	NW	NAME
MF	MAINTENANCE	NX	NAME
MG	MAINTENANCE	NY	NAME
MH	MAINTENANCE	NZ	NAME
MI	MAINTENANCE	OA	ORIGIN
MJ	MAINTENANCE	OB	ORIGIN
MK	MAINTENANCE	OC	ORIGIN
ML	MAINTENANCE	OD	ORIGIN
MM	MAINTENANCE	OE	ORIGIN
MN	MAINTENANCE	OF	ORIGIN
MO	MAINTENANCE	OG	ORIGIN
MP	MAINTENANCE	OH	ORIGIN
MQ	MAINTENANCE	OI	ORIGIN
MR	MAINTENANCE	OJ	ORIGIN
MS	MAINTENANCE	OK	ORIGIN
MT	MAINTENANCE	OL	ORIGIN
MU	MAINTENANCE	OM	ORIGIN
MV	MAINTENANCE	ON	ORIGIN
MW	MAINTENANCE	OO	ORIGIN
MX	MAINTENANCE	OP	ORIGIN
MY	MAINTENANCE	OQ	ORIGIN
MZ	MAINTENANCE	OR	ORIGIN
NA	NAME	OS	ORIGIN
NB	NAME	OT	ORIGIN
NC	NAME	OU	ORIGIN
ND	NAME	OV	ORIGIN
NE	NAME	OW	ORIGIN
NF	NAME	OX	ORIGIN
NG	NAME	OY	ORIGIN
NH	NAME	OZ	ORIGIN
NI	NAME	PA	PARKING
NJ	NAME	PB	PARKING
NK	NAME	PC	PARKING
NL	NAME	PD	PARKING
NM	NAME	PE	PARKING
NO	NAME	PF	PARKING
NP	NAME	PG	PARKING
NQ	NAME	PH	PARKING
NR	NAME	PI	PARKING
NS	NAME	PJ	PARKING
NT	NAME	PK	PARKING
NU	NAME	PL	PARKING
NV	NAME	PM	PARKING
NW	NAME	PN	PARKING
NX	NAME	PO	PARKING
NY	NAME	PP	PARKING
NZ	NAME	PQ	PARKING
OA	ORIGIN	PR	PARKING
OB	ORIGIN	PS	PARKING
OC	ORIGIN	PT	PARKING
OD	ORIGIN	PU	PARKING
OE	ORIGIN	PV	PARKING
OF	ORIGIN	PW	PARKING
OG	ORIGIN	PX	PARKING
OH	ORIGIN	PY	PARKING
OI	ORIGIN	PZ	PARKING
OJ	ORIGIN	QA	QUANTITY
OK	ORIGIN	QB	QUANTITY
OL	ORIGIN	QC	QUANTITY
OM	ORIGIN	QD	QUANTITY
ON	ORIGIN	QE	QUANTITY
OO	ORIGIN	QF	QUANTITY
OP	ORIGIN	QG	QUANTITY
OQ	ORIGIN	QH	QUANTITY
OR	ORIGIN	QI	QUANTITY
OS	ORIGIN	QJ	QUANTITY
OT	ORIGIN	QK	QUANTITY
OU	ORIGIN	QL	QUANTITY
OV	ORIGIN	QM	QUANTITY
OW	ORIGIN	QN	QUANTITY
OX	ORIGIN	QO	QUANTITY
OY	ORIGIN	QP	QUANTITY
OZ	ORIGIN	QQ	QUANTITY
PA	PARKING	QR	QUANTITY
PB	PARKING	QS	QUANTITY
PC	PARKING	QT	QUANTITY
PD	PARKING	QU	QUANTITY
PE	PARKING	QV	QUANTITY
PF	PARKING	QW	QUANTITY
PG	PARKING	QX	QUANTITY
PH	PARKING	QY	QUANTITY
PI	PARKING	QZ	QUANTITY
PJ	PARKING	RA	RANGE
PK	PARKING	RB	RANGE
PL	PARKING	RC	RANGE
PM	PARKING	RD	RANGE
PN	PARKING	RE	RANGE
PO	PARKING	RF	RANGE
PP	PARKING	RG	RANGE
PQ	PARKING	RH	RANGE
PR	PARKING	RI	RANGE
PS	PARKING	RJ	RANGE
PT	PARKING	RK	RANGE
PU	PARKING	RL	RANGE
PV	PARKING	RM	RANGE
PW	PARKING	RN	RANGE
PX	PARKING	RO	RANGE
PY	PARKING	RP	RANGE
PZ	PARKING	RQ	RANGE
QA	QUANTITY	RS	RANGE
QB	QUANTITY	RT	RANGE
QC	QUANTITY	RU	RANGE
QD	QUANTITY	RV	RANGE
QE	QUANTITY	RW	RANGE
QF	QUANTITY	RX	RANGE
QG	QUANTITY	RY	RANGE
QH	QUANTITY	RZ	RANGE
QI	QUANTITY	SA	SANITARY
QJ	QUANTITY	SB	SANITARY
QK	QUANTITY	SC	SANITARY
QL	QUANTITY	SD	SANITARY
QM	QUANTITY	SE	SANITARY
QN	QUANTITY	SF	SANITARY
QO	QUANTITY	SG	SANITARY
QP	QUANTITY	SH	SANITARY
QQ	QUANTITY	SI	SANITARY
QR	QUANTITY	SJ	SANITARY
QS	QUANTITY	SK	SANITARY
QT	QUANTITY	SL	SANITARY
QU	QUANTITY	SM	SANITARY
QV	QUANTITY	SN	SANITARY
QW	QUANTITY	SO	SANITARY
QX	QUANTITY	SP	SANITARY
QY	QUANTITY	SQ	SANITARY
QZ	QUANTITY	SR	SANITARY
RA	RANGE	SS	SANITARY
RB	RANGE	ST	SANITARY
RC	RANGE	SU	SANITARY
RD	RANGE	SV	SANITARY
RE	RANGE	SW	SANITARY
RF	RANGE	SX	SANITARY
RG	RANGE	SY	SANITARY
RH	RANGE	SZ	SANITARY
RI	RANGE	TA	TARGET
RJ	RANGE	TB	TARGET
RK	RANGE	TC	TARGET
RL	RANGE	TD	TARGET
RM	RANGE	TE	TARGET
RN	RANGE	TF	TARGET



E332800

E332850

NOTES

SURVEY CO-ORDINATE SCHEDULE

STATION	EASTING	NORTHING	ELEVATION	STATION	EASTING	NORTHING	ELEVATION
1	87.827	87.901	87.840	2	88.018	88.015	88.019
3	88.031	88.033	88.052	4	88.053	88.037	88.037
5	88.053	88.037	88.037	6	88.053	88.037	88.037
7	88.053	88.037	88.037	8	88.053	88.037	88.037
9	88.053	88.037	88.037	10	88.053	88.037	88.037
11	88.053	88.037	88.037	12	88.053	88.037	88.037
13	88.053	88.037	88.037	14	88.053	88.037	88.037
15	88.053	88.037	88.037	16	88.053	88.037	88.037
17	88.053	88.037	88.037	18	88.053	88.037	88.037
19	88.053	88.037	88.037	20	88.053	88.037	88.037
21	88.053	88.037	88.037	22	88.053	88.037	88.037
23	88.053	88.037	88.037	24	88.053	88.037	88.037
25	88.053	88.037	88.037	26	88.053	88.037	88.037
27	88.053	88.037	88.037	28	88.053	88.037	88.037
29	88.053	88.037	88.037	30	88.053	88.037	88.037
31	88.053	88.037	88.037	32	88.053	88.037	88.037
33	88.053	88.037	88.037	34	88.053	88.037	88.037
35	88.053	88.037	88.037	36	88.053	88.037	88.037
37	88.053	88.037	88.037	38	88.053	88.037	88.037
39	88.053	88.037	88.037	40	88.053	88.037	88.037
41	88.053	88.037	88.037	42	88.053	88.037	88.037
43	88.053	88.037	88.037	44	88.053	88.037	88.037
45	88.053	88.037	88.037	46	88.053	88.037	88.037
47	88.053	88.037	88.037	48	88.053	88.037	88.037
49	88.053	88.037	88.037	50	88.053	88.037	88.037
51	88.053	88.037	88.037	52	88.053	88.037	88.037
53	88.053	88.037	88.037	54	88.053	88.037	88.037
55	88.053	88.037	88.037	56	88.053	88.037	88.037
57	88.053	88.037	88.037	58	88.053	88.037	88.037
59	88.053	88.037	88.037	60	88.053	88.037	88.037
61	88.053	88.037	88.037	62	88.053	88.037	88.037
63	88.053	88.037	88.037	64	88.053	88.037	88.037
65	88.053	88.037	88.037	66	88.053	88.037	88.037
67	88.053	88.037	88.037	68	88.053	88.037	88.037
69	88.053	88.037	88.037	70	88.053	88.037	88.037
71	88.053	88.037	88.037	72	88.053	88.037	88.037
73	88.053	88.037	88.037	74	88.053	88.037	88.037
75	88.053	88.037	88.037	76	88.053	88.037	88.037
77	88.053	88.037	88.037	78	88.053	88.037	88.037
79	88.053	88.037	88.037	80	88.053	88.037	88.037
81	88.053	88.037	88.037	82	88.053	88.037	88.037
83	88.053	88.037	88.037	84	88.053	88.037	88.037
85	88.053	88.037	88.037	86	88.053	88.037	88.037
87	88.053	88.037	88.037	88	88.053	88.037	88.037
89	88.053	88.037	88.037	90	88.053	88.037	88.037
91	88.053	88.037	88.037	92	88.053	88.037	88.037
93	88.053	88.037	88.037	94	88.053	88.037	88.037
95	88.053	88.037	88.037	96	88.053	88.037	88.037
97	88.053	88.037	88.037	98	88.053	88.037	88.037
99	88.053	88.037	88.037	100	88.053	88.037	88.037

LAND SURVEY INFORMATION

GRID: X
VERTICAL DATUM: X
HEIGHT ESTABLISHED VIA TRIMBLE VLS NOW NETWORK
COMMERCIAL RTK GPS CORRECTION SERVICE
LOCAL SCALE FACTOR: X

Electromagnetic and/or Ground Penetrating Radar techniques have been used to locate/map underground utilities and features on this drawing. Subsite Surveys Ltd has made every endeavour to make sure that the information contained within this drawing is accurate and of the highest quality. Subsite Surveys Ltd has used any record drawings provided by the client or by the Statutory Utility Providers, at the client's request, at the time of the survey. Any information taken from these drawings (e.g. pipe size and position) is not guaranteed. Historic record information is often incomplete and inaccurate and cannot be relied upon.

