

Drainage Strategy Report (DSR) For:
SAB Phase 3, Land off Upper Colliers Row,
Heolgerrig,
Merthyr Tydfil, CF48 1UN

Prepared for:

Maxiom

REF: 19735-DSR

DATE: June 2024

Document Control

Project	SAB Phase 3, Land off Upper Colliers Row, Heolgerrig, Merthyr Tydfil, CF48 1UN
Client	Maxiom
Vale Consultancy Ref:	19735-DSR

Document Checking:

Prepared By: F Payne

Signed:



Checked By: M Jones

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Verified By: M Jones

Signed:



Issue	Date	Status
01	18.06.2024	First issue
02		
03		

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2 INTRODUCTION

2.1 Site Location

Vale Consultancy has been instructed by Maxiom Ltd. (the *client*) to undertake a drainage strategy report (DSR) for the proposed development at land off Upper Colliers Row, Heolgerrig, Merthyr Tydfil, CF48 1UN.

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

The proposed development is located on the west side of Heolgerrig, Merthyr Tydfil on an undeveloped parcel of land on the western side of Upper Colliers Row just southwest of the A470. The site is bounded by undeveloped grassland and wooded areas to the south, residential buildings and a church to the west and Pantycelyn road to the north.

The proposed development site is within the constraints of undeveloped land and is therefore classified as “**Greenfield**”. The following drainage strategy will cover the hydraulic design criteria of the surface water drainage network only.



Figure 1: Site Location Satellite Plan

2.2 Proposed Development

The intention of the proposed project is to develop the site into 10 residential plots with two private access roads to serve 4 of the plots. The remaining plots will have direct access from Upper Colliers Row.

As the plots will be self-build (multiple phases) this report and the SAB application it supports only considers a portion of the overall development. This is the third phase of the development to apply for SAB approval.

Phase 1

Phase 1 covered one plot (Plot 4) and the northern private access road which gained SAB approval in July 2021 (Ref: SAB/21/0011).

Phase 2

Phase 2 is covered 4 plots (Plot 1, Plot 2, Plot 6 and Plot 7) and gained approval in June 2022 (Ref: SAB/22/0005).

Phase 3 (this phase)

This phase includes 4 plots (Plots 5, 8, 9 and 10) and the southern private driveway.

Future phases

There will likely be 1-2 more future phases to cover the remainder of the development.

The total site area is approximately 7700m² (0.770ha) however the area to be developed that is considered within this phase, report and the SAB application it supports is approximately 1540m² (0.154ha) as denoted by the green line boundaries on drawing no. 19735_500 in **Appendix B**.

2.3 Existing Geology

Site investigations and soakaway testing was undertaken by Matt Jones of Vale Consultancy in March 2021, refer to **Appendix C** for the full report. Nine trial pits were dug, ground water was not encountered and soils encountered were logged. In summary the site was found to have an upper layer of topsoil approximately 200mm deep with roots present within the soil, more densely in some areas than others. The site was cleared prior to the site investigations so it was likely there were plants and small trees in these areas. Beneath the layer of topsoil and to the depth of the trial pits which were all about 1m deep the ground generally consisted of shale mixed with a finer gravelly soil.

Infiltration tests were performed 3 times in each trial pit. Rapid draining was experienced with every test and the lowest infiltration value recorded was 5.95x10⁻⁵ m/s. Although infiltration rates are consistently good across the site the trial pit closest to any proposed infiltration feature should be used for design, i.e. TP5 results should be used for soakaways in Plot 5 etc.

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

Superficial deposits: Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.

Bedrock geology: South Wales Lower Coal Measures Formation - Mudstone, siltstone and sandstone. Sedimentary bedrock formed between 319 and 318 million years ago during the Carboniferous period.

2.4 Flood Risk

Flood risk has been assessed using the NRW Development Advice Map (DAM) and Flood Risk Assessment Wales Map (FRAWM). The site is located within Zone A of the DAM, so is therefore considered to be at little or no risk of fluvial or tidal/coastal flooding. Furthermore, upon review of the detailed FRAWM map the site is located outside all flood risk extents for flooding from rivers, the sea, surface water and small watercourses. It is therefore considered to have less than a 0.1% chance of flooding from all flood types. Further flood risk assessment is not considered necessary.

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

3 SURFACE WATER

3.1 Existing Drainage Systems

The site is undeveloped land with no existing drainage. DCWW sewer and water records have been reviewed and no asset of DCWW is within the site boundary.

A foul water drainage system is being designed and built to serve the development which is being offered for adoption to DCWW via S104 agreement.

Under SAB/22/0005 a surface water drain was approved to be built along the eastern border of the development which connects into the culvert under the adjacent highway. As part of this work stubs/manholes were to be provided for the plots fronting the road for the rest of the scheme with the agreement that each plot can discharge to the drain at a rate of 1 l/s.

3.2 Proposed Drainage Systems

3.2.1 **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 has not been used as there is no foreseeable demand for non-potable water within the development proposals throughout its design life. There is no foreseeable need to harvest water as DCWW

has not identified any potential stresses on the mains water supply. The use of rainwater harvesting is not a cost-effective/viable option for managing surface water runoff in comparison to the water supply benefit for this type of development.

To further demonstrate that rainwater harvesting is not considered viable within the proposals, a break-even recovery of costs has been evaluated based on the cost of the rainwater harvesting system expected to be required against the money saved by the reduced amount of potable water required.

Indicative cost estimate for a capture-store-pump-use based on a 4,800-litre tank serving a 4-bedroom house (Costs based on tank size calculator and products provided by www.rainwaterharvesting.co.uk):

Onsite installation costs (Inc of exaction/backfill, pipework electrical supply etc) = £2,000.00

RWH system with a 4,800 litre below ground tank delivered to site = £3,200

Capital Costs circa = £5,200.00

Average potable/domestic water consumption/day/person = 140 l/day

Annual consumption based on a 4-bedroom house with 6 persons = $6 \times 140 \times 365 = 306,600$ litres = 306.6m³

DCWW Standard volumetric measured rate = £1.36 / m³

Typical water bill/annum = $£1.36 \times 306.6\text{m}^3 = £417$

Building with RWH system would provide a 25% reduction on water demand: $£417 \times 0.75 = £312.75/\text{annum}$

Saving per year on potable water = $417.00 - 312.75 = £104.25$

Break even recovery of costs = $£5,200 / £104.25 = 50$ years

Therefore, a saving from the reduced amount of potable water required set against the capital investment cost would result in a 50-year break even recovery of costs.

In addition, other factors to consider are the practicalities of installing a 4,800-litre tank below ground within the site constraints and building footprint and the location of an above ground RWH tank would present the same siting/location problems in addition to the aesthetics of a 4,800 litre unit.

No solution, move to next Priority Level

Priority Level 2 – Discharge via infiltration:

During site investigations and infiltration testing undertaken by Matt Jones of Vale Consultancy in March 2021 it was found that the site's underlying ground has good infiltration properties. From the tests undertaken to BRE365 Digest standards the lowest infiltration rate encountered was 5.95×10^{-5} m/s.

Although the site's underlying ground has good infiltration properties due to site constraints i.e. steep gradients, need for retaining structures and close proximity to a highway. The plots adjacent to the highway have been deemed unsuitable for infiltration.

Therefore, it is proposed that plot 5 will drain via infiltration using infiltration rates from the testing undertaken in TP5 (within this plot of land). The southern private driveway will drain via infiltration using results from the nearest trial pit (TP8) using the same principals that were agreed for the northern private drive under SAB/21/0011. Plots 8, 9 and 10 will discharge to the surface water drain approved under SAB/22/0005 which ultimately discharges to the culvert under the highway.

This has been previously discussed with the SAB officer who agrees this is a better (viable) solution.

Partial solution, move to next Priority Level

Priority Level 3 – Discharge to an open surface water body:

As briefly mentioned above a culverted watercourse exists under the adjacent highway. Under SAB/22/0005 a surface water drain was approved to be built along the eastern border of the development which connects into the culvert. As part of this work stubs/manholes were to be provided for the plots fronting the road for the rest of the scheme with the agreement that each plot can discharge to the drain at a rate of 1 l/s.

Priority Level 3 solution. Priority Levels 4-5 have not been considered as they are considered less desirable.

3.2.2 **S2:** Surface Water Runoff Hydraulic Control.

Proposed SuDS drainage system

Plot 5

The proposed driveway will be permeable and will not drain any other additional areas so will therefore blanket discharge (self-drain) to ground via infiltration. The roof will drain to the raingarden proposed in the front garden area via Sel Raintaina filter chambers before discharging to the geocellular soakaway in the rear garden.

Plots 8, 9 and 10

Roof areas will drain to the raingardens proposed in the front gardens via Sel Raintaina filter chambers. The raingardens will drain to geocellular attenuation tanks beneath the driveways. The driveways will be permeable and will drain directly into the attenuation tanks. An ACO drain is proposed on the boundary of the driveway with the highway which also connects into the attenuation tank. This will provide an extra factor of safety against preventing runoff into the adjacent highway. A flow control chamber is proposed for each plot to restrict flows to 1 l/s into the surface water drain which discharges to the culvert.

Southern private driveway

As per the principals of the other 'already approved' private driveway, the impermeable surface will have a balanced camber crossfall with raingardens on each side of the road. This will allow the road to drain over edge into the raingardens where water will infiltrate. Due to the gradient of the road an ACO drain is proposed at the threshold with the adjacent highway. The ACO drain will also discharge to the raingardens.

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 developed area of each plot is considered to be maximised, therefore, an allowance for urban creep is considered not necessary.

Plot 5

The geocellular soakaway has been sized such that there is sufficient storage volume for no flooding for all events up to and including the critical 1 in 100-year event + 30% climate change allowance. Similarly, the depth of stone sub-base beneath the self-draining permeable driveway is sufficient to ensure no flooding for the same 1 in 100-year event + 30% climate change allowance.

Private driveway

The raingardens have been sized such that there is sufficient storage volume for no flooding for all events up to and including the critical 1 in 100-year event + 30% climate change allowance.

Plots 8, 9 and 10

The geocellular attenuation tanks have been sized such that there is sufficient storage volume for no flooding for all events up to and including the critical 1 in 100-year event + 30% climate change allowance at a maximum discharge rate of 1 l/s per plot.

Refer to the hydraulic calculations in **Appendix E**.

The raingardens to serve the houses of each plot have been proposed for their interception, water quality, amenity and biodiversity benefits rather than for use as attenuation storage and as such the attenuation storage for surface water runoff from the houses will be provided in the geocellular attenuation tanks.

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.

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 can change 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 so 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 24.3 of the CIRIA SuDS Manual 2015 where SuDS are designed to infiltrate more than 5mm from the contributing catchment for all events then interception will be effectively delivered. This is the case for the infiltration systems proposed on Plot 5 and the private driveway.

For plots 8, 9 and 10 interception will be provided by the raingardens and permeable paving following the same design as what was approved for plots 1, 2, 6 and 7 under SAB/22/0005.

Exceedance Flows

It is necessary to assess the risk and consequence of flooding for exceedance events. This is to determine the likely water flow paths and destinations that would be caused by a storm event that exceeds the critical 1 in 100-year + 30% climate change allowance that the surface water drainage system is designed for.

In these very unlikely events, it is possible that the surface water system will surcharge and flood.

To assess the impact of this the proposed drainage systems have been sensitivity tested for the 1 in 1000-year event.

Plot 5

Driveway – 225mm sub-base surcharges 54mm – no flooding

Geocellular soakaway – 1.6m³ of flooding

Private Driveway

No flooding from either raingarden.

Plots 8, 9 and 10

No flooding for the 1 in 1000-year event. The flow control chambers proposed for these plots will incorporate overflow pipes. Once the attenuation storage volume is maximised, any additional volumes will discharge at an unfettered rate via the overflow pipes, bypassing the flow control. Even in events exceeding the critical 1 in 100-year + 30% climate change allowance, surface level flooding is considered extremely unlikely.

In conclusion, the volume of floodwater expected to leave the site for the 1000-year event is relatively low and considered to be of little risk to people's health and damage to property. The highway, although unlikely, may experience some additional surface water but nothing more than an inconvenience.

3.2.3 **S3:** Water Quality

Although, for this site, pollutant levels will be low. The water quality improvement being provided by the proposed SuDS solution has been assessed using the simple index approach as per section 26.7.1 of the CIRIA SuDS Manual 2015.

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
		Total Suspended Solids (TSS)	Metals	Hydro-carbons		Total Suspended Solids (TSS)	Metals	Hydro-carbons	

									each contaminant type)
Individual property driveway	Low	0.5	0.4	0.4	Permeable paving	0.7	0.6	0.7	Yes
Residential roof	Very low	0.2	0.2	0.05	Raingarden	0.8	0.8	0.8	Yes

Table 1: *Water quality – Simple index approach*

The proposed design will ensure that surface water runoff will either pass through the permeable paving or bioretention raingardens before discharging to ground via infiltration or to the ordinary watercourse. These SuDS components will separate the smaller particles and chemicals from the surface water discharge as it filters through providing sufficient water quality treatment to any discharging water.

Bioretention areas can provide effective water treatment such as the removal of fine sediments and associated pollutants which are trapped within the surface vegetation and groundcover. As surface water passes through the filter medium beneath further removal of fine particles and contaminants takes place. Similarly, permeable paving traps fine sediments and associated pollutants in its upper layers improving water quality as it filters through the various layers within the permeable paving make-up.

Where it is not practical to drain a roof area to a raingarden, Sel Raintaina filter chambers are proposed. These combine a permeable cover that allows water through but traps foliage/larger debris and a catchpit with traps finer sediments and solids.

The proposed SuDS components will be sufficient in removing contaminants and pollutants for the proposed site and will only have a positive impact on the receiving water quality.

3.2.4 **S4:** Amenity

To maximise amenity within the SuDS proposals, the drainage solution has been integrated throughout the proposed scheme. Permeable paving has been proposed in place of a traditional impermeable block paving for the driveways, seamlessly integrating SuDS into an amenity area. The raingardens will provide benefits which include managing surface water and encouraging biodiversity whilst also providing opportunity to include a range of plant species into the area.

The proposed SuDS system is considered to improve the sites attractiveness and expand on the desirability of the area by providing attractive, high-quality features almost seamlessly integrated within the site whilst at the same time deliver an effective surface water drainage system, prioritising infiltration.

3.2.5 **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 a bioretention raingardens as proposed can help to retain or provide new quality habitat for wildlife, having a positive contribution to retaining or improving biodiversity in the area. The use of planting native species can support local biodiversity by providing habitat and food for invertebrates and birds.

A planting schedule has been developed giving recommended plant species suitable to the environment which can be incorporated into the raingarden areas, refer to drawing 19735_500_r01 in **Appendix B**.

