DRAINAGE STRATEGY

Hoyland Common



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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 **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, refer to **Appendix B**

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 the railway to the south and entering the Harley Dike
6. 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 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 is then assumed to head towards a culvert (unknown size) under the railway, behind the station House building. From the south of the railway line this then meanders to Longley Spring cottage and connects to the Harley Dike as it crosses Sheffield Road. It is not proposed to reutilise this outfall.

The Western catchment collects approximately 16.55Ha 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 Highway agency drains. As the site is re-levelled it is proposed to only retain these connections for the remaining green infrastructure on the embankments outside the revised plot areas, to the Motorway Drain A with site area. This will be a substantial reduction on existing flows form the field 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 pond located at the southern end of the site, discharged at the QBAR discharge rate based only on the area of contributing catchment for the 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 proposed storage pond, 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 C** (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 D**.

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 storage pond 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 into only the southern outfalls;

1. Through a proposed storage pond 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 C.**

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
- 30% for Green embankments and verges

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 lined with impermeable membranes as infiltration is considered effectively unviable at the site.

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 pond constructed upstream of the outfall at the western culvert directly adjacent to Bell woods, with attenuation for the site.

4.2.5 Immediately downstream of the proposed storage pond, 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 82.4l/s Qbar rate.

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 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 reduing the load form the original green fields.

5.3.2 This restricted discharge will be achieved on site by constructing a storage pond 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--0300-302** included in **Appendix E**. Discharge from the Pond 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 pond 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 ponds for the attenuation storage can provide amenity benefits to the local community, 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		
Ponds		0.7	0.7	0.5
Remaining		**0.0**	**0.0**	**0.2**
Where the ponds alone are 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 23.1 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 23.1 Operation and maintenance requirements for ponds and wetlands

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices, eg penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1 m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay.	Every 1–5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, eg every 25–50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets and overflows.	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 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 site reaches 50% occupancy, the maintenance will be the responsibility of Newlands Developments. The newly proposed pond and outfall Swale will not be adopted, so will require future maintenance provided by a maintenance contract, it is anticipated that pond 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-0300-301** included in **Appendix E.** 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. The proposed residential development is proposed to have a separate foul water connection not associated to this development

7.2 Peak Foul Water Discharge Rate

'Sewage Sector Guidance Appendix C' has been used to calculate the peak foul flows from the residential, commercial and school. 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	**26.394 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, this has forced a requirement for a section of the foul drainage system to be pumped in order to reach the nearest public foul drainage network located in Fitzwilliam street to the Northeast. The proposed pumping station will be offered to YWS for adoption and will discharge at 26.4l/s (or as agreed with YWS) with its own emergency storage with telemetry control to manage flows.

It is anticipated that the proposed pumping station will need to be designed for adoption in accordance with the standards required by Yorkshire Water

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	36.19 ha	21.714 l/s	78.17
	Total		**94.33m3**

And the pumping station will need to pump at a rate of 26.4l/s:

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

Areas Schedule

Plot No.	Warehouse GIA sqft	Warehouse GIA sqm	Offices GIA sqft	Offices GIA sqm	**Total GIA sqft**	Total GIA sqm	Cars Parking	HGV Parking	Docks
1	298700	27750	40594	3771	**339821**	31571	650	595	163
2	480000	44593	44800	4162	**524800**	48755	380	133	64
Total	778700	72343	85394	7933	**864621**	80326	1030	728	227

Note: total Area figure for plot 1 includes VMU / gatehouse areas (as area schedule on Site Plan)

net site area
4.92ha

net site area
18.00ha

APPLICATION RED LINE AREA

net site area
10.47ha

Overhead Electricity Cables
No Building Zone hatched Blue

Revision:

P1	first issue	29mar2019	PL
P2	Unit 2 scheme added	09dec2019	PL
P3	Unit 2 layout updated	10dec2019	PL
P4	layout updated	16dec2019	PL
P5	new road design, redline adjusted	29jan2020	PL
P6	residential site access proposal indicated	29jan2020	PL
P7	small commercial site layouts added	31jan2020	PL
P8	areas table corrected	03feb2020	PL
P9	updated following comments	03feb2020	PL
P10	net site areas noted	03feb2020	PL
P11	plot 2 changed to 2 units	12feb2020	RM
P12	road updated, ponds added	24feb2020	PL
P13	plot 2 amended to single unit	25mar2020	RM
P14	new RPS road design update	13apr2020	PL
P15	balancing pond, road and red line amended	15apr2020	RM
P16	Minor update to road	20apr2020	JM
P17	roundabout and Plot 2 access update	28apr2020	PL
P18	net site plot areas adjusted and shown	07may2020	PL
P19	plateau contours updated	19may2020	PL
P20	further earthworks update	20may2020	PL
P21	redline and road update	21may2020	PL
P22	acoustic fence, generator added, areas update	29may2020	PL
P23	acoustic barrier extent updated	04jun2020	PL
P24	Area Table corrected	10jun2020	PL
P25	Plot 5 access added	15jun2020	PL

0 50m 100m SCALE 1:2500

N

Hoyland Common
Barnsley M1, J36

newlands developments

pHp Architects
www.peter-haddon.com

Masterplan

Drawing Status:	Preliminary
CAD Reference:	4400-001
Drawn:	PL
Date:	feb2020
Scale @A1:	1/2500

Project No:	Drawing No:	Rev:
4400	001	P25

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Hoyland North
Masterplan Framework Area
(visible extents)

Birdwell Roundabout

Plot 4
(EMP)
2.03ha

Plot 3
(EMP)
5.09ha

Hoyland Common
Primary School

B6096 Hoyland Road

HOYLAND COMMON

M1

Tankersley Lane

Plot 6
(RESI)
2.53ha

Plot 5
(EMP)
1.70ha

A6135 Sheffield Road

Potential Access into
Sports & Community
Facilities

Plot 1
(EMP)
18.35ha

Plot 2
(EMP)
9.02ha

Hoyland South
Masterplan Framework Area
(visible extents)

Bell Ground

ATTENUATION

DRAFT

NOTES
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Ordnance Survey base mapping - supplied by client.

N

0 50 100 150 200 250m

KEY

- Allocation Site Boundary
- Approximate Extent of Existing Vegetation (based on aerial image)
- Approximate Location of Overhead Wires (with 30m clearance zone)
- Existing Public Rights of Way
- Employment Parcels (approx 34.05ha)
- Residential Parcels (approx 2.53ha)
- Proposed Spine Road
- Access Points
- Indicative Location of Attenuation Features
- Proposed Buffer Planting
- Inidicative Green Link

Newlands Developments
Hoyland West,
Hoyland

CAPACITY PLAN

1:2500 @ A1
17 April 2020 CC / DH
9295-L-02 rev **I**

masterplanning
environmental assessment
landscape design
urban design
ecology
architecture
arboriculture

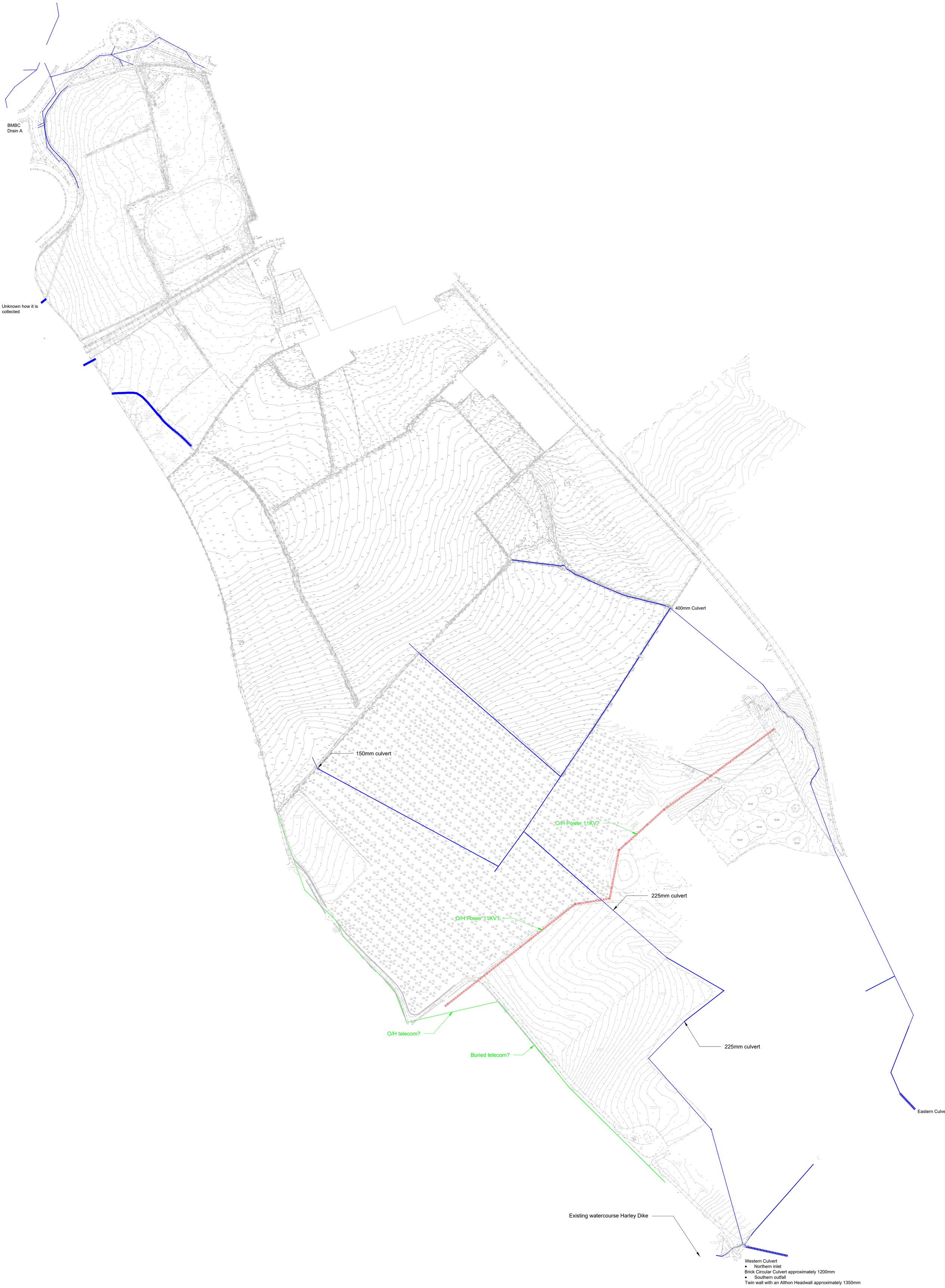
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File: K:\9200\9295\LANDS\Plans\9295-L-02I Capacity Plan.vwx

