

BDW North Thames

Land at Talbot Way, Letchworth

Drainage Technical Note

**Report Ref:
2502330-ACE-XX-XX-RP-C-0301**

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REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
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Distribution

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1.0 Introduction

Scope

- 1.1. Ardent Consulting Engineers, hereafter referred to as 'Ardent', has been appointed by BDW North Thames to provide a Drainage Strategy and Drainage Technical Note in support of a reserved matters planning application for a residential development comprising 120 units.
- 1.2. The site benefits from outline planning, ref; 21/00504/OP. This report has been prepared to demonstrate a suitable drainage strategy can be implemented for the site.

Development Proposals

- 1.3. The development proposals seek Reserved Matters permission for a residential development of comprising 120 residential units (40% affordable) including detailed appearance, landscaping, layout and scale in line with the approved outline application (ref. 21/00504/OP) and the design principles within the LGCHF LG3 Design Framework. Refer to **Figure 1-1** for an extract of the site layout and to **Appendix A** for the full plan.



Figure 1-1: Extract of Site Layout (HTA Architects Ltd.)

- 1.4. A vehicular access point and pedestrian access to the development are proposed off Flint Road to the south of the development. Two pedestrian accesses are proposed to the north of the development off the existing public right of way. A vehicular access to the existing allotments on the west of the site.
- 1.5. The total application area of the site is approximately 5.54ha, while the net developable area is circa 3.63 ha.

Planning Background

- 1.6. Outline planning has been granted conditional permission in April 2025 with all matters reserved except access, for a *"residential development comprising of up to 120 dwellings with vehicular access via Flint Road"*.
- 1.7. The outline planning application was supported by a Flood Risk Assessment (FRA) and Drainage Strategy produced by Environmental Protection Group Ltd. (EPG), both dated January 2023. The proposed drainage strategy prepared by Ardent in support of the Reserved Matters application aligns with the principles established in the approved Outline FRA. Any deviations from the outline strategy have been clearly communicated and represent improvements to the overall design.
- 1.8. The Outline Planning conditions relevant to the drainage proposals are Conditions 3, 4, 6, and 7. Condition 5 relates to temporary drainage and is therefore included within the scope of temporary works and is excluded from this statement. The former conditions are outlined below:

1.8.1. Condition 3: *Prior to commencement of development, in accordance with the submitted Surface Water Management Drainage Strategy by EPG (Revisions 2.0, January 2023, ref: EPG-9262-DS-01) and additional information prepared by EPG (dated 25th April 2023, ref: EPG-LGC-LTR-04), detailed designs of a surface water drainage scheme, incorporating the following measures shall be submitted to and approved by the Local Planning Authority:*

(a) Detailed infiltration testing in accordance with BRE Digest 365 (or equivalent) OR if infiltration is proven to be unfavourable, then surface water runoff rates will be attenuated and restricted to greenfield rates (no greater than 8l/s) and will discharge to the Anglian Water sewer in Flint Road;

(b) Detailed designs, modelling calculations and plans of the drainage conveyance network (including engineering drawings of all SuDS elements) in the: -50%

annual probability critical rainfall event to show no surcharging of the drainage network;

- 3.33% annual probability critical rainfall event plus climate change to show no above ground flooding on any part of the site;

- 1% annual probability critical rainfall plus climate change event to show, if any, the depth, volume and storage location of any above ground flooding from the drainage network ensuring that flooding does not occur in any part of a building or any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

(c) Half drain down times for any infiltration SuDS features to demonstrate that they are able to half drain within 24 hours. Attenuation features should be able to half drain in 24-48 hours.

(d) Details of all surface water management features to be designed in accordance with The SuDS Manual (CIRIA C753, 2015 or any subsequent updates), including appropriate treatment stages for water quality prior to discharge.

(e) Finished ground floor levels of properties are a minimum of 300mm above expected flood levels of all sources of flooding or 150mm above ground level, whichever is the more precautionary.

(f) A plan showing exceedance flow routes within and off site above the 1% AEP (plus climate change) storm event.

The approved scheme shall be implemented prior to the first occupation of the development.

Reason: To ensure the flood risk is adequately addressed for each new dwelling and not increased in accordance with NPPF Paragraphs 167 and 169 and Policy NE7 of the North Hertfordshire Local Plan 2011-2031.

1.8.2. Condition 4: *The development hereby approved shall not be occupied until details of the maintenance and management of the sustainable drainage scheme have been submitted to and approved in writing by the Local Planning Authority. The drainage scheme shall be implemented prior to first occupation of the development hereby approved and thereafter managed and maintained in accordance with the approved details in perpetuity. The Local Planning Authority*

shall be granted access to inspect the sustainable drainage scheme for the lifetime of the development. The details of the scheme to be submitted for approval shall include:

- (a) A timetable for its implementation;*
- (b) Details of SuDS features and connecting drainage structures and maintenance requirement for each aspect;*
- (c) A management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public body or statutory undertaker, or any other arrangements to secure the operation of the sustainable drainage scheme throughout its lifetime.*

Reason: To ensure that the development achieves a high standard of sustainability and ensure the flood risk is adequately addressed for each new dwelling and not increased in accordance with Policies NE7 and NE8 of the North Hertfordshire Local Plan 2011-2031.

1.8.3. Condition 6: *No works involving excavations that penetrate into the chalk aquifer below the groundwater table (for example, piling or the installation of a geothermal open/closed loop system) system shall be carried out until the following has been submitted to and approved in writing by the Local Planning Authority:*

- (i) An Intrusive Ground Investigation to identify the current state of the site and appropriate techniques to avoid displacing any shallow contamination to a greater depth.*
- (ii) A risk assessment identifying both the aquifer and the abstraction points as potential receptors of contamination.*
- (iii) A method statement detailing the depth and type of excavations (eg piling) to be undertaken including mitigation measures (e.g. appropriate piling design) to prevent and/or minimise any potential migration of pollutants to public water supply. Any excavations must be undertaken in accordance with the terms of the approved method statement.*

Reason: To avoid displacing any shallow contamination to a greater depth and to prevent and/or minimise any potential migration of pollutants to a public water supply abstraction.

- 1.8.4. Condition 7:** *Prior to construction above damp-proof course, a scheme for on-site foul water drainage works, including connection point and discharge rate to the public network, shall be submitted to and approved in writing by the Local Planning Authority.*

Reason: To prevent environmental and amenity problems arising from flooding.

2.0 Existing Site

Description

- 2.1. The site is situated on the north-east of Letchworth Garden City to the east of Talbot Way and north of Flint Road. The site is bounded by allotments and then residential properties on the western side. The northern side is bounded by an existing public right of way and further residential properties. On the southern and eastern sides are some existing woodland areas that bound the site. This woodland separates the southern edge of the site from an existing industrial estate off Flint Road.
- 2.2. The site and the surrounding area are shown in **Figure 2-1**.



Figure 2-1: Site and surrounding area (Google maps)

- 2.3. The Local Planning Authority (LPA) for the site is North Hertfordshire District Council (NHC), and Hertfordshire County Council (HCC) are the Lead Local Flood Authority (LLFA). The site is entirely greenfield, and has never been developed with the exception to an existing track serving the allotments adjacent to the site. There are existing hedgerows and tree lines on the site, with a woodland area on the south of the site. The approximate centre of the site is at grid coordinates 523275m easting, 234085m northing.

- 2.4. The site is referenced as 'LG3' within North Hertfordshire District Council's Local Plan 2011-2031. This document is part of the council's Development Plan which is used to determine planning applications. Within the Local Plan, 'LG3', is one of the twelve sites in Letchworth that have been allocated with an aim to be built over the plan period.
- 2.5. The topographical survey, which was undertaken by Greenhatch Group Ltd. in April 2019, is included in **Appendix B**. The site is generally flat around the highpoint of 89.05m on the northern/western part of the site. The land then slopes down from the higher areas at circa 1:16 slope toward the fence line on the lower points of the site on the south to circa 76.10m. Beyond the fence line is some dense trees and vegetation that slope steeply down toward the low point of circa 74.45m in the south-eastern corner of the site.

Existing Drainage

- 2.6. Anglian Water sewer asset records have been obtained for the whole of the site and are included in **Appendix C**. An extract of the sewer records is shown in **Figure 2-2**.



Figure 2-2: Extract of Existing Anglian Water asset records (Anglian Water)

- 2.7. Based on the available information, there are no existing surface water sewers located within the application boundary. South of the site, a 375mm diameter surface water sewer extends southwards along Flint Road. Adjacent to this, a 225mm diameter foul water sewer also extends southwards along Flint Road.

3.0 Surface Water Drainage

Technical Standards

3.1. The surface water drainage strategy for the proposed development is in accordance with the following technical standards and best practice guidance, which are referred to throughout this section:

- North Hertfordshire Council Local Plan 2011-2031;
- Hertfordshire County Council LLFA Summary Guidance for developers (dated August 2021);
- The CIRIA SuDS Manual C753;
- Non-statutory technical standards for sustainable drainage systems. A Best Practice Guidance was published by the Local Authority SuDS Officer Organisation (LASOO) in July 2015 to accompany this document;
- BS8582 Code of practice for surface water management for development sites;
- The National Planning Policy Framework.

Outline Drainage Strategy

3.2. The approved Outline drainage strategy utilised infiltration to dispose of runoff. The infiltration rates used on the strategy, based off testing completed by G7 Geotech (see **Appendix D**) completed in October 2021, used the most favourable value (1.41×10^{-5} m/s). However, as stated in the SuDS Manual section 25.3, "*the worst-case infiltration rate value should be used unless sound justification for doing otherwise is demonstrated*". Given that there is no noticeable change in ground conditions across the site, there is no justification to use the more favourable rate. Examining the potential to utilise infiltration for the proposed drainage strategy, the worst case rate should be used (2.06×10^{-6} m/s).

3.3. In order to secure support from Herts LLFA and remove the holding objection, the outline drainage strategy had to demonstrate an alternative option was available which was not reliant upon infiltration. For this option, the infiltration basin became an attenuation basin and an offsite connection to the existing surface water sewers was agreed with Anglian Water at a maximum discharge rate of 8l/s.

3.4. To provide adequate attenuation capacity within the Outline drainage strategy, cellular tanks buried beneath detention basins were used. In the drainage design calculations for the Outline drainage strategy, default CV (runoff coefficient) values were used. A 10% Urban Creep factor was applied to the impermeable areas within the outline proposals.

Drainage Hierarchy Consideration

- 3.5. In accordance with the CIRIA guidance C753 (hereafter referred to as the SuDS manual), the drainage hierarchy needs to be considered and is listed below in descending order of preference:

- 3.5.1. Infiltration to the maximum extent that is practical – where it is safe and acceptable to do so;
- 3.5.2. Discharge to surface waters;
- 3.5.3. Discharge to surface water sewers;
- 3.5.4. Discharge to a combined sewer (last resort).

Infiltration

- 3.6. In accordance with the drainage hierarchy, infiltration was considered as the primary method for surface water disposal. The feasibility of infiltration is subject to verification of ground conditions, soil contamination, and soakage capacity, in line with the requirements of *The SuDS Manual* and *BRE Digest 365*.
- 3.7. As outlined in paragraph 3.3, the approved outline drainage strategy proposed the use of infiltration to manage surface water runoff. Four infiltration tests were undertaken across the site; however, only two of these tests could be completed successfully due to slow infiltration and difficulties achieving measurable soakage. The completed tests recorded infiltration rates of approximately 1.5×10^{-5} m/s, while the incomplete or failed tests indicated much lower rates, in the region of 2.0×10^{-6} m/s or below. In accordance with *The SuDS Manual*, the lowest measured rate should be adopted for design purposes unless distinct geological variation can be demonstrated. Given that all test locations targeted the same chalk strata, the lower infiltration rate has been used to assess viability.
- 3.8. Using the lowest verified infiltration rate of 2.0×10^{-6} m/s, infiltration basins would require in the order of 1,400 m³ of attenuation to accommodate design storm events, which would more than double the approved outline storage provision. Furthermore, drainage modelling indicates that with this infiltration rate, the basins would not achieve the required half-drain time (≤ 24 hours) as set out in *The SuDS Manual Table 26.2*.
- 3.9. The above points confirm that infiltration is not a practical or reliable option for the development. The combination of limited test success, poor soakage performance, and excessive storage requirements therefore renders an infiltration-based strategy unviable for this site.

Discharge to surface waters

- 3.10. There are no existing watercourses or waterbodies within or adjacent to the site. As such, discharge to a watercourse is not considered a viable option for this development.

Discharge to surface waters sewers

- 3.11. In accordance with the drainage hierarchy, it is proposed that surface water runoff from the site will discharge to the existing public sewer network to the south at a restricted rate of 8.0 l/s, which is below the calculated greenfield runoff rate. This discharge rate was agreed in principle by Anglian Water at the outline stage, and has subsequently been reaffirmed through technical correspondence by Ardent with Anglian Water (see **Appendix E**). Hertfordshire County Council, as Lead Local Flood Authority, has confirmed that they accept this approach (see **Appendix F**).

Consideration of Sustainable Drainage Systems (SuDS)

3.12. DEFRA's Non-statutory technical guidance for Sustainable Drainage Systems and "The SuDS manual" have been used to develop the appropriate SuDS strategy. The constraints and opportunities for the use of various SuDS components are summarised in **Table 3-1** below.

Table 3-1: General viability of SuDS components for the development

SuDS Component	Infiltration Devices
Constraints	Given that the site is suspected to have limited infiltration soakage capacity, infiltration devices are not considered a viable drainage option.
Opportunities	None.
SuDS Component	Lined Permeable Paving (Source Control)
Constraints	The treatment and conveyance benefits of permeable paving rely on regular maintenance. While value engineering may be applied at the detailed design stage, incorporating alternative sustainable treatment stages is recommended to manage water quality effectively.
Opportunities	Permeable paving can be used to provide a stage of treatment in private drives around the site, should this be required as part of the treatment train.
SuDS Component	Rainwater Harvesting (Source Control)
Constraints	The benefits of rainwater harvesting on a specific design storm event cannot be quantified, due to the seasonal availability of storage within the structure.
Opportunities	Opportunities in garden areas to provide harvesting features such as water butts exist. However, it is difficult to quantify contribution, and therefore not included within calculations as part of this surface water management strategy.
SuDS Component	Swales (Permeable Conveyance)
Constraints:	In order to provide practicable attenuation benefits 1:3 side-slope swales tend to require a significant land requirement.
Opportunities:	Where possible swales will be incorporated along roads and in open spaces in coordination with the architect and landscape architect. These can be underdrained where required to reduce landtake.
SuDS Component	Bioretention Systems (Filtration)
Constraints:	Bioretention systems have more rigorous upkeep and maintenance and are therefore often poorly maintained. This leads to clogging over time. They are subject to coordination and can be difficult to get adopted within the sewer network.
Opportunities:	Bio Retention and Raingardens will be incorporated within verges and/or public landscaped areas, designed in coordination with the architect and landscape architect.
SuDS Component	Green Roofs (Source Control)

Constraints:	Subject to Architect's design and house-types, all houses will have pitched roofs. Increased structural load not feasible for individual houses.
Opportunities:	None.
SuDS Component	Attenuation Ponds/Basins (Retention/Detention)
Constraints:	In order to provide practicable attenuation benefits, 1:3 side slopes ponds/basins tend to require significant land requirement. There are also existing treelines/hedge lines on the edges of the site that are likely to be retained for the development. Any ponds/basins and associated reprofiling of levels will need to be located outside the root protection areas for these trees.
Opportunities:	There is space within the development to allow basins to be used to provide stormwater storage and treatment.
SuDS Component	Attenuation Tanks (Retention/Detention)
Constraints:	Attenuation Tanks require a significant land requirement which would need to be strategically placed and correctly aligned within the above construction type.
Opportunities:	Where required to provide supplementary attenuation tanks can be used where readily accessible such as parking spaces and open spaces, these will be designed as part of the SuDS treatment train to ensure source control is provided upstream to remove sediment and other contaminants.

3.13. Going through each of the different SuDS components in **Table 4-1**, it has been deemed that Attenuation Basins, Swales, and Bioretention Systems are the most viable option to provide both surface water storage and treatment within the surface water drainage system prior to discharging off site. Buried storage will be required to provide additional attenuation volume due to the steep topography and existing landscaping limiting the effective volume of the basins.

3.14. A proposed SuDS Treatment Plan has been produced as part of the drainage strategy. A copy of this can be found in **Appendix G**.

