

Land Off Mill Lane South Shields

Flood Risk Assessment & Drainage Strategy

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25041-01

Client:
Story Homes

Revision:
E

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Revision	Date	Comments	Prepared by	Checked by
-	14.11.25	Initial issue	AT	PB
A	19.11.25	Amended to suit client comments	AT	PB
B	04.12.25	Job title renamed	AT	AT
C	11.05.26	Sections 4.7 & 5 revised	PB	AT
D	12.06.26	Amended to suit new layout	AT	AT
E	03.07.26	Amended to suit revised layout. Emergency access removed.	AT	AT

Executive Summary

Site Location	The site is a 10.5Ha greenfield site located off Lizard Lane, South Shields, South Tyneside, SR6 7LS. The topographical survey indicates that site levels peak at the north western boundary at 42.53m AOD and fall towards a low spot adjacent to the eastern boundary at 29.39m AOD.
Site Proposals	Site proposals show a residential development of 205 plots and associated infrastructure.
Ground Conditions	A Geo-Environmental Assessment by Intelligent Ground Solutions indicate the site is “underlain by Glaciofluvial Deposits in the east and Devensian Till in the west” and “groundwater was not encountered”. “Two of the three soakaway infiltration tests failed” and “the site is underlain by Dolomite Limestone bedrock”.
Nearest Watercourse	The nearest watercourse is an unnamed ditch c.1.9km away to the south located off a residential estate in South Bents. The nearest body of water is the North Sea, c.550m away to the east.
Nearest Surface Water Sewer	The nearest surface sewer is located within White Rocks Grove c.100m to the east of the site.
Nearest Combined Sewer	The nearest foul water sewer is located within White Rocks Grove c.100m to the east of the site.
Nearest Foul Water Sewer	The nearest combined sewer is located within the A183.
Flood Zone	EA flood maps indicate that the development boundary is located entirely within an area classified as a Flood Zone 1 .
Surface Water Flooding	‘High and medium risk’ mapping indicate an area of flooding located at the low point of the site, adjacent to the eastern boundary. ‘Low risk’ mapping indicates a surface water flood route flowing through the site. The proposed development is to maintain and not obstruct the existing surface water flood route so it can return to its predevelopment condition once off site. Proposed site levels will allow the flood flow route to be diverted via highways, shared drives and plot rear gardens. Proposed plot finished floor level’s will be raised above the level which flooding spills off site and plots will be raised above the flood route diversion. Therefore, the surface water flood risk to plots will be alleviated and can be considered low .
Ground Water	The site is underlain by clays with impeded drainage characteristics and as such, the risk of ground water flooding is considered low .
Surface Water Discharge Rate	The discharge rate should be restricted to 17 litres/sec peak discharge for all events up to and including the 100-year event with a 45% allowance for climate change and 10% urban creep.
SUDS	1 Detention basin. 1 Vortex flow control. Private drives should discharge to permeable paving providing one source of treatment.

The above summary should not be used in isolation and reference should be made to the full report.

1. Introduction

Coast Consulting Engineers have been commissioned by Story Homes to assess the flood risk associated with a proposed development on land off Lizard Lane, South Shields, South Tyneside, SR6 7LS. The Flood Risk Assessment is reviewed in accordance with the National Planning Policy Framework (NPPF) for Development and Flood Risk. In conjunction with assessing the site for flood risk, a proposed drainage strategy has been prepared.

This site-specific Flood Risk Assessment (FRA) has been undertaken to determine the risk of flooding to the proposed development from all sources in accordance with the National Planning Policy Framework (NPPF) and to assess the flood risk to others as a result of the development. The assessment will recommend how the risk can be managed in line with planning policy requirements.

One of the key aims of the National Planning Policy Framework (NPPF) is to ensure that flood risk is considered at all stages of the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. Where new development is necessary in such areas, the policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.

1.1 National Planning Policy Framework (NPPF)

The NPPF requires that:

- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account the vulnerability of its users, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.
- A site-specific flood risk assessment is required for proposals greater than 1 ha in size in a Flood Zone 1; all proposals for new development in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as identified in the Strategic Flood Risk Assessment).

The following definitions for flood zones are derived from NPPF:

FLOOD ZONE 1:

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

FLOOD ZONE 2:

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

FLOOD ZONE 3:

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

In addition to the risk of flooding from rivers or sea, consideration must also be given to surface water flooding, flooding due to ground water and flooding from artificial sources such as sewer failure or overtopping of reservoirs.

2. Site Location, Topographical Features and Proposals

The site is a 10.5Ha greenfield site located off Lizard Lane, South Shields, South Tyneside, SR6 7LS and c.600m north of Whitburn village centre. Adjacent to the northern boundary is Kitchener Road and the eastern boundary is bound by the A183. Adjacent to the southern boundary is Marsden Primary School and an existing residential estate, the western boundary is bound by Lizard Lane.

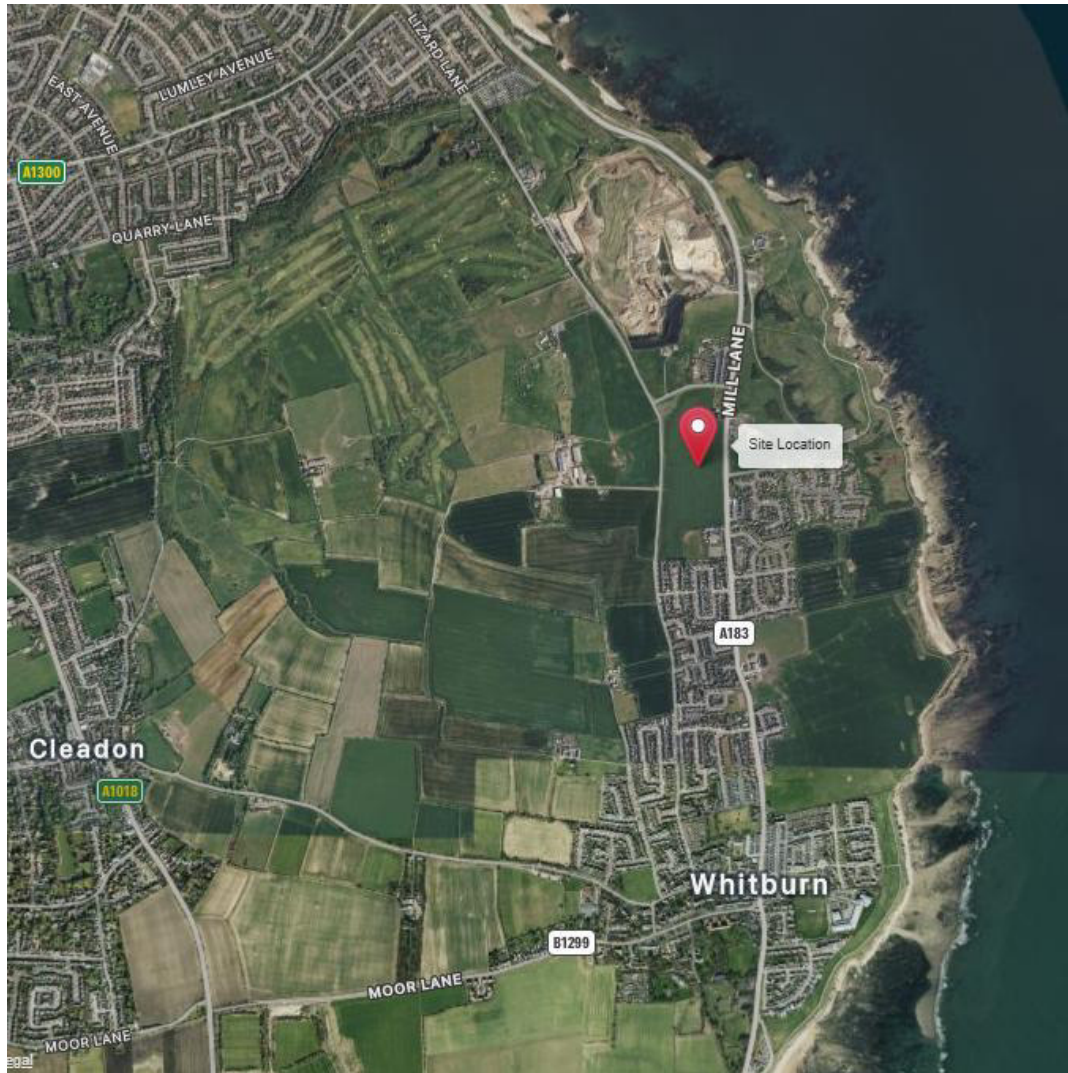


Figure 2.1 – Site location Plan.

The topographical survey indicates that site levels peak at the north western boundary at 42.53m AOD and fall towards a low spot adjacent to the eastern boundary at 29.39m AOD. Refer to Appendix A.

In June 2025, a Geo-Environmental Assessment was undertaken by Intelligent Ground Solutions, report reference: 25/4660.A.1. The report “recorded a limited thickness of Made Ground, which is in turn underlain by Glaciofluvial Deposits in the east and Devensian Till in the west with bedrock of the Roker Formation. Groundwater was not encountered

during the intrusive works or the monitoring visits undertaken in the installed standpipes.” Also, “two of the three soakaway infiltration tests failed”.

2.1 Development Proposals

The proposed scheme is a residential development comprising of 205 properties with associated garages, gardens and parking. Vehicular access to the development will be via a new junction to the A183. Refer to Appendix B.

2.2 Existing Watercourses

The Environment Agency’s Statutory Main River Map shows that the nearest main river is the River Don c.4.7km away to the southwest. The nearest watercourse is an unnamed ditch c.1.9km away to the south located off a residential estate in South Bents. There are no nearby watercourses within the vicinity of the site as shown within figure 2.2.

The nearest body of water is the North Sea, c.550m away to the east.

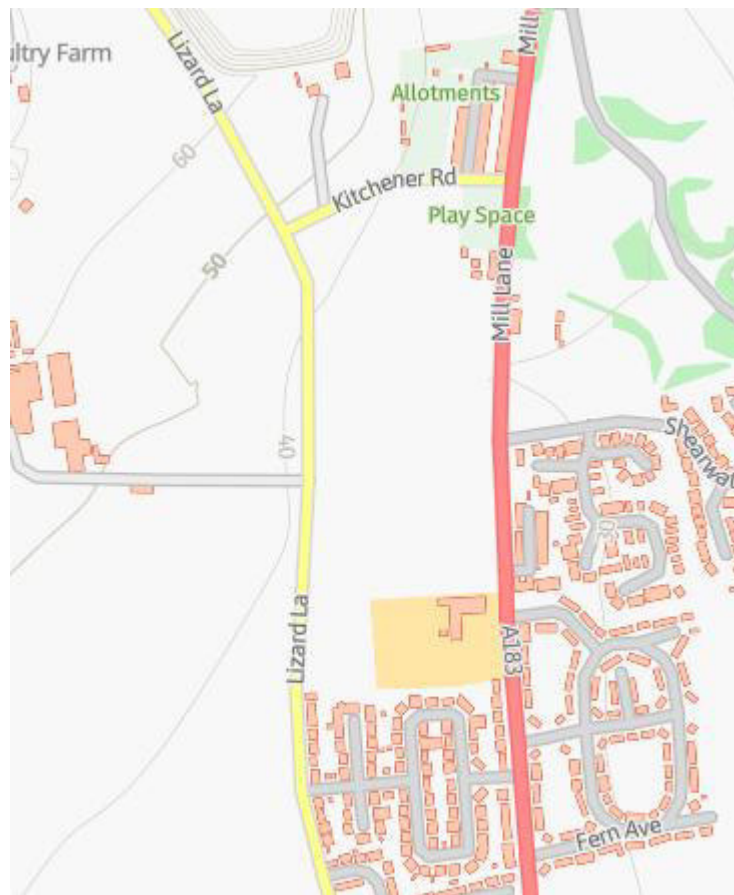


Figure 2.2 – Environment Agency’s Statutory Main River Map.

2.3 Existing Sewers

Existing sewer records were obtained from Northumbrian Water Ltd (NWL) and show there are no existing sewers within the site boundary. The nearest surface and foul water sewers

are located within White Rocks Grove c.100m to the east of the site. The nearest combined sewer is located within the A183. Refer to Appendix C.

3. Potential Sources of Flooding and Proposed Mitigation

As required by the National Planning Policy Framework (NPPF) and Technical Guidance to the NPPF, each potential source of flooding needs to be considered; rivers and sea, land, groundwater, sewers and artificial sources (such as reservoirs and canals). Consideration also needs to be given to the flood risk vulnerability classification for this type of development.

3.1.1 Flood Risk from Rivers and Seas

Environment Agency flood maps have been acquired to assist with this assessment. The flood maps indicate that the development boundary is located entirely within an area classified as a **Flood Zone 1**. Land located within a flood zone 1 is defined as having less than a 1 in 1,000 annual probability of river flooding (low risk). Environment Agency maps also confirm that the site does not lie within an area served by their flood warning scheme. Refer to the extract below which identifies the Flood Zones within and in proximity to the development site. The site is not considered to be at risk of flooding from rivers or sea. Refer to figure 3.1 below.

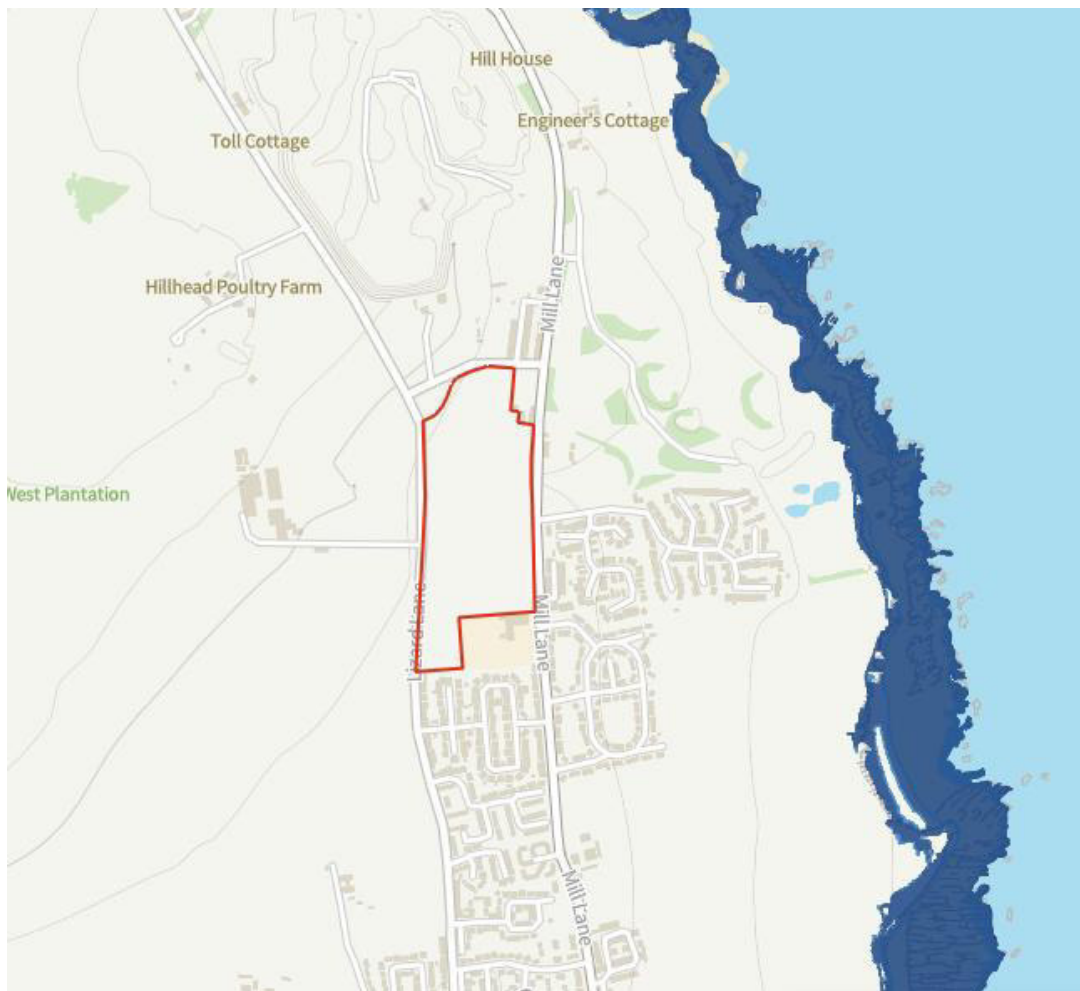


Figure 3.1 – Flood zone map.

3.2 Flood Risk Vulnerability Classification

Annex 3 of the National Planning Policy Framework (2024) states the following with respect to flood risk vulnerability classification.

3.2.1 More vulnerable

- Hospitals.
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- **Buildings used for dwelling houses**, student halls of residence, drinking establishments, nightclubs and hotels.
- Non-residential uses for health services, nurseries and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan

Table 3 of the Technical Guidance to the National Planning Policy Framework states the following with respect to appropriate land uses:

Table 3: flood risk vulnerability and flood zone 'compaibility'

Flood Risk Vulnerability Classification (See Table 2)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	x	Exception Test required	✓
Zone 3b functional floodplain	Exception Test required	✓	x	x	x

Key: ✓ Development is appropriate.
x Development should not be permitted.

An exception test will not be required in this instance as development is located outside of a flood zone 2 or flood zone 3. **The development is considered appropriate in land classified as a flood zone 1.**

3.3 Surface Water Flood Risk

The Environment Agency **'high and medium risk'** flood maps indicate an area of surface water flooding located at the low point of the site, adjacent to the eastern boundary. The **'low risk'** flood map indicates surface water flooding entering the site at the southwestern boundary from Lizard Lane and flows off site in an easterly direction to Marsden Primary School. The flooding at the school enters the site at the southern boundary, flows north to the low point where it amasses, and then flows east off site in line with existing topography. Additionally, two small isolated areas at the site midpoint and at the western boundary are identified on the **'low risk'** map. It should be noted that **'low risk'** flood maps represent a 1 in 1,000-year (0.1 – 1% annual probability) likelihood risk of flooding.

The proposed development is to maintain and not obstruct the existing surface water flood route so it can return to its predevelopment condition once off site. Proposed site levels will allow the flood flow route to be diverted upon entering the site via highways, shared drives and plot rear gardens to the SuDS detention basin. As the surface water flood levels rise, the ponding within the basin will spill over the eastern boundary to return to its original flow route path.

Proposed plot finished floor level's will be raised by minimum 300mm above the level at which flooding spills off site over the eastern boundary and plots will be raised above the proposed level of the flood route diversion. Therefore, the surface water flood risk to plots will be alleviated and can be considered **low**. The installation of a positive surface water drainage system will reduce or eliminate occurrences of standing water.



