TJ Infrastructure Ltd

Project: The Stables, Tanhouse Lane

Title: SuDs Drainage Strategy and Flood Risk Assessment

Reference: STL-SuDs-01

Client: Matt Rushent

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Rev	Description	Date
00	First Issue	01/12/2023

Author	Signature	Date
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Table of Contents

Appendices

1 Introduction

1.1 Project Background

1.1.1 TJ Infrastructure (the consultant) has been commissioned by Matt Rushent (the Client) to produce an SuDs Drainage Strategy and Flood Risk Assessment Report in relation to the proposed new development at The Stables, Tanhouse Lane.

1.1.2 The development includes the construction of three new detached dwellings using the existing vehicular access off of Tanhouse Lane with a change to the existing hardstanding extent to suit the new units.

1.1.3 The existing converted barns in the south east of the development are existing and retained through the works and within the same ownership, but not forming part of this application.

1.2 Method

1.2.1 The report will firstly assess the existing site, including a Flood Risk Assessment, and any potential constraints to the development and the drainage strategy. It will then assess the opportunities for sustainable measures to be included with the drainage strategy and the discharge points for both foul and surface water.

1.2.2 The following report will assess the development proposals against the requirements of the NPPF and the standing advice of the Environment Agency and Lead Local Flood Authority (LLFA).

1.2.3 After the introductory section, the following is discussed:

- Section 2 describes the existing site conditions.
- Section 3 includes a Flood Risk Assessment.
- Section 4 assesses any potential constraints to the development.
- Section 5 analyses the existing site drainage.
- Section 6 proposed surface water SuDs network and outfall.
- Section 7 proposed foul water network and outfall.
- Section 8 provides the summary and conclusions.

2 Existing site

2.1 Site Description

2.1.1 The site is located off of Tanhouse Lane, Engine Common, Iron Acton to the north of Yate with the approximate coordinates for the site E: 369900, N: 184975.

2.1.2 The proposed location of the development is on the land surrounding the existing converted barn accessible from Tanhouse Lane.

2.1.3 The site surroundings are rural village on the northern edge of Engine Common consisting of a small number of residential properties locally with a large proportion of green space consisting of open fields and farms in the wider area until Yate to the south.

2.1.4 A topographical survey has been undertaken for the site prior to some additional development to the existing barn buildings to the south east. The site is broadly split into two areas with the land to the north of the barns, and the area to the west. This shows that the north area falls from west to east from levels around 66.6mAOD to 66.1mAOD.

2.1.5 To the west there is limited topographical survey information as therefore it has been supplemented through interrogation of the Environment Agency LiDAR dataset. This gives a high level to the west of approximately 68.0mAOD falling to 66.1mAOD adjacent to the existing barn. The topographical survey is contained in Appendix A.

2.1.6 In the surrounding area the levels fall from west to east towards the tributary of the Ladden Brook which lies approximately 330m to the east locally flowing in a northern direction. This is based on contouring information available on OS mapping.

2.2 Watercourses

2.2.1 The nearest Main River is the reach of the Ladden Brook to the north of Tanhouse Lane, with the reach and tributaries leading up to this point being classified as minor watercourses.

2.2.2 There are multiple minor watercourses in the local area some of which have been identified on OS mapping, and others identified during a site walkover and from the topographical information and LiDAR data.

2.2.3 Along Tanhouse Lane to the west of the site entrance there are highways ditches\watercourses along the northern and southern channel lines, with the northern channel continuing to the east with a confluence from another channel just to the east of the site.

2.2.4 The southern watercourse curves to the south just to the west of the existing site access and whilst not fully shown on the topographical information the local LiDAR data indicates a continuation of the channel just on the other side of the site boundary. On the topographical survey there is a headwall type structure just to the north west of the existing barn by the oak tree with a culverted section flowing to the south.

2.2.5 This culvert opens up to a channel to the south of the site and formed part of the topographical survey and proposed works for the adjacent development to the south which details the diversion of the watercourse through a culvert to the east, but also a bifurcation in the flows as there is also an open channel which flows to the south.

2.2.6 Both of these flows eventually head back to the north to the southern channel line of Tanhouse Lane as shown on the mapping below:

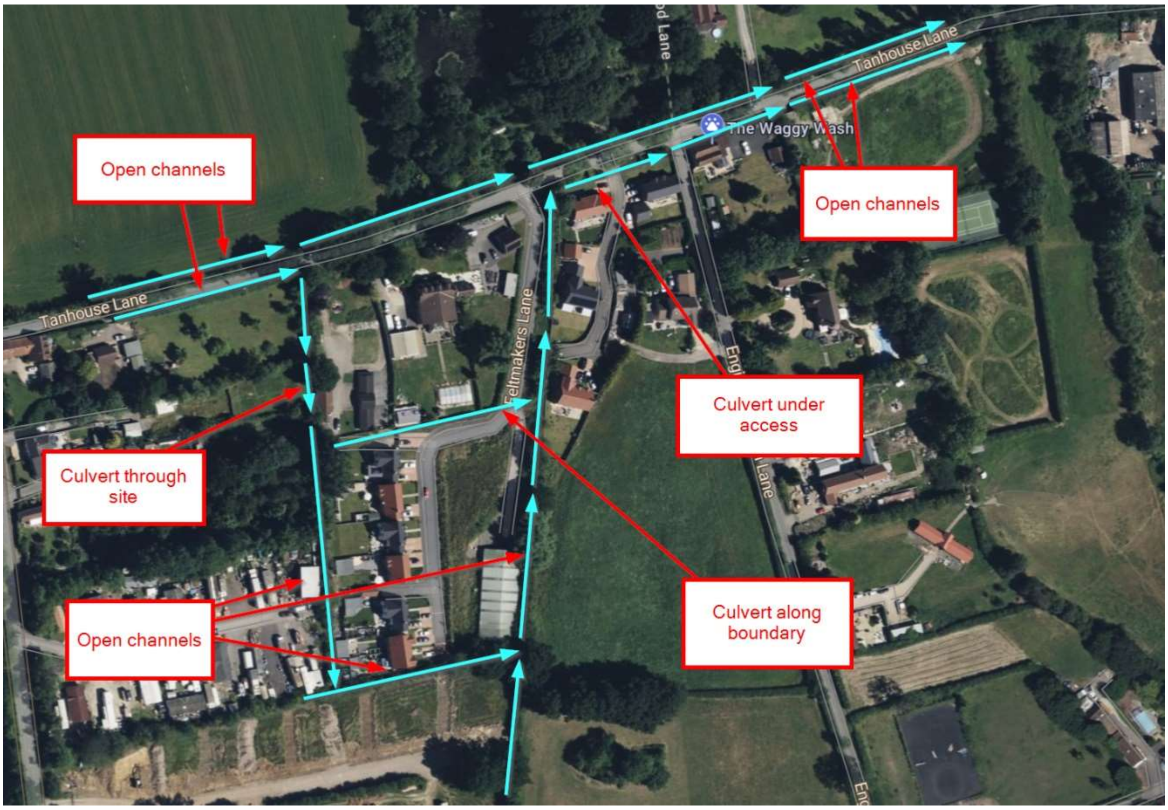


Figure 2.1 – Location of features and route of watercourse

2.3 Existing Private Drainage

2.3.1 The topographical survey does not identify any formalised private drainage features on the site, with the hardstandings draining generally to the local minor watercourses, and the foul for the local area known to run to a series of private Package Treatment Plants (PTPs) and septic tanks prior to discharge to the watercourse.

2.3.2 The private drainage which was installed as part of the Feltmakers Lane development to the south has been included on the drainage strategy drawings for completeness and includes the line of the culverted watercourse to the south east.

2.4 Public Sewers

2.4.1 Wessex Water mapping has been checked for the site but there are no foul, surface water or combined sewers in the local area.

3 Development and Flood Risk

3.1 Proposed Development Vulnerability Classification

3.1.1 The proposals include construction of three new dwellings and the reconfiguration of the existing hardstanding but maintaining access to the existing property to the south east. From Table 2 of the PPG buildings used for dwelling houses have a vulnerability classification of More Vulnerable.

3.2 Flood Zone Classification

3.2.1 The Gov.uk website provides basic flood mapping data to determine the Flood Zoning classification for the proposed development.

3.2.2 This planning mapping indicates that the site is entirely located within an area classified as Flood Zone 1, with the nearest Flood Zones associated with the Ladden Brook to the east.

3.2.3 Given the relative levels between the site and the Ladden Brook (the latter approximately 6.0m lower) flooding is unlikely to affect the site. Flood Zone mapping from the Gov.uk website shown below:

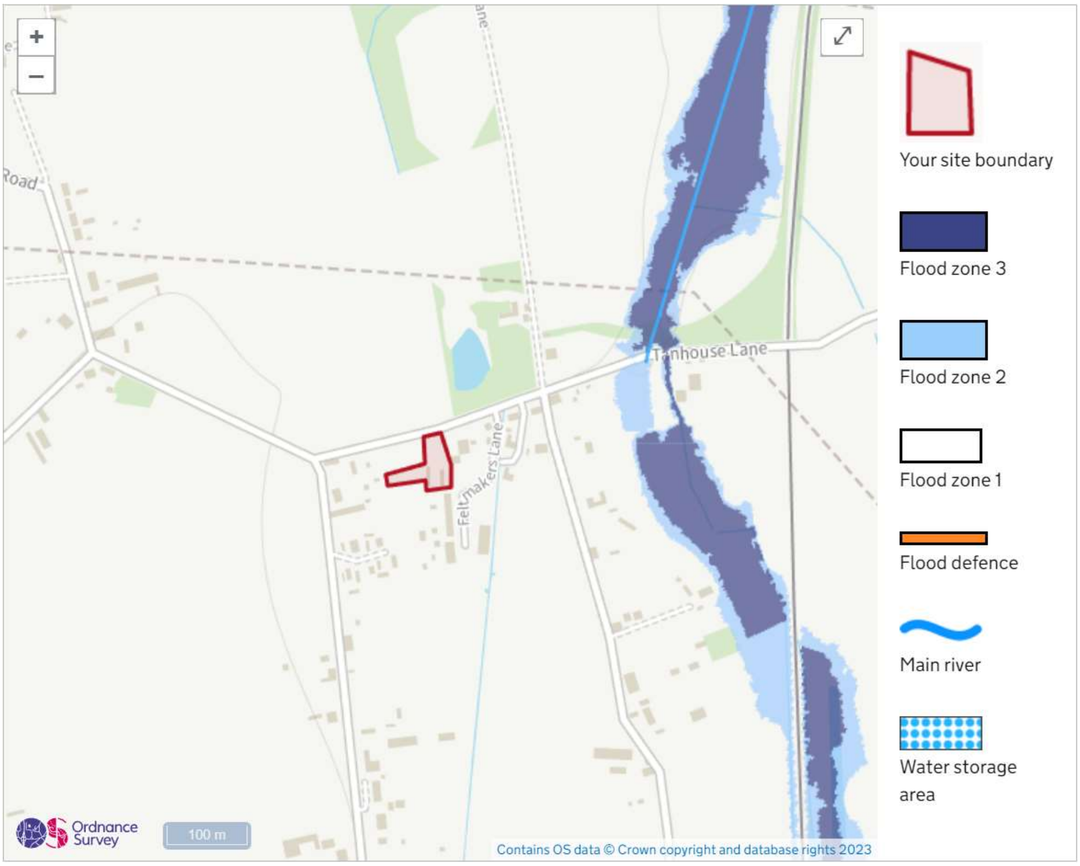


Figure 3.1 – Flood Zoning mapping (Gov.uk)

3.3 Fluvial Flooding

3.3.1 The Gov.uk website provides basic flood risk mapping data to determine the flood risk classification for the proposed development.

3.3.2 This mapping mirrors the Flood Zone mapping for the proposed development being only associated with the Ladden Brook to the east. The Gov.uk mapping which covers both fluvial and tidal is shown in the figure below.

3.3.3 Fluvial flooding also includes the minor watercourses around the development, but these will be covered in the surface water section.

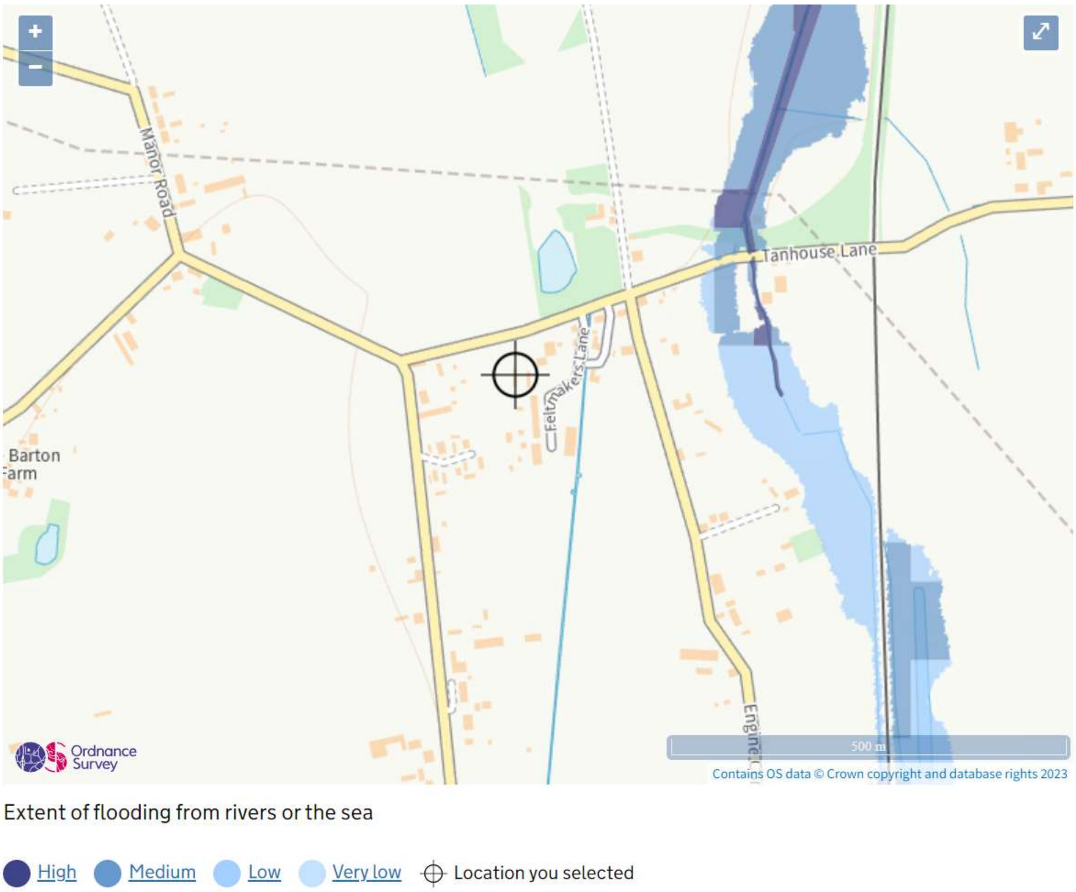


Figure 3.2 – Fluvial\Tidal flood risk mapping (Gov.uk)

3.3.4 Given the elevation and inland nature of the site this is fluvial only and, on this basis, fluvial flooding to the development is considered to be low.

3.4 Coastal/Tidal Flooding

3.4.1 Given the inland location of the site tidal flooding to the development is considered to be negligible.

3.5 Flood Defences

3.5.1 There are no flood defences serving the development.

3.6 Flooding from Climate Change

3.6.1 There is no climate change information available with the mapping information above, however as noted the relative levels means the effects of climate change will not increase the flood risk sufficiently to affect the proposed development.

3.6.2 Climate change will be taken in to account for the proposed development as detailed in section 6 below.

3.7 Flooding from Groundwater

3.7.1 The area around Engine Common and Iron Acton is known for having a high groundwater table. The Ground Investigation report undertaken by Ground Investigation Limited (Ref: P1435.1.1) notes that the site is directly underlain by the South Wales Middle Coal Measures Formation which is a mudstone\siltstone formation which likely weathered to clay soil at the surface.

