DRAINAGE STRATEGY

Hoyland Common

NK020040
HOYLA-RPS-SI-D-RP-DS01
Drainage Strategy
P06
March 2022

rpsgroup.com

Quality Management

Version	Status	Authored by	Reviewed by	Approved by	Review date
P01	First Issue - DRAFT	J Barttram	S.McLean	S.Green	22/05/20
P02	Planning Issue	J.Barttram	S.McLean	P.Adcock	11/06/20
P03	Planning Issue	J.Barttram	S.McLean	P.Adcock	16/06/20
P04	Planning Issue- Revised	J.Barttram	S.McLean	P.Adcock	23/07/20
P05	Planning – Basin Updates	A.Evans	S.McLean	S.Hall	09/04/21
P06	Planning update	S.McLean	A.Evans	S.Hall	02/03/22

Approval for issue

Steve Hall	SH	2 March 2022

File/Model Location

Document location:	N:\200\40\Reports\Drainage\Infrastructure
Model / Appendices location:	N:\200\40\Reports\Drainage\Infrastructure

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1 INTRODUCTION

1.1.1 RPS Group has been commissioned by Newlands to prepare the drainage strategy for its site in Hoyland, near Barnsley to support the Hybrid planning application for a development of employment uses (B1, B2 and B8), new link road, associated works including provision of internal access roads, drainage and landscaping

- Outline with all matter reserved apart from means of access for up to 71,515 sq. m of employment uses (B1, B2, B8)
- Full application for 31,568 sq. of B8, new link road including new roundabout to link with Hoyland south Masterplan Area (Local Plan references HS68, HS65, HS61, HS58, HS6, SL5)

1.1.2 The proposed development comprises of a National distribution centre with accompanying haulage, operational and parking areas, alongside multiple open plots for other commercial developments and a single plot for a proposed residential development indicated within the regional council's local plan, refer to drawing **HOYLA-RPS-SI-XX-DR-D—0330 in Appendix A**

In addition to the proposed development above, is the requirement for further accompanying infrastructure, including a major highway reconfiguration for the diversion of the A6135/Sheffield road to access the development plots and a significant drainage scheme to cater for the storm water and foul water generated as a result of the development and the new hardstanding areas. This report specifically reviews the main segment of the proposed drainage infrastructure which includes the drainage within the highway, and the main carrier drainage which conveys storm water to the outfalls at the southern development boundary. This report will not define the strategies for each individual development plot.

1.1.3 The purpose of this report is to confirm the strategy for the foul and surface water drainage systems within the site plan. This report has been prepared in conjunction with a Flood Risk Assessment, RCEF76268.

1.1.4 The contents of this report are to be read in conjunction with all supporting drawings and/or documents referenced herein, appended to this report or submitted in support of the Outline Planning Application for this development.

1.2 Site Location and Extents

1.2.1 The proposed development site is located approximately 6.5km to the south of Barnsley city centre in Yorkshire, at National Grid reference 435439, 399598

1.2.2 The area of the proposed development encompasses an area of a total of 50 ha that extends for a length of around 2km from the proposed diversion of the existing highway (A6135) at the northern end of the site at Tankersley Roundabout, to the southern outfall of the proposed drainage infrastructure, to the east of Tankersley park.

2 EXISTING SITE

2.1 Description

2.1.1 The site from the proposed Hoyland development is located approximately 6.5km south of Barnsley, directly adjacent to the east of junction 36 of the M1 motorway. Approximate National Grid coordinates for the site are 435439mE, 399598mN. The proposed development site comprises of an area of approximately 50 hectares. The existing site currently has several points of access, primarily via Tankersley Lane, Black Lane or Sheffield Road (A6135) which all pass-through different segments of the developable land.

2.1.2 The existing site currently encompasses several areas which have a variety of land uses. At the northern end of the site (directly adjacent to M1 junction 36 and to the north of Tankersley lane), the land is currently utilised for agricultural purposes and sport and leisure events, which include the use of existing football and cricket pitches. At the southern end of the site, the land is predominately agricultural.

2.1.3 The topographical survey for the developable land was undertaken was undertaken in 3 separate phases, with the latest two phases undertaken by Ellam Land Surveys in March 2019 and February 2020. According to the survey there is a general fall in ground level from East to West across the majority of the proposed development site.

2.1.4 In order to facilitate construction of the proposed commercial developments, it will be necessary to undertake preliminary earthworks to build-up the existing ground levels to create level areas for the construction of commercial units. The required earthworks would primarily be required in the eastern plots where the existing ground levels fall away significantly from east to west.

2.1.5 Geotechnical survey reports have been produced by Applied Geology and form part of this planning submission, reference AG3080-19-AK21 and AG3080-19-AK36

2.2 Existing Drainage Features

2.2.1 Following desktop study and site investigations, it is understood that the existing site has 6 outfall points discharging surface water. These are denoted as follows:

1. Motorway Drain A – this appears to link into the Birdwell Roundabout Attenuation built for the road and collects the existing field run-off within a perimeter French drain
2. Motorway Drain B – this appears to be a low point collecting water from the field and a low ditch collecting from Tankersley Road, this then opens into the field and follows the field boundary to the outfall point. Although no formal outfall could be seen in the dense vegetation but did show signs of ponding water but no water present.
3. Motorway Drain C – this appears to be a low ditch discharging towards the motorway but with no formal c evidence of how it was connected
4. Motorway Sheet flow – the field south of Tankersly Lane also included a low point that shed flows of water onto the motorway which had a series of gullies collecting it
5. South Eastern Outfall in a 400mm culvert that runs by Sheffield road and connects to a culvert under Sheffield road towards the old Quarry
6. South Western outfall appears to be a series of ditches and culverts through the Bell Ground woods and the field to the south, eventually entering the Western culvert under the railway to the south and entering the Harley Dike

2.2.2 The South Eastern catchment, which includes existing drainage from properties on the perimeter of the site, collects approximately 26.1Ha of the proposed development site and connects to the Harley Dike down the eastern edge of the site in an existing Culvert. The Culvert is identified as 400mm on the topographic survey. This culvert is believed to become above ground about 180m to the south beyond the Parkside Farm. This channel then goes below ground and then crosses Sheffield road to a connection by the old Quarry. This then connects into Harley Dyke further upstream.

The South Western catchment collects approximately 16.789Ha of the proposed development site, this is then funnelled by walls and a shallow ditch to the woodland area where it then appears to sheet flow and funnel through low sections of the topography to the Western Culvert and into Harley Dike

The Northern catchment is split into two outfalls, both appearing to connect to the existing Highway drains. As the site is re-levelled it is proposed to only retain these connections for the remaining green infrastructure on the embankments on the new highway and outside the revised plot areas, to the Motorway Drain A with site area. This will be a substantial reduction on existing flows from the field currently entering these drains

2.3 Geology and Ground Conditions

2.3.1 At present, geotechnical investigations of the development site include basic desktop study, and topsoil analysis report carried out by TIM O'HARE ASSOCIATES in March 2020. The topsoil report has confirmed that the topsoil across site generally comprise of a variety of clay soils. It was noted that the samples collected by the analysis appeared to have undergone structural degradation (albeit this may have been in part caused by damage to the soil during sampling when the soil was wet), and this could indicate that the soils are likely to suffer from a "*lack of drainage and insufficient aeration, particularly in a wet and plastic state*" (TIM O'HARE 2020).

2.3.2 Applied geology Geotechnical survey reports have been produced and form a separate part of this planning submission, reference AG3080-19-AK21 and AG3080-19-AK36

2.4 Infiltration

2.4.1 Based on the Applied Geology geotechnical information available, the site is showing typical infiltration rates with very low infiltration rates not adequate for the use of soakaways. Therefore, at this stage the proposals for the outline drainage strategy is based upon the assumption that there will be no infiltration from the site. However, BRE Digest permeability testing will need to be scheduled to confirm whether the site has any areas viable for surface water infiltration.

2.5 Flood Risk

2.5.1 According to the Flood Risk Assessment, (RPS Report RCEF76268 included as a separate report as part of the Planning application)**.** The site is in a Low Flood Risk Zone (as shown on the EA website);

- As the site is within Flood Zone 1 and is therefore considered to have less than 1 in 1000 annual probability of fluvial flooding.
- There are some small areas of surface water flooding shown within the site, however, these will largely be altered and collected by the development and development drainage.

The risk of flooding from groundwater is considered to be low; the investigative work carried out by Applied Geology did not encounter significant amounts of groundwater.

2.5.2 The SuDS being proposed.

- For all the proposed plots along with the majority of the road, surface water will be stored within an attenuation Basin located at the southern end of the site, discharged at the QBAR discharge rate based only on the area of contributing catchment for the South western ditch located to the south of the site.
- Surface water attenuation will be provided for events up to the 1 in 100 year plus 30% allowance for climate change as required by BMBC.

2.6 Proposed Development

2.6.1 Primarily it is proposed that the Hoyland development scheme will create a new central UK hub and distribution centre for Hermes courier service. In addition, it is anticipated that the development will facilitate the opportunity and expansion for both Hermes and non-Hermes related commercial business within the district of Hoyland.

The overall development is proposed to be divided into five different plot areas as follows:

- The main plot area for Hermes distribution centre
- Four separate commercial plots for other businesses
- And a separate plot for residential expansion (highlighted within the district council's local plan)

3 DESIGN CONSTRAINTS / PARAMETERS

3.1 Surface Water Drainage Design Constraints

3.1.1 Constraints placed on the design of surface water drainage serving the proposed development are as follows:

- For greenfield developments within the Barnsley metropolitan district, the peak rate of run-off from the development to any surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield run-off rate for the same event. Therefore, the surface water discharge rate for all storms up to and including the 1 in 100-year return period, with an additional 30% allowance for future climate change will be limited to Qbar. The discharge rates are subject to approval from Barnsley metropolitan district, as Lead Local Flood Authority (LLFA) and the Environment Agency.
- Storm simulations are to be carried out using Flood Studies Report (FSR) rainfall data for all events as agreed with BMBC
- Infiltration is considered to be unviable (see 2.4 above), so it is proposed to convey storm water to the Western culvert an into Harley Dike – It is proposed that the for the surface water from the southern catchment will pass through this outfall after passing through a series of proposed storage Basin, subject to Environment Agency approval.
- On the residential development parcel, impermeable catchments are assumed to be 60%
- Attenuation features to be designed to have 300mm freeboard over the critical 1:100 year + climate change water level.
- The surface water drainage design has been carried out in accordance with C753 'The SuDS Manual', 'Sewage Sector Guidance Appendix C, the Flood and Water Management Act 2010 and any additional requirements set out Barnsley Metropolitan Borough Council (as Lead Local Flood Authority – LLFA), the Environment Agency and the Local Water Authority.

3.2 Surface Water Hydraulic Design Variables

3.2.1 The proposed surface water drainage design has been carried out using the industry standard MicroDrainage software suite, incorporating the following parameters;

- Catchment Area: approximately 50 ha; contributing impermeable area 47Ha
- FSR Data
- FSR Rainfall Model - England & Wales
- PIMP (%) 100
- M5-60 (mm) 19.000
- Ratio R 0.362
- Maximum time of Concentration (mins) 30
- Volumetric Runoff Coefficient 0.750
- Design return periods: 1 in 1, 1 in 30 & 1 in 100 year
- Climate change: Rainfall profiles increased by 30% during the 1 in 100-year event.
- CV (proportion of rainfall forming surface water run-off): Summer 0.75, Winter 0.84
- Maximum allowable discharge rate, refer to **Appendix B** (Qbar, based on contributing area from UK SUDS):
  - Southern Catchment area = 16.789Ha – 82.41l/s
- Ignore infiltration for peak flow design.

3.2.2 The new surface water drainage systems have been designed to satisfy the following criteria;

i) No surcharging to be permitted during the critical 1 in 1-year return period;

ii) No flooding to be permitted during the critical 1:30 year return period;

iii) Controlled flooding may be permitted during the critical 1 in 100-year return period, with an additional 30% allowance for future climate change.

The proposed drainage system has been modelled as a network within MicroDrainage and simulations have been run for the 1:1, 1:30 and 1:100-year return period, the latter with an additional 30% allowance for future climate change. The MicroDrainage calculations can be found in **Appendix C**.

4 PROPOSED SURFACE WATER DRAINAGE STRATEGY

4.1 Discharge Rates

4.1.1 Due to infiltration being considered unviable for site-wide surface water drainage disposal as discussed in 2.4.1 above, the proposed surface water drainage strategy is to restrict the post-development discharge rate to Greenfield rates for all storms up to the 1:100 year + 30% climate change event, in accordance with the Lead Local Flood Authority (Barnsley Metropolitan Borough Council) requirements. As it is proposed to discharge the flows from the southern catchment to Harley Dike via a series of storage Basins this discharge rate will also be subject to approval from the Environment Agency to ensure that flood risk is not increased downstream of the development.

4.1.2 The Hoyland development was split into two separate regions (The Northern and Southern Catchments) however based on the proposed plot layouts and the existing and proposed levels it is proposed to discharge the whole development site, into only the southern outfall;

1. Through a proposed storage basin system before discharging into the existing Western culvert joining Harley Dike (An existing EA watercourse)

Using UK SUDS, existing rural run-off rates for each of the development areas have been calculated, the UK SUDS calculations can be found in **Appendix B.**

4.1.3 The remaining green embankments surrounding the new Roads and plots are classed as Land drainage and as such cannot be connected to the adopted drainage network under Sewer Sector Guidance. To accommodate this natural flow now separated from the original land drainage network, it is proposed that a new land drain network is created to divert this flow to suitable existing land drainage outfalls across the site, as agreed with the LLFA. These new connections will offer substantially reduced catchment areas to the existing discharge locations, but will also maintain a suitable level of natural flow to maintain any downstream habitats that may be reliant on seasonal discharges of water. These drainage features are illustrated on RPS drawing **HOYLA-RPS-SI-XX-DR-CR-0511-515** included in **Appendix A**

4.2 Surface Water Drainage Strategy

4.2.1 As stated in 4.1.2 above, the catchment that will be served by the network totals approximately 50Ha. In terms of impermeable area post-development, the contributing area has been estimated based on a proposed density of

- 90% per parcel for plot 1 and 2
- 90% per parcel for plot 3, 4 and 5
- 60% for the residential plot
- 100% for all roads

4.2.2 It is proposed to install an adopted underground piped gravity system to serve the Hoyland development that will incorporate spurs into each future development plot to allow for future connections. In terms of the site wide drainage system, this is a robust approach as the plot catchments are taken into the network as single point inflows, plot with minimal allowance for the potential storage in the upstream pipe networks with plots.

4.2.3 Each system has been designed in line with 'Sewage Sector Guidance Appendix C. Cut-off filter drains will also be incorporated to deal with areas of soft landscaping that are to be reprofiled due to the earthworks operations; these filter drains will be connected to the existing land drainage in the site area and agreed with the local LLFA.

4.2.4 In order to achieve the restricted discharge rate, it will be necessary to provide attenuation storage. It is proposed that the storage within the southern catchment will be within a proposed adopted and private Basin system, constructed upstream of the outfall at the western culvert directly adjacent to Bell woods, with attenuation for the whole site provided here. The Adopted attenuation will wholly store the 1:30 year storm event with an overflow weir connecting to the private basin in the event of a storm in excess of that event.

4.2.5 Immediately downstream of the proposed storage basin system, it is intended to install a flow control, Hydro-brake or similar equivalent, that will control the flows sufficiently to ensure that even during the critical 1 in 100 year event, surface water discharge from the Southern catchment does not exceed the agreed 82.4l/s Qbar rate.

4.2.6 Down stream of the Attenuation the restricted flow will enter a cascading Swale to help remove any further diffuse pollutants, before it is directed into the Harley Dyke water course.

5 SUDS

5.1 Objectives

5.1 Surface water runoff on new developments should be managed at source, with flows controlled to mimic the natural pre-development rates to reduce downstream impact wherever possible. Water should be conveyed through SuDS components of the surface water management train to ensure effective pre-treatment and appropriate flow control prior to discharge from site, thus giving due consideration to water quality and water quantity whilst creating & sustaining better places for people and nature, local amenity & diversity.

5.2 Strategy

5.2.1 The general drainage strategy for the proposed site is based on SuDS, in accordance with CIRIA C753 'The SuDS Manual' to reduce the impact on the receiving watercourse.

5.2.2 In addition to the water flow and quality benefits, the on-site SuDS measures seek to provide biodiversity enhancements for the local environment. The nature and location of the future development would suggest a lesser importance is placed with regards to potential amenity benefits.

5.3 Water Quantity

5.3.1 Run-off from the Hoyland development will be restricted to a combined total of 82.4l/s, equivalent to the pre-development Qbar flow rate for the existing southern outfall catchment, This is substantially smaller than the total site Qbar discharge rate as the site collects and diverts flows from other catchments. This diverted flow will greatly improve the highway catchment network to the North by reducing the load from the original farm fields and sports ground.

5.3.2 This restricted discharge will be achieved on site by constructing a series of storage basin systems before the southern rail culvert crossing. As per Chapter 23 of C753 'The SuDS Manual', the attenuation will be located immediately upstream of the proposed outfalls. This feature is illustrated on RPS drawing **HOYLA-RPS-SI-XX-DR-D--0334-336** included in **Appendix A**. Discharge from the Basin is controlled via vortex flow controls installed immediately upstream of the outfalls from the site.

5.4 Water Quality

5.4.1 Surface water quality management is an important requirement for all storm drainage proposals. The proximity of Plots 1 and 2 to the existing site of bell woods as a wildlife site highlights importance to this issue on the development. With regards to the quality of the discharge from site, C753 describes a Simple Index Approach based on assessing the pollution hazard indices for a particular catchment / development and also providing indicative mitigation indices for typical SuDS features. Table 26.2 of C753 extracted below identifies pollution hazard indices for the varying land usage pertinent to this application.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Notes

1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).

2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

Based on the above, the proposed development can be broken down and categorised as follows:

Catchment	Pollution Hazard Level	TSS	Metals	Hydrocarbons
Roofs	Low	0.3	0.2	0.05
Highways	Medium	0.7	0.6	0.7
Commercial Haulage yard	High	0.8	0.8	0.9

5.4.2 However, the plots themselves will be responsible for dealing with any on plot drainage pollution issues like haulage yards, this is anticipated to be dealt with by the possible construction of appropriate class 1 Separator systems, permeable paving, filter strips and/or other appropriate methods to suit the future development uses.

5.4.3 Table 26.3 indicates indicative pollution hazard level mitigation indices for different SuDS measures

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Notes

1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.

2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.

3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.

4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.

5 See Chapter 14 for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: **http://tinyurl.com/qf7yuj7**

6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

5.4.4 Based on Tables 26.2 & 26.3 illustrated above, the Basins should provide the majority of treatment required for the run-off from the proposed infrastructure development except for hydrocarbons. However, when used in combination with a final discharge Swale and utilising trapped gullies and on plot treatment systems such as interceptors or permeable paving. this will provide enough treatment to mitigate the pollutive impact of the development on storm water drainage system.

5.4.5 In addition to the quantity and quality improvements discussed above, using basins for the attenuation storage can provide amenity benefits to the local community in the private basin, as well as biodiversity benefits to the local environment.

5.4.6 The following table provides details of the proposed water quality treatments associated with the potential pollutants from the site wide catchments;

Southern Catchment	Pollution Hazard Level	TSS	Metals	Hydrocarbons
		Pollutants		
Roofs	Low	0.3	0.2	0.05
Highways	Medium	0.7	0.6	0.7
Worse case	**Medium**	**0.7**	**0.6**	**0.7**
		Mitigation		
Basin		0.5	0.5	0.6
Remaining		**0.2**	**0.1**	**0.2**
Where the Basin alone is not enough to mitigate the potential pollutants (In particular hydrocarbons) associated with the development therefore additional mitigation is required.				
		Additional Mitigation		
Swale		0.25 (1/2 0.5)	0.3 (1/2 0.6)	0.3 (1/2 0.6)
Remaining Pollutants		**0.0**	**0.0**	**0.0**

6 MAINTENANCE

The following information indicates the typical maintenance regime that will need to be implemented by the Developer / End User to ensure continued satisfactory operation of the site drainage systems. The maintenance activities would be split into three categories, namely Regular, Occasional & Remedial, as detailed in the table below;

TABLE 32.1 Typical key SuDS components operation and maintenance activities (for full specifications, see Chapters 11–23)

Operation and maintenance activity	SuDS component												
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter drain	Modular storage	Pervious pavement	Swale/bioretention/ trees	Filter strip	Green roofs	Proprietary treatment systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter and debris removal	■	■	■	■	□	■	■	□	■	■	■		□
Grass cutting	■	■	■	■	□	■	■	□	□	■	■		
Weed and invasive plant control	□	□	□	□		□	□		□		□	■	
Shrub management (including pruning)	□	□	□	□					□	□	□		
Shoreline vegetation management	■	■	□										
Aquatic vegetation management	■	■	□										
Occasional maintenance													
Sediment management[1]	■	■	■	■	■	■	■	■	■	■	■		■
Vegetation replacement	□	□	□	□						□	□	■	
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation /repair	□	□	□	□	□	□	□	□	□	□	□	□	
Infiltration surface reconditioning				□	□	□	□		□	□	□		

Key

■ will be required

□ may be required

Notes

1 Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

Regular maintenance consists of basic tasks carried out on a frequent and predictable schedule, including inspections/monitoring, silt or oil removal (if required more frequently than once per year), sweeping of surfaces and litter/debris removal.

Occasional maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis that the regular tasks. Guidance on the components pertinent to this drainage proposal are detailed in the extracted Table 16.1 below.

Remedial maintenance comprises the intermittent tasks that may be required to rectify faults associated with system, although the likelihood of faults can be minimised by good design, construction and regular

maintenance activities. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, so timings are difficult to predict.

In addition to general cleaning, Tables 16.1 and 22.1 indicate the minimum required maintenance regime that needs to be implemented post construction for the SuDS elements that will comprise the bulk of the proposed drainage system – see extracts from C753 below. In addition to this, Table 14.2 indicates the potential maintenance requirements for the anticipated proprietary plot level full/bypass retention separators, however further advice would need to be sought from the Manufacturers.

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 reseeding 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

TABLE 14.2 An example of operation and maintenance requirements for a proprietary treatment system

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every six months

It is currently understood that unless the site or individual plots of the site are sold (typically the commercial development parcels), the responsibility for the maintenance of the core drainage Attenuation and Swale system will lie with the Water authority with the second Basin area being retained privately by the Developer, Newlands Developments. The Highway network and the main infrastructure Surface water drainage will be offered for adoption to the relevant Highway authority or Yorkshire water. Foul water drainage networks are all proposed to be adopted by Yorkshire water, However until the development exceeds 50% capacity for plots 1-3, the maintenance will be the responsibility of the developer (Newlands Developments Ltd). The proposed SuDS for this project will be have shared ownership.

Basin 1 and the swale will be adopted by Yorkshire Water and will in turn take on the ongoing maintenance for these facilities. Basin 2 will remain in the ownership of Newlands Developments so will require future maintenance provided by a maintenance contract. it is anticipated that Basin maintenance will be linked with the maintenance requirements for the Green spaces within the whole site.

7 FOUL WATER DRAINAGE

7.1 Foul Water Drainage Design

It is proposed to design and construct a new below ground foul water drainage system to convey commercial wastewater from the proposed development plots to the existing Yorkshire Water public sewer network to the northeast of the application area. The drainage network for the Hoyland Development will be constructed on the perimeter of the site areas and situated within the proposed highway network as illustrated on RPS drawing **HOYLA-RPS-SI-XX-DR-D-0331-334** included in **Appendix A.** It is envisaged that the entire network will be designed and constructed in accordance with 'Sewage Sector Guidance Appendix C as well as BS EN 752. The development network will be subject to a S104 agreement with Yorkshire Water. Yorkshire Water retain the rights to a full S104 agreement for the development until the site is fully developed.

7.2 Peak Foul Water Discharge Rate

'Sewage Sector Guidance Appendix C' has been used to calculate the peak foul flows from the residential, and commercial sites. The following breakdown applies:

Residential - 4000 l/unit/day Peak flow

Commercial – 0.6l/s/ha Peak flow

Peak Flows Hoyland development

Type	No. Units/Area	Peak Flow (l/s)
Residential	Units	
Plot 6	101	4.68 l/s
Commercial	Area (Ha)	
Plo1 1	18.35	11.01 l/s
Plot 2	9.02	5.412 l/s
Plot 3	5.09	3.054 l/s
Plot 4	2.03	1.218 l/s
Plot 5	1.70	1.02l/s
	Total	**26.4 l/s**

7.3 Pumping

Due to the site's low-lying ground levels and scarce availability of any existing foul drainage networks, close in proximity to the Hoyland Development site. The original point of connection proposed by Yorkshire Water (Fitzwilliam St, Hoyland to the Northeast of the development) has proved of insufficient capacity to accept the proposed flows following detailed modelling. Yorkshire Water has since offered an alternation at a point off Stead Lane/Warren View to the East of the project.

The proposed pumping station will be offered to YWS for adoption and will discharge at 13.2/s (or as agreed with YWS) to comply with section D5.6.1 in Sewer sector Guidance, that's states

The design flow rate of the pump units in foul pumping stations serving less than 500 dwellings should be at least the maximum of:
a) half the incoming peak design flow rate (see Clause B3.1.1); and

b) the flow rate required to achieve a minimum flow velocity in the rising main in accordance with D6.3.1.

With the system providing online emergency storage with telemetry control to manage flows.

Based on SSG v2, Foul pumping stations serving less than 500 dwellings, as a minimum, the storage should equate to 160 litres per dwelling, and for commercial or industrial developments one hour of peak design flow rate. For pumping stations serving 500 dwellings or more, the sewerage company should be consulted to determine the storage requirements.

Type	No. Units/Area	Peak Flow	Storage (m^3)
Residential	101	160 l/s	16.16
Commercial	35.67 ha	21.7 l/s	78.12
	Total		**94.28m3**

8 CONCLUSIONS

8.1 Surface Water Drainage Design

8.1.1 The proposed surface water network has been designed to be incorporated into the proposed landscape providing both amenity and environmental benefits. It will provide the Hoyland development area with a sustainable drainage network to manage extreme storm events up to 1 in 100 year + 30% (Climate Change) storm events.

a. The entire surface water network in The Hoyland development has been designed in accordance with Sewage Sector Guidance Appendix C as well as BS EN 752. The development network will be subject to a S104 agreement from Yorkshire Water.

b. The proposed Network will provide betterment to the greenfield runoff currently discharging from this site as flows have been limited to Qbar rates for the existing site catchment, but includes for area outside this catchment so will reduce the catchment area and subsequent flooding risk for the Eastern catchment and the M1 Motorway/BMBC Highway drains..

8.2 Foul Water Drainage Design

8.2.1 The proposed foul water network will provide the Hoyland development area with a sustainable gravity foul drainage network, linked to an adopted pumping station.

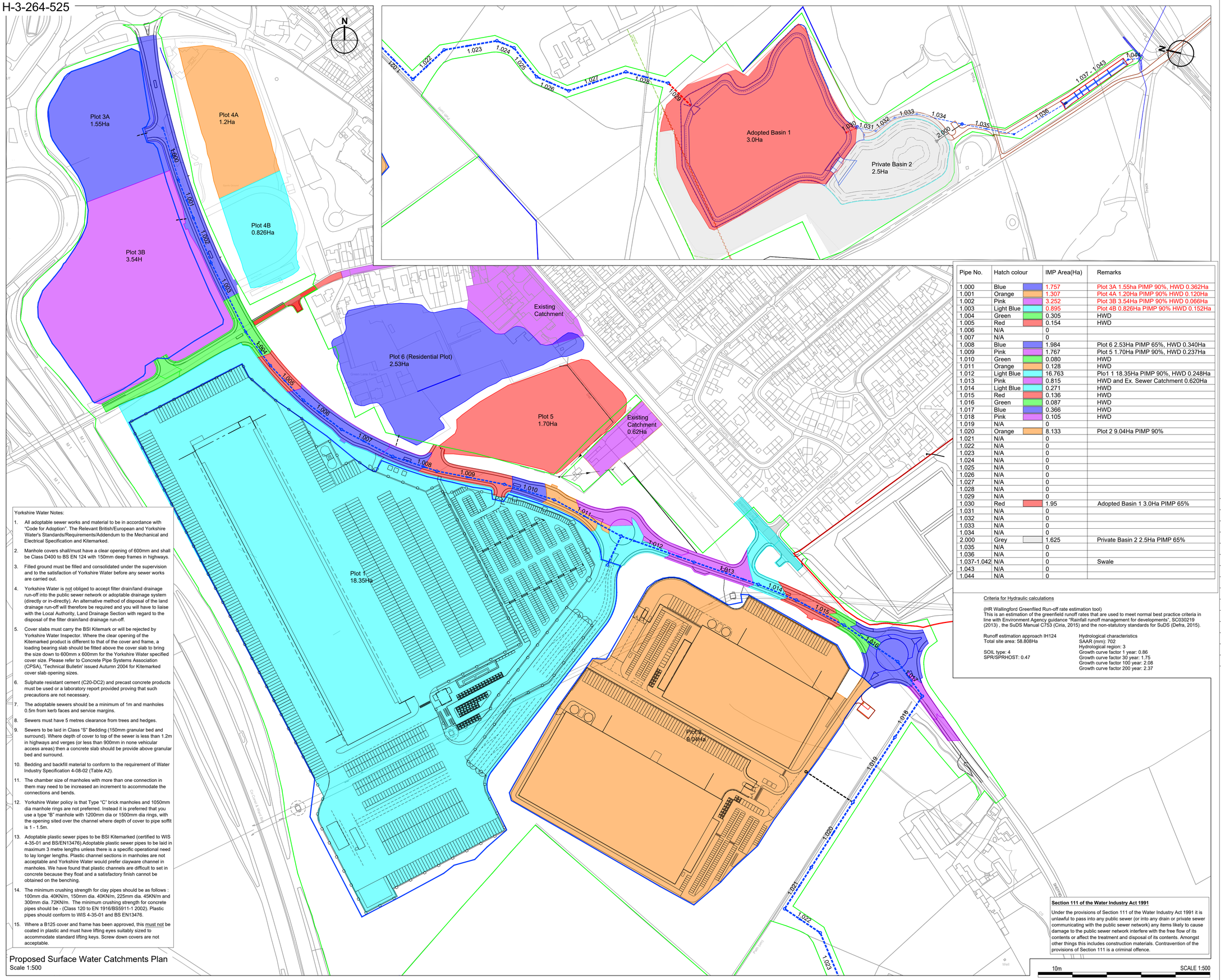
a. The entire foul water network in the Hoyland development has been designed in accordance with Sewage Sector Guidance Appendix C as well as BS EN 752. The development network will be subject to a S104 agreement from Yorkshire Water.