Subsite Surveys Ltd is not liable for any topographical survey that has not been undertaken by us. Any inaccuracies relating to topographical plans/development plans/Ordnance Survey data that we have no control over is the liability of the customer. Where quoted, depth information of underground services/features is stated. Depths are generally within +/- 10% accurate, but cannot be guaranteed. Any depths shown are drains are usually to invert (base of drainage channel) unless otherwise stated.

The completeness of any underground survey cannot be 100% guaranteed and the results from these types of surveys are not infallible. If the location or depth of services/features is of particular importance to a project then it is strongly advised that discussions are held with Subsite Surveys Ltd regarding any possible limitations or anomalies. It is also strongly advised that trial excavations should be undertaken to confirm survey results. We cannot be held responsible for any inaccuracies beyond those that could be reasonably expected by a competent company.

ABBREVIATIONS (Land & Utilities)

AV	ASBESTOS	AV	ASBESTOS	AV	ASBESTOS
BA	BARRIER	BA	BARRIER	BA	BARRIER
BE	BENCH	BE	BENCH	BE	BENCH
BO	BORDER	BO	BORDER	BO	BORDER
BR	BURIED	BR	BURIED	BR	BURIED
BU	BURIED	BU	BURIED	BU	BURIED
CA	CABLE	CA	CABLE	CA	CABLE
CB	CABLE	CB	CABLE	CB	CABLE
CC	CABLE	CC	CABLE	CC	CABLE
CD	CABLE	CD	CABLE	CD	CABLE
CE	CABLE	CE	CABLE	CE	CABLE
CF	CABLE	CF	CABLE	CF	CABLE
CG	CABLE	CG	CABLE	CG	CABLE
CH	CABLE	CH	CABLE	CH	CABLE
CI	CABLE	CI	CABLE	CI	CABLE
CJ	CABLE	CJ	CABLE	CJ	CABLE
CK	CABLE	CK	CABLE	CK	CABLE
CL	CABLE	CL	CABLE	CL	CABLE
CM	CABLE	CM	CABLE	CM	CABLE
CN	CABLE	CN	CABLE	CN	CABLE
CO	CABLE	CO	CABLE	CO	CABLE
CP	CABLE	CP	CABLE	CP	CABLE
CQ	CABLE	CQ	CABLE	CQ	CABLE
CR	CABLE	CR	CABLE	CR	CABLE
CS	CABLE	CS	CABLE	CS	CABLE
CT	CABLE	CT	CABLE	CT	CABLE
CU	CABLE	CU	CABLE	CU	CABLE
CV	CABLE	CV	CABLE	CV	CABLE
CW	CABLE	CW	CABLE	CW	CABLE
CX	CABLE	CX	CABLE	CX	CABLE
CY	CABLE	CY	CABLE	CY	CABLE
CZ	CABLE	CZ	CABLE	CZ	CABLE
DA	CABLE	DA	CABLE	DA	CABLE
DB	CABLE	DB	CABLE	DB	CABLE
DC	CABLE	DC	CABLE	DC	CABLE
DD	CABLE	DD	CABLE	DD	CABLE
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DF	CABLE	DF	CABLE	DF	CABLE
DG	CABLE	DG	CABLE	DG	CABLE
DH	CABLE	DH	CABLE	DH	CABLE
DI	CABLE	DI	CABLE	DI	CABLE
DJ	CABLE	DJ	CABLE	DJ	CABLE
DK	CABLE	DK	CABLE	DK	CABLE
DL	CABLE	DL	CABLE	DL	CABLE
DM	CABLE	DM	CABLE	DM	CABLE
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DT	CABLE	DT	CABLE	DT	CABLE
DU	CABLE	DU	CABLE	DU	CABLE
DV	CABLE	DV	CABLE	DV	CABLE
DW	CABLE	DW	CABLE	DW	CABLE
DX	CABLE	DX	CABLE	DX	CABLE
DY	CABLE	DY	CABLE	DY	CABLE
DZ	CABLE	DZ	CABLE	DZ	CABLE
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EC	CABLE	EC	CABLE	EC	CABLE
ED	CABLE	ED	CABLE	ED	CABLE
EE	CABLE	EE	CABLE	EE	CABLE
EF	CABLE	EF	CABLE	EF	CABLE
EG	CABLE	EG	CABLE	EG	CABLE
EH	CABLE	EH	CABLE	EH	CABLE
EI	CABLE	EI	CABLE	EI	CABLE
EJ	CABLE	EJ	CABLE	EJ	CABLE
EK	CABLE	EK	CABLE	EK	CABLE
EL	CABLE	EL	CABLE	EL	CABLE
EM	CABLE	EM	CABLE	EM	CABLE
EN	CABLE	EN	CABLE	EN	CABLE
EO	CABLE	EO	CABLE	EO	CABLE
EP	CABLE	EP	CABLE	EP	CABLE
EQ	CABLE	EQ	CABLE	EQ	CABLE
ER	CABLE	ER	CABLE	ER	CABLE
ES	CABLE	ES	CABLE	ES	CABLE
ET	CABLE	ET	CABLE	ET	CABLE
EU	CABLE	EU	CABLE	EU	CABLE
EV	CABLE	EV	CABLE	EV	CABLE
EW	CABLE	EW	CABLE	EW	CABLE
EX	CABLE	EX	CABLE	EX	CABLE
EY	CABLE	EY	CABLE	EY	CABLE
EZ	CABLE	EZ	CABLE	EZ	CABLE
FA	CABLE	FA	CABLE	FA	CABLE
FB	CABLE	FB	CABLE	FB	CABLE
FC	CABLE	FC	CABLE	FC	CABLE
FD	CABLE	FD	CABLE	FD	CABLE
FE	CABLE	FE	CABLE	FE	CABLE
FF	CABLE	FF	CABLE	FF	CABLE
FG	CABLE	FG	CABLE	FG	CABLE
FH	CABLE	FH	CABLE	FH	CABLE
FI	CABLE	FI	CABLE	FI	CABLE
FJ	CABLE	FJ	CABLE	FJ	CABLE
FK	CABLE	FK	CABLE	FK	CABLE
FL	CABLE	FL	CABLE	FL	CABLE
FM	CABLE	FM	CABLE	FM	CABLE
FN	CABLE	FN	CABLE	FN	CABLE
FO	CABLE	FO	CABLE	FO	CABLE
FP	CABLE	FP	CABLE	FP	CABLE
FQ	CABLE	FQ	CABLE	FQ	CABLE
FR	CABLE	FR	CABLE	FR	CABLE
FS	CABLE	FS	CABLE	FS	CABLE
FT	CABLE	FT	CABLE	FT	CABLE
FU	CABLE	FU	CABLE	FU	CABLE
FV	CABLE	FV	CABLE	FV	CABLE
FW	CABLE	FW	CABLE	FW	CABLE
FX	CABLE	FX	CABLE	FX	CABLE
FY	CABLE	FY	CABLE	FY	CABLE
FZ	CABLE	FZ	CABLE	FZ	CABLE
GA	CABLE	GA	CABLE	GA	CABLE
GB	CABLE	GB	CABLE	GB	CABLE
GC	CABLE	GC	CABLE	GC	CABLE
GD	CABLE	GD	CABLE	GD	CABLE
GE	CABLE	GE	CABLE	GE	CABLE
GF	CABLE	GF	CABLE	GF	CABLE
GH	CABLE	GH	CABLE	GH	CABLE
GI	CABLE	GI	CABLE	GI	CABLE
GJ	CABLE	GJ	CABLE	GJ	CABLE
GK	CABLE	GK	CABLE	GK	CABLE
GL	CABLE	GL	CABLE	GL	CABLE
GM	CABLE	GM	CABLE	GM	CABLE
GN	CABLE	GN	CABLE	GN	CABLE
GO	CABLE	GO	CABLE	GO	CABLE
GP	CABLE	GP	CABLE	GP	CABLE
GQ	CABLE	GQ	CABLE	GQ	CABLE
GR	CABLE	GR	CABLE	GR	CABLE
GS	CABLE	GS	CABLE	GS	CABLE
GT	CABLE	GT	CABLE	GT	CABLE
GU	CABLE	GU	CABLE	GU	CABLE
GV	CABLE	GV	CABLE	GV	CABLE
GW	CABLE	GW	CABLE	GW	CABLE
GX	CABLE	GX	CABLE	GX	CABLE
GY	CABLE	GY	CABLE	GY	CABLE
GZ	CABLE	GZ	CABLE	GZ	CABLE
HA	CABLE	HA	CABLE	HA	CABLE
HB	CABLE	HB	CABLE	HB	CABLE
HC	CABLE	HC	CABLE	HC	CABLE
HD	CABLE	HD	CABLE	HD	CABLE
HE	CABLE	HE	CABLE	HE	CABLE
HF	CABLE	HF	CABLE	HF	CABLE
HG	CABLE	HG	CABLE	HG	CABLE
HH	CABLE	HH	CABLE	HH	CABLE
HI	CABLE	HI	CABLE	HI	CABLE
HJ	CABLE	HJ	CABLE	HJ	CABLE
HK	CABLE	HK	CABLE	HK	CABLE
HL	CABLE	HL	CABLE	HL	CABLE
HM	CABLE	HM	CABLE	HM	CABLE
HN	CABLE	HN	CABLE	HN	CABLE
HO	CABLE	HO	CABLE	HO	CABLE
HP	CABLE	HP	CABLE	HP	CABLE
HQ	CABLE	HQ	CABLE	HQ	CABLE
HR	CABLE	HR	CABLE	HR	CABLE
HS	CABLE	HS	CABLE	HS	CABLE
HT	CABLE	HT	CABLE	HT	CABLE
HU	CABLE	HU	CABLE	HU	CABLE
HV	CABLE	HV	CABLE	HV	CABLE
HW	CABLE	HW	CABLE	HW	CABLE
HX	CABLE	HX	CABLE	HX	CABLE
HY	CABLE	HY	CABLE	HY	CABLE
HZ	CABLE	HZ	CABLE	HZ	CABLE
IA	CABLE	IA	CABLE	IA	CABLE
IB	CABLE	IB	CABLE	IB	CABLE
IC	CABLE	IC	CABLE	IC	CABLE
ID	CABLE	ID	CABLE	ID	CABLE
IE	CABLE	IE	CABLE	IE	CABLE
IF	CABLE	IF	CABLE	IF	CABLE
IG	CABLE	IG	CABLE	IG	CABLE
IH	CABLE	IH	CABLE	IH	CABLE
II	CABLE	II	CABLE	II	CABLE
IJ	CABLE	IJ	CABLE	IJ	CABLE
IK	CABLE	IK	CABLE	IK	CABLE
IL	CABLE	IL	CABLE	IL	CABLE
IM	CABLE	IM	CABLE	IM	CABLE
IN	CABLE	IN	CABLE	IN	CABLE
IO	CABLE	IO	CABLE	IO	CABLE
IP	CABLE	IP	CABLE	IP	CABLE
IQ	CABLE	IQ	CABLE	IQ	CABLE
IR	CABLE	IR	CABLE	IR	CABLE
IS	CABLE	IS	CABLE	IS	CABLE
IT	CABLE	IT	CABLE	IT	CABLE
IU	CABLE	IU	CABLE	IU	CABLE
IV	CABLE	IV	CABLE	IV	CABLE
IW	CABLE	IW	CABLE	IW	CABLE
IX	CABLE	IX	CABLE	IX	CABLE
IY	CABLE	IY	CABLE	IY	CABLE
IZ	CABLE	IZ	CABLE	IZ	CABLE
JA	CABLE	JA			

APPENDIX 3

WELSH WATER ASSET MAP INFORMATION



Dŵr Cymru
Welsh Water

Sewer Plan PPA0006032



LEGEND(Representative of most common features)

Waste networks:

Foul chamber

Surface water chamber

Combined chamber

Combined sewer overflow

Special purpose chamber

Treatment works

Pumping station

NB: Sewer symbol colour indicates the type.