3.15. A proposed SuDS Maintenance Plan has been produced as part of the drainage strategy. A copy of this can be found in **Appendix H**.

Climate Change Allowance

3.16. The Planning Practice Guidance (PPG), last updated in August 2022, states that to allow for the predicted impacts of climate change on peak rainfall allowance, consideration should be given to the catchment within which the site is located. The site is located in the Upper and Bedford Ouse Management Catchment.

3.17. The PPG states that to account for the impact of climate change on surface water runoff within the catchment, the following increases stated **Table 3-2** below,

should be applied to the site rainfall intensities. For developments with lifetime up to or beyond 2100, the upper end allowances should be used.

3.18. Therefore, in line with the policy requirements, the proposed drainage strategy will apply 35% and 40% for the effects of climate change on the 3.3% and 1% annual exceedance rainfall events.

Table 3-2: Upper and Bedford Ouse Management Catchment Climate Change Allowance Factors

Upper and Bedford Ouse Management Catchment	Higher Central	Upper End
3.3% annual exceedance rainfall event		
Total potential change 2050s	20%	35%
Total potential change 2070s	25%	35%
1% annual exceedance rainfall event		
Total potential change 2050s	20%	40%
Total potential change 2070s	25%	40%

Proposed Surface Water Drainage Strategy

3.19. For the net developable area of 3.63 ha, it is proposed to limit the total surface water discharge for all storm events up to and including the 1 in 100 year plus climate change events into the existing sewers back to 8.0 l/s. This approach is in line with the conditional planning approval for the outline strategy (21/00504/OP) which stated in **Condition 3**, that *"if infiltration is proven to be unfavourable, then surface water runoff rates will be attenuated and restricted to greenfield rates (no greater than 8l/s) and will discharge to the Anglian Water sewer in Flint Road"*.

3.20. A meeting has been held with HCC as the LLFA to confirm the approach for the stormwater drainage design. The meeting minutes are provided in **Appendix F**. In line with the outline strategy, HCC have agreed to the use of default CV (runoff coefficient) values for the calculations. The network has also been assessed with a CV value of 1.0 to assess the need for any flood mitigation measures.

3.21. Using hydraulic modelling software, the surface water design calculations have been carried out for the following storm events: 1 in 2 year, 1 in 30 year + 35% climate

change, 1 in 100 year +40% climate change. The calculations are included in **Appendix I** and the results show that the attenuation features provide sufficient storage and no flooding, in line with current best practice.

3.22. The total impermeable area for the development has been measured as 2.17 ha based on the site layout included in **Appendix A** this is based on The SUDS manual approach, using 60% of the development area as assumed impermeable area. This 60% of the development area is also accounting for Urban creep.

3.23. The total impermeable area for the development has been calculated as 2.17 ha, based on the site layout shown in **Appendix A**. This figure has been derived using the SuDS Manual (C753) methodology, assuming 60% of the total development area to be impermeable. The 60% allowance is robust and accounts for urban creep.

3.24. The proposed drainage strategy is included in **Appendix J** and indicates how the site will be drained, including the location of attenuation features, the indicative pipe network, and the discharge location.

3.25. The strategy divides the development into three separate catchments – northern, central, and a southern catchment. Runoff from the hardstanding areas is collected and conveyed by swales and pipework with bioretention / raingarden systems across the site. The surface water storage in the network is provided by two detention basins and an offline cellular tank. Flow controls are placed directly downstream of the basins and the tank to restricts flows through the network and maximise storage utilisation.

3.26. Vegetated headwalls have been provided at the basin inlet and outlets, offering significant landscaping benefits by promoting natural planting and enhancing the green infrastructure within the vicinity. We have provided an example construction detail of a vegetated headwall in **Appendix K**, based on GeoGrow Ltd.'s Rootlok Vegetated Wall System. An equivalent or similar system can be used for the Detention Basin, subject to approval from the adopting authority

3.27. The respective catchment areas, impermeable area including urban creep, and drainage features for each catchment are summarised below in **Table 3-3**.

Table 3-3: Drainage Catchment Area Summary

Catchment	Catchment Area (ha)	Impermeable Area +UC (ha)	Drainage Features
Northern	0.85	0.51	<i>Pipework, Swales, Detention Basin</i>
Central	1.89	1.13	<i>Pipework, Swales, Detention Basin, Bioretention System</i>
Southern	0.89	0.53	<i>Pipework, Swales, Cellular Tank, Bioretention System</i>
Total	3.63	2.17ha	<i>Pipework, Swales, Detention Basin, Bioretention System</i>

3.28. Surface water runoff from each of the catchments is conveyed via pipework and restricted through flow controls in the network. Refer to the drainage strategy in **Appendix J** for how each of the catchment within the network are connected. The net surface water runoff from the development is restricted to 8.0 l/s prior to outfall to the existing Anglian Water sewer. The overall storage provision across the basins and tank is sufficient to accommodate all rainfall events up to and including the 1 in 100 year plus 40% climate change allowance, with an additional 300 mm freeboard incorporated for exceedance management.

3.29. Following correspondence with Anglian Water, the proposed discharge rate of 8l/s into the sewer network south of the site, has been agreed. The email confirmation is included in **Appendix E**. This connection is still subject to a completed Section 106 agreement.

3.30. In the event that the capacity of the sewer network is exceeded, excess surface water will be conveyed along the established overland flow routes. These routes are designed to direct flows away from building and habited areas, guiding them toward the site's natural low points. Exceedance/overland flow routes arrows are also shown on the drainage strategy in **Appendix J**.

Surface Water Runoff Quality

3.31. Without implementing appropriate SuDS features with adequate treatment provision, the surface water runoff from the proposed impermeable surfacing would increase the risk of surface water contamination. The CIRIA C753 SuDS Manual, sets out the process for determining pollution risk from the land use and the treatment potential for a development with the 'Simple Index Approach'. Specifically, Tables

26.2, 26.3, and 26.4 in the SuDS Manual which have been duplicated in **Appendix H**.

3.32. Table 26.2 from the SuDS Manual identifying the indicative pollution hazard indices for the relevant land uses. Based on the proposed layout, the Pollution Hazard Level would be considered 'Very Low' to 'Low' for the majority of the development site, with the exception of the proposed main access road, as it is currently anticipated this will accommodate more than 300 traffic movements per day. Therefore, the Pollution Hazard Level for the main access road is considered 'Medium'.

3.33. To assess the treatment provision for each of the catchments, the SuDS mitigation contributions for the drainage features in each catchment are considered separately. To provide adequate treatment to the surface water runoff the total mitigation indices for the SuDS strategy need to exceed the pollution hazard level. The treatment calculation is provided in **Appendix H**. The calculation demonstrates that across the different catchments the array of swales, bioretention systems, and detention basins, swale, provide sufficient treatment of metals, hydrocarbons, and total suspended solids for the 'Medium' pollution Hazard Levels from the development.

3.34. It has therefore been demonstrated that adequate treatment is provided within the proposed SuDS network prior to discharging surface water runoff into the existing Anglian Water sewers.

Exceedance Routes

3.35. As a result of heavy or extreme storm events, it is sometimes unavoidable that the capacity of the sewers and other drainage systems will be exceeded. This could occur in any of the following events:

- when the runoff exceeds the inlet capacity of the drainage system;
- when the receiving water or pipe system becomes overloaded/blocked or;
- when the outfall is restricted due to flood levels in the receiving water

3.36. To limit the impact of flow exceedance on people and properties, the flow exceedance routes must be assessed and suitable mitigation measures must be incorporated. To offset the impact of exceedance the levels and masterplan have been designed to direct flows away from buildings/habited areas and toward the low points of the site and non-habited areas. These exceedance routes ultimately mimic the current flow routes on the site.

3.37. Additionally, the proposed attenuation features have been located toward the lower lying areas of the site, to ensure that any exceedance flows can be swiftly directed toward the low points of the site. The overland flow routes for the proposals are shown on the drainage strategy included in **Appendix J**.

Future Maintenance and Adoption

3.38. It is the intention that the main sewers will be adopted under a Section 104 agreement. If the proposed roads are not adopted by the Highway Authority (Hertfordshire County Council), then a suitable drainage easement around the sewers will have to be considered.

3.39. If it is not possible to get the SuDS components included within the S104 agreement, they will be conveyed to a management company for maintenance.

3.40. All the plot drainage will remain private, while all the gullies and connections within access roads will be managed by a management company if the roads are not being offered for adoption.

3.41. A maintenance plan is also included in **Appendix G**. These have been informed by the guidance outlined within the CIRIA C753 SuDS Manual, and will be supplemented by manufacturers specifications. Any drainage/SuDS features that can be adopted will be managed by HCC or Anglian Water, otherwise, a management company will be responsible for their maintenance.

4.0 Foul Water Drainage

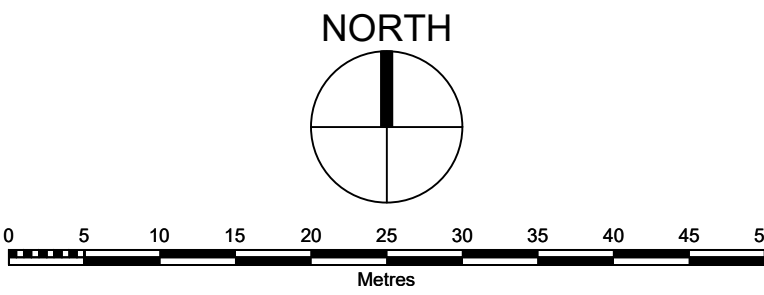
- 4.1. The proposed development comprises of 120 units. In line with the Sewerage Sector Guidance Appendix C, clause B3.1b, the peak design rate for foul water can be determined as a rate of 4000 litres per day for each dwelling. Therefore, the peak foul flow rate comes to a total of 5.6 l/s.
- 4.2. Due to the site topography, plots 103-115, totalling 13 units in the south eastern corner of the site are at a lower level than the nearest existing Anglian water asset, a private package pump is proposed to serve these units. This will fall under the responsibility of a private management company and will discharge to the proposed adoptable foul sewers within the development prior to discharging to the existing Anglian water asset in flint road. The private package pump will not put an additional l/s on top of the peak foul flow rate mentioned in paragraph 4.1.
- 4.3. The adoptable foul water drainage will collect flows generated from the proposed dwellings and convey them via a gravity sewer network toward the existing Anglian Water foul sewer located to the south of the site. Previous pre-development enquiries have been received from Anglian Water in 2021 and 2024 each of which confirmed capacity to accommodate the development discharge into the 225mm foul sewer adjacent to the site access. Specifically, Manhole F3901. See **Appendix E**.
- 4.4. The drainage strategy which shows the foul water drainage system is shown in **Appendix J**.

5.0 Conclusion

- 5.1. Ardent Consulting Engineers, has been appointed by BDW North Thames to provide a Drainage Strategy and Drainage Statement in support of a reserved matters planning application for a residential development comprising up to 120 units. The site benefits from outline planning and this report has been prepared to demonstrate a suitable drainage strategy can be implemented for the site.
- 5.2. The approved outline strategy utilised infiltration to dispose of surface water runoff which, upon review, the site is deemed unsuitable for infiltration. Instead, in line with the drainage hierarchy, the proposed drainage strategy will discharge into existing Anglian Water sewers located adjacent to the site as agreed with both the LLFA and Anglian Water.
- 5.3. The proposed drainage network manages the site through three catchments, with attenuation provided by two detention basins and an offline cellular tank. Surface water is conveyed via swales and pipework, supplemented by bioretention features, before being discharged at an agreed restricted rate of 8.0 l/s to the existing Anglian Water sewer. The system is designed to accommodate the 1 in 100 year plus 40% climate change event with additional 300mm freeboard in the basins to manage exceedance.
- 5.4. Water quality treatment of runoff has been designed in accordance with the CIRIA C753 SuDS Manual. It has been shown that using Simple Index Approach, the current proposals provide adequate pollution hazard mitigation for the surface water. Additional Source Control measures have also been included within the landscaped areas across the site as requested by the LLFA.
- 5.5. To limit the impact of exceedance flow routes on the proposed development, the masterplan and levels will be designed to convey flows away from buildings and toward non-habited area and the lower points of the site. These routes also simulate the existing flow paths and therefore will not increase flood risk.
- 5.6. It is proposed that the foul water flows from the development be conveyed by sewers and discharged into the existing Anglian Water sewer located south of the site. The peak design rate for foul water has been determined (as a rate 4000 litres per day for each dwelling) as 5.6 l/s. This approach has been agreed with Anglian Water and follows what was approved at outline planning.

Appendix A – Site Layout

Do not scale from drawings unless by agreement with HTA. Use figured dimensions only.
Check all dimensions on the print to confirm the works. Drawing to be read in conjunction with other relevant consultant information.
This drawing is the copyright of HTA Design LLP and must not be copied or reproduced in part or in whole, without the express permission of HTA Design LLP.
Drawing to be read in conjunction with specification.



- Site Boundary
- Plot number
- Car parking plot number
- Visitor car parking
- Temporary Sales Arena car parking
- Affordable Rent
- Shared Ownership
- Social Rent



I	12.05.26	JPA	Northern SUDS basin correctly shown
H	10.05.26	JPA	Southern access adjusted to match highways consultant design
F	30.05.26	JPA	Adoptable Highway extended outside southern quarters
G	01.05.26	JPA	Village green footpath updated, note corrected
E	27.04.26	JPA	Landscape and SUDS updated
D	21.11.25	JPA	Minor amendments to plots 83/84, 88/89 and various other plots, parking for substitution relocated
C	31.10.25	SAB	Road Design Amended
B	08.10.25	JPA	Affordable Rent and SH updated - social rent plots 10, 20, plots 35, 36 changed from Y162 to Y160, plots 45, 47 changed from Y164 to Y162
A	29.09.25	JPA	Various plots updated with different boundaries: plots 11, 14, 17, 46, 55, 88, 91, 97, 98
Rev	08.09.25	JPA	Partners Internal Referral, Sales centre parking relocated, Initial Issue Pre-Planning Pack to Foundation
Date	08.09.25	Drawn	
Drawn	08.09.25	Drawn	

PLANNING
BDW North Thames
Letchworth LG3
Proposed Site Layout

Drawing number	HTA-A DR 0100	revision	1
Scale	1:500	checked by	JPA
HTA Design LLP		approved by	BAR-LGC
www.hta.co.uk			
London	Edinburgh	Manchester	Bristol



Appendix B – Topographical Survey

Appendix C – Anglian Water Sewer Records



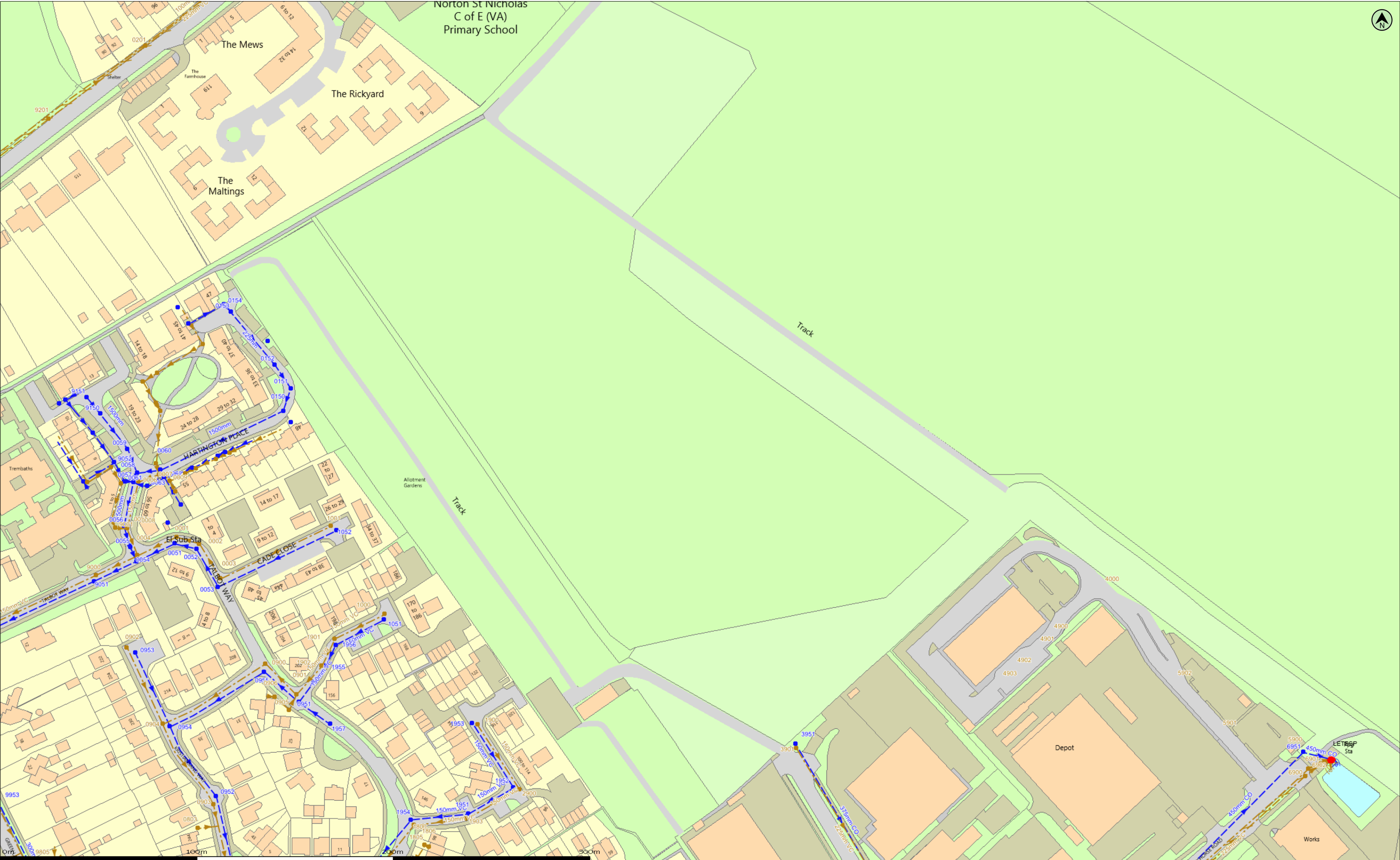
(c) Crown copyright and database rights 2025 Ordnance Survey AC0000813445 Date: 07/05/25 Scale: 1:1250 Map Centre: 523364,233875 Data updated: 30/04/25 Our Ref: 1763254 - 1 Wastewater Plan A4 Powered by digdat

