

University of Chichester

Drainage Strategy

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Quality information

Prepared by	Checked by	Verified by	Approved by
Stamatia Kantziari	Nick Price	Farmer Anne	Niall Mulligan
Graduate Infrastructure Engineer	Senior Infrastructure Engineer	Associate Director	Associate, Programme and Project Management

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Prepared for (the Client):

University of Chichester

Prepared by:

AECOM Infrastructure & Environment UK Limited
Midpoint
Alencon Link
Basingstoke
Hampshire RG21 7PP
UK



aecon@com

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1. Drainage Strategy

In order to prevent any increased surface water or sewer flood risk either to the Site or to adjacent sites due to the Proposed Development, an outline drainage strategy has been developed for the Site. The drainage strategy specifies the mitigation measures that can be used to manage surface water flood risk.

1.1 Background

The NPPF states that as well as assessing risk to a development, an FRA should consider the risk of flooding arising from a development.

Greenfield and undeveloped sites rely on natural drainage to convey or absorb rainfall. In general, site development reduces the permeability of the site, increasing the rate of water running off the site to nearby watercourses, potentially increasing flood risk to downstream areas. Therefore appropriate drainage arrangements are required for new developments to ensure that flood risk to others is not increased.

According to the Flood Risk and Coastal Change Planning Practice Guidance, the surface water arrangements for any development site should be such that the peak flow rates of surface water leaving a developed site are no greater than the rates prior to the Proposed Development, unless specific off-site arrangements are made and result in the same net effect. In addition, surface water arising from a development site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the Proposed Development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account. The following sections of the drainage strategy establish the hydraulic capacity of the existing outfalls that serve the Site and provide details of SuDS that are required to ensure that the Proposed Development will not increase the peak rate of surface water discharged from the Site.

Building Regulations Part H 2015 states that surface water shall be discharged by one of the following methods 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 reasonable practicable,
- c. a sewer.

Where possible, this hierarchy has been followed as described in the following sections.

1.2 Disposal of surface water via Infiltration

The information contained within the WSP| Parsons Brinckerhoff UK (WSP) Ground Investigation Report (GI) indicates the presence of shallow ground water at approx. 0.55m to 2.54m below ground level. In general the soil types that are typically unsuitable for infiltration features, including Lambeth Clay with overlying superficial deposits and made ground. The GI also performed two infiltration tests, both of which stopped at 180 minutes which showed a very slow infiltration rate for the first 20 minutes, showing a reduction in water depth of approx. 30mm, after which no further infiltration or reduction in the water depth was noted. Based on these results the Drainage Strategy will preclude the use of infiltration drainage features.

The surface water drainage strategy has therefore progressed on the basis of providing positive outfalls to suitable existing surface water sewer or watercourse.

1.3 Proposed Discharge Rates and Greenfield Rates

The Proposed Development occupies an area of the existing Chichester University site that is currently undeveloped. It is expected that the existing Site drains via natural processes, with an element of the runoff being absorbed into the ground while the remainder of the runoff is able to escape the Site along paths most conducive to surface water flow. This is generally expected to be from north to south toward an existing surface water ditch which runs along the southern perimeter of the Site. The existing site predominately falls at 1:300 to the south with 1:400 fall towards the eastern perimeter where an existing cut off ditch is present. Both drainage ditches

convey runoff to the southeast corner of the Site where the ditch crosses beneath the B2259 and discharges to the River Lidsey Rife.

Based on the existing site conditions, in order to ensure that the proposed development mimics the existing regime and does not result in an increase in surface water drainage discharged, the proposed discharge rates will be limited to the Greenfield rates.

The total area within the Site boundary is 0.39ha however the total drained area is 0.267ha, comprising of a proposed student accommodation building, a lined detention basin, adjacent soft landscaping and a provision for a future accommodation block. The remainder of the Site area will be either staying as undeveloped landscaped surfaces or have a negligible surface area therefore will drain to the permeable landscaping and any resultant flows will be intercepted by the existing ditch, as per the undeveloped regime.

Existing Greenfield runoff rates have been calculated for the Site using the Source Control module of MicroDrainage software (ICP SUDS – FSR Method). The model has been subjected to simulated rainfall events for the 1 in 1, 1 in 30 and 1 in 100 year events.

The Greenfield rate calculation results are tabulated in the following table:

Table 1-0: Greenfield Runoff Rates for the Site

Return Period (Years)	Greenfield Runoff Rates (l/s)
1	0.8*
30	2.1*
100	3.0*
QBAR	0.9*

*Where the greenfield runoff rate is less than 5l/s the strategy proposes to use 5l/s minimum.

To meet the BREEAM excellent criteria the proposed runoff rates for the surface water drainage networks must be restricted to the QBAR Greenfield runoff rates, however Section 12, Pol03 of the BREEAM Technical Manual states 'where the limiting discharge flow rate would require a flow rate of less than 5L/s at a discharge point, a flow rate of up to 5l/s may be used where required to reduce the risk of blockage'. Details of the calculations are included within Appendix A. The areas specified in the section above are detailed on drawings within Appendix A.