3.2.6 **S6:** Operation and Maintenance Requirements

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 each homeowner, who is responsible for the maintenance with guidance on the types and frequency of inspections and maintenance work that is required for their proposed SuDS elements. It also provides a cost estimate for the inspection and maintenance requirements over the development's lifetime.

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

4 CONCLUSIONS

The total site area of the proposed residential development at land off Colliers Row, Merthyr Tydfil is approximately 7700m² (0.770ha) however the area to be developed that is considered within this report and the SAB application it supports is approximately 1540m² (0.154ha) as denoted by the green line boundaries on drawing no. 19735_500 in **Appendix B**.

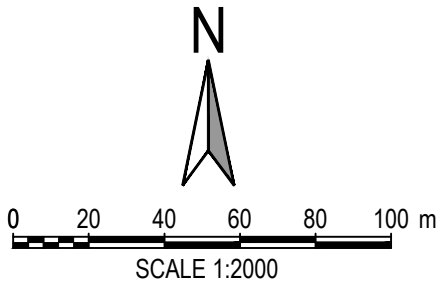
The proposed development will provide the site with a new sustainable surface water drainage system that will incorporate SuDS features providing a solution that will manage surface water for storm events up to and including the critical duration 1 in 100-year storm event plus 30% climate change allowance. Mimicking the sites predeveloped characteristics as much as possible the proposed surface water drainage systems will partially discharge to ground via infiltration. Due to site constraints this cannot be the only discharge destination, as such, the site will also drain to the culverted watercourse beneath the adjacent highway.

The SuDS components considered suitable for this site are permeable paving and bioretention raingardens. Geocellular attenuation tanks are proposed for each plot downstream of SuDS components to provide attenuation storage prior to discharge. Surface water will be captured and intercepted as close to source as possible and will be treated by a SuDS component prior to discharge.

Plot 5 and the private driveway will drain via infiltration. Plots 8, 9 and 10 will drain to the culvert as maximum discharge rate of 1 l/s per plot.

Overall, the proposed surface water drainage system seeks to be a cost effective and easily maintainable sustainable drainage solution. The surface water discharge location is the most appropriate and preferred method within the sites constraints and the SuDS components incorporated in the design provide sufficient interception, water quality, amenity and biodiversity benefits.

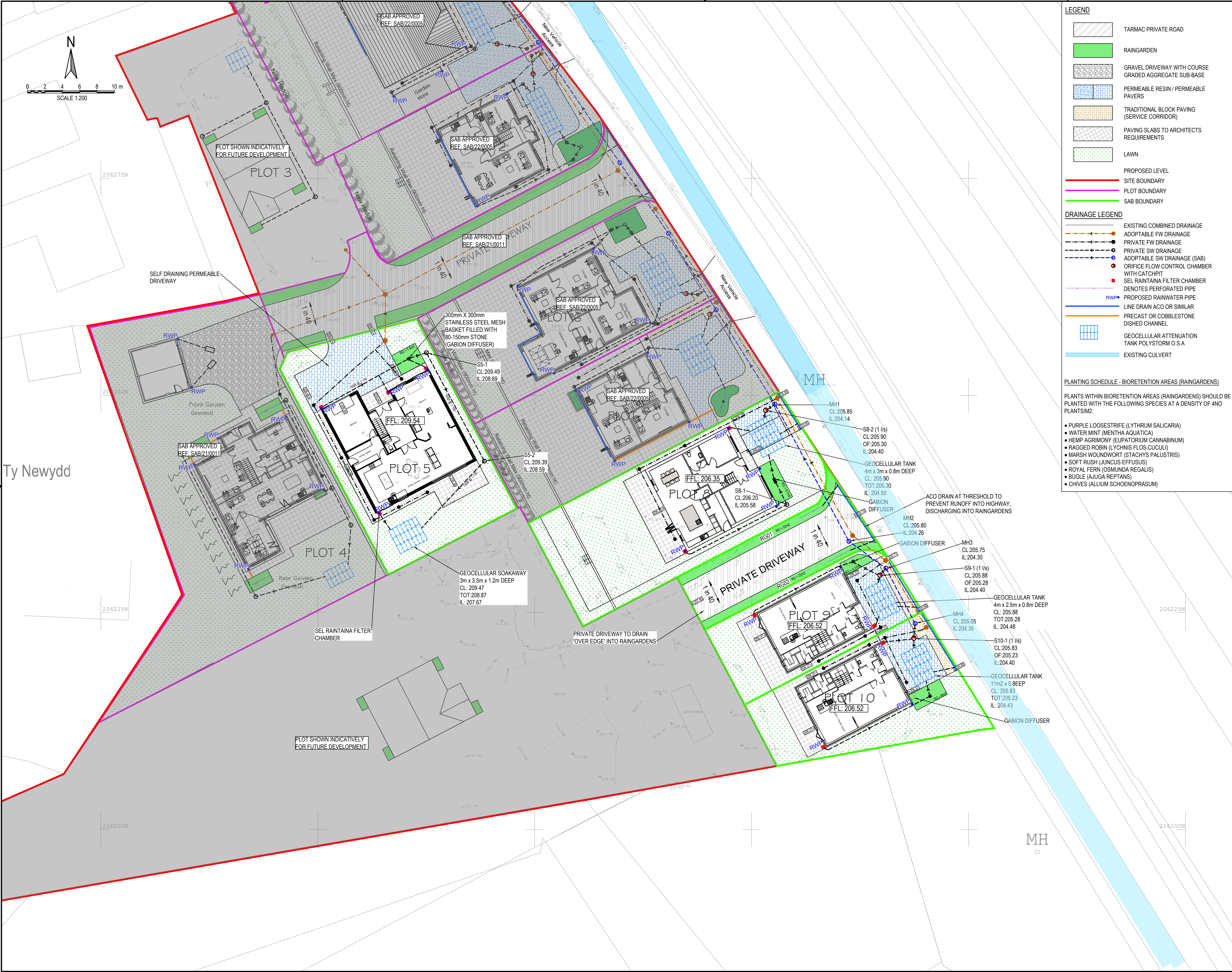
APPENDIX A: Existing Site Plans



- 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.

01	FP	FP	MJ	17.06.24	PRELIMINARY ISSUE
rev.	drawn	chkd.	apprvd.	date	description
Client MAXIOM					
Project UPPER COLLIERS ROW, MERTHYR TYDFIL, CF48 1UN					
Title SITE LOCATION PLAN					
Vale Consultancy 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		
17.06.24	FP	FP	17.06.24	MJ	17.06.24
scale @ A3		project no.			
1:2000		19735			
status	drg. no.				rev.
P	19735_100				01

APPENDIX B: Proposed Site Plans



LEGEND

- TARMAC PRIVATE ROAD
- RAINGARDEN
- GRAVEL DRIVEWAY WITH COURSE GRADED AGGREGATE SUB-BASE
- PERMEABLE RESIN / PERMEABLE PAVERS
- TRADITIONAL BLOCK PAVING (SERVICE CORRIDOR)
- PAVING SLABS TO ARCHITECTS REQUIREMENTS
- LAWN

- PROPOSED LEVEL
- SITE BOUNDARY
- PLOT BOUNDARY
- SAB BOUNDARY

DRAINAGE LEGEND

- EXISTING COMBINED DRAINAGE
- ADOPTABLE FW DRAINAGE
- PRIVATE FW DRAINAGE
- PRIVATE SW DRAINAGE
- ADOPTABLE SW DRAINAGE (SAB)
- ORIFICE FLOW CONTROL CHAMBER WITH CATCHPIT
- SEL RAIN TAINA FILTER CHAMBER
- DENOTES PERFORATED PIPE
- PROPOSED RAINWATER PIPE
- LINE DRAIN ACO OR SIMILAR
- PRECAST OR COBBLESTONE DISHED CHANNEL
- GEOCELLULAR ATTENUATION TANK POLYSTORM O.S.A
- EXISTING CULVERT

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 (LYONIS FLOS-CUCULI)
- MARSH WOUNDWORT (STACHYS PALUSTRIS)
- SOFT RUSH (JUNCUS EFFUSUS)
- ROYAL FERN (OSMUNDA REGALIS)
- BUGLE (AJUGA REPTANS)
- CHIVES (ALLIUM SCHOENOPRASMUS)

NOTES:

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- 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.

DRAINAGE NOTES:

- MH COVERS AND FRAMES TO CONFORM TO BS EN 124 - HIGHWAYS AND PUBLIC CAR PARKS (D400) - LIGHTLY TRAFFICKED ROADS AND PRIVATE CAR PARKS (C250) - DOMESTIC DRIVEWAYS (B125)
- 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. MEWS DEVELOPMENTS) 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;
 - OTHER 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. 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 CONTRACTOR SHALL INSTALL DRAINS TO THE INVERT LEVELS SHOWN FOR EACH MANHOLE OR OTHER INDICATED POSITION.
- ALL FOUL DRAINAGE TO BE MINIMUM 100mm DIAMETER AND LAID TO THE INVERT LEVELS SHOWN OR A MINIMUM 1 IN 80 FALL, UNLESS OTHERWISE NOTED.
- ALL STORM WATER DRAINAGE TO BE A MINIMUM OF 150mm DIAMETER AND LAID TO THE INVERT LEVELS SHOWN OR A MINIMUM 1 IN 150 FALL, UNLESS OTHERWISE NOTED.
- ALL ADOPTABLE THERMOPLASTIC STRUCTURED WALL SEWER PIPE SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 13476-1 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 8kN/m² (SN8).
- ALL JOINTING IN ACCORDANCE WITH MANUFACTURERS TECHNICAL ADVICE & SPECIFICATION.
- ALL NON ADOPTABLE DRAINAGE TO BE THE STANDARD UPVC 110mm, 160mm DRAINAGE AND MANUFACTURED TO BS EN 1401 AND BS 4660 UNLESS NOTED OTHERWISE.
- SOIL & VENT PIPE LOCATION AND NUMBER TO BE CONFIRMED WITH ARCHITECT.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS DRAWINGS, TOGETHER WITH THEIR LATEST SPECIFICATIONS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER AS SOON AS POSSIBLE.
- FIGURED DIMENSIONS ONLY TO BE USED. ANY QUERIES OR DISCREPANCIES TO BE REFERRED TO THE ENGINEER.
- PRIOR TO ORDERING ANY MATERIALS THE CONTRACTOR IS TO CONFIRM MANUFACTURER/PIPE MATERIAL AND GRADE PROPOSED WITH WATER AUTHORITY.
- DESIGN RISK ASSESSMENTS AND METHOD STATEMENTS ARE TO BE PROVIDED TO THE PRINCIPLE CONTRACTOR PRIOR TO THE COMMENCEMENT OF ANY WORKS.
- THE DEVELOPER MUST SELF-VET AND CERTIFY THAT THE DESIGN CRITERIA, MATERIAL STANDARDS AND WORKMANSHIP SPECIFICATIONS FOR THE PROPOSED ADOPTABLE SEWERS ARE IN ACCORDANCE WITH DEWW AS THE STATUTORY SEWERAGE UNDERTAKER AND THE WELSH MINISTERS BUILD STANDARDS.

01 PRELIMINARY ISSUE

rev. drawn chkd. approved date description

Client
MAXIOM & A JONES

Project
LAND OFF UPPER COLLIERS ROW,
METHRYR TYDFIL, CF48 1UN

Title
PHASE 3
DRAINAGE PLAN



29 Bocan Park, Old Field Road, Pen-coed, Bridgend, CF35 5LJ.
Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk

date	drawn	checked	approved
11.06.24	FP	FP	MJ

scale @ A1
1:200

project no.
19735

status	dr. no.	rev.
P	19735_500	01

DRAWING STATUS
A - Approval, AB - As-Built, C - Construction, D - Draft, P - Preliminary, T - Tender





SCALE 1:20



SCALE 1:20

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.

01	FP	FP	FP	MJ	11.06.24	PRELIMINARY ISSUE			
rev.	drawn	chd.	appr'd	date	description				
Client MAXIOM & A JONES									
Project LAND OFF UPPER COLLIER'S ROW, METHRYR TYDFIL, CF48 1UN									
Title PHASE 3 DRAINAGE DETAILS SHEET 2 OF 2									
 Vale Consultancy 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		
11.06.24	FP			FP	11.06.24			MJ	11.06.24
scale @ A1				project no.					
AS SHOWN				19735					
status	drg. no.							rev.	
P	19735_502							01	

A1



- LEGEND

FLOW EXCEEDANCE ARROW	
CATCHMENT AREA A = 60m ²	
CATCHMENT AREA B = 220m ²	
CATCHMENT AREA C = 200m ²	
CATCHMENT AREA D = 160m ²	
CATCHMENT AREA E = 170m ²	
CATCHMENT AREA F = 180m ²	

DRAINAGE LEGEND

	EXISTING COMBINED DRAINAGE
	ADAPTABLE FW DRAINAGE
	PRIVATE FW DRAINAGE
	PRIVATE SW DRAINAGE
	ADAPTABLE SW DRAINAGE (SAB)
	ORIFICE FLOW CONTROL CHAMBER
	SEL RAINWATER FILTER CHAMBER
	DENOTES PERFORATED PIPE
	RWP/ PROPOSED RAINWATER PIPE
	LINE DRAIN ACO OR SIMILAR
	PRECAST OR COBBLESTONE DISHED CHANNEL
	GEOCELLULAR ATTENUATION TANK POLYSTORM O.S.A
	EXISTING CULVERT

01	rev.	dwn.	chngd.	appr'd.	MJ	18.06.24	PRELIMINARY ISSUE		
							description		
Client MAXIMO & A JONES									
Project LAND OFF UPPER COLLIERIES ROW, METHRYR TYDFIL, CF48 1UN									
Title PHASE 3 CATCHMENT AREAS AND EXCEEDANCE FLOW PLAN									
 Vale Consultancy 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			
11.06.24		FP		FP		11.06.24		MJ	
scale @ A1 1:200				project no. 19735					
status		drg. no.							rev.
P		19735_503							01

DRAWING STATUS
A - Approval, AB - As-Built, C - Construction, D - Draft, P - Preliminary, T - Tender

APPENDIX C: Infiltration Test Report

Infiltration Test For:

Land off Upper Colliers Row,
Heolgerrig,
Merthyr Tydfil,
CF48 1UN

Prepared for:

Maxiom

REF: 11188-SR01

DATE: 11/05/2021

Document Control

Project	Colliers Row, Heolgerrig, Merthyr Tydfil, CF48 1UN
Client	Maxiom
Vale Consultancy Ref:	11188-SR01

Document Checking:

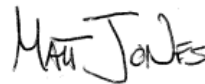
Prepared By: F Payne

Signed:



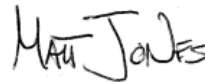
Checked By: M Jones

Signed:



Verified By: M Jones

Signed:



Issue	Date	Status
01	11/05/2021	First issue
02		
03		

1 Contents

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2.1	Trial pit soil conditions	3
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1 Introduction

1.1 Brief

Vale Consultancy has been instructed by Maxiomi (*the client*) to undertake soil infiltration tests to the BRE 365 digest standard at Colliers Row, Heolgerrig, Merthyr Tydfil, CF48 1UN. NGR: SO 03913 06292

Nine trial pits have been proposed around the site to determine the local geology and permeation rates on site. These tests will be approximately 1m³ in size and tested a maximum of 3 times or as many as possible in the timeframe allowed.

