

Vale Consultancy

CONSULTING CIVIL & STRUCTURAL ENGINEERS

DRAINAGE STRATEGY REPORT (DSR)

Rhodes Avenue,
Port Talbot,
SA12 6UT

Prepared for: CJ Construction
Project Ref: 21980_DSR

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DOCUMENT CONTROL

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Client:	CJ Construction
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Issue	Prepared by	Approved by	Date	Status
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1 INTRODUCTION

1.1 Site Location

Vale Consultancy has been instructed by CJ Construction (the Client) to undertake a drainage strategy report (DSR) for the proposed development at Rhodes Avenue, Port Talbot, SA12 6UT.

Refer to **Appendix A** – Existing Site Plans

The proposed development is located approximately 1.5km north-west of Port Talbot town centre. The site is in an urban setting and can be accessed via Rhodes Avenue. Immediately surrounding the development site are other residential properties and the Neath Port Talbot hospital. As there is no site requirement for rain water harvesting and infiltration tests are likely to fail, it is our proposal to attenuate and discharge flows at a green field rate to the existing highway drain in Rhodes Avenue.

The proposed development site is previously developed and is therefore classed as a **‘Brownfield’** site. The following drainage strategy will cover the hydraulic design criteria of the surface water drainage network only.



Figure 1: Site Location Satellite Plan



1.2 Proposed Development

The intention of the proposed project is to construct 3 flats and 2 bungalows along with associated raingardens & permeable surfaces into the scheme to provide interception, amenity & biodiversity across the site.

The total site area is approximately 0.184ha, the whole site is to be developed and as such the development/SAB boundary will also be 0.184ha.

Refer to **Appendix B** – Proposed Plans

1.3 Existing Geology

To date a site investigation has not taken place, however, with use of the BGS geology viewer the site is located on tidal flat deposits known for having a low permeability. Soilscape confirms this information also identifying that the water table will be relatively high in the soil. In all it is likely that infiltration techniques will not be suitable for the site. Further information about the soil classification can be seen below. Further information is available from historic BGS borehole logs close to the site, the record shows that the water table is at 1.4m below the surface and that the superficial geology is primarily silty clay or made ground. Given that the made ground contains domestic waste, it is also likely contaminated and therefore unsuitable for infiltration.

British Geological Survey records note that the site is listed to have the following:

Superficial deposits: Tidal Flat Deposits - Clay, silt and sand. Sedimentary superficial deposit formed between 11.8 thousand years ago and the present during the Quaternary period.

Bedrock geology: South Wales Middle Coal Measures Formation - Mudstone, siltstone and sandstone. Sedimentary bedrock formed between 318 and 309.5 million years ago during the Carboniferous period.

Refer to **Appendix D** – British Geological Survey records

1.4 Flood Risk

Flood risk has been assessed using the NRW development advice map and detailed view map. The site is located within Flood Zone 3 for both coastal and fluvial flooding, however, the site is located in a TAN15 defended area, so is therefore considered to be at little or no risk of fluvial or tidal/coastal flooding. Further flood risk assessment should not be considered necessary due to the fact that the site is located in a TAN15 defended area.

Refer to **Appendix D** – Natural Resource Wales Flood Risk Assessment Wales Map (FRAWM)



2 SURFACE WATER

2.1 Existing Drainage Systems

As the proposed scheme is situated on a Brownfield site therefore there is likely to be existing drainage apparatus within the site, furthermore, there are public/highway sewers within the adjacent roads. It is envisaged that foul drainage from the site will drain to the existing foul water sewer located in Rhodes Avenue. Refer to the DCWW asset map in **Appendix A** for the location of the existing sewer.

2.2 Proposed Drainage Systems

2.2.1 **S1:** SuDS hierarchy of surface water discharge locations

The following receptors have been considered for surface water runoff on site, in order of SuDS preference. The aim of SuDS Standards is to ensuring that the most effective drainage scheme is delivered with the most preferred levels of surface water destination, where the design can move to the next means of discharge only under exception criteria.

1. **Surface water collection for reuse.**
2. **Discharge by infiltration into ground**
3. **Discharge into open surface water body**
4. **Discharge into surface water sewer, highway drain, or other drainage system**
5. **Discharge into combined sewer.**

Priority Level 1 - Surface water collected for reuse:

Rainwater harvesting is not proposed due to the practicalities of such a system as well as there being no foreseeable demand for non-potable water within the development proposals throughout its design life. There is also no foreseeable need to harvest water as DCWW has not identified any potential stresses on the mains water supply.

The need for non-potable water is low and the cost for such a system is high therefore it is deemed not feasible. The costs for installing such a system for a residential property set against the money saving due to reduced usage of potable water from the water provider typically results in a 50-60 year return.

No solution, move to next Priority Level

Priority Level 2 – Discharge via infiltration:

As explained in section 1.3, infiltration testing is unlikely to give positive results in the expected soil types, as such it is not proposed that the site will discharge excess surface water flows to the ground via infiltration.

No solution, move to next Priority Level



Priority Level 3 – Discharge into open surface water body:

As there are no open surface water bodies in the vicinity of the site it is not viable to discharge via this method.

No solution, move to next Priority Level

Priority Level 4 – Discharge to a surface water sewer, highway drain, or other drainage system

As no other options are viable it is proposed to reutilise the probable existing method of discharge of the site to the existing highway surface water drainage network located in Rhodes Avenue. Surface water flows will discharge to the sewer at the minimum viable rate.

Practical solution found

2.2.2 **S2:** Surface Water Runoff Hydraulic Control

Proposed SuDS drainage system

The proposed surface water drainage system will connect and discharge to the existing highway surface water drain located in Rhodes Avenue.

The proposed SuDS drainage system is relatively simple, the concept is to discharge roof run-off from the properties through a variety of SuDS features such as a rain garden and porous car park. Rain gardens are located adjacent to the properties and will receive flows from the roof areas where possible whilst the parking bay areas will drain via a porous car park construction. The surface water flows will culminate in the permeable car park area. With use of a flow control chamber outgoing flows will be restricted to a rate of x.xL/Sec. The outfall location from the porous subbase is situated adjacent to Rhodes Avenue. The outfall location from the porous carpark is the existing combined sewer located in Rhodes Avenue.

Refer to **Appendix B** for the proposed surface water drainage layout illustrating how surface water is collected and conveyed towards their discharge location.

Hydraulic Control

The proposed SuDS drainage system will use a combination of SuDs features including bioretention raingardens and porous car park to collect, attenuate and filtrate surface water runoff. Attenuation will be designed such that no flooding will occur for a 1 in 100-year storm event plus 40% climate change and a flow control device will be installed downstream of the attenuation systems to control discharge to their respective outfall.

In accordance with best practice CIRIA C753: Chapter 24, the rate of run-off for the developed site should be no greater than the estimated peak runoff rate and runoff volumes from the site in its pre-developed state (Greenfield) to help ensure that the flood risk associated with the receiving watercourse is not increased by the development proposals. The approach for estimating runoff rates and volumes from the proposed impermeable catchment areas have been calculated using the FEH ReFH2 method. This method allows estimation of the amount of runoff likely to be generated from the development proposals from a range of storm returns. The proposal is to discharge the surface water runoff from the site at a managed greenfield rate to the existing watercourse to the rear of the site.

A discharge rate of 0.8L/Sec is proposed utilising a 20mm orifice plate. For hydraulic design of the drainage network refer to **Appendix E – Design Calculations**.



Interception of runoff

For greenfield sites the majority of rainfall events during the year create no noticeable surface water runoff, the rainwater will normally evapotranspire or recharge groundwater. Whereas, impermeable surfaces generate runoff from virtually all rainfall events. Therefore, the development of greenfield sites changes its surface water runoff characteristics and can have a negative impact on the morphology and ecology of receiving watercourses.

By providing interception of runoff through SuDS systems, developed sites can be designed to have zero runoff for most small rainfall events and more closely replicate the surface water characteristics of its former greenfield state.

As per Box 24.6 of the CIRIA SuDS Manual C753, bioretention areas can be assumed to comply when the impermeable surface area is less than 5 times the vegetated surface area receiving the runoff. Moreover, a porous surface (car parking/hardstanding ground) has been proposed to serve the site and as per Box 24.6 of the CIRIA SuDS Manual C753, when the porous surface also drains an adjacent impermeable area, compliance can be assumed for all soil types where the surface is unlined, as long as the extra impermeable area is no greater than the porous surface area. To evaluate the compliance of the proposed scheme, each impermeable area will be compared against the SuDS features to which they are being drained, please see the below table.

Interception Area Check			
Contributing Area(m ²)	Interception Area Required(m ²)	SuDS Feature(m ²) Intercepting Contributing Area	Interception Compliant? (Yes/No)
Catchments D,J + 0.5*G	22.9m ²	RG1 = 40.4m ²	Yes
Catchments F,K + 0.5*G	17.19m ²	RG2 = 19.6m ²	Yes
Catchments L + E	15.28 m ²	RG3 = 11.5m ²	Yes* when accounting for free interception area in Car park 1 23m ²
Catchments O	11.2 m ²	RG4 =11.5m ²	Yes
Catchments P	11.2 m ²	RG5 =11.5m ²	Yes
Catchments N+Q	52.4m ²	Car park 1 = 75m ²	Yes

The proposed SuDS components are designed to allow the soil to absorb and evapotranspire the first 5mm of rainfall for most events when the soil is not saturated, as such the proposed drainage system is considered to be compliant for interception.

Refer to **Appendix B** for a contributing areas plan showing what areas of the site drain to each SuDS component as well as proposed drainage plans and design.

Exceedance Event Analysis & Management



It is necessary to assess the risk and consequence of flooding for exceedance events. This is to determine the likely flood volumes and water flow paths that would be caused by a storm event that exceeds the critical 1 in 100-year + 40% climate change allowance that the surface water drainage system is designed for. Please see the below table outlining the storage depths, freeboard & flooded volume of the proposed SuDS features serving the site.

SuDS feature storage depths, freeboard & flooded volume information				
SuDS feature	Storage depth(m)	Freeboard(m) for 1 in 100yr + 40% CC	Freeboard(m) for 1 in 1000yr	Flooded Volume(m ³) from 1 in 1000yr event
Car park 1	0.45m	0.0m	0.0m	0m ³

To assess the exceedance events the SuDS features have also been checked against the 1 in 1000-year event. As demonstrated by the table above, no features flood in the critical 1 in 1000 year event.

Calculations have been conducted for the proposed raingardens and/or permeable surfacing as such these features will also provide storage as well as water quality, amenity and biodiversity benefits.

If the drainage systems fail in an exceedance event surface water will flood from the proposed features and flows will largely fall towards Rhodes Avenue.

Refer to **Appendix B** for a flood exceedance plan.

2.2.3 **S3:** Water Quality

To assess that the water quality being provided by the proposed SuDS solution is sufficient, the simple index approach as per section 26.7.1 of the CIRIA SuDS Manual 2015 is applied.

To deliver adequate water quality treatment the total SuDS mitigation index must be more than or equal to the pollution hazard index for each contaminant type. The pollution hazard and mitigation indices have been taken from tables 26.2 and 26.3 of the CIRIA SuDS Manual 2015.

Water quality - Simple Index Approach									
Land Use	Pollution Hazard Level	Pollution hazard index			SuDS Components for land use	Mitigation Index			Mitigation hazard index > Pollution hazard index (for each contaminant type)
		Total Suspended Solids (TSS)	Metals	Hydro-carbons		Total Suspended Solids (TSS)	Metals	Hydro-carbons	
Residential roof	Low	0.2	0.2	0.05	Bioretention system (Raingarden), Permeable Pavement	0.8 + 0.5 (0.7) = 1.15	0.8 + 0.5 (0.6) = 1.10	0.8 + 0.5 (0.7) = 1.15	Yes
Property driveway	Low	0.5	0.4	0.4	Filter drain & Permeable Pavement	0.4 + 0.5 (0.7) = 0.75	0.4 + 0.5 (0.6) = 0.7	0.4 + 0.5 (0.7) = 0.75	Yes



The proposed design will ensure that surface water runoff will pass through the proposed SuDS features before discharging to the existing highway drain. Surface water will be treated by multiple SuDS component before discharging to the existing surface water highway drain at the front of the site. The SuDS components will separate the smaller particles and chemicals from the surface water discharge as it traverses through the feature, providing sufficient water quality treatment to any discharging water.

2.2.4 **S4:** Amenity

Infiltration drainage is not viable for the majority of the site due to poor infiltration rates; however, several raingardens have been incorporated to boost the amenity benefits to the site and surrounding area. The design aims to keep surface water as close to the ground surface as possible without over complicating the SuDS solution.

The ground conditions and likely groundwater depth is expected to give the result that infiltration is unsuitable for the site.

Given the nature of the development proposals, the proposed SuDS solution maximises amenity benefits by providing attractive open areas used for drainage that can incorporate planting and biodiversity benefits, it aims to keep surface water on or as close to the ground surface as possible. The proposed SuDS features will incorporate areas of planting and soft landscaping in an environment that would traditionally be dominated by hardstanding ground.

2.2.5 **S5:** Biodiversity

In urban areas, it is of particular importance to provide biodiversity. As these areas can be generally inhabitable for wildlife. By providing small biodiverse areas across larger urban environments wildlife can start to link areas and create networks, providing habitat as well as improving biodiversity and sustainability.

Although rural areas are quite often richly biodiverse, developments in rural areas should also consider providing components that will improve or retain biodiversity to prepare for the future as it is quite apparent that urban environments are forever expanding. This is of particular importance in sub-urban areas such as the outskirts of towns and cities.

The use of raingardens can help to provide a new quality habitat for wildlife, having a positive contribution to biodiversity in the area. The use of planting native species can support local biodiversity by providing habitat and food for invertebrates and birds. Ephemeral water bodies can be a specific requirement for the life cycle of some plants and animals. A list of plants species suitable to the bioretention raingarden environment can be incorporated are included on the drainage details drawings, refer to **Appendix B**.

