BDW Southern Counties

New Place Farm, Pulborough

Flood Risk Assessment

681387-R1(0)-FRA
October 2024

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RSK GENERAL NOTES

Project No.: 681387-R1(0)-FRA

Site: New Place Farm, Pulborough

Title: Flood Risk Assessment

Client: BDW Southern Counties

Date: October 2024

Office: Hemel Hempstead

Status: Draft

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Date:	31.10.2024	Date:	31.10.2024

Issue No	Version/Details	Date issued	Author	Reviewed by	Approved by
R1(0)	Draft	31.10.24	JW / GA	MC	CW

Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK LDE Ltd.

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1 INTRODUCTION

RSK Land and Development Engineering Ltd were commissioned by BDW Southern Counties (the client) to provide a Flood Risk Assessment (FRA) to support the planning application at New Place Farm, Pulborough (the site). Development proposals include the potential development of a residential scheme of up to 168 dwellings.

The purpose of the FRA is to establish the risk associated with the proposed development and to propose suitable mitigation, if required, to reduce the flood risk to a more acceptable level. The FRA must demonstrate that the development will be safe for its lifetime (100 years for residential developments) taking account of the vulnerability of its users, without increasing flood risk elsewhere.

This document has been produced to assess the flood risk from tidal, fluvial, surface water, groundwater, sewers, reservoirs and artificial sources in line with the National Planning Policy Framework (NPPF)[1] and its corresponding Planning Practice Guidance (PPG)[2]. It includes a summary of the proposed surface water drainage strategy, showing how Sustainable Drainage Systems (SuDS) have been used to demonstrate surface water is appropriately managed on-site, with the aim that there is no increased risk of flooding on-site or elsewhere as a result of the development.

This assessment has been undertaken in consultation with the relevant authorities, and with reference to data, documents and guidance published by the Environment Agency (EA), the Lead Local Flood Authority (LLFA) (West Sussex County Council), the Local Planning Authority (LPA) (Horsham District Council), and the Water Authority (Southern Water).

The comments given in this report and opinions expressed are subject to RSK Group Service Constraints provided in **Appendix A**.

[1] Communities and Local Government, 'National Planning Policy Framework', published March 2012 and last updated December 2023.

[2] Communities and Local Government, 'Planning Practice Guidance - Flood Risk and Coastal Change, ID 7', published March 2014 and last updated August 2022.

2 SITE DESCRIPTION & PROPOSALS

2.1 Existing site

2.1.1 Site description

The site is located at New Place Farm, Pulborough in the county of West Sussex and can be located at National Grid Reference 505650 E, 119323 N and postcode RH20 2GN. A site location plan is included as **Figure 2.1**.

The site covers an area of approximately 16.29Ha and currently comprises of a mixture of hardstanding structures and areas of soft landscaping used to cultivate plants for New Place Nursery. The hardstanding areas are made up of the main farmhouse building, glasshouses and storage warehouses in the northwestern region of the site; whilst the rest of the site consists of soft landscaping for plant cultivation and grassland areas. The site also contains a section of woodland in the northwest corner, which separates the northern boundary from the railway line. To the north and east of the site is further areas of soft landscaping, whilst to the south and west are areas of existing residential development.

Figure 2.1: Site location plan

2.1.2 Topography

A site-specific topographic survey has been carried out by NJC Surveys Limited. The survey shows the existing site levels vary from approximately 59.87m above ordnance datum (mAOD) in the northeast corner, down to 27.13mAOD in the southwest corner. The land generally slopes toward the southwest corner, with the soft landscaping areas having a gradient of approximately 1:20, whilst the area around the farmhouse in the northwest is relatively flat.

The topographic survey is included in **Appendix B**.

2.1.3 Existing drainage

2.1.3.1 Public

Southern Water sewer plans have been obtained for the site and are included in **Appendix C**. These plans indicate the following network of sewers in the vicinity of the site:

- A 150mm diameter foul sewer that begins its run to the west of the houses on Drovers Lane. This sewer flows south where it then inflows into a 150mm diameter sewer on Glebelands.
- A 150mm diameter foul sewer that flows east to west along Glebelands to the south of the site. This sewer then turns to flow southward, away from the site, at the western end of Glebelands.
- A small network of foul sewer that serve the houses to the south of the site, which collate and flow into the 150mm diameter foul sewer on Glebelands.

2.1.3.2 Private

Surface water runoff currently discharges to the surface water drainage channels throughout the site via overland flow. Evidence of this was found during a site visit. Photo 6 within **Appendix L** highlights a surface water flow route within the surface geology.

2.2 Development proposals

The development proposals for the site include the construction of residential development of approximately 170 dwellings, with access, green spaces and associated amenities.

The relevant proposed site plans are included as **Appendix D**.

3 ENVIRONMENTAL SETTING

3.1 Hydrology

Reference to Ordnance Survey (OS) mapping and the EA's web-based mapping indicates that the nearest EA main river is the River Arun, which is located approximately 800m southwest of the site. This main river generally flows north to south, meandering eastward past the town of Pulborough.

Other notable surface water features in the vicinity of the site include:

- A small man-made reservoir located within the centre of the site. It is assumed that the water stored within this reservoir is used to water the plantings within the nursery.
- A small drainage channel that begins approximately 50m northwest of the site and flows southwest, adjacent to the railway line. This channel flows into a ponded region, 200m west of the site.
- A surface water channel located approximately 300m north of the site.
- A series of connected ponds located approximately 400m southeast of the site.
- The River Stor located approximately 900m southeast of the site. This EA main river flows east to west and discharges into the River Arun south of the town of Pulborough.

The topographic survey conducted by NJC Surveys indicates four surface water channels within the site boundary, these were confirmed during a site visit.

Two of the channels flow north to south within hedge lines that run through the site and act as field borders. These channels are the main drainage channels within the site and collect surface run off from the site. There are also two channels that flow east to west, one in the east of the site and the other along the southern boundary of the site. The ditch to the east discharges into the central ditch via a culvert; whilst the ditch on the southern boundary connects the eastern north to south ditch to the western ditch. The western north to south ditch has an offsite connection through a culvert which discharges surface water flows to an Ordinary Watercourse that runs parallel to the footpath off Strawberry Field. **Figure 3.1** shows the onsite water features.

Evidence of these channels and their connections can be found within **Appendix L.**

Figure 3.1: QGIS mapping of Surface Water features on site

3.2 Geology

Based on published geological records for the area (British Geological Survey online mapping), the site exhibits the following geology:

- Superficial Geology: None.
- Bedrock Geology: Hythe Formation – Sandstone.

Site-specific geotechnical investigations have been undertaken by GRM Development Solutions Ltd. And were carried out in August 2022 (report reference: GRM/P7298/F.2). The report details the existing geology and hydrogeology, groundwater levels, permeability and contamination. The key points related to flood risk and drainage are highlighted below:

- The ground conditions on site were observed to be:
    - Topsoil,
    - Made ground,
    - Head Deposits (Clays and Silts),
    - Hythe Formation (Sandstone).

- Contamination observations were limited to Made Ground that contained occasional anthropogenic materials throughout its depth (typically brick, concrete or plastic).
- Across all monitoring locations (21 in total) and all visits (12 spread out over the three investigations), typically the trial pit locations recorded no groundwater. Some locations recorded small amounts of water intermittently, which is considered to be representative of water infiltrating through low permeable soils or from perched lenses.

Soakage Tests were also carried out by GRM Development Solutions Ltd. (report reference: GRM/ P7298 SA.2) in a number of trial pits across the site and the infiltration rates in **Table 3.1** were calculated.

Table 3.1: Trial pit reference and average infiltration rate

Trial pit	Average infiltration rate (m/s)
SA101	1.45×10^{-5}
SA102	6.48×10^{-6}
SA103	1.56×10^{-4}
SA104	1.05×10^{-5}
SA105	1.23×10^{-5}
SA106	1.61×10^{-5}
SA107	5.05×10^{-6}
SA108	N/A

Trial pit	Average infiltration rate (m/s)
WS103	2.28×10^{-6}
WS104	N/A
WS105	4.36×10^{-6}
WS106	1.98×10^{-6}
WS108	9.73×10^{-5}
WS109	2.78×10^{-6}
WS111	N/A
WS112	N/A
WS112a	2.53×10^{-6}
WS113	2.32×10^{-6}
WS114	2.38×10^{-6}
WS115	2.94×10^{-6}
WS118	2.97×10^{-6}

The report states: *"It is considered that the variability is due to the geology of the site, specifically the variable nature of the head deposits, with cohesive clays and silts being recorded, compared to the underlying Hythe Formation."* With the results *"considered to*

indicate potentially but variably good performance in the Hythe Formation and generally poor and variable performance in the Head Deposits."

3.3 Hydrogeology

Hydrogeological information was obtained from the online Magic Maps service. These maps indicate that:

- The site is not underlain by a superficial aquifer.
- The site is underlain by a Principal bedrock aquifer.
- The site is located in an area of High groundwater vulnerability.
- The site is not located within a groundwater Source Protection Zone.

Although the site-specific ground investigation carried out by GRM Development Solutions Ltd. notes that the majority of the boreholes carried out did not note any groundwater, the report states: *"long term monitoring of groundwater levels has not been conducted… and levels may be seasonally variable".*

4 SOURCES OF FLOOD RISK

4.1 Criteria

In accordance with the NPPF and advice from the EA, an assessment of the risk associated with various flooding sources is required along with consideration of the effects of climate change over the design life of the development (in this case assumed to be 100 years for a residential development).

The EA's most recent climate change guidance, published in May 2022[3], should be referenced in order to identify the appropriate peak river flow and rainfall intensity allowances for the scheme. The appropriate allowance for peak river flow is based on the location of the site in the country, the lifetime of development, the relevant flood zone and the vulnerability of the proposed end use.

The flood risk elements that need to be considered for any site are defined in BS 8533 'Assessing and managing flood risk in development Code of practice'[4] as the "Forms of Flooding" and are listed as:

- Flooding from rivers (fluvial flood risk);
- Flooding from the sea (tidal flood risk);
- Flooding from the land;
- Flooding from groundwater;
- Flooding from sewers (sewer and drain exceedance, pumping station failure etc); and
- Flooding from reservoirs, canals and other artificial structures.

The following section reviews each of these in respect of the subject site.

4.2 Flooding from rivers (fluvial flood risk)

The EA Flood Zone mapping study for England is available on their website at: https://flood-map-for-planning.service.gov.uk.

The latest EA published flood zone map **(Figure 4.1)** shows that the site lies within Flood Zone 1, representing a 1 in 1000 year or less annual probability of flooding from fluvial and tidal sources.

[3] Environment Agency, 'Guidance: Flood Risk Assessments: Climate Change Allowances'. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, last updated May 2022.

[4] BSI, 'BS 8533-2017 Assessing and managing flood risk in development Code of practice', December 2017.

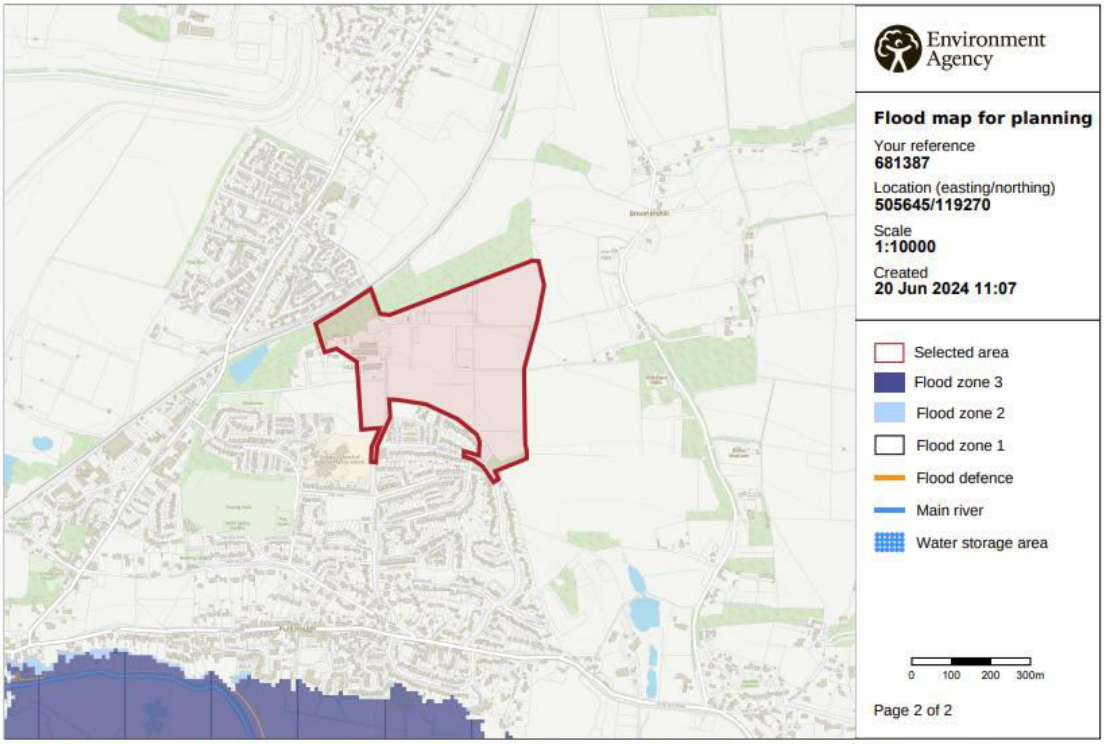


Figure 4.1: Environment Agency 'Flood map for planning'

A site visit confirmed there are several minor drainage ditches throughout the site, these have not been modelled by the EA due to the very limited catchment areas. These ditches are not considered to be a flood risk to the site as the high point of the region is located within the northeastern corner of the site and thus there is a small upstream catchment for these ditches and hence limited flows will be present. These ditches serve as surface water management for the current site, and this has been considered in the post development drainage strategy for the site.

Fluvial flooding is likely to increase as a result of climate change. A greater intensity and frequency of precipitation is likely to raise river levels and increase the likelihood of a river overtopping its banks. Climate change guidance for river modelling was updated by the EA in May 2022. The impact upon the site should be negligible given its location within Flood Zone 1.

The overall risk of fluvial flooding is considered to be **very low.**

4.3 Flooding from the sea (tidal flood risk)

The site is not considered to be at risk from tidal flooding due to its inland location.

The overall tidal flood risk is considered to be **very low.**

4.4 Flooding from the land (surface water flood risk)

If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse.

Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff can occur. Excess surface water flows from the site are believed to drain naturally to the local water features, either by overland flow or through infiltration.

The EA's surface water flood map (**Figure 4.2**) shows that the majority of the site to be at 'very low' risk i.e. a less than 1 in 1000 year annual probability of surface water flooding. There is an overland flow path which runs through the woodland region to the northwest of the site. This flow path is present during the 'high' risk i.e. a greater than 3.3% annual probability and flows parallel to the railway line with depths between 300mm and 900mm for the 'high', 'medium' and 'low' risk events.

It was confirmed during a site visit that the woodland section within the northwestern corner of the site is significantly downgradient from the rest of the site. It was also confirmed that there is a ditch that runs alongside the railway line which is likely where the flow path discussed above is contained. Hence there is minimal flood risk to the site associated with this flow path.

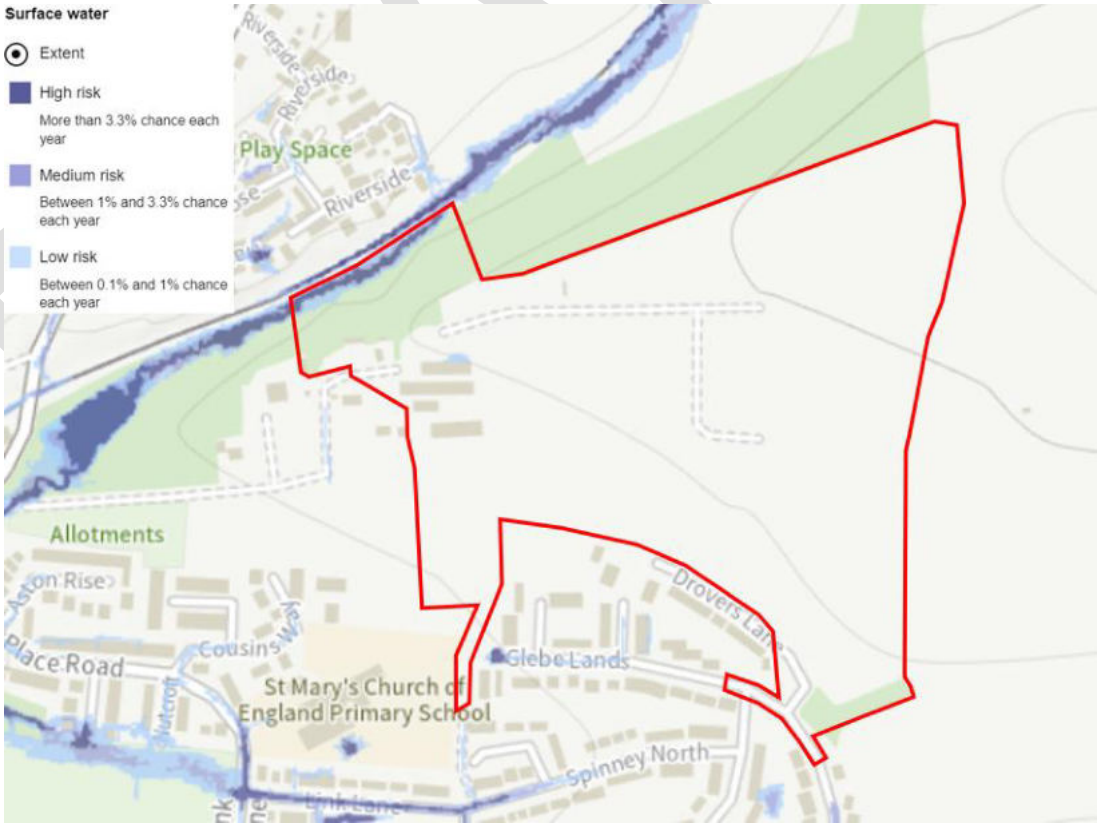


Figure 4.2: Environment Agency 'Flood risk from surface water' map

The topography on site shows the site falls towards the southwest and therefore any surface water runoff will likely fall away in this direction. Runoff generated by the proposed development will need to be controlled to prevent surface water flooding elsewhere. This is discussed below in **Section 7.**

Surface water flooding is likely to increase as a result of climate change in a similar ratio to fluvial flooding. Increased intensity and frequency of precipitation is likely to lead to reduced infiltration and increased overland flow. Climate change guidance was updated by the EA in May 2022. Revised allowances for climate change have been included in the indicative drainage strategy.

The overall risk of surface water flooding at the site is considered to be **very low.**

4.5 Flooding from groundwater

Groundwater flooding tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas, the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

The site-specific ground investigation conducted by GRM Development Solutions Ltd. in August 2022 confirmed the site's underlying geologies to be Topsoil, Made ground and Head Deposits, over Hythe Formation. It also confirmed that the majority of the investigative boreholes did not strike groundwater.

Climate change could increase the risk of groundwater flooding as a result of increased precipitation filtering into the groundwater body. This is less likely to cause a significant change to flood risk than from other sources, since groundwater flow is not as confined. It is probable that any locally perched aquifers may be more affected, but these are likely to be isolated. The change in flood risk as a result of climate change is likely to be low.

The overall groundwater flood risk is considered to be **very low.**

4.6 Flooding from sewers

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its conveyance capacity, the system becomes blocked, or it cannot discharge due to a high water level in the receiving watercourse. When exceeded, the surcharged pipe work could lead to flooding from backed up manholes and gully connections.

Sewer details have been referenced from sewer record plans obtained from Southern Water. The plans indicate the only sewers within the vicinity of the site are the 150mm foul sewers that serve the housing to the south. Based on the local topography, any surcharged water would most likely follow the road levels and flow away from the site to the south and will unlikely impact the site.

Climate change is likely to result in an increase in flooding from sewers. Increased rainfall and more frequent flooding put existing sewer and drainage systems under additional pressure resulting in the potential for more frequent surcharging and potential flooding. This would increase the frequency of local sewer flooding but would not be significant in terms of the proposed development.

The overall sewer flood risk to the site is considered to be **very low.**

4.7 Flooding from reservoirs

Flood events can occur from a sudden release of large volumes of water from reservoirs. The EA reservoir flood map (reproduced as **Figure 4.3**) shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large.

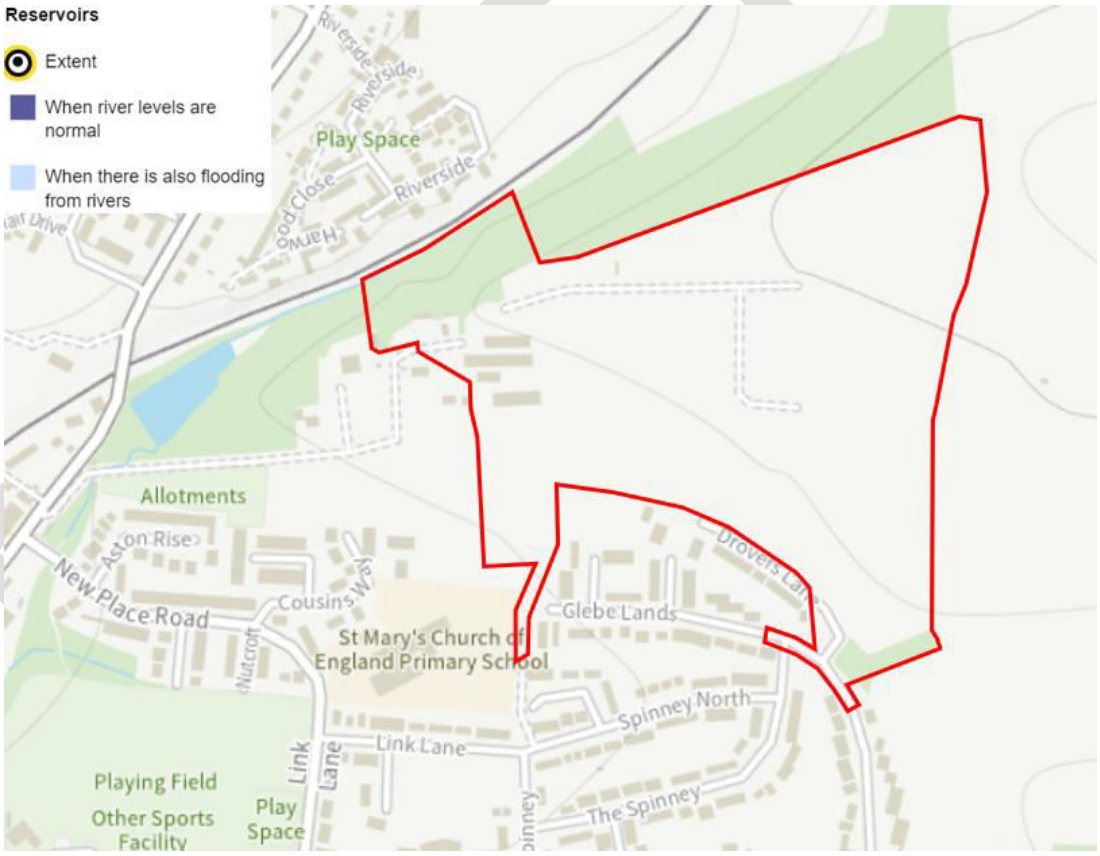


Figure 4.3: Environment Agency 'Flood risk from reservoirs' map

The EA mapping was updated in 2021 to demonstrate the potential maximum extent of flooding for two scenarios - a "dry day scenario" in which river levels are "normal", and a "wet day scenario" where the flooding from the reservoir coincides with flooding from rivers.

The mapping shows that the site is not in a location at risk of reservoir flooding when river levels are normal and should the peak fluvial event and reservoir failure occur at the same time. Reservoir flooding is extremely unlikely and there has been no loss of life in the UK from reservoir flooding since 1925. Since then, reservoir safety legislation has been introduced to ensure reservoirs are maintained.

Reservoirs can be managed over time, controlling inflow/outflow of water and therefore there is the capacity to control the effects of climate change. Increased rainfall has the potential to increase base flow, but this should be minimal. It is unlikely that there will be a substantial change to the risk of flooding for this site as a result of climate change.

The resultant flood risk is considered to be **very low.**

4.8 Other sources of flooding

4.8.1 Canals

There are no Canal & River Trust owned canals within the vicinity of the site.

4.8.2 Other artificial features

There is a man-made reservoir located within the centre of the site that is believed to connect into the site's irrigation system to allow the plant nursery to be watered effectively. As this is a man-made system and is not considered to receive any additional inflows, it poses little flood risk to the site.

The resultant flood risk from 'other' sources is considered to be **very low.**

5 MITIGATION MEASURES AND RESIDUAL RISK

5.1 Sequential approach within application boundary

The only region considered to be at flood risk from any source, is the woodland area in the northwestern corner of the site. Based on the development plan, which can be found in **Appendix D,** no development will be placed within this area, showing a sequential approach has been taken to the placement of development within the site boundary.

5.2 Overland flood flow

There is a surface water overland flow route present within the woodland region in the northwestern corner of the site. Since no development will be placed within this region, the flow path will remain undisrupted and continue to flow as per the current situation.

All surface water runoff up to the 1 in 100 year climate change storm generated on site will be stored on site and discharged to the watercourses on site as per the indicative drainage design in **Section 7**. Surface flows may be generated on site due to drainage capacity exceedance; these can be conveyed into the SuDS features.

5.3 Finished floor levels

As this site is unlikely to be affected by fluvial, surface water or any other sources of flooding there is no need to incorporate any raised finished floor levels into the design. Low lying areas that could lead to ponding of surface flows will be avoided by careful design of finished levels.

5.4 Easements and consents

Under the Water Resources Act 1991 and associated byelaws, works in, over, under or adjacent to main rivers require the consent of the EA and works in, over, under or adjacent to ordinary watercourses will require IDB, Local Authority or LLFA consent. This is to ensure that they neither interfere with the IDB/EA/LPA/LLFA's work nor adversely affect the environment, fisheries, wildlife and flood defence in the locality.

Due to the presence of a multiple surface water drainage channels within the vicinity of the site location it is possible that the LLFA may require consents and easements for works in and around these channels. Since the indicative drainage strategy will also look to discharge to a drainage channel, the LLFA should be contacted to determine feasibility and constraints.

Any consent works usually take place post planning, prior to construction, however, the principals of any development within the appropriate easements should be agreed at the planning stage.

5.5 Flood compensation

The site is shown to be outside the 1 in 100 year climate change floodplain, so floodplain compensatory measures are not deemed necessary.

5.6 Safe access/egress

As the site is lies outside of the 1 in 100 year plus climate change fluvial flood extent and is not identified as being at significant risk of flooding from other sources, safe access and egress will be available for the design flood event.

5.7 Groundwater

The site-specific investigation carried out by GRM Development Solutions Ltd. confirmed that the underlying geologies and groundwater levels are unlikely to pose a flood risk to this site.

Long-term groundwater monitoring could be undertaken as a precautionary measure.

6 PLANNING POLICY CONTEXT

6.1 National planning policy

Section 14 of the NPPF details the overarching requirements relating to flood risk for any development. The key message is that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

In areas at risk of flooding, the NPPF requires that the following criteria are met:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

The PPG supports the NPPF and provides further advice regarding the assessment of flood risk and the application of the Sequential and Exception Tests.

6.1.1 Land use vulnerability

Table 2 of the PPG indicates the compatibility of various land uses in each flood zone, dependent on their vulnerability to flooding. **Table 6.1** below is reproduced from Table 2 of PPG.

Table 6.1: Flood risk vulnerability and flood zone 'compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate
	Zone 2	Appropriate	Appropriate	Exception Test Required	Appropriate	Appropriate
	Zone 3a	Exception Test Required	Appropriate	Should not be permitted	Exception Test Required	Appropriate
	Zone 3b functional floodplain	Exception Test Required	Appropriate	Should not be permitted	Should not be permitted	Should not be permitted

With reference to Annex 3 of the NPPF, the proposed development, based on its residential use, is classed as 'more vulnerable'. This classification of development is appropriate for areas within Flood Zone 1 and therefore appropriate for the subject site.

6.1.2 Sequential Test

The Sequential Test aims to direct new development to areas with the lowest probability of flooding. The site has been identified as located within Flood Zone 1 with no other significant flooding issues from other sources, as such the sequential test has been passed.

6.1.3 Exception Test

In accordance with **Table 6.1**, there is no requirement to apply the Exception Test for a 'more vulnerable' development within Flood Zone 1.

6.2 Local planning policy

Key and current local planning policy of relevance relating to flood risk and drainage for the area which the site is located in, has been reproduced below.