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

1.2 Site Investigations

The site is a parcel of undeveloped land located east of the properties of Ty Newydd and Cephas Free Presbyterian Church and to the west of Upper Colliers Row.

The test pits were dug on 2nd March 2021, and the soakaway tests performed on the same day by Matt Jones (chartered engineer for Vale Consultancy). The weather on the day of testing was sunny and dry.

Refer to **Appendix C** – Site photos

2 Site findings

The following tests were performed to the BRE 365 Digest Standard and to the best of the ability of those involved, subject to site constraints and weather conditions.

2.1 Trial pit soil conditions

Nine pits were dug to a depth of approximately 1m without issue. Ground water was not found during the initial dig or between the time they were dug and the subsequent filling. Soils encountered were logged at the following approximate depths:

Pit 1

Topsoil:	0-0.2m	- Topsoil with some roots
Superficial soils:	0.2-1.0m	- Mostly shale mixed with finer gravelly soil
Bedrock:	Not encountered	

Pit 2

Topsoil:	0-0.2m	- Topsoil with some roots
Superficial soils:	0.2-1.0m	- Mostly shale mixed with finer gravelly soil
Bedrock:	Not encountered	

Pit 3

Topsoil:	0-0.2m	- Topsoil with some roots
Superficial soils:	0.2-1.0m	- Mostly shale mixed with finer gravelly soil
Bedrock:	Not encountered	

Pit 4

Topsoil: 0-0.2m - Topsoil with some roots
Superficial soils: 0.2-1.0m - Mostly shale mixed with finer gravelly soil
Bedrock: Not encountered

Pit 5

Topsoil: 0-0.2m - Topsoil with some roots
Superficial soils: 0.2-1.0m - Mostly shale mixed with finer gravelly soil
Bedrock: Not encountered

Pit 6

Topsoil: 0-0.2m - Topsoil
Superficial soils: 0.2-1.0m - Mostly shale mixed with finer gravelly soil
Bedrock: Not encountered

Pit 7

Topsoil: 0-0.2m - Topsoil
Superficial soils: 0.2-1.0m - Loam soil with roots and small stones
Bedrock: Not encountered

Pit 8

Topsoil: 0-0.2m - Topsoil
Superficial soils: 0.2-1.0m - Mostly shale mixed with finer gravelly soil
Bedrock: Not encountered

Pit 9

Topsoil: 0-0.2m - Topsoil
Superficial soils: 0.2-1.0m - Mostly shale mixed with finer gravelly soil
Bedrock: Not encountered

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

Superficial deposits: Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.

Bedrock geology: South Wales Lower Coal Measures Formation - Mudstone, siltstone and sandstone. Sedimentary bedrock formed between 319 and 318 million years ago during the Carboniferous period.

2.2 Test results

The following tests were performed three times in each of the trial pits, and rapid draining was experienced with every test pit, except slower in TP7 due to the trial pit not being deep enough to reach the underlying shale. As such, the results from this trial pit has been disregarded for use in design as proposed soakaways will be constructed within the underlying shale. In some tests the hose filling the trial pits could not run fast enough to effectively fill the trial pits. The lowest F value obtained was **5.95E-05 m/s**.

2.3 Conclusions

Infiltration on site has been found to be a potential option due to the infiltration rates observed. Any proposed soakaways should be constructed within the shale layers where infiltration rates are good.

APPENDIX A: Site Test Plans



APPENDIX B: Infiltration Test Results

Soakaway Test Results - BRE 365 Digest standards

Site: Colliers Row, Merthyr Tydfil

Client: Maxiom

Soakaway Test Results - BRE 365 Digest standards			
Trial Pit 01		Date:	02/03/2021
		Performed by:	Matt Jones (Vale Consultancy)
Dimensions	(m)	Weather:	Dry sunny
Width	0.6	Topsoil:	Topsoil with some roots
Length	1.0	Superficial soil:	Mostly shale mixed with finer gravelly soil
Depth of pit	0.5	Comments:	Trial pits were dug approx. 1m deep but only filled to 0.5m
75% effective depth =	0.38		
25% effective depth =	0.13		

Test No.	Time (min)	Depth (m)			
1	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 0.083$		
	5	0.13	$f =$	1.28571	m/hr
			$f =$	3.57E-04	m/s
2	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 0.083$		
	5	0.13	$f =$	1.28571	m/hr
			$f =$	3.57E-04	m/s
3	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 0.083$		
	5	0.13	$f =$	1.28571	m/hr
			$f =$	3.57E-04	m/s
Lowest infiltration rate =		3.57E-04	m/s		

Soakaway Test Results - BRE 365 Digest standards

Site: Colliers Row, Merthyr Tydfil

Client: Maxiom

Soakaway Test Results - BRE 365 Digest standards			
Trial Pit 02		Date:	02/03/2021
		Performed by:	Matt Jones (Vale Consultancy)
Dimensions	(m)	Weather:	Dry sunny
Width	0.6	Topsoil:	Topsoil with some roots
Length	1.0	Superficial soil:	Mostly shale mixed with finer gravelly soil
Depth of pit	0.5	Comments:	Trial pits were dug approx. 1m deep but only filled to 0.5m
75% effective depth =		0.38	
25% effective depth =		0.13	

Test No.	Time (min)	Depth (m)			
1	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.483		
	29	0.13	f =	0.22167	m/hr
			f =	6.16E-05	m/s
2	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.467		
	28	0.13	f =	0.22959	m/hr
			f =	6.38E-05	m/s
3	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.500		
	30	0.13	f =	0.21429	m/hr
			f =	5.95E-05	m/s
Lowest infiltration rate =					
			5.95E-05	m/s	

Soakaway Test Results - BRE 365 Digest standards

Site: Colliers Row, Merthyr Tydfil

Client: Maxiom

Soakaway Test Results - BRE 365 Digest standards			
Trial Pit 03		Date:	02/03/2021
		Performed by:	Matt Jones (Vale Consultnacy)
Dimensions	(m)	Weather:	Dry sunny
Width	0.6	Topsoil:	Topsoil with some roots
Length	1.0	Superficial soil:	Mostly shale mixed with finer gravelly soil
Depth of pit	0.5	Comments:	Trial pits were dug approx. 1m deep but only filled to 0.5m
75% effective depth =		0.38	
25% effective depth =		0.13	

Test No.	Time (min)	Depth (m)			
1	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.083		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
2	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.083		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
3	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.083		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
Lowest infiltration rate =					
			3.57E-04	m/s	

Soakaway Test Results - BRE 365 Digest standards

Site: Colliers Row, Merthyr Tydfil

Client: Maxiom

Soakaway Test Results - BRE 365 Digest standards			
Trial Pit 04		Date:	02/03/2021
		Performed by:	Matt Jones (Vale Consultancy)
Dimensions	(m)	Weather:	Dry sunny
Width	0.6	Topsoil:	Topsoil with some roots
Length	1.0	Superficial soil:	Mostly shale mixed with finer gravelly soil
Depth of pit	0.5	Comments:	Trial pits were dug approx. 1m deep but only filled to 0.5m
75% effective depth =		0.38	
25% effective depth =		0.13	

Test No.	Time (min)	Depth (m)			
1	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.083		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
2	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.083		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
3	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.083		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
Lowest infiltration rate =					
			3.57E-04	m/s	

Soakaway Test Results - BRE 365 Digest standards

Site: Colliers Row, Merthyr Tydfil

Client: Maxiom

Soakaway Test Results - BRE 365 Digest standards			
Trial Pit 05		Date:	02/03/2021
		Performed by:	Matt Jones (Vale Consultancy)
Dimensions	(m)	Weather:	Dry sunny
Width	0.6	Topsoil:	Topsoil with some roots
Length	1.0	Superficial soil:	Mostly shale mixed with finer gravelly soil
Depth of pit	0.5	Comments:	Trial pits were dug approx. 1m deep but only filled to 0.5m
75% effective depth =		0.38	
25% effective depth =		0.13	

Test No.	Time (min)	Depth (m)			
1	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.433		
	26	0.13	f =	0.24725	m/hr
			f =	6.87E-05	m/s
2	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.483		
	29	0.13	f =	0.22167	m/hr
			f =	6.16E-05	m/s
3	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.500		
	30	0.13	f =	0.21429	m/hr
			f =	5.95E-05	m/s
Lowest infiltration rate =					
			5.95E-05	m/s	

Soakaway Test Results - BRE 365 Digest standards

Site: Colliers Row, Merthyr Tydfil

Client: Maxiom

Soakaway Test Results - BRE 365 Digest standards			
Trial Pit 06		Date:	02/03/2021
		Performed by:	Matt Jones (Vale Consultancy)
Dimensions	(m)	Weather:	Dry sunny
Width	0.6	Topsoil:	Topsoil
Length	1.0	Superficial soil:	Mostly shale mixed with finer gravelly soil
Depth of pit	0.5	Comments:	Trial pits were dug approx. 1m deep but only filled to 0.5m
75% effective depth =		0.38	
25% effective depth =		0.13	

Test No.	Time (min)	Depth (m)			
1	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.083		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
2	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.083		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
3	0	0.38	Vp75-25 (m³) = 0.1500 As50 (m²) = 1.4 tp75-25 (hours) = 0.083		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
Lowest infiltration rate =					
			3.57E-04	m/s	

Soakaway Test Results - BRE 365 Digest standards

Site: Colliers Row, Merthyr Tydfil

Client: Maxiom

Soakaway Test Results - BRE 365 Digest standards			
Trial Pit 07		Date:	02/03/2021
		Performed by:	Matt Jones (Vale Consultancy)
Dimensions	(m)	Weather:	Dry sunny
Width	0.6	Topsoil:	Topsoil with some roots
Length	1.0	Superficial soil:	Loam soil with roots and small stones
Depth of pit	0.5	Comments:	Trial pits were dug approx. 1m deep but only filled to 0.5m
75% effective depth =	0.38		
25% effective depth =	0.13		

Test No.	Time (min)	Depth (m)			
1	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 1.050$		
	63	0.13	$f =$	0.10204	m/hr
			$f =$	2.83E-05	m/s
2	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 1.133$		
	68	0.13	$f =$	0.09454	m/hr
			$f =$	2.63E-05	m/s
3	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 1.200$		
	72	0.13	$f =$	0.08929	m/hr
			$f =$	2.48E-05	m/s
Lowest infiltration rate =		2.48E-05	m/s		

Soakaway Test Results - BRE 365 Digest standards

Site: Colliers Row, Merthyr Tydfil

Client: Maxiom

Soakaway Test Results - BRE 365 Digest standards			
Trial Pit 08		Date:	02/03/2021
		Performed by:	Matt Jones (Vale Consultancy)
Dimensions	(m)	Weather:	Dry sunny
Width	0.6	Topsoil:	Topsoil
Length	1.0	Superficial soil:	Mostly shale mixed with finer gravelly soil
Depth of pit	0.5	Comments:	Trial pits were dug approx. 1m deep but only filled to 0.5m
75% effective depth =	0.38		
25% effective depth =	0.13		

Test No.	Time (min)	Depth (m)			
1	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 0.400$		
	24	0.13	$f =$	0.26786	m/hr
			$f =$	7.44E-05	m/s
2	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 0.433$		
	26	0.13	$f =$	0.24725	m/hr
			$f =$	6.87E-05	m/s
3	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 0.483$		
	29	0.13	$f =$	0.22167	m/hr
			$f =$	6.16E-05	m/s
Lowest infiltration rate =		6.16E-05	m/s		

Soakaway Test Results - BRE 365 Digest standards

Site: Colliers Row, Merthyr Tydfil

Client: Maxiom

Soakaway Test Results - BRE 365 Digest standards			
Trial Pit 09		Date:	02/03/2021
		Performed by:	Matt Jones (Vale Consultancy)
Dimensions	(m)	Weather:	Dry sunny
Width	0.6	Topsoil:	Topsoil
Length	1.0	Superficial soil:	Mostly shale mixed with finer gravelly soil
Depth of pit	0.5	Comments:	Trial pits were dug approx. 1m deep but only filled to 0.5m
75% effective depth =	0.38		
25% effective depth =	0.13		

Test No.	Time (min)	Depth (m)			
1	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 0.083$		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
2	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 0.083$		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
3	0	0.38	$V_{p75-25} \text{ (m}^3\text{)} = 0.1500$ $As_{50} \text{ (m}^2\text{)} = 1.4$ $tp_{75-25} \text{ (hours)} = 0.083$		
	5	0.13	f =	1.28571	m/hr
			f =	3.57E-04	m/s
Lowest infiltration rate =		3.57E-04	m/s		