Figure 3.2 – Extent of 1 in 30 year (>3.3% annual probability) surface water flooding (High Risk)

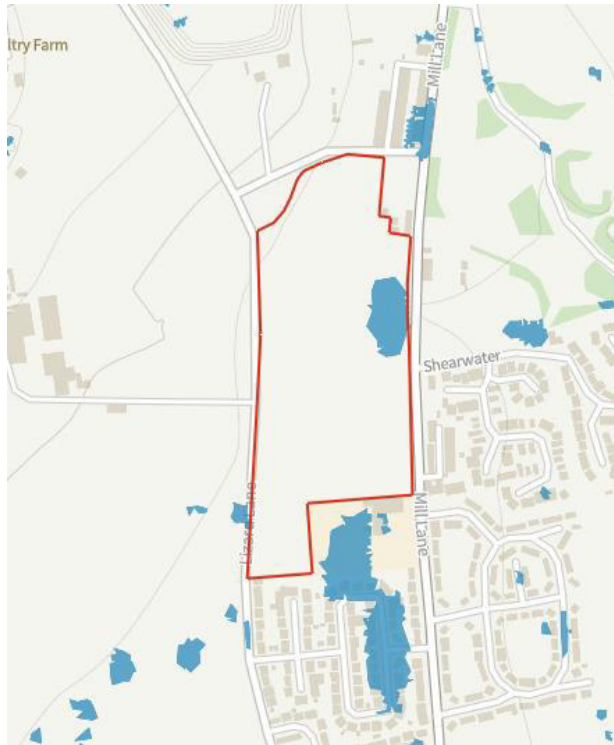


Figure 3.3 – Extent of 1 in 100 year (1% - 3.3% annual probability) surface water flooding (Medium Risk)



Figure 3.4 – Extent of 1 in 1,000 year (0.1% - 1% annual probability) surface water flooding (Low Risk)

3.4 Ground Water Flood Risk

Flooding due to ground water occurs when the levels of water below the ground rise and emanate above finished ground level. This occurs more frequently when the site is underlain by a permeable strata. The site is underlain by clays with impeded drainage characteristics and the Geo-Environmental Assessment did not encounter groundwater, therefore **the risk of ground water flooding is considered low.**

3.5 Reservoir Flood Risk

Artificial sources of flood risk such as man-made ponds or reservoirs can cause a potential risk of flooding. Environment Agency flood risk mapping shows there is **no risk from reservoir flooding to the site,** indicated in figure 3.5 below.



Figure 3.5 – Reservoir flood risk map.

4. Surface Water Disposal

Part H of the Building Regulations 2010 provides a recommended hierarchy for surface water disposal:

1. By infiltration
2. To watercourse
3. To sewer

4.1 Infiltration

As noted earlier, the site is “underlain by Glaciofluvial Deposits in the east and Devensian Till” and “two of the three soakaway infiltration tests failed” therefore soakaway drainage is not considered appropriate.

4.2 Watercourse

The Environment Agency’s Statutory Main River Map shows that the nearest main river is the River Don c.4.7km away to the southwest. The nearest watercourse is an unnamed ditch c.1.9km away to the south located off a residential estate in South Bents.

Due to the watercourse being a great distance away and the need to cross third-party land, discharge to watercourse is not considered feasible.

4.3 Sewer

There are no existing sewers within the site boundary. The nearest surface sewer is located within White Rocks Grove c.100m to the east of the site, and the nearest combined sewer is located within the A183.

It is proposed to discharge the surface water drainage to an existing NWL surface water manhole 7304, located within White Rocks Gove and the proposed location of discharge is in line with the NWL Pre Planning Enquiry response. Refer to Appendix D.

4.4 Discharge Rate Proposals

In accordance with North East Lead Local Flood Authority policy, post-development surface water discharge should be restricted to either the equivalent Qbar greenfield peak rate or, to rates no more than the 1 in 1 and 1 in 100 year greenfield runoff rate, both calculated using the total site area excluding any significant areas of public open space. Greenfield runoff rates have been calculated in line with IH124 method for 1Ha using greenfield runoff estimation tool on HR Wallingford website <https://www.uksuds.com> and results are summarised in figure 4.1.

Greenfield runoff

Method

Method

IH124

IH124

SAAR (mm)

My value

620

mm

How should SPR be derived?

WRAP soil type

WRAP soil type

2

SPR

0.3

QBar (IH124) (l/s)

1.6

l/s

Figure 4.1 – Greenfield runoff rates.

The site area is 10.5Ha, this has been multiplied with QBar for 1Ha (1.6l/s) to generate a total site discharge rate of 17l/s and NWL have confirmed acceptance of the proposed rate. Refer to Appendix D.

4.5 SUDS Techniques

In line with National Planning Policy, SUDS techniques are to be utilised as part of the design of the surface water network. The applicable techniques and the benefits that they bring to the development are outlined below.

- Detention basin: One online detention basin will be installed for the residential development to contain flows up to and including the 100 year event with a 45% allowance for climate change and an additional 10% increase in impermeable areas due to urban creep. Detention basins are effective in peak flow reduction, water quality treatment in the settlement of solids and have good amenity and ecological potential. The detention basin has a water volume of 3,267m³ at the design maximum water depth of 1m.
- Flow control: A vortex flow control for each network will be utilised for the development catchment areas to restrict flows to predevelopment greenfield rates.
- Permeable paving is proposed to private driveways and shared private driveways. Permeable paving is effective in slowing run off rates and removal of pollutants. The permeable surfacing will be Type B (partial infiltration) to give surface water a opportunity to infiltrate but given the expected poor infiltration, a connector drain should be installed.

4.6 Water Quality Treatment

SuDS provided are used to mitigate against pollution from runoff of different land types within the development proposals. An assessment of the suitability of SuDS proposed has been undertaken utilising the Simple Index Approach published by CIRIA and HR Wallingford. The pollution hazard level varies between land types, figure 4.2 shows the proposed mitigation of detention basins and permeable paving has greater mitigation indices therefore providing adequate water treatment.

Pollution Hazard Indices				
Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roof	Very Low	0.2	0.2	0.05
Residential Parking	Low	0.5	0.4	0.4
Low Traffic Highways	Low	0.5	0.4	0.4
Mitigation Indices				
Detention Basins		0.5	0.5	0.6
Permeable Paving		0.7	0.6	0.7

Figure 4.2 – Pollution hazard matrix based on SIA.

4.7 Surface Water Flood Flow Path

With reference to section 3.3 and Figure 3.4, there is a low risk (1 in 1,000 year) overland surface water flood flow path which enters the site's southern boundary adjacent to Marsden Primary School and flows towards the existing low spot on the eastern boundary. Proposed levels have been designed to maintain this flood route and direct flow to the SuDS detention basin. The detention basin is designed to attenuate flow from on-site impermeable areas for all storm events up to the 100 year return period with allowance for climate change and has a top level of 31.400m AOD. The topographic survey shows the existing low point on the eastern boundary is 32.710m AOD at the southern end of the existing wall. In an extreme rainfall event (above the 100 year event), should flood water reach this level it would spill over the top of the eastern site boundary at 32.710m AOD on to the highway and continue to flow in an easterly direction, maintaining the current exceedance flow path. Proposed dwellings adjacent to the basin have a minimum floor level of 33.075m AOD to ensure they are not at risk of flooding from overland flows in an extreme rainfall event. Refer to Appendix E.

5. Foul Water

5.1 Pre Planning Enquiry

Northumbrian Water have provided a Pre Planning Enquiry response letter dated 28th May 2025 and valid for one year which states “the foul flows can discharge without restriction into the 300mm diameter combined sewer to the east of the site via manhole 6301.” Refer to Appendix D.

5.2 Proposed Foul Discharge

Peak foul flow has been estimated using the following formula from NWL’s Pre-Planning Enquiry Guidance Notes.

$$\text{Foul discharge (l/s)} = \text{No. of properties} \times 0.046$$

Based on 205 dwellings, peak foul flows are calculated to be **9.4l/s**.

5.3 Diversion of Existing Highway Drain

NWL have confirmed that their sewer modelling has identified the 300mm diameter combined sewer located in Shearwater is at potential risk of causing highway flooding during storm events if additional foul flows from the development are discharged to this sewer. This is limited the sewer run between manholes 6301 and 8302 (refer to Appendix C). It should be noted there are no recorded instances of flooding within this section of sewer.

Story Homes will undertake work to divert a section of highway surface water drainage serving the A183 Mill Lane so that surface water flows no longer discharge to the combined sewer. As there is no issue currently, this removal of highway drainage is to be provided to generate capacity in the combined sewer. By doing so, the proposed foul flows of 9.43l/s will be able discharge in to the combined sewer whilst also reducing the likelihood of sewer flooding during instances of heavy rainfall.

NWL sewer maps (Appendix C) show a highway drain (represented by a dashed green line) originating within the footpath on the west side of the A183, opposite the northern vehicular access to the garage. The highway drain runs north for 80m prior to turning east and discharging into the combined public sewer at manhole 6301.

It is proposed that the highway drain connection to the combined sewer at manhole 6301 will be removed and a new connection provided to the proposed 225mm diameter surface water outfall from the on-site detention basin to the surface water public sewer in White Rocks Grove at manhole 7304. Refer to the Engineering Appraisal drawings in Appendix E for details of the proposed diversion. NWL have confirmed that their network modelling shows that the additional surface water flows can be accommodated within the existing surface water network.

The catchment served by the extent of existing highway drainage network to be diverted has been calculated to be 3,100sqm (0.31Ha). Average rainfall intensity for 60-minute storms based on the latest Flood Estimation Handbook (FEH22) data are as per the table

below for a range of return periods. The Rational Method is an established method of calculating the peak flow generated by these return periods based on the drained catchment.

Rational Method formula $Q = 2.78CiA$,

Q = peak flow rate (l/s)

C = runoff coefficient (1.0 for impermeable surface)

I = rainfall intensity (mm/hr)

A = drained area (Ha)

Return Period	Average 60 min rainfall intensity (mm/hr)	Drained Area (Ha)	Peak Flow (l/s)
1	4.964	0.31	4.3
2	10.900	0.31	9.4
5	17.627	0.31	15.2
10	22.374	0.31	19.3
30	30.013	0.31	25.9
100	38.797	0.31	33.4

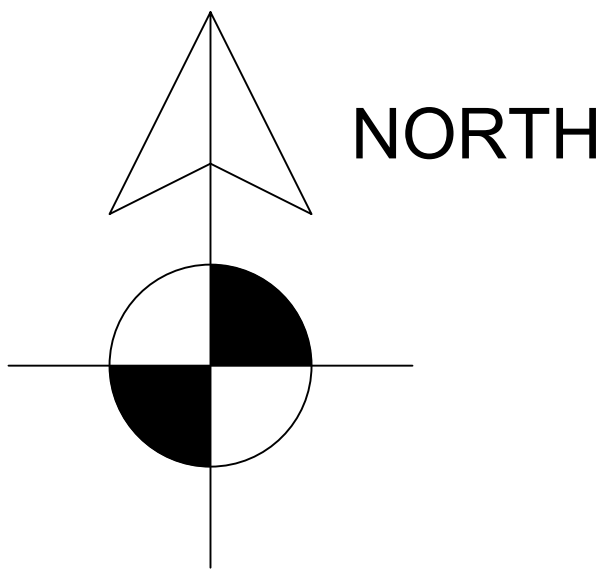
NWL have confirmed there are no recorded instances of sewer flooding in this area to date. Flooding of combined sewers is more likely to occur during heavy or prolonged rainfall. The table above shows that for all return periods equal to or greater than 2 years, the calculated peak flow from removing surface water from the combined sewer will be greater than the peak foul flows generated by the proposed development (9.4l/s).

6. References

The following reference documents have been used in the preparation of this report.

- National Planning Policy Framework (2024).
- Technical Guidance to the National Planning Policy Framework.
- Environment Agency online flood maps.
- Building Regulations Document H (2010).
- The SuDS Manual CIRIA C753.
- Non-statutory technical standards for sustainable drainage – LASOO.
- North-East Lead Local Flood Authorities Sustainable Drainage Local Standards

Appendix A – Topographical Survey



Legend			
Topographical Line Features			
Building Line	Edge of Grass	Road Sign	
Building Open Sided	Edge of Stone	Retaining Wall	
Bottom of Bank	Edge of Tackle	Street Furniture	
Cliff Face	Footpath	Sign Post	
Drainage Channel	Hedge (centre & width)	Top of Bank	
Concrete	Kerb Channel	Track	
Concrete Edge	Kerb Top	Utility Box	
Creeper	Level Change	Vegetation Edge	
Change of Surface	Overground Pipe	Wall	
Drain Leaking	Ramp Edge	Water Line	
Ditch Base	Road Channel		
Drain Top			
Edge of Block Pavement			
Fence			
Edge of Steel			
Fence Types		Utility Features	
Barbed Wire	Cable TV	Combined Sewer	
Chain Link	Electric	Foul Sewer	
Close Board	Gas	GPR Detection	
Knee Rail	Open Board	Post/Hut	
Open Board	Palisade	Post/Wire	
Palisade	Railing	Wire Mesh	
Railing	Unspecified		
Symbols			
Electricity Pylon		Telephone Mast	
Shrub/Bush		Tree	

Abbreviations			
BL Building Line	FP Fence Post	RDL Ridge Level	EOT End of trace
BM Benchmark	GP Gas Post	RS Road Sign	EOR End of route
BO Bulb	GV Gas Valve	RS Road Sign	EUD Empty utility duct
CTV Cable TV	GU Gully	SS Stop Cook	UTS Unable to locate
DO Door	IC Inspection Cover	SP Sign Post	UTL Unable to Lift
DP Down Pipe	L Invert Level	SV Stop Valve	UTT Unable to trace
EAV Eave Level	LC Lamp Column	TS Top of Fence Level	
EP Electricity Pylon	LEP Lamp/Electric Pole	TH Threshold Level	
ES Earth Road	LFP Lamp Post	TL Top of Rail Level	
EPY Electricity Pylon	MA Manhole	WL Water Level	
FI Fire Hydrant	OH Overhead	WM Water Meter	
FL Floor Level	PO Post	VP Vent Pipe	

Station Coordinates			
Name	Easting	Northing	Height
S1	440557.016	563362.221	32.623
S2	440616.241	563651.261	34.543
S3	440479.577	563072.343	38.637



DRAWING REVISION RECORD			
No.	Description	Date	By

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Grid Reference System & Orientation
Survey coordinates are oriented to Ordnance Survey National Grid (OSGB36) Plane Grid System, using OSTN15 transformation, established by GNSS observations tied to Ordnance Survey OSNET at station ST, via VRG corrections service.
The remainder of the survey is at a scale factor of 1.0 plane grid, so co-ordinates shown are not true OS coordinates, which have a scale factor applied.

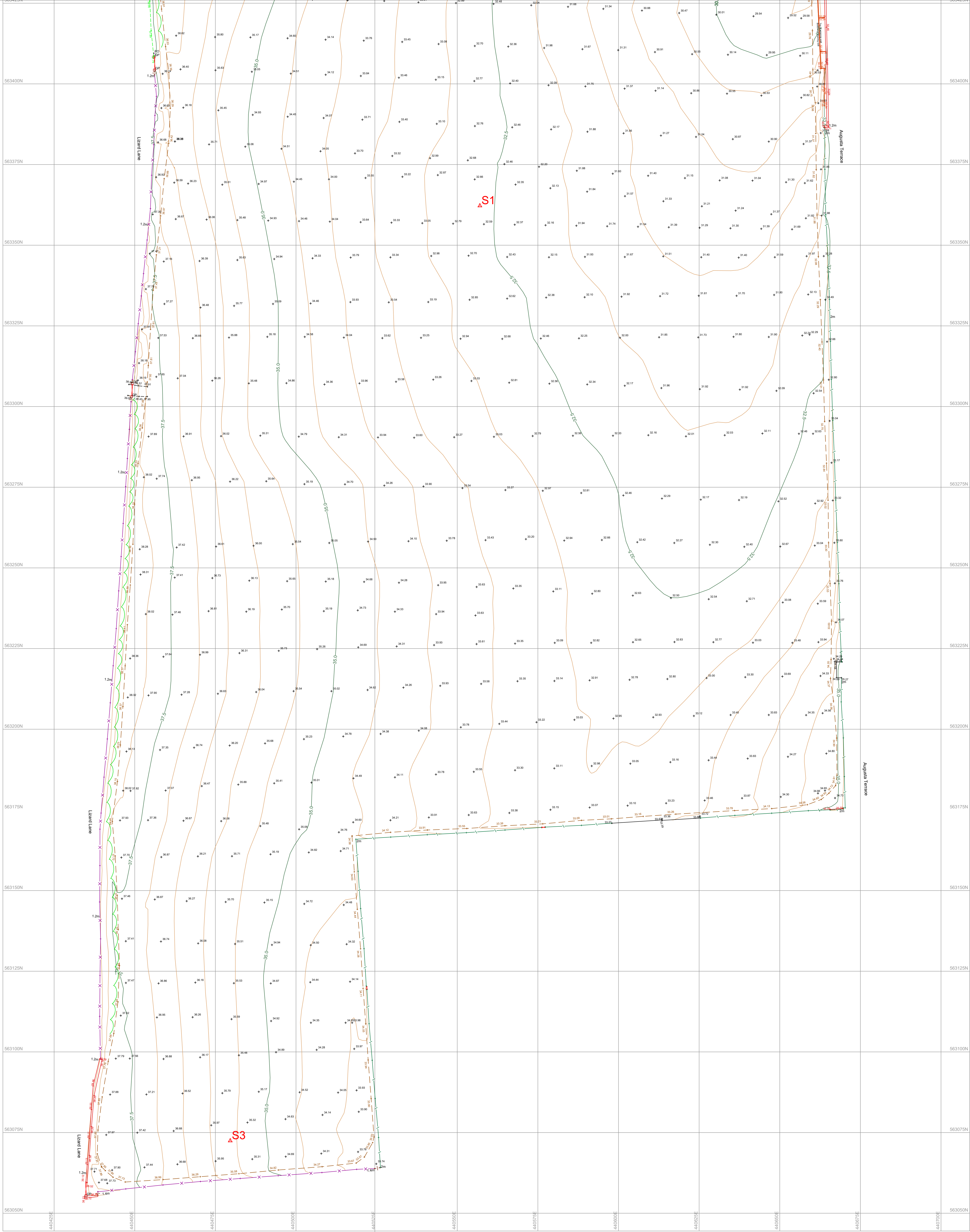
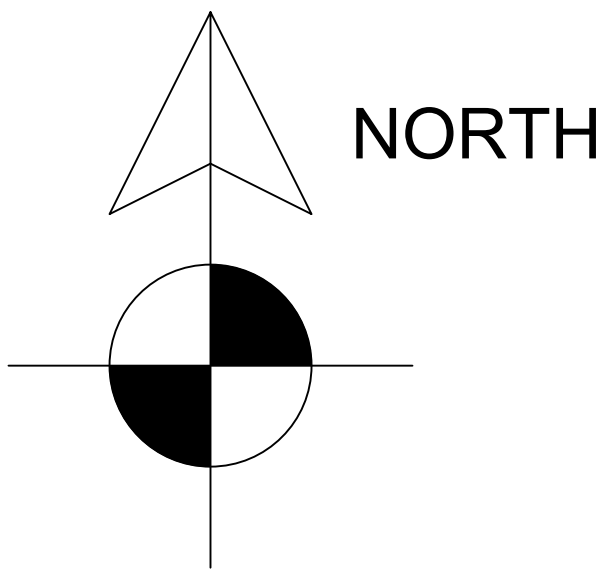
Height Datum
Elevations are to Ordnance Datum Newlyn (ODN) using OSGM15 geoid model via OSNET.
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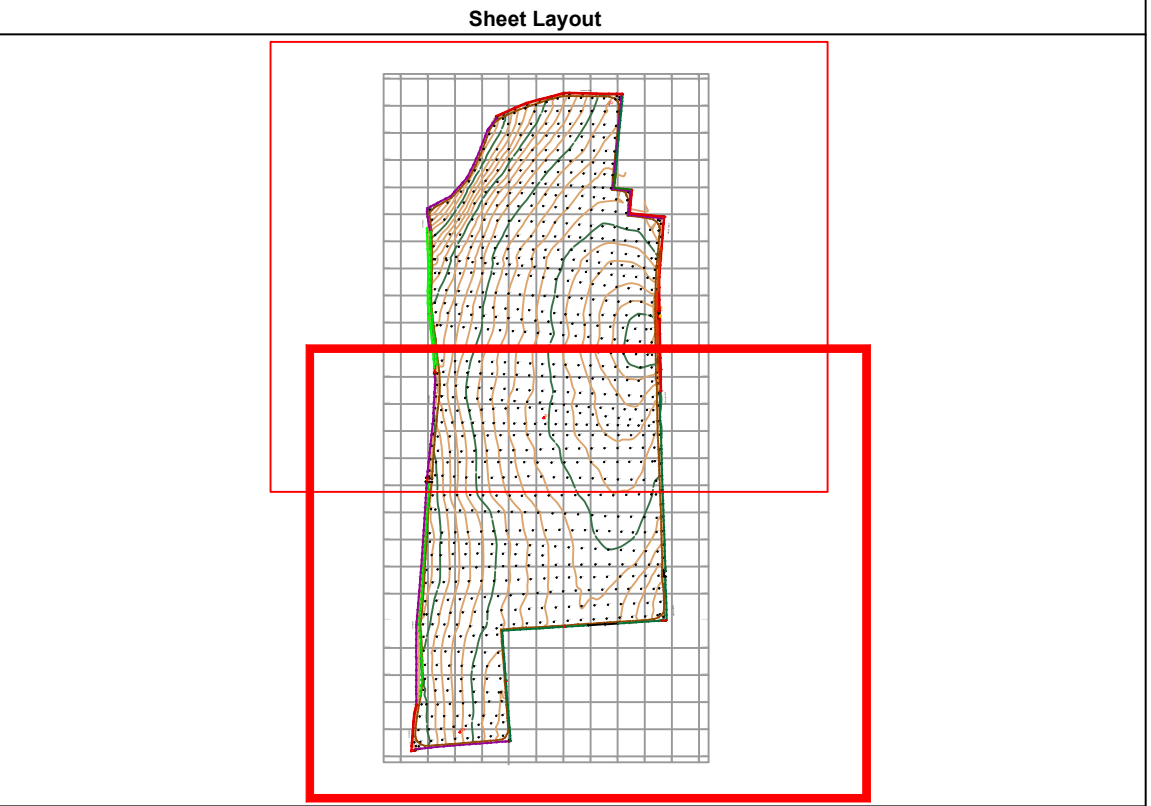
T: 01429 225 712 W: www.gridmarksurvey.com