This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2025 Ordnance Survey AC0000813445. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer	--- -- --	Outfall*	⊕	Sewage Treatment Works	□
Surface Sewer	---		⊕	Public Pumping Station	●
Combined Sewer	---				
Final Effluent	---	Inlet*			
Rising Main*	--- -- --				
Private Sewer*	---				
Decommissioned Sewer*	---	Manhole*	●	Decommissioned Pumping Station	●

*(Colour denotes effluent type)

dcronin@ardent-ce.co.uk	
Talbot Way 2502330	



(c) Crown copyright and database rights 2025 Ordnance Survey AC0000813445 Date: 07/05/25 Scale: 1:1250 Map Centre: 523295,234100 Data updated: 30/04/25 Our Ref: 1763244 - 1 Wastewater Plan A2 Powered by digdat

This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2025 Ordnance Survey AC0000813445. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

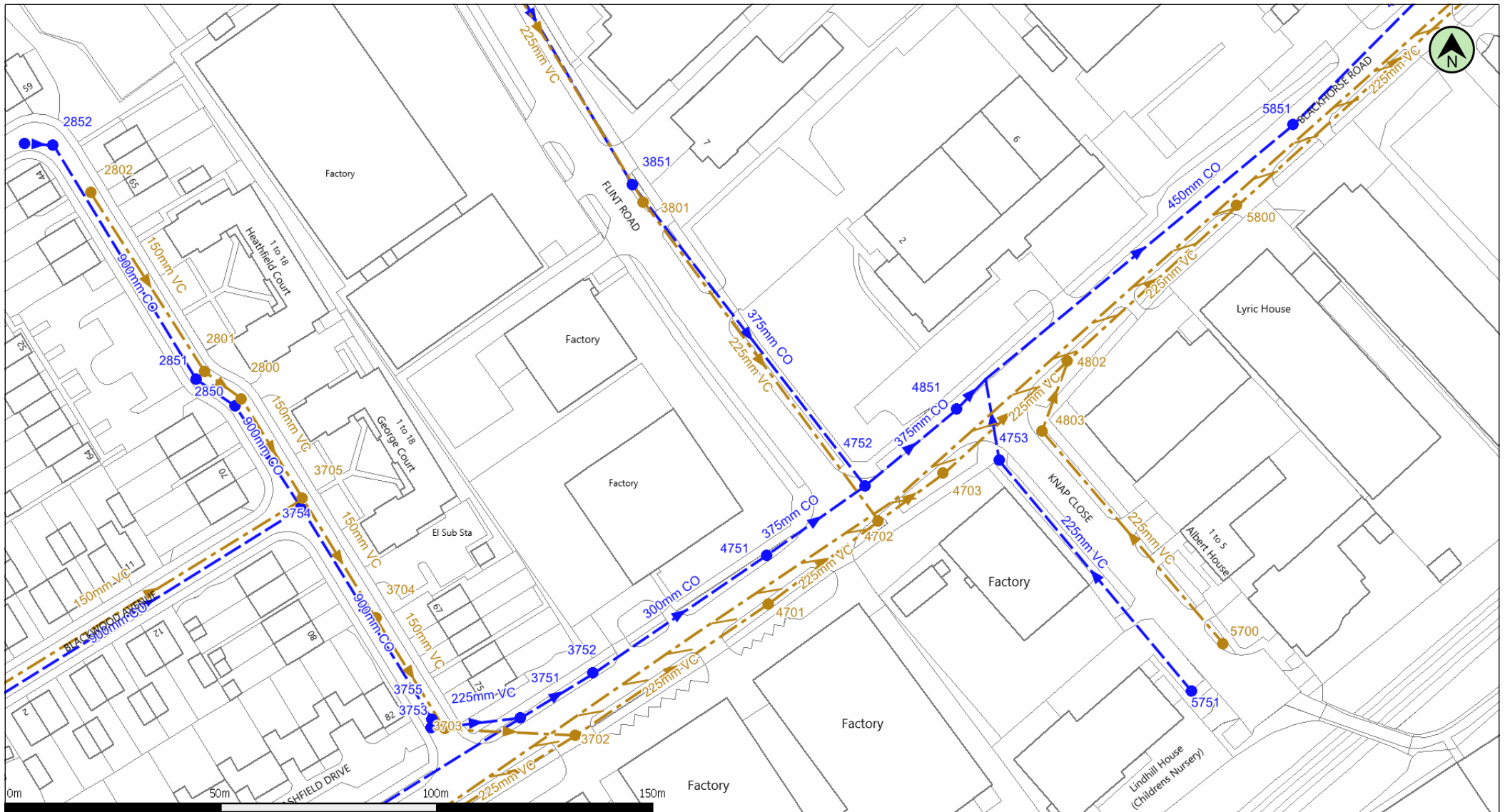
Foul Sewer	--- --	Outfall*
Surface Sewer	---	Inlet*
Combined Sewer	---	Manhole*
Final Effluent	---	
Rising Main*	---	
Private Sewer*	---	
Decommissioned Sewer*	---	

Ⓔ	Sewage Treatment Works
Ⓔ	Public Pumping Station
●	Decommissioned Pumping Station

*(Colour denotes effluent type)

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(c) Crown copyright and database rights 2025 Ordnance Survey AC0000813445 Date: 13/05/25 Scale: 1:1250 Map Centre: 523417,233811 Data updated: 30/04/25 Our Ref: 1767616 - 1 Wastewater Plan A4 Powered by digdat

This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2025 Ordnance Survey AC0000813445. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer	--- --	Outfall*	⊕	Sewage Treatment Works	□
Surface Sewer	---		⊕	Public Pumping Station	●
Combined Sewer	---		⊕		
Final Effluent	---	Inlet*	⊕		
Rising Main*	---		⊕		
Private Sewer*	---		⊕		
Decommissioned Sewer*	---	Manhole*	⊕	Decommissioned Pumping Station	⊕

*(Colour denotes effluent type)

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Appendix D – G7 Geotech Infiltration Test

REPORT ON TRIAL PIT SOAKAGE TESTS

Report 1277: Rev 0

9th November 2021

PROPOSED RESIDENTIAL DEVELOPMENT:

**LAND EAST OF TALBOT WAY, LETCHWORTH GARDEN CITY,
HERTFORDSHIRE SG6**



Client:	THE ENVIRONMENTAL PROTECTION GROUP LTD Warrington Business Park Long Lane Warrington WA2 8TX
On Behalf of:	LETCWORTH GARDEN CITY HERITAGE FOUNDATION

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REPORT ON TRIAL PIT SOAKAGE TESTS

PROPOSED RESIDENTIAL DEVELOPMENT:

**LAND EAST OF TALBOT WAY, LETCHWORTH GARDEN CITY,
HERTFORDSHIRE SG6**

DOCUMENT ISSUE RECORD

Revision	Author	Checked	Date
Rev 0	Keith Gibbs BSc, MSc, FGS	Alan Watson BSc (Eng), CEnv, CEng, MICE	9 th November 2021

G7 Geotech reports are independently checked

Report 1277 : Rev 0

9th November 2021

G7 Geotech Ltd has prepared this Report for the Client and their professional advisors under the Standard Terms of Appointment for Ground Investigations and Geotechnical / Geoenvironmental Consultancy accompanying our quotation. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by us. This Report may not be relied upon by any other party without the prior and express written agreement of G7 Geotech Ltd.

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	TRIAL PIT RECORDS
	FOREWORD TO SOAKAGE TEST RESULTS
	SOAKAGE TEST RESULTS

APPENDIX C	PLANS AND MAPS
	PROPOSED RESIDENTIAL DEVELOPMENT PLAN
	TOPOGRAPHIC PLAN
	SITE PLAN
	LOCATION PLAN

APPENDIX D	UTILITIES SEARCH REPORT
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1.0 INTRODUCTION

A new residential development is proposed on land east of Talbot Way in the Norton area of Letchworth Garden City.

G7 Geotech Ltd have been instructed by The Environmental Protection Group Ltd to undertake soakage tests in trial pits in general accordance with BRE 365 (2016), 'Soakaway Design', with the aim of providing design data for infiltration surface water drainage.

This Report on Trial Pit Soakage Tests includes factual exploratory records, field test results, a summary of the ground conditions encountered and concludes with an assessment for the proposed sustainable drainage provision.

2.0 SITE DESCRIPTION

The site is situated to the east of Talbot Way in the Norton area of Letchworth Garden City, Hertfordshire SG6. National grid reference 523270E 234090N has been derived near the centre of the proposed development area.

At the time of our trial pits and soakage tests in October 2021, the site comprised a large rectangular shaped field with trees and hedges around the fenced perimeter boundaries.

Along the western side, the site is separated from the adjacent residential areas along Talbot Way by local community garden allotments. Along the northern side are similar residential developments and a school. To the east is open farmland, whilst the Flint Road light industrial estate is present along the southern side.

There was no indication of recent crop cultivation within the field with the ground surface covered in short grass. The site measures approximately 5.5 hectares. The appended Topographic Plan (Ref: GreenHatch Group Ltd drawing 33132_T, Rev 1, dated 12th December 2019), indicates ground elevations to slope down in an approximate SE direction from about +88 mOD to +75 mOD.

The appended plans show the site area with test positions and the site location.

3.0 EXPLORATORY WORK

Prior to our fieldwork a Utility Search Report was commissioned to determine the likely presence of buried services (Groundsure G7GEO-8210240). This report is appended.

The trial pits and soakage tests were carried out on the 22nd October 2021. Trial pits were excavated by a rubber tyred backhoe machine (JCB), and water was supplied by a bowser towed by a four wheeled drive vehicle commissioned by G7 Geotech Ltd. Prior to excavation, and as an additional precaution the positions were checked for buried services using CAT scanning.

The trial pit locations were specified by the client. Our investigation comprised the following elements.

Machine excavated trial pits

Four trial pits (SA01 to SA04) were excavated to depths of between 0.55m and 1.50m BGL. The investigation and testing were under the supervision of an experienced geotechnical engineer. The excavations were 'squared off' as far as reasonably practical to aid in determining accurate measurements prior to soakage testing.

All of the excavations were backfilled with arisings and made safe prior to completion of our fieldwork.

Soakage tests in trial pits

Soakage tests were undertaken in all the trial pits in general accordance with BRE 365 (2016), 'Soakaway Design'. Water was delivered by a towable bowser commissioned by G7 Geotech Ltd.

The number of cycles of soakage testing that can be completed in one day is largely determined by the rate of infiltration achieved. At this site we were able to complete three cycles of tests in SA03 and SA04. In SA01 and SA02 time only allowed for a single cycle of testing due to the much reduced rate of infiltration achieved at these locations.

The engineering trial pit records, test results and exploratory location plan are appended.

4.0 GROUND CONDITIONS

Published geological mapping from the BGS indicates the Lowestoft Formation (Glacial Till) at shallow depth (under the northern part of the site only), underlain by Holywell Nodular Chalk and New Pit Chalk Formation. The Chalk strata is shown to outcrop below the southern part of the site.

SA01 and SA02 were excavated in the central part of the southern half of the site, whilst SA03 and SA04 were located at the south-eastern corner. In all of the trial pits and below the surface topsoil/subsoil layers the Chalk was met to the full depth of excavation. The chalk initially comprised a white structureless stratum of fine to coarse gravel of chalk within a silt matrix. In SA02 a closely bedded structure was evident from about 0.80m and in SA03 and SA04 below depths of 0.50m and 0.60m respectively. Flints were absent within the chalk to the depths excavated.

Groundwater was not encountered in our trial pits which were taken to a maximum depth of 1.50m BGL.

Our soakage tests indicated the following soakage rates:

Trial Pit (and depth of test m BGL)	Soakage Rates (metres / sec)
SA01 (0.55)	2.06×10^{-6}
SA02 (1.50)	2.49×10^{-6}
SA03 (0.50)	4.61×10^{-5} , 1.64×10^{-5} , 1.48×10^{-5}
SA04 (1.50)	2.26×10^{-5} , 1.74×10^{-5} , 1.41×10^{-5}

The tests in SA03 and SA04 indicate medium permeability and good drainage conditions in the south-eastern corner of the site. The three tests in each of these positions indicated a gradually reducing soakage rate following repeated re-fills.

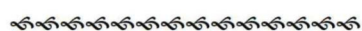
The tests further upslope in SA01 and SA02 indicated low permeability but nevertheless good drainage conditions in the central part of the southern half of the site. The slower infiltration rate at these positions did not allow time for repeated re-fills.

5.0 CONCLUSIONS

The proposed residential development scheme is shown on the appended 'Landscape GA plan', (The Environment Partnership Ref. D906.001 dated 30 April 2020).

Our test results indicate soakage rates of between 2.49×10^{-6} and 1.41×10^{-5} , when taking the lowest result at each test location. These results represent low to medium permeability and moderate to good drainage conditions typical of chalk. The results can be utilised in drainage design subject to the usual allowances for seasonal / weather variations, and prolonged rainfall.

There was a noticeable variation in the infiltration rates achieved between the two distinct test areas. The highest infiltration rates were noted where the closely bedded chalk occurred at shallower levels in SA03 and SA04 which were also situated at the lowest point on site. If possible, soakaways should be designed to penetrate into the closely bedded chalk.



GENERAL INFORMATION, LIMITATIONS AND EXCEPTIONS

Unless otherwise stated, our Report is a Ground Investigation Report [GIR] as defined in BS EN1997-2. Our Report is not intended to be and should not be viewed or treated as a Geotechnical Design Report [GDR] as defined in EN1997-2. If 'design' recommendations are provided, they are for guidance only and are intended to allow the designer to assess the results and implications of our investigation/testing and to permit preliminary design of relevant elements of the proposed scheme. When the title of the report is 'Factual Report on Ground Investigation' this means that geotechnical design recommendations are not provided.

The scope and methods of investigation used have been chosen taking into account project and site constraints including but not limited to access and space limitations. Where it has not been possible to reasonably undertake an EC7 compliant scope or investigation technique we have adopted a practical and economic scope and technique(s) to obtain indicative soil parameters and any interpretation is based upon our engineering experience and relevant published information.

The Report is issued on the condition that G7 Geotech Ltd will under no circumstances be liable for any loss arising directly or indirectly from ground conditions between the exploratory points which differ from those identified during our investigation. In addition G7 Geotech Ltd will not be liable for any loss arising directly or indirectly from any opinion given on the possible configuration of strata both between the exploratory points and/or below the maximum depth of the investigation; such opinions, where given, are for guidance only and no liability can be accepted as to their accuracy. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in using this Report.