1.4 Proposed Surface Water Infrastructure

A preliminary proposed drainage network has been developed to determine the feasibility of draining the proposed student accommodation buildings and achieving an outfall into the existing surface water ditch located south of the site. A network has not been developed for the future student accommodation building, however the estimated runoff produced by the building area will be included in the attenuation calculations to future proof the drainage strategy.

The networks will be designed to cater for all storms up to and including the 100 year events with an allowance of 40% additional runoff for climate change. The networks will include attenuation in the form of a detention basin to allow the runoff rates to be limited to those detailed in Section 1.3. Where these flows are smaller than the lowest practical flow rates that can be achieved by vortex flow controls without undue risk of blockages, a minimum flow rate will be agreed with the EA prior to further stages of design. The industry-accepted minimum rate is 5 l/s, therefore when the greenfield runoff rate is less than 5l/s as shown in Table 1-0, the strategy recommends that 5l/s is used. 1-0

The proposed drainage network will include pipes and chambers laid around the perimeter of the proposed building, accepting surface water flows from the rainwater pipes. The network has been designed to allow the appropriate cover to all pipes for protection against expecting loading and the gradients to achieve self-cleansing velocities of at least 1m/s full bore conditions. Drawings included within Appendix B shows the indicative layouts of the proposed network.

The surface water flow from the proposed drainage network will be controlled with a vortex flow control chamber to limit the surface water discharged from the site to the rates stated in Section 1.3 above.

As the source of the surface water run off accepted by the proposed drainage network is from roof areas, the use of pollution prevention features is not required. However it is recommended the proposed drainage network includes catchpits downstream of the detention basin to intercept silt therefore reducing the risk of blockages in the downstream network, particularly the vortex flow control chamber.

The proposed surface water network has been modelled in Micro Drainage applying sufficient attenuation and the results showed that there is no flooding for any of the storms.

1.5 Attenuation

Attenuation features will be implemented within the drainage networks to achieve the following:

1. Provide sufficient volume to store the balance of runoff between that generated from the critical storm event and the discharge rates set in section 1.3.
2. Provide filtration to the runoff in order to ensure that silt and pollutants are intercepted as far as practicable prior to release of the runoff to offsite sewers.
3. Provide amenity space that encourages residents to use the outdoor space safely.
4. Provide a means to develop the biodiversity credentials of the Site.

Typically the site falls from towards the southern boundary with an average gradient of 1:300, favourable to open water features such as swales and detention basins. By utilising a vegetated open water feature the proposed drainage strategy can achieve all the objectives outlined above. From a technical perspective, by incorporating an open water feature the attenuation can be positioned high in the ground allowing the site to achieve an outfall into the very shallow existing surface water ditch.

The total drained area including the proposed student accommodation, future student accommodation and the proposed basin area has been estimated at 2667m². Using the rates shown in Table 1-0 the attenuation requirement has been calculated providing an approximately volume of up to 170m³ (using the Source Control module of Microdrainage software and the Quick Storage Estimate tool) as detailed in the calculation contained within Appendix A

This volume is provided within a single detention basin located south of the proposed student accommodation building. The base level of the proposed detention basin has been calculated at approx. 0.100m AOD. The proposed drainage network has been modelled using Microdrainage software and shows a water depth of approximately 0.5m in the 1 in 100 year event creating an associated freeboard of 0.70m assuming an adjacent ground level of 1.300m AOD. Refer to Calculations in Appendix A.

With a proposed total depth of 1.2m the basin is capable of attenuating approximately 300m³, with no allowance for freeboard. The FRA has identified a high groundwater table, it is therefore recommended that the basin will be lined with an impermeable membrane to avoid the ingress of ground water. Any associated earthworks will be designed with side slopes no steeper than 1:4 to facilitate access for maintenance as well as use by residents during dry spells. Future design of the detention basin will be progressed in a manner to protect the liner from flotation.

1.6 Maintenance and Adoption

The proposed surface water drainage infrastructure serves one curtilage and therefore is unlikely to be adopted. With this in mind the drainage shall be designed in accordance with Building Regulations Part H and the relevant British Standards to provide drainage systems that are suitable the Proposed Development and can be accessed and maintained as required.

Gullies and linear channels will include sump units to capture silt and reduce the likelihood of blockages further downstream. The chambers at strategic locations along the network will also include sumps. The flow control devices will include bypass doors that can be activated in the event of a blockage.