2.2.6 **S6:** Operation and Maintenance Requirements

The construction management plan and construction phasing plan will be developed by the appointed contractor, as the SuDS scheme requires coordination with all other elements of the development that will be constructed as part of the scheme, including plot strip/trench fill foundations, plot/boundary walls, foul drainage. We understand that the construction management plan and construction phasing plan can be conditioned to the SAB approval.

To ensure SuDS components continue to operate reliably, regular inspection and maintenance should be carried out. In most cases, appropriate information should be provided by the relevant manufacturer on what has been installed, how it works, when to inspect it and whether maintenance will be required. CIRIA C753



The SuDS Manual also provides information on the operation and maintenance requirements for various SuDS components.

An inspection and maintenance plan has been produced for the site proposals, providing the site owner, who is responsible for the maintenance, guidance on the types and frequency of inspections and maintenance work that is required for the proposed SuDS element. It also provides a cost estimate for the inspection and maintenance requirements over the development's lifetime.

Refer to **Appendix F – Management & Maintenance Plan**.

3 CONCLUSIONS

The 0.184ha brownfield site at Rhodes Avenue, Port Talbot, SA12 6UT is to be developed such that 3 flats and 2 bungarlowes are to be constructed. The total site area is approximately 0.184ha, the whole site is to be developed and as such the development/SAB boundary will also be 0.184ha. All surface water incident upon each respective catchment is collected, conveyed and discharged towards the downstream SuDS components as illustrated on the drainage plan which can be found in **Appendix B**. In an exceedance event, surface water runoff will generally flow towards the bellmouth junction at the entrance to the site.

There is no evidence on site of a pre-existing surface water drainage system serving the site directly.

Following the hierarchical approach to discharge location of surface water for new developments as set out in the Statutory Standards for SuDS. The proposed development will provide the site with a new sustainable surface water drainage system that will incorporate multiple SuDS features and a controlled discharge, providing a solution that will intercept and treat surface water runoff before discharging to the adjacent highway surface water sewer.

The proposed SuDS features will provide sufficient attenuation storage for all storm events up to and including the critical duration 1 in 100-year storm event plus 40%, before discharging at a controlled rate of 0.8 L/SEC to the adjacent highway surface water drain, refer to **Appendix E – Design Calculations**.

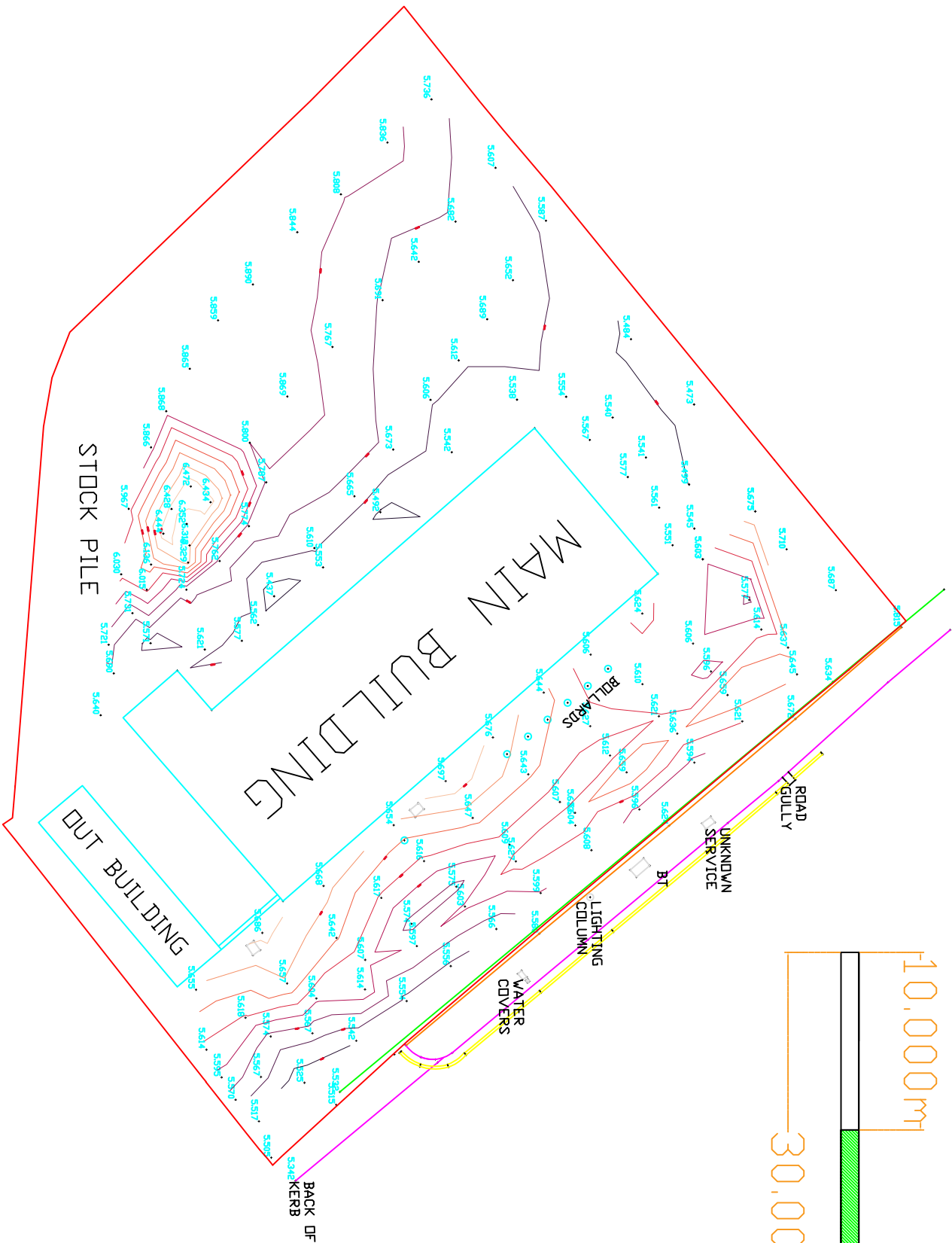
The SuDS components considered suitable for this site are permeable paving and raingardens. Surface water will convey from the roofs of the properties and will either discharge directly onto the permeable surface, or discharge to adjacent raingardens where the water will get treated by a combination of native plant species and stone drainage blankets. The SuDS solution provides improvements to water quality, amenity and biodiversity.

A foul water drainage system is required as part of this development. It is intended to convey foul flows through a piped network to the existing foul water sewer located in Rhodes Avenue.

Overall, the proposed surface water drainage system seeks to be a cost effective and easily maintainable sustainable drainage solution. The surface water discharge locations are the most appropriate and preferred method within the sites constraints and the SuDS components incorporated in the design provide suitable surface water management as close to the source as possible and also provide water quality, amenity and biodiversity benefits.



APPENDIX A: Existing Site Plans



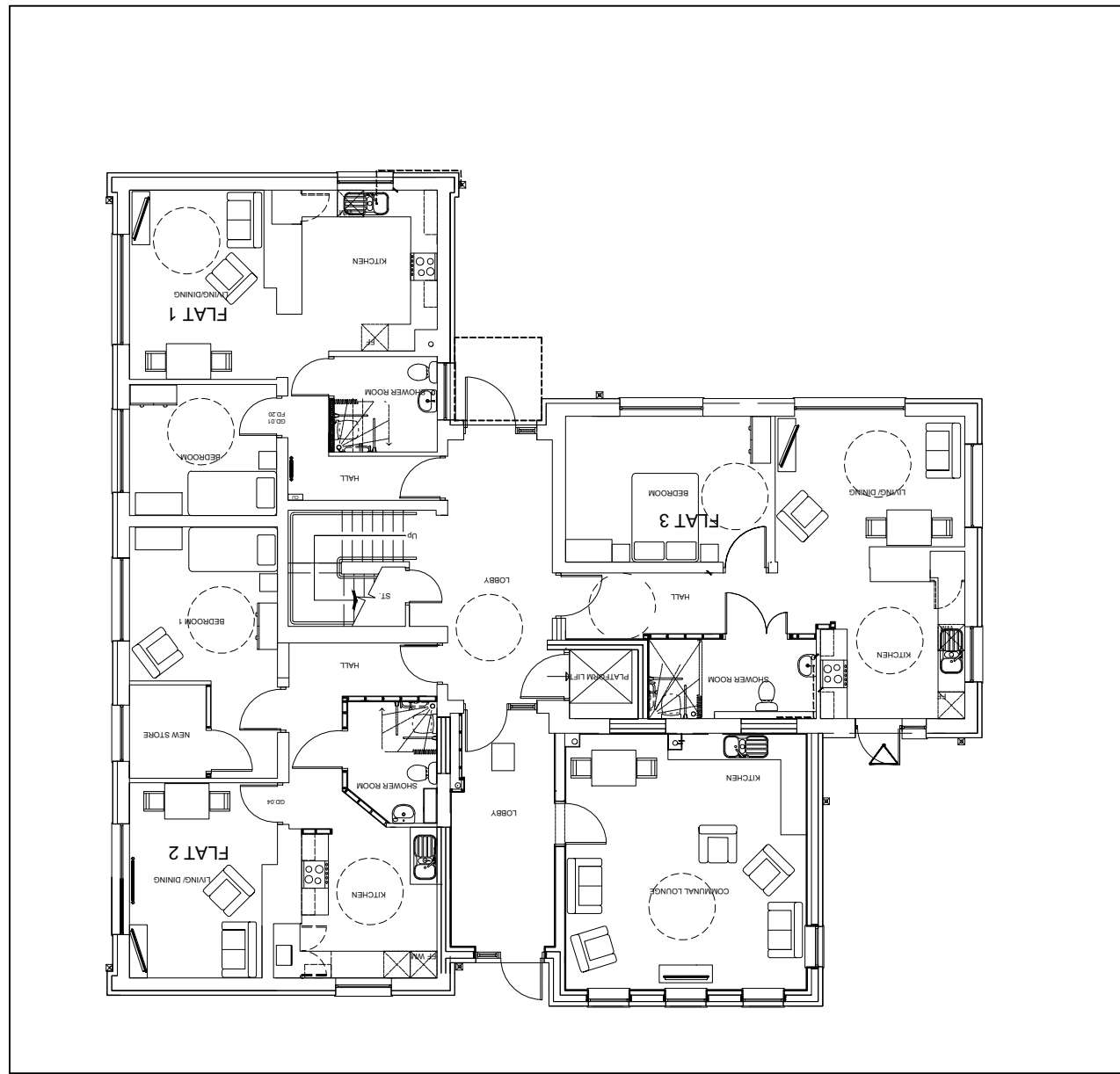
NOTES:
LEVELS RELATE TO DS DATUM
CONTOUR LINE INTERVALS VERY DEPENDING ON FEATURE

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Bj		Amendment				Date
Drawing Status						
Folio Name						
Drawing No.						
For Comment						
C01						

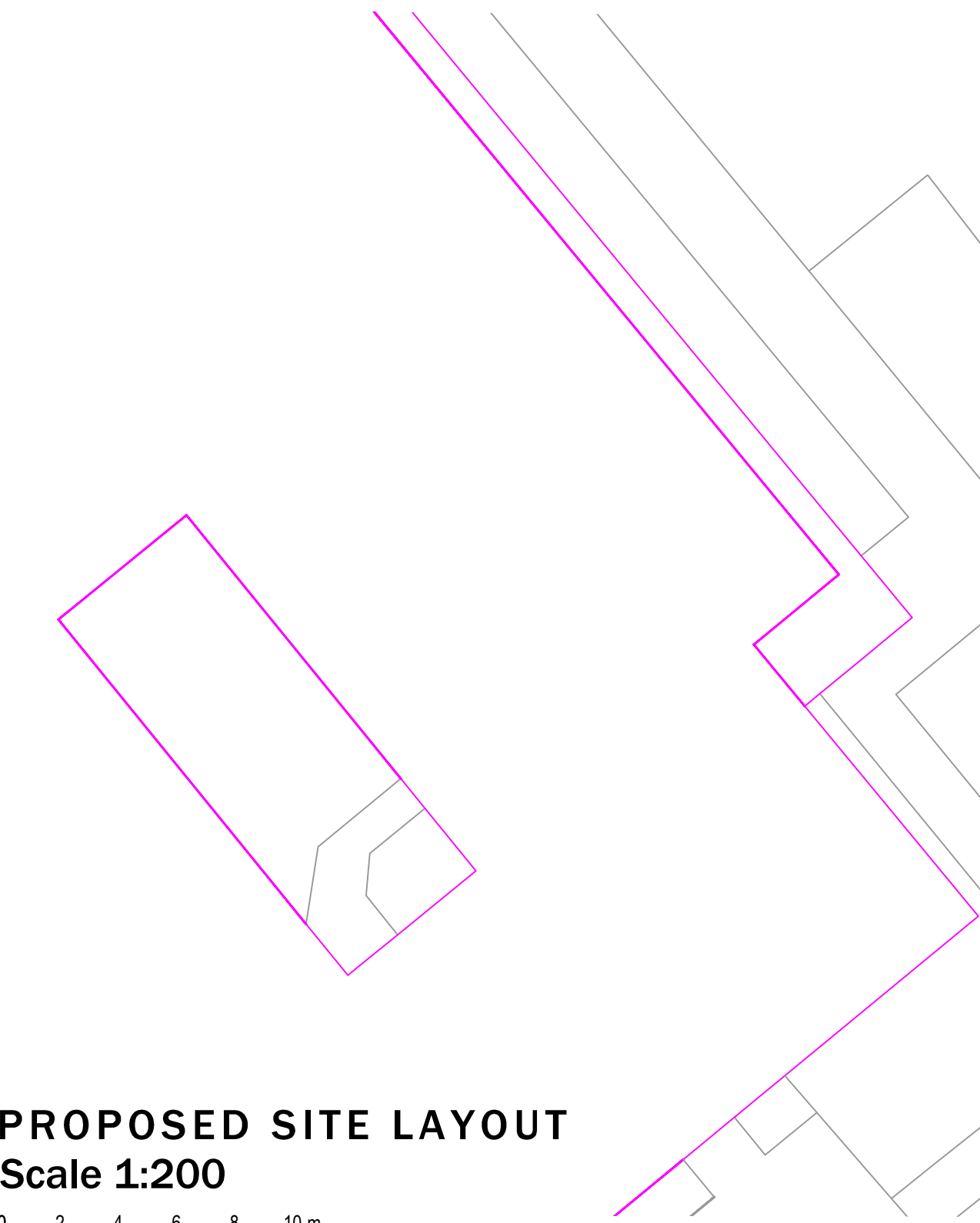
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Project:	Potential plots
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Drawing Date:	April 2024
Drawing Description:	L CROSS
Drawing Checked:	