APPENDICES

Appendix A

Proposed strategic Layout Plans

H-3-264-525



Yorkshire Water Notes:

1. All adoptable sewer works and material to be in accordance with "Code for Adoption". The Relevant British/European and Yorkshire Water's Standards/Requirements/Addendum to the Mechanical and Electrical Specification and Kitemarked.
2. Manhole covers shall/must have a clear opening of 600mm and shall be Class D400 to BS EN 124 with 150mm deep frames in highways.
3. Filled ground must be filled and consolidated under the supervision and to the satisfaction of Yorkshire Water before any sewer works are carried out.
4. Yorkshire Water is not obliged to accept filter drain/land drainage run-off into the public sewer network or adoptable drainage system (directly or in-directly). An alternative method of disposal of the land drainage run-off will therefore be required and you will have to liaise with the Local Authority, Land Drainage Section with regard to the disposal of the filter drain/land drainage run-off.
5. Cover slabs must carry the BSI Kitemark or will be rejected by Yorkshire Water Inspector. Where the clear opening of the Kitemarked product is different to that of the cover and frame, a loading bearing slab should be fitted above the cover slab to bring the size down to 600mm x 600mm for the Yorkshire Water specified cover size. Please refer to Concrete Pipe Systems Association (CPSA), 'Technical Bulletin' issued Autumn 2004 for Kitemarked cover slab opening sizes.
6. Sulphate resistant cement (C20-DC2) and precast concrete products must be used or a laboratory report provided proving that such precautions are not necessary.
7. The adoptable sewers should be a minimum of 1m and manholes 0.5m from kerb faces and service margins.
8. Sewers must have 5 metres clearance from trees and hedges.
9. Sewers to be laid in Class "S" Bedding (150mm granular bed and surround). Where depth of cover to top of the sewer is less than 1.2m in highways and verges (or less than 900mm in none vehicular access areas) then a concrete slab should be provide above granular bed and surround.
10. Bedding and backfill material to conform to the requirement of Water Industry Specification 4-08-02 (Table A2).
11. The chamber size of manholes with more than one connection in them may need to be increased an increment to accommodate the connections and bends.
12. Yorkshire Water policy is that Type "C" brick manholes and 1050mm dia manhole rings are not preferred. Instead it is preferred that you use a type "B" manhole with 1200mm dia or 1500mm dia rings, with the opening sited over the channel where depth of cover to pipe soffit is 1 - 1.5m.
13. Adoptable plastic sewer pipes to be BSI Kitemarked (certified to WIS 4-35-01 and BS/EN13476).Adoptable plastic sewer pipes to be laid in maximum 3 metre lengths unless there is a specific operational need to lay longer lengths. Plastic channel sections in manholes are not acceptable and Yorkshire Water would prefer clayware channel in manholes. We have found that plastic channels are difficult to set in concrete because they float and a satisfactory finish cannot be obtained on the benching.
14. The minimum crushing strength for clay pipes should be as follows : 100mm dia. 40KN/m, 150mm dia. 40KN/m, 225mm dia. 45KN/m and 300mm dia. 72KN/m. The minimum crushing strength for concrete pipes should be - (Class 120 to EN 1916/BS911-1 2002). Plastic pipes should conform to WIS 4-35-01 and BS EN13476.
15. Where a B125 cover and frame has been approved, this must not be coated in plastic and must have lifting eyes suitably sized to accommodate standard lifting keys. Screw down covers are not acceptable.

Proposed Surface Water Catchments Plan

Scale 1:500

Pipe No.	Hatch colour	IMP Area(Ha)	Remarks
1.000	Blue	1.757	Plot 3A 1.55ha PIMP 90%, HWD 0.362Ha
1.001	Orange	1.307	Plot 4A 1.20Ha PIMP 90% HWD 0.120Ha
1.002	Pink	3.252	Plot 3B 3.54Ha PIMP 90% HWD 0.066Ha
1.003	Light Blue	0.895	Plot 4B 0.826Ha PIMP 90% HWD 0.152Ha
1.004	Green	0.305	HWD
1.005	Red	0.154	HWD
1.006	N/A	0	
1.007	N/A	0	
1.008	Blue	1.984	Plot 6 2.53Ha PIMP 65%, HWD 0.340Ha
1.009	Pink	1.767	Plot 5 1.70Ha PIMP 90%, HWD 0.237Ha
1.010	Green	0.080	HWD
1.011	Orange	0.128	HWD
1.012	Light Blue	16.763	Plo1 1 18.35Ha PIMP 90%, HWD 0.248Ha
1.013	Pink	0.815	HWD and Ex. Sewer Catchment 0.620Ha
1.014	Light Blue	0.271	HWD
1.015	Red	0.136	HWD
1.016	Green	0.087	HWD
1.017	Blue	0.366	HWD
1.018	Pink	0.105	HWD
1.019	N/A	0	
1.020	Orange	8.133	Plot 2 9.04Ha PIMP 90%
1.021	N/A	0	
1.022	N/A	0	
1.023	N/A	0	
1.024	N/A	0	
1.025	N/A	0	
1.026	N/A	0	
1.027	N/A	0	
1.028	N/A	0	
1.029	N/A	0	
1.030	Red	1.95	Adopted Basin 1 3.0Ha PIMP 65%
1.031	N/A	0	
1.032	N/A	0	
1.033	N/A	0	
1.034	N/A	0	
2.000	Grey	1.625	Private Basin 2 2.5Ha PIMP 65%
1.035	N/A	0	
1.036	N/A	0	
1.037-1.042	N/A	0	Swale
1.043	N/A	0	
1.044	N/A	0	

Criteria for Hydraulic calculations

(HR Wallingford Greenfiled Run-off rate estimation tool)
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015).

Runoff estimation approach IH124
Total site area: 58.868Ha

SOIL type: 4
SPR/SPRHOST: 0.47

Hydrological characteristics
SAAR (mm): 702
Hydrological region: 3
Growth curve factor 1 year: 0.86
Growth curve factor 30 year: 1.75
Growth curve factor 100 year: 2.08
Growth curve factor 200 year: 2.37

Section 111 of the Water Industry Act 1991

Under the provisions of Section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes construction materials. Contravention of the provisions of Section 111 is a criminal offence.

10m SCALE 1:500

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Notes - For more Detailed notes refer to Drawing 020040-RPS-SI-XX-DR-D-Notes

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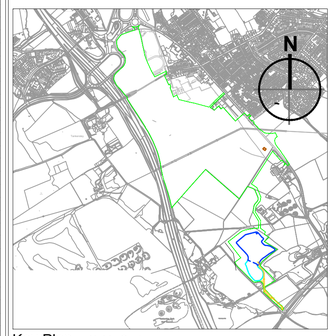
3. This drawing should be read in conjunction with all other relevant drawings and specifications.
4. Masterplan taken from PHP drawing 4400-001 Rev P30, received 02/11/2020.
5. All works to be carried out in accordance with the Specification for Highway Works, the South Yorkshire Residential Design Guide and the requirements of Barnsley Metropolitan Borough Council and Sewer Sector Guidance.
6. 6. All information shown on this drawing is subject to Technical Approval from BMBC and Yorkshire Water.

Key

- Planning Boundary
- Proposed Surface Water Sewer
- Proposed Highway Surface Water Drainage
- Proposed Private Surface Water Drainage



Key Plan Not to Scale

Rev	Description	By	Ckd	Date
P14	Plot 2 layout amended	SMC	ANT	26.10.21
P13	HIghway Drainage Amended Catchments	SMC	ANT	14.07.21
P12	Catchments broken down as agreed in call	SMC	ANT	14.05.21
P11	Catchments broken down further	JNB	SMC	10.05.21
P10	Drawing areas revised to areas per pipe	JNB	SMC	26.04.21
P09	Extra Notes added	ANT	SMC	01.04.21
P08	Update to Attenuation Basin Boundary	ANT	SMC	15.03.21
P07	Update to foul pump station layout, Verges amended	MWF	SMC	29.01.21
P06	Updated for S104 Approval following YWS Comments	JNB	SMC	26.11.20
P05	Updated following revised boundaries	JNB	SMC	09.11.20
P04	Updated following YWS Comments	JNB	SMC	06.11.20
P03	Added Design flow rates	JNB	SMC	23.09.20
P02	S104 Approval - Plateau levels added	JNB	SMC	09.09.20
P01	Issued for S104 Approval	JNB	SMC	19.08.20

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Client newlands developments

Project Hoyland Common

Title Proposed Site Plan & Catchment Plan

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	18.08.2020
Task Team Manager	**Information Author**	**Task Information Manager**
SG	JNB	SMC

Status
S4 (Suitable for Stage Approval)

Document Number
HOYLA-RPS-SI-XX-DR-D-330

Revision
P14

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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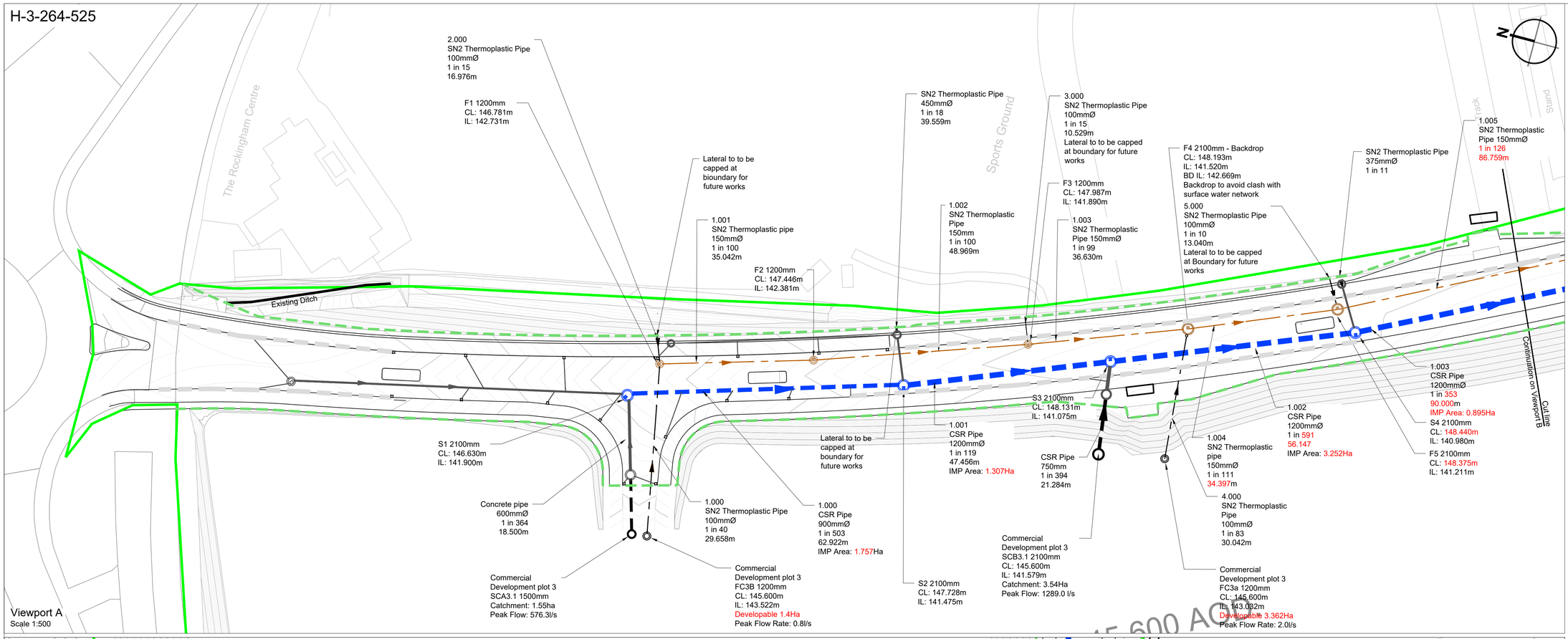
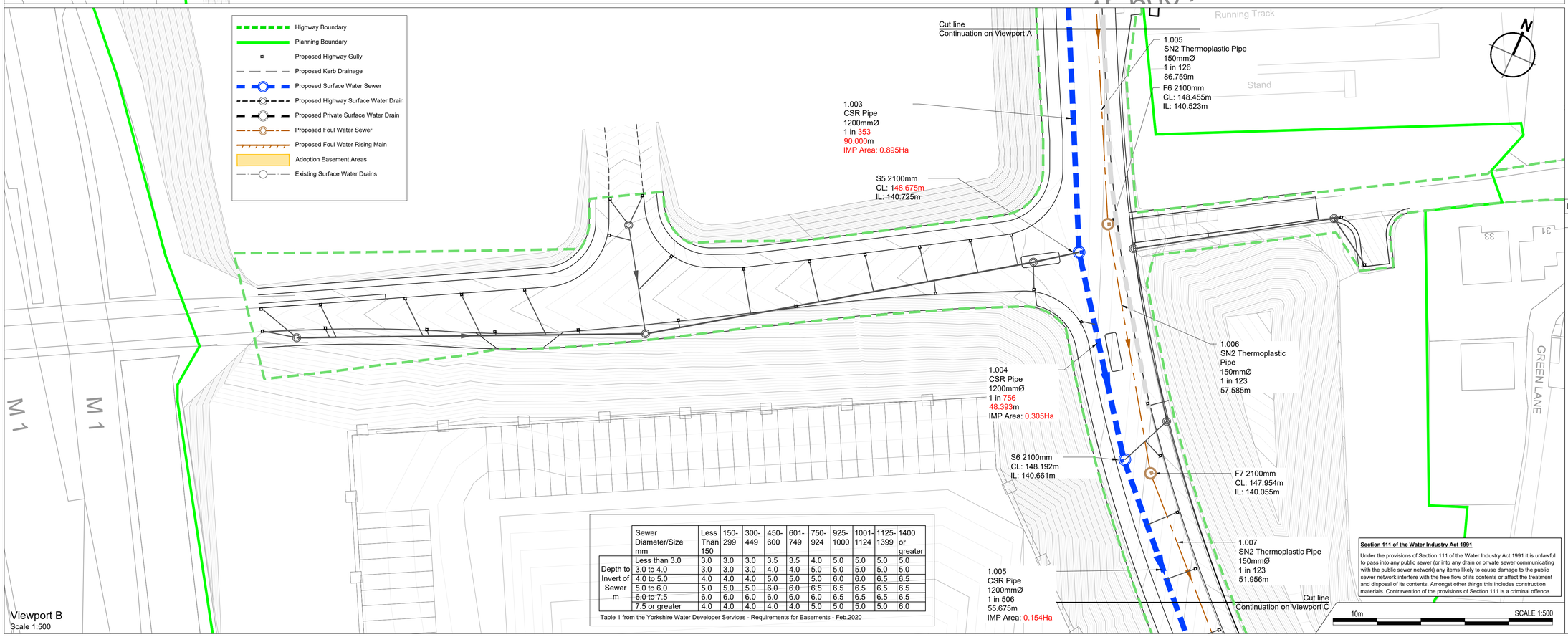
H-3-264-525





	Sewer Diameter/Size mm	Less Than 150	150-299	300-449	450-600	601-749	750-924	925-1000	1001-1124	1125-1399	1400 or greater
Depth to Invert of Sewer m	Less than 3.0	3.0	3.0	3.0	3.5	3.5	4.0	5.0	5.0	5.0	5.0
	3.0 to 4.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0
	4.0 to 5.0	4.0	4.0	4.0	5.0	5.0	5.0	6.0	6.0	6.5	6.5
	5.0 to 6.0	5.0	5.0	5.0	6.0	6.0	6.5	6.5	6.5	6.5	6.5
	6.0 to 7.5	6.0	6.0	6.0	6.0	6.0	6.0	6.5	6.5	6.5	6.5
	7.5 or greater	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0	6.0

Table 1 from the Yorkshire Water Developer Services - Requirements for Easements - Feb.2020

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10. Bedding and backfill material to conform to the requirement of Water Industry Specification 4-08-02 (Table A2).
11. The chamber size of manholes with more than one connection in them may need to be increased an increment to accommodate the connections and bends.
12. Yorkshire Water policy is that Type "C" brick manholes and 1050mm dia manhole rings are not preferred. Instead it is preferred that you use a type "B" manhole with 1200mm dia or 1500mm dia rings, with the opening sited over the channel where depth of cover to pipe soffit is 1 - 1.5m
13. Adoptable plastic sewer pipes to be BSI Kitemarked (certified to WIS 4-35-01 and BS/EN13476).Adoptable plastic sewer pipes to be laid in maximum 3 metre lengths unless there is a specific operational need to lay longer lengths. Plastic channel sections in manholes are not acceptable and Yorkshire Water would prefer clayware channel in manholes. We have found that plastic channels are difficult to set in concrete because they float and a satisfactory finish cannot be obtained on the benching.
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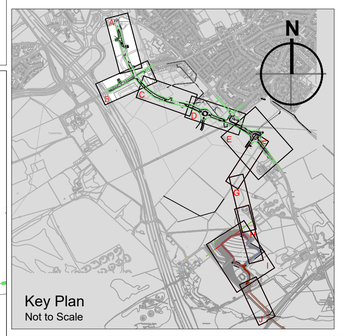
15. Where a B125 cover and frame has been approved, this must not be coated in plastic and must have lifting eyes suitably sized to accommodate standard lifting keys. Screw down covers are not acceptable.
16. Yorkshire Water's Signs will be required once the detention basin is transferred to Yorkshire Water (Yorkshire Water will provide the signs and charge the developer for the signs).



Rev	Description	By	Ckd	Date
P14	HA Drainage amended MH locations	SMC	ANT	14.07.21

MAKING COMPLEX EASY
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Client
newlands developments

Project
Hoyland Common

Title
Proposed Drainage GA
S104 Approval
(Sheet 1 of 6)

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	18.08.20
Task Team Manager	**Information Author**	**Task Information Manager**
SG	JNB	SMC

Status
S4 (Suitable for Stage Approval)

Document Number
HOYLA-RPS-SI-XX-DR-CR-331

Revision
P14

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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Section 111 of the Water Industry Act 1991

Under the provisions of Section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes construction materials. Contravention of the provisions of Section 111 is a criminal offence.

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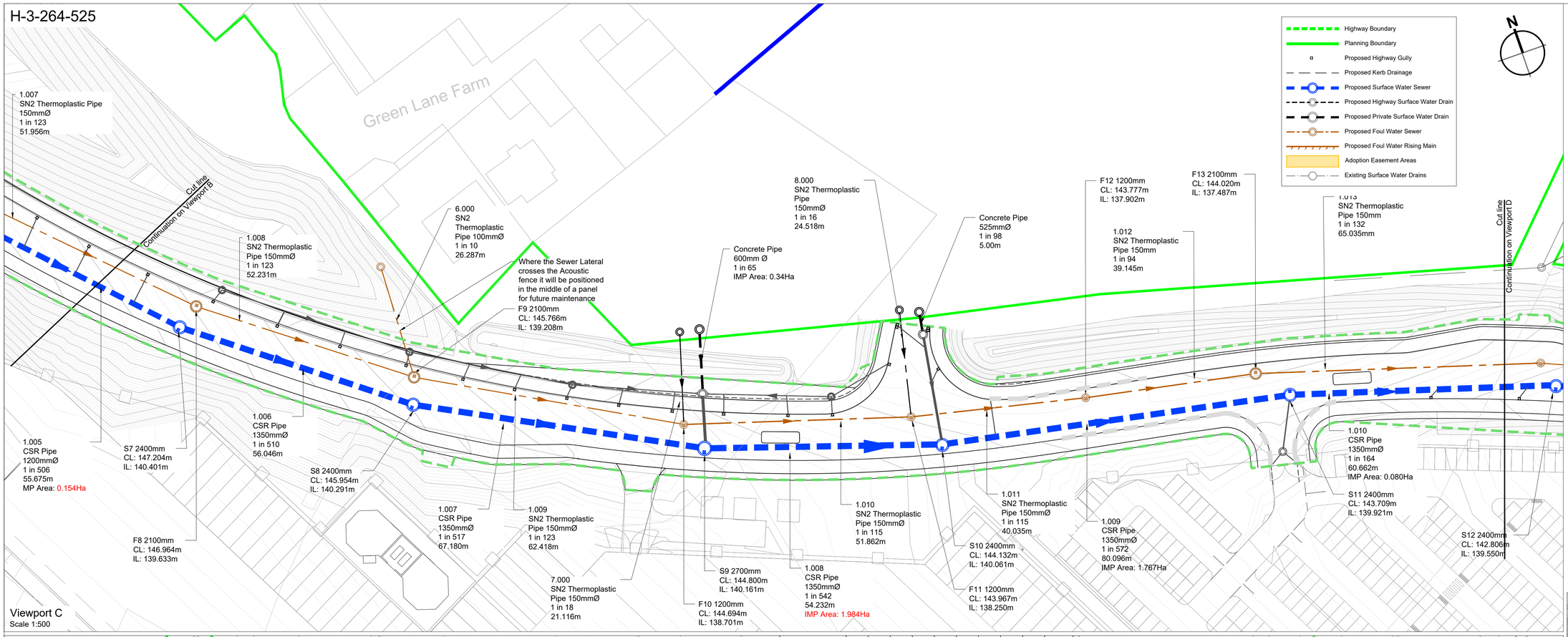
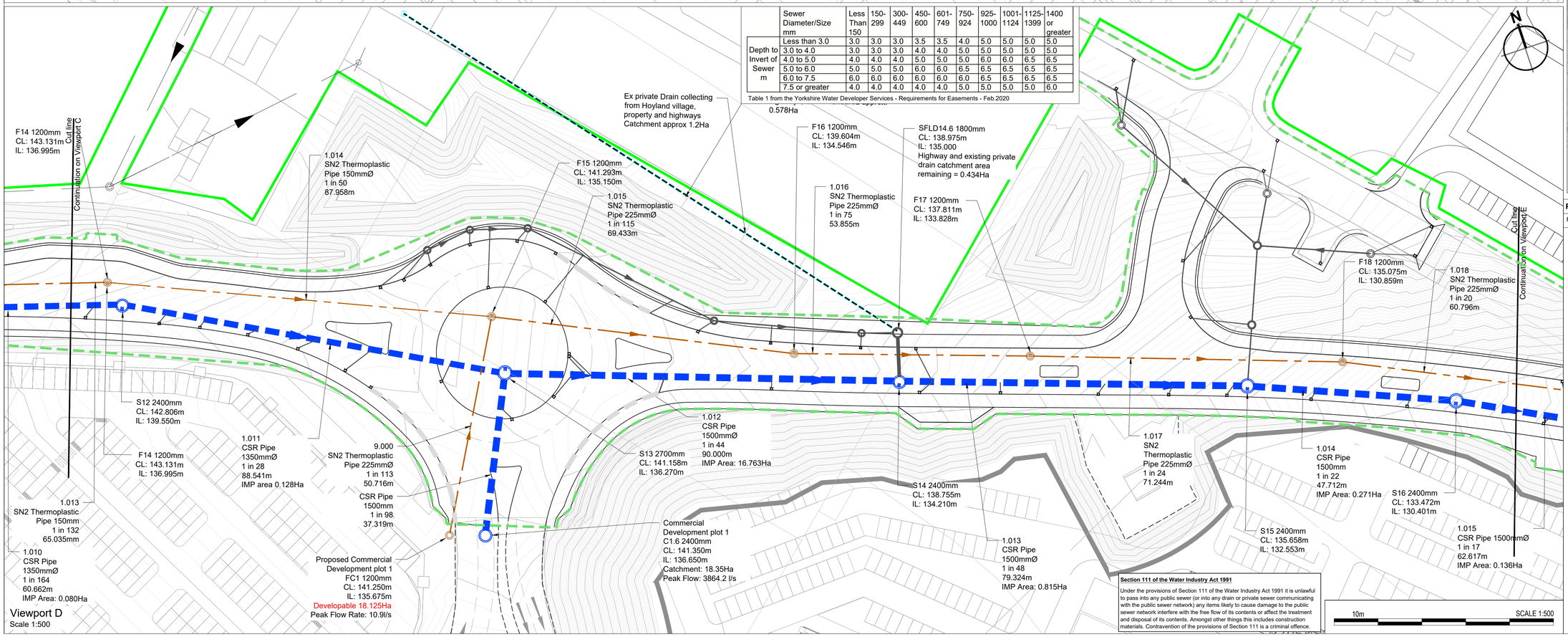


Viewport C
Scale 1:500



Viewport D
Scale 1:500

Sewer Diameter/Size mm		Less Than 150	150-299	300-449	450-600	601-749	750-924	925-1000	1001-1124	1125-1399	1400 or greater
Depth to Invert of Sewer m	Less than 3.0	3.0	3.0	3.0	3.5	3.5	4.0	5.0	5.0	5.0	5.0
	3.0 to 4.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0
	4.0 to 5.0	4.0	4.0	4.0	5.0	5.0	5.0	6.0	6.0	6.5	6.5
	5.0 to 6.0	5.0	5.0	5.0	6.0	6.0	6.5	6.5	6.5	6.5	6.5
	6.0 to 7.5	6.0	6.0	6.0	6.0	6.0	6.0	6.5	6.5	6.5	6.5
	7.5 or greater	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0	6.0

Table 1 from the Yorkshire Water Developer Services - Requirements for Easements - Feb.2020

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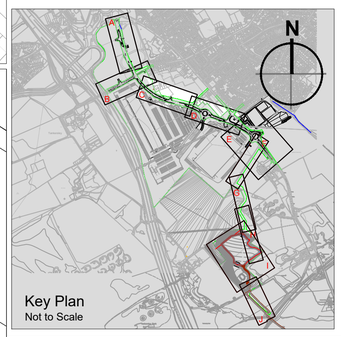

Rev	Description	By	Ckd	Date
P17	HA Drainage amended MH locations	SMC	ANT	14.07.21

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rps MAKING COMPLEX EASY

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Client
newlands developments

Project
Hoyland Common

Title
Proposed Drainage GA
S104 Approval
(Sheet 2 of 6)

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	18.08.2020
Task Team Manager	**Information Author**	**Task Information Manager**
SG	JNB	SMC

Status
S4 (Suitable for Stage Approval)

Document Number	Revision
HOYLA-RPS-SI-XX-DR-D-332	P17

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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H-3-264-525