3.7.2 Mapping from within this report also notes that whilst there is a large area of 'Limited Potential for Groundwater Flooding to Occur' that the proposed site is outside of this extent:

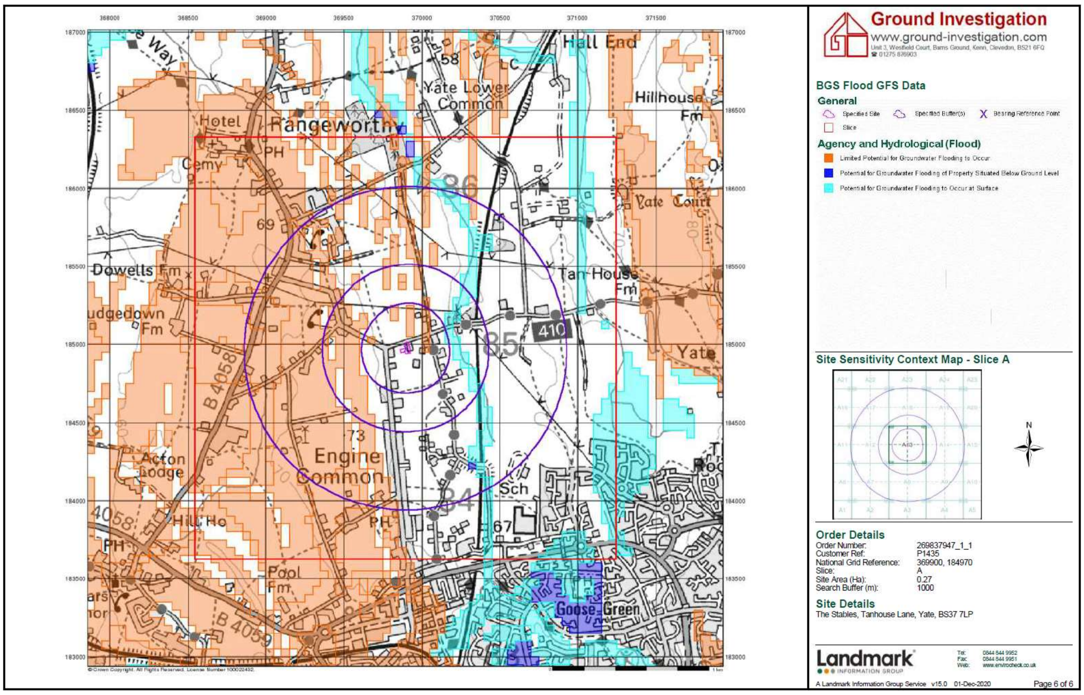


Figure 3.3 Extract from Ground Investigation Limited report showing risk of groundwater flooding

3.7.3 Additionally, the report summarised groundwater as follows:

Groundwater seepages were noted at between 0.50 and 1.65 m depth in the trial pits, with subsequent standing levels of between 1.25 and 1.65 m recorded after a couple of hours, prior to backfilling.

At one position (TP2) the water was entering via a land drain, whilst in TP5, relatively *shallow perched water was seeping in from the Made Ground.*

3.7.4 Given the relative depths of groundwater, the clay and mudstone composition of the ground, and the presence of the local watercourses which would drain groundwater, flood risk from groundwater is considered to be low.

3.8 Flooding from Adopted Sewers

3.8.1 As there are no adopted sewers in the local area there is no flood risk.

3.9 Flooding from Private Drainage

3.9.1 The proposed development will replace the access vehicular hardstanding with a permeable construction as part of the drainage strategy. The proposed development will also include a SuDs scheme to manage flows up to the 1 in 100 year plus climate change event and therefore flooding from private drainage will be low.

3.9.2 There are no adjacent properties where other private networks would affect the site. Localised flooding within the area would follow the overland flow routes along the existing network of minor watercourses.

3.10 Flooding from Surface Water

3.10.1 Surface water flood maps are available on the Gov.uk website. This mapping is similar to the Flood Zoning to the east, however this does show the locations of the local watercourses around Feltmakers Lane as shown in the figure below:

Extent of flooding from surface water

High Medium Low Very low Location you selected

Figure 3.4 Surface water flood risk

3.10.2 This mapping does not include in the modelling for culverts and formalised drainage networks, and is limited as to the accuracy of the LiDAR mapping which is typically over a 1m or 2m grid. This means that where the LiDAR grid does not align with the watercourses the invert levels of the channels will not be picked up correctly. This can either mean the channels are completely missed, or can mean that discontinuous low points are picked up which will then be noted as flooding in the above modelling where in reality there is a flow.

3.10.3 From review of the local LiDAR information there is only a few points along the channel which is to the west of the vehicular access to the site which suggest a line of a watercourse, but this wouldn’t be picked up as a clean channel within the modelling. There is also a line of surface water flooding shown along Feltmakers Lane but this is shown as an open, but blind, channel on the LiDAR information which is historic prior to the development of Feltmakers Lane and does not include for the culverted outfall to the lower watercourse to the east.

3.10.4 Flooding is also shown around Weavers Lane to the east of Feltmakers Lane, but again this is a culverted line of the watercourse which is unlikely to be modelled correctly in this assessment.

3.10.5 The watercourses flanking Tanhouse Lane are not flagged up as being at risk and this suggests that there is capacity for these flows, and therefore this suggests that there is sufficient capacity within the local watercourses to convey the local flows.

3.10.6 Based on the above the flood risk from surface water is considered to be low.

3.11 Flooding from Reservoirs, Canals and Artificial Sources

3.11.1 There are no canals within the vicinity of the site that could present a risk to the site.

3.11.2 The Environment Agency Flood Risk from Reservoirs Map indicates that the site is not at risk of flooding from reservoirs.

3.11.3 Because of the above flooding from reservoirs or canals is deemed to be low.

3.12 Overall Flood Risk

3.12.1 As noted in the previous sections the flood risk to the proposed development is considered to be low from all sources and therefore is suitable for the type of development proposed.

3.13 The Sequential Test

3.13.1 The aim of the Sequential Test is to guide development away from areas at risk of flooding towards land situated within the Environment Agency's Flood Zone 1 classification.

3.13.2 As the site is wholly within Flood Zone 1 the Sequential Test is not required.

3.14 The Exception Test

3.14.1 The flood risk from all sources has been considered above as low from all sources and therefore the Exception Test is not required.

4 Site Constraints

4.1 Background

4.1.1 The following is an assessment of the potential constraints to the proposed development which may have an effect on the design proposals. This assessment is based on the information which is available at the time of writing and additional constraints may become apparent through the design process.

4.2 Flood Risk

4.2.1 Section 3 assessed flood risk from all sources and noted them to be low. This is reliant on maintaining the existing watercourse routes through the proposed development.

4.3 Watercourses

4.3.1 The watercourses are to be retained in their existing condition as part of the development proposals due to the requirement for a vehicular access to the western part of the site. As part of the proposed works investigations will be undertaken on the existing culvert to ensure it is in good condition and reinforced as required for the vehicular access.

4.4 Adjacent Development

4.4.1 At the time of writing no adjacent proposed development has been identified which needs to be taken into consideration with the proposed development.

4.5 Public Sewers

4.5.1 As there are no public sewers running through the site there are no constraints on the new development.

4.6 Geological Setting

4.6.1 Infiltration testing was not undertaken on site due to the presence of the spring which indicates a groundwater level which would be prohibitive to infiltration techniques with current design standards.

4.6.2 Additionally planning and development history from the local area indicates that the use of soakaways is not advisable, however with shallow features these can be left with a permeable liner to infiltrate as much as possible, but the drainage strategy requires a formalised outfall.

4.7 Additional Constraints

4.7.1 No additional constraints have been identified for the proposed development.

5 Existing Drainage

5.1 Existing Drainage

5.1.1 As noted above there is limited information on the existing surface water network but it is likely to be a series of overland flows to the watercourse.

5.2 Greenfield Runoff Rates

5.2.1 The equivalent Greenfield runoff rates the site have been determined using the FEH methodology for the existing impermeable area of 990m^2. The greenfield discharge rates are as follows:

Return Period	Discharge Unit Rate (l\s)
2	0.6
Qbar	0.7
30	1.4
100	1.7

5.3 Existing Discharge Rates

5.3.1 The existing discharge rate has been determined through assessment of the potential catchment generation using the Rational Method as detailed in the SuDs Manual.

5.3.2 Using the FEH point data to generate rainfall characteristic of the site the average 1 in 100 year 15min rainfall is 92.8mm/hr. This is likely to be the critical storm duration for the site given the small size of the catchment with a time of concentration less than 15mins, but this being the shortest duration produced by calculation methods. Based on the existing impermeable area of 373m^2 this gives a peak runoff rate of 9.6 l/s.

5.4 Foul Drainage

5.4.1 There is no noted existing foul drainage within the site, however due to the proximity of existing known PTP and septic tank discharges to the local watercourse network with the change in the General Binding Rules as of the 2nd October 2023 an application for an Environmental Permit will be required per property as they will be privately owned and maintained.

6 Proposed Surface Water Drainage

6.1 Discharge Locations

6.1.1 The hierarchy of discharge receptors gives the following order of priority with the next level only permissible for use where the above receptors cannot be achieved by reasonably practicable means:

- An adequate soakaway or some other adequate infiltration system,
- A watercourse,
- A surface water sewer,
- A combined sewer.

6.1.2 Infiltration testing has not been undertaken due to the presence of the groundwater table below the site, and with known issues with the use of soakaways in the local area. Therefore, features can be lined with permeable geotextiles, but a formalised outfall\s will be required.

6.1.3 The second receptor is a watercourse and as there is an existing watercourse running through the development this should be the receptor of the flows.

6.2 Discharge Rate

6.2.1 Based on the discussion in section 5 the existing discharge rate for the 1 in 100 year event is 9.6 l/s, however in accordance with best practice the proposed SuDs will target greenfield runoff rates, but with a lower limit of 2.0l/s as a minimum practicable discharge rate. With a climate change allowance of 45% on the 1 in 100 year event, and 40% on the 1 in 30 year event in accordance with the Avon Bristol and North Somerset Streams Management Catchment peak rainfall allowances.

6.3 Attenuation

6.3.1 An appraisal of the attenuation options for the site has been developed with the design team. Due to the requirements to keep attenuation shallow to avoid buoyancy issues with the groundwater table a permeable subbase will be used for all of the vehicular hardstandings varying in thickness depending on the hydraulic requirements.

6.3.2 The attenuation volume has also been supplemented with a shallow attenuation basin in the open green area to the north of the site.

6.3.3 Water butts have also been included for plant and garden watering.

6.4 Proposed Surface Water Network

6.4.1 Based on the above assessment the site will discharge at 2.0 l/s for all events up to and including the 1 in 100 year +CC event across the range of durations.

6.4.2 Due to the location of the RPZs across the site the main conveyance will be through the permeable subbase for the vehicular hardstanding which will include tree friendly construction (such as a cellweb or treetex cellular confinement) and this will remove the requirement for formalised pipework. This also enables the connectivity between the northern and western parts of the site and reach the outfall to the watercourse to the south.

6.4.3 The flows from the site will be controlled by an orifice plate within a control chamber prior to the formalised outfall to the existing culverted watercourse. This is linked to the subbase via a diffuser unit which will function as a French drain.

6.4.4 The proposed drainage strategy is shown on drawings in Appendix B along with the drainage details for the development, with corresponding hydraulic calculations in Appendix C.

6.4.5 The network has been modelled using nominal pipes connecting the various areas and catchments, this modelling approximation is shown on the modelling layout D002.

6.5 Exceedance

6.5.1 The proposed site levels follow the same general levels as the existing site, includes falls to the east around the dwellings to the west, and to the south for the new dwelling to the north. Any exceedance of the drainage network would also overland flow towards the watercourse away from people and property.

6.6 Operations and Maintenance

6.6.1 A draft Operations and Maintenance Manual (O&M) has been included within Appendix D. This is to be used as a template as it will need to be developed through the detailed design stage and can only be finalised after construction to accurately reflect the as-built conditions and the supplier specific details from proprietary systems.

7 Proposed Foul Water Drainage

7.1 Discharge Locations

7.1.1 As there are no public foul sewers in the local area an alternative outfall is required. The foul outfall discharge hierarchy is as follows:

- A public sewer; or, where not reasonably practicable,
- A private sewer communicating with a public sewer; or, where that is not reasonably practicable,
- Either a septic tank which has an appropriate form of secondary treatment or another wastewater treatment system; or, where not reasonably practicable,
- A cesspool.

7.1.2 Therefore, as the first two options are not available the third outfall via a treatment system will be used. As there is a watercourse on site this will be the form of a Package Treatment Plant (PTP).

7.1.3 Whilst the daily volume based on British Water Flows and Loads 4 for the individual properties is all below the lower bound for the General Binding Rules the change in regulations as of 2nd October 2023 means that all of the properties will require individual applications such that each homeowner is responsible for their own plant and the effluent quality.

7.1.4 The treated foul effluent will share an outfall between the properties, with two of the units needing a pumped outfall from the PTP to keep the levels shallow and to minimise the works around RPZs. The treated foul effluent will share an outfall with the surface water into the watercourse.

8 Summary & Conclusion

8.1 Summary

8.1.1 The report has assessed the potential constraints to the site, including flood risk from all sources. This identified that flood risk from all sources is low. The only constraint to the development was to not include any works which would adversely affect the flow in the watercourse.

8.1.2 The existing surface water runoff rate has been calculated as 9.6 l/s for the 1 in 100 year event, however in accordance with best practice the discharge rate has been limited to greenfield rates but within the minimum maintainable rate of 2.0 l/s for the 1 in 100 year plus climate change event.

8.1.3 The majority of the attenuation is provided within the voided stone subbase of the vehicular access through the development, with a small volume provided in a shallow attenuation basin to the north. The connectivity is through the voided stone subbase linked to a flow control via a diffuser box functioning in reverse like a French Drain. The flow control will be in the form of an orifice plate with a leaf filter to mitigate the risk of blockage.

8.1.4 Water butts have also been included for plant and garden watering.

8.1.5 As there are no public foul sewers in the local area the foul will flow to a Package Treatment Plant (PTP) per property with an outfall to the watercourse shared with the surface water outfall.

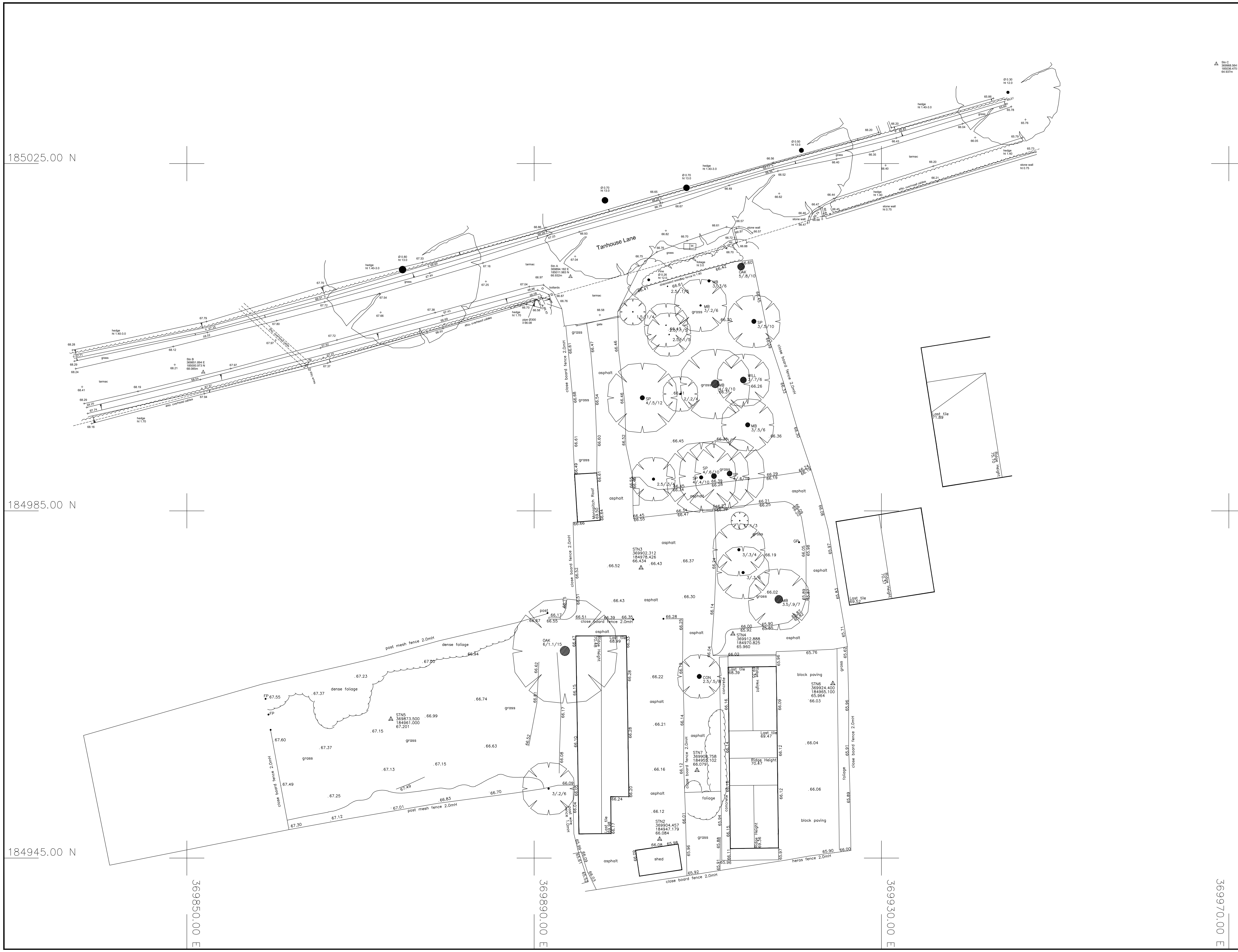
8.1.6 Due to changes in the Environmental Permitting Regulations an application per property will be required.

8.2 Conclusion

8.2.1 Based on the low risk of flooding from all sources, the provision of a SuDs network to manage surface water in accordance with best practice and a viable foul outfall where there are no public sewers the development is suitable for the location.