Comments made relating to ground-water or ground-gas are based upon observations made during our investigation unless otherwise stated. Ground-water and ground-gas conditions may vary with time from those reported due to factors such as seasonal effects, atmospheric effects and and/or tidal conditions. We recommend that if monitoring installations have been included as part of our investigation, continued monitoring should be carried out to maximise the information gained.

Specific geotechnical features/hazards such as [but not limited to] areas of root-related desiccation and dissolution features in chalk/soluble rock can exist in discrete localised areas - there can be no certainty that any or all of such features/hazards have been located, sampled or identified. Where a risk is identified the designer should provide appropriate contingencies to mitigate the risk through additional exploratory work and/or an engineered solution.

Where spread foundations are used, we recommend that all excavations are inspected and approved by suitably experienced personnel; appropriate inspection records should be kept. This should also apply to any structures which are in direct contact with the soil where the soil could have a detrimental effect on performance or integrity of the structure.

Ground contamination often exists in small discrete areas - there can be no certainty that any or all such areas have been located, sampled or identified.

The findings and opinions conveyed in this Report may be based on information from a variety of third party sources such as commercially available desk based geological and environmental searches, historical maps, mining reports, radon reports, geotechnical laboratory testing and contamination laboratory analyses. G7 Geotech Ltd cannot and does not provide any guarantee as to the authenticity, accuracy or reliability of such information from third parties; such information has not been independently verified unless stated in our Report.

Our Report is written in the context of an agreed scope of work between G7 Geotech Ltd and the Client and should not be used in any different context. In light of additional information becoming available, improved practices and changes in legislation, amendment or re-interpretation of the assessment or the Report in part or in whole may be necessary after its original publication.

Unless otherwise stated our investigation does not include an arboricultural survey, asbestos survey, ecological survey or flood risk assessment and these should be deemed to be outside the scope of our investigation.

Issue 04 : 3rd August 2020

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APPENDIX A

PHOTOGRAPHS



Photograph No 1 : Plant and equipment at locations of SA03 and SA04



Photograph No 2 : View W and NW from SE side of site



Photograph No 3 : View S from northern margin of site.



Photograph No 4 : View NW from location of SA03

APPENDIX B

FOREWORD TO TRIAL PIT RECORDS

TRIAL PIT RECORDS

FOREWORD TO SOAKAGE TEST RESULTS

SOAKAGE TEST RESULTS

FOREWORD TO TRIAL PITS

GENERAL

The Trial Pit Records are compiled from the geotechnical engineer's description of the strata encountered, based on an examination of the soil arisings and the results of field and laboratory tests. Based on this data, the report presents an opinion on the configuration of strata within the site. However, such reasonable assumptions are given for guidance only and no liability can be accepted for changes in conditions not revealed by the trial pits.

EXCAVATION METHODS

Trial pits can be undertaken by either mechanical excavator or by the use of hand tools which allows the ground conditions to be reasonably well established. Some disturbance of the ground is inevitable which can influence field tests. Depths BGL relating to field tests undertaken on soil arisings are approximate only.

GROUNDWATER

The depth at which ground water is struck is entered on the Trial Pit Records. However, this observation may not indicate the true water level at that period. Due to the speed of excavation, natural ground water may be present at a depth slightly higher than the water strike. Moreover, ground water levels are subject to variations caused by changes in the local drainage conditions and by seasonal effects. When a moderate inflow of water does take place, excavation is suspended for at least 10 minutes to enable a more accurate short-term water level to be achieved. An estimate of the rate of inflow is also given. This is a relative term and serves only as a guide to the probable flow of water into an excavation. Further observations of the water level are made on completion.

SAMPLES

Disturbed bulk samples and small disturbed samples are taken and placed in polythene bags for geotechnical testing. Small jar samples and plastic tub samples are taken for laboratory ground contamination testing. Where ground water is encountered in sufficient quantity, a sample of the ground water is also taken.

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G7 Geotech G7 Geotech Ltd 49, Church Rd Leyland PR25 3AA		TRIAL PIT RECORD		Trial Pit No SA01 Sheet 1 of 1																										
Project Name: Proposed residential development		Job No 1277		Trial Pit SA01 machine excavated on 22/10/21 Groundwater not encountered. Trial Pit backfilled with arisings on completion. GL 84.5 mOD GR:523300E 234050N																										
Location: Land East of Talbot Way, Letchworth Garden City, Hertfordshire SG6																														
Client: The Environmental Protection Group Ltd																														
<table><thead><tr><th colspan="2"><u>Depth</u></th><th><u>Strata Descriptions</u></th><th colspan="2"><u>Samples & Tests</u></th></tr><tr><th>From</th><th>To</th><th></th><th>Depth</th><th>Type</th></tr></thead><tbody><tr><td>0.00</td><td>0.20</td><td>TOPSOIL: dark grey brown sandy silty gravelly silty clay with frequent rootlets. Gravel comprising fine to coarse chalk</td><td>0.15</td><td>D</td></tr><tr><td>0.20</td><td>0.55</td><td>White slightly mottled grey CHALK. Frequent fine to coarse gravel sized chalk fragments in structureless silt matrix</td><td></td><td></td></tr><tr><td colspan="5">Remarks: Soakage test carried out at 0.55m BGL. Pit sides remained stable during excavation. Dry, no groundwater met.</td></tr></tbody></table>						<u>Depth</u>		<u>Strata Descriptions</u>	<u>Samples & Tests</u>		From	To		Depth	Type	0.00	0.20	TOPSOIL: dark grey brown sandy silty gravelly silty clay with frequent rootlets. Gravel comprising fine to coarse chalk	0.15	D	0.20	0.55	White slightly mottled grey CHALK. Frequent fine to coarse gravel sized chalk fragments in structureless silt matrix			Remarks: Soakage test carried out at 0.55m BGL. Pit sides remained stable during excavation. Dry, no groundwater met.				
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<u>Photographs</u> 																														

G7 Geotech G7 Geotech Ltd 49, Church Rd Leyland PR25 3AA		TRIAL PIT RECORD		Trial Pit No SA02 Sheet 1 of 1																									
Project Name: Proposed residential development		Job No 1277		Trial Pit SA02 machine excavated on 22/10/21 Groundwater not encountered. Trial Pit backfilled with arisings on completion. GL 84.0 mOD GR:523295E 234065N																									
Location: Land East of Talbot Way, Letchworth Garden City, Hertfordshire SG6																													
Client: The Environmental Protection Group Ltd																													
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Photographs  																													

G7 Geotech G7 Geotech Ltd 49, Church Rd Leyland PR25 3AA		TRIAL PIT RECORD		Trial Pit No SA03 Sheet 1 of 1																															
Project Name: Proposed residential development		Job No 1277		Trial Pit SA03 machine excavated on 22/10/21 Groundwater not encountered. Trial Pit backfilled with arisings on completion. GL 77.75 mOD GR:523400E 234045N																															
Location: Land East of Talbot Way, Letchworth Garden City, Hertfordshire SG6																																			
Client: The Environmental Protection Group Ltd																																			
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Photographs  																																			

G7 Geotech G7 Geotech Ltd 49, Church Rd Leyland PR25 3AA		TRIAL PIT RECORD		Trial Pit No SA04 Sheet 1 of 1																														
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Photographs  																																		

FOREWORD TO SOAKAGE TESTS

GENERAL

The soakage tests are undertaken in general accordance with BRE Digest 365 : 2016, Soakaway design. Soakage tests are undertaken in either machine-excavated or hand-excavated trial pits and water can be delivered either by means of a lorry mounted bowser or by portable 25 litre plastic containers, depending on the size / depth of excavation.

The BRE guidance requires soakage rates to be calculated on the basis of water levels recorded at 25% and 75% of the effective depth of the proposed soakaway. Soakage rates can vary substantially. In highly permeable granular soils the added water may drain relatively quickly, or in practically impermeable cohesive soils the water may drain very slowly, if at all. In the case of soils of low permeability or practically impermeable soils, water levels at 25% and 75% of the effective depth may not be achievable in the available time. In these circumstances, soakage rates are calculated based on alternative selected water levels and this is stated on the results sheets.

Where soakage tests are undertaken to assess the potential for infiltration drainage beneath a sports pitch, or other widescale drainage blanket, they can be undertaken in shallow trial pits of about 0.50m depth to target the proposed pitch formation level. In these circumstances, where the drainage blanket may be relatively thin or may include check dams at intervals, the effective depth of the soakaway as described in BRE Digest 365, is not necessarily relevant to the soakage rate calculation. Alternative selected water levels are therefore taken as the basis for calculation of the soakage rates.

The BRE Digest 365 requires soakage tests to be repeated to give 3 tests at each location in order to model the effects of reduced permeability resulting from saturation of the soils following prolonged rainfall. In the case of soils of low permeability or practically impermeable soils, repeat tests may not always be feasible in the available time. However, in these circumstances, soakaways may not be a suitable drainage option anyway, and a single test, can be sufficient in order to prove this negative outcome.

The Soakage Test Records are compiled from the geotechnical engineer's description of the strata encountered, based on an examination of the soil arisings and the results of field tests. Based on this data, the report presents an opinion on the configuration of strata within the site. However, such reasonable assumptions are given for guidance only, and no liability can be accepted for changes in conditions not revealed by the trial pits / soakage tests.

EXCAVATION METHODS

Trial pits can be undertaken either by mechanical excavator or by the use of hand tools which allows the ground conditions to be reasonably well established. Some disturbance of the ground is inevitable and depending on the type of excavator bucket used this can influence soakage test results.

GROUNDWATER

The depth at which ground water is struck is entered on the Soakage Test and Trial Pit Records. However, this observation may not indicate the true water level at that period. Due to the speed of excavation, natural ground water may be present at a depth slightly higher than the water strike. Moreover, ground water levels are subject to variations caused by changes in the local drainage conditions and by seasonal effects. When a moderate inflow of water does take place, excavation is suspended for at least 10 minutes to enable a more accurate short-term water level to be achieved. An estimate of the rate of inflow is also given. This is a relative term and serves only as a guide to the probable flow of water into an excavation. Further observations of the water level are made on completion.

SAMPLES

Disturbed soil samples are taken and placed in polythene bags for geotechnical testing. Small jar samples and plastic tub samples are taken for laboratory ground contamination testing. Where ground water is encountered in sufficient quantity, a sample of the ground water is also taken.

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SOAKAGE TEST RESULT

Soakage Test No
SA01
Sheet 1 of 1

Project Name: Proposed Residential Development
Job No
1277

Location: Land to the East of Talbot Way, Letchworth Garden City, Herts SG6

Client: EPG Ltd

Soakage test undertaken with
rubber tyred backhoe excavator (JCB)
at 0.55m depth.

SOAKAGE RATE

TP SOAKAGE TEST SA01 DEPTH 0.55 TEST No 1 DATE : 22nd October 2021

CASING DEPTH 0.00 m
DIMENSIONS
WIDTH 0.40 m
LENGTH 1.00 m
DIAMETER m
PERIMETER 2.800 m
BASE AREA 0.400 m²

SOIL TYPE :- GL - 0.20 TOPSOIL
0.20 - 0.55 White CHALK

Readings measured from 0.00 m above ground level

No	time	depth	Depth bgl
1	0	0.300	0.300
2	1	0.300	0.300
3	2	0.305	0.305
4	3	0.305	0.305
5	4	0.310	0.310
6	5	0.310	0.310
7	10	0.315	0.315
8	15	0.320	0.320
9	20	0.320	0.320
10	25	0.320	0.320
11	30	0.320	0.320
12	40	0.320	0.320
13	73	0.330	0.330
14	88	0.340	0.340
15	122	0.350	0.350
16	156	0.360	0.360
17	186	0.360	0.360

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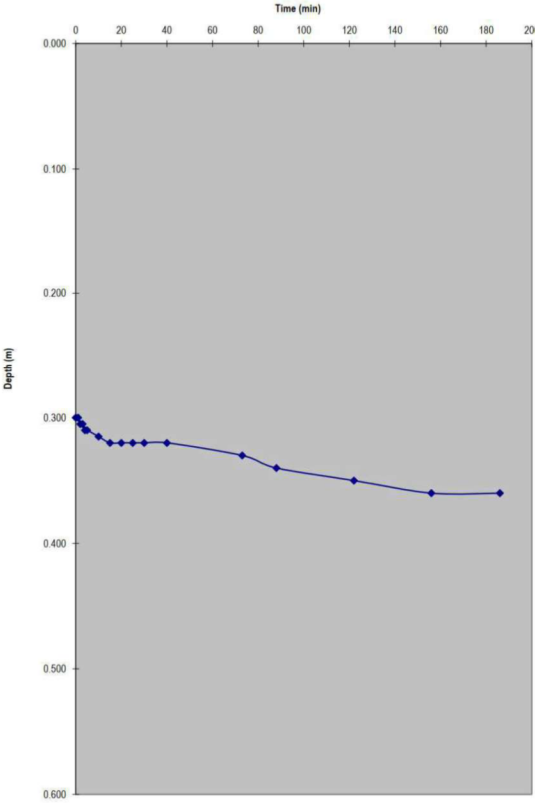
	Water Level (m)	Time sec
Top WL	7	0.32 600
Bottom WL	15	0.35 7320

Vol change = 0.0140 m³ V
Soakage area = 1.0090 m² A
Time = 6720 sec T

Soakage Rate 2.06E-06 m/sec

Soakage Rate is calculated using two selected water levels
(equivalent to those at 25% and 75% of the fall in water level during
the test) and is based on BRE Digest 365: 2016: Soakaway Design

Water Level v Time Graph



SOAKAGE TEST RESULT

Soakage Test No

SA02

Sheet 1 of 1

Project Name: Proposed Residential Development

Job No
1277

Location: Land to the East of Talbot Way, Letchworth Garden City, Herts SG6

Client: EPG Ltd

Soakage test undertaken with
rubber tyred backhoe excavator (JCB)
at 1.50m depth.

SOAKAGE RATE

TP SOAKAGE TEST SA02 DEPTH 1.50 TEST No 1 DATE: 22nd October 2021

CASING DEPTH 0.00 m

DIMENSIONS

WIDTH 0.40 m

LENGTH 1.50 m

DIAMETER m

PERIMETER 3.800 m

BASE AREA 0.600 m²

Readings measured from 0.00 m above ground level

SOIL TYPE :-

GL - 0.25 TOPSOIL
0.25 - 1.50 White CHALK

No	time	depth	Depth bgl
1	0	0.630	0.630
2	1	0.650	0.650
3	2	0.650	0.650
4	3	0.650	0.650
5	4	0.660	0.660
6	5	0.670	0.670
7	10	0.670	0.670
8	15	0.680	0.680
9	25	0.690	0.690
10	30	0.690	0.690
11	35	0.700	0.700
12	45	0.710	0.710
13	60	0.720	0.720
14	93	0.750	0.750
15	106	0.760	0.760
16	141	0.780	0.780
17	180	0.790	0.790
18	209	0.810	0.810

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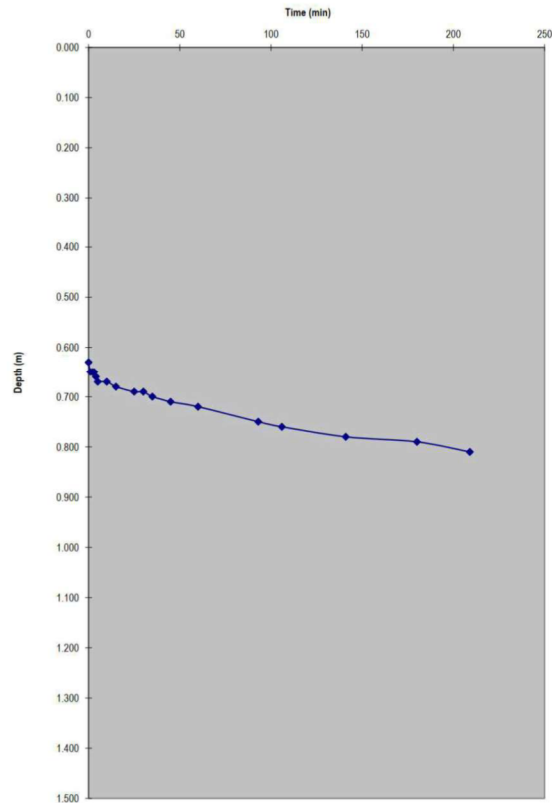
	Water Level (m)	Time sec
Top WL	6 0.67	300
Bottom WL	15 0.76	6360

Vol change = 0.0540 m³ V
 Soakage area = 3.5830 m² A
 Time = 6060 sec T

Soakage Rate 2.49E-06 m/sec

Soakage Rate is calculated using two selected water levels
 (equivalent to those at 25% and 75% of the fall in water level during
 the test) and is based on BRE Digest 365: 2016: Soakaway Design

Water Level v Time Graph



SOAKAGE TEST RESULT

Soakage Test No

SA03

Sheet 1 of 1

Project Name: Proposed Residential Development

Job No
1277

Location: Land to the East of Talbot Way, Letchworth Garden City, Herts SG6

Client: EPG Ltd

Soakage test undertaken with
rubber tyred backhoe excavator (JCB)
at 0.60m depth.