Sewer Diameter/Size mm		Less Than 150	150-299	300-449	450-600	601-749	750-924	925-1000	1001-1124	1125-1399	1400 or greater
Depth to Invert of Sewer m	Less than 3.0	3.0	3.0	3.0	3.5	3.5	4.0	5.0	5.0	5.0	5.0
	3.0 to 4.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0
	4.0 to 5.0	4.0	4.0	4.0	5.0	5.0	5.0	6.0	6.0	6.5	6.5
	5.0 to 6.0	5.0	5.0	5.0	6.0	6.0	6.5	6.5	6.5	6.5	6.5
	6.0 to 7.5	6.0	6.0	6.0	6.0	6.0	6.0	6.5	6.5	6.5	6.5
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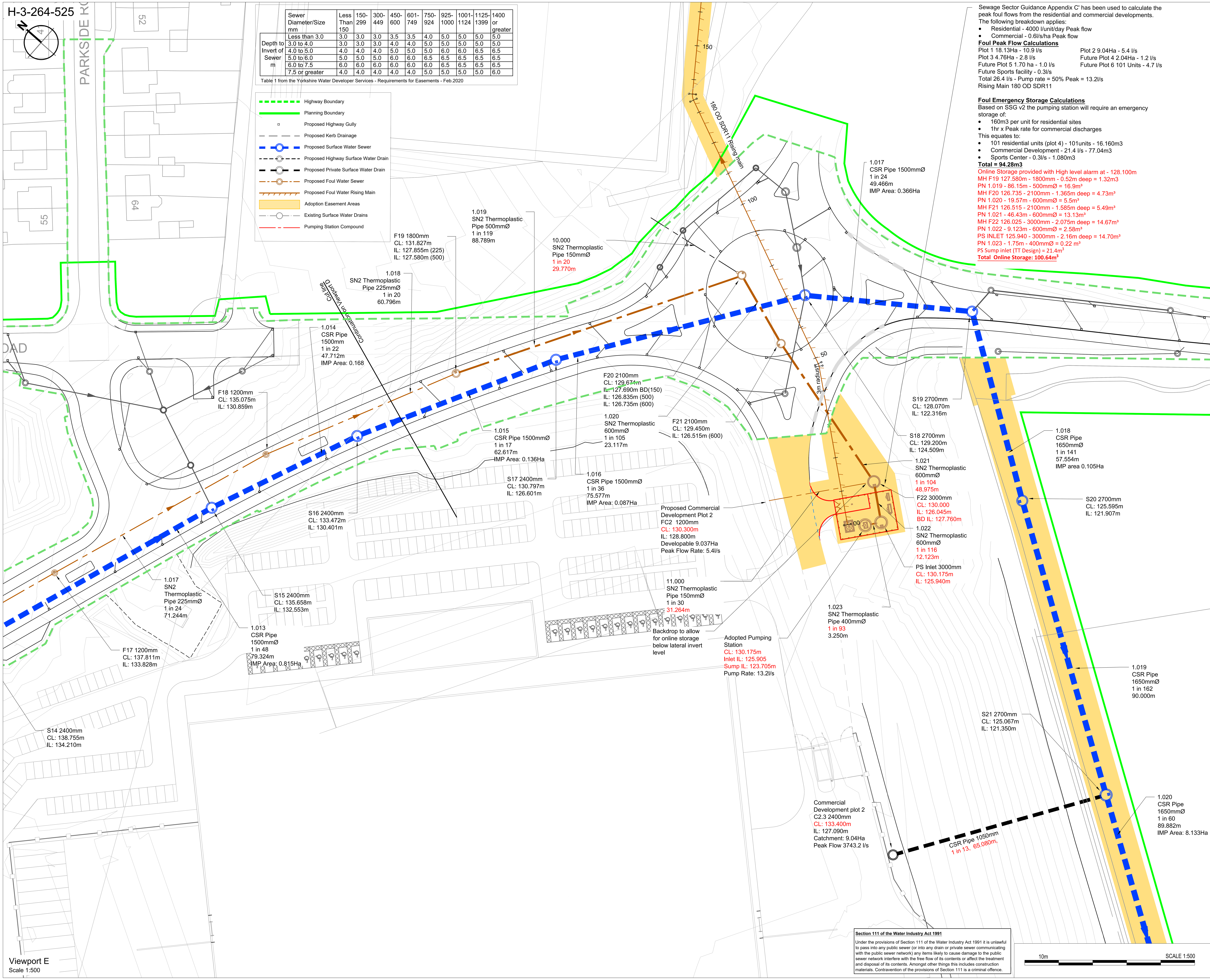
Table 1 from the Yorkshire Water Developer Services - Requirements for Easements - Feb.2020

- Highway Boundary
- Planning Boundary
- Proposed Highway Gully
- Proposed Kerb Drainage
- Proposed Surface Water Sewer
- Proposed Highway Surface Water Drain
- Proposed Private Surface Water Drain
- Proposed Foul Water Sewer
- Proposed Foul Water Rising Main
- Adoption Easement Areas
- Existing Surface Water Drains
- Pumping Station Compound



Sewage Sector Guidance Appendix C' has been used to calculate the peak foul flows from the residential and commercial developments.
The following breakdown applies:

- Residential - 4000 l/unit/day Peak flow
- Commercial - 0.6l/s/ha Peak flow

Foul Peak Flow Calculations

Plot 1 18.13Ha - 10.9 l/s
Plot 2 9.04Ha - 5.4 l/s
Plot 3 4.76Ha - 2.8 l/s
Future Plot 4 2.04Ha - 1.2 l/s
Future Plot 5 1.70 ha - 1.0 l/s
Future Plot 6 101 Units - 4.7 l/s
Future Sports facility - 0.3l/s
Total 26.4 l/s - Pump rate = 50% Peak = 13.2l/s
Rising Main 180 OD SDR11

Foul Emergency Storage Calculations

Based on SSG v2 the pumping station will require an emergency storage of:

- 160m3 per unit for residential sites
- 1hr x Peak rate for commercial discharges

This equates to:

- 101 residential units (plot 4) - 101units - 16.160m3
- Commercial Development - 21.4 l/s - 77.04m3
- Sports Center - 0.3l/s - 1.080m3

Total = 94.28m3

Online Storage provided with High level alarm at - 128.100m
MH F19 127.580m - 1800mm - 0.52m deep = 1.32m3
PN 1.019 - 86.15m - 500mmØ = 16.9m³
MH F20 126.735 - 2100mm - 1.365m deep = 4.73m³
PN 1.020 - 19.57m - 600mmØ = 5.5m³
MH F21 126.515 - 2100mm - 1.585m deep = 5.49m³
PN 1.021 - 46.43m - 600mmØ = 13.13m³
MH F22 126.025 - 3000mm - 2.075m deep = 14.67m³
PN 1.022 - 9.123m - 600mmØ = 2.58m³
PS INLET 125.940 - 3000mm - 2.16m deep = 14.70m³
PN 1.023 - 1.75m - 400mmØ = 0.22 m³
PS Sump inlet (TT Design) = 21.4m³
Total Online Storage: 100.64m³

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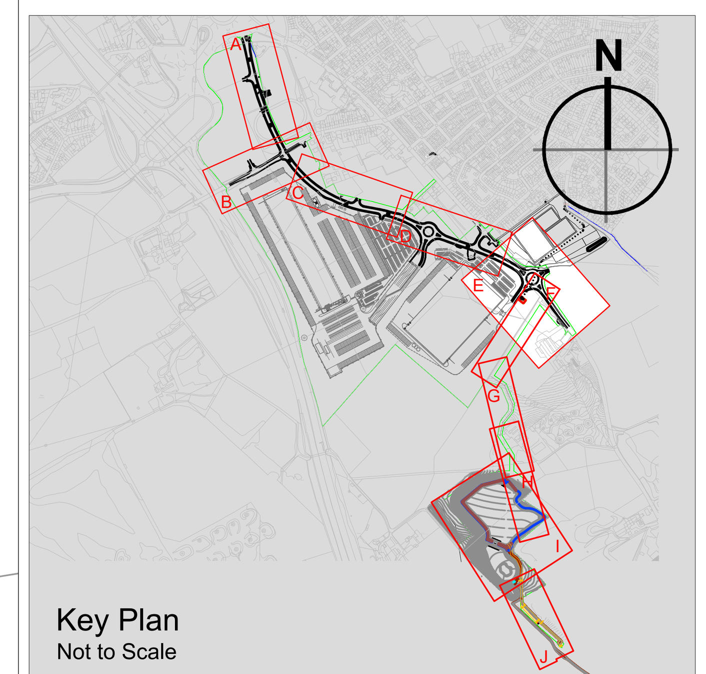

Key Plan
Not to Scale

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10m SCALE 1:500

Rev	Description	By	Ckd	Date
P19	PS Details updated to suit comments	SMC	ANT	26.10.21

MAKING COMPLEX EASY

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T:01636 605 700 E: rpsnewark@rpsgroup.com

Client: newlands developments

Project: Hoyland Common

Title: Proposed Drainage GA
S104 Approval
(Sheet 3 of 6)

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	18.08.2020
Task Team Manager	Information Author	Task Information Manager
SG	JNB	SMC

Status
S4 (Suitable for Stage Approval)

Document Number: HOYLA-RPS-SI-XX-DR-CR-333
Revision: P19

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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H-3-264-525

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Sewer Diameter/Size mm		Less Than 150	150-299	300-449	450-600	601-749	750-924	925-1000	1001-1124	1125-1399	1400 or greater
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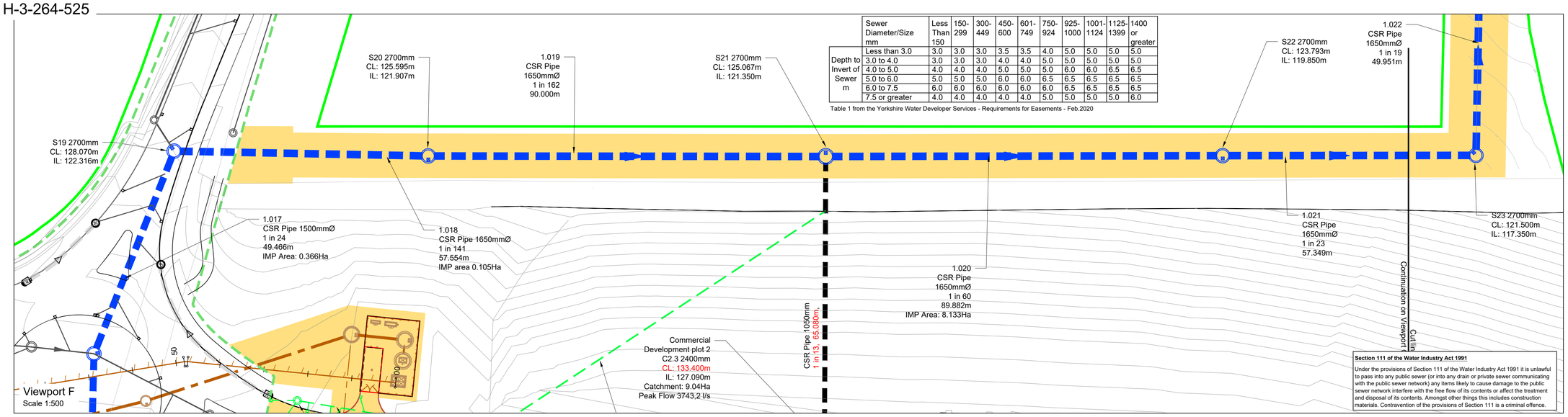

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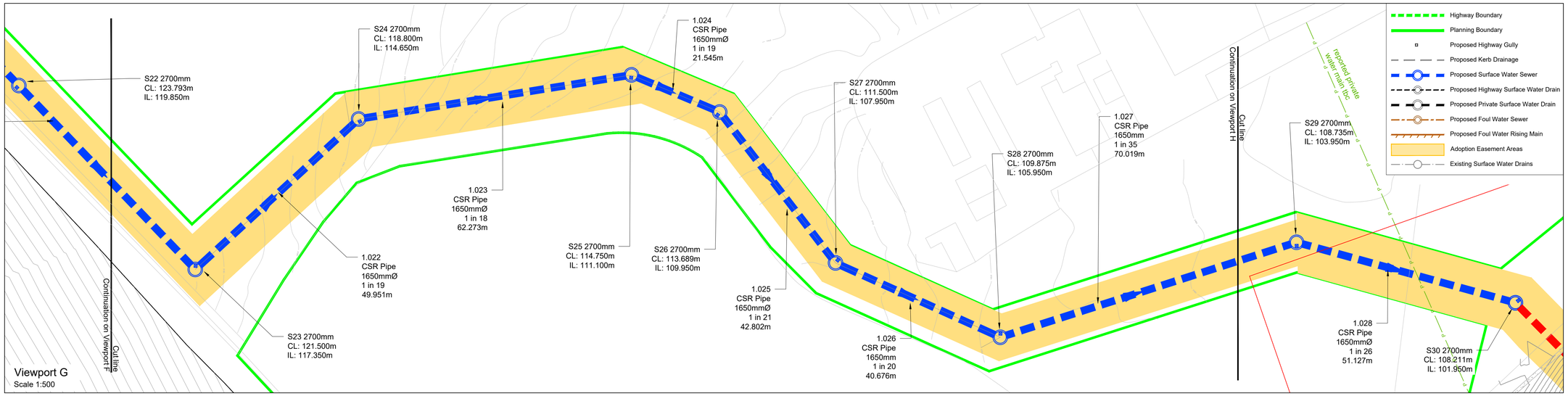

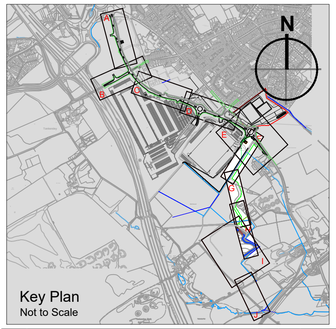

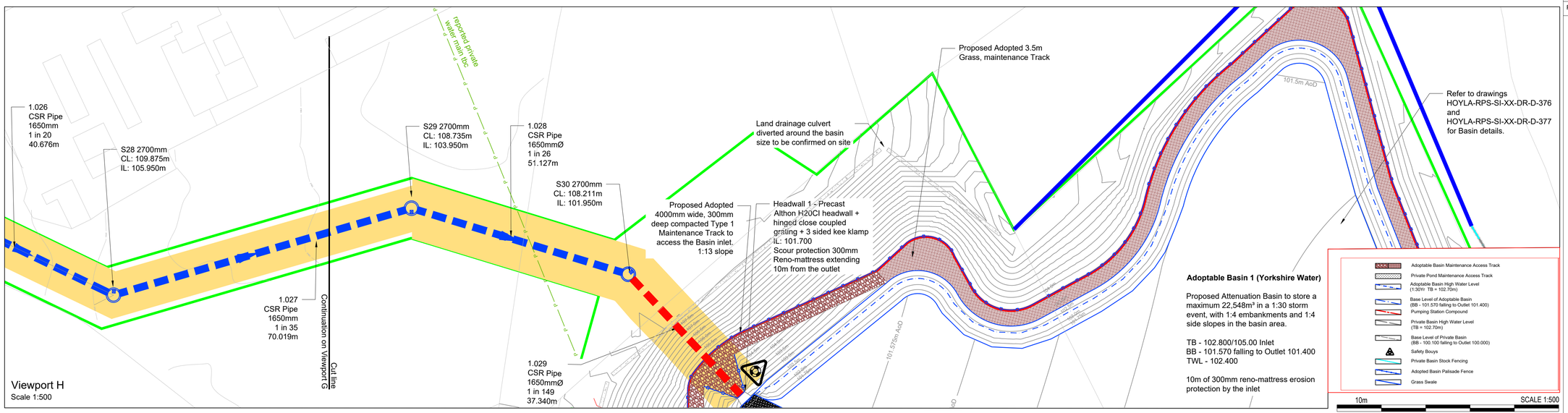

Adoptable Basin 1 (Yorkshire Water)

Proposed Attenuation Basin to store a maximum 22,548m³ in a 1:30 storm event, with 1:4 embankments and 1:4 side slopes in the basin area.

TB - 102.800/105.00 Inlet
BB - 101.570 falling to Outlet 101.400
TWL - 102.400

10m of 300mm reno-mattress erosion protection by the inlet

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Rev	Description	By	Ckd	Date
P17	PS Details updated	SMC	ANT	26.10.21

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NK020040	1:500	18.08.2020
Task Team Manager	**Information Author**	**Task Information Manager**
SG	JNB	SMC

Status
S4 (Suitable for Stage Approval)

Document Number
HOYLA-RPS-SI-XX-DR-D-334

Revision
P17

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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H-3-264-525

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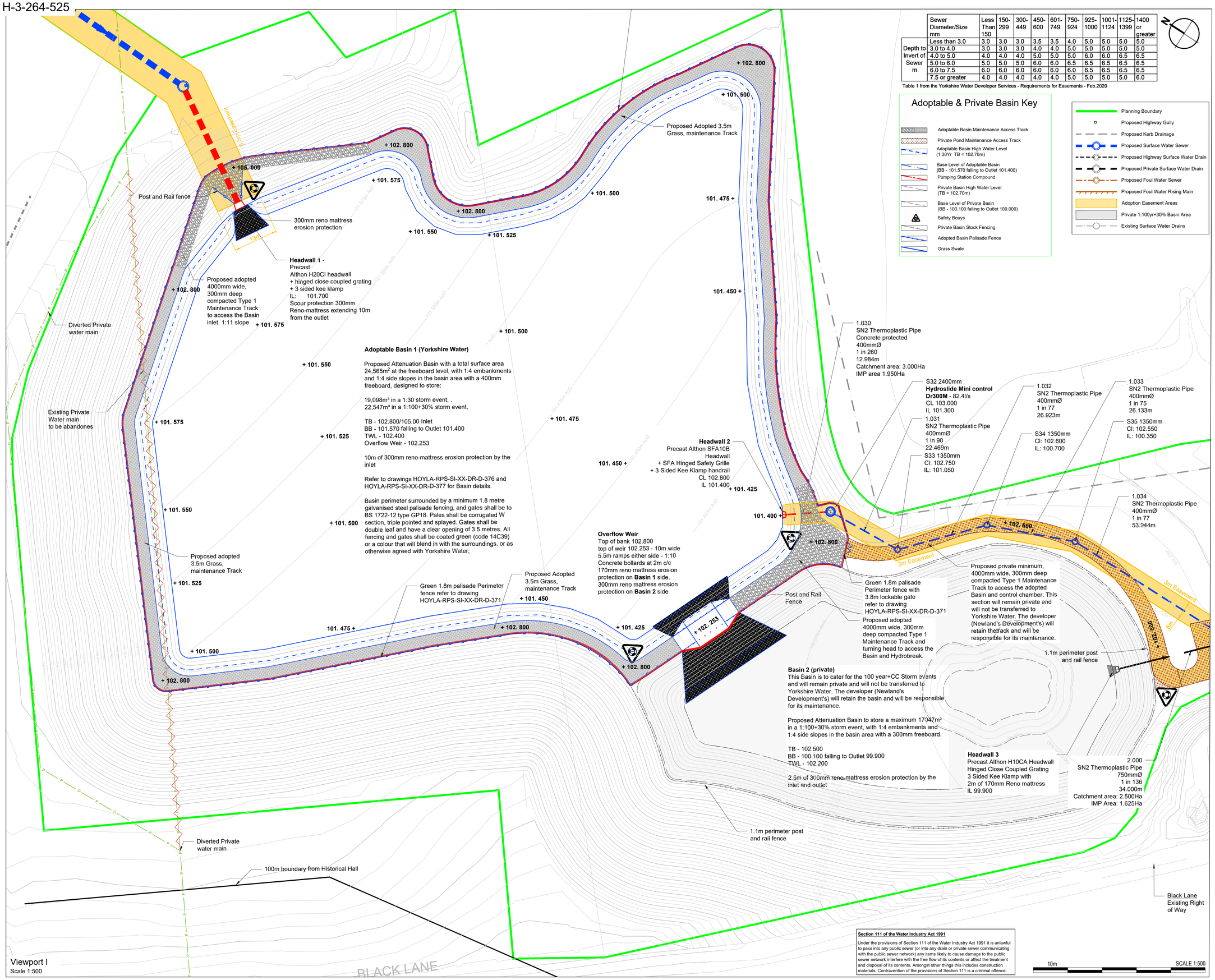

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Table 1 from the Yorkshire Water Developer Services - Requirements for Easements - Feb.2020

Adoptable & Private Basin Key

- Adoptable Basin Maintenance Access Track
- Private Pond Maintenance Access Track
- Adoptable Basin High Water Level (1:30Yr TB = 102.70m)
- Base Level of Adoptable Basin (BB - 101.570 falling to Outlet 101.400)
- Pumping Station Compound
- Private Basin High Water Level (TB = 102.70m)
- Base Level of Private Basin (BB - 100.100 falling to Outlet 100.000)
- Safety Bouys
- Private Basin Stock Fencing
- Adopted Basin Palisade Fence
- Grass Swale

- Planning Boundary
- Proposed Highway Gully
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- Proposed Surface Water Sewer
- Proposed Highway Surface Water Drain
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- Proposed Foul Water Sewer
- Proposed Foul Water Rising Main
- Adoption Easement Areas
- Private 1:100yr+30% Basin Area
- Existing Surface Water Drains

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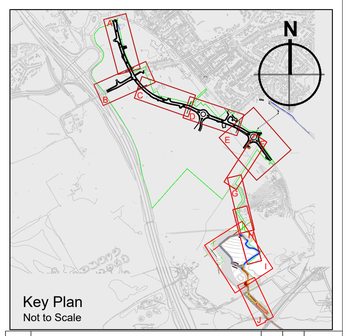

Rev	Description	By	Ckd	Date
P15	Basin 2 fencing changed to Post and rail	SMC	AE	26.10.21

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Client: newlands developments

Project: Hoyland Common

Title: Proposed Drainage GA
S104 Approval
(Sheet 5 of 6)

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	18.08.2020
Task Team Manager	**Information Author**	**Task Information Manager**
SG	JNB	SMC

Status: S4 (Suitable for Stage Approval)

Document Number: HOYLA-RPS-SI-XX-DR-D-335

Revision: P15

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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H-3-264-525

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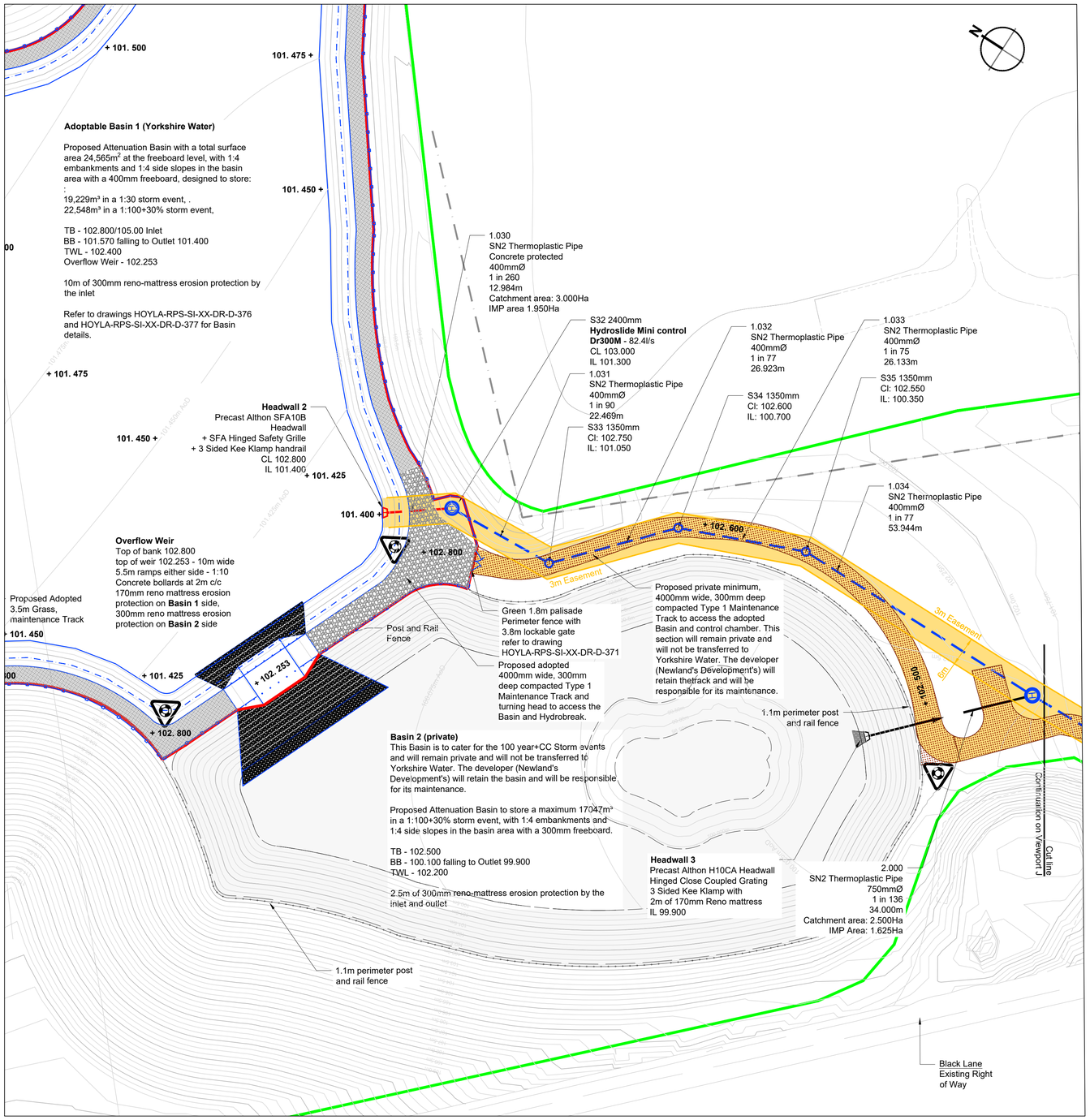
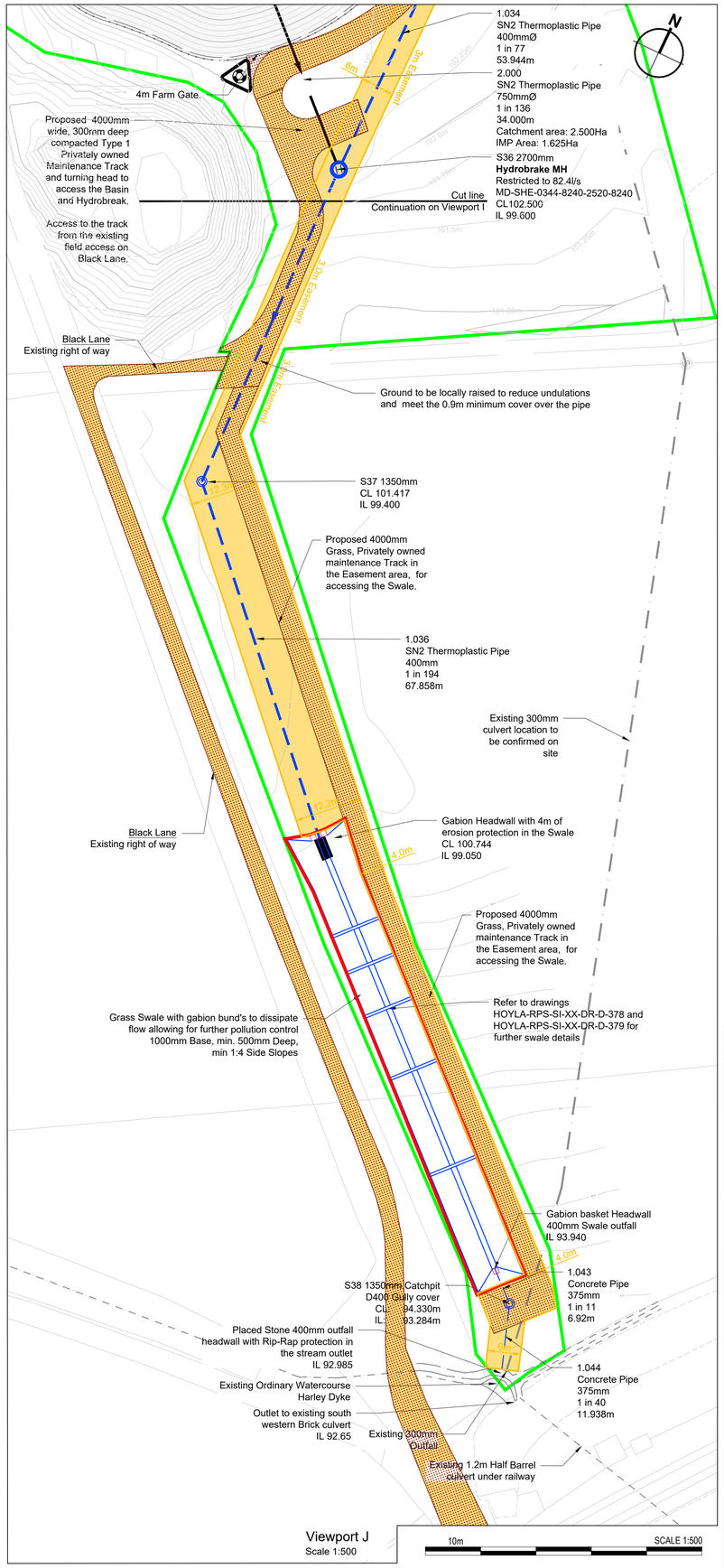


Viewport Ia
Scale 1:500



Viewport J
Scale 1:500

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C. This drawing should be read in conjunction with all other relevant drawings and specifications.