Appendix A

Topographical Survey



STANDARD REFERENCES

ABBREVIATIONS

bl	bollard	lp	lamp post
bb	belisha beacon	mk	marker post
bs	bus stop	mh	manhole
bt	telecoms	nb	notice board
catv	cable TV cover	np	nameplate (road)
cl	cover level	p	post
conc	concrete	pb	post box
cws	combined sewer	ret.	retaining wall
dk	drop kerb	re	rodding eye
eic	electricity ic	rg	road gully
ESS	Elec. Sub-Station	rs	road sign
ep	electricity pole	rwp	rainwater pipe
fb	flower bed	sp	signpost
fh	fire hydrant	sv	stop valve
fl	floor level	svp	soil vent pipe
fp	footpath	sws	storm water sewer
fl.p	flagpole	tcb	telephone callbox
fws	foul water sewer	tp	telegraph pole
g	gully	tl	traffic light
gsv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	w'lap	woodlap fence
irf	iron railing fence	wm	water tap
jb	junction box	wp	wood post
ko	kerb outlet	wt	water tap

Notes

1. This survey has been computed and drawn about the Supplied survey Grid.
2. All levels are in metres and relate to the Supplied survey stations.
3. This survey was measured for a scale of 1:200, any subsequent enlargements should be verified on site.

Revisions

1. Highway to the North Added to Existing Survey.

Clifton Surveys Ltd
Topographical and Measured Building Surveyors

1 Wellington Park
Clifton
Bristol
BS8 2UR
TEL: (0117) 9735898
e-mail: info@cliftonsurveys.com
web: www.cliftonsurveys.com

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Surveyed	B Knowlson	Date	February 2021
Drawn	B Knowlson	Checked	February 2021

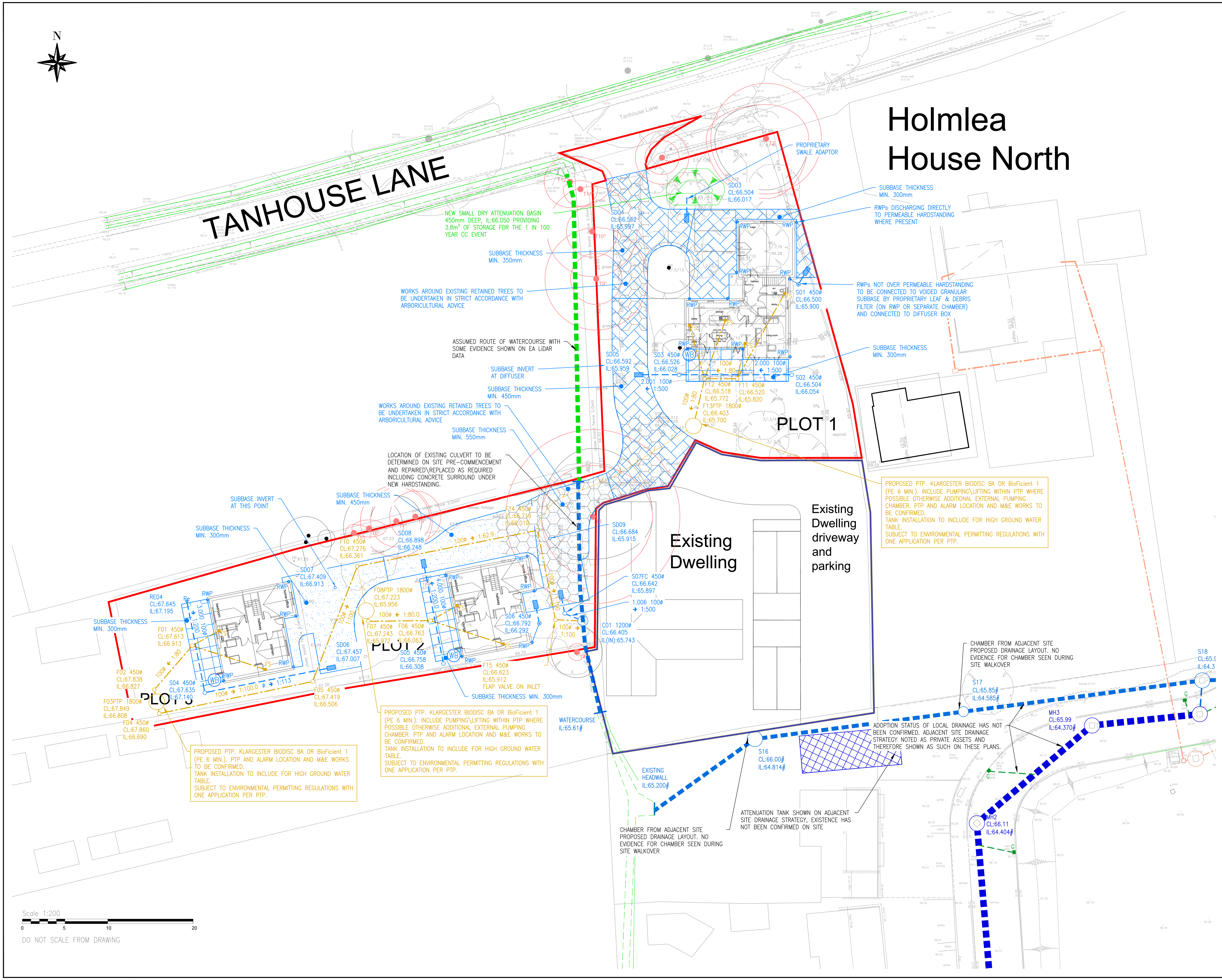
Drawing Title: Topographical Survey
Tanhouse Lane
Rangeworthy, Bristol
BS37 7LP

Client: FirstFox Architecture Ltd
38a Fir Tree Lane
Bristol
BS5 8TZ

Drawing No.	Scale A1 @
415/4711/1	1:200

Appendix B

Drawings



Notes:

LEGEND

- SITE BOUNDARY
- EXISTING PRIVATE FOUL WATER SEWER & CHAMBER
- EXISTING PRIVATE SURFACE WATER SEWER & MANHOLE
- EXISTING WATERCOURSE
- EXISTING GEOCELLULAR TANK
- PROPOSED PRIVATE SURFACE WATER DRAIN & CHAMBER (100mmø UNLESS NOTED OTHERWISE)
- SD07 CL:67.409 IL:66.913 — SD[xx] NOTES MODELLING NODE CHAMBER WITH HARDSTANDING COVER LEVEL AND FORMATION LEVEL OF SUBBASE
- PROPOSED PRIVATE FOUL WATER DRAIN & CHAMBER (100mmø UNLESS NOTED OTHERWISE)
- PROPOSED PRIVATE FOUL WATER RISING MAIN
- FS — INTERNAL FOUL CONNECTION POINT (INDICATIVE)
- RWP — RAINWATER DOWNPIPE
- PROPRIETARY DIFFUSER BOX IN TO PERMEABLE MEDIA. WHERE DIRECT CONNECTION FROM RWP THIS SHOULD BE A SURFACE DIFFUSER TO FILTER LEAVES AND SILT
- WB — PROPOSED WATER BUTT
- FULLY PERMEABLE BLOCK PAVE CONSTRUCTION NOTE #
- REINFORCED GRAVEL PERMEABLE CONSTRUCTION NOTE #
- FULLY PERMEABLE PATIO CONSTRUCTION NOTE #

NOTE # –WITH VOIDED (0.3) AGGREGATE TO BS7533 (OR TYPE 3 WHERE VOIDS RATIO COMPLIANCE CONFIRMED BY SUPPLIER) THICKNESS AS NOTED

- PERMEABLE SUBBASE TO INCLUDE TREE FRIENDLY CONSTRUCTION (CELLWEB OR SIMILAR)

NOTES:

1. DO NOT SCALE FROM DRAWING
2. DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS, DETAILS AND SPECIFICATIONS.
3. EXISTING DRAINAGE INFORMATION BASED ON WESSEX WATER ASSET PLANS AND TOPOGRAPHICAL SURVEY
4. CHECK ALL EXISTING DRAINAGE INVERTS AND PIPE SIZES AND REPORT FINDINGS TO ENGINEER PRIOR TO COMMENCING DRAINAGE CONSTRUCTION WORKS
5. FOUL DRAIN MINIMUM GRADIENTS (WHERE NOT SHOWN):
   5.1. NO w\c 1:40
   5.2. 1–4 w\c 1:80
6. SURFACE WATER MINIMUM GRADIENTS (WHERE NOT SHOWN):
   6.1. 100mm @ 1:80
   6.2. 150mm @ 1:100
6. PLASTIC PIPES TO HAVE A JETTING RESISTANCE OF 4000psi
7. ALL ADOPTED WORKS TO BE IN ACCORDANCE WITH THE DCG AND TO WESSEX WATER'S APPROVAL
8. ALL PRIVATE WORKS TO BE IN ACCORDANCE WITH BUILDING REGULATIONS PART H

PLASTIC PIPES ARE TO BE IN ACCORDANCE WITH THE DCG:

E2.21 THERMOPLASTICS SOLID WALL PIPES AND FITTINGS FOR GRAVITY SEWERS

1. THERMOPLASTICS PIPES, JOINTS AND FITTINGS FOR GRAVITY SEWERS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1401–1 (PVC–u), BS EN 1852–1 (PP), OR BS EN 12666–1 (PE) AS APPROPRIATE.
2. ANCILLARY DRAINAGE FITTINGS SHALL COMPLY WITH BS EN 13598–1 OR BS 4660, AS APPROPRIATE.

E2.22 THERMOPLASTICS STRUCTURED WALL PIPE

1. THERMOPLASTICS STRUCTURED WALL SEWER PIPE SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 13476–1 AND WIS 4–35–01 AND BS EN 13476–2 OR BS EN 13476–3. PIPES SHALL BE BSI KITEMARKED OR HAVE EQUIVALENT THIRD PARTY CERTIFICATION.
2. PIPES LESS THAN OR EQUAL TO 500 mm IN DIAMETER SHALL HAVE NOMINAL SHORT–TERM RING STIFFNESS NOT LESS THAN 8 kN PER M2 (SN8) OR BE SUBJECT TO A QUALITY SYSTEM FOR STORAGE AND EMBEDMENT.
3. NOMINAL SHORT–TERM RING STIFFNESS OF 2 kN PER M2 (SN2) IS ACCEPTABLE FOR PIPES GREATER THAN 500 mm IN DIAMETER, SUBJECT TO STRUCTURAL DESIGN LOAD CALCULATIONS IN ACCORDANCE WITH BS 9295:2019 WHICH SHALL BE PROVIDED TO SUPPORT THIS.
4. MAXIMUM LENGTH OF PIPE FOR LAYING IS 3 m OR 10 x DN, WHICHEVER IS THE GREATER.

REV:	DESCRIPTION:	BY:	DATE:
P03	Cellweb extents shown	TN	19/12/23
P02	Topo clipped from adjacent land	TN	06/12/23
P01	First issue	TN	29/11/23

STATUS: PLANNING

TJ Infrastructure
Toby.Nicks@TJInfrastructure.com

CLIENT: St Martin Commercial Properties Ltd

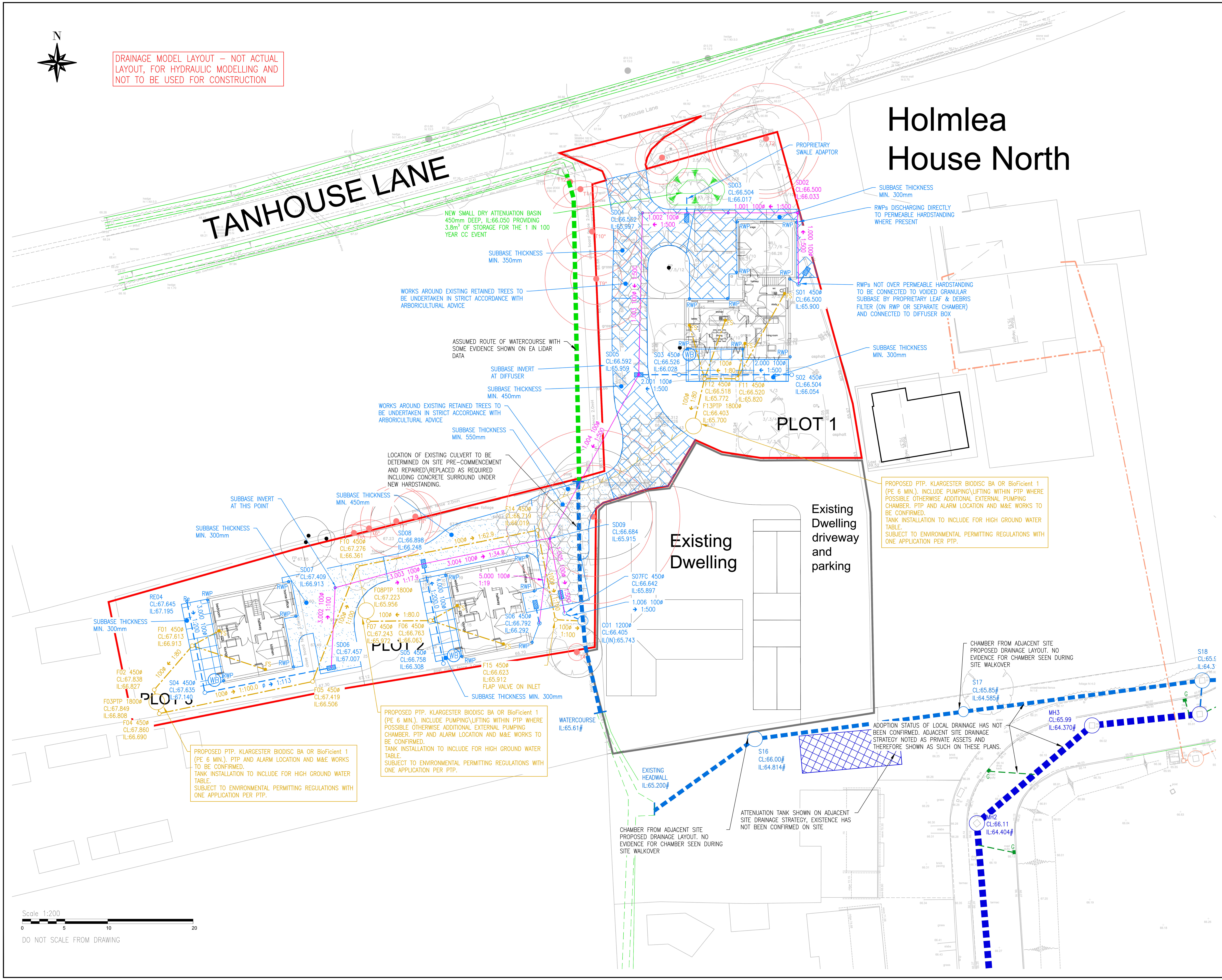
ARCHITECT: FirstFox Architecture

SITE: The Stables, Tanhouse Lane

TITLE: Drainage Layout

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:200	29/11/23	TN	TN

PROJECT NO:	DRAWING NO:	REVISION:
STL	D-001	P03



Notes:

LEGEND

- SITE BOUNDARY
- EXISTING PRIVATE FOUL WATER SEWER & CHAMBER
- EXISTING PRIVATE SURFACE WATER SEWER & MANHOLE
- EXISTING WATERCOURSE
- EXISTING GEOCELLULAR TANK
- PROPOSED PRIVATE SURFACE WATER DRAIN & CHAMBER (100mmø UNLESS NOTED OTHERWISE)
- SD07 CL:67.409 IL:66.913 — SD[xx] NOTES MODELLING NODE CHAMBER WITH HARDSTANDING COVER LEVEL AND FORMATION LEVEL OF SUBBASE
- PROPOSED PRIVATE FOUL WATER DRAIN & CHAMBER (100mmø UNLESS NOTED OTHERWISE)
- PROPOSED PRIVATE FOUL WATER RISING MAIN
- FS — INTERNAL FOUL CONNECTION POINT (INDICATIVE)
- RWP — RAINWATER DOWNPIPE
- PROPRIETARY DIFFUSER BOX IN TO PERMEABLE MEDIA. WHERE DIRECT CONNECTION FROM RWP THIS SHOULD BE A SURFACE DIFFUSER TO FILTER LEAVES AND SILT
- WB — PROPOSED WATER BUTT
- FULLY PERMEABLE BLOCK PAVE CONSTRUCTION NOTE #
- REINFORCED GRAVEL PERMEABLE CONSTRUCTION NOTE #
- FULLY PERMEABLE PATIO CONSTRUCTION NOTE #

NOTE # –WITH VOIDED (0.3) AGGREGATE TO BS7533 (OR TYPE 3 WHERE VOIDS RATIO COMPLIANCE CONFIRMED BY SUPPLIER) THICKNESS AS NOTED

- PERMEABLE SUBBASE TO INCLUDE TREE FRIENDLY CONSTRUCTION (CELLWEB OR SIMILAR)

NOTES:

1. DO NOT SCALE FROM DRAWING
2. DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS, DETAILS AND SPECIFICATIONS.
3. EXISTING DRAINAGE INFORMATION BASED ON WESSEX WATER ASSET PLANS AND TOPOGRAPHICAL SURVEY
4. CHECK ALL EXISTING DRAINAGE INVERTS AND PIPE SIZES AND REPORT FINDINGS TO ENGINEER PRIOR TO COMMENCING DRAINAGE CONSTRUCTION WORKS
5. FOUL DRAIN MINIMUM GRADIENTS (WHERE NOT SHOWN):
   5.1. NO w\c 1:40
   5.2. 1–4 w\c 1:80
6. SURFACE WATER MINIMUM GRADIENTS (WHERE NOT SHOWN):
   6.1. 100mm @ 1:80
   6.2. 150mm @ 1:100
6. PLASTIC PIPES TO HAVE A JETTING RESISTANCE OF 4000psi
7. ALL ADOPTED WORKS TO BE IN ACCORDANCE WITH THE DCG AND TO WESSEX WATER'S APPROVAL
8. ALL PRIVATE WORKS TO BE IN ACCORDANCE WITH BUILDING REGULATIONS PART H

PLASTIC PIPES ARE TO BE IN ACCORDANCE WITH THE DCG:

E2.21 THERMOPLASTICS SOLID WALL PIPES AND FITTINGS FOR GRAVITY SEWERS

1. THERMOPLASTICS PIPES, JOINTS AND FITTINGS FOR GRAVITY SEWERS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1401–1 (PVC–u), BS EN 1852–1 (PP), OR BS EN 12666–1 (PE) AS APPROPRIATE.
2. ANCILLARY DRAINAGE FITTINGS SHALL COMPLY WITH BS EN 13598–1 OR BS 4660, AS APPROPRIATE.