RED - Combined

GREEN - Surface Water

BROWN - Foul

Purple - Former S24 sewers (for indicative purposes only)

Outfall

Lamphole

Storm Overflow

Rising main

Gravity sewer

Private sewer

Private sewer subject to Sect. 104 adoption agreement

Private Sewer Transfer

Lateral Drain

Inspection Chamber

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation.

Dŵr Cymru Cyfngedig (the Company) gives this information as to the position of its underground apparatus by way of general guidance only and on the understanding that it is based on the best information available and is not warranted as to its correctness in the event of excavations or other works made in the vicinity of the Company's apparatus. The error of location appears to be carrying out any excavations with reference to the information which is supplied by the Company, as shown in accordance with statutory requirements of sections 103 and 109 of the Water Industry Act 1991 which is based upon the best information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not include the whereabouts of water mains, surface water drains, lateral drains or other pipes and any excavation should be made in September 1998 or, if that date is the practical latest date for the provision of the New Roads and Street Works Act 1991 and the Company's rights to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

**EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.**

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Map Ref: 332905.350930
Map scale: 1:1750
Printed by: Natalie Walmsley
Printed on: 23 Sep 2021

APPENDIX 4

WELSH WATER PREDEVELOPMENT ENQUIRY RESPONSE

Ramboll
Lisa Sawyer
Caldicot
NP26 9AN

Date: 23/09/2021
Our Ref: PPA0006032

Dear Lisa,

Site: Wrexham Football Club.

Development: New stand and associated external paved areas.

I refer to your pre-planning enquiry received relating to the above site, seeking our views on the capacity of our network of assets and infrastructure to accommodate your proposed development. Having reviewed the details submitted I can provide the following comments which should be taken into account within any future planning application for the development.

APPRAISAL

Firstly, we note that the proposal relates to proposed development at Wrexham Football Club and acknowledge that the site comprises of a potential windfall development with no allocated status in the Local Development Plan (LDP). Accordingly, whilst it does not appear an assessment has been previously undertaken of the public sewerage and watermains systems, we offer the following comments as part of our appraisal of this development.

Please note, notwithstanding the following assessment, we would advise there is also a mandatory requirement to undertake pre-application consultation with all 'Specialist Consultees', including Dwr Cymru Welsh Water as the statutory water and sewerage undertaker, in accordance with Schedule 4 of Town & Country Planning (Development Management Procedure) (Wales) (Amendment) Order 2016. As a major development, amounting to more than 1000 sqm, you will be statutorily required to consult Welsh Water and a substantive response will be issued within 28 days from the date of the notice as per the requirements of Article 2E.

Public Sewerage Network

The proposed development site is located in the immediate vicinity of a separate sewerage system, comprising foul and surface water public sewers, which drains to Five Fords Wastewater Treatment Works (WwTW).

We can advise that Five Fords WwTW does have a phosphate permit. You will need to discuss this matter further with the local planning authority.

This site is crossed by public sewers with their approximate positions being marked on the attached Statutory Public Sewer Record. In accordance with the Water Industry Act 1991, Dwr Cymru Welsh Water requires access to its apparatus at all times in order to carry out maintenance and repairs. No part of any building will be permitted within the protection zone of the public sewers measured 3 metres either side of the centreline. Our strong recommendation is that your site layout takes into account the location of the assets crossing the site and should be referred to in any master-planning exercises or site layout plans submitted as part of any subsequent planning application. Further information regarding Asset Protection is provided in the attached Advice & Guidance note.

You are also advised that some public sewers and lateral drains may not be recorded on our maps of public sewers because they were originally privately owned and were transferred into public ownership by nature of the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011. The presence of such assets may affect the proposal. In order to assist you may contact Dwr Cymru Welsh Water on 0800 085 3968 to establish the location and status of the apparatus in and around your site. Please be mindful that under the Water Industry Act 1991 Dwr Cymru Welsh Water has rights of access to its apparatus at all times.

Surface Water Drainage

As of 7th January 2019, this proposed development may be subject to Schedule 3 of the Flood and Water Management Act 2010. The development therefore may require approval of Sustainable Drainage Systems (SuDS) features, in accordance with the 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems'. As highlighted in these standards, the developer is required to explore and fully exhaust all surface water drainage options in accordance with a hierarchy which states that discharge to a combined sewer shall only be made as a last resort. Disposal should be made through the hierarchical approach, preferring infiltration and, where infiltration is not possible, disposal to a surface water drainage body in liaison with the Land Drainage Authority and/or Natural Resources Wales.

It is therefore recommended that the developer consult with Wrexham Council, as the determining SuDS Approval Body (SAB), in relation to their proposals for SuDS features. Please note, DCWW is a statutory consultee to the SAB application process and will provide comments to any SuDS proposals by response to SAB consultation. Please refer to further detailed advice relating to surface water management included in our attached Advice & Guidance note.

In addition, please note that no highway or land drainage run-off will be permitted to discharge directly or indirectly into the public sewerage system.

Foul Water Drainage – Sewerage Network

We have considered the impact of foul flows generated by the proposed development and concluded that flows can be accommodated within the public sewerage system. We advise that the flows should be connected to the combined sewer at or downstream of manhole SJ32508905 located within existing site to the South West.



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We welcome correspondence in
Welsh and English

Dŵr Cymru Cyf, a limited company registered in
Wales no 2366777. Registered office: Pentwyn Road,
Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu gohebiaeth yn y
Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.

Should a planning application be submitted for this development we will seek to control these points of communication via appropriate planning conditions and therefore recommend that any drainage layout or strategy submitted as part of your application takes this into account. However, should you wish for an alternative connection point to be considered please provide further information to us in the form of a drainage strategy, preferably in advance of a planning application being submitted.

You may need to apply to Dwr Cymru Welsh Water for any connection to the public sewer under Section 106 of the Water Industry Act 1991. However, if the connection to the public sewer network is either via a lateral drain (i.e. a drain which extends beyond the connecting property boundary) or via a new sewer (i.e. serves more than one property), it is now a mandatory requirement to first enter into a Section 104 Adoption Agreement (Water Industry Act 1991). The design of the sewers and lateral drains must also conform to the Welsh Ministers Standards for Foul Sewers and Lateral Drains, and conform with the publication "Sewers for Adoption"- 7th Edition. Further information can be obtained via the Developer Services pages of www.dwrcymru.com.

Trade Effluent

If the development will give rise to a new discharge (or alter an existing discharge) of trade effluent, directly or indirectly to the public sewerage system, then a Discharge Consent under Section 118 of the Water Industry Act 1991 is required from Dwr Cymru / Welsh Water. Please note that the issuing of a Discharge Consent is independent of the planning process and a consent may be refused although planning permission is granted.

SEWERAGE TREATMENT

No problems are envisaged with the Waste Water Treatment Works for the treatment of domestic discharges from this site.

WATER SUPPLY

We do not serve this area with a potable water supply, we would advise consulting the local water supplier to discuss proposals.

Our response is based on the information provided by your application. Should the proposal alter during the course of the application process we kindly request that we are re-consulted and reserve the right to make new representation.

If you have any queries please contact the undersigned on 0800 917 2652 or via email at developer.services@dwrcymru.com



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Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu gohebiaeth yn y
Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.

Please quote our reference number in all communications and correspondence.