Appendix B

Topographic Survey


BMBC
Drain A
Unknown how it is
collected
400mm Culvert
150mm culvert
O/H Power 11KV?
225mm culvert
O/H Power 11KV?
O/H telecom?
Buried telecom?
225mm culvert
Eastern Culvert
Existing watercourse Harley Dike
Western Culvert
• Northern inlet
Brick Circular Culvert approximately 1200mm
• Southern outfall
Twin wall with an Althon Headwall approximately 1350mm

Appendix C

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 D

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)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	29.340	0.480	61.1	1.476	5.00	0.0	0.600	o	600	Pipe/Conduit	
S2.000	69.356	0.200	346.8	0.183	5.00	0.0	0.600	o	400	Pipe/Conduit	
S2.001	39.670	0.130	305.2	0.145	0.00	0.0	0.600	o	400	Pipe/Conduit	
S1.001	62.968	0.125	503.7	0.159	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S3.000	36.331	2.380	15.3	1.432	5.00	0.0	0.600	o	400	Pipe/Conduit	
S1.002	53.900	0.100	539.0	0.120	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)
S1.000	0.00	5.16	143.000	1.476	0.0	0.0	0.0	3.12	881.8	0.0
S2.000	0.00	6.15	143.050	0.183	0.0	0.0	0.0	1.01	126.6	0.0
S2.001	0.00	6.76	142.850	0.328	0.0	0.0	0.0	1.08	135.1	0.0
S1.001	0.00	7.39	141.920	1.963	0.0	0.0	0.0	1.66	1877.4	0.0
S3.000	0.00	5.12	145.000	1.432	0.0	0.0	0.0	4.85	609.6	0.0
S1.002	0.00	7.95	141.795	3.515	0.0	0.0	0.0	1.60	1814.5	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)	HYD SECT	DIA (mm)	Section Type	Auto Design
S4.000	31.300	0.255	122.7	3.348	5.00	0.0	0.600	o	750	Pipe/Conduit	
S1.003	47.500	0.095	500.0	0.129	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S5.000	41.443	3.575	11.6	1.089	5.00	0.0	0.600	o	375	Pipe/Conduit	
S1.004	87.525	0.175	500.1	0.197	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S6.000	90.000	0.500	180.0	0.160	5.00	0.0	0.600	o	300	Pipe/Conduit	
S6.001	90.000	1.100	81.8	0.160	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	53.433	0.100	534.3	0.157	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.006	55.864	0.110	507.9	0.103	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.007	56.016	0.110	509.2	0.073	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.008	67.245	0.130	517.3	0.109	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S7.000	15.691	0.100	156.9	1.740	5.00	0.0	0.600	o	600	Pipe/Conduit	
S8.000	84.260	2.825	29.8	0.225	5.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	25.769	0.600	42.9	0.054	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.002	17.466	0.085	205.5	0.019	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.003	29.792	1.615	18.4	0.045	0.00	0.0	0.600	o	300	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	5.21	142.400	3.348	0.0	0.0	0.0	2.52	1115.5	0.0
S1.003	0.00	8.43	141.695	6.992	0.0	0.0	0.0	1.67	1884.5	0.0
S5.000	0.00	5.13	146.000	1.089	0.0	0.0	0.0	5.35	590.5	0.0
S1.004	0.00	9.30	141.600	8.278	0.0	0.0	0.0	1.67	1884.2	0.0
S6.000	0.00	6.28	143.925	0.160	0.0	0.0	0.0	1.17	82.6	0.0
S6.001	0.00	7.15	143.425	0.320	0.0	0.0	0.0	1.74	123.0	0.0
S1.005	0.00	9.86	141.425	8.755	0.0	0.0	0.0	1.61	1822.5	0.0
S1.006	0.00	10.42	141.325	8.858	0.0	0.0	0.0	1.65	1869.7	0.0
S1.007	0.00	10.91	140.915	8.931	0.0	0.0	0.0	1.89	3346.8	0.0
S1.008	0.00	11.51	140.805	9.040	0.0	0.0	0.0	1.88	3320.5	0.0
S7.000	0.00	5.13	142.900	1.740	0.0	0.0	0.0	1.94	549.0	0.0
S8.000	0.00	5.58	149.400	0.225	0.0	0.0	0.0	2.40	95.6	0.0
S8.001	0.00	5.76	146.500	0.279	0.0	0.0	0.0	2.41	170.1	0.0
S8.002	0.00	6.03	145.900	0.298	0.0	0.0	0.0	1.09	77.3	0.0
S8.003	0.00	6.16	145.815	0.343	0.0	0.0	0.0	3.68	260.0	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)	HYD SECT	DIA (mm)	Section Type	Auto Design
S8.004	55.448	1.200	46.2	0.030	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.000	34.000	0.725	46.9	0.023	5.00	0.0	0.600	o	150	Pipe/Conduit	
S7.001	24.000	1.125	21.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.009	54.308	0.100	543.1	0.100	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S10.000	45.049	0.400	112.6	0.575	5.00	0.0	0.600	o	500	Pipe/Conduit	
S1.010	70.786	0.140	505.6	0.119	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.011	68.451	0.235	291.3	0.110	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.012	90.000	3.580	25.1	0.342	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S11.000	494.826	2.800	176.7	6.300	5.00	0.0	0.600	o	1200	Pipe/Conduit	
S12.000	79.840	0.340	234.8	1.350	5.00	0.0	0.600	o	1500	Pipe/Conduit	
S11.001	132.986	0.320	415.6	0.990	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S13.000	462.157	3.400	135.9	6.300	5.00	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)
S8.004	0.00	6.56	144.200	0.373	0.0	0.0	0.0	2.32	163.9	0.0
S9.000	0.00	5.38	143.875	0.023	0.0	0.0	0.0	1.47	26.0	0.0
S7.001	0.00	6.64	142.700	2.136	0.0	0.0	0.0	5.29	1495.1	0.0
S1.009	0.00	12.00	140.675	11.276	0.0	0.0	0.0	1.83	3240.1	0.0
S10.000	0.00	5.37	141.925	0.575	0.0	0.0	0.0	2.05	401.8	0.0
S1.010	0.00	12.62	140.525	11.971	0.0	0.0	0.0	1.90	3358.8	0.0
S1.011	0.00	13.08	140.385	12.081	0.0	0.0	0.0	2.51	4432.4	0.0
S1.012	0.00	13.25	140.150	12.423	0.0	0.0	0.0	8.57	15142.9	0.0
S11.000	0.00	7.93	140.800	6.300	0.0	0.0	0.0	2.81	3179.6	0.0
S12.000	0.00	5.48	138.000	1.350	0.0	0.0	0.0	2.80	4939.2	0.0
S11.001	0.00	8.99	137.660	8.640	0.0	0.0	0.0	2.10	3707.2	0.0
S13.000	0.00	7.40	140.800	6.300	0.0	0.0	0.0	3.21	3627.5	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)	HYD SECT	DIA (mm)	Section Type	Auto Design
S11.002	291.717	0.450	648.3	1.170	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S11.003	37.342	0.080	466.8	1.170	0.00	0.0	0.600	o	1500	Pipe/Conduit	
S1.013	39.650	0.500	79.3	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.014	75.804	1.060	71.5	0.236	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S14.000	89.576	1.000	89.6	0.039	5.00	0.0	0.600	o	150	Pipe/Conduit	
S14.001	69.500	1.250	55.6	0.035	0.00	0.0	0.600	o	150	Pipe/Conduit	
S14.002	12.190	0.450	27.1	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.003	18.225	1.200	15.2	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.004	47.000	1.000	47.0	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.005	34.800	1.100	31.6	0.210	0.00	0.0	0.600	o	300	Pipe/Conduit	
S14.006	71.900	0.500	143.8	0.111	0.00	0.0	0.600	o	400	Pipe/Conduit	
S14.007	14.130	0.995	14.2	0.213	0.00	0.0	0.600	o	400	Pipe/Conduit	
S1.015	75.923	3.010	25.2	0.204	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.016	81.214	3.175	25.6	0.304	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.017	57.566	1.635	35.2	0.199	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.018	72.116	2.040	35.4	0.368	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.019	56.067	1.850	30.3	0.368	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.020	90.058	1.500	60.0	0.000	0.00	0.0	0.600	o	1800	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)
S11.002	0.00	11.89	137.100	16.110	0.0	0.0	0.0	1.68	2963.8	0.0
S11.003	0.00	12.20	136.650	17.280	0.0	0.0	0.0	1.98	3496.7	0.0
S1.013	0.00	13.38	136.270	29.703	0.0	0.0	0.0	5.39	13705.6	0.0
S1.014	0.00	13.60	135.770	29.939	0.0	0.0	0.0	5.67	14434.2	0.0
S14.000	0.00	6.41	143.875	0.039	0.0	0.0	0.0	1.06	18.8	0.0
S14.001	0.00	7.26	142.875	0.074	0.0	0.0	0.0	1.35	23.9	0.0
S14.002	0.00	7.34	141.550	0.099	0.0	0.0	0.0	2.52	100.3	0.0
S14.003	0.00	7.43	141.100	0.129	0.0	0.0	0.0	3.37	134.2	0.0
S14.004	0.00	7.84	139.900	0.159	0.0	0.0	0.0	1.91	76.1	0.0
S14.005	0.00	8.05	138.825	0.369	0.0	0.0	0.0	2.81	198.3	0.0
S14.006	0.00	8.81	137.625	0.480	0.0	0.0	0.0	1.57	197.5	0.0
S14.007	0.00	8.86	137.125	0.693	0.0	0.0	0.0	5.03	632.1	0.0
S1.015	0.00	13.73	134.710	30.836	0.0	0.0	0.0	9.56	24327.3	0.0
S1.016	0.00	13.87	131.700	31.140	0.0	0.0	0.0	9.49	24157.4	0.0
S1.017	0.00	13.99	128.525	31.339	0.0	0.0	0.0	8.09	20585.6	0.0
S1.018	0.00	14.14	126.890	31.707	0.0	0.0	0.0	8.07	20544.0	0.0
S1.019	0.00	14.25	124.850	32.075	0.0	0.0	0.0	8.72	22190.7	0.0
S1.020	0.00	14.49	123.000	32.075	0.0	0.0	0.0	6.19	15756.3	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)	HYD SECT	DIA (mm)	Section Type	Auto Design
S15.000	400.000	5.250	76.2	4.676	5.00	0.0	0.600	o	900	Pipe/Conduit	
S16.000	400.000	5.250	76.2	4.676	5.00	0.0	0.600	o	900	Pipe/Conduit	
S15.001	51.376	4.550	11.3	0.000	0.00	0.0	0.600	o	1050	Pipe/Conduit	
S1.021	89.816	1.500	59.9	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.022	57.407	2.500	23.0	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.023	44.667	1.500	29.8	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.024	63.910	4.250	15.0	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.025	20.812	1.150	18.1	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.026	43.217	2.100	20.6	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.027	38.874	1.600	24.3	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.028	72.258	1.200	60.2	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.029	51.127	1.215	42.1	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.030	36.030	0.855	42.1	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.031	54.378	1.295	42.0	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.032	33.012	0.785	42.1	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.033	24.500#	1.050	23.3	0.000	0.00	0.0	0.600	o	1800	Pipe/Conduit	
S1.034	38.961	0.200	194.8	2.940	0.00	0.0	0.600	o	400	Pipe/Conduit	
S1.035	54.229	0.270	200.8	0.000	0.00	0.0	0.600	o	400	Pipe/Conduit	
S1.036	72.885	0.780	93.4	0.000	0.00	0.0	0.600	\/	-4	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)
S15.000	0.00	6.86	132.500	4.676	0.0	0.0	0.0	3.59	2285.1	0.0
S16.000	0.00	6.86	132.500	4.676	0.0	0.0	0.0	3.59	2285.1	0.0
S15.001	0.00	6.94	127.100	9.351	0.0	0.0	0.0	10.28	8903.7	0.0
S1.021	0.00	14.73	121.500	41.426	0.0	0.0	0.0	6.20	15777.6	0.0
S1.022	0.00	14.83	120.000	41.426	0.0	0.0	0.0	10.02	25498.4	0.0
S1.023	0.00	14.91	117.500	41.426	0.0	0.0	0.0	8.80	22387.1	0.0
S1.024	0.00	15.00	116.000	41.426	0.0	0.0	0.0	12.39	31517.0	0.0
S1.025	0.00	15.03	111.750	41.426	0.0	0.0	0.0	11.29	28726.4	0.0
S1.026	0.00	15.10	110.600	41.426	0.0	0.0	0.0	10.59	26936.3	0.0
S1.027	0.00	15.16	108.500	41.426	0.0	0.0	0.0	9.74	24787.8	0.0
S1.028	0.00	15.36	106.900	41.426	0.0	0.0	0.0	6.18	15733.2	0.0
S1.029	0.00	15.47	105.700	41.426	0.0	0.0	0.0	7.40	18827.2	0.0
S1.030	0.00	15.56	104.485	41.426	0.0	0.0	0.0	7.39	18813.6	0.0
S1.031	0.00	15.68	103.630	41.426	0.0	0.0	0.0	7.41	18847.2	0.0
S1.032	0.00	15.75	102.335	41.426	0.0	0.0	0.0	7.40	18833.1	0.0
S1.033	0.00	15.79	101.550	41.426	0.0	0.0	0.0	9.94	25294.8	0.0
S1.034	0.00	16.27	100.500	44.366	0.0	0.0	0.0	1.35	169.5	0.0
S1.035	0.00	16.96	100.300	44.366	0.0	0.0	0.0	1.33	166.9	0.0
S1.036	0.00	17.28	100.030	44.366	0.0	0.0	0.0	3.73	5135.4	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)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.037	72.564	5.250	13.8	0.000	0.00	0.0	0.600	\/	-4	Pipe/Conduit	
S1.038	18.446	1.260	14.6	0.000	0.00	0.0	0.600	\/	-4	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	17.41	99.250	44.366	0.0	0.0	0.0	9.71	13381.6	0.0
S1.038	0.00	17.44	94.000	44.366	0.0	0.0	0.0	9.44	13001.9	0.0