Client	Story Homes				
Site	Lizard Lane, Whitburn				
Drawing Title	Topographical Survey				
Surveyed By	CB JW	Drawn By	JW	QA By	CM
Scale	1:500 @ A0	Date	22 Nov 2024		
Drawing No.	1941-1	Rev No.	A	Sheet No.	1 OF 2



Legend			
Topographical Line Features			
Building Line	Edge of Tarmac	Road Sign	
Building Open Sided	Edge of Grass	Retaining Wall	
Bottom of Bank	Edge of Stone	Street Furniture	
Cliff Face	Edge of Tackle	Sign Post	
Drainage Channel	Footpath	Top of Bank	
Concrete	Hedge Centre & width	Utility Box	
Concrete Edge	Kerb Channel	Verge	
Croppy	Kerb Top	Vegetation Edge	
Change of Surface	Level Edge	Wall	
Ditch Levee Right	Overground Pipe	Water Line	
Ditch Base	Ramp Edge		
Ditch Top	Road Channel		
Edge of Block Pav			
Edge of Steel			
Fence Types		Symbols	
Barbed Wire	Cable TV	Electricity Pylon	
Chain Link	Combined Sewer	Telephone Mast	
Chain Board	Electric	Shrub/Bush	
Know Rail	Foul Sewer	Tree	
Open Board	Gas		
Palisade	GPR Detection		
Post/Hill	Telephone		
Post/Wire	Storm Sewer		
Rating	Unknown		
Wire Mesh	Unknown Utility		
Unspecified	Valve		
Abbreviations			
BL Building Line	FP Fence Post	RDL Ridge Level	EOT End of trace
BM Benchmark	GP Gate Post	RSL Reading Eye	ESR End of service
BO Bulb	GV Gas Valve	RS Road Sign	EUD Empty utility duct
CTV Cable TV	GU Gully	SS Stop Cook	UTS Unable to locate
DO Door	IC Inspection Cover	SP Sign Post	UTL Unable to Lift
DP Down Pipe	L Invert Level	SV Stop Valve	UTT Unable to trace
ELV Elev Level	LC Lamp Column	TS Top of Fence Level	
EP Earth Rod	LEP Lamp/Electric Pole	TH Threshold Level	
EPY Electricity Pylon	L.P. Lamp Post	TL Top of Rail Level	
FI Fire Hydrant	OH Overhead	WM Waste Water	
FL Floor Level	PO Post	VP Vent Pipe	

Station Coordinates			
STATION CO-ORDINATES			
Name	Easting	Northing	Height
S1	440557.016	563362.221	32.623
S2	440616.241	563551.261	34.543
S3	440475.577	563072.343	35.657



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Survey Information

Grid Reference System & Orientation
Survey co-ordinates are oriented to Ordnance Survey National Grid (OSGB36) Plane Grid System, using OSTN15 transformation, established by GNSS observations tied to Ordnance Survey OSNET at station ST, via VRG corrections service.
The remainder of the survey is at a scale factor of 1.0 plane grid, so co-ordinates shown are not true OS co-ordinates, which have a scale factor applied.

Height Datum
Elevations are to Ordnance Datum Newlyn (ODN) using OSGM15 geoid model via OSNET.
Survey stations are established for mapping purposes only, and not to be used for construction without notice and written approval from Gridmark Survey Limited.



Gridmark Survey Ltd, Castle Eden Studios, Stockton Road,
Castle Eden, Co. Durham, TS27 4SD

T: 01429 225 712 W: www.gridmarksurvey.com

Client Story Homes

Site Lizard Lane, Whitburn

Drawing Title Topographical Survey

Surveyed By	CB JW	Drawn By	JW	QA By	CM
Scale	1:500 @ A0	Date	22 Nov 2024		
Drawing No.	1941-1	Rev No.	A	Sheet No.	2 OF 2

Appendix B – Architectural Layout



Site Boundaries:
Site Planning Boundary

- Affordable Units:
- Denotes Rented Social Landlord (RSL) Unit (41 No.)
 - Denotes Discount Market Value (DMV) Unit (21 No.)
 - Denotes First Homes (FH) Unit (20 No.)

Visitor Parking:
VP Denotes VP Bay (74 No.)

- Bedrooms:
- Denotes 1-Bedroom Unit
 - Denotes 2-Bedroom Unit
 - Denotes 3-Bedroom Unit
 - Denotes 4-Bedroom Unit
 - Denotes 5-Bedroom Unit

- Other information:
- Denotes Existing Tree Groups
 - Denotes SuDs Feature



DEVELOPMENT
MILL LANE, WHITBURN

DRAWING
PROPOSED SITE PLAN

DRAWN BY	DR	DATE	28.05.2026
CHECKED BY	-	SCALE	1:1000 @A1
DWG PACK	PLN	DRAWING NUMBER	MLLN.PLN.02
Revisions	Notes	Date	
P1	Initial issue for Planning Submission	07.10.2025	
P2	Site Entrance updated. Planning comments incorporated. Affordable Features updated (Skidway, Cycle sheds and additional Patio added. Accommodation Schedule Updated	08.06.2026	

© **Story Homes North East**
Riverview Business Centre, Ametyst Road, Newcastle
Business Park, Newcastle Upon Tyne, NE4 7YL
Tel 0191 226 7260

HOUSETYPE SCHEDULE OF ACCOMMODATION

SITE NAME									
MILL LANE, WHITBURN									
REV. REF.									P3
MILL SCH.01									
REF.	HOUSETYPE	COMPLIANCE	CONFIG.	PARKING	SQ. FT.	RSL NO.	FH NO.	DMV NO.	TOT. SQ. FT.
1 BEDROOM RANGE									
BID	Beilford	M4(2) - GF ONLY	1 Bed Apartment	Front Parking	624	8			4992
2 BEDROOM RANGE									
BFD	Bransford	M4(2)	2 Bed Semi/Terraced	Front Parking	759	14	3		12903
NFD	Newford	M4(3)	2 Bed Semi/Bungalow	Front Parking	777	10			7770
BOW	Bowditch	M4(2)	2 Bed Semi	Front Parking	759	10	2		2277
3 BEDROOM RANGE									
FFD	Fulford	M4(2)	3 Bed Semi/Terraced	Front Parking	906	12	15	2	26804
HAI	Hullin	M4(2)	3 Bed Semi/Terraced	Front Parking	995		3	8	8955
ASD	Ashford	M4(2)	3 Bed Detached	Integ Single Garage	1060			13	11760
MYD	Mayford	M4(2)	3 Bed Semi	Front Parking	1079			14	15106
4 BEDROOM RANGE									
SKD	Skiddaw	M4(2)	4 Bed Semi/Terraced	Front Parking	1359	2		4	5436
RFD	Rushford	M4(2)	4 Bed Semi	Front Parking	1409			14	19726
CFD	Clifford	M4(2)	4 Bed Detached	Integ Single Garage	1360			17	23120
WFD	Westford	M4(2)	4 Bed Detached	Detached Single Garage	1435			8	11480
LFD	Linford	M4(2)	4 Bed Detached	Integ Single Garage	1536			20	30720
HFD	Hartford	M4(2)	4 Bed Detached	Integ Single Garage	1622			20	32440
5 BEDROOM RANGE									
CND	Cranford	M4(2)	5 Bed Detached	Integ Large Garage	1961			17	33337
TOTAL AFFORDABLE AND OPEN MARKET UNITS					46	20	16	123	24896
TOTAL UNITS AND SQ. FT.								205	24896

Appendix C – NWL Sewer Maps



Waste Water -	NWL Responsibility					Water Network -			Network Types			AB Asbestos	
	Combined		Private/Non NWL	Combined			Distribution			Treated		Abandoned	
	Foul		Foul		Combined		Treated			Raw		Out of Comm	
	Surface		Surface		Foul		Raw			Fire		Proposed	
	Treated Eff		Treated Eff		Surface		Supply			Private			
	Untreated Eff		Trade Eff										
	Overflow		Watercourse										

User : BOWMS

Date : 08/05/2025 09:54:22

Map Sheet : NZ4063SE

Title :

Centre Point : 440649,563343

Paper / Scale : A0@1:1250



The material contained on this plot has been reproduced from an Ordnance Survey map with permission of the controller of H.M.S.O. Crown Copyright Reserved. Licence No.AC0000851702. The information shown on this plan should be regarded as approximate and is intended for guidance only. No Liability of any kind whatsoever is accepted by Northumbrian Water, it's servants or agents for any omission. The actual position of any water mains or sewers shown on the plan must be established by taking trial holes in all cases. In the case of water mains Northumbrian Water must be given two working days notice of their intention to excavate trial holes. With effect from 1 October 2011, private lateral drains and sewers automatically transferred to Northumbrian Water under a scheme made by the Secretary of State pursuant to section 105A Water Industry Act 1991. These former private drains and sewers together with existing private connections may not be shown but their presence should be anticipated. WARNING...Where indicated on the plan there could be abandoned asbestos cement materials or shards of pipe. If excavating in the vicinity of these abandoned asbestos cement materials, the appropriate Health & Safety precautions should be taken. Northumbrian Water accepts no liability in respect of claims, costs, losses or other liabilities which arise as the result of the presence of the pipes or any failure to take adequate precautions. Emergency Telephone Number: 0345 717 1100

10 m

Appendix D – NWL Pre Planning Enquiry Responses

Direct Line: 07596315994
Email: developmentenquiries@nwl.co.uk
Our Ref: 337283

Wednesday, 28 May 2025

Coast Consulting Engineers
7 Silverton Court
Cramlington
NE23 7RY

Dear Paul,

Re: Pre-Planning Enquiry – East of Lizard Lane

Further to the Point of Connection Application for the above site, received May 7th 2025, we are now able to provide the following response.

We have based our response on the information in your application and accompanying correspondence. Therefore, should any of the information now be different, then you must ensure that you inform us of any changes as further Network Modelling may be required and our response may also change, leading to this response being invalid.

Northumbrian Water assesses the impact of the proposed development on our assets and assesses the capacity within our networks to accommodate and treat the anticipated flows arising from the development. We do not therefore offer comment on aspects of planning applications that are outside of our area of control.

Enclosed in this response is a scaled plan showing the **approximate** position of the water and sewerage networks within the vicinity of this site.

We have changed the way contractors and developers can access our assets.

Historically only our own staff and framework contractors could access our sewerage network. As of 1st January 2018, we are allowing third party contractors to access our sewer network on a site by site basis, subject to certain conditions.

Further information (including how to apply) is available from our web site - <https://www.nwl.co.uk/services/developers/developer-sewerage-services/>

Also enclosed is our extract showing locations within the approximate vicinity of this site that have, from our records, experienced flooding. This has been provided to demonstrate the known flood risks within the vicinity which have been considered as part of our assessment on this enquiry.

We have also carried out a review of your application and can confirm the following:

Sewerage and Sewage Treatment

Northumbrian Water would ask that you please separate the foul and surface water flows in accordance with Part H of the Building Regulations prior to the final connection to the public sewer.

All new connections to the public sewerage system must first be approved through the Section 106 of the Water Industry Act 1991 process prior to construction.

Should you decide to proceed with this development, a fully completed Sewer Connection application form will be required. These are available to download from the following link:

<https://www.nwl.co.uk/services/developers/developer-sewerage-services/new-sewer-connections-s106/>

- Foul Water Discharge

The foul flows can discharge without restriction into the **300mm** diameter **combined** public sewer to the east of the site via manhole **6301**.

- Surface Water Discharge

No surface water flow from the proposed development will be allowed to connect into the existing public sewerage system unless it is proven that the alternative options which are listed within Part H of the Building Regulations 2003 are not available:

Rainwater from a system provided pursuant to sub-paragraphs (1) or (2) shall discharge to one of the following, listed in order of priority –

(a) an adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable,

(b) a watercourse; or, where that is not reasonably practicable,

(c) a sewer.

If the more sustainable options prove to be unfeasible, a restricted surface water flow of **17 l/sec** would be permitted to discharge into the **225mm** diameter **surface water** public sewer to the east of the site within White Rocks via manhole **7304**. Any excess in flows must be attenuated on site.

- For Information

The Lead Local Flood Authority may require surface water flows to discharge at a different rate to that which has been agreed by Northumbrian Water. As the statutory consultee on flood risk and drainage matters, they have the authority to do so therefore, we suggest that you contact them to discuss this in further detail.

Written approval for all individual connections (direct or indirect) to the public sewerage system should be obtained through the Section 106 process, following completion of the detailed drainage design and before the commencement of any drainage works on site.

- Storm Overflows

We have identified that there are **2** storm overflows downstream of your proposed development.

Attached is a copy of the Drainage and Waste Water Management Plan (DWMP) for the drainage area your proposed development sits within. This plan shows the location of the storm overflows within the catchment and their current investment status as part of our storm overflow discharge reduction plan.

If you require further information regarding any potential impact your proposed development may have on spill frequencies, please contact us to discuss how this could be provided.

- Sewage Treatment Capacity

The Sewage Treatment Works to which this development finally discharges to is **Hendon** and these works are able to accept the additional flows.

Please note that this response is valid for 1 year only and you should resubmit your proposals should this period lapse prior to your development beginning.

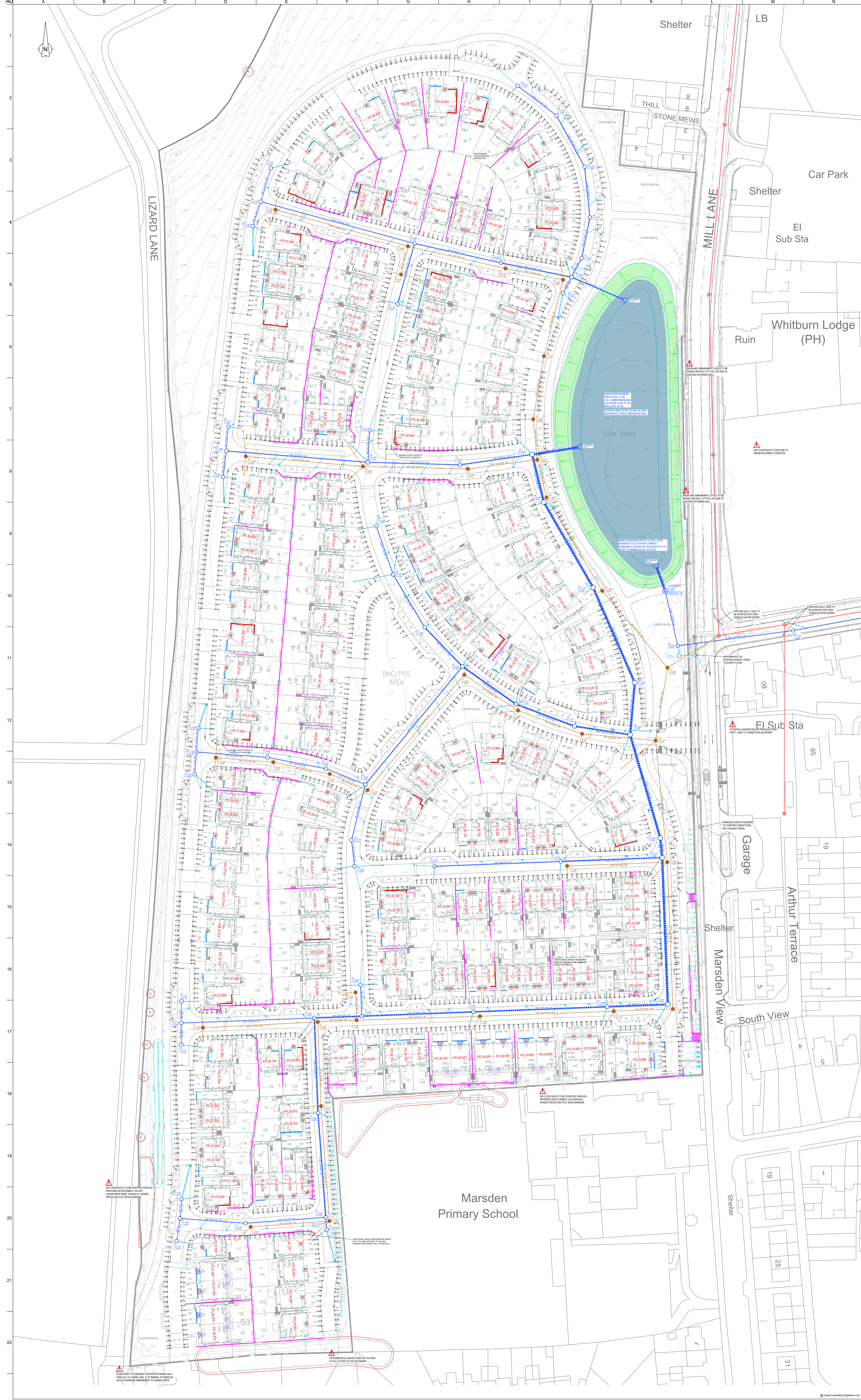
Should you require any further assistance or information, then please do not hesitate to contact me at developmentenquiries@nwl.co.uk or alternatively on 07596315994, please quote our reference number above in any future correspondence.