West Sussex County Council Local Flood Risk Management Strategy[5]

The District and Borough Councils are the responsible authorities for managing planning control and making decisions on what will or will not be granted planning permission. West Sussex County Council is responsible for planning control of libraries, waste sites, mineral sites and schools. Current planning policy directs development away from flood risk areas, however, there remains an emphasis on development and the economy. Permitting safe housing is a constant challenge for developers and planners.

With regard to development in flood risk areas, site allocations and planning applications are informed and assessed by the planning process in a number of ways. The planning process, in accordance with the National Planning Policy Framework (NPPF), applies a principle called the Sequential Test that seeks to direct development towards areas with the lowest risk of flooding.

Where the Sequential Test is not possible, the Exception Test is undertaken whereby it must be demonstrated that any development in an area at risk of flooding will provide wider sustainability benefits to the community that outweigh flood risk, and that such development will be safe for its lifetime. Flood risk should not be increased elsewhere as a result of development. Flooding from new development cannot be allowed to impact on third parties.

West Sussex LLFA Policy for the Management of Surface Water[6]

<u>SuDS Policy 1: Follow the drainage hierarchy</u>

1. Surface runoff not collected for use must be discharged according to the following discharge hierarchy:
    a. to ground,
    b. to a surface water body,
    c. to a surface water sewer, highway drain, or another drainage system, or
    d. to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewerage undertaker.
2. The selection of a discharge point should be clearly demonstrated and evidenced.

<u>SuDS Policy 2: Manage Flood Risk Through Design</u>

1. The drainage scheme proposed is to:
    a. protect people and property on the development site from flooding; and,

[5] West Sussex County Council Local Flood Risk Management Strategy, accessible at: https://www.westsussex.gov.uk/media/1595/local_flood_risk_management_strategy.pdf

[6] West Sussex LLFA Policy for the Management of Surface Water, accessible at: https://www.midsussex.gov.uk/media/3826/ws-llfa-policy-for-management-of-surface-water.pdf

b. avoid creating any additional flood risk outside of the development in any part of the catchment, either upstream or downstream.

2. Any drainage scheme must manage all sources of surface water, including exceedance flows and surface flows from offsite, provide for emergency ingress and egress and ensure adequate connectivity.

3. For large sites where development is to be phased, there will need to be a strategic site surface water management system that allows different parts of the site to be developed at different times while ensuring that each of the design criteria can be met.

SuDS Policy 3: Mimic Natural Flows and Drainage Flow Paths

1. Drainage schemes should be designed to match greenfield discharge rates and follow natural drainage routes as far as possible; pumps should therefore not form part of drainage schemes.

2. Greenfield runoff should be calculated from FEH or a similar approved method. SAAR and any other rainfall data used in run-off storage calculations should be based upon FEH rainfall values.

Horsham District Council Local Plan 2023 – 2040 (Regulation 19)[7]

Strategic Policy 6: Climate Change

Climate Change Adaptation

1. Development will only be supported if it includes site and building level measures to adapt to the future impacts of climate change and reduce vulnerability, particularly in terms of the comfort, health and wellbeing of current and future occupiers. Flood risk, water supply, overheating and changes to the District's landscape should also be considered. Measures should include but are not limited to:

    a. Use of site and interior building layout: new buildings should be orientated to maximise the opportunities for both natural heating and ventilation and to reduce the exposure to wind and other elements, and the potential for overheating;

    b. The conservation of water supplies to minimise the risk and impact of drought and flooding;

    c. The use of green/blue infrastructure and dual use Sustainable Drainage Systems (SuDS) to provide multifunctional benefits such as helping to absorb heat, reduce surface water runoff, provide flood storage capacity and assist habitat migration; and

[7] Horsham District Council Local Plan 2023 – 2040 (Regulation 19), accessible at: https://strategicplanning.horsham.gov.uk/Regulation_19_Local_Plan/consultationHome

d. Moderating external temperatures through the use of green walls and roofs, tree planting or other nature-based solutions and landscaping for shade and drainage design.

2. Development will be supported providing it avoids responses to climate impacts which lead to increases in energy use and carbon dioxide emissions. In considering the likely impact of climate change over the lifetime of the development reference should be made to the most recent climate change projections.

Sustainability Statement

3. Development will be supported provided a Sustainability Statement is submitted which demonstrates how the development has taken measures to mitigate and adapt to the effects of climate change.

Strategic Policy 10: Flooding

1. Development proposals will only be supported where they follow a sequential approach to flood risk management, so that priority is given to development sites and areas with the lowest risk of flooding, where shown to be safe, and shown not to increase flood risk elsewhere.
2. Development proposals will be supported provided that they meet all of the following that are relevant:
    a. Consider flood risk at an early stage in deciding the layout and design of the site;
    b. Take a sequential approach to ensure most vulnerable uses are placed in lowest risk areas;
    c. Are not located on the functional floodplain (Flood Zone 3b), except for water compatible uses and essential infrastructure;
    d. Where located in Flood Zone 2 and 3, have undergone a sequential test and, if necessary, exceptions test, using a 1 in 100 annual probability flood level including an appropriate allowance for climate change;
    e. Not result in a net loss of flood storage capacity, and not adversely affect flood routing and thereby increase flood risk elsewhere;
    f. If over 1 hectare and in Flood Zone 1, or in Flood Zone 2 and 3, are accompanied by a site-specific Flood Risk Assessment;
    g. Comply with the tests and recommendations set out in the Horsham District Strategic Flood Risk Assessments (SFRAs);
    h. Where there is the potential to increase flood risk, incorporate the use of sustainable drainage systems (SuDS) unless technically unfeasible, or incorporate water management measures which reduce the risk of flooding and ensure flood risk is not increased elsewhere;
    i. Make appropriate provision for surface water drainage to ground, water courses or surface water sewer. Development will not be allowed to drain to the foul sewer;

j. Where technically feasible, utilise drainage techniques that mimic natural drainage patterns and manage surface water as close to the source as possible;

k. Comply with the objective of the Water Framework Directive, and with the findings of the Gatwick Sub Region Water Cycle Study, in order to maintain water quality and water availability in rivers and wetlands and wastewater treatment requirements; and

l. Include a management plan to maintain the flood water assets in perpetuity.

3. New development which incorporates SuDS will be supported where it considers amenity value, green infrastructure, local ecological resources including water quality and biodiversity, natural flood management methods, and contributes towards environmental net gain. An appropriately detailed assessment should be submitted to demonstrate an appropriate SuDS strategy.

7 SURFACE AND FOUL WATER DRAINAGE ASSESSMENT

7.1 Scope

This section discusses the potential quantitative effects of the development on both the risk of surface water flooding on-site and elsewhere within the catchment, as well as the type of potential SuDS features that could be incorporated as part of the masterplan.

The NPPF states that SuDS should be considered wherever practical. The use of SuDS is also encouraged by regional and local policy. In accordance with the Horsham District Council Local Plan, West Sussex County Council Local Flood Risk Management Strategy and Policy for Management of Surface Water; the surface water drainage strategy should seek to implement a SuDS hierarchy that aspires to achieve reductions in surface water runoff rates to greenfield rates.

In addition, Building Regulations Part H[8] requires that the first choice of surface water disposal should be to discharge to an adequate soakaway or infiltration system, where practicable. If this is not reasonably practicable then discharge should be to a watercourse, the least favourable option being to a sewer (surface water before combined). Infiltration techniques should therefore be applied wherever they are appropriate.

This assessment includes an overview and comparison of the existing scenario and proposed development scenario. The existing and proposed areas are provided in the Table below:

Table 7.1: Existing and proposed site areas

Land use	Existing area (m^2)	Proposed area (m^2)
Impermeable	14,067m^2 (9%)	39,970m^2 (25%)
Permeable	146,229m^2 (91%)	122,988m^2 (75%)
Total	162,958m^2	162,958m^2

[8] HM Government (2010 with 2013 amendments), 'The Building Regulations 2010: Approved Document H - Drainage and Waste Disposal (2002 Edition incorporating 2010 amendments)'.

7.2 Pre-development situation

The pro-rata IoH 124[9] method has been used to estimate the Greenfield surface water runoff for a 1ha site to give a l/s/ha rate, using the HR Wallingford Greenfield runoff rate estimation tool. Calculations are contained in **Appendix G**.

Table 7.2: IOH 124 surface water runoff (greenfield) for 1ha

Return period	Peak flow (l/s)
QBar	6.1
1 in 1 year	5.2
1 in 30 year	13.8
1 in 100 year	19.4

7.3 Post-development situation

The proposed development is for a residential end use. This will result in an increase in impermeable area and surface water runoff across the site. It will therefore be necessary to manage surface water on-site through conveyance towards the proposed point of discharge, whilst providing sufficient attenuation for all events up to the 1 in 100 year event inclusive of a climate change percentage. Based on latest climate change guidance sites located within the Arun and Western Streams Management Catchment and have a design lifetime that exceeds the 2100 epoch should use the 'upper end' climate change allowance, which in this case is 45%.

7.3.1 Point of discharge

Discharge options from the site have been considered in line with the SuDS hierarchy, as follows.

Infiltration

Infiltration should be considered as the primary option to discharge surface water from the developed study area. The effectiveness of infiltration is completely dependent on the physical conditions at the study area.

A site specific ground investigation and soakaway testing conducted by GRM Development Solutions Ltd. in August 2022 stated that *"soakaway rates were highly variable due to the nature of head deposits"* and that rates were *"generally poor"*. As such, infiltration based SuDS are not considered a viable discharge option at this site.

Discharge to watercourse

[9] Institute of Hydrology (IoH), 'Flood Estimation for small catchments - Report 124', 1994.

There are several surface water drainage channels within the boundary, that collate surface water from the site to the southwest corner where the site discharges to an Ordinary Watercourse via a culvert.

Discharging surface water directly to a local watercourse is considered feasible and since the site drains naturally in this way utilising/enhancing the existing connection(s) will act to mimic the natural scenario.

As per the requirements of local policy any discharge to the watercourse will not exacerbate flood risk when restricted to the 1 in 1 year greenfield rate of 5.2l/s/ha.

Discharge to surface water sewer

Due to the lack of surface water sewers within the immediate vicinity of the site and as preferable methods are available, it is not considered feasible to discharge surface water to a sewer.

7.3.2 Network Flow modelling

To determine whether the proposed SuDS provide sufficient attenuation storage, the WinDes ' 4-Stage Design Guide' tool has been used. The WinDes '4-Stage Design Guide' tool allows for an indicative network to be modelled based upon attenuation feature dimensions, rainfall values and permitted discharge rates, in line with CIRIA guidance. These volumes can be later revised at detail design stage by the introduction of specific flow control methods.

The proposed surface water discharge rate from the site will be 22.60 l/s. This rate was previously agreed to be the LLFA in outline planning application (DC/21/2321). In the application a drainage concept plan was completed by RPS Group in May 2021 (drawing ref: AAC5680-RPS-xx-xx-DR-C-600-01) using this rate. It should be noted that this runoff rate is between the 1 in 1 year greenfield rate of 20.74l/s and the QBar rate of 24.33l/s.

Calculations have been run using the approved rate by the LLFA, restricting offsite flows to 22.60l/s. The proposed impermeable area has been based on an assumed 100% of the developable area. No allowance is included in the calculations for infiltration as a worse-case scenario.

Calculations show this system can attenuate surface water runoff without flooding during a 1 in 100 year event inclusive of 45% climate change. Further details on the storage structure and sizing, with attenuation calculations can be found in **Appendix H**.

7.3.3 Proposed drainage strategy

The surface water strategy has been designed and split into 3 catchment areas (East, Central and West) which outfall into the southern boundary ditch. Each catchment has a detention basin storage area and flow control to restrict the discharge rate into the existing ditch. The discharge rates do not exceed the approved outline planning discharge rates.

Network 1 – East

The proposed strategy for the eastern area is for the surface water drainage to discharge into the Detention Basin 1 in the south under gravity. A flow control set at 4.9 l/s will restrict surface water entering the southern ditch which has been designed in accordance with the principles set out during the outline planning stage. A Detention Basin storage capacity of 1,017m^3 is required with the flow restriction.

Network 2 – Central

The proposed strategy for the central area is for the drainage to discharge into the Storage Basin in the south under gravity. A flow control of 12.5 l/s will restrict surface water entering the southern ditch which has been designed in accordance with the principles set out during the outline planning stage. The surface water runoff from this part of the development is through a system of sewers, swales and Attenuation Basins 2 and 3, and has a combined storage capacity of 2,791m^3.

Network 3 – West

The proposed strategy for the western area is for the drainage to discharge into the Storage Basin in the south under gravity. The catchment for Basin 4 includes Phase 1 residential housing and an additional allowance for a future development of 10 dwellings within the Heritage site. A flow control set at 5.2 l/s will restrict surface water entering the southern ditch which has been designed in accordance with the principles set out during the outline planning stage. Attenuation Basin 4 has a storage volume of 1,124m^3.

The proposed SuDS for the site include a combination of permeable paving and modular storage which have been located depending on the positions of proposed building, topography and location of outfalls. The proposed SuDS features are designed to provide the required storage volume to retain the 1 in 100 plus 45% climate change event. The SuDS measures are outlined in the Indicative Surface Water Strategy as attached in **Appendix I**.

In principle, the strategy contains the following features:

- **Infiltration** rates are considered variable / poor on site due to the nature of the underlying geology and therefore **soakaways** will be considered in moderation. Additional soakaway tests will be required within the soft landscaping features to ascertain infiltration rates and the suitability of soakaways being partially incorporated into the drainage storage design areas. Individual house soakaways may be possible depending on ownership and responsibility. Alternatively modular storage could also be designed as soakaways beneath communal parking areas. All soakaways will need to be designed taking into consideration groundwater levels (to prevent any interference with the water table), any potential contamination (considered unlikely on this site) and the site-specific infiltration rates, all of which will need to be confirmed at the detailed design stage. All soakaway features should be located at a minimum 5m distance from buildings in accordance with Building Regulations Part H[8].
- **Permeable paving** has been located along the access road in the north of the site and is indicated as 0.3m deep. This feature provides surface water attenuation and water quality benefits. Main roads will not be constructed using permeable paving

due to ownership and future maintenance issues, where responsibility will most likely lie with the highway authority.

- **A modular storage tank** has been located within the eastern catchment to provide additional surface water attenuation. Modular storage has been indicated as one to two cells deep (0.4m - 0.8m). There is potential to introduce modular storage under the detention basins to reduce the depth of the water depth at peak events in the detention basins. It should be noted that in areas of high groundwater levels, these tanks may need to be lined to prevent groundwater ingress. Potential floatation issues should also be considered at the detailed design stage.
- **Swales** have been utilised alongside roads to convey runoff through the drainage network to the various attenuation features.
- Four **detention basins** have been strategically located within the area of open space along the southern boundary. The topography in this area is suitable for SuDS features. To accommodate the required volumes, the feature has been designed up to 1m deep and has side slopes of 1:3 to comply with safety and maintenance guidelines as highlighted in the SuDS Manual[10].
- **Rainwater harvesting** is not proposed as part of this development and therefore has not been included as part of any of the calculations.

The dimensions, volumes and location of the SuDS features will need to be revised as the masterplan develops and during the detailed planning stage. Detailed design of individual features is not part of the scope of this report. Preliminary design criteria have been based upon guidance given in the CIRIA publication 'The SUDS Manual'[10].

Temporary drainage should be established for the construction phase of development to prevent silt mobilisation, potentially impacting on flow regimes and silt pollution downstream. The construction of SuDS should be considered in the early stages of site design.

A summary of the proposed surface water drainage strategy is included within the completed West Sussex drainage proforma, attached as **Appendix J**. A West Sussex Flood Risk Validation Checklist can also be found in **Appendix J.**

7.3.4 Adoption and maintenance

The Design and Construction Guidance for Foul and Surface Water Sewers (DCG)[11] states that as of April 1st 2020, sewerage authorities are required to adopt some SuDS features, including basins and swales. However, SuDS features that are classified as forming part of a building or yard (i.e. permeable paving) will not be adoptable under the DCG and will require a second adopting authority or maintenance company. Therefore, the long-term maintenance of some SuDS features within the site boundary will most likely be undertaken by Southern Water as the adopting authority. However, the

[10] CIRIA, 'The SUDS Manual – C753', 2015.

[11] Water UK, 'Sewerage Sector Guidance Appendix C – Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England', March 2020.

maintenance of other features such as permeable paving will most likely be undertaken by a management company.

Maintenance of SuDS features should be undertaken in line with maintenance schedules outlined in the SuDS Manual and if adopted, any Southern Water maintenance guidance. An example of a typical maintenance regime for the proposed SuDS can be found in **Appendix K**. Similar regimes would be applicable for all other SuDS features on site. Full maintenance schedules should be confirmed at the detailed design stage in consultation with appropriate product suppliers.

7.4 Water quality

The SUDS Manual contains guidance on how to assess water quality, stating *"Determining the hazard posed by the land use activities at a site and the extent to which underlying soil layers and/or proposed treatment components reduce the associated risk can be done using a variety of methods that vary in complexity and data requirements."*

The assessment methodology required is determined by reference to Table 4.3 of the SuDS Manual. Based on this, the quality impacts of the proposed development can be summarised with the following pollution hazard levels and management requirements for discharge to the receiving surface water (there will be no infiltration on site, therefore receiving groundwater is not considered here):

- Residential roofs – **Very Low** Pollution Hazard – Simple Index Approach;
- Individual property driveways, roofs, residential car parks, low traffic roads, non-residential car parking with infrequent change (schools, offices) – **Low** Pollution Hazard – Simple Index Approach; and

It is therefore considered appropriate to use the Simple Index Approach (SIA) for the purpose of this assessment. The Simple Index Approach (SIA) to assessing water quality management requirements has been developed by CIRIA to support the implementation of the water quality management design methods set out in the SuDS Manual, with appropriate cross referencing to the relevant 'Design Conditions'. The CIRIA Susdrain website contains a spreadsheet based procedure that can be used for all the UK.

Simple Index Approach

Table 26.1 of the SUDS Manual indicates that for the Simple Index Approach:

- Simple pollution hazard indices should be based on land use (e.g. Table 26.2).
- Risk reduction for Surface Water should be done using Simple SuDS hazard mitigation indices (e.g. Table 26.3).

Extracts of Tables 26.2 and 26.3 are replicated below, highlighting the relevant features applicable to this site:

Table 7.3: Extract of SuDS Manual 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
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. <300 traffic movements/day	Low	0.5	0.4	0.4

Table 7.4: Extract of Table 26.3: Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation Indices		
	TSS	Metals	Hydro-carbons
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6

The SuDS Manual States:

Total SuDS mitigation index ≥ pollution hazard index

(for each contaminant type) (for each contaminant type)

When two or more SuDS components are used in a series:

Total SuDS mitigation index = mitigation index $_1$, + 0.5 (mitigation index $_2$)

Where: Mitigation index $_n$ = mitigation index for component n

A factor of 0.5 is used to account for the reduction performance of secondary or tertiary components associated with already reduced inflow concentrations.

Taking each land type use in turn:

- Commercial roofs – has a TSS index of 0.3, a Metals index of 0.2 and a Hydrocarbons index of 0.05.

- Individual driveways – has a TSS index of 0.5, a Metals index of 0.4 and a Hydrocarbons index of 0.4.
- Total pollution index – TSS has an index of 0.8, Metals has an index of 0.6 and Hydrocarbons has an index of 0.45.

Taking each SuDS technique used in turn:

- Permeable Paving – has a TSS index of 0.7, a Metals index of 0.6 and a Hydrocarbons index of 0.7.
- Detention Basin (x0.5) – has a TSS index of 0.5, a Metals index of 0.5 and a Hydrocarbons index of 0.6.
- Total mitigation index – TSS has an index of 0.95, Metals has an index of 0.75 and Hydrocarbons has an index of 1.0.

As is required by the SuDS manual, the total SuDS mitigation index is greater than the total pollution hazard index.

In summary, the use of a combination of SuDS as outlined above should demonstrate that in line with current guidelines, runoff is limited from the site following redevelopment and the use of treatment train consisting of permeable paving and an attenuation basin will also provide significant water quality benefits.

7.5 Foul drainage provision

As with the surface water network, there is an extensive on-site private foul network throughout the proposed development. This foul network will connect into the Southern Water existing public foul sewer network to the south of the development.

The foul drainage will connect to two existing foul manholes at MH7001 in Glebelands and MH5103 adjacent to the southern boundary.

- MH7001 - A 150mm diameter foul sewer that begins its run to the west of the houses on Drovers Lane. This sewer flows south where it then inflows into a 150mm diameter sewer on Glebelands.
- MH5103 - A 150mm diameter foul sewer that flows east to west along Glebelands to the south of the site. This sewer then turns to flow southward, away from the site, at the western end of Glebelands.

The upstream foul drainage will connect into these manholes under gravity and be offered for adoption under a S104 Agreement.

The foul water design follows the approved Drainage Strategy and is shown connecting to MH7001 and MH5103. The foul drainage strategy for the subject site is shown in **(Appendix I).**

Southern Water confirm that there is currently adequate capacity in the local sewer network to accommodate foul flows from the proposed development. Southern Water were contacted to assess the proposed connection point at existing manhole 7001 in Glebelands. A response was received on 31st August 2021 and Southern Water have confirmed MH5103 is located within private land ownership and will require the landlord's consent. A S98 Sewer requisition may be required to connect to the Southern Water manhole.

8 CONCLUSIONS AND RECOMMENDATIONS

This FRA complies with the NPPF and Planning Practice Guidance and demonstrates that flood risk from all sources has been considered in the proposed development. It is also consistent with the Local Planning Authority requirements with regard to flood risk.

The proposed development site lies in an area designated by the EA as Flood Zone 1 and is outlined to have a chance of flooding of less than 1 in 1,000 (<0.1%) in any year from fluvial sources. The site is also considered to be at no significant risk from all other sources of flooding.

The proposed development is classified as 'more vulnerable' and therefore considered appropriate within Flood Zone 1 without application of the Exception Test.

This FRA has considered multiple sources of flooding and concluded the following:

Table 8.1: Flood risk summary

Source	Level of risk	Mitigation
Fluvial	**Very Low** Flood Zone 1	-No Mitigation Required.
Tidal	**Very Low** Inland Location	-No Mitigation Required.
Surface water	**Very Low**	-No Mitigation Required. -No development will be placed within the area the surface water flow path intersects the boundary. -The development will incorporate a surface water drainage strategy to accommodate surface water generated on site. Surface water will be attenuated on site and discharged directly to the nearby watercourse(s). -SuDS will be utilised to control surface water flows, designed to store the volume of water associated with a 1 in 100 year rainfall event (including a 45% allowance for climate change), providing a betterment over the existing scenario.
Groundwater	**Very Low**	-No Mitigation Required.
Sewers	**Very Low**	-No Mitigation Required.

Source	Level of risk	Mitigation
Reservoir	**Very Low**	-No Mitigation Required.
Other sources	**Very Low**	-No Mitigation Required.

Overall, taking into account the above points, the development of the site should not be precluded on flood risk grounds.

APPENDIX A
RSK GROUP SERVICE CONSTRAINTS

1. This report and the drainage design carried out in connection with the report (together the "Services") were compiled and carried out by RSK LDE Ltd (RSK) for BDW Southern Counties (the "client") in accordance with the terms of a contract between RSK and the "client" dated June 2024. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable civil engineer at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.

2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate, or such other terms as may be agreed between RSK and the client.

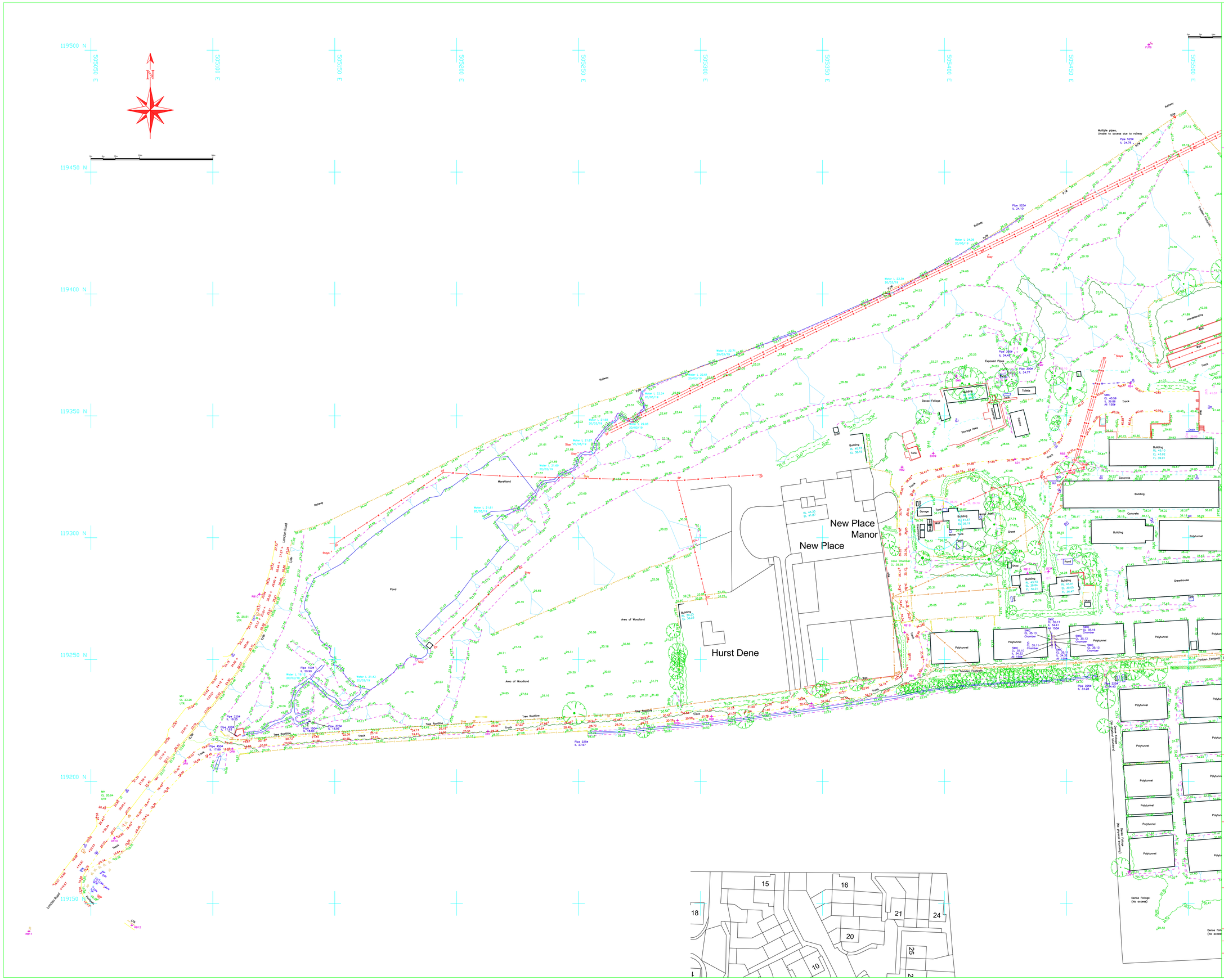
6. The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.

7. The Services are based upon RSK's observations of existing physical conditions at the site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.

8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (boreholes, trial pits etc) annotated on site plans are not drawn to scale but are centred over the appropriate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX B
TOPOGRAPHIC SURVEY



Survey Notes

1: This Survey is related to the Original Site Grid .

2: All Levels are related to the Original Site Datum.

3: The information Shown on this drawing is surveyed to the accuracy of the base scale shown.

4: Man entry to sewers has not been undertaken. Depths and pipe sizes are measured / estimated from the ground. This should be checked with Local Authority records or on site prior to the commencement of any works.

5: Boundaries shown are physical features and may not represent legally conveyed ownership.

6: Some services or features on the ground may be missing due to parked vehicles and other obstructions.

7: Where adjacent buildings have been surveyed remotely all walls may not be shown due to obstructions along lines of sight.

8: This plan should only be used for its original purpose. NJC Surveys LTD accepts no responsibility for this plan if it is supplied to any party other than the original client.