Yours faithfully,

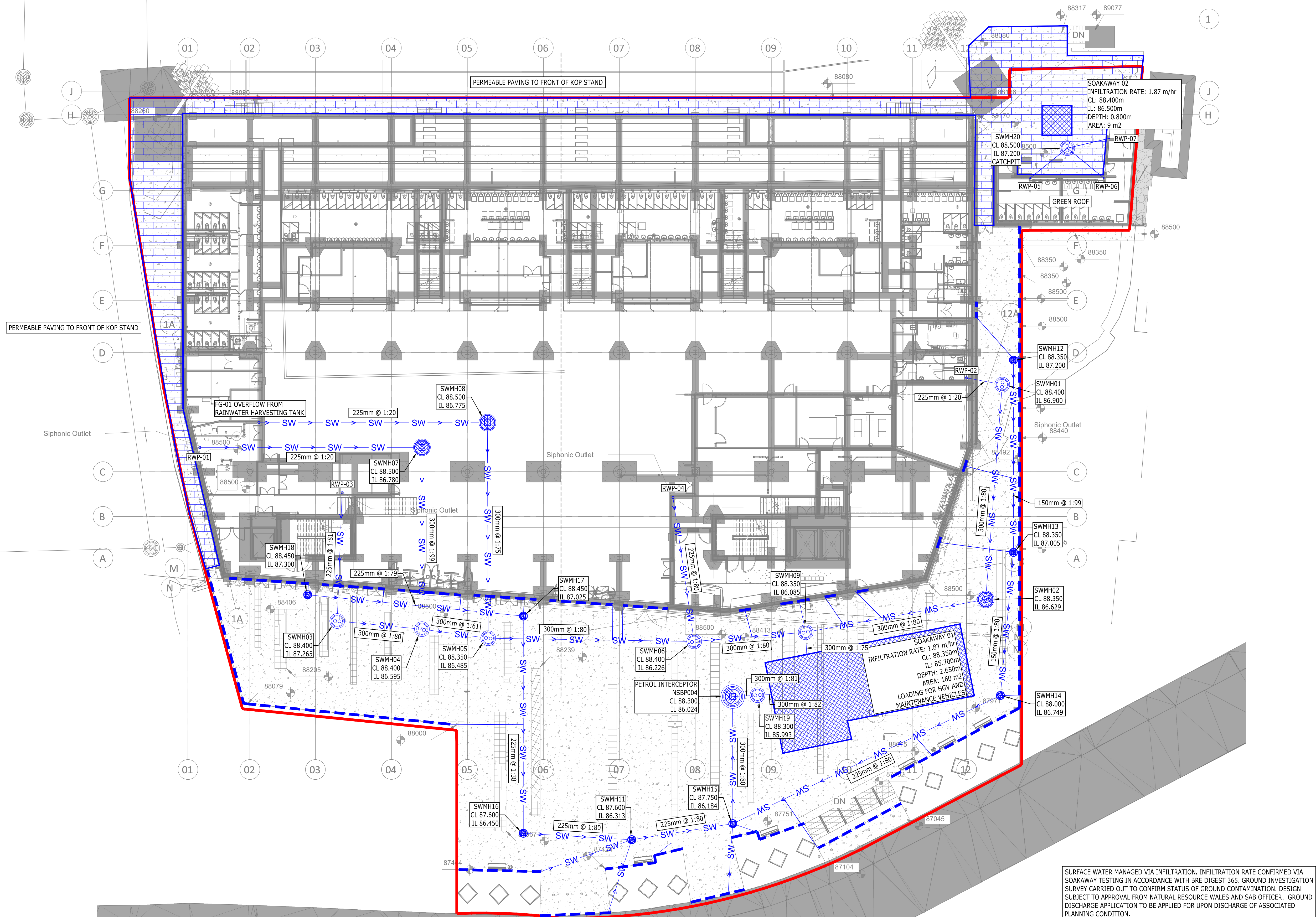
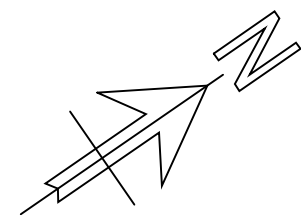


Owain George
Planning Liaison Manager
Developer Services

Please Note that demands upon the water and sewerage systems change continually; consequently the information given above should be regarded as reliable for a maximum period of 12 months from the date of this letter.

APPENDIX 5

DRAINAGE STRATEGY DRAWING



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- Notes
- DO NOT SCALE FROM THIS DRAWING.
 - ALL DIMENSIONS ARE METRES U.N.O.
 - ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM U.N.O.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
 - THIS DRAWING IS TO BE READ IN RELATION TO THE SUBJECT OF THE TITLE. OTHER INFORMATION IS CONSIDERED INDICATIVE ONLY.
 - ALL BRANCH CONNECTIONS ARE TO BE SET AT 1:40 UNLESS OTHERWISE NOTED.
 - COVERS DOWNSTREAM OF SIPHONIC NETWORK ARE TO BE VENTED.
 - MANHOLE COVERS IN VEHICULAR AREAS TO BE D400 COVERS, FOR PEDESTRIAN AREAS TO BE B125.
 - INTERNAL MANHOLES ARE TO BE DOUBLE SEALED AND LOCKABLE.

- KEY:
- SITE BOUNDARY
 - PROPOSED SURFACE WATER DRAINAGE
 - SURFACE WATER CATCH PIT MANHOLE
 - SURFACE WATER DRAINAGE MANHOLE
 - PERMEABLE PAVING
 - SOAKAWAY
 - PPIC SURFACE WATER MANHOLE
 - LINEAR DRAIN

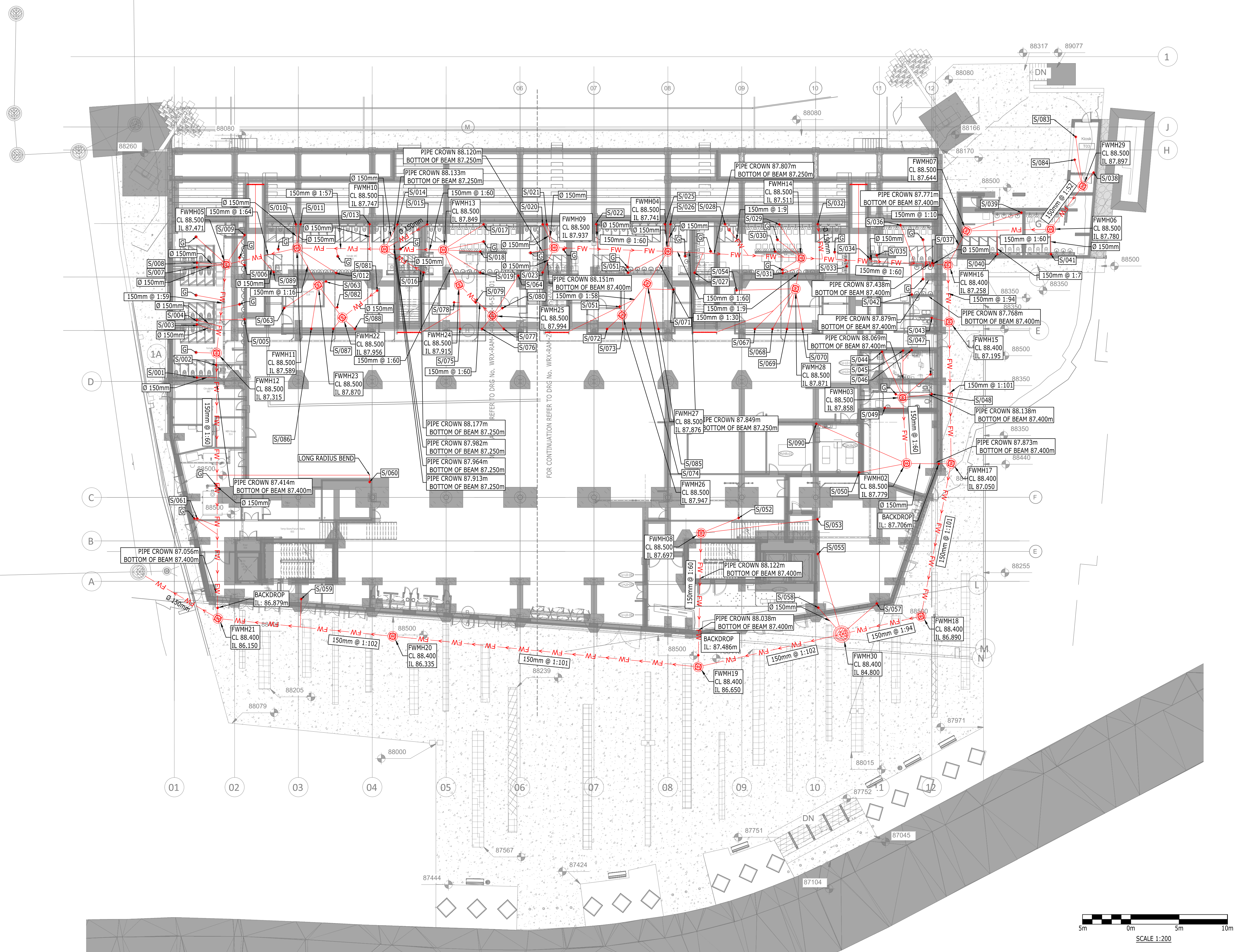
P05	STAGE 4A ISSUE	17.08 2023	SB JW	SP
P04	STAGE 4A ISSUE	28.04 2023	NK JW	PC
P03	STAGE 4A ISSUE	19.04 2023	NK JW	PC
P02	PRELIMINARY ISSUE	31.03 2023	NK JW	PC
P01	PRELIMINARY ISSUE	28.10 2022	MHW JW	PC
Rev	Description	Date	By Chk	App

FOR INFORMATION

WREXHAM AFC
KOP STAND

RAMBOLL
tel 020 7631 5291 london@ramboll.co.uk
www.ramboll.co.uk

Project No:	Scale (8A1):	Drawn:	Date:
1620012485	1:200	MHW	OCT'22
Drawing No:	Suitability:	Rev:	
WRX-RAM-ZZ-ZZ-DR-CD-00102	S3	P05	



Project No: 1620012485	Scale (@A1): 1:200	Drawn: MHW	Date: OCT'22
Drawing No: VRX-RAM-ZZ-ZZ-DR-CD-00101		Suitability: S3	Rev: P03

APPENDIX 6

SURFACE WATER HYDRAULIC CALCULATIONS

Ramboll UK Ltd		Page 1
240 Blackfriars Road London SE1 8NW		
Date 18/08/2023	Designed by SBARTON	
File SW UPDATE 230817.MDX	Checked by	
Micro Drainage		Network 2020.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.331	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	500	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	15.769	0.158	100.0	0.017	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	8.300	0.083	100.0	0.009	5.00	0.0	0.600	o	100	Pipe/Conduit	
S2.001	7.568	4.475	1.7	0.000	0.00	0.0	0.700	o	100	Pipe/Conduit	
S1.001	33.348	0.333	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.000	13.744	0.137	100.0	0.138	5.00	0.0	0.600	o	100	Pipe/Conduit	
S3.001	13.159	15.254	0.9	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
S4.000	18.799	0.188	100.0	0.020	5.00	0.0	1.300	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	56.20	5.26	86.950	0.017	0.0	0.0	0.0	1.00	17.8	2.5
S2.000	56.55	5.18	91.400	0.009	0.0	0.0	0.0	0.77	6.0	1.4
S2.001	56.46	5.20	91.317	0.009	0.0	0.0	0.0	5.85	46.0	1.4
S1.001	53.93	5.81	86.792	0.026	0.0	0.0	0.0	1.00	17.8	3.8
S3.000	56.04	5.30	101.900	0.138	0.0	0.0	0.0	0.77	6.0«	20.9
S3.001	55.93	5.32	101.763	0.138	0.0	0.0	0.0	8.40	66.0	20.9
S4.000	55.82	5.35	87.600	0.020	0.0	0.0	0.0	0.90	15.8	3.1

