



928 Oxford Road

SuDS Assessment

Job Number: 1148

Date	Version	Notes/Amendments
February 2022	1	Issued for Information

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Acronyms	
AOD	Above Ordnance Datum
CIRIA	Construction Industry Research and Information Association
EA	Environment Agency
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
NSTS	DEFRA's Non-Statutory Technical Standards
PPG	Planning Practice Guidance
SuDS	Sustainable Drainage Systems
SFRA	Strategic Flood Risk Assessment

Introduction

Flume Consulting Engineers have been appointed to undertake a SuDS Assessment for the proposed development at 928 Oxford Road, Tilehurst, Reading, RG30 6TJ.

This Sustainable Drainage Systems (SuDS) Assessment has been carried out in accordance with the National Planning Policy Framework (NPPF) and the Planning Practice Guidance 'Flood Risk and Coastal Change'. This SuDS Assessment also incorporates advice and guidance from the Environment Agency (EA), the Strategic Flood Risk Assessment (SFRA), produced by the Reading Borough Council and CIRIA documents.

The Environment Agency's (EA) indicative floodplain map shows that the site is located in Flood Zone 1, however a SuDS Assessment has been carried out to assess the available options for SuDS use for the proposed development, and to adhere to Reading Borough Council's requirements for Major Planning Applications, specifically the following:

Applies to all Major planning applications. The proposal should provide:

- I. Detailed designs for the drainage system including (components, levels, volumes of storage). **Provided in Appendix A.***
- II. Infiltration tests of the existing ground. **Provided in Appendix A.***
- III. Design calculations to show that the runoff from the site post development is no greater than the existing runoff from the site for a 1 in 100 year, 6 hour rainfall event, that no flooding occurs anywhere on site for a 1 in 30 year rainfall event and no flooding occurs in any building (including basement) or any utility plant susceptible to water during a 1 in 100 year rainfall event. **Provided in Appendix A.***
- IV. Connection details to existing watercourse and drainage networks if infiltration methods are not used together with acceptance of these connections from the relevant approving body (EA, LFA, Canal and River trust, Sewage undertaker). **SuDS systems based on infiltration are proposed.***

The aim of this report is to satisfy all of the aforementioned requirements.

Site Description and Location

The application site comprises a currently vacant 1930s public house known as *The Restoration* with associated car parking and soft landscaping. The last use of the site was as a car wash within the car park. The site has 3no. crossover access points from the Oxford Road.

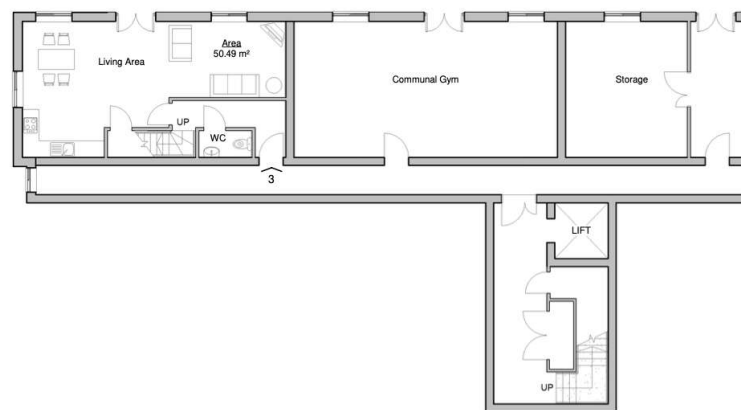
The site postcode is RG30 6TJ and the OS grid reference is SU 68297 74471.



FIGURE 1. SITE LOCATION

Development Proposal

The planning application proposes to demolish the vacant Restoration Public House and erect 18no. Apartments with associated amenity space, parking, and landscaping. The existing hard landscaping will be removed during the proposed works, and any new hardstanding areas will utilise porous permeable paving to reduce surface run off. The proposed building is located in a similar position as the Restoration, with landscaped amenity space to the rear and parking to the east. The car park has also been located in a similar position as existing.



Proposed Lower Ground Floor Plan

SCALE 1:100



Proposed Ground Floor Plan

SCALE 1:100

FIGURE 2. PROPOSED BUILDING LAYOUTS

Flood Risk

The EA's indicative floodplain map shows that the site is located in Flood Zone 1 and is not at risk of flooding (Figure 3). Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.

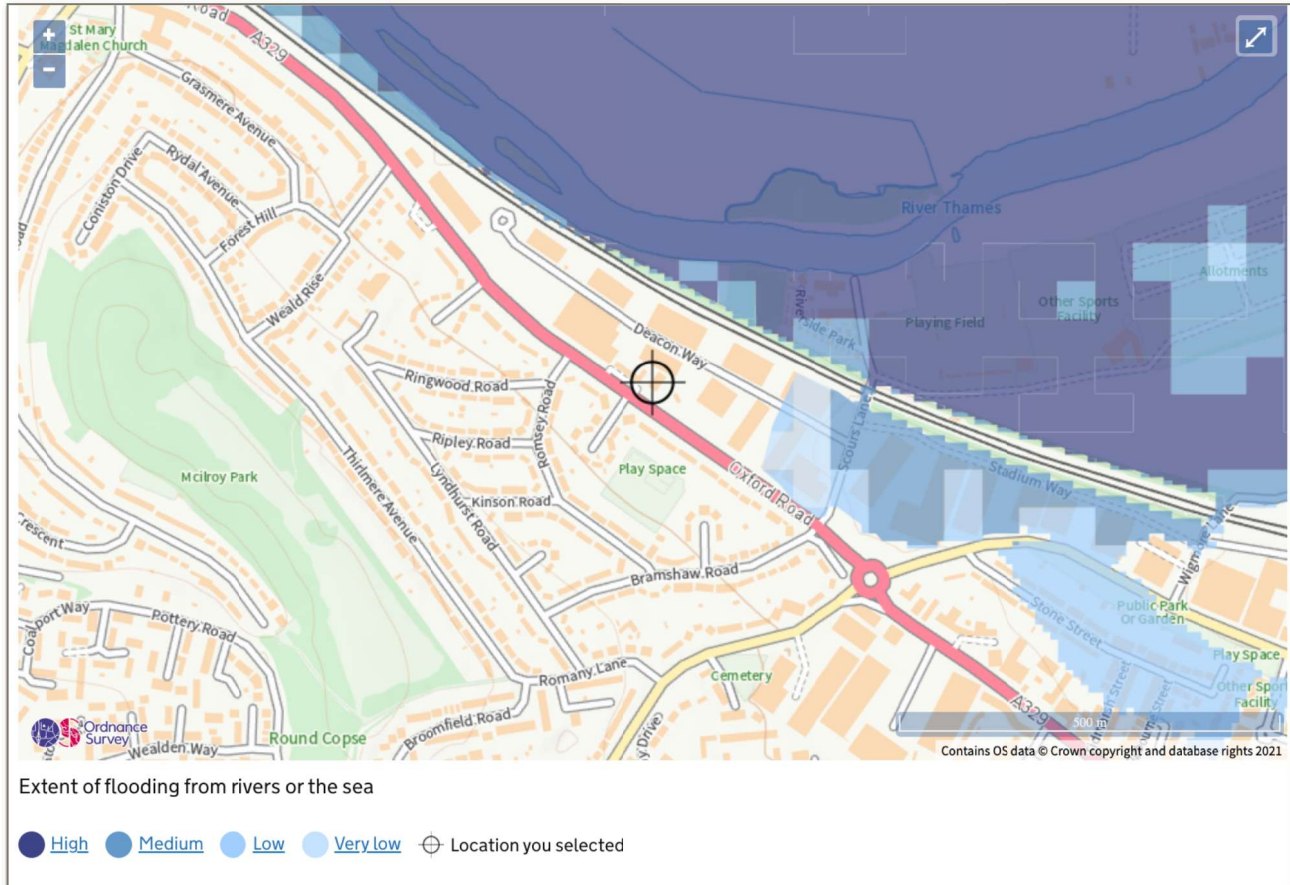


FIGURE 3. ENVIRONMENT AGENCY FLOOD RISK FROM RIVERS OR SEA MAP (GOV.UK, 2022)

Surface Water Run-off Assessment

Existing Run-off

The total site area which includes the existing building and associated external landscaping, is approximately 1800m²/0.180ha, and 1000m² of which is impermeable hardstanding and roof areas.

The existing peak run-off rate for the design storm event (1 in 1, 1 in 30 and 1 in 100 year) was calculated using the modified rational method as shown below:

$$Q_{1ex} = 2.78 \times 33 \times 0.10 = \underline{9.17 \text{ l/s}}$$

$$Q_{30ex} = 2.78 \times 83 \times 0.10 = \underline{25.07 \text{ l/s}}$$

$$Q_{100ex} = 2.78 \times 106 \times 0.10 = \underline{29.47 \text{ l/s}}$$

Proposed Run-off (Unmitigated without SuDS Measures)

According to Planning Practice Guidance (PPG), “generally the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable: 1. Into the ground (infiltration) 2. To a surface water body; 3. To a surface water sewer, highway drain or another drainage system; 4. To a combined sewer”, whilst ensuring that surface water run-off is managed as close to its source as possible.

The proposed development is for the construction of a new building and associated external works following the demolition of the existing building. The existing development has extensive hard landscaped areas, and proposals involve no additional hardstanding areas compared to the existing development. The proposed development will therefore not generate any additional surface water run-off.