The detention basin will require maintenance as detailed in the extract from the SuDS Manual below:

TABLE 22.1 Operation and maintenance requirements for detention basins		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseedling or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

1.7 Proposed Surface Water Outfall and Offsite Drainage

The proposed drainage network described within Section 1.4 will outfall into an existing surface pipe located southeast of the proposed accommodation building. The connection will be made by construction a new chamber onto the existing pipe as shown on drawing UOCC-ACM-XX-05-DR-DR-00001 within Appendix B. The existing pipe is 300mm diameter laid at 1:300 providing a design capacity of 60l/s. As shown on WSP drawing 0938-D-106-B the existing surface water drainage network is limit via a flow control device upstream of the proposed connection point. WSP drawing 0938-D-106-B indicates the peak flow is restricted to 5l/s. The proposed flow control serving the proposed surface water network restricts to a peak rate of 5l/s, therefore the combined flow through the existing 300mm pipe will be 10l/s peak, confirming that the existing pipe can accept the proposed flows arising from the Proposed Development.

Upon review of the topographical survey, the existing 300mm pipe discharges to an existing surface water ditch located along the southern boundary of the Site. From this outfall it is understood that the existing surface water ditch will convey flows east towards the B2259. It is assumed that the ditch enters a culvert below the B2259, which then discharges back into a ditch east of the highway. The ditch appears to convey runoff east, ultimately discharging into the River Lidsey Rife.

It is recommended that a survey is undertaken to assess the condition of the existing surface water ditch and the culvert running beneath the B2259 to determine if any remedial works are required to improve capacity and conveyance to reduce the flood risk.

1.8 Foul Water Drainage

1.8.1 Existing Infrastructure

The Site has an existing foul water sewer running from west to east along the southern boundary. At the southeast corner of the Site the existing foul sewer turns south leaving the Proposed Development. The existing foul water pipe is owned by Southern Water therefore consent to connect and a pre development enquiry will be required to confirm the connection point and the capacity of the existing sewer.

1.8.2 Foul Water Discharge Connection Point

The proposed connection point to serve the foul water network is manhole S106/SWFW 4604 which is south of the proposed building at National Grid Reference SZ944996. The existing connection manhole has a cover level of 1.380m and an invert level of 0.180m.

1.8.3 Proposed Infrastructure

The proposed foul drainage network will include pipes and chambers around the perimeter of the proposed building, accepting soil vent pipes (SVP). The network has been designed to allow the appropriate cover to all pipes for protection against expecting loading and the gradients to achieve the required self-cleansing velocities. A preliminary assessment of the drainage invert levels and gradients has been undertaken that shows the proposed foul water drainage network can drain via gravity to the existing network on site. Drawings included within Appendix B show the indicative layout of the proposed foul water network.

2. Summary

The Drainage strategy has concluded the following:

- In accordance with the flood risk vulnerability table, the Proposed Development is classified as 'More Vulnerable' and is permitted within Flood Zone 3a therefore requiring a 40% climate change factor.
- The Proposed Development has a high groundwater table therefore infiltration features have not been considered.
- QBAR runoff is 0.9l/s therefore the Proposed Development will use 5l/s, the minimum practical discharge rate via a vortex flow control device.
- The Proposed Development will cause the impermeable area within the Site to be increased. Sustainable Drainage Systems will be required to ensure that the Proposed Development will not cause the peak rate of surface water discharge from the Site to be increased. An outline drainage strategy has been developed in order to demonstrate that sufficient space is available within the development to attenuate within a detention basin and discharge at 5l/s for all events up to and including the 1 in 100 year event with a 40% allowance for climate change. The SuDS features that have been selected include a detention basin in order to maximise opportunities for landscape and ecological enhancement. The attenuated discharge will be conveyed to the provide 300mm pipe southeast of the proposed building.
- The proposed foul drainage network which serves the Proposed Development will include pipes and chambers around the perimeter of the proposed building and will be discharging to S106/SWFW 4604 manhole which is south of the proposed building.

- The proposed detention basin has been designed with additional capacity in order to accept overland flood flows above the design criteria of a 100 year storm event + 40% for climate change. If the capacity of the detention basin were to be exceeded, the ground levels fall from north to south, away from the proposed buildings, directing exceedance flows to an existing ditch along the southern boundary of the Proposed Development. Levels around the proposed buildings should be designed to direct overland flows towards the detention basin.
- A Pre-Planning Enquiry will be required to assess the capacity of the existing foul water sewer.
- Capacity within the existing sewers cannot be reserved, therefore it is recommended that as the Proposed Development and foul water drainage design evolves, Southern Water should be consulted to confirm the acceptability of the proposed rates, capacity of the receiving existing sewer and the most suitable connection location. The same consideration should be given to the surface water connections and capacity checks.