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S4.001	18.799	0.188	100.0	0.000	0.00	0.0	1.300	o	150	Pipe/Conduit	
S5.000	14.517	0.376	38.6	0.031	5.00	0.0	1.300	o	150	Pipe/Conduit	
S4.002	2.946	0.074	40.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	28.279	0.236	120.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	21.307	0.207	103.2	0.056	5.00	0.0	1.300	o	150	Pipe/Conduit	
S1.003	7.334	0.061	120.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	23.272	0.233	100.0	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
S7.001	19.646	0.196	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S8.000	17.986	0.180	100.0	0.139	5.00	0.0	0.600	o	100	Pipe/Conduit	
S8.001	5.949	15.249	0.4	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
S7.002	41.866	0.259	161.6	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.000	12.298	0.123	100.0	0.139	5.00	0.0	0.600	o	100	Pipe/Conduit	
S9.001	8.847	15.565	0.6	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S4.001	54.39	5.70	87.412	0.020	0.0	0.0	0.0	0.90	15.8	3.1
S5.000	56.61	5.17	87.600	0.031	0.0	0.0	0.0	1.45	25.6	4.7
S4.002	54.26	5.73	87.224	0.051	0.0	0.0	0.0	1.60	28.2	7.5
S1.002	52.44	6.21	86.384	0.215	0.0	0.0	0.0	1.19	47.4	30.6
S6.000	55.68	5.38	87.600	0.056	0.0	0.0	0.0	0.90	15.8	8.4
S1.003	52.06	6.31	86.148	0.271	0.0	0.0	0.0	1.19	47.4	38.2
S7.000	55.67	5.39	86.850	0.006	0.0	0.0	0.0	1.00	17.8	0.9
S7.001	54.33	5.71	86.617	0.006	0.0	0.0	0.0	1.00	17.8	0.9
S8.000	55.65	5.39	101.900	0.139	0.0	0.0	0.0	0.77	6.0«	20.9
S8.001	55.62	5.40	101.720	0.139	0.0	0.0	0.0	12.50	98.2	20.9
S7.002	51.78	6.39	86.346	0.155	0.0	0.0	0.0	1.03	40.8	21.7
S9.000	56.18	5.27	101.900	0.139	0.0	0.0	0.0	0.77	6.0«	21.2
S9.001	56.12	5.28	101.777	0.139	0.0	0.0	0.0	10.35	81.3	21.2

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240 Blackfriars Road London SE1 8NW																						
Date 18/08/2023	Designed by SBARTON																					
File SW UPDATE 230817.MDX	Checked by																					
Micro Drainage		Network 2020.1																				
<u>Synthetic Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Profile Type</td> <td>Summer</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.000</td> <td>Storm Duration (mins)</td> <td>30</td> </tr> <tr> <td>Ratio R</td> <td>0.331</td> <td></td> <td></td> </tr> </table>			Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	2	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Storm Duration (mins)	30	Ratio R	0.331		
Rainfall Model	FSR	Profile Type	Summer																			
Return Period (years)	2	Cv (Summer)	0.750																			
Region	England and Wales	Cv (Winter)	0.840																			
M5-60 (mm)	18.000	Storm Duration (mins)	30																			
Ratio R	0.331																					
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Date 18/08/2023	Designed by SBARTON	
File SW UPDATE 230817.MDX	Checked by	
Micro Drainage		Network 2020.1
<u>Online Controls for Storm</u> <u>Orifice Manhole: SGR D`, DS/PN: S2.001, Volume (m³): 0.5</u></p> <p>Diameter (m) 0.030 Discharge Coefficient 0.600 Invert Level (m) 91.317</p> <p><u>Orifice Manhole: SGR A`, DS/PN: S3.001, Volume (m³): 0.6</u> Diameter (m) 0.030 Discharge Coefficient 0.600 Invert Level (m) 101.763 <u>Orifice Manhole: S4, DS/PN: S4.002, Volume (m³): 1.7</u> Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 87.224 <u>Orifice Manhole: SGR C`, DS/PN: S8.001, Volume (m³): 0.7</u></p> <p>Diameter (m) 0.030 Discharge Coefficient 0.600 Invert Level (m) 101.720</p> <p><u>Orifice Manhole: SGR B`, DS/PN: S9.001, Volume (m³): 0.6</u> Diameter (m) 0.030 Discharge Coefficient 0.600 Invert Level (m) 101.777 <u>Orifice Manhole: S12, DS/PN: S10.002, Volume (m³): 0.3</u> Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 87.205 <u>Orifice Manhole: S14, DS/PN: S1.006, Volume (m³): 3.2</u> Diameter (m) 0.001 Discharge Coefficient 0.600 Invert Level (m) 85.667		
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Date 18/08/2023 File SW UPDATE 230817.MDX	Designed by SBARTON Checked by	
Micro Drainage Network 2020.1		

Storage Structures for Storm

Tank or Pond Manhole: SGR D, DS/PN: S2.000

Invert Level (m) 91.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	90.0	0.150	90.0	0.151	0.0

Tank or Pond Manhole: SGR A, DS/PN: S3.000

Invert Level (m) 101.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	640.0	0.150	640.0	0.151	0.0

Tank or Pond Manhole: SGR C, DS/PN: S8.000

Invert Level (m) 101.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	640.0	0.150	640.0	0.151	0.0

Tank or Pond Manhole: SGR B, DS/PN: S9.000

Invert Level (m) 101.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	640.0	0.150	640.0	0.151	0.0

Cellular Storage Manhole: STank, DS/PN: S1.005

Invert Level (m) 85.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 1.87000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 1.87000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	160.0	160.0	2.151	0.0	160.0
2.150	160.0	160.0			

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APPENDIX 7

FOUL WATER CALCULATIONS

LOCATION	Wrexham
Project :	Wrexham AFC - Kop stand
Project No :	1620012485
Title :	Proposed foul water flow rates
Revision:	P01

Made by : JW
Date : 28.06.2022
Checked by : PC
Date : 28.06.2022

APPLIANCE	Discharge Units ¹⁾ (du/l/s)	Number of appliances ²⁾	Total of du's (l/s)
Toilet Bowl with flushing box	1.8	116	208.8
Basin	0.3	93	27.9
Bath	0.8		0
Shower Tray	0.6	1	0.6
Kitchen Sink	0.8	4	3.2
Urinal	0.5	81	40.5
Washing Machine	1.5		0
Dishwasher	0.8	2	1.6
Floor Gully	1.5	7	10.5
Bidet	0.5		0
Drinking fountain	0.05		0
Sprinkling tap	0.3		0

(ΣDu) total load (du-l/s) for this location	293.1
--	--------------

Total waste flow rate based on equation (l/s) (Q_{ww}) = K (√ du's)	17.12
Any pumped waste discharge (l/s) (Q_p)	0.00
Any continuous discharge (e.g. condensate etc) (l/s) (Q_c)	0.00
Peak design flow rate for stack/location (Q_{tot}) (l/s)	17.12

Average flow (l/s)	2.85 *
---------------------------	---------------

*average flow rates dependant upon fitting usage and building operation hours

Frequency of use factors (K)	
Intermittent use-e.g. domestic/guesthouse/	0.50
Frequent use- e.g. Restaurant/Office	0.70
Congested use- e.g. Public use	1.00
Special use- e.g. laboratory	1.20

Enter Frequency of use factor (from above)	1.00
---	-------------

Designers notes :
 1) Wastewater discharge units in accordance with BS EN 12056-2:2000 table 2
 2) The calculations are based on CZWG drawings issued 17/07/2013 1944-00-SK01-1000-P01

APPENDIX 8

INFILTRATION TEST RESULTS

Dear Wrexham AFC Limited,

Please find below the results of your Infiltration testing. The information contained below is a summary of the site works carried out on 13th July 2022.

Geology

An examination of the available British Geological Survey data of the area for the site has been examined and indicates that the site has superficial drift deposits composed of Glaciofluvial Sheet Deposits (sand and gravel), and bedrock deposits recorded as the Etruria Formation (mudstone).

Fieldworks

The programme of this investigation included the excavation of two trial pits. The locations of the soakaway tests were selected by the client. During this work, the soils encountered were logged in general accordance with BS5930: 1990, as amended in 2007.

Percolation Testing

During the soakaway tests the water achieved a fall from 75% to 25% of the effective depth of the storage volume. The results obtained from the soakaway tests are summarised below:

WS	Dimensions (m)	Depth (m)	Soil Description	Infiltration Rate (m/sec)	Drainage Characteristics
TP01 test1	1.95 x 0.70	2.50	Dark brown gravelly SAND.	7.3E-4	Good
TP01 test2	1.95 x 0.70	2.50	Dark brown gravelly SAND.	4.7E-4	Good
TP01 test3	1.95 x 0.70	2.50	Dark brown gravelly SAND.	4.0E-4	Good
TP02 test1	1.80 x 0.70	2.50	Dark brown gravelly SAND.	1.4E-3	Good
TP02 test2	1.80 x 0.70	2.50	Dark brown gravelly SAND.	5.2E-4	Good
TP02 test3	1.80 x 0.70	2.50	Dark brown gravelly SAND.	4.2E-4	Good

Conclusion

The soils encountered beneath the site were found to be predominantly SAND. The soakage rates obtained during the investigation were found to be good and permeable. Given the data from the test, it is considered that the use of soakaways is suitable for this site.

References

- Building Research Establishment (BRE) Digest 365, *Soakaway Design*, September 1991.
- British Standards Institution (1999) BS5930: *Code of practice for site investigations*, B.S.I., London.
- British Standards Institution (2007), Amendment No 1, BS5930: *Code of practice for site investigations*, B.S.I., London.

Please do contact me on 01243 787150 or 07758 162624 should you have any questions.