Yours sincerely,



Laura Roberts
Technical Support Advisor
Developer Services

Appendix E – Drainage Proposals



ADOPTABLE DRAINAGE KEY

- PROPOSED SURFACE WATER SEWER
- PROPOSED HIGHWAY GULLY
- PROPOSED FOUL SEWER
- EXISTING COMBINED SEWER
- EXISTING SURFACE WATER SEWER

EXTERNAL WORKS KEY

- PROPOSED EXTERNAL LEVEL
- PROPOSED BACK OF FOOTPATH LEVEL
- EXISTING LEVEL
- PROPOSED GRADIENT
- 1200mm X 1200mm PART M4(2) LEVEL ACCESS
- 1500mm X 1500mm PART M4(3) LEVEL ACCESS
- PROPOSED RETAINING WALL WITH RETAINED HEIGHT
- PROPOSED STEPS - 150mm RISE. MINIMUM 280mm GOING. WHERE 3 OR MORE RISERS. A SUITABLE GRIPPABLE HANDRAIL ON ONE SIDE OF THE FLIGHT BETWEEN 850mm AND 1000mm ABOVE THE FINISH LINE OF THE FLIGHT AND EXTENDING 300mm BEYOND THE TOP AND BOTTOM NOSINGS.
- EXPOSED BRICKWORK
- DRAINAGE CHANNEL WITH SUMPP/GULLY. FOR LIGHT VEHICLE

HIGHWAYS

- ALL EXCAVATIONS BELOW ADOPTED HIGHWAYS TO BE BACKFILLED WITH TYPE 1 AND COMPACTED IN LAYERS NOT EXCEEDING 150mm.
- HIGHWAY AUTHORITY TO BE CONTACTED AS SOON AS CONTRACTOR IS ON SITE TO ENABLE EARLY DISCUSSIONS WITH THE CLERK OF WORKS.
- MANHOLE INSPECTION CHAMBER COVERS IN TRAFFICKED AREAS TO BE LOADING TYPE D400 AND B125 IN NON-TRAFFICKED AREAS.
- ALL GULLIES TO BE TRAPPED AS SHOWN ON THE DETAILS DRAWINGS.

ADOPTED DRAINAGE

- POSITION AND LEVELS OF EXISTING MANHOLES AND SEWERS ARE TO BE CHECKED ON SITE AS SOON AS POSSIBLE AND PREFERABLY BEFORE SITE ACTIVITIES COMMENCE.
- THE SEWER CONNECTION IS TO BE CARRIED OUT BY AN NNL APPROVED CONTRACTOR.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAINAGE DETAILS DRAWINGS.
- FOR PROPOSED ADOPTED DRAINAGE PIPES WITH LESS THAN 900mm COVER IN AREAS NOT SUBJECT TO VEHICULAR LOADING AND LESS THAN 1200mm IN VEHICULAR LOADING AREAS TO BE CONCRETE PROTECTED.
- ADOPTED DRAINAGE IS TO COMPLY WITH 'DESIGN AND CONSTRUCTION GUIDANCE'.
- PIPE SURROUND TO BE GRANULAR TYPE 'S' UNLESS NOTED OTHERWISE.

PRIVATE DRAINAGE

- PRIVATE DRAINAGE IS TO COMPLY WITH ALL STATUTORY REQUIREMENTS AND ACCORD WITH BS EN 752 AND BUILDING REGULATIONS APPROVED DOCUMENT H.
- PIPE BEDDING SHOULD GRANULAR UNLESS NOTED OTHERWISE AND THE GRANULAR MATERIAL TO BE TO BS882 PTF 2 AND TO BUILDING REGULATIONS PART H.
- PIPE SIZES TO BE 100MM U.N.O.
- FOR DRAINAGE PIPES TO BE CAST IN CONCRETE TO HAVE ROCKER PIPES EITHER SIDE OF CONCRETE.

Rev	Date	Description	By	Chkd	Appd
P8	03.07.26	Amended to suit revised layout. Emergency access removed.	AT	P8	P8
P7	12.06.26	Amended to suit revised layout.	AT	AT	AT
P6	22.05.26	Roads 1 - 8 lowered	AT	AT	P8
P5	11.05.26	Highway drainage diversion added	P8	AT	P8
P4	04.12.25	Levels amended adjacent to plot 153. Drawing job life reviewed	AT	P8	P8
P3	14.11.25	Detached levels added. Highway and drainage levels amended to northern section of site	AT	P8	P8
P2	27.10.25	Amended to suit revised layout	AT	P8	P8
P1	11.09.25	Preliminary issue	AT	P8	P8

COAST
CONSULTING ENGINEERS

7 Shilton Court, Northumberland Business Park, NE23 7RY
0191 597 8775
Client:

STORY HOMES
NORTH EAST

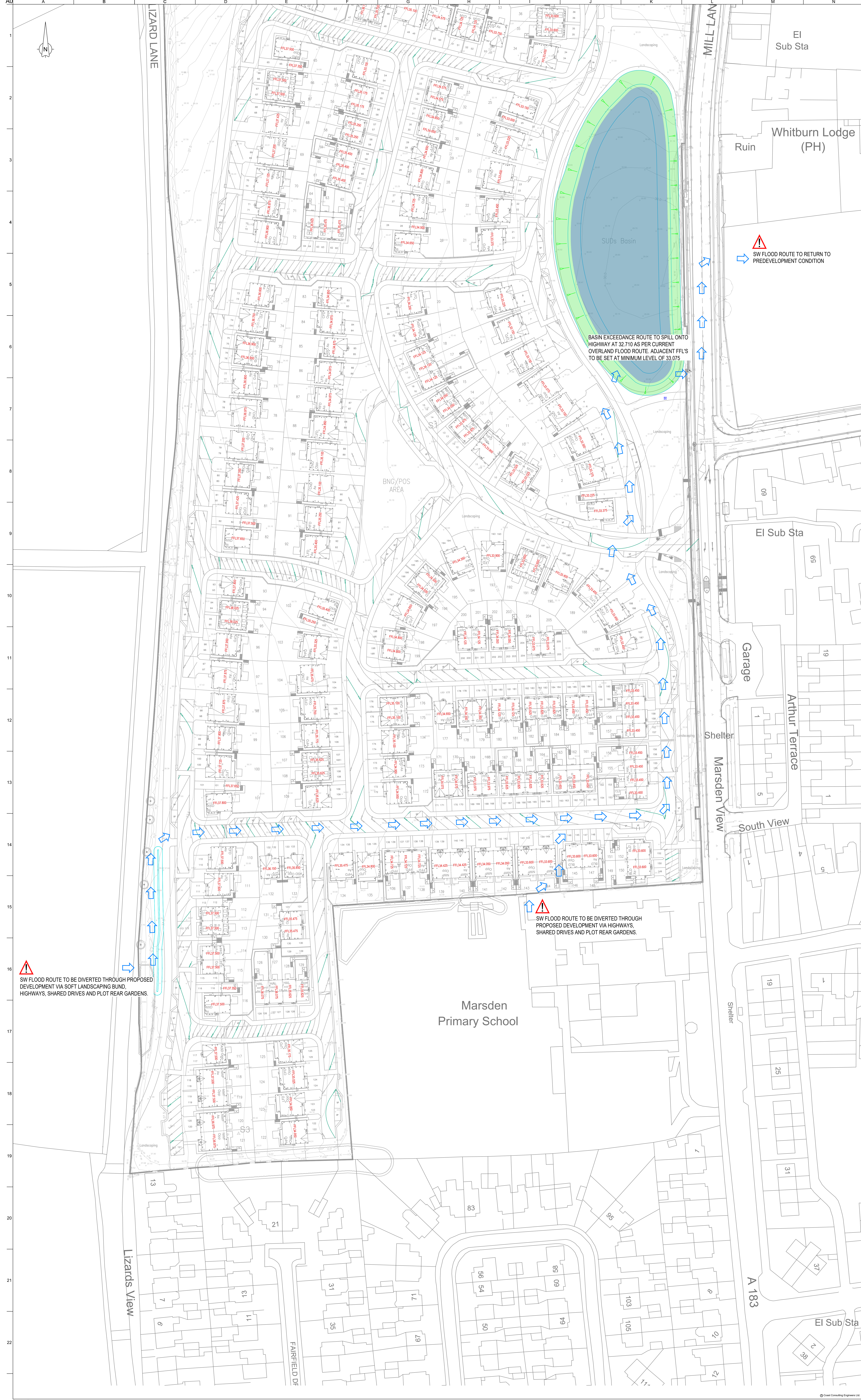
Job Title:
LAND OFF MILL LANE SOUTH SHIELDS

Drawing Title:
ENGINEERING APPRAISAL OVERVIEW SHEET 6 OF 6

Scale at A0:
1:500

Drawing Status:
PRELIMINARY

Job No: 25041	Drawing No: 206	Issue: P8
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KEY

SW FLOOD FLOW ROUTE

SW FLOOD ROUTE TO RETURN TO PREDEVELOPMENT CONDITION

SW FLOOD ROUTE TO BE DIVERTED THROUGH PROPOSED DEVELOPMENT VIA SOFT LANDSCAPING BUND, HIGHWAYS, SHARED DRIVES AND PLOT REAR GARDENS.

SW FLOOD ROUTE TO BE DIVERTED THROUGH PROPOSED DEVELOPMENT VIA HIGHWAYS, SHARED DRIVES AND PLOT REAR GARDENS.

BASIN EXCEEDANCE ROUTE TO SPILL ONTO HIGHWAY AT 32.710 AS PER CURRENT OVERLAND FLOOD ROUTE. ADJACENT FFL'S TO BE SET AT MINIMUM LEVEL OF 33.075

P6	03.07.26	Amended to suit revised layout. Emergency access removed.	AT	P6	P6
P5	12.06.26	Amended to suit revised layout.	AT	P6	P6
P4	04.12.25	Levels amended adjacent to plot 153. Drawing job title renamed	AT	P6	P6
P3	14.11.25	Amended to suit revised route of flood path showing off site	AT	P6	P6
P2	27.10.25	Amended to suit revised layout	AT	P6	P6
P1	11.09.25	Preliminary Issue	AT	P6	P6
Issue	Date	Description	By	Chkd	Appd



7 Silchester Court, Northumberland Business Park, NE23 7RY
0191 5877878
Client

STORY HOMES
NORTH EAST

Job Title
LAND OFF MILL LANE
SOUTH SHIELDS

Drawing Title
SURFACE WATER FLOOD ROUTE
DIVERSION

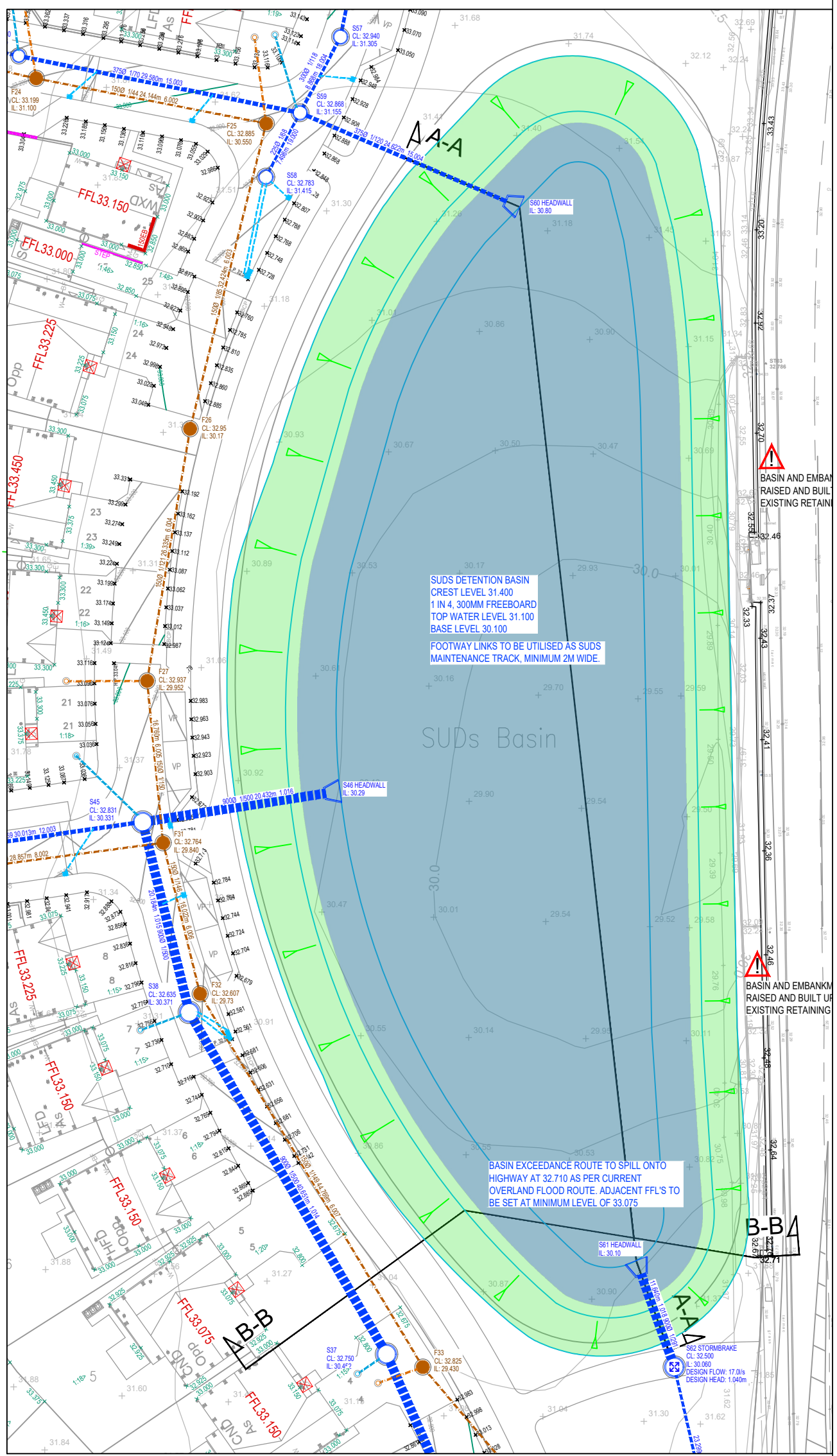
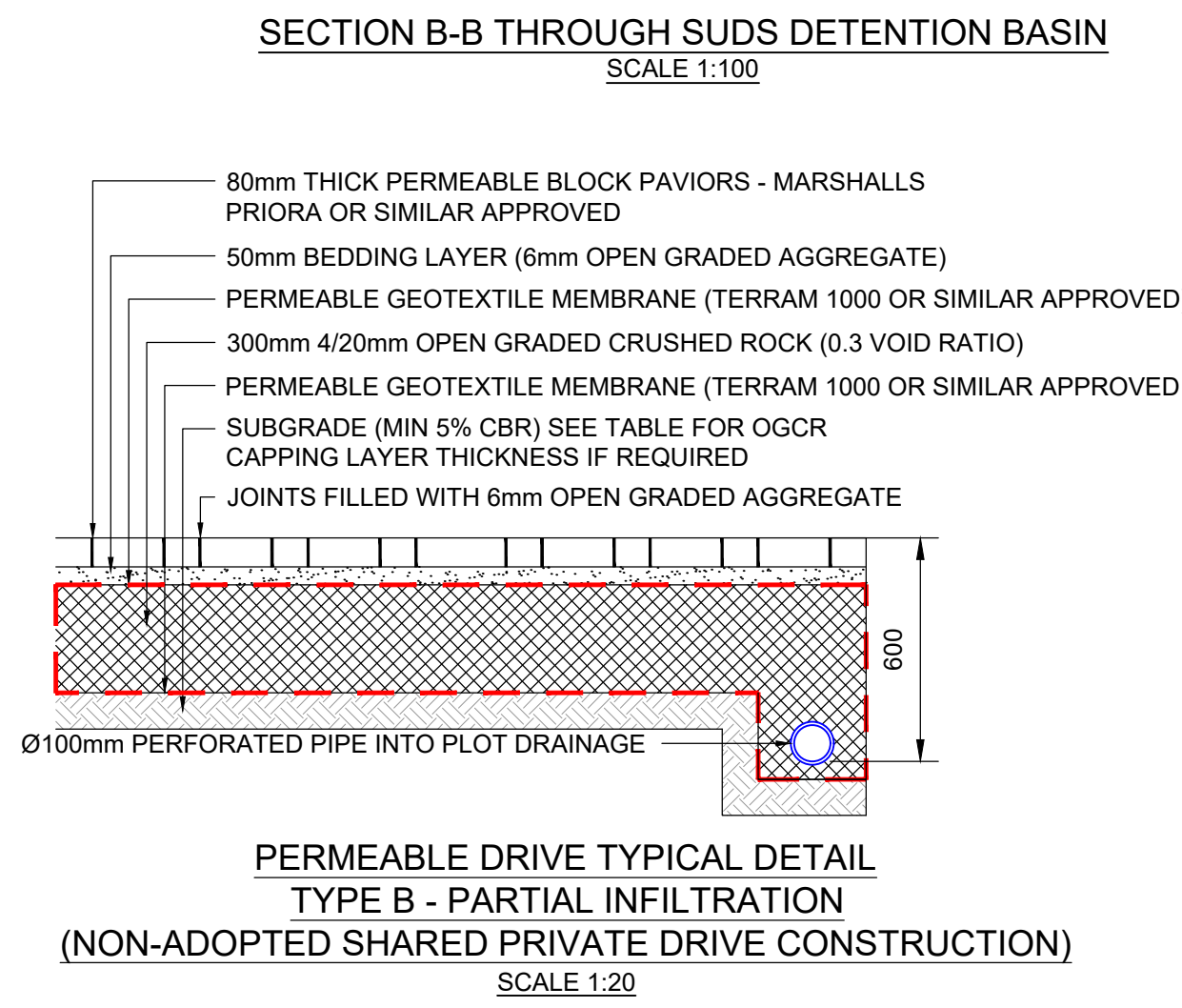
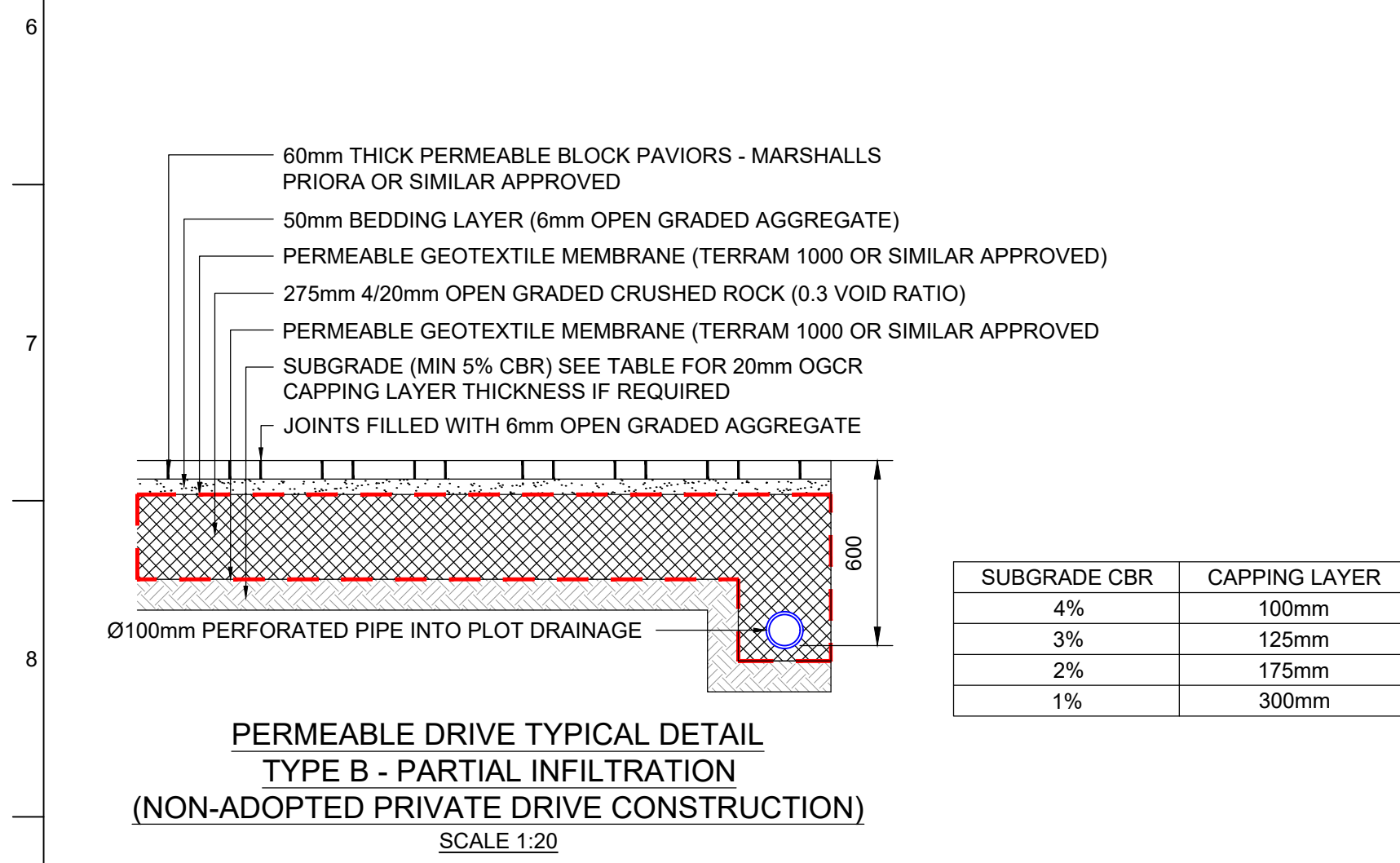
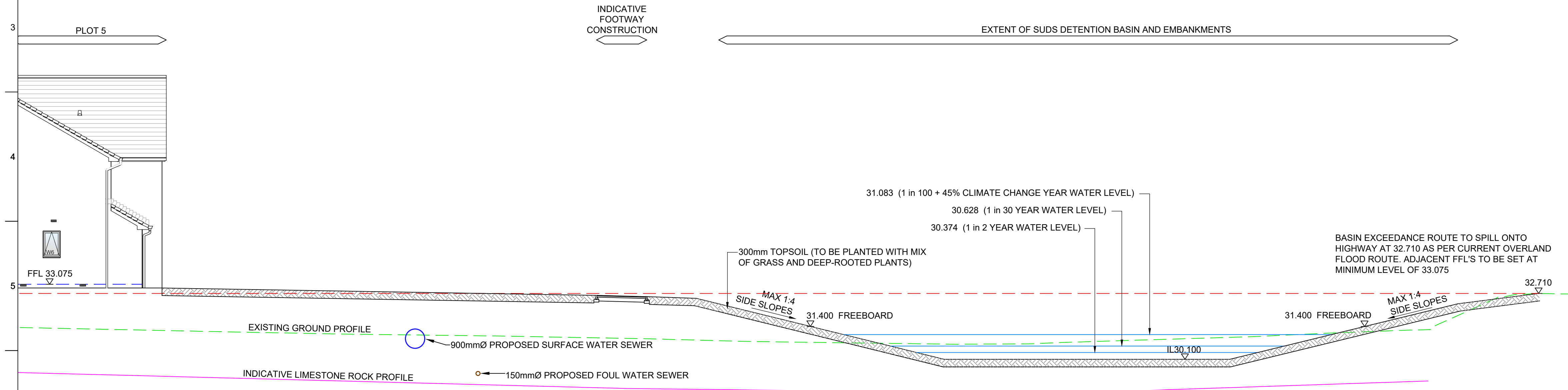
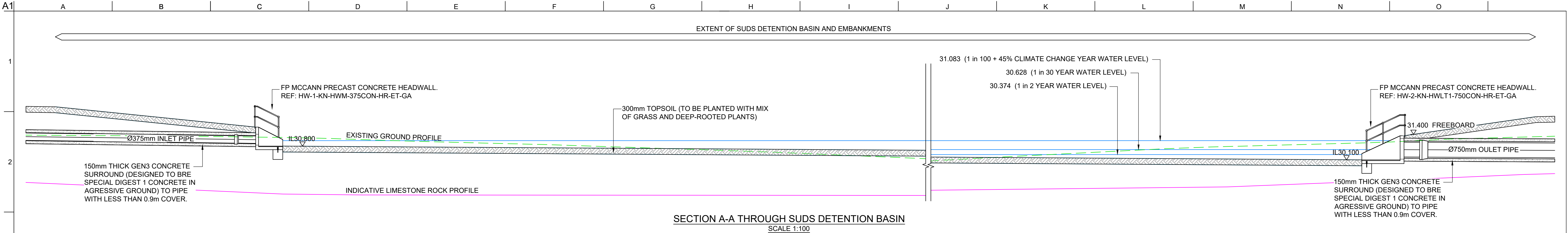
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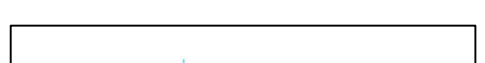
Drawing Status
PRELIMINARY