Please refer to Figure 4, outlining the possibility of incorporating SuDS into the scheme to reduce the surface water run-off and volumes further.

SuDS Assessment

It is recommended that Sustainable Drainage Systems (SuDS) be introduced to mimic natural drainage pathways as close to source as possible, reducing the impact of urbanisation on watercourse flows, and ensures the protection and enhancement of water quality, while encouraging the recharge of groundwater.

In accordance with the EA's guidelines, DEFRA's Non-statutory technical standards for sustainable drainage systems (NSTS), Building Regulations and Water Authorities advice, surface water run-off should be managed as close to its source as possible. The proposed SuDS will aim to reduce surface water run-off to the required rates where possible and practical, in line with national and local policy.

CIRIA SuDS Manual (C753) states that a development should utilise SuDS unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

- I. Use infiltration techniques, such as porous surfaces in non-clay areas,
- II. attenuate rainwater in ponds or open water features for gradual release,
- III. attenuate rainwater by storing in tanks or sealed water features for gradual release,
- IV. discharge rainwater direct to a watercourse,
- V. discharge rainwater to a surface water sewer / drain,
- VI. discharge rainwater to the combined sewer.

The possibility of implementing SuDS at the site was assessed using a hierarchy of preferred surface water management methods. The following paragraphs discuss the various methods in order of that hierarchy and evaluate the site's suitability for each method.

A Ground investigation was carried out to confirm the possibility of utilising infiltration systems for the proposed development. These tests were undertaken in accordance with *BRE Digest 365*, and the results are appended with the hydraulic calculations in Appendix A. The results indicate that infiltration is feasible ($1.90 \times 10^{-4} \text{ m/s}$), and therefore a Cellular Soakaway and Permeable Pavements have been incorporated as outlined in the following sections.

SuDS Component	Site Suitability	Comments
Green Roofs & Rainwater Reuse	X / ✓	No flat roofs were proposed on the scheme which might facilitate Green Roofs. However, Watering Butts may also be introduced in the form of an above ground surface water holding chamber which will be used for landscaping purposes (rainwater reuse).
Soakaways	✓	A Cellular Soakaway will be incorporated in the scheme. These should be constructed more than 5m from any structure.
Filter Strips	✓	A form of filter strips will be incorporated along the edge of the permeable car park.
Infiltration Trenches	X	Other SuDS features are preferred in this instance.
Swales	X	Not suitable due to site layout and size of the development.
Bioretention	X	Not suitable due to site layout and size of the development.
Porous Pavements	✓	Permeable Paving will be introduced around the proposed building and car parking area. Although it is expected the surface water to infiltrate into the ground, an overflow within the sub-base will be incorporated and discharge to the cellular soakaway if needed. Surface water will infiltrate into the ground below the permeable pavement.
Geocellular Systems	X	Other SuDS features are preferred in this instance.
Infiltration basins	X	Not suitable due to site layout and size of the development.
Detention basins	X	Not suitable due to site layout and size of the development.
Ponds	X	Not suitable due to site layout and size of the development.
Stormwater wetlands	X	Not suitable due to site layout and size of the development.

FIGURE 4. SUDS SITE SUITABILITY

Living Roofs & Rainwater Re-use

Green Roofs have not been incorporated as part of the proposed scheme. The SuDS Manual C753 states “Green roofs can provide benefits in terms of reducing peak flow rates to the site drainage system – principally for small and medium-sized events.”. However, the SuDS Manual also goes further to say that they behave like traditional roofs during storm events or return periods greater than this, limiting their effectiveness for these types of occurrences.

Infiltration

The preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration system. The BGS maps confirm that infiltration is possible due to the presence of the Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated). There are no superficial deposits present in the area. The results of site-specific infiltration tests (1.90×10^{-4} m/s) are included in Appendix A, which supports the use of infiltration based SuDS systems.

Therefore, a cellular soakaway is proposed accommodating surface water run-off from the roof and hardstanding areas. The cellular soakaway has been designed to accommodate the 1 in 100 year return period, plus an allowance for climate change. In addition, permeable pavements infiltrating to ground will be utilised to drain all hardstanding areas. As a worst-case scenario, the hydraulic calculations consider surface water run-off from the hardstanding areas drain to the cellular soakaway.

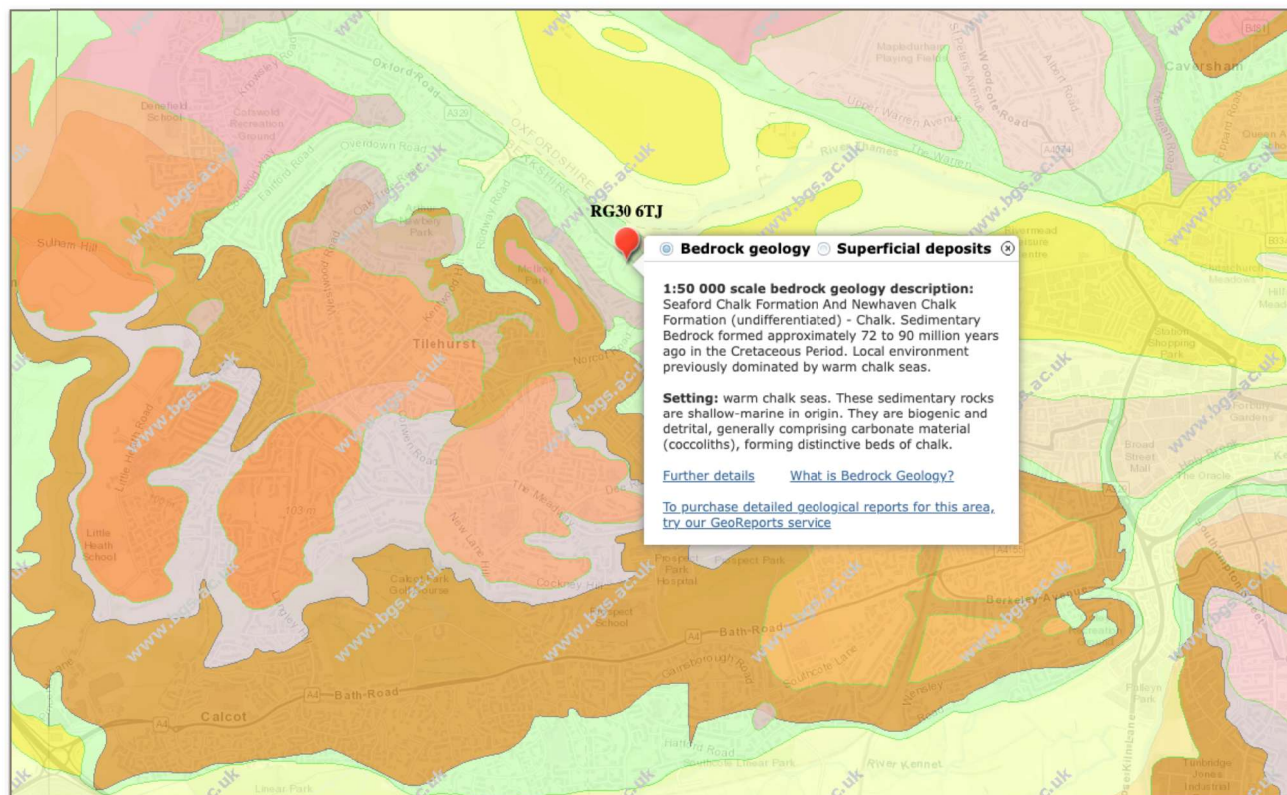


FIGURE 5. BGS GEOLOGICAL MAPS

Cellular Soakaway

Based on the geological maps and site-specific infiltration tests, infiltration can be used to drain the surface water run-off from the roof and hardstanding areas. A Cellular Soakaway is proposed, and has been designed to accommodate the 1 in 100 year return period plus a 40% allowance for climate change. These calculations are included in Appendix A.

Permeable Pavements

Infiltration through permeable paving is considered to be a practical solution to reduce surface water run-off rates and volumes. An overflow will also be incorporated as a failsafe due to any potential variability of the infiltration properties of the underlying ground, which will be connected to cellular soakaway. Infiltration through Permeable Pavements (2D plane only) can also be utilised closer to structures. Permeable Pavements serving themselves behave in a similar way to soft landscaping and can be placed directly against the edge of structures.

Attenuation capacity of the Permeable Pavement

The surface water runs-off from the permeable paving will self-attenuate and infiltrate into the ground. An infiltration rate of 1×10^{-5} m/s was used to define the paving thicknesses.

infiltration rate = 1×10^{-5} m/s						
		1 in 10	1 in 30	1 in 100	1 in 100 + 20%	1 in 100 + 30%
M5-60	r	10	3.33	1	0.5	0.25
20	0.4	50	50	70	90	105
	0.3	50	50	65	85	100
	0.2	50	50	60	85	95
17	0.4	50	50	55	70	80
	0.3	50	50	50	65	75
	0.2	50	50	50	60	70
14	0.4					
	0.3	50	50	50	50	50
	0.2	50	50	50	50	50

FIGURE 6. PERMEABLE PAVEMENT AND ASSOCIATED PAVING THICKNESSES REQUIRED (INTERPAVE, 2018)

The external hard and soft landscaping will infiltrate into the ground. An allowance for Urban Creep is considered in the calculations to allow for additional surface water run-off volumes in the calculations.