1. All adoptable sewer works and material to be in accordance with "Code for Adoption". The Relevant British/European and Yorkshire Water's Standards/Requirements/Addendum to the Mechanical and Electrical Specification and Kitemarked.
2. Manhole covers shall/must have a clear opening of 600mm and shall be Class D400 to BS EN 124 with 150mm deep frames in highways.
3. Filled ground must be filled and consolidated under the supervision and to the satisfaction of Yorkshire Water before any sewer works are carried out.
4. Yorkshire water Is not obliged to accept filter drain/land drainage run-off into the public sewer network or adoptable drainage system (directly or in-directly). An alternative method of disposal of the land drainage run-off will therefore be required and you will have to liaise with the Local Authority, Land drainage Section with regard to the disposal of the filter/land drainage run-off.
5. Cover slabs must carry the BSI Kitemark or will be rejected by Yorkshire Water Inspector. Where the clear opening of the Kitemarked product is different to that of the cover and frame, a loading bearing slab should be fitted above the cover slab to bring the size down to 600mm x 600mm for the Yorkshire Water specified cover size. Please refer to Concrete Pipe Systems Association (CPSA), 'Technical Bulletin' issued 2004 for Kitemarked cover slab opening sizes
6. Sulphate resistant cement (C20-DC2) and precast concrete products must be used, or a laboratory report provided proving tat such precautions are not necessary.
7. The adoptable sewers should be a minimum of 1m and manholes 0.5m from kerb faces and service margins.
8. Sewers must have 5 metres clearance from trees and hedges.
9. Sewers to be laid in class 'S' bedding (150mm Granular bed and surround). Where depth of cover to top of sewer is less then 1.2m in highways and verges (or less than 900mm in none vehicular access areas) then a concrete slab should be provide above granular bed and surround.
10. Bedding and backfill material to conform to the requirement of Water Industry Specification 4-08-02 (Table A2).
11. The chamber size of manholes with more than one connection in them may need to be increased an increment to accommodate the connections and bends.
12. Yorkshire Water policy is that Type "C" brick manholes and 1050mm dia manhole rings are not preferred. Instead it is preferred that you use a type "B" manhole with 1200mm dia or 1500mm dia rings, with the opening sited over the channel where depth of cover to pipe soffit is 1 - 1.5m
13. Adoptable plastic sewer pipes to be BSI Kitemarked (certified to WIS 4-35-01 and BS/EN13476).Adoptable plastic sewer pipes to be laid in maximum 3 metre lengths unless there is a specific operational need to lay longer lengths. Plastic channel sections in manholes are not acceptable and Yorkshire Water would prefer clayware channel in manholes. We have found that plastic channels are difficult to set in concrete because they float and a satisfactory finish cannot be obtained on the benching.
14. The minimum crushing strength for clay pipes should be as follows : 100mm dia. 40KN/m, 150mm dia. 40KN/m, 225mm dia. 45KN/m and 300mm dia. 72KN/m. The minimum crushing strength for concrete pipes should be - (Class 120 to EN 1916/BS5911-1 2002). Plastic pipes should conform to WIS 4-35-01 and BS EN13476
15. Where a B125 cover and frame has been approved, this must not be coated in plastic and must have lifting eyes suitably sized to accommodate standard lifting keys. Screw down covers are not acceptable.
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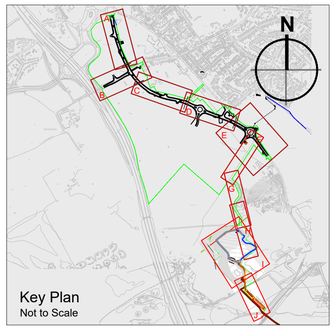

Rev	Description	By	Ckd	Date
P09	Basin 2 fencing changed to Post and rail	SMC	SH	26.10.21

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Client
newlands developments

Project
Hoyland Common

Title
Proposed Drainage GA
S104 Approval
(Sheet 6 of 6)

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	15.03.2021
Task Team Manager	**Information Author**	**Task Information Manager**
SG	MF	SMC

Status
S4 (Suitable for Stage Approval)

Document Number
HOYLA-RPS-SI-XX-DR-D-336
Revision
P09

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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Planning Boundary
Proposed Highway Gully
Proposed Kerb Drainage
Proposed Surface Water Sewer
Proposed Highway Surface Water Drain
Proposed Private Surface Water Drain
Proposed Foul Water Sewer
Proposed Foul Water Rising Main
Adoption Easement Areas
Private 1:100yr+30% Basin Area
Existing Surface Water Drains
Adoptable Basin Maintenance Access Track
Private Pond Maintenance Access Track
Adoptable Basin High Water Level (1:30Yr TB = 102.70m)
Base Level of Adoptable Basin (BB - 101.570 falling to Outlet 101.400)
Pumping Station Compound
Private Basin High Water Level (TB = 102.70m)
Base Level of Private Basin (BB - 100.100 falling to Outlet 100.000)
Safety Bouys
Private Basin Stock Fencing
Adopted Basin Palisade Fence
Grass Swale

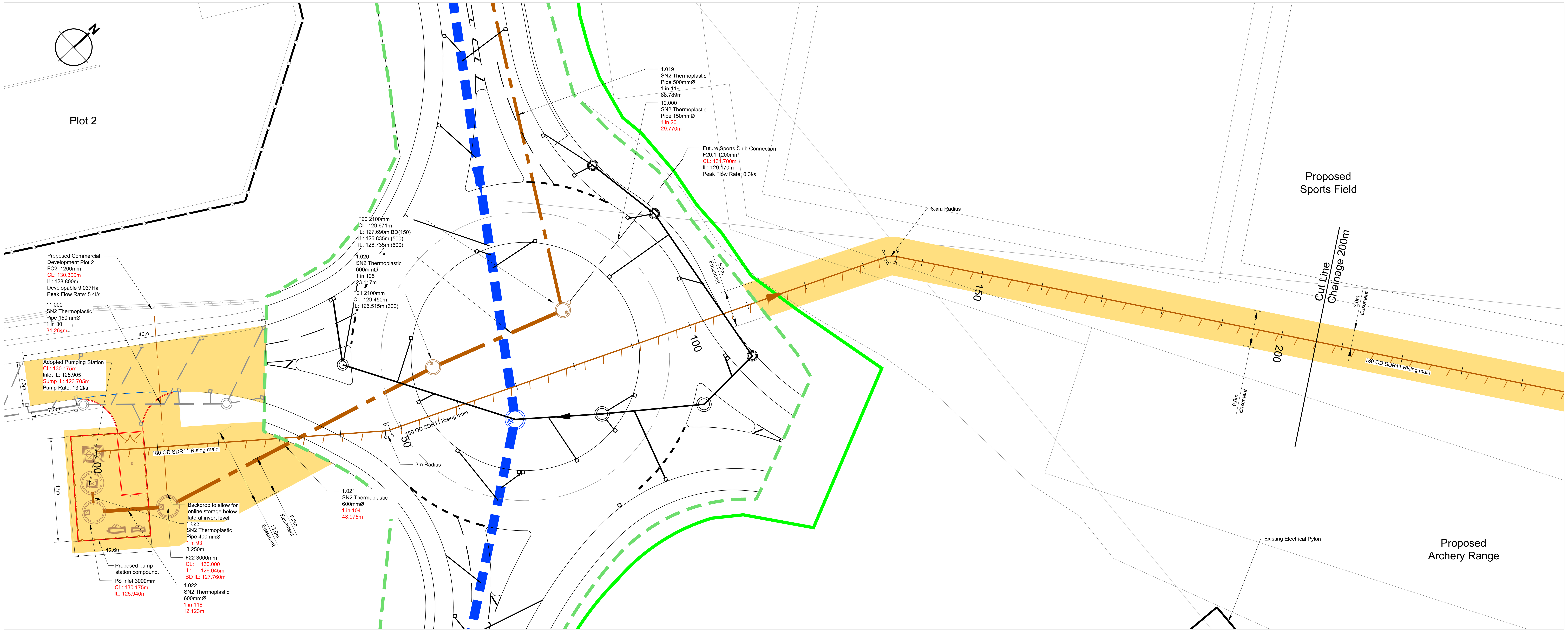
	Sewer Diameter/Size mm	Less Than 150	150-299	300-449	450-600	601-749	750-924	925-1000	1001-1124	1125-1399	1400 or greater
Depth to Invert of Sewer m	Less than 3.0	3.0	3.0	3.0	3.5	3.5	4.0	5.0	5.0	5.0	5.0
	3.0 to 4.0	3.0	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0
	4.0 to 5.0	4.0	4.0	4.0	5.0	5.0	5.0	6.0	6.0	6.5	6.5
	5.0 to 6.0	5.0	5.0	5.0	6.0	6.0	6.5	6.5	6.5	6.5	6.5
	6.0 to 7.5	6.0	6.0	6.0	6.0	6.0	6.0	6.5	6.5	6.5	6.5
	7.5 or greater	4.0	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0	6.0

Table 1 from the Yorkshire Water Developer Services - Requirements for Easements - Feb.2020

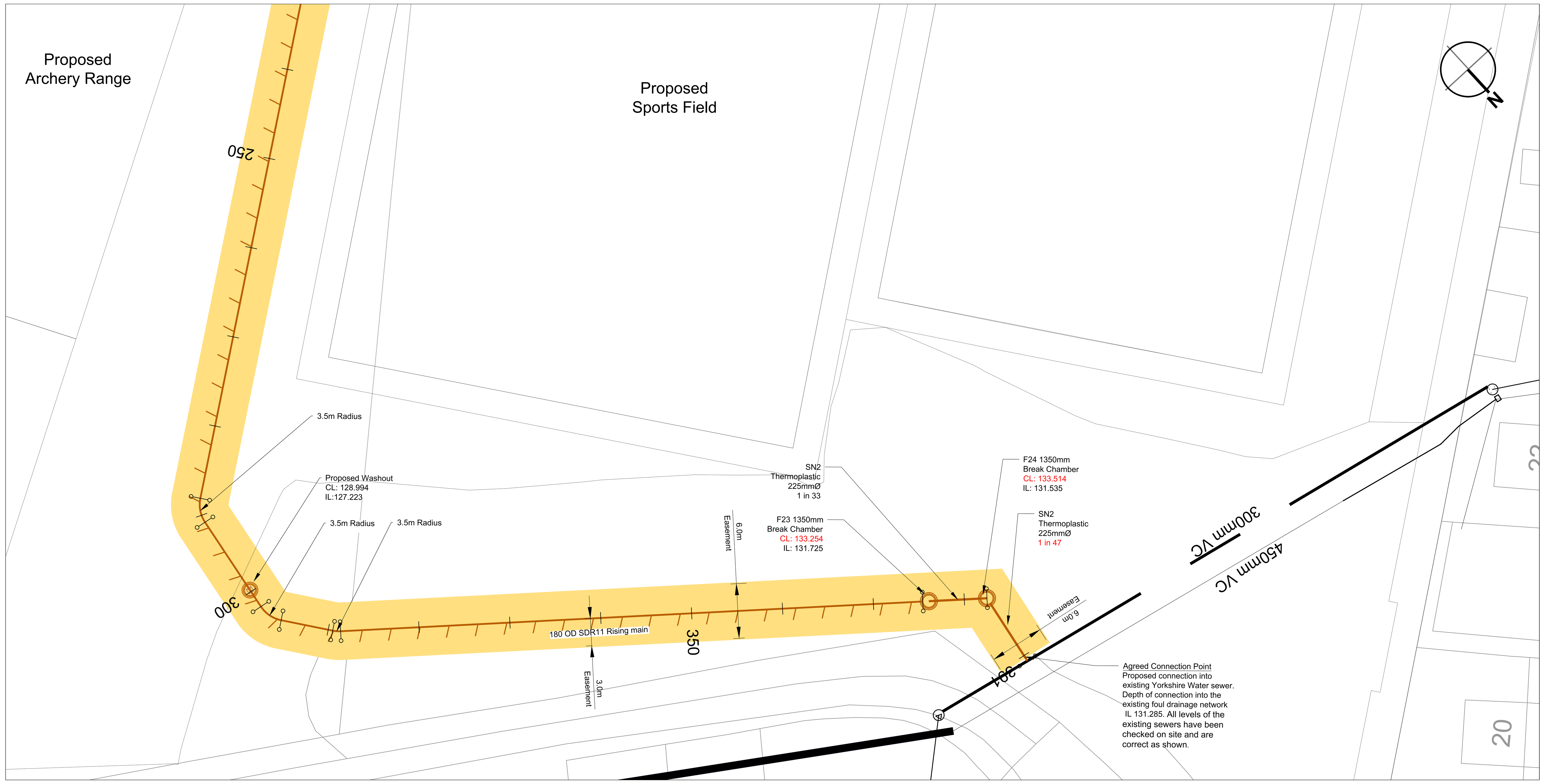
Section 111 of the Water Industry Act 1991

Under the provisions of Section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes construction materials. Contravention of the provisions of Section 111 is a criminal offence.

H-3-264-525



Foul Water Rising Main Layout (Viewport A)
Scale 1:250



Foul Water Rising Main Layout (Viewport B)
Scale 1:250

5m SCALE 1:250

Notes -

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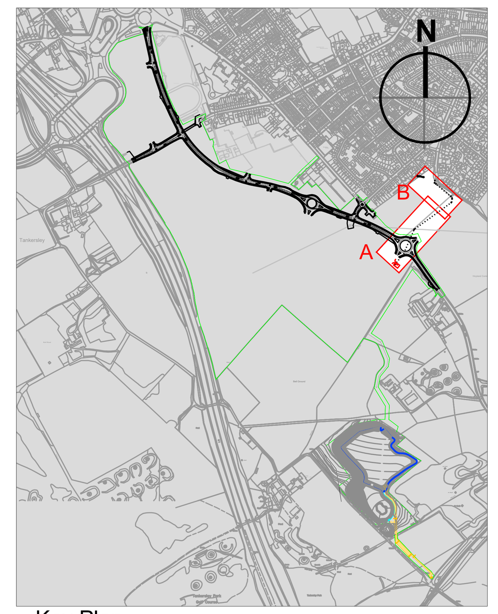
3. This drawing should be read in conjunction with all other relevant drawings and specifications.
4. Masterplan taken from PHP drawing 4400-001 Rev P30, received 02/11/2020.
5. All works to be carried out in accordance with the Specification for Highway Works, the South Yorkshire Residential Design Guide and the requirements of Barnsley Metropolitan Borough Council (BMBC) and Sewer Sector Guidance.
6. All information shown on this drawing is subject to Technical Approval from BMBC and Yorkshire Water.
7. Foul water designed in line with Sewer Sector Guidance, Flows from:
   7.1. - Industrial plots based on 0.6l/s/Ha
   7.2. - Residential plots based on 4000l/unit/day peak flow.
8. Highway drains designed to DMRB and SSG specifications.
9. Kerb drainage based on detailed design by Marshalls PLc.
10. All adoptable sewer works and material to be in accordance with "Code for Adoption". The Relevant British/European and Yorkshire Water's Standards/Requirements/Addendum to the Mechanical and Electrical Specification and Kitemarked.
11. The outside edge of adoptable sewers should be a minimum of 1m and manholes 0.5m from kerb faces and service margins.
12. Sewers must have 5 metres clearance from trees and hedges.
13. Adoptable plastic sewer pipes to be BSI Kitemarked (certified to WIS 4-35-01 and BS/EN13476).Adoptable plastic sewer pipes to be laid in maximum 3 metre lengths unless there is a specific operational need to lay longer lengths. Plastic channel sections in manholes are not acceptable and Yorkshire Water would prefer clayware channel in manholes. We have found that plastic channels are difficult to set in concrete because they float and a satisfactory finish cannot be obtained on the benching.
14. Manhole covers shall/must have a clear opening of 600mm and shall be Class D400 to BS EN 124 with 150mm deep frames in highways.
15. The pipes are to be selected by the contractor to have a suitable strength for the service conditions. The bedding's shown are the minimum requirements. The contractor must ensure that the bedding provided is suitable for the selected pipes and loading conditions. Details of proposals for the pipes and bedding's are to be submitted to the contract administrator for approval before the work commences
16. All pipes are to be suitable for main road traffic unless specified otherwise.
17. Yorkshire water Is not obliged to accept filter drain/land drainage run-off into the public sewer network or adoptable drainage system (directly or in-directly). An alternative method of disposal of the land drainage run-off will therefore be required and you will have to liaise with the Local Authority, Land drainage Section with regard to the disposal of the filter/land drainage run-off.
18. Cover slabs must carry the BSI Kitemark or will be rejected by Yorkshire Water Inspector. Where the clear opening of the Kitemarked product is different to that of the cover and frame, a loading bearing slab should be fitted above the cover slab to bring the size down to 600mm x 600mm for the Yorkshire Water specified cover size. Please refer to Concrete Pipe Systems Association (CPSA), 'Technical Bulletin' issued 2004 for Kitemarked cover slab opening sizes
19. Sulphate resistant cement (C20-DC2) and precast concrete products must be used, or a laboratory report provided proving tat such precautions are not necessary.
20. Sewers to be laid in class 'S' bedding (150mm Granular bed and surround). Where depth of cover to top of sewer is less then 1.2m in highways and verges (or less than 900mm in none vehicular access areas) then a concrete slab should be provide above granular bed and surround.
21. Yorkshire Water policy is that Type "C" brick manholes and 1050mm dia manhole rings are not preferred. Instead it is preferred that you use a type "B" manhole with 1200mm dia or 1500mm dia rings, with the opening sited over the channel where depth of cover to pipe soffit is 1 - 1.5m
22. The minimum crushing strength for clay pipes should be as follows : 100mm dia. 40KN/m, 150mm dia. 40KN/m, 225mm dia. 45KN/m and 300mm dia. 72KN/m. The minimum crushing strength for concrete pipes should be - (Class 120 to EN 1916/BS5911-1 2002). Plastic pipes should conform to WIS 4-35-01 and BS EN13476
23. Filled ground must be filled and consolidated under the supervision and to the satisfaction of Yorkshire Water before any sewer works are carried out.
24. Sewers must have 5 metres clearance from trees and hedges.
25. Bedding and backfill material to conform to the requirement of Water Industry Specification 4-08-02 (Table A2).
26. Filled ground must be filled and consolidated under the supervision and to the satisfaction of Yorkshire Water before any sewer works are carried out.
27. The chamber size of manholes with more than one connection in them may need to be increased an increment to accommodate the connections and bends.
28. Where a B125 cover and frame has been approved, this must not be coated in plastic and must have lifting eyes suitably sized to accommodate standard lifting keys. Screw down covers are not acceptable.
29. All levels of the existing sewers have been checked on site and are correct as shown

Rising Main Note

30. For rising mains, non-degradable marker tape should be laid 300mm above the top of the pipe. For a non-metal main, the marker tape should incorporate a trace wire brought to the surface at a marker post every 1000 metres (approximately) and connected to terminals on the marker post. At the pumping station, the tape should enter through a sealed duct, 300mm below the finished paved area, and should be terminated with one metre of wire coiled inside the valve chamber. At the discharge end of the rising main, the tape should be terminated inside the discharge manhole and coiled around a brass hook

Key

- Planning Boundary
- Proposed Highway Gully
- Proposed Kerb Drainage
- Proposed Surface Water Sewer
- Proposed Highway Surface Water Drain
- Proposed Private Surface Water Drain
- Proposed Foul Water Sewer
- Proposed Foul Water Rising Main
- Adoption Easement Areas
- Proposed Toe Drain
- Existing Surface Water Drains



Key Plan
Not to Scale

Rev	Description	By	Ckd	Date
P11	Revised following PS moving	SMC	AE	26.10.21
P10	Revised following comments for S104 Approval	SMC	AE	25.08.21
P09	Revised to suit Pumping station amendments	SMC	AE	14.07.21
P08	Revised following comments for S104 Approval	SMC	AE	27.05.21
P07	Revised following comments for S104 Approval	JNB	AE	21.05.21
P06	Revised following comments for S104 Approval	MF	SM	29.01.21
P05	F23 amended to suit S106	JNB	SM	06.01.21

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Client
newlands developments

Project Hoyland Common

Title S104 Foul Water Rising Main General Arrangement

RPS Project Number	Scale @ A1	Date Created
NK020040	As Shown	18.08.2020
Task Team Manager	Information Author	Task Information Manager
SG	JNB	SM

Status
S4 (Suitable For Stage Approval)

Document Number	Revision
020040-RPS-SI-XX-DR-D-360	P11

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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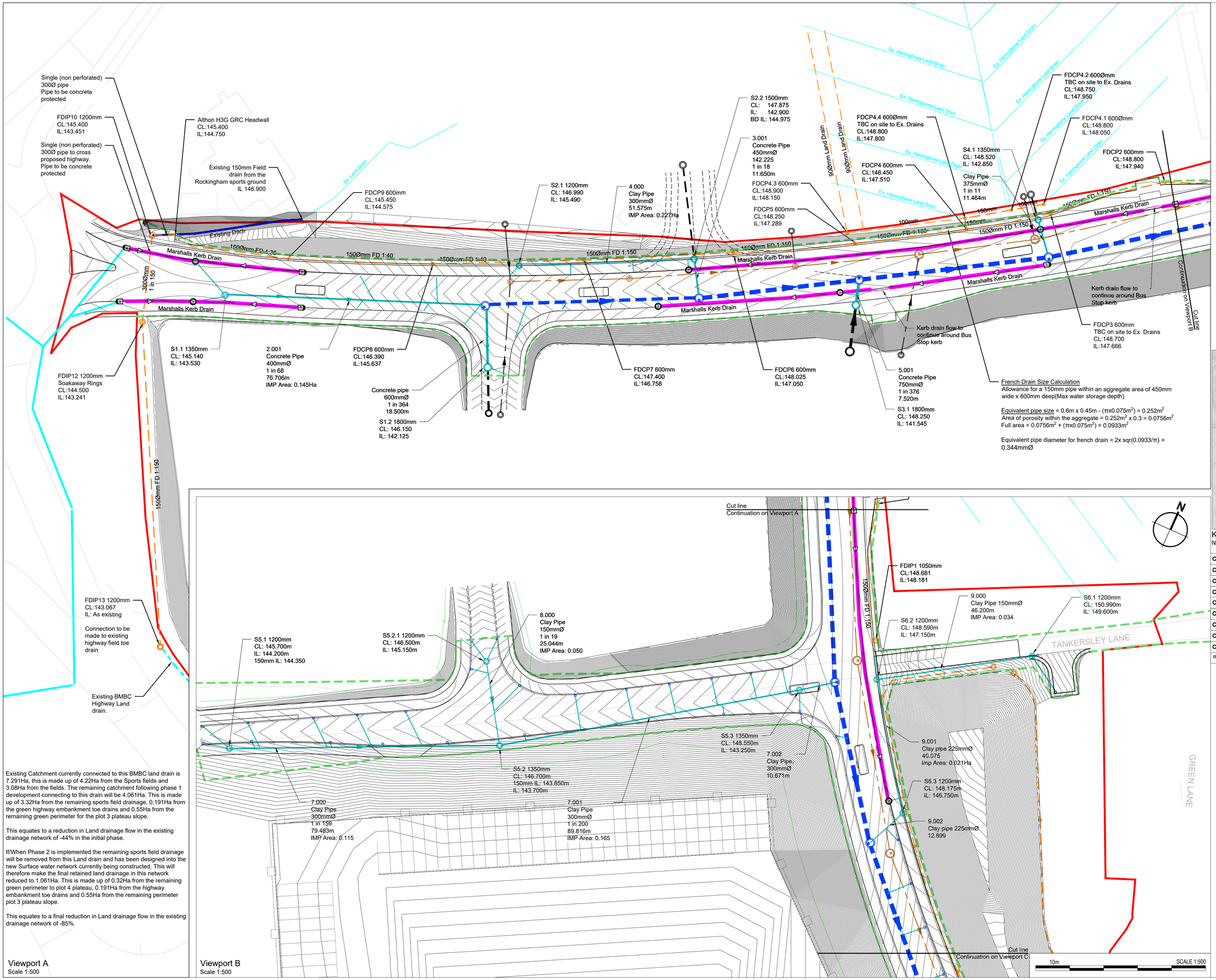

Existing Catchment currently connected to this BMBC land drain is 7.291Ha, this is made up of 4.22Ha from the Sports fields and 3.08Ha from the fields. The remaining catchment following phase 1 development connecting to this drain will be 4.061Ha. This is made up of 3.32Ha from the remaining sports field drainage, 0.191Ha from the green highway embankment toe drains and 0.55Ha from the remaining green perimeter for the plot 3 plateau slope.

This equates to a reduction in Land drainage flow in the existing drainage network of -44% in the initial phase.

If/When Phase 2 is implemented the remaining sports field drainage will be removed from this Land drain and has been designed into the new Surface water network currently being constructed. This will therefore make the final retained land drainage in this network reduced to 1.061Ha. This is made up of 0.32Ha from the remaining green perimeter to plot 4 plateau, 0.191Ha from the highway embankment toe drains and 0.55Ha from the remaining perimeter plot 3 plateau slope.

This equates to a final reduction in Land drainage flow in the existing drainage network of -85%.

Viewport A
Scale 1:500

Viewport B
Scale 1:500

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4. Masterplan taken from PHP drawing 4400-001 Rev P25, received 15/06/2020.
5. All works to be carried out in accordance with the Specification for Highway Works, the South Yorkshire Residential Design Guide and the requirements of Barnsley Metropolitan Borough Council.
6. Foul water designed in line with Sewer Sector Guidance, Flows from:
   - Industrial plots based on 0.6l/s/Ha
   - Residential plots based on 4000l/unit/day peak flow.
7. Adopted Surface water designed in line with Sewer Sector Guidance.
8. Highway drains designed to DMRB and SSG specifications.
9. Kerb drainage based on detailed design by Marshalls PLc.
10. Embankment toe drains are connected to existing drainage outfalls to both provide a base flow to those habitats and to maintain ground water drains. Catchments for all toe drains connections are greatly reduced vs the original site.

Key

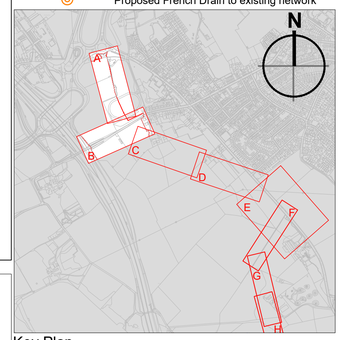
- Planning Boundary
- Proposed Highway Gully
- Proposed Kerb Drainage
- Proposed Surface Water Sewer
- Proposed Highway Surface Water Sewer
- Proposed Private Surface Water Sewer
- Proposed Foul Water Sewer
- Proposed Foul Water Rising Main
- Proposed French Drain to existing network

French Drain Size Calculation

Allowance for a 150mm pipe within an aggregate area of 450mm wide x 600mm deep(Max water storage depth).