Appendix A Calculations

Chichester University Student Accommodation Greenfield Micro Drainage Calculations

Greenfield Run off Rates using the ICP SUDS Module of the Rural Runoff Calculator:

ICP SUDS

ICP SUDS Input (FGF Method)

Return Period (Years): 100

Area (ha): 0.267

SAAR (mm): 714

Soil: 0.400

Growth Curve: (None)

Partly Urbanised Catchment (QBAR)

Urban: 0.000

Region: Region 7

Calculate

Results

QBAR rural (l/s): 0.9

QBAR urban (l/s): 0.9

Return Period Flood

	Region	QBAR (l/s)	Q (100 yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
ICP SUDS	Region 1	0.9	2.3	0.8	1.8	2.3
	Region 2	0.9	2.4	0.8	1.8	2.4
ADAS 345	Region 3	0.9	1.8	0.8	1.6	1.9
	Region 4	0.9	2.4	0.8	1.8	2.4
FEH	Region 5	0.9	3.3	0.8	2.2	3.3
	Region 6/Region 7	0.9	3.0	0.8	2.1	3.0
Greenfield Volume	Region 8	0.9	2.2	0.7	1.8	2.2
	Region 9	0.9	2.8	0.8	1.6	2.8
Greenfield Volume (ReFH2)	Region 10	0.9	1.8	0.8	1.6	1.9

OK Cancel Help

Enter Return Period between 1 and 1000

Attenuation volume calculation using the Quick Storage Estimate tool:

Quick Storage Estimate

Results

Global Variables require approximate storage of between 115 m³ and 170 m³.

These values are estimates only and should not be used for design purposes.

Variables

Results

Design

Overview 2D

Overview 3D

Vt

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

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Date 19/11/2018 15:32
File SURFACE WATER MODEL.MDX
XP Solutions

Designed by stamatia.kantziari
Checked by
Network 2018.1



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Existing

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)

1000

M5-60 (mm)

19.000

Ratio R

0.350

Maximum Rainfall (mm/hr)

50

Maximum Time of Concentration (mins)

30

Foul Sewage (l/s/ha)

0.000

Volumetric Runoff Coeff.

0.750

PIMP (%)

100

Add Flow / Climate Change (%)

0

Minimum Backdrop Height (m)

0.200

Maximum Backdrop Height (m)

1.500

Min Design Depth for Optimisation (m)

1.200

Min Vel for Auto Design only (m/s)

1.00

Min Slope for Optimisation (1:X)

500

Designed with Level Soffits

Network Design Table for Existing

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
E1.000	8.434	0.056	150.6	0.010	1.00	0.0	0.600	o	225	Pipe/Conduit	⚡
E1.001	39.291	0.262	150.0	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	⚡
E1.002	9.979	0.067	148.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	⚡
E1.003	8.009	0.053	151.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	⚡
E1.004	4.891	0.033	148.2	0.022	0.00	0.0	0.600	o	225	Pipe/Conduit	⚡
E1.005	4.891	0.033	148.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	⚡
E1.006	14.681	0.098	149.8	0.184	0.00	0.0	0.600	o	400	Pipe/Conduit	⚡
E1.007	14.681	0.098	149.8	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	⚡
E1.008	22.673	0.113	200.6	0.014	0.00	0.0	0.600	o	300	Pipe/Conduit	⚡
E1.009	20.289	0.203	100.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	⚡
E2.000	23.632	0.158	149.6	0.021	1.00	0.0	0.600	o	150	Pipe/Conduit	⚡

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
E1.000	50.00	1.13	0.797	0.010	0.0	0.0	0.0	1.06	42.3	1.4
E1.001	50.00	1.75	0.851	0.026	0.0	0.0	0.0	1.07	42.4	3.5
E1.002	50.00	1.90	0.889	0.026	0.0	0.0	0.0	1.07	42.5	3.5
E1.003	50.00	2.03	0.922	0.026	0.0	0.0	0.0	1.06	42.2	3.5
E1.004	50.00	2.10	0.967	0.048	0.0	0.0	0.0	1.07	42.6	6.5
E1.005	50.00	2.18	0.935	0.048	0.0	0.0	0.0	1.07	42.6	6.5
E1.006	50.00	2.34	0.977	0.232	0.0	0.0	0.0	1.54	193.5	31.4
E1.007	50.00	2.50	0.977	0.232	0.0	0.0	0.0	1.54	193.5	31.4
E1.008	50.00	2.84	0.977	0.246	0.0	0.0	0.0	1.11	78.2	33.3
E1.009	50.00	3.05	0.985	0.246	0.0	0.0	0.0	1.57	111.1	33.3
E2.000	50.00	1.48	0.980	0.021	0.0	0.0	0.0	0.82	14.5	2.8

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<u>Network Design Table for Existing</u> <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>I.Area (ha)</th><th>T.E. (mins)</th><th>Base Flow (l/s)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th><th>Section Type</th><th>Auto Design</th></tr><tr><td>E1.010</td><td>14.953</td><td>0.150</td><td>100.0</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td><td></td></tr><tr><td>E1.011</td><td>6.588</td><td>0.066</td><td>100.0</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>150</td><td>Pipe/Conduit</td><td></td></tr></table> <u>Network Results Table</u> <table><tr><th>PN</th><th>Rain (mm/hr)</th><th>T.C. (mins)</th><th>US/IL (m)</th><th>Σ I.Area (ha)</th><th>Σ Base Flow (l/s)</th><th>Foul (l/s)</th><th>Add Flow (l/s)</th><th>Vel (m/s)</th><th>Cap (l/s)</th><th>Flow (l/s)</th></tr><tr><td>E1.010</td><td>50.00</td><td>3.21</td><td>-0.338</td><td>0.267</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.57</td><td>111.1</td><td>36.2</td></tr><tr><td>E1.011</td><td>50.00</td><td>3.32</td><td>-0.337</td><td>0.267</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.00</td><td>17.8</td><td>36.2</td></tr></table>												PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design	E1.010	14.953	0.150	100.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		E1.011	6.588	0.066	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit		PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	E1.010	50.00	3.21	-0.338	0.267	0.0	0.0	0.0	1.57	111.1	36.2	E1.011	50.00	3.32	-0.337	0.267	0.0	0.0	0.0	1.00	17.8	36.2
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Summary of Critical Results by Maximum Level (Rank 1) for Existing