SOAKAGE RATE

TP SOAKAGE TEST SA03 DEPTH 0.60 TEST No 1 DATE: 22nd October 2021

CASING DEPTH 0.00 m

DIMENSIONS

WIDTH 0.40 m

LENGTH 1.20 m

DIAMETER m

PERIMETER 3.200 m

BASE AREA 0.480 m²

Readings measured from 0.00 m above ground level

SOIL TYPE :-

GL - 0.10 TOPSOIL

0.10 - 0.30 Soft grey brown sandy silty gravelly CLAY.

0.30 - 0.60 White CHALK

No	time	depth	Depth bgl
1	0	0.350	0.350
2	1	0.370	0.370
3	2	0.380	0.380
4	3	0.390	0.390
5	4	0.400	0.400
6	5	0.410	0.410
7	10	0.450	0.450
8	15	0.470	0.470
9	20	0.490	0.490
10	25	0.510	0.510
11	30	0.530	0.530
12	35	0.550	0.550

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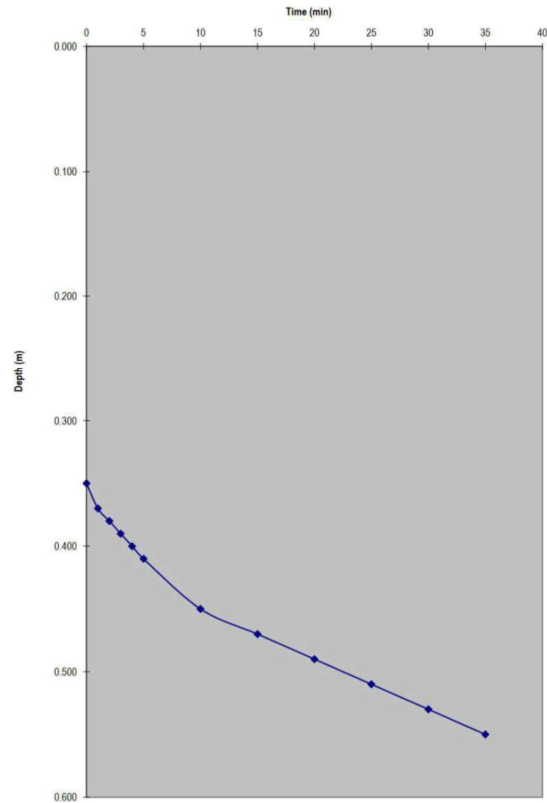
	Water Level (m)	Time sec
Top WL	5	0.40 240
Bottom WL	9	0.49 1200

Vol change = 0.0432 m³ V
 Soakage area = 0.9760 m² A
 Time = 960 sec T

Soakage Rate 4.61E-05 m/sec

Soakage Rate is calculated using two selected water levels
 (equivalent to those at 25% and 75% of the fall in water level during
 the test) and is based on BRE Digest 365: 2016: Soakaway Design

Water Level v Time Graph



SOAKAGE TEST RESULT

Soakage Test No

SA03

Sheet 1 of 1

Project Name: Proposed Residential Development

Job No
1277

Location: Land to the East of Talbot Way, Letchworth Garden City, Herts SG6

Client: EPG Ltd

Soakage test undertaken with
rubber tyred backhoe excavator (JCB)
at 0.60m depth.

SOAKAGE RATE

TP SOAKAGE TEST SA03 DEPTH 0.60 TEST No 2 DATE: 22nd October 2021

CASING DEPTH 0.00 m

DIMENSIONS

WIDTH 0.40 m

LENGTH 1.20 m

DIAMETER m

PERIMETER 3.200 m

BASE AREA 0.480 m²

Readings measured from 0.00 m above ground level

SOIL TYPE :-

GL - 0.10 TOPSOIL

0.10 - 0.30 Soft grey brown sandy silty gravelly CLAY.

0.30 - 0.60 White CHALK

No	time	depth	Depth bgl
1	0	0.350	0.350
2	1	0.360	0.360
3	3	0.370	0.370
4	4	0.370	0.370
5	5	0.370	0.370
6	10	0.390	0.390
7	15	0.400	0.400
8	20	0.430	0.430
9	25	0.440	0.440
10	30	0.440	0.440
11	35	0.450	0.450
12	45	0.470	0.470
13	60	0.490	0.490
14	85	0.530	0.530
15	97	0.550	0.550

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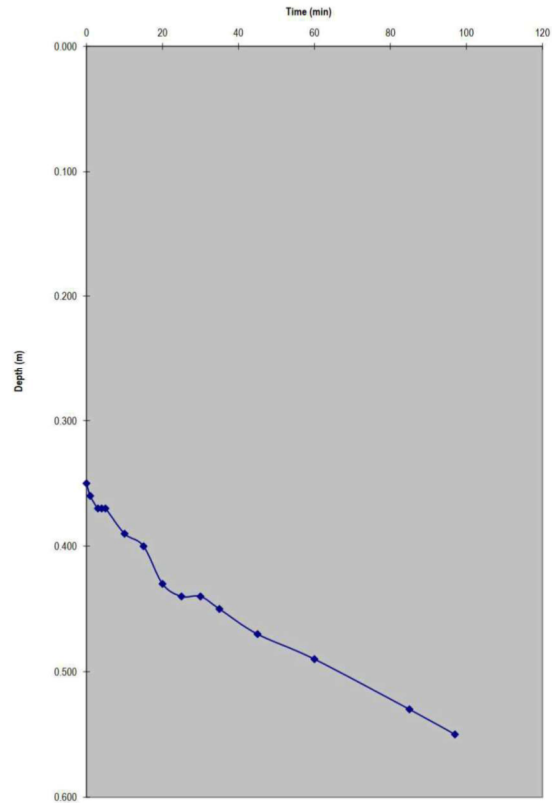
	Water Level (m)	Time sec
Top WL	7	0.40
Bottom WL	13	0.49

Vol change = 0.0432 m³ V
 Soakage area = 0.9760 m² A
 Time = 2700 sec T

Soakage Rate 1.64E-05 m/sec

Soakage Rate is calculated using two selected water levels
 (equivalent to those at 25% and 75% of the fall in water level during
 the test) and is based on BRE Digest 365: 2016: Soakaway Design

Water Level v Time Graph



SOAKAGE TEST RESULT

Soakage Test No

SA03

Sheet 1 of 1

Project Name: Proposed Residential Development

Job No
1277

Location: Land to the East of Talbot Way, Letchworth Garden City, Herts SG6

Client: EPG Ltd

Soakage test undertaken with
rubber tyred backhoe excavator (JCB)
at 0.60m depth.

SOAKAGE RATE

TP SOAKAGE TEST SA03 DEPTH 0.60 TEST No 3 DATE: 22nd October 2021

CASING DEPTH 0.00 m

DIMENSIONS

WIDTH 0.40 m

LENGTH 1.20 m

DIAMETER m

PERIMETER 3.200 m

BASE AREA 0.480 m²

Readings measured from 0.00 m above ground level

SOIL TYPE :-

GL - 0.10 TOPSOIL

0.10 - 0.30 Soft grey brown sandy silty gravelly CLAY.

0.30 - 0.60 White CHALK

No	time	depth	Depth bgl
1	0	0.380	0.380
2	1	0.390	0.390
3	2	0.400	0.400
4	3	0.410	0.410
5	4	0.410	0.410
6	5	0.410	0.410
7	10	0.430	0.430
8	15	0.440	0.440
9	20	0.450	0.450
10	45	0.490	0.490
11	60	0.520	0.520
12	70	0.540	0.540
13	80	0.550	0.550

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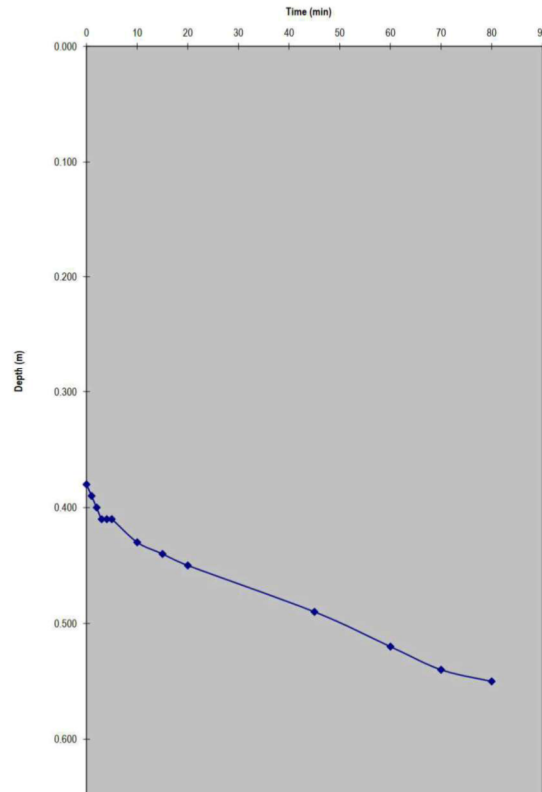
	Water Level (m)	Time sec
Top WL	7 0.43	600
Bottom WL	10 0.49	2700

Vol change = 0.0288 m³ V
 Soakage area = 0.9280 m² A
 Time = 2100 sec T

Soakage Rate 1.48E-05 m/sec

Soakage Rate is calculated using two selected water levels
 (equivalent to those at 25% and 75% of the fall in water level during
 the test) and is based on BRE Digest 365: 2016: Soakaway Design

Water Level v Time Graph



SOAKAGE TEST RESULT

Soakage Test No

SA04

Sheet 1 of 1

Project Name: Proposed Residential Development

Job No
1277

Location: Land to the East of Talbot Way, Letchworth Garden City, Herts SG6

Client: EPG Ltd

Soakage test undertaken with
rubber tyred backhoe excavator (JCB)
at 1.50m depth.

SOAKAGE RATE

TP SOAKAGE TEST SA04 DEPTH 1.50 TEST No 1 DATE: 22nd October 2021

CASING DEPTH 0.00 m

DIMENSIONS

WIDTH 0.40 m

LENGTH 1.40 m

DIAMETER m

PERIMETER 3.600 m

BASE AREA 0.560 m²

Readings measured from 0.00 m above ground level

SOIL TYPE :-

GL - 0.10 TOPSOIL

0.10 - 0.30 Soft grey brown sandy silty gravelly CLAY.

0.30 - 1.50 White CHALK

No	time	depth	Depth bgl
1	0	0.800	0.800
2	1	0.830	0.830
3	2	0.850	0.850
4	3	0.860	0.860
5	4	0.870	0.870
6	5	0.890	0.890
7	10	0.930	0.930
8	15	0.970	0.970
9	20	1.000	1.000
10	25	1.030	1.030
11	30	1.060	1.060
12	40	1.100	1.100
13	45	1.130	1.130
14	60	1.190	1.190
15	98	1.270	1.270
16	105	1.300	1.300
17	120	1.370	1.370

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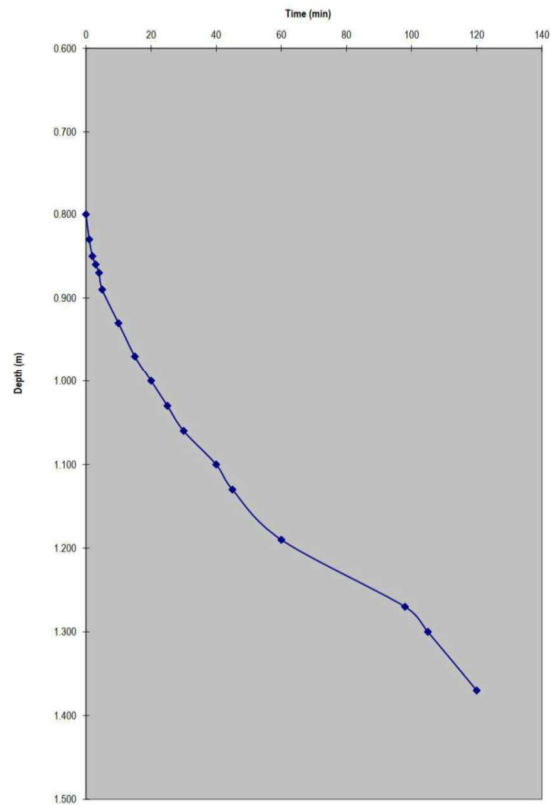
	Water Level (m)	Time sec
Top WL	7	0.93
Bottom WL	14	1.19
		3600

Vol change = 0.1456 m³ V
 Soakage area = 2.1440 m² A
 Time = 3000 sec T

Soakage Rate 2.26E-05 m/sec

Soakage Rate is calculated using two selected water levels
 (equivalent to those at 25% and 75% of the fall in water level during
 the test) and is based on BRE Digest 365: 2016: Soakaway Design

Water Level v Time Graph



SOAKAGE TEST RESULT

Soakage Test No

SA04

Sheet 1 of 1

Project Name: Proposed Residential Development

Job No
1277

Location: Land to the East of Talbot Way, Letchworth Garden City, Herts SG6

Client: EPG Ltd

Soakage test undertaken with
rubber tyred backhoe excavator (JCB)
at 1.50m depth.

SOAKAGE RATE

TP SOAKAGE TEST SA04 DEPTH 1.50 TEST No 2 DATE: 22nd October 2021

CASING DEPTH 0.00 m

DIMENSIONS

WIDTH 0.40 m

LENGTH 1.40 m

DIAMETER m

PERIMETER 3.600 m

BASE AREA 0.560 m²

Readings measured from 0.00 m above ground level

SOIL TYPE :-

GL - 0.10 TOPSOIL

0.10 - 0.30 Soft grey brown sandy silty gravelly CLAY.

0.30 - 1.50 White CHALK

No	time	depth	Depth bgl
1	0	0.770	0.770
2	1	0.790	0.790
3	2	0.800	0.800
4	3	0.810	0.810
5	4	0.820	0.820
6	5	0.830	0.830
7	10	0.850	0.850
8	15	0.870	0.870
9	21	0.900	0.900
10	25	0.920	0.920
11	30	0.950	0.950
12	45	1.010	1.010
13	60	1.090	1.090
14	72	1.120	1.120
15	80	1.150	1.150
16	90	1.160	1.160
17	100	1.190	1.190
18	125	1.240	1.240
19	140	1.270	1.270

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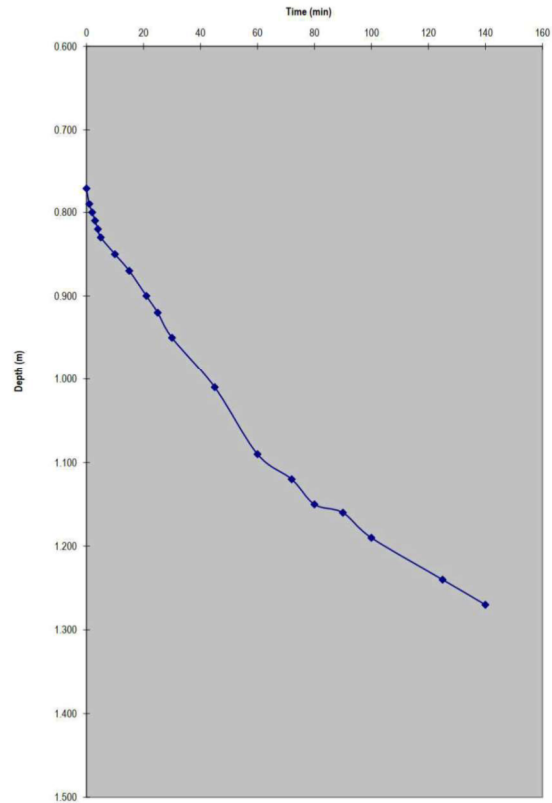
	Water Level (m)	Time sec
Top WL	9	0.90
Bottom WL	15	1.15

Vol change = 0.1400 m³ V
 Soakage area = 2.2700 m² A
 Time = 3540 sec T

Soakage Rate 1.74E-05 m/sec

Soakage Rate is calculated using two selected water levels
 (equivalent to those at 25% and 75% of the fall in water level during
 the test) and is based on BRE Digest 365: 2016: Soakaway Design

Water Level v Time Graph



SOAKAGE TEST RESULT

Soakage Test No

SA04

Sheet 1 of 1

Project Name: Proposed Residential Development

Job No
1277

Location: Land to the East of Talbot Way, Letchworth Garden City, Herts SG6

Client: EPG Ltd

Soakage test undertaken with
rubber tyred backhoe excavator (JCB)
at 1.50m depth.