To allow for the extra rainfall being collected, the permeable construction thickness will be increased to give a larger storage volume. According to Interpave guidance¹, the following calculation can be used to determine this volume:

$$T = t(AI + AP) / AP$$

Where:

T = Thickness of permeable construction to store water from impermeable and permeable contributing areas

t = Thickness of permeable construction to store water from permeable area only (105mm)

AI = Area of impermeable surfacing draining onto the permeable area

AP = Area of CBPP.

$$T = 105(50 + 500) / 500 = \underline{116\text{mm}}$$

Therefore, the proposed thickness of the permeable pavement (350mm thick) has adequate capacity to accommodate an additional surface water run-off (Approx. 50m²).

These calculations are based on a 30% void ratio of the permeable sub-base. The following compares the required volumes of the permeable pavements, and the achieved volumes within the permeable sub-base:

Required volume:

$$= 500 \times 0.116 \times (0.30)$$

$$= 17.40\text{m}^3$$

Achieved volume:

$$= 500 \times 0.350 \times (0.30)$$

$$= 52.50\text{m}^3$$

The storage capacity of the proposed permeable pavement exceeds the required storage volume, including an allowance of 10% additional run-off as a result of urban creep. The surface water run-off from the permeable paving will self-attenuate and infiltrate into the surrounding ground.

¹ Interpave's Design and Construction of Concrete Block Permeable Pavements

Attenuation

The inclusion of Infiltration systems are the preferred form of SuDS. The proposals will incorporate permeable paving and a cellular soakaway, discharging surface water run-off into the ground.

SuDS Run-off Summary

Return Period	Greenfield	Existing	Proposed (without SuDS Measures)	Proposed (with SuDS Measures)
1 in 1 Year	0.25	9.17	9.17	0.00 (all hardstanding areas and run-off from buildings infiltrates to ground)
1 in 30 Year	0.68	25.07	25.07	0.00 (all hardstanding areas and run-off from buildings infiltrates to ground)
1 in 100 Year	0.94	29.47	29.47	0.00 (all hardstanding areas and run-off from buildings infiltrates to ground)
1 in 100 Year + 40%cc	N/A	N/A	41.25	0.00 (all hardstanding areas and run-off from buildings infiltrates to ground)

In conclusion, the incorporation of Permeable Paving ('2d' Infiltration) and a Cellular Soakaway ('3d' Infiltration) will reduce the development's surface water run-off rates compared with the existing development. These SuDS systems provide an overall reduction in surface water run-off rates for all storm events up to the 1 in 100 year plus climate change compared to the unmitigated scenario by 100%. Furthermore, a form of Rainwater Harvesting (Watering Butts) will be utilised primarily to reduce water demand.

Surface Water Maintenance Strategy

The drainage design will be designed to be fully maintainable in accordance with building regulations and the recommendations of CIRIA C753 – SuDS Manual, outlined below.

Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Monitoring/Inspections	Initial Inspection.	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required take remedial action.	Annually (and after severe storms)
Regular Maintenance	Rubbish and litter removal	As required
	Brushing and vacuuming - standard cosmetic sweep across surface	Once a year after Autumn leaf fall
Remedial Actions	Remedial work to any depressions or rutting considered detrimental to the structural performance.	As required
	Rehabilitation of surface with remedial sweeping	Every 10-15 years or as required.

Cellular Storage Tank / Soakaway

Maintenance Schedule	Required Action	Typical Frequency
Monitoring / Inspections	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are working as they should	Annually or after severe storms
Regular Maintenance	Inspect and identify any elements that are not operating correctly.	Monthly for three months, then Half yearly or as required.
	Remove sediments / debris from catch pits / gullies and control structures	Annually, after severe storms or as required
Remedial Actions	Repair inlets, outlets, vents, overflows and control structures.	As required

Conclusions

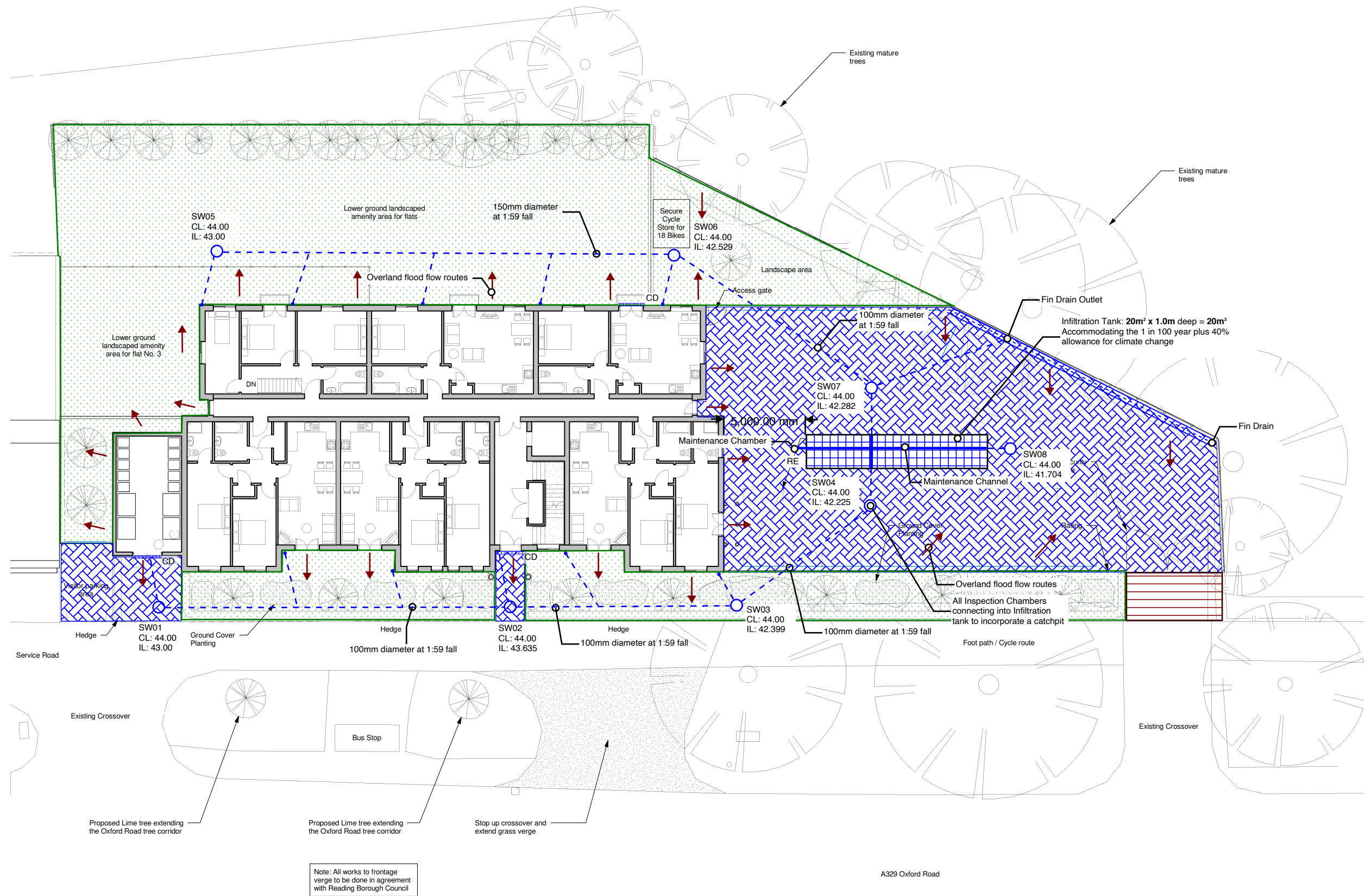
- The site resides in Flood Zone 1 where there is less than 1 in 1000 annual probability of river or sea flooding (<0.1%). Developments in this flood zone have no restrictions other than ensuring surface water drainage proposals do not increase the flood risk on site and the surrounding areas.
- It is assumed that the existing building and hardstanding areas currently discharges surface water at unrestricted rates to the public sewer. The incorporation of a Cellular Soakaway and Permeable Paving will reduce the proposed surface water run-off from the development, providing an overall reduction in run-off rates for all storm events up to the 1 in 100 year plus allowance for climate change compared to the existing development by up to 100%. This is also in line with the LLFA's advice.
- A SuDS Maintenance Plan will also be in place to ensure efficient operation and prevent failure of the system.
- A completed Section 106 of the Water Industry Act 1991 application (providing details on proposed flows), requesting consent for discharging foul water from the proposed development to the public sewers should be submitted to the water authority for approval.

Note:

This report has been prepared for the purposes of submitting for planning to the local planning authority for review, in relation to the associated SuDS for the proposed development and uses the most up-to-date information available to us at the time. It should not be relied upon by anyone else or used for any other purpose. This report is confidential to our Client; it should only be shown to others with their permission. We retain copyright of this report which should only be reproduced with our permission.