APPENDIX B:
Proposed Site Plans

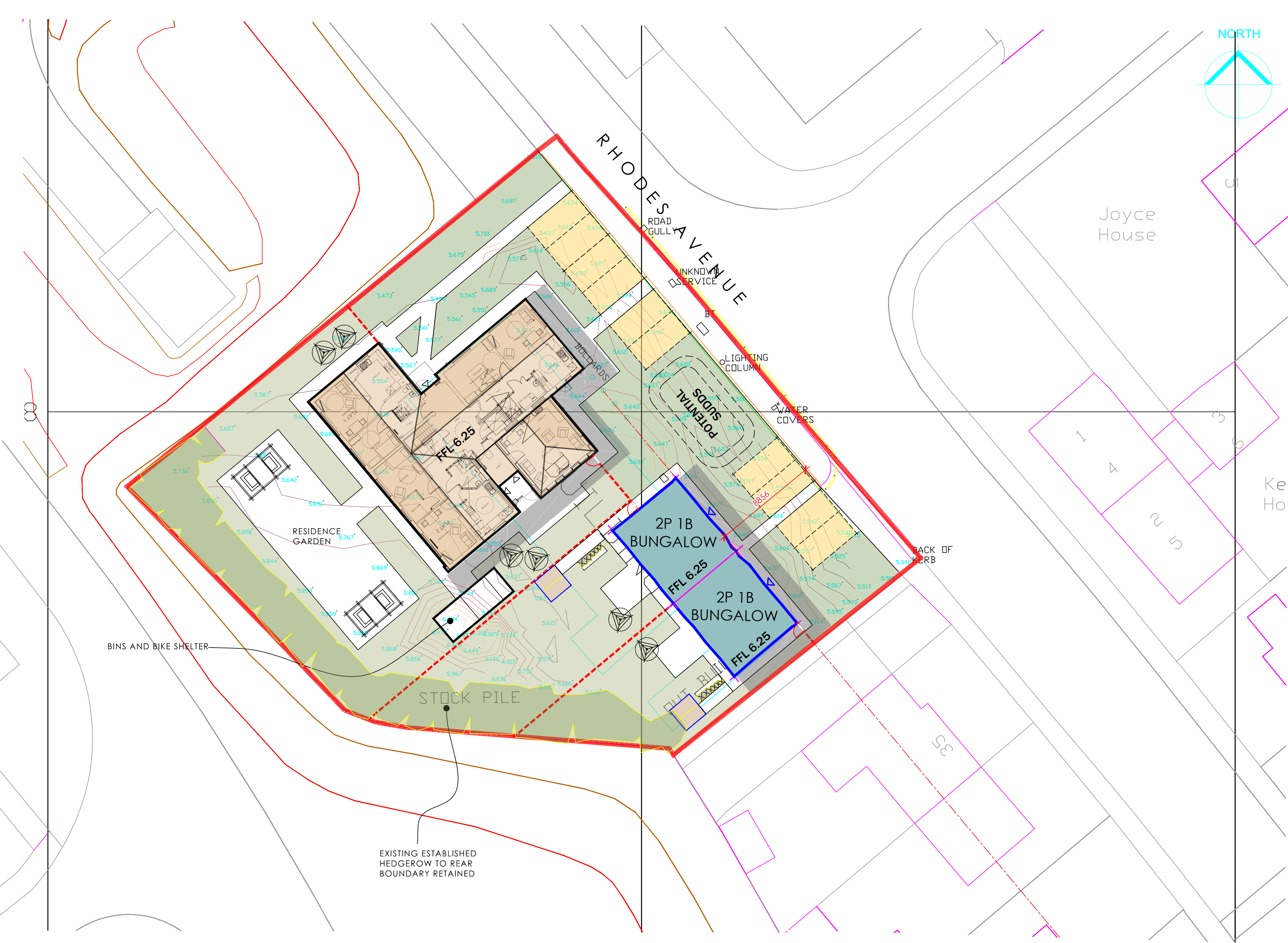


TYPICAL FLOOR PLAN
Scale 1:200



PROPOSED SITE LAYOUT
Scale 1:200

0 2 4 6 8 10 m
SCALE 1:200



PROPOSED SITE LAYOUT
Scale 1:250

0 1.25 2.5 3.75 5.0 6.25 m
SCALE 1:125

Do not scale from this drawing.
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Design.

Revisions
REV. A. APRIL 25
TOPO INFO ADDED AND STREET SCENE
REVISED TO BASE BUILDINGS BY 500mm.
REV. B. FEB 25
LAYOUT UPDATED AND BUILDINGS
ADDED AT CLIENTS REQUEST.
REV. C. APRIL 25
LAYOUT UPDATED AND BUILDINGS
ADDED AT CLIENTS REQUEST.
REV. D. FEB 25
LAYOUT UPDATED AND STREET
ELEVATIONS ADDED.

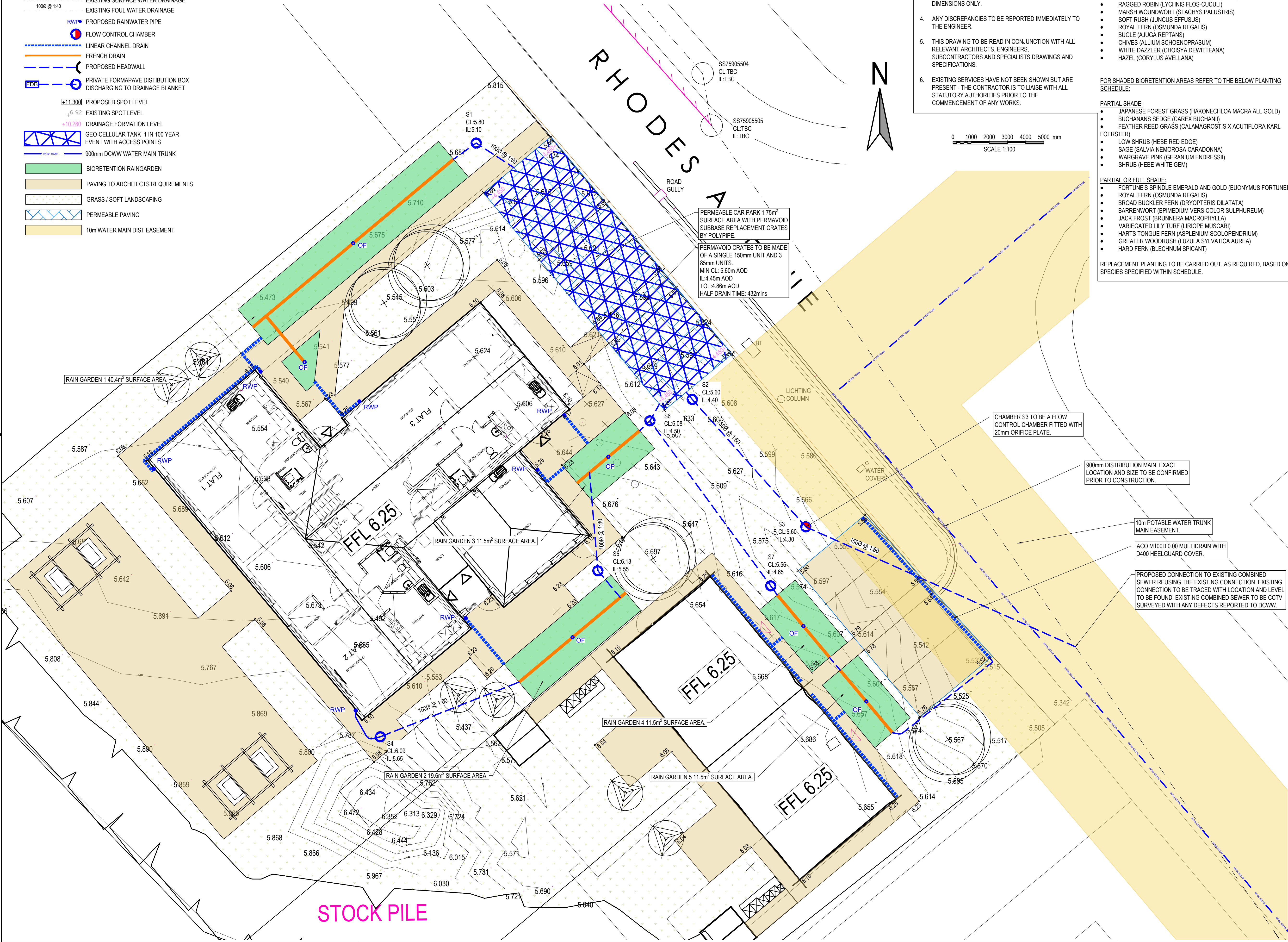
Drawing No	Scale	Revision
LTS405.03.01	1:200 @ A1	C
Drawing Title	Date	Checked
Feasibility layout + Elevations	May 24	KML

Drawing Purpose
FEASIBILITY

Client
C J Construction
Job Title
Rhodes Avenue, Port Talbot

DRAINAGE LEGEND

- 1500 @ 1:150 PROPOSED SURFACE WATER DRAINAGE
- EXISTING COMBINED DRAINAGE
- EXISTING SURFACE WATER DRAINAGE
- 1000 @ 1:40 EXISTING FOUL WATER DRAINAGE
- RWP PROPOSED RAINWATER PIPE
- FLOW CONTROL CHAMBER
- LINEAR CHANNEL DRAIN
- FRENCH DRAIN
- PROPOSED HEADWALL
- FDB PRIVATE FORMAPAVE DISTRIBUTION BOX DISCHARGING TO DRAINAGE BLANKET
- PROPOSED SPOT LEVEL
- EXISTING SPOT LEVEL
- DRAINAGE FORMATION LEVEL
- GEO-CELLULAR TANK 1 IN 100 YEAR EVENT WITH ACCESS POINTS
- 900mm DCWW WATER MAIN TRUNK
- BIORETENTION RAINGARDEN
- PAVING TO ARCHITECTS REQUIREMENTS
- GRASS / SOFT LANDSCAPING
- PERMEABLE PAVING
- 10m WATER MAIN DIST EASEMENT



DRAWING NOTES:

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
- DO NOT SCALE FROM THE DRAWING. USE FIGURED DIMENSIONS ONLY.
- ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
- EXISTING SERVICES HAVE NOT BEEN SHOWN BUT ARE PRESENT - THE CONTRACTOR IS TO LIAISE WITH ALL STATUTORY AUTHORITIES PRIOR TO THE COMMENCEMENT OF ANY WORKS.

PLANTING SCHEDULE - BIORETENTION AREAS (RAINGARDENS)

PLANTS WITHIN BIORETENTION AREAS (RAINGARDENS) SHOULD BE PLANTED WITH THE FOLLOWING SPECIES AT A DENSITY OF 4NO PLANTS/M2:

- PURPLE LOOSESTRIPE (LYTHRUM SALICARIA)
- WATER MINT (MENTHA AQUATICA)
- HEMP AGRIMONY (EUPATORIUM CANNABINUM)
- RAGGED ROBIN (LYCHNIS FLOS-CUCULI)
- MARSH WOUNDWORT (STACHYS PALUSTRIS)
- SOFT RUSH (JUNCUS EFFUSUS)
- ROYAL FERN (OSMUNDA REGALIS)
- BUGLE (AJUGA REPTANS)
- CHIVES (ALLIUM SCHOENOPRASUM)
- WHITE DAZZLER (CHOISYA DEWITTEANA)
- HAZEL (CORYLUS AVELLANA)

FOR SHADED BIORETENTION AREAS REFER TO THE BELOW PLANTING SCHEDULE:

PARTIAL SHADE:

- JAPANESE FOREST GRASS (HAKONECHLOA MACRA ALL GOLD)
- BUCHANANS SEDGE (CAREX BUCHANII)
- FEATHER REED GRASS (CALAMAGROSTIS X ACUTIFLORA KARL FOERSTER)
- LOW SHRUB (HEBE RED EDGE)
- SAGE (SALVIA NEMOROSA CARADONNA)
- WARGRAVE PINK (GERANIUM ENDRESSII)
- SHRUB (HEBE WHITE GEM)

PARTIAL OR FULL SHADE:

- FORTUNE'S SPINDLE EMERALD AND GOLD (EUONYMUS FORTUNEI)
- ROYAL FERN (OSMUNDA REGALIS)
- BROAD BUCKLER FERN (DRYOPTERIS DILATATA)
- BARRENWORT (EPIMEDIUM VERSICOLOR SULPHUREUM)
- JACK FROST (BRUNNERA MACROPHYLLA)
- VARIEGATED LILY TURF (LIRIOPE MUSCARI)
- HARTS TONGUE FERN (ASPLENIUM SOLOPENDRIUM)
- GREATER WOODRUSH (LUZULA SYLVATICA AUREA)
- HARD FERN (BLECHNUM SPICANT)