APPENDIX C: Site Photos



TP1



TP2



TP3



TP4



TP5



TP6



TP7



TP8



TP9

**APPENDIX D: Natural Resource Wales Development Advice Map (DAM) and Flood Risk Assessment
Wales Map (FRAWM)**



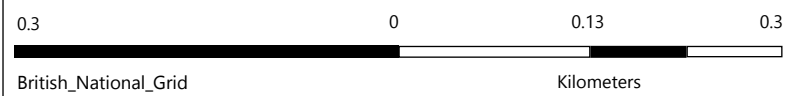
Map Perygl Llifogydd / Flood Risk Map -

Allwedd / Map Key

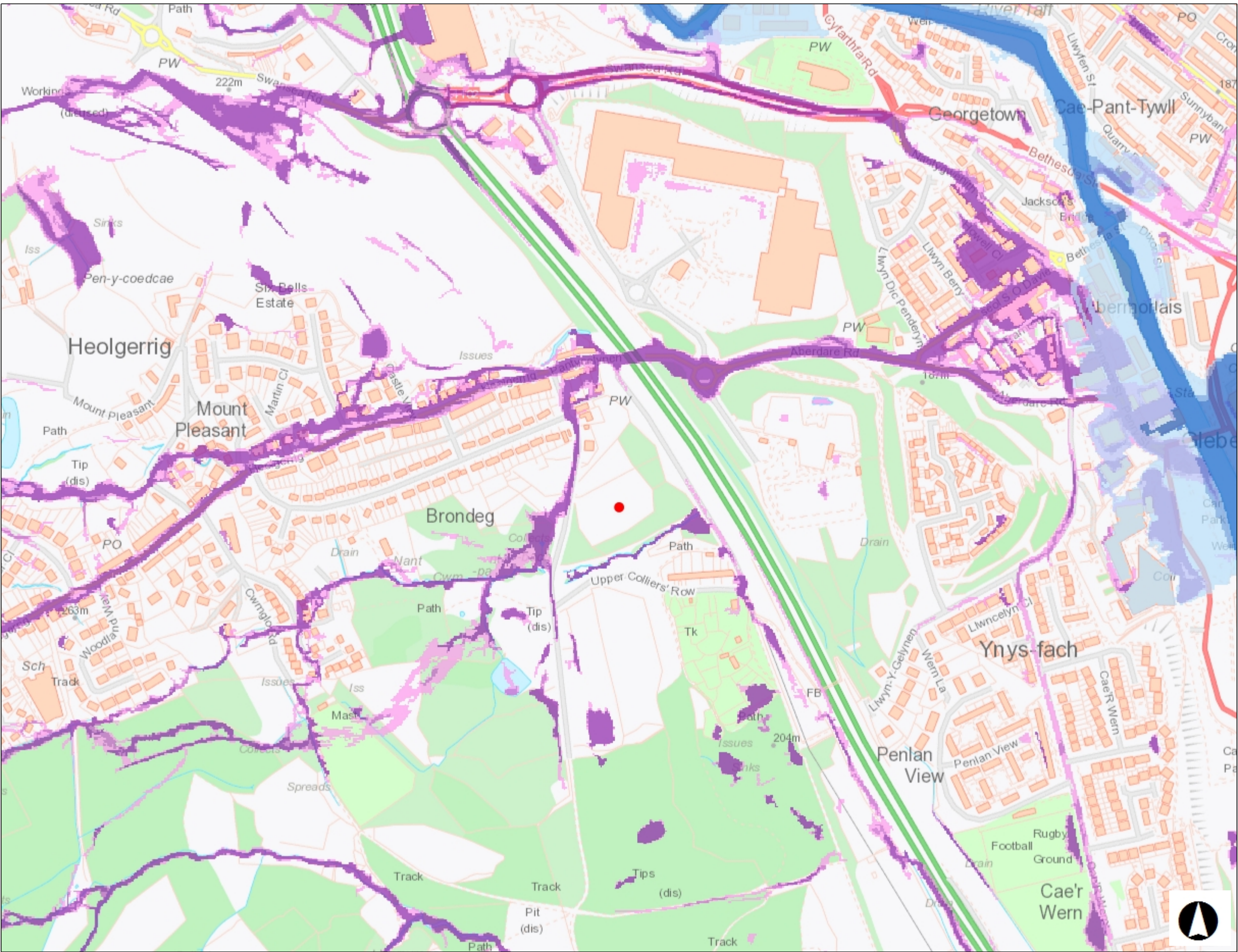
- Zone C1
- Zone C2
- Zone B
- Zone A

Graddfa / Scale at A3 1: 5,000

Dyddiad / Date
12/05/2021



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Map Perygl Llifogydd / Flood Risk Map -

Allwedd / Map Key

 Risk Level Under Review

Flood Risk from Rivers - Extent

-  High
-  Medium
-  Low

Flood Risk from the Sea

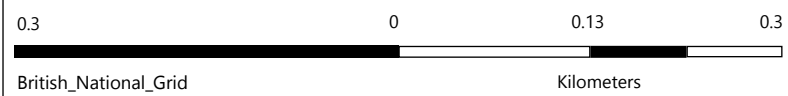
-  High
-  Medium
-  Low

Flood Risk from Surface Water & Small Watercourses - Extent

-  High
-  Medium
-  Low

Graddfa / Scale at A3 1: 5,000

Dyddiad / Date
12/05/2021



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APPENDIX E: Design Calculations