	Prepared By	Checked By	Approved for issue
Name	Tom Quigg BSc MSc CEng MICE	Magaly Sedeño BA	Tom Quigg BSc MSc CEng MICE
Signature			
Date	31 January 2022	31 January 2022	31 January 2022

Appendix A - SuDS Strategy: Drawings and Hydraulic Calculations



Notes:

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DRAINAGE KEY

○	Rainwater Pipe
○	Surface Water Inspection Chamber
- - -	Surface Water Drainage Pipe
□	Yard Gully
	Channel Drain
CL	Cover Level
IL	Invert Level
[Grid Pattern]	Infiltration Tank
[Cross-hatch Pattern]	Permeable Paving

A Planning Issue TQ 31/01/22

REV	DESCRIPTION	BY	DATE
STATUS	Issued for Information		



CLIENT: Mr Hargun

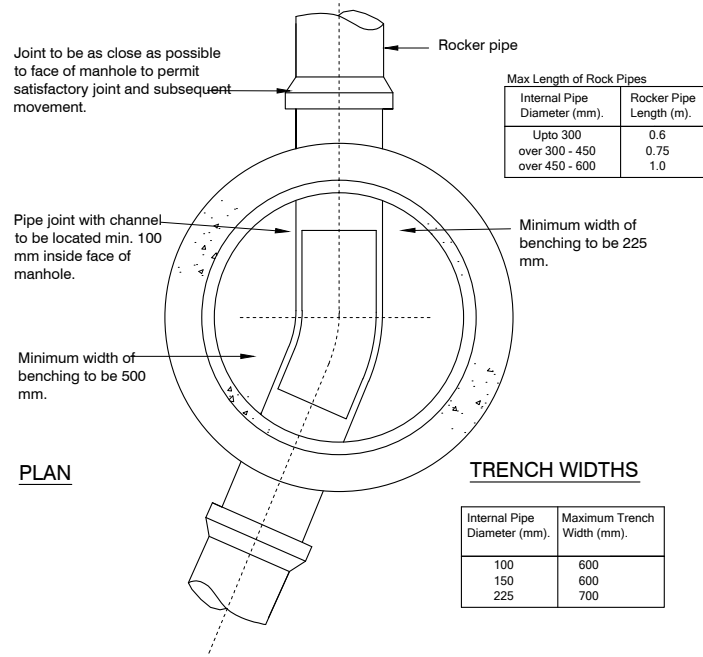
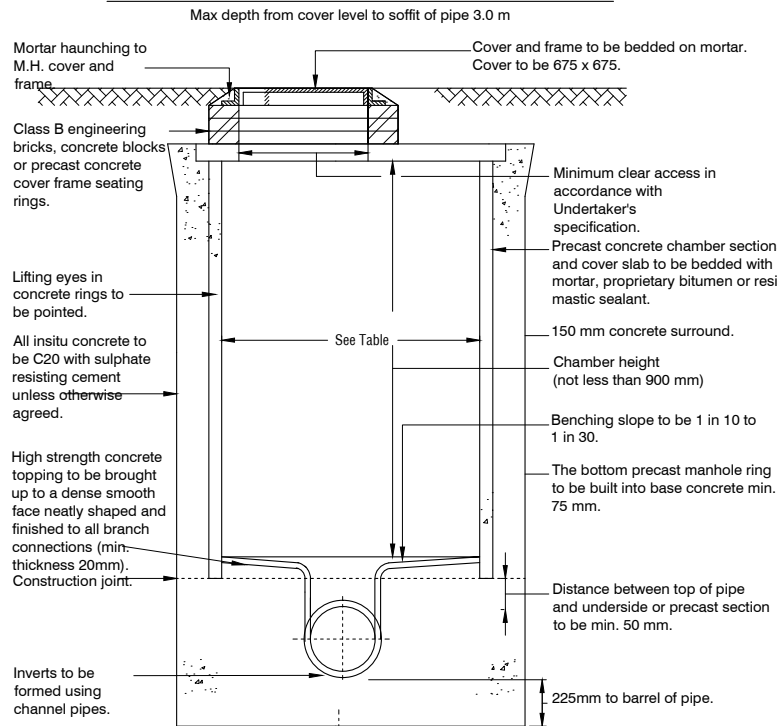
ARCHITECT: Bluebird Design & Surveying

SITE: 928 Oxford Road

TITLE: Below Ground Drainage / SuDS Plan

SCALE	AT A3	DATE	DRAWN	CHECKED
Scale Bar		30/11/21	TQ	MST
PROJECT NO	DRAWING NO	REVISION		
1148	C-100	A		

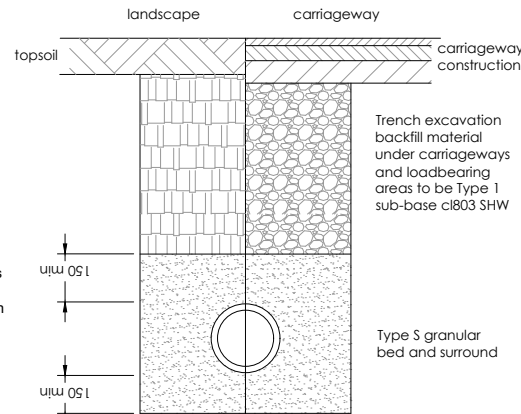
TYPICAL MANHOLE DETAIL - TYPE B



Pipe Bore & Strength (= "standard strength" of BS65 as Regs)	Bedding Class	Laid in fields	Laid in light roads	Laid in main roads
100Ø 40kn/m	B, S or A2	0.6m - 8m	1.2m - 8m +	1.2m - 8m
150Ø 40kn/m	B, S or A2	0.6m - 5m	1.2m - 5m	1.2m - 4.5m
225Ø 45kn/m	B, S or A2	0.6m - 5m	1.2m - 5m	1.2m - 4.5m

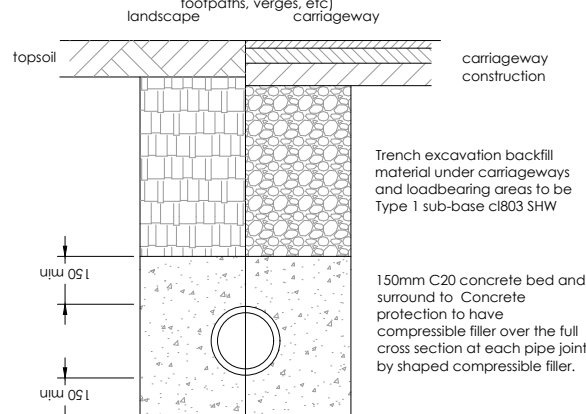
Clayware pipes to BS EN 295
Minimum cover in road set to 1.2m irrespective of pipe strength
Where cover less than minimum quoted, use Class A2 concrete bed and surround

Minimum dimension for manholes						Notes
Type	Size of largest pipe (DN)	Min internal dimensions (1) Rectangular length and width	Circular diameter	Min clear opening size (1) Rectangular length and width	Circular diameter	
Manhole < 1.5 deep to soffit	150 225 300 >300	750 x 675 (7) 1200 x 675 1200 x 750 1800 x (DN+450)	1050 (7) 1200 1200 The larger of 1800 OR (DN + 450)	750 x 675 (2) 1200 x 675 (2)	na (3)	1. Large sizes may be required for manholes on bends or where there are junctions. 2. May be reduced to 600 where required by highway loading considerations, subject to safe system of work being specified. 3. Not applicable due to working space needed. 4. Minimum height of chamber in shafted manhole 2m from benching to under side of reducing slab. 5. Min clear space between ladder or steps and the opposite face of the shaft should be approximately 900mm. 6. Winch only - no steps or ladders, permanent or removable. 7. The minimum size of any manhole serving a sewer (i.e any drain serving more than one property) should be 1200mm x 675mm rectangular or 1200mm diameter.
> 1.5 deep to soffit	225 300 375 - 450 >450	1200 x 1000 1200 x 1075 1305 x 1225 1800 x (DN + 775)	1200 1200 1200 The larger of 1800 OR (DN + 775)	600 x 600	600	
Manhole >3.0m deep to soffit of pipe	Steps (5) Ladder (5) Winch (6)	1050 x 800 1200 x 800 900 x 800	1050 1200 900	600 x 600 600 x 600	600 600	



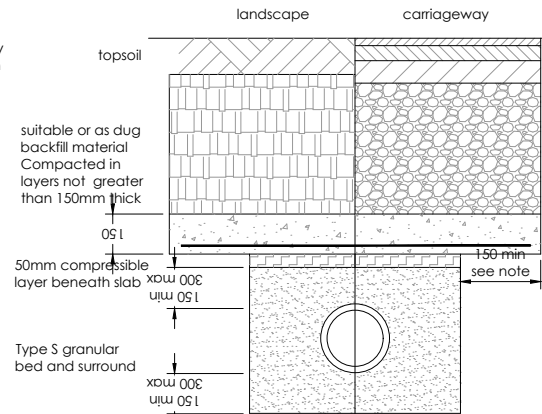
TYPE S GRANULAR SURROUND BED

To be used where cover to pipe soffit is greater than 1200mm in vehicular areas and greater than 900mm in non-trafficked areas (ie footpaths, verges, etc)



TYPE Z CONCRETE BED AND SURROUND

To be used where cover to pipe soffit is less than 1200mm in vehicular areas and 900mm in non-trafficked areas (ie footpaths, verges, etc)



CONCRETE SLAB PROTECTION

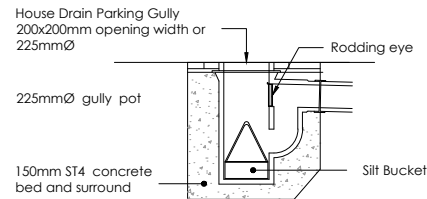
To be used where cover to pipe soffit is less than 1200mm in vehicular areas and 900mm in non-trafficked areas (ie footpaths, verges, etc)

Pipe nominal size (DN)	Pipe Bedding Requirement (mm)
100	10 nominal single size
over 100 150	10 or 14mm nominal single size or 14mm to 5mm graded
over 150-300	10, 14 or 20mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded
over 300 to 550	14, 20 or 40mm nominal single-size crushed rock or 14mm to 5mm graded or 20mm to 5mm graded
over 550	14, 20 or 40mm nominal single-size crushed rock or 14mm to 5mm graded or 20mm to 5mm graded or 40mm to 5mm graded

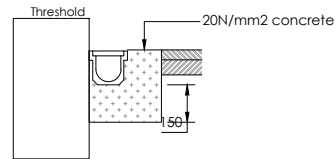
GRANULAR BEDDING AND SIDEFILL MATERIAL GRADINGS

carriageway construction
Trench excavation backfill material under carriageways and loadbearing areas to be Type 1 sub-base c1803 SHW
150mm ST4 concrete slab
20mm nominal size aggregate
Steel mesh (393) reinforcement 50mm clearance from base of concrete slab.