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 2160, 2880, 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
E1.000	ESW01	15 Summer	100	+40%					0.787
E1.001	ESW02	15 Summer	100	+40%					0.753
E1.002	ESW03	120 Winter	100	+40%					0.573
E1.003	ESW04	120 Winter	100	+40%	100/60 Winter				0.570
E1.004	ESW05	180 Winter	100	+40%	100/60 Winter				0.568
E1.005	EFAKE01	60 Summer	100	+40%					0.460
E1.006	EINLET	180 Winter	100	+40%	100/60 Winter				0.567
E1.007	EFAKE02	180 Winter	100	+40%	100/60 Winter				0.565
E1.008	EOUTLET	180 Winter	100	+40%	100/30 Summer				0.589
E1.009	ESW06	180 Winter	100	+40%	30/60 Winter				0.610
E2.000	ESW09	180 Winter	100	+40%	1/60 Winter				0.594
E1.010	ESW07	180 Winter	100	+40%	1/60 Winter				0.610
E1.011	ESW08	15 Winter	100	+40%					-0.328

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
E1.000	ESW01	-0.145	0.000	0.25		8.3		OK	
E1.001	ESW02	-0.123	0.000	0.40		15.9		OK	
E1.002	ESW03	-0.041	0.000	0.14		5.1		OK	