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Manhole Schedules for Southern Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdro (mm)
SC3A	145.600	2.600	Open Manhole	1500	S1.000	143.000	600				
S1	145.300	2.250	Open Manhole	1350	S2.000	143.050	400				
S2	146.300	3.450	Open Manhole	1350	S2.001	142.850	400	S2.000	142.850	400	
S3	147.100	5.180	Open Manhole	2100	S1.001	141.920	1200	S1.000	142.520	600	
								S2.001	142.720	400	
SC4B	148.450	3.450	Open Manhole	1350	S3.000	145.000	400				
S4	147.900	6.105	Open Manhole	2100	S1.002	141.795	1200	S1.001	141.795	1200	
								S3.000	142.620	400	2
SC3B	145.600	3.200	Open Manhole	1800	S4.000	142.400	750				
S5	148.150	6.455	Open Manhole	2100	S1.003	141.695	1200	S1.002	141.695	1200	
								S4.000	142.145	750	
SC4A	149.000	3.000	Open Manhole	1350	S5.000	146.000	375				
S6	148.690	7.090	Open Manhole	2100	S1.004	141.600	1200	S1.003	141.600	1200	
								S5.000	142.425	375	
S7	145.500	1.575	Open Manhole	1200	S6.000	143.925	300				
S8	147.100	3.675	Open Manhole	1200	S6.001	143.425	300	S6.000	143.425	300	
S9	148.400	6.975	Open Manhole	2100	S1.005	141.425	1200	S1.004	141.425	1200	
								S6.001	142.325	300	
S10	148.225	6.900	Open Manhole	2100	S1.006	141.325	1200	S1.005	141.325	1200	
S11	147.250	6.335	Open Manhole	2400	S1.007	140.915	1500	S1.006	141.215	1200	
S12	146.000	5.195	Open Manhole	2400	S1.008	140.805	1500	S1.007	140.805	1500	
SC6.0	144.875	1.975	Open Manhole	1500	S7.000	142.900	600				
SFD1	150.900	1.500	Open Manhole	1200	S8.000	149.400	225				
SFD2	147.700	1.200	Open Manhole	1200	S8.001	146.500	300	S8.000	146.575	225	
SFD3	147.100	1.200	Open Manhole	1200	S8.002	145.900	300	S8.001	145.900	300	
SFD3a	147.100	1.285	Open Manhole	1200	S8.003	145.815	300	S8.002	145.815	300	
SFD4	145.400	1.200	Open Manhole	1200	S8.004	144.200	300	S8.003	144.200	300	
SFD5	145.000	1.125	Open Manhole	1200	S9.000	143.875	150				
SC6.1	144.875	2.175	Open Manhole	1500	S7.001	142.700	600	S7.000	142.800	600	10
								S8.004	143.000	300	
								S9.000	143.150	150	
S13	144.850	4.175	Open Manhole	2400	S1.009	140.675	1500	S1.008	140.675	1500	
								S7.001	141.575	600	
SC5.0	144.200	2.275	Open Manhole	1500	S10.000	141.925	500				
S14	144.150	3.625	Open Manhole	2400	S1.010	140.525	1500	S1.009	140.575	1500	5
								S10.000	141.525	500	
S15	143.850	3.465	Open Manhole	2400	S1.011	140.385	1500	S1.010	140.385	1500	
S16	142.850	2.700	Open Manhole	2400	S1.012	140.150	1500	S1.011	140.150	1500	