NOTE :- Slab must span trench completely bearing on original ground both sides. Bearing width (150mm min) will vary with pipe size, consult Engineer



TRAPPED YARD GULLY



TYPICAL ACO DRAINAGE DETAIL

- Aco drainage to be class C (NW100) with slotted cast iron grating laid to manufacturers recommendations Units to be laid in 30m lengths falling to trapped Aco drain gullies with 150mm connection to main surface water sewer Aco channels should be set 2-3mm below finished road levels
- Ensure that when concreting, asphaltting or paving near channels they should be strutted for example by inserting gratings

For further information refer to manufacturers literature 'Aco Drain Surface Water Drainage System'

Aco drain can be obtained from

Aco Polymer Products Ltd
Hitchin Road,
Shefford,
Beds
SG17 5JS
Tel: (01462) 816666
Fax: (01462) 815895

Notes:

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- This drawing is to be read in conjunction with the Drainage Layout 1106-C100 Drawing
- All private drainage works to be constructed in accordance with the latest edition of the Building Regulations part H (Drainage & Waste Disposal) and to BSEN752.
- All manholes within block paved and slabbed areas to have recessed covers and frames.
- Pipe runs near Buildings: If trench is within 1m of a building it shall be filled with concrete up to the lowest level of the adjacent foundation. If trench is greater than 1m from a building the trench shall be filled with concrete up to a level below the building equal to the distance from the building less 150mm.
- Where pathways fall towards the dwelling gullies and channels are to be provided to prevent water damaging building.
- All existing drainage levels to be checked prior to commencement of works. Any discrepancy to be reported to the appointed engineers.
- All paving gullies to suit low point and to be trapped.
- Cellular Storage System to be constructed in accordance with manufacturers information.

A Planning Issue TQ 31/01/22

REV: DESCRIPTION: BY: DATE:

STATUS: Issued for Information



CLIENT: Mr Hargun

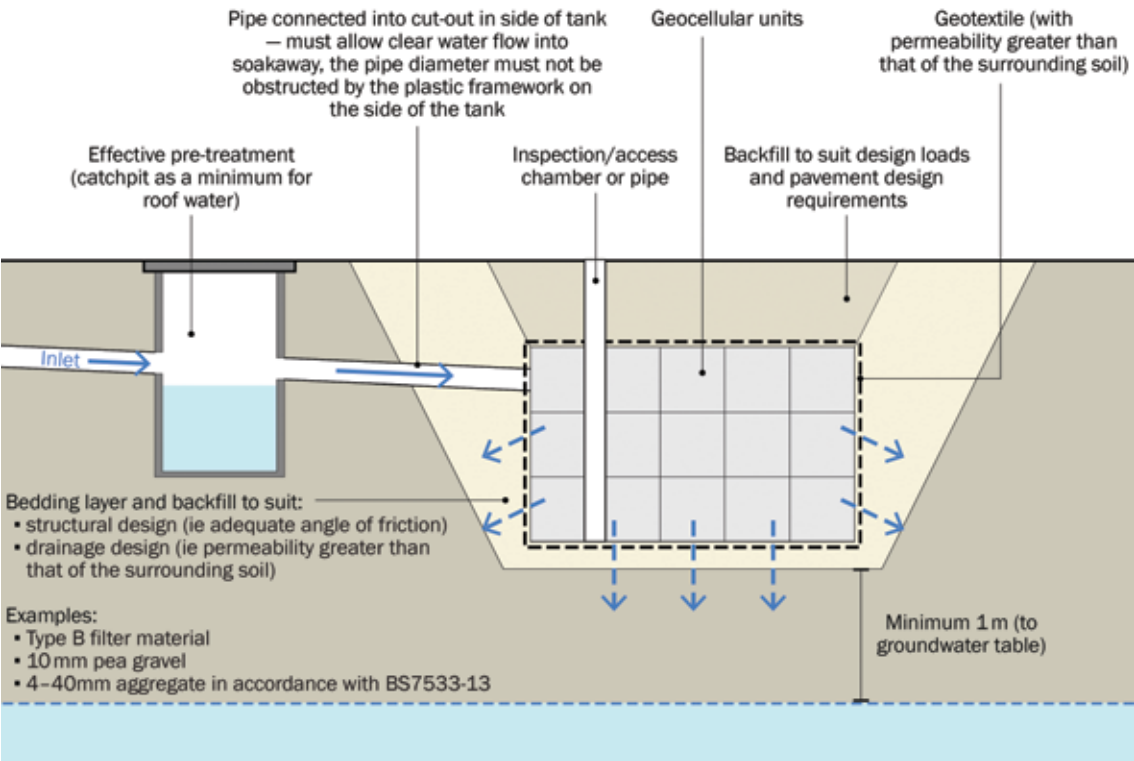
ARCHITECT: Bluebird Design & Surveying

SITE: 928 Oxford Road

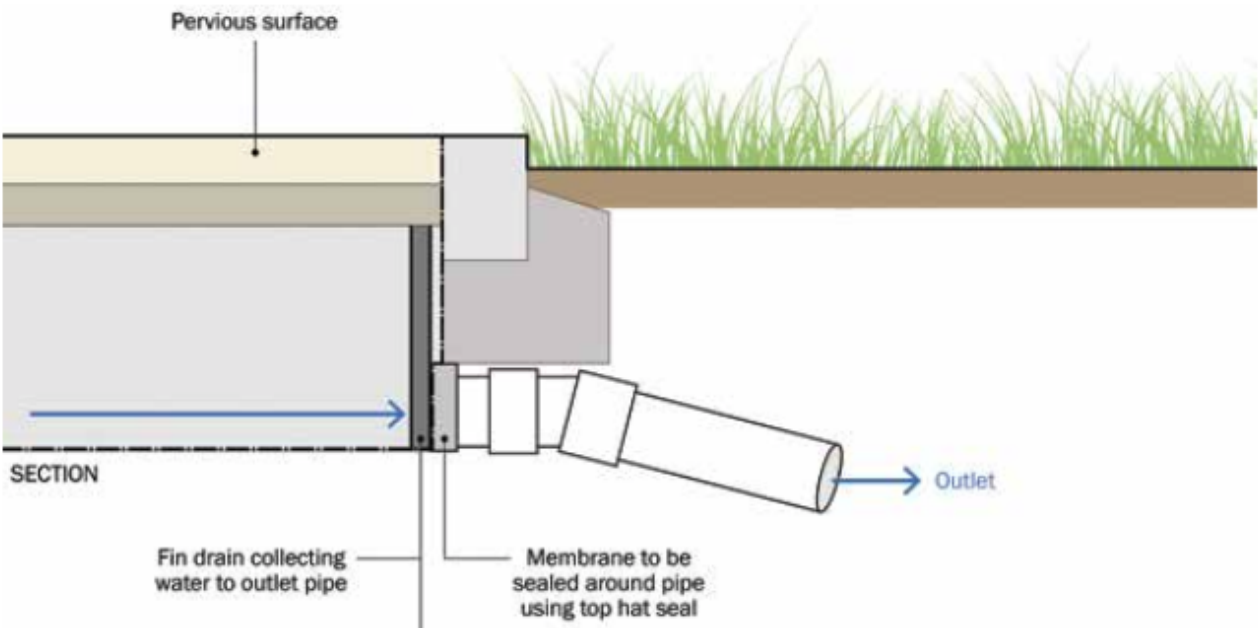
TITLE: Below Ground Drainage Details

SCALE: AT A3: Scale Bar DATE: 30/11/21 DRAWN: TQ CHECKED: MST

PROJECT NO: 1148 DRAWING NO: C-110 REVISION: A



TYPICAL INFILTRATION TANK



TYPICAL FIN DRAIN DETAIL

Notes:

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1. This drawing is to be read in conjunction with the Drainage Layout 1106-C100 Drawing

2. All private drainage works to be constructed in accordance with the latest edition of the Building Regulations part H (Drainage & Waste Disposal) and to BS EN752.

3. All manholes within block paved and slabbed areas to have recessed covers and frames.

4. Pipe runs near Buildings: If trench is within 1m of a building it shall be filled with concrete up to the lowest level of the adjacent foundation. If trench is greater than 1m from a building the trench shall be filled with concrete up to a level below the building equal to the distance from the building less 150mm.