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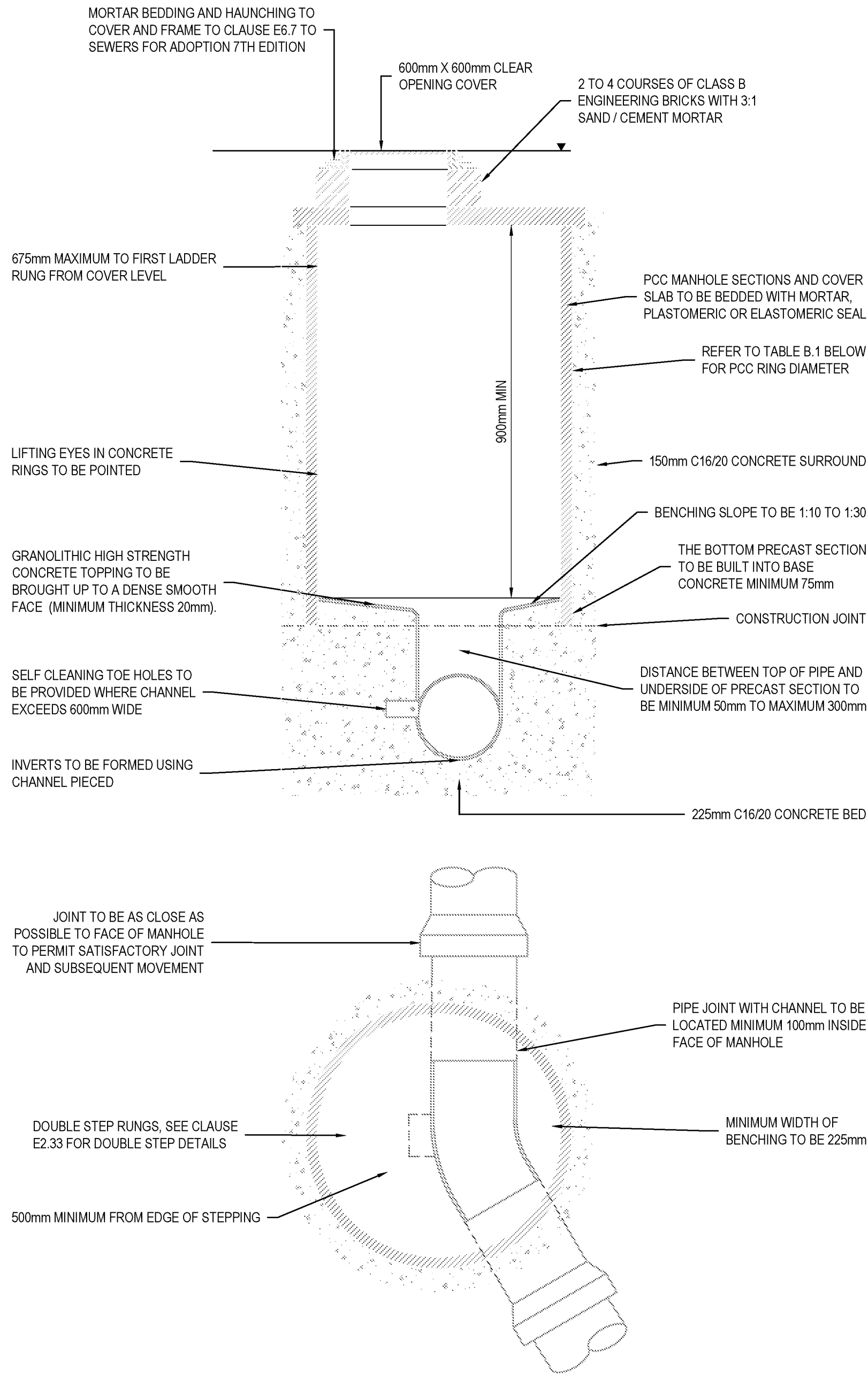
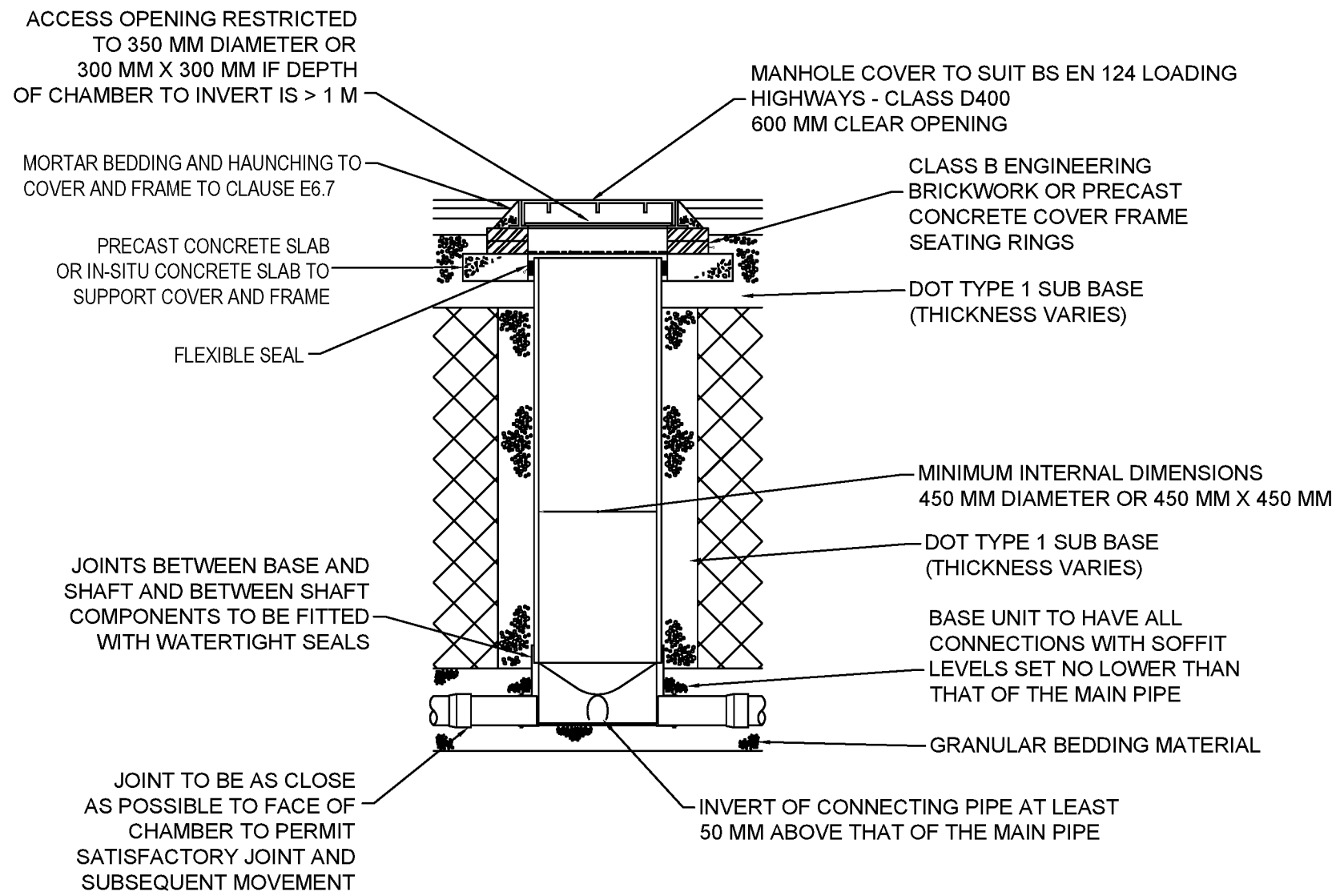
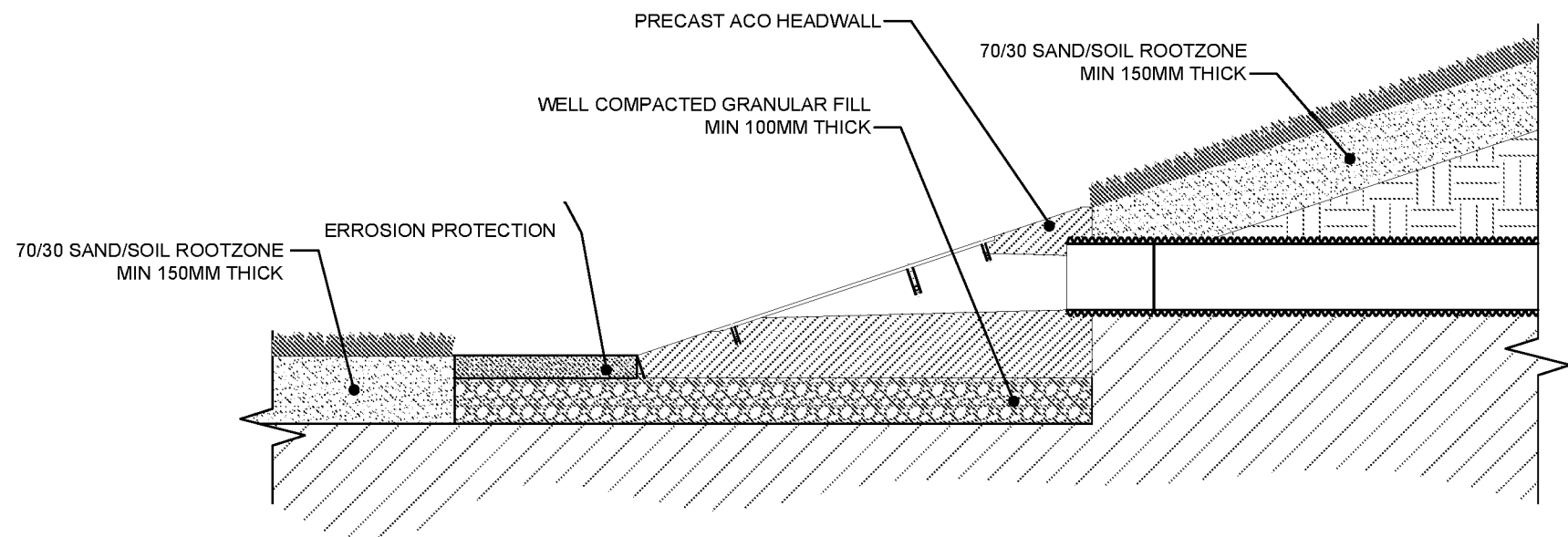