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Manhole Schedules for Southern Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdro (mm)
SC1.1	143.250	2.450	Open Manhole	2100	S11.000	140.800	1200				
SC1.2	141.000	3.000	Open Manhole	2400	S12.000	138.000	1500				
SC1.3	143.250	5.590	Open Manhole	2400	S11.001	137.660	1500	S11.000	138.000	1200	4
								S12.000	137.660	1500	
SC1.4	143.250	2.450	Open Manhole	2100	S13.000	140.800	1200				
SC1.5	142.000	4.900	Open Manhole	2400	S11.002	137.100	1500	S11.001	137.340	1500	24
								S13.000	137.400	1200	
SC1.6	139.500	2.850	Open Manhole	2400	S11.003	136.650	1500	S11.002	136.650	1500	
S17	141.100	4.830	Open Manhole	2700	S1.013	136.270	1800	S1.012	136.570	1500	
								S11.003	136.570	1500	
S18	140.210	4.440	Open Manhole	2700	S1.014	135.770	1800	S1.013	135.770	1800	
SFD6	145.000	1.125	Open Manhole	1200	S14.000	143.875	150				
SFD7	144.000	1.125	Open Manhole	1200	S14.001	142.875	150	S14.000	142.875	150	
SFD8	142.750	1.200	Open Manhole	1200	S14.002	141.550	225	S14.001	141.625	150	
SFD9	142.300	1.200	Open Manhole	1200	S14.003	141.100	225	S14.002	141.100	225	
SFD10	141.100	1.200	Open Manhole	1200	S14.004	139.900	225	S14.003	139.900	225	
SFD11	140.100	1.275	Open Manhole	1200	S14.005	138.825	300	S14.004	138.900	225	
SFD12	139.000	1.375	Open Manhole	1350	S14.006	137.625	400	S14.005	137.725	300	
SFD13	138.500	1.375	Open Manhole	1350	S14.007	137.125	400	S14.006	137.125	400	
S19	137.710	3.000	Open Manhole	2700	S1.015	134.710	1800	S1.014	134.710	1800	
								S14.007	136.130	400	2
S20	134.700	3.000	Open Manhole	2700	S1.016	131.700	1800	S1.015	131.700	1800	
S21	131.525	3.000	Open Manhole	2700	S1.017	128.525	1800	S1.016	128.525	1800	
S22	129.890	3.000	Open Manhole	2700	S1.018	126.890	1800	S1.017	126.890	1800	
S23	127.850	3.000	Open Manhole	2700	S1.019	124.850	1800	S1.018	124.850	1800	
S24	126.000	3.000	Open Manhole	2700	S1.020	123.000	1800	S1.019	123.000	1800	
SC2.1	134.750	2.250	Open Manhole	1800	S15.000	132.500	900				
SC2.2	134.750	2.250	Open Manhole	1800	S16.000	132.500	900				
SC2.3	134.750	7.650	Open Manhole	1950	S15.001	127.100	1050	S15.000	127.250	900	
								S16.000	127.250	900	
S25	124.500	3.000	Open Manhole	2700	S1.021	121.500	1800	S1.020	121.500	1800	
								S15.001	122.550	1050	30
S26	123.000	3.000	Open Manhole	2700	S1.022	120.000	1800	S1.021	120.000	1800	
S27	120.500	3.000	Open Manhole	2700	S1.023	117.500	1800	S1.022	117.500	1800	
S28	119.000	3.000	Open Manhole	2700	S1.024	116.000	1800	S1.023	116.000	1800	
S29	114.750	3.000	Open Manhole	2700	S1.025	111.750	1800	S1.024	111.750	1800	
S30	113.600	3.000	Open Manhole	2700	S1.026	110.600	1800	S1.025	110.600	1800	
S31	111.500	3.000	Open Manhole	2700	S1.027	108.500	1800	S1.026	108.500	1800	

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Manhole Schedules for Southern Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdr (mm)
S32	109.900	3.000	Open Manhole	2700	S1.028	106.900	1800	S1.027	106.900	1800	
S33	108.700	3.000	Open Manhole	2700	S1.029	105.700	1800	S1.028	105.700	1800	
S34	108.250	3.765	Open Manhole	2700	S1.030	104.485	1800	S1.029	104.485	1800	
S35	108.250	4.620	Open Manhole	2700	S1.031	103.630	1800	S1.030	103.630	1800	
S36	105.750	3.415	Open Manhole	2700	S1.032	102.335	1800	S1.031	102.335	1800	
S37	106.250	4.700	Open Manhole	2700	S1.033	101.550	1800	S1.032	101.550	1800	
S38	104.500	4.000	Open Manhole	2700	S1.034	100.500	400	S1.033	100.500	1800	
S39	101.600	1.300	Open Manhole	1350	S1.035	100.300	400	S1.034	100.300	400	
SHW	101.500	1.470	Open Manhole	1350	S1.036	100.030	-4	S1.035	100.030	400	
SSwale 1	99.750	0.500	Junction		S1.037	99.250	-4	S1.036	99.250	-4	
SSwale 2	94.500	0.500	Junction		S1.038	94.000	-4	S1.037	94.000	-4	
S	93.500	0.760	Open Manhole	0		OUTFALL		S1.038	92.740	-4	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SC3A	435128.835	400271.344	435128.835	400271.344	Required	
S1	435133.748	400386.018	435133.748	400386.018	Required	
S2	435149.270	400318.421	435149.270	400318.421	Required	
S3	435157.015	400279.514	435157.015	400279.514	Required	
SC4B	435210.830	400233.341	435210.830	400233.341	Required	
S4	435177.102	400219.836	435177.102	400219.836	Required	
SC3B	435165.821	400156.959	435165.821	400156.959	Required	
S5	435194.769	400168.899	435194.769	400168.899	Required	

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Manhole Schedules for Southern Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SC4A	435248.949	400145.287	435248.949	400145.287	Required	
S6	435212.825	400124.975	435212.825	400124.975	Required	
S7	435095.438	399956.244	435095.438	399956.244	Required	
S8	435174.392	399999.444	435174.392	399999.444	Required	
S9	435251.220	400046.321	435251.220	400046.321	Required	
S10	435282.902	400003.294	435282.902	400003.294	Required	
S11	435321.437	399962.849	435321.437	399962.849	Required	
S12	435365.873	399928.742	435365.873	399928.742	Required	
SC6.0	435436.798	399935.441	435436.798	399935.441	Required	
SFD1	435303.482	400074.113	435303.482	400074.113	Required	
SFD2	435341.448	399998.887	435341.448	399998.887	Required	
SFD3	435363.734	399985.949	435363.734	399985.949	Required	
SFD3a	435370.235	399969.738	435370.235	399969.738	Required	
SFD4	435381.232	399942.050	435381.232	399942.050	Required	
SFD5	435465.034	399911.140	435465.034	399911.140	Required	

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Manhole Schedules for Southern Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SC6.1	435432.284	399920.413	435432.284	399920.413	Required	
S13	435425.368	399897.402	435425.368	399897.402	Required	
SC5.0	435484.955	399924.654	435484.955	399924.654	Required	
S14	435476.922	399880.327	435476.922	399880.327	Required	
S15	435546.574	399867.704	435546.574	399867.704	Required	
S16	435611.975	399847.500	435611.975	399847.500	Required	
SC1.1	435165.545	399924.340	435165.545	399924.340	Required	
SC1.2	435401.891	399401.667	435401.891	399401.667	Required	
SC1.3	435380.233	399478.513	435380.233	399478.513	Required	
SC1.4	435289.986	399951.764	435289.986	399951.764	Required	
SC1.5	435498.503	399539.320	435498.503	399539.320	Required	
SC1.6	435674.199	399772.193	435674.199	399772.193	Required	
S17	435691.469	399805.301	435691.469	399805.301	Required	
S18	435728.377	399790.814	435728.377	399790.814	Required	
SFD6	435486.489	399902.909	435486.489	399902.909	Required	

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Manhole Schedules for Southern Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SFD7	435574.402	399885.730	435574.402	399885.730	Required	
SFD8	435640.033	399862.614	435640.033	399862.614	Required	
SFD9	435648.499	399853.771	435648.499	399853.771	Required	
SFD10	435665.753	399847.907	435665.753	399847.907	Required	
SFD11	435710.825	399834.598	435710.825	399834.598	Required	
SFD12	435734.826	399809.345	435734.826	399809.345	Required	
SFD13	435800.423	399779.893	435800.423	399779.893	Required	
S19	435799.987	399765.948	435799.987	399765.948	Required	
S20	435871.597	399740.723	435871.597	399740.723	Required	
S21	435945.022	399706.017	435945.022	399706.017	Required	
S22	435989.521	399669.497	435989.521	399669.497	Required	
S23	436040.346	399618.335	436040.346	399618.335	Required	
S24	436011.694	399570.142	436011.694	399570.142	Required	
SC2.3	435919.920	399522.443	435919.920	399522.443	Required	
S25	435962.970	399494.403	435962.970	399494.403	Required	

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Manhole Schedules for Southern Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S26	435914.703	399418.659	435914.703	399418.659	Required	
S27	435883.928	399370.198	435883.928	399370.198	Required	
S28	435921.012	399345.299	435921.012	399345.299	Required	
S29	435945.614	399286.314	435945.614	399286.314	Required	
S30	435942.259	399265.774	435942.259	399265.774	Required	
S31	435915.244	399232.042	435915.244	399232.042	Required	
S32	435907.968	399193.855	435907.968	399193.855	Required	
S33	435945.469	399132.089	435945.469	399132.089	Required	
S34	435943.719	399080.993	435943.719	399080.993	Required	
S35	435972.323	399059.085	435972.323	399059.085	Required	
S36	435955.639	399007.330	435955.639	399007.330	Required	
S37	435977.234	398982.361	435977.234	398982.361	Required	
S38	435948.777	398756.487	435948.777	398756.487	Required	
S39	435972.554	398725.622	435972.554	398725.622	Required	
SHW	435978.961	398671.773	435978.961	398671.773	Required	

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Manhole Schedules for Southern Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SSwale 1	436029.454	398619.148			No Entry	
SSwale 2	436081.537	398568.622			No Entry	
S	436092.718	398553.951			No Entry	

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)
S1.038	S	93.500	92.740	0.000	0	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	2.000
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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	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