Job No
25041

Drawing No
207

Issue
P6



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						Scale at A1 AS SHOWN									
						Drawing Status PRELIMINARY									
Job No		25041		Drawing No		95		Issue P4							
P4		12.06.26	Amended to suit revised layout			AT	PB	PB							
P3		04.12.25	Drawing job title renamed			AT	PB	PB							
P2		19.11.25	Section amended to show plot 5			AT	PB	PB							
P1		14.11.25	Preliminary Issue			AT	PB	PB							
Issue		Date	Description			By	Chkd	Appd							

Appendix F – Surface Water Drainage Calculations

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S1	0.039	1350	Type C	37.723	36.298	1.275	440454.024	563107.336
S2	0.056	1350	Type C	37.553	36.128	1.275	440456.048	563124.521
S3	0.030	1350	Type C	37.627	35.955	1.447	440455.465	563116.636
S4	0.030	1350	Type C	36.302	34.874	1.203	440482.392	563114.646
S5	0.154	1500	Type C	34.643	33.213	1.205	440515.831	563112.077
S6	0.030	1350	Type C	34.696	32.955	1.291	440515.427	563117.093
S7	0.085	1500	Type B	35.220	32.695	2.000	440512.238	563160.137
S9	0.097	1350	Type B	37.807	36.150	1.507	440455.982	563206.024
S8	0.063	1350	Type C	37.712	36.156	1.406	440455.986	563188.187
S10	0.068	1350	Type B	37.716	35.985	1.506	440455.984	563197.105
S11	0.030	1500	Type B	35.420	32.570	2.325	440510.741	563199.204
S12	0.140	1350	Type C	35.008	33.305	1.478	440529.764	563212.802
S13	0.044	1500	Type B	34.936	32.515	1.896	440530.256	563199.952
S14	0.140	1500	Type C	33.973	32.173	1.275	440576.198	563201.713
S15	0.256	1500	Type C	33.124	31.081	1.368	440631.268	563203.823
S16	0.031	1800	Type C	33.019	30.806	1.313	440656.263	563204.781
S17	0.079	1200	Type B	34.297	32.345	1.652	440560.182	563261.660
S18	0.234	1350	Type C	33.223	31.400	1.373	440612.194	563263.654
S19	0.074	1800	Type C	32.935	30.685	1.350	440653.946	563265.254
S20	0.017	1800	Type C	32.954	30.669	1.385	440653.149	563273.357
S21	0.073	1350	Type C	37.833	36.305	1.378	440462.927	563318.583
S22	0.091	1350	Type B	38.025	36.365	1.510	440461.510	563299.564
S23	0.028	1350	Type B	37.932	36.160	1.547	440462.192	563308.727
S24	0.030	1350	Type C	36.505	34.945	1.335	440491.481	563306.544
S25	0.014	1350	Type C	35.405	33.690	1.490	440515.564	563301.858
S26	0.060	1350	Type C	34.902	33.280	1.397	440527.274	563261.684
S27	0.026	1350	Type C	34.797	33.170	1.402	440526.049	563272.459
S28	0.098	1350	Type C	34.588	32.879	1.408	440531.740	563295.371
S29	0.116	1350	Type B	34.262	32.296	1.741	440536.261	563401.782
S30	0.157	1350	Type B	34.052	32.090	1.662	440543.164	563381.886
S31	0.037	1350	Type B	33.875	31.783	1.642	440556.152	563360.104
S32	0.104	1500	Type B	33.640	31.483	1.557	440571.701	563343.964
S33	0.137	1500	Type B	33.377	31.090	1.687	440593.716	563328.459
S34	0.056	1500	Type C	33.110	31.030	1.480	440617.793	563319.374
S35	0.109	1800	Type C	32.950	30.580	1.470	440640.733	563315.867
S36	0.000	1800	Type B	33.200	30.537	1.763	440642.635	563337.339
S37	0.106	1800	Type C	32.750	30.452	1.398	440625.525	563376.463
S38	0.114	1800	Type C	32.635	30.371	1.364	440605.196	563411.666
S39	0.150	1350	Type C	36.857	35.357	1.275	440473.213	563422.119
S40	0.110	1350	Type C	37.072	35.647	1.275	440475.314	563442.701
S41	0.062	1350	Type C	36.965	35.170	1.495	440474.465	563432.749
S42	0.066	1200	Type B	34.660	32.725	1.710	440533.462	563441.173
S43	0.090	1500	Type B	34.605	32.485	1.820	440532.797	563428.070
S44	0.032	1350	Type C	33.128	31.361	1.392	440570.696	563427.030
S45	0.073	1800	Type B	32.831	30.331	1.600	440600.407	563431.274
S46 - HW	0.000	1800	Type C	31.800	30.290	0.610	440620.734	563434.469
S47	0.076	1350	Type C	37.930	36.404	1.376	440492.842	563549.177
S48	0.061	1350	Type C	37.670	36.320	1.200	440485.434	563525.341
S49	0.058	1350	Type C	37.750	36.135	1.390	440488.741	563535.401
S50	0.182	1350	Type B	34.783	32.925	1.558	440545.025	563493.224
S51	0.042	1200	Type B	34.568	32.300	1.968	440551.996	563518.188
S52	0.119	1350	Type C	33.280	31.575	1.330	440587.618	563510.193
S53	0.125	1350	Type C	34.197	32.670	1.302	440594.454	563583.128
S54	0.029	1350	Type C	33.635	32.070	1.340	440610.415	563570.881
S55	0.019	1350	Type C	33.308	31.880	1.203	440621.980	563549.787
S56	0.009	1350	Type C	33.109	31.515	1.294	440624.189	563528.878
S57	0.015	1350	Type C	32.940	31.305	1.335	440620.781	563512.163
S58	0.070	1350	Type C	32.783	31.415	1.143	440613.087	563497.718
S59	0.086	1350	Type C	32.868	31.155	1.338	440616.612	563504.336
S60 - HW	0.000	1500	Type C	32.525	30.800	1.200	440639.239	563494.626
S61 - HW	0.000	1800	Type C	31.800	30.100	0.800	440651.255	563386.102
S62	0.000	1800	Type B	32.500	30.060	2.215	440655.172	563375.140
S63	0.000	1200	Type B	33.000	29.910	2.865	440660.381	563352.432
S64	0.000	1200	Type B	31.769	29.620	1.924	440707.823	563358.788

Manhole Schedule

Manhole	Catchment Area (ha)	Size (mm)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S65	0.000	1350	Type C	29.407	28.090	1.092	440774.459	563370.927
S66	0.000	1350	Type C	29.033	27.970	0.838	440782.455	563353.671
S67	0.000	1350	Type C	29.426	27.805	1.396	440767.987	563330.588
7304 EXIST MH	0.000	1350	Type C	29.485	27.775	1.485	440767.410	563325.890

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S1	36.298	S3	36.030	Circ	150	9.412	35	0.600	1.275	1.447
2.000	S2	36.128	S3	36.030	Circ	150	7.906	81	0.600	1.275	1.447
1.001	S3	35.955	S4	34.874	Circ	225	27.001	25	0.600	1.447	1.203
1.002	S4	34.874	S6	33.180	Circ	225	33.125	20	0.600	1.203	1.291
3.000	S5	33.213	S6	33.180	Circ	225	5.032	152	0.600	1.205	1.291
1.003	S6	32.955	S7	32.770	Circ	450	43.162	233	0.600	1.291	2.000
1.004	S7	32.695	S11	32.570	Circ	525	39.095	313	0.600	2.000	2.325
4.000	S9	36.150	S10	36.060	Circ	150	8.919	99	0.600	1.507	1.506
5.000	S8	36.156	S10	36.060	Circ	150	8.919	93	0.600	1.406	1.506
4.001	S10	35.985	S11	32.870	Circ	225	54.797	18	0.600	1.506	2.325
1.005	S11	32.570	S13	32.515	Circ	525	19.530	355	0.600	2.325	1.896
6.000	S12	33.305	S13	32.815	Circ	225	12.860	26	0.600	1.478	1.896
1.006	S13	32.515	S14	32.173	Circ	525	45.976	135	0.600	1.896	1.275
1.007	S14	32.173	S15	31.231	Circ	525	55.110	58	0.600	1.275	1.368
1.008	S15	31.081	S16	31.031	Circ	675	25.013	500	0.600	1.368	1.313
1.009	S16	30.806	S19	30.685	Circ	900	60.517	500	0.600	1.313	1.350
7.000	S17	32.345	S18	31.550	Circ	300	52.051	65	0.600	1.652	1.373
7.001	S18	31.400	S19	31.135	Circ	450	41.782	158	0.600	1.373	1.350
1.010	S19	30.685	S20	30.669	Circ	900	8.142	500	0.600	1.350	1.385
1.011	S20	30.669	S35	30.580	Circ	900	44.285	500	0.600	1.385	1.470
8.000	S21	36.305	S23	36.235	Circ	150	9.884	141	0.600	1.378	1.547
9.000	S22	36.365	S23	36.235	Circ	150	9.188	71	0.600	1.510	1.547
8.001	S23	36.160	S24	34.945	Circ	225	29.370	24	0.600	1.547	1.335
8.002	S24	34.945	S25	33.690	Circ	225	24.534	20	0.600	1.335	1.490
8.003	S25	33.690	S28	32.954	Circ	225	17.429	24	0.600	1.490	1.408
10.000	S26	33.280	S27	33.170	Circ	225	10.844	99	0.600	1.397	1.402
10.001	S27	33.170	S28	32.954	Circ	225	23.608	109	0.600	1.402	1.408
8.004	S28	32.879	S32	31.783	Circ	300	62.914	57	0.600	1.408	1.557
11.000	S29	32.296	S30	32.165	Circ	225	21.059	161	0.600	1.741	1.662
11.001	S30	32.090	S31	31.933	Circ	300	25.360	161	0.600	1.662	1.642
11.002	S31	31.783	S32	31.633	Circ	450	22.412	149	0.600	1.642	1.557
8.005	S32	31.483	S33	31.090	Circ	600	26.927	68	0.600	1.557	1.687
8.006	S33	31.090	S34	31.030	Circ	600	25.734	429	0.600	1.687	1.480
8.007	S34	31.030	S35	30.880	Circ	600	23.207	155	0.600	1.480	1.470
1.012	S35	30.580	S36	30.537	Circ	900	21.556	500	0.600	1.470	1.763
1.013	S36	30.537	S37	30.452	Circ	900	42.702	500	0.600	1.762	1.398
1.014	S37	30.452	S38	30.371	Circ	900	40.651	500	0.600	1.398	1.364
1.015	S38	30.371	S45	30.331	Circ	900	20.184	500	0.600	1.364	1.600
12.000	S39	35.357	S41	35.245	Circ	225	10.704	95	0.600	1.275	1.495
13.000	S40	35.647	S41	35.320	Circ	150	9.988	31	0.600	1.275	1.495
12.001	S41	35.170	S43	32.485	Circ	300	58.520	22	0.600	1.495	1.820
14.000	S42	32.725	S43	32.560	Circ	225	13.120	80	0.600	1.710	1.820
12.002	S43	32.485	S44	31.436	Circ	300	37.913	36	0.600	1.820	1.392
12.003	S44	31.361	S45	30.856	Circ	375	30.013	59	0.600	1.392	1.600
1.016	S45	30.331	S46 - HW	30.290	Circ	900	20.577	500	0.600	1.600	0.610
1.017	S46 - HW	30.290	S61 - HW	30.100	Circ	900	57.191	301	0.600	0.610	0.800
15.000	S47	36.404	S49	36.210	Circ	150	14.373	74	0.600	1.376	1.390
16.000	S48	36.320	S49	36.210	Circ	150	10.590	96	0.600	1.200	1.390
15.001	S49	36.135	S51	32.375	Circ	225	65.556	17	0.600	1.390	1.968
17.000	S50	32.925	S51	32.300	Circ	300	25.919	41	0.600	1.558	1.968
15.002	S51	32.300	S52	31.650	Circ	300	36.508	56	0.600	1.968	1.330
15.003	S52	31.575	S59	31.155	Circ	375	29.580	70	0.600	1.330	1.338
18.000	S53	32.670	S54	32.070	Circ	225	20.118	34	0.600	1.302	1.340
18.001	S54	32.070	S55	31.880	Circ	225	24.057	127	0.600	1.340	1.203
18.002	S55	31.880	S56	31.590	Circ	225	21.025	72	0.600	1.203	1.294
18.003	S56	31.515	S57	31.305	Circ	300	17.059	81	0.600	1.294	1.335

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Shape	Dimension (mm)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
18.004	S57	31.305	S59	31.230	Circ	300	8.868	118	0.600	1.335	1.338
19.000	S58	31.415	S59	31.305	Circ	225	7.498	68	0.600	1.143	1.338
15.004	S59	31.155	S60 - HW	30.950	Circ	375	24.622	120	0.600	1.338	1.200
15.005	S60 - HW	30.800	S61 - HW	30.475	Circ	525	109.187	336	0.600	1.200	0.800
1.018	S61 - HW	30.100	S62	30.060	Circ	900	11.640	291	0.600	0.800	1.540
1.019	S62	30.060	S63	29.910	Circ	225	23.299	155	0.600	2.215	2.865
1.020	S63	29.910	S64	29.620	Circ	225	47.865	165	0.600	2.865	1.924
1.021	S64	29.620	S65	28.090	Circ	225	67.733	44	0.600	1.924	1.092
1.022	S65	28.090	S66	27.970	Circ	225	19.019	158	0.600	1.092	0.838
1.023	S66	27.970	S67	27.805	Circ	225	27.242	165	0.600	0.838	1.396
1.024	S67	27.805	7304 EXIST MH	27.775	Circ	225	4.733	160	0.600	1.396	1.485