Survey Key

Street Furniture Symbols & Abbreviations

- BBS — Beltaine Beacon
- BoL — Bollards
- BOL — Bollard
- BS — Bus Stop
- DR — Drain
- EP — Electric Pole
- FL — Flood Light
- FS — Flag staff
- GP — Gate Post
- GU — Gully
- GV — Gas Valve
- IC — Inspection Cover
- LB — Letter Bin
- LP — Lamp Post
- TL — Traffic Light
- TM1 — Marine Post
- SMP — Marine Plate
- FH1 — Fire Hydrant
- WO — Wash Out
- WM — Water Meter
- TV — Cable Television
- MK — Marker Post
- MP — Mile Post
- PB — Pillar Box
- Pipe — Pipe
- PM — Parking Meter
- PO — Post
- RE — Rodding Eye
- RP — Reflector Post
- RS — Road Sign
- BT — Bus Tag
- SI — Sign
- BU — Stump
- SV — Stop Valve
- TP — Telegraph Pole
- UP — Vent Pipe
- TC — Telecommunication
- WT — Water Tap
- KO — Kerb Outlet
- AV — Air Valve
- TCB — Tel Cell Box
- TIP — Trial Pit
- STN — Survey Control Station

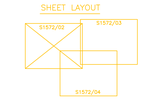
Fence Types & Abbreviations

- CHP — Chestnut Paling
- CR — Cross Rounding
- CL — Chain Link
- ConP — Concrete Panel
- CI — Corrugated Iron
- CBr — Crash Barrier
- El — Electric
- HM — Hit and Miss
- Hed — Hoarding
- Int — Interwoven
- IR — Iron Railings
- PR — Railings
- Pal — Palisade
- PW — Picket (Wooden)
- BW — Post & Barbed Wire
- PC — Post & Chain
- PR — Post & Rail
- PW — Post & Wire
- PM — Post & Wire Mesh
- TR — Trip Rail

Feature Lines

- Hedge
- Fence
- Gate
- Stile
- Footpath
- Kerbline
- Verge/Edge of Track or Change Of Surface
- Sewer Lines
- Ditch / Embankment etc.
- Overhead Electric Line
- Overhead Telecom Line
- Individual Tree-Sized
- Building — Structure
- Wall — Wall
- RWall — Retaining Wall

SHEET LAYOUT



SURVEY CONTROL

STN	EASTINGS	NORTHINGS	LEVEL
DR5	505345.481	119231.981	32.1915
DR6	505304.494	119226.745	30.8235
DR6A	505290.547	119225.066	30.3351
DR7	505212.798	119220.600	26.2733
DR8	505107.954	119213.415	19.6554
DR9	505088.754	119208.478	19.4816
DR10	505059.696	119176.765	19.8648
EM7	505439.502	119371.925	37.4748
EM8	505404.868	119366.381	34.2807
EX99	505395.415	119334.656	36.6468
FUT1	505915.977	119404.095	54.9680
FUT2	505929.572	119489.034	59.2422
FUT3	505818.378	119511.878	53.8487
FUT4	505705.799	119452.618	49.1318
FUT5	505712.489	119468.555	49.4077
FUT6	505483.769	119502.318	28.3341
FUT7	505459.060	119534.404	30.7989
LD1	505428.878	119332.198	38.0996
LD3A	505442.694	119286.222	36.3037
LD30	505455.565	119276.103	36.2811
LD4	505468.982	119290.949	37.7408
LD5	505523.371	119310.991	38.5507
LD6	505542.172	119311.466	40.5074
LD6A	505543.647	119347.296	41.9986
LD9	505475.651	119162.959	30.8198
NJC1	505683.016	119079.365	33.2100
NJC2	505772.758	119052.159	35.5550
NJC2A	505812.008	119005.457	34.3540
NJC2B	505806.844	118993.664	34.0190
NJC97	505537.561	119207.708	33.6850
NJC98	505540.665	119158.816	31.5210
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RB1	505387.922	119242.307	33.4574
RB1B	505383.675	119261.215	34.0845
RB1E	505434.063	119285.470	36.0480
RB2	505382.605	119328.992	36.3189
RB3	505449.923	119333.400	39.1324
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RB10	505119.067	119276.846	26.0065
RB11	505024.600	119138.585	19.3881
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REV	DATE	DESCRIPTION	BY	APP.

njc SURVEYS LTD

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Ashby de la Zouch,
Leicestershire
LE65 1BS

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Topographical Surveys • Building Surveys • GPS Surveys • Setting Out
Dimensional Control • Monitoring Surveys • Ground Modelling • Volumetric Calculations

Client

CATESBY PROPERTY GROUP

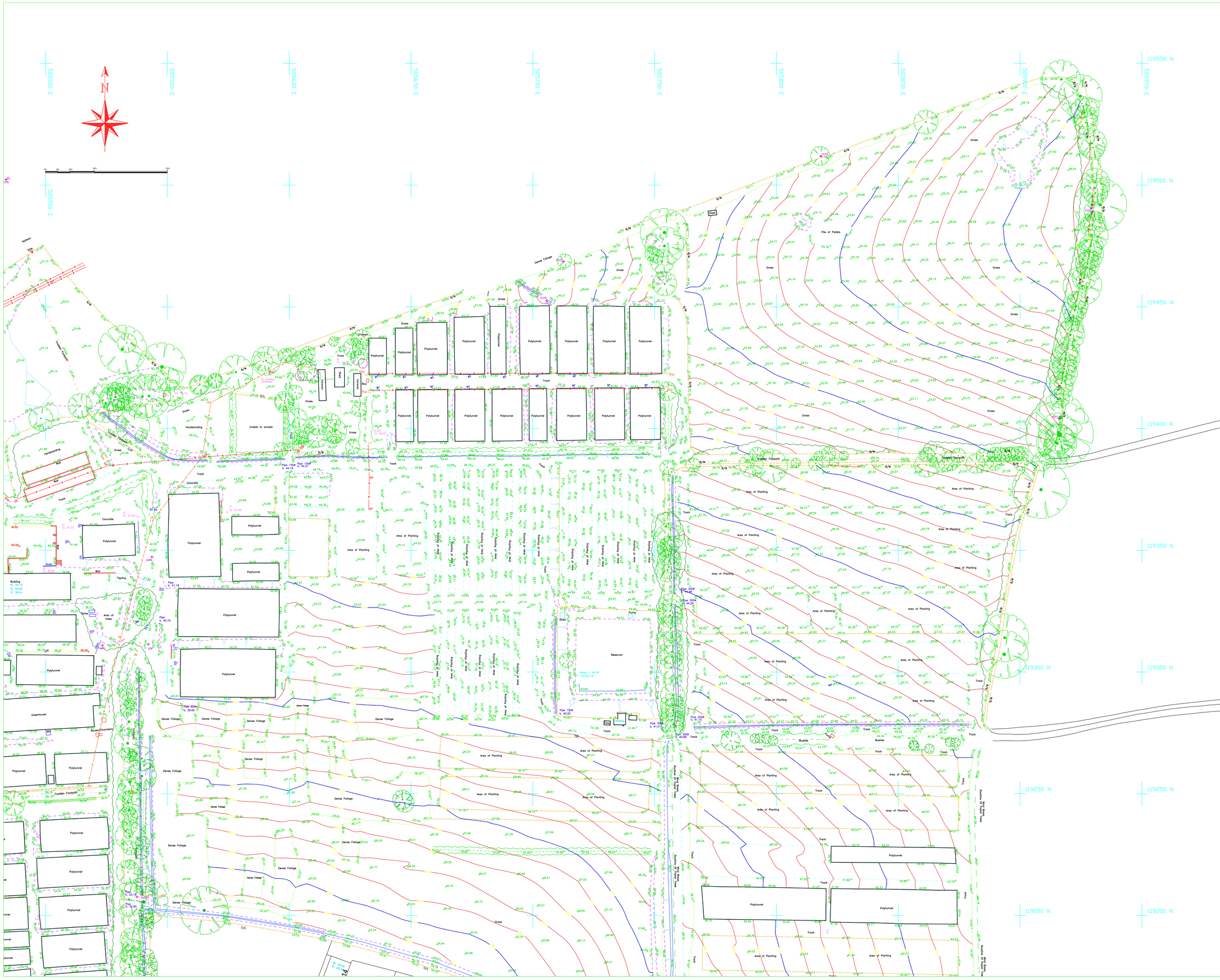
Project Title

London Road,
Pulborough

Drawing Title

Topographical
Survey

Drawn	Checked	Authorised
TMB	NJC	NJC
Date	**Scale**	**Sheet size**
18/03/2019	1/500	A0
Drg. No.		**Revision**
S1572/02		



Survey Notes

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Survey Key

Street Furniture Symbols & Abbreviations

BB	Bellaire Beacon	MK	Marker Post
BL	Bollards	MP	Mile Post
BO	Bollard	PB	Pillar Box
BS	Bus Stop	Pipe	Pipe
DI	Drain	PM	Parking Meter
EP	Electric Pole	PO	Post
FL	Flood Light	RE	Rodding Eye
FS	Flag staff	RP	Reflector Post
GP	Gate Post	RS	Road Sign
GU	Gully	BT	Bus Tag
GV	Gas Valve	SI	Sign
IC	Inspection Cover	Stump	Stump
LB	Letter Box	SV	Stop Valve
LP	Lamp Post	TP	Telegraph Pole
TL	Traffic Light	VP	Vent Pipe
MH	Manhole	TC	Telecommunication
SWP	Name Plate	WT	Water Tap
FH	Fire Hydrant	KO	Kerb Outlet
WO	Wash Out	AV	Air Valve
WM	Water Meter	TCB	Tel Call Box
TV	Cable Television	TIP	Trial Pit
		STN	Survey Control Station

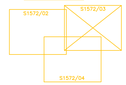
Fence Types & Abbreviations

CHP	Chestnut Paling
CB	Close Boarding
CL	Chain Link
ConPan	Concrete Panel
CS	Corrugated Iron
CBr	Crash Barrier
El.	Electric
HM	Hit and Miss
Hed	Hoarding
Int	Interwoven
MR	Iron Railings
OS	Open Slat
Pal	Palisade
PIK	Picket (Wooden)
B/W	Post & Barbed Wire
P/C	Post & Chain
P/R	Post & Rail
P/W	Post & Wire
P/M	Post & Wire Mesh
T/R	Trip Rail

Feature Lines

	Hedge		Overhead Electric Line
	Fence		Overhead Telecom Line
	Gate		
	Stile		Individual Tree-Sized
	Footpath		
	Kerbline	Building	Structure
	Verge/Edge of Track or Change Of Surface		
	Sewer Lines	Wall	Wall
	Ditch / Embankment etc.	RWall	Retaining Wall

SHEET LAYOUT



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REV	DATE	DESCRIPTION	BY	APP.

NJC SURVEYS LTD
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Client

CATESBY PROPERTY GROUP

Project Title

London Road,
Pulborough

Drawing Title

Topographical
Survey

Drawn	Checked	Authorised
TMB	NJC	NJC
Date 18/03/2019	Scale 1/500	Sheet size A0
Drg. No. S1572/03		Revision

Survey Notes

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Survey Key

Street Furniture Symbols & Abbreviations

BS	Bellstra Beacon	⊕	MkV	Marker Post	
Bo	Bollards	⊕	MP	Mile Post	
BL	Bollard	⊕	PB	Pillar Box	
BS	Bus Stop	⊕	Pipe	Pipe	
Dr	Drain	⊕	PM	Parking Meter	
EP	Electric Pole	⊕	Post	Post	
FL	Flood Light	⊕	RE	Rodding Eye	
FS	Flag staff	⊕	RP	Reflector Post	
GP	Gate Post	⊕	RS	Road Sign	
GU	Gully	⊕	ST	Stop Tap	
GV	Gas Valve	⊕	SI	Sign	
IC	Inspection Cover	⊕	SU	Stump	
LB	Letter Box	⊕	SV	Stop Valve	
LP	Lamp Post	⊕	TP	Telegraph Pole	
TL	Traffic Light	⊕	VP	Vent Pipe	
NL	Name Plate	⊕	YC	Yorkshire Connection	
FH	Fire Hydrant	⊕	WV	Water Tap	
WO	Wash Out	⊕	KO	Kerb Outlet	
WM	Water Meter	⊕	AV	Air Valve	
TV	Cable Television	⊕	TCB	Tel Call Box	
		⊕	TrP	Trial Pit	
		⊕	STN	Survey Control Station	

Fence Types & Abbreviations

CrP	Chestnut Paling
CrR	Cross Rounded
CL	Chain Link
CoP	Concrete Panel
CI	Corrugated Iron
CB	Crash Barrier
El	Electric
HM	Hit and Miss
Hed	Hoarding
Int	Interwoven
Ir	Iron Railings
OS	Open Slat
Pal	Palisade
PW	Picket (Wooden)
B/W	Post & Barbed Wire
P/C	Post & Chain
P/R	Post & Rail
P/W	Post & Wire
P/M	Post & Wire Mesh
T/R	Top Rail

Feature Lines

	Hedge		Overhead Electric Line
PW	Fence		Overhead Telecom Line
	Gate		
	Stile		Individual Tree-Sized
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	Kerbline	Building	Structure
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SHEET LAYOUT

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REV	DATE	DESCRIPTION	BY	APP.

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Client

CATESBY PROPERTY GROUP

Project Title

London Road,
Pulborough

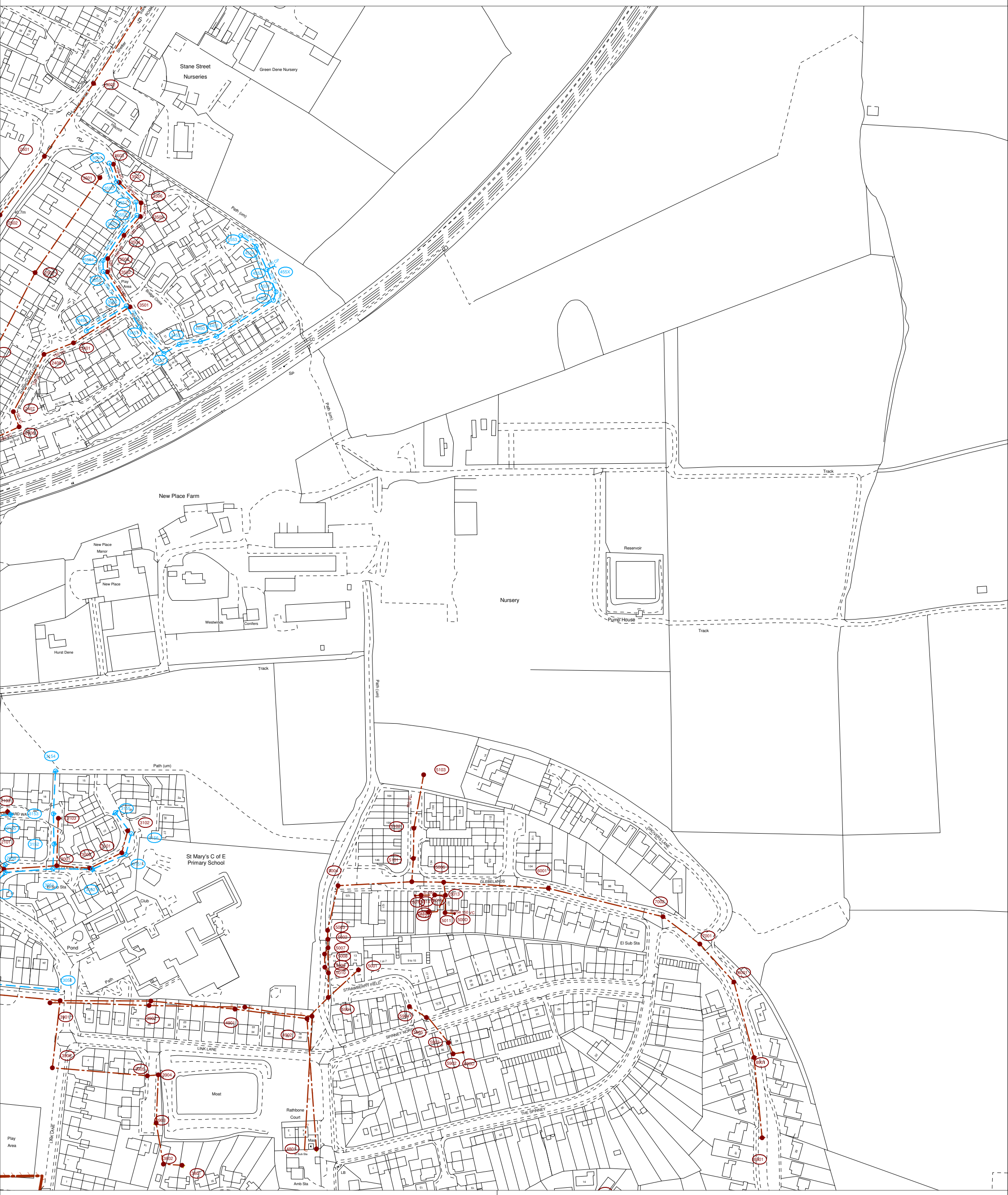
Drawing Title

Topographical Survey

Drawn	Checked	Authorised
TMB	NJC	NJC
Date 18/03/2019	Scale 1/500	Sheet size A0
Drg. No. S1572/04		Revision

APPENDIX C
SOUTHERN WATER SEWER RECORDS

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

Southern Water

O.S. REF: TQ0519SE

Scale: 1:2500

N

Printed By: Mercy

Date: 24-2-2021

Sewer Plot

Site Plan

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

Requested By:

from Southern Water

Adam Granger
RPS Consultancy Services
321 Bradford Street
Birmingham
West Midlands
B5 6ET

Your ref

Our ref
DS_CC_PPE-123163

Date
31 August 2021

Contact
Tel 0330 303 0119

Dear Mr Granger,

Level 1 Capacity Check Enquiry: Former Nursery, Drovers Lane, Pulborough, West Sussex, RH20 2GN.

We have completed the capacity check for the above development site and the results are as follows:

Foul Water

The enquiry has been reassessed to determine the capacity available for 1.81 l/s at manhole reference TQ05197001.

There is currently adequate capacity in the local sewerage network to accommodate a foul flow of **1.81 l/s** for the above development at manhole reference TQ0519**7001**. Please note that no surface water flows (existing or proposed) can be accommodated within the existing foul sewerage system unless agreed by the Lead Local Flood Authority in consultation with Southern Water, after the hierarchy Part H3 of Building Regulations has been complied with.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: Developer Services Portal (southernwater.co.uk)

Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

from Southern Water

Adam Granger
RPS Consultancy Services
321 Bradford Street
Birmingham
West Midlands
B5 6ET

Your ref

Our ref
DS_CC_PPE-123163

Date
23 July 2021

Contact
Tel 0330 303 0119

Dear Mr Granger,

Level 1 Capacity Check Enquiry: Former Nursery, Drovers Lane, Pulborough, West Sussex, RH20 2GN.

We have completed the capacity check for the above development site and the results are as follows:

Foul Water

There is currently adequate capacity in the local sewerage network to accommodate a split foul flow of **1.81 l/s** for the above development at manhole reference TQ0519**7001** and TQ0519**5103**. Please note that no surface water flows (existing or proposed) can be accommodated within the existing foul sewerage system unless agreed by the Lead Local Flood Authority in consultation with Southern Water, after the hierarchy Part H3 of Building Regulations has been complied with.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: Developer Services Portal (southernwater.co.uk)

Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

APPENDIX D
PROPOSED DEVELOPMENT PLANS

CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:–

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Notes:

1. This drawing is to be read in conjunction with all relevant Architects and Engineers drawings and specifications.
2. Topographical Survey and Levels from NJC Survey Ltd, Drawing Number S1572 Dated 18th March 2019
3. Layout based on FINC Architects Drawing, dated .25.10.2024

Legend:

Planning Application Boundary

Future Phase 2 Heritage Planning Application Boundary

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P01	25.10.2024	Issued for PLANNING SUBMISSION	SH	GXA	RD

LDE
CIVILS | STRUCTURES | HYDROLOGY
an RSK company
Abbey Park
Humber Road
Coventry
CV3 4AQ
United Kingdom
Tel: +44 (0) 24 7650 5600
Fax: +44 (0) 24 7650 1417
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client
BARRATT DAVID WILSON (SOUTHERN COUNTIES)

Project Title
NEW PLACE FARM
PULBOROUGH
WEST SUSSEX

Status
PLANNING

Drawing Title
SITE LAYOUT

Drawn	Date	Checked	Date	Approved	Date
GXA	08.24	GXA	08.24	RD	08.24

Scale	Orig Size	Dimensions
1:1,000	A1	m

Project No. 890815

Drawing File 890815 - RSK-ZZ-XX-DR-C-8000 Site Layout.dwg

Drawing No.							Rev.
890815	RSK	ZZ	XX	DR	C	8000	P01
Project	Orig.	Vol./Sys.	Lev./Loc.	Type	Role	Draw. No.	

Scale
0 10 20 30 40 50m

File Location: Z:\P-LDE (PROJECTS)\890815 - NEW PLACE FARM, PULBOROUGH\GRAPHIN\FRASTRUCTURE\DRAWINGS\8 - PLANNING\890815 - RSK-ZZ-XX-DR-C-8000 SITE LAYOUT.DWG

APPENDIX E
ENVIRONMENT AGENCY CORRESPONDENCE

Response to your request

The Environment Agency's records indicate that the above site is located in Flood Zone 1 (land assessed as having less than 0.1% (1 in 1,000) chance of flooding in any given year from **rivers or the sea**). Therefore, the likelihood of flooding from rivers and sea in this area is estimated as 'very low'.

Proximity to Flood Zones 2 or 3

The above site is approximately 591 metres away from Flood Zone 3. We are therefore unable to provide data from our detailed fluvial or tidal models which is relevant to your site.

More information on Flood Zones can be found on the GOV.UK website:

http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-1-flood-zones/

Surface water flooding

Our mapping indicates that this site is within 80m of surface water flooding.

For information on flooding from all other sources, such as surface water, please contact the Lead Local Flood Authority, which in this case is West Sussex County Council. A link to their information available online is shown below:

https://www.westsussex.gov.uk/fire-emergencies-and-crime/dealing-with-extreme-weather/dealing-with-flooding/flood-risk-management/local-flood-risk-management-strategy/

Please note that the above is a link to an external website which the Environment Agency does not control or maintain. Therefore, the link may not be the most up-to-date at the date of this letter. If the link does not work, and you are unable to find the information about surface water flooding on the relevant website, please contact the authority named above directly.

customer service line 03708 506 506
gov.uk/environment-agency

Where you can find further information

- Detailed long-term flood information and maps can be found on the GOV.UK website:

  https://flood-warning-information.service.gov.uk/long-term-flood-risk/

- Flood maps for planning can be found on the GOV.UK website:

  https://flood-map-for-planning.service.gov.uk/

- Please be aware that in February 2016 the Environment Agency updated its guidance on climate change allowances. The standard allowance of adding 20% to peak flows – as per previous guidance in the National Planning Policy Framework, may not be applicable for the purposes of informing development proposals. It is possible that our current modelling has under estimated flood risk when taking climate change into consideration. This does not however have an effect on Flood Zones 2 or 3. For further information please visit:

  https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

- Further details about the Environment Agency information supplied can be found on the GOV.UK website:

  https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

- If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency information for Flood Risk Assessments:

  https://www.gov.uk/planning-applications-assessing-flood-risk

  https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

If you have any queries or would like to discuss the content of this letter further please call us on 03708 506 506, or reply to the email sent to you with this letter attached.

Please get in touch if you have any further queries or contact us within two (2) months if you would like us to review the information we have sent.

For information on what you can expect from us and our full service commitment to you, please click on this link:

https://www.gov.uk/government/publications/environment-agency-customer-service-commitment--2/environment-agency-customer-service-commitment

Yours sincerely,

Customers & Engagement Team, Environmental Planning and Engagement, Solent and South Downs Area
Environment Agency, Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD

SSDEnquiries@environment-agency.gov.uk

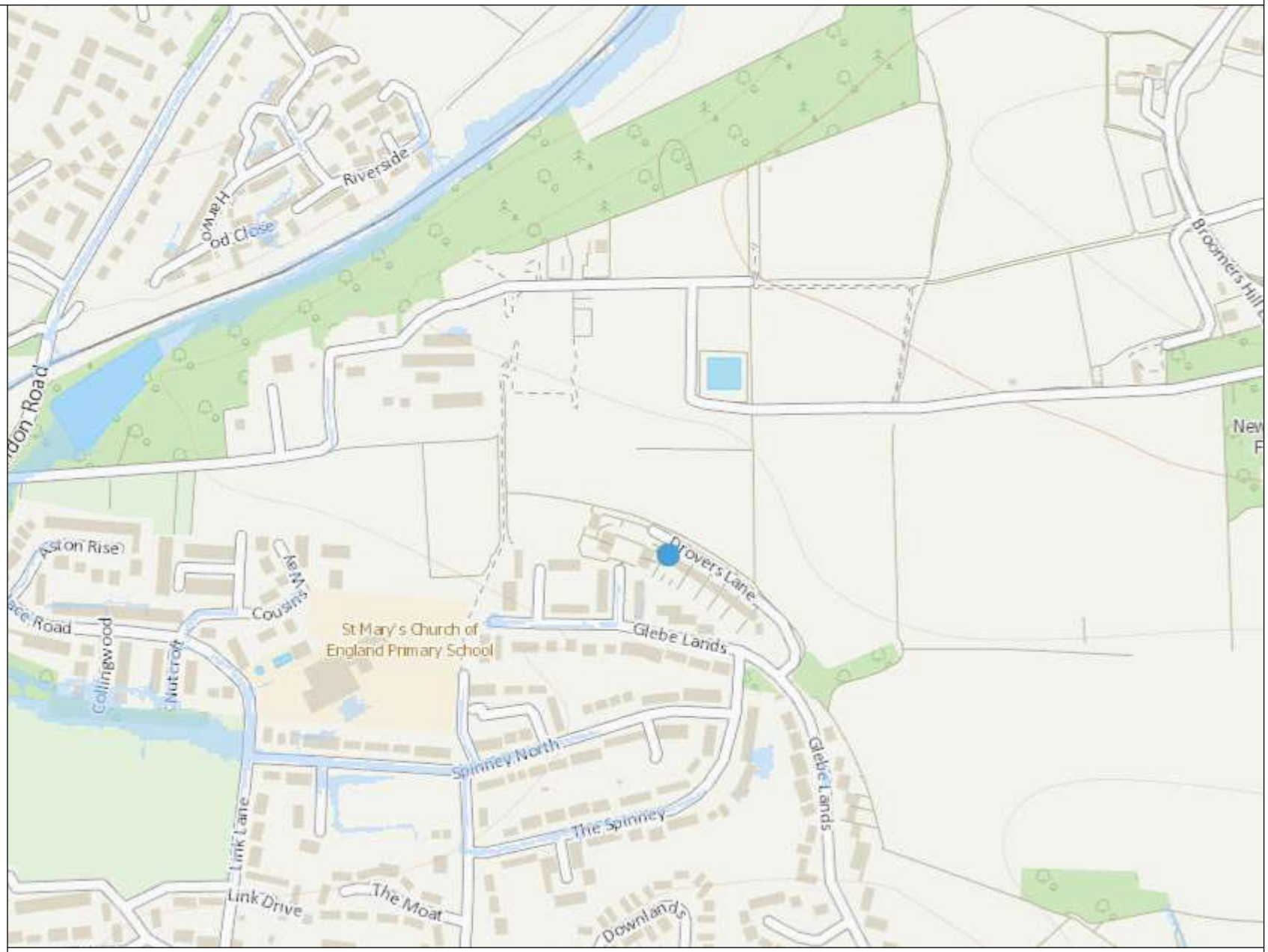
National Contact Call Centre 03708 506506

Risk of Flooding from Surface Water, Created 3/2/2021

Environment Agency

Legend

- Statutory Main Rivers
- Flood Extent 1 in 1000



1: 5,000

0 125

Metres

N W E S

APPENDIX F
LLFA CORRESPONDENCE

Further to my recent email. Below is a link to our current Surface Water Policy which should answer your questions re. requirements for surface water drainage and SuDS schemes and what climate change allowances you require etc.

https://www.westsussex.gov.uk/media/12230/ws_llfa_policy_for_management_of_surface_water.pdf

Regards,

Kevin Macknay
Flood Risk Management – Team Leader
Highways, Transport and Planning
Place Services
West Sussex County Council

CALL IM EMAIL
Location: Western Area Office, Drayton Lane, Nr. Chichester, West Sussex. PO20 2AJ.
Contact: Internal: 26429 | **External:** +44 (0)330 222 6429 | **Mobile:** +44 (0)7540 641819
E-mail: kevin.macknay@westsussex.gov.uk

Report a problem with a road or pavement or raise a highways related enquiry

Follow us at @WSHighways

APPENDIX G
GREENFIELD RUNOFF CALCULATIONS

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.470
Area (ha)	1.000	Urban	0.000
SAAR (mm)	852	Region Number	Region 7

Results	**l/s**
QBAR Rural	6.1
QBAR Urban	6.1
Q100 years	19.4
Q1 year	5.2
Q30 years	13.8
Q100 years	19.4