Hydro-Brake® Optimum Manhole: S38, DS/PN: S1.034, Volume (m³): 78.4

Unit Reference	MD-SHE-0326-8240-3700-8240
Design Head (m)	3.700
Design Flow (l/s)	82.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	326
Invert Level (m)	100.500
Minimum Outlet Pipe Diameter (mm)	Site Specific Design (Contact Hydro International)
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.700	82.2
Flush-Flo™	1.068	82.4
Kick-Flo®	2.259	64.8
Mean Flow over Head Range	-	71.7

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	9.7	1.200	82.2	3.000	74.3	7.000	112.1
0.200	33.3	1.400	81.3	3.500	80.0	7.500	116.0
0.300	59.1	1.600	79.7	4.000	85.4	8.000	119.7
0.400	70.6	1.800	77.2	4.500	90.4	8.500	123.3
0.500	74.8	2.000	73.4	5.000	95.2	9.000	126.8
0.600	77.8	2.200	67.3	5.500	99.7	9.500	130.1
0.800	81.2	2.400	66.7	6.000	104.0		
1.000	82.3	2.600	69.3	6.500	108.2		

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Storage Structures for Southern Storm

Tank or Pond Manhole: S38, DS/PN: S1.034

Invert Level (m) 100.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	6377.0	1.500	9453.0	3.700	14595.0	4.000	0.0
0.500	7405.0	2.500	11779.0	3.999	15322.0		

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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	2.000
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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	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	ON
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
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.	Water Level (m)
S1.000	SC3A	15 Winter	100	+30%	100/15 Summer				145.251
S2.000	S1	15 Winter	100	+30%	100/15 Summer				145.113
S2.001	S2	15 Winter	100	+30%	100/15 Summer				145.040
S1.001	S3	15 Winter	100	+30%	30/15 Winter				144.941
S3.000	SC4B	15 Winter	100	+30%	100/15 Summer				147.642
S1.002	S4	15 Winter	100	+30%	30/15 Summer				144.903
S4.000	SC3B	15 Winter	100	+30%	30/15 Summer				145.512
S1.003	S5	15 Winter	100	+30%	30/15 Summer				144.812
S5.000	SC4A	15 Winter	100	+30%	100/15 Summer				147.016
S1.004	S6	15 Winter	100	+30%	30/15 Summer				144.379
S6.000	S7	15 Winter	100	+30%	100/15 Summer				144.790
S6.001	S8	15 Winter	100	+30%	100/15 Summer				144.569
S1.005	S9	15 Winter	100	+30%	30/15 Summer				143.761
S1.006	S10	15 Winter	100	+30%	30/15 Winter				143.198
S1.007	S11	30 Winter	100	+30%	100/15 Summer				142.592
S1.008	S12	30 Winter	100	+30%	100/15 Summer				142.451
S7.000	SC6.0	15 Winter	100	+30%	30/15 Summer				144.197
S8.000	SFD1	15 Winter	100	+30%	100/15 Summer				150.187
S8.001	SFD2	15 Winter	100	+30%	100/15 Summer				146.851
S8.002	SFD3	15 Winter	100	+30%	30/15 Summer				146.445

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SC3A	1.651	0.000	0.91		629.0	SURCHARGED	
S2.000	S1	1.663	0.000	0.52		62.3	FLOOD RISK	
S2.001	S2	1.790	0.000	0.87		106.0	SURCHARGED	
S1.001	S3	1.821	0.000	0.49		737.3	SURCHARGED	
S3.000	SC4B	2.242	0.000	1.11		601.9	SURCHARGED	
S1.002	S4	1.908	0.000	0.95		1330.0	SURCHARGED	
S4.000	SC3B	2.362	0.000	1.80		1425.5	FLOOD RISK	
S1.003	S5	1.917	0.000	1.91		2714.0	SURCHARGED	
S5.000	SC4A	0.641	0.000	0.96		516.5	SURCHARGED	
S1.004	S6	1.579	0.000	1.98		3146.8	SURCHARGED	
S6.000	S7	0.565	0.000	0.88		70.4	SURCHARGED	
S6.001	S8	0.844	0.000	1.01		120.1	SURCHARGED	
S1.005	S9	1.136	0.000	2.28		3222.5	SURCHARGED	
S1.006	S10	0.673	0.000	2.18		3181.4	SURCHARGED	
S1.007	S11	0.177	0.000	1.19		2928.0	SURCHARGED	
S1.008	S12	0.146	0.000	1.14		2898.1	SURCHARGED	
S7.000	SC6.0	0.697	0.000	2.58		894.8	SURCHARGED	
S8.000	SFD1	0.562	0.000	1.08		100.7	SURCHARGED	
S8.001	SFD2	0.051	0.000	0.82		124.4	SURCHARGED	
S8.002	SFD3	0.245	0.000	2.00		132.7	SURCHARGED	

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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.
S8.003	SFD3a	15 Winter	100	+30%				
S8.004	SFD4	15 Winter	100	+30%	100/15 Summer			
S9.000	SFD5	15 Winter	100	+30%				
S7.001	SC6.1	15 Winter	100	+30%				
S1.009	S13	30 Winter	100	+30%	100/15 Summer			
S10.000	SC5.0	15 Winter	100	+30%				
S1.010	S14	30 Winter	100	+30%	100/15 Winter			
S1.011	S15	30 Winter	100	+30%				
S1.012	S16	30 Winter	100	+30%				
S11.000	SC1.1	15 Winter	100	+30%	100/15 Winter			
S12.000	SC1.2	30 Winter	100	+30%	100/15 Summer			
S11.001	SC1.3	30 Winter	100	+30%	100/15 Summer			
S13.000	SC1.4	15 Winter	100	+30%				
S11.002	SC1.5	30 Winter	100	+30%	30/15 Winter			
S11.003	SC1.6	30 Winter	100	+30%	30/30 Winter			
S1.013	S17	30 Winter	100	+30%	100/15 Winter			
S1.014	S18	30 Winter	100	+30%				
S14.000	SFD6	15 Winter	100	+30%	100/15 Summer			
S14.001	SFD7	15 Winter	100	+30%	100/15 Summer			
S14.002	SFD8	15 Winter	100	+30%				
S14.003	SFD9	15 Winter	100	+30%				
S14.004	SFD10	15 Winter	100	+30%	100/15 Summer			
S14.005	SFD11	15 Winter	100	+30%	100/15 Summer			
S14.006	SFD12	15 Winter	100	+30%	100/15 Summer			
S14.007	SFD13	15 Winter	100	+30%				
S1.015	S19	30 Winter	100	+30%				
S1.016	S20	30 Winter	100	+30%				
S1.017	S21	30 Winter	100	+30%				
S1.018	S22	30 Winter	100	+30%				
S1.019	S23	30 Winter	100	+30%				
S1.020	S24	30 Winter	100	+30%				
S15.000	SC2.1	15 Winter	100	+30%	100/15 Winter			
S16.000	SC2.2	15 Winter	100	+30%	100/15 Winter			
S15.001	SC2.3	15 Winter	100	+30%				
S1.021	S25	30 Winter	100	+30%				
S1.022	S26	30 Winter	100	+30%				
S1.023	S27	30 Winter	100	+30%				
S1.024	S28	30 Winter	100	+30%				
S1.025	S29	30 Winter	100	+30%				
S1.026	S30	30 Winter	100	+30%				
S1.027	S31	30 Winter	100	+30%				
S1.028	S32	30 Winter	100	+30%				
S1.029	S33	30 Winter	100	+30%				
S1.030	S34	30 Winter	100	+30%	100/30 Winter			
S1.031	S35	30 Winter	100	+30%				
S1.032	S36	30 Winter	100	+30%	100/30 Winter			
S1.033	S37	2880 Winter	100	+30%	100/180 Winter			
S1.034	S38	2880 Winter	100	+30%	1/30 Summer			
S1.035	S39	10080 Winter	30	+0%				