Regards

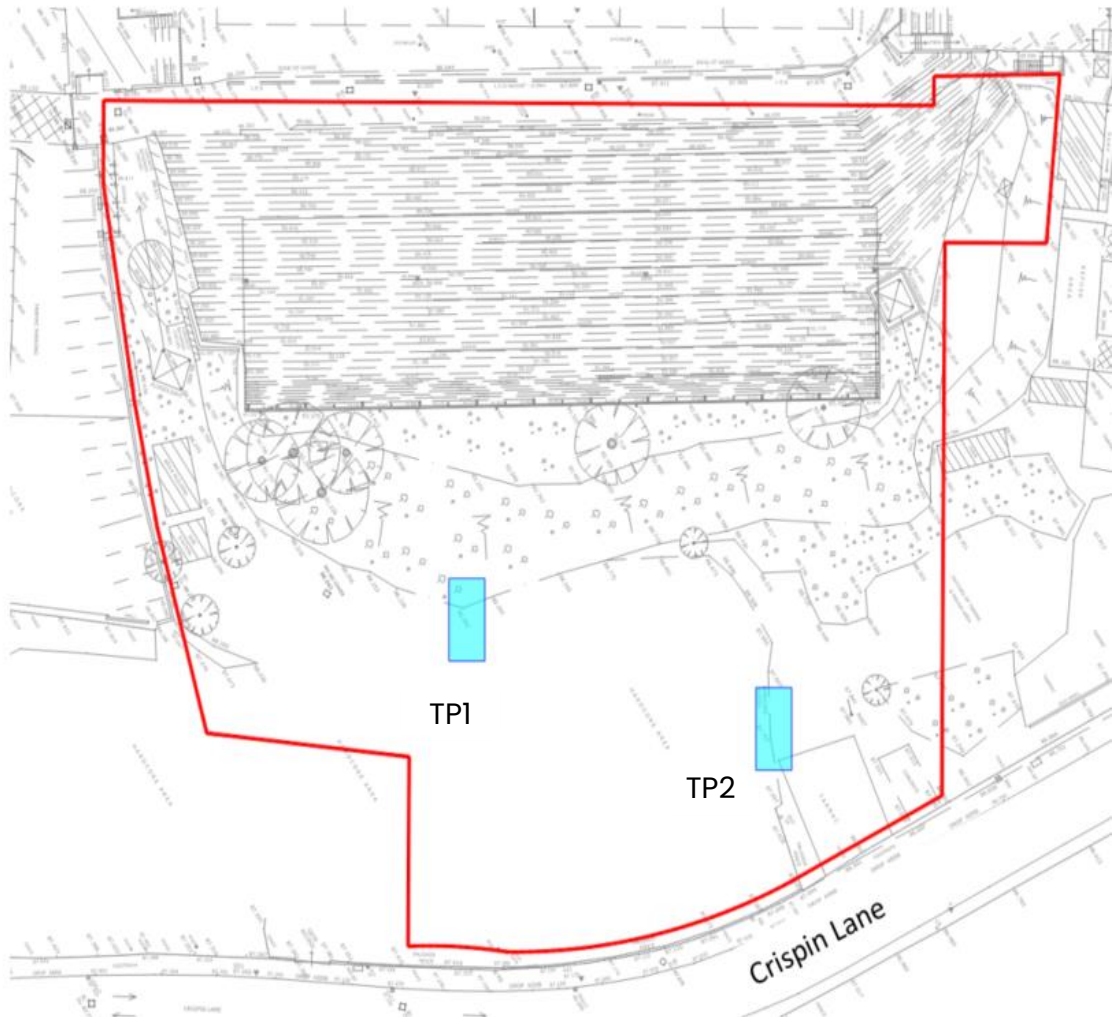
A handwritten signature in grey ink that reads 'Nick Hammond'.

Nick Hammond
Geo-Environmental Engineer



Appendix A





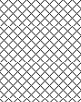
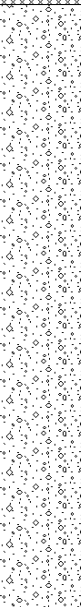
Site Investigation Plan



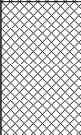
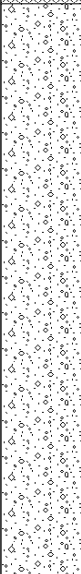
Kop Stand - Wrexham
YEX4390
Jul-22

Appendix B



				Trial Pit Log			TrialPit No TP01 Sheet 1 of 1	
Project Name: Kop Stand, Wrexham AFC				Project No. YEX4390		Co-ords: - Level:		Date 13/07/2022
Location: Mold Road, Wrexham, LL11 2AH						Dimensions (m):		Scale 1:25
Client: Gardiner & Theobald						Depth 2.50		Logged LB
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.10			MADE GROUND. Grey fine to coarse angular COBBLES and GRAVEL of concrete	
				0.50			MADE GROUND. Blackish brown gravelly SAND containing occasional concrete, brick, metal debris and plastic bottles	
				2.50			Dark brown very gravelly cobbly fine to medium SAND. Gravel is fine to coarse rounded to subangular of sandstone, mudstone and siltstone. Cobbles of sandstone.	1
							End of Pit at 2.50m	2
								3
								4
								5
Remarks: No groundwater encountered. Excavation sides collapsing.								
Stability:								



				Trial Pit Log			TrialPit No TP02 Sheet 1 of 1	
Project Name: Kop Stand, Wrexham AFC				Project No. YEX4390		Co-ords: - Level:		Date 13/07/2022
Location: Mold Road, Wrexham, LL11 2AH						Dimensions (m):		Scale 1:25
Client: Gardiner & Theobald						Depth 2.50		Logged LB
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.15			MADE GROUND. Grey fine to coarse angular COBBLES and GRAVEL of concrete	
				0.60			MADE GROUND. Blackish brown gravelly SAND containing occasional concrete, brick, metal debris and plastic bottles	
				2.50			Dark brown very gravelly cobbly fine to medium SAND. Gravel is fine to coarse rounded to subangular of sandstone, mudstone and siltstone. Cobbles of sandstone.	1
							End of Pit at 2.50m	2
								3
								4
								5
Remarks: No groundwater encountered. Excavation sides collapsing.								
Stability:								



Appendix C

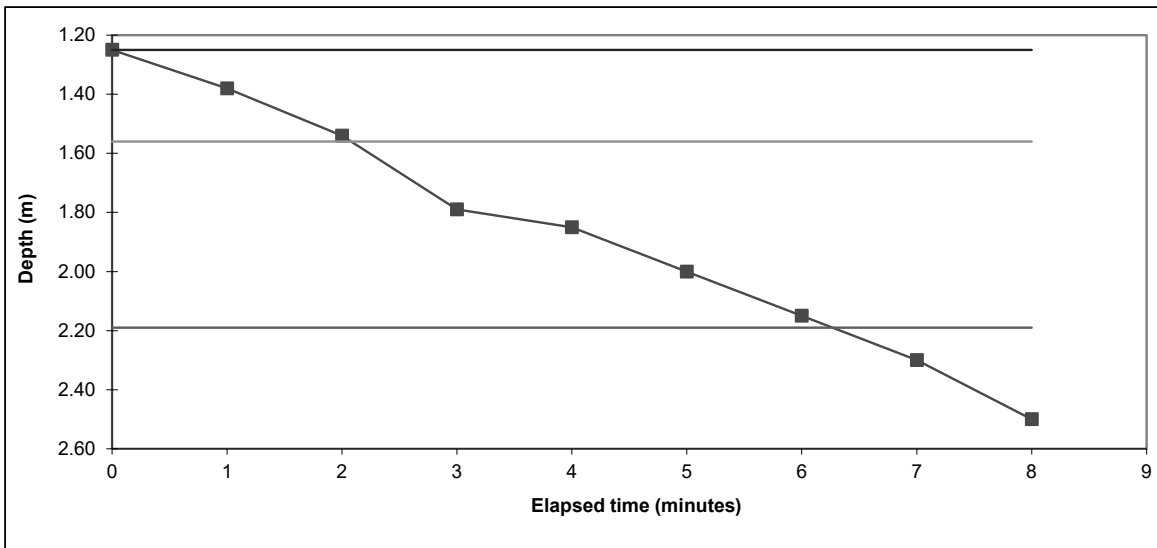


Your Environment

Soakaway Test

Trial Pit No:	TP01	Test No:	1	Date:	13/07/2022
Length (m):	1.950	Datum Height:		0.00 m agl	
Width (m):	0.70	Granular infill:	None		
Depth (m):	2.50	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.250		
1	1.380		
2	1.540		
3	1.790		
4	1.850		
5	2.000		
6	2.150		
7	2.300		
8	2.500		



Start water depth for analysis (mbgl)	1.25		
75% effective depth (mbgl):	1.56	Elapsed time (mins):	2.1
50% effective depth (mbgl):	1.88		
25% effective depth (mbgl):	2.19	Elapsed time (mins):	6.3
Base of soakage zone (mbgl):	2.50		
Volume outflow between 75% and 25% effective depth (m ³):		0.860	
Mean surface area of outflow (m ²):		4.65	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):		4.2	

Soil infiltration rate (m/s):	7.3E-4
Remarks	Results processed following BRE 365 (2007). 800L of water used for the test

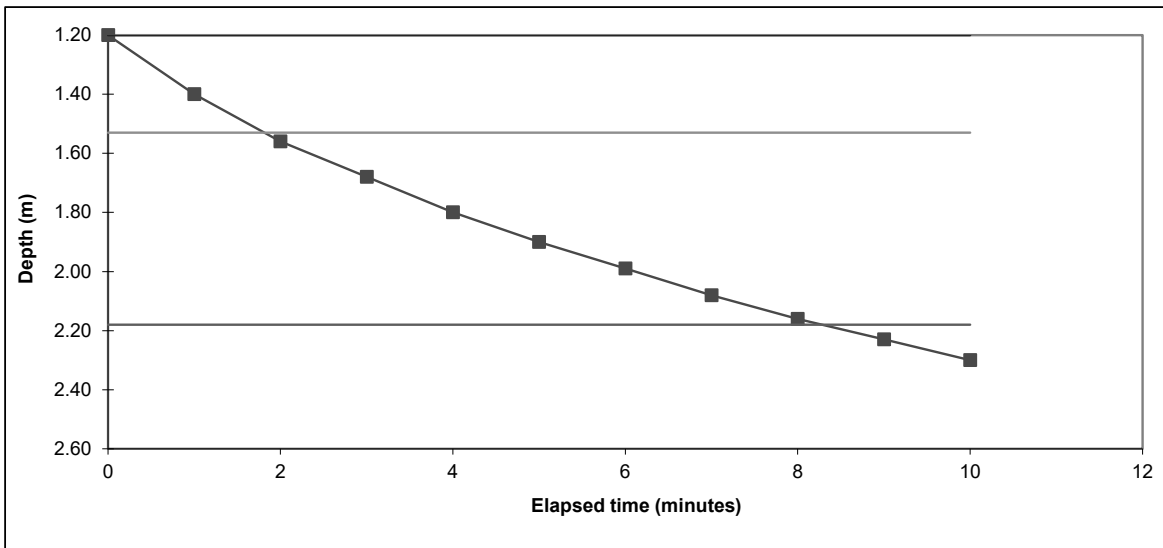
Client:	Wrexham AFC Limited	TP01
Site:	Kop Stand, Wrexham AFC	

Your Environment

Soakaway Test

Trial Pit No:	TP01	Test No:	2	Date:	13/07/2022
Length (m):	1.950	Datum Height:		0.00 m agl	
Width (m):	0.70	Granular infill:	None		
Depth (m):	2.50	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.200		
1	1.400		
2	1.560		
3	1.680		
4	1.800		
5	1.900		
6	1.990		
7	2.080		
8	2.160		
9	2.230		
10	2.300		