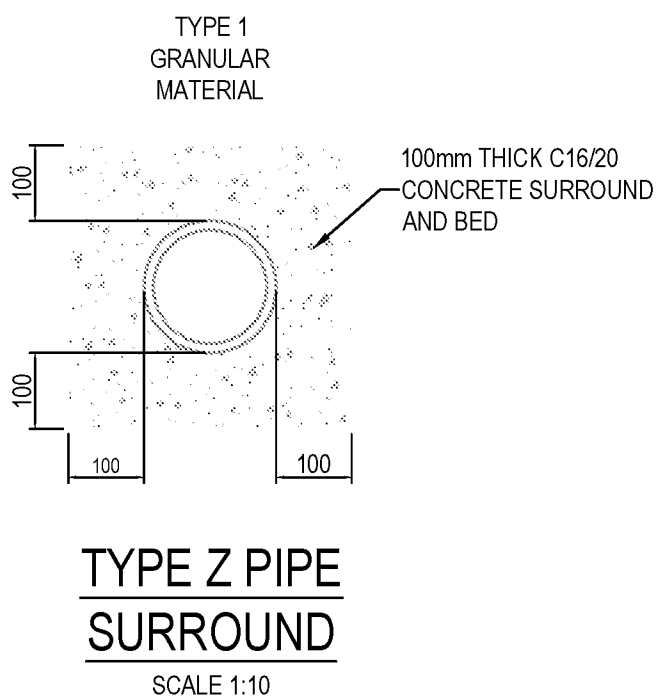
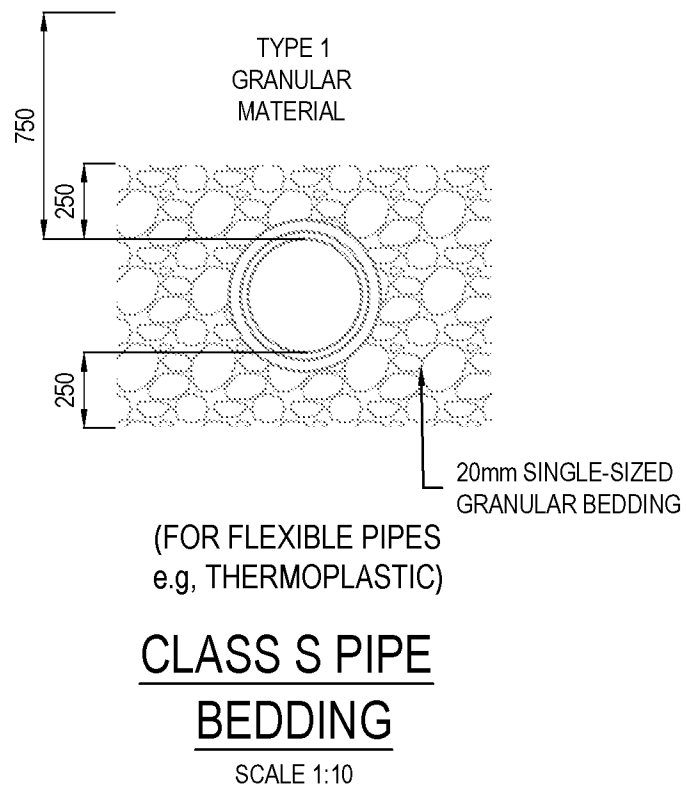
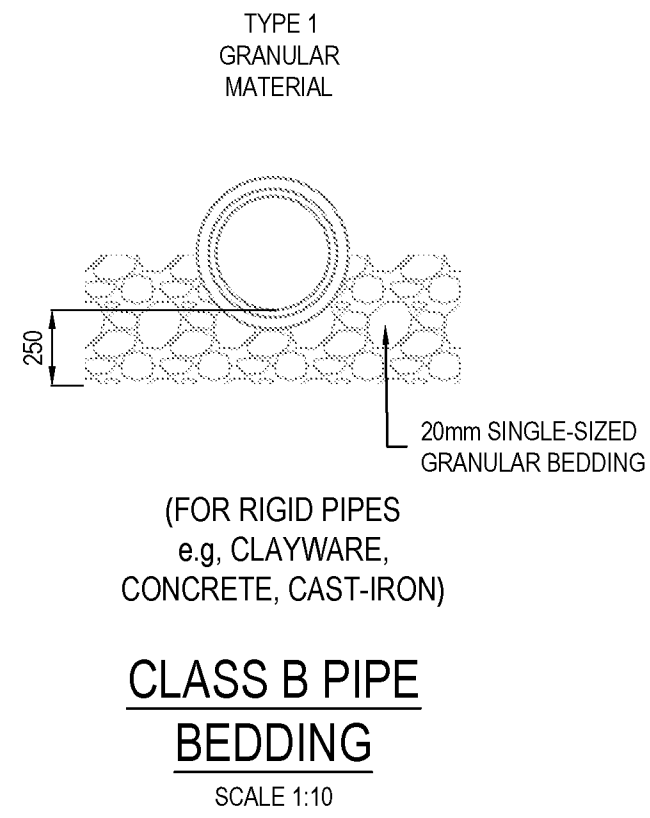
Summary of Critical Results by Maximum Level (Rank 1) for Existing