Outfall Details

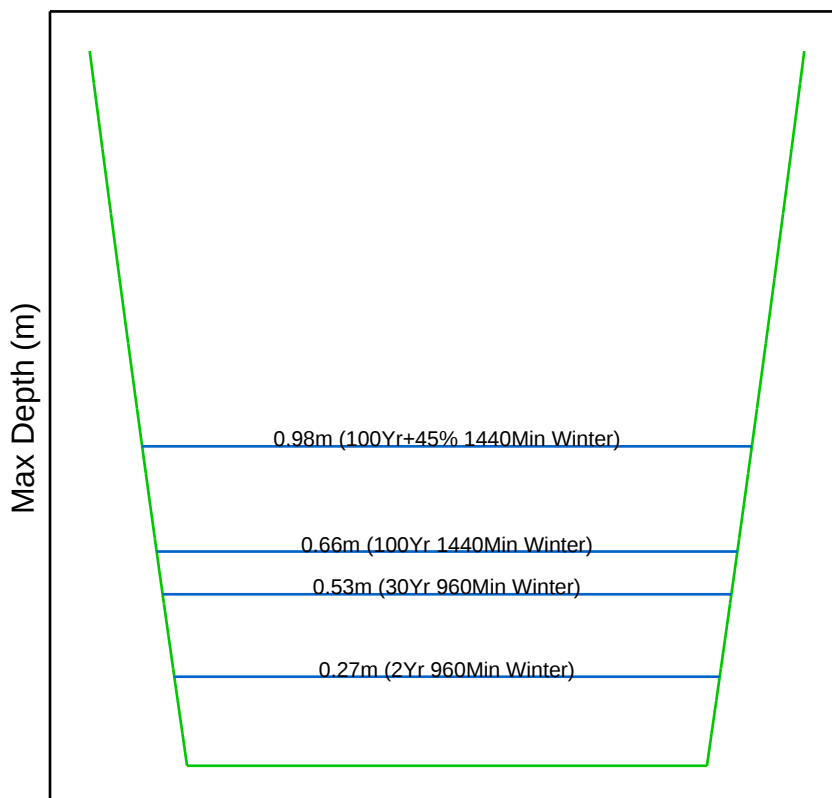
Outfall Manhole 7304 EXIST MH : Free Discharge

Flow Control Details

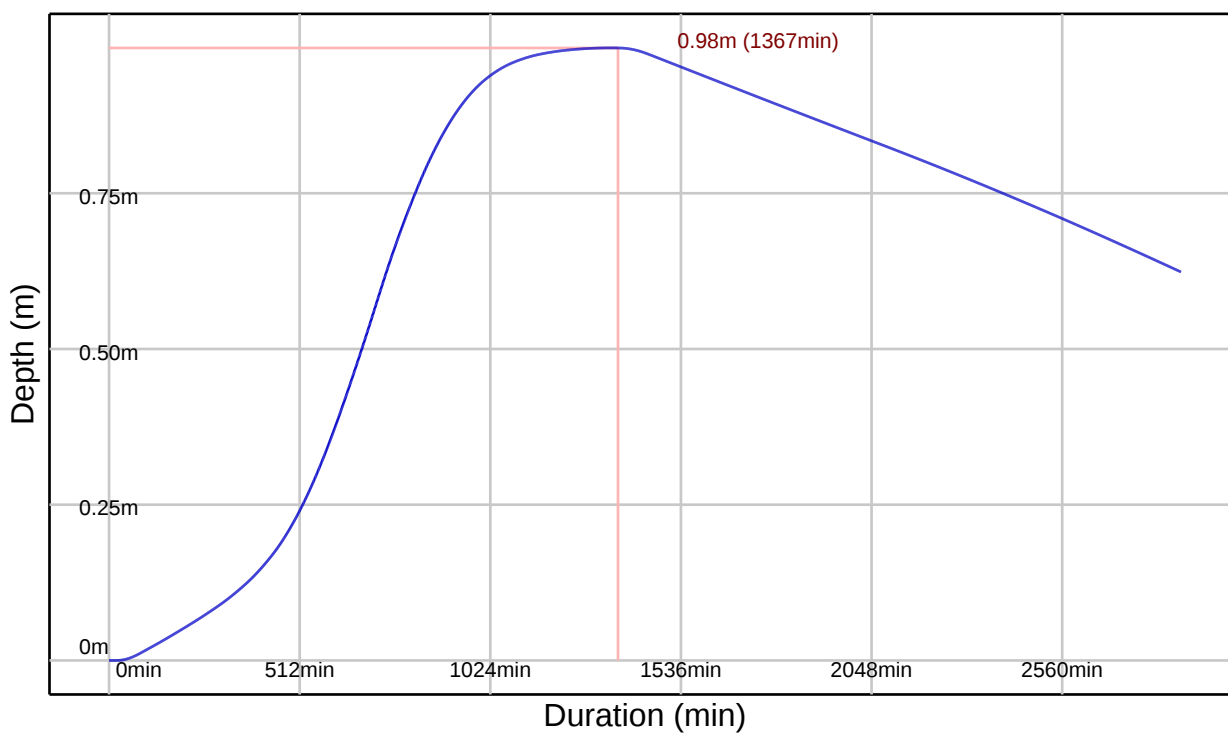
Pond Structure at Manhole S61 - HW

Pond Invert (m)	Max Depth (m)	Volume To Water Level (m3)	Water Level (m)	Freeboard (m)	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
30.100	2.200	3267.453	31.100	1.200	0.00000000	0.00000000	2.00

Pond Depth/Area Diagram at S61 - HW



Pond 1 at S61 - HW (100Yr+45% 1440Min Winter)

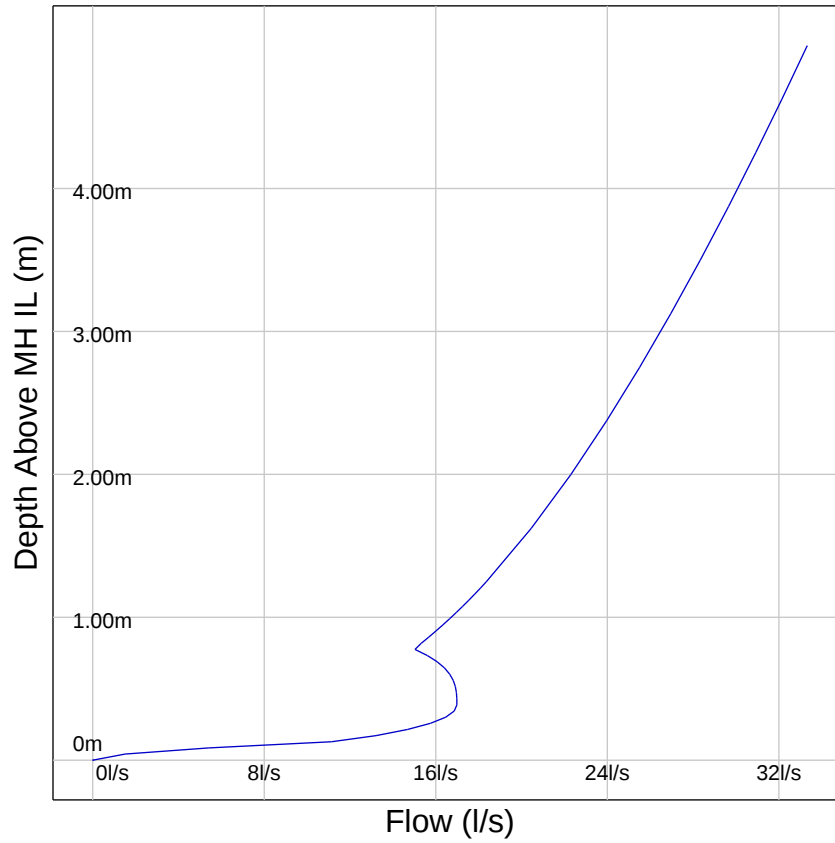


Controls within Manhole S62

StormBrake Control

Model Ref	Design Depth (m)	Design Flow (l/s)	Invert Offset (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
FPM-SB1-01040-01700-1100	1.040	17.000	0.000	0.387	16.984	0.778	14.986

StormBrake Control from S62 to S63



Simulation Settings

FEH2022 (point): Filename=FEH_Point_Descriptors_440560_563383_v5_0_1.xml

Summer (Cv: 0.75), Winter (Cv: 0.84)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

Return Periods (yrs) + Climate Change: (2, +0%), (30, +0%), (100, +0%), (100, +45%)

Manhole Flood Risk Freeboard: 0.300m

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
2Yr 15Min Winter	26.400	0.00	-0.13	100Yr 15Min Summer	90.092	0.00	0.10
2Yr 15Min Summer	26.400	0.00	-0.12	100Yr 15Min Winter	90.092	0.00	0.06
2Yr 30Min Winter	17.200	0.00	-0.12	100Yr 30Min Summer	60.395	0.00	0.03
2Yr 30Min Summer	17.200	0.00	-0.13	100Yr 30Min Winter	60.395	0.00	0.00
2Yr 60Min Winter	10.900	0.00	-0.09	100Yr 60Min Summer	38.797	0.00	-0.01
2Yr 60Min Summer	10.900	0.00	-0.10	100Yr 60Min Winter	38.797	0.00	-0.02
2Yr 120Min Summer	7.650	0.00	-0.06	100Yr 120Min Summer	22.687	0.00	-0.02
2Yr 120Min Winter	7.650	0.00	-0.06	100Yr 120Min Winter	22.687	0.00	-0.03
2Yr 180Min Summer	6.148	0.00	-0.05	100Yr 180Min Summer	16.472	0.00	-0.02
2Yr 180Min Winter	6.148	0.00	-0.05	100Yr 180Min Winter	16.472	0.00	-0.03
2Yr 240Min Summer	5.106	0.00	-0.05	100Yr 240Min Summer	13.269	0.00	-0.02
2Yr 240Min Winter	5.106	0.00	-0.05	100Yr 240Min Winter	13.269	0.00	-0.02
2Yr 360Min Summer	3.949	0.00	-0.04	100Yr 360Min Summer	9.678	0.00	-0.02
2Yr 360Min Winter	3.949	0.00	-0.04	100Yr 360Min Winter	9.678	0.00	-0.02
2Yr 480Min Summer	3.273	0.00	-0.03	100Yr 480Min Summer	7.725	0.00	-0.01
2Yr 480Min Winter	3.273	0.00	-0.03	100Yr 480Min Winter	7.725	0.00	-0.02
2Yr 600Min Summer	2.801	0.00	-0.02	100Yr 600Min Summer	6.496	0.00	-0.01
2Yr 600Min Winter	2.801	0.00	-0.02	100Yr 600Min Winter	6.496	0.00	-0.01
2Yr 720Min Winter	2.453	0.00	-0.02	100Yr 720Min Summer	5.641	0.00	-0.01
2Yr 720Min Summer	2.453	0.00	-0.02	100Yr 720Min Winter	5.641	0.00	-0.01
2Yr 960Min Summer	1.991	0.00	-0.01	100Yr 960Min Summer	4.523	0.00	-0.01
2Yr 960Min Winter	1.991	0.00	-0.01	100Yr 960Min Winter	4.523	0.00	-0.01
2Yr 1440Min Summer	1.477	0.00	-0.01	100Yr 1440Min Summer	3.340	0.00	-0.01
2Yr 1440Min Winter	1.477	0.00	-0.01	100Yr 1440Min Winter	3.340	0.00	-0.01
30Yr 15Min Summer	70.877	0.00	-0.04	100Yr+45% 15Min Summer	130.634	0.00	0.00
30Yr 15Min Winter	70.877	0.00	-0.03	100Yr+45% 15Min Winter	130.634	0.00	-0.10
30Yr 30Min Summer	47.143	0.00	0.01	100Yr+45% 30Min Summer	87.572	0.00	-0.07
30Yr 30Min Winter	47.143	0.00	-0.03	100Yr+45% 30Min Winter	87.572	0.00	-0.06
30Yr 60Min Summer	30.013	0.00	0.00	100Yr+45% 60Min Summer	56.256	0.00	-0.01
30Yr 60Min Winter	30.013	0.00	-0.03	100Yr+45% 60Min Winter	56.256	0.00	0.00
30Yr 120Min Winter	18.005	0.00	-0.02	100Yr+45% 120Min Summer	32.896	0.00	-0.03
30Yr 120Min Summer	18.005	0.00	-0.03	100Yr+45% 120Min Winter	32.896	0.00	-0.02
30Yr 180Min Summer	13.254	0.00	-0.02	100Yr+45% 180Min Summer	23.884	0.00	-0.03
30Yr 180Min Winter	13.254	0.00	-0.02	100Yr+45% 180Min Winter	23.884	0.00	-0.01
30Yr 240Min Summer	10.708	0.00	-0.02	100Yr+45% 240Min Summer	19.239	0.00	-0.03
30Yr 240Min Winter	10.708	0.00	-0.02	100Yr+45% 240Min Winter	19.239	0.00	-0.00
30Yr 360Min Summer	7.873	0.00	-0.01	100Yr+45% 360Min Summer	14.034	0.00	-0.03
30Yr 360Min Winter	7.873	0.00	-0.01	100Yr+45% 360Min Winter	14.034	0.00	0.00
30Yr 480Min Summer	6.315	0.00	-0.01	100Yr+45% 480Min Summer	11.201	0.00	-0.03
30Yr 480Min Winter	6.315	0.00	-0.01	100Yr+45% 480Min Winter	11.201	0.00	0.00
30Yr 600Min Winter	5.315	0.00	-0.01	100Yr+45% 600Min Summer	9.419	0.00	-0.03
30Yr 600Min Summer	5.315	0.00	-0.01	100Yr+45% 600Min Winter	9.419	0.00	-0.00
30Yr 720Min Summer	4.612	0.00	-0.01	100Yr+45% 720Min Summer	8.180	0.00	-0.02
30Yr 720Min Winter	4.612	0.00	-0.01	100Yr+45% 720Min Winter	8.180	0.00	-0.01
30Yr 960Min Summer	3.688	0.00	-0.02	100Yr+45% 960Min Summer	6.558	0.00	-0.02
30Yr 960Min Winter	3.688	0.00	-0.01	100Yr+45% 960Min Winter	6.558	0.00	-0.01
30Yr 1440Min Summer	2.700	0.00	-0.01	100Yr+45% 1440Min Winter	4.842	0.00	-0.02
30Yr 1440Min Winter	2.700	0.00	-0.01	100Yr+45% 1440Min Summer	4.842	0.00	-0.01

Simulation Results

Return Period (yrs) + Climate Change (%):

2yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Winter	8	36.337	0.040	4.744		OK
S2	15 min Winter	8	36.188	0.060	6.866		OK
S3	15 min Winter	8	36.012	0.057	15.096		OK
S4	15 min Winter	8	34.934	0.060	18.604		OK
S5	15 min Winter	8	33.317	0.104	18.808		OK
S6	15 min Winter	9	33.087	0.132	39.625		OK
S7	15 min Winter	9	32.845	0.150	50.215		OK
S9	15 min Winter	8	36.239	0.089	11.879		OK
S8	15 min Winter	8	36.223	0.067	7.696		OK
S10	15 min Winter	8	36.056	0.071	27.611		OK
S11	15 min Winter	9	32.767	0.197	80.772		OK
S12	15 min Winter	8	33.367	0.062	17.100		OK
S13	15 min Winter	9	32.693	0.178	102.428		OK
S14	15 min Winter	9	32.325	0.152	118.379		OK
S15	15 min Winter	9	31.344	0.263	145.398		OK
S16	15 min Winter	13	31.066	0.260	79.461		OK
S17	15 min Winter	9	32.397	0.052	9.071		OK
S18	15 min Winter	8	31.514	0.114	37.722		OK
S19	15 min Winter	12	31.062	0.377	123.089		OK
S20	15 min Winter	12	31.060	0.392	113.344		OK
S21	15 min Winter	8	36.387	0.082	8.879		OK
S22	15 min Winter	8	36.442	0.077	11.148		OK
S23	15 min Winter	8	36.231	0.071	23.110		OK
S24	15 min Winter	8	35.016	0.071	26.609		OK
S25	15 min Winter	9	33.769	0.079	27.793		OK
S26	15 min Winter	8	33.336	0.056	7.318		OK
S27	15 min Winter	8	33.239	0.069	10.401		OK
S28	15 min Winter	9	33.000	0.120	49.541		OK
S29	15 min Winter	8	32.386	0.090	14.087		OK
S30	15 min Winter	8	32.218	0.128	32.936		OK
S31	15 min Winter	9	31.896	0.113	36.499		OK
S32	15 min Winter	9	31.621	0.138	98.993		OK
S33	15 min Winter	9	31.318	0.228	115.124		OK
S34	15 min Winter	9	31.224	0.194	121.999		OK
S35	15 min Winter	12	31.059	0.479	187.910		OK
S36	15 min Winter	12	31.054	0.517	189.884		OK
S37	15 min Winter	12	31.044	0.592	190.408		OK
S38	15 min Winter	11	31.031	0.660	195.233		OK
S39	15 min Winter	8	35.449	0.091	18.246		OK
S40	15 min Winter	8	35.715	0.067	13.416		OK
S41	15 min Winter	8	35.250	0.080	38.926		OK
S42	15 min Winter	8	32.781	0.056	7.989		OK
S43	15 min Winter	9	32.599	0.114	55.567		OK
S44	15 min Winter	9	31.485	0.124	60.330		OK
S45	15 min Winter	11	31.029	0.698	233.597		OK
S46 - HW	15 min Winter	11	31.022	0.732	221.197		OK
S47	15 min Winter	8	36.474	0.070	9.306		OK
S48	15 min Winter	8	36.387	0.067	7.501		OK
S49	15 min Winter	9	36.200	0.065	22.682		OK
S50	15 min Winter	8	32.996	0.071	22.162		OK
S51	15 min Winter	9	32.420	0.120	48.928		OK
S52	15 min Winter	9	31.704	0.129	63.373		OK
S53	15 min Winter	8	32.731	0.061	15.222		OK
S54	15 min Winter	8	32.169	0.099	18.629		OK
S55	15 min Winter	9	31.970	0.090	20.342		OK
S56	15 min Winter	9	31.599	0.084	21.672		OK
S57	15 min Winter	9	31.412	0.107	23.529		OK
S58	15 min Winter	8	31.470	0.055	8.538		OK
S59	15 min Winter	9	31.365	0.210	105.406		OK
S60 - HW	15 min Winter	10	31.028	0.228	99.549		OK