SOAKAGE RATE

TP SOAKAGE TEST SA04 DEPTH 1.50 TEST No 3 DATE: 22nd October 2021

CASING DEPTH 0.00 m

DIMENSIONS

WIDTH 0.40 m

LENGTH 1.40 m

DIAMETER m

PERIMETER 3.600 m

BASE AREA 0.560 m²

Readings measured from 0.00 m above ground level

SOIL TYPE :-

GL - 0.10 TOPSOIL

0.10 - 0.30 Soft grey brown sandy silty gravelly CLAY.

0.30 - 1.50 White CHALK

No	time	depth	Depth bgl
1	0	0.750	0.750
2	1	0.760	0.760
3	2	0.770	0.770
4	3	0.780	0.780
5	4	0.790	0.790
6	5	0.800	0.800
7	10	0.820	0.820
8	15	0.860	0.860
9	20	0.880	0.880
10	30	0.920	0.920
11	45	0.960	0.960
12	60	1.020	1.020
13	82	1.070	1.070
14	90	1.100	1.100
15	95	1.120	1.120

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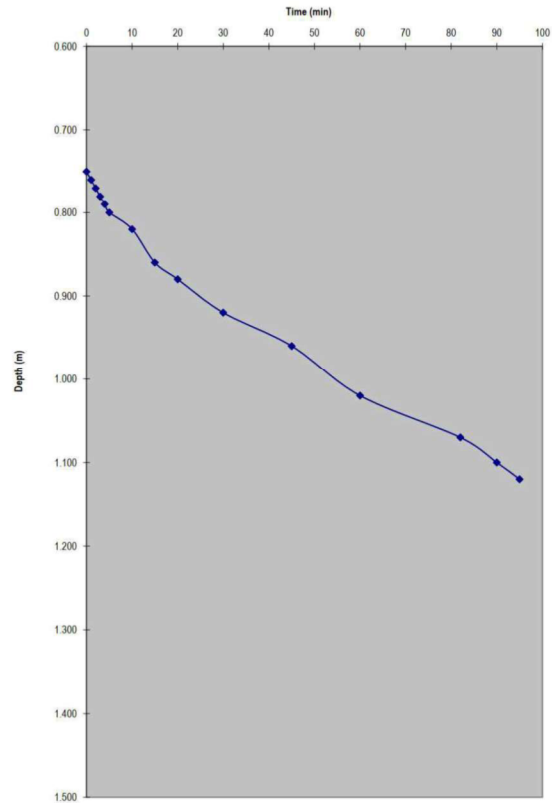
	Water Level (m)	Time sec
Top WL	7	0.82
Bottom WL	12	1.02
		600
		3600

Vol change = 0.1120 m³ V
 Soakage area = 2.6480 m² A
 Time = 3000 sec T

Soakage Rate 1.41E-05 m/sec

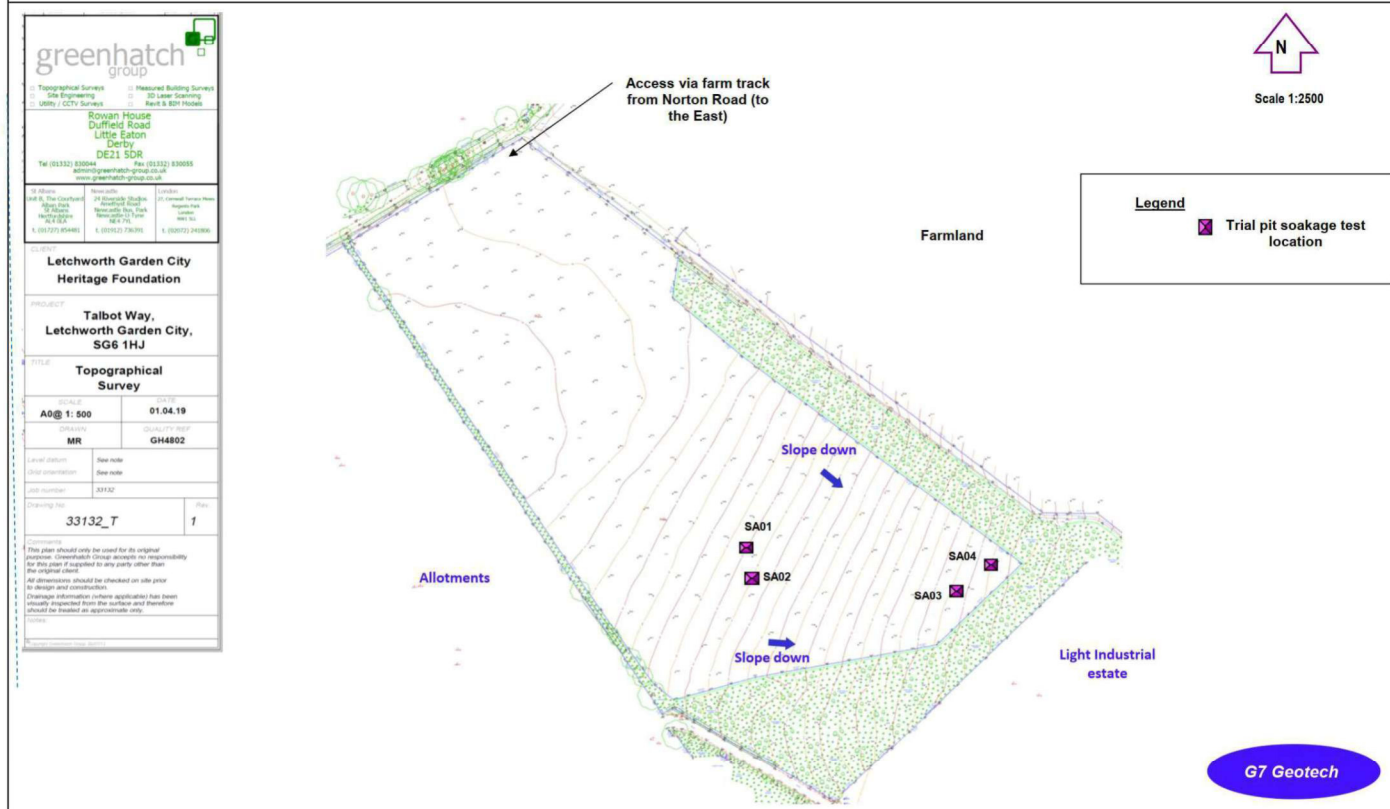
Soakage Rate is calculated using two selected water levels
 (equivalent to those at 25% and 75% of the fall in water level during
 the test) and is based on BRE Digest 365: 2016: Soakaway Design

Water Level v Time Graph



Site Location	LAND EAST OF TALBOT WAY, LETCHWORTH GARDEN CITY, HERTS SG6	Report No	1277
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SITE PLAN



Appendix E – Anglian Water Technical Correspondence

Thomas Rayment

From: Ben Brooks
Sent: 09 September 2025 01:04
To: Planning Liaison; Peter Maddock
Cc: Thomas Rayment
Subject: [Filed on 2025-09-09] RE: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

Categories: Filed to CloudFiler

Claire,

Thanks for your prompt confirmation.

Much appreciated.

ARDENT
CONSULTING ENGINEERS

Ben Brooks
Project Director

AN EMPLOYEE OWNED COMPANY

T 0207 680 4088

Infrastructure | Transport Planning | Flood Risk | Acoustics | Air Quality

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From: Planning Liaison <planningliaison@anglianwater.co.uk>
Sent: 08 September 2025 16:09
To: Ben Brooks <bbrooks@ardent-ce.co.uk>; Peter Maddock <pmaddock@ardent-ce.co.uk>; Planning Liaison <planningliaison@anglianwater.co.uk>
Cc: Thomas Rayment <trayment@ardent-ce.co.uk>
Subject: RE: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

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Good afternoon Ben,

Thank you for your email.

I can confirm that as this site has outline planning your connection point as per our report reference PPE-0216650 to MH3901 located in Flint Road at National Grid reference (NGR) TL 23343 33938 remains the connection point for this development.

Kind regards,

Claire Wootton



Claire Wootton

Pre-Development Senior Engineer

Telephone: 07970 467823

Anglian Water Services Limited

Thorpe Wood House, Thorpe Wood, Peterborough,
Cambridgeshire, PE3 6WT



For details on how to submit a pre-planning enquiry to the Pre-Development Team, please visit the ["how to apply"](#) section on our website.

For further information please email us at planningliaison@anglianwater.co.uk or visit our website at: <https://www.anglianwater.co.uk/developing/planning--capacity/planning-and-capacity/>

From: Ben Brooks <bbrooks@ardent-ce.co.uk>

Sent: 04 September 2025 20:56

To: Peter Maddock <pmaddock@ardent-ce.co.uk>; Planning Liaison <planningliaison@anglianwater.co.uk>

Cc: Thomas Rayment <trayment@ardent-ce.co.uk>

Subject: RE: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

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All,

For completeness, the emails below confirm they supersede the SW connection report in the latest pre-dev report (attached), however my expectation was the Foul Connection point (MH3901) indicated within the pre-dev was unchanged.

Hopefully this is a simple confirmation email that we can still refer to the attached pre-dev for the agreed foul connection (noting the scheme has outline planning on the basis of this connection following the pre-dev undertaken in 2021 – also attached).

Kind Regards,



Ben Brooks
Project Director

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From: Peter Maddock <pmaddock@ardent-ce.co.uk>

Sent: 04 September 2025 15:45

To: Planning Liaison <planningliaison@anglianwater.co.uk>

Cc: Thomas Rayment <trayment@ardent-ce.co.uk>; Ben Brooks <bbrooks@ardent-ce.co.uk>

Subject: RE: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

Hi Doug,

Hope you have been well.

I am following on from the previous email by my colleague Tom, in which he discussed the possibility of a foul water connection.

With regards to capacity in the network here, please could you confirm, is a foul water connection into the foul chamber MH 3901 (adjacent to our surface water connection) viable?

For your reference, I have attached the sewer records in this location. The development is comprised of 120 units.

Please let me know if any of the above is unclear or if you need any further information to confirm.

Kind regards,

Peter Maddock

Engineer



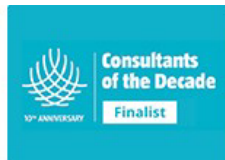
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T | 020 7680 4088 E | pmaddock@ardent-ce.co.uk

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From: Planning Liaison <planningliaison@anglianwater.co.uk>

Sent: 07 July 2025 15:04

To: Thomas Rayment <trayment@ardent-ce.co.uk>

Subject: [Filed on 2025-07-07] RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

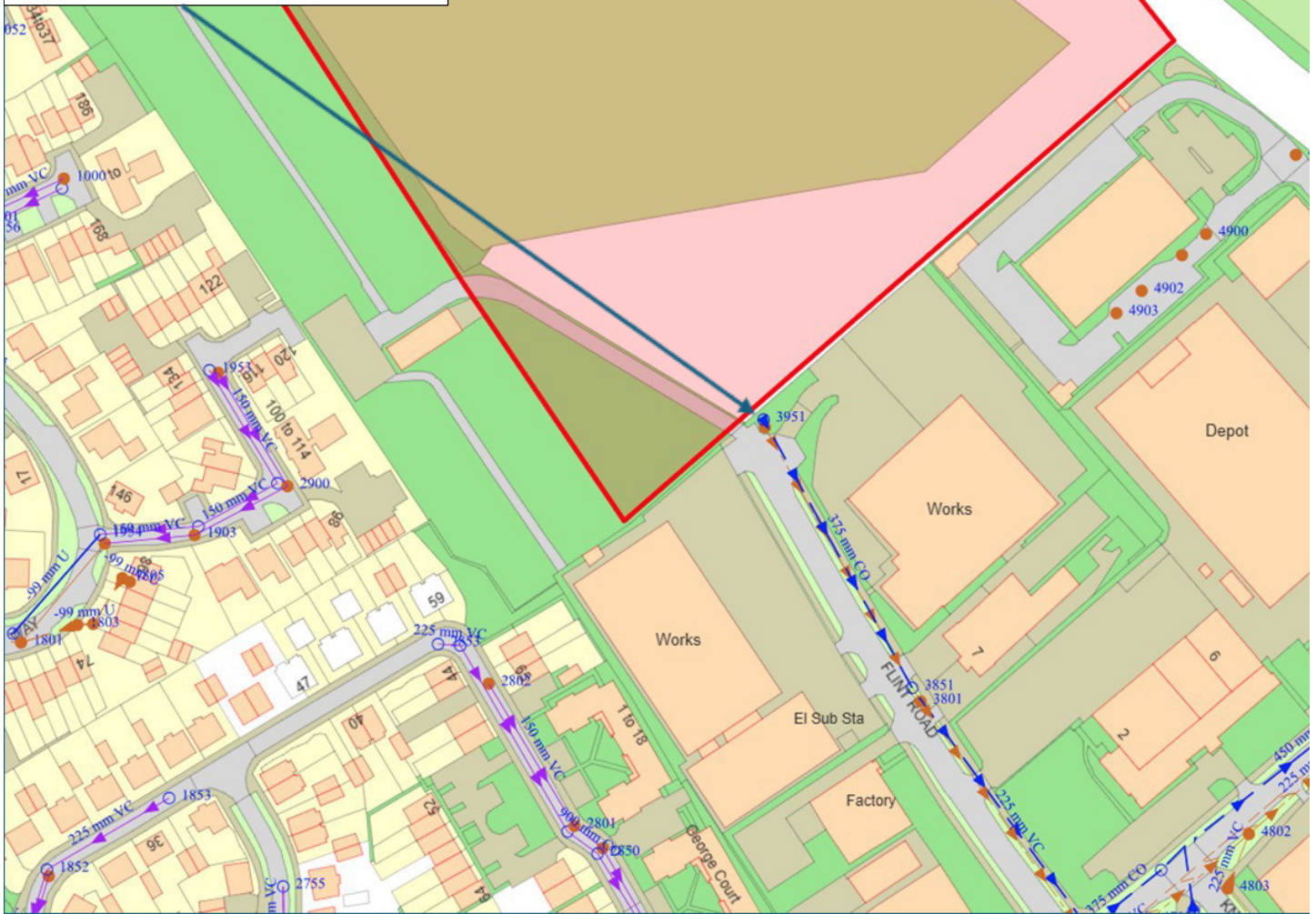
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Hi Tom,

Thank you for the correction.

Yes, that was a typo on my behalf, Anglian Water accept the connection to MH3951 at a rate of 8l/s.

Connection point to the 375mm
surface water sewer at MH3951
at 8l/s





From: Thomas Rayment <trayment@ardent-ce.co.uk>

Sent: 04 July 2025 14:10

To: Planning Liaison <planningliaison@anglianwater.co.uk>; Ben Brooks <bbrooks@ardent-ce.co.uk>

Cc: Dear, Colin <colin.dear@barratthomes.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

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Good afternoon Doug,

Thank you for getting back so quickly. I believe there is some confusion in the email below. Our preferred connection point is MH3951, but you state MH4752. Can you please clarify Anglian Water accept the connection to MH3951 at a rate of 8l/s?

Many Thanks,

Thomas Rayment

Principal Engineer

!!! I will be going on paternity leave at short notice. My colleagues are aware !!!