E2.22 THERMOPLASTICS STRUCTURED WALL PIPE

1. THERMOPLASTICS STRUCTURED WALL SEWER PIPE SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 13476–1 AND WIS 4–35–01 AND BS EN 13476–2 OR BS EN 13476–3. PIPES SHALL BE BSI KITEMARKED OR HAVE EQUIVALENT THIRD PARTY CERTIFICATION.
2. PIPES LESS THAN OR EQUAL TO 500 mm IN DIAMETER SHALL HAVE NOMINAL SHORT–TERM RING STIFFNESS NOT LESS THAN 8 kN PER M2 (SN8) OR BE SUBJECT TO A QUALITY SYSTEM FOR STORAGE AND EMBEDMENT.
3. NOMINAL SHORT–TERM RING STIFFNESS OF 2 kN PER M2 (SN2) IS ACCEPTABLE FOR PIPES GREATER THAN 500 mm IN DIAMETER, SUBJECT TO STRUCTURAL DESIGN LOAD CALCULATIONS IN ACCORDANCE WITH BS 9295:2019 WHICH SHALL BE PROVIDED TO SUPPORT THIS.
4. MAXIMUM LENGTH OF PIPE FOR LAYING IS 3 m OR 10 x DN, WHICHEVER IS THE GREATER.

REV:	DESCRIPTION:	BY:	DATE:
P03	Cellweb extents shown	TN	19/12/23
P02	Topo clipped from adjacent land	TN	06/12/23
P01	First issue	TN	01/12/23

STATUS: PLANNING

TJ Infrastructure

Toby.Nicks@TJInfrastructure.com

CLIENT: St Martin Commercial Properties Ltd

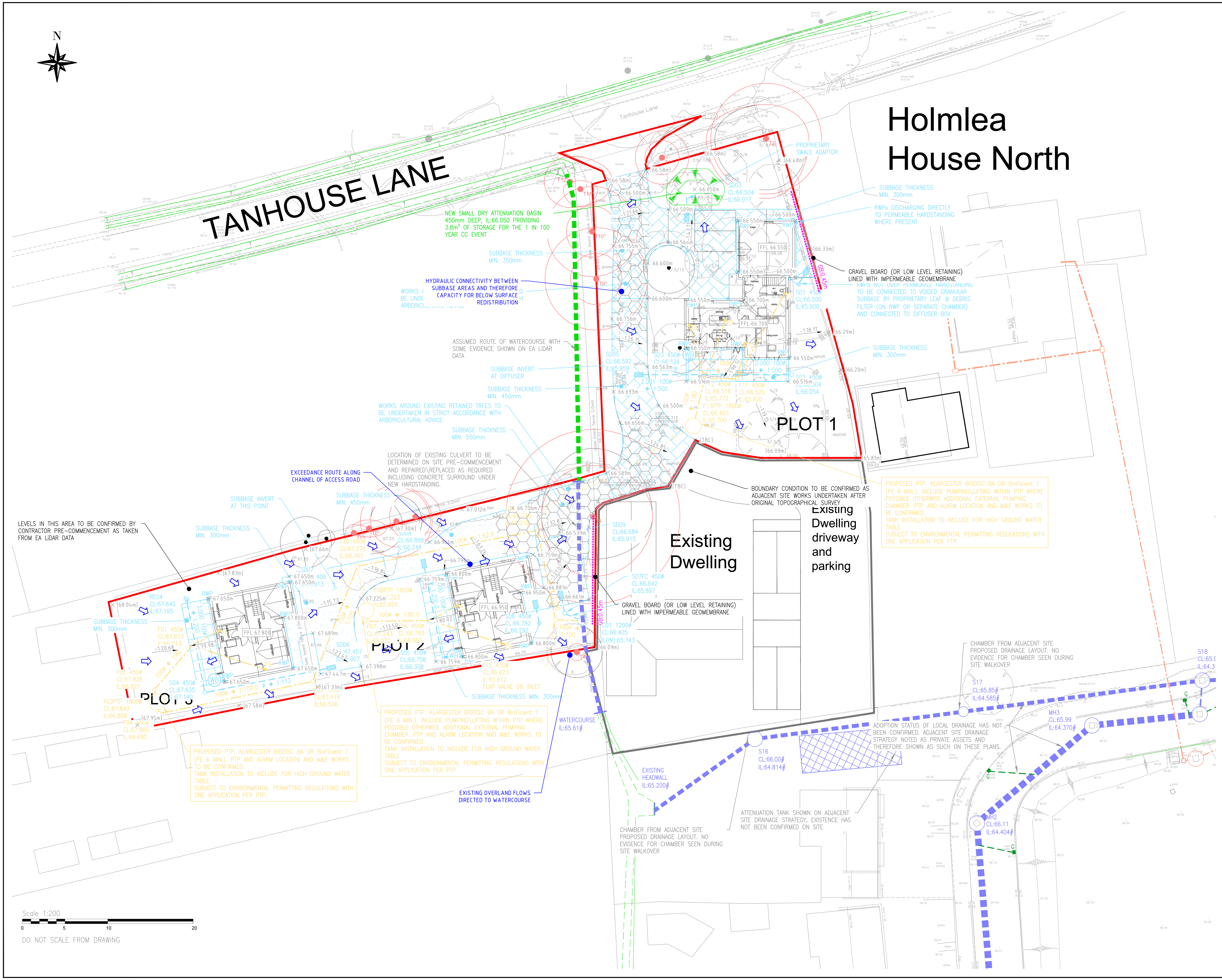
ARCHITECT: FirstFox Architecture

SITE: The Stables, Tanhouse Lane

TITLE: Drainage Model

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:200	01/12/23	TN	TN

PROJECT NO:	DRAWING NO:	REVISION:
STL	D-002	P03



Notes:

LEGEND

- SITE BOUNDARY
- EXISTING PRIVATE FOUL WATER SEWER & CHAMBER
- EXISTING PRIVATE SURFACE WATER SEWER & MANHOLE
- EXISTING WATERCOURSE
- EXISTING GEOCELLULAR TANK
- PROPOSED PRIVATE SURFACE WATER DRAIN & CHAMBER (100mmø UNLESS NOTED OTHERWISE)
- SD[xx] NOTES MODELLING NODE CHAMBER WITH HARDSTANDING COVER LEVEL AND FORMATION LEVEL OF SUBBASE
- PROPOSED PRIVATE FOUL WATER DRAIN & CHAMBER (100mmø UNLESS NOTED OTHERWISE)
- PROPOSED PRIVATE FOUL WATER RISING MAIN
- INTERNAL FOUL CONNECTION POINT (INDICATIVE)
- RAINWATER DOWNPIPE
- PROPRIETARY DIFFUSER BOX IN TO PERMEABLE MEDIA. WHERE DIRECT CONNECTION FROM RWP THIS SHOULD BE PROPRIETARY DIFFUSER TO FILTER LEAVES AND SILT
- PROPOSED WATER BUTT
- FULLY PERMEABLE BLOCK PAVE CONSTRUCTION NOTE #
- REINFORCED GRAVEL PERMEABLE CONSTRUCTION NOTE #
- FULLY PERMEABLE PATIO CONSTRUCTION NOTE #

NOTE # -WITH VOIDED (0.3) AGGREGATE TO BS7533 (OR TYPE 3 WHERE VOIDS RATIO COMPLIANCE CONFIRMED BY SUPPLIER) THICKNESS AS NOTED

- PERMEABLE SUBBASE TO INCLUDE TREE FRIENDLY CONSTRUCTION (CELLWEB OR SIMILAR)

NOTES:
1. DO NOT SCALE FROM DRAWING

- PROPOSED OVERLAND FLOW ROUTE

REV:	DESCRIPTION:	BY:	DATE:
P03	Cellweb extents shown	TN	19/12/23
P02	Topo clipped from adjacent land	TN	06/12/23
P01	First issue	TN	29/11/23

STATUS: PLANNING

Toby.Nicks@TJInfrastructure.com

CLIENT: St Martin Commercial Properties Ltd

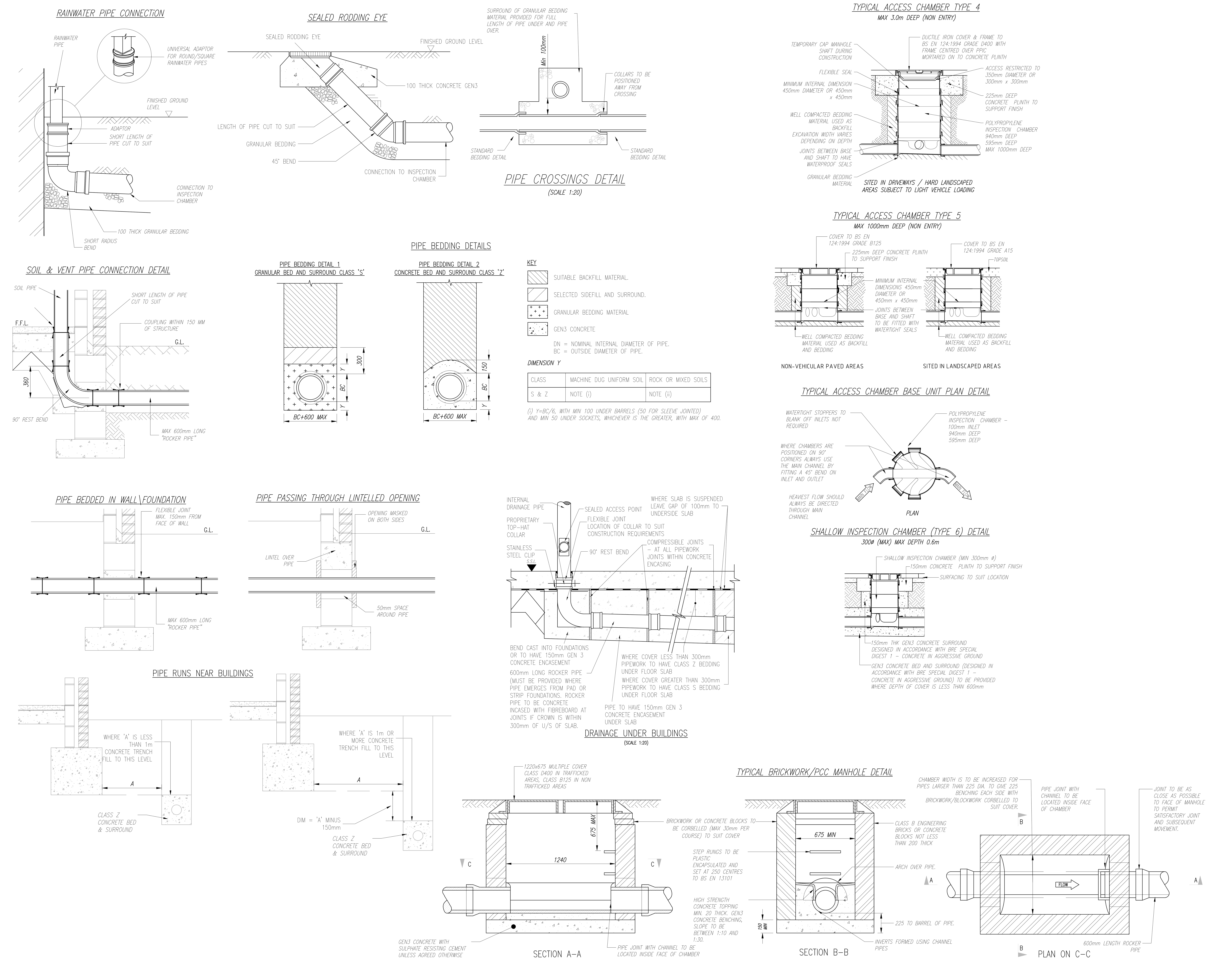
ARCHITECT: FirstFox Architecture

SITE: The Stables, Tanhouse Lane

TITLE: Exceedance Routing

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:200	12/01/23	TN	TN

PROJECT NO:	DRAWING NO:	REVISION:
STL	D-003	P03



Notes:

REV:	DESCRIPTION:	BY:	DATE:
P01	First issue	TN	01/12/23

STATUS: PLANNING

Toby.Nicks@TJInfrastructure.com

CLIENT: St Martin Commercial Properties Ltd

ARCHITECT: FirstFox Architecture

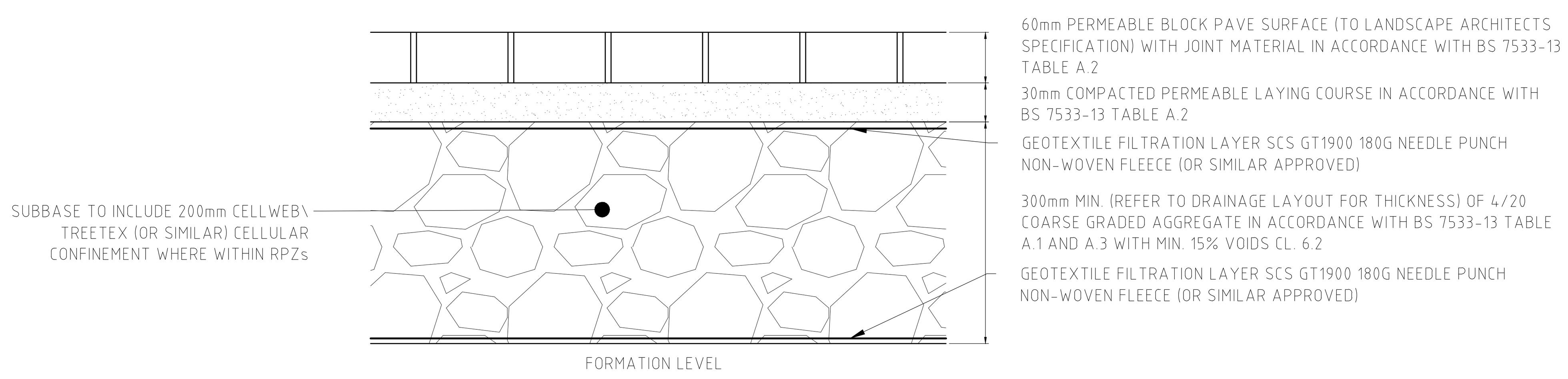
SITE: The Stables, Tanhouse Lane

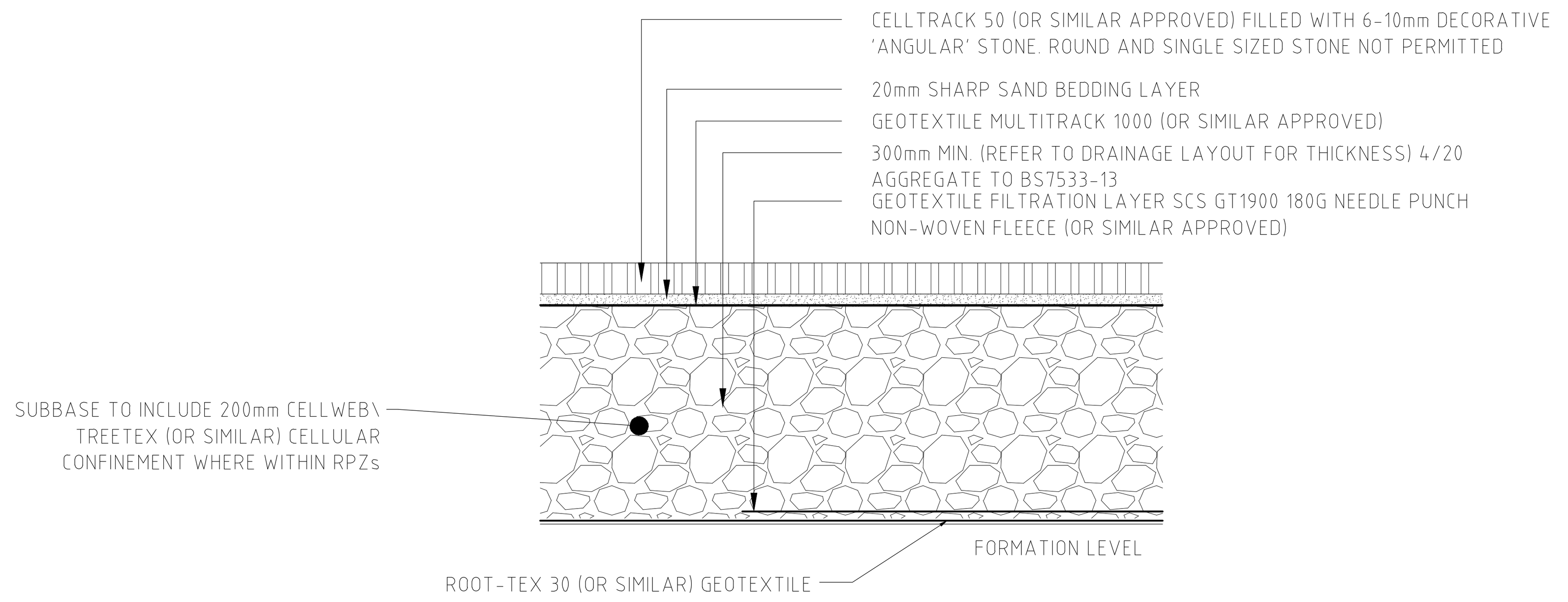
TITLE: Drainage Details (Sheet 1 of 2)