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S61 - HW	960 min Winter	719	30.374	0.274	14.851		OK
S62	960 min Winter	719	30.374	0.314	14.842		Surcharged
S63	960 min Winter	720	30.007	0.097	14.842		OK
S64	960 min Winter	720	29.685	0.065	14.842		OK
S65	960 min Winter	721	28.184	0.094	14.842		OK
S66	960 min Winter	721	28.064	0.094	14.842		OK
S67	960 min Winter	721	27.897	0.092	14.842		OK
7304 EXIST MH	960 min Winter	722	27.860	0.085	14.842		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S1	S3	0.039	1.288	4.691	0.156	OK
2.000	15 min Winter	8	S2	S3	0.059	1.056	6.782	0.344	OK
1.001	15 min Winter	8	S3	S4	0.058	1.835	14.981	0.143	OK
1.002	15 min Winter	9	S4	S6	0.059	2.191	18.315	0.155	OK
3.000	15 min Winter	8	S5	S6	0.099	1.107	18.648	0.444	OK
1.003	15 min Winter	9	S6	S7	0.131	1.052	40.490	0.192	OK
1.004	15 min Winter	9	S7	S11	0.173	0.809	50.406	0.185	OK
4.000	15 min Winter	8	S9	S10	0.086	1.114	11.725	0.658	OK
5.000	15 min Winter	8	S8	S10	0.065	1.027	7.593	0.413	OK
4.001	15 min Winter	8	S10	S11	0.071	2.533	27.080	0.217	OK
1.005	15 min Winter	9	S11	S13	0.188	1.170	81.163	0.317	OK
6.000	15 min Winter	8	S12	S13	0.061	1.948	16.974	0.167	OK
1.006	15 min Winter	9	S13	S14	0.165	1.754	102.305	0.245	OK
1.007	15 min Winter	9	S14	S15	0.150	2.289	116.028	0.183	OK
1.008	15 min Winter	9	S15	S16	0.249	1.210	143.753	0.345	OK
1.009	15 min Winter	13	S16	S19	0.315	0.852	147.353	0.166	OK
7.000	15 min Winter	9	S17	S18	0.052	1.134	9.305	0.068	OK
7.001	15 min Winter	9	S18	S19	0.113	1.183	37.033	0.144	OK
1.010	15 min Winter	12	S19	S20	0.384	0.921	182.483	0.206	OK
1.011	15 min Winter	12	S20	S35	0.435	0.749	177.648	0.200	OK
8.000	15 min Winter	8	S21	S23	0.080	0.908	8.735	0.587	OK
9.000	15 min Winter	8	S22	S23	0.075	1.246	11.020	0.521	OK
8.001	15 min Winter	8	S23	S24	0.071	2.135	22.938	0.216	OK
8.002	15 min Winter	8	S24	S25	0.075	2.279	26.353	0.223	OK
8.003	15 min Winter	9	S25	S28	0.078	2.309	28.112	0.262	OK
10.000	15 min Winter	8	S26	S27	0.062	0.805	7.242	0.138	OK
10.001	15 min Winter	9	S27	S28	0.068	1.004	10.176	0.205	OK
8.004	15 min Winter	9	S28	S32	0.119	1.910	50.064	0.341	OK
11.000	15 min Winter	8	S29	S30	0.089	0.944	13.787	0.338	OK
11.001	15 min Winter	8	S30	S31	0.125	1.165	32.283	0.370	OK
11.002	15 min Winter	9	S31	S32	0.112	1.205	37.011	0.140	OK
8.005	15 min Winter	9	S32	S33	0.183	1.363	99.371	0.119	OK
8.006	15 min Winter	9	S33	S34	0.211	1.301	115.535	0.350	OK
8.007	15 min Winter	9	S34	S35	0.188	1.601	121.624	0.220	OK
1.012	15 min Winter	12	S35	S36	0.498	1.170	280.913	0.317	OK
1.013	15 min Winter	14	S36	S37	0.554	1.071	260.134	0.294	OK
1.014	15 min Winter	13	S37	S38	0.624	0.988	312.194	0.352	OK
1.015	15 min Winter	14	S38	S45	0.679	1.048	343.380	0.388	OK
12.000	15 min Winter	8	S39	S41	0.089	1.239	18.059	0.339	OK
13.000	15 min Winter	8	S40	S41	0.066	1.784	13.305	0.412	OK
12.001	15 min Winter	8	S41	S43	0.097	1.953	38.538	0.161	OK
14.000	15 min Winter	8	S42	S43	0.055	1.055	7.888	0.135	OK
12.002	15 min Winter	9	S43	S44	0.113	2.338	56.690	0.306	OK
12.003	15 min Winter	11	S44	S45	0.137	1.958	60.857	0.234	OK
1.016	15 min Winter	13	S45	S46 - HW	0.715	1.170	391.465	0.442	OK
1.017	15 min Winter	13	S46 - HW	S61 - HW	0.375	2.781	445.002	0.389	OK
15.000	15 min Winter	8	S47	S49	0.069	1.158	9.161	0.444	OK
16.000	15 min Winter	8	S48	S49	0.065	1.003	7.389	0.408	OK
15.001	15 min Winter	9	S49	S51	0.065	2.429	23.107	0.185	OK
17.000	15 min Winter	8	S50	S51	0.095	1.150	21.993	0.127	OK
15.002	15 min Winter	9	S51	S52	0.118	1.918	49.722	0.335	OK
15.003	15 min Winter	9	S52	S59	0.169	1.320	63.793	0.267	OK
18.000	15 min Winter	8	S53	S54	0.080	1.192	15.116	0.168	OK

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
18.001	15 min Winter	8	S54	S55	0.094	1.155	18.283	0.397	OK
18.002	15 min Winter	9	S55	S56	0.089	1.411	20.673	0.338	OK
18.003	15 min Winter	9	S56	S57	0.096	1.119	21.784	0.177	OK
18.004	15 min Winter	9	S57	S59	0.121	1.021	23.580	0.231	OK
19.000	15 min Winter	9	S58	S59	0.057	1.132	8.477	0.135	OK
15.004	15 min Winter	9	S59	S60 - HW	0.204	1.730	106.023	0.582	OK
15.005	15 min Winter	10	S60 - HW	S61 - HW	0.219	1.185	100.634	0.383	OK
1.018	960 min Winter	719	S61 - HW	S62	0.294	0.128	14.842	0.013	OK
1.019	960 min Winter	719	S62	S63	0.095	0.930	14.842	0.357	OK
1.020	960 min Winter	720	S63	S64	0.081	1.144	14.842	0.368	OK
1.021	960 min Winter	721	S64	S65	0.080	1.180	14.842	0.189	OK
1.022	960 min Winter	721	S65	S66	0.094	0.944	14.842	0.361	OK
1.023	960 min Winter	721	S66	S67	0.093	0.954	14.842	0.368	OK
1.024	960 min Winter	722	S67	7304 EXIST MH	0.088	1.025	14.842	0.363	OK

Return Period (yrs) + Climate Change (%):

30yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Winter	8	36.366	0.068	12.744		OK
S2	15 min Winter	8	36.242	0.114	18.443		OK
S3	15 min Winter	8	36.052	0.097	40.587		OK
S4	15 min Winter	8	34.976	0.102	50.069		OK
S5	15 min Winter	8	33.421	0.208	50.516		OK
S6	15 min Winter	9	33.184	0.229	106.314		OK
S7	15 min Winter	9	32.981	0.286	135.116		OK
S9	15 min Winter	9	36.476	0.326	30.010		Surcharged
S8	15 min Winter	8	36.293	0.137	20.671		OK
S10	15 min Winter	9	36.108	0.123	71.654		OK
S11	15 min Winter	9	32.924	0.354	217.521		OK
S12	15 min Winter	8	33.413	0.108	45.929		OK
S13	15 min Winter	9	32.829	0.314	275.684		OK
S14	15 min Winter	9	32.436	0.263	319.516		OK
S15	15 min Winter	10	31.851	0.770	374.003		Surcharged
S16	15 min Winter	10	31.855	1.049	380.121		Surcharged
S17	15 min Winter	8	32.432	0.087	25.880		OK
S18	15 min Winter	11	31.807	0.408	60.655		OK
S19	15 min Winter	11	31.755	1.070	459.651		Surcharged
S20	15 min Winter	11	31.744	1.075	487.856		Surcharged
S21	15 min Winter	8	36.536	0.231	23.849		Surcharged
S22	15 min Winter	8	36.616	0.251	29.942		Surcharged
S23	15 min Winter	8	36.283	0.123	60.800		OK
S24	15 min Winter	9	35.069	0.124	69.881		OK
S25	15 min Winter	9	33.831	0.141	74.600		OK
S26	15 min Winter	8	33.380	0.100	19.656		OK
S27	15 min Winter	8	33.292	0.122	27.973		OK
S28	15 min Winter	9	33.105	0.226	132.229		OK
S29	15 min Winter	8	32.470	0.174	37.838		OK
S30	15 min Winter	8	32.339	0.248	88.660		OK
S31	15 min Winter	9	31.977	0.194	98.002		OK
S32	15 min Winter	10	31.767	0.284	242.097		OK
S33	15 min Winter	11	31.771	0.681	221.262		Surcharged
S34	15 min Winter	11	31.739	0.709	240.889		Surcharged
S35	15 min Winter	11	31.701	1.121	776.016		Surcharged
S36	15 min Winter	11	31.646	1.109	782.869		Surcharged
S37	15 min Winter	11	31.566	1.114	816.612		Surcharged
S38	15 min Winter	9	31.487	1.116	341.813		Surcharged
S39	15 min Winter	8	35.531	0.173	49.009		OK
S40	15 min Winter	9	35.833	0.186	33.893		Surcharged
S41	15 min Winter	8	35.304	0.134	102.158		OK
S42	15 min Winter	8	32.822	0.097	21.458		OK
S43	15 min Winter	8	32.695	0.210	152.496		OK
S44	15 min Winter	9	31.644	0.283	161.162		OK
S45	15 min Winter	9	31.461	1.130	527.048		Surcharged
S46 - HW	15 min Winter	9	31.421	1.131	539.230		Surcharged
S47	15 min Winter	9	36.600	0.196	23.510		Surcharged
S48	15 min Winter	8	36.456	0.136	20.148		OK
S49	15 min Winter	9	36.245	0.110	61.264		OK
S50	15 min Winter	8	33.043	0.118	59.525		OK
S51	15 min Winter	8	32.525	0.225	133.992		OK
S52	15 min Winter	9	31.956	0.381	168.764		Surcharged
S53	15 min Winter	8	32.773	0.103	40.885		OK
S54	15 min Winter	8	32.267	0.197	50.116		OK
S55	15 min Winter	9	32.057	0.177	54.455		OK
S56	15 min Winter	9	31.839	0.324	56.548		Surcharged
S57	15 min Winter	9	31.791	0.486	59.322		Surcharged
S58	15 min Winter	9	31.773	0.358	21.568		Surcharged
S59	15 min Winter	9	31.759	0.604	265.595		Surcharged
S60 - HW	15 min Winter	11	31.228	0.428	248.098		OK
S61 - HW	960 min Winter	798	30.628	0.528	17.095		OK
S62	960 min Winter	870	30.659	0.599	16.619		Surcharged
S63	480 min Winter	311	30.015	0.105	16.983		OK
S64	480 min Summer	370	29.690	0.070	16.983		OK

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S65	480 min Summer	371	28.191	0.101	16.983		OK
S66	480 min Summer	371	28.072	0.102	16.983		OK
S67	480 min Summer	371	27.904	0.099	16.983		OK
7304 EXIST MH	480 min Summer	371	27.866	0.091	16.983		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S1	S3	0.066	1.673	12.635	0.420	OK
2.000	15 min Winter	8	S2	S3	0.109	1.320	18.223	0.924	OK
1.001	15 min Winter	8	S3	S4	0.099	2.379	40.340	0.386	OK
1.002	15 min Winter	8	S4	S6	0.101	2.859	49.357	0.418	OK
3.000	15 min Winter	8	S5	S6	0.194	1.368	49.844	1.187	OK
1.003	15 min Winter	9	S6	S7	0.225	1.368	109.019	0.517	OK
1.004	15 min Winter	9	S7	S11	0.320	0.984	136.015	0.499	OK
4.000	15 min Winter	9	S9	S10	0.150	1.737	30.702	1.724	Surcharged
5.000	15 min Winter	8	S8	S10	0.131	1.248	20.185	1.099	OK
4.001	15 min Winter	9	S10	S11	0.122	3.276	72.355	0.581	OK
1.005	15 min Winter	9	S11	S13	0.334	1.517	218.696	0.855	OK
6.000	15 min Winter	8	S12	S13	0.105	2.517	45.660	0.448	OK
1.006	15 min Winter	9	S13	S14	0.288	2.286	276.380	0.662	OK
1.007	15 min Winter	10	S14	S15	0.388	2.596	319.462	0.503	OK
1.008	15 min Winter	10	S15	S16	0.675	1.593	372.172	0.894	Surcharged
1.009	15 min Winter	10	S16	S19	0.900	0.907	381.332	0.430	OK
7.000	15 min Winter	11	S17	S18	0.163	1.506	25.105	0.183	OK
7.001	15 min Winter	11	S18	S19	0.429	1.534	107.538	0.419	OK
1.010	15 min Winter	11	S19	S20	0.900	0.974	484.717	0.547	OK
1.011	15 min Winter	13	S20	S35	0.900	0.861	515.299	0.582	OK
8.000	15 min Winter	8	S21	S23	0.143	1.327	23.022	1.547	OK
9.000	15 min Winter	9	S22	S23	0.147	1.644	28.863	1.366	OK
8.001	15 min Winter	9	S23	S24	0.123	2.721	60.606	0.571	OK
8.002	15 min Winter	9	S24	S25	0.132	2.886	70.286	0.595	OK
8.003	15 min Winter	9	S25	S28	0.146	2.787	74.994	0.699	OK
10.000	15 min Winter	8	S26	S27	0.111	0.998	19.488	0.373	OK
10.001	15 min Winter	9	S27	S28	0.135	1.174	27.526	0.555	OK
8.004	15 min Winter	9	S28	S32	0.222	2.381	133.516	0.909	OK
11.000	15 min Winter	8	S29	S30	0.174	1.158	37.227	0.914	OK
11.001	15 min Winter	9	S30	S31	0.239	1.444	86.602	0.993	OK
11.002	15 min Winter	9	S31	S32	0.189	1.567	99.155	0.376	OK
8.005	15 min Winter	10	S32	S33	0.442	1.626	272.731	0.328	OK
8.006	15 min Winter	10	S33	S34	0.600	1.580	285.795	0.866	Surcharged
8.007	15 min Winter	10	S34	S35	0.600	1.911	284.311	0.515	Surcharged
1.012	15 min Winter	12	S35	S36	0.900	1.326	797.606	0.900	OK
1.013	15 min Winter	12	S36	S37	0.900	1.347	829.998	0.937	OK
1.014	15 min Winter	12	S37	S38	0.900	1.430	890.242	1.005	OK
1.015	15 min Winter	12	S38	S45	0.900	1.546	944.122	1.066	OK
12.000	15 min Winter	8	S39	S41	0.165	1.550	48.524	0.912	OK
13.000	15 min Winter	9	S40	S41	0.136	2.151	34.438	1.066	OK
12.001	15 min Winter	8	S41	S43	0.172	2.439	101.730	0.426	OK
14.000	15 min Winter	8	S42	S43	0.116	1.159	21.282	0.365	OK
12.002	15 min Winter	9	S43	S44	0.208	2.924	151.394	0.817	OK
12.003	15 min Winter	9	S44	S45	0.329	2.383	157.395	0.606	OK
1.016	15 min Winter	12	S45	S46 - HW	0.900	1.823	1076.814	1.215	OK
1.017	15 min Winter	12	S46 - HW	S61 - HW	0.496	3.643	1153.051	1.007	OK
15.000	15 min Winter	9	S47	S49	0.144	1.376	23.961	1.160	OK
16.000	15 min Winter	8	S48	S49	0.131	1.217	19.644	1.085	OK
15.001	15 min Winter	9	S49	S51	0.130	2.829	61.509	0.491	OK
17.000	15 min Winter	8	S50	S51	0.172	1.442	59.198	0.342	OK
15.002	15 min Winter	9	S51	S52	0.262	2.314	132.130	0.890	OK
15.003	15 min Winter	9	S52	S59	0.375	1.531	159.646	0.669	Surcharged
18.000	15 min Winter	8	S53	S54	0.150	1.467	40.681	0.452	OK
18.001	15 min Winter	9	S54	S55	0.186	1.412	48.896	1.061	OK
18.002	15 min Winter	9	S55	S56	0.201	1.743	54.037	0.885	OK
18.003	15 min Winter	10	S56	S57	0.300	1.169	54.844	0.445	Surcharged
18.004	15 min Winter	11	S57	S59	0.300	1.005	60.335	0.591	Surcharged

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
19.000	15 min Winter	9	S58	S59	0.225	1.148	21.183	0.336	OK
15.004	15 min Winter	10	S59	S60 - HW	0.363	2.419	264.598	1.451	OK
15.005	15 min Winter	11	S60 - HW	S61 - HW	0.386	1.518	258.868	0.984	OK
1.018	960 min Winter	879	S61 - HW	S62	0.563	0.208	70.754	0.061	OK
1.019	720 min Summer	479	S62	S63	0.102	0.964	16.983	0.409	OK
1.020	480 min Summer	369	S63	S64	0.088	1.187	16.983	0.421	OK
1.021	480 min Summer	370	S64	S65	0.086	1.221	16.983	0.217	OK
1.022	480 min Summer	371	S65	S66	0.101	0.976	16.983	0.413	OK
1.023	480 min Summer	371	S66	S67	0.101	0.987	16.983	0.422	OK
1.024	480 min Summer	371	S67	7304 EXIST MH	0.095	1.061	16.983	0.415	OK

Return Period (yrs) + Climate Change (%):

100yr+0%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Winter	8	36.377	0.079	16.203		OK
S2	15 min Winter	9	36.291	0.163	22.045		Surcharged
S3	15 min Winter	8	36.065	0.110	50.539		OK
S4	15 min Winter	8	34.991	0.117	62.602		OK
S5	15 min Winter	8	33.479	0.265	64.229		Surcharged
S6	15 min Winter	8	33.224	0.269	138.284		OK
S7	15 min Winter	9	33.044	0.349	169.565		OK
S9	15 min Winter	9	36.641	0.491	38.138		Surcharged
S8	15 min Winter	8	36.380	0.225	26.283		Surcharged
S10	15 min Winter	9	36.129	0.144	90.968		OK
S11	15 min Winter	9	32.990	0.420	273.900		OK
S12	15 min Winter	8	33.431	0.126	58.398		OK
S13	15 min Winter	9	32.883	0.368	346.918		OK
S14	15 min Winter	10	32.529	0.356	376.715		OK
S15	15 min Winter	10	32.140	1.059	466.293		Surcharged
S16	15 min Winter	11	32.082	1.276	440.171		Surcharged
S17	15 min Winter	8	32.443	0.098	32.906		OK
S18	15 min Summer	10	32.104	0.704	100.823		Surcharged
S19	15 min Winter	11	32.055	1.370	537.325		Surcharged
S20	15 min Winter	11	32.040	1.371	550.144		Surcharged
S21	15 min Winter	9	36.639	0.334	28.506		Surcharged
S22	15 min Winter	9	36.776	0.411	35.789		Surcharged
S23	15 min Winter	9	36.303	0.143	76.617		OK
S24	15 min Winter	9	35.090	0.145	88.663		OK
S25	15 min Winter	9	33.865	0.175	94.741		OK
S26	15 min Winter	8	33.398	0.118	24.992		OK
S27	15 min Winter	10	33.323	0.153	28.641		OK
S28	15 min Winter	10	33.260	0.381	149.337		Surcharged
S29	15 min Winter	9	32.615	0.319	45.226		Surcharged
S30	15 min Winter	9	32.444	0.354	107.732		Surcharged
S31	15 min Winter	11	32.192	0.409	83.739		OK
S32	15 min Winter	11	32.177	0.693	259.704		Surcharged
S33	15 min Winter	11	32.124	1.034	306.301		Surcharged
S34	15 min Winter	11	32.063	1.033	325.163		Surcharged
S35	15 min Winter	11	31.997	1.417	909.771		Surcharged
S36	15 min Winter	11	31.927	1.390	916.302		Surcharged
S37	15 min Winter	10	31.813	1.361	886.668		Surcharged
S38	15 min Winter	10	31.697	1.326	909.683		Surcharged
S39	15 min Winter	8	35.609	0.251	62.313		Surcharged
S40	15 min Winter	9	36.076	0.429	43.072		Surcharged
S41	15 min Winter	9	35.323	0.153	127.490		OK
S42	15 min Winter	8	32.836	0.111	27.283		OK
S43	15 min Winter	10	32.813	0.328	166.143		Surcharged
S44	15 min Winter	10	31.875	0.514	184.495		Surcharged
S45	15 min Winter	10	31.622	1.291	1097.225		Surcharged
S46 - HW	15 min Winter	10	31.515	1.225	1082.873		Flood Risk
S47	15 min Winter	9	36.765	0.360	29.876		Surcharged
S48	15 min Winter	8	36.548	0.227	25.617		Surcharged
S49	15 min Winter	9	36.261	0.126	77.097		OK
S50	15 min Winter	9	33.067	0.142	71.146		OK
S51	15 min Winter	10	32.887	0.587	145.996		Surcharged
S52	15 min Winter	10	32.223	0.648	187.191		Surcharged
S53	15 min Winter	9	32.812	0.142	48.867		OK
S54	15 min Winter	10	32.570	0.500	51.545		Surcharged
S55	15 min Winter	10	32.319	0.439	59.234		Surcharged
S56	15 min Winter	10	32.043	0.528	61.572		Surcharged
S57	15 min Winter	10	31.986	0.681	66.054		Surcharged
S58	15 min Winter	10	31.962	0.547	22.875		Surcharged
S59	15 min Winter	10	31.947	0.792	304.922		Surcharged
S60 - HW	15 min Winter	11	31.305	0.505	298.524		OK
S61 - HW	1440 min Winter	1162	30.760	0.660	20.421		OK
S62	1440 min Winter	1128	30.790	0.730	23.262		Surcharged
S63	480 min Winter	272	30.015	0.105	16.983		OK
S64	1440 min Winter	759	29.690	0.070	16.983		OK