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
E1.003	ESW04	0.023	0.000	0.15		4.9	SURCHARGED	
E1.004	ESW05	0.076	0.000	0.22		6.5	SURCHARGED	
E1.005	EFAKE01	0.000	0.000	0.63		18.8	SURCHARGED*	
E1.006	EINLET	0.090	0.000	0.23		32.0	SURCHARGED	
E1.007	EFAKE02	0.088	0.000	0.09		12.5	SURCHARGED*	
E1.008	EOUTLET	0.212	0.000	0.12		8.5	SURCHARGED	
E1.009	ESW06	0.345	0.000	0.07		6.6	SURCHARGED	
E2.000	ESW09	0.524	0.000	0.21		2.9	SURCHARGED	
E1.010	ESW07	0.548	0.000	0.05		5.0	SURCHARGED	
E1.011	ESW08	-0.091	0.000	0.33		5.0		OK

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Appendix B Drainage Drawings

ISO A1 594mm x 841mm
Approved: N/A
Created: N/A
Designed: N/A
Project Management Initials:
Last Saved: 19/11/2018 14:56:14
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DIAMETER OF LARGEST PIPE IN MANHOLE (mm)	INTERNAL DIAMETER OF MANHOLE (mm)
150 - 375mm	1200
450	1350
455 - 525	1500
555 - 675	1500
690 - 900	1800

TABLE B.1 MANHOLE DIAMETER

PIPE DIA.	ROCKER PIPE LENGTH
600mm	0.6m
675-750mm	1.0m
>825mm	1.25m

TABLE 2

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PROJECT

Chichester University

CLIENT

CONSULTANT

AECOM Infrastructure & Environment UK Lt
Midpoint, Alencon Link,
Basingstoke, Hampshire, RG21 7PP
+44 (0)1256 310 200 tel
+44 (0)1256 310 201 fax
www.aecom.com

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KEY PLAN

PROJECT NUMBER

60580070

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STANDARD DETAILS

SHEET NUMBER

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