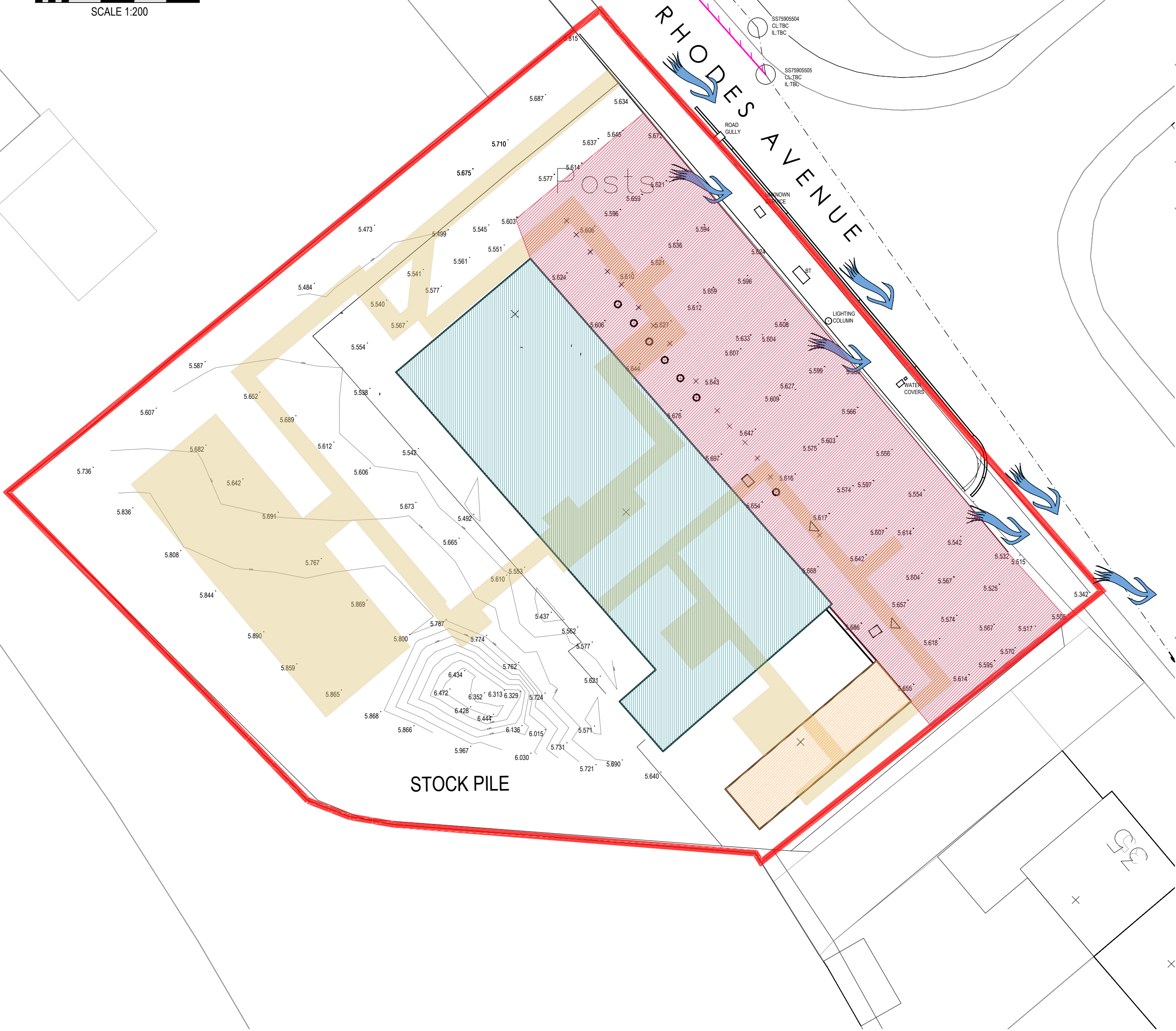
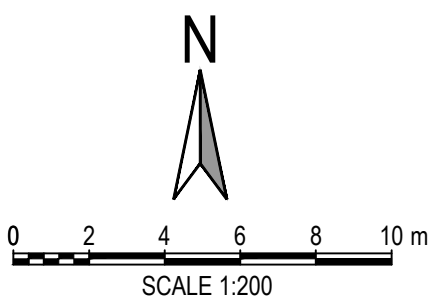
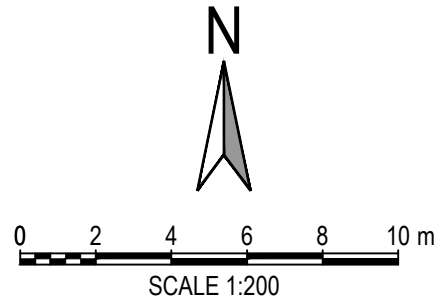
REPLACEMENT PLANTING TO BE CARRIED OUT, AS REQUIRED, BASED ON SPECIES SPECIFIED WITHIN SCHEDULE.

GENERAL DRAINAGE NOTES:

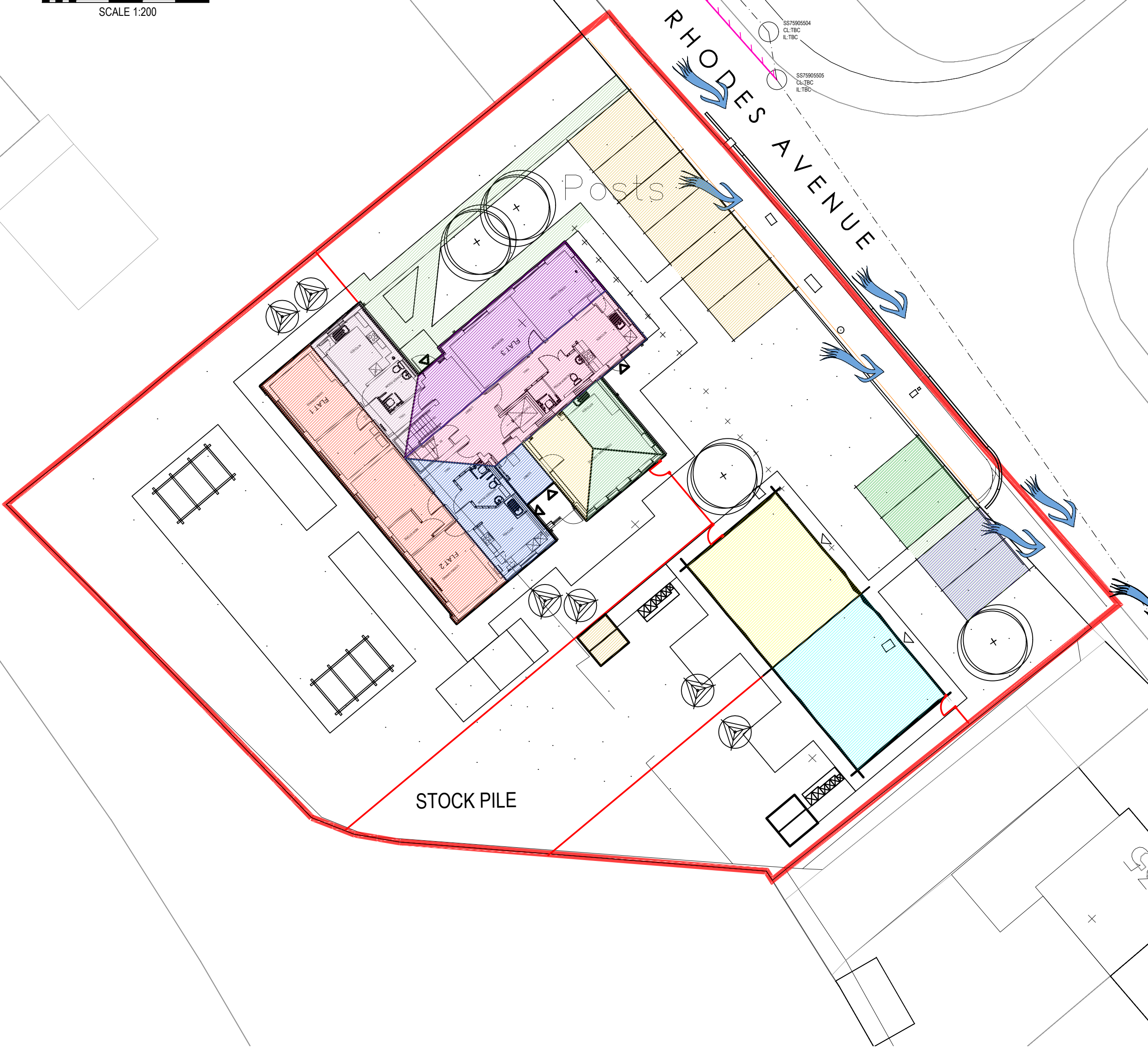
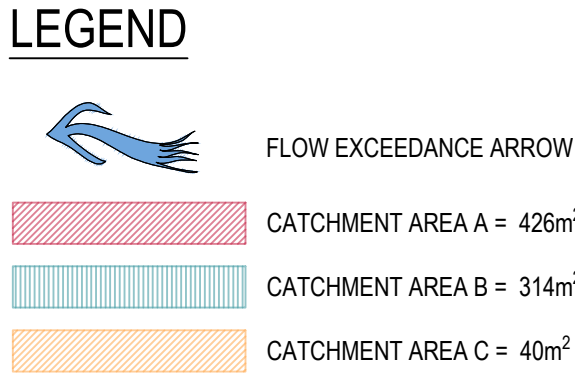
- MH COVERS AND FRAMES TO CONFORM TO BS EN 124: HIGHWAYS AND FOOTWAYS TO FRONT OF BUILDINGS (D400) - FOOTWAYS TO REAR OF BUILDINGS (C250)
- TYPE S BEDDING AND SURROUND TO ALL PIPES EXCEPT IN THE FOLLOWING CIRCUMSTANCES, IN WHICH TYPE Z BEDDING AND SURROUND ARE TO BE USED:
 - DOMESTIC GARDENS AND PATHWAYS WITHOUT ANY POSSIBILITY OF VEHICULAR ACCESS, 0.35m;
 - DOMESTIC DRIVEWAYS, PARKING AREAS AND YARDS WITH HEIGHT RESTRICTIONS TO PREVENT ENTRY BY VEHICLES WITH A GROSS VEHICLE WEIGHT IN EXCESS OF 7.5 TONNES, 0.5m;
 - DOMESTIC DRIVEWAYS, PARKING AREAS AND NARROW STREETS WITHOUT FOOTWAYS (E.G. NEWIS DEVELOPMENT) WITH LIMITED ACCESS FOR VEHICLES WITH A GROSS VEHICLE WEIGHT IN EXCESS OF 7.5 TONNES, 0.9m;
 - AGRICULTURAL LAND AND PUBLIC OPEN SPACE, 0.9m;
 - HIGHWAYS AND PARKING AREAS WITH UNRESTRICTED ACCESS TO VEHICLES WITH A GROSS VEHICLE WEIGHT IN EXCESS OF 7.5 TONNES, 1.2m.
- ALL EXISTING MANHOLE INVERTS TO BE CHECKED AND REPORTED TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF DRAINAGE WORKS. EXISTING PIPE CONNECTIONS ARE TO BE CCTV SURVEYED AND INSPECTED BY THE ENGINEER AND LOCAL AUTHORITY. IF THE PIPE CONNECTION IS FOUND TO BE DAMAGED OR IN DISTRESS, THE CONTRACTOR IS TO CARRY OUT REMEDIAL WORKS OR PROVIDE A NEW CONNECTION TO THE EXISTING SEWER (PIPE SIZE AND GRADIENT TO BE DETERMINED BY THE ENGINEER).
- THE GRADIENTS INDICATED AGAINST THE DRAIN RUNS ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL INSTALL DRAINS TO THE INVERT LEVELS SHOWN FOR EACH MANHOLE OR OTHER INDICATED POSITION.
- ALL PLOT FOUL DRAINAGE TO BE MINIMUM 100mm DIAMETER UNLESS OTHERWISE NOTED.
- ALL ADAPTABLE THERMOPLASTIC STRUCTURED WALL SEWER PIPE SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 13476-1 AND WIS 4-35-01 AND BS EN 13476-2 OR BS EN 13476-3. PIPES SHALL BE BSI KITEMARKED OR HAVE EQUIVALENT THIRD PARTY CERTIFICATION. PIPES LESS THAN OR EQUAL TO 500mm DIA. SHALL HAVE A SHORT-TERM RING STIFFNESS OF NOT LESS THAN 8kNm² (SN8).
- ALL JOINTING IN ACCORDANCE WITH MANUFACTURERS TECHNICAL ADVICE & SPECIFICATION.
- ALL NON ADAPTABLE DRAINAGE TO BE THE STANDARD UPVC 110mm, 160mm DRAINAGE AND MANUFACTURED TO BS-EN 1401 AND BS 4660 UNLESS NOTED OTHERWISE.
- ALL STORM WATER DRAINAGE TO BE A MINIMUM OF 150mm DIAMETER UNLESS OTHERWISE NOTED.
- SOIL & VENT PIPE LOCATION AND NUMBER TO BE CONFIRMED WITH ARCHITECT.
- PRIOR TO ORDERING ANY MATERIALS THE CONTRACTOR IS TO CONFIRM MANUFACTURER/PIPE MATERIAL AND GRADE PROPOSED WITH WATER AUTHORITY.
- TEMPORARY WORKS DESIGN BY OTHERS.
- DESIGN RISK ASSESSMENTS AND METHOD STATEMENTS ARE TO BE PROVIDED TO THE PRINCIPLE CONTRACTOR PRIOR TO THE COMMENCEMENT OF ANY WORKS.