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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)	Pipe Flow (l/s)	Status	Level Exceeded
S8.003	SFD3a	145.994	-0.121	0.000	0.65		154.3	OK	
S8.004	SFD4	144.681	0.181	0.000	1.07		166.0	SURCHARGED	
S9.000	SFD5	143.949	-0.076	0.000	0.48		12.0	OK	
S7.001	SC6.1	143.232	-0.068	0.000	1.00		1061.1	OK	
S1.009	S13	142.294	0.119	0.000	1.41		3344.4	SURCHARGED	
S10.000	SC5.0	142.280	-0.145	0.000	0.83		294.6	OK	
S1.010	S14	142.101	0.076	0.000	1.31		3414.3	SURCHARGED	
S1.011	S15	141.590	-0.295	0.000	1.00		3398.6	OK	
S1.012	S16	140.699	-0.951	0.000	0.29		3423.1	OK	
S11.000	SC1.1	142.019	0.019	0.000	0.84		2568.1	SURCHARGED	
S12.000	SC1.2	139.859	0.359	0.000	0.14		497.5	SURCHARGED	
S11.001	SC1.3	139.849	0.689	0.000	0.74		2357.3	SURCHARGED	
S13.000	SC1.4	141.724	-0.276	0.000	0.78		2717.7	OK	
S11.002	SC1.5	139.698	1.098	0.000	1.49		4111.8	SURCHARGED	
S11.003	SC1.6	138.694	0.544	0.000	1.85		4307.2	SURCHARGED	
S1.013	S17	138.213	0.143	0.000	1.21		7703.8	SURCHARGED	
S1.014	S18	137.028	-0.542	0.000	0.83		7712.0	OK	
S14.000	SFD6	144.255	0.230	0.000	0.88		16.2	SURCHARGED	
S14.001	SFD7	143.485	0.460	0.000	1.16		27.2	SURCHARGED	
S14.002	SFD8	141.656	-0.119	0.000	0.44		38.0	OK	
S14.003	SFD9	141.207	-0.118	0.000	0.45		54.4	OK	
S14.004	SFD10	140.153	0.028	0.000	0.94		68.4	SURCHARGED	
S14.005	SFD11	139.286	0.161	0.000	0.95		173.8	SURCHARGED	
S14.006	SFD12	138.275	0.250	0.000	1.21		224.4	SURCHARGED	
S14.007	SFD13	137.387	-0.138	0.000	0.74		328.6	OK	
S1.015	S19	135.611	-0.899	0.000	0.50		7821.3	OK	
S1.016	S20	132.588	-0.912	0.000	0.49		7851.8	OK	
S1.017	S21	129.618	-0.707	0.000	0.68		7869.6	OK	
S1.018	S22	127.909	-0.781	0.000	0.61		7896.5	OK	
S1.019	S23	125.905	-0.745	0.000	0.65		7918.5	OK	
S1.020	S24	124.133	-0.667	0.000	0.72		7926.2	OK	
S15.000	SC2.1	133.618	0.218	0.000	0.95		2098.7	SURCHARGED	
S16.000	SC2.2	133.618	0.218	0.000	0.95		2098.7	SURCHARGED	
S15.001	SC2.3	127.718	-0.432	0.000	0.64		4187.8	OK	
S1.021	S25	122.759	-0.541	0.000	0.83		9161.1	OK	
S1.022	S26	121.055	-0.745	0.000	0.64		9190.1	OK	
S1.023	S27	118.761	-0.539	0.000	0.83		9199.5	OK	
S1.024	S28	116.894	-0.906	0.000	0.49		9192.4	OK	
S1.025	S29	113.137	-0.413	0.000	0.95		9166.8	OK	
S1.026	S30	111.718	-0.682	0.000	0.70		9172.3	OK	
S1.027	S31	109.732	-0.568	0.000	0.81		9192.1	OK	
S1.028	S32	108.384	-0.316	0.000	0.92		9106.6	OK	
S1.029	S33	107.372	-0.128	0.000	0.91		9069.7	OK	
S1.030	S34	106.364	0.079	0.000	1.09		9057.0	SURCHARGED	
S1.031	S35	105.279	-0.151	0.000	0.88		9051.5	OK	
S1.032	S36	104.272	0.137	0.000	1.13		9058.4	SURCHARGED	
S1.033	S37	104.114	0.764	0.000	0.07		662.8	SURCHARGED	
S1.034	S38	104.113	3.213	0.000	0.54		82.2	SURCHARGED	

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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)	Pipe Flow (l/s)	Status	Level Exceeded
S1.035	S39	100.508	-0.192	0.000	0.53		82.3	OK	

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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.	Water Level (m)
S1.036	SHW	2880 Winter	30	+0%					100.092
S1.037	SSwale 1	7200 Winter	30	+0%					99.280
S1.038	SSwale 2	7200 Winter	30	+0%					94.031

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.036	SHW	-0.438	0.000	0.02		82.3	OK	
S1.037	SSwale 1	-0.470	0.000	0.01		82.3	OK	
S1.038	SSwale 2	-0.469	0.000	0.02		82.3	OK	

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FOUL SEWERAGE DESIGN

Design Criteria for Foul

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.60	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	3.00	Minimum Backdrop Height (m)	0.000
Flow Per Person (l/per/day)	0.00	Maximum Backdrop Height (m)	0.000
Persons per House	0.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	0.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	38.372	0.385	99.7	1.640	0	0.0	1.500	o	150	Pipe/Conduit	
F2.000	23.287	2.155	10.8	0.895	0	0.0	1.500	o	150	Pipe/Conduit	
F1.001	35.042	0.235	149.1	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.002	48.969	0.330	148.4	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F3.000	20.272	2.030	10.0	0.695	0	0.0	1.500	o	150	Pipe/Conduit	
F1.003	27.103	0.185	146.5	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F4.000	36.849	0.460	80.1	3.720	0	0.0	1.500	o	150	Pipe/Conduit	
F1.004	46.206	0.310	149.1	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	143.600	1.640	0.0	0	0.0	44	0.67	0.88	15.5	3.0
F2.000	145.390	0.895	0.0	0	0.0	19	1.22	2.68	47.3	1.6
F1.001	143.215	2.535	0.0	0	0.0	62	0.66	0.72	12.7	4.6
F1.002	142.980	2.535	0.0	0	0.0	62	0.66	0.72	12.7	4.6
F3.000	144.680	0.695	0.0	0	0.0	17	1.16	2.78	49.2	1.3
F1.003	142.650	3.230	0.0	0	0.0	71	0.71	0.72	12.8	5.8
F4.000	142.925	3.720	0.0	0	0.0	65	0.92	0.98	17.3	6.7
F1.004	142.465	6.950	0.0	0	0.0	121	0.82	0.72	12.7	12.5

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Network Design Table for Foul

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F5.000	15.967	1.600	10.0	1.210	0	0.0	1.500	o	150	Pipe/Conduit	
F1.005	84.487	0.845	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.006	57.596	0.575	100.2	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.007	51.956	0.520	99.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.008	52.231	0.520	100.4	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.009	62.418	0.625	99.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.010	49.956	0.500	99.9	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F6.000	12.654	1.265	10.0	1.918	0	0.0	1.500	o	150	Pipe/Conduit	
F1.011	41.947	0.350	120.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.012	39.145	0.325	120.4	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.013	65.035	0.540	120.4	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.014	90.000	1.865	48.3	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F7.000	29.404	0.160	183.8	19.240	0	0.0	1.500	o	300	Pipe/Conduit	
F1.015	67.371	0.265	254.2	0.000	0	0.0	1.500	o	300	Pipe/Conduit	
F1.016	53.855	0.210	256.5	0.000	0	0.0	1.500	o	300	Pipe/Conduit	
F1.017	71.232	1.265	56.3	0.000	0	0.0	1.500	o	300	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F5.000	143.755	1.210	0.0	0	0.0	22	1.38	2.78	49.2	2.2
F1.005	142.080	8.160	0.0	0	0.0	88	1.02	1.15	45.6	14.7
F1.006	141.235	8.160	0.0	0	0.0	88	1.02	1.15	45.6	14.7
F1.007	140.660	8.160	0.0	0	0.0	88	1.02	1.15	45.7	14.7
F1.008	140.140	8.160	0.0	0	0.0	88	1.02	1.15	45.5	14.7
F1.009	139.620	8.160	0.0	0	0.0	88	1.02	1.15	45.7	14.7
F1.010	138.995	8.160	0.0	0	0.0	88	1.02	1.15	45.7	14.7
F6.000	139.835	1.918	0.0	0	0.0	27	1.59	2.78	49.1	3.5
F1.011	138.495	10.078	0.0	0	0.0	104	1.01	1.05	41.6	18.1
F1.012	138.145	10.078	0.0	0	0.0	104	1.01	1.05	41.6	18.1
F1.013	137.820	10.078	0.0	0	0.0	104	1.01	1.05	41.6	18.1
F1.014	137.280	10.078	0.0	0	0.0	81	1.41	1.65	65.8	18.1
F7.000	135.500	19.240	0.0	0	0.0	146	1.01	1.02	72.2	34.6
F1.015	135.340	29.318	0.0	0	0.0	215	0.97	0.87	61.3	52.8
F1.016	135.075	29.318	0.0	0	0.0	216	0.97	0.86	61.1	52.8
F1.017	134.865	29.318	0.0	0	0.0	133	1.75	1.85	130.8	52.8

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Network Design Table for Foul

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.018	60.817	2.950	20.6	0.000	0	0.0	1.500	o	300	Pipe/Conduit	
F1.019	85.094	2.260	37.7	0.000	0	0.0	1.500	o	300	Pipe/Conduit	
F1.020	73.598	2.105	35.0	0.000	0	0.0	1.500	o	300	Pipe/Conduit	
F8.000	16.723	0.140	119.5	10.290	0	0.0	1.500	o	225	Pipe/Conduit	
F1.021	2.480	0.010	248.0	0.000	0	0.0	1.500	o	375	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.018	133.600	29.318	0.0	0	0.0	101	2.53	3.06	216.4	52.8
F1.019	130.650	29.318	0.0	0	0.0	118	2.03	2.26	160.0	52.8
F1.020	128.390	29.318	0.0	0	0.0	116	2.09	2.35	166.1	52.8
F8.000	126.500	10.290	0.0	0	0.0	105	1.02	1.05	41.7	18.5
F1.021	126.210	39.608	0.0	0	0.0	217	1.07	1.02	112.3	71.3