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
AS SHOWN	01/12/23	TN	TN

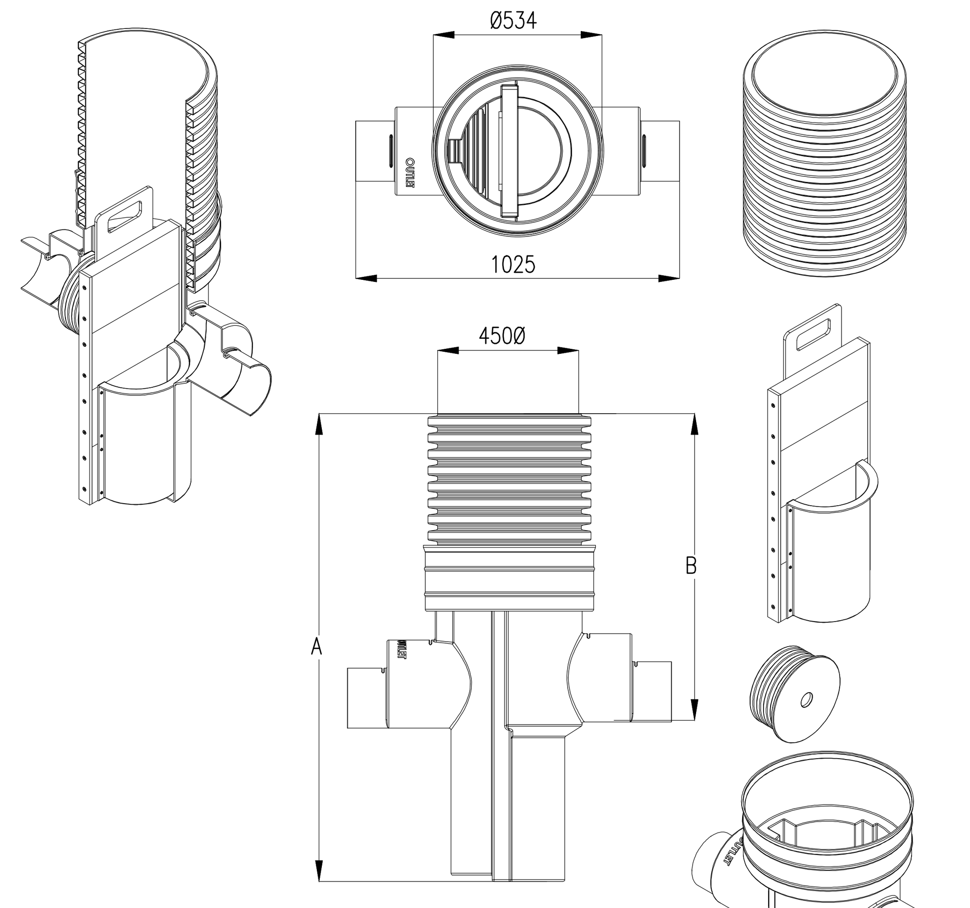
PROJECT NO:	DRAWING NO:	REVISION:
STL	D-005	P01

BLOCK PAVED PARKING BAYS
(PERMEABLE CONSTRUCTION SYSTEM 3.0% CBR)
SUBJECT TO LIGHT VEHICLE LOADING ONLY



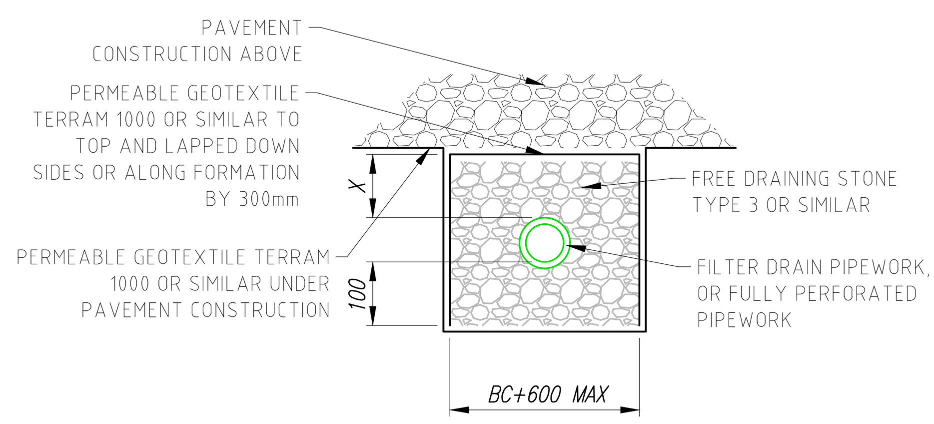


PERMEABLE PARKING DRIVEWAY CONSTRUCTION
NOT TO BE USED FOR CONSTRUCTION TRAFFIC
LIGHT VEHICLES ONLY

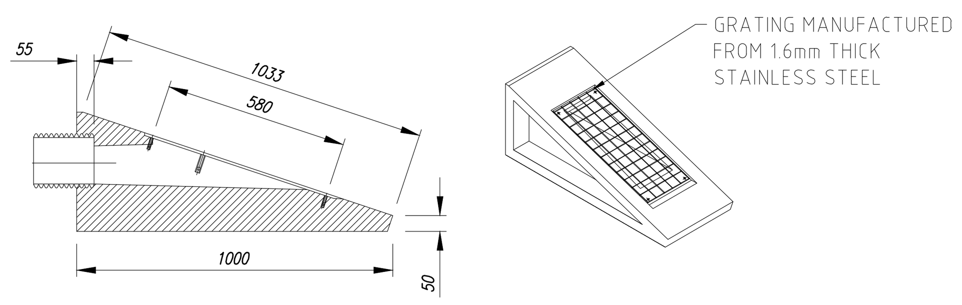


PRODUCT CODE	Pipework Options Ø (mm)	Depth A (mm)	Invert B (mm)
OFCC500/1.5	150-225	1480	965
OFCC500/2	150-225	1990	1475
OFCC500/2.4	150-225	2400	1885
OFCC500/3	150-225	3000	2485

TURTLE ORIFLO C SERIES ORIFICE FLOW CONTROL



FILTER DRAIN PIPE BEDDING DETAIL
PERMEABLE GRANULAR BED AND SURROUND



ALTHON SWALE INLET HEADWALL

Notes:

P01	First issue	TN	01/12/23
REV:	DESCRIPTION:	BY:	DATE:

STATUS: PLANNING

Toby.Nicks@TJInfrastructure.com

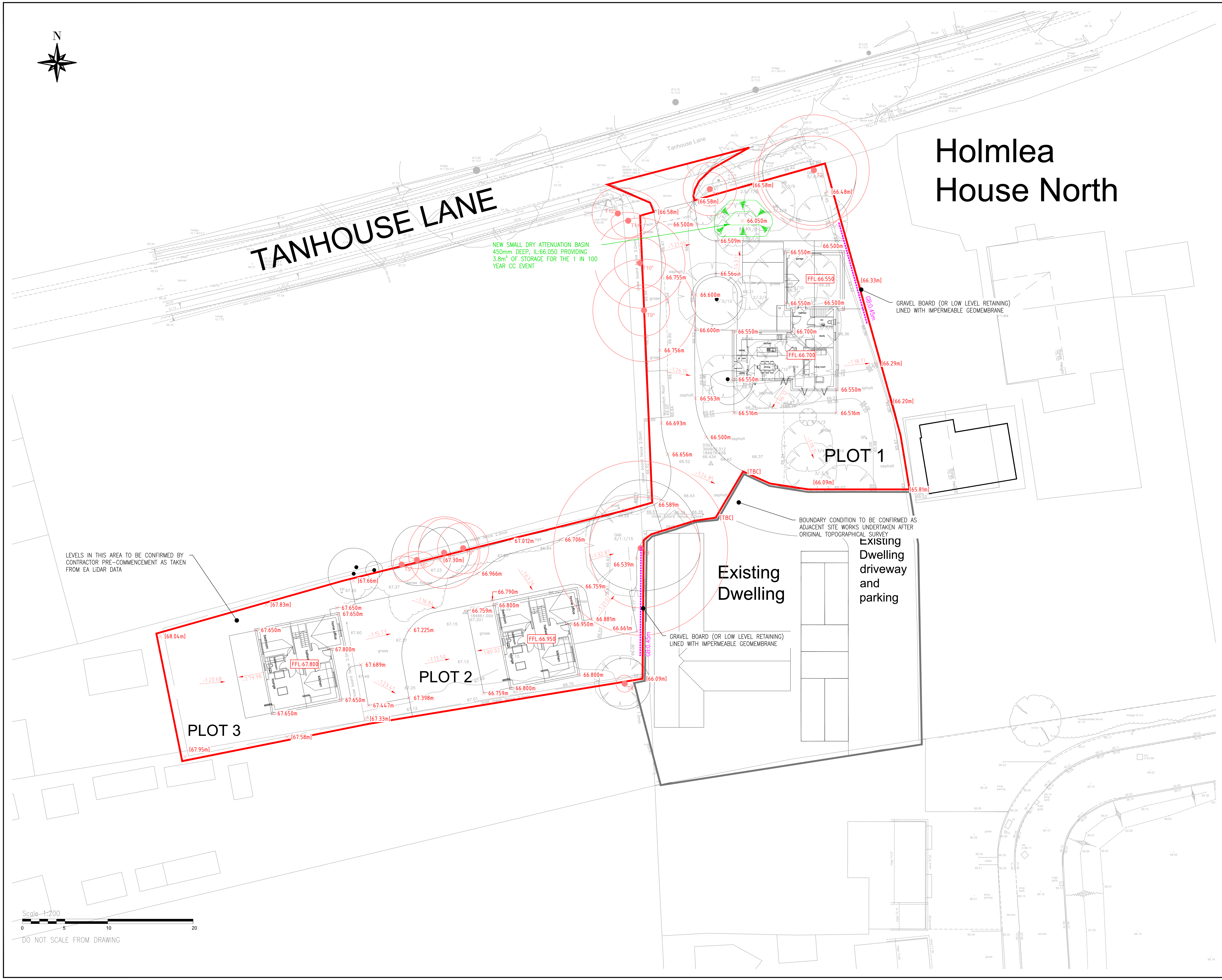
CLIENT: St Martin Commercial Properties Ltd

ARCHITECT: FirstFox Architecture

SITE: The Stables, Tanhouse Lane

TITLE: Drainage Details (Sheet 2 of 2)

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
AS SHOWN	01/12/23	TN	TN
PROJECT NO:	DRAWING NO:		REVISION:
STL	D-006		P01



Notes:

PLOT INFORMATION

- FFL: 27.850 — FINISHED FLOOR LEVEL (HOUSE/DWELLING AND GARAGES)
- 68.75 — PROPOSED FINISHED LEVEL
- [68.20] — EXISTING GROUND LEVEL TIE-IN. EXACT LEVEL TO BE CONFIRMED BY THE SITE CONTRACTOR AND ANY DISCREPANCIES REPORTED ENGINEER PRIOR TO COMMENCEMENT OF ANY WORKS
- 1 in 80 — GRADIENT
- EARTHWORKS (1:3 SLOPE UNLESS STATED OTHERWISE).
- GB:0.45m — GRAVEL BOARD RETAINING

LEVELS NOTE:
TOPOGRAPHICAL SURVEY UNDERTAKEN BEFORE ADJACENT WORKS WITHIN THE BLUE LINE BOUNDARY AND THEREFORE LEVELS IN THIS AREA TO BE CONFIRMED.
LIMITED TOPOGRAPHICAL SURVEY TO THE WEST WHICH HAS BEEN SUPPLEMENTED WITH LiDAR DATA AND SHOULD BE CONFIRMED BY CONTRACTOR PRE-COMMENCEMENT.

REV:	DESCRIPTION:	BY:	DATE:
P02	Topo clipped from adjacent land	TN	06/12/23
P01	First issue	TN	29/11/23

STATUS: PLANNING

TJ Infrastructure
Toby.Nicks@TJInfrastructure.com

CLIENT: St Martin Commercial Properties Ltd

ARCHITECT: FirstFox Architecture

SITE: The Stables, Tanhouse Lane

TITLE: Proposed Levels

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:200	01/12/23	TN	TN

PROJECT NO:	DRAWING NO:	REVISION:
STL	E-001	P02

Appendix C

Causeway Flow Hydraulic Modelling

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	1.500
CV	0.750	Preferred Cover Depth (m)	0.600
Time of Entry (mins)	10.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	1.0		

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100	150

(Trench) Link Type

Shape	Rectangular	Height (mm)	495	Follow Ground	x
Barrels	1	Auto Increment (mm)	75		

Available Diameters (mm)

100

(Trench) Link Type

Shape	Rectangular	Height (mm)	650	Follow Ground	x
Barrels	1	Auto Increment (mm)	75		

Available Diameters (mm)

100

(Trench) Link Type

Shape	Rectangular	Height (mm)	498	Follow Ground	x
Barrels	1	Auto Increment (mm)	75		

Available Diameters (mm)

100

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S01	0.004	10.00	66.500	450	369918.164	184995.739	0.450
SD02			66.500		369918.053	185004.115	0.467
SD03	0.014	10.00	66.504		369909.915	185004.111	0.487
SD04	0.009	10.00	66.562		369899.892	185004.107	0.565
S02	0.004	10.00	66.504	450	369917.370	184985.146	0.450
S03	0.004	10.00	66.526	450	369904.174	184985.146	0.498
SD05	0.013	10.00	66.592		369899.453	184985.146	0.633
RE04	0.003	10.00	67.645	100	369846.523	184958.629	0.450
S04	0.004	10.00	67.635	450	369848.638	184947.913	0.495
SD06	0.005	10.00	67.457		369863.447	184950.836	0.450

Flow+ v10.6.234 Copyright © 1988-2023 Causeway Technologies Ltd

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SD07	0.010	10.00	67.409		369863.890	184960.201	0.496
S05	0.007	10.00	66.758	450	369876.579	184951.327	0.450
SD08	0.008	10.00	66.898		369874.273	184963.013	0.650
S06	0.005	10.00	66.792	450	369887.806	184956.030	0.500
SD09	0.010	10.00	66.684		369889.037	184966.025	0.769
S07FC			66.642	450	369890.779	184957.190	0.745
C01			66.405	1200	369892.422	184956.275	0.512

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	S01	SD02	8.377	0.600	66.050	66.033	0.017	500.0	100	10.41	1.0
1.001	SD02	SD03	8.138	0.600	66.033	66.017	0.016	508.6	100	10.82	1.0
1.002	SD03	SD04	10.023	0.600	66.017	65.997	0.020	501.2	100	11.31	1.0
1.003	SD04	SD05	18.966	0.600	65.997	65.959	0.038	499.1	100	12.25	1.0
2.000	S02	S03	13.196	0.600	66.054	66.028	0.026	500.0	100	10.65	1.0
2.001	S03	SD05	4.721	0.600	66.028	66.019	0.009	524.6	100	10.89	1.0
1.004	SD05	SD09	21.774	0.600	65.959	65.915	0.044	494.9	100	13.32	1.0
3.000	RE04	S04	10.923	0.600	67.195	67.140	0.055	200.0	100	10.34	1.0
3.001	S04	SD06	15.095	0.600	67.140	67.007	0.133	113.5	100	10.69	1.0
3.002	SD06	SD07	9.375	0.600	67.007	66.913	0.094	99.7	100	10.89	1.0
3.003	SD07	SD08	10.757	0.600	66.913	66.248	0.665	16.2	100	10.98	1.0
4.000	S05	SD08	11.911	0.600	66.308	66.248	0.060	200.0	100	10.37	1.0
3.004	SD08	SD09	15.068	0.600	66.248	65.915	0.333	45.2	100	11.20	1.0
5.000	S06	SD09	10.071	0.600	66.292	65.915	0.377	26.7	100	10.11	1.0
1.005	SD09	S07FC	9.005	0.600	65.915	65.897	0.018	500.0	100	13.77	1.0
1.006	S07FC	C01	1.881	0.600	65.897	65.893	0.004	470.2	100	13.86	1.0