PRELIMINARY

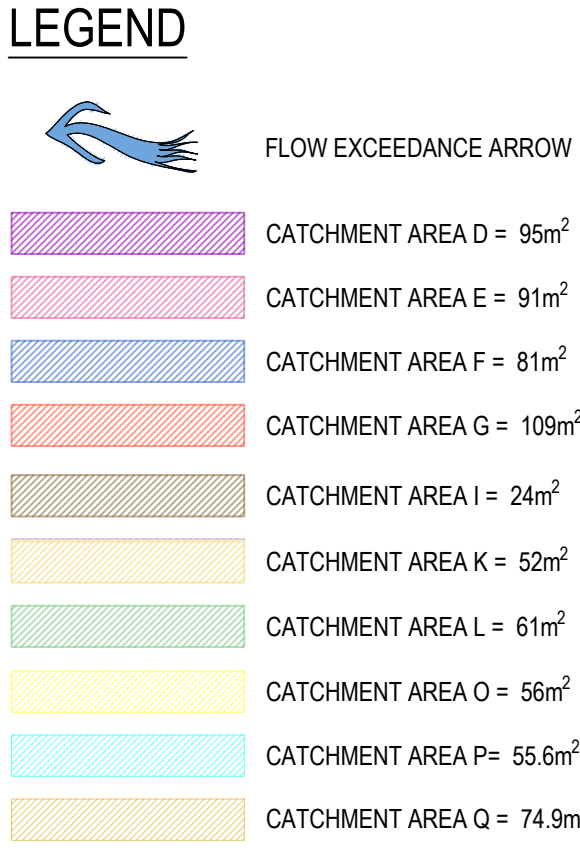
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rev.	drawn	chkd	appd	date	description
Client					
CJ CONSTRUCTION (WALES) Ltd					
Project					
LAND AT RHODES AVENUE NEATH PORT TALBOT SA12 6UT					
Title					
DRAINAGE LAYOUT					
ValeConsultancy CONSULTING CIVIL & STRUCTURAL ENGINEERS 29 Bocam Park, Old Field Road, Pencoed, Bridgend CF35 5LJ. Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk					
date	drawn	checked	approved		
27.06.25	RGP	NC	27.06.25	FP	27.06.25
scale @ A1				project no.	
1:100				21980	
status	drw. no.				rev.
P	21980/500				01



EXISTING SURFACE WATER CATCHMENTS AREA



PROPOSED SURFACE WATER CATCHMENTS AREA



- DRAWING NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 2. ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
 3. DO NOT SCALE FROM THE DRAWING. USE FIGURED DIMENSIONS ONLY.
 4. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
 5. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
 6. EXISTING SERVICES HAVE NOT BEEN SHOWN BUT ARE PRESENT - THE CONTRACTOR IS TO LIAISE WITH ALL STATUTORY AUTHORITIES PRIOR TO THE COMMENCEMENT OF ANY WORKS.

PRELIMINARY

01	RGP	NC	FP	20.06.25	PRELIMINARY ISSUE
rev.	drawn	chkd.	appd.	date	description
Client					
CJ CONSTRUCTION (WALES) Ltd					
Project					
LAND AT RHODES AVENUE NEATH PORT TALBOT SA12 6UT					
Title					
CATCHMENT PLANS					
 CONSULTING CIVIL & STRUCTURAL ENGINEERS 29 Bocam Park, Old Field Road, Pencoed, Bridgend CF35 5LJ. Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk					
date	drawn	checked	approved		
20.06.25	RGP	NC	FP	20.06.25	20.06.25
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1:200			21980		
status	drw. no.				rev.
P	21980/501				01

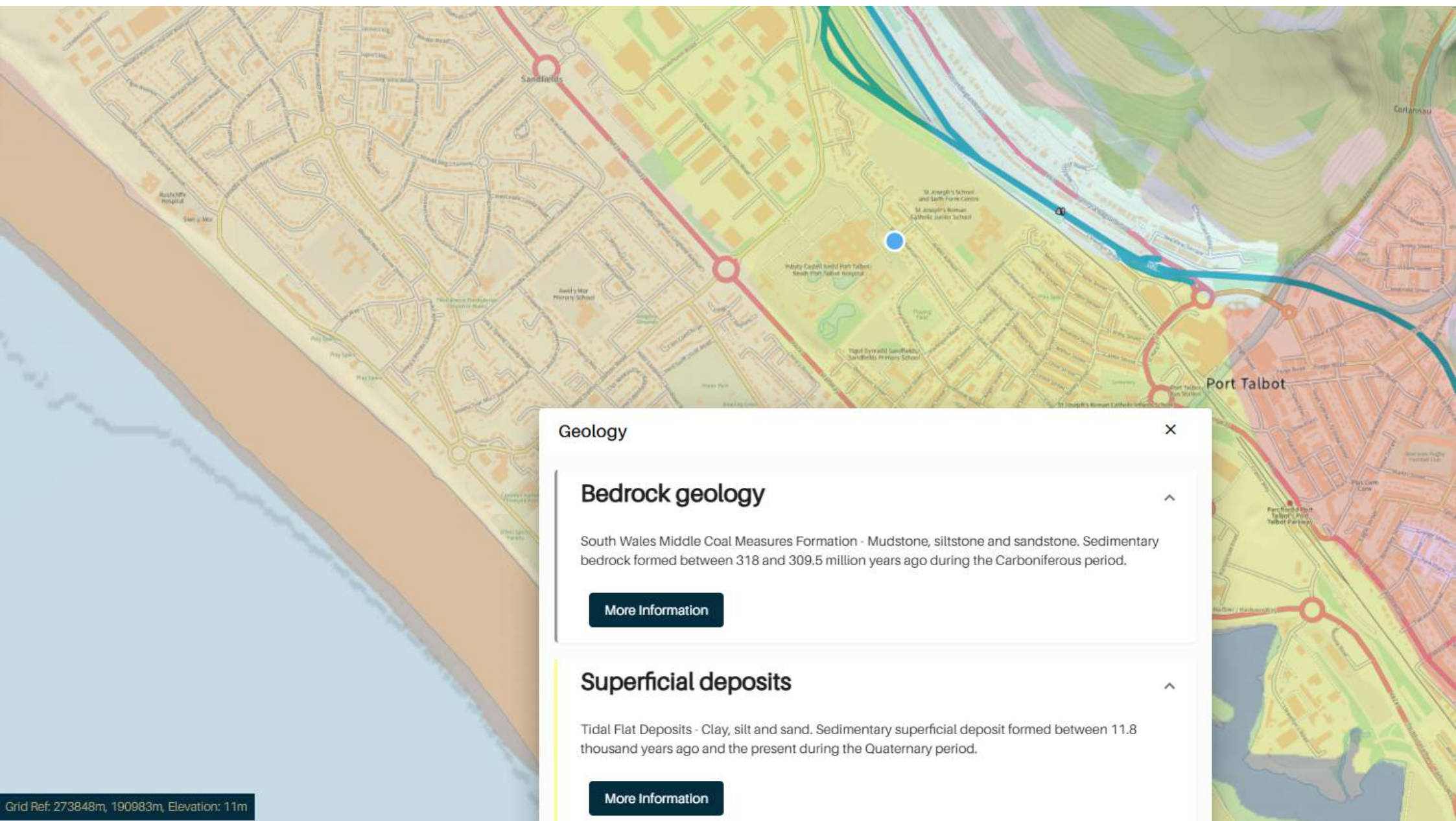


APPENDIX C:
Ground Investigation Reports



APPENDIX D:

British Geological Survey Records, Natural Resource Wales Flood Risk
Assessment Wales Map (FRAWM) AND DCWW ASSET MAPS



Flood Map for Planning - Detail
Enter title (max 35 characters)

Legend

TAN15 Defended Zones

- Rivers
- Sea
- Rivers and Sea

Sea

- Flood Zone 3
- Flood Zone 2

Surface Water and Small Watercourses

- Flood Zone 3
- Flood Zone 2



Disclaimer

<https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en>

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Flood Map for Planning - Detail
Enter title (max 35 characters)

Legend

TAN15 Defended Zones

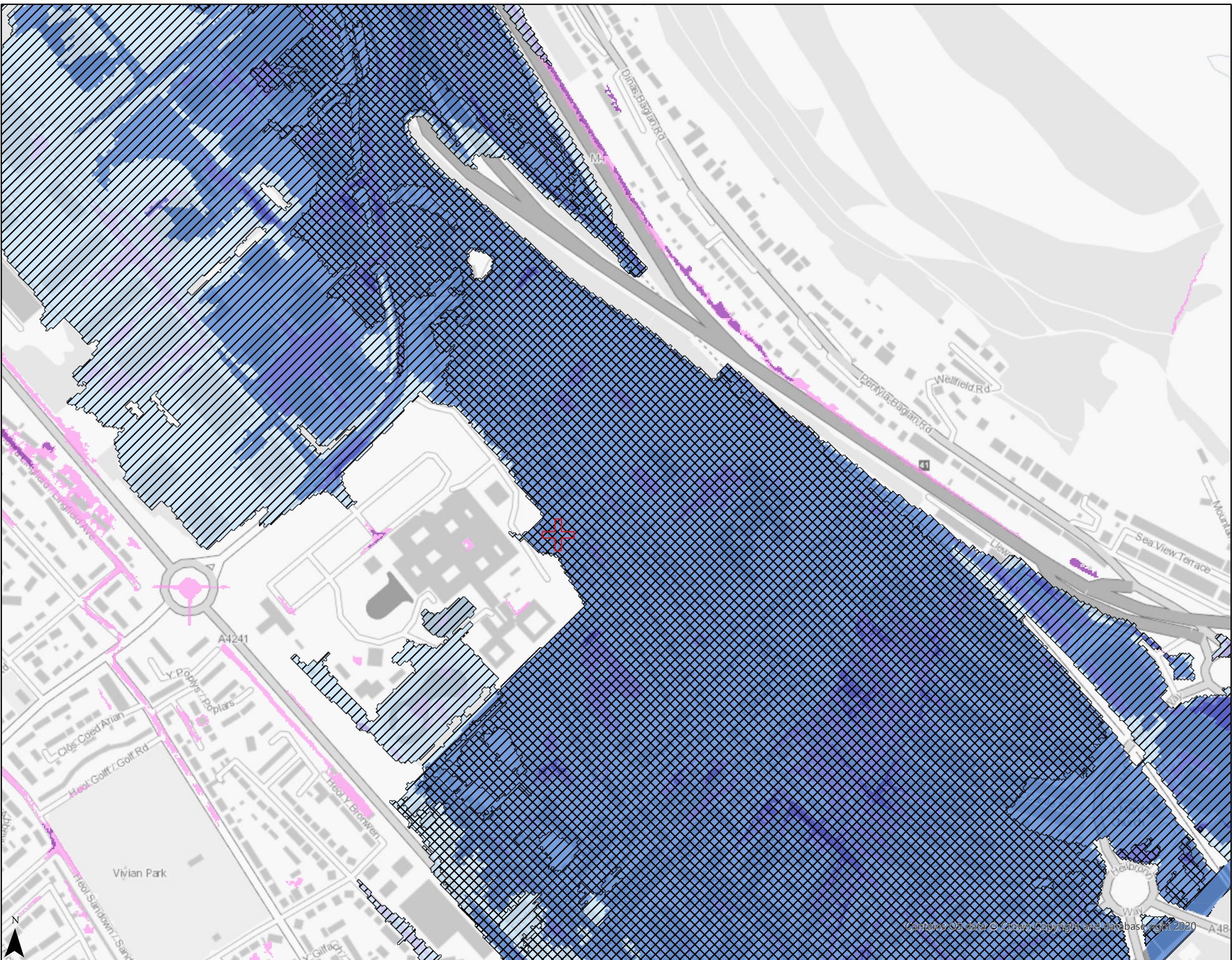
- Rivers
- Sea
- Rivers and Sea

Rivers

- Flood Zone 3
- Flood Zone 2

Surface Water and Small Watercourses

- Flood Zone 3
- Flood Zone 2



Disclaimer

<https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en>

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ARUP GEOTECHNICS

BAGLAN SITE

RECORD OF BOREHOLE 1

APPENDIX	SS79SE/232
JOB NO	17720/03
MADE BY	MJS
DATE MADE	06/01/88

NGR 7552 9054

DAILY PROGRESS	DEPTH TO WATER	DEPTHS OF CASING	SAMPLES		LEGEND	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA	
			DEPTH						TYPE
			FROM	TO					
05/01/87			0.00	0.50	D	0.10	6.01	GROUND LEVEL 6.11m AOD TOPSOIL: Brown organic silt with some medium gravel	
								Firm brown clayey SILT with a little gravel of slag and a little glass and plastic (CAPPING LAYER FOR DOMESTIC REFUSE)	
			1.00	1.45	B	0.90	5.21		
			1.15	1.45	C (9)				
	1.40		1.40		W			Plastic, glass, rotting newspaper with a little dark brown gravel of slag (DOMESTIC REFUSE)	
			1.80		D				
			2.00		B				
		1.50	2.15	2.45	C (5)	2.40	3.71	A/A mixed with medium brown clayey fibrous organic silt (BURIED TOPSOIL)	
						2.70	3.41		
			3.00	3.45	D			Very soft grey mottled brown clayey SILT with a little rotting vegetation (ALLUVIUM)	
		2.70	3.15	3.45	S (2)	3.35	2.76		
			3.50	4.00	B			Soft grey slightly organic silty CLAY (ALLUVIUM)	
						4.05	2.06		
		3.20	4.15	4.45	S (4)			Soft grey slightly clayey sandy SILT (ALLUVIUM)	
			5.00	5.45	D				
		4.70	5.15	5.45	S (9)	5.35	0.76	Medium dense grey medium grey slightly organic fine SAND becoming dark grey and more organic with depth (ALLUVIUM)	
						5.70	0.41		
						6.00	0.11	Soft grey mottled brown silty CLAY with a little rotting vegetation (ALLUVIUM)	
			6.00	7.00	B				
			7.00	7.15	S (7)			Soft to firm dark brown PEAT	
			8.00	8.15	S (6)	8.25	-2.14		
			9.00	9.50	B			Very soft grey slightly organic sandy SILT with occasional thin organic layers (ALLUVIUM)	
			9.00	9.15	S (2)				

REMARKS

1. Water struck in CPT at 1.40m rose to 0.80m after 15 minutes
2. No SPT at 6.0m due to soft clay squeezing up casing to 4.80m, casing driven through soft zone