APPENDIX H
SURFACE WATER DRAINAGE CALCULATIONS

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.025	5.00	42.991	1350	505825.613	119255.110	1.591
1A	0.047	5.00	42.700	130	505804.052	119256.194	2.200
2	0.059	5.00	41.581	1350	505799.250	119235.196	2.581
12	0.039	5.00	40.370	1350	505785.575	119220.078	1.570
3	0.030	5.00	41.547	1800	505804.710	119229.618	2.947
13	0.063	5.00	43.990	1350	505876.291	119234.561	1.790
15	0.067	5.00	43.617	1350	505876.558	119204.843	1.517
14	0.012	5.00	43.775	1350	505875.982	119217.527	1.775
4	0.098	5.00	41.264	1800	505818.657	119203.617	2.839
5	0.124	5.00	40.648	1350	505818.002	119154.701	3.098
6	0.075	5.00	39.459	1350	505780.507	119159.437	2.059
7	0.000	5.00	38.500	1350	505781.749	119144.946	1.400
16	0.058	5.00	42.250	1350	505877.422	119138.534	1.650
22	0.014	5.00	41.742	1350	505877.271	119112.376	2.242
17	0.020	5.00	42.071	1350	505877.838	119124.761	2.746
17A	0.025	5.00	41.288	1350	505851.009	119126.571	2.322
18	0.036	5.00	40.361	1350	505819.921	119128.669	1.811
23	0.036	5.00	39.165	1350	505853.765	119069.256	1.765
24	0.070	5.00	38.700	1500	505811.982	119076.545	1.650
19	0.064	5.00	39.626	1500	505818.468	119100.257	2.766
20	0.007	5.00	39.500	1500	505804.182	119102.802	2.690
21	0.000	5.00	38.500	1350	505796.371	119112.124	1.735
8	0.000	5.00	38.500	1350	505784.316	119138.008	1.800
9	0.000	5.00	38.500	1350	505779.989	119135.463	1.810
10	0.000	5.00	38.500	1500	505771.972	119132.379	1.825
11	0.000		38.500	1350	505754.448	119137.347	1.900

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	33.039	0.600	Colebrook-White	41.400	39.000	2.400	13.8	225	5.17	50.0
8.000	1A	2	21.540	0.600	Colebrook-White	40.500	39.000	1.500	14.4	225	5.10	50.0
1.001	2	3	7.805	0.600	Colebrook-White	39.000	38.675	0.325	24.0	225	5.21	50.0
2.000	12	3	21.381	0.600	Colebrook-White	38.800	38.675	0.125	171.0	225	5.28	50.0
1.002	3	4	29.505	0.600	Colebrook-White	38.600	38.425	0.175	168.6	300	5.76	50.0
3.000	13	14	17.037	0.600	Colebrook-White	42.200	42.000	0.200	85.2	225	5.12	50.0
4.000	15	14	12.697	0.600	Colebrook-White	42.100	42.000	0.100	127.0	225	5.05	50.0

Flow (l/s)	Pro Velocity (m/s)
4.5	1.644
8.5	1.936
23.7	2.164
7.0	0.754
36.1	1.159
11.4	1.113
12.1	0.981

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.001	14	4	58.989	0.600	Colebrook-White	42.000	38.500	3.500	16.9	225	5.50	50.0
1.003	4	5	48.921	0.600	Colebrook-White	38.425	37.625	0.800	61.2	300	6.20	50.0
1.004	5	6	33.474	0.600	Colebrook-White	37.550	37.400	0.150	223.2	375	6.57	50.0
1.005	6	7	13.293	0.600	Colebrook-White	37.400	37.100	0.300	44.3	375	6.64	50.0
1.006	7	8	7.645	0.600	Colebrook-White	37.100	36.700	0.400	19.1	375	6.67	50.0
5.000	16	17	13.779	0.600	Colebrook-White	40.600	39.400	1.200	11.5	225	5.05	50.0
6.000	22	17	12.398	0.600	Colebrook-White	39.500	39.400	0.100	124.0	225	5.18	50.0
5.001	17	17A	58.049	0.600	Colebrook-White	39.325	38.966	0.359	161.7	300	5.85	50.0
5.001a	17A	18	31.159	0.600	Colebrook-White	38.966	38.550	0.416	74.9	300	6.14	50.0
5.002	18	19	28.449	0.600	Colebrook-White	38.550	36.860	1.690	16.8	300	5.97	50.0
7.000	23	24	44.295	0.600	Colebrook-White	37.400	37.050	0.350	126.6	300	5.45	50.0
7.001	24	20	24.631	0.600	Colebrook-White	37.050	36.935	0.115	214.2	300	5.78	50.0
5.003	19	20	14.511	0.600	Colebrook-White	36.860	36.810	0.050	290.2	375	6.09	50.0
5.004	20	21	12.162	0.600	Colebrook-White	36.810	36.765	0.045	270.3	375	6.19	50.0
5.005	21	8	28.554	0.600	Colebrook-White	36.765	36.700	0.065	439.3	375	6.42	50.0
1.007	8	9	5.020	0.600	Colebrook-White	36.700	36.690	0.010	502.0	525	6.71	50.0
1.008	9	10	8.590	0.600	Colebrook-White	36.690	36.675	0.015	572.7	525	6.78	50.0
1.009	10	11	18.215	0.600	Colebrook-White	36.675	36.600	0.075	242.9	525	6.93	49.5

Flow (l/s)	Pro Velocity (m/s)
25.7	2.518
79.5	2.067
101.9	1.326
115.5	2.554
115.5	3.490
10.5	2.227
2.5	0.632
16.6	0.955
21.1	1.353
27.6	2.505
6.5	0.799
19.2	0.898
39.2	0.956
59.6	1.093
59.6	0.905
175.1	1.101
175.1	1.040
173.3	1.470

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	33.039	13.8	225	Circular_Default Sewer Type	42.991	41.400	1.366	41.581	39.000	2.356
8.000	21.540	14.4	225	Circular_Default Sewer Type	42.700	40.500	1.975	41.581	39.000	2.356
1.001	7.805	24.0	225	Circular_Default Sewer Type	41.581	39.000	2.356	41.547	38.675	2.647
2.000	21.381	171.0	225	Circular_Default Sewer Type	40.370	38.800	1.345	41.547	38.675	2.647
1.002	29.505	168.6	300	Circular_Default Sewer Type	41.547	38.600	2.647	41.264	38.425	2.539
3.000	17.037	85.2	225	Circular_Default Sewer Type	43.990	42.200	1.565	43.775	42.000	1.550

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1350	Manhole	Adoptable	2	1350	Manhole	Adoptable
8.000	1A	130	Manhole	Adoptable	2	1350	Manhole	Adoptable
1.001	2	1350	Manhole	Adoptable	3	1800	Manhole	Adoptable
2.000	12	1350	Manhole	Adoptable	3	1800	Manhole	Adoptable
1.002	3	1800	Manhole	Adoptable	4	1800	Manhole	Adoptable
3.000	13	1350	Manhole	Adoptable	14	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.000	12.697	127.0	225	Circular_Default Sewer Type	43.617	42.100	1.292	43.775	42.000	1.550
3.001	58.989	16.9	225	Circular_Default Sewer Type	43.775	42.000	1.550	41.264	38.500	2.539
1.003	48.921	61.2	300	Circular_Default Sewer Type	41.264	38.425	2.539	40.648	37.625	2.723
1.004	33.474	223.2	375	Circular_Default Sewer Type	40.648	37.550	2.723	39.459	37.400	1.684
1.005	13.293	44.3	375	Circular_Default Sewer Type	39.459	37.400	1.684	38.500	37.100	1.025
1.006	7.645	19.1	375	Circular_Default Sewer Type	38.500	37.100	1.025	38.500	36.700	1.425
5.000	13.779	11.5	225	Circular_Default Sewer Type	42.250	40.600	1.425	42.071	39.400	2.446
6.000	12.398	124.0	225	Circular_Default Sewer Type	41.742	39.500	2.017	42.071	39.400	2.446
5.001	58.049	161.7	300	Circular_Default Sewer Type	42.071	39.325	2.446	41.288	38.966	2.022
5.001a	31.159	74.9	300	Circular_Default Sewer Type	41.288	38.966	2.022	40.361	38.550	1.511
5.002	28.449	16.8	300	Circular_Default Sewer Type	40.361	38.550	1.511	39.626	36.860	2.466
7.000	44.295	126.6	300	Circular_Default Sewer Type	39.165	37.400	1.465	38.700	37.050	1.350
7.001	24.631	214.2	300	Circular_Default Sewer Type	38.700	37.050	1.350	39.500	36.935	2.265
5.003	14.511	290.2	375	Circular_Default Sewer Type	39.626	36.860	2.391	39.500	36.810	2.315
5.004	12.162	270.3	375	Circular_Default Sewer Type	39.500	36.810	2.315	38.500	36.765	1.360
5.005	28.554	439.3	375	Circular_Default Sewer Type	38.500	36.765	1.360	38.500	36.700	1.425
1.007	5.020	502.0	525	Circular_Default Sewer Type	38.500	36.700	1.275	38.500	36.690	1.285
1.008	8.590	572.7	525	Circular_Default Sewer Type	38.500	36.690	1.285	38.500	36.675	1.300
1.009	18.215	242.9	525	Circular_Default Sewer Type	38.500	36.675	1.300	38.500	36.600	1.375

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	15	1350	Manhole	Adoptable	14	1350	Manhole	Adoptable
3.001	14	1350	Manhole	Adoptable	4	1800	Manhole	Adoptable
1.003	4	1800	Manhole	Adoptable	5	1350	Manhole	Adoptable
1.004	5	1350	Manhole	Adoptable	6	1350	Manhole	Adoptable
1.005	6	1350	Manhole	Adoptable	7	1350	Manhole	Adoptable
1.006	7	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable
5.000	16	1350	Manhole	Adoptable	17	1350	Manhole	Adoptable
6.000	22	1350	Manhole	Adoptable	17	1350	Manhole	Adoptable
5.001	17	1350	Manhole	Adoptable	17A	1350	Manhole	Adoptable
5.001a	17A	1350	Manhole	Adoptable	18	1350	Manhole	Adoptable
5.002	18	1350	Manhole	Adoptable	19	1500	Manhole	Adoptable
7.000	23	1350	Manhole	Adoptable	24	1500	Manhole	Adoptable
7.001	24	1500	Manhole	Adoptable	20	1500	Manhole	Adoptable
5.003	19	1500	Manhole	Adoptable	20	1500	Manhole	Adoptable
5.004	20	1500	Manhole	Adoptable	21	1350	Manhole	Adoptable
5.005	21	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable
1.007	8	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
1.008	9	1350	Manhole	Adoptable	10	1500	Manhole	Adoptable
1.009	10	1500	Manhole	Adoptable	11	1350	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-13	Drain Down Time (mins)	240	100 year (l/s)	19.4
Summer CV	1.000	Additional Storage (m³/ha)	20.0	Check Discharge Volume	✓
Winter CV	1.000	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	
Analysis Speed	Normal	2 year (l/s)	6.1		
Skip Steady State	✓	30 year (l/s)	13.8		

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.10	Betterment (%)	0
Greenfield Method	IH124	Region	1	QBar	0.4
Positively Drained Area (ha)	1.600	Growth Factor 2 year	0.90	Q 2 year (l/s)	0.4
SAAR (mm)	975	Growth Factor 30 year	1.95	Q 30 year (l/s)	0.8
Soil Index	1	Growth Factor 100 year	2.48	Q 100 year (l/s)	1.0

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.10	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI		Betterment (%)	0
Positively Drained Area (ha)	1.600	Return Period (years)	100	PR	
Soil Index	1	Climate Change (%)	0	Runoff Volume (m^3)	

Node 10 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	36.675	Product Number	CTL-SHE-0093-4900-1800-4900
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.9	Min Node Diameter (mm)	1200

Node 8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	36.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	112.0	0.0	1.000	716.0	0.0	1.600	1140.0	0.0
0.700	371.0	0.0	1.200	979.0	0.0	1.601	0.1	0.0

Node 24 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	37.050	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

Node 23 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	37.400	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

Node 12 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	38.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	96.0	0.0	0.500	96.0	0.0	0.501	0.1	0.0

Node 12 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	38.800	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

Node 1A Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	40.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.50	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	21.0	0.0	0.500	88.0	0.0	0.501	0.1	0.0

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.036	5.00	50.174	1350	505886.038	119373.294	1.425
24	0.052	5.00	49.687	1350	505844.920	119380.442	1.425
2	0.006	5.00	49.952	1350	505870.436	119376.667	1.852
25	0.020	5.00	47.612	1350	505875.099	119318.933	1.337
3	0.088	5.00	47.730	1350	505855.155	119325.079	1.755
26	0.017	5.00	47.466	1350	505763.582	119368.861	1.425
27	0.039	5.00	46.423	1350	505764.497	119345.180	1.698
28	0.049	5.00	46.256	1350	505778.097	119339.029	1.806
30	0.056	5.00	47.789	1350	505816.148	119355.399	1.589
29	0.042	5.00	47.214	1350	505815.146	119336.783	3.014
4	0.061	5.00	47.482	1350	505827.021	119332.912	3.482
5	0.093	5.00	46.555	1350	505822.726	119315.479	2.955
31	0.042	5.00	45.447	1350	505847.228	119283.170	1.444
6	0.046	5.00	44.834	1350	505816.686	119287.199	1.834
7	0.038	5.00	44.435	1350	505810.459	119282.801	1.679
8	0.070	5.00	43.022	1350	505773.872	119286.298	2.385
9	0.022	5.00	41.727	1350	505757.570	119270.538	1.775
10	0.053	5.00	41.192	1350	505736.217	119280.411	2.120
11	0.089	5.00	40.592	1350	505714.819	119286.929	1.970
12	0.029	5.00	38.622	1350	505702.517	119252.248	1.711
13	0.083	5.00	37.601	1500	505694.383	119225.207	1.575
50	0.075	5.00	37.223	1350	505729.877	119207.048	1.573
51	0.068	5.00	37.019	1350	505715.426	119212.491	1.444
14	0.010	5.00	37.373	1500	505700.000	119217.854	2.101
15	0.013	5.00	36.835	1500	505682.404	119208.746	1.650
16	0.000	5.00	35.700	1500	505672.875	119195.120	1.200
17	0.000	5.00	35.700	1500	505671.119	119190.998	1.500
18	0.000	5.00	35.700	1350	505664.303	119195.056	1.702
19	0.000	5.00	34.900	1350	505646.540	119203.986	1.300
32	0.048	5.00	46.086	1350	505748.391	119367.450	1.525
43	0.026	5.00	44.453	1350	505748.964	119328.755	1.425
33	0.013	5.00	45.043	1350	505748.754	119341.612	2.091
44	0.037	5.00	44.578	1350	505695.395	119358.976	1.425
45	0.021	5.00	43.913	1350	505695.799	119343.956	1.425
34	0.059	5.00	44.057	1350	505699.817	119339.813	1.782
35	0.064	5.00	43.508	1350	505693.764	119332.101	1.908
36	0.077	5.00	41.208	1350	505686.644	119294.375	1.582
46	0.052	5.00	46.067	1350	505667.004	119394.116	1.305
47	0.043	5.00	44.641	1350	505666.947	119368.176	1.641
48	0.085	5.00	42.664	1500	505663.423	119332.540	2.664
49	0.045	5.00	40.871	1350	505659.717	119299.067	1.229
37	0.005	5.00	40.871	1500	505667.569	119297.837	1.626
38	0.044	5.00	39.188	1500	505662.559	119259.433	1.788
39	0.007	5.00	36.561	1500	505653.159	119231.388	2.117
52	0.107	5.00	40.741	1350	505623.101	119303.234	1.398
53	0.024	5.00	40.443	1350	505609.510	119304.394	1.425
54	0.090	5.00	38.091	1350	505605.884	119267.762	1.867
55	0.016	5.00	39.450	1350	505549.977	119286.707	1.450
56	0.065	5.00	38.229	1350	505548.695	119261.442	1.625

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
57	0.000	5.00	37.372	1350	505547.535	119246.188	1.425
58	0.050	5.00	36.250	1350	505582.297	119238.823	1.225
40	0.118	5.00	36.756	1500	505602.996	119235.993	2.656
41	0.000	5.00	36.600	1500	505601.082	119229.870	3.100
42	0.000	5.00	34.800	1500	505599.686	119218.074	1.500
20	0.000		34.800	1500	505598.895	119212.371	1.650
21	0.000	5.00	34.800	1500	505585.207	119211.594	1.672
22	0.000		34.775	1500	505579.045	119205.905	1.665
23	0.000		34.600	1500	505577.244	119198.521	1.500

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	17.451	0.600	Colebrook-White	48.749	48.100	0.649	26.9	225	5.20	50.0
2.000	24	2	24.384	0.600	Colebrook-White	48.262	48.100	0.162	150.5	225	5.41	50.0
1.001	2	3	54.380	0.600	Colebrook-White	48.100	46.050	2.050	26.5	225	5.78	50.0
3.000	25	3	21.543	0.600	Colebrook-White	46.275	46.050	0.225	95.7	225	5.36	50.0
1.002	3	4	28.532	0.600	Colebrook-White	45.975	44.075	1.900	15.0	300	6.26	50.0
4.000	26	27	22.043	0.600	Colebrook-White	46.041	44.800	1.241	17.8	225	5.13	50.0
4.001	27	28	7.962	0.600	Colebrook-White	44.725	44.450	0.275	29.0	300	5.20	50.0
4.002	28	29	46.200	0.600	Colebrook-White	44.450	44.200	0.250	184.8	300	5.97	50.0
5.000	30	29	18.643	0.600	Colebrook-White	46.200	44.275	1.925	9.7	225	5.13	50.0
4.003	29	4	12.490	0.600	Colebrook-White	44.200	44.075	0.125	99.9	300	6.18	50.0
1.003	4	5	17.954	0.600	Colebrook-White	44.000	43.600	0.400	44.9	375	6.56	50.0
1.004	5	6	28.918	0.600	Colebrook-White	43.600	43.075	0.525	55.1	375	6.69	50.0
6.000	31	6	30.807	0.600	Colebrook-White	44.003	43.225	0.778	39.6	225	5.27	50.0
1.005	6	7	7.624	0.600	Colebrook-White	43.000	42.756	0.244	31.2	450	6.72	50.0
1.006	7	8	36.754	0.600	Colebrook-White	42.756	40.637	2.119	17.3	450	6.86	49.8
1.007	8	9	22.674	0.600	Colebrook-White	40.637	40.037	0.600	37.8	450	7.00	49.3
1.008	9	10	23.525	0.600	Colebrook-White	39.952	39.072	0.880	26.7	525	7.10	49.0
1.009	10	11	22.369	0.600	Colebrook-White	39.072	38.622	0.450	49.7	525	7.25	48.5
1.010	11	12	36.798	0.600	Colebrook-White	38.622	36.911	1.711	21.5	525	7.40	48.0
1.011	12	13	28.238	0.600	Colebrook-White	36.911	36.026	0.885	31.9	525	7.55	47.6

Flow (l/s)	Pro Velocity (m/s)
6.5	1.431
9.4	0.857
17.0	1.905
3.6	0.773
36.5	2.827
3.1	1.326
10.1	1.542
19.0	0.945
10.1	2.360
36.7	1.414
84.2	2.343
101.0	2.275
7.6	1.316
116.9	2.877
123.3	3.620
134.5	2.791
137.6	3.146
145.5	2.548
159.4	3.545
163.1	3.088

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.012	13	14	9.253	0.600	Colebrook-White	36.026	35.272	0.754	12.3	525	7.60	47.4
11.000	50	51	15.442	0.600	Colebrook-White	35.650	35.575	0.075	205.9	300	5.14	50.0
11.001	51	14	16.332	0.600	Colebrook-White	35.575	35.497	0.078	209.4	300	5.41	50.0
1.013	14	15	19.814	0.600	Colebrook-White	35.272	35.185	0.087	227.7	525	7.85	46.6
1.014	15	16	16.627	0.600	Colebrook-White	35.185	34.500	0.685	24.3	525	7.90	46.5
1.015	16	17	4.480	0.600	Colebrook-White	34.500	34.200	0.300	14.9	525	7.98	46.2
1.016	17	18	16.633	0.600	Colebrook-White	34.200	33.998	0.202	82.3	525	8.25	45.5
1.017	18	19	11.175	0.600	Colebrook-White	33.998	33.600	0.398	28.1	525	8.29	45.4
1.018	19	20	48.377	0.600	Colebrook-White	33.600	33.150	0.450	107.5	525	9.09	43.3
7.000	32	33	25.841	0.600	Colebrook-White	44.561	42.952	1.609	16.1	225	5.16	50.0
8.000	43	33	12.859	0.600	Colebrook-White	43.028	42.952	0.076	169.2	225	5.21	50.0
7.001	33	34	48.970	0.600	Colebrook-White	42.952	42.350	0.602	81.3	225	5.83	50.0
9.000	44	45	15.025	0.600	Colebrook-White	43.153	42.488	0.665	22.6	225	5.09	50.0
9.001	45	34	5.771	0.600	Colebrook-White	42.488	42.350	0.138	41.8	225	5.19	50.0
7.002	34	35	9.804	0.600	Colebrook-White	42.275	41.600	0.675	14.5	300	5.86	50.0
7.003	35	36	38.392	0.600	Colebrook-White	41.600	39.626	1.974	19.4	300	6.14	50.0
7.004	36	37	19.387	0.600	Colebrook-White	39.626	39.395	0.231	83.9	300	6.37	50.0
10.000	46	47	25.940	0.600	Colebrook-White	44.762	43.000	1.762	14.7	225	5.13	50.0
10.001	47	48	35.810	0.600	Colebrook-White	43.000	40.000	3.000	11.9	225	5.29	50.0
10.002	48	49	33.678	0.600	Colebrook-White	40.000	39.642	0.358	94.1	225	5.56	50.0
10.003	49	37	7.948	0.600	Colebrook-White	39.642	39.470	0.172	46.2	225	5.69	50.0
7.005	37	38	38.729	0.600	Colebrook-White	39.245	37.400	1.845	21.0	450	6.61	50.0
7.006	38	39	30.245	0.600	Colebrook-White	37.400	34.444	2.956	10.2	450	6.74	50.0
7.007	39	40	47.859	0.600	Colebrook-White	34.444	34.175	0.269	177.9	450	7.54	47.6
12.000	52	53	13.640	0.600	Colebrook-White	39.343	39.018	0.325	42.0	225	5.11	50.0
12.001	53	54	36.811	0.600	Colebrook-White	39.018	36.224	2.794	13.2	225	5.28	50.0
12.002	54	40	31.900	0.600	Colebrook-White	36.224	34.400	1.824	17.5	225	5.53	50.0
13.000	55	56	25.298	0.600	Colebrook-White	38.000	36.604	1.396	18.1	225	5.14	50.0

Flow (l/s)	Pro Velocity (m/s)
176.6	4.462
13.6	0.827
25.8	0.980
199.4	1.557
201.2	3.616
199.9	4.308
196.8	2.288
196.4	3.405
187.3	2.044
8.7	1.881
4.7	0.678
15.7	1.242
6.7	1.540
10.5	1.416
36.9	2.861
48.4	2.778
62.3	1.729
9.4	1.991
17.2	2.538
32.5	1.412
40.7	1.956
103.9	3.223
111.9	4.262
107.7	1.479
19.3	1.675
23.7	2.687
39.9	2.808
2.9	1.282

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
13.001	56	57	15.298	0.600	Colebrook-White	36.604	35.947	0.657	23.3	225	5.22	50.0
13.002	57	58	35.534	0.600	Colebrook-White	35.947	35.025	0.922	38.5	225	5.48	50.0
13.003	58	40	20.892	0.600	Colebrook-White	35.025	34.400	0.625	33.4	225	5.82	50.0
7.008	40	41	6.415	0.600	Colebrook-White	34.100	33.500	0.600	10.7	525	7.65	47.3
7.009	41	42	11.878	0.600	Colebrook-White	33.500	33.300	0.200	59.4	525	7.68	47.2
7.010	42	20	5.758	0.600	Colebrook-White	33.300	33.150	0.150	38.4	525	7.76	46.9
1.019	20	21	13.710	0.600	Colebrook-White	33.150	33.128	0.022	623.2	750	9.31	42.7
1.020	21	22	11.157	0.600	Colebrook-White	33.128	33.110	0.018	619.8	750	9.50	42.3
1.021	22	23	4.516	0.600	Colebrook-White	33.110	33.100	0.010	451.6	675	9.51	42.3

Flow (l/s)	Pro Velocity (m/s)
14.6	1.919
14.6	1.590
23.7	1.923
187.4	4.771
187.0	2.550
185.8	2.993
353.9	1.206
350.5	1.207
350.5	1.355

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	17.451	26.9	225	Circular_Default Sewer Type	50.174	48.749	1.200	49.952	48.100	1.627
2.000	24.384	150.5	225	Circular_Default Sewer Type	49.687	48.262	1.200	49.952	48.100	1.627
1.001	54.380	26.5	225	Circular_Default Sewer Type	49.952	48.100	1.627	47.730	46.050	1.455
3.000	21.543	95.7	225	Circular_Default Sewer Type	47.612	46.275	1.112	47.730	46.050	1.455
1.002	28.532	15.0	300	Circular_Default Sewer Type	47.730	45.975	1.455	47.482	44.075	3.107
4.000	22.043	17.8	225	Circular_Default Sewer Type	47.466	46.041	1.200	46.423	44.800	1.398
4.001	7.962	29.0	300	Circular_Default Sewer Type	46.423	44.725	1.398	46.256	44.450	1.506
4.002	46.200	184.8	300	Circular_Default Sewer Type	46.256	44.450	1.506	47.214	44.200	2.714
5.000	18.643	9.7	225	Circular_Default Sewer Type	47.789	46.200	1.364	47.214	44.275	2.714
4.003	12.490	99.9	300	Circular_Default Sewer Type	47.214	44.200	2.714	47.482	44.075	3.107
1.003	17.954	44.9	375	Circular_Default Sewer Type	47.482	44.000	3.107	46.555	43.600	2.580
1.004	28.918	55.1	375	Circular_Default Sewer Type	46.555	43.600	2.580	44.834	43.075	1.384
6.000	30.807	39.6	225	Circular_Default Sewer Type	45.447	44.003	1.219	44.834	43.225	1.384
1.005	7.624	31.2	450	Circular_Default Sewer Type	44.834	43.000	1.384	44.435	42.756	1.229
1.006	36.754	17.3	450	Circular_Default Sewer Type	44.435	42.756	1.229	43.022	40.637	1.935

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1350	Manhole	Adoptable	2	1350	Manhole	Adoptable
2.000	24	1350	Manhole	Adoptable	2	1350	Manhole	Adoptable
1.001	2	1350	Manhole	Adoptable	3	1350	Manhole	Adoptable
3.000	25	1350	Manhole	Adoptable	3	1350	Manhole	Adoptable
1.002	3	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable
4.000	26	1350	Manhole	Adoptable	27	1350	Manhole	Adoptable
4.001	27	1350	Manhole	Adoptable	28	1350	Manhole	Adoptable
4.002	28	1350	Manhole	Adoptable	29	1350	Manhole	Adoptable
5.000	30	1350	Manhole	Adoptable	29	1350	Manhole	Adoptable
4.003	29	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable
1.003	4	1350	Manhole	Adoptable	5	1350	Manhole	Adoptable
1.004	5	1350	Manhole	Adoptable	6	1350	Manhole	Adoptable
6.000	31	1350	Manhole	Adoptable	6	1350	Manhole	Adoptable
1.005	6	1350	Manhole	Adoptable	7	1350	Manhole	Adoptable
1.006	7	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	22.674	37.8	450	Circular_Default Sewer Type	43.022	40.637	1.935	41.727	40.037	1.240
1.008	23.525	26.7	525	Circular_Default Sewer Type	41.727	39.952	1.250	41.192	39.072	1.595
1.009	22.369	49.7	525	Circular_Default Sewer Type	41.192	39.072	1.595	40.592	38.622	1.445
1.010	36.798	21.5	525	Circular_Default Sewer Type	40.592	38.622	1.445	38.622	36.911	1.186
1.011	28.238	31.9	525	Circular_Default Sewer Type	38.622	36.911	1.186	37.601	36.026	1.050
1.012	9.253	12.3	525	Circular_Default Sewer Type	37.601	36.026	1.050	37.373	35.272	1.576
11.000	15.442	205.9	300	Circular_Default Sewer Type	37.223	35.650	1.273	37.019	35.575	1.144
11.001	16.332	209.4	300	Circular_Default Sewer Type	37.019	35.575	1.144	37.373	35.497	1.576
1.013	19.814	227.7	525	Circular_Default Sewer Type	37.373	35.272	1.576	36.835	35.185	1.125
1.014	16.627	24.3	525	Circular_Default Sewer Type	36.835	35.185	1.125	35.700	34.500	0.675
1.015	4.480	14.9	525	Circular_Default Sewer Type	35.700	34.500	0.675	35.700	34.200	0.975
1.016	16.633	82.3	525	Circular_Default Sewer Type	35.700	34.200	0.975	35.700	33.998	1.177
1.017	11.175	28.1	525	Circular_Default Sewer Type	35.700	33.998	1.177	34.900	33.600	0.775
1.018	48.377	107.5	525	Circular_Default Sewer Type	34.900	33.600	0.775	34.800	33.150	1.125
7.000	25.841	16.1	225	Circular_Default Sewer Type	46.086	44.561	1.300	45.043	42.952	1.866
8.000	12.859	169.2	225	Circular_Default Sewer Type	44.453	43.028	1.200	45.043	42.952	1.866
7.001	48.970	81.3	225	Circular_Default Sewer Type	45.043	42.952	1.866	44.057	42.350	1.482
9.000	15.025	22.6	225	Circular_Default Sewer Type	44.578	43.153	1.200	43.913	42.488	1.200
9.001	5.771	41.8	225	Circular_Default Sewer Type	43.913	42.488	1.200	44.057	42.350	1.482
7.002	9.804	14.5	300	Circular_Default Sewer Type	44.057	42.275	1.482	43.508	41.600	1.608
7.003	38.392	19.4	300	Circular_Default Sewer Type	43.508	41.600	1.608	41.208	39.626	1.282
7.004	19.387	83.9	300	Circular_Default Sewer Type	41.208	39.626	1.282	40.871	39.395	1.176
10.000	25.940	14.7	225	Circular_Default Sewer Type	46.067	44.762	1.080	44.641	43.000	1.416
10.001	35.810	11.9	225	Circular_Default Sewer Type	44.641	43.000	1.416	42.664	40.000	2.439
10.002	33.678	94.1	225	Circular_Default Sewer Type	42.664	40.000	2.439	40.871	39.642	1.004
10.003	7.948	46.2	225	Circular_Default Sewer Type	40.871	39.642	1.004	40.871	39.470	1.176
7.005	38.729	21.0	450	Circular_Default Sewer Type	40.871	39.245	1.176	39.188	37.400	1.338
7.006	30.245	10.2	450	Circular_Default Sewer Type	39.188	37.400	1.338	36.561	34.444	1.667