Equivalent pipe size = 0.6m x 0.45m - (πx0.075m^2) = 0.252m^2
Area of porosity within the aggregate = 0.252m^2 x 0.3 = 0.0756m^2
Full area = 0.0756m^2 + (πx0.075m^2) = 0.0933m^2

Equivalent pipe diameter for french drain = 2x sqr(0.0933/π) = 0.344mmØ



Key Plan
Not to Scale

Rev	Description	By	Ckd	Date
C10	updated to suit approved S104 plans	SMC	ANT	17.01.22
C09	Highway Drainage Amended	SMC	ANT	30.06.21
C08	Highway Drainage Amended	SMC	ANT	22.06.21
C07	DRAFT Highway Drainage Amended	SMC	ANT	21.06.21
C06	Highway Drainage depths rationalised	SMC	ANT	26.05.21
C05	Land Drainage updated	SMC	ANT	08.05.21
C04	Extra Land Drains Added	SMC	ANT	04.05.21
C03	Surface Water French Drains & Rockingham Drain Link	JNB	SMC	22.04.21
C02	Thermoplastic pipes removed	KA	ANT	20.04.21

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Client: newlands developments

Project: Hoyland

Title: Highway Drainage Layout (Sheet 1 of 5)

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	08.07.2020
Task Team Manager	**Information Author**	**Task Information Manager**
SG	JNB	SMC

Status: A5 (Approved for Construction)

Document Number: HOYLA-RPS-SI-XX-DR-CR-511
Revision: C10

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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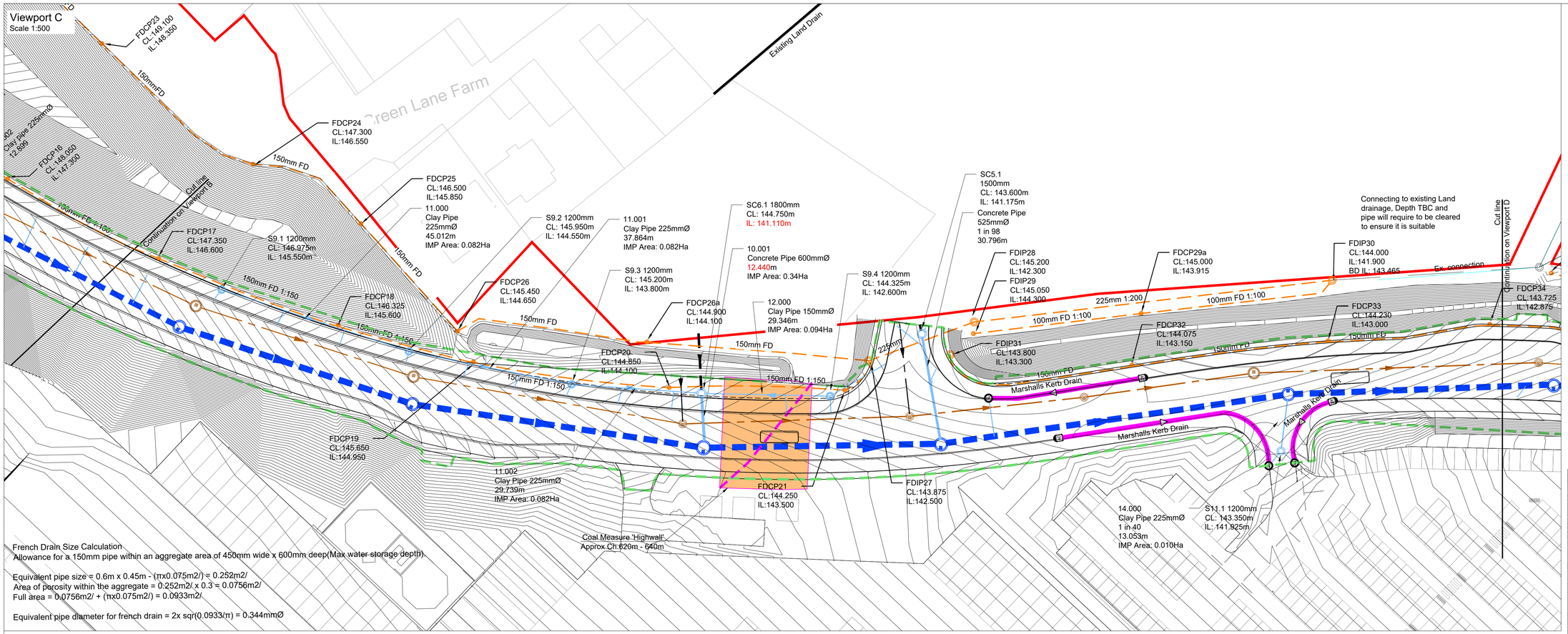

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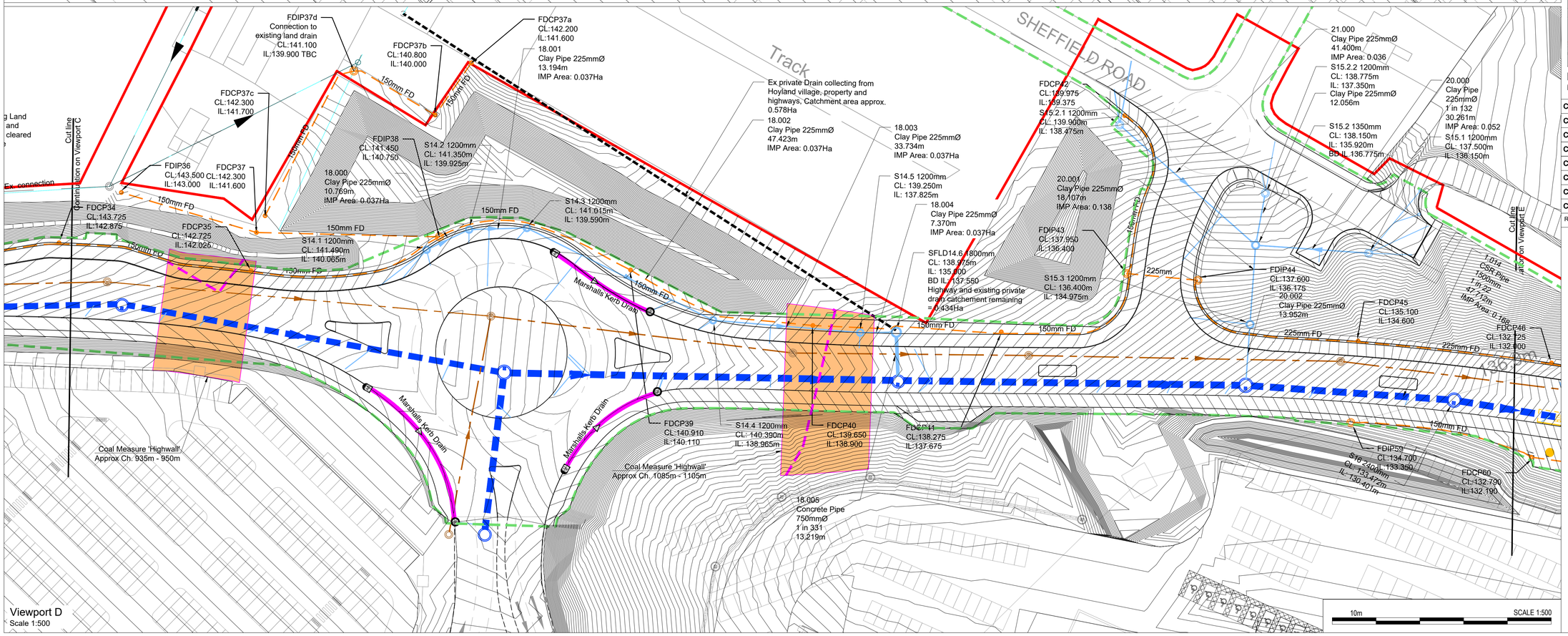
Equivalent pipe diameter for french drain = 2x sqr(0.0933/π) = 0.344mmØ



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Notes

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4. Masterplan taken from PHP drawing 4400-001 Rev P25, received 15/06/2020.
5. All works to be carried out in accordance with the Specification for Highway Works, the South Yorkshire Residential Design Guide and the requirements of Barnsley Metropolitan Borough Council.
6. Foul water designed in line with Sewer Sector Guidance, Flows from:
   - Industrial plots based on 0.6l/s/Ha
   - Residential plots based on 4000l/unit/day peak flow.
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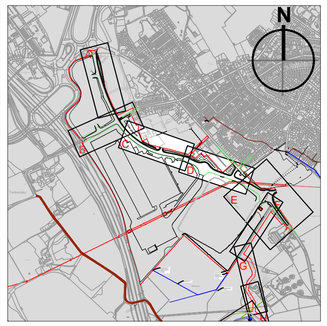
Key

- Planning Boundary
- Proposed Highway Gully
- Proposed Kerb Drainage
- Proposed Surface Water Sewer
- Proposed Highway Surface Water Sewer
- Proposed Private Surface Water Sewer
- Proposed Foul Water Sewer
- Proposed Foul Water Rising Main
- Proposed Toe Drain



Key Plan
Not to scale

Rev	Description	By	Ckd	Date
C08	Highway Drainage Amended to suit S104 updates	SMC	ANT	07.12.21
C07	Highway Drainage Amended	SMC	ANT	30.06.21
C06	Highway Drainage Amended	SMC	ANT	22.06.21
C05	DRAFT Highway Drainage Amended	SMC	ANT	21.06.21
C04	Updated Land & Highway drains + 'Highwalls'	SMC	ANT	08.05.21
C03	Updated Land & Highway drains + 'Highwalls'	SMC	ANT	08.05.21
C02	Updated Land Drain	MF	AE	06.04.21
C01	Construction Issue	KA	ANT	13.01.21

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Client
newlands developments

Project
Hoyland

Title
Highway Drainage Layout
(Sheet 2 of 5)

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	08.07.2020
Task Team Manager	**Information Author**	**Task Information Manager**
SG	JNB	SMC

Status
A5 (Approved for Construction)

Document Number
HOYLA-RPS-SI-XX-DR-CR-512
Revision
C08
Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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Viewport E
Scale 1:500

24.002
Clay Pipe 225mmØ
11.176m
IMP area 0.018Ha

18.4 1200mm
CL: 129.500m
IL: 128.050m

FDIP49
CL:129.650
IL:128.000

S18.5 1200mm
CL: 129.507m
IL: 127.925m

FDIP50
CL:129.600
IL:127.875

24.003
Clay Pipe 225mmØ
1 in 98
16.731m
IMP Area: 0.018Ha

S18.6 1350mm
CL: 129.195m
IL: 127.770m

24.004
Clay Pipe
225mmØ
14.235m
IMP: 0.141

FDCP51
CL:129.040
IL:128.300

24.001
Clay Pipe 225mmØ
28.247m
IMP Area: 0.045Ha

S18.3 1200mm
CL: 129.810m
IL: 128.390m

FDCP48
CL:129.900
IL:129.200

24.000
Clay Pipe 225mmØ
12.786m
IMP Area: 0.018Ha

S18.2 1200mm
CL: 129.975m
IL: 128.550m

FDCP47
CL:130.890
IL:130.100

FDIP52
CL:128.450
IL:127.000

S19.2 1200mm
CL: 127.925m
IL: 123.885m

25.000
Clay Pipe 300mmØ
1 in 200
53.100m
IMP Area: 0.039

S19.1 1200mm
CL: 125.650m
IL: 124.150m

Existing gully positions to be retained and replaced with double gullies
Existing Surface water spine drainage for the road to be retained beyond this point

Marshalls Kerb Drain

Continued on Viewport D

FDCP46
CL:132.125
IL:132.000

FDCP62
CL:129.875
IL:129.275

FDCP61
CL:131.125
IL:130.500

FDCP60
CL:132.700
IL:132.100

FDIP59
CL:134.700
IL:133.350

23.000
Clay Pipe 225mmØ
29.556m
IMP Area: 0.050Ha

CP1
CL:131.600
IL:128.975

FDIP63
CL:129.850
IL:128.350

S18.1 1200mm
CL: 129.659m
IL: 126.045m

FDIP64
CL:129.850
IL:128.150

FDIP65
CL:127.450
IL:126.500

FDIP66
CL:126.500
IL:125.600

25.001
Clay Pipe
300mmØ
8.395m
IMP Area: 0.066

FDIP69
CL:125.500
IL:124.300 tbc

Connection to existing Highway drain TBC on site

FDIP68
CL:127.000
IL:126.300

Clay Pipe 100mmØ
perforated
52.781m
IMP Area: 0.006

CCS

FDIP67
1500mm
CL:125.640
GL:125.200
400mm IL124.300
300mm IL 124.400
150mm IL 124.750

150mm drain connection

1x1x1 gabion basket with 150mm outfall pipe
CL 125.300
IL 124.800

Connection to existing 400mm Land drain.
IL 124.21m

Existing Catchment currently connected to this land drain is 28.665Ha. This is made up of field drains and a private surface water sewer collecting from parts of Hoyland and Sheffield Road.

The remaining catchment following development connecting to this drain will be 3.22Ha. This is made up of 3.22Ha from the green highway embankments, plot 2 green embankments and toe drains.

This equates to a reduction in Land drainage flow in the existing drainage network of -89%.

Reprofile the existing field drain ditch to drain the embankment toe
Ditch to be minimum:
0.5m deep
0.3m base
1:2 side slopes

French Drain Size Calculation
Allowance for a 150mm pipe within an aggregate area of 450mm wide x 600mm deep(Max water storage depth).

Equivalent pipe size = 0.6m x 0.45m - (πx0.075m2/) = 0.252m2/
Area of porosity within the aggregate = 0.252m2/ x 0.3 = 0.0756m2/
Full area = 0.0756m2/ + (πx0.075m2/) = 0.0933m2/

Equivalent pipe diameter for french drain = 2x sqr(0.0933/π) = 0.344mmØ

10m SCALE 1:500

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Notes

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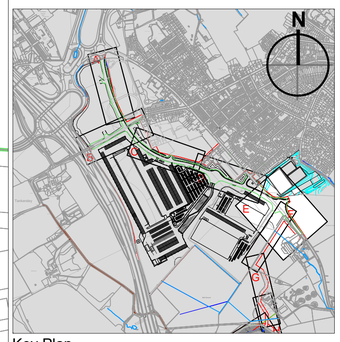
3. This drawing should be read in conjunction with all other relevant drawings and specifications.
4. Masterplan taken from PHP drawing 4400-001 Rev P25, received 15/06/2020.
5. All works to be carried out in accordance with the Specification for Highway Works, the South Yorkshire Residential Design Guide and the requirements of Barnsley Metropolitan Borough Council.
6. Foul water designed in line with Sewer Sector Guidance, Flows from:
   - Industrial plots based on 0.6l/s/Ha
   - Residential plots based on 4000l/unit/day peak flow.
7. Adopted Surface water designed in line with Sewer Sector Guidance.
8. Highway drains designed to DMRB and SSG specifications.
9. Kerb drainage based on detailed design by Marshalls PLc.
10. Embankment toe drains are connected to existing drainage outfalls to both provide a base flow to those habitats and to maintain ground water drains. Catchments for all toe drains connections are greatly reduced vs the original site.

Key

- Planning Boundary
- Proposed Highway Gully
- Proposed Kerb Drainage
- Proposed Surface Water Sewer
- Proposed Highway Surface Water Sewer
- Proposed Private Surface Water Sewer
- Proposed Foul Water Sewer
- Proposed Foul Water Rising Main
- Proposed highway French Drain



Key Plan
Not to Scale

Rev	Description	By	Ckd	Date
C08	FDIP67 Amended	SMC	ANT	01.03.21
C07	Drainage and background updated to suit S104	SMC	ANT	07.12.21
C06	Highway Drainage Amended	SMC	ANT	30.06.21
C05	Highway Drainage Amended	SMC	ANT	22.06.21

MAKING COMPLEX EASY

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Client
newlands developments

Project
Hoyland

Title
Highway Drainage Layout
(Sheet 3 of 5)

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	08.07.2020
Task Team Manager	Information Author	Task Information Manager
SG	JNB	SMC

Status
A5 (Approved for Construction)

Document Number
HOYLA-RPS-SI-XX-DR-CR-513

Revision
C08

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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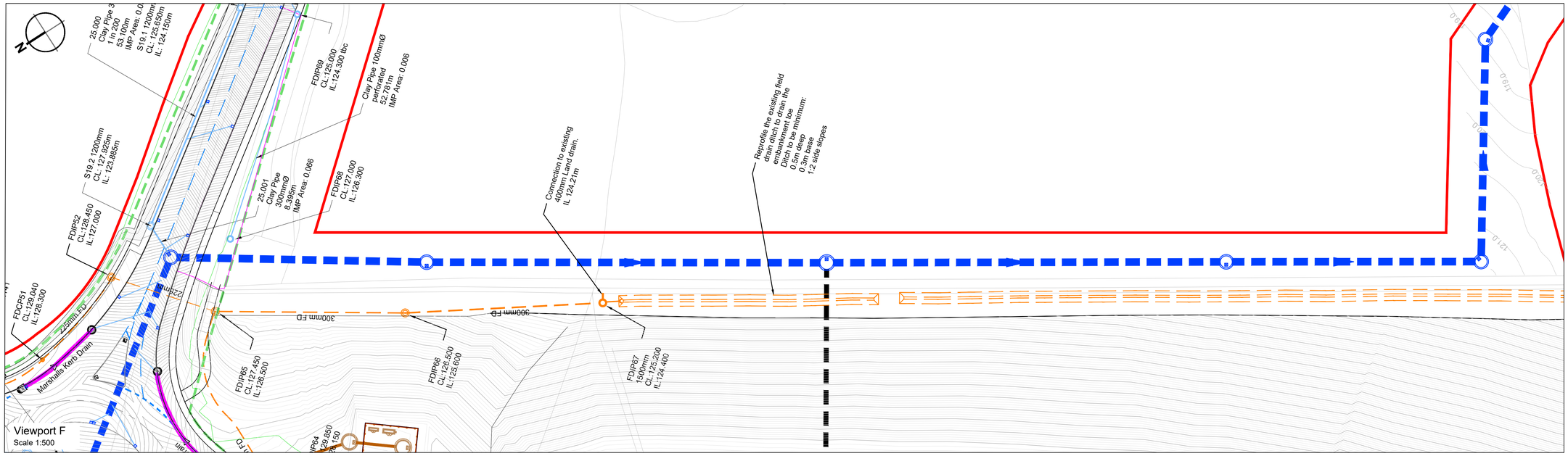

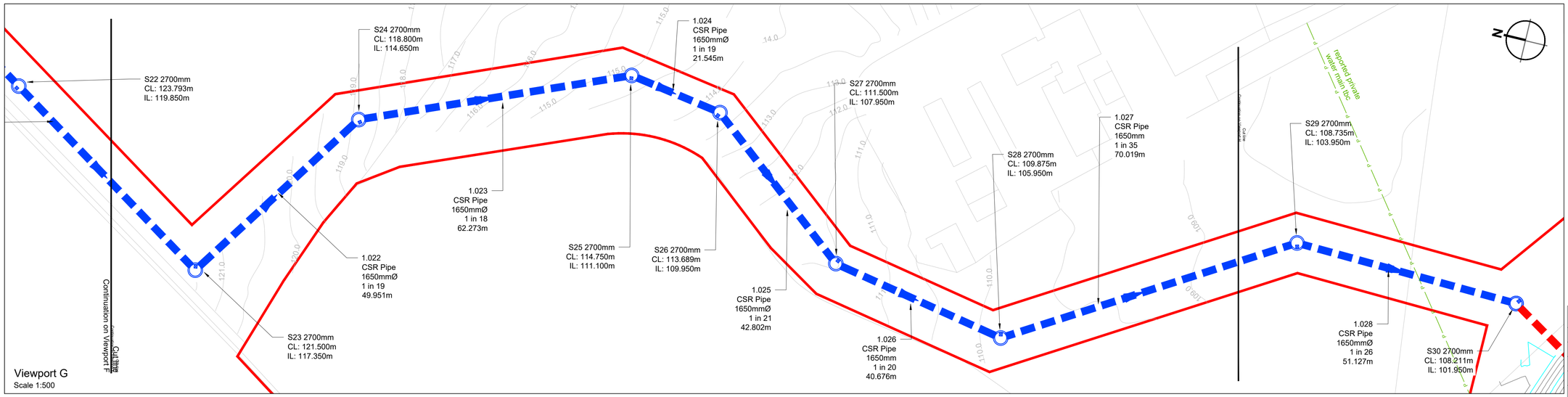

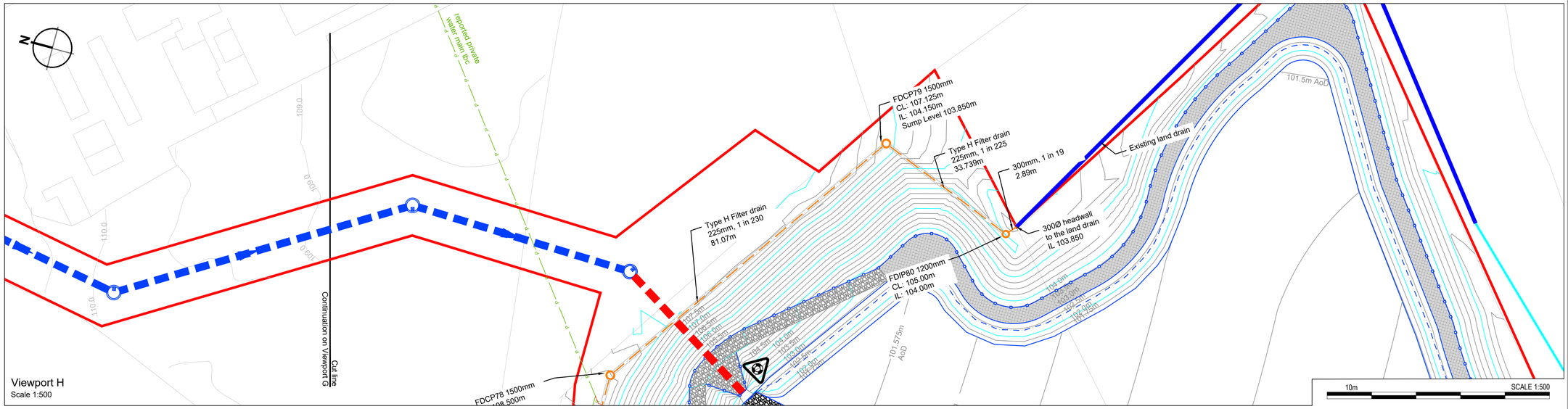

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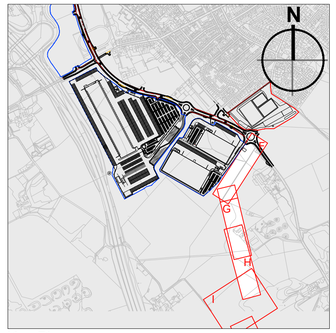
- Proposed Foul Water Sewer
- Proposed Foul Water Rising Main
- Proposed French/cutoff Drain



Key Plan
Not to Scale

Rev	Description	By	Ckd	Date
C02	Drainage updated to suit Highway drainage details and the S104 updates	SMC	ANT	07.12.21
C01	Construction Issue	KA	ANT	13.01.21
P03	BMBC comments received 26.11.20 incorporated	AB	ANT	02.12.20
P02	BMBC comments incorporated	JNB	SMC	26.10.20
P01	First Issue	JNB	SMC	21.08.20

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Client: newlands developments

Project: Hoyland

Title: Highway Drainage Layout (Sheet 4 of 5)

RPS Project Number	Scale @ A1	Date Created
NK020040	1:500	08.07.2020
Task Team Manager	**Information Author**	**Task Information Manager**
SG	JNB	SMC

Status: A5 (Approved for Construction)

Document Number: HOYLA-RPS-SI-XX-DR-CR-514

Revision: C02

Project Code - Originator - Zone - Level - Type - Role - Drawing Number

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4. Masterplan taken from PHP drawing 4400-001 Rev P25, received 15/06/2020.
5. All works to be carried out in accordance with the Specification for Highway Works, the South Yorkshire Residential Design Guide and the requirements of Barnsley Metropolitan Borough Council.
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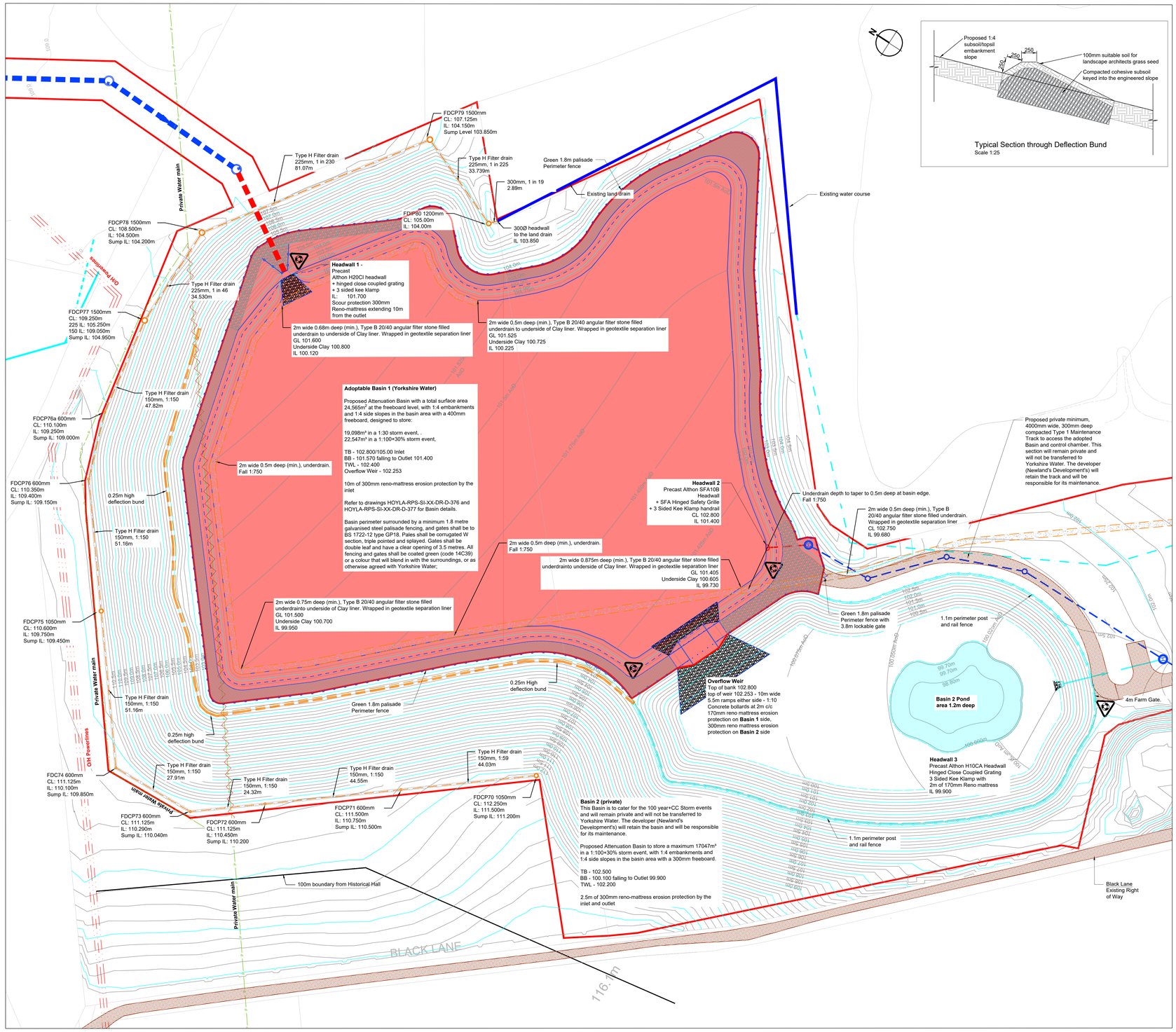
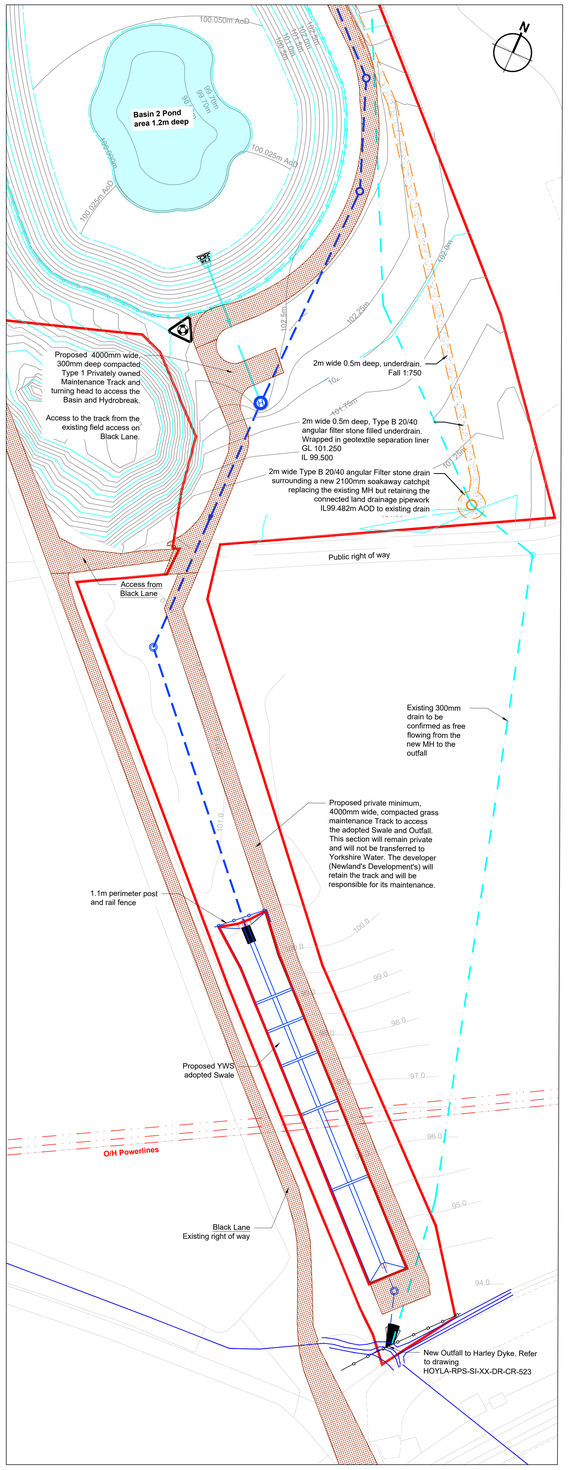
Underdrain

Current drainage pathway collecting the seeping water during excavation is a 0.5m deep 1.0m wide v channel this equates to a flow capacity of 0.25m³ with a zero fall. The proposed under drain is proposed as a 2m wide, 0.5m deep channel filled with angular gravel that will leave approximately 30% voids, with a fall of at least 1:750. This equates to a flow capacity of 0.3m³. As this is a greater capacity than the current seeping pathway it will move the seeping water under the basin liner to the outfall point.