TYPE OF BORING
SHELL AND AUGER GL TO 14.20m

DIAMETER OF BORING
140mm TO 14.20m

CASING TUBES
150mm TO 13.60m

BOREHOLE 1



ARUP GEOTECHNICS

BAGLAN SITE

RECORD OF BOREHOLE 1

ADDITIONAL	SS79SE/232
JOB NO	17720/03
MADE BY	MJS
DATE MADE	01/06/88

DAILY PROGRESS	DEPTH TO WATER	DEPTHS OF CASING	SAMPLES			LEGEND	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA	
			DEPTH		TYPE					
			FROM	TO						
			10.10	11.00	B				GROUND LEVEL	
		10.05	10.20	10.50	S (32)		10.25	-4.14		Dense brown subrounded to rounded medium to coarse GRAVEL with a little fine gravel and a little soft grey clay at the top (FLUVIOGLACIAL GRAVELS)
	10.50		10.50		W					
			11.00		B					
		10.60	11.15	11.45	C (32)					
05/01/88	3.00									
06/01/88	2.80									
		12.00	12.15	12.45	C (61)					
								Very dense brown subrounded to rounded medium to coarse GRAVEL with some fine gravel and coarse sand and a little cobble (FLUVIOGLACIAL GRAVELS)		
			13.00	13.50	B					
		12.90	13.00	13.10	C (600)					
06/01/88	3.30	13.60	14.00	14.13	C (270)				END OF BOREHOLE	
						14.20	-8.09			

REMARKS

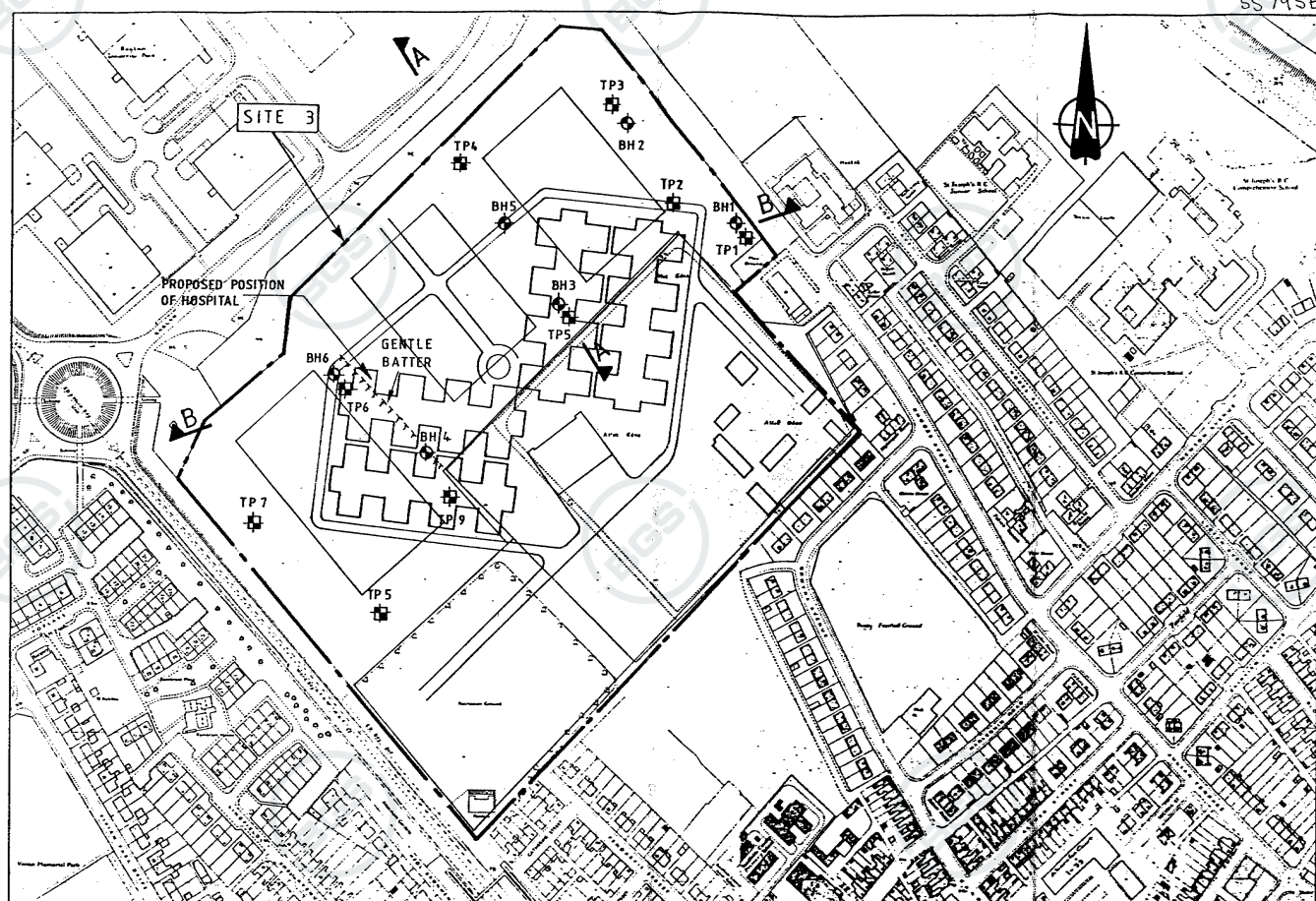
- Water struck at 10.50m, rose to 3.00m after 20 minutes
- CPT at 13.00m, 38, 50* blows for 25mm
- CPT at 14.00m, 33, 50* blows for 55mm

TYPE OF BORING
SEE PREVIOUS SHEET

DIAMETER OF BORING
SEE PREVIOUS SHEET

CASING TUBES
SEE PREVIOUS SHEET

BOREHOLE 1



Scale - 1:2500

Legend

-  Trial Pit Location
-  Borehole Location
-  Areas not available for investigation

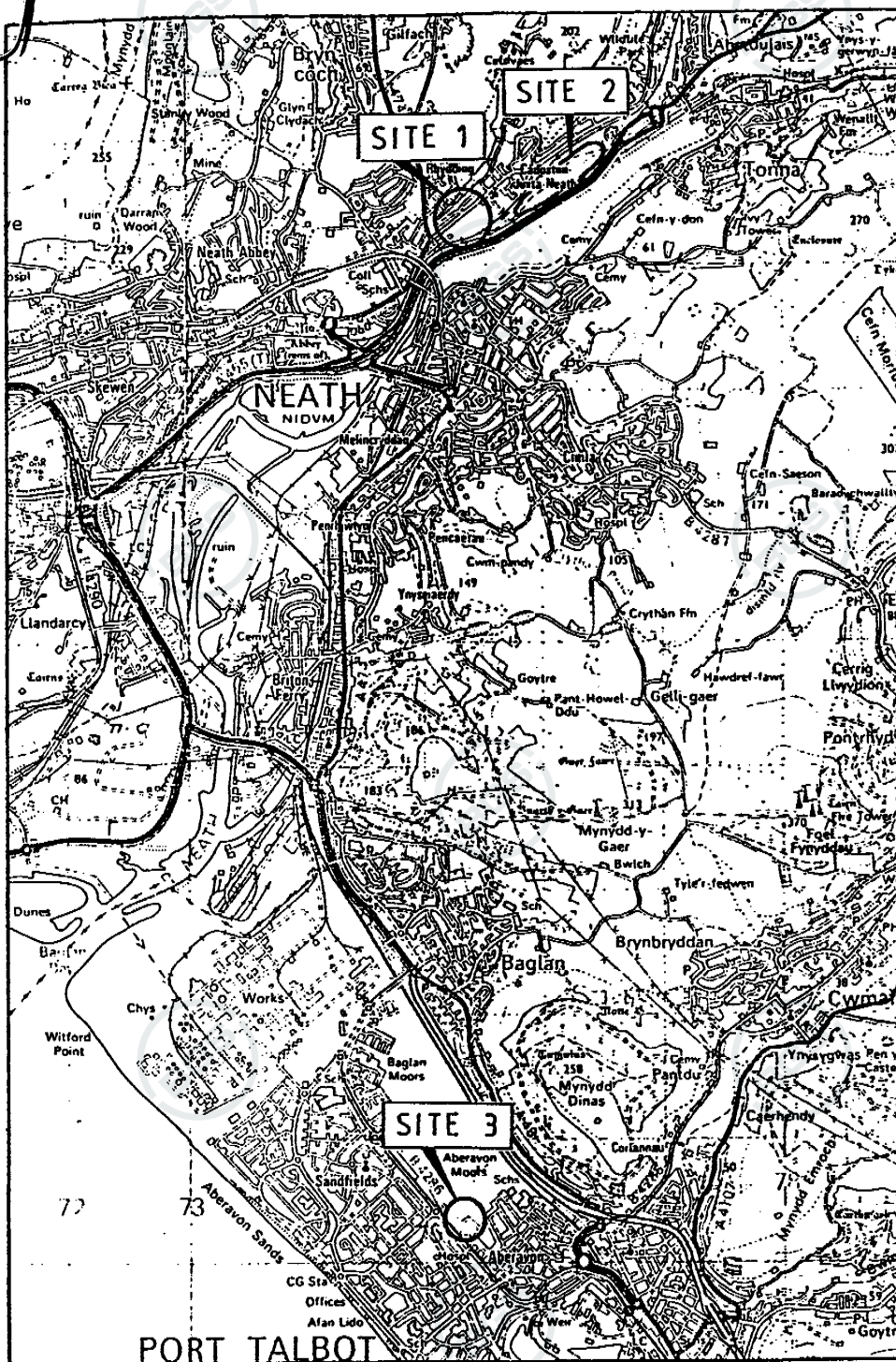
**PROPOSED SITE LAYOUT
BAGLAN SITE**

SS79SE of sheet to S

FIGURE

2c

SS79NE/81-86
SS79SE/232-237



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Scale - 1 : 50 000

SITE 2 LANDFILL SITE - SS79NE
SITE 3 BAGLAN SITE - SS79SE?

SITE LOCATION

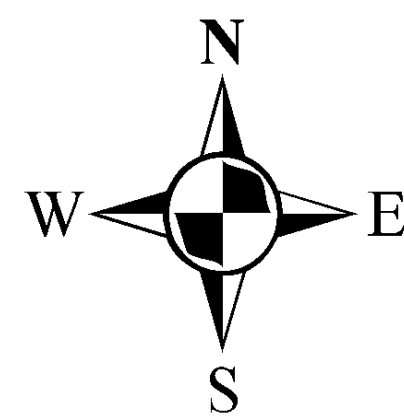
FIGURE

1



Dŵr Cymru
Welsh Water

Neath Port Talbot, SA12 6UX



LEGEND

- Clean network:
- Sluice valve
 - Pressure reducing valve
 - Meter
 - Bulk meter
 - Hydrant
 - Cap end
 - Air valve
 - Stop tap
 - Water Treatment Works
 - Water Pumping Station
 - Existing main
 - Non-operational main
 - Raw Water
- NB: Water main symbol colour indicates the type.
- LIGHT BLUE - Trunk
DARK BLUE - Distribution
YELLOW - Raw Water

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 (AC) or Pitch Fibre (PF)) 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 Cyllyngrdd (The Company) gives this information as to the position of its underground apparatus by way of general guidance only and to the best understanding that it is based on the best information available and is not warranted as to its completeness or that it is correct in the event of excavations or other works made in the vicinity of the Company's apparatus. The user of this information should be aware that the information is not intended to be used as a basis for any excavation or other works made in the vicinity of the Company's apparatus. The user of this information should be aware that the information is not intended to be used as a basis for any excavation or other works made in the vicinity of the Company's apparatus. The user of this information should be aware that the information is not intended to be used as a basis for any excavation or other works made in the vicinity of the Company's apparatus.

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

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

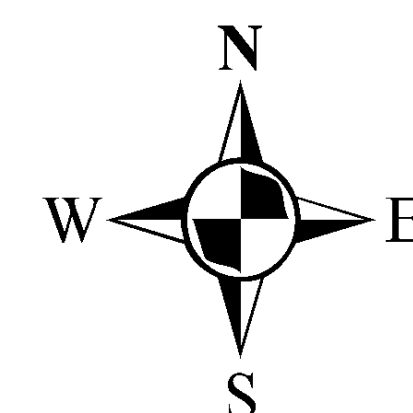
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Map Ref: 275534,190494
Map scale: 1:1250
Printed by: Jessica Asamoah
Printed on: 29 Apr 2025



Dŵr Cymru
Welsh Water

Neath Port Talbot, SA12 6UX



LEGEND(Representative of most common features)

- Waste network:**
- Foul chamber
 - Surface water chamber
 - Combined chamber
 - Combined sewer overflow
 - Special purpose chamber
 - Treatment works
 - Pumping station
 - Outfall
 - Lamp hole
 - Storm Overflow
 - Rising main
 - Gravity sewer
 - Private sewer
 - Private sewer subject to Sect. 124 adoption agreement
 - Private Sewer Transfer
 - Lateral Drain
 - Inspection Chamber
- NB: Sewer symbol colour indicates the type.
- RED - Combined
 - GREEN - Surface Water
 - BROWN - Foul
 - Purple - Former S24 sewers (for indicative purposes only)

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 (PF)) 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.