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	8	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable
1.008	9	1350	Manhole	Adoptable	10	1350	Manhole	Adoptable
1.009	10	1350	Manhole	Adoptable	11	1350	Manhole	Adoptable
1.010	11	1350	Manhole	Adoptable	12	1350	Manhole	Adoptable
1.011	12	1350	Manhole	Adoptable	13	1500	Manhole	Adoptable
1.012	13	1500	Manhole	Adoptable	14	1500	Manhole	Adoptable
11.000	50	1350	Manhole	Adoptable	51	1350	Manhole	Adoptable
11.001	51	1350	Manhole	Adoptable	14	1500	Manhole	Adoptable
1.013	14	1500	Manhole	Adoptable	15	1500	Manhole	Adoptable
1.014	15	1500	Manhole	Adoptable	16	1500	Manhole	Adoptable
1.015	16	1500	Manhole	Adoptable	17	1500	Manhole	Adoptable
1.016	17	1500	Manhole	Adoptable	18	1350	Manhole	Adoptable
1.017	18	1350	Manhole	Adoptable	19	1350	Manhole	Adoptable
1.018	19	1350	Manhole	Adoptable	20	1500	Manhole	Adoptable
7.000	32	1350	Manhole	Adoptable	33	1350	Manhole	Adoptable
8.000	43	1350	Manhole	Adoptable	33	1350	Manhole	Adoptable
7.001	33	1350	Manhole	Adoptable	34	1350	Manhole	Adoptable
9.000	44	1350	Manhole	Adoptable	45	1350	Manhole	Adoptable
9.001	45	1350	Manhole	Adoptable	34	1350	Manhole	Adoptable
7.002	34	1350	Manhole	Adoptable	35	1350	Manhole	Adoptable
7.003	35	1350	Manhole	Adoptable	36	1350	Manhole	Adoptable
7.004	36	1350	Manhole	Adoptable	37	1500	Manhole	Adoptable
10.000	46	1350	Manhole	Adoptable	47	1350	Manhole	Adoptable
10.001	47	1350	Manhole	Adoptable	48	1500	Manhole	Adoptable
10.002	48	1500	Manhole	Adoptable	49	1350	Manhole	Adoptable
10.003	49	1350	Manhole	Adoptable	37	1500	Manhole	Adoptable
7.005	37	1500	Manhole	Adoptable	38	1500	Manhole	Adoptable
7.006	38	1500	Manhole	Adoptable	39	1500	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
7.007	47.859	177.9	450	Circular_Default Sewer Type	36.561	34.444	1.667	36.756	34.175	2.131
12.000	13.640	42.0	225	Circular_Default Sewer Type	40.741	39.343	1.173	40.443	39.018	1.200
12.001	36.811	13.2	225	Circular_Default Sewer Type	40.443	39.018	1.200	38.091	36.224	1.642
12.002	31.900	17.5	225	Circular_Default Sewer Type	38.091	36.224	1.642	36.756	34.400	2.131
13.000	25.298	18.1	225	Circular_Default Sewer Type	39.450	38.000	1.225	38.229	36.604	1.400
13.001	15.298	23.3	225	Circular_Default Sewer Type	38.229	36.604	1.400	37.372	35.947	1.200
13.002	35.534	38.5	225	Circular_Default Sewer Type	37.372	35.947	1.200	36.250	35.025	1.000
13.003	20.892	33.4	225	Circular_Default Sewer Type	36.250	35.025	1.000	36.756	34.400	2.131
7.008	6.415	10.7	525	Circular_Default Sewer Type	36.756	34.100	2.131	36.600	33.500	2.575
7.009	11.878	59.4	525	Circular_Default Sewer Type	36.600	33.500	2.575	34.800	33.300	0.975
7.010	5.758	38.4	525	Circular_Default Sewer Type	34.800	33.300	0.975	34.800	33.150	1.125
1.019	13.710	623.2	750	Circular_Default Sewer Type	34.800	33.150	0.900	34.800	33.128	0.922
1.020	11.157	619.8	750	Circular_Default Sewer Type	34.800	33.128	0.922	34.775	33.110	0.915
1.021	4.516	451.6	675	Circular_Default Sewer Type	34.775	33.110	0.990	34.600	33.100	0.825

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
7.007	39	1500	Manhole	Adoptable	40	1500	Manhole	Adoptable
12.000	52	1350	Manhole	Adoptable	53	1350	Manhole	Adoptable
12.001	53	1350	Manhole	Adoptable	54	1350	Manhole	Adoptable
12.002	54	1350	Manhole	Adoptable	40	1500	Manhole	Adoptable
13.000	55	1350	Manhole	Adoptable	56	1350	Manhole	Adoptable
13.001	56	1350	Manhole	Adoptable	57	1350	Manhole	Adoptable
13.002	57	1350	Manhole	Adoptable	58	1350	Manhole	Adoptable
13.003	58	1350	Manhole	Adoptable	40	1500	Manhole	Adoptable
7.008	40	1500	Manhole	Adoptable	41	1500	Manhole	Adoptable
7.009	41	1500	Manhole	Adoptable	42	1500	Manhole	Adoptable
7.010	42	1500	Manhole	Adoptable	20	1500	Manhole	Adoptable
1.019	20	1500	Manhole	Adoptable	21	1500	Manhole	Adoptable
1.020	21	1500	Manhole	Adoptable	22	1500	Manhole	Adoptable
1.021	22	1500	Manhole	Adoptable	23	1500	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-13	Drain Down Time (mins)	240	100 year (l/s)	19.4
Summer CV	1.000	Additional Storage (m³/ha)	20.0	Check Discharge Volume	✓
Winter CV	1.000	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	
Analysis Speed	Normal	2 year (l/s)	6.1		
Skip Steady State	✓	30 year (l/s)	13.8		

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.10	Betterment (%)	0
Greenfield Method	IH124	Region	1	QBar	2.0
Positively Drained Area (ha)	8.000	Growth Factor 2 year	0.90	Q 2 year (l/s)	1.8
SAAR (mm)	999	Growth Factor 30 year	1.95	Q 30 year (l/s)	4.0
Soil Index	1	Growth Factor 100 year	2.48	Q 100 year (l/s)	5.1

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.10	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI		Betterment (%)	0
Positively Drained Area (ha)	8.000	Return Period (years)	100	PR	
Soil Index	1	Climate Change (%)	0	Runoff Volume (m^3)	

Node 22 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	33.110	Product Number	CTL-SHE-0154-1250-1500-1250
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	12.5	Min Node Diameter (mm)	1500

Node 20 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	33.150
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	198.0	0.0	1.150	1354.0	0.0	1.650	2187.0	0.0
0.150	758.0	0.0	1.250	1783.0	0.0	1.651	0.1	0.0

Node 17 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	34.200
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	240.0	0.0	1.100	718.0	0.0	1.501	0.1	0.0
1.000	340.0	0.0	1.500	1059.0	0.0			

Node 50 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	35.650	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	8	Depth (m)	0.500
Safety Factor	2.0	Width (m)	6.000	Inf Depth (m)	
Porosity	0.30	Length (m)	15.000		

Node 51 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	35.575	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	8	Depth (m)	0.500
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	40.000		

Node 13 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	36.026	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	5	Depth (m)	0.500
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	15.000		

Node 52 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	39.343	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.500
Safety Factor	2.0	Width (m)	8.000	Inf Depth (m)	
Porosity	0.30	Length (m)	25.000		

Node 39 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	34.444
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	7

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	20.0	0.0	0.400	20.0	0.0	0.401	0.1	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	116.144	32.865	30 year 360 minute summer	36.346	9.353
2 year 15 minute winter	81.505	32.865	30 year 360 minute winter	23.626	9.353
2 year 30 minute summer	76.046	21.518	30 year 480 minute summer	28.382	7.500
2 year 30 minute winter	53.366	21.518	30 year 480 minute winter	18.856	7.500
2 year 60 minute summer	51.462	13.600	30 year 600 minute summer	23.086	6.315
2 year 60 minute winter	34.190	13.600	30 year 600 minute winter	15.774	6.315
2 year 120 minute summer	35.529	9.389	30 year 720 minute summer	20.462	5.484
2 year 120 minute winter	23.604	9.389	30 year 720 minute winter	13.752	5.484
2 year 180 minute summer	28.732	7.394	30 year 960 minute summer	16.671	4.390
2 year 180 minute winter	18.677	7.394	30 year 960 minute winter	11.043	4.390
2 year 240 minute summer	23.420	6.189	30 year 1440 minute summer	11.951	3.203
2 year 240 minute winter	15.560	6.189	30 year 1440 minute winter	8.032	3.203
2 year 360 minute summer	18.509	4.763	30 year 2160 minute summer	8.505	2.351
2 year 360 minute winter	12.031	4.763	30 year 2160 minute winter	5.860	2.351
2 year 480 minute summer	14.851	3.925	30 year 2880 minute summer	7.078	1.897
2 year 480 minute winter	9.867	3.925	30 year 2880 minute winter	4.757	1.897
2 year 600 minute summer	12.301	3.365	30 year 4320 minute summer	5.406	1.413
2 year 600 minute winter	8.405	3.365	30 year 4320 minute winter	3.560	1.413
2 year 720 minute summer	11.046	2.960	30 year 5760 minute summer	4.524	1.158
2 year 720 minute winter	7.423	2.960	30 year 5760 minute winter	2.928	1.158
2 year 960 minute summer	9.150	2.409	30 year 7200 minute summer	3.924	1.001
2 year 960 minute winter	6.061	2.409	30 year 7200 minute winter	2.533	1.001
2 year 1440 minute summer	6.695	1.794	30 year 8640 minute summer	3.508	0.895
2 year 1440 minute winter	4.500	1.794	30 year 8640 minute winter	2.264	0.895
2 year 2160 minute summer	4.844	1.339	30 year 10080 minute summer	3.211	0.819
2 year 2160 minute winter	3.338	1.339	30 year 10080 minute winter	2.072	0.819
2 year 2880 minute summer	4.081	1.094	100 year +45% CC 15 minute summer	546.775	154.718
2 year 2880 minute winter	2.743	1.094	100 year +45% CC 15 minute winter	383.702	154.718
2 year 4320 minute summer	3.193	0.835	100 year +45% CC 30 minute summer	366.816	103.796
2 year 4320 minute winter	2.103	0.835	100 year +45% CC 30 minute winter	257.415	103.796
2 year 5760 minute summer	2.728	0.698	100 year +45% CC 60 minute summer	251.917	66.574
2 year 5760 minute winter	1.766	0.698	100 year +45% CC 60 minute winter	167.367	66.574
2 year 7200 minute summer	2.412	0.615	100 year +45% CC 120 minute summer	147.617	39.011
2 year 7200 minute winter	1.557	0.615	100 year +45% CC 120 minute winter	98.073	39.011
2 year 8640 minute summer	2.193	0.559	100 year +45% CC 180 minute summer	110.822	28.518
2 year 8640 minute winter	1.415	0.559	100 year +45% CC 180 minute winter	72.037	28.518
2 year 10080 minute summer	2.037	0.520	100 year +45% CC 240 minute summer	86.398	22.833
2 year 10080 minute winter	1.315	0.520	100 year +45% CC 240 minute winter	57.401	22.833
30 year 15 minute summer	298.112	84.355	100 year +45% CC 360 minute summer	64.865	16.692
30 year 15 minute winter	209.201	84.355	100 year +45% CC 360 minute winter	42.164	16.692
30 year 30 minute summer	198.287	56.108	100 year +45% CC 480 minute summer	50.544	13.357
30 year 30 minute winter	139.149	56.108	100 year +45% CC 480 minute winter	33.580	13.357
30 year 60 minute summer	135.115	35.707	100 year +45% CC 600 minute summer	41.086	11.238
30 year 60 minute winter	89.767	35.707	100 year +45% CC 600 minute winter	28.073	11.238
30 year 120 minute summer	80.945	21.391	100 year +45% CC 720 minute summer	36.419	9.761
30 year 120 minute winter	53.778	21.391	100 year +45% CC 720 minute winter	24.476	9.761
30 year 180 minute summer	61.384	15.796	100 year +45% CC 960 minute summer	29.709	7.823
30 year 180 minute winter	39.901	15.796	100 year +45% CC 960 minute winter	19.680	7.823
30 year 240 minute summer	48.131	12.720	100 year +45% CC 1440 minute summer	21.359	5.724
30 year 240 minute winter	31.977	12.720	100 year +45% CC 1440 minute winter	14.354	5.724

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 2160 minute summer	15.208	4.203	100 year +45% CC 5760 minute winter	5.114	2.023
100 year +45% CC 2160 minute winter	10.479	4.203	100 year +45% CC 7200 minute summer	6.777	1.729
100 year +45% CC 2880 minute summer	12.625	3.384	100 year +45% CC 7200 minute winter	4.374	1.729
100 year +45% CC 2880 minute winter	8.485	3.384	100 year +45% CC 8640 minute summer	5.997	1.530
100 year +45% CC 4320 minute summer	9.543	2.495	100 year +45% CC 8640 minute winter	3.870	1.530
100 year +45% CC 4320 minute winter	6.285	2.495	100 year +45% CC 10080 minute summer	5.437	1.387
100 year +45% CC 5760 minute summer	7.901	2.023	100 year +45% CC 10080 minute winter	3.509	1.387

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	48.788	0.039	6.8	0.0763	0.0000	OK
15 minute summer	24	10	48.338	0.076	9.9	0.1653	0.0000	OK
15 minute summer	2	11	48.164	0.064	17.6	0.0953	0.0000	OK
15 minute summer	25	10	46.316	0.041	3.8	0.0706	0.0000	OK
15 minute summer	3	11	46.050	0.075	37.2	0.1817	0.0000	OK
15 minute summer	26	10	46.066	0.025	3.2	0.0419	0.0000	OK
15 minute summer	27	10	44.771	0.046	10.6	0.0864	0.0000	OK
15 minute summer	28	11	44.549	0.099	19.8	0.1945	0.0000	OK
15 minute summer	30	10	46.238	0.038	10.6	0.0814	0.0000	OK
15 minute summer	29	11	44.331	0.131	37.8	0.2240	0.0000	OK
15 minute summer	4	11	44.147	0.147	85.7	0.2612	0.0000	OK
15 minute summer	5	11	43.771	0.171	102.7	0.3527	0.0000	OK
15 minute summer	31	10	44.050	0.047	8.0	0.0954	0.0000	OK
15 minute summer	6	11	43.169	0.169	119.3	0.3267	0.0000	OK
15 minute summer	7	11	42.877	0.121	126.3	0.2276	0.0000	OK
15 minute summer	8	11	40.808	0.171	139.1	0.3458	0.0000	OK
15 minute summer	9	11	40.092	0.140	143.2	0.2359	0.0000	OK
15 minute summer	10	11	39.258	0.186	152.8	0.3591	0.0000	OK
15 minute summer	11	11	38.764	0.142	168.6	0.3312	0.0000	OK
15 minute summer	12	11	37.085	0.174	173.5	0.3084	0.0000	OK
15 minute summer	13	11	36.164	0.138	187.7	1.2515	0.0000	OK
15 minute summer	50	11	35.736	0.086	14.2	0.8797	0.0000	OK
15 minute summer	51	12	35.697	0.122	25.7	1.4088	0.0000	OK
15 minute summer	14	11	35.578	0.306	211.3	0.5699	0.0000	OK
15 minute summer	15	12	35.367	0.182	213.0	0.3497	0.0000	OK
15 minute summer	16	11	34.707	0.207	214.0	0.3649	0.0000	OK
30 minute summer	17	22	34.402	0.202	196.8	50.9273	0.0000	OK
30 minute summer	18	22	34.151	0.153	137.6	0.2185	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	2	6.7	1.026	0.067	0.1202
15 minute summer	24	2.000	2	9.8	0.935	0.231	0.2549
15 minute summer	2	1.001	3	17.4	1.906	0.172	0.4967
15 minute summer	25	3.000	3	3.7	0.766	0.069	0.1037
15 minute summer	3	1.002	4	37.2	2.785	0.129	0.3809
15 minute summer	26	4.000	27	3.2	1.327	0.026	0.0526
15 minute summer	27	4.001	28	10.5	0.818	0.051	0.1066
15 minute summer	28	4.002	29	19.4	0.787	0.238	1.1472
15 minute summer	30	5.000	29	10.5	2.130	0.063	0.1119
15 minute summer	29	4.003	4	37.6	1.353	0.338	0.3467
15 minute summer	4	1.003	5	85.9	1.935	0.287	0.7975
15 minute summer	5	1.004	6	103.2	2.216	0.382	1.3479
15 minute summer	31	6.000	6	7.8	1.307	0.094	0.1844
15 minute summer	6	1.005	7	119.4	2.710	0.206	0.3376
15 minute summer	7	1.006	8	126.4	2.837	0.162	1.6465
15 minute summer	8	1.007	9	139.2	2.681	0.264	1.1777
15 minute summer	9	1.008	10	143.2	2.506	0.152	1.3496
15 minute summer	10	1.009	11	152.5	2.654	0.221	1.2905
15 minute summer	11	1.010	12	168.3	3.079	0.160	2.0154
15 minute summer	12	1.011	13	172.7	3.219	0.201	1.5193
15 minute summer	13	1.012	14	186.1	2.146	0.134	0.8128
15 minute summer	50	11.000	51	13.4	0.623	0.173	0.3330
15 minute summer	51	11.001	14	24.1	0.938	0.315	0.4197
15 minute summer	14	1.013	15	211.1	2.159	0.659	1.9437
15 minute summer	15	1.014	16	214.0	3.008	0.217	1.2002
15 minute summer	16	1.015	17	215.2	3.810	0.171	0.2987
30 minute summer	17	1.016	18	137.6	2.145	0.257	1.0701
30 minute summer	18	1.017	19	137.5	2.141	0.150	0.7212

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	19	22	33.803	0.203	137.5	0.2905	0.0000	OK
15 minute summer	32	10	44.601	0.040	9.1	0.0825	0.0000	OK
15 minute summer	43	10	43.081	0.053	4.9	0.0944	0.0000	OK
15 minute summer	33	11	43.034	0.082	16.4	0.1277	0.0000	OK
15 minute summer	44	10	43.191	0.038	7.0	0.0747	0.0000	OK
15 minute summer	45	10	42.549	0.061	11.0	0.1055	0.0000	OK
15 minute summer	34	11	42.350	0.075	37.3	0.1579	0.0000	OK
15 minute summer	35	11	41.689	0.089	49.1	0.1870	0.0000	OK
15 minute summer	36	11	39.793	0.167	63.2	0.4021	0.0000	OK
15 minute summer	46	10	44.803	0.041	9.9	0.0909	0.0000	OK
15 minute summer	47	10	43.052	0.052	18.0	0.1016	0.0000	OK
15 minute summer	48	10	40.133	0.133	33.9	0.3199	0.0000	OK
15 minute summer	49	11	39.779	0.137	41.6	0.2968	0.0000	OK
15 minute summer	37	11	39.370	0.125	106.2	0.2284	0.0000	OK
15 minute summer	38	11	37.501	0.101	114.3	0.2271	0.0000	OK
15 minute summer	39	12	34.667	0.223	115.6	4.8622	0.0000	OK
15 minute summer	52	11	39.425	0.082	20.3	1.0576	0.0000	OK
15 minute summer	53	11	39.080	0.062	23.7	0.1088	0.0000	OK
15 minute summer	54	11	36.314	0.090	40.0	0.2167	0.0000	OK
15 minute summer	55	10	38.024	0.024	3.0	0.0400	0.0000	OK
15 minute summer	56	10	36.662	0.058	15.3	0.1290	0.0000	OK
15 minute summer	57	10	36.011	0.064	15.2	0.0917	0.0000	OK
15 minute summer	58	11	35.108	0.083	24.5	0.1865	0.0000	OK
15 minute summer	40	11	34.246	0.146	189.8	0.3882	0.0000	OK
15 minute summer	41	11	33.738	0.238	189.4	0.4209	0.0000	OK
480 minute summer	42	384	33.702	0.402	51.8	0.7103	0.0000	OK
480 minute summer	20	392	33.700	0.550	132.7	423.3720	0.0000	OK
480 minute summer	21	392	33.700	0.572	15.5	1.0105	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	19	1.018	20	137.2	1.894	0.294	3.8387
15 minute summer	32	7.000	33	9.0	1.122	0.069	0.2293
15 minute summer	43	8.000	33	4.8	0.509	0.121	0.1288
15 minute summer	33	7.001	34	16.0	1.238	0.277	0.6320
15 minute summer	44	9.000	45	7.0	1.072	0.063	0.0989
15 minute summer	45	9.001	34	10.8	1.331	0.134	0.0470
15 minute summer	34	7.002	35	37.4	2.392	0.128	0.1535
15 minute summer	35	7.003	36	49.1	1.725	0.194	1.1097
15 minute summer	36	7.004	37	63.4	1.664	0.523	0.7390
15 minute summer	46	10.000	47	9.8	1.669	0.072	0.1533
15 minute summer	47	10.001	48	17.8	1.161	0.118	0.5613
15 minute summer	48	10.002	49	33.4	1.346	0.624	0.8371
15 minute summer	49	10.003	37	41.8	1.805	0.545	0.1841
15 minute summer	37	7.005	38	106.3	3.430	0.150	1.2039
15 minute summer	38	7.006	39	114.3	2.712	0.113	1.5639
15 minute summer	39	7.007	40	111.2	1.476	0.460	3.6062
15 minute summer	52	12.000	53	19.4	1.783	0.241	0.1491
15 minute summer	53	12.001	54	23.7	2.014	0.165	0.4360
15 minute summer	54	12.002	40	40.1	2.758	0.321	0.4645
15 minute summer	55	13.000	56	3.0	0.604	0.024	0.1307
15 minute summer	56	13.001	57	15.2	1.750	0.140	0.1326
15 minute summer	57	13.002	58	15.0	1.337	0.178	0.4007
15 minute summer	58	13.003	40	24.2	1.884	0.269	0.2689
15 minute summer	40	7.008	41	189.4	2.670	0.127	0.4626
15 minute summer	41	7.009	42	189.4	2.026	0.301	1.1566
480 minute summer	42	7.010	20	85.4	1.386	0.109	1.1328
480 minute summer	20	1.019	21	15.5	0.267	0.032	4.8412
480 minute summer	21	1.020	22	13.6	0.182	0.028	4.0822

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	22	392	33.700	0.590	13.6	1.0422	0.0000	OK
15 minute summer	23	1	33.100	0.000	12.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
480 minute summer	22	Hydro-Brake®	23	12.5			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	48.812	0.063	17.5	0.1221	0.0000	OK
15 minute summer	24	10	48.392	0.130	25.3	0.2820	0.0000	OK
15 minute summer	2	11	48.207	0.107	45.3	0.1597	0.0000	OK
15 minute summer	25	10	46.341	0.066	9.7	0.1151	0.0000	OK
15 minute summer	3	10	46.093	0.118	96.5	0.2879	0.0000	OK
15 minute summer	26	10	46.081	0.040	8.3	0.0667	0.0000	OK
15 minute summer	27	10	44.801	0.076	27.2	0.1444	0.0000	OK
15 minute summer	28	10	44.617	0.167	51.0	0.3306	0.0000	OK
15 minute summer	30	10	46.261	0.061	27.3	0.1302	0.0000	OK
15 minute summer	29	11	44.452	0.252	97.6	0.4303	0.0000	OK
15 minute summer	4	11	44.298	0.298	220.0	0.5311	0.0000	OK
15 minute summer	5	11	43.976	0.376	263.2	0.7755	0.0000	SURCHARGED
15 minute summer	31	10	44.080	0.077	20.4	0.1559	0.0000	OK
15 minute summer	6	11	43.307	0.307	299.0	0.5930	0.0000	OK
15 minute summer	7	11	42.953	0.197	318.2	0.3715	0.0000	OK
15 minute summer	8	11	40.952	0.315	351.6	0.6348	0.0000	OK
15 minute summer	9	11	40.198	0.246	363.9	0.4123	0.0000	OK
15 minute summer	10	11	39.402	0.330	389.0	0.6374	0.0000	OK
15 minute summer	11	11	38.865	0.243	430.8	0.5676	0.0000	OK
15 minute summer	12	11	37.211	0.300	444.5	0.5310	0.0000	OK
15 minute summer	13	11	36.316	0.290	482.8	4.5327	0.0000	OK
15 minute summer	50	12	35.915	0.265	44.4	5.7586	0.0000	OK
15 minute summer	51	13	35.908	0.333	60.9	9.1162	0.0000	SURCHARGED
15 minute summer	14	12	35.872	0.600	480.2	1.1170	0.0000	SURCHARGED
15 minute summer	15	12	35.495	0.310	482.6	0.5962	0.0000	OK
15 minute winter	16	6	34.971	0.471	466.5	0.8326	0.0000	OK
30 minute summer	17	22	34.591	0.391	464.2	102.1647	0.0000	OK
30 minute summer	18	22	34.313	0.315	386.3	0.4503	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	2	17.4	1.300	0.173	0.2402
15 minute summer	24	2.000	2	25.0	1.183	0.592	0.5157
15 minute summer	2	1.001	3	44.8	2.454	0.441	0.9917
15 minute summer	25	3.000	3	9.5	1.000	0.179	0.2056
15 minute summer	3	1.002	4	96.1	2.766	0.333	1.1673
15 minute summer	26	4.000	27	8.2	1.756	0.066	0.1031
15 minute summer	27	4.001	28	27.1	1.011	0.131	0.2171
15 minute summer	28	4.002	29	50.0	0.966	0.614	2.3866
15 minute summer	30	5.000	29	27.2	2.142	0.162	0.3902
15 minute summer	29	4.003	4	96.3	1.646	0.866	0.7448
15 minute summer	4	1.003	5	220.0	2.192	0.735	1.8329
15 minute summer	5	1.004	6	259.6	2.593	0.961	2.8984
15 minute summer	31	6.000	6	20.4	1.651	0.246	0.3812
15 minute summer	6	1.005	7	300.6	3.293	0.518	0.6934
15 minute summer	7	1.006	8	319.1	3.436	0.410	3.4022
15 minute summer	8	1.007	9	353.7	3.283	0.671	2.4394
15 minute summer	9	1.008	10	364.4	3.008	0.387	2.8461
15 minute summer	10	1.009	11	389.5	3.232	0.565	2.6918
15 minute summer	11	1.010	12	431.0	3.826	0.411	4.1440
15 minute summer	12	1.011	13	444.3	3.599	0.516	3.5237
15 minute summer	13	1.012	14	475.6	2.493	0.342	1.5643
15 minute summer	50	11.000	51	35.2	0.704	0.456	1.0517
15 minute summer	51	11.001	14	81.4	1.270	1.063	1.1501
15 minute summer	14	1.013	15	477.6	2.536	1.491	3.4530
15 minute summer	15	1.014	16	482.7	3.373	0.489	2.3851
15 minute winter	16	1.015	17	466.1	4.004	0.370	0.6824
30 minute summer	17	1.016	18	386.3	2.504	0.723	2.5576
30 minute summer	18	1.017	19	386.0	2.502	0.421	1.7550