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PIPELINE SCHEDULES for Foul

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	150	FC3b	145.600	143.600	1.850	Open Manhole	1200
F2.000	o	150	FC4b	148.300	145.390	2.760	Open Manhole	1200
F1.001	o	150	F1	147.200	143.215	3.835	Open Manhole	1200
F1.002	o	150	F2	147.725	142.980	4.595	Open Manhole	1200
F3.000	o	150	FC4b2	148.600	144.680	3.770	Open Manhole	1200
F1.003	o	150	F3	148.100	142.650	5.300	Open Manhole	1200
F4.000	o	150	FC3a	145.600	142.925	2.525	Open Manhole	1200
F1.004	o	150	F4	148.110	142.465	5.495	Open Manhole	1200
F5.000	o	150	FC4a	148.600	143.755	4.695	Open Manhole	1200
F1.005	o	225	F5	148.400	142.080	6.095	Open Manhole	1200
F1.006	o	225	F6	148.400	141.235	6.940	Open Manhole	1200
F1.007	o	225	F7	147.900	140.660	7.015	Open Manhole	1200
F1.008	o	225	F8	146.875	140.140	6.510	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	38.372	99.7	F1	147.200	143.215	3.835	Open Manhole	1200
F2.000	23.287	10.8	F1	147.200	143.235	3.815	Open Manhole	1200
F1.001	35.042	149.1	F2	147.725	142.980	4.595	Open Manhole	1200
F1.002	48.969	148.4	F3	148.100	142.650	5.300	Open Manhole	1200
F3.000	20.272	10.0	F3	148.100	142.650	5.300	Open Manhole	1200
F1.003	27.103	146.5	F4	148.110	142.465	5.495	Open Manhole	1200
F4.000	36.849	80.1	F4	148.110	142.465	5.495	Open Manhole	1200
F1.004	46.206	149.1	F5	148.400	142.155	6.095	Open Manhole	1200
F5.000	15.967	10.0	F5	148.400	142.155	6.095	Open Manhole	1200
F1.005	84.487	100.0	F6	148.400	141.235	6.940	Open Manhole	1200
F1.006	57.596	100.2	F7	147.900	140.660	7.015	Open Manhole	1200
F1.007	51.956	99.9	F8	146.875	140.140	6.510	Open Manhole	1200
F1.008	52.231	100.4	F9	145.700	139.620	5.855	Open Manhole	1200

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PIPELINE SCHEDULES for Foul

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.009	o	225	F9	145.700	139.620	5.855	Open Manhole	1200
F1.010	o	225	F10	144.600	138.995	5.380	Open Manhole	1200
F6.000	o	150	FC5	144.425	139.835	4.440	Open Manhole	1200
F1.011	o	225	F11	143.900	138.495	5.180	Open Manhole	1200
F1.012	o	225	F12	143.725	138.145	5.355	Open Manhole	1200
F1.013	o	225	F13	143.800	137.820	5.755	Open Manhole	1200
F1.014	o	225	F14	143.050	137.280	5.545	Open Manhole	1200
F7.000	o	300	FC1	139.500	135.500	3.700	Open Manhole	1200
F1.015	o	300	F15	141.100	135.340	5.460	Open Manhole	1200
F1.016	o	300	F16	139.550	135.075	4.175	Open Manhole	1200
F1.017	o	300	F17	137.825	134.865	2.660	Open Manhole	1200
F1.018	o	300	F18	135.100	133.600	1.200	Open Manhole	1200
F1.019	o	300	F19	132.150	130.650	1.200	Open Manhole	1200
F1.020	o	300	F20	129.890	128.390	1.200	Open Manhole	1200
F8.000	o	225	FC2	130.500	126.500	3.775	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.009	62.418	99.9	F10	144.600	138.995	5.380	Open Manhole	1200
F1.010	49.956	99.9	F11	143.900	138.495	5.180	Open Manhole	1200
F6.000	12.654	10.0	F11	143.900	138.570	5.180	Open Manhole	1200
F1.011	41.947	120.0	F12	143.725	138.145	5.355	Open Manhole	1200
F1.012	39.145	120.4	F13	143.800	137.820	5.755	Open Manhole	1200
F1.013	65.035	120.4	F14	143.050	137.280	5.545	Open Manhole	1200
F1.014	90.000	48.3	F15	141.100	135.415	5.460	Open Manhole	1200
F7.000	29.404	183.8	F15	141.100	135.340	5.460	Open Manhole	1200
F1.015	67.371	254.2	F16	139.550	135.075	4.175	Open Manhole	1200
F1.016	53.855	256.5	F17	137.825	134.865	2.660	Open Manhole	1200
F1.017	71.232	56.3	F18	135.100	133.600	1.200	Open Manhole	1200
F1.018	60.817	20.6	F19	132.150	130.650	1.200	Open Manhole	1200
F1.019	85.094	37.7	F20	129.890	128.390	1.200	Open Manhole	1200
F1.020	73.598	35.0	F21	130.500	126.285	3.915	Open Manhole	1350
F8.000	16.723	119.5	F21	130.500	126.360	3.915	Open Manhole	1350

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PIPELINE SCHEDULES for Foul

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.021	o	375	F21	130.500	126.210	3.915	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.021	2.480	248.0	FSUMP	135.250	126.200	8.675	Open Manhole	3000

Free Flowing Outfall Details for Foul

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.021	FSUMP	135.250	126.200	0.000	3000	0

Simulation Criteria for Foul

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

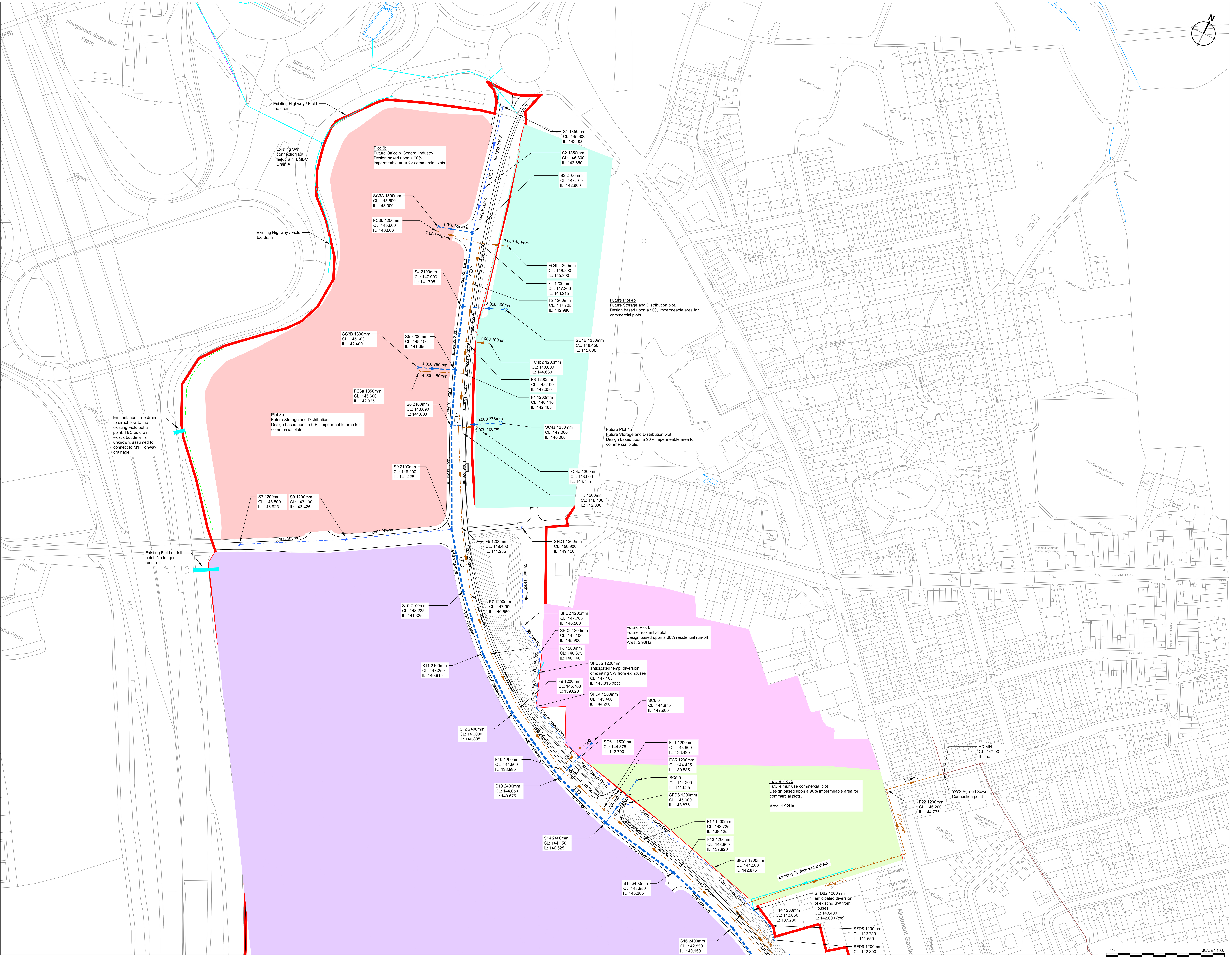
Synthetic Rainfall Details

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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Appendix E

RPS Drainage Drawings



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Notes

1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.
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. Drainage subject to detailed design & subsequent approval from Yorkshire Water Services and the LLFA
6. Foul water drainage is to be adopted and is subject to S104 approval agreement and approval of a S106 connection to the existing foul sewer with Yorkshire Water.
7. Surface water drainage is to be adopted and is subject to S104 approval agreement with Yorkshire Water up to the inlet to the proposed Attenuation Pond.
8. Any existing Drainage to be retained from properties on Sheffield road and Tankersley Road will be subject to S185 diversion approval with Yorkshire water where appropriate.