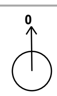
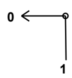
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.337	2.7	0.0	0.350	0.367	0.004	0.0	5	0.077
1.001	0.334	2.6	0.0	0.367	0.387	0.004	0.0	5	0.076
1.002	0.337	2.6	0.0	0.387	0.465	0.018	0.0	10	0.125
1.003	0.338	2.7	0.1	0.465	0.533	0.026	0.0	11	0.139
2.000	0.337	2.7	0.0	0.350	0.398	0.004	0.0	5	0.077
2.001	0.329	2.6	0.0	0.398	0.473	0.008	0.0	7	0.092
1.004	0.339	2.7	0.1	0.533	0.669	0.047	0.0	15	0.172
3.000	0.540	4.2	0.0	0.350	0.395	0.003	0.0	4	0.095
3.001	0.721	5.7	0.0	0.395	0.350	0.007	0.0	4	0.151
3.002	0.770	6.0	0.0	0.350	0.396	0.012	0.0	6	0.204
3.003	1.930	15.2	0.1	0.396	0.550	0.022	0.0	5	0.471
4.000	0.540	4.2	0.0	0.350	0.550	0.007	0.0	5	0.126
3.004	1.149	9.0	0.1	0.550	0.669	0.037	0.0	7	0.364
5.000	1.499	11.8	0.0	0.400	0.669	0.005	0.0	3	0.227
1.005	0.337	2.7	0.3	0.669	0.645	0.099	0.0	21	0.213
1.006	0.348	2.7	0.3	0.645	0.412	0.099	0.0	21	0.220

Pipeline Schedule

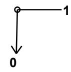
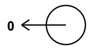
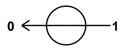
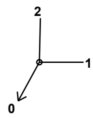
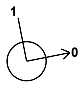
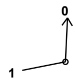
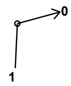
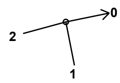
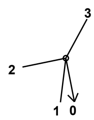
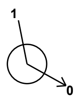
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	8.377	500.0	100	Circular	66.500	66.050	0.350	66.500	66.033	0.367
1.001	8.138	508.6	100	Circular	66.500	66.033	0.367	66.504	66.017	0.387
1.002	10.023	501.2	100	Circular	66.504	66.017	0.387	66.562	65.997	0.465
1.003	18.966	499.1	100	Circular	66.562	65.997	0.465	66.592	65.959	0.533
2.000	13.196	500.0	100	Circular	66.504	66.054	0.350	66.526	66.028	0.398
2.001	4.721	524.6	100	Circular	66.526	66.028	0.398	66.592	66.019	0.473
1.004	21.774	494.9	100	Circular	66.592	65.959	0.533	66.684	65.915	0.669
3.000	10.923	200.0	100	Circular	67.645	67.195	0.350	67.635	67.140	0.395
3.001	15.095	113.5	100	Circular	67.635	67.140	0.395	67.457	67.007	0.350
3.002	9.375	99.7	100	Circular	67.457	67.007	0.350	67.409	66.913	0.396
3.003	10.757	16.2	100	Circular	67.409	66.913	0.396	66.898	66.248	0.550
4.000	11.911	200.0	100	Circular	66.758	66.308	0.350	66.898	66.248	0.550
3.004	15.068	45.2	100	Circular	66.898	66.248	0.550	66.684	65.915	0.669
5.000	10.071	26.7	100	Circular	66.792	66.292	0.400	66.684	65.915	0.669
1.005	9.005	500.0	100	Circular	66.684	65.915	0.669	66.642	65.897	0.645
1.006	1.881	470.2	100	Circular	66.642	65.897	0.645	66.405	65.893	0.412

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S01	450	Manhole	Manhole	SD02		Junction	
1.001	SD02		Junction		SD03		Junction	
1.002	SD03		Junction		SD04		Junction	
1.003	SD04		Junction		SD05		Junction	
2.000	S02	450	Manhole	Manhole	S03	450	Manhole	Manhole
2.001	S03	450	Manhole	Manhole	SD05		Junction	
1.004	SD05		Junction		SD09		Junction	
3.000	RE04	100	Manhole	Manhole	S04	450	Manhole	Manhole
3.001	S04	450	Manhole	Manhole	SD06		Junction	
3.002	SD06		Junction		SD07		Junction	
3.003	SD07		Junction		SD08		Junction	
4.000	S05	450	Manhole	Manhole	SD08		Junction	
3.004	SD08		Junction		SD09		Junction	
5.000	S06	450	Manhole	Manhole	SD09		Junction	
1.005	SD09		Junction		S07FC	450	Manhole	Manhole
1.006	S07FC	450	Manhole	Manhole	C01	1200	Manhole	Manhole

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S01	369918.164	184995.739	66.500	0.450	450				
						0	1.000	66.050	100
SD02	369918.053	185004.115	66.500	0.467		1	1.000	66.033	100
									
						0	1.001	66.033	100
SD03	369909.915	185004.111	66.504	0.487		1	1.001	66.017	100
						0	1.002	66.017	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SD04	369899.892	185004.107	66.562	0.565			1	1.002	65.997	100
							0	1.003	65.997	100
S02	369917.370	184985.146	66.504	0.450	450					
							0	2.000	66.054	100
S03	369904.174	184985.146	66.526	0.498	450		1	2.000	66.028	100
							0	2.001	66.028	100
SD05	369899.453	184985.146	66.592	0.633			1	2.001	66.019	100
							2	1.003	65.959	100
							0	1.004	65.959	100
RE04	369846.523	184958.629	67.645	0.450	100					
							0	3.000	67.195	100
S04	369848.638	184947.913	67.635	0.495	450		1	3.000	67.140	100
							0	3.001	67.140	100
SD06	369863.447	184950.836	67.457	0.450			1	3.001	67.007	100
							0	3.002	67.007	100
SD07	369863.890	184960.201	67.409	0.496			1	3.002	66.913	100
							0	3.003	66.913	100
S05	369876.579	184951.327	66.758	0.450	450					
							0	4.000	66.308	100
SD08	369874.273	184963.013	66.898	0.650			1	4.000	66.248	100
							2	3.003	66.248	100
							0	3.004	66.248	100
S06	369887.806	184956.030	66.792	0.500	450					
							0	5.000	66.292	100
SD09	369889.037	184966.025	66.684	0.769			1	5.000	65.915	100
							2	3.004	65.915	100
							3	1.004	65.915	100
							0	1.005	65.915	100
S07FC	369890.779	184957.190	66.642	0.745	450		1	1.005	65.897	100
							0	1.006	65.897	100

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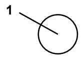
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
C01	369892.422	184956.275	66.405	0.512	1200		1	1.006	65.893	100

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	100 year (l/s)	2.0
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m^3/ha)	0.0		
Analysis Speed	Detailed	Check Discharge Rate(s)	✓		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
5	0	0	0
10	0	0	0
30	0	0	0
30	40	0	0
100	0	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	QBar/QMed conversion factor	1.124
Greenfield Method	FEH	Growth Factor 100 year	2.57
Positively Drained Area (ha)	0.099	Betterment (%)	0
SAAR (mm)	800	QMed	0.6
Host	1	QBar	0.7
BFIHost	0.347	Q 100 year (l/s)	1.7
Region	4		

Node S07FC Online Orifice Control

Flap Valve	x	Design Depth (m)	0.580	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	2.0		
Invert Level (m)	65.897	Diameter (m)	0.036		

Node RE04 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	67.195	Slope (1:X)	80.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	9.850	Inf Depth (m)	
Porosity	0.30	Length (m)	3.100		

Node SD07 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.959	Slope (1:X)	17.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	5.000		

Node S05 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.309	Slope (1:X)	80.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	25	Depth (m)	0.300
Safety Factor	2.0	Width (m)	9.850	Inf Depth (m)	
Porosity	0.30	Length (m)	3.100		

Node SD08 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.448	Slope (1:X)	30.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	9	Depth (m)	0.450
Safety Factor	2.0	Width (m)	4.460	Inf Depth (m)	
Porosity	0.30	Length (m)	17.900		

Node SD09 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.000	Slope (1:X)	30.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	228	Depth (m)	0.550
Safety Factor	2.0	Width (m)	7.320	Inf Depth (m)	
Porosity	0.30	Length (m)	13.660		

Node SD03 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.050	Slope (1:X)	80.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.300
Safety Factor	2.0	Width (m)	11.600	Inf Depth (m)	
Porosity	0.30	Length (m)	6.000		

Node SD04 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.000	Slope (1:X)	80.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.350
Safety Factor	2.0	Width (m)	5.960	Inf Depth (m)	
Porosity	0.30	Length (m)	15.100		

Node S03 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.050	Slope (1:X)	80.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.300
Safety Factor	2.0	Width (m)	12.000	Inf Depth (m)	
Porosity	0.30	Length (m)	3.300		

Node SD05 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.000	Slope (1:X)	80.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	2.0	Width (m)	5.357	Inf Depth (m)	
Porosity	0.30	Length (m)	22.400		

Node SD03 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	66.050
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	9.8	0.0	0.450	24.4	0.0

Node S04 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	3.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	67.140	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	0	Diameter (mm)	500

Node SD08 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	4.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.248	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	45	Diameter (mm)	500

Node S03 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	2.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	66.028	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	500

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m³)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	96.238	27.232
2 year 15 minute winter	67.535	27.232
2 year 30 minute summer	62.962	17.816
2 year 30 minute winter	44.184	17.816
2 year 60 minute summer	42.789	11.308
2 year 60 minute winter	28.428	11.308

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 120 minute summer	30.723	8.119
2 year 120 minute winter	20.412	8.119
2 year 180 minute summer	25.234	6.493
2 year 180 minute winter	16.402	6.493
2 year 240 minute summer	20.736	5.480
2 year 240 minute winter	13.776	5.480
2 year 360 minute summer	16.508	4.248
2 year 360 minute winter	10.731	4.248
2 year 480 minute summer	13.243	3.500
2 year 480 minute winter	8.798	3.500
2 year 600 minute summer	10.951	2.995
2 year 600 minute winter	7.483	2.995
2 year 720 minute summer	9.816	2.631
2 year 720 minute winter	6.597	2.631
2 year 960 minute summer	8.110	2.136
2 year 960 minute winter	5.372	2.136
2 year 1440 minute summer	5.929	1.589
2 year 1440 minute winter	3.985	1.589
2 year 2160 minute summer	4.299	1.188
2 year 2160 minute winter	2.962	1.188
2 year 2880 minute summer	3.633	0.974
2 year 2880 minute winter	2.442	0.974
2 year 4320 minute summer	2.868	0.750
2 year 4320 minute winter	1.889	0.750
2 year 5760 minute summer	2.468	0.632
2 year 5760 minute winter	1.597	0.632
2 year 7200 minute summer	2.190	0.559
2 year 7200 minute winter	1.413	0.559
2 year 8640 minute summer	1.994	0.509
2 year 8640 minute winter	1.287	0.509
2 year 10080 minute summer	1.852	0.472
2 year 10080 minute winter	1.195	0.472
5 year 15 minute summer	156.175	44.192
5 year 15 minute winter	109.596	44.192
5 year 30 minute summer	102.274	28.940
5 year 30 minute winter	71.771	28.940
5 year 60 minute summer	68.899	18.208
5 year 60 minute winter	45.775	18.208
5 year 120 minute summer	45.587	12.047
5 year 120 minute winter	30.287	12.047
5 year 180 minute summer	36.209	9.318
5 year 180 minute winter	23.537	9.318
5 year 240 minute summer	29.155	7.705
5 year 240 minute winter	19.370	7.705
5 year 360 minute summer	22.607	5.817
5 year 360 minute winter	14.695	5.817
5 year 480 minute summer	17.902	4.731
5 year 480 minute winter	11.893	4.731
5 year 600 minute summer	14.684	4.017
5 year 600 minute winter	10.033	4.017
5 year 720 minute summer	13.086	3.507
5 year 720 minute winter	8.795	3.507

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
5 year 960 minute summer	10.723	2.824
5 year 960 minute winter	7.103	2.824
5 year 1440 minute summer	7.741	2.075
5 year 1440 minute winter	5.202	2.075
5 year 2160 minute summer	5.538	1.530
5 year 2160 minute winter	3.816	1.530
5 year 2880 minute summer	4.630	1.241
5 year 2880 minute winter	3.112	1.241
5 year 4320 minute summer	3.581	0.936
5 year 4320 minute winter	2.358	0.936
5 year 5760 minute summer	3.032	0.776
5 year 5760 minute winter	1.962	0.776
5 year 7200 minute summer	2.657	0.678
5 year 7200 minute winter	1.715	0.678
5 year 8640 minute summer	2.394	0.611
5 year 8640 minute winter	1.545	0.611
5 year 10080 minute summer	2.204	0.562
5 year 10080 minute winter	1.422	0.562
10 year 15 minute summer	196.366	55.565
10 year 15 minute winter	137.801	55.565
10 year 30 minute summer	129.616	36.677
10 year 30 minute winter	90.958	36.677
10 year 60 minute summer	87.556	23.138
10 year 60 minute winter	58.170	23.138
10 year 120 minute summer	55.887	14.769
10 year 120 minute winter	37.130	14.769
10 year 180 minute summer	43.664	11.236
10 year 180 minute winter	28.383	11.236
10 year 240 minute summer	34.849	9.210
10 year 240 minute winter	23.153	9.210
10 year 360 minute summer	26.831	6.905
10 year 360 minute winter	17.441	6.905
10 year 480 minute summer	21.157	5.591
10 year 480 minute winter	14.056	5.591
10 year 600 minute summer	17.307	4.734
10 year 600 minute winter	11.825	4.734
10 year 720 minute summer	15.394	4.126
10 year 720 minute winter	10.346	4.126
10 year 960 minute summer	12.587	3.314
10 year 960 minute winter	8.338	3.314
10 year 1440 minute summer	9.049	2.425
10 year 1440 minute winter	6.082	2.425
10 year 2160 minute summer	6.434	1.778
10 year 2160 minute winter	4.433	1.778
10 year 2880 minute summer	5.346	1.433
10 year 2880 minute winter	3.593	1.433
10 year 4320 minute summer	4.084	1.068
10 year 4320 minute winter	2.690	1.068
10 year 5760 minute summer	3.421	0.876
10 year 5760 minute winter	2.214	0.876
10 year 7200 minute summer	2.974	0.759
10 year 7200 minute winter	1.919	0.759

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
10 year 8640 minute summer	2.662	0.679
10 year 8640 minute winter	1.718	0.679
10 year 10080 minute summer	2.436	0.621
10 year 10080 minute winter	1.572	0.621
30 year 15 minute summer	259.241	73.356
30 year 15 minute winter	181.923	73.356
30 year 30 minute summer	172.337	48.765
30 year 30 minute winter	120.938	48.765
30 year 60 minute summer	116.959	30.909
30 year 60 minute winter	77.705	30.909
30 year 120 minute summer	72.093	19.052
30 year 120 minute winter	47.897	19.052
30 year 180 minute summer	55.514	14.286
30 year 180 minute winter	36.086	14.286
30 year 240 minute summer	43.971	11.620
30 year 240 minute winter	29.214	11.620
30 year 360 minute summer	33.632	8.655
30 year 360 minute winter	21.862	8.655
30 year 480 minute summer	26.480	6.998
30 year 480 minute winter	17.593	6.998
30 year 600 minute summer	21.668	5.927
30 year 600 minute winter	14.805	5.927
30 year 720 minute summer	19.295	5.171
30 year 720 minute winter	12.967	5.171
30 year 960 minute summer	15.835	4.170
30 year 960 minute winter	10.490	4.170
30 year 1440 minute summer	11.417	3.060
30 year 1440 minute winter	7.673	3.060
30 year 2160 minute summer	8.077	2.232
30 year 2160 minute winter	5.566	2.232
30 year 2880 minute summer	6.656	1.784
30 year 2880 minute winter	4.473	1.784
30 year 4320 minute summer	4.972	1.300
30 year 4320 minute winter	3.275	1.300
30 year 5760 minute summer	4.083	1.045
30 year 5760 minute winter	2.643	1.045
30 year 7200 minute summer	3.496	0.892
30 year 7200 minute winter	2.256	0.892
30 year 8640 minute summer	3.089	0.788
30 year 8640 minute winter	1.994	0.788
30 year 10080 minute summer	2.797	0.714
30 year 10080 minute winter	1.805	0.714
30 year +40% CC 15 minute summer	362.937	102.699
30 year +40% CC 15 minute winter	254.693	102.699
30 year +40% CC 30 minute summer	241.271	68.271
30 year +40% CC 30 minute winter	169.313	68.271
30 year +40% CC 60 minute summer	163.742	43.272
30 year +40% CC 60 minute winter	108.786	43.272
30 year +40% CC 120 minute summer	100.930	26.673
30 year +40% CC 120 minute winter	67.056	26.673
30 year +40% CC 180 minute summer	77.720	20.000
30 year +40% CC 180 minute winter	50.520	20.000