5. Where pathways fall towards the dwelling gullies and channels are to be provided to prevent water damaging building.

6. All existing drainage levels to be checked prior to commencement of works. Any discrepancy to be reported to the appointed engineers.

7. All paving gullies to suit low point and to be trapped.

8. Cellular Storage System to be constructed in accordance with manufacturers information.

A	Planning Issue	TQ	31/01/22
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REV:	DESCRIPTION:	BY:	DATE:
STATUS: Issued for Information			



CLIENT:	Mr Hargun
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ARCHITECT:	Bluebird Design & Surveying
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SITE:	928 Oxford Road
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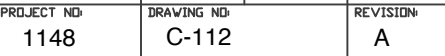
TITLE:	Below Ground Drainage Details
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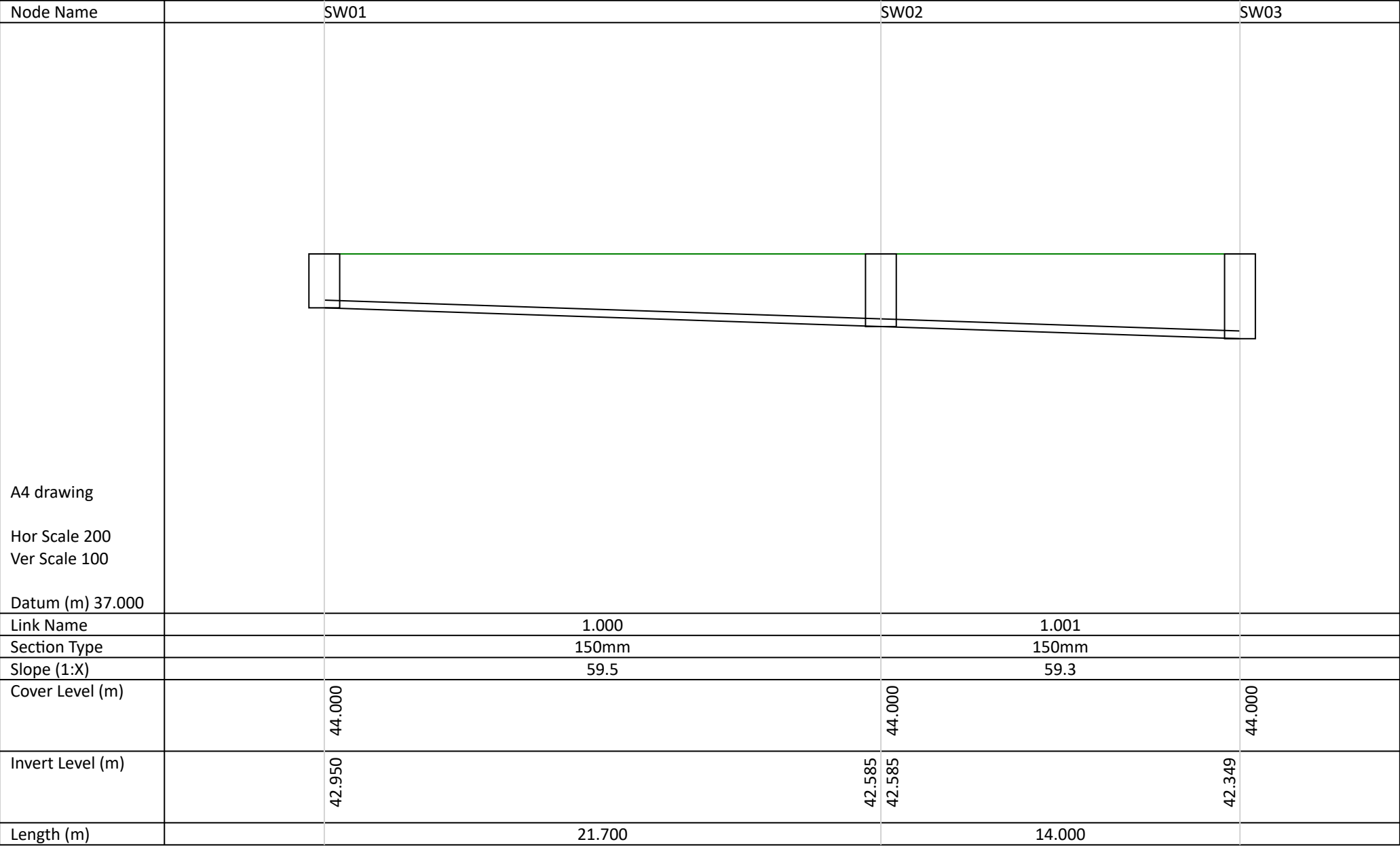
SCALE AT A3:	DATE:	DRAWN:	CHECKED:
Scale Bar	30/11/21	TQ	MST
PROJECT NO:	DRAWING NO:	REVISION:	
1148	C-111	A	

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW01	44.000	1.050	1200		0	1.000	42.950
SW02	44.000	1.415	1200		1	1.000	42.585
SW03	44.000	1.651	1200		0	1.001	42.585
SW04	44.000	1.825	1200		1	1.001	42.349
SW05	44.000	1.050	1200		0	1.002	42.349
SW06	44.000	1.521	1200		1	1.002	42.175
SW07	44.000	2.296	1200		0	1.003	42.175
SW08	44.000	2.346	1200		1	1.003	42.000
SW09	44.000	2.500	1200		0	2.000	42.950
SW10	44.000	2.500	1200		1	2.000	42.479
SW11	44.000	2.500	1200		0	2.001	42.479
SW12	44.000	2.500	1200		1	2.001	41.704
SW13	44.000	2.500	1200		2	1.003	41.704
SW14	44.000	2.500	1200		0	1.004	41.704
SW15 - SA	44.000	2.500	1200		1	1.004	41.654

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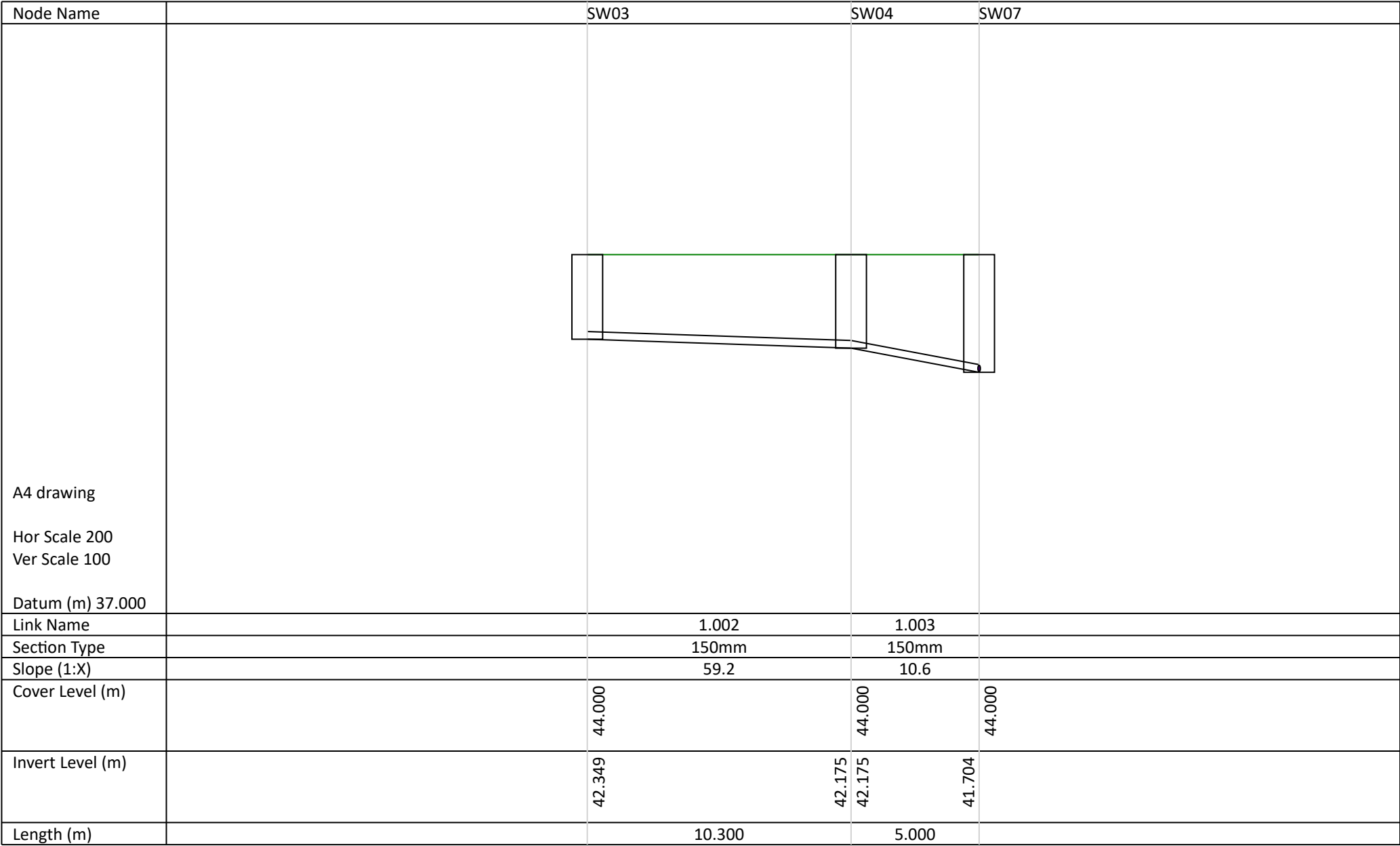
A	Planning Issue	TQ	31/01/22
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REV:	DESCRIPTION:	BY:	DATE:
STATUS: Issued for Information			