Start water depth for analysis (mbgl)	1.20		
75% effective depth (mbgl):	1.53	Elapsed time (mins):	1.8
50% effective depth (mbgl):	1.85		
25% effective depth (mbgl):	2.18	Elapsed time (mins):	8.3
Base of soakage zone (mbgl):	2.50		
Volume outflow between 75% and 25% effective depth (m ³):			0.887
Mean surface area of outflow (m ²):			4.81
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			6.5

Soil infiltration rate (m/s):	4.7E-4
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Remarks	Results processed following BRE 365 (2007). 800L of water used for the test
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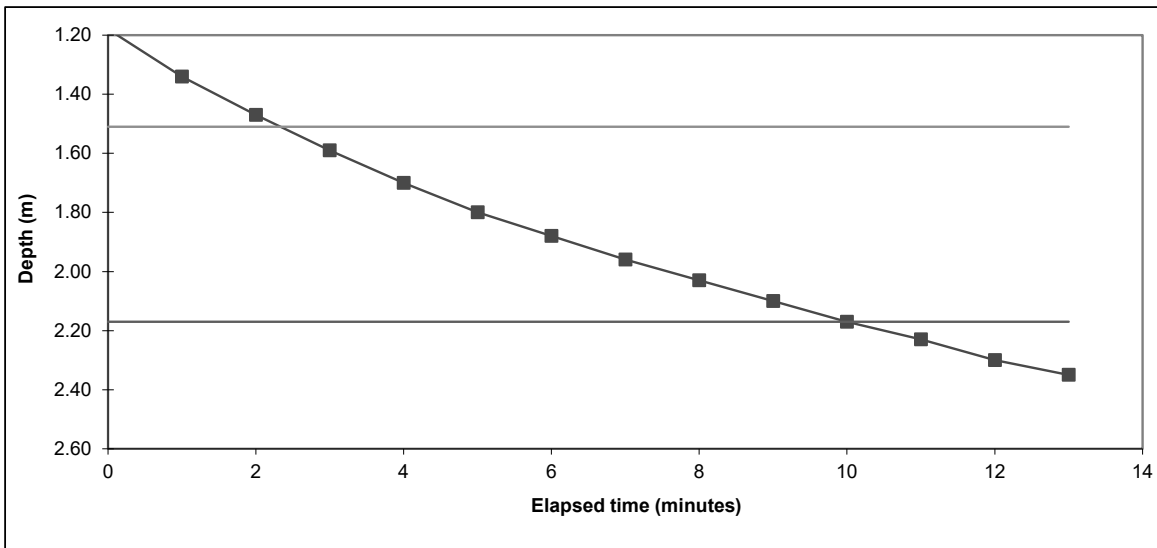
Client:	Wrexham AFC Limited	TP01
Site:	Kop Stand, Wrexham AFC	

Your Environment

Soakaway Test

Trial Pit No:	TP01	Test No:	3	Date:	13/07/2022
Length (m):	1.950	Datum Height:		0.00 m agl	
Width (m):	0.70	Granular infill:	None		
Depth (m):	2.50	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.180		
1	1.340		
2	1.470		
3	1.590		
4	1.700		
5	1.800		
6	1.880		
7	1.960		
8	2.030		
9	2.100		
10	2.170		
11	2.230		
12	2.300		
13	2.350		



Start water depth for analysis (mbgl)	1.18		
75% effective depth (mbgl):	1.51	Elapsed time (mins):	2.3
50% effective depth (mbgl):	1.84		
25% effective depth (mbgl):	2.17	Elapsed time (mins):	10.0
Base of soakage zone (mbgl):	2.50		

Volume outflow between 75% and 25% effective depth (m ³):	0.901
Mean surface area of outflow (m ²):	4.86
(side area at 50% effective depth + base area)	
Time for outflow between 75% and 25% effective depth (mins):	7.7

Soil infiltration rate (m/s):	4.0E-4
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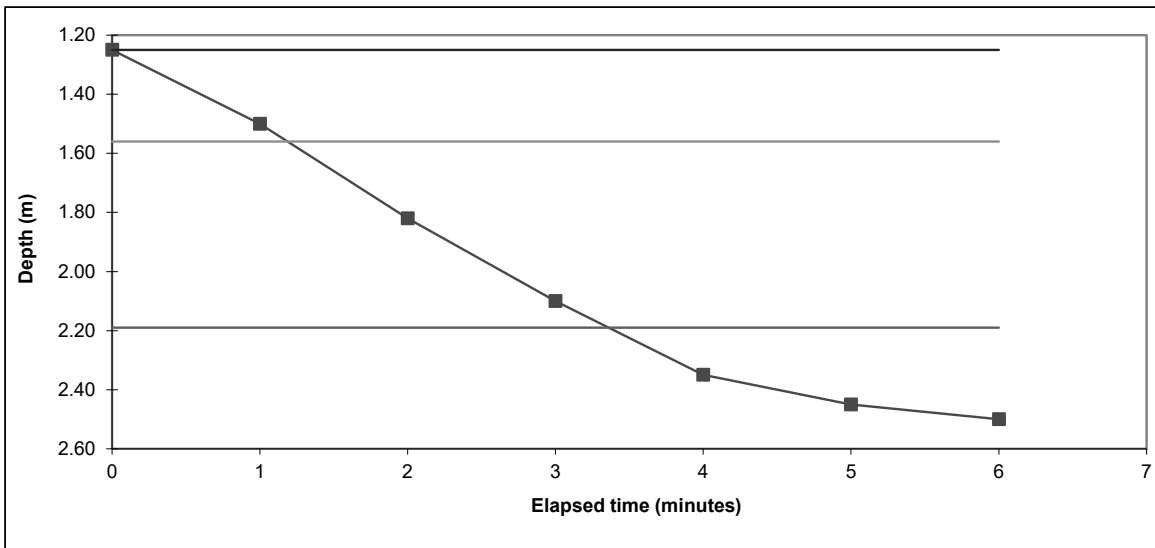
Remarks	Results processed following BRE 365 (2007). 800L of water used for the test
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Client:	Wrexham AFC Limited	TP01
Site:	Kop Stand, Wrexham AFC	

Your Environment

Soakaway Test

Trial Pit No:	TP02	Test No:	1	Date:	13/07/2022
Length (m):	1.800	Datum Height:		0.00 m agl	
Width (m):	0.70	Granular infill:	None		
Depth (m):	2.50	Porosity of infill:	1	(assumed)	
Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)		
0	1.250				
1	1.500				
2	1.820				
3	2.100				
4	2.350				
5	2.450				
6	2.500				



Start water depth for analysis (mbgl)	1.25		
75% effective depth (mbgl):	1.56	Elapsed time (mins):	1.2
50% effective depth (mbgl):	1.88		
25% effective depth (mbgl):	2.19	Elapsed time (mins):	3.4
Base of soakage zone (mbgl):	2.50		
Volume outflow between 75% and 25% effective depth (m ³):		0.794	
Mean surface area of outflow (m ²):		4.36	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):		2.2	

Soil infiltration rate (m/s):	1.4E-3
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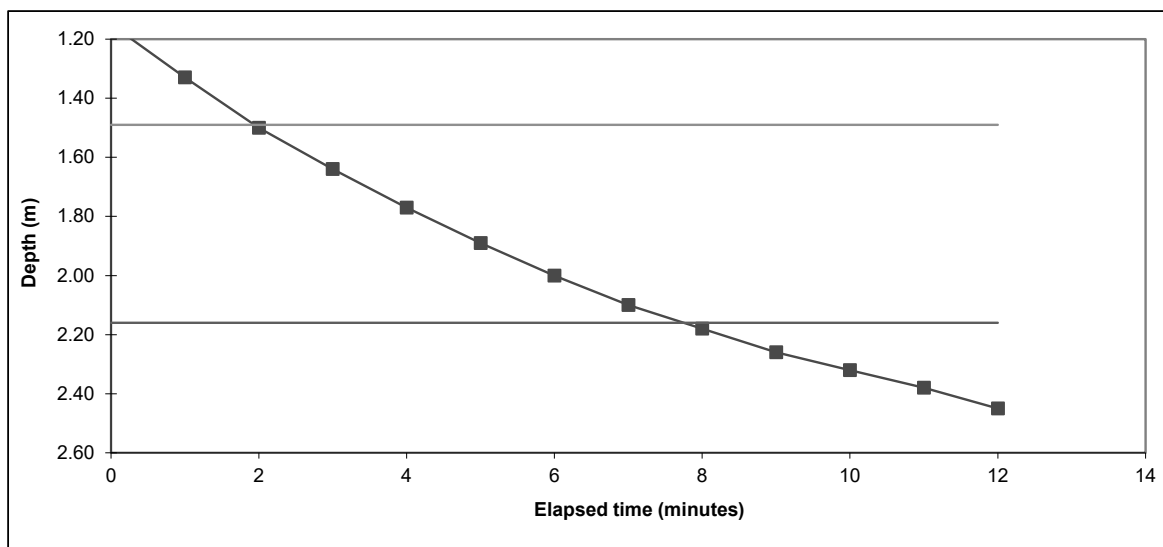
Remarks	Results processed following BRE 365 (2007). 800L of water used for the test
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Client:	Wrexham AFC Limited	TP02
Site:	Kop Stand, Wrexham AFC	

Your Environment

Soakaway Test

Trial Pit No:	TP02	Test No:	2	Date:	13/07/2022
Length (m):	1.800	Datum Height:		0.00 m agl	
Width (m):	0.70	Granular infill:	None		
Depth (m):	2.50	Porosity of infill:	1	(assumed)	
Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)		
0	1.150				
1	1.330				
2	1.500				
3	1.640				
4	1.770				
5	1.890				
6	2.000				
7	2.100				
8	2.180				
9	2.260				
10	2.320				
11	2.380				
12	2.450				



Start water depth for analysis (mbgl)	1.15		
75% effective depth (mbgl):	1.49	Elapsed time (mins):	1.9
50% effective depth (mbgl):	1.83		
25% effective depth (mbgl):	2.16	Elapsed time (mins):	7.8
Base of soakage zone (mbgl):	2.50		
Volume outflow between 75% and 25% effective depth (m ³):	0.844		
Mean surface area of outflow (m ²):	4.61		
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):	5.9		

Soil infiltration rate (m/s):	5.2E-4
Remarks	Results processed following BRE 365 (2007). 800L of water used for the test