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	19	480	34.235	0.635	62.2	0.9081	0.0000	SURCHARGED
15 minute summer	32	10	44.625	0.064	23.4	0.1321	0.0000	OK
15 minute summer	43	10	43.118	0.090	12.7	0.1624	0.0000	OK
15 minute summer	33	11	43.097	0.145	42.1	0.2257	0.0000	OK
15 minute summer	44	10	43.214	0.061	18.0	0.1194	0.0000	OK
15 minute summer	45	10	42.594	0.106	28.1	0.1830	0.0000	OK
15 minute summer	34	10	42.407	0.132	96.4	0.2760	0.0000	OK
15 minute summer	35	10	41.749	0.149	127.3	0.3123	0.0000	OK
15 minute summer	36	11	40.235	0.609	164.0	1.4652	0.0000	SURCHARGED
15 minute summer	46	10	44.827	0.065	25.3	0.1454	0.0000	OK
15 minute summer	47	10	43.084	0.084	46.1	0.1651	0.0000	OK
15 minute summer	48	12	40.961	0.961	87.2	2.3106	0.0000	SURCHARGED
15 minute summer	49	11	40.105	0.463	96.4	1.0013	0.0000	SURCHARGED
15 minute summer	37	11	39.452	0.207	260.1	0.3781	0.0000	OK
15 minute summer	38	11	37.559	0.159	280.2	0.3589	0.0000	OK
15 minute summer	39	12	34.959	0.515	283.1	8.9656	0.0000	SURCHARGED
15 minute summer	52	11	39.487	0.144	52.1	2.9098	0.0000	OK
15 minute summer	53	11	39.118	0.100	59.7	0.1774	0.0000	OK
15 minute summer	54	11	36.389	0.165	101.4	0.3957	0.0000	OK
15 minute summer	55	10	38.038	0.038	7.8	0.0631	0.0000	OK
15 minute summer	56	10	36.702	0.098	39.3	0.2188	0.0000	OK
15 minute summer	57	10	36.054	0.107	39.0	0.1525	0.0000	OK
15 minute summer	58	10	35.174	0.149	63.0	0.3352	0.0000	OK
15 minute summer	40	11	34.390	0.290	472.9	0.7696	0.0000	OK
600 minute winter	41	600	34.249	0.749	48.0	1.3232	0.0000	SURCHARGED
480 minute winter	42	496	34.247	0.947	59.6	1.6734	0.0000	SURCHARGED
480 minute winter	20	480	34.235	1.085	198.6	1042.2690	0.0000	SURCHARGED
480 minute winter	21	480	34.235	1.107	14.3	1.9554	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
480 minute winter	19	1.018	20	60.7	0.705	0.130	10.4510
15 minute summer	32	7.000	33	23.3	1.390	0.178	0.4665
15 minute summer	43	8.000	33	12.5	0.618	0.314	0.2680
15 minute summer	33	7.001	34	41.3	1.561	0.716	1.2949
15 minute summer	44	9.000	45	17.9	1.335	0.163	0.2036
15 minute summer	45	9.001	34	27.9	1.673	0.346	0.0963
15 minute summer	34	7.002	35	96.1	2.986	0.328	0.3166
15 minute summer	35	7.003	36	126.5	2.100	0.500	2.0197
15 minute summer	36	7.004	37	162.8	2.313	1.342	1.3514
15 minute summer	46	10.000	47	25.2	2.183	0.185	0.3001
15 minute summer	47	10.001	48	45.8	1.456	0.303	0.9556
15 minute summer	48	10.002	49	76.6	1.927	1.429	1.3394
15 minute summer	49	10.003	37	95.1	2.391	1.240	0.3129
15 minute summer	37	7.005	38	259.8	4.301	0.367	2.3438
15 minute summer	38	7.006	39	279.8	3.192	0.276	3.1505
15 minute summer	39	7.007	40	277.3	1.774	1.146	7.1183
15 minute summer	52	12.000	53	48.6	2.213	0.604	0.2990
15 minute summer	53	12.001	54	59.6	2.474	0.414	0.8897
15 minute summer	54	12.002	40	101.5	3.387	0.812	0.9558
15 minute summer	55	13.000	56	7.7	0.764	0.063	0.2664
15 minute summer	56	13.001	57	39.0	2.224	0.361	0.2686
15 minute summer	57	13.002	58	38.7	1.663	0.461	0.8250
15 minute summer	58	13.003	40	62.3	2.347	0.690	0.5543
15 minute summer	40	7.008	41	473.7	2.871	0.318	1.0379
600 minute winter	41	7.009	42	57.7	1.435	0.092	2.5660
480 minute winter	42	7.010	20	140.1	1.519	0.179	1.2439
480 minute winter	20	1.019	21	14.3	0.278	0.029	6.0341
480 minute winter	21	1.020	22	13.3	0.194	0.027	4.9104

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	22	480	34.234	1.124	13.3	1.9869	0.0000	SURCHARGED
15 minute summer	23	1	33.100	0.000	12.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
480 minute winter	22	Hydro-Brake®	23	12.5			

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	48.836	0.087	32.1	0.1679	0.0000	OK
15 minute summer	24	11	48.478	0.216	46.4	0.4677	0.0000	OK
15 minute summer	2	10	48.258	0.158	82.3	0.2359	0.0000	OK
15 minute summer	25	12	46.492	0.217	17.9	0.3753	0.0000	OK
15 minute summer	3	12	46.445	0.470	177.3	1.1446	0.0000	SURCHARGED
15 minute summer	26	12	46.303	0.262	15.2	0.4383	0.0000	SURCHARGED
15 minute summer	27	12	46.276	1.551	49.9	2.9321	0.0000	FLOOD RISK
15 minute summer	28	12	46.256	1.806	84.5	3.5650	1.2102	FLOOD
15 minute summer	30	11	46.322	0.122	50.0	0.2613	0.0000	OK
15 minute summer	29	12	46.059	1.859	141.3	3.1787	0.0000	SURCHARGED
15 minute summer	4	12	45.762	1.762	331.7	3.1407	0.0000	SURCHARGED
15 minute summer	5	11	45.024	1.424	403.7	2.9342	0.0000	SURCHARGED
15 minute summer	31	10	44.108	0.105	37.5	0.2115	0.0000	OK
15 minute summer	6	11	43.506	0.506	474.4	0.9788	0.0000	SURCHARGED
15 minute summer	7	11	43.046	0.290	505.5	0.5465	0.0000	OK
15 minute summer	8	11	41.470	0.833	563.4	1.6806	0.0000	SURCHARGED
15 minute summer	9	11	40.300	0.348	577.2	0.5841	0.0000	OK
15 minute summer	10	11	39.561	0.489	620.6	0.9441	0.0000	OK
15 minute summer	11	12	39.023	0.401	689.4	0.9372	0.0000	OK
15 minute summer	12	12	38.085	1.174	701.5	2.0788	0.0000	SURCHARGED
15 minute summer	13	13	37.320	1.294	723.8	12.1126	0.0000	FLOOD RISK
15 minute summer	50	13	37.000	1.350	75.9	14.7165	0.0000	FLOOD RISK
15 minute summer	51	13	36.971	1.396	140.5	21.3625	0.0000	FLOOD RISK
15 minute summer	14	13	36.857	1.585	800.7	2.9509	0.0000	SURCHARGED
15 minute summer	15	13	35.990	0.805	802.8	1.5494	0.0000	SURCHARGED
30 minute summer	16	21	35.222	0.722	787.3	1.2762	0.0000	SURCHARGED
30 minute summer	17	25	34.921	0.721	785.3	200.4498	0.0000	SURCHARGED
960 minute winter	18	1020	34.797	0.799	132.6	1.1438	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	2	32.0	1.497	0.317	0.3823
15 minute summer	24	2.000	2	45.5	1.321	1.076	0.8379
15 minute summer	2	1.001	3	82.0	2.757	0.809	1.8581
15 minute summer	25	3.000	3	20.1	1.052	0.379	0.8515
15 minute summer	3	1.002	4	166.3	2.761	0.577	2.0092
15 minute summer	26	4.000	27	20.3	1.898	0.164	0.8767
15 minute summer	27	4.001	28	60.0	1.075	0.289	0.5607
15 minute summer	28	4.002	29	92.5	1.313	1.135	3.2534
15 minute summer	30	5.000	29	48.0	2.145	0.285	0.5763
15 minute summer	29	4.003	4	154.3	2.191	1.388	0.8795
15 minute summer	4	1.003	5	335.6	3.043	1.121	1.9803
15 minute summer	5	1.004	6	401.7	3.642	1.487	3.1896
15 minute summer	31	6.000	6	37.3	1.766	0.449	0.8856
15 minute summer	6	1.005	7	473.1	3.466	0.816	1.0157
15 minute summer	7	1.006	8	503.9	3.481	0.647	4.8966
15 minute summer	8	1.007	9	558.5	3.526	1.059	3.5914
15 minute summer	9	1.008	10	575.5	3.203	0.612	4.2508
15 minute summer	10	1.009	11	613.6	3.430	0.891	4.3233
15 minute summer	11	1.010	12	676.8	4.008	0.645	7.2343
15 minute summer	12	1.011	13	665.7	3.582	0.774	6.1003
15 minute summer	13	1.012	14	713.1	3.301	0.513	1.9990
15 minute summer	50	11.000	51	58.9	0.837	0.764	1.0874
15 minute summer	51	11.001	14	118.3	1.684	1.547	1.1501
15 minute summer	14	1.013	15	793.7	3.674	2.478	4.2805
15 minute summer	15	1.014	16	800.9	3.708	0.812	3.5920
30 minute summer	16	1.015	17	785.3	3.635	0.624	0.9678
30 minute summer	17	1.016	18	472.2	2.509	0.883	3.5933
960 minute winter	18	1.017	19	112.9	1.657	0.123	2.4142

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	19	930	34.769	1.168	112.9	1.6721	0.0000	FLOOD RISK
15 minute summer	32	10	44.649	0.088	42.9	0.1818	0.0000	OK
15 minute summer	43	12	43.691	0.663	23.2	1.1907	0.0000	SURCHARGED
15 minute summer	33	12	43.668	0.716	70.4	1.1142	0.0000	SURCHARGED
15 minute summer	44	10	43.237	0.084	33.0	0.1638	0.0000	OK
15 minute summer	45	12	42.956	0.468	51.7	0.8070	0.0000	SURCHARGED
15 minute summer	34	12	42.877	0.602	156.9	1.2613	0.0000	SURCHARGED
15 minute summer	35	12	42.569	0.969	209.6	2.0371	0.0000	SURCHARGED
15 minute summer	36	11	41.106	1.480	262.3	3.5588	0.0000	FLOOD RISK
15 minute summer	46	10	44.852	0.090	46.4	0.2002	0.0000	OK
15 minute summer	47	12	43.468	0.468	84.6	0.9153	0.0000	SURCHARGED
15 minute summer	48	11	42.664	2.664	150.8	6.4069	2.6462	FLOOD
15 minute summer	49	11	40.756	1.114	152.4	2.4098	0.0000	FLOOD RISK
15 minute summer	37	11	39.515	0.270	416.6	0.4942	0.0000	OK
15 minute summer	38	12	37.659	0.259	454.5	0.5842	0.0000	OK
15 minute summer	39	12	36.316	1.872	453.9	11.5881	0.0000	FLOOD RISK
15 minute summer	52	12	39.580	0.237	95.5	7.4514	0.0000	SURCHARGED
15 minute summer	53	12	39.204	0.186	95.7	0.3295	0.0000	OK
15 minute summer	54	12	38.091	1.867	172.6	4.4733	0.5493	FLOOD
15 minute summer	55	10	38.052	0.052	14.3	0.0851	0.0000	OK
15 minute summer	56	12	36.785	0.181	72.2	0.4040	0.0000	OK
15 minute summer	57	12	36.572	0.625	72.2	0.8945	0.0000	SURCHARGED
15 minute summer	58	12	36.036	1.011	106.3	2.2732	0.0000	FLOOD RISK
15 minute summer	40	12	35.167	1.067	771.5	2.8343	0.0000	SURCHARGED
960 minute winter	41	945	34.770	1.270	59.2	2.2434	0.0000	SURCHARGED
960 minute winter	42	930	34.769	1.469	70.7	2.5951	0.0000	FLOOD RISK
960 minute winter	20	930	34.768	1.618	129.4	2011.1830	0.0000	FLOOD RISK
960 minute winter	21	930	34.767	1.639	13.5	2.8970	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
960 minute winter	19	1.018	20	76.0	0.646	0.163	10.4510
15 minute summer	32	7.000	33	42.7	1.562	0.328	0.7001
15 minute summer	43	8.000	33	21.3	0.664	0.534	0.5114
15 minute summer	33	7.001	34	65.7	1.652	1.139	1.9476
15 minute summer	44	9.000	45	32.9	1.498	0.299	0.3973
15 minute summer	45	9.001	34	47.5	1.868	0.589	0.2295
15 minute summer	34	7.002	35	155.1	3.035	0.529	0.6904
15 minute summer	35	7.003	36	199.9	2.839	0.790	2.7035
15 minute summer	36	7.004	37	260.5	3.700	2.146	1.3514
15 minute summer	46	10.000	47	46.2	2.415	0.339	0.7023
15 minute summer	47	10.001	48	74.9	2.100	0.495	1.4242
15 minute summer	48	10.002	49	115.9	2.915	2.163	1.3394
15 minute summer	49	10.003	37	151.8	3.817	1.979	0.3146
15 minute summer	37	7.005	38	417.0	4.551	0.589	3.7042
15 minute summer	38	7.006	39	447.9	3.534	0.441	3.8215
15 minute summer	39	7.007	40	449.7	2.839	1.859	7.5829
15 minute summer	52	12.000	53	74.8	2.305	0.929	0.5112
15 minute summer	53	12.001	54	92.4	2.537	0.641	1.3795
15 minute summer	54	12.002	40	144.6	3.636	1.157	1.2687
15 minute summer	55	13.000	56	14.2	0.866	0.116	0.5078
15 minute summer	56	13.001	57	72.2	2.488	0.667	0.5662
15 minute summer	57	13.002	58	63.2	1.748	0.752	1.4132
15 minute summer	58	13.003	40	94.6	2.378	1.048	0.8309
15 minute summer	40	7.008	41	772.2	3.575	0.519	1.3859
960 minute winter	41	7.009	42	70.7	1.235	0.112	2.5660
960 minute winter	42	7.010	20	105.4	1.340	0.134	1.2439
960 minute winter	20	1.019	21	13.5	0.279	0.027	6.0341
960 minute winter	21	1.020	22	14.8	0.184	0.030	4.9104

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	22	945	34.768	1.658	14.8	2.9296	0.0000	FLOOD RISK
15 minute summer	23	1	33.100	0.000	12.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
960 minute winter	22	Hydro-Brake®	23	13.1			

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.051	5.00	44.388	1350	505613.481	119375.106	1.425
15	0.052	5.00	43.801	1350	505578.112	119372.401	1.801
2	0.007	5.00	44.088	1350	505596.926	119373.706	2.390
3	0.094	5.00	42.338	1350	505594.836	119340.731	2.024
4	0.037	5.00	40.641	1350	505592.616	119306.350	2.516
5	0.099	5.00	40.389	1350	505565.078	119308.985	2.336
16	0.021	5.00	40.798	1350	505523.824	119338.866	1.425
17	0.020	5.00	39.532	1350	505476.589	119340.994	1.432
18	0.090	5.00	40.641	1350	505475.423	119313.554	3.841
19	0.081	5.00	39.700	1350	505508.620	119311.914	2.100
6	0.085	5.00	40.340	1350	505522.821	119311.201	3.140
7	0.057	5.00	37.585	1500	505521.511	119263.766	3.085
20	0.021	5.00	37.442	1350	505474.320	119284.552	1.742
21	0.043	5.00	36.801	1200	505473.623	119265.847	1.601
22	0.000	5.00	36.114	1200	505475.559	119252.787	1.514
23	0.000	5.00	35.982	1200	505493.545	119251.394	1.782
24	0.000	5.00	35.417	1200	505499.124	119242.739	1.617
8	0.009	5.00	35.897	1500	505522.350	119243.609	2.847
9	0.000	5.00	33.900	1500	505517.881	119222.078	2.800
10	0.000	5.00	33.000	1500	505511.949	119208.210	2.000
11	0.000	5.00	32.500	1500	505501.127	119190.135	1.600
12	0.000	5.00	32.500	1500	505510.367	119174.044	1.630
13	0.000	5.00	32.500	1500	505518.057	119170.282	1.650
14	0.000	5.00	31.982	1500	505535.198	119155.009	1.182

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)	Flow (l/s)	Pro Velocity (m/s)
1.000	1	2	16.614	0.600	Colebrook-White	42.963	41.773	1.190	14.0	225	5.16	50.0	9.2	2.018
2.000	15	2	18.859	0.600	Colebrook-White	42.000	41.773	0.227	83.1	225	5.19	50.0	9.4	1.062
1.001	2	3	33.041	0.600	Colebrook-White	41.698	40.314	1.384	23.9	300	5.61	50.0	19.9	2.011
1.002	3	4	34.453	0.600	Colebrook-White	40.314	38.200	2.114	16.3	300	6.18	50.0	36.9	2.750
1.003	4	5	27.664	0.600	Colebrook-White	38.125	38.053	0.072	384.2	375	6.64	50.0	43.5	0.885
1.004	5	6	42.315	0.600	Colebrook-White	38.053	37.600	0.453	93.4	375	7.35	48.2	59.2	1.625
3.000	16	6	27.683	0.600	Colebrook-White	39.373	37.500	1.873	14.8	225	5.27	50.0	3.8	1.522
4.000	17	18	27.465	0.600	Colebrook-White	38.100	36.875	1.225	22.4	225	5.27	50.0	3.6	1.285

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.001	18	20	23.728	0.600	Colebrook-White	36.800	35.700	1.100	21.6	300	5.57	50.0
4.002	19	6	23.728	0.600	Colebrook-White	37.600	37.500	0.100	237.3	225	5.88	50.0
1.005	6	7	47.453	0.600	Colebrook-White	37.200	34.500	2.700	17.6	525	8.14	45.8
1.006	7	8	20.174	0.600	Colebrook-White	34.500	33.125	1.375	14.7	525	8.47	44.9
5.000	20	21	18.718	0.600	Colebrook-White	35.700	35.200	0.500	37.4	300	5.18	50.0
5.001	21	22	13.203	0.600	Colebrook-White	35.200	34.600	0.600	22.0	300	5.35	50.0
5.002	22	23	18.040	0.600	Colebrook-White	34.600	34.200	0.400	45.1	300	5.58	50.0
5.003	23	24	10.297	0.600	Colebrook-White	34.200	33.800	0.400	25.7	300	5.71	50.0
5.004	24	8	23.242	0.600	Colebrook-White	33.800	33.350	0.450	51.6	300	5.92	50.0
1.007	8	9	21.990	0.600	Colebrook-White	33.050	31.100	1.950	11.3	600	8.48	44.9
1.008	9	10	15.083	0.600	Colebrook-White	31.100	31.000	0.100	150.8	600	8.55	44.7
1.009	10	11	21.067	0.600	Colebrook-White	31.000	30.900	0.100	210.7	600	8.77	44.1
1.010	11	12	18.555	0.600	Colebrook-White	30.900	30.870	0.030	618.5	600	9.08	43.3
1.011	12	13	8.561	0.600	Colebrook-White	30.870	30.850	0.020	428.1	600	9.22	43.0
1.012	13	14	27.279	0.600	Colebrook-White	30.850	30.800	0.050	545.6	600	9.73	41.8

Flow (l/s)	Pro Velocity (m/s)
19.9	2.080
14.6	0.817
87.2	3.215
94.8	3.509
23.7	1.794
31.4	2.354
31.4	1.820
31.4	2.224
31.4	1.730
124.5	4.112
123.9	1.606
122.2	1.415
120.0	0.940
119.2	1.078
115.9	0.977

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	16.614	14.0	225	Circular_Default Sewer Type	44.388	42.963	1.200	44.088	41.773	2.090
2.000	18.859	83.1	225	Circular_Default Sewer Type	43.801	42.000	1.576	44.088	41.773	2.090
1.001	33.041	23.9	300	Circular_Default Sewer Type	44.088	41.698	2.090	42.338	40.314	1.724
1.002	34.453	16.3	300	Circular_Default Sewer Type	42.338	40.314	1.724	40.641	38.200	2.141
1.003	27.664	384.2	375	Circular_Default Sewer Type	40.641	38.125	2.141	40.389	38.053	1.961
1.004	42.315	93.4	375	Circular_Default Sewer Type	40.389	38.053	1.961	40.340	37.600	2.365
3.000	27.683	14.8	225	Circular_Default Sewer Type	40.798	39.373	1.200	40.340	37.500	2.615
4.000	27.465	22.4	225	Circular_Default Sewer Type	39.532	38.100	1.207	40.641	36.875	3.541
4.001	23.728	21.6	300	Circular_Default Sewer Type	40.641	36.800	3.541	37.442	35.700	1.442

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1350	Manhole	Adoptable	2	1350	Manhole	Adoptable
2.000	15	1350	Manhole	Adoptable	2	1350	Manhole	Adoptable
1.001	2	1350	Manhole	Adoptable	3	1350	Manhole	Adoptable
1.002	3	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable
1.003	4	1350	Manhole	Adoptable	5	1350	Manhole	Adoptable
1.004	5	1350	Manhole	Adoptable	6	1350	Manhole	Adoptable
3.000	16	1350	Manhole	Adoptable	6	1350	Manhole	Adoptable
4.000	17	1350	Manhole	Adoptable	18	1350	Manhole	Adoptable
4.001	18	1350	Manhole	Adoptable	20	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.002	23.728	237.3	225	Circular_Default Sewer Type	39.700	37.600	1.875	40.340	37.500	2.615
1.005	47.453	17.6	525	Circular_Default Sewer Type	40.340	37.200	2.615	37.585	34.500	2.560
1.006	20.174	14.7	525	Circular_Default Sewer Type	37.585	34.500	2.560	35.897	33.125	2.247
5.000	18.718	37.4	300	Circular_Default Sewer Type	37.442	35.700	1.442	36.801	35.200	1.301
5.001	13.203	22.0	300	Circular_Default Sewer Type	36.801	35.200	1.301	36.114	34.600	1.214
5.002	18.040	45.1	300	Circular_Default Sewer Type	36.114	34.600	1.214	35.982	34.200	1.482
5.003	10.297	25.7	300	Circular_Default Sewer Type	35.982	34.200	1.482	35.417	33.800	1.317
5.004	23.242	51.6	300	Circular_Default Sewer Type	35.417	33.800	1.317	35.897	33.350	2.247
1.007	21.990	11.3	600	Circular_Default Sewer Type	35.897	33.050	2.247	33.900	31.100	2.200
1.008	15.083	150.8	600	Circular_Default Sewer Type	33.900	31.100	2.200	33.000	31.000	1.400
1.009	21.067	210.7	600	Circular_Default Sewer Type	33.000	31.000	1.400	32.500	30.900	1.000
1.010	18.555	618.5	600	Circular_Default Sewer Type	32.500	30.900	1.000	32.500	30.870	1.030
1.011	8.561	428.1	600	Circular_Default Sewer Type	32.500	30.870	1.030	32.500	30.850	1.050
1.012	27.279	545.6	600	Circular_Default Sewer Type	32.500	30.850	1.050	31.982	30.800	0.582

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.002	19	1350	Manhole	Adoptable	6	1350	Manhole	Adoptable
1.005	6	1350	Manhole	Adoptable	7	1500	Manhole	Adoptable
1.006	7	1500	Manhole	Adoptable	8	1500	Manhole	Adoptable
5.000	20	1350	Manhole	Adoptable	21	1200	Manhole	Adoptable
5.001	21	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable
5.002	22	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable
5.003	23	1200	Manhole	Adoptable	24	1200	Manhole	Adoptable
5.004	24	1200	Manhole	Adoptable	8	1500	Manhole	Adoptable
1.007	8	1500	Manhole	Adoptable	9	1500	Manhole	Adoptable
1.008	9	1500	Manhole	Adoptable	10	1500	Manhole	Adoptable
1.009	10	1500	Manhole	Adoptable	11	1500	Manhole	Adoptable
1.010	11	1500	Manhole	Adoptable	12	1500	Manhole	Adoptable
1.011	12	1500	Manhole	Adoptable	13	1500	Manhole	Adoptable
1.012	13	1500	Manhole	Adoptable	14	1500	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-13	Drain Down Time (mins)	240	100 year (l/s)	19.4
Summer CV	1.000	Additional Storage (m³/ha)	20.0	Check Discharge Volume	✓
Winter CV	1.000	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	
Analysis Speed	Normal	2 year (l/s)	6.1		
Skip Steady State	✓	30 year (l/s)	13.8		

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.10	Betterment (%)	0
Greenfield Method	IH124	Region	1	QBar	1.8
Positively Drained Area (ha)	8.000	Growth Factor 2 year	0.90	Q 2 year (l/s)	1.6
SAAR (mm)	900	Growth Factor 30 year	1.95	Q 30 year (l/s)	3.5
Soil Index	1	Growth Factor 100 year	2.48	Q 100 year (l/s)	4.5

Pre-development Discharge Volume

Site Makeup	Greenfield	SPR	0.10	Storm Duration (mins)	360
Greenfield Method	FSR/FEH	CWI		Betterment (%)	0
Positively Drained Area (ha)	8.000	Return Period (years)	100	PR	
Soil Index	1	Climate Change (%)	0	Runoff Volume (m^3)	

Node 13 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	30.850	Product Number	CTL-SHE-0102-5200-1400-5200
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.2	Min Node Diameter (mm)	1200

Node 11 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	30.900
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	177.0	0.0	1.100	734.0	0.0	1.201	0.1	0.0
0.100	415.0	0.0	1.200	995.0	0.0			

Node 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	38.053	Slope (1:X)	80.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	3	Depth (m)	0.400
Safety Factor	2.0	Width (m)	10.000	Inf Depth (m)	
Porosity	1.00	Length (m)	25.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	116.144	32.865	2 year 2880 minute winter	2.743	1.094
2 year 15 minute winter	81.505	32.865	2 year 4320 minute summer	3.193	0.835
2 year 30 minute summer	76.046	21.518	2 year 4320 minute winter	2.103	0.835
2 year 30 minute winter	53.366	21.518	2 year 5760 minute summer	2.728	0.698
2 year 60 minute summer	51.462	13.600	2 year 5760 minute winter	1.766	0.698
2 year 60 minute winter	34.190	13.600	2 year 7200 minute summer	2.412	0.615
2 year 120 minute summer	35.529	9.389	2 year 7200 minute winter	1.557	0.615
2 year 120 minute winter	23.604	9.389	2 year 8640 minute summer	2.193	0.559
2 year 180 minute summer	28.732	7.394	2 year 8640 minute winter	1.415	0.559
2 year 180 minute winter	18.677	7.394	2 year 10080 minute summer	2.037	0.520
2 year 240 minute summer	23.420	6.189	2 year 10080 minute winter	1.315	0.520
2 year 240 minute winter	15.560	6.189	30 year 15 minute summer	298.112	84.355
2 year 360 minute summer	18.509	4.763	30 year 15 minute winter	209.201	84.355
2 year 360 minute winter	12.031	4.763	30 year 30 minute summer	198.287	56.108
2 year 480 minute summer	14.851	3.925	30 year 30 minute winter	139.149	56.108
2 year 480 minute winter	9.867	3.925	30 year 60 minute summer	135.115	35.707
2 year 600 minute summer	12.301	3.365	30 year 60 minute winter	89.767	35.707
2 year 600 minute winter	8.405	3.365	30 year 120 minute summer	80.945	21.391
2 year 720 minute summer	11.046	2.960	30 year 120 minute winter	53.778	21.391
2 year 720 minute winter	7.423	2.960	30 year 180 minute summer	61.384	15.796
2 year 960 minute summer	9.150	2.409	30 year 180 minute winter	39.901	15.796
2 year 960 minute winter	6.061	2.409	30 year 240 minute summer	48.131	12.720
2 year 1440 minute summer	6.695	1.794	30 year 240 minute winter	31.977	12.720
2 year 1440 minute winter	4.500	1.794	30 year 360 minute summer	36.346	9.353
2 year 2160 minute summer	4.844	1.339	30 year 360 minute winter	23.626	9.353
2 year 2160 minute winter	3.338	1.339	30 year 480 minute summer	28.382	7.500
2 year 2880 minute summer	4.081	1.094	30 year 480 minute winter	18.856	7.500