Vale Consultancy					Page 1																																																																																																																																																																																					
29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...																																																																																																																																																																																										
Date 17/06/2024 15:00 File 19735_Plot 5 Drivew...		Designed by freddy.payne Checked by																																																																																																																																																																																								
Innovyze			Source Control 2020.1																																																																																																																																																																																							
Summary of Results for 100 year Return Period (+30%) Half Drain Time : 4 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>209.246</td><td>0.036</td><td>1.8</td><td>0.6</td><td>0 K</td></tr><tr><td>30 min Summer</td><td>209.253</td><td>0.043</td><td>2.2</td><td>0.7</td><td>0 K</td></tr><tr><td>60 min Summer</td><td>209.252</td><td>0.042</td><td>2.1</td><td>0.7</td><td>0 K</td></tr><tr><td>120 min Summer</td><td>209.244</td><td>0.034</td><td>1.7</td><td>0.6</td><td>0 K</td></tr><tr><td>180 min Summer</td><td>209.238</td><td>0.028</td><td>1.4</td><td>0.5</td><td>0 K</td></tr><tr><td>240 min Summer</td><td>209.235</td><td>0.025</td><td>1.3</td><td>0.4</td><td>0 K</td></tr><tr><td>360 min Summer</td><td>209.230</td><td>0.020</td><td>1.0</td><td>0.3</td><td>0 K</td></tr><tr><td>480 min Summer</td><td>209.227</td><td>0.017</td><td>0.9</td><td>0.2</td><td>0 K</td></tr><tr><td>600 min Summer</td><td>209.225</td><td>0.015</td><td>0.7</td><td>0.2</td><td>0 K</td></tr><tr><td>720 min Summer</td><td>209.223</td><td>0.013</td><td>0.7</td><td>0.2</td><td>0 K</td></tr><tr><td>960 min Summer</td><td>209.221</td><td>0.011</td><td>0.6</td><td>0.1</td><td>0 K</td></tr><tr><td>1440 min Summer</td><td>209.219</td><td>0.009</td><td>0.4</td><td>0.1</td><td>0 K</td></tr><tr><td>2160 min Summer</td><td>209.217</td><td>0.007</td><td>0.3</td><td>0.1</td><td>0 K</td></tr><tr><td>2880 min Summer</td><td>209.217</td><td>0.007</td><td>0.3</td><td>0.1</td><td>0 K</td></tr><tr><td>4320 min Summer</td><td>209.216</td><td>0.006</td><td>0.2</td><td>0.0</td><td>0 K</td></tr><tr><td>5760 min Summer</td><td>209.215</td><td>0.005</td><td>0.2</td><td>0.0</td><td>0 K</td></tr><tr><td>7200 min Summer</td><td>209.215</td><td>0.005</td><td>0.2</td><td>0.0</td><td>0 K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>103.740</td><td>0.0</td><td>13</td></tr><tr><td>30 min Summer</td><td>76.034</td><td>0.0</td><td>21</td></tr><tr><td>60 min Summer</td><td>53.146</td><td>0.0</td><td>36</td></tr><tr><td>120 min Summer</td><td>33.827</td><td>0.0</td><td>66</td></tr><tr><td>180 min Summer</td><td>26.096</td><td>0.0</td><td>96</td></tr><tr><td>240 min Summer</td><td>21.723</td><td>0.0</td><td>128</td></tr><tr><td>360 min Summer</td><td>16.736</td><td>0.0</td><td>186</td></tr><tr><td>480 min Summer</td><td>13.856</td><td>0.0</td><td>248</td></tr><tr><td>600 min Summer</td><td>11.939</td><td>0.0</td><td>308</td></tr><tr><td>720 min Summer</td><td>10.555</td><td>0.0</td><td>368</td></tr><tr><td>960 min Summer</td><td>8.661</td><td>0.0</td><td>490</td></tr><tr><td>1440 min Summer</td><td>6.527</td><td>0.0</td><td>732</td></tr><tr><td>2160 min Summer</td><td>4.920</td><td>0.0</td><td>1096</td></tr><tr><td>2880 min Summer</td><td>4.045</td><td>0.0</td><td>1460</td></tr><tr><td>4320 min Summer</td><td>3.108</td><td>0.0</td><td>2132</td></tr><tr><td>5760 min Summer</td><td>2.610</td><td>0.0</td><td>2840</td></tr><tr><td>7200 min Summer</td><td>2.307</td><td>0.0</td><td>3536</td></tr></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	209.246	0.036	1.8	0.6	0 K	30 min Summer	209.253	0.043	2.2	0.7	0 K	60 min Summer	209.252	0.042	2.1	0.7	0 K	120 min Summer	209.244	0.034	1.7	0.6	0 K	180 min Summer	209.238	0.028	1.4	0.5	0 K	240 min Summer	209.235	0.025	1.3	0.4	0 K	360 min Summer	209.230	0.020	1.0	0.3	0 K	480 min Summer	209.227	0.017	0.9	0.2	0 K	600 min Summer	209.225	0.015	0.7	0.2	0 K	720 min Summer	209.223	0.013	0.7	0.2	0 K	960 min Summer	209.221	0.011	0.6	0.1	0 K	1440 min Summer	209.219	0.009	0.4	0.1	0 K	2160 min Summer	209.217	0.007	0.3	0.1	0 K	2880 min Summer	209.217	0.007	0.3	0.1	0 K	4320 min Summer	209.216	0.006	0.2	0.0	0 K	5760 min Summer	209.215	0.005	0.2	0.0	0 K	7200 min Summer	209.215	0.005	0.2	0.0	0 K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	103.740	0.0	13	30 min Summer	76.034	0.0	21	60 min Summer	53.146	0.0	36	120 min Summer	33.827	0.0	66	180 min Summer	26.096	0.0	96	240 min Summer	21.723	0.0	128	360 min Summer	16.736	0.0	186	480 min Summer	13.856	0.0	248	600 min Summer	11.939	0.0	308	720 min Summer	10.555	0.0	368	960 min Summer	8.661	0.0	490	1440 min Summer	6.527	0.0	732	2160 min Summer	4.920	0.0	1096	2880 min Summer	4.045	0.0	1460	4320 min Summer	3.108	0.0	2132	5760 min Summer	2.610	0.0	2840	7200 min Summer	2.307	0.0	3536
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status																																																																																																																																																																																					
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960 min Summer	209.221	0.011	0.6	0.1	0 K																																																																																																																																																																																					
1440 min Summer	209.219	0.009	0.4	0.1	0 K																																																																																																																																																																																					
2160 min Summer	209.217	0.007	0.3	0.1	0 K																																																																																																																																																																																					
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4320 min Summer	209.216	0.006	0.2	0.0	0 K																																																																																																																																																																																					
5760 min Summer	209.215	0.005	0.2	0.0	0 K																																																																																																																																																																																					
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Vale Consultancy					Page 2	
29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...						
Date 17/06/2024 15:00 File 19735_Plot 5 Drivew...		Designed by freddy.payne Checked by				
Innovyze			Source Control 2020.1			
Summary of Results for 100 year Return Period (+30%)						
	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
	8640 min Summer	209.215	0.005	0.1	0.0	0 K
	10080 min Summer	209.215	0.005	0.1	0.0	0 K
	15 min Winter	209.245	0.035	1.8	0.6	0 K
	30 min Winter	209.249	0.039	2.0	0.7	0 K
	60 min Winter	209.245	0.035	1.8	0.6	0 K
	120 min Winter	209.236	0.026	1.3	0.4	0 K
	180 min Winter	209.231	0.021	1.1	0.3	0 K
	240 min Winter	209.228	0.018	0.9	0.3	0 K
	360 min Winter	209.224	0.014	0.7	0.2	0 K
	480 min Winter	209.221	0.011	0.6	0.1	0 K
	600 min Winter	209.220	0.010	0.5	0.1	0 K
	720 min Winter	209.219	0.009	0.4	0.1	0 K
	960 min Winter	209.218	0.008	0.4	0.1	0 K
	1440 min Winter	209.217	0.007	0.3	0.1	0 K
	2160 min Winter	209.216	0.006	0.2	0.0	0 K
	2880 min Winter	209.215	0.005	0.2	0.0	0 K
	4320 min Winter	209.215	0.005	0.1	0.0	0 K
	5760 min Winter	209.214	0.004	0.1	0.0	0 K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
	8640 min Summer	2.101	0.0	4392		
	10080 min Summer	1.953	0.0	5088		
	15 min Winter	103.740	0.0	13		
	30 min Winter	76.034	0.0	21		
	60 min Winter	53.146	0.0	38		
	120 min Winter	33.827	0.0	68		
	180 min Winter	26.096	0.0	98		
	240 min Winter	21.723	0.0	128		
	360 min Winter	16.736	0.0	186		
	480 min Winter	13.856	0.0	250		
	600 min Winter	11.939	0.0	310		
	720 min Winter	10.555	0.0	372		
	960 min Winter	8.661	0.0	490		
	1440 min Winter	6.527	0.0	714		
	2160 min Winter	4.920	0.0	1084		
	2880 min Winter	4.045	0.0	1420		
	4320 min Winter	3.108	0.0	2368		
	5760 min Winter	2.610	0.0	2944		
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...						
Date 17/06/2024 15:00 File 19735_Plot 5 Drivew...		Designed by freddy.payne Checked by				
Innovyze			Source Control 2020.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter		209.214	0.004	0.1	0.0	0 K
8640 min Winter		209.214	0.004	0.1	0.0	0 K
10080 min Winter		209.214	0.004	0.1	0.0	0 K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
7200 min Winter		2.307	0.0	3376		
8640 min Winter		2.101	0.0	4392		
10080 min Winter		1.953	0.0	5072		
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...		
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Innovyze	Source Control 2020.1	
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...		
Date 17/06/2024 15:00 File 19735_Plot 5 Drivew...	Designed by freddy.payne Checked by	
Innovyze	Source Control 2020.1	
Model Details Storage is Online Cover Level (m) 209.490 Porous Car Park Structure Infiltration Coefficient Base (m/hr) 0.21420 Membrane Percolation (mm/hr) 1000 Max Percolation (l/s) 17.8 Safety Factor 1.5 Porosity 0.30 Invert Level (m) 209.210 Width (m) 8.0 Length (m) 8.0 Slope (1:X) 1000.0 Depression Storage (mm) 5 Evaporation (mm/day) 3 Membrane Depth (m) 0		
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...						
Date 06/06/2024 16:53 File 19735_Plot 5 Soakaw...		Designed by freddy.payne Checked by				
Innovyze			Source Control 2020.1			
Summary of Results for 100 year Return Period (+30%)						
Half Drain Time : 112 minutes.						
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	
15 min Summer	208.188	0.518	0.7	5.2	0 K	
30 min Summer	208.399	0.729	0.8	7.3	0 K	
60 min Summer	208.608	0.938	0.9	9.4	0 K	
120 min Summer	208.698	1.028	0.9	10.3	0 K	
180 min Summer	208.741	1.071	1.0	10.7	0 K	
240 min Summer	208.761	1.091	1.0	10.9	0 K	
360 min Summer	208.763	1.093	1.0	10.9	0 K	
480 min Summer	208.743	1.073	1.0	10.7	0 K	
600 min Summer	208.713	1.043	1.0	10.4	0 K	
720 min Summer	208.679	1.009	0.9	10.1	0 K	
960 min Summer	208.606	0.936	0.9	9.3	0 K	
1440 min Summer	208.465	0.795	0.8	7.9	0 K	
2160 min Summer	208.297	0.627	0.7	6.3	0 K	
2880 min Summer	208.170	0.500	0.7	5.0	0 K	
4320 min Summer	208.000	0.330	0.6	3.3	0 K	
5760 min Summer	207.891	0.221	0.5	2.2	0 K	
7200 min Summer	207.821	0.151	0.5	1.5	0 K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)			
15 min Summer	103.740	0.0	18			
30 min Summer	76.034	0.0	33			
60 min Summer	53.146	0.0	60			
120 min Summer	33.827	0.0	98			
180 min Summer	26.096	0.0	132			
240 min Summer	21.723	0.0	166			
360 min Summer	16.736	0.0	236			
480 min Summer	13.856	0.0	306			
600 min Summer	11.939	0.0	374			
720 min Summer	10.555	0.0	442			
960 min Summer	8.661	0.0	576			
1440 min Summer	6.527	0.0	834			
2160 min Summer	4.920	0.0	1208			
2880 min Summer	4.045	0.0	1584			
4320 min Summer	3.108	0.0	2292			
5760 min Summer	2.610	0.0	3008			
7200 min Summer	2.307	0.0	3744			
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...						
Date 06/06/2024 16:53 File 19735_Plot 5 Soakaw...			Designed by freddy.payne Checked by			
Innovyze			Source Control 2020.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
	8640 min Summer	207.773	0.103	0.5	1.0	0 K
	10080 min Summer	207.742	0.072	0.5	0.7	0 K
	15 min Winter	208.189	0.519	0.7	5.2	0 K
	30 min Winter	208.402	0.732	0.8	7.3	0 K
	60 min Winter	208.615	0.945	0.9	9.4	0 K
	120 min Winter	208.702	1.032	0.9	10.3	0 K
	180 min Winter	208.740	1.070	1.0	10.7	0 K
	240 min Winter	208.749	1.079	1.0	10.8	0 K
	360 min Winter	208.725	1.055	1.0	10.5	0 K
	480 min Winter	208.678	1.008	0.9	10.1	0 K
	600 min Winter	208.625	0.955	0.9	9.5	0 K
	720 min Winter	208.569	0.899	0.9	9.0	0 K
	960 min Winter	208.460	0.790	0.8	7.9	0 K
	1440 min Winter	208.272	0.602	0.7	6.0	0 K
	2160 min Winter	208.066	0.396	0.6	3.9	0 K
	2880 min Winter	207.924	0.254	0.5	2.5	0 K
	4320 min Winter	207.754	0.084	0.5	0.8	0 K
	5760 min Winter	207.716	0.046	0.4	0.5	0 K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
	8640 min Summer	2.101	0.0	4416		
	10080 min Summer	1.953	0.0	5144		
	15 min Winter	103.740	0.0	18		
	30 min Winter	76.034	0.0	32		
	60 min Winter	53.146	0.0	60		
	120 min Winter	33.827	0.0	102		
	180 min Winter	26.096	0.0	138		
	240 min Winter	21.723	0.0	178		
	360 min Winter	16.736	0.0	254		
	480 min Winter	13.856	0.0	328		
	600 min Winter	11.939	0.0	398		
	720 min Winter	10.555	0.0	470		
	960 min Winter	8.661	0.0	606		
	1440 min Winter	6.527	0.0	866		
	2160 min Winter	4.920	0.0	1252		
	2880 min Winter	4.045	0.0	1616		
	4320 min Winter	3.108	0.0	2292		
	5760 min Winter	2.610	0.0	2888		
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...						
Date 06/06/2024 16:53 File 19735_Plot 5 Soakaw...		Designed by freddy.payne Checked by				
Innovyze			Source Control 2020.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter		207.710	0.040	0.4	0.4	0 K
8640 min Winter		207.707	0.037	0.3	0.4	0 K
10080 min Winter		207.704	0.034	0.3	0.3	0 K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
7200 min Winter		2.307	0.0	3672		
8640 min Winter		2.101	0.0	4320		
10080 min Winter		1.953	0.0	5048		
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...		
Date 06/06/2024 16:53 File 19735_Plot 5 Soakaw...	Designed by freddy.payne Checked by	
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...																				
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Model Details Storage is Online Cover Level (m) 209.470 Cellular Storage Structure Invert Level (m) 207.670 Infiltration Coefficient Base (m/hr) 0.21420 Infiltration Coefficient Side (m/hr) 0.21420 Safety Factor 1.5 Porosity 0.95 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>10.5</td><td>10.5</td><td>1.201</td><td>0.0</td><td>26.1</td></tr><tr><td>1.200</td><td>10.5</td><td>26.1</td><td></td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	10.5	10.5	1.201	0.0	26.1	1.200	10.5	26.1			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)															
0.000	10.5	10.5	1.201	0.0	26.1															
1.200	10.5	26.1																		
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<u>Summary of Results for 100 year Return Period (+30%)</u> Half Drain Time : 86 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max Overflow (l/s)</th><th>Max Σ Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>204.900</td><td>0.400</td><td>0.0</td><td>0.8</td><td>0.0</td><td>0.8</td><td>4.6</td><td>OK</td></tr><tr><td>30 min Summer</td><td>205.058</td><td>0.558</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>6.4</td><td>OK</td></tr><tr><td>60 min Summer</td><td>205.207</td><td>0.707</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>8.1</td><td>OK</td></tr><tr><td>120 min Summer</td><td>205.267</td><td>0.767</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>8.7</td><td>OK</td></tr><tr><td>180 min Summer</td><td>205.292</td><td>0.792</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>9.0</td><td>OK</td></tr><tr><td>240 min Summer</td><td>205.299</td><td>0.799</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>9.1</td><td>OK</td></tr><tr><td>360 min Summer</td><td>205.287</td><td>0.787</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>9.0</td><td>OK</td></tr><tr><td>480 min Summer</td><td>205.261</td><td>0.761</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>8.7</td><td>OK</td></tr><tr><td>600 min Summer</td><td>205.229</td><td>0.729</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>8.3</td><td>OK</td></tr><tr><td>720 min Summer</td><td>205.196</td><td>0.696</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>7.9</td><td>OK</td></tr><tr><td>960 min Summer</td><td>205.129</td><td>0.629</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>7.2</td><td>OK</td></tr><tr><td>1440 min Summer</td><td>205.012</td><td>0.512</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>5.8</td><td>OK</td></tr><tr><td>2160 min Summer</td><td>204.884</td><td>0.384</td><td>0.0</td><td>0.8</td><td>0.0</td><td>0.8</td><td>4.4</td><td>OK</td></tr><tr><td>2880 min Summer</td><td>204.797</td><td>0.297</td><td>0.0</td><td>0.7</td><td>0.0</td><td>0.7</td><td>3.4</td><td>OK</td></tr><tr><td>4320 min Summer</td><td>204.691</td><td>0.191</td><td>0.0</td><td>0.6</td><td>0.0</td><td>0.6</td><td>2.2</td><td>OK</td></tr><tr><td>5760 min Summer</td><td>204.630</td><td>0.130</td><td>0.0</td><td>0.5</td><td>0.0</td><td>0.5</td><td>1.5</td><td>OK</td></tr><tr><td>7200 min Summer</td><td>204.594</td><td>0.094</td><td>0.0</td><td>0.5</td><td>0.0</td><td>0.5</td><td>1.1</td><td>OK</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Overflow Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>103.740</td><td>0.0</td><td>5.2</td><td>0.0</td><td>18</td></tr><tr><td>30 min Summer</td><td>76.034</td><td>0.0</td><td>7.6</td><td>0.0</td><td>32</td></tr><tr><td>60 min Summer</td><td>53.146</td><td>0.0</td><td>10.6</td><td>0.0</td><td>60</td></tr><tr><td>120 min Summer</td><td>33.827</td><td>0.0</td><td>13.5</td><td>0.0</td><td>92</td></tr><tr><td>180 min Summer</td><td>26.096</td><td>0.0</td><td>15.7</td><td>0.0</td><td>126</td></tr><tr><td>240 min Summer</td><td>21.723</td><td>0.0</td><td>17.4</td><td>0.0</td><td>162</td></tr><tr><td>360 min Summer</td><td>16.736</td><td>0.0</td><td>20.1</td><td>0.0</td><td>230</td></tr><tr><td>480 min Summer</td><td>13.856</td><td>0.0</td><td>22.2</td><td>0.0</td><td>300</td></tr><tr><td>600 min Summer</td><td>11.939</td><td>0.0</td><td>23.9</td><td>0.0</td><td>366</td></tr><tr><td>720 min Summer</td><td>10.555</td><td>0.0</td><td>25.3</td><td>0.0</td><td>432</td></tr><tr><td>960 min Summer</td><td>8.661</td><td>0.0</td><td>27.7</td><td>0.0</td><td>560</td></tr><tr><td>1440 min Summer</td><td>6.527</td><td>0.0</td><td>31.3</td><td>0.0</td><td>810</td></tr><tr><td>2160 min Summer</td><td>4.920</td><td>0.0</td><td>35.4</td><td>0.0</td><td>1172</td></tr><tr><td>2880 min Summer</td><td>4.045</td><td>0.0</td><td>38.8</td><td>0.0</td><td>1532</td></tr><tr><td>4320 min Summer</td><td>3.108</td><td>0.0</td><td>44.7</td><td>0.0</td><td>2252</td></tr><tr><td>5760 min Summer</td><td>2.610</td><td>0.0</td><td>50.1</td><td>0.0</td><td>2992</td></tr><tr><td>7200 min Summer</td><td>2.307</td><td>0.0</td><td>55.4</td><td>0.0</td><td>3680</td></tr></table>									Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	204.900	0.400	0.0	0.8	0.0	0.8	4.6	OK	30 min Summer	205.058	0.558	0.0	0.9	0.0	0.9	6.4	OK	60 min Summer	205.207	0.707	0.0	1.0	0.0	1.0	8.1	OK	120 min Summer	205.267	0.767	0.0	1.0	0.0	1.0	8.7	OK	180 min Summer	205.292	0.792	0.0	1.0	0.0	1.0	9.0	OK	240 min Summer	205.299	0.799	0.0	1.0	0.0	1.0	9.1	OK	360 min Summer	205.287	0.787	0.0	1.0	0.0	1.0	9.0	OK	480 min Summer	205.261	0.761	0.0	1.0	0.0	1.0	8.7	OK	600 min Summer	205.229	0.729	0.0	1.0	0.0	1.0	8.3	OK	720 min Summer	205.196	0.696	0.0	1.0	0.0	1.0	7.9	OK	960 min Summer	205.129	0.629	0.0	0.9	0.0	0.9	7.2	OK	1440 min Summer	205.012	0.512	0.0	0.9	0.0	0.9	5.8	OK	2160 min Summer	204.884	0.384	0.0	0.8	0.0	0.8	4.4	OK	2880 min Summer	204.797	0.297	0.0	0.7	0.0	0.7	3.4	OK	4320 min Summer	204.691	0.191	0.0	0.6	0.0	0.6	2.2	OK	5760 min Summer	204.630	0.130	0.0	0.5	0.0	0.5	1.5	OK	7200 min Summer	204.594	0.094	0.0	0.5	0.0	0.5	1.1	OK	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)	15 min Summer	103.740	0.0	5.2	0.0	18	30 min Summer	76.034	0.0	7.6	0.0	32	60 min Summer	53.146	0.0	10.6	0.0	60	120 min Summer	33.827	0.0	13.5	0.0	92	180 min Summer	26.096	0.0	15.7	0.0	126	240 min Summer	21.723	0.0	17.4	0.0	162	360 min Summer	16.736	0.0	20.1	0.0	230	480 min Summer	13.856	0.0	22.2	0.0	300	600 min Summer	11.939	0.0	23.9	0.0	366	720 min Summer	10.555	0.0	25.3	0.0	432	960 min Summer	8.661	0.0	27.7	0.0	560	1440 min Summer	6.527	0.0	31.3	0.0	810	2160 min Summer	4.920	0.0	35.4	0.0	1172	2880 min Summer	4.045	0.0	38.8	0.0	1532	4320 min Summer	3.108	0.0	44.7	0.0	2252	5760 min Summer	2.610	0.0	50.1	0.0	2992	7200 min Summer	2.307	0.0	55.4	0.0	3680
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																																																																														
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Innovyze				Source Control 2020.1					
<u>Summary of Results for 100 year Return Period (+30%)</u>									
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	
8640 min Summer	204.570	0.070	0.0	0.4	0.0	0.4	0.8	0 K	
10080 min Summer	204.552	0.052	0.0	0.4	0.0	0.4	0.6	0 K	
15 min Winter	204.901	0.401	0.0	0.8	0.0	0.8	4.6	0 K	
30 min Winter	205.060	0.560	0.0	0.9	0.0	0.9	6.4	0 K	
60 min Winter	205.212	0.712	0.0	1.0	0.0	1.0	8.1	0 K	
120 min Winter	205.266	0.766	0.0	1.0	0.0	1.0	8.7	0 K	
180 min Winter	205.282	0.782	0.0	1.0	0.0	1.0	8.9	0 K	
240 min Winter	205.277	0.777	0.0	1.0	0.0	1.0	8.9	0 K	
360 min Winter	205.240	0.740	0.0	1.0	0.0	1.0	8.4	0 K	
480 min Winter	205.189	0.689	0.0	1.0	0.0	1.0	7.9	0 K	
600 min Winter	205.138	0.638	0.0	0.9	0.0	0.9	7.3	0 K	
720 min Winter	205.088	0.588	0.0	0.9	0.0	0.9	6.7	0 K	
960 min Winter	204.997	0.497	0.0	0.8	0.0	0.8	5.7	0 K	
1440 min Winter	204.855	0.355	0.0	0.7	0.0	0.7	4.0	0 K	
2160 min Winter	204.721	0.221	0.0	0.6	0.0	0.6	2.5	0 K	
2880 min Winter	204.642	0.142	0.0	0.5	0.0	0.5	1.6	0 K	
4320 min Winter	204.559	0.059	0.0	0.4	0.0	0.4	0.7	0 K	
5760 min Winter	204.519	0.019	0.0	0.4	0.0	0.4	0.2	0 K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)				
8640 min Summer	2.101	0.0	60.5	0.0	4408				
10080 min Summer	1.953	0.0	65.6	0.0	5144				
15 min Winter	103.740	0.0	5.2	0.0	18				
30 min Winter	76.034	0.0	7.6	0.0	32				
60 min Winter	53.146	0.0	10.6	0.0	58				
120 min Winter	33.827	0.0	13.5	0.0	96				
180 min Winter	26.096	0.0	15.7	0.0	134				
240 min Winter	21.723	0.0	17.4	0.0	172				
360 min Winter	16.736	0.0	20.1	0.0	248				
480 min Winter	13.856	0.0	22.2	0.0	318				
600 min Winter	11.939	0.0	23.9	0.0	388				
720 min Winter	10.555	0.0	25.3	0.0	456				
960 min Winter	8.661	0.0	27.7	0.0	586				
1440 min Winter	6.527	0.0	31.3	0.0	838				
2160 min Winter	4.920	0.0	35.4	0.0	1196				
2880 min Winter	4.045	0.0	38.8	0.0	1556				
4320 min Winter	3.108	0.0	44.7	0.0	2252				
5760 min Winter	2.610	0.0	50.1	0.0	2992				
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...																																																																				
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Summary of Results for 100 year Return Period (+30%) <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max Overflow (l/s)</th><th>Max Σ Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>7200 min Winter</td><td>204.500</td><td>0.000</td><td>0.0</td><td>0.3</td><td>0.0</td><td>0.3</td><td>0.0</td><td>OK</td></tr><tr><td>8640 min Winter</td><td>204.500</td><td>0.000</td><td>0.0</td><td>0.3</td><td>0.0</td><td>0.3</td><td>0.0</td><td>OK</td></tr><tr><td>10080 min Winter</td><td>204.500</td><td>0.000</td><td>0.0</td><td>0.3</td><td>0.0</td><td>0.3</td><td>0.0</td><td>OK</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Overflow Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>7200 min Winter</td><td>2.307</td><td>0.0</td><td>55.4</td><td>0.0</td><td>0</td></tr><tr><td>8640 min Winter</td><td>2.101</td><td>0.0</td><td>60.5</td><td>0.0</td><td>0</td></tr><tr><td>10080 min Winter</td><td>1.953</td><td>0.0</td><td>65.6</td><td>0.0</td><td>0</td></tr></table>									Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	7200 min Winter	204.500	0.000	0.0	0.3	0.0	0.3	0.0	OK	8640 min Winter	204.500	0.000	0.0	0.3	0.0	0.3	0.0	OK	10080 min Winter	204.500	0.000	0.0	0.3	0.0	0.3	0.0	OK	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)	7200 min Winter	2.307	0.0	55.4	0.0	0	8640 min Winter	2.101	0.0	60.5	0.0	0	10080 min Winter	1.953	0.0	65.6	0.0	0
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status																																																												
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29 Bocam Park Old Field Road, Pencoed Bridgend, Glamorgan, CF3...		
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Date 07/06/2024 11:23 File 19735_Plot 8 Attenu...	Designed by freddy.payne Checked by	
Innovyze		Source Control 2020.1