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S65	1440 min Winter	760	28.191	0.101	16.983		OK
S66	1440 min Winter	761	28.072	0.102	16.983		OK
S67	1440 min Winter	761	27.904	0.099	16.983		OK
7304 EXIST MH	1440 min Winter	761	27.866	0.091	16.983		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S1	S3	0.077	1.772	16.068	0.534	OK
2.000	15 min Winter	9	S2	S3	0.142	1.347	22.505	1.141	OK
1.001	15 min Winter	8	S3	S4	0.113	2.499	50.231	0.481	OK
1.002	15 min Winter	9	S4	S6	0.115	3.031	62.130	0.526	OK
3.000	15 min Winter	8	S5	S6	0.214	1.632	63.733	1.517	OK
1.003	15 min Winter	9	S6	S7	0.270	1.405	137.003	0.650	OK
1.004	15 min Winter	9	S7	S11	0.384	1.004	170.467	0.625	OK
4.000	15 min Winter	9	S9	S10	0.150	2.208	39.023	2.191	Surcharged
5.000	15 min Winter	8	S8	S10	0.145	1.456	25.423	1.384	OK
4.001	15 min Winter	9	S10	S11	0.143	3.450	91.803	0.737	OK
1.005	15 min Winter	9	S11	S13	0.394	1.575	274.495	1.073	OK
6.000	15 min Winter	8	S12	S13	0.121	2.659	58.059	0.570	OK
1.006	15 min Winter	10	S13	S14	0.357	2.322	345.609	0.828	OK
1.007	15 min Winter	10	S14	S15	0.440	2.614	382.700	0.603	OK
1.008	15 min Winter	9	S15	S16	0.675	1.739	498.133	1.196	Surcharged
1.009	15 min Winter	11	S16	S19	0.900	0.913	448.370	0.506	OK
7.000	15 min Winter	9	S17	S18	0.197	1.606	32.003	0.233	OK
7.001	15 min Winter	10	S18	S19	0.450	1.569	134.896	0.525	OK
1.010	15 min Winter	10	S19	S20	0.900	0.983	565.588	0.638	OK
1.011	15 min Winter	13	S20	S35	0.900	0.938	578.778	0.653	OK
8.000	15 min Winter	9	S21	S23	0.147	1.663	29.220	1.963	OK
9.000	15 min Winter	9	S22	S23	0.150	2.073	36.629	1.733	Surcharged
8.001	15 min Winter	9	S23	S24	0.144	2.860	76.877	0.724	OK
8.002	15 min Winter	9	S24	S25	0.160	3.001	89.259	0.755	OK
8.003	15 min Winter	9	S25	S28	0.200	2.800	94.425	0.880	OK
10.000	15 min Winter	9	S26	S27	0.130	1.051	24.847	0.475	OK
10.001	15 min Winter	10	S27	S28	0.189	1.196	35.756	0.721	OK
8.004	15 min Winter	10	S28	S32	0.300	2.357	156.887	1.068	Surcharged
11.000	15 min Winter	9	S29	S30	0.225	1.163	46.257	1.135	OK
11.001	15 min Winter	9	S30	S31	0.277	1.601	109.232	1.253	OK
11.002	15 min Winter	11	S31	S32	0.429	1.627	121.059	0.459	OK
8.005	15 min Winter	10	S32	S33	0.600	1.657	320.506	0.385	Surcharged
8.006	15 min Winter	9	S33	S34	0.600	1.657	323.854	0.981	Surcharged
8.007	15 min Winter	11	S34	S35	0.600	1.932	328.592	0.595	Surcharged
1.012	15 min Winter	13	S35	S36	0.900	1.507	958.456	1.082	OK
1.013	15 min Winter	13	S36	S37	0.900	1.592	1012.820	1.143	OK
1.014	15 min Winter	13	S37	S38	0.900	1.712	1088.893	1.229	OK
1.015	15 min Winter	13	S38	S45	0.900	1.802	1146.343	1.294	OK
12.000	15 min Winter	8	S39	S41	0.213	1.575	60.922	1.145	OK
13.000	15 min Winter	9	S40	S41	0.150	2.477	43.767	1.355	Surcharged
12.001	15 min Winter	9	S41	S43	0.227	2.505	128.133	0.536	OK
14.000	15 min Winter	10	S42	S43	0.164	1.190	27.282	0.468	OK
12.002	15 min Winter	9	S43	S44	0.300	2.948	187.135	1.010	Surcharged
12.003	15 min Winter	9	S44	S45	0.375	2.355	192.802	0.742	Surcharged
1.016	15 min Winter	12	S45	S46 - HW	0.900	2.033	1293.595	1.460	OK
1.017	1440 min Winter	1162	S46 - HW	S61 - HW	0.564	0.995	69.795	0.061	OK
15.000	15 min Winter	9	S47	S49	0.150	1.691	29.889	1.448	Surcharged
16.000	15 min Winter	9	S48	S49	0.144	1.416	24.693	1.364	OK
15.001	15 min Winter	9	S49	S51	0.176	2.788	77.368	0.618	OK
17.000	15 min Winter	9	S50	S51	0.221	1.494	74.775	0.432	OK
15.002	15 min Winter	10	S51	S52	0.300	2.287	148.335	0.999	Surcharged
15.003	15 min Winter	10	S52	S59	0.375	1.700	187.801	0.787	Surcharged
18.000	15 min Winter	9	S53	S54	0.184	1.508	50.674	0.562	OK
18.001	15 min Winter	9	S54	S55	0.225	1.406	54.631	1.185	OK
18.002	15 min Winter	10	S55	S56	0.225	1.685	58.728	0.961	OK
18.003	15 min Winter	11	S56	S57	0.300	1.188	62.999	0.511	Surcharged
18.004	15 min Winter	13	S57	S59	0.300	1.065	75.281	0.738	Surcharged

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
19.000	15 min Winter	8	S58	S59	0.225	1.225	27.387	0.435	OK
15.004	15 min Winter	10	S59	S60 - HW	0.375	2.761	304.943	1.673	Surcharged
15.005	15 min Winter	11	S60 - HW	S61 - HW	0.437	1.552	296.866	1.129	OK
1.018	1440 min Winter	1608	S61 - HW	S62	0.695	0.208	71.697	0.062	OK
1.019	1440 min Winter	758	S62	S63	0.102	0.964	16.983	0.409	OK
1.020	1440 min Winter	759	S63	S64	0.088	1.187	16.983	0.421	OK
1.021	1440 min Winter	760	S64	S65	0.086	1.221	16.983	0.217	OK
1.022	1440 min Winter	761	S65	S66	0.101	0.976	16.983	0.413	OK
1.023	1440 min Winter	761	S66	S67	0.101	0.987	16.983	0.422	OK
1.024	1440 min Winter	761	S67	7304 EXIST MH	0.095	1.061	16.983	0.415	OK

Return Period (yrs) + Climate Change (%):

100yr+45%

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	15 min Winter	8	36.399	0.101	23.459		OK
S2	15 min Winter	8	36.452	0.324	33.952		Surcharged
S3	15 min Winter	8	36.095	0.140	73.877		OK
S4	15 min Winter	8	35.024	0.150	91.333		OK
S5	15 min Winter	10	33.739	0.526	73.178		Surcharged
S6	15 min Winter	11	33.626	0.671	129.194		Surcharged
S7	15 min Winter	11	33.558	0.863	165.338		Surcharged
S9	15 min Winter	9	37.099	0.949	55.384		Surcharged
S8	15 min Winter	9	36.591	0.436	35.880		Surcharged
S10	15 min Winter	10	36.250	0.265	115.720		Surcharged
S11	15 min Winter	11	33.500	0.930	281.590		Surcharged
S12	15 min Winter	10	33.581	0.276	66.534		Surcharged
S13	15 min Winter	11	33.418	0.903	361.908		Surcharged
S14	15 min Winter	11	33.141	0.968	417.849		Surcharged
S15	15 min Winter	11	32.715	1.634	508.470		Surcharged
S16	15 min Winter	11	32.622	1.816	523.357		Surcharged
S17	15 min Winter	11	32.678	0.333	27.615		Surcharged
S18	15 min Winter	11	32.629	1.229	113.223		Surcharged
S19	15 min Winter	11	32.573	1.888	669.533		Surcharged
S20	15 min Winter	11	32.549	1.880	678.787		Surcharged
S21	15 min Winter	10	36.995	0.690	34.548		Surcharged
S22	15 min Winter	9	37.234	0.869	51.972		Surcharged
S23	15 min Winter	10	36.588	0.428	95.582		Surcharged
S24	15 min Winter	11	35.678	0.733	99.315		Surcharged
S25	15 min Winter	11	34.772	1.082	104.013		Surcharged
S26	15 min Winter	11	34.173	0.893	20.974		Surcharged
S27	15 min Winter	11	34.156	0.986	29.684		Surcharged
S28	15 min Winter	11	34.082	1.203	164.440		Surcharged
S29	15 min Winter	10	33.339	1.043	54.812		Surcharged
S30	15 min Winter	10	33.107	1.017	128.613		Surcharged
S31	15 min Winter	11	32.792	1.009	125.070		Surcharged
S32	15 min Winter	11	32.754	1.271	327.072		Surcharged
S33	15 min Winter	11	32.678	1.588	382.255		Surcharged
S34	15 min Winter	11	32.581	1.551	406.639		Surcharged
S35	15 min Winter	11	32.480	1.900	1129.801		Surcharged
S36	15 min Winter	11	32.370	1.833	1136.597		Surcharged
S37	15 min Winter	10	32.214	1.762	1085.117		Surcharged
S38	15 min Winter	10	32.056	1.685	1132.823		Surcharged
S39	15 min Winter	8	35.810	0.453	90.217		Surcharged
S40	15 min Winter	9	36.698	1.050	62.549		Surcharged
S41	15 min Winter	9	35.393	0.223	184.087		OK
S42	15 min Winter	10	33.961	1.236	31.084		Surcharged
S43	15 min Winter	10	33.920	1.435	238.415		Surcharged
S44	15 min Winter	10	32.387	1.026	236.535		Surcharged
S45	15 min Winter	10	31.948	1.617	1401.111		Surcharged
S46 - HW	15 min Winter	10	31.782	1.492	1405.682		Flood Risk
S47	15 min Winter	9	37.188	0.784	43.386		Surcharged
S48	15 min Winter	9	36.786	0.466	34.970		Surcharged
S49	15 min Winter	9	36.323	0.188	111.106		OK
S50	15 min Winter	10	34.064	1.139	86.229		Surcharged
S51	15 min Winter	11	33.930	1.630	172.484		Surcharged
S52	15 min Winter	11	32.865	1.290	229.854		Surcharged
S53	15 min Winter	10	33.593	0.923	59.226		Surcharged
S54	15 min Winter	11	33.342	1.272	59.485		Flood Risk
S55	15 min Winter	11	32.980	1.100	70.398		Surcharged
S56	15 min Winter	11	32.578	1.063	74.039		Surcharged
S57	15 min Winter	11	32.494	1.189	79.467		Surcharged
S58	15 min Winter	11	32.454	1.039	24.470		Surcharged
S59	15 min Winter	11	32.436	1.281	369.975		Surcharged
S60 - HW	15 min Winter	12	31.527	0.727	358.097		Surcharged
S61 - HW	1440 min Winter	1348	31.083	0.983	16.177		Surcharged
S62	1440 min Winter	1348	31.083	1.023	16.173		Surcharged
S63	60 min Summer	40	30.015	0.105	16.982		OK
S64	1440 min Winter	652	29.690	0.070	16.983		OK

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S65	1440 min Winter	653	28.191	0.101	16.983		OK
S66	1440 min Winter	654	28.072	0.102	16.983		OK
S67	1440 min Winter	654	27.904	0.099	16.983		OK
7304 EXIST MH	1440 min Winter	654	27.866	0.091	16.983		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
1.000	15 min Winter	8	S1	S3	0.097	1.917	23.264	0.773	OK
2.000	15 min Winter	9	S2	S3	0.150	1.855	32.788	1.662	Surcharged
1.001	15 min Winter	8	S3	S4	0.145	2.760	73.422	0.703	OK
1.002	15 min Winter	9	S4	S6	0.184	3.237	90.160	0.763	OK
3.000	15 min Winter	8	S5	S6	0.225	2.318	92.182	2.194	OK
1.003	15 min Winter	9	S6	S7	0.450	1.395	189.018	0.897	OK
1.004	15 min Winter	8	S7	S11	0.525	1.020	220.752	0.810	OK
4.000	15 min Winter	9	S9	S10	0.150	3.169	56.003	3.144	Surcharged
5.000	15 min Winter	9	S8	S10	0.150	2.078	36.725	1.999	Surcharged
4.001	15 min Winter	10	S10	S11	0.225	3.485	128.989	1.035	OK
1.005	15 min Winter	9	S11	S13	0.525	1.644	352.134	1.377	OK
6.000	15 min Winter	10	S12	S13	0.225	2.816	84.193	0.826	OK
1.006	15 min Winter	9	S13	S14	0.525	2.353	442.665	1.061	OK
1.007	15 min Winter	9	S14	S15	0.525	2.576	447.017	0.704	OK
1.008	30 min Summer	17	S15	S16	0.675	1.707	573.021	1.376	Surcharged
1.009	30 min Summer	18	S16	S19	0.900	0.884	562.339	0.635	OK
7.000	15 min Winter	11	S17	S18	0.300	1.674	47.103	0.343	Surcharged
7.001	15 min Winter	8	S18	S19	0.450	1.607	165.688	0.645	OK
1.010	30 min Winter	18	S19	S20	0.900	1.113	708.084	0.799	OK
1.011	15 min Winter	13	S20	S35	0.900	1.157	735.804	0.830	OK
8.000	15 min Winter	8	S21	S23	0.150	2.323	41.055	2.759	Surcharged
9.000	15 min Winter	8	S22	S23	0.150	2.884	50.965	2.411	Surcharged
8.001	15 min Winter	9	S23	S24	0.225	2.925	105.164	0.990	OK
8.002	30 min Summer	17	S24	S25	0.225	3.007	108.897	0.922	OK
8.003	30 min Summer	16	S25	S28	0.225	2.781	105.261	0.981	OK
10.000	15 min Winter	8	S26	S27	0.225	1.054	31.873	0.609	OK
10.001	15 min Winter	15	S27	S28	0.225	1.424	41.021	0.827	OK
8.004	30 min Summer	19	S28	S32	0.300	2.394	169.196	1.152	Surcharged
11.000	15 min Winter	8	S29	S30	0.225	1.608	63.920	1.569	OK
11.001	15 min Winter	9	S30	S31	0.300	2.141	150.470	1.726	Surcharged
11.002	30 min Summer	18	S31	S32	0.450	1.704	154.557	0.586	OK
8.005	15 min Winter	8	S32	S33	0.600	1.684	365.065	0.439	Surcharged
8.006	15 min Winter	11	S33	S34	0.600	1.698	386.958	1.172	Surcharged
8.007	15 min Winter	11	S34	S35	0.600	2.046	410.281	0.743	Surcharged
1.012	15 min Winter	13	S35	S36	0.900	1.873	1191.644	1.345	OK
1.013	15 min Winter	13	S36	S37	0.900	1.934	1230.481	1.389	OK
1.014	15 min Winter	13	S37	S38	0.900	2.035	1294.474	1.461	OK
1.015	15 min Winter	13	S38	S45	0.900	2.118	1347.239	1.520	OK
12.000	15 min Winter	8	S39	S41	0.225	2.228	88.604	1.665	OK
13.000	15 min Winter	9	S40	S41	0.150	3.521	62.227	1.926	Surcharged
12.001	15 min Winter	9	S41	S43	0.261	2.862	182.289	0.763	OK
14.000	30 min Summer	16	S42	S43	0.225	1.187	30.534	0.524	OK
12.002	15 min Winter	11	S43	S44	0.300	3.154	222.929	1.203	Surcharged
12.003	15 min Winter	11	S44	S45	0.375	2.356	243.793	0.938	Surcharged
1.016	15 min Winter	12	S45	S46 - HW	0.900	2.538	1614.778	1.822	OK
1.017	1440 min Winter	1342	S46 - HW	S61 - HW	0.847	1.082	99.137	0.087	OK
15.000	15 min Winter	9	S47	S49	0.150	2.419	42.746	2.070	Surcharged
16.000	15 min Winter	9	S48	S49	0.150	2.018	35.664	1.970	Surcharged
15.001	15 min Winter	9	S49	S51	0.206	2.902	109.623	0.876	OK
17.000	15 min Winter	8	S50	S51	0.300	1.530	93.566	0.541	Surcharged
15.002	15 min Winter	10	S51	S52	0.300	2.664	188.303	1.268	Surcharged
15.003	15 min Winter	10	S52	S59	0.375	2.145	236.932	0.993	Surcharged
18.000	15 min Winter	9	S53	S54	0.225	1.630	63.336	0.703	OK
18.001	15 min Winter	9	S54	S55	0.225	1.708	67.895	1.473	OK
18.002	15 min Winter	11	S55	S56	0.225	1.786	70.997	1.162	OK
18.003	15 min Winter	12	S56	S57	0.300	1.188	76.393	0.620	Surcharged
18.004	15 min Winter	13	S57	S59	0.300	1.390	85.881	0.842	Surcharged

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Max Velocity (m/s)	Max Flow (l/s)	Flow / Capacity	Status
19.000	15 min Winter	8	S58	S59	0.225	1.203	37.461	0.595	OK
15.004	15 min Winter	10	S59	S60 - HW	0.375	3.386	373.994	2.051	Surcharged
15.005	15 min Winter	12	S60 - HW	S61 - HW	0.466	1.781	361.554	1.375	OK
1.018	1440 min Winter	2875	S61 - HW	S62	0.900	0.136	24.507	0.021	OK
1.019	1440 min Summer	696	S62	S63	0.102	0.963	16.983	0.409	OK
1.020	1440 min Winter	652	S63	S64	0.088	1.187	16.983	0.421	OK
1.021	1440 min Winter	653	S64	S65	0.086	1.221	16.983	0.217	OK
1.022	1440 min Winter	653	S65	S66	0.101	0.976	16.983	0.413	OK
1.023	1440 min Winter	654	S66	S67	0.101	0.987	16.983	0.422	OK
1.024	1440 min Winter	654	S67	7304 EXIST MH	0.095	1.061	16.983	0.415	OK



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