CLIENT:	Mr Hargun
ARCHITECT:	Bluebird Design & Surveying

SITE:	928 Oxford Road		
TITLE:	Inspection Chamber Schedule and Longitudinal Sections		
SCALE AT A3:	DATE:	DRAWN:	CHECKED:
Scale Bar	30/11/21	TQ	MST
PROJECT NO:	DRAWING NO:	REVISION:	
1148	C-113	A	



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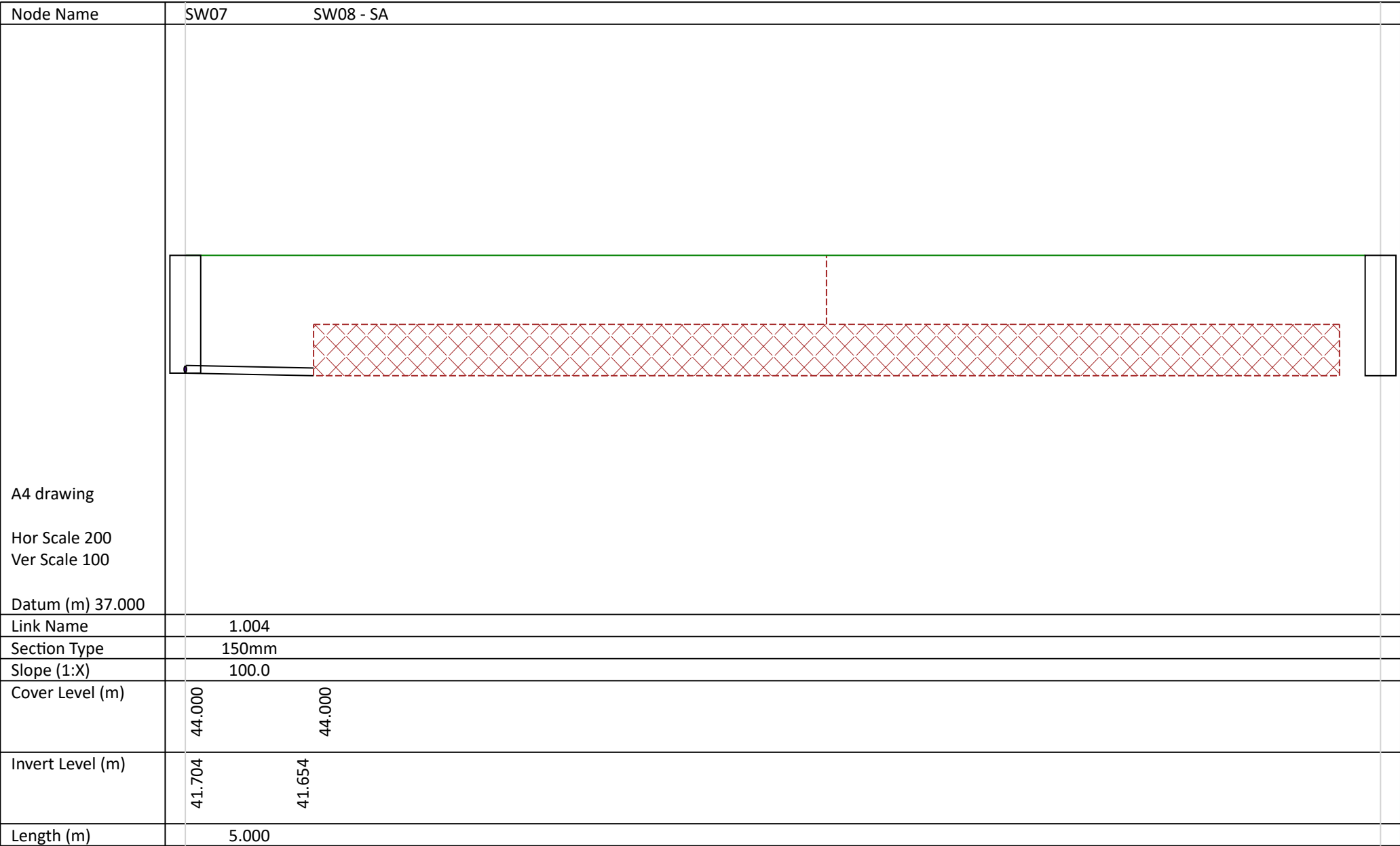
A	Planning Issue	TQ	31/01/22
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REV:	DESCRIPTION:	BY:	DATE:
STATUS: Issued for Information			



CLIENT:	Mr Hargun
ARCHITECT:	Bluebird Design & Surveying

SITE:	928 Oxford Road		
TITLE:	Inspection Chamber Schedule and Longitudinal Sections		
SCALE AT A3:	DATE:	DRAWN:	CHECKED:
Scale Bar	30/11/21	TQ	MST
PROJECT NO:	DRAWING NO:	REVISION:	
1148	C-114	A	



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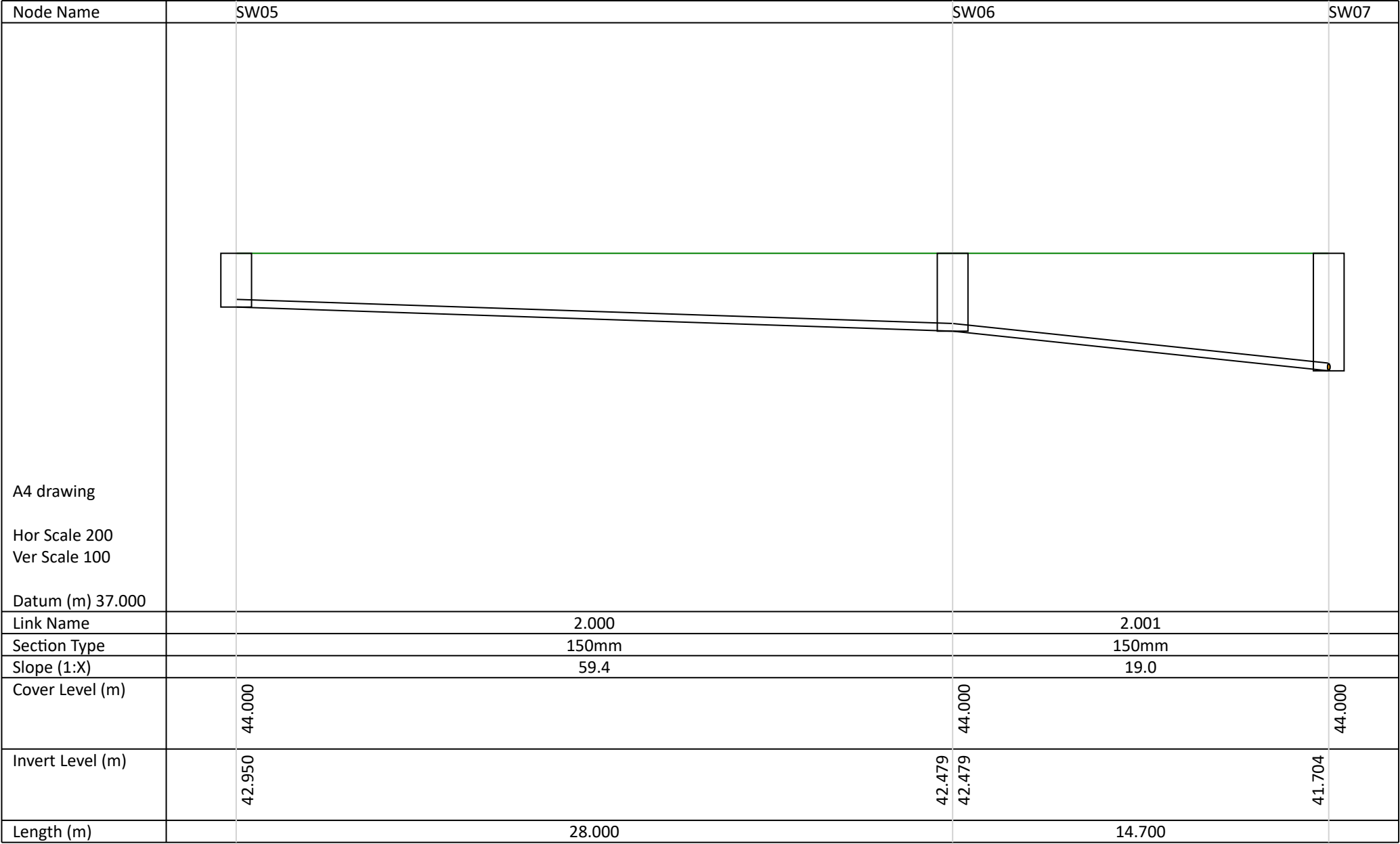
A	Planning Issue	TQ	31/01/22
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REV:	DESCRIPTION:	BY:	DATE:
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SITE:	928 Oxford Road		
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SCALE AT A3:	DATE:	DRAWN:	CHECKED:
Scale Bar	30/11/21	TQ	MST
PROJECT NO:	DRAWING NO:	REVISION:	
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A	Planning Issue	TQ	31/01/22
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REV	DESCRIPTION	BY	DATE
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CLIENT:	Mr Hargun
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SITE:	928 Oxford Road		
TITLE:	Inspection Chamber Schedule and Longitudinal Sections		
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Scale Bar	30/11/21	TQ	MST
PROJECT NO:	DRAWING NO:	REVISION:	
1148	C-116	A	