Model Details

Storage is Online Cover Level (m) 205.900

Cellular Storage Structure

Invert Level (m) 204.500
Infiltration Coefficient Base (m/hr) 0.00000
Infiltration Coefficient Side (m/hr) 0.00000
Safety Factor 2.0
Porosity 0.95

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	12.0	12.0	0.801	0.0	23.1
0.800	12.0	23.1			

Orifice Outflow Control

Diameter (m) 0.023 Invert Level (m) 204.400
Discharge Coefficient 0.600

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 205.300

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Summary of Results for 100 year Return Period (+30%) Half Drain Time : 70 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max Overflow (l/s)</th><th>Max Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>204.881</td><td>0.401</td><td>0.0</td><td>0.8</td><td>0.0</td><td>0.8</td><td>3.8</td><td>OK</td></tr><tr><td>30 min Summer</td><td>205.035</td><td>0.555</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>5.3</td><td>OK</td></tr><tr><td>60 min Summer</td><td>205.173</td><td>0.693</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>6.6</td><td>OK</td></tr><tr><td>120 min Summer</td><td>205.226</td><td>0.746</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>7.1</td><td>OK</td></tr><tr><td>180 min Summer</td><td>205.244</td><td>0.764</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>7.3</td><td>OK</td></tr><tr><td>240 min Summer</td><td>205.244</td><td>0.764</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>7.3</td><td>OK</td></tr><tr><td>360 min Summer</td><td>205.223</td><td>0.743</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>7.1</td><td>OK</td></tr><tr><td>480 min Summer</td><td>205.189</td><td>0.709</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>6.7</td><td>OK</td></tr><tr><td>600 min Summer</td><td>205.152</td><td>0.672</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>6.4</td><td>OK</td></tr><tr><td>720 min Summer</td><td>205.114</td><td>0.634</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>6.0</td><td>OK</td></tr><tr><td>960 min Summer</td><td>205.043</td><td>0.563</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>5.3</td><td>OK</td></tr><tr><td>1440 min Summer</td><td>204.925</td><td>0.445</td><td>0.0</td><td>0.8</td><td>0.0</td><td>0.8</td><td>4.2</td><td>OK</td></tr><tr><td>2160 min Summer</td><td>204.802</td><td>0.322</td><td>0.0</td><td>0.7</td><td>0.0</td><td>0.7</td><td>3.1</td><td>OK</td></tr><tr><td>2880 min Summer</td><td>204.723</td><td>0.243</td><td>0.0</td><td>0.6</td><td>0.0</td><td>0.6</td><td>2.3</td><td>OK</td></tr><tr><td>4320 min Summer</td><td>204.630</td><td>0.150</td><td>0.0</td><td>0.5</td><td>0.0</td><td>0.5</td><td>1.4</td><td>OK</td></tr><tr><td>5760 min Summer</td><td>204.580</td><td>0.100</td><td>0.0</td><td>0.5</td><td>0.0</td><td>0.5</td><td>1.0</td><td>OK</td></tr><tr><td>7200 min Summer</td><td>204.550</td><td>0.070</td><td>0.0</td><td>0.4</td><td>0.0</td><td>0.4</td><td>0.7</td><td>OK</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Overflow Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>103.740</td><td>0.0</td><td>4.4</td><td>0.0</td><td>18</td></tr><tr><td>30 min Summer</td><td>76.034</td><td>0.0</td><td>6.5</td><td>0.0</td><td>32</td></tr><tr><td>60 min Summer</td><td>53.146</td><td>0.0</td><td>9.0</td><td>0.0</td><td>56</td></tr><tr><td>120 min Summer</td><td>33.827</td><td>0.0</td><td>11.5</td><td>0.0</td><td>88</td></tr><tr><td>180 min Summer</td><td>26.096</td><td>0.0</td><td>13.3</td><td>0.0</td><td>124</td></tr><tr><td>240 min Summer</td><td>21.723</td><td>0.0</td><td>14.8</td><td>0.0</td><td>158</td></tr><tr><td>360 min Summer</td><td>16.736</td><td>0.0</td><td>17.1</td><td>0.0</td><td>226</td></tr><tr><td>480 min Summer</td><td>13.856</td><td>0.0</td><td>18.8</td><td>0.0</td><td>294</td></tr><tr><td>600 min Summer</td><td>11.939</td><td>0.0</td><td>20.3</td><td>0.0</td><td>360</td></tr><tr><td>720 min Summer</td><td>10.555</td><td>0.0</td><td>21.5</td><td>0.0</td><td>426</td></tr><tr><td>960 min Summer</td><td>8.661</td><td>0.0</td><td>23.6</td><td>0.0</td><td>550</td></tr><tr><td>1440 min Summer</td><td>6.527</td><td>0.0</td><td>26.6</td><td>0.0</td><td>796</td></tr><tr><td>2160 min Summer</td><td>4.920</td><td>0.0</td><td>30.1</td><td>0.0</td><td>1164</td></tr><tr><td>2880 min Summer</td><td>4.045</td><td>0.0</td><td>33.0</td><td>0.0</td><td>1528</td></tr><tr><td>4320 min Summer</td><td>3.108</td><td>0.0</td><td>38.0</td><td>0.0</td><td>2248</td></tr><tr><td>5760 min Summer</td><td>2.610</td><td>0.0</td><td>42.6</td><td>0.0</td><td>2944</td></tr><tr><td>7200 min Summer</td><td>2.307</td><td>0.0</td><td>47.0</td><td>0.0</td><td>3672</td></tr></table>									Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	204.881	0.401	0.0	0.8	0.0	0.8	3.8	OK	30 min Summer	205.035	0.555	0.0	0.9	0.0	0.9	5.3	OK	60 min Summer	205.173	0.693	0.0	1.0	0.0	1.0	6.6	OK	120 min Summer	205.226	0.746	0.0	1.0	0.0	1.0	7.1	OK	180 min Summer	205.244	0.764	0.0	1.0	0.0	1.0	7.3	OK	240 min Summer	205.244	0.764	0.0	1.0	0.0	1.0	7.3	OK	360 min Summer	205.223	0.743	0.0	1.0	0.0	1.0	7.1	OK	480 min Summer	205.189	0.709	0.0	1.0	0.0	1.0	6.7	OK	600 min Summer	205.152	0.672	0.0	1.0	0.0	1.0	6.4	OK	720 min Summer	205.114	0.634	0.0	0.9	0.0	0.9	6.0	OK	960 min Summer	205.043	0.563	0.0	0.9	0.0	0.9	5.3	OK	1440 min Summer	204.925	0.445	0.0	0.8	0.0	0.8	4.2	OK	2160 min Summer	204.802	0.322	0.0	0.7	0.0	0.7	3.1	OK	2880 min Summer	204.723	0.243	0.0	0.6	0.0	0.6	2.3	OK	4320 min Summer	204.630	0.150	0.0	0.5	0.0	0.5	1.4	OK	5760 min Summer	204.580	0.100	0.0	0.5	0.0	0.5	1.0	OK	7200 min Summer	204.550	0.070	0.0	0.4	0.0	0.4	0.7	OK	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)	15 min Summer	103.740	0.0	4.4	0.0	18	30 min Summer	76.034	0.0	6.5	0.0	32	60 min Summer	53.146	0.0	9.0	0.0	56	120 min Summer	33.827	0.0	11.5	0.0	88	180 min Summer	26.096	0.0	13.3	0.0	124	240 min Summer	21.723	0.0	14.8	0.0	158	360 min Summer	16.736	0.0	17.1	0.0	226	480 min Summer	13.856	0.0	18.8	0.0	294	600 min Summer	11.939	0.0	20.3	0.0	360	720 min Summer	10.555	0.0	21.5	0.0	426	960 min Summer	8.661	0.0	23.6	0.0	550	1440 min Summer	6.527	0.0	26.6	0.0	796	2160 min Summer	4.920	0.0	30.1	0.0	1164	2880 min Summer	4.045	0.0	33.0	0.0	1528	4320 min Summer	3.108	0.0	38.0	0.0	2248	5760 min Summer	2.610	0.0	42.6	0.0	2944	7200 min Summer	2.307	0.0	47.0	0.0	3672
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																																																																														
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Winter</td><td>205.221</td><td>0.741</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>7.0</td><td>0 K</td></tr><tr><td>180 min Winter</td><td>205.226</td><td>0.746</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>7.1</td><td>0 K</td></tr><tr><td>240 min Winter</td><td>205.212</td><td>0.732</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>7.0</td><td>0 K</td></tr><tr><td>360 min Winter</td><td>205.162</td><td>0.682</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>6.5</td><td>0 K</td></tr><tr><td>480 min Winter</td><td>205.104</td><td>0.624</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>5.9</td><td>0 K</td></tr><tr><td>600 min Winter</td><td>205.048</td><td>0.568</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>5.4</td><td>0 K</td></tr><tr><td>720 min Winter</td><td>204.996</td><td>0.516</td><td>0.0</td><td>0.8</td><td>0.0</td><td>0.8</td><td>4.9</td><td>0 K</td></tr><tr><td>960 min Winter</td><td>204.904</td><td>0.424</td><td>0.0</td><td>0.8</td><td>0.0</td><td>0.8</td><td>4.0</td><td>0 K</td></tr><tr><td>1440 min Winter</td><td>204.770</td><td>0.290</td><td>0.0</td><td>0.7</td><td>0.0</td><td>0.7</td><td>2.8</td><td>0 K</td></tr><tr><td>2160 min Winter</td><td>204.651</td><td>0.171</td><td>0.0</td><td>0.5</td><td>0.0</td><td>0.5</td><td>1.6</td><td>0 K</td></tr><tr><td>2880 min Winter</td><td>204.586</td><td>0.106</td><td>0.0</td><td>0.5</td><td>0.0</td><td>0.5</td><td>1.0</td><td>0 K</td></tr><tr><td>4320 min Winter</td><td>204.521</td><td>0.041</td><td>0.0</td><td>0.4</td><td>0.0</td><td>0.4</td><td>0.4</td><td>0 K</td></tr><tr><td>5760 min Winter</td><td>204.490</td><td>0.010</td><td>0.0</td><td>0.3</td><td>0.0</td><td>0.3</td><td>0.1</td><td>0 K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Overflow Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>8640 min Summer</td><td>2.101</td><td>0.0</td><td>51.4</td><td>0.0</td><td>4408</td></tr><tr><td>10080 min Summer</td><td>1.953</td><td>0.0</td><td>55.8</td><td>0.0</td><td>5136</td></tr><tr><td>15 min Winter</td><td>103.740</td><td>0.0</td><td>4.4</td><td>0.0</td><td>18</td></tr><tr><td>30 min Winter</td><td>76.034</td><td>0.0</td><td>6.5</td><td>0.0</td><td>31</td></tr><tr><td>60 min Winter</td><td>53.146</td><td>0.0</td><td>9.0</td><td>0.0</td><td>58</td></tr><tr><td>120 min Winter</td><td>33.827</td><td>0.0</td><td>11.5</td><td>0.0</td><td>92</td></tr><tr><td>180 min Winter</td><td>26.096</td><td>0.0</td><td>13.3</td><td>0.0</td><td>132</td></tr><tr><td>240 min Winter</td><td>21.723</td><td>0.0</td><td>14.8</td><td>0.0</td><td>170</td></tr><tr><td>360 min Winter</td><td>16.736</td><td>0.0</td><td>17.1</td><td>0.0</td><td>242</td></tr><tr><td>480 min Winter</td><td>13.856</td><td>0.0</td><td>18.9</td><td>0.0</td><td>312</td></tr><tr><td>600 min Winter</td><td>11.939</td><td>0.0</td><td>20.3</td><td>0.0</td><td>378</td></tr><tr><td>720 min Winter</td><td>10.555</td><td>0.0</td><td>21.5</td><td>0.0</td><td>444</td></tr><tr><td>960 min Winter</td><td>8.661</td><td>0.0</td><td>23.6</td><td>0.0</td><td>570</td></tr><tr><td>1440 min Winter</td><td>6.527</td><td>0.0</td><td>26.6</td><td>0.0</td><td>822</td></tr><tr><td>2160 min Winter</td><td>4.920</td><td>0.0</td><td>30.1</td><td>0.0</td><td>1172</td></tr><tr><td>2880 min Winter</td><td>4.045</td><td>0.0</td><td>33.0</td><td>0.0</td><td>1528</td></tr><tr><td>4320 min Winter</td><td>3.108</td><td>0.0</td><td>38.0</td><td>0.0</td><td>2248</td></tr><tr><td>5760 min Winter</td><td>2.610</td><td>0.0</td><td>42.6</td><td>0.0</td><td>2944</td></tr></table>									Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	8640 min Summer	204.530	0.050	0.0	0.4	0.0	0.4	0.5	0 K	10080 min Summer	204.516	0.036	0.0	0.4	0.0	0.4	0.3	0 K	15 min Winter	204.882	0.402	0.0	0.8	0.0	0.8	3.8	0 K	30 min Winter	205.038	0.558	0.0	0.9	0.0	0.9	5.3	0 K	60 min Winter	205.179	0.699	0.0	1.0	0.0	1.0	6.6	0 K	120 min Winter	205.221	0.741	0.0	1.0	0.0	1.0	7.0	0 K	180 min Winter	205.226	0.746	0.0	1.0	0.0	1.0	7.1	0 K	240 min Winter	205.212	0.732	0.0	1.0	0.0	1.0	7.0	0 K	360 min Winter	205.162	0.682	0.0	1.0	0.0	1.0	6.5	0 K	480 min Winter	205.104	0.624	0.0	0.9	0.0	0.9	5.9	0 K	600 min Winter	205.048	0.568	0.0	0.9	0.0	0.9	5.4	0 K	720 min Winter	204.996	0.516	0.0	0.8	0.0	0.8	4.9	0 K	960 min Winter	204.904	0.424	0.0	0.8	0.0	0.8	4.0	0 K	1440 min Winter	204.770	0.290	0.0	0.7	0.0	0.7	2.8	0 K	2160 min Winter	204.651	0.171	0.0	0.5	0.0	0.5	1.6	0 K	2880 min Winter	204.586	0.106	0.0	0.5	0.0	0.5	1.0	0 K	4320 min Winter	204.521	0.041	0.0	0.4	0.0	0.4	0.4	0 K	5760 min Winter	204.490	0.010	0.0	0.3	0.0	0.3	0.1	0 K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)	8640 min Summer	2.101	0.0	51.4	0.0	4408	10080 min Summer	1.953	0.0	55.8	0.0	5136	15 min Winter	103.740	0.0	4.4	0.0	18	30 min Winter	76.034	0.0	6.5	0.0	31	60 min Winter	53.146	0.0	9.0	0.0	58	120 min Winter	33.827	0.0	11.5	0.0	92	180 min Winter	26.096	0.0	13.3	0.0	132	240 min Winter	21.723	0.0	14.8	0.0	170	360 min Winter	16.736	0.0	17.1	0.0	242	480 min Winter	13.856	0.0	18.9	0.0	312	600 min Winter	11.939	0.0	20.3	0.0	378	720 min Winter	10.555	0.0	21.5	0.0	444	960 min Winter	8.661	0.0	23.6	0.0	570	1440 min Winter	6.527	0.0	26.6	0.0	822	2160 min Winter	4.920	0.0	30.1	0.0	1172	2880 min Winter	4.045	0.0	33.0	0.0	1528	4320 min Winter	3.108	0.0	38.0	0.0	2248	5760 min Winter	2.610	0.0	42.6	0.0	2944
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																																																																																													
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Innovyze		Source Control 2020.1