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EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map scale: 1:1250
Printed by: Jessica Asamoah
Printed on: 29 Apr 2025



APPENDIX E: Design Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
RG1	0.011	5.00	5.800	1	0.600
S1			5.800	450	0.700
CP1	0.008	5.00	5.600	1	1.150
S2			5.600	450	1.200
S4	0.004	5.00	6.090	450	0.440
RG2	0.004	5.00	6.200	1	0.600
S5			6.130	450	0.580
RG3	0.009	5.00	6.080	1	0.570
S6			6.080	450	1.580
S7	0.017	5.00	5.560	450	0.910
S3			5.600	450	1.300

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	RG1	S1	1.500	0.600	5.200	5.100	0.100	15.0	100	5.01	50.0
1.001	S1	CP1	3.200	0.600	5.100	4.500	0.600	5.3	100	5.03	50.0
1.002	CP1	S2	2.100	0.600	4.450	4.400	0.050	42.0	150	5.46	50.0
1.003	S2	S3	3.900	0.600	4.400	4.300	0.100	39.0	150	5.50	50.0
2.000	S4	RG2	8.200	0.600	5.650	5.600	0.050	164.0	100	5.23	50.0
2.001	RG2	S5	1.900	0.600	5.600	5.550	0.050	38.0	100	5.25	50.0
2.002	S5	RG3	5.420	0.600	5.550	5.510	0.040	135.5	100	5.39	50.0
2.003	RG3	S6	1.000	0.600	5.510	5.500	0.010	100.0	100	5.41	50.0
2.004	S6	CP1	1.640	0.600	4.500	4.450	0.050	32.8	100	5.43	50.0
3.002	S7	S6	2.200	0.600	4.650	4.500	0.150	14.7	150	5.01	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.005	15.7	2.0	0.500	0.600	0.011	0.0	24	1.365
1.001	3.371	26.5	2.0	0.600	1.000	0.011	0.0	18	1.965
1.002	1.557	27.5	9.6	1.000	1.050	0.053	0.0	61	1.421
1.003	1.616	28.6	9.6	1.050	1.150	0.053	0.0	60	1.462
2.000	0.598	4.7	0.7	0.340	0.500	0.004	0.0	27	0.435
2.001	1.255	9.9	1.4	0.500	0.480	0.008	0.0	26	0.901
2.002	0.659	5.2	1.4	0.480	0.470	0.008	0.0	36	0.565
2.003	0.769	6.0	3.1	0.470	0.480	0.017	0.0	50	0.771
2.004	1.351	10.6	6.1	1.480	1.050	0.034	0.0	54	1.397
3.002	2.644	46.7	3.1	0.760	1.430	0.017	0.0	26	1.502

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	1.500	15.0	100	Circular	5.800	5.200	0.500	5.800	5.100	0.600
1.001	3.200	5.3	100	Circular	5.800	5.100	0.600	5.600	4.500	1.000
1.002	2.100	42.0	150	Circular	5.600	4.450	1.000	5.600	4.400	1.050
1.003	3.900	39.0	150	Circular	5.600	4.400	1.050	5.600	4.300	1.150
2.000	8.200	164.0	100	Circular	6.090	5.650	0.340	6.200	5.600	0.500
2.001	1.900	38.0	100	Circular	6.200	5.600	0.500	6.130	5.550	0.480
2.002	5.420	135.5	100	Circular	6.130	5.550	0.480	6.080	5.510	0.470
2.003	1.000	100.0	100	Circular	6.080	5.510	0.470	6.080	5.500	0.480
2.004	1.640	32.8	100	Circular	6.080	4.500	1.480	5.600	4.450	1.050
3.002	2.200	14.7	150	Circular	5.560	4.650	0.760	6.080	4.500	1.430

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	RG1	1	Manhole	Adoptable	S1	450	Manhole	Adoptable
1.001	S1	450	Manhole	Adoptable	CP1	1	Manhole	Adoptable
1.002	CP1	1	Manhole	Adoptable	S2	450	Manhole	Adoptable
1.003	S2	450	Manhole	Adoptable	S3	450	Manhole	Adoptable
2.000	S4	450	Manhole	Adoptable	RG2	1	Manhole	Adoptable
2.001	RG2	1	Manhole	Adoptable	S5	450	Manhole	Adoptable
2.002	S5	450	Manhole	Adoptable	RG3	1	Manhole	Adoptable
2.003	RG3	1	Manhole	Adoptable	S6	450	Manhole	Adoptable
2.004	S6	450	Manhole	Adoptable	CP1	1	Manhole	Adoptable
3.002	S7	450	Manhole	Adoptable	S6	450	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
RG1	5.800	0.600	1				
				0	1.000	5.200	100
S1	5.800	0.700	450				
				0	1.001	5.100	100
CP1	5.600	1.150	1				
				1	1.001	4.500	100
				2	2.004	4.450	100
				0	1.002	4.450	150
S2	5.600	1.200	450				
				1	1.002	4.400	150
				0	1.003	4.400	150
S4	6.090	0.440	450				
				0	2.000	5.650	100
RG2	6.200	0.600	1				
				1	2.000	5.600	100
				0	2.001	5.600	100

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S5	6.130	0.580	450	1	2.001	5.550	100
				0	2.002	5.550	100
RG3	6.080	0.570	1	1	2.002	5.510	100
				0	2.003	5.510	100
S6	6.080	1.580	450	1	3.002	4.500	150
				2	2.003	5.500	100
				0	2.004	4.500	100
S7	5.560	0.910	450	0	3.002	4.650	150
S3	5.600	1.300	450	1	1.003	4.300	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	1.2
Rainfall Events	Singular	Drain Down Time (mins)	600	5 year (l/s)	1.8
Summer CV	1.000	Additional Storage (m³/ha)	0.0	30 year (l/s)	2.6
Winter CV	1.000	Starting Level (m)		100 year (l/s)	3.1
Analysis Speed	Detailed	Check Discharge Rate(s)	✓	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
5	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0
1000	0	0	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Betterment (%)	0
Brownfield Method	MRM	Q 2 year (l/s)	1.2
Contributing Area (ha)	0.085	Q 5 year (l/s)	1.8
PIMP (%)	100	Q 30 year (l/s)	2.6
CV	1.000	Q 100 year (l/s)	3.1
Time of Concentration (mins)	5.00		

Node S3 Online Orifice Control

Flap Valve	x	Invert Level (m)	4.300	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.020		

Node CP1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	4.450
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	495

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	75.0	0.0	0.450	75.0	0.0	0.451	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RG1	10	5.227	0.027	1.8	0.0000	0.0000	OK
15 minute summer	S1	10	5.118	0.018	1.8	0.0029	0.0000	OK
360 minute summer	CP1	264	4.572	0.122	3.6	8.6748	0.0000	OK
360 minute summer	S2	264	4.572	0.172	1.8	0.0273	0.0000	SURCHARGED
15 minute winter	S4	11	5.674	0.024	0.6	0.0039	0.0000	OK
15 minute winter	RG2	11	5.626	0.026	1.2	0.0000	0.0000	OK
15 minute winter	S5	11	5.583	0.033	1.2	0.0052	0.0000	OK
15 minute summer	RG3	11	5.563	0.053	2.6	0.0000	0.0000	OK
360 minute summer	S6	264	4.572	0.072	1.9	0.0114	0.0000	OK
15 minute summer	S7	10	4.675	0.025	2.7	0.0039	0.0000	OK
360 minute summer	S3	264	4.572	0.272	2.1	0.0432	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RG1	1.000	S1	1.8	1.353	0.113	0.0020	
15 minute summer	S1	1.001	CP1	1.8	1.852	0.067	0.0031	
360 minute summer	CP1	1.002	S2	1.8	0.519	0.064	0.0346	
360 minute summer	S2	1.003	S3	2.1	0.147	0.075	0.0687	
15 minute winter	S4	2.000	RG2	0.6	0.392	0.128	0.0126	
15 minute winter	RG2	2.001	S5	1.2	0.640	0.122	0.0036	
15 minute winter	S5	2.002	RG3	1.2	0.381	0.231	0.0172	
15 minute summer	RG3	2.003	S6	2.6	0.674	0.429	0.0038	
360 minute summer	S6	2.004	CP1	2.4	0.818	0.229	0.0113	
15 minute summer	S7	3.002	S6	2.7	0.816	0.058	0.0109	
360 minute summer	S3	Orifice		0.4				14.9

Results for 5 year Critical Storm Duration. Lowest mass balance: 98.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RG1	10	5.234	0.034	2.7	0.0000	0.0000	OK
15 minute summer	S1	10	5.123	0.023	2.7	0.0036	0.0000	OK
360 minute winter	CP1	288	4.625	0.175	2.7	12.4356	0.0000	SURCHARGED
360 minute winter	S2	288	4.625	0.225	2.2	0.0357	0.0000	SURCHARGED
15 minute summer	S4	10	5.681	0.031	1.0	0.0050	0.0000	OK
15 minute summer	RG2	10	5.634	0.034	2.0	0.0000	0.0000	OK
15 minute summer	S5	11	5.593	0.043	1.9	0.0069	0.0000	OK
15 minute summer	RG3	11	5.580	0.070	4.0	0.0000	0.0000	OK
360 minute winter	S6	288	4.625	0.125	1.8	0.0198	0.0000	SURCHARGED
15 minute summer	S7	10	4.680	0.030	4.1	0.0048	0.0000	OK
360 minute winter	S3	288	4.624	0.324	1.6	0.0516	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RG1	1.000	S1	2.7	1.481	0.170	0.0027	
15 minute summer	S1	1.001	CP1	2.7	2.069	0.100	0.0041	
360 minute winter	CP1	1.002	S2	1.8	0.512	0.066	0.0370	
360 minute winter	S2	1.003	S3	1.6	0.244	0.057	0.0687	
15 minute summer	S4	2.000	RG2	1.0	0.435	0.205	0.0181	
15 minute summer	RG2	2.001	S5	1.9	0.705	0.193	0.0053	
15 minute summer	S5	2.002	RG3	1.9	0.422	0.369	0.0246	
15 minute summer	RG3	2.003	S6	4.0	0.752	0.668	0.0054	
360 minute winter	S6	2.004	CP1	1.8	0.798	0.173	0.0128	
15 minute summer	S7	3.002	S6	4.1	0.872	0.087	0.0148	
360 minute winter	S3	Orifice		0.5				20.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RG1	10	5.243	0.043	4.1	0.0000	0.0000	OK
15 minute summer	S1	10	5.129	0.029	4.1	0.0046	0.0000	OK
240 minute winter	CP1	232	4.712	0.262	4.2	18.6639	0.0000	SURCHARGED
240 minute winter	S2	232	4.712	0.312	2.0	0.0496	0.0000	SURCHARGED
15 minute summer	S4	10	5.689	0.039	1.5	0.0062	0.0000	OK
15 minute summer	RG2	10	5.646	0.046	3.0	0.0000	0.0000	OK
15 minute summer	S5	11	5.624	0.074	2.9	0.0118	0.0000	OK
15 minute summer	RG3	11	5.612	0.102	6.1	0.0000	0.0000	SURCHARGED
240 minute winter	S6	232	4.712	0.212	2.7	0.0337	0.0000	SURCHARGED
240 minute winter	S7	232	4.712	0.062	1.4	0.0099	0.0000	OK
240 minute winter	S3	232	4.712	0.412	1.3	0.0655	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RG1	1.000	S1	4.1	1.615	0.259	0.0038	
15 minute summer	S1	1.001	CP1	4.1	2.312	0.153	0.0076	
240 minute winter	CP1	1.002	S2	2.0	0.559	0.073	0.0370	
240 minute winter	S2	1.003	S3	1.3	0.249	0.046	0.0687	
15 minute summer	S4	2.000	RG2	1.5	0.466	0.314	0.0261	
15 minute summer	RG2	2.001	S5	2.9	0.749	0.296	0.0091	
15 minute summer	S5	2.002	RG3	2.9	0.446	0.560	0.0381	
15 minute summer	RG3	2.003	S6	6.1	0.815	1.010	0.0073	
240 minute winter	S6	2.004	CP1	2.6	0.939	0.249	0.0128	
240 minute winter	S7	3.002	S6	1.4	0.617	0.030	0.0269	
240 minute winter	S3	Orifice		0.5				21.5

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RG1	10	5.249	0.049	5.0	0.0000	0.0000	OK
15 minute summer	S1	10	5.132	0.032	5.0	0.0051	0.0000	OK
360 minute winter	CP1	336	4.781	0.331	4.1	23.5947	0.0000	SURCHARGED
360 minute winter	S2	336	4.781	0.381	1.6	0.0606	0.0000	SURCHARGED
30 minute summer	S4	18	5.694	0.044	1.8	0.0069	0.0000	OK
15 minute summer	RG2	11	5.656	0.056	3.6	0.0000	0.0000	OK
15 minute summer	S5	11	5.653	0.103	3.5	0.0163	0.0000	SURCHARGED
15 minute summer	RG3	11	5.630	0.120	7.3	0.0000	0.0000	SURCHARGED
360 minute winter	S6	336	4.781	0.281	2.6	0.0447	0.0000	SURCHARGED
360 minute winter	S7	336	4.781	0.131	1.3	0.0209	0.0000	OK
360 minute winter	S3	336	4.781	0.481	1.3	0.0765	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RG1	1.000	S1	5.0	1.677	0.316	0.0045	
15 minute summer	S1	1.001	CP1	5.0	2.433	0.187	0.0112	
360 minute winter	CP1	1.002	S2	1.6	0.521	0.059	0.0370	
360 minute winter	S2	1.003	S3	1.3	0.174	0.045	0.0687	
30 minute summer	S4	2.000	RG2	1.8	0.481	0.388	0.0316	
15 minute summer	RG2	2.001	S5	3.5	0.755	0.351	0.0117	
15 minute summer	S5	2.002	RG3	3.5	0.446	0.671	0.0424	
15 minute summer	RG3	2.003	S6	7.3	0.937	1.208	0.0075	
360 minute winter	S6	2.004	CP1	3.0	0.854	0.286	0.0128	
360 minute winter	S7	3.002	S6	1.3	0.593	0.028	0.0373	
360 minute winter	S3	Orifice		0.6				26.5