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +40% CC 240 minute summer	61.560	16.268
30 year +40% CC 240 minute winter	40.899	16.268
30 year +40% CC 360 minute summer	47.085	12.117
30 year +40% CC 360 minute winter	30.607	12.117
30 year +40% CC 480 minute summer	37.072	9.797
30 year +40% CC 480 minute winter	24.630	9.797
30 year +40% CC 600 minute summer	30.335	8.297
30 year +40% CC 600 minute winter	20.727	8.297
30 year +40% CC 720 minute summer	27.013	7.240
30 year +40% CC 720 minute winter	18.154	7.240
30 year +40% CC 960 minute summer	22.169	5.838
30 year +40% CC 960 minute winter	14.685	5.838
30 year +40% CC 1440 minute summer	15.984	4.284
30 year +40% CC 1440 minute winter	10.743	4.284
30 year +40% CC 2160 minute summer	11.308	3.125
30 year +40% CC 2160 minute winter	7.792	3.125
30 year +40% CC 2880 minute summer	9.318	2.497
30 year +40% CC 2880 minute winter	6.262	2.497
30 year +40% CC 4320 minute summer	6.961	1.820
30 year +40% CC 4320 minute winter	4.584	1.820
30 year +40% CC 5760 minute summer	5.716	1.463
30 year +40% CC 5760 minute winter	3.700	1.463
30 year +40% CC 7200 minute summer	4.894	1.248
30 year +40% CC 7200 minute winter	3.159	1.248
30 year +40% CC 8640 minute summer	4.325	1.103
30 year +40% CC 8640 minute winter	2.791	1.103
30 year +40% CC 10080 minute summer	3.916	0.999
30 year +40% CC 10080 minute winter	2.528	0.999
100 year 15 minute summer	328.056	92.829
100 year 15 minute winter	230.215	92.829
100 year 30 minute summer	219.430	62.091
100 year 30 minute winter	153.986	62.091
100 year 60 minute summer	150.545	39.785
100 year 60 minute winter	100.019	39.785
100 year 120 minute summer	90.655	23.958
100 year 120 minute winter	60.229	23.958
100 year 180 minute summer	69.284	17.829
100 year 180 minute winter	45.037	17.829
100 year 240 minute summer	54.759	14.471
100 year 240 minute winter	36.381	14.471
100 year 360 minute summer	41.979	10.803
100 year 360 minute winter	27.287	10.803
100 year 480 minute summer	33.296	8.799
100 year 480 minute winter	22.121	8.799
100 year 600 minute summer	27.447	7.507
100 year 600 minute winter	18.753	7.507
100 year 720 minute summer	24.602	6.594
100 year 720 minute winter	16.534	6.594
100 year 960 minute summer	20.385	5.368
100 year 960 minute winter	13.504	5.368
100 year 1440 minute summer	14.833	3.975
100 year 1440 minute winter	9.969	3.975

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 2160 minute summer	10.467	2.893
100 year 2160 minute winter	7.212	2.893
100 year 2880 minute summer	8.541	2.289
100 year 2880 minute winter	5.740	2.289
100 year 4320 minute summer	6.213	1.624
100 year 4320 minute winter	4.091	1.624
100 year 5760 minute summer	4.981	1.275
100 year 5760 minute winter	3.224	1.275
100 year 7200 minute summer	4.174	1.065
100 year 7200 minute winter	2.694	1.065
100 year 8640 minute summer	3.620	0.924
100 year 8640 minute winter	2.337	0.924
100 year 10080 minute summer	3.225	0.823
100 year 10080 minute winter	2.082	0.823
100 year +45% CC 15 minute summer	475.681	134.601
100 year +45% CC 15 minute winter	333.811	134.601
100 year +45% CC 30 minute summer	318.173	90.032
100 year +45% CC 30 minute winter	223.279	90.032
100 year +45% CC 60 minute summer	218.291	57.688
100 year +45% CC 60 minute winter	145.027	57.688
100 year +45% CC 120 minute summer	131.450	34.738
100 year +45% CC 120 minute winter	87.332	34.738
100 year +45% CC 180 minute summer	100.462	25.852
100 year +45% CC 180 minute winter	65.303	25.852
100 year +45% CC 240 minute summer	79.400	20.983
100 year +45% CC 240 minute winter	52.752	20.983
100 year +45% CC 360 minute summer	60.869	15.664
100 year +45% CC 360 minute winter	39.566	15.664
100 year +45% CC 480 minute summer	48.280	12.759
100 year +45% CC 480 minute winter	32.076	12.759
100 year +45% CC 600 minute summer	39.798	10.886
100 year +45% CC 600 minute winter	27.193	10.886
100 year +45% CC 720 minute summer	35.673	9.561
100 year +45% CC 720 minute winter	23.974	9.561
100 year +45% CC 960 minute summer	29.559	7.784
100 year +45% CC 960 minute winter	19.580	7.784
100 year +45% CC 1440 minute summer	21.508	5.764
100 year +45% CC 1440 minute winter	14.455	5.764
100 year +45% CC 2160 minute summer	15.177	4.194
100 year +45% CC 2160 minute winter	10.458	4.194
100 year +45% CC 2880 minute summer	12.385	3.319
100 year +45% CC 2880 minute winter	8.324	3.319
100 year +45% CC 4320 minute summer	9.008	2.355
100 year +45% CC 4320 minute winter	5.932	2.355
100 year +45% CC 5760 minute summer	7.223	1.849
100 year +45% CC 5760 minute winter	4.675	1.849
100 year +45% CC 7200 minute summer	6.052	1.544
100 year +45% CC 7200 minute winter	3.906	1.544
100 year +45% CC 8640 minute summer	5.249	1.339
100 year +45% CC 8640 minute winter	3.388	1.339
100 year +45% CC 10080 minute summer	4.677	1.193
100 year +45% CC 10080 minute winter	3.019	1.193

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Results for 2 year Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	S01	136	66.135	0.085	0.1	0.0135	0.0000	OK
180 minute winter	SD02	136	66.135	0.102	0.1	0.0000	0.0000	SURCHARGED
180 minute winter	SD03	136	66.135	0.118	0.8	1.9579	0.0000	SURCHARGED
180 minute winter	SD04	136	66.135	0.138	0.8	1.3118	0.0000	SURCHARGED
180 minute winter	S02	136	66.134	0.080	0.1	0.0128	0.0000	OK
180 minute winter	S03	136	66.134	0.106	0.5	0.9331	0.0000	SURCHARGED
180 minute winter	SD05	136	66.134	0.175	1.2	1.1727	0.0000	SURCHARGED
15 minute winter	RE04	14	67.212	0.017	0.3	0.0355	0.0000	OK
15 minute winter	S04	14	67.163	0.023	0.7	0.0106	0.0000	OK
15 minute winter	SD06	14	67.036	0.029	1.1	0.0000	0.0000	OK
15 minute winter	SD07	15	66.937	0.024	1.8	0.0000	0.0000	OK
15 minute winter	S05	15	66.333	0.025	0.6	0.0721	0.0000	OK
15 minute winter	SD08	14	66.288	0.040	3.1	0.0207	0.0000	OK
30 minute winter	S06	22	66.305	0.013	0.4	0.0020	0.0000	OK
180 minute winter	SD09	132	66.133	0.218	2.1	0.5934	0.0000	SURCHARGED
180 minute winter	S07FC	132	66.128	0.231	1.3	0.0368	0.0000	SURCHARGED
15 minute summer	C01	1	65.893	0.000	1.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	S01	1.000	SD02	0.1	0.209	0.039	0.0625	
180 minute winter	SD02	1.001	SD03	0.1	0.096	0.038	0.0637	
180 minute winter	SD03	1.002	SD04	0.4	0.228	0.164	0.0784	
180 minute winter	SD04	1.003	SD05	0.6	0.178	0.244	0.1484	
180 minute winter	S02	2.000	S03	0.1	0.122	0.038	0.0961	
180 minute winter	S03	2.001	SD05	-0.3	0.236	-0.104	0.0369	
180 minute winter	SD05	1.004	SD09	1.0	0.173	0.393	0.1704	
15 minute winter	RE04	3.000	S04	0.3	0.244	0.063	0.0122	
15 minute winter	S04	3.001	SD06	0.7	0.411	0.116	0.0242	
15 minute winter	SD06	3.002	SD07	1.0	0.642	0.173	0.0153	
15 minute winter	SD07	3.003	SD08	1.8	0.860	0.122	0.0235	
15 minute winter	S05	4.000	SD08	0.6	0.270	0.136	0.0265	
15 minute winter	SD08	3.004	SD09	3.1	0.489	0.342	0.0812	
30 minute winter	S06	5.000	SD09	0.4	0.107	0.034	0.0423	
180 minute winter	SD09	1.005	S07FC	1.3	0.287	0.474	0.0705	
180 minute winter	S07FC	Orifice	C01	1.3				15.7

Results for 5 year Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	S01	148	66.184	0.134	0.2	0.0212	0.0000	SURCHARGED
180 minute winter	SD02	144	66.184	0.151	0.2	0.0000	0.0000	SURCHARGED
180 minute winter	SD03	144	66.184	0.167	1.4	3.6148	0.0000	SURCHARGED
180 minute winter	SD04	144	66.183	0.186	1.3	2.4143	0.0000	SURCHARGED
180 minute winter	S02	140	66.183	0.129	0.2	0.0205	0.0000	SURCHARGED
180 minute winter	S03	144	66.183	0.155	0.7	1.6108	0.0000	SURCHARGED
180 minute winter	SD05	144	66.183	0.224	1.8	2.1633	0.0000	SURCHARGED
30 minute winter	RE04	23	67.215	0.020	0.4	0.0506	0.0000	OK
30 minute winter	S04	21	67.168	0.028	1.0	0.0146	0.0000	OK
15 minute winter	SD06	14	67.043	0.036	1.7	0.0000	0.0000	OK
15 minute winter	SD07	14	66.943	0.030	3.0	0.0000	0.0000	OK
15 minute winter	S05	15	66.340	0.032	1.0	0.1179	0.0000	OK
15 minute winter	SD08	14	66.301	0.053	5.0	0.0352	0.0000	OK
15 minute winter	S06	14	66.309	0.017	0.7	0.0026	0.0000	OK
30 minute winter	SD09	26	66.197	0.282	6.6	1.2960	0.0000	SURCHARGED
30 minute winter	S07FC	27	66.191	0.294	1.5	0.0468	0.0000	SURCHARGED
15 minute summer	C01	1	65.893	0.000	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	S01	1.000	SD02	0.2	0.178	0.064	0.0655	
180 minute winter	SD02	1.001	SD03	0.1	0.096	0.052	0.0637	
180 minute winter	SD03	1.002	SD04	-0.5	0.228	-0.206	0.0784	
180 minute winter	SD04	1.003	SD05	-0.8	0.181	-0.310	0.1484	
180 minute winter	S02	2.000	S03	0.2	0.122	0.067	0.1033	
180 minute winter	S03	2.001	SD05	-0.4	0.226	-0.135	0.0369	
180 minute winter	SD05	1.004	SD09	1.2	0.178	0.434	0.1704	
30 minute winter	RE04	3.000	S04	0.4	0.278	0.092	0.0159	
30 minute winter	S04	3.001	SD06	1.0	0.454	0.171	0.0324	
15 minute winter	SD06	3.002	SD07	1.7	0.731	0.274	0.0213	
15 minute winter	SD07	3.003	SD08	3.0	0.963	0.195	0.0333	
15 minute winter	S05	4.000	SD08	0.9	0.306	0.221	0.0377	
15 minute winter	SD08	3.004	SD09	5.0	0.727	0.550	0.0907	
15 minute winter	S06	5.000	SD09	0.7	0.174	0.059	0.0437	
30 minute winter	SD09	1.005	S07FC	1.5	0.313	0.578	0.0705	
30 minute winter	S07FC	Orifice	C01	1.4				11.9

Results for 10 year Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	S01	116	66.216	0.166	0.3	0.0264	0.0000	FLOOD RISK
120 minute winter	SD02	116	66.216	0.183	0.2	0.0000	0.0000	FLOOD RISK
120 minute winter	SD03	116	66.216	0.199	2.1	4.7704	0.0000	FLOOD RISK
120 minute winter	SD04	118	66.216	0.219	2.1	3.2873	0.0000	SURCHARGED
120 minute winter	S02	116	66.215	0.161	0.3	0.0256	0.0000	FLOOD RISK
120 minute winter	S03	116	66.215	0.187	1.0	2.0623	0.0000	SURCHARGED
120 minute winter	SD05	116	66.215	0.256	3.0	2.9884	0.0000	SURCHARGED
15 minute winter	RE04	15	67.218	0.023	0.5	0.0616	0.0000	OK
15 minute winter	S04	15	67.171	0.031	1.2	0.0172	0.0000	OK
15 minute winter	SD06	13	67.047	0.040	2.0	0.0000	0.0000	OK
15 minute winter	SD07	13	66.946	0.033	3.6	0.0000	0.0000	OK
15 minute winter	S05	15	66.344	0.036	1.3	0.1504	0.0000	OK
30 minute winter	SD08	23	66.326	0.078	6.0	0.0720	0.0000	OK
15 minute winter	S06	13	66.311	0.019	0.9	0.0030	0.0000	OK
30 minute winter	SD09	27	66.246	0.331	8.1	2.0180	0.0000	SURCHARGED
30 minute winter	S07FC	28	66.240	0.343	1.7	0.0545	0.0000	SURCHARGED
15 minute summer	C01	1	65.893	0.000	1.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	S01	1.000	SD02	0.2	0.237	0.094	0.0655	
120 minute winter	SD02	1.001	SD03	0.2	0.107	0.075	0.0637	
120 minute winter	SD03	1.002	SD04	-0.7	0.210	-0.283	0.0784	
120 minute winter	SD04	1.003	SD05	-1.4	0.193	-0.522	0.1484	
120 minute winter	S02	2.000	S03	0.3	0.123	0.096	0.1033	
120 minute winter	S03	2.001	SD05	-0.5	0.237	-0.196	0.0369	
120 minute winter	SD05	1.004	SD09	-2.0	-0.256	-0.752	0.1704	
15 minute winter	RE04	3.000	S04	0.5	0.287	0.113	0.0184	
15 minute winter	S04	3.001	SD06	1.2	0.475	0.207	0.0374	
15 minute winter	SD06	3.002	SD07	2.0	0.772	0.334	0.0245	
15 minute winter	SD07	3.003	SD08	3.6	1.008	0.238	0.0447	
15 minute winter	S05	4.000	SD08	1.2	0.312	0.279	0.0514	
30 minute winter	SD08	3.004	SD09	5.7	0.776	0.631	0.1081	
15 minute winter	S06	5.000	SD09	0.9	0.169	0.076	0.0445	
30 minute winter	SD09	1.005	S07FC	1.7	0.350	0.626	0.0705	
30 minute winter	S07FC	Orifice	C01	1.5				15.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	S01	118	66.266	0.216	0.4	0.0343	0.0000	FLOOD RISK
120 minute winter	SD02	118	66.266	0.232	0.3	0.0000	0.0000	FLOOD RISK
120 minute winter	SD03	118	66.265	0.248	2.5	6.5895	0.0000	FLOOD RISK
120 minute winter	SD04	120	66.265	0.268	2.6	4.6234	0.0000	FLOOD RISK
120 minute winter	S02	118	66.265	0.211	0.4	0.0335	0.0000	FLOOD RISK
120 minute winter	S03	118	66.265	0.237	1.2	2.7586	0.0000	FLOOD RISK
120 minute winter	SD05	118	66.265	0.306	3.9	4.5187	0.0000	SURCHARGED
15 minute winter	RE04	14	67.221	0.026	0.7	0.0834	0.0000	OK
15 minute winter	S04	14	67.177	0.037	1.6	0.0231	0.0000	OK
15 minute winter	SD06	14	67.055	0.048	2.7	0.0000	0.0000	OK
15 minute winter	SD07	13	66.952	0.039	4.9	0.0000	0.0000	OK
30 minute winter	S05	26	66.408	0.100	2.5	0.7431	0.0000	OK
30 minute winter	SD08	25	66.404	0.156	7.4	0.1971	0.0000	SURCHARGED
15 minute winter	S06	13	66.313	0.021	1.1	0.0033	0.0000	OK
30 minute winter	SD09	30	66.292	0.377	9.3	2.8289	0.0000	SURCHARGED
30 minute winter	S07FC	31	66.284	0.387	1.7	0.0616	0.0000	SURCHARGED
15 minute summer	C01	1	65.893	0.000	1.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	S01	1.000	SD02	0.3	0.233	0.127	0.0655	
120 minute winter	SD02	1.001	SD03	0.3	0.093	0.103	0.0637	
120 minute winter	SD03	1.002	SD04	-0.8	0.220	-0.291	0.0784	
120 minute winter	SD04	1.003	SD05	-1.7	-0.216	-0.637	0.1484	
120 minute winter	S02	2.000	S03	0.3	0.123	0.128	0.1033	
120 minute winter	S03	2.001	SD05	-0.6	0.236	-0.223	0.0369	
120 minute winter	SD05	1.004	SD09	-2.5	-0.321	-0.943	0.1704	
15 minute winter	RE04	3.000	S04	0.7	0.321	0.153	0.0232	
15 minute winter	S04	3.001	SD06	1.6	0.523	0.289	0.0473	
15 minute winter	SD06	3.002	SD07	2.7	0.846	0.451	0.0304	
15 minute winter	SD07	3.003	SD08	4.9	1.053	0.322	0.0573	
30 minute winter	S05	4.000	SD08	2.0	0.324	0.466	0.0932	
30 minute winter	SD08	3.004	SD09	6.3	0.832	0.700	0.1179	
15 minute winter	S06	5.000	SD09	1.1	0.270	0.093	0.0453	
30 minute winter	SD09	1.005	S07FC	1.7	0.336	0.654	0.0705	
30 minute winter	S07FC	Orifice	C01	1.6				19.7