Calculated by:

Site name:

Site location:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:

Longitude:

Reference:

Date:

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics	Default	Edited
SAAR (mm):	648	648
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	0.29	0.29
1 in 1 year (l/s):	0.25	0.25
1 in 30 years (l/s):	0.68	0.68
1 in 100 year (l/s):	0.94	0.94
1 in 200 years (l/s):	1.1	1.1

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.800
Ratio-R	0.400	Preferred Cover Depth (m)	0.900
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SW01	0.015	5.00	44.000	1200	1.050
SW02	0.010	5.00	44.000	1200	1.415
SW03	0.005	5.00	44.000	1200	1.651
SW04	0.010	5.00	44.000	1200	1.825
SW05	0.015	5.00	44.000	1200	1.050
SW06	0.010	5.00	44.000	1200	1.521
SW07	0.015	5.00	44.000	1200	2.296
SW08 - SA	0.000	5.00	44.000	1200	2.346

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SW01	SW02	21.700	0.600	42.950	42.585	0.365	59.5	150	5.28	50.0
1.001	SW02	SW03	14.000	0.600	42.585	42.349	0.236	59.3	150	5.46	50.0
1.002	SW03	SW04	10.300	0.600	42.349	42.175	0.174	59.2	150	5.59	50.0
1.003	SW04	SW07	5.000	0.600	42.175	41.704	0.471	10.6	150	5.61	50.0
2.000	SW05	SW06	28.000	0.600	42.950	42.479	0.471	59.4	150	5.36	50.0
2.001	SW06	SW07	14.700	0.600	42.479	41.704	0.775	19.0	150	5.46	50.0
1.004	SW07	SW08 - SA	5.000	0.600	41.704	41.654	0.050	100.0	150	5.70	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.307	23.1	2.0	0.900	1.265	0.015	0.0	30	0.809
1.001	1.308	23.1	3.4	1.265	1.501	0.025	0.0	39	0.940
1.002	1.309	23.1	4.1	1.501	1.675	0.030	0.0	42	0.988
1.003	3.110	55.0	5.4	1.675	2.146	0.040	0.0	32	1.997
2.000	1.307	23.1	2.0	0.900	1.371	0.015	0.0	30	0.809
2.001	2.323	41.1	3.4	1.371	2.146	0.025	0.0	29	1.408
1.004	1.005	17.8	10.8	2.146	2.196	0.080	0.0	85	1.053

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	21.700	59.5	150	Circular	44.000	42.950	0.900	44.000	42.585	1.265
1.001	14.000	59.3	150	Circular	44.000	42.585	1.265	44.000	42.349	1.501
1.002	10.300	59.2	150	Circular	44.000	42.349	1.501	44.000	42.175	1.675
1.003	5.000	10.6	150	Circular	44.000	42.175	1.675	44.000	41.704	2.146
2.000	28.000	59.4	150	Circular	44.000	42.950	0.900	44.000	42.479	1.371
2.001	14.700	19.0	150	Circular	44.000	42.479	1.371	44.000	41.704	2.146
1.004	5.000	100.0	150	Circular	44.000	41.704	2.146	44.000	41.654	2.196

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SW01	1200	Manhole	Adoptable	SW02	1200	Manhole	Adoptable
1.001	SW02	1200	Manhole	Adoptable	SW03	1200	Manhole	Adoptable
1.002	SW03	1200	Manhole	Adoptable	SW04	1200	Manhole	Adoptable
1.003	SW04	1200	Manhole	Adoptable	SW07	1200	Manhole	Adoptable
2.000	SW05	1200	Manhole	Adoptable	SW06	1200	Manhole	Adoptable
2.001	SW06	1200	Manhole	Adoptable	SW07	1200	Manhole	Adoptable
1.004	SW07	1200	Manhole	Adoptable	SW08 - SA	1200	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW01	44.000	1.050	1200				
				0	1.000	42.950	150
SW02	44.000	1.415	1200				
				0	1.001	42.585	150
SW03	44.000	1.651	1200				
				0	1.002	42.349	150
SW04	44.000	1.825	1200				
				0	1.003	42.175	150
SW05	44.000	1.050	1200				
				0	2.000	42.950	150
SW06	44.000	1.521	1200				
				0	2.001	42.479	150
SW07	44.000	2.296	1200				
				1	2.001	41.704	150
				2	1.003	41.704	150
				0	1.004	41.704	150

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW08 - SA	44.000	2.346	1200	1	1.004	41.654	150



Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

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

Node SW08 - SA Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.68400	Safety Factor	1.0	Invert Level (m)	41.654
Side Inf Coefficient (m/hr)	0.68400	Porosity	0.95	Time to half empty (mins)	20

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	20.0	0.0	1.000	20.0	40.0	1.001	0.0	40.0

Results for 5 year Critical Storm Duration. Lowest mass balance: 99.42%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	10	42.989	0.039	3.5	0.0555	0.0000	OK
15 minute winter	SW02	10	42.637	0.052	5.8	0.0655	0.0000	OK
15 minute winter	SW03	11	42.410	0.061	6.9	0.0729	0.0000	OK
15 minute winter	SW04	10	42.216	0.041	9.2	0.0513	0.0000	OK
15 minute winter	SW05	10	42.990	0.040	3.5	0.0566	0.0000	OK
15 minute winter	SW06	10	42.517	0.038	5.8	0.0479	0.0000	OK
60 minute winter	SW07	47	42.072	0.368	9.6	0.4645	0.0000	SURCHARGED
60 minute winter	SW08 - SA	47	42.070	0.416	8.9	8.3763	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	SW01	1.000	SW02	3.4	0.768	0.149	0.0976
15 minute winter	SW02	1.001	SW03	5.7	0.949	0.247	0.0843
15 minute winter	SW03	1.002	SW04	6.9	1.293	0.296	0.0550
15 minute winter	SW04	1.003	SW07	9.1	0.821	0.166	0.0539
15 minute winter	SW05	2.000	SW06	3.4	0.948	0.149	0.1016
15 minute winter	SW06	2.001	SW07	5.7	0.549	0.140	0.1551
60 minute winter	SW07	1.004	SW08 - SA	8.9	0.948	0.499	0.0880
60 minute winter	SW08 - SA	Infiltration		2.9			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.42%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	10	42.998	0.048	5.2	0.0680	0.0000	OK
15 minute winter	SW02	10	42.650	0.065	8.6	0.0820	0.0000	OK
15 minute winter	SW03	10	42.425	0.076	10.2	0.0908	0.0000	OK
60 minute winter	SW04	46	42.267	0.092	7.1	0.1140	0.0000	OK
15 minute winter	SW05	10	42.999	0.049	5.2	0.0698	0.0000	OK
15 minute winter	SW06	10	42.525	0.046	8.6	0.0586	0.0000	OK
60 minute winter	SW07	46	42.266	0.562	14.1	0.7096	0.0000	SURCHARGED
60 minute winter	SW08 - SA	47	42.261	0.607	13.1	12.2201	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	SW01	1.000	SW02	5.1	0.850	0.222	0.1312
15 minute winter	SW02	1.001	SW03	8.5	1.050	0.367	0.1135
15 minute winter	SW03	1.002	SW04	10.1	1.389	0.439	0.0787
60 minute winter	SW04	1.003	SW07	7.1	0.646	0.129	0.0723
15 minute winter	SW05	2.000	SW06	5.1	1.059	0.221	0.1352
15 minute winter	SW06	2.001	SW07	8.5	0.641	0.207	0.1635
60 minute winter	SW07	1.004	SW08 - SA	13.1	1.048	0.737	0.0880
60 minute winter	SW08 - SA	Infiltration		4.5			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.42%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	10	43.016	0.066	9.4	0.0938	0.0000	OK
15 minute winter	SW02	12	42.777	0.192	15.6	0.2437	0.0000	SURCHARGED
60 minute winter	SW03	47	42.772	0.423	9.7	0.5044	0.0000	SURCHARGED
60 minute winter	SW04	47	42.769	0.594	12.0	0.7366	0.0000	SURCHARGED
15 minute winter	SW05	10	43.017	0.067	9.4	0.0947	0.0000	OK
60 minute winter	SW06	47	42.768	0.289	8.1	0.3650	0.0000	SURCHARGED
60 minute winter	SW07	47	42.765	1.061	23.3	1.3389	0.0000	SURCHARGED
60 minute winter	SW08 - SA	47	42.750	1.096	21.6	20.2495	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	SW01	1.000	SW02	9.3	0.987	0.403	0.2612
15 minute winter	SW02	1.001	SW03	15.5	1.165	0.670	0.2465
60 minute winter	SW03	1.002	SW04	8.9	1.301	0.387	0.1813
60 minute winter	SW04	1.003	SW07	11.1	0.741	0.203	0.0880
15 minute winter	SW05	2.000	SW06	9.4	1.207	0.408	0.3136
60 minute winter	SW06	2.001	SW07	8.1	0.614	0.197	0.2588
60 minute winter	SW07	1.004	SW08 - SA	21.6	1.229	1.218	0.0880
60 minute winter	SW08 - SA	Infiltration		7.6			