Viewport I
Scale 1:500



Viewport J
Scale 1:500

Key

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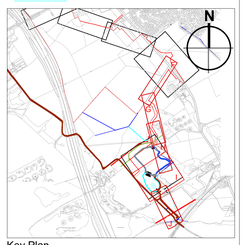
- Proposed Highway Surface Water Sewer
- Proposed Private Surface Water Sewer
- Proposed Foul Water Sewer
- Proposed Foul Water Rising Main
- Proposed French/cutoff Drain
- Yorkshire water adopted area
- Access Tracks
- Permanent Water



Key Plan
Not to Scale

Rev	Description	By	Ckd	Date
C06	Toe under drain amended, bund detail added	SMC	ANT	28.02.22
C05	Toe under drain added	SMC	ANT	09.02.22
C04	Extra details and notes added	SMC	ANT	20.01.22
C03	Details amended	SMC	ANT	12.01.22
C02	Basin design revised to suit YWS requirements	SMC	ANT	07.12.21
C01	Construction Issue	KA	ANT	13.01.21

MAKING COMPLEX EASY
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Client
newlands developments

Project
Hoyland

Title
Highway Drainage Layout
(Sheet 5 of 5)

RPS Project Number	Scale @ A0	Date Created
NK020040	1:500	08.07.2020
Task Team Manager	**Information Author**	**Task Information Manager**
SG	JNB	SMC

Status
A5 (Approved for Construction)

Document Number
HOYLA-RPS-SI-XX-DR-CR-515
Project Code - Originator - Zone - Level - Type - Role - Drawing Number

Revision
C06

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10m SCALE 1:500

Appendix B

RPS UK SUDS Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	scott mclean
Site name:	Hoyland Common
Site location:	Southern Outfall

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

Site Details

Latitude:	53.48500° N
Longitude:	1.46056° W
Reference:	3992267808
Date:	Apr 07 2020 21:29

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 16.789

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	710	710
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	82.41	82.41
1 in 1 year (l/s):	70.87	70.87
1 in 30 years (l/s):	144.22	144.22
1 in 100 year (l/s):	171.42	171.42
1 in 200 years (l/s):	195.31	195.31

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

Appendix C

RPS MicroDrainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Southern Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.362	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.000
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Southern Storm

- Indicates pipe length does not match coordinates

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	82.999	1.700	48.8	0.000	5.00	0.0	0.600		o	600	Pipe/Conduit	
S1.001	32.400	0.089	364.0	1.395	0.00	0.0	0.600		o	600	Pipe/Conduit	
S2.000	12.439	0.220	56.5	0.053	5.00	0.0	0.600		o	150	Pipe/Conduit	
S2.001	76.706	1.130	67.9	0.148	0.00	0.0	0.600		o	400	Pipe/Conduit	
S3.000	33.903	0.340	99.7	0.177	5.00	0.0	0.600		o	225	Pipe/Conduit	
S3.001	22.430	0.225	99.7	0.032	0.00	0.0	0.600		o	225	Pipe/Conduit	
S3.002	14.007	1.110	12.6	0.018	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.002	62.922	0.125	503.4	0.227	0.00	0.0	0.600		o	900	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)
S1.000	0.00	5.40	144.000	0.000	0.0	0.0	0.0	3.49	987.1	0.0
S1.001	0.00	5.82	142.289	1.395	0.0	0.0	0.0	1.27	359.2	0.0
S2.000	0.00	5.15	144.000	0.053	0.0	0.0	0.0	1.34	23.7	0.0
S2.001	0.00	5.71	143.530	0.201	0.0	0.0	0.0	2.29	288.2	0.0
S3.000	0.00	5.43	144.250	0.177	0.0	0.0	0.0	1.31	52.1	0.0
S3.001	0.00	5.72	143.910	0.209	0.0	0.0	0.0	1.31	52.1	0.0
S3.002	0.00	5.78	143.685	0.227	0.0	0.0	0.0	3.70	147.3	0.0
S1.002	0.00	6.58	141.900	2.050	0.0	0.0	0.0	1.39	884.1	0.0

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Network Design Table for Southern Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S4.000	39.559	2.175	18.2	1.080	5.00	0.0	0.600		o	400	Pipe/Conduit	
S1.003	47.456	0.392	121.1	0.001	0.00	0.0	0.600		o	1200	Pipe/Conduit	
S5.000	62.680	1.800	34.8	0.000	5.00	0.0	0.600		o	750	Pipe/Conduit	
S5.001	21.284	0.054	394.1	3.186	0.00	0.0	0.600		o	750	Pipe/Conduit	
S1.004	53.710	0.095	565.4	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
S6.000	19.201	1.746	11.0	0.743	5.00	0.0	0.600		o	375	Pipe/Conduit	
S1.005	88.554	0.255	347.3	0.000	0.00	0.0	0.600		o	1200	Pipe/Conduit	
S7.000	79.483	0.500	159.0	0.115	5.00	0.0	0.600		o	300	Pipe/Conduit	
S8.000	25.044	0.437	57.3	0.050	5.00	0.0	0.600		o	150	Pipe/Conduit	
S7.001	87.478	0.900	97.2	0.165	0.00	0.0	0.600		o	300	Pipe/Conduit	
S7.002	17.979	0.900	20.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
S1.006	52.304	0.064	817.3	0.127	0.00	0.0	0.600		o	1200	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)
S4.000	0.00	5.15	144.450	1.080	0.0	0.0	0.0	4.44	558.3	0.0
S1.003	0.00	6.81	141.475	3.131	0.0	0.0	0.0	3.40	3844.7	0.0
S5.000	0.00	5.22	143.400	0.000	0.0	0.0	0.0	4.75	2099.3	0.0
S5.001	0.00	5.47	141.579	3.186	0.0	0.0	0.0	1.40	620.0	0.0
S1.004	0.00	7.38	141.075	6.317	0.0	0.0	0.0	1.57	1771.3	0.0
S6.000	0.00	5.06	143.551	0.743	0.0	0.0	0.0	5.49	606.3	0.0
S1.005	0.00	8.12	140.980	7.060	0.0	0.0	0.0	2.00	2264.1	0.0
S7.000	0.00	6.06	143.925	0.115	0.0	0.0	0.0	1.24	88.0	0.0
S8.000	0.00	5.31	144.065	0.050	0.0	0.0	0.0	1.33	23.5	0.0
S7.001	0.00	6.98	143.425	0.330	0.0	0.0	0.0	1.59	112.7	0.0
S7.002	0.00	7.06	142.525	0.330	0.0	0.0	0.0	3.53	249.8	0.0
S1.006	0.00	8.79	140.725	7.517	0.0	0.0	0.0	1.30	1470.9	0.0

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Network Design Table for Southern Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S9.000	44.142	2.225	19.8	0.034	5.00	0.0	0.600		o	150	Pipe/Conduit	
S9.001	41.720	0.200	208.6	0.020	0.00	0.0	0.600		o	225	Pipe/Conduit	
S9.002	13.252#	5.164	2.6	0.001	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.007	55.675	0.110	506.1	0.099	0.00	0.0	0.600		o	1200	Pipe/Conduit	
S1.008	56.046	0.110	509.5	0.000	0.00	0.0	0.600		o	1350	Pipe/Conduit	
S1.009	67.180	0.130	516.8	0.000	0.00	0.0	0.600		o	1350	Pipe/Conduit	
S10.000	14.245	0.220	64.8	1.644	5.00	0.0	0.600		o	600	Pipe/Conduit	
S11.000	44.490	1.350	33.0	0.082	5.00	0.0	0.600		o	225	Pipe/Conduit	
S11.001	38.116	0.675	56.5	0.082	0.00	0.0	0.600		o	225	Pipe/Conduit	
S11.002	29.739#	0.550	54.1	0.082	0.00	0.0	0.600		o	225	Pipe/Conduit	
S12.000	29.346	0.580	50.6	0.094	5.00	0.0	0.600		o	225	Pipe/Conduit	
S10.001	12.906	0.199	64.9	0.000	0.00	0.0	0.600		o	600	Pipe/Conduit	
S1.010	54.232	0.100	542.3	0.000	0.00	0.0	0.600		o	1350	Pipe/Conduit	
S13.000	30.796	0.314	98.1	1.530	5.00	0.0	0.600		o	525	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)
S9.000	0.00	5.32	149.300	0.034	0.0	0.0	0.0	2.27	40.1	0.0
S9.001	0.00	6.10	147.000	0.054	0.0	0.0	0.0	0.90	35.8	0.0
S9.002	0.00	6.12	146.800	0.055	0.0	0.0	0.0	8.23	327.2	0.0
S1.007	0.00	9.35	140.661	7.671	0.0	0.0	0.0	1.66	1872.9	0.0
S1.008	0.00	9.87	140.401	7.671	0.0	0.0	0.0	1.77	2540.3	0.0
S1.009	0.00	10.51	140.291	7.671	0.0	0.0	0.0	1.76	2522.3	0.0
S10.000	0.00	5.08	141.330	1.644	0.0	0.0	0.0	3.03	856.6	0.0
S11.000	0.00	5.32	145.900	0.082	0.0	0.0	0.0	2.29	90.9	0.0
S11.001	0.00	5.69	144.550	0.164	0.0	0.0	0.0	1.74	69.3	0.0
S11.002	0.00	5.97	143.875	0.246	0.0	0.0	0.0	1.78	70.9	0.0
S12.000	0.00	5.27	142.900	0.094	0.0	0.0	0.0	1.84	73.3	0.0
S10.001	0.00	6.04	141.110	1.984	0.0	0.0	0.0	3.03	855.9	0.0
S1.010	0.00	11.04	140.161	9.655	0.0	0.0	0.0	1.72	2461.7	0.0
S13.000	0.00	5.23	141.225	1.530	0.0	0.0	0.0	2.26	489.7	0.0

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Network Design Table for Southern Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.011	80.096	0.140	572.1	0.237	0.00	0.0	0.600		o	1350	Pipe/Conduit	
S14.000	13.053	0.326	40.0	0.010	5.00	0.0	0.600		o	225	Pipe/Conduit	
S1.012	60.662	0.371	163.5	0.070	0.00	0.0	0.600		o	1350	Pipe/Conduit	
S1.013	88.541	3.130	28.3	0.128	0.00	0.0	0.600		o	1350	Pipe/Conduit	
S15.000	494.826	2.800	176.7	6.053	8.00	0.0	0.600		o	1200	Pipe/Conduit	
S16.000	79.840	0.340	234.8	1.440	8.00	0.0	0.600		o	1500	Pipe/Conduit	
S15.001	132.986	0.560	237.5	0.990	0.00	0.0	0.600		o	1500	Pipe/Conduit	
S17.000	462.157	3.400	135.9	5.963	8.00	0.0	0.600		o	1200	Pipe/Conduit	
S15.002	292.037	0.450	649.0	0.990	0.00	0.0	0.600		o	1500	Pipe/Conduit	
S15.003	37.319	0.380	98.2	1.080	0.00	0.0	0.600		o	1500	Pipe/Conduit	
S1.014	90.000	1.560	57.7	0.248	0.00	0.0	0.600		o	1500	Pipe/Conduit	
S18.000	20.572#	0.515	39.9	0.037	5.00	0.0	0.600		o	225	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)
S1.011	0.00	11.83	140.061	11.422	0.0	0.0	0.0	1.67	2396.3	0.0
S14.000	0.00	5.10	141.372	0.010	0.0	0.0	0.0	2.07	82.4	0.0
S1.012	0.00	12.15	139.921	11.502	0.0	0.0	0.0	3.14	4498.2	0.0
S1.013	0.00	12.35	139.550	11.630	0.0	0.0	0.0	7.57	10841.0	0.0
S15.000	0.00	10.93	140.800	6.053	0.0	0.0	0.0	2.81	3179.6	0.0
S16.000	0.00	8.48	138.000	1.440	0.0	0.0	0.0	2.80	4939.2	0.0
S15.001	0.00	11.73	137.660	8.483	0.0	0.0	0.0	2.78	4911.4	0.0
S17.000	0.00	10.40	140.800	5.963	0.0	0.0	0.0	3.21	3627.5	0.0
S15.002	0.00	14.63	137.100	15.435	0.0	0.0	0.0	1.68	2962.1	0.0
S15.003	0.00	14.78	136.650	16.515	0.0	0.0	0.0	4.33	7650.1	0.0
S1.014	0.00	15.04	136.270	28.393	0.0	0.0	0.0	5.65	9988.2	0.0
S18.000	0.00	5.17	140.200	0.037	0.0	0.0	0.0	2.08	82.5	0.0

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Network Design Table for Southern Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S18.001	17.520#	0.600	29.2	0.037	0.00	0.0	0.600		o	225	Pipe/Conduit	
S18.002	48.065#	1.600	30.0	0.037	0.00	0.0	0.600		o	225	Pipe/Conduit	
S18.003	32.151#	1.220	26.4	0.037	0.00	0.0	0.600		o	225	Pipe/Conduit	
S18.004	7.370#	0.740	10.0	0.037	0.00	0.0	0.600		o	225	Pipe/Conduit	
S19.000	133.933	7.000	19.1	0.434	5.00	0.0	0.600		o	400	Pipe/Conduit	
S18.005	13.219	0.040	330.5	0.001	0.00	0.0	0.600		o	750	Pipe/Conduit	
S1.015	79.324	1.657	47.9	0.195	0.00	0.0	0.600		o	1500	Pipe/Conduit	
S20.000	31.979	0.320	100.0	0.051	5.00	0.0	0.600		o	225	Pipe/Conduit	
S20.001	12.928	0.150	86.2	0.001	0.00	0.0	0.600		o	225	Pipe/Conduit	
S21.000	20.916	1.495	14.0	0.036	5.00	0.0	0.600		o	150	Pipe/Conduit	
S20.002	27.538	0.755	36.5	0.102	0.00	0.0	0.600		o	225	Pipe/Conduit	
S20.003	25.548	1.047	24.4	0.001	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.016	47.712	2.152	22.2	0.080	0.00	0.0	0.600		o	1500	Pipe/Conduit	
S1.017	62.617	3.800	16.5	0.136	0.00	0.0	0.600		o	1500	Pipe/Conduit	
S1.018	75.293	2.091	36.0	0.087	0.00	0.0	0.600		o	1500	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)
S18.001	0.00	5.29	139.685	0.074	0.0	0.0	0.0	2.43	96.6	0.0
S18.002	0.00	5.62	139.085	0.111	0.0	0.0	0.0	2.40	95.3	0.0
S18.003	0.00	5.83	137.485	0.148	0.0	0.0	0.0	2.56	101.7	0.0
S18.004	0.00	5.86	136.265	0.185	0.0	0.0	0.0	4.17	165.8	0.0
S19.000	0.00	5.52	142.000	0.434	0.0	0.0	0.0	4.33	544.3	0.0
S18.005	0.00	6.00	135.000	0.620	0.0	0.0	0.0	1.53	677.6	0.0
S1.015	0.00	15.26	134.210	29.208	0.0	0.0	0.0	6.21	10967.2	0.0
S20.000	0.00	5.41	136.100	0.051	0.0	0.0	0.0	1.31	52.0	0.0
S20.001	0.00	5.56	135.780	0.052	0.0	0.0	0.0	1.41	56.0	0.0
S21.000	0.00	5.13	137.200	0.036	0.0	0.0	0.0	2.71	47.8	0.0
S20.002	0.00	5.77	135.630	0.190	0.0	0.0	0.0	2.17	86.4	0.0
S20.003	0.00	5.93	134.875	0.191	0.0	0.0	0.0	2.66	105.8	0.0
S1.016	0.00	15.34	132.553	29.479	0.0	0.0	0.0	9.13	16126.4	0.0
S1.017	0.00	15.44	130.401	29.615	0.0	0.0	0.0	10.59	18709.5	0.0
S1.018	0.00	15.62	126.601	29.702	0.0	0.0	0.0	7.16	12649.0	0.0

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Network Design Table for Southern Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S22.000	25.244	0.261	96.7	0.059	5.00	0.0	0.600		o	225	Pipe/Conduit	
S23.000	17.422	0.245	71.1	0.009	5.00	0.0	0.600		o	225	Pipe/Conduit	
S24.000	19.401#	0.250	77.6	0.018	5.00	0.0	0.600		o	225	Pipe/Conduit	
S24.001	11.350#	0.100	113.5	0.018	0.00	0.0	0.600		o	225	Pipe/Conduit	
S24.002	15.927#	0.300	53.1	0.018	0.00	0.0	0.600		o	225	Pipe/Conduit	
S24.003	12.733#	0.125	101.9	0.018	0.00	0.0	0.600		o	225	Pipe/Conduit	
S24.004	16.731#	0.170	98.4	0.018	0.00	0.0	0.600		o	225	Pipe/Conduit	
S23.001	18.860	1.971	9.6	0.141	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.019	46.644	2.043	22.8	0.126	0.00	0.0	0.600		o	1500	Pipe/Conduit	
S25.000	53.173	0.265	200.7	0.039	5.00	0.0	0.600		o	300	Pipe/Conduit	
S25.001	8.753	0.119	73.6	0.065	0.00	0.0	0.600		o	300	Pipe/Conduit	
S1.020	62.116	0.409	151.9	0.001	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.021	90.000	0.557	161.6	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S26.000	389.805	5.250	74.2	4.066	5.00	0.0	0.600		o	900	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)
S22.000	0.00	5.32	126.045	0.059	0.0	0.0	0.0	1.33	52.9	0.0
S23.000	0.00	5.19	128.000	0.009	0.0	0.0	0.0	1.55	61.7	0.0
S24.000	0.00	5.22	128.700	0.018	0.0	0.0	0.0	1.49	59.1	0.0
S24.001	0.00	5.37	128.450	0.036	0.0	0.0	0.0	1.23	48.8	0.0
S24.002	0.00	5.52	128.350	0.054	0.0	0.0	0.0	1.80	71.5	0.0
S24.003	0.00	5.68	128.050	0.072	0.0	0.0	0.0	1.30	51.5	0.0
S24.004	0.00	5.89	127.925	0.090	0.0	0.0	0.0	1.32	52.4	0.0
S23.001	0.00	5.97	127.755	0.240	0.0	0.0	0.0	4.26	169.2	0.0
S1.019	0.00	15.70	124.509	30.127	0.0	0.0	0.0	8.99	15891.2	0.0
S25.000	0.00	5.80	124.050	0.039	0.0	0.0	0.0	1.11	78.2	0.0
S25.001	0.00	5.88	123.785	0.104	0.0	0.0	0.0	1.84	129.7	0.0
S1.020	0.00	15.99	122.316	30.232	0.0	0.0	0.0	3.69	7884.3	0.0
S1.021	0.00	16.40	121.907	30.232	0.0	0.0	0.0	3.57	7642.9	0.0
S26.000	0.00	6.79	132.500	4.066	0.0	0.0	0.0	3.64	2314.9	0.0

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Network Design Table for Southern Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S27.000	400.138	5.250	76.2	4.067	5.00	0.0	0.600		o	900	Pipe/Conduit	
S26.001	59.408	5.140	11.6	0.000	0.00	0.0	0.600		o	1050	Pipe/Conduit	
S1.022	89.882	1.500	59.9	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.023	57.349	2.500	22.9	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.024	47.349	2.700	17.5	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.025	63.910	3.550	18.0	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.026	20.812	1.150	18.1	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.027	43.217	2.000	21.6	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.028	38.874	2.000	19.4	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.029	72.258	2.000	36.1	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.030	51.127	2.000	25.6	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.031	37.340#	0.250	149.4	0.000	0.00	0.0	0.600		o	1650	Pipe/Conduit	
S1.032	12.984	0.050	259.7	1.950	0.00	0.0	0.600		o	400	Pipe/Conduit	
S1.033	22.469	0.250	89.9	0.000	0.00	0.0	0.600		o	400	Pipe/Conduit	
S1.034	26.923	0.350	76.9	0.000	0.00	0.0	0.600		o	400	Pipe/Conduit	
S1.035	26.133	0.350	74.7	0.000	0.00	0.0	0.600		o	400	Pipe/Conduit	
S1.036	53.944	0.700	77.1	0.000	0.00	0.0	0.600		o	400	Pipe/Conduit	
S28.000	34.000	0.250	136.0	1.625	5.00	0.0	0.600		o	750	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)
S27.000	0.00	6.86	132.500	4.067	0.0	0.0	0.0	3.59	2284.7	0.0
S26.001	0.00	6.95	127.090	8.133	0.0	0.0	0.0	10.16	8800.3	0.0
S1.022	0.00	16.66	121.350	38.365	0.0	0.0	0.0	5.88	12568.5	0.0
S1.023	0.00	16.76	119.850	38.365	0.0	0.0	0.0	9.51	20330.8	0.0
S1.024	0.00	16.83	117.350	38.365	0.0	0.0	0.0	10.88	23256.8	0.0
S1.025	0.00	16.93	114.650	38.365	0.0	0.0	0.0	10.73	22953.3	0.0
S1.026	0.00	16.96	111.100	38.365	0.0	0.0	0.0	10.71	22893.2	0.0
S1.027	0.00	17.04	109.950	38.365	0.0	0.0	0.0	9.80	20948.5	0.0
S1.028	0.00	17.10	107.950	38.365	0.0	0.0	0.0	10.33	22089.2	0.0
S1.029	0.00	17.26	105.950	38.365	0.0	0.0	0.0	7.57	16194.4	0.0
S1.030	0.00	17.35	103.950	38.365	0.0	0.0	0.0	9.01	19257.6	0.0
S1.031	0.00	17.52	101.950	38.365	0.0	0.0	0.0	3.72	7950.5	0.0
S1.032	0.00	17.71	101.350	40.315	0.0	0.0	0.0	1.17	146.6	0.0
S1.033	0.00	17.90	101.300	40.315	0.0	0.0	0.0	1.99	250.3	0.0
S1.034	0.00	18.10	101.050	40.315	0.0	0.0	0.0	2.15	270.7	0.0
S1.035	0.00	18.30	100.700	40.315	0.0	0.0	0.0	2.19	274.7	0.0
S1.036	0.00	18.72	100.350	40.315	0.0	0.0	0.0	2.15	270.4	0.0
S28.000	0.00	5.24	99.900	1.625	0.0	0.0	0.0	2.40	1059.4	0.0

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Network Design Table for Southern Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.037	61.586	0.200	307.9	0.000	0.00	0.0	0.600		o	400	Pipe/Conduit	
S1.038	67.858	0.350	193.9	0.000	0.00	0.0	0.600		o	400	Pipe/Conduit	
S1.039	17.718#	0.440	40.3	0.000	0.00	0.0		0.035	\/	-4	Pipe/Conduit	
S1.040	7.144	0.180	39.7	0.000	0.00	0.0		0.035	\/	-4	Pipe/Conduit	
S1.041	8.609	0.215	40.0	0.000	0.00	0.0		0.035	\/	-4	Pipe/Conduit	
S1.042	12.217	0.305	40.1	0.000	0.00	0.0		0.035	\/	-4	Pipe/Conduit	
S1.043	18.952#	0.475	39.9	0.000	0.00	0.0		0.035	\/	-4	Pipe/Conduit	
S1.044	20.332#	0.995	20.4	0.000	0.00	0.0		0.035	\/	-4	Pipe/Conduit	
S1.045	6.940#	0.656	10.6	0.000	0.00	0.0		0.035	o	375	Pipe/Conduit	
S1.046	11.939#	0.299	39.9	0.000	0.00	0.0		0.035	o	375	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)
S1.037	0.00	19.68	99.650	41.940	0.0	0.0	0.0	1.07	134.5	0.0
S1.038	0.00	20.52	99.450	41.940	0.0	0.0	0.0	1.35	169.9	0.0
S1.039	0.00	20.67	99.050	41.940	0.0	0.0	0.0	1.94	2668.2	0.0
S1.040	0.00	20.73	98.110	41.940	0.0	0.0	0.0	1.95	2687.6	0.0
S1.041	0.00	20.80	97.430	41.940	0.0	0.0	0.0	1.94	2675.7	0.0
S1.042	0.00	20.91	96.715	41.940	0.0	0.0	0.0	1.94	2675.2	0.0
S1.043	0.00	21.07	95.910	41.940	0.0	0.0	0.0	1.95	2680.5	0.0
S1.044	0.00	21.20	94.935	41.940	0.0	0.0	0.0	2.72	3745.5	0.0
S1.045	0.00	21.26	93.940	41.940	0.0	0.0	0.0	1.81	200.2	0.0
S1.046	0.00	21.47	93.284	41.940	0.0	0.0	0.0	0.93	103.1	0.0

Conduit Sections for Southern Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-4	\/	750	500	14.0		1.128	1.378

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Free Flowing Outfall Details for Southern Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.046	S	93.500	92.985	0.000	2100	0

Simulation Criteria for Southern Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.351		

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Online Controls for Southern Storm

Hydroslide Manhole: S1-31 Basin control, DS/PN: S1.032, Volume (m³): 89.7

Design Head (m)	0.800	Invert Level (m)	101.400
Design Flow (l/s)	82.4	Maximum Head (m)	1.050
Range	Mini	Minimum Pipe Diameter (mm)	300
Application	Stormwater	Minimum Manhole Diameter (mm)	1500
Model	DR 300 M		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.2	1.200	79.3	3.000	125.4	7.000	191.5
0.200	31.1	1.400	85.6	3.500	135.4	7.500	198.2
0.300	58.4	1.600	91.5	4.000	144.7	8.000	204.7
0.400	82.4	1.800	97.1	4.500	153.5	8.500	211.0
0.500	82.4	2.000	102.4	5.000	161.8	9.000	217.1
0.600	82.4	2.200	107.3	5.500	169.7	9.500	223.1
0.800	82.4	2.400	112.1	6.000	177.3		
1.000	82.4	2.600	116.7	6.500	184.5		

Hydro-Brake® Optimum Manhole: S36, DS/PN: S1.037, Volume (m³): 35.0

Unit Reference	MD-SHE-0344-8240-2520-8240
Design Head (m)	2.520
Design Flow (l/s)	82.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	344
Invert Level (m)	99.650
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.520	82.4
Flush-Flo™	0.764	82.4
Kick-Flo®	1.664	67.4
Mean Flow over Head Range	-	71.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.0	0.500	79.9	1.200	79.7	2.000	73.7
0.200	34.9	0.600	81.6	1.400	76.7	2.200	77.2
0.300	63.6	0.800	82.4	1.600	70.6	2.400	80.5
0.400	76.9	1.000	81.5	1.800	70.0	2.600	83.7

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Hydro-Brake® Optimum Manhole: S36, DS/PN: S1.037, Volume (m³): 35.0

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
3.000	89.7	5.000	115.0	7.000	135.5	9.000	153.2
3.500	96.6	5.500	120.4	7.500	140.1	9.500	157.3
4.000	103.1	6.000	125.6	8.000	144.6		
4.500	109.2	6.500	130.7	8.500	148.9		

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Offline Controls for Southern Storm

Complex Manhole: S1-31 Basin control, DS/PN: S1.032, Loop to PN: S28.000

Weir

Discharge Coef 0.544 Width (m) 10.000 Invert Level (m) 102.254

V-Notch Weir

Angle of V in Degrees 135.000 Discharge Coefficient 0.590 Invert Level (m) 102.254

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Storage Structures for Southern Storm

Tank or Pond Manhole: S1-31 Basin control, DS/PN: S1.032

Invert Level (m) 101.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	21274.0	1.000	23842.0	1.301	0.0
0.854	23444.0	1.300	24565.0		

Tank or Pond Manhole: S36, DS/PN: S1.037

Invert Level (m) 99.650

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	0.0	0.350	5524.0	2.350	8200.0	3.050	9241.0
0.349	0.0	1.350	6808.0	2.750	8791.0	3.051	0.0

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
Hot Start Level (mm) 0 Inlet Coeffiecient 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 Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.351
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 DVD Status ON
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SCA3.0	15 Summer	1	+0%				
S1.001	SCA3.1	15 Winter	1	+0%	30/15 Summer			
S2.000	S1.1	15 Winter	1	+0%	100/15 Summer			
S2.001	S1.2	15 Winter	1	+0%				
S3.000	S2.1	15 Winter	1	+0%	30/15 Summer			
S3.001	S2.2	15 Winter	1	+0%	30/15 Summer			
S3.002	S2.3	15 Winter	1	+0%	100/15 Winter			
S1.002	S1	15 Winter	1	+0%	100/15 Summer			
S4.000	SC4B	15 Winter	1	+0%	100/15 Summer			
S1.003	S2	15 Winter	1	+0%	100/15 Summer			
S5.000	SCB3.0	15 Summer	1	+0%				
S5.001	SCB3.1	15 Winter	1	+0%	30/15 Summer			
S1.004	S3	15 Winter	1	+0%	100/15 Summer			
S6.000	SC4A	15 Winter	1	+0%				
S1.005	S4	15 Winter	1	+0%	100/15 Summer			
S7.000	SHWD5.1	15 Winter	1	+0%	100/15 Summer			
S8.000	SHWD5.2.1	15 Winter	1	+0%	100/15 Summer			
S7.001	SHWD5.2	15 Winter	1	+0%	100/15 Summer			
S7.002	SHWD5.3	15 Winter	1	+0%	100/15 Winter			
S1.006	S5	15 Winter	1	+0%	30/15 Summer			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SCA3.0	144.000	-0.600	0.000	0.00			0.0	OK
S1.001	SCA3.1	142.578	-0.311	0.000	0.47			139.4	OK
S2.000	S1.1	144.058	-0.092	0.000	0.31			6.7	OK
S2.001	S1.2	143.607	-0.323	0.000	0.08			22.6	OK
S3.000	S2.1	144.357	-0.118	0.000	0.45			21.9	OK
S3.001	S2.2	144.028	-0.107	0.000	0.54			25.5	OK
S3.002	S2.3	143.755	-0.155	0.000	0.21			27.4	OK
S1.002	S1	142.225	-0.575	0.000	0.28			209.5	OK
S4.000	SC4B	144.592	-0.258	0.000	0.27			136.8	OK
S1.003	S2	141.779	-0.896	0.000	0.13			325.9	OK
S5.000	SCB3.0	143.400	-0.750	0.000	0.00			0.0	OK
S5.001	SCB3.1	142.050	-0.279	0.000	0.71			317.7	OK
S1.004	S3	141.662	-0.613	0.000	0.45			620.4	OK
S6.000	SC4A	143.661	-0.265	0.000	0.19			94.2	OK
S1.005	S4	141.517	-0.663	0.000	0.34			650.6	OK
S7.000	SHWD5.1	144.009	-0.216	0.000	0.16			13.8	OK
S8.000	SHWD5.2.1	144.119	-0.096	0.000	0.28			6.2	OK
S7.001	SHWD5.2	143.547	-0.178	0.000	0.33			36.2	OK
S7.002	SHWD5.3	142.608	-0.217	0.000	0.17			36.3	OK
S1.006	S5	141.392	-0.533	0.000	0.58			658.7	OK