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	S01	176	66.354	0.304	0.5	0.0484	0.0000	FLOOD RISK
180 minute winter	SD02	176	66.354	0.321	0.4	0.0000	0.0000	FLOOD RISK
180 minute winter	SD03	176	66.354	0.337	2.6	9.9859	0.0000	FLOOD RISK
180 minute winter	SD04	176	66.354	0.357	2.6	6.9212	0.0000	FLOOD RISK
180 minute winter	S02	176	66.353	0.299	0.5	0.0476	0.0000	FLOOD RISK
180 minute winter	S03	176	66.353	0.325	1.1	3.9647	0.0000	FLOOD RISK
180 minute winter	SD05	176	66.353	0.394	3.9	7.6850	0.0000	FLOOD RISK
15 minute winter	RE04	15	67.227	0.032	1.0	0.1200	0.0000	OK
15 minute winter	S04	13	67.184	0.044	2.3	0.0312	0.0000	OK
15 minute winter	SD06	14	67.065	0.058	3.9	0.0000	0.0000	OK
15 minute winter	SD07	14	66.960	0.047	6.9	0.0003	0.0000	OK
30 minute winter	S05	27	66.532	0.224	4.1	1.9004	0.0000	FLOOD RISK
30 minute winter	SD08	26	66.527	0.279	9.1	0.5198	0.0000	SURCHARGED
60 minute winter	S06	51	66.368	0.076	1.2	0.0121	0.0000	OK
60 minute winter	SD09	50	66.368	0.453	8.9	4.4887	0.0000	SURCHARGED
60 minute winter	S07FC	51	66.359	0.462	1.9	0.0734	0.0000	FLOOD RISK
15 minute summer	C01	1	65.893	0.000	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	S01	1.000	SD02	0.4	0.178	0.161	0.0655	
180 minute winter	SD02	1.001	SD03	0.4	0.093	0.134	0.0637	
180 minute winter	SD03	1.002	SD04	-0.7	0.228	-0.258	0.0784	
180 minute winter	SD04	1.003	SD05	-1.6	-0.201	-0.594	0.1484	
180 minute winter	S02	2.000	S03	0.4	0.125	0.160	0.1033	
180 minute winter	S03	2.001	SD05	-0.4	0.235	-0.141	0.0369	
180 minute winter	SD05	1.004	SD09	-2.5	-0.320	-0.940	0.1704	
15 minute winter	RE04	3.000	S04	0.9	0.348	0.220	0.0295	
15 minute winter	S04	3.001	SD06	2.3	0.565	0.398	0.0604	
15 minute winter	SD06	3.002	SD07	3.9	0.922	0.638	0.0392	
15 minute winter	SD07	3.003	SD08	6.9	1.078	0.453	0.0617	
30 minute winter	S05	4.000	SD08	2.5	0.322	0.594	0.0932	
30 minute winter	SD08	3.004	SD09	6.6	0.841	0.726	0.1179	
60 minute winter	S06	5.000	SD09	1.2	0.220	0.102	0.0717	
60 minute winter	SD09	1.005	S07FC	1.9	0.326	0.701	0.0705	
60 minute winter	S07FC	Orifice	C01	1.8				26.1

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	S01	176	66.319	0.269	0.4	0.0428	0.0000	FLOOD RISK
180 minute winter	SD02	176	66.319	0.286	0.3	0.0000	0.0000	FLOOD RISK
180 minute winter	SD03	176	66.319	0.302	2.3	8.6527	0.0000	FLOOD RISK
180 minute winter	SD04	176	66.319	0.322	2.4	6.0647	0.0000	FLOOD RISK
180 minute winter	S02	176	66.318	0.264	0.4	0.0420	0.0000	FLOOD RISK
180 minute winter	S03	176	66.318	0.290	1.0	3.5051	0.0000	FLOOD RISK
180 minute winter	SD05	176	66.318	0.359	3.6	6.4220	0.0000	FLOOD RISK
15 minute winter	RE04	15	67.225	0.030	0.9	0.1076	0.0000	OK
15 minute winter	S04	15	67.181	0.041	2.0	0.0283	0.0000	OK
15 minute winter	SD06	14	67.061	0.054	3.4	0.0000	0.0000	OK
15 minute winter	SD07	14	66.957	0.044	6.1	0.0000	0.0000	OK
30 minute winter	S05	27	66.493	0.185	3.5	1.5420	0.0000	FLOOD RISK
30 minute winter	SD08	26	66.489	0.241	8.3	0.3789	0.0000	SURCHARGED
60 minute winter	S06	49	66.347	0.055	1.1	0.0087	0.0000	OK
60 minute winter	SD09	50	66.347	0.432	8.6	3.9817	0.0000	SURCHARGED
60 minute winter	S07FC	50	66.338	0.441	1.8	0.0701	0.0000	SURCHARGED
15 minute summer	C01	1	65.893	0.000	1.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	S01	1.000	SD02	0.3	0.240	0.128	0.0655	
180 minute winter	SD02	1.001	SD03	0.3	0.106	0.106	0.0637	
180 minute winter	SD03	1.002	SD04	-0.7	0.228	-0.265	0.0784	
180 minute winter	SD04	1.003	SD05	-1.5	-0.193	-0.569	0.1484	
180 minute winter	S02	2.000	S03	0.3	0.125	0.128	0.1033	
180 minute winter	S03	2.001	SD05	-0.4	0.237	-0.139	0.0369	
180 minute winter	SD05	1.004	SD09	-2.3	-0.295	-0.867	0.1704	
15 minute winter	RE04	3.000	S04	0.8	0.338	0.198	0.0275	
15 minute winter	S04	3.001	SD06	2.0	0.557	0.360	0.0554	
15 minute winter	SD06	3.002	SD07	3.4	0.891	0.563	0.0359	
15 minute winter	SD07	3.003	SD08	6.1	1.078	0.402	0.0601	
30 minute winter	S05	4.000	SD08	2.4	0.302	0.558	0.0932	
30 minute winter	SD08	3.004	SD09	6.3	0.844	0.703	0.1179	
60 minute winter	S06	5.000	SD09	1.1	0.203	0.093	0.0616	
60 minute winter	SD09	1.005	S07FC	1.8	0.324	0.684	0.0705	
60 minute winter	S07FC	Orifice	C01	1.8				25.4

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 97.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	S01	232	66.494	0.444	0.5	0.0706	0.0000	FLOOD RISK
240 minute winter	SD02	232	66.494	0.461	0.4	0.0000	0.0000	FLOOD RISK
240 minute winter	SD03	232	66.494	0.477	2.7	13.0507	0.0000	FLOOD RISK
240 minute winter	SD04	232	66.494	0.497	2.5	6.9212	0.0000	FLOOD RISK
240 minute winter	S02	228	66.492	0.438	0.5	0.0697	0.0000	FLOOD RISK
240 minute winter	S03	228	66.492	0.464	1.0	4.2620	0.0000	FLOOD RISK
240 minute winter	SD05	228	66.492	0.533	3.9	11.1917	0.0000	FLOOD RISK
15 minute winter	RE04	15	67.231	0.036	1.3	0.1580	0.0000	OK
15 minute winter	S04	14	67.191	0.051	3.0	0.0413	0.0000	OK
15 minute winter	SD06	14	67.077	0.070	5.1	0.0000	0.0000	OK
15 minute winter	SD07	15	66.969	0.056	9.0	0.0060	0.0000	OK
30 minute winter	S05	27	66.685	0.377	5.7	2.6362	0.0000	FLOOD RISK
30 minute winter	SD08	27	66.678	0.430	12.7	1.5060	0.0000	FLOOD RISK
240 minute winter	S06	232	66.486	0.194	0.6	0.0308	0.0000	SURCHARGED
240 minute winter	SD09	232	66.486	0.571	5.5	7.7702	0.0000	FLOOD RISK
240 minute winter	S07FC	232	66.474	0.577	2.0	0.0918	0.0000	FLOOD RISK
15 minute summer	C01	1	65.893	0.000	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	S01	1.000	SD02	0.4	0.240	0.164	0.0655	
240 minute winter	SD02	1.001	SD03	0.4	0.095	0.141	0.0637	
240 minute winter	SD03	1.002	SD04	-1.2	0.228	-0.443	0.0784	
240 minute winter	SD04	1.003	SD05	-1.4	0.187	-0.542	0.1484	
240 minute winter	S02	2.000	S03	0.4	0.125	0.164	0.1033	
240 minute winter	S03	2.001	SD05	0.8	0.235	0.297	0.0369	
240 minute winter	SD05	1.004	SD09	-2.3	-0.292	-0.857	0.1704	
15 minute winter	RE04	3.000	S04	1.2	0.370	0.287	0.0361	
15 minute winter	S04	3.001	SD06	3.0	0.604	0.526	0.0746	
15 minute winter	SD06	3.002	SD07	5.1	0.977	0.836	0.0484	
15 minute winter	SD07	3.003	SD08	9.0	1.294	0.591	0.0663	
30 minute winter	S05	4.000	SD08	-2.7	-0.351	-0.647	0.0932	
30 minute winter	SD08	3.004	SD09	7.9	1.005	0.872	0.1179	
240 minute winter	S06	5.000	SD09	0.6	0.116	0.051	0.0788	
240 minute winter	SD09	1.005	S07FC	2.0	0.269	0.764	0.0705	
240 minute winter	S07FC	Orifice	C01	2.0				46.7

Appendix D

Operations and Maintenance Manual

TJ Infrastructure Ltd

Project: The Stables, Tanhouse Lane

Title: SuDs Operations and Maintenance Manual

Reference: STL-O&Ms-01

Client: Matt Rushent

TJ
Infrastructure

Rev	Description	Date
00	First Issue	01/12/2023

Author	Signature	Date
Toby Nicks MEng (Hons) CEng MICE	T Nicks	01/12/2023

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Table of Contents

Appendices

Appendix A

Drawings

1 Introduction

1.1 Project Background

1.1.1 TJ Infrastructure (the consultant) has been commissioned by Matt Rushent (the Client) to produce an SuDs Operations and Maintenance Manual in relation to the proposed new development at The Stable, Tanhouse Lane. This follows on from the SuDs Drainage Strategy report Ref: STL-SUDS-01.

1.1.2 Particular reference is paid to the inspection, aftercare and maintenance of SuDs drainage features as part of this manual in order to demonstrate to the LLFA or adopting authority the effectiveness and longevity of the SuDs features designed within the scheme as opposed to the standard Building Regulations local and domestic drainage and/or the main discharge drainage connections to 'Design and Construction Guidance' standards.

1.1.3 This report is based on current best practice guidance.

1.1.4 Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the construction phase, and are deemed a material derivation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

1.1.5 In accordance with the SuDs Drainage Strategy Report the surface water network has been designed to accommodate the 1 in 100 year storm rainfall event plus an allowance for climate change. As the flows are generally being attenuated on site and within SuDs features there will be a period of time after storm events where the network is still partially or fully surcharged and is draining down. Where this surcharging is still present after 48hrs appropriate action should be taken as noted below.

1.2 SuDs for The Stables, Tanhouse Lane

1.2.1 The SuDs across the site is generally accommodated within the permeable subbases across the site, with the inclusion of water butts, and a small attenuation basin to the north of the site.

1.2.2 The SuDs also aim to:

- Control the flow, volume and frequency of water leaving the development,
- Prevent pollution by intercepting silt and cleaning runoff from hard surfaces,
- Provide attractive surroundings for the community,
- Create opportunities for wildlife.

1.3 Scope of O&M Manual

1.3.1 This manual is intended to give details of the operation and maintenance for the range of SuDs features included with the drainage strategy. Where proprietary products are specified the manufacturer's instructions and recommendations should be followed in priority, and appended to this document unless specifically noted otherwise due to project constraints.

1.3.2 The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.

1.3.3 This document is currently in a template format until the site is constructed so that accurate information on locations, types of features, and proprietary products can be listed in the final version.

1.3.4 Where assets are noted as being private they should be written in to the title deeds of the respective properties to ensure there is a legal responsibility for the maintenance and upkeep of those features. The responsibility can be vest in a third party management company to undertake the works but where no such arrangement exists it shall, in all cases, revert back to the property owner\s.

1.3.5 Maintenance has been separated into different categories for each type of feature as follows:

- Regular care – Inspection of key components (inlets, outlets etc.), litter collection, grass cutting
- Occasional tasks – managing vegetation and removing silt build-up in the SuDs features
- Remedial work – identifying failures in the SuDs network and how to repair them

1.4 Management Companies

1.4.1 This manual can include references to management companies for some of the responsibilities for inspection and maintenance of the drainage features. Where this term is included it should be noted that the ultimate responsibility for the features is with the building owner\s who share benefit from the particular asset, or that a feature is required for safe and effective maintenance and operation of a feature that they do use.

1.5 Emergency Actions

1.5.1 Spillages on site may require emergency action. Most spillages on development sites are of compounds that do not pose a serious risk to the environment if they enter the drainage network in a slow and controlled manner with time available for natural breakdown in the treatment system through the permeable paving, and filter drain through the geocellular attenuation tank. Therefore, small spillages of oil, milk or other known organic substances should be removed where possible using soak mats as recommended by the Environment Agency, with residual spillage allowed to bioremediate in the drainage system.

1.5.2 In the event of a serious spillage, either by volume or of unknown or toxic compounds, then isolate the spillage with soil, turf or fabric and block the outlet pipes from chamber(s) downstream of the spillage with a bung(s). (A bung for blocking pipes may be made by wrapping soil or turf in a plastic sheet or closely woven fabric.)

1.5.3 Contact the Environment Agency and Local Authority immediately.

1.6 Timetable for Implementation

1.6.1 The construction timetable is subject to planning responses and liaison with third parties such as Highways, and seeking approvals from the LLFA for the new outfalls (where required) etc. but the originally programmed start of construction is early 2024 with a 12 month construction period.

1.6.2 During construction all responsibilities lay with the contractor until such time as snagging has been successfully completed.

2 Operations and Maintenance Activities

2.1.1 All proposed surface water drainage within the site boundary will be privately managed by the building owner/s or maintained by a private management company on their behalf.

2.1.2 The permeable paving and shallow attenuation basin are designed to store water and attenuate it over a long period of time, however if the subbase is still full, or partly full, 48 hours after the end of a rainfall event this should be investigated immediately as it may indicate a failure, or partial failure, within the network.

2.1.3 Maintenance of the surface water drainage shall include, but not be limited to, the following actions:

Action	Frequency	Responsibility
As Built. Once construction of drainage network has been completed a CCTV survey should be undertaken to detect and defects which should be rectified to the original design.	Once	Main contractor
Pipe and chambers. Visual inspection of chambers, and clearance of any deleterious materials. Inspection of inlet and outlet. If any blockages are detected an inspection of the connecting pipework should be undertaken to determine potential causes.	Annually (or directly following an extreme storm event) Remedial action	Building owner on plot, management company outside of this
Permeable subbase\Paving. Visual inspection of connecting chamber (only need to inspect one per extent of permeable subbase), cleansing of sump	Biannually (or directly following an extreme storm event)	Building owner on plot, management

and removal of silt to be undertaken as required. Inspection of inlets\outlets to ensure no debris build-up and removal of any deleterious materials. Where the subbase is not functioning correctly this may indicate an issue with the connecting filter drain which should then be replaced. Ponding on surface without high water in chambers may indicate upper geotextile is clogged and needs to be replaced. Rocking of pavers at surface, or sand on top of pavers, potentially indicates build-up of water in bedding layer and the geotextile needs to be replace and bedding and pavers relaid.	 Remedial action Remedial action Remedial action Remedial action	company outside of this
Attenuation basins. Inspect/check the attenuation basin inlet/outlet to ensure they are in good condition and operating as designed. Removal of deleterious material. Areas of sedimentation build up should be excavated and removed from site with testing undertaken on material to confirm level of pollutant risk of the exported material.	Annually (or directly following an extreme storm event) Quarterly Remedial action	Management company

Soft landscaping and planting of the area should be maintained in accordance with the details provided by the Landscape Architect or as appropriate for the vegetation mix provided to provide clear flow.		
Flow Control (orifice). Visual inspection of the chamber. Check operation and condition of by-pass\filter. Cleansing of sump and removal of silt to be undertaken as required.	Quarterly (or directly following an extreme storm event)	Management Company

Appendix A

Drawings

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