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 600 minute summer	23.086	6.315	100 year +45% CC 180 minute summer	110.822	28.518
30 year 600 minute winter	15.774	6.315	100 year +45% CC 180 minute winter	72.037	28.518
30 year 720 minute summer	20.462	5.484	100 year +45% CC 240 minute summer	86.398	22.833
30 year 720 minute winter	13.752	5.484	100 year +45% CC 240 minute winter	57.401	22.833
30 year 960 minute summer	16.671	4.390	100 year +45% CC 360 minute summer	64.865	16.692
30 year 960 minute winter	11.043	4.390	100 year +45% CC 360 minute winter	42.164	16.692
30 year 1440 minute summer	11.951	3.203	100 year +45% CC 480 minute summer	50.544	13.357
30 year 1440 minute winter	8.032	3.203	100 year +45% CC 480 minute winter	33.580	13.357
30 year 2160 minute summer	8.505	2.351	100 year +45% CC 600 minute summer	41.086	11.238
30 year 2160 minute winter	5.860	2.351	100 year +45% CC 600 minute winter	28.073	11.238
30 year 2880 minute summer	7.078	1.897	100 year +45% CC 720 minute summer	36.419	9.761
30 year 2880 minute winter	4.757	1.897	100 year +45% CC 720 minute winter	24.476	9.761
30 year 4320 minute summer	5.406	1.413	100 year +45% CC 960 minute summer	29.709	7.823
30 year 4320 minute winter	3.560	1.413	100 year +45% CC 960 minute winter	19.680	7.823
30 year 5760 minute summer	4.524	1.158	100 year +45% CC 1440 minute summer	21.359	5.724
30 year 5760 minute winter	2.928	1.158	100 year +45% CC 1440 minute winter	14.354	5.724
30 year 7200 minute summer	3.924	1.001	100 year +45% CC 2160 minute summer	15.208	4.203
30 year 7200 minute winter	2.533	1.001	100 year +45% CC 2160 minute winter	10.479	4.203
30 year 8640 minute summer	3.508	0.895	100 year +45% CC 2880 minute summer	12.625	3.384
30 year 8640 minute winter	2.264	0.895	100 year +45% CC 2880 minute winter	8.485	3.384
30 year 10080 minute summer	3.211	0.819	100 year +45% CC 4320 minute summer	9.543	2.495
30 year 10080 minute winter	2.072	0.819	100 year +45% CC 4320 minute winter	6.285	2.495
100 year +45% CC 15 minute summer	546.775	154.718	100 year +45% CC 5760 minute summer	7.901	2.023
100 year +45% CC 15 minute winter	383.702	154.718	100 year +45% CC 5760 minute winter	5.114	2.023
100 year +45% CC 30 minute summer	366.816	103.796	100 year +45% CC 7200 minute summer	6.777	1.729
100 year +45% CC 30 minute winter	257.415	103.796	100 year +45% CC 7200 minute winter	4.374	1.729
100 year +45% CC 60 minute summer	251.917	66.574	100 year +45% CC 8640 minute summer	5.997	1.530
100 year +45% CC 60 minute winter	167.367	66.574	100 year +45% CC 8640 minute winter	3.870	1.530
100 year +45% CC 120 minute summer	147.617	39.011	100 year +45% CC 10080 minute summer	5.437	1.387
100 year +45% CC 120 minute winter	98.073	39.011	100 year +45% CC 10080 minute winter	3.509	1.387

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	43.004	0.041	9.7	0.0879	0.0000	OK
15 minute summer	15	10	42.065	0.065	9.9	0.1306	0.0000	OK
15 minute summer	2	10	41.758	0.060	20.6	0.0900	0.0000	OK
15 minute summer	3	10	40.389	0.075	38.3	0.1761	0.0000	OK
15 minute summer	4	11	38.294	0.169	44.9	0.2910	0.0000	OK
15 minute summer	5	12	38.181	0.128	62.8	6.8421	0.0000	OK
15 minute summer	16	10	39.400	0.027	4.0	0.0459	0.0000	OK
15 minute summer	17	10	38.129	0.029	3.8	0.0489	0.0000	OK
15 minute summer	18	10	36.859	0.059	20.8	0.1125	0.0000	OK
15 minute summer	19	10	37.710	0.110	15.4	0.2414	0.0000	OK
15 minute summer	6	12	37.292	0.092	78.4	0.1819	0.0000	OK
15 minute summer	7	12	34.598	0.098	88.0	0.2091	0.0000	OK
15 minute summer	20	10	35.777	0.077	24.7	0.1289	0.0000	OK
15 minute summer	21	10	35.276	0.076	32.7	0.1270	0.0000	OK
15 minute summer	22	10	34.696	0.096	32.5	0.1086	0.0000	OK
15 minute summer	23	11	34.282	0.082	32.3	0.0922	0.0000	OK
15 minute summer	24	11	33.898	0.098	32.5	0.1104	0.0000	OK
15 minute summer	8	11	33.147	0.097	121.3	0.1775	0.0000	OK
15 minute summer	9	11	31.319	0.219	121.1	0.3864	0.0000	OK
15 minute winter	10	8	31.273	0.273	114.4	0.4829	0.0000	OK
480 minute summer	11	352	31.220	0.320	31.3	129.1193	0.0000	OK
480 minute summer	12	344	31.220	0.350	5.8	0.6177	0.0000	OK
480 minute summer	13	360	31.220	0.370	5.3	0.6530	0.0000	OK
15 minute summer	14	1	30.800	0.000	4.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	2	9.6	1.993	0.069	0.0802
15 minute summer	15	2.000	2	9.7	1.054	0.170	0.1740
15 minute summer	2	1.001	3	20.5	1.733	0.090	0.3922
15 minute summer	3	1.002	4	37.9	2.445	0.137	0.5557
15 minute summer	4	1.003	5	44.7	1.190	0.441	1.0924
15 minute summer	5	1.004	6	49.3	1.533	0.238	1.3621
15 minute summer	16	3.000	6	3.9	1.513	0.029	0.0720
15 minute summer	17	4.000	18	3.7	1.285	0.034	0.0795
15 minute summer	18	4.001	20	20.7	1.727	0.086	0.2859
15 minute summer	19	4.002	6	15.0	0.829	0.448	0.4313
15 minute summer	6	1.005	7	78.6	2.961	0.068	1.2600
15 minute summer	7	1.006	8	87.8	3.311	0.069	0.5351
15 minute summer	20	5.000	21	24.5	1.727	0.134	0.2652
15 minute summer	21	5.001	22	32.5	1.947	0.136	0.2208
15 minute summer	22	5.002	23	32.3	1.861	0.195	0.3140
15 minute summer	23	5.003	24	32.5	1.845	0.148	0.1819
15 minute summer	24	5.004	8	32.8	1.706	0.211	0.4463
15 minute summer	8	1.007	9	121.1	2.056	0.059	1.3442
15 minute summer	9	1.008	10	121.8	1.322	0.218	1.4166
15 minute winter	10	1.009	11	116.0	2.210	0.245	1.3308
480 minute summer	11	1.010	12	5.8	0.247	0.021	2.9975
480 minute summer	12	1.011	13	5.3	0.155	0.016	1.5087
480 minute summer	13	Hydro-Brake®	14	5.2			

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.07%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	43.030	0.067	24.8	0.1434	0.0000	OK
15 minute summer	15	10	42.111	0.111	25.3	0.2220	0.0000	OK
15 minute summer	2	10	41.795	0.097	53.1	0.1452	0.0000	OK
15 minute summer	3	10	40.436	0.122	98.6	0.2888	0.0000	OK
15 minute summer	4	11	38.416	0.291	116.0	0.5030	0.0000	OK
15 minute summer	5	12	38.270	0.217	162.6	19.3854	0.0000	OK
15 minute summer	16	10	39.415	0.042	10.2	0.0727	0.0000	OK
15 minute summer	17	10	38.146	0.046	9.7	0.0780	0.0000	OK
15 minute summer	18	10	36.895	0.095	53.4	0.1810	0.0000	OK
15 minute summer	19	11	37.827	0.227	39.4	0.5009	0.0000	SURCHARGED
15 minute summer	6	11	37.347	0.147	197.7	0.2905	0.0000	OK
15 minute summer	7	11	34.663	0.163	223.2	0.3477	0.0000	OK
15 minute summer	20	10	35.830	0.130	63.4	0.2173	0.0000	OK
15 minute summer	21	10	35.331	0.131	83.8	0.2191	0.0000	OK
15 minute summer	22	10	34.766	0.166	83.4	0.1882	0.0000	OK
15 minute summer	23	10	34.343	0.143	83.0	0.1621	0.0000	OK
15 minute summer	24	11	33.970	0.170	82.9	0.1922	0.0000	OK
15 minute summer	8	11	33.204	0.154	309.3	0.2819	0.0000	OK
480 minute winter	9	464	31.561	0.461	40.2	0.8151	0.0000	OK
480 minute winter	10	464	31.561	0.561	39.4	0.9918	0.0000	OK
480 minute winter	11	464	31.561	0.661	38.7	313.9581	0.0000	SURCHARGED
480 minute winter	12	464	31.561	0.691	6.1	1.2218	0.0000	SURCHARGED
480 minute winter	13	472	31.562	0.712	6.9	1.2581	0.0000	SURCHARGED
15 minute summer	14	1	30.800	0.000	5.2	0.0000	0.0000	OK

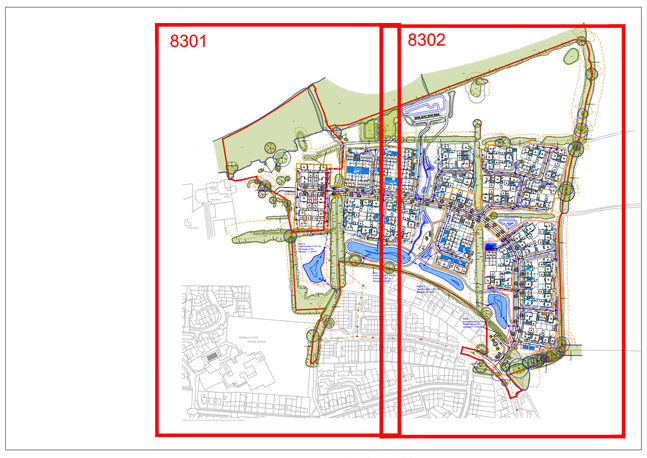
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	2	24.7	2.587	0.176	0.1583
15 minute summer	15	2.000	2	25.0	1.345	0.438	0.3506
15 minute summer	2	1.001	3	52.8	2.261	0.231	0.7734
15 minute summer	3	1.002	4	98.0	2.480	0.354	1.3955
15 minute summer	4	1.003	5	114.5	1.573	1.129	2.1342
15 minute summer	5	1.004	6	121.4	1.916	0.586	2.6815
15 minute summer	16	3.000	6	10.1	1.996	0.074	0.1402
15 minute summer	17	4.000	18	9.6	1.696	0.087	0.1554
15 minute summer	18	4.001	20	53.2	2.204	0.221	0.5748
15 minute summer	19	4.002	6	38.2	1.044	1.137	0.8392
15 minute summer	6	1.005	7	197.0	3.727	0.170	2.5244
15 minute summer	7	1.006	8	221.3	4.200	0.174	1.0656
15 minute summer	20	5.000	21	62.9	2.137	0.345	0.5512
15 minute summer	21	5.001	22	83.4	2.393	0.351	0.4605
15 minute summer	22	5.002	23	83.0	2.267	0.500	0.6614
15 minute summer	23	5.003	24	82.9	2.235	0.377	0.3824
15 minute summer	24	5.004	8	83.8	2.149	0.541	0.9067
15 minute summer	8	1.007	9	309.0	2.536	0.150	2.7111
480 minute winter	9	1.008	10	39.4	0.926	0.070	3.8206
480 minute winter	10	1.009	11	38.7	0.909	0.082	5.8542
480 minute winter	11	1.010	12	6.1	0.273	0.022	5.2265
480 minute winter	12	1.011	13	6.9	0.196	0.021	2.4114
480 minute winter	13	Hydro-Brake®	14	5.2			

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.07%

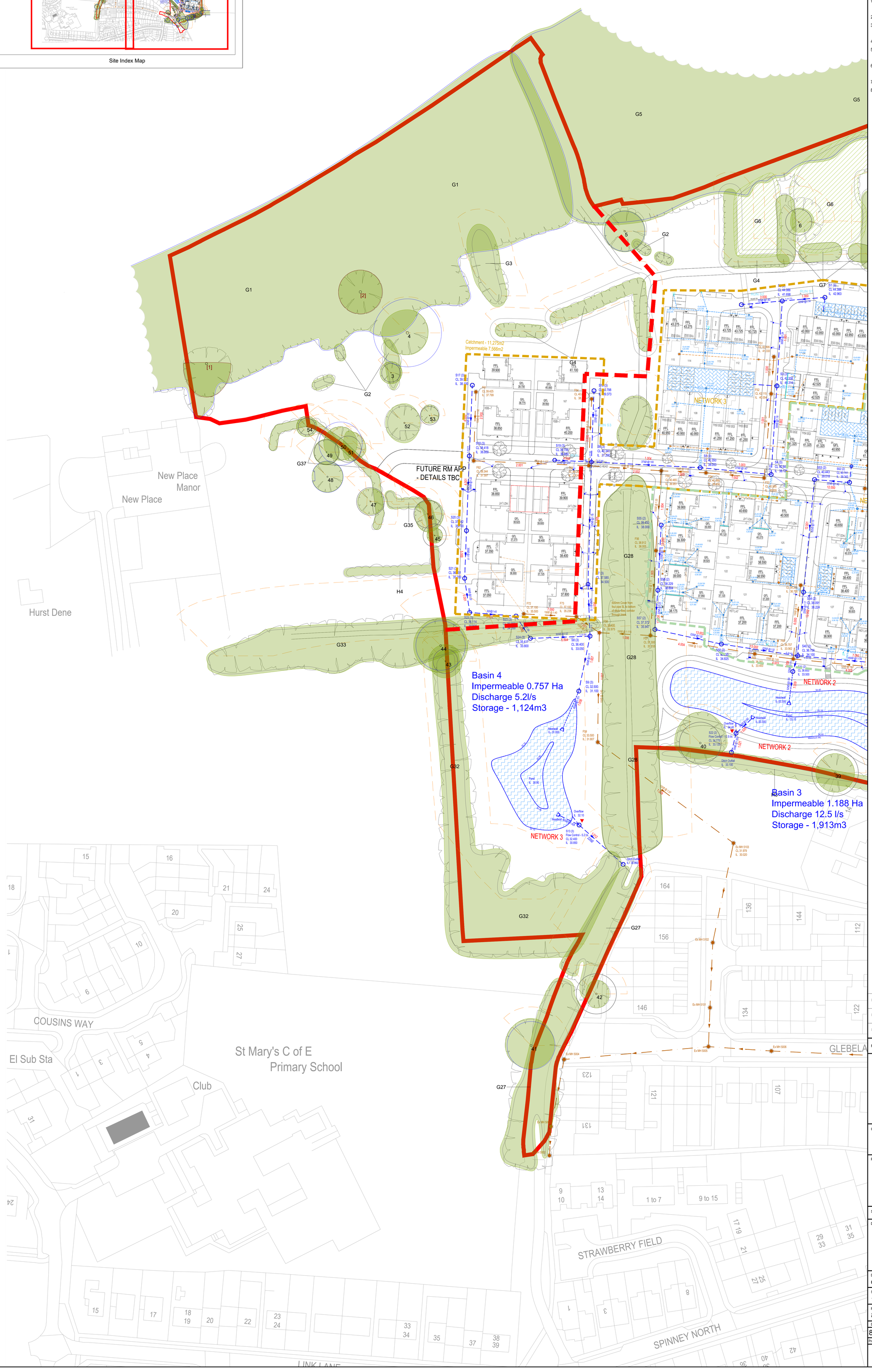
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	43.057	0.094	45.5	0.2015	0.0000	OK
15 minute summer	15	10	42.167	0.167	46.4	0.3355	0.0000	OK
15 minute summer	2	10	41.835	0.137	97.4	0.2037	0.0000	OK
15 minute summer	3	10	40.490	0.176	180.9	0.4163	0.0000	OK
15 minute summer	4	11	38.759	0.634	212.0	1.0939	0.0000	SURCHARGED
15 minute summer	5	13	38.374	0.321	295.6	41.7871	0.0000	OK
15 minute summer	16	10	39.431	0.058	18.8	0.0993	0.0000	OK
15 minute summer	17	10	38.162	0.062	17.9	0.1068	0.0000	OK
15 minute summer	18	10	36.934	0.134	98.1	0.2538	0.0000	OK
15 minute summer	19	11	38.221	0.621	72.3	1.3679	0.0000	SURCHARGED
15 minute summer	6	11	37.397	0.197	340.1	0.3890	0.0000	OK
15 minute summer	7	11	34.727	0.227	387.6	0.4841	0.0000	OK
15 minute summer	20	10	35.893	0.193	116.6	0.3225	0.0000	OK
15 minute summer	21	10	35.402	0.202	154.0	0.3374	0.0000	OK
15 minute summer	22	10	34.874	0.274	153.2	0.3098	0.0000	OK
15 minute summer	23	11	34.445	0.245	152.2	0.2766	0.0000	OK
15 minute summer	24	11	34.154	0.354	151.4	0.4008	0.0000	SURCHARGED
15 minute summer	8	11	33.255	0.205	541.4	0.3759	0.0000	OK
960 minute winter	9	930	32.086	0.986	41.7	1.7431	0.0000	SURCHARGED
960 minute winter	10	915	32.087	1.087	41.1	1.9202	0.0000	SURCHARGED
960 minute winter	11	930	32.086	1.186	40.9	679.3334	0.0000	SURCHARGED
960 minute winter	12	930	32.087	1.217	5.9	2.1510	0.0000	SURCHARGED
960 minute winter	13	945	32.086	1.236	6.7	2.1839	0.0000	SURCHARGED
15 minute summer	14	1	30.800	0.000	5.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	1	1.000	2	45.3	3.024	0.323	0.2487
15 minute summer	15	2.000	2	45.8	1.529	0.803	0.5651
15 minute summer	2	1.001	3	97.1	2.611	0.425	1.2275
15 minute summer	3	1.002	4	179.0	2.822	0.647	1.9550
15 minute summer	4	1.003	5	210.6	1.981	2.076	2.9133
15 minute summer	5	1.004	6	198.1	2.079	0.956	4.0318
15 minute summer	16	3.000	6	18.6	2.375	0.137	0.2172
15 minute summer	17	4.000	18	17.7	2.013	0.160	0.2415
15 minute summer	18	4.001	20	97.8	2.496	0.407	0.9275
15 minute summer	19	4.002	6	70.2	1.766	2.092	0.9289
15 minute summer	6	1.005	7	339.0	4.176	0.292	3.8710
15 minute summer	7	1.006	8	385.6	4.770	0.304	1.6324
15 minute summer	20	5.000	21	115.7	2.356	0.635	0.9209
15 minute summer	21	5.001	22	153.2	2.571	0.644	0.7790
15 minute summer	22	5.002	23	152.2	2.408	0.918	1.1618
15 minute summer	23	5.003	24	151.4	2.393	0.688	0.6792
15 minute summer	24	5.004	8	148.0	2.318	0.955	1.4941
15 minute summer	8	1.007	9	540.8	2.692	0.263	4.0337
960 minute winter	9	1.008	10	41.1	0.758	0.073	4.2485
960 minute winter	10	1.009	11	40.9	0.793	0.087	5.9341
960 minute winter	11	1.010	12	5.9	0.265	0.021	5.2265
960 minute winter	12	1.011	13	6.7	0.185	0.020	2.4114
960 minute winter	13	Hydro-Brake®	14	5.2			

APPENDIX I
WORKING DRAWINGS AND SURFACE WATER DRAINAGE STRATEGY



Site Index Map



CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:–

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Notes:

1. This drawing is to be read in conjunction with all relevant Architects and Engineers drawings and specifications.
2. Layout based on the Finc Architects Layout dated 2024.10.24.
3. Top Survey information taken from NJC Surveys Drawing S1572, dated March 2019
4. All levels quoted are in metres A.O.D.
5. For Levels Layout see Drawing No's. 890815-RSK-ZZ-XX-DR-C-8200 series Site Site Levels.
6. All drainage to be installed to Southern Water adoptable standards, DCG compliant.
7. All road gullies shall be located away from proposed entrances to houses.
8. For tree protection areas and trees to be removed refer to the Arborculturalist's drawings and/or report.

Drainage Legend:

- Proposed Adoptable Surface Water Sewer
- Adoptable Surface Water Manhole
- Indicative Private SW Drainage routes
- Permeable Block Paving
- Below Ground Storage Tank
- Proposed Headwall
- Lake Spur Pond Storage
- Proposed Flow Control
- Road Gully
- Proposed Adoptable Foul Water Sewer
- Proposed Adoptable Manhole
- Indicative Private Foul Drainage routes
- Planning Application Boundary
- Flow Modelling Pipe reference (1.001)
- Network Catchments

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P03	25.10.2024	Issued for PLANNING SUBMISSION	SH	GXA	RD
P02	21.10.2024	Preliminary Issue following BDW comments from workshop.	GXA	GXA	RD
P01	27.09.2024	Preliminary Issue	GXA	GXA	RD

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Client
BARRATT DAVID WILSON
(SOUTHERN COUNTIES)

Project Title
NEW PLACE FARM
PULBOROUGH
WEST SUSSEX

Status: PLANNING

Drawing Title
SITE DRAINAGE
WEST

Drawn	Date	Checked	Date	Approved	Date
GXA	08.24	GXA	08.24	RD	08.24

Scale	Orig Size	Dimensions
1:500	A0	m

Project No. 890815
Drawing File 890815-RSK-ZZ-XX-DR-C-8300 to 8302 Site Drainage.dwg

Drawing No.							Rev.
890815	RSK	ZZ	XX	DR	C	8301	P03
Project	Orig.	Vol./Sys.	Lev./Loc.	Type	Role	Draw. No.	

Scale
0 5 10 15 20 25m

File Location: Z:\P-LDE (PROJECTS)\890815 - NEW PLACE FARM, PULBOROUGH\GRAPH\INFRASTRUCTURE\DRAWINGS\8 - PLANNING\890815-RSK-ZZ-XX-DR-C-8300 TO 8302 SITE DRAINAGE.DWG

CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

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Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P03	25.10.2024	Issued for PLANNING SUBMISSION	SH	GXA	RD
P02	15.10.2024	Preliminary Issue following BDW comments from workshop.	GXA	GXA	RD
P01	.27.09.2024	Preliminary Issue	GXA	GXA	RD

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Client
BARRATT DAVID WILSON (SOUTHERN COUNTIES)

Project Title
NEW PLACE FARM
PULBOROUGH
WEST SUSSEX

Status: PLANNING

Drawing Title
SITE DRAINAGE EAST

Drawn	Date	Checked	Date	Approved	Date
GXA	08.24	GXA	08.24	RD	08.24

Scale	Orig Size	Dimensions
1:500	A0	m

Project No. 890815
Drawing File 890815-RSK-ZZ-XX-DR-C-8300 to 8302 Site Drainage.dwg

Drawing No.							Rev.
890815	RSK	ZZ	XX	DR	C	8302	P03
Project	Orig.	Vol./Sys.	Lev./Loc.	Type	Role	Draw. No.	

Scale 0 5 10 15 20 25m

File Location: Z:\PJ-LDE (PROJECTS)\890815 - NEW PLACE FARM, PULBOROUGH\GRAPHIN\FRASTRUCTURE\DRAWINGS\8 - PLANNING\890815-RSK-ZZ-XX-DR-C-8300 TO 8302 SITE DRAINAGE.DWG

NETWORK 3

Node	House	Garages	Driveway	Road	10% Urban Creep Contribution		Total Area (ha)
	Area m2						
S1 (3)	193			298	19.3		0.0510
S2 (3)				64	0		0.0064
S15 (3)	202		106	193	20.2		0.0523
S3 (3)	208		98	612	20.8		0.0939
S4 (3)				368	0		0.0368
S5 (3)	475	69	138	256	47.5		0.0986
S6 (3)				853	0		0.0853
S7 (3)	153	70	110	219	15.3		0.0567
S8(3)					0		0.0000
S16(3)	83	25	35	60	8.3		0.0211
S17 (3)	80	25	35	50	8		0.0198
S18 (3)	203	90	195	382	20.3		0.0890
S19 (3)	203	90	195	305	20.3		0.0813
S20 (3)				210	0		0.0210
S21 (3)	153	70	110	85	15.3		0.0433
S22 (3)					0		0.0000
					0		0.0000
						Total	0.7566

NETWORK 2

Node	House	Garages	Driveway	Road	10% Urban Creep Contribution		Total Area (ha)	
	Area m2							
S1 (2)	160	45	104	40	16		0.0365	
S2 (2)				58	0		0.0058	
S24 (2)	227	69	144	53	22.7		0.0516	
S3 (2)	295	69	186	296	29.5		0.0876	
S25(2)				200			0.0200	
S26 (2)	83	24	55		8.3		0.0170	
S27 (2)	154	45	101	73	15.4		0.0388	
S28 (2)	184	69	134	82	18.4		0.0487	
S29 (2)				418	0		0.0418	
S30 (2)	220	48	172	97	22		0.0559	
S4 (2)	185	24	89	295	18.5		0.0612	
S5 (2)	261	93	262	284	26.1		0.0926	
S6 (2)	74			312	7.4		0.0393	
S31 (2)	153	48	92	110	15.3		0.0418	
S7 (2)				382	0		0.0382	
S8 (2)	282	114	251	25	28.2		0.0700	
S9 (2)				221	0		0.0221	
S10 (2)	247		127	131	24.7		0.0530	
S11 (2)	197	45	131	491	19.7		0.0884	
S12 (2)				290	0		0.0290	
S13 (2)	295		234	270	29.5		0.0629	
S14 (2)				100	0		0.0100	
S50 (2)	326	25	365		32.6		0.0749	
S51 (2)	161	25	193	288	16.1		0.0683	
S15 (2)				128	0		0.0128	
								1.1881
S32 (2)	95	90	138	152	9.5		0.0485	
S33 (2)				130	0		0.0130	
S43 (2)	107	45	98		10.7		0.0261	
S44 (2)	127	23	87	120	12.7		0.0370	
S45 (2)	102		102		10.2		0.0214	
S34 (2)	196		90	281	19.6		0.0587	
S35A (2)	120			353	12		0.0485	
S35 (2)				157	0		0.0157	
S36 (2)	210	45	140	353	21		0.0769	
S46 (2)				518	0		0.0518	
S47 (2)	128		64	228	12.8		0.0433	
S48 (2)	300		338	180	30		0.0848	
S49 (2)				452	0		0.0452	
								1.1881
S37 (2)					0		0.0000	
S38 (2)	207	69	140		20.7		0.0437	
S39 (2)					0		0.0000	
S40 (2)	286	69	148	648	28.6		0.1180	
S52 (2)	537	24	153	298	53.7		0.1066	
S53 (2)				238	0		0.0238	
S54 (2)	286		199	380	28.6		0.0894	
S55 (2)	83			65	8.3		0.0156	
S56 (2)	223	93	182	130	22.3		0.0650	
S57 (2)					0		0.0000	
S58 (2)	185	69	149	74	18.5		0.0496	
S41 (2)					0		0.0000	1.0823
						Total	2.2705	

NETWORK 1

Node	House	Garages	Driveway	Road	10% Urban Creep Contribution		Total Area (ha)
	Area m2						
S1 (1)	104	45	91		10.4		0.0250
S1A (1)				470	0		0.0470
S2 (1)				590	0		0.0590
S3 (1)	153	48	87		15.3		0.0303
S12 (1)	139			240	13.9		0.0393
S13 (1)	248	90	209	65	24.8		0.0637
S14 (1)				120	0		0.0120
S15 (1)	248	90	186	128			0.0677
S4 (1)	297	96	204	355	29.7		0.0982
S5 (1)	305	48	307	548	30.5		0.1239
S6 (1)	254	90	188	194	25.4		0.0751
S16 (1)	224	69	151	110	22.4		0.0576
S17 (1)	94		96		9.4		0.0199
S22 (1)	74	24	110	175	7.4		0.0390
S18 (1)				355	0		0.0355
S19 (1)	104	45	85	394	10.4		0.0638
S20 (1)				68	0		0.0068
S23 (1)	174	24	148		17.4		0.0363
S24 (1)	130	45	100	413	13		0.0701
						Total	0.9704

CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:-

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Notes:

1. This drawing is to be read in conjunction with all relevant Architects and Engineers drawings and specifications.
2. Topographical Survey and Levels from NJC Survey Ltd, Drawing Number S1572 Dated 18th March 2019
3. Layout based on FINC Architects Drawing 24.1874.1001 Dated August 2024.