PN	US/MH Name	Level Exceeded
S1.000	SCA3.0	
S1.001	SCA3.1	
S2.000	S1.1	
S2.001	S1.2	
S3.000	S2.1	
S3.001	S2.2	
S3.002	S2.3	
S1.002	S1	
S4.000	SC4B	
S1.003	S2	
S5.000	SCB3.0	
S5.001	SCB3.1	
S1.004	S3	
S6.000	SC4A	
S1.005	S4	
S7.000	SHWD5.1	
S8.000	SHWD5.2.1	
S7.001	SHWD5.2	
S7.002	SHWD5.3	
S1.006	S5	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S9.000	SHWD6.1	15 Winter	1	+0%				
S9.001	SHWD6.2	15 Winter	1	+0%				
S9.002	SHWD6.3	15 Winter	1	+0%				
S1.007	S6	15 Winter	1	+0%	100/15 Summer			
S1.008	S7	15 Winter	1	+0%	100/15 Summer			
S1.009	S8	30 Winter	1	+0%	100/15 Summer			
S10.000	SC6.0	15 Winter	1	+0%	30/15 Summer			
S11.000	SHWD9.1	15 Winter	1	+0%	100/15 Winter			
S11.001	SHWD9.2	15 Winter	1	+0%	100/15 Summer			
S11.002	SHWD9.3	15 Winter	1	+0%	30/15 Summer			
S12.000	SHWD9.4	15 Winter	1	+0%				
S10.001	SC6.1	15 Winter	1	+0%	30/15 Summer			
S1.010	S9	30 Winter	1	+0%	100/15 Summer			
S13.000	SC5.0	15 Winter	1	+0%	30/15 Summer			
S1.011	S10	30 Winter	1	+0%	100/15 Summer			
S14.000	SHWD11.1	15 Winter	1	+0%				
S1.012	S11	30 Winter	1	+0%				
S1.013	S12	30 Winter	1	+0%				
S15.000	SC1.1	15 Winter	1	+0%				
S16.000	SC1.2	15 Winter	1	+0%	100/15 Winter			
S15.001	SC1.3	15 Winter	1	+0%	100/15 Summer			
S17.000	SC1.4	15 Winter	1	+0%				
S15.002	SC1.5	15 Winter	1	+0%	100/15 Summer			
S15.003	SC1.6	30 Winter	1	+0%				
S1.014	S13	30 Winter	1	+0%				
S18.000	SHWD14.1	15 Winter	1	+0%				
S18.001	SHWD14.2	15 Winter	1	+0%				
S18.002	SHWD14.3	15 Winter	1	+0%				
S18.003	SHWD14.4	15 Winter	1	+0%				
S18.004	SHWD14.5	15 Winter	1	+0%				
S19.000	SEx Drain	15 Winter	1	+0%				
S18.005	SHWD14.6	15 Winter	1	+0%				
S1.015	S14	30 Winter	1	+0%				
S20.000	SHWD15.1	15 Winter	1	+0%				
S20.001	SHWD15.2	15 Winter	1	+0%	100/15 Summer			
S21.000	SHWD15.3.1	15 Winter	1	+0%				
S20.002	SHWD15.3	15 Winter	1	+0%	100/15 Summer			
S20.003	SHWD15.4	15 Winter	1	+0%				
S1.016	S15	30 Winter	1	+0%				
S1.017	S16	30 Winter	1	+0%				
S1.018	S17	30 Winter	1	+0%				
S22.000	SHWD18.1	15 Winter	1	+0%				
S23.000	SHWD18.6.1	15 Winter	1	+0%				
S24.000	SHWD18.1	15 Winter	1	+0%				
S24.001	SHWD18.2	15 Winter	1	+0%				
S24.002	SHWD18.3	15 Winter	1	+0%				
S24.003	SHWD18.4	15 Winter	1	+0%				
S24.004	SHWD18.5	15 Winter	1	+0%				

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S9.000	SHWD6.1	149.333	-0.117	0.000	0.11			4.3	OK
S9.001	SHWD6.2	147.066	-0.159	0.000	0.19			6.4	OK
S9.002	SHWD6.3	146.823	-0.202	0.000	0.02			6.5	OK
S1.007	S6	141.228	-0.633	0.000	0.45			654.6	OK
S1.008	S7	140.991	-0.760	0.000	0.33			637.7	OK
S1.009	S8	140.873	-0.768	0.000	0.30			597.3	OK
S10.000	SC6.0	141.611	-0.319	0.000	0.44			208.0	OK
S11.000	SHWD9.1	145.952	-0.173	0.000	0.12			10.3	OK
S11.001	SHWD9.2	144.633	-0.142	0.000	0.29			19.0	OK
S11.002	SHWD9.3	143.977	-0.123	0.000	0.42			27.8	OK
S12.000	SHWD9.4	142.963	-0.162	0.000	0.17			11.8	OK
S10.001	SC6.1	141.432	-0.278	0.000	0.54			243.6	OK
S1.010	S9	140.752	-0.759	0.000	0.35			647.3	OK
S13.000	SC5.0	141.480	-0.270	0.000	0.47			193.5	OK
S1.011	S10	140.614	-0.797	0.000	0.35			684.7	OK
S14.000	SHWD11.1	141.391	-0.206	0.000	0.02			1.3	OK
S1.012	S11	140.350	-0.921	0.000	0.22			684.9	OK
S1.013	S12	139.797	-1.103	0.000	0.08			687.8	OK
S15.000	SC1.1	141.160	-0.840	0.000	0.20			604.8	OK
S16.000	SC1.2	138.215	-1.285	0.000	0.04			142.1	OK
S15.001	SC1.3	138.106	-1.054	0.000	0.19			800.9	OK
S17.000	SC1.4	141.131	-0.869	0.000	0.16			548.3	OK
S15.002	SC1.5	137.849	-0.751	0.000	0.43			1192.5	OK
S15.003	SC1.6	137.215	-0.935	0.000	0.30			1177.3	OK
S1.014	S13	136.764	-1.006	0.000	0.24			1859.1	OK
S18.000	SHWD14.1	140.237	-0.188	0.000	0.06			4.7	OK
S18.001	SHWD14.2	139.733	-0.177	0.000	0.10			8.6	OK
S18.002	SHWD14.3	139.141	-0.169	0.000	0.14			12.5	OK
S18.003	SHWD14.4	137.548	-0.162	0.000	0.17			16.5	OK
S18.004	SHWD14.5	136.327	-0.163	0.000	0.17			20.5	OK
S19.000	SEx Drain	142.086	-0.314	0.000	0.10			53.6	OK
S18.005	SHWD14.6	135.217	-0.533	0.000	0.18			74.6	OK
S1.015	S14	134.698	-1.012	0.000	0.23			1878.2	OK
S20.000	SHWD15.1	136.154	-0.171	0.000	0.13			6.3	OK
S20.001	SHWD15.2	135.835	-0.170	0.000	0.13			6.5	OK
S21.000	SHWD15.3.1	137.232	-0.118	0.000	0.10			4.6	OK
S20.002	SHWD15.3	135.710	-0.145	0.000	0.27			21.8	OK
S20.003	SHWD15.4	134.948	-0.152	0.000	0.23			22.0	OK
S1.016	S15	133.012	-1.041	0.000	0.21			1884.1	OK
S1.017	S16	130.792	-1.109	0.000	0.15			1885.9	OK
S1.018	S17	127.064	-1.037	0.000	0.21			1886.4	OK
S22.000	SHWD18.1	126.104	-0.166	0.000	0.15			7.4	OK
S23.000	SHWD18.6.1	128.022	-0.203	0.000	0.02			1.1	OK
S24.000	SHWD18.1	128.730	-0.195	0.000	0.04			2.3	OK
S24.001	SHWD18.2	128.498	-0.177	0.000	0.10			4.2	OK
S24.002	SHWD18.3	128.397	-0.178	0.000	0.10			6.1	OK
S24.003	SHWD18.4	128.115	-0.160	0.000	0.18			8.1	OK

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S24.004	SHWD18.5	127.996	-0.154	0.000	0.21			10.0	OK

PN	US/MH Name	Level Exceeded
S9.000	SHWD6.1	
S9.001	SHWD6.2	
S9.002	SHWD6.3	
S1.007	S6	
S1.008	S7	
S1.009	S8	
S10.000	SC6.0	
S11.000	SHWD9.1	
S11.001	SHWD9.2	
S11.002	SHWD9.3	
S12.000	SHWD9.4	
S10.001	SC6.1	
S1.010	S9	
S13.000	SC5.0	
S1.011	S10	
S14.000	SHWD11.1	
S1.012	S11	
S1.013	S12	
S15.000	SC1.1	
S16.000	SC1.2	
S15.001	SC1.3	
S17.000	SC1.4	
S15.002	SC1.5	
S15.003	SC1.6	
S1.014	S13	
S18.000	SHWD14.1	
S18.001	SHWD14.2	
S18.002	SHWD14.3	
S18.003	SHWD14.4	
S18.004	SHWD14.5	
S19.000	SEx Drain	
S18.005	SHWD14.6	
S1.015	S14	
S20.000	SHWD15.1	
S20.001	SHWD15.2	
S21.000	SHWD15.3.1	
S20.002	SHWD15.3	
S20.003	SHWD15.4	
S1.016	S15	
S1.017	S16	
S1.018	S17	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Level Exceeded
S22.000	SHWD18.1	
S23.000	SHWD18.6.1	
S24.000	SHWD18.1	
S24.001	SHWD18.2	
S24.002	SHWD18.3	
S24.003	SHWD18.4	
S24.004	SHWD18.5	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge
S23.001	SHWD18.6	15 Winter	1	+0%	
S1.019	S18	30 Winter	1	+0%	
S25.000	SHWD19.1	15 Winter	1	+0%	100/15 Winter
S25.001	SHWD19.2	15 Winter	1	+0%	100/15 Summer
S1.020	S19	30 Winter	1	+0%	100/15 Summer
S1.021	S20	30 Winter	1	+0%	100/15 Winter
S26.000	SC2.1	15 Winter	1	+0%	
S27.000	SC2.2	15 Winter	1	+0%	
S26.001	SC2.3	15 Winter	1	+0%	
S1.022	S21	30 Winter	1	+0%	
S1.023	S22	30 Winter	1	+0%	
S1.024	S23	30 Winter	1	+0%	
S1.025	S24	30 Winter	1	+0%	
S1.026	S25	30 Winter	1	+0%	
S1.027	S26	30 Winter	1	+0%	
S1.028	S27	30 Winter	1	+0%	
S1.029	S28	30 Winter	1	+0%	
S1.030	S29	30 Winter	1	+0%	
S1.031	S30	30 Winter	1	+0%	30/30 Winter
S1.032	S1-31 Basin control	1440 Winter	1	+0%	1/600 Winter
S1.033	S32	1440 Winter	1	+0%	100/360 Winter
S1.034	S33	1440 Winter	1	+0%	100/360 Winter
S1.035	S34	1440 Winter	1	+0%	100/240 Winter
S1.036	S35	1440 Winter	1	+0%	100/180 Winter
S28.000	SPrivate HW	15 Winter	1	+0%	
S1.037	S36	1440 Winter	1	+0%	30/120 Summer
S1.038	S37	1440 Winter	1	+0%	
S1.039	SSwale Start (Outfalling headwall)	1440 Winter	1	+0%	
S1.040	SSwale 1	1440 Winter	1	+0%	
S1.041	SSwale 2	1440 Winter	1	+0%	
S1.042	SSwale 3	1440 Winter	1	+0%	
S1.043	SSwale 4	1440 Winter	1	+0%	
S1.044	SSwale 5	1440 Winter	1	+0%	
S1.045	SHeadwall End	1440 Winter	1	+0%	
S1.046	S38	1440 Winter	1	+0%	

PN	US/MH Name	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S23.001	SHWD18.6				127.818
S1.019	S18				124.975
S25.000	SHWD19.1				124.101
S25.001	SHWD19.2				123.858
S1.020	S19				123.031
S1.021	S20				122.565
S26.000	SC2.1				132.792

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S27.000	SC2.2				132.794
S26.001	SC2.3				127.353
S1.022	S21				121.875
S1.023	S22				120.307
S1.024	S23				117.797
S1.025	S24				115.065
S1.026	S25				111.662
S1.027	S26				110.438
S1.028	S27				108.438
S1.029	S28				106.438
S1.030	S29				104.438
S1.031	S30				102.749
S1.032	S1-31 Basin control		100/120 Winter	17	101.798
S1.033	S32				101.455
S1.034	S33				101.196
S1.035	S34				100.845
S1.036	S35				100.490
S28.000	SPrivate HW				100.162
S1.037	S36				100.014
S1.038	S37				99.631
S1.039	SSwale Start (Outfalling headwall)				99.129
S1.040	SSwale 1				98.188
S1.041	SSwale 2				97.508
S1.042	SSwale 3				96.794
S1.043	SSwale 4				95.988
S1.044	SSwale 5				95.001
S1.045	SHeadwall End				94.095
S1.046	S38				93.511

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
S23.001	SHWD18.6	-0.162	0.000	0.17		
S1.019	S18	-1.034	0.000	0.21		
S25.000	SHWD19.1	-0.249	0.000	0.06		
S25.001	SHWD19.2	-0.227	0.000	0.14		
S1.020	S19	-0.935	0.000	0.39		
S1.021	S20	-0.992	0.000	0.34		
S26.000	SC2.1	-0.608	0.000	0.22		
S27.000	SC2.2	-0.606	0.000	0.23		
S26.001	SC2.3	-0.787	0.000	0.14		
S1.022	S21	-1.125	0.000	0.22		
S1.023	S22	-1.193	0.000	0.17		
S1.024	S23	-1.203	0.000	0.17		
S1.025	S24	-1.235	0.000	0.14		
S1.026	S25	-1.088	0.000	0.25		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
S1.027	S26	-1.162	0.000	0.19		
S1.028	S27	-1.162	0.000	0.19		
S1.029	S28	-1.162	0.000	0.19		
S1.030	S29	-1.162	0.000	0.19		
S1.031	S30	-0.851	0.000	0.47		
S1.032	S1-31 Basin control	0.048	0.000	0.60	0.0	
S1.033	S32	-0.245	0.000	0.32		
S1.034	S33	-0.254	0.000	0.29		
S1.035	S34	-0.255	0.000	0.28		
S1.036	S35	-0.260	0.000	0.27		
S28.000	SPrivate HW	-0.488	0.000	0.26		
S1.037	S36	-0.036	0.000	0.54		
S1.038	S37	-0.219	0.000	0.42		
S1.039	SSwale Start (Outfalling headwall)	-0.421	0.000	0.03		
S1.040	SSwale 1	-0.422	0.000	0.03		
S1.041	SSwale 2	-0.422	0.000	0.03		
S1.042	SSwale 3	-0.421	0.000	0.03		
S1.043	SSwale 4	-0.422	0.000	0.03		
S1.044	SSwale 5	-0.434	0.000	0.02		
S1.045	SHeadwall End	-0.220	0.000	0.36		
S1.046	S38	-0.148	0.000	0.68		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S23.001	SHWD18.6	26.0	OK	
S1.019	S18	1897.8	OK	
S25.000	SHWD19.1	4.8	OK	
S25.001	SHWD19.2	11.7	OK	
S1.020	S19	1899.9	OK	
S1.021	S20	1895.4	OK	
S26.000	SC2.1	502.9	OK	
S27.000	SC2.2	501.8	OK	
S26.001	SC2.3	987.8	OK	
S1.022	S21	2063.3	OK	
S1.023	S22	2063.8	OK	
S1.024	S23	2063.7	OK	
S1.025	S24	2063.3	OK	
S1.026	S25	2062.7	OK	
S1.027	S26	2062.8	OK	
S1.028	S27	2063.4	OK	
S1.029	S28	2063.6	OK	
S1.030	S29	2063.4	OK	
S1.031	S30	2062.3	OK	
S1.032	S1-31 Basin control	67.2	SURCHARGED	
S1.033	S32	67.2	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.034	S33	67.2	OK	
S1.035	S34	67.2	OK	
S1.036	S35	67.2	OK	
S28.000	SPrivate HW	203.4	OK*	
S1.037	S36	67.5	OK	
S1.038	S37	67.5	OK	
S1.039	SSwale Start (Outfalling headwall)	67.5	OK	
S1.040	SSwale 1	67.5	OK	
S1.041	SSwale 2	67.5	OK	
S1.042	SSwale 3	67.5	OK	
S1.043	SSwale 4	67.5	OK	
S1.044	SSwale 5	67.5	OK	
S1.045	SHeadwall End	67.5	OK	
S1.046	S38	67.5	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
Hot Start Level (mm) 0 Inlet Coeffiecient 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 Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.351
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 DVD Status ON
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SCA3.0	15 Summer	30	+0%				
S1.001	SCA3.1	15 Winter	30	+0%	30/15 Summer			
S2.000	S1.1	15 Winter	30	+0%	100/15 Summer			
S2.001	S1.2	15 Winter	30	+0%				
S3.000	S2.1	15 Winter	30	+0%	30/15 Summer			
S3.001	S2.2	15 Winter	30	+0%	30/15 Summer			
S3.002	S2.3	15 Winter	30	+0%	100/15 Winter			
S1.002	S1	15 Winter	30	+0%	100/15 Summer			
S4.000	SC4B	15 Winter	30	+0%	100/15 Summer			
S1.003	S2	15 Winter	30	+0%	100/15 Summer			
S5.000	SCB3.0	15 Summer	30	+0%				
S5.001	SCB3.1	15 Winter	30	+0%	30/15 Summer			
S1.004	S3	15 Winter	30	+0%	100/15 Summer			
S6.000	SC4A	15 Winter	30	+0%				
S1.005	S4	15 Winter	30	+0%	100/15 Summer			
S7.000	SHWD5.1	15 Winter	30	+0%	100/15 Summer			
S8.000	SHWD5.2.1	15 Winter	30	+0%	100/15 Summer			
S7.001	SHWD5.2	15 Winter	30	+0%	100/15 Summer			
S7.002	SHWD5.3	15 Winter	30	+0%	100/15 Winter			
S1.006	S5	15 Winter	30	+0%	30/15 Summer			

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SCA3.0	144.000	-0.600	0.000	0.00			0.0	OK
S1.001	SCA3.1	142.909	0.020	0.000	1.22			362.7	SURCHARGED
S2.000	S1.1	144.099	-0.051	0.000	0.76			16.4	OK
S2.001	S1.2	143.663	-0.267	0.000	0.24			65.0	OK
S3.000	S2.1	144.660	0.185	0.000	1.08			52.8	SURCHARGED
S3.001	S2.2	144.268	0.133	0.000	1.26			60.1	SURCHARGED
S3.002	S2.3	143.799	-0.111	0.000	0.50			64.4	OK
S1.002	S1	142.500	-0.300	0.000	0.70			524.3	OK
S4.000	SC4B	144.691	-0.159	0.000	0.67			335.2	OK
S1.003	S2	142.359	-0.316	0.000	0.30			741.4	OK
S5.000	SCB3.0	143.400	-0.750	0.000	0.00			0.0	OK
S5.001	SCB3.1	142.530	0.201	0.000	1.87			830.4	SURCHARGED
S1.004	S3	142.275	0.000	0.000	1.07			1473.4	OK
S6.000	SC4A	143.730	-0.196	0.000	0.46			230.8	OK
S1.005	S4	142.113	-0.067	0.000	0.81			1550.2	OK
S7.000	SHWD5.1	144.061	-0.164	0.000	0.40			33.8	OK
S8.000	SHWD5.2.1	144.158	-0.057	0.000	0.68			15.3	OK
S7.001	SHWD5.2	143.655	-0.070	0.000	0.89			96.8	OK
S7.002	SHWD5.3	142.666	-0.159	0.000	0.45			96.2	OK
S1.006	S5	141.960	0.035	0.000	1.39			1575.2	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	SCA3.0	
S1.001	SCA3.1	
S2.000	S1.1	
S2.001	S1.2	
S3.000	S2.1	
S3.001	S2.2	
S3.002	S2.3	
S1.002	S1	
S4.000	SC4B	
S1.003	S2	
S5.000	SCB3.0	
S5.001	SCB3.1	
S1.004	S3	
S6.000	SC4A	
S1.005	S4	
S7.000	SHWD5.1	
S8.000	SHWD5.2.1	
S7.001	SHWD5.2	
S7.002	SHWD5.3	
S1.006	S5	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S9.000	SHWD6.1	15 Winter	30	+0%				
S9.001	SHWD6.2	15 Winter	30	+0%				
S9.002	SHWD6.3	15 Winter	30	+0%				
S1.007	S6	15 Winter	30	+0%	100/15 Summer			
S1.008	S7	30 Winter	30	+0%	100/15 Summer			
S1.009	S8	30 Winter	30	+0%	100/15 Summer			
S10.000	SC6.0	15 Winter	30	+0%	30/15 Summer			
S11.000	SHWD9.1	15 Winter	30	+0%	100/15 Winter			
S11.001	SHWD9.2	15 Winter	30	+0%	100/15 Summer			
S11.002	SHWD9.3	15 Winter	30	+0%	30/15 Summer			
S12.000	SHWD9.4	15 Winter	30	+0%				
S10.001	SC6.1	15 Winter	30	+0%	30/15 Summer			
S1.010	S9	30 Winter	30	+0%	100/15 Summer			
S13.000	SC5.0	15 Winter	30	+0%	30/15 Summer			
S1.011	S10	30 Winter	30	+0%	100/15 Summer			
S14.000	SHWD11.1	15 Winter	30	+0%				
S1.012	S11	30 Winter	30	+0%				
S1.013	S12	30 Winter	30	+0%				
S15.000	SC1.1	15 Winter	30	+0%				
S16.000	SC1.2	15 Winter	30	+0%	100/15 Winter			
S15.001	SC1.3	15 Winter	30	+0%	100/15 Summer			
S17.000	SC1.4	15 Winter	30	+0%				
S15.002	SC1.5	15 Winter	30	+0%	100/15 Summer			
S15.003	SC1.6	30 Winter	30	+0%				
S1.014	S13	30 Winter	30	+0%				
S18.000	SHWD14.1	15 Winter	30	+0%				
S18.001	SHWD14.2	15 Winter	30	+0%				
S18.002	SHWD14.3	15 Winter	30	+0%				
S18.003	SHWD14.4	15 Winter	30	+0%				
S18.004	SHWD14.5	15 Winter	30	+0%				
S19.000	SEx Drain	15 Winter	30	+0%				
S18.005	SHWD14.6	15 Winter	30	+0%				
S1.015	S14	30 Winter	30	+0%				
S20.000	SHWD15.1	15 Winter	30	+0%				
S20.001	SHWD15.2	15 Winter	30	+0%	100/15 Summer			
S21.000	SHWD15.3.1	15 Winter	30	+0%				
S20.002	SHWD15.3	15 Winter	30	+0%	100/15 Summer			
S20.003	SHWD15.4	15 Winter	30	+0%				
S1.016	S15	30 Winter	30	+0%				
S1.017	S16	30 Winter	30	+0%				
S1.018	S17	30 Winter	30	+0%				
S22.000	SHWD18.1	15 Winter	30	+0%				
S23.000	SHWD18.6.1	15 Winter	30	+0%				
S24.000	SHWD18.1	15 Winter	30	+0%				
S24.001	SHWD18.2	15 Winter	30	+0%				
S24.002	SHWD18.3	15 Winter	30	+0%				
S24.003	SHWD18.4	15 Winter	30	+0%				
S24.004	SHWD18.5	15 Winter	30	+0%				

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S9.000	SHWD6.1	149.353	-0.097	0.000	0.27			10.4
S9.001	SHWD6.2	147.113	-0.112	0.000	0.48			16.4
S9.002	SHWD6.3	146.835	-0.190	0.000	0.06			16.7
S1.007	S6	141.861	0.000	0.000	1.02			1487.4
S1.008	S7	141.409	-0.342	0.000	0.73			1413.3
S1.009	S8	141.289	-0.352	0.000	0.70			1387.5
S10.000	SC6.0	142.128	0.198	0.000	1.08			506.0
S11.000	SHWD9.1	145.983	-0.142	0.000	0.29			25.1
S11.001	SHWD9.2	144.703	-0.072	0.000	0.78			51.4
S11.002	SHWD9.3	144.251	0.151	0.000	1.13			75.0
S12.000	SHWD9.4	143.003	-0.122	0.000	0.42			28.9
S10.001	SC6.1	141.863	0.153	0.000	1.35			603.7
S1.010	S9	141.167	-0.344	0.000	0.83			1533.8
S13.000	SC5.0	141.837	0.087	0.000	1.15			472.3
S1.011	S10	141.017	-0.394	0.000	0.84			1638.0
S14.000	SHWD11.1	141.402	-0.195	0.000	0.04			3.1
S1.012	S11	140.620	-0.651	0.000	0.53			1638.5
S1.013	S12	139.939	-0.961	0.000	0.18			1645.5
S15.000	SC1.1	141.387	-0.613	0.000	0.43			1317.9
S16.000	SC1.2	138.591	-0.909	0.000	0.09			346.5
S15.001	SC1.3	138.549	-0.611	0.000	0.39			1658.2
S17.000	SC1.4	141.339	-0.661	0.000	0.38			1316.1
S15.002	SC1.5	138.480	-0.120	0.000	0.95			2600.3
S15.003	SC1.6	137.572	-0.578	0.000	0.69			2676.3
S1.014	S13	137.067	-0.703	0.000	0.55			4329.2
S18.000	SHWD14.1	140.259	-0.166	0.000	0.15			11.5
S18.001	SHWD14.2	139.765	-0.145	0.000	0.27			23.6
S18.002	SHWD14.3	139.183	-0.127	0.000	0.39			35.5
S18.003	SHWD14.4	137.598	-0.112	0.000	0.50			47.6
S18.004	SHWD14.5	136.377	-0.113	0.000	0.49			59.5
S19.000	SEx Drain	142.137	-0.263	0.000	0.25			131.1
S18.005	SHWD14.6	135.366	-0.384	0.000	0.47			190.9
S1.015	S14	134.997	-0.713	0.000	0.54			4363.4
S20.000	SHWD15.1	136.188	-0.137	0.000	0.32			15.5
S20.001	SHWD15.2	135.870	-0.135	0.000	0.33			15.9
S21.000	SHWD15.3.1	137.251	-0.099	0.000	0.25			11.2
S20.002	SHWD15.3	135.778	-0.077	0.000	0.75			60.1
S20.003	SHWD15.4	135.005	-0.095	0.000	0.61			60.0
S1.016	S15	133.282	-0.771	0.000	0.48			4381.7
S1.017	S16	131.021	-0.880	0.000	0.36			4389.7
S1.018	S17	127.337	-0.764	0.000	0.49			4393.7
S22.000	SHWD18.1	126.141	-0.129	0.000	0.37			18.1
S23.000	SHWD18.6.1	128.033	-0.192	0.000	0.05			2.8
S24.000	SHWD18.1	128.749	-0.176	0.000	0.10			5.6
S24.001	SHWD18.2	128.531	-0.144	0.000	0.28			11.5
S24.002	SHWD18.3	128.431	-0.144	0.000	0.27			17.4
S24.003	SHWD18.4	128.166	-0.109	0.000	0.52			23.2

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S24.004	SHWD18.5	128.055	-0.095	0.000	0.62			28.9