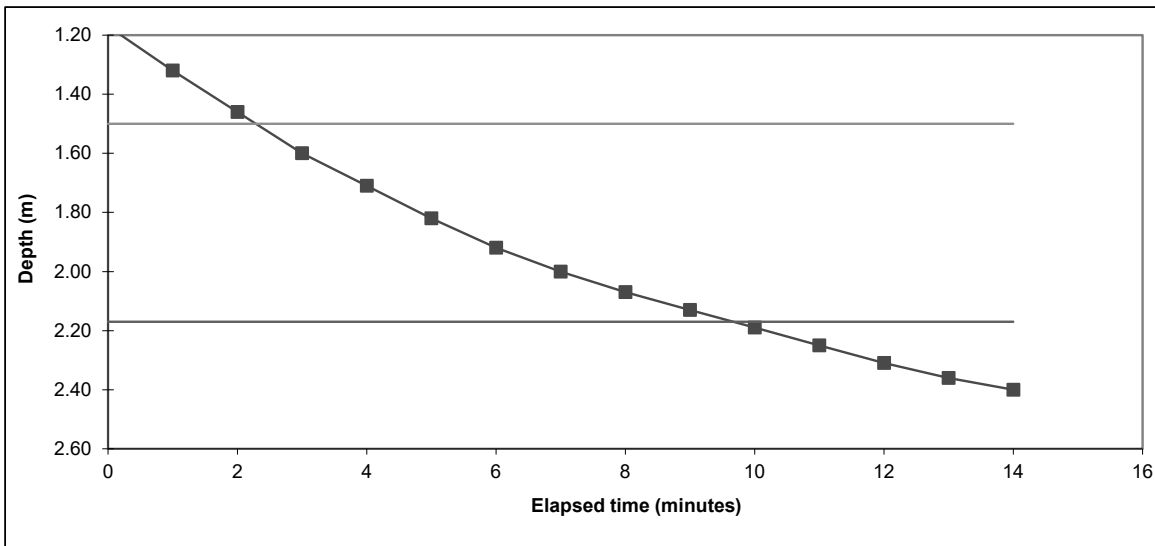
Client:	Wrexham AFC Limited	TP02
Site:	Kop Stand, Wrexham AFC	

Your Environment

Soakaway Test

Trial Pit No:	TP02	Test No:	3	Date:	13/07/2022
Length (m):	1.950	Datum Height:		0.00 m agl	
Width (m):	0.70	Granular infill:	None		
Depth (m):	2.50	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.170	14	2.400
1	1.320		
2	1.460		
3	1.600		
4	1.710		
5	1.820		
6	1.920		
7	2.000		
8	2.070		
9	2.130		
10	2.190		
11	2.250		
12	2.310		
13	2.360		



Start water depth for analysis (mbgl)	1.17		
75% effective depth (mbgl):	1.50	Elapsed time (mins):	2.3
50% effective depth (mbgl):	1.84		
25% effective depth (mbgl):	2.17	Elapsed time (mins):	9.7
Base of soakage zone (mbgl):	2.50		
Volume outflow between 75% and 25% effective depth (m ³):			0.915
Mean surface area of outflow (m ²):			4.86
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			7.4

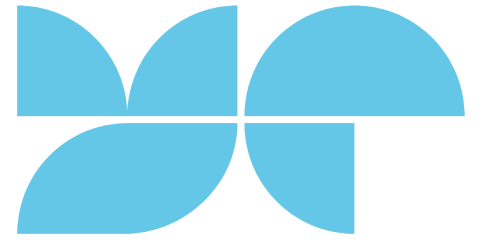
Soil infiltration rate (m/s):	4.2E-4
Remarks	Results processed following BRE 365 (2007). 800L of water used for the test

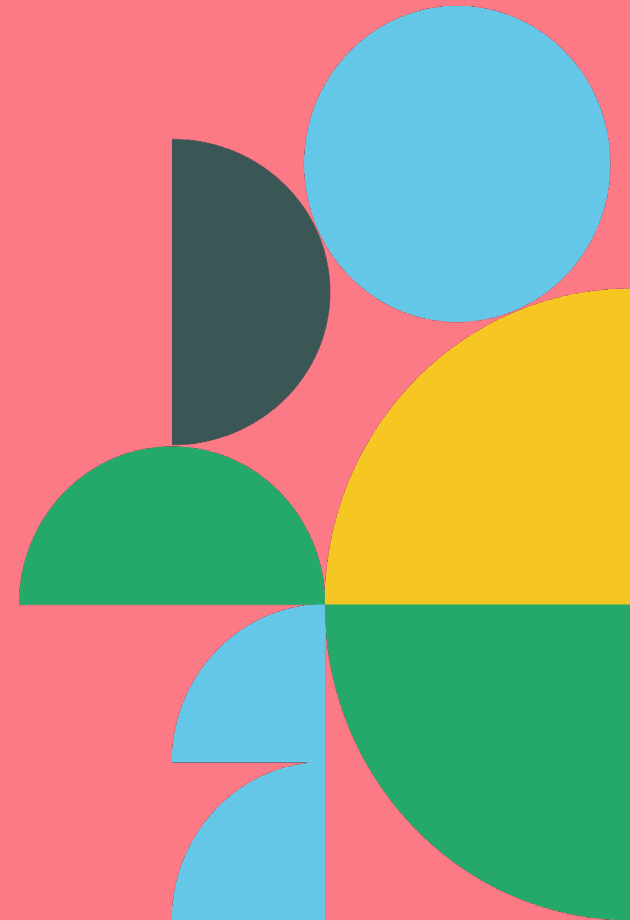
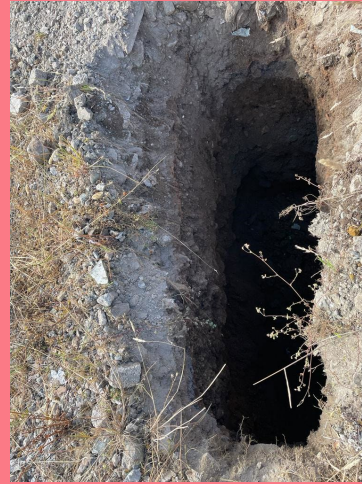
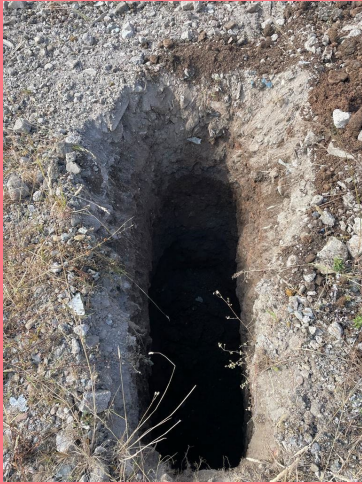
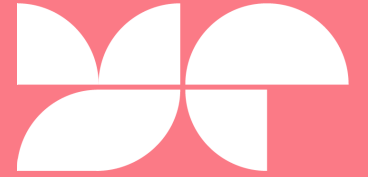
Client:	Wrexham AFC Limited	TP02
Site:	Kop Stand, Wrexham AFC	

Appendix D



YEX4390
TP01 Photos





APPENDIX 9

SUDS APPROVING BODY (SAB) RE-APPLICATION

 wrexham COUNTY BOROUGH COUNCIL CYNGOR BWRDEISTREF SIROL wrecsam	SuDS Scheme Application for suds Approving Body (SAB) Approval – Wales Application Review Record	Page 1 of 2
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Scheme Title:	Wrexham Athletic Football Club	Date:	28-04-2023
Application Ref:	SAB_PRE_2021_0601		
Review Type	SAB – Design Review 1.2		
Assessor	M. Rogers / Nick Banks		
Applicant	Wrexham AFC		
Documents Referenced	WRX-RAM-ZZ-ZZ-DR-CD-00102-p03 and Ramboll email 21.04.2023		
Report Convention			
- WCBC comments – black text suffixed with bracketed date defining when <i>commentary added to record</i>; - Designer Response – red text suffixed with bracketed date defining when commentary added to record; - Comments closed – grey highlight encapsulating black/red text complete with suffixed date of closure. Note comment closure is a reviewer only function.			
Review History:			
Design Review 1 – <i>This document summarises discussions between the Development Team and representatives of Pell Frischmann on 09.08.2022 (teams call) regarding the current Drainage Strategy for the Pre-Application stage.</i>			
Design Review 2 – <i>Updated drainage proposal (00102-p03) and email received 21.04.2023.</i>			
S0 - General Comments			
S0.1 Please refer to the information Required for a Full Application set out in Table A&B of the application form.			
S1. Surface water runoff destination			
S1.1 Due to potential site constraints discharge of surface water runoff to a DCWW combined sewer was discussed. This would only be an acceptable proposal if it was demonstrated that other discharge destinations (e.g. Infiltration) are not viable. Review comment: Infiltration now proven viable and included in proposals-28.04.2023 S1.2 Any SW connection to DCWW sewer would be subject to their approval and discharge limits. Review comment: no longer included in proposals -28.04.2023 S1.3 Ideas were discussed of rainwater harvesting to provide water for non-potable usage such as flushing W.C's, however, the use of this water for pitch irrigation was in abeyance due to water quality parameters. – It was recommended that the full potential of surface water re-use on the site should be investigated given the relatively			

Application Review Record

large water consumption of a site such as this. **Review comment: rainwater harvesting is included in proposal as part of a site wide strategy**-28.04.2023

S2. Surface water runoff hydraulic control

S2.1 Proposals included below ground cellular storage, which given the site constraints appeared a practical solution. -28.04.2023

S2.2 The SW design should consider 100yr + 40% CCA . -28.04.2023

S3. Water Quality

S3.1 Inclusion of a green-roof and permeable paving within the proposals were acknowledged as providing water quality improvements. -28.04.2023

S3.2 A pollution risk assessment for the proposed land use, accompanied with a CIRIA C753 Simple Index Approach assessment will be required for the final design. -28.04.2023

S4. Amenity

S4.1 Inclusion of a green-roof within the proposals were acknowledged as providing amenity value. **Review comment: raingardens no longer included in proposals due to clashes, opportunity to include in final design should be taken if practical.** -28.04.2023

S5. Biodiversity

S5.1 Inclusion of a green-roof with the proposals were acknowledged as providing biodiversity value. **Review comment: raingardens no longer included in proposals due to clashes, opportunity to include in final design should be taken if practical.** -28.04.2023

S6. Design of drainage for construction, operation and maintenance

S6.1 Sufficient detail of proposed drainage and drainage products shall be provided in the full submission so that, suitability, operation / performance as well as any maintenance requirements can be fully considered. - 28.04.2023