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From: Planning Liaison <planningliaison@anglianwater.co.uk>

Sent: 04 July 2025 14:00

To: Ben Brooks <bbrooks@ardent-ce.co.uk>; Planning Liaison <planningliaison@anglianwater.co.uk>

Cc: Dear, Colin <colin.dear@barratthomes.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>; Thomas Rayment <trayment@ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

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Hi Tom/Ben,

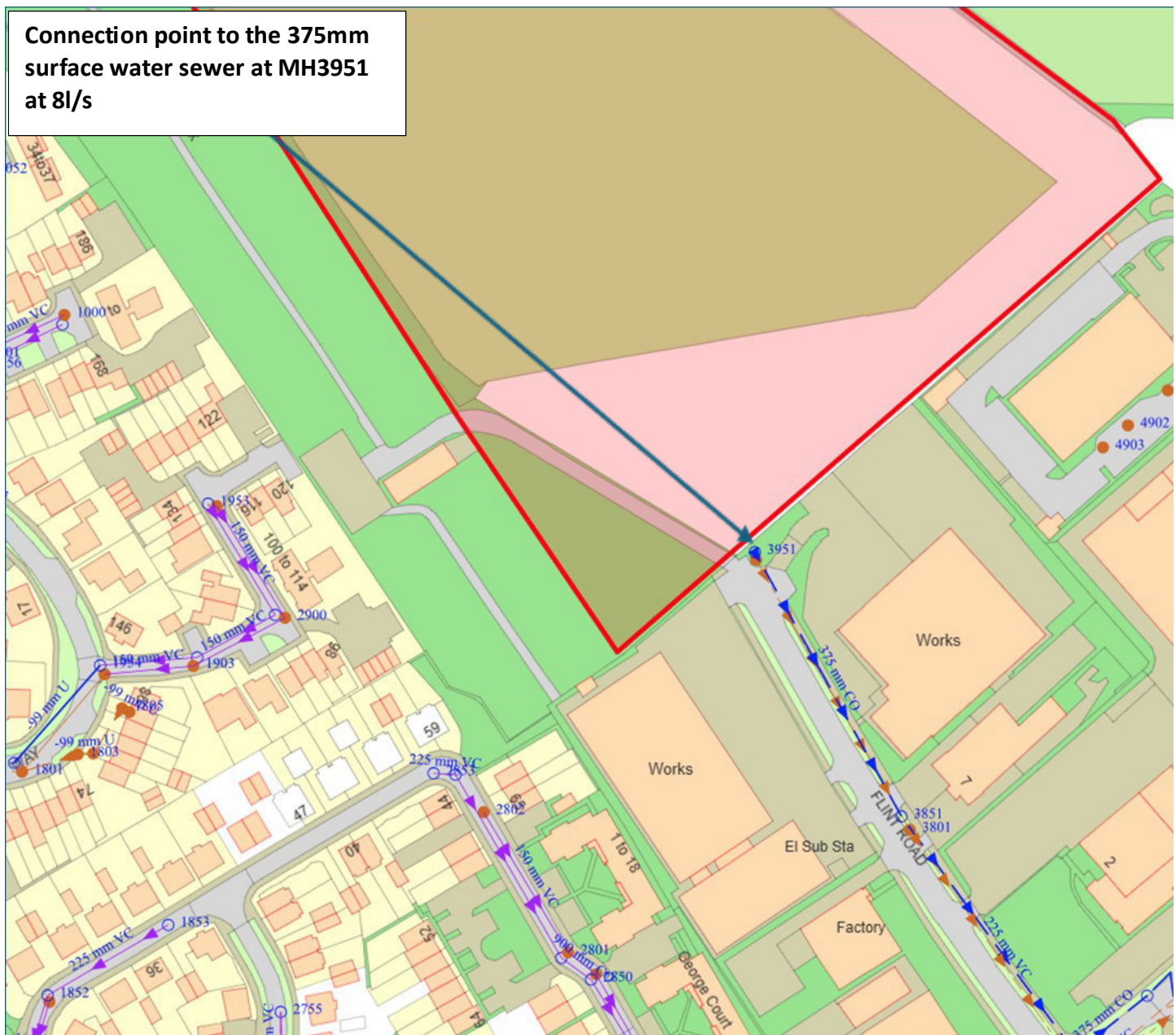
Thank you, Tom, for the quick Teams call that we had yesterday and the clarity you provided about your request for the above site.

We have also received GDPR approval from RSK and can formally respond to your request.

Having looked at the two PPE reports which you summarised your request as follows:

- “Planning Pre-Dev Report 01”, PPE-0111381 dated 22/01/2021, allowing a discharge rate at 8l/s to MH 3951
- “Planning Pre-Dev Report 02”; PPE-0216650 dated 29/10/2024, allowing a discharge rate at 7.58l/s to MH 4752.

The first PPE-0111381 dated 2021 is out of date and the second one is in date (PPE-0216650) and Anglian Water accept your preferred connection point to the surface water sewer south of your development at MH4752 at a maximum rate of 8l/s for all events. **Reasons:** The connection is to the same size sewer and at an easily accessible point from your development site.



Please take this email correspondence as confirmation for your connection point to supersede the one in our Pre-Planning report issued on 29/10/2024.

If you have any further questions, do not hesitate to get in touch with our team on the contacts below.

Kind Regards,
Doug

Doug Mlambo

Senior Engineer (Flood Risk)

For details on how to submit a pre-planning enquiry to the Pre-Development Team, please visit the "[how to apply](#)" section on our website.

Growth Planning Team Telephone: **03450263912**

Anglian Water Services Limited

Growth, Planning & Capacity Team

Thorpe Wood House, Thorpe Wood, Peterborough,
Cambridgeshire, PE3 6WT

From: Ben Brooks <bbrooks@ardent-ce.co.uk>

Sent: 02 July 2025 22:52

To: Planning Liaison <planningliaison@anglianwater.co.uk>

Cc: Dear, Colin <colin.dear@barratthomes.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>; Thomas Rayment <trayment@ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

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Charlotte,

We have requested RSK provide you with an email.

Let us know if there is anything else we can do to speed thing up.

Thanks,

Ben Brooks

Project Director

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From: Planning Liaison <planningliaison@anglianwater.co.uk>

Sent: 02 July 2025 14:58

To: Ben Brooks <bbrooks@ardent-ce.co.uk>

Cc: Dear, Colin <colin.dear@barratthomes.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>; Thomas Rayment <trayment@ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

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Hi Ben,

We completely understand this, just sadly we must have an email from the owner, just for the avoidance of any doubt. I would love to have accepted it but we are regulated and have to ensure this is audited correctly. Anglian Water have always requested a "written" email from the owner to ensure the GDPR checks have passed.

Mark and Drainage I have removed as this is a Pre-Dev they are not able to support unfortunately. I will update them as soon as we have issued a response.

I have asked our senior engineer to review the information as a matter of urgency for you.

Kind regards,
Charlotte



Charlotte

Pre-Development Engineer

For details on how to submit a pre-planning enquiry to the Pre-Development Team, please visit the "[how to apply](#)" section on our website.

Growth Planning Team contact number: 0345 026 3912

Anglian Water Services Limited



From: Ben Brooks <bbrooks@ardent-ce.co.uk>

Sent: 01 July 2025 22:02

To: Planning Liaison <planningliaison@anglianwater.co.uk>

Cc: Mark Mould <mMould@anglianwater.co.uk>; Development Services - Drainage <Drainage@anglianwater.co.uk>;

Dear, Colin <colin.dear@barratthomes.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>; Thomas Rayment <trayment@ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

Importance: High

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Charlotte,

Your email (attached) did not specify that the written permission needed to be an email confirmation, we assumed incorrectly that the request for something in writing referred to headed paper as is typically the case.

I have attached the email trail – is this adequate? Neither BDW nor Ardent are going to fraudulently create a letter from RSK to save £500 in Pre-dev costs, using the previous pre-dev response as the starting point was to try and save us all time and effort.

On the basis we have waited more than 2 weeks for you to confirm you need an email can you please progress with reviewing the information available and providing a response to our queries?

We can get you what you need but given the impending planning application for the scheme we cannot afford to spend more time waiting for a response.

Kind Regards,

Ben Brooks

Project Director

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From: Planning Liaison <planningliaison@anglianwater.co.uk>

Sent: 01 July 2025 09:48

To: Ben Brooks <bbrooks@ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

EXTERNAL EMAIL: Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Good morning Ben,

Unfortunately we need a written email from RSK to approve us discussing this Pre-Planning enquiry with you. We can not accept any other documentation as we need to ensure it has come from the enquiry owner to ensure we have passed the necessary GDPR steps.

They can email us, anyone from RSK to planningliaison@anglianwater.co.uk to enable this discussion, please mark this for my attention so that I can ensure it is picked up as a priority.

Kind regards,
Charlotte



Charlotte

Pre-Development Engineer

For details on how to submit a pre-planning enquiry to the Pre-Development Team, please visit the "how to apply" section on our website.

Growth Planning Team contact number: 0345 026 3912

Anglian Water Services Limited



From: Ben Brooks <bbrooks@ardent-ce.co.uk>

Sent: 23 June 2025 12:38

To: Planning Liaison <planningliaison@anglianwater.co.uk>; Mark Mould <mMould@anglianwater.co.uk>

Cc: Development Services - Drainage <Drainage@anglianwater.co.uk>; Dear, Colin <colin.dear@barratthomes.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>; Thomas Rayment <trayment@ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

Importance: High

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All,

I have not seen a response to the below email.

Can you please confirm you are now able to engage with us and ideally provide a response to our original enquiry on 2nd June (attached email for ease).

Kind Regards,

Ben Brooks

Project Director

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From: Ben Brooks

Sent: 13 June 2025 17:58

To: Planning Liaison <planningliaison@anglianwater.co.uk>; Mark Mould <mMould@anglianwater.co.uk>

Cc: Development Services - Drainage <Drainage@anglianwater.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

All,

Please find letter from RSK (now re-branded as LDE) confirming we are able to engage with Anglian Water.

Is this adequate to allow you to talk to us about the 2024 pre-planning assessment report?

Kind Regards,

Ben Brooks

Project Director

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From: Ben Brooks

Sent: 09 June 2025 19:04

To: Planning Liaison <planningliaison@anglianwater.co.uk>; Mark Mould <mMould@anglianwater.co.uk>

Cc: Development Services - Drainage <Drainage@anglianwater.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

Thanks both,

We are waiting for RSK to provide permission via our client for us to talk to you on their Pre-Dev.

Once we have this we will circulate to get the ball rolling.

Mark,

Regarding your comments on requisition, I'm aware the landowner is in discussion and if we went ahead with this option our preference would be a negotiated solution but I feel at this fairly early stage knowing we had a requisition option available would provide the client with some comfort they won't be ransomed.

Kind Regards,

Ben Brooks

Project Director

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From: Planning Liaison <planningliaison@anglianwater.co.uk>

Sent: 09 June 2025 10:56

To: Mark Mould <mMould@anglianwater.co.uk>

Cc: Development Services - Drainage <Drainage@anglianwater.co.uk>; Ben Brooks <bbrooks@ardent-ce.co.uk>;
Dominic Cronin <dcronin@Ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

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Good morning Mark,

Thank you, I picked this up on the 4th June.

Unfortunately, we not received GDPR consent to speak with ardent about this site, until we have we are unable to disclose any further details. If Ardent wish to apply for a surface water assessment to answer their queries below, they will need to apply through our webpage, this can no longer be applied through inflow [How to Apply](#), the form is around ¾ of the way down this webpage.

Thank you for sending this on, I hope you had a good break.

Kind regards,
Charlotte



Charlotte

Pre-Development Engineer

For details on how to submit a pre-planning enquiry to the Pre-Development Team, please visit the ["how to apply"](#) section on our website.

Growth Planning Team contact number: 0345 026 3912

Anglian Water Services Limited



From: Mark Mould <mMould@anglianwater.co.uk>

Sent: 09 June 2025 10:30

To: Planning Liaison <planningliaison@anglianwater.co.uk>

Cc: Development Services - Drainage <Drainage@anglianwater.co.uk>; bbrooks@ardent-ce.co.uk; dcronin@ardent-ce.co.uk

Subject: FW: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

Good morning planning team.

Whilst I was on leave I was copied in on an email sent to the drainage mailbox. Not sure if this was forwarded on to you but you will note that Ardent are seeking confirmation regards the surface water outfall point. Could you please review and respond.

Regards the option of a requisition Ben, have you spoken to the appropriate land owner to see if they would be prepared to be named on a Section 104 agreement as an adjoining owner? It could save a lot of extra time and money if they did rather than going down the requisition route whereby you would be liable to cover all land agent costs (ours and landowners) and any compensation that may be deemed liable through negotiations. Plus our fees are increased if entering a Section 30 Anglian Water Act 1977 type agreement with a 100% bond due on top.

Kind regards

Mark Mould

Drainage Engineer Development Services

Mobile 07855 147595

Office: 03456 066087 Option 2

Anglian Water Services Limited

Great Billing WRC, 23 Crow Lane, Northampton NN3 9BX



From: Thomas Rayment <trayment@ardent-ce.co.uk>

Sent: 02 June 2025 16:26

To: Development Services - Drainage <Drainage@anglianwater.co.uk>; Mark Mould <mMould@anglianwater.co.uk>

Cc: Ben Brooks <bbrooks@ardent-ce.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>

Subject: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

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Good afternoon,

I'm getting in touch to request confirmation on a few points relating to the proposed drainage connections for our site located at [Talbot Way, Letchford]. We note there have been two pre-development enquiries at the site, see attached predevelopment 1 and 2, a brief overview is outlined below.

- "Planning Pre-Dev Report 01", dated 22/01/2021, allowing a discharge rate at 8l/s to MH 3951,
- "Planning Pre-Dev Report 02"; dated 29/10/2024, allowing a discharge rate at 7.58l/s to MH 4752.

We would like to confirm the surface water connection at the site entrance, *Report-01*. We understand this is the same sewer we have previously been offered a connection to. Assuming the diameter is consistent, we do not foresee any issues but would appreciate formal confirmation.

Alternatively, we would like to discuss the possibility whether foul and surface water can be connected via a requisition, see attached plan, 2502330-ACE-XX-00-DR-C-0151, showing an alternative option which connect to existing Anglian water assets. Our understanding is that these would both connect downstream of the current point of connection, so we anticipate this should be acceptable also.

It would be very helpful to have your input on the above, and to understand whether you foresee any constraints or requirements we should be aware of. Please let us know if you require any further information or plans from our side.

Many Thanks,

Thomas Rayment

Principal Engineer

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Registered in England No 2366656

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Thomas Rayment

From: Planning Liaison <planningliaison@anglianwater.co.uk>
Sent: 07 July 2025 15:04
To: Thomas Rayment
Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)
Attachments: image014.emz

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Hi Tom,

Thank you for the correction.

Yes, that was a typo on my behalf, Anglian Water accept the connection to MH3951 at a rate of 8l/s.

2



From: Thomas Rayment <trayment@ardent-ce.co.uk>

Sent: 04 July 2025 14:10

To: Planning Liaison <planningliaison@anglianwater.co.uk>; Ben Brooks <bbrooks@ardent-ce.co.uk>

Cc: Dear, Colin <colin.dear@barratthomes.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

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Good afternoon Doug,

Thank you for getting back so quickly. I believe there is some confusion in the email below. Our preferred connection point is MH3951, but you state MH4752. Can you please clarify Anglian Water accept the connection to MH3951 at a rate of 8l/s?

Many Thanks,

Thomas Rayment

Principal Engineer

!!! I will be going on paternity leave at short notice. My colleagues are aware !!!