Key:

- Proposed Adoptable Surface Water
- Proposed Highway Drainage
- Proposed Private Surface Water
- Existing Surface water drains
- Proposed Adoptable Foul Water
- Proposed Adoptable rising Main
- Proposed Toe Drain
- Development Plot Area 1 (Hermes)
- Development Plot Area 2
- Development Plot Area 3
- Development Plot Area 4
- Development Plot Area 5
- Development Plot Area 6



Key Plan
Not to Scale

Rev	Description	By	Ckd	Date
P08	Revised For Planning	JNB	SMC	23.07.20
P07	Option for all SW to go South	JNB	SMC	13.07.20
P06	Access added	JNB	SMC	16.06.20
P05	Issued for Planning	JNB	SMC	11.06.20
P04	Issued for Draft Planning	SMC	LM	22.05.20
P03	Drainage Layout Amended	JNB	SMC	09.04.20
P02	Drainage Detail Added	SMC	SG	23.03.20
P01	First Issue	AB	SMC	09.03.20

MAKING COMPLEX EASY

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Client: newlands developments

Project: Hoyland

Title: Proposed Drainage Strategy Sheet 1 of 3

RPS Project Number	Scale @ A1	Date Created
NK020040	1:1000	09.03.20
Task Team Manager	Information Author	Task Information Manager
SG	JNB	SMC

Status: S2

Document Number: HOYLA-RPS-SI-XX-DR-D-0300
Project Code - Originator - Zone - Level - Type - Role - Drawing Number

Revision: P08

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Notes

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8. Any existing Drainage to be retained from properties on Sheffield road and Tankersley Road will be subject to S185 diversion approval with Yorkshire water where appropriate.

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- Proposed Toe Drain
- Development Plot Area 1 (Hermes)
- Development Plot Area 2
- Development Plot Area 3
- Development Plot Area 4
- Development Plot Area 5
- Development Plot Area 6

Plot 1
Future commercial distribution center SW and FW connection.
Plot to be allowed free flowing connection to surface water drainage system.
Attenuation based upon a 90% impermeable area for commercial plots.

Area: 18.2Ha

Plot 2
Future multi-use commercial SW and FW connection
Plot to be allowed free flowing connection to surface water drainage system.

Attenuation based upon a 90% impermeable area for commercial plots.

Area: 10.39Ha

S16 2400mm CL: 142.850 IL: 140.150
F14 1200mm CL: 143.050 IL: 137.280
Houses CL: 143.400 IL: 142.000 (tbc)
SFD8 1200mm CL: 142.750 IL: 141.550
SFD9 1200mm CL: 142.300 IL: 141.100
SFD10 1200mm CL: 141.100 IL: 139.900
SFD11 1200mm CL: 140.100 IL: 138.825
F15 1200mm CL: 141.100 IL: 135.340
SFD12 1350mm CL: 139.000 IL: 137.625
F16 1200mm CL: 139.550 IL: 135.075
SS17 3000mm CL: 141.100 IL: 136.270
FC1 1200mm CL: 139.500 IL: 135.500
C1.6 2400mm CL: 139.500 IL: 136.650
SS18 2700mm CL: 140.210 IL: 135.770
SFD13 1350mm CL: 138.500 IL: 137.125
F17 1200mm CL: 137.825 IL: 134.865
SFD13a 1200mm anticipated diversion of existing SW from Alotments CL: 138.500 IL: 137.200 (tbc)
SS19 2700mm CL: 137.710 IL: 134.710
F18 1200mm CL: 135.100 IL: 133.600
Toe drain incorporated into the site drainage
SS20 2700mm CL: 134.700 IL: 131.700
F19 1200mm CL: 132.150 IL: 130.650
SS21 2700mm CL: 131.525 IL: 128.525
SS22 2700mm CL: 129.890 IL: 126.890
F21 1200mm CL: 130.500 IL: 126.210
FC2 1350mm CL: 130.500 IL: 126.500
Adopted Pumping station CL 130.500 IL 126.200 SUMP IL 125.000
F20 1200mm CL: 129.890 IL: 128.390
SS23 2700mm CL: 127.850 IL: 124.850
'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
- Plot 1 18.35Ha - 11.01 l/s
- Plot 2 9.02Ha - 5.412 l/s
- Plot 3 5.09Ha - 3.054 l/s
- Plot 4 2.03Ha - 1.218 l/s
- Plot 5 1.70 ha - 1.02 l/s
- Plot 6 101 Units – 4.68 l/s

Total 26.394 l/s

Foul Storage required
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
- 101 residential units - 101units - 16.160m³
- Commercial Development - 21.714 l/s - 78.170m³

Total = 94.33m³

SS24 2700mm CL: 126.000 IL: 123.000
SS25 2700mm CL: 124.500 IL: 121.500
SS26 2700mm CL: 123.000 IL: 120.000
SS27 2700mm CL 120.500 IL 117.500
SS28 2700mm CL: 119.000 IL: 116.000
SS29 2700mm CL: 114.750 IL: 111.750
SS30 2700mm CL: 113.600 IL: 110.600
SS31 2700mm CL: 111.500 IL: 108.500
SS32 2700mm CL: 109.900 IL: 106.900
SS33 2700 CL: 108.700 IL: 105.700
C2.3 2000mm CL: 134.750 IL: 127.100
Existing drainage Ditch outfall, for the toe drain CL 117.000 Ex.IL 116.500
Existing 150mm land drain outfall drain to wooodland, for the toe drain connection. CL: 131.00 Ex.IL 129.88
Existing Drainage in the road to be retained and gullies moved to match the new layout



Key Plan
Not to Scale

P09	Revised For Planning	JNB	SMC	23.07.20
P08	Option for all SW to go South	JNB	SMC	13.07.20
P07	Access added	JNB	SMC	16.06.20
P06	Issued for Planning	JNB	SMC	11.06.20
P05	Issued for Draft Planning	SMC	LM	22.05.20
P04	Drainage Option 1 Amended	SMC	SMC	30.04.20
P03	Drainage Layout Amended	JNB	SMC	09.04.20
P02	Drainage Detail Added	SMC	SG	23.03.20
P01	First Issue	AB	SMC	09.03.20
Rev	Description	By	Ckd	Date

RPS MAKING COMPLEX EASY
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Client: newlands developments

Project: Hoyland

Title: Proposed Drainage Strategy Sheet 2 of 3

RPS Project Number	Scale @ A1	Date Created
NK020040	1:1000	09.03.20
Task Team Manager	Information Author	Task Information Manager
SG	JNB	SMC

Status: S2

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

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10m SCALE 1:1000

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Notes

1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.
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. Drainage subject to detailed design & subsequent approval from Yorkshire Water Services and the LLFA
6. Foul water drainage is to be adopted and is subject to S104 approval agreement and approval of a S106 connection to the existing foul sewer with Yorkshire Water.
7. Surface water drainage is to be adopted and is subject to S104 approval agreement with Yorkshire Water up to the inlet to the proposed Attenuation Pond.
8. Any existing Drainage to be retained from properties on Sheffield road and Tankersley Road will be subject to S185 diversion approval with Yorkshire water where appropriate.

Key:

- Proposed Adoptable Surface Water
- Proposed Highway Drainage
- Proposed Private Surface Water
- Existing Surface water drains
- Proposed Adoptable Foul Water
- Proposed Adoptable rising Main
- Proposed Toe Drain
- Development Plot Area 1 (Hermes)
- Development Plot Area 2
- Development Plot Area 3
- Development Plot Area 4
- Development Plot Area 5
- Development Plot Area 6

SS33 2700
CL: 108.700
IL: 105.700

1600mm

SS34 2700mm
CL: 108.250
IL: 103.685

1050 1800mm

SS35 2700mm
CL: 108.250
IL: 102.085

1050 1800mm

Existing Drainage Culvert IL and size tbc likley to be 225mm with IL 104.000 so above the proposed culvert crown of 103.75

SS36 2700mm
CL: 105.250
IL: 101.455

1050 1800mm

SS37 2700mm
CL: 104.500
IL: 101.250

1050 1800mm

100m Radius from Old Hall

Proposed 43,000m³ Attenuation Pond with 1:5 embankments and 1.4 side slopes in the pond area.
TB - 104.500
BB - 99.300
NWL - 100.500
TWL - 104.200
Pond Inlet to be designed with a pre treatment forebay and 6m of placed stone erosion protection by the inlet

Proposed Pond Bund
To construct the pond requires that a bund is needed to bring the 102.00m existing ground level up to 104.50m top of bund level. This will require Geotechnical guidance on soils to calculate a safe bund construction to support retaining the potential 2.5m head of water behind it.

Hydrobrake Optimum
Restricted to 82.4l/s

1350mm

1350 400mm

SS38 1350mm
CL 104.500
IL 100.490

SS39 1350mm
CL: 101.600
IL: 100.300

Inlet Headwall with 4m of placed stone erosion protection in the Swale
CL 101.500
IL 100.030

1050 Swale

Grass Swale with bund's to dissipate flow allowing for further pollution control
750mm Base
500mm Deep
1:4 Side Slopes
CL 99.750
IL 99.250

1050 Swale

Grass Swale with bunds
750mm Base
500mm Deep
1:4 Side Slopes
CL 94.500
IL 94.000

1050 Swale

Existing Ditch

Existing Stream

Outlet to existing south western Brick culvert
IL 92.74
Invert

Outlet to existing south eastern culvert

Issues
The Old Hall Cottage
Tankersley Old Hall
The Foxwood
Old Hall Farm Cottage
Old Hall Farm
Shaft
112.8m
Subway
Track
Path (um)
113.1m
118.9m
BLACK LANE
111.1m
Pond
Pumping Station
Drain
Spreads
Issues
FB
Path (um)
Collects
Pond
Tankersley Park
Pond
Track
103.3m
Shaft
Air Shaft
Path (um)
Air Shaft
Lidgett House
101.5m
FB
LIDGETT GRANGE
A 61945
SHEFFIELD ROAD
Lidgett Garage
Shaft (disused)
114.1m
113.0m
MP
106.7m
102.6m
Sloping House
MP 167.5
SP
LB
Longley Spring
Longley Spring Cottage
Ivy Cottage
Longley Spring CG
Pear Cottage
Smithy Cottage
Harley Dike
MP 167.25
99.9m
ROAD CLOSURE
Harley Dike



Key Plan
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Task Team Manager	**Information Author**	**Task Information Manager**
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