Legend:

- 1.001 — Proposed Adoptable Surface Water Sewer
- Adoptable Surface Water Manhole
- Permeable Block Paving
- Below Ground Storage Tank
- Catchment Area - House
- Catchment Area - Garage
- Catchment Area - Driveway
- Catchment Area - Parking Court
- Catchment Area - Road
- S1 - 0.012 — Total Catchment Area for each Node in Ha (Includes 10% Urban Creep Housing)
- Total Catchemnt Areas included to node
- Planning Boundary

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P02	25.10.2024	Issued for PLANNING	CPM	GXA	RD
P01	20.09.2024	Preliminary Issue	LN	GXA	RD

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Client
BARRATT DAVID WILSON (SOUTHERN COUNTIES)

Project Title
NEW PLACE FARM
PULBOROUGH
WEST SUSSEX

Status
PLANNING

Drawing Title
CATCHMENT PLAN

Drawn	Date	Checked	Date	Approved	Date
LN	09.24	GXA	09.24	RD	09.24

Scale	Orig Size	Dimensions
1:1,000	A1	m

Project No. 890815
Drawing File 890815 - RSK-ZZ-XX-DR-C-8305 Catchment plan.dwg

Drawing No.							Rev.
890815	RSK	ZZ	XX	DR	C	8305	P02
Project	Orig.	Vol./Sys.	Lev./Loc.	Type	Role	Draw. No.	

Scale
0 10 20 30 40 50m

File Location: Z:\P-LDE\PROJECTS\890815 - NEW PLACE FARM, PULBOROUGH\GRAPHIN\FRASTRUCTURE\DRAWINGS\9 - PLANNING\890815 - RSK-ZZ-XX-DR-C-8305 CATCHMENT PLAN.DWG

File Location: Z:\P-LDE (PROJECTS)\890815 - NEW PLACE FARM, PULBOROUGH\GRAPHIN\FRASTRUCTURE\DRAWINGS\8 - PLANNING\890815 - RSK-ZZ-XX-DR-C-8308 OVERLAND FLOW ROUTE PLAN.DWG

CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:–

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Notes:

1. This drawing is to be read in conjunction with all relevant Architects and Engineers drawings and specifications.
2. This drawing is to be printed in COLOUR.
3. All levels quoted are in metres A.O.D.
4. For Drainage information, refer to 890815 - RSK-ZZ-XX-DR-C-8300 to 8302 Site Drainage.
5. Topographical Survey and Levels from NJC Survey Ltd, Drawing Number S1572 Dated 18th March 2019
6. Layout based on FINC Architects Drawing 24.1874.1001 Dated August 2024.

Legend:

FFL 44.250	Proposed Finished Floor Level (FFL)
	Overland Flow Route
	Flood Exceedances
	Site Boundary

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P02	25.10.2024	Issued for PLANNING	LN	GXA	RD
P01	23.10.2024	Preliminary Issue	LN	GXA	RD

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Client
BARRATT DAVID WILSON (SOUTHERN COUNTIES)

Project Title
NEW PLACE FARM
PULBOROUGH
WEST SUSSEX

Status
PLANNING

Drawing Title
OVERLAND FLOW ROUTE AND FLOOD EXCEEDANCE PLAN

Drawn	Date	Checked	Date	Approved	Date
LN	09.24	GXA	09.24	RD	09.24

Scale	Orig Size	Dimensions
1:1,000	A1	m

Project No. 890815

Drawing File 890815 - RSK-ZZ-XX-DR-C-8308 Overland Flow Route Plan.dwg

Drawing No.

Project	Orig.	Vol./Sys.	Lev./Loc.	Type	Role	Draw. No.	Rev.
890815	RSK	ZZ	XX	DR	C	8308	P02

Scale
0 10 20 30 40 50m

APPENDIX J
LLFA SUDS PROFORMA

Surface Water Drainage Proforma

West Sussex County Council (WSCC) as Lead Local Flood Authority recommends this proforma is completed and submitted to support any planning application for a major development. The information contained in this form will be used by WSCC officers in their role as 'statutory consultee' on surface water drainage. The proforma should accompany the site-specific Flood Risk Assessment and Drainage Strategy submitted as part of the planning application.

1. Site Details

No.	Requirement	Answer	Application Type
1.1	Address including postcode	New Place Farm, Pulborough, RH20 2GN	Outline & Full
1.2	OS grid reference (easting and northing)	505650 E, 119323 N	Outline & Full
1.3	Planning application reference		Outline & Full
1.4	Total site area (hectares)	16.298Ha	Outline & Full
1.5	Pre-development use	Mixture of hardstanding structures and areas of soft landscaping used to cultivate plants for New Place Nursery	Outline & Full
1.6	Proposed design life	170 dwellings, with access, green spaces and associated amenities.	Outline & Full
1.7	Have agreements in principle for discharge been provided (where applicable)? (YES/NO)		Outline & Full
1.8	Topographic Survey Plan showing existing site layout, site levels and drainage system	Appendix B - 681387-R1(0)-FRA	Outline & Full

2. Discharge Hierarchy/Methods of Discharge[1]

No.	Requirement	Answer	Application Type
2.1	Store rainwater for later use (reuse) (YES/NO)	NO	Full
2.2	Infiltration techniques such as soakaways, permeable paving, etc (YES/NO)	YES	Outline & Full
2.3	Hybrid (YES/NO)	YES	Outline & Full

[1] Runoff may be discharged via one or multiple methods.

No.	Requirement	Answer	Application Type
2.4	Attenuation with restricted discharge to watercourse (YES/NO)	YES	Outline & Full
2.5	Attenuation with restricted discharge to surface water sewer (YES/NO)	NO	Outline & Full
2.6	Attenuation with restricted discharge to combined sewer (YES/NO)	NO	Outline & Full

3. Calculation Inputs

No.	Requirement	Answer	Application Type
3.1	Area within site which is drained by SuDS[2] (hectares)	3.99Ha	Outline & Full
3.2	Impermeable area drained pre-development[3] (hectares)	1.40Ha	Outline & Full
3.3	Impermeable area drained post-development[3] (hectares)	3.99Ha	Outline & Full
3.4	Urban Creep (hectares)	0.10Ha	Outline & Full
3.5	Climate change factor applied (1 in 30 and 1 in 100) (percentage)	45%	Outline & Full

4. Infiltration Feasibility/Ground Investigations

No.	Requirement	Answer	Application Type
4.1	Has winter groundwater monitoring and infiltration been undertaken? (YES/NO)	YES	Outline & Full
4.2	Period of winter groundwater monitoring (from/to)	12 months	Outline & Full
4.3	Depth to highest recorded groundwater level (mAOD)	None present	Full
4.4	Infiltration rate	average rate of 2.12x10^-5 (not acceptable)	Outline & Full

[2] Impermeable area should be measured pre and post development. Impermeable surfaces include roofs, pavements, driveways and paths, where runoff is conveyed to the drainage system.

[3] 10% Urban Creep should be added to the volumes required for storage and not increase discharge rates.

No.	Requirement	Answer	Application Type
4.5	Depth of infiltration structure (mAOD)	n/a	Full
4.6	Safety factor used for sizing infiltration storage	n/a	Outline & Full

5. Calculation Outputs: Greenfield Runoff Rates[4]

No.	Requirement	Answer	Application Type
5.1	Qbar (l/s)	24.28	Outline & Full
5.2	1 in 1 year rainfall (l/s)	20.78	Outline & Full
5.3	1 in 30 year rainfall (l/s)	55.15	Outline & Full
5.4	1 in 100 year rainfall (l/s)	77.54	Outline & Full

6. Calculation Outputs: Brownfield Runoff Rates (including Urban Creep) (if applicable)

No.	Requirement	Answer	Application Type
6.1	1 in 1 year rainfall (l/s)	n/a	Outline & Full
6.2	1 in 30 year rainfall (l/s)	n/a	Outline & Full
6.3	1 in 100 year rainfall (l/s)	n/a	Outline & Full

7. Calculation Outputs: Volume Control/Infiltration Provision

No.	Requirement	Answer	Application Type
7.1	Infiltration (m^3)	n/a	Outline & Full
7.2	Attenuation (m^3)	5013	Outline & Full
7.3	Separate volume designated as long-term storage[5] (m^3)	0	Full
7.4	Total volume control (sum of inputs for 7.1 to 7.3) (m^3)	5103	Full

[4] Flows within long term storage areas should be infiltrated to the ground or discharged at low flow rate of maximum 2 litres per second per hectare (l/s/ha).

[5] In calculations and for the avoidance of doubt FEH shall be used FSR is not acceptable, and CV values must equal 1.

8. Calculation Outputs: Attenuation/Restricted Discharge

No.	Requirement		Answer	Application Type
8.1	Proposed discharge rate (critical storm)	1 in 1 (100%) AEP (m/s)	0.0226	Outline & Full
		1 in 30 (3.33%) AEP (m/s)	0.0226	Outline & Full
		1 in 30 (3.33%) AEP plus climate change (m/s)	0.0226	Outline & Full
		1 in 100 (1%) AEP (m/s)	0.0226	Outline & Full
		1 in 100 (1%) AEP plus climate change (m/s)	0.0226	Outline & Full
8.2	Calculations show critical storm durations (both by max height and max discharge) for 1 in 1, 1 in 30, 1 in 30 plus climate change, 1 in 100 and 1 in 100 year plus climate change allowance can be accommodated on site (YES/NO)		YES - Appendix H - 681387-R1(0)-FRA	Outline & Full
8.3	Has treatment of potential contaminants been considered? (YES/NO)		YES	Outline & Full
8.4	Demonstration of source control features with substantive evidence why these cannot be used if not (YES/NO)		YES	Full
8.5	If discharging into a watercourse, piped system or the sea, has the proposed drainage network been modelled against predicted top water levels for the 1 in 100 year storm event plus climate change allowance, within the existing system? (YES/NO)		YES	Full

9. Other Supporting Details

No.	Requirement	Answer	Application Type
9.1	Plan detailing location of groundwater monitoring and infiltration testing	n/a	Outline & Full
9.2	Detailed drainage design layout	YES - Appendix I - 681387-R1(0)-FRA - 890815-RSK-ZZ-XX-DR-C-8301 Rev P03 Site Drainage East & West	Full
9.3	Maintenance strategy	YES - Appendix K - 681387-R1(0)-FRA - 890815 SUDS Management Strategy Report	Full

No.	Requirement	Answer	Application Type
9.4	Detailed development layout	YES - Appendix D - 681387-R1(0)-FRA - 890815 - RSK-ZZ-XX-DR-C-8000 Rev P01 Site Layout	Full
9.5	Impermeable area plan	YES - Appendix I - 681387-R1(0)-FRA - 890815-RSK-ZZ-XX-DR-C-8305 Rev P02 Catchment Plan	Full
9.6	Phasing plan?	Not available at pesent	Full
9.7	If ground levels are being raised over 300mm above existing levels and is unavoidable, have detailed plans been provided, together with drainage proposals, to address any potential drainage related issues?	No	Full

The above form should be completed using evidence from information which should be appended to this form. The information being submitted should be proportionate to the site conditions, flood risks and magnitude of development. It should serve as a summary of the drainage proposals and should clearly show that the proposed discharge rate and volume as a result of development will not be increasing. Where there is an increase in discharge rate or volume, then the relevant section of this form must be completed with clear evidence demonstrating how the requirements will be met.

This form is completed using factual information and can be used as a summary of the surface water drainage strategy on this site.

Form completed by	Granville Ashworth
Qualification of person responsible for signing off this proforma	Senior Infrastructure Engineer
Company	RSK LDE
On behalf of (client's details)	BDW Southern Counties
Date	31.10.2024

west sussex county council

Flood Risk Validation Checklist for Planning Applications

SITE NAME	New Place Farm, Pulborough
DATE	31/10/2024

1. Proforma

Description	Document/Drawing Ref and Page No. APPLICANT TO COMPLETE	Submitted? (Yes/No) LPA TO CHECK
Application only be validated by LPA if the LLFA surface water proforma is completed and attached	Appendix J - 681387-R1 (0)-FRA	YES

2. Site Surveys (if appropriate)

Description	Document/Drawing Ref and Page No. APPLICANT TO COMPLETE	Submitted? (Yes/No) LPA TO CHECK
Topographic survey	Appendix B - 681387-R1(0)-FRA	YES
Details of existing site layout, drainage, and catchment areas plus pre- and post-development impermeable areas	Section 2 - 681387-R1(0)-FRA Section 7 - 681387-R1(0)-FRA Appendix I - 681387-R1(0)-FRA	YES
Evidence of % increase for urban creep and how it has been applied to post-development calculations	Appendix I - 681387-R1(0)-FRA - 890815-RSK-ZZ-XX-DR-C-8305 Rev P02 Catchment P	YES
Ground investigation including groundwater level information (for seasonally high groundwater level), potential contamination and infiltration testing (to BRE365 or similar)	Section 3 - 681387-R1(0)-FRA GRM Development Solutions Ltd, August 2022 (GRM/P7298/F.2)	YES
Existing drainage scheme survey, e.g., CCTV or historic plans	n/a	
Survey of existing waterbodies, e.g., watercourses, ponds or springs and culverts or bridges	Appendix L - 681387-R1(0)-FRA	YES

3. Plans and Drawings

Description	Document/Drawing Ref and Page No. APPLICANT TO COMPLETE	Submitted? (Yes/No) LPA TO CHECK
Layout drawing including drainage scheme SuDS and other water features. Including invert levels, cover levels, conveyance systems any pipe gradients, flow directions and labels that match any drainage modelling calculations. Outfall locations, control devices, attenuation systems and water quality treatment features.	Appendix I - 681387-R1(0)-FRA 890815-RSK-ZZ-XX-DR-C-8302 Rev P03 Site Drainage East 890815-RSK-ZZ-XX-DR-C-8302 Rev P03 Site Drainage West 890815-RSK-ZZ-XX-DR-C-8308 Rev P02 Overland Flow Route 890815-RSK-ZZ-XX-DR-C-8305 Rev P02 Catchment Plan	YES

Description	Document/Drawing Ref and Page No. APPLICANT TO COMPLETE	Submitted? (Yes/No) LPA TO CHECK
High level construction management plan including phasing access arrangements and operational characteristics. Temporary drainage and water pollution including discharge points and flow controls should be included.	n/a	
Landscaping planting scheme for vegetated SuDS	n/a	
Maintenance plan and confirmation in principle of adopting authority for the lifetime of the development	Appendix K - 681387-R1(0)-FRA 890815 SUDS Management Strategy Report 890815-RSK-ZZ-XX-DR-C-8307 Rev P02 SUDS Management Plan	YES

4. Assessments

Description	Document/Drawing Ref and Page No. APPLICANT TO COMPLETE	Submitted? (Yes/No) LPA TO CHECK
Evidence that that the SuDS hierarchy and the 4 pillars have been met	Section 7.3.1 - 681387-R1(0)-FRA	YES
Full supporting calculations for the drainage design including design parameters using FEH and predevelopment greenfield runoff rates/volumes	Appendix G - 681387-R1(0)-FRA Appendix H - 681387-R1(0)-FRA	YES
Critical storm simulation results of the conveyance network by level and discharge for events 100% AEP, 3.33% AEP, 3.33% AEP plus climate change, 1% AEP and 1% AEP plus climate change	Appendix H - 681387-R1 (0)-FRA	YES
Evidence of calculations to support the sizing of storage features to accommodate the 3.33% AEP plus climate change and 1% AEP climate change critical storms	Appendix H - 681387-R1 (0)-FRA	YES
Evidence and drawing of where any flooding would occur during a 1% AEP plus climate change critical storm event would occur. Information should include extent, depth, and velocity of flooding, demonstrating that it would not leave the site boundary.	N/a - no flooding with SuDS drainage system	
Flood resistance and resilience measures 300mm above flood levels	Appendix I - 681387-R1(0)-FRA	YES
Drawing showing exceedance flows greater than 1% AEP plus climate change or if the drainage system is compromised	Appendix I - 681387-R1(0)-FRA 890815-RSK-ZZ-XX-DR-C-8308 Rev P02 Overland Flow Route	YES

5. Supplementary Evidence

Description	Document/Drawing Ref and Page No. APPLICANT TO COMPLETE	Submitted? (Yes/No) LPA TO CHECK
Confirmation of discharge location approval (in principal agreements from third parties if appropriate)	n/a	
Confirmation of any consents required	n/a	
Evidence of predevelopment discharge capacity analysis (where discharging from an existing pipe)	n/a	

APPENDIX K
SUDS MANAGEMENT STRATEGY

Client: BDW Southern Counties

Project: New Place Farm Pulborough, West Sussex

Sustainable Drainage System (SuDS) Management Strategy

Project No. 890815

DATE: NOVEMBER 2021

RSK GENERAL NOTES

Project No.: 890815-1 (01)

Title: New Place Farm, Pulborough, West Sussex

Client: BDW Southern Counties

Date: October 2024

Office: RSK Land and Development Ltd, 18 Frogmore Road, Hemel Hempstead, Herts, HP3 9RT.

Status: Draft

Author	Granville Ashworth	**Technical reviewer**	Andrew Muthusami
Date:	October 2024	Date:	October 2024
Project manager	Rupert Domoney		
Date:	October 2024		

CONTENTS

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2 MAINTENANCE RESPONSIBILITIES 4
3 MAINTENANCE REGIME 5
3.1 Permeable Paving 5
3.2 Detention Basins 6
3.3 Swales 7
3.4 Storage Tanks 8
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3.6 Operation and Maintenance Requirements for Trees 9
APPENDIX A INSPECTION CHECKLIST 10

1 INTRODUCTION

This management strategy has been prepared by RSK Land and Development Engineering Ltd on behalf of BDW Southern Counties, to satisfy planning conditions related to new Place Farm, Pulborough, West Suusex (The Development).

The SUDS considered for the purposes of this statement, include drainage features that will be employed to reduce and manage surface water runoff from the development to a design return period of One hundred years plus climate change. This is required so that The Development will not increase the risk of flooding to the site and its environs. All drainage on site is taken to the underlying strata via infiltration features. Such features include the following:

- Permeable paving;
- Infiltration/Detention Basins and Swales
- Filter strips and drains

This document outlines the long term maintenance of the proposed surface water system and will make reference to the following documents, some of which provide further detail on the maintenance operations required:

- CIRIA Report C753, *'The SUDS Manual'*, 2015
- CIRIA Report C625, *'Model Agreements for Sustainable Water Management Systems'*, 2004; and
- Interpave, *'Permeable pavements: Guide to the Design, Construction and Maintenance of Concrete Block Permeable Pavements'*, ed. 4, 2006.

2 MAINTENANCE RESPONSIBILITIES

Responsibility for drainage within England and Wales rests with various bodies. For The Development, the drainage responsibilities will be divided between the following:

- **Private Landowner** – each Householder will be responsible for the maintenance of drainage features within individual property curtilages.
- **Communal Areas** - A Management company will be set up for the Development to maintain all permeable paving, stormwater attenuation tanks, detention basins, outfalls and any associated flow controls within communal areas. However, it should be noted that if, the Flood and Water Management Act 2010 is ever fully implemented this allows a surface water drainage system to be vested to the SUDS approving body (SAB) in this case West Sussex County Council. This would be reviewed at the time of any implementation of the act.

3 MAINTENANCE REGIME

As the maintenance of the communal SUDS features will be carried out via a Management Company, the form of agreement should include the required maintenance listed below. Should the maintenance be transferred at a later date to a public body, then the model agreement SUDS MA1 should be used, details of which can be found in the CIRIA guidance C625.

The following section describes the required maintenance for each feature in turn. The SUDS maintenance requirements listed below should be reviewed after the first 5 years, with a view to agreeing a new regime for the ongoing maintenance.

Notwithstanding the routine inspections and maintenance requirements, after severe storm events all features shall be inspected to clear debris and repair damaged structures or features. Records of the maintenance carried out shall be prepared by the Management Company.

3.1 Permeable Paving

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three monthly 48h after large storms in first six months

Maintenance schedule	Required action	Typical frequency
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

3.2 Detention Basins

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

3.3 Swales

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass- to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for >48 hours	Monthly or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspection inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design level	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of soil surface	As required
	Remove build up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

3.4 Storage Tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, the annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survery inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

3.5 Filter Drains

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly or as required
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 398:2010	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly or as required
	Clear, perforated pipework of blockages	As required

3.6 Operation and Maintenance Requirements for Trees

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly or as required
	Manage other vegetation and remove nuisance plants	Monthly
	Inspect inlets and outlets	Monthly
Occasional maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually
	Water	As required
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

APPENDIX A
INSPECTION CHECKLIST

General information			
Site ID			
Site location and co-ordinates (GIS if appropriate)			
Elements forming the SuDS scheme		Approved drawing reference	
Inspection frequency		Approved specification reference	
Type of development		Specific purpose of any parts of the scheme (eg biodiversity, wildlife and visual aspects)	

Inspection Date	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date completed
General inspection items								
Is there any evidence of erosion, channelling, ponding (where not desirable) or other poor hydraulic performance?								
Is there any evidence of accidental spillages, oils, poor water quality, odours or nuisance insects?								
Have any health and safety risks been identified to either the public or maintenance operatives?								
Silt/Sediment accumulation								
Is there any sediment accumulation at inlets (or other defined accumulation zones such as the surface of filter drains or infiltration basins and within proprietary devices)? If yes, state depth (mm) and extent. Is removal required? If yes, state waste disposal requirements and confirm that all waste management requirements have been complied with (consult environmental regulator)								
Is surface clogging visible potentially problematic where water has to soak into the underlying construction or ground (eg underdrained swale or infiltration basin)?								
Does permeable or porous surfacing require sweeping to remove silt?								

Inspection Date	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date completed
Is there evidence of litter accumulation in the system? If yes, is this a blockage risk?								
Is there any evidence of any other clogging or blockage of outlets or drainage paths?								
Is the vegetation condition satisfactory (density, weed growth, coverage etc)? (check against approved planting regime)								
Does any part of the system require weeding, pruning or mowing? (check against maintenance frequency state in approved design).								
Is there any evidence of invasive species becoming established? If yes, state action required								
Are any check dams or weirs in good condition?								
Is there any evidence of any accidental damage to the system (eg wheel ruts?)								
Is there any evidence of cross connections or other unauthorised inflows?								
Is there any evidence of tampering with the flow control?								
Are there any other matters that could affect the performance of the system in relation to the design objectives for hydraulic, water quality, biodiversity and visual aspects?								

Inspection Date	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date completed
Other observations								
Information appended (eg photos)								
Continue as current Increase maintenance Decrease maintenance								
Proposed date for next inspection								

SuDS Components

Pervious surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or discharge to surface water. Porous surface replaces traditional impermeable surfaces.	
Area Control		
Conveyance Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff, and can infiltrate the water into the ground (if ground conditions allow).	
Modular Storage	Modular plastic geocellular systems with a high void ratio that can be used to create a below ground infiltration (soakaway) or storage structure.	
Filter strips	A vegetated/grassed area of gently sloping ground designed to drain water evenly off adjacent impermeable areas and filter out silt and other material.	
Regional Control		
Detention basin	Dry, vegetated surface basins that attenuate stormwater runoff by providing temporary storage and controlled release of detained runoff.	
Extended detention basins	Extended detention basins are normally dry, though they may have small permanent pools at the inlet and outlet. They are designed to detain a certain volume of runoff as well as providing water quality treatment.	
Ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment and a shallow marsh. They provide temporary storage for additional storm runoff above the permanent water level. Wet ponds may provide amenity and wildlife benefits.	

CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:–

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Notes:

1. This drawing is to be read in conjunction with all relevant Architects and Engineers drawings and specifications.
2. Topographical Survey and Levels from NJC Survey Ltd, Drawing Number S1572 Dated 18th March 2019
3. Layout based on FINC Architects Drawing 24.1874.1001 Dated August 2024.

Legend:

- Site Boundary
- Pipework and Manho
- Enhanced Swale
- Existing Ditch
- Proposed Porous Paving
- Proposed Cellular Storage
- Proposed Pond / Detention Basin
- Proposed Flow Control

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P02	23.10.2024	Issued for PLANNING	LN	GXA	RD
P01	15.10.2024	Preliminary Issue	LN	GXA	RD

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Client
BARRATT DAVID WILSON (SOUTHERN COUNTIES)

Project Title
NEW PLACE FARM
PULBOROUGH
WEST SUSSEX

Status
PLANNING

Drawing Title
SUDS MANAGEMENT PLAN

Drawn	Date	Checked	Date	Approved	Date
LN	09.24	GXA	09.24	RD	09.24

Scale	Orig Size	Dimensions
1:1,000	A1	m

Project No. 890815

Drawing File 890815 - RSK-ZZ-XX-DR-C-8307 SuDS Management Plan.dwg

Drawing No.							Rev.
890815	RSK	ZZ	XX	DR	C	8307	P02
Project	Orig.	Vol./Sys.	Lev./Loc.	Type	Role	Draw. No.	

Scale
0 10 20 30 40 50m

File Location: Z:\P-LDE (PROJECTS)\890815 - NEW PLACE FARM, PULBOROUGH\GRAPHIN\FRSTRUCTURE\DRAWINGS\8 - PLANNING\890815 - RSK-ZZ-XX-DR-C-8307 SUDS MANAGEMENT PLAN.DWG

APPENDIX L
SITE VISIT NOTES AND PHOTOS

	Report No: 681387	PHOTOGRAPHIC LOG

Client name: Catesby Estates	**Site Location:** New Place Farm, Pulborough – Site Walkover

Photo No. 1	**Date:** 10.07.24
Description: Photo of the railway line that makes up the northwestern boundary of the site and the ditch where the surface water flow path is located.	

Photo No. 2	**Date:** 10.07.24
Description: Photo showing the elevation differences between the site and the railway line (flow path) location.	

	Report No: 681387	PHOTOGRAPHIC LOG

Client name: Catesby Estates	**Site Location:** New Place Farm, Pulborough – Site Walkover

Photo No. 3	**Date:** 10.07.24	
Description: An overgrown surface water drainage channel located in the eastern part of the site that flows east to west.		

Photo No. 4	**Date:** 10.07.24	
Description: Current greenhouses on site with irrigation systems		

	Report No: 681387	PHOTOGRAPHIC LOG

Client name: Catesby Estates	**Site Location:** New Place Farm, Pulborough – Site Walkover

Photo No. 5	**Date:** 10.07.24	
Description: Current unused hatchling area with irrigation system		

Photo No. 6	**Date:** 10.07.24	
Description: Evidence of surface water overland flow running along foot paths throughout the site.		

	Report No: 681387	PHOTOGRAPHIC LOG

Client name: Catesby Estates	**Site Location:** New Place Farm, Pulborough – Site Walkover

Photo No. 7	**Date:** 10.07.24
Description: Overgrown surface water drainage channel running through the centre of the site.	

Photo No. 8	**Date:** 10.07.24
Description: Culvert linking the eastern surface water channel and main, central surface water channel.	

	Report No: 681387	PHOTOGRAPHIC LOG

Client name: Catesby Estates	**Site Location:** New Place Farm, Pulborough – Site Walkover

Photo No. 9	**Date:** 10.07.24	
Description: Local depression located alongside the footpath off Strawberry Field.		

Photo No. 10	**Date:** 10.07.24	
Description: Surface water drainage ditch that runs alongside the footpath from Strawberry Field.		

	Report No: 681387	PHOTOGRAPHIC LOG

Client name: Catesby Estates	**Site Location:** New Place Farm, Pulborough – Site Walkover

Photo No. 11	**Date:** 10.07.24	
Description: Man-made reservoir used to water plants within the plant nursery.		

Photo No. 12	**Date:** 10.07.24	
Description: Overgrown southern drainage ditch that runs along the site's southern boundary.		

	Report No: 681387	PHOTOGRAPHIC LOG

Client name: Catesby Estates	**Site Location:** New Place Farm, Pulborough – Site Walkover

Photo No. 13	**Date:** 10.07.24	
Description: Location of connection between the surface water ditch on the southern boundary to the main outfall ditch.		

Photo No. 14	**Date:** 10.07.24	
Description: Start of culvert from the main drainage ditch leaving the site.		

	Report No: 681387	PHOTOGRAPHIC LOG

Client name: Catesby Estates	**Site Location:** New Place Farm, Pulborough – Site Walkover

Photo No. 15	**Date:** 10.07.24
Description: End of culvert leaving the site to flow into a surface water channel flowing south adjacent to the footpath.	

Photo No. 16	**Date:** 10.07.24
Description: New Southern Water installation location next to the end of the culvert outfall. It is not known what the purpose of this structure is.