Model Details

Storage is Online Cover Level (m) 205.880

Cellular Storage Structure

Invert Level (m) 204.480
Infiltration Coefficient Base (m/hr) 0.00000
Infiltration Coefficient Side (m/hr) 0.00000
Safety Factor 2.0
Porosity 0.95

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	10.0	10.0	0.801	0.0	20.1
0.800	10.0	20.1			

Orifice Outflow Control

Diameter (m) 0.023 Invert Level (m) 204.400
Discharge Coefficient 0.600

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 205.280

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<u>Summary of Results for 100 year Return Period (+30%)</u> Half Drain Time : 87 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max Overflow (l/s)</th><th>Max Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>204.827</td><td>0.397</td><td>0.0</td><td>0.7</td><td>0.0</td><td>0.7</td><td>4.2</td><td>OK</td></tr><tr><td>30 min Summer</td><td>204.982</td><td>0.552</td><td>0.0</td><td>0.8</td><td>0.0</td><td>0.8</td><td>5.8</td><td>OK</td></tr><tr><td>60 min Summer</td><td>205.128</td><td>0.698</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>7.3</td><td>OK</td></tr><tr><td>120 min Summer</td><td>205.191</td><td>0.761</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>8.0</td><td>OK</td></tr><tr><td>180 min Summer</td><td>205.220</td><td>0.790</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>8.3</td><td>OK</td></tr><tr><td>240 min Summer</td><td>205.229</td><td>0.799</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>8.3</td><td>OK</td></tr><tr><td>360 min Summer</td><td>205.219</td><td>0.789</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>8.2</td><td>OK</td></tr><tr><td>480 min Summer</td><td>205.192</td><td>0.762</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>8.0</td><td>OK</td></tr><tr><td>600 min Summer</td><td>205.159</td><td>0.729</td><td>0.0</td><td>1.0</td><td>0.0</td><td>1.0</td><td>7.6</td><td>OK</td></tr><tr><td>720 min Summer</td><td>205.124</td><td>0.694</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>7.3</td><td>OK</td></tr><tr><td>960 min Summer</td><td>205.057</td><td>0.627</td><td>0.0</td><td>0.9</td><td>0.0</td><td>0.9</td><td>6.6</td><td>OK</td></tr><tr><td>1440 min Summer</td><td>204.944</td><td>0.514</td><td>0.0</td><td>0.8</td><td>0.0</td><td>0.8</td><td>5.4</td><td>OK</td></tr><tr><td>2160 min Summer</td><td>204.824</td><td>0.394</td><td>0.0</td><td>0.7</td><td>0.0</td><td>0.7</td><td>4.1</td><td>OK</td></tr><tr><td>2880 min Summer</td><td>204.744</td><td>0.314</td><td>0.0</td><td>0.6</td><td>0.0</td><td>0.6</td><td>3.3</td><td>OK</td></tr><tr><td>4320 min Summer</td><td>204.649</td><td>0.219</td><td>0.0</td><td>0.5</td><td>0.0</td><td>0.5</td><td>2.3</td><td>OK</td></tr><tr><td>5760 min Summer</td><td>204.595</td><td>0.165</td><td>0.0</td><td>0.5</td><td>0.0</td><td>0.5</td><td>1.7</td><td>OK</td></tr><tr><td>7200 min Summer</td><td>204.564</td><td>0.134</td><td>0.0</td><td>0.4</td><td>0.0</td><td>0.4</td><td>1.4</td><td>OK</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Overflow Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>103.740</td><td>0.0</td><td>4.7</td><td>0.0</td><td>18</td></tr><tr><td>30 min Summer</td><td>76.034</td><td>0.0</td><td>6.8</td><td>0.0</td><td>32</td></tr><tr><td>60 min Summer</td><td>53.146</td><td>0.0</td><td>9.6</td><td>0.0</td><td>58</td></tr><tr><td>120 min Summer</td><td>33.827</td><td>0.0</td><td>12.2</td><td>0.0</td><td>90</td></tr><tr><td>180 min Summer</td><td>26.096</td><td>0.0</td><td>14.1</td><td>0.0</td><td>124</td></tr><tr><td>240 min Summer</td><td>21.723</td><td>0.0</td><td>15.6</td><td>0.0</td><td>160</td></tr><tr><td>360 min Summer</td><td>16.736</td><td>0.0</td><td>18.1</td><td>0.0</td><td>228</td></tr><tr><td>480 min Summer</td><td>13.856</td><td>0.0</td><td>19.9</td><td>0.0</td><td>296</td></tr><tr><td>600 min Summer</td><td>11.939</td><td>0.0</td><td>21.5</td><td>0.0</td><td>362</td></tr><tr><td>720 min Summer</td><td>10.555</td><td>0.0</td><td>22.8</td><td>0.0</td><td>428</td></tr><tr><td>960 min Summer</td><td>8.661</td><td>0.0</td><td>24.9</td><td>0.0</td><td>558</td></tr><tr><td>1440 min Summer</td><td>6.527</td><td>0.0</td><td>28.2</td><td>0.0</td><td>806</td></tr><tr><td>2160 min Summer</td><td>4.920</td><td>0.0</td><td>31.9</td><td>0.0</td><td>1168</td></tr><tr><td>2880 min Summer</td><td>4.045</td><td>0.0</td><td>34.9</td><td>0.0</td><td>1528</td></tr><tr><td>4320 min Summer</td><td>3.108</td><td>0.0</td><td>40.3</td><td>0.0</td><td>2248</td></tr><tr><td>5760 min Summer</td><td>2.610</td><td>0.0</td><td>45.1</td><td>0.0</td><td>2944</td></tr><tr><td>7200 min Summer</td><td>2.307</td><td>0.0</td><td>49.8</td><td>0.0</td><td>3680</td></tr></table>									Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	204.827	0.397	0.0	0.7	0.0	0.7	4.2	OK	30 min Summer	204.982	0.552	0.0	0.8	0.0	0.8	5.8	OK	60 min Summer	205.128	0.698	0.0	0.9	0.0	0.9	7.3	OK	120 min Summer	205.191	0.761	0.0	1.0	0.0	1.0	8.0	OK	180 min Summer	205.220	0.790	0.0	1.0	0.0	1.0	8.3	OK	240 min Summer	205.229	0.799	0.0	1.0	0.0	1.0	8.3	OK	360 min Summer	205.219	0.789	0.0	1.0	0.0	1.0	8.2	OK	480 min Summer	205.192	0.762	0.0	1.0	0.0	1.0	8.0	OK	600 min Summer	205.159	0.729	0.0	1.0	0.0	1.0	7.6	OK	720 min Summer	205.124	0.694	0.0	0.9	0.0	0.9	7.3	OK	960 min Summer	205.057	0.627	0.0	0.9	0.0	0.9	6.6	OK	1440 min Summer	204.944	0.514	0.0	0.8	0.0	0.8	5.4	OK	2160 min Summer	204.824	0.394	0.0	0.7	0.0	0.7	4.1	OK	2880 min Summer	204.744	0.314	0.0	0.6	0.0	0.6	3.3	OK	4320 min Summer	204.649	0.219	0.0	0.5	0.0	0.5	2.3	OK	5760 min Summer	204.595	0.165	0.0	0.5	0.0	0.5	1.7	OK	7200 min Summer	204.564	0.134	0.0	0.4	0.0	0.4	1.4	OK	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)	15 min Summer	103.740	0.0	4.7	0.0	18	30 min Summer	76.034	0.0	6.8	0.0	32	60 min Summer	53.146	0.0	9.6	0.0	58	120 min Summer	33.827	0.0	12.2	0.0	90	180 min Summer	26.096	0.0	14.1	0.0	124	240 min Summer	21.723	0.0	15.6	0.0	160	360 min Summer	16.736	0.0	18.1	0.0	228	480 min Summer	13.856	0.0	19.9	0.0	296	600 min Summer	11.939	0.0	21.5	0.0	362	720 min Summer	10.555	0.0	22.8	0.0	428	960 min Summer	8.661	0.0	24.9	0.0	558	1440 min Summer	6.527	0.0	28.2	0.0	806	2160 min Summer	4.920	0.0	31.9	0.0	1168	2880 min Summer	4.045	0.0	34.9	0.0	1528	4320 min Summer	3.108	0.0	40.3	0.0	2248	5760 min Summer	2.610	0.0	45.1	0.0	2944	7200 min Summer	2.307	0.0	49.8	0.0	3680
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<u>Summary of Results for 100 year Return Period (+30%)</u>								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	204.543	0.113	0.0	0.4	0.0	0.4	1.2	OK
10080 min Summer	204.527	0.097	0.0	0.4	0.0	0.4	1.0	OK
15 min Winter	204.828	0.398	0.0	0.7	0.0	0.7	4.2	OK
30 min Winter	204.985	0.555	0.0	0.8	0.0	0.8	5.8	OK
60 min Winter	205.133	0.703	0.0	0.9	0.0	0.9	7.3	OK
120 min Winter	205.188	0.758	0.0	1.0	0.0	1.0	7.9	OK
180 min Winter	205.205	0.775	0.0	1.0	0.0	1.0	8.1	OK
240 min Winter	205.201	0.771	0.0	1.0	0.0	1.0	8.1	OK
360 min Winter	205.165	0.735	0.0	1.0	0.0	1.0	7.7	OK
480 min Winter	205.116	0.686	0.0	0.9	0.0	0.9	7.2	OK
600 min Winter	205.064	0.634	0.0	0.9	0.0	0.9	6.6	OK
720 min Winter	205.014	0.584	0.0	0.9	0.0	0.9	6.1	OK
960 min Winter	204.926	0.496	0.0	0.8	0.0	0.8	5.2	OK
1440 min Winter	204.793	0.363	0.0	0.7	0.0	0.7	3.8	OK
2160 min Winter	204.672	0.242	0.0	0.6	0.0	0.6	2.5	OK
2880 min Winter	204.603	0.173	0.0	0.5	0.0	0.5	1.8	OK
4320 min Winter	204.533	0.103	0.0	0.4	0.0	0.4	1.1	OK
5760 min Winter	204.499	0.069	0.0	0.3	0.0	0.3	0.7	OK
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)			
8640 min Summer	2.101	0.0	54.5	0.0	4408			
10080 min Summer	1.953	0.0	59.1	0.0	5144			
15 min Winter	103.740	0.0	4.7	0.0	18			
30 min Winter	76.034	0.0	6.8	0.0	32			
60 min Winter	53.146	0.0	9.6	0.0	58			
120 min Winter	33.827	0.0	12.2	0.0	94			
180 min Winter	26.096	0.0	14.1	0.0	134			
240 min Winter	21.723	0.0	15.6	0.0	172			
360 min Winter	16.736	0.0	18.1	0.0	244			
480 min Winter	13.856	0.0	20.0	0.0	314			
600 min Winter	11.939	0.0	21.5	0.0	382			
720 min Winter	10.555	0.0	22.8	0.0	450			
960 min Winter	8.661	0.0	24.9	0.0	578			
1440 min Winter	6.527	0.0	28.2	0.0	824			
2160 min Winter	4.920	0.0	31.9	0.0	1188			
2880 min Winter	4.045	0.0	34.9	0.0	1536			
4320 min Winter	3.108	0.0	40.3	0.0	2248			
5760 min Winter	2.610	0.0	45.1	0.0	2944			
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Model Details

Storage is Online Cover Level (m) 205.830

Cellular Storage Structure

Invert Level (m) 204.430

Infiltration Coefficient Base (m/hr) 0.00000

Infiltration Coefficient Side (m/hr) 0.00000

Safety Factor 2.0

Porosity 0.95

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	11.0	11.0	0.801	0.0	21.6
0.800	11.0	21.6			