PN	US/MH Name	Status	Level Exceeded
S9.000	SHWD6.1	OK	
S9.001	SHWD6.2	OK	
S9.002	SHWD6.3	OK	
S1.007	S6	OK	
S1.008	S7	OK	
S1.009	S8	OK	
S10.000	SC6.0	SURCHARGED	
S11.000	SHWD9.1	OK	
S11.001	SHWD9.2	OK	
S11.002	SHWD9.3	SURCHARGED	
S12.000	SHWD9.4	OK	
S10.001	SC6.1	SURCHARGED	
S1.010	S9	OK	
S13.000	SC5.0	SURCHARGED	
S1.011	S10	OK	
S14.000	SHWD11.1	OK	
S1.012	S11	OK	
S1.013	S12	OK	
S15.000	SC1.1	OK	
S16.000	SC1.2	OK	
S15.001	SC1.3	OK	
S17.000	SC1.4	OK	
S15.002	SC1.5	OK	
S15.003	SC1.6	OK	
S1.014	S13	OK	
S18.000	SHWD14.1	OK	
S18.001	SHWD14.2	OK	
S18.002	SHWD14.3	OK	
S18.003	SHWD14.4	OK	
S18.004	SHWD14.5	OK	
S19.000	SEx Drain	OK	
S18.005	SHWD14.6	OK	
S1.015	S14	OK	
S20.000	SHWD15.1	OK	
S20.001	SHWD15.2	OK	
S21.000	SHWD15.3.1	OK	
S20.002	SHWD15.3	OK	
S20.003	SHWD15.4	OK	
S1.016	S15	OK	
S1.017	S16	OK	
S1.018	S17	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Status	Level Exceeded
S22.000	SHWD18.1	OK	
S23.000	SHWD18.6.1	OK	
S24.000	SHWD18.1	OK	
S24.001	SHWD18.2	OK	
S24.002	SHWD18.3	OK	
S24.003	SHWD18.4	OK	
S24.004	SHWD18.5	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge
S23.001	SHWD18.6	15 Winter	30	+0%	
S1.019	S18	30 Winter	30	+0%	
S25.000	SHWD19.1	15 Winter	30	+0%	100/15 Winter
S25.001	SHWD19.2	15 Winter	30	+0%	100/15 Summer
S1.020	S19	30 Winter	30	+0%	100/15 Summer
S1.021	S20	30 Winter	30	+0%	100/15 Winter
S26.000	SC2.1	15 Winter	30	+0%	
S27.000	SC2.2	15 Winter	30	+0%	
S26.001	SC2.3	15 Winter	30	+0%	
S1.022	S21	30 Winter	30	+0%	
S1.023	S22	30 Winter	30	+0%	
S1.024	S23	30 Winter	30	+0%	
S1.025	S24	30 Winter	30	+0%	
S1.026	S25	30 Winter	30	+0%	
S1.027	S26	30 Winter	30	+0%	
S1.028	S27	30 Winter	30	+0%	
S1.029	S28	30 Winter	30	+0%	
S1.030	S29	30 Winter	30	+0%	
S1.031	S30	30 Winter	30	+0%	30/30 Winter
S1.032	S1-31 Basin control	1440 Winter	30	+0%	1/600 Winter
S1.033	S32	480 Winter	30	+0%	100/360 Winter
S1.034	S33	360 Winter	30	+0%	100/360 Winter
S1.035	S34	480 Winter	30	+0%	100/240 Winter
S1.036	S35	600 Winter	30	+0%	100/180 Winter
S28.000	SPrivate HW	15 Winter	30	+0%	
S1.037	S36	1440 Winter	30	+0%	30/120 Summer
S1.038	S37	1440 Winter	30	+0%	
S1.039	SSwale Start (Outfalling headwall)	1440 Winter	30	+0%	
S1.040	SSwale 1	1440 Winter	30	+0%	
S1.041	SSwale 2	1440 Winter	30	+0%	
S1.042	SSwale 3	1440 Summer	30	+0%	
S1.043	SSwale 4	1440 Summer	30	+0%	
S1.044	SSwale 5	1440 Summer	30	+0%	
S1.045	SHeadwall End	1440 Winter	30	+0%	
S1.046	S38	1440 Winter	30	+0%	

PN	US/MH Name	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S23.001	SHWD18.6				127.870
S1.019	S18				125.252
S25.000	SHWD19.1				124.131
S25.001	SHWD19.2				123.913
S1.020	S19				123.549
S1.021	S20				123.007
S26.000	SC2.1				132.986

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S27.000	SC2.2				132.990
S26.001	SC2.3				127.502
S1.022	S21				122.208
S1.023	S22				120.594
S1.024	S23				118.077
S1.025	S24				115.323
S1.026	S25				112.034
S1.027	S26				110.738
S1.028	S27				108.742
S1.029	S28				106.743
S1.030	S29				104.742
S1.031	S30				103.695
S1.032	S1-31 Basin control		100/120 Winter	17	102.246
S1.033	S32				101.473
S1.034	S33				101.214
S1.035	S34				100.863
S1.036	S35				100.508
S28.000	SPrivate HW				100.341
S1.037	S36				100.210
S1.038	S37				99.649
S1.039	SSwale Start (Outfalling headwall)				99.137
S1.040	SSwale 1				98.195
S1.041	SSwale 2				97.516
S1.042	SSwale 3				96.800
S1.043	SSwale 4				95.995
S1.044	SSwale 5				95.007
S1.045	SHeadwall End				94.109
S1.046	S38				93.538

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
S23.001	SHWD18.6	-0.110	0.000	0.51		
S1.019	S18	-0.757	0.000	0.49		
S25.000	SHWD19.1	-0.219	0.000	0.16		
S25.001	SHWD19.2	-0.172	0.000	0.37		
S1.020	S19	-0.417	0.000	0.91		
S1.021	S20	-0.550	0.000	0.78		
S26.000	SC2.1	-0.414	0.000	0.50		
S27.000	SC2.2	-0.410	0.000	0.50		
S26.001	SC2.3	-0.638	0.000	0.32		
S1.022	S21	-0.792	0.000	0.54		
S1.023	S22	-0.906	0.000	0.41		
S1.024	S23	-0.923	0.000	0.40		
S1.025	S24	-0.977	0.000	0.35		
S1.026	S25	-0.716	0.000	0.61		

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
S1.027	S26	-0.862	0.000	0.46		
S1.028	S27	-0.858	0.000	0.46		
S1.029	S28	-0.857	0.000	0.46		
S1.030	S29	-0.858	0.000	0.46		
S1.031	S30	0.095	0.000	1.14		
S1.032	S1-31 Basin control	0.496	0.000	0.73	0.0	
S1.033	S32	-0.227	0.000	0.39		
S1.034	S33	-0.236	0.000	0.35		
S1.035	S34	-0.237	0.000	0.35		
S1.036	S35	-0.242	0.000	0.33		
S28.000	SPrivate HW	-0.309	0.000	0.64		
S1.037	S36	0.160	0.000	0.63		
S1.038	S37	-0.201	0.000	0.50		
S1.039	SSwale Start (Outfalling headwall)	-0.413	0.000	0.03		
S1.040	SSwale 1	-0.415	0.000	0.03		
S1.041	SSwale 2	-0.414	0.000	0.03		
S1.042	SSwale 3	-0.415	0.000	0.03		
S1.043	SSwale 4	-0.415	0.000	0.03		
S1.044	SSwale 5	-0.428	0.000	0.02		
S1.045	SHeadwall End	-0.206	0.000	0.42		
S1.046	S38	-0.121	0.000	0.80		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S23.001	SHWD18.6	77.9	OK	
S1.019	S18	4411.3	OK	
S25.000	SHWD19.1	11.7	OK	
S25.001	SHWD19.2	32.2	OK	
S1.020	S19	4411.5	OK	
S1.021	S20	4397.1	OK	
S26.000	SC2.1	1117.9	OK	
S27.000	SC2.2	1108.3	OK	
S26.001	SC2.3	2238.5	OK	
S1.022	S21	4981.9	OK	
S1.023	S22	4952.9	OK	
S1.024	S23	4968.8	OK	
S1.025	S24	4985.8	OK	
S1.026	S25	4990.3	OK	
S1.027	S26	4980.4	OK	
S1.028	S27	4961.7	OK	
S1.029	S28	4952.6	OK	
S1.030	S29	4977.9	OK	
S1.031	S30	4974.5	SURCHARGED	
S1.032	S1-31 Basin control	82.4	SURCHARGED	
S1.033	S32	82.4	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.034	S33	82.4	OK	
S1.035	S34	82.4	OK	
S1.036	S35	82.4	OK	
S28.000	SPrivate HW	498.3	OK*	
S1.037	S36	79.3	SURCHARGED	
S1.038	S37	79.3	OK	
S1.039	SSwale Start (Outfalling headwall)	79.3	OK	
S1.040	SSwale 1	79.3	OK	
S1.041	SSwale 2	79.3	OK	
S1.042	SSwale 3	78.9	OK	
S1.043	SSwale 4	78.9	OK	
S1.044	SSwale 5	78.9	OK	
S1.045	SHeadwall End	79.3	OK	
S1.046	S38	79.3	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
Hot Start Level (mm) 0 Inlet Coeffiecient 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 Storage Structures 2
Number of Online Controls 2 Number of Time/Area Diagrams 0
Number of Offline Controls 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.351
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 DVD Status ON
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SCA3.0	15 Summer	100	+30%				
S1.001	SCA3.1	15 Winter	100	+30%	30/15 Summer			
S2.000	S1.1	15 Winter	100	+30%	100/15 Summer			
S2.001	S1.2	15 Winter	100	+30%				
S3.000	S2.1	15 Winter	100	+30%	30/15 Summer			
S3.001	S2.2	15 Winter	100	+30%	30/15 Summer			
S3.002	S2.3	15 Winter	100	+30%	100/15 Winter			
S1.002	S1	15 Winter	100	+30%	100/15 Summer			
S4.000	SC4B	15 Winter	100	+30%	100/15 Summer			
S1.003	S2	15 Winter	100	+30%	100/15 Summer			
S5.000	SCB3.0	15 Winter	100	+30%				
S5.001	SCB3.1	15 Winter	100	+30%	30/15 Summer			
S1.004	S3	15 Winter	100	+30%	100/15 Summer			
S6.000	SC4A	15 Winter	100	+30%				
S1.005	S4	30 Winter	100	+30%	100/15 Summer			
S7.000	SHWD5.1	15 Winter	100	+30%	100/15 Summer			
S8.000	SHWD5.2.1	15 Winter	100	+30%	100/15 Summer			
S7.001	SHWD5.2	15 Winter	100	+30%	100/15 Summer			
S7.002	SHWD5.3	30 Winter	100	+30%	100/15 Winter			
S1.006	S5	30 Winter	100	+30%	30/15 Summer			

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SCA3.0	144.000	-0.600	0.000	0.00			0.0	OK
S1.001	SCA3.1	143.870	0.981	0.000	1.93			571.5	SURCHARGED
S2.000	S1.1	144.288	0.138	0.000	1.26			27.2	SURCHARGED
S2.001	S1.2	143.706	-0.224	0.000	0.39			106.4	OK
S3.000	S2.1	145.992	1.517	0.000	1.76			86.0	SURCHARGED
S3.001	S2.2	144.999	0.864	0.000	2.08			98.8	SURCHARGED
S3.002	S2.3	144.235	0.325	0.000	0.79			101.2	SURCHARGED
S1.002	S1	143.638	0.838	0.000	1.04			777.6	SURCHARGED
S4.000	SC4B	145.566	0.716	0.000	1.09			547.6	SURCHARGED
S1.003	S2	143.536	0.861	0.000	0.49			1226.7	SURCHARGED
S5.000	SCB3.0	144.042	-0.108	0.000	0.01			10.2	OK
S5.001	SCB3.1	144.044	1.715	0.000	2.87			1277.2	SURCHARGED
S1.004	S3	143.486	1.211	0.000	1.76			2408.8	SURCHARGED
S6.000	SC4A	143.800	-0.126	0.000	0.77			388.1	OK
S1.005	S4	143.278	1.098	0.000	1.24			2373.6	SURCHARGED
S7.000	SHWD5.1	144.659	0.434	0.000	0.63			53.1	SURCHARGED
S8.000	SHWD5.2.1	144.822	0.607	0.000	1.01			22.6	SURCHARGED
S7.001	SHWD5.2	144.454	0.729	0.000	1.28			139.1	SURCHARGED
S7.002	SHWD5.3	143.230	0.405	0.000	0.55			117.3	SURCHARGED
S1.006	S5	142.966	1.041	0.000	2.17			2457.2	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	SCA3.0	
S1.001	SCA3.1	
S2.000	S1.1	
S2.001	S1.2	
S3.000	S2.1	
S3.001	S2.2	
S3.002	S2.3	
S1.002	S1	
S4.000	SC4B	
S1.003	S2	
S5.000	SCB3.0	
S5.001	SCB3.1	
S1.004	S3	
S6.000	SC4A	
S1.005	S4	
S7.000	SHWD5.1	
S8.000	SHWD5.2.1	
S7.001	SHWD5.2	
S7.002	SHWD5.3	
S1.006	S5	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S9.000	SHWD6.1	15 Winter	100	+30%				
S9.001	SHWD6.2	15 Winter	100	+30%				
S9.002	SHWD6.3	15 Winter	100	+30%				
S1.007	S6	30 Winter	100	+30%	100/15 Summer			
S1.008	S7	30 Winter	100	+30%	100/15 Summer			
S1.009	S8	30 Winter	100	+30%	100/15 Summer			
S10.000	SC6.0	15 Winter	100	+30%	30/15 Summer			
S11.000	SHWD9.1	15 Winter	100	+30%	100/15 Winter			
S11.001	SHWD9.2	15 Winter	100	+30%	100/15 Summer			
S11.002	SHWD9.3	15 Winter	100	+30%	30/15 Summer			
S12.000	SHWD9.4	15 Winter	100	+30%				
S10.001	SC6.1	15 Winter	100	+30%	30/15 Summer			
S1.010	S9	30 Winter	100	+30%	100/15 Summer			
S13.000	SC5.0	15 Winter	100	+30%	30/15 Summer			
S1.011	S10	30 Winter	100	+30%	100/15 Summer			
S14.000	SHWD11.1	15 Winter	100	+30%				
S1.012	S11	30 Winter	100	+30%				
S1.013	S12	30 Winter	100	+30%				
S15.000	SC1.1	15 Winter	100	+30%				
S16.000	SC1.2	15 Winter	100	+30%	100/15 Winter			
S15.001	SC1.3	15 Winter	100	+30%	100/15 Summer			
S17.000	SC1.4	15 Winter	100	+30%				
S15.002	SC1.5	15 Winter	100	+30%	100/15 Summer			
S15.003	SC1.6	30 Winter	100	+30%				
S1.014	S13	30 Winter	100	+30%				
S18.000	SHWD14.1	15 Winter	100	+30%				
S18.001	SHWD14.2	15 Winter	100	+30%				
S18.002	SHWD14.3	15 Winter	100	+30%				
S18.003	SHWD14.4	15 Winter	100	+30%				
S18.004	SHWD14.5	15 Winter	100	+30%				
S19.000	SEx Drain	15 Winter	100	+30%				
S18.005	SHWD14.6	15 Winter	100	+30%				
S1.015	S14	30 Winter	100	+30%				
S20.000	SHWD15.1	15 Winter	100	+30%				
S20.001	SHWD15.2	15 Winter	100	+30%	100/15 Summer			
S21.000	SHWD15.3.1	15 Winter	100	+30%				
S20.002	SHWD15.3	15 Winter	100	+30%	100/15 Summer			
S20.003	SHWD15.4	15 Winter	100	+30%				
S1.016	S15	30 Winter	100	+30%				
S1.017	S16	30 Winter	100	+30%				
S1.018	S17	30 Winter	100	+30%				
S22.000	SHWD18.1	15 Winter	100	+30%				
S23.000	SHWD18.6.1	15 Winter	100	+30%				
S24.000	SHWD18.1	15 Winter	100	+30%				
S24.001	SHWD18.2	15 Winter	100	+30%				
S24.002	SHWD18.3	15 Winter	100	+30%				
S24.003	SHWD18.4	15 Winter	100	+30%				
S24.004	SHWD18.5	15 Winter	100	+30%				

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S9.000	SHWD6.1	149.371	-0.079	0.000	0.45			17.5
S9.001	SHWD6.2	147.160	-0.065	0.000	0.81			27.6
S9.002	SHWD6.3	146.847	-0.178	0.000	0.10			28.1
S1.007	S6	142.624	0.763	0.000	1.69			2474.6
S1.008	S7	142.260	0.509	0.000	1.27			2445.6
S1.009	S8	142.089	0.448	0.000	1.22			2416.4
S10.000	SC6.0	143.263	1.333	0.000	1.80			844.3
S11.000	SHWD9.1	146.207	0.082	0.000	0.48			41.6
S11.001	SHWD9.2	145.939	1.164	0.000	1.13			74.4
S11.002	SHWD9.3	145.087	0.987	0.000	1.65			109.4
S12.000	SHWD9.4	143.043	-0.082	0.000	0.71			48.6
S10.001	SC6.1	142.518	0.808	0.000	2.24			1000.5
S1.010	S9	141.892	0.381	0.000	1.51			2791.4
S13.000	SC5.0	142.623	0.873	0.000	1.92			790.5
S1.011	S10	141.582	0.171	0.000	1.57			3047.0
S14.000	SHWD11.1	141.412	-0.185	0.000	0.07			5.2
S1.012	S11	140.992	-0.279	0.000	0.99			3043.9
S1.013	S12	140.094	-0.806	0.000	0.34			3049.0
S15.000	SC1.1	141.623	-0.377	0.000	0.71			2177.7
S16.000	SC1.2	139.514	0.014	0.000	0.15			560.3
S15.001	SC1.3	139.501	0.341	0.000	0.58			2469.4
S17.000	SC1.4	141.543	-0.457	0.000	0.63			2208.0
S15.002	SC1.5	139.303	0.703	0.000	1.47			4036.8
S15.003	SC1.6	138.150	0.000	0.000	1.00			3864.2
S1.014	S13	137.369	-0.401	0.000	0.89			6939.2
S18.000	SHWD14.1	140.278	-0.147	0.000	0.26			19.3
S18.001	SHWD14.2	139.793	-0.117	0.000	0.46			39.7
S18.002	SHWD14.3	139.220	-0.090	0.000	0.66			59.7
S18.003	SHWD14.4	137.645	-0.065	0.000	0.84			80.0
S18.004	SHWD14.5	136.423	-0.067	0.000	0.83			100.0
S19.000	SEx Drain	142.184	-0.216	0.000	0.42			220.4
S18.005	SHWD14.6	135.513	-0.237	0.000	0.79			321.1
S1.015	S14	135.293	-0.417	0.000	0.87			7019.8
S20.000	SHWD15.1	136.229	-0.096	0.000	0.53			26.1
S20.001	SHWD15.2	136.144	0.139	0.000	0.66			31.7
S21.000	SHWD15.3.1	137.268	-0.082	0.000	0.42			18.8
S20.002	SHWD15.3	136.094	0.239	0.000	1.14			91.3
S20.003	SHWD15.4	135.047	-0.053	0.000	0.94			91.7
S1.016	S15	133.543	-0.510	0.000	0.77			7040.9
S1.017	S16	131.221	-0.680	0.000	0.58			7060.1
S1.018	S17	127.604	-0.497	0.000	0.78			7072.3
S22.000	SHWD18.1	126.176	-0.094	0.000	0.62			30.4
S23.000	SHWD18.6.1	128.044	-0.181	0.000	0.08			4.7
S24.000	SHWD18.1	128.764	-0.161	0.000	0.18			9.4
S24.001	SHWD18.2	128.559	-0.116	0.000	0.47			19.3
S24.002	SHWD18.3	128.458	-0.117	0.000	0.46			29.2
S24.003	SHWD18.4	128.235	-0.040	0.000	0.86			38.3

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S24.004	SHWD18.5	128.143	-0.007	0.000	1.00			46.6

PN	US/MH Name	Status	Level Exceeded
S9.000	SHWD6.1	OK	
S9.001	SHWD6.2	OK	
S9.002	SHWD6.3	OK	
S1.007	S6	SURCHARGED	
S1.008	S7	SURCHARGED	
S1.009	S8	SURCHARGED	
S10.000	SC6.0	SURCHARGED	
S11.000	SHWD9.1	SURCHARGED	
S11.001	SHWD9.2	FLOOD RISK	
S11.002	SHWD9.3	FLOOD RISK	
S12.000	SHWD9.4	OK	
S10.001	SC6.1	SURCHARGED	
S1.010	S9	SURCHARGED	
S13.000	SC5.0	SURCHARGED	
S1.011	S10	SURCHARGED	
S14.000	SHWD11.1	OK	
S1.012	S11	OK	
S1.013	S12	OK	
S15.000	SC1.1	OK	
S16.000	SC1.2	SURCHARGED	
S15.001	SC1.3	SURCHARGED	
S17.000	SC1.4	OK	
S15.002	SC1.5	SURCHARGED	
S15.003	SC1.6	OK	
S1.014	S13	OK	
S18.000	SHWD14.1	OK	
S18.001	SHWD14.2	OK	
S18.002	SHWD14.3	OK	
S18.003	SHWD14.4	OK	
S18.004	SHWD14.5	OK	
S19.000	SEx Drain	OK	
S18.005	SHWD14.6	OK	
S1.015	S14	OK	
S20.000	SHWD15.1	OK	
S20.001	SHWD15.2	SURCHARGED	
S21.000	SHWD15.3.1	OK	
S20.002	SHWD15.3	SURCHARGED	
S20.003	SHWD15.4	OK	
S1.016	S15	OK	
S1.017	S16	OK	
S1.018	S17	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Status	Level Exceeded
S22.000	SHWD18.1	OK	
S23.000	SHWD18.6.1	OK	
S24.000	SHWD18.1	OK	
S24.001	SHWD18.2	OK	
S24.002	SHWD18.3	OK	
S24.003	SHWD18.4	OK	
S24.004	SHWD18.5	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge
S23.001	SHWD18.6	15 Winter	100	+30%	
S1.019	S18	30 Winter	100	+30%	
S25.000	SHWD19.1	30 Winter	100	+30%	100/15 Winter
S25.001	SHWD19.2	30 Winter	100	+30%	100/15 Summer
S1.020	S19	30 Winter	100	+30%	100/15 Summer
S1.021	S20	30 Winter	100	+30%	100/15 Winter
S26.000	SC2.1	15 Winter	100	+30%	
S27.000	SC2.2	15 Winter	100	+30%	
S26.001	SC2.3	15 Winter	100	+30%	
S1.022	S21	30 Winter	100	+30%	
S1.023	S22	30 Winter	100	+30%	
S1.024	S23	30 Winter	100	+30%	
S1.025	S24	30 Winter	100	+30%	
S1.026	S25	30 Winter	100	+30%	
S1.027	S26	30 Winter	100	+30%	
S1.028	S27	30 Winter	100	+30%	
S1.029	S28	30 Winter	100	+30%	
S1.030	S29	30 Winter	100	+30%	
S1.031	S30	30 Winter	100	+30%	30/30 Winter
S1.032	S1-31 Basin control	480 Winter	100	+30%	1/600 Winter
S1.033	S32	1440 Winter	100	+30%	100/360 Winter
S1.034	S33	1440 Winter	100	+30%	100/360 Winter
S1.035	S34	1440 Winter	100	+30%	100/240 Winter
S1.036	S35	1440 Winter	100	+30%	100/180 Winter
S28.000	SPrivate HW	1440 Summer	100	+30%	
S1.037	S36	1440 Winter	100	+30%	30/120 Summer
S1.038	S37	960 Summer	100	+30%	
S1.039	SSwale Start (Outfalling headwall)	960 Summer	100	+30%	
S1.040	SSwale 1	960 Summer	100	+30%	
S1.041	SSwale 2	960 Summer	100	+30%	
S1.042	SSwale 3	960 Summer	100	+30%	
S1.043	SSwale 4	480 Summer	100	+30%	
S1.044	SSwale 5	480 Summer	100	+30%	
S1.045	SHeadwall End	480 Summer	100	+30%	
S1.046	S38	480 Summer	100	+30%	

PN	US/MH Name	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S23.001	SHWD18.6				127.915
S1.019	S18				125.889
S25.000	SHWD19.1				124.645
S25.001	SHWD19.2				124.640
S1.020	S19				124.635
S1.021	S20				123.775
S26.000	SC2.1				133.196

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S27.000	SC2.2				133.202
S26.001	SC2.3				127.643
S1.022	S21				122.521
S1.023	S22				120.827
S1.024	S23				118.304
S1.025	S24				115.526
S1.026	S25				112.390
S1.027	S26				111.006
S1.028	S27				109.005
S1.029	S28				107.005
S1.030	S29				105.425
S1.031	S30				104.345
S1.032	S1-31 Basin control		100/120 Winter	17	102.394
S1.033	S32				102.151
S1.034	S33				102.098
S1.035	S34				102.081
S1.036	S35				102.065
S28.000	SPrivate HW				100.650
S1.037	S36				102.045
S1.038	S37				99.654
S1.039	SSwale Start (Outfalling headwall)				99.138
S1.040	SSwale 1				98.197
S1.041	SSwale 2				97.517
S1.042	SSwale 3				96.802
S1.043	SSwale 4				95.997
S1.044	SSwale 5				95.008
S1.045	SHeadwall End				94.113
S1.046	S38				93.545

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
S23.001	SHWD18.6	-0.065	0.000	0.85		
S1.019	S18	-0.120	0.000	0.79		
S25.000	SHWD19.1	0.295	0.000	0.22		
S25.001	SHWD19.2	0.555	0.000	0.50		
S1.020	S19	0.669	0.000	1.45		
S1.021	S20	0.218	0.000	1.24		
S26.000	SC2.1	-0.204	0.000	0.83		
S27.000	SC2.2	-0.198	0.000	0.84		
S26.001	SC2.3	-0.497	0.000	0.54		
S1.022	S21	-0.479	0.000	0.85		
S1.023	S22	-0.673	0.000	0.66		
S1.024	S23	-0.696	0.000	0.63		
S1.025	S24	-0.774	0.000	0.55		
S1.026	S25	-0.360	0.000	0.97		

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
S1.027	S26	-0.594	0.000	0.74		
S1.028	S27	-0.595	0.000	0.74		
S1.029	S28	-0.595	0.000	0.74		
S1.030	S29	-0.175	0.000	0.73		
S1.031	S30	0.745	0.000	1.81		
S1.032	S1-31 Basin control	0.644	0.000	0.73	913.9	
S1.033	S32	0.451	0.000	0.39		
S1.034	S33	0.648	0.000	0.35		
S1.035	S34	0.981	0.000	0.35		
S1.036	S35	1.315	0.000	0.33		
S28.000	SPrivate HW	0.000	0.000	0.80		
S1.037	S36	1.995	0.000	0.66		
S1.038	S37	-0.196	0.000	0.52		
S1.039	SSwale Start (Outfalling headwall)	-0.412	0.000	0.03		
S1.040	SSwale 1	-0.413	0.000	0.04		
S1.041	SSwale 2	-0.413	0.000	0.04		
S1.042	SSwale 3	-0.413	0.000	0.03		
S1.043	SSwale 4	-0.413	0.000	0.03		
S1.044	SSwale 5	-0.427	0.000	0.02		
S1.045	SHeadwall End	-0.202	0.000	0.44		
S1.046	S38	-0.114	0.000	0.83		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S23.001	SHWD18.6	129.6	OK	
S1.019	S18	7031.5	OK	
S25.000	SHWD19.1	16.0	SURCHARGED	
S25.001	SHWD19.2	43.4	SURCHARGED	
S1.020	S19	7017.4	SURCHARGED	
S1.021	S20	6998.1	SURCHARGED	
S26.000	SC2.1	1862.7	OK	
S27.000	SC2.2	1852.3	OK	
S26.001	SC2.3	3743.2	OK	
S1.022	S21	7882.4	OK	
S1.023	S22	7881.7	OK	
S1.024	S23	7879.7	OK	
S1.025	S24	7877.4	OK	
S1.026	S25	7874.8	OK	
S1.027	S26	7880.0	OK	
S1.028	S27	7880.9	OK	
S1.029	S28	7879.4	OK	
S1.030	S29	7865.3	OK	
S1.031	S30	7869.3	SURCHARGED	
S1.032	S1-31 Basin control	82.4	SURCHARGED	
S1.033	S32	82.4	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Southern Storm

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.034	S33	82.4	SURCHARGED	
S1.035	S34	82.4	SURCHARGED	
S1.036	S35	82.4	SURCHARGED	
S28.000	SPrivate HW	625.4	SURCHARGED*	
S1.037	S36	82.3	SURCHARGED	
S1.038	S37	82.3	OK	
S1.039	SSwale Start (Outfalling headwall)	82.3	OK	
S1.040	SSwale 1	82.3	OK	
S1.041	SSwale 2	82.3	OK	
S1.042	SSwale 3	82.3	OK	
S1.043	SSwale 4	82.3	OK	
S1.044	SSwale 5	82.3	OK	
S1.045	SHeadwall End	82.3	OK	
S1.046	S38	82.3	OK	

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