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	RG1	440	5.328	0.128	0.9	0.0000	0.0000	SURCHARGED
480 minute winter	S1	440	5.328	0.228	0.9	0.0362	0.0000	SURCHARGED
480 minute winter	CP1	440	5.328	0.878	4.2	32.0981	0.0000	FLOOD RISK
480 minute winter	S2	440	5.328	0.928	1.5	0.1475	0.0000	FLOOD RISK
30 minute summer	S4	19	5.733	0.083	2.5	0.0132	0.0000	OK
15 minute summer	RG2	11	5.722	0.122	4.8	0.0000	0.0000	SURCHARGED
15 minute summer	S5	11	5.703	0.153	4.4	0.0243	0.0000	SURCHARGED
15 minute summer	RG3	11	5.665	0.155	9.8	0.0000	0.0000	SURCHARGED
480 minute winter	S6	440	5.328	0.828	2.6	0.1316	0.0000	SURCHARGED
480 minute winter	S7	440	5.328	0.678	1.4	0.1078	0.0000	FLOOD RISK
480 minute winter	S3	440	5.327	1.027	1.0	0.1634	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	RG1	1.000	S1	0.9	1.163	0.057	0.0117	
480 minute winter	S1	1.001	CP1	0.9	1.097	0.034	0.0250	
480 minute winter	CP1	1.002	S2	1.3	0.549	0.047	0.0370	
480 minute winter	S2	1.003	S3	-1.4	0.175	-0.051	0.0687	
30 minute summer	S4	2.000	RG2	2.2	0.483	0.473	0.0605	
15 minute summer	RG2	2.001	S5	4.4	0.741	0.452	0.0149	
15 minute summer	S5	2.002	RG3	4.6	0.589	0.891	0.0424	
15 minute summer	RG3	2.003	S6	9.8	1.250	1.620	0.0077	
480 minute winter	S6	2.004	CP1	2.6	0.854	0.248	0.0128	
480 minute winter	S7	3.002	S6	1.3	0.552	0.029	0.0387	
480 minute winter	S3	Orifice		0.8				36.1

Results for 1000 year Critical Storm Duration. Lowest mass balance: 98.45%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	RG1	480	5.493	0.293	0.8	0.0000	0.0000	SURCHARGED
600 minute winter	S1	480	5.493	0.393	0.8	0.0625	0.0000	SURCHARGED
600 minute winter	CP1	480	5.493	1.043	3.8	32.0981	0.0000	FLOOD RISK
600 minute winter	S2	480	5.493	1.093	1.3	0.1738	0.0000	FLOOD RISK
30 minute summer	S4	19	5.736	0.086	2.5	0.0137	0.0000	OK
30 minute summer	RG2	19	5.724	0.124	4.6	0.0000	0.0000	SURCHARGED
30 minute summer	S5	19	5.704	0.154	4.5	0.0245	0.0000	SURCHARGED
30 minute summer	RG3	19	5.663	0.153	9.7	0.0000	0.0000	SURCHARGED
600 minute winter	S6	480	5.494	0.994	2.5	0.1580	0.0000	SURCHARGED
600 minute winter	S7	480	5.494	0.844	1.2	0.1341	0.0000	FLOOD RISK
600 minute winter	S3	480	5.493	1.193	1.8	0.1897	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	RG1	1.000	S1	0.8	1.126	0.051	0.0117	
600 minute winter	S1	1.001	CP1	0.8	0.978	0.030	0.0250	
600 minute winter	CP1	1.002	S2	1.3	0.512	0.049	0.0370	
600 minute winter	S2	1.003	S3	1.8	0.153	0.064	0.0687	
30 minute summer	S4	2.000	RG2	2.2	0.484	0.478	0.0615	
30 minute summer	RG2	2.001	S5	4.5	0.728	0.459	0.0149	
30 minute summer	S5	2.002	RG3	4.6	0.593	0.898	0.0424	
30 minute summer	RG3	2.003	S6	9.7	1.234	1.600	0.0077	
600 minute winter	S6	2.004	CP1	2.8	0.775	0.260	0.0128	
600 minute winter	S7	3.002	S6	1.2	0.504	0.025	0.0387	
600 minute winter	S3	Orifice		0.9				40.7



APPENDIX F:
Management & Maintenance Plan

MANAGEMENT & MAINTENANCE PLAN

Rhodes Avenue
Port Talbot
SA12 6UT

Prepared for: CJ Construction
Project Ref: 21980

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DOCUMENT CONTROL

Project:	Rhodes Avenue
Client:	CJ Construction
Vale Consultancy Ref:	21980

Issue	Prepared by	Approved by	Date	Status
01	Dan Rees	Freddy Payne BEng (Hons)	27.06.25	First issue



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1 INTRODUCTION

- 1.1. This SuDS Management and Maintenance Plan has been prepared by Vale Consultancy in support of a SuDS scheme for the proposed development at Rhodes Avenue, port Talbot, SA12 6UT.
- 1.2. The proposed project consists of 3 flats and 2 bungalows and associated external works areas to form a new business park, whilst also incorporating various, raingardens & permeable surfaces into the scheme to provide interception, amenity & biodiversity across the site.
- 1.3. The scheme incorporates a sustainable drainage system for surface water runoff, which consists of raingardens, permeable paving, and a detention basin.
- 1.4. The method for disposal of surface water runoff is to discharge to the existing highway surface water drain at the lowest practical rate.
- 1.5. The purpose of this document is to set out the overall management and maintenance objectives for the proposed SuDS components and to describe the long-term maintenance required to allow the system to continue operating as is intended.
- 1.6. All references to SuDS components are based on the SAB submission drawings:
 - **21980_500_r01 – Site Drainage**
 - **21980_501_r01 Drainage Details Sheet 1 of 2**
 - **21980_502_r01 Drainage Details Sheet 1 of 2**
 - **21980_503_r01 Flow Exceedance & Catchment Area Plan**

2 MANAGEMENT RESPONSIBILITIES

- 2.1. The current site owner(s) shall be responsible for the implementation of the Management and Maintenance Plan. If deemed necessary, all maintenance operations shall be undertaken by suitable and qualified contractor appointed by the site owner.
- 2.2. All inspections and maintenance work must be recorded. This allows for future assessment of the maintenance activities and their response to the system. It can also provide protection against legal claims should the system be exceeded in a storm event leading to flooding elsewhere.

3 MANAGEMENT OBJECTIVES

- 3.1. The site shall be managed and maintained as an attractive, tidy, and safe finish to all landscape elements.
- 3.2. The proposed planting shall enhance the biodiversity and nature conservation interests.
- 3.3. The Site Owner(s) shall ensure establishment and long-term health of all landscape elements for the benefit of the tenants and visual amenity of the area.
- 3.4. Best Health & Safety practices shall always be used.
- 3.5. To monitor standards and make amendments where required, it is expected that the Site Owner will review the management work (with reference to this document) at least quarterly for the first year and annually thereafter.



first year and annually thereafter.

4 INSPECTION AND MAINTENANCE ACCESS

- 4.1. Access to the site(s) for inspection and maintenance can be gained via the proposed junction accessed off of Rhodes Avenue.
- 4.2. Maintenance vehicles can park in the car park areas for maintenance of the various SuDS features as required.

5 MAINTENANCE VISITS OR INSPECTIONS

- 5.1. The Site Owner or appointed maintenance contractor shall carry out a minimum of 12 maintenance visits or inspections per year to check drainage SuDS components. Visits shall be monthly. Additional visits may be needed to deal with extreme weather conditions or specific horticultural requirements.

6 GENERAL

- 6.1. All materials and workmanship are to be to the highest possible standards and shall be in accordance with relevant British Standards, good horticultural and arboricultural practices, and the landscape specification.
- 6.2. The Site Owner shall employ suitably qualified staff for all work and when using sprays and mechanical equipment. All equipment shall be kept in a sound condition, fit for use and purpose.
- 6.3. The Site Owner and their appointed contractors shall comply with all relevant Health and Safety regulations and good working practices.
- 6.4. The Site Owner shall take care when work is beside any structure or paved area and will, at their own cost, be responsible for making good any damage caused.
- 6.5. Weeds, pruning's, leaves, rubbish and other arisings shall be removed from site for composting, where possible. No material shall be left on site, and the area shall be left in a neat and tidy condition after each visit.

7 LITTER COLLECTION

- 7.1. All hard surfacing shall be swept as necessary, and all rubbish removed from site.
- 7.2. Litter picking/clearance shall take place during each maintenance visit and all waste shall be removed from site.
- 7.3. During autumn maintenance visits all fallen leaves shall be collected and removed from site.



8 ORNAMENTAL PLANTING

Specific objectives:

- To ensure early establishment and healthy growth
- To maintain a dense canopy cover
- To maintain year-round appearance and visual interest

Maintenance Operations:

- 8.1. All shrub beds in the raingardens & detention basin shall be maintained substantially free of weeds. Work shall be done either manually or with appropriate selective weed killer in accordance with manufacturer's recommendations. If weed killer is used the dead weeds shall be removed at the next maintenance visit. Care must be taken to avoid damage to adjacent planting and grass and replaced immediately if affected by weed killer.
- 8.2. Once established, shrubs shall be selectively thinned or reduced in height as appropriate by removal or pruning to allow room for growth and avoid overcrowding/overshadowing and create a natural form rather than cube or cloud shapes. Care shall be taken to avoid over pruning and so creating obvious gaps in the shrub beds.
- 8.3. Ground cover plants shall be clipped or pruned if necessary, to give a neat and tidy finish and contained within the planting bed. Work to remove dead vegetation shall be carried out during the winter months.
- 8.4. Pruning of herbaceous planting:
In spring cut stems close to the 'crown' or 'dormant' top of the plant, avoiding the removal of new shoots.
 - Tidy up the base of the plant, removing dead foliage and debris.
 - Remove all material from site.
 - If necessary, apply a 50mm layer of fine horticultural mulch. This will help moisture retention in the soil, contribute to weed suppression and allow delicate stems to grow.
 - Leave dried flower head over winter for relevant species e.g. ornamental grasses.
- 8.5. Fertilising:
 - One application, just before or at the time of spring growth.
 - A balanced fertiliser is required, one high in Phosphorus (which encourages blooming as well as strong roots and disease resistance). Fertilisers high in nitrogen should not be used as nitrogen promotes excess foliage at the expense of flowers and roots which can result in weak stems



9 TRADITIONAL DRAINAGE

- 9.1. A bi-monthly site inspection should be carried out, checking for any areas that are not operating correctly and collecting/removing litter and debris.
- 9.2. All rainwater pipes, channel drains, gullies and inspection chambers should be inspected biannually, typically spring and autumn.
- 9.3. Any excessive sediment build-up in rainwater pipes, channel drains, gullies or inspection chambers causing blockage or poor performance shall be cleared and cleaned as required.
- 9.4. Flow control devices provide customised water quantity management for surface water across a wide range of flows and for a variety of applications. The flow control has no moving parts and no power requirements and provides reliable, low-maintenance, engineered flood management. The two most common flow control devices are vortex and orifice plate flow controls. This scheme will incorporate orifice flow controls only and maintenance requirements are as detailed in section 9.

10 SUMMARY OF INSPECTION AND MAINTENANCE FOR SUDS

- 10.1. The following briefly summarises the frequency and type of inspections and maintenance required for the SuDS components and drainage system used in this scheme:

10.2. General

Operation and maintenance requirements for traditional drainage components		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of traditional drainage including rainwater pipes, channel drains, gullies and inspection chambers (as applicable).	Bi-annually
	Remove litter or build-up of foliage	Bi-annually (or as required)
Occasional maintenance	Clear channel drains and gullies of silt build up	Every 5 years (or as required)
Remedial Actions	Jet/vac inspection chambers and below ground pipework when blocked or performance is affected due to partial blockages	Every 20 years (or as required)



10.3. Flow control devices / chambers

Operation and maintenance requirements for vortex flow control		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of flow control device including litter and debris removal	Routine maintenance should be undertaken on completion of drainage works and then annually thereafter
	Check emergency drain down (if fitted) is in good working order	
	Check and clean orifice screening device and replace if damaged	
	Check component fixings are secure	
Occasional maintenance	De-silting / sediment removal	As required upon inspection
Remedial Actions	Damage repair	As required upon inspection

10.4. Bioretention areas (Raingardens)

Operation and maintenance requirements for Bioretention Raingardens		
Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years



10.5. Pervious Paving

Operation and maintenance requirements for Pervious Pavements		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations - pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required - once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and 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 performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation. and/or weed growth - if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually



11 LIFETIME MANAGEMENT AND MAINTENANCE COSTS FOR SUDS

11.1. Lifetime management and maintenance costs have been broken down for each SuDS drainage system. Costs are based on a 60-year design life.

11.2. The costs associated with the management and maintenance of the SuDS system over the 60-year design life of the scheme has been estimated based on the inspection and maintenance activities in section 10, as follows:

11.3. General

- General monthly inspection by the site owner (incl. litter removal) – no cost as is incorporated in general site maintenance undertaken by site owner
- Biannual check of traditional drainage - no cost as is incorporated in general site maintenance undertaken by site owner
- Annual check of flow control chamber - no cost as is incorporated in general site maintenance undertaken by site owner

11.4. Bioretention areas (Raingardens)

- Annual inspection - no cost as is incorporated in general site maintenance undertaken by site owner.
- Annual pruning/fertilising - no cost as is incorporated in general site maintenance undertaken by site owner.
- Plant replacement over 60 years, assuming 10% of plants need to be replaced each year with Meadowmat SuDS & Slopes seed mix (10% of $94.5 \text{ m}^2 = 9.45 \text{ m}^2$) @ £2 / m^2 / year - £1,134

11.5. Permeable Block Paving

- Weed kill every 5 years @ £0.30 / m^2 x 127 m^2 - £419
- Take up and clean/replace surface course once in year 30 @ £15 / m^2 x 127 m^2 - £1,905
- Brush and/or power wash surface every 10 years @ £500 / application - $£500 \times 5 = £2,500$

11.6. Detention Basin

- Cut grass – bi-monthly during growing season (Spring-Summer) – **over 60 years @ £20 per cut x 3 cuts per year - £3,600**
- Plant replacement over 60 years, assuming 10% of plants need to be replaced each year with Meadowmat SuDS & Slopes seed mix (10% of $58 \text{ m}^2 = 5.8 \text{ m}^2$) @ £2 / m^2 / year - £696

11.7. The total sum of management and maintenance costs for the proposed SuDS over a 60-year design life - **£10,254 or circa £171 a year.**