Orifice Outflow Control

Diameter (m) 0.023 Invert Level (m) 204.400

Discharge Coefficient 0.600

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 205.230

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Date 07/06/2024 15:20 File 19735_RG01_r01.SRCX			Designed by freddy.payne Checked by			
Innovyze			Source Control 2020.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
	8640 min Summer	205.039	0.099	0.2	0.1	0 K
	10080 min Summer	205.033	0.093	0.2	0.1	0 K
	15 min Winter	205.426	0.486	1.2	1.4	0 K
	30 min Winter	205.478	0.538	1.4	1.7	0 K
	60 min Winter	205.494	0.554	1.4	1.8	0 K
	120 min Winter	205.445	0.505	1.3	1.5	0 K
	180 min Winter	205.402	0.462	1.1	1.3	0 K
	240 min Winter	205.366	0.426	1.0	1.1	0 K
	360 min Winter	205.310	0.370	0.8	0.8	0 K
	480 min Winter	205.268	0.328	0.7	0.6	0 K
	600 min Winter	205.236	0.296	0.6	0.5	0 K
	720 min Winter	205.211	0.271	0.6	0.4	0 K
	960 min Winter	205.172	0.232	0.5	0.3	0 K
	1440 min Winter	205.124	0.184	0.4	0.2	0 K
	2160 min Winter	205.084	0.144	0.3	0.1	0 K
	2880 min Winter	205.061	0.121	0.2	0.1	0 K
	4320 min Winter	205.035	0.095	0.2	0.1	0 K
	5760 min Winter	205.021	0.081	0.1	0.0	0 K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
	8640 min Summer	2.101	0.0	4344		
	10080 min Summer	1.953	0.0	5072		
	15 min Winter	103.740	0.0	15		
	30 min Winter	76.034	0.0	24		
	60 min Winter	53.146	0.0	42		
	120 min Winter	33.827	0.0	76		
	180 min Winter	26.096	0.0	108		
	240 min Winter	21.723	0.0	140		
	360 min Winter	16.736	0.0	200		
	480 min Winter	13.856	0.0	260		
	600 min Winter	11.939	0.0	320		
	720 min Winter	10.555	0.0	380		
	960 min Winter	8.661	0.0	500		
	1440 min Winter	6.527	0.0	736		
	2160 min Winter	4.920	0.0	1100		
	2880 min Winter	4.045	0.0	1468		
	4320 min Winter	3.108	0.0	2188		
	5760 min Winter	2.610	0.0	2936		
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<u>Summary of Results for 100 year Return Period (+30%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
	7200 min Winter	205.012	0.072	0.1	0.0	0 K
	8640 min Winter	205.006	0.066	0.1	0.0	0 K
	10080 min Winter	205.002	0.062	0.1	0.0	0 K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
	7200 min Winter	2.307	0.0	3608		
	8640 min Winter	2.101	0.0	4392		
	10080 min Winter	1.953	0.0	4992		
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Model Details Storage is Online Cover Level (m) 205.740 Infiltration Trench Structure Infiltration Coefficient Base (m/hr) 0.22176 Infiltration Coefficient Side (m/hr) 0.22176 Safety Factor 1.5 Porosity 0.30 Invert Level (m) 204.940 Trench Width (m) 1.0 Trench Length (m) 22.0 Slope (1:X) 40.0 Cap Volume Depth (m) 0.000 Cap Infiltration Depth (m) 0.000		
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Date 07/06/2024 15:22 File 19735_RG02_r01.SRCX			Designed by freddy.payne Checked by			
Innovyze			Source Control 2020.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>						
	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
	8640 min Summer	205.039	0.099	0.2	0.1	0 K
	10080 min Summer	205.033	0.093	0.2	0.1	0 K
	15 min Winter	205.426	0.486	1.2	1.4	0 K
	30 min Winter	205.478	0.538	1.4	1.7	0 K
	60 min Winter	205.494	0.554	1.4	1.8	0 K
	120 min Winter	205.445	0.505	1.3	1.5	0 K
	180 min Winter	205.402	0.462	1.1	1.3	0 K
	240 min Winter	205.366	0.426	1.0	1.1	0 K
	360 min Winter	205.310	0.370	0.8	0.8	0 K
	480 min Winter	205.268	0.328	0.7	0.6	0 K
	600 min Winter	205.236	0.296	0.6	0.5	0 K
	720 min Winter	205.211	0.271	0.6	0.4	0 K
	960 min Winter	205.172	0.232	0.5	0.3	0 K
	1440 min Winter	205.124	0.184	0.4	0.2	0 K
	2160 min Winter	205.084	0.144	0.3	0.1	0 K
	2880 min Winter	205.061	0.121	0.2	0.1	0 K
	4320 min Winter	205.035	0.095	0.2	0.1	0 K
	5760 min Winter	205.021	0.081	0.1	0.0	0 K
	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
	8640 min Summer	2.101	0.0	4344		
	10080 min Summer	1.953	0.0	5072		
	15 min Winter	103.740	0.0	15		
	30 min Winter	76.034	0.0	24		
	60 min Winter	53.146	0.0	42		
	120 min Winter	33.827	0.0	76		
	180 min Winter	26.096	0.0	108		
	240 min Winter	21.723	0.0	140		
	360 min Winter	16.736	0.0	200		
	480 min Winter	13.856	0.0	260		
	600 min Winter	11.939	0.0	320		
	720 min Winter	10.555	0.0	380		
	960 min Winter	8.661	0.0	500		
	1440 min Winter	6.527	0.0	736		
	2160 min Winter	4.920	0.0	1100		
	2880 min Winter	4.045	0.0	1468		
	4320 min Winter	3.108	0.0	2188		
	5760 min Winter	2.610	0.0	2936		
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<u>Summary of Results for 100 year Return Period (+30%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter		205.012	0.072	0.1	0.0	0 K
8640 min Winter		205.006	0.066	0.1	0.0	0 K
10080 min Winter		205.002	0.062	0.1	0.0	0 K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
7200 min Winter		2.307	0.0	3608		
8640 min Winter		2.101	0.0	4392		
10080 min Winter		1.953	0.0	4992		
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 303927 206263 S0 03927 06263</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>1.000</td> </tr> <tr> <td>Cv (Winter)</td> <td>1.000</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.008 <table> <tr> <td>Time (mins)</td> <td>Area</td> </tr> <tr> <td>From: To:</td> <td>(ha)</td> </tr> <tr> <td>0</td> <td>5 0.008</td> </tr> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 303927 206263 S0 03927 06263	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	1.000	Cv (Winter)	1.000	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+30	Time (mins)	Area	From: To:	(ha)	0	5 0.008
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APPENDIX F: Management & Maintenance Plan

**Management and Maintenance Plan for
Sustainable Drainage (SuDS):**
SAB Phase 3, Land off Upper Colliers Row,
Heolgerrig,
Merthyr Tydfil, CF48 1UN

Prepared for:

Maxiom

REF: 19735-MP01

DATE: June 2024



Vale Consultancy
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Document Control

Project	SAB Phase 3, Land off Upper Colliers Row, Heolgerrig, Merthyr Tydfil, CF48 1UN
Client	Maxiom
Vale Consultancy Ref:	19735-MP01

Document Checking:

Prepared By:	F Payne	Signed:	
Checked By:	M Jones	Signed:	
Verified By:	M Jones	Signed:	

Issue	Date	Status
1	18.06.2024	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 Land off Upper Colliers Row, Heolgerrig, Merthyr Tydfil, CF48 1UN (Phase 3).
- 1.2. The proposed scheme is to construct four residential dwellings (plots 5, 8, 9 & 10) and a private driveway which forms part of a larger 10 plot residential scheme. Each plot is to be self-build and will require their own SuDS drainage systems to be developed and agreed with the SAB. This document is to supplement the relevant SAB application and provide guidance to the future owners.
- 1.3. The scheme incorporates sustainable drainage systems for surface water runoff consisting of raingardens, permeable paving and attenuation tanks. The methods for disposal of surface water runoff are discharge to ground via infiltration and discharge to an ordinary watercourse.
- 1.4. 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.
- 1.5. All references to SuDS components are based on the SAB submission drawings:
 - *19735_500_r01 Drainage Plan*
 - *19735_501_r01 Drainage Details Sh1*
 - *19735_502_r01 Drainage Details Sh2*

2. MANAGEMENT RESPONSIBILITIES

- 2.1. The current site owner for each dwelling 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. The surface water sewer that each plot will discharge to will serve multiple properties, therefore, this surface water sewer will be adopted by the SAB as mandatory.
- 2.3. 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 Site Owner shall ensure establishment and long-term health of all landscape elements for the benefit of the tenants and visual amenity of the area.
- 3.3. Best Health & Safety practices shall always be used.
- 3.4. 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.

4 INSPECTION AND MAINTENANCE ACCESS

- 4.1. Access for inspection and maintenance can be gained from the adjacent roadway.

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 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:

- 7.1. All shrub beds in the raingarden areas 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.
- 7.2. 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.
- 7.3. 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.
- 7.4. 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.
 - 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.
- 7.5. 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

8 LITTER COLLECTION

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

9 HARD SURFACES

- 9.1. A common-sense approach to the maintenance of the permeable paving will be adopted, the maintenance program is outlined as follows and is designed to ensure the structural and hydraulic performance of the permeable paving system.
- 9.2. The site owner or management company is to inspect each of the respective assigned areas of the hard landscape for which they have responsibility on a six-monthly basis to identify and repair any damaged areas.
- 9.3. Seasonal maintenance (leaf and snow clearance, de-icing). To be proactively managed with the checking weather reports.
- 9.4. Surfaces to be always kept weed and litter free. Spray paved areas every 10 years or as required with herbicide to keep weed free.
- 9.5. The permeable paving should be brushed once a year after autumn leaf fall or less frequently as required, based on site-specific observations. Water jetting may also be required to rehabilitate the surface when clogging becomes apparent.
- 9.6. Visually inspect the surface on a regular basis typically 2 per year (Spring and Autumn). Ensure no displacement of any organic matter has occurred on the surface, particularly after heavy precipitation. The paving should be agitated (e.g. brushed, vacuumed, etc.) at least once a year, to ensure no vegetation of any sort can grow and develop in the voids.

Note: If the infiltration rate of the paving becomes prolonged, allowing ponding to develop, and rehabilitation through remedial sweeping is not effective, a more specialist sweeper with water jetting and oscillating and rotating brushes may be required.

- 9.7. Repair any subsidence or breakages promptly in accordance with best practice, manufacturer's guidance and using matching materials.
- 9.8. Inspect and repair all edging on a regular basis making good any damage or wear promptly to maintain the good upkeep of the development.

10 TRADITIONAL DRAINAGE AND FLOW CONTROL CHAMBERS

- 10.1. A monthly site inspection should be carried out, checking for any areas that are not operating correctly and collecting/removing litter and debris.
- 10.2. All rainwater pipes, linear drains, gullies and inspection chambers should be inspected biannually, typically spring and autumn.
- 10.3. Any excessive sediment build-up in rainwater pipes, linear drains, gullies or inspection chambers causing blockage or poor performance shall be cleared and cleaned as required.
- 10.4. 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. Maintenance for the two types varies slightly and is to be undertaken according to manufacturer's specifications. However, as a general guide should include the following:

Vortex Flow Control

Maintenance Schedule	Required Action	Typical Frequency
Routine Maintenance	Inspection	Routine maintenance should be undertaken on completion of drainage works. Year 1, Year 3 and then every 5 years
	Litter / debris removal	
	Check emergency drain down is in good working order	
	Check component fixings are secure	
Occasional Maintenance	De-silting / sediment removal	As required upon inspection
Remedial Maintenance	Damage repair	As required upon inspection

Orifice Flow Control

Maintenance Schedule	Required Action	Typical Frequency
Routine Maintenance	Inspection	Routine maintenance should be undertaken on completion of drainage works and then annually thereafter
	Litter / debris removal	
	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 Maintenance	Damage repair	As required upon inspection

11 SUMMARY OF INSPECTION AND MAINTENANCE

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

11.2. General

- General inspections of SuDS areas (Bioretention areas (raingardens), permeable paving) – monthly and shall include litter collection.
- Biannual check of traditional drainage including rainwater pipes, linear drains, gullies and inspection chambers.
- Annual check of flow control chamber

11.3. Bioretention raingarden areas

- Inspect surfaces for silting and ponding, check for de-watering between storms to determine if any remedial work is required – annually
- Grass cutting (if deemed necessary) – monthly during growing season (April – October)
- Pruning, weed removal and plant replacement, assess plants for disease infection, poor growth and invasive species – annually

11.4. Permeable paving

- Initial inspection – within 3 months of completion
- Visual inspection - 2 times a year
- General brushing of surface - once a year
- Weed removal – as required, expect every 10 years
- Remediate areas of Rutting and depressions – as required
- Rehabilitate surface with brushing and water jetting when clogging becomes apparent – as required, approximately every 30 years
- Inspection for performance and clogging and ancillary drainage components – once a year

12 LIFETIME MANAGEMENT AND MAINTENANCE COSTS

12.1. The costs associated with the management and maintenance of the SuDS systems over the 60-year design life of the scheme has been estimated based on the inspection and maintenance activities in section 11. A cost breakdown has been undertaken for the surface water drainage system serving each plot (based on plot 5 – worst case) and for the private driveway.

12.2. Plot residential dwelling management and maintenance costs

12.3. General

- General monthly inspection (incl. litter removal) – included in general maintenance undertaken by the Site owner

12.4. Bioretention areas

- Annual plant replacement over 59 years, assuming 10% replacement each year @ £25/m² – $25 \times (9.7 \times 0.1) \times 59 = £1,430$

12.5. Permeable paving

- Visual inspections - included in general maintenance undertaken by the Site owner
- Annual brush/sweep – included in general maintenance undertaken by the Site owner
- Weed kill every 10 years @ £0.80 / m² x 60m² - £288
- Brush/water jetting rehabilitation every 10 years @ £7.50/m² x 60m² - £450 x 6 = £2,700
- Replace / take up and clean permeable paving once in year 30 @ £30/m² x 60m² = £1,800

12.6. The total sum of management and maintenance costs for the proposed SuDS serving each plot over a 60-year design life - **£6,218 or circa £100 a year**

12.7. Private driveway

12.8. General

- General monthly inspection (incl. litter removal) – included in general maintenance undertaken by the Site owner

12.9. Bioretention areas

- Annual plant replacement over 59 years, assuming 10% replacement each year @ £25/m² – $25 \times (44 \times 0.1) \times 59 = £6,490$

12.10. The total sum of management and maintenance costs for the proposed SuDS serving each plot over a 60-year design life - **£6,490 or circa £110 a year**