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T | 020 7680 4088 **M** | 07932 936 924 **E** | trayment@ardent-ce.co.uk

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From: Planning Liaison <planningliaison@anglianwater.co.uk>

Sent: 04 July 2025 14:00

To: Ben Brooks <bbrooks@ardent-ce.co.uk>; Planning Liaison <planningliaison@anglianwater.co.uk>

Cc: Dear, Colin <colin.dear@barratthomes.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>; Thomas Rayment <trayment@ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

EXTERNAL EMAIL: Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Hi Tom/Ben,

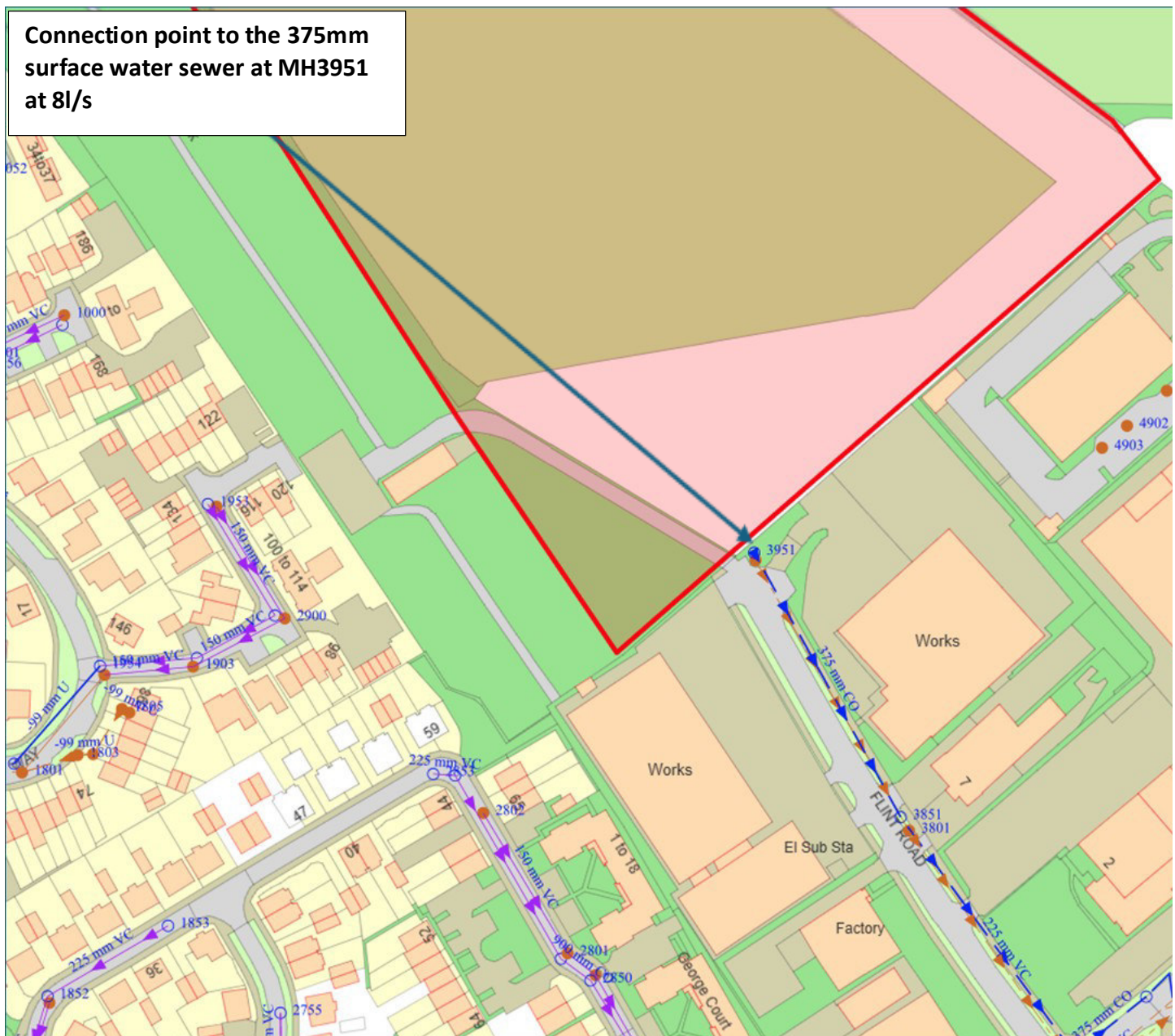
Thank you, Tom, for the quick Teams call that we had yesterday and the clarity you provided about your request for the above site.

We have also received GDPR approval from RSK and can formally respond to your request.

Having looked at the two PPE reports which you summarised your request as follows:

- “Planning Pre-Dev Report 01”, PPE-0111381 dated 22/01/2021, allowing a discharge rate at 8l/s to MH 3951
- “Planning Pre-Dev Report 02”; PPE-0216650 dated 29/10/2024, allowing a discharge rate at 7.58l/s to MH 4752.

The first PPE-0111381 dated 2021 is out of date and the second one is in date (PPE-0216650) and Anglian Water accept your preferred connection point to the surface water sewer south of your development at MH4752 at a maximum rate of 8l/s for all events. **Reasons:** The connection is to the same size sewer and at an easily accessible point from your development site.



Please take this email correspondence as confirmation for your connection point to supersede the one in our Pre-Planning report issued on 29/10/2024.

If you have any further questions, do not hesitate to get in touch with our team on the contacts below.

Kind Regards,
Doug

Doug Mlambo

Senior Engineer (Flood Risk)

For details on how to submit a pre-planning enquiry to the Pre-Development Team, please visit the "[how to apply](#)" section on our website.

Growth Planning Team Telephone: **03450263912**

Anglian Water Services Limited

Growth, Planning & Capacity Team

Thorpe Wood House, Thorpe Wood, Peterborough,
Cambridgeshire, PE3 6WT

From: Ben Brooks <bbrooks@ardent-ce.co.uk>

Sent: 02 July 2025 22:52

To: Planning Liaison <planningliaison@anglianwater.co.uk>

Cc: Dear, Colin <colin.dear@barratthomes.co.uk>; Dominic Cronin <dcronin@Ardent-ce.co.uk>; Thomas Rayment <trayment@ardent-ce.co.uk>

Subject: RE: Existing Planning Pre-Dev Enquiry (Talbot Way, Letchford)

EXTERNAL MAIL - Please be aware this mail is from an external sender - THINK BEFORE YOU CLICK

Charlotte,

We have requested RSK provide you with an email.

Let us know if there is anything else we can do to speed thing up.

Thanks,

Ben Brooks

Project Director

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Appendix F – Hertfordshire County Council LLFA Meeting Minutes

MEETING AGENDA

DATE AND TIME: 16:00 – 17:00 Wednesday 21st May 2025

SUBJECT: Hertfordshire County Council (HCC) LLFA /
Ardent Consulting Engineers - Catch up

VENUE: Video Call (Microsoft Teams)

REF: 2025-05-21_HCC-ACE

THOSE PRESENT: Emma Bullen (EB) – Herts County Council (LLFA);
David Uncle (DU) – Herts County Council (LLFA);
Alex Jones (AJ) – WSP (Support HCC LLFA);
Jake Silverton (JS) - WSP (Support HCC LLFA);
Colin Dear (CD) – Barratt David Wilson (North Thames);
Ben Brooks (BB) – Ardent Consulting Engineers;
Edward Fambley (EF) – Ardent Consulting Engineers;
Thomas Rayment (TR) – Ardent Consulting Engineers.

1.0 Welcome and Introductions

2.0 Project Discussions

2.1 2502330 – Land at Talbot Way, Letchworth (BB/TR)

ITEM	NOTES	ACTION
1.00	Welcome and Introductions	
1.10	BB introduces himself and outlines the requirements of this meeting. The proposal is to outline Ardent's drainage strategies are acceptable and the changes made are necessary due to the unfeasibility of the original statement.	
2.00	Project Discussions	
2.10	Land at Talbot Way, Letchworth (21/00504/OP)	
		
2.11	BB describes the previous drainage strategy and its unfeasibility. Infiltration rates shown at outline are unsatisfactory and the next stage on the hierarchy should be sought. It was noted that the current Ciria guidance is to use the lowest infiltration rate achieved on the site, unless there is a distinct change in geology which in this case there is not as all testing was undertaken within the chalk. See Appendix A for infiltration rates and details of the testing undertaken.	TR

ITEM	NOTES	ACTION
2.12	Ardent to re-consult with Anglian Water to reconfirm the 8 l/s discharge at a later stage.	TR
2.13	BB notes deep sewers (4.5–5.0m) are typical in the area, with existing ones around 4.0m. DCG/SSG allows upto 6m for typical manhole construction.	
2.14	BB outlines a second option which will also provide a gravity connection through the commercial development just north of Blackhorse road.	
2.15	AJ agrees infiltration shouldn't be pursued if unviable and supports gravity-fed solutions.	
2.16	AJ says the drainage statement must explain why infiltration isn't viable and follow the drainage design hierarchy	
2.17	AJ suggests the basin can retain infiltration properties, but drainage modelling should assume none, to keep the design robust.	
2.18	BB agrees the basin can be unlined to allow infiltration but should not factor into calculations.	
2.19	BB outlines the drainage proposal, including buried storage and CIRIA treatment compliance, see Appendix B .	TR
2.20	BB notes Ardent would include more SuDS, but site constraints (landscaping/tree buffers/ecology) limit this.	
2.21	TR clarifies the distinction between the bioretention and dry swale elements on site, emphasizing that the dry swale provides multi-stage treatment for the entire development via an underdrain and filter medium.	
2.22	AJ finds the proposed strategy acceptable, emphasizing that clear justification is essential for the changes from Outline to Reserved Matters.	
2.23	DU states that Condition 3 allows connection to Anglian Water's existing asset—limited to 8 l/s—provided it can be clearly demonstrated that infiltration is not viable.	
2.24	BB re-iterates the site has shown poor infiltration; therefore it would not be necessary for more BRE 365 infiltration rates to be undertaken. Better infiltration rates would not supersede the previous testing, and these rates prove that infiltration is unviable. <i>In particular the conditions do not state for additional testing to be done, rather to</i>	

ITEM	NOTES	ACTION
	<i>prove infiltration is unfavourable.</i>	
2.25	DU mentions additional source control measures and the desire for them where possible. BB adds that the proposed drainage strategy remains compliant with CIRIA SuDS treatment indices, which addresses the requirements set out within the planning condition, see Appendix C.	
2.26	BB inquires about the runoff coefficient. DU confirms HCC's preferred value is 1.0. BB and DU agree to proceed with the default value, as set out in the outline strategy. Drainage calculations will also use $C_v = 1.0$ to as a sensitivity test to assess the impact on modelling and determine flood mitigation measures if necessary.	

Appendix G – SUDS Maintenance Plan

SuDS Management & Maintenance Strategy

Maintenance and Management

The attenuation basins, swales, connecting pipework, chambers, and flow controls would be maintained by a management company set up by the developer. As construction has not yet commenced, the process of finalising the management company contract has not yet commenced. The developer will ensure that the measures as outlined below form part of the management company contract details, for the ongoing maintenance of all SuDS features on site.

The indicative maintenance requirements for each proposed SuDS component is given below. Taken from CIRIA report C753 "The SuDS Manual".

Drainage Pipes

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Remove sediment and debris from inspection chambers and flow control chambers	Annually
	Cleaning of gutters and any filters on downpipes	Annually
	Remove any root ingress	As required
Occasional Maintenance	CCTV survey of drains to check alignment, cracking and joint displacement	10 year intervals

SuDS Management & Maintenance Strategy**Attenuation Basins**

Maintenance schedule	Maintenance Task	Frequency
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass - meadow grass in and around basin	Half yearly (spring, before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets, and overflows for blockages, and clear is required	Monthly
	Inspect banksides, structures, pipework etc. for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlets and forebays	Annually (or as required)
	Manage wetland plants in outlet pool- where provided	Annually

SuDS Management & Maintenance Strategy

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 returfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven levels and reinstate design levels	As required

Swales

Maintenance schedule	Maintenance Task	Frequency
Regular Maintenance	Remove litter and debris	Monthly, or as required
	Cut the 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

SuDS Management & Maintenance Strategy

	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
	Inspect 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% of the filter strip area
Remedial Actions	Repair erosion or other damage by re-turfing or reseed	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the 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

SuDS Management & Maintenance Strategy**Bio-retention Systems**

Maintenance schedule	Maintenance Task	Frequency
Regular Maintenance	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc. and replace as necessary	Quarterly
	Inspect inlets and outlets for blockages.	Quarterly
	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required

SuDS Management & Maintenance Strategy

Remedial Actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years
	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Attenuation Tank

Maintenance Period	Maintenance Task	Frequency
Maintenance Work	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risk to performance)	Monthly
	Remove sediment from pre-treatment structures and/or internal forebays.	Annually, or as required
Remedial Work	Repair/rehabilitate inlets, outlets, 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.
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required.

Appendix H – SUDS Treatment Plan

Pollution hazard indices for different land use classifications (land use shaded applicable for the development)

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

sites; trunk roads and motorways				
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Indicative SuDS mitigation indices for discharges to surface waters
(SuDS components shaded applicable to this development)

SuDS component	Pollution Hazard Mitigation indices		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bio retention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Hydrodynamic Vortex Separator	0.5	0.4	0.5
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Indicative SuDS mitigation indices for discharges to surface water outfalls

<u>Northern Catchment</u>			
For surface water discharge from all roads except low traffic roads and trunks/motorways			
Source	Required mitigation indices		
	TSS	Metals	Hydrocarbons
Medium	0.7	0.6	0.7
Drainage Network			
Detention Basin (mitigation index ₁)	0.5	0.5	0.6
Swales (mitigation index ₂)	0.5	0.6	0.6
Detention Basin (mitigation index ₃)	0.5	0.5	0.6
Total	1.0	1.05	1.2
Check	+0.3	+0.45	+0.5

Total SuDS mitigation index = mitigation index₁ + (0.5 x mitigation index₂)

<u>Central Catchment</u>			
For surface water discharge from all roads except low traffic roads and trunks/motorways			
Source	Required mitigation indices		
	TSS	Metals	Hydrocarbons
Medium	0.7	0.6	0.7
Drainage Network			
Swales (mitigation index ₁)	0.5	0.6	0.6
Bioretention System (mitigation index ₂)	0.8	0.8	0.8
Total	0.9	1.0	1.0
Check	+0.2	+0.4	+0.3

Total SuDS mitigation index = mitigation index₁ + (0.5 x mitigation index₂)

<u>Southern Catchment</u>			
For surface water discharge from all roads except low traffic roads and trunks/motorways			
Source	Required mitigation indices		
	TSS	Metals	Hydrocarbons
Medium	0.7	0.6	0.7
Drainage Network			
Detention Basin (mitigation index ₁)	0.5	0.5	0.6
Swales (mitigation index ₂)	0.5	0.6	0.6
Bioretention System (mitigation index ₃)	0.8	0.8	0.8
Total	1.15	1.2	1.3
Check	+0.45	+0.6	+0.6

Total SuDS mitigation index = mitigation index₁ + (0.5 x mitigation index₂)

Appendix I – Proposed Drainage Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	1	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	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		

1 Link Type

Template	Freeform Carrier	Auto Increment (mm)	75
Shape	Circular	Follow Ground	x
Barrels	1		

Available Diameters (mm)

100

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
S1	0.110	5.00	88.941	1200	523165.209	234151.045	1.821	87.120
S2	0.110	5.00	88.841	1200	523196.724	234158.348	2.027	86.814
S3	0.110	5.00	88.778	1350	523187.020	234168.308	2.085	86.693
S4	0.110	5.00	88.324	1350	523166.921	234194.702	1.717	86.607
S5	0.110	5.00	88.080	1350	523184.471	234207.102	1.529	86.551
BASIN-01			87.989	1350	523185.552	234232.735	1.489	86.500
S6-FC			88.000	1350	523204.890	234228.980	1.530	86.470
S7			87.600	1350	523232.930	234206.208	1.280	86.320
S8			87.610	1350	523249.020	234192.930	1.365	86.245
S9	0.060	5.00	88.525	1350	523234.235	234161.180	1.650	86.875
S10	0.060	5.00	88.059	1200	523247.224	234180.279	1.868	86.191
S11	0.060	5.00	87.595	1350	523270.533	234166.130	1.595	86.000
S12	0.060	5.00	86.072	1350	523306.653	234140.724	2.097	83.975
S13	0.060	5.00	88.758	1200	523198.718	234100.741	1.808	86.950
S14	0.060	5.00	88.830	1200	523211.913	234110.339	1.989	86.841
S15	0.060	5.00	88.723	1350	523216.833	234139.077	1.773	86.950
S16	0.050	5.00	88.492	1200	523228.331	234130.535	2.152	86.340
S17	0.050	5.00	87.453	1200	523258.683	234109.577	1.809	85.644
S18	0.050	5.00	87.161	1200	523233.894	234051.272	1.791	85.370
S19	0.050	5.00	86.814	1200	523254.506	234068.187	1.794	85.020
S20			86.353	1200	523278.198	234093.152	1.913	84.440
S21	0.060	5.00	85.809	1350	523286.679	234085.271	1.884	83.925
S22	0.060	5.00	85.693	1350	523306.762	234103.174	2.053	83.640
S23	0.060	5.00	85.010	1350	523323.404	234124.884	2.270	82.740
S24	0.050	5.00	84.185	1350	523335.480	234116.919	2.055	82.130
S25	0.050	5.00	82.676	1350	523352.711	234100.878	2.146	80.530
S26	0.050	5.00	81.373	1350	523368.658	234089.412	2.133	79.240
S27	0.050	5.00	80.047	1350	523387.457	234082.512	2.172	77.875
S28	0.050	5.00	79.711	1350	523391.397	234076.737	2.041	77.670
BASIN-02			78.800	1350	523402.451	234051.044	1.600	77.200
S29-FC			78.800	1350	523394.821	234031.228	1.800	77.000
S30			79.319	1350	523385.643	234021.044	2.362	76.957
S31			79.823	1350	523367.687	234020.074	2.922	76.901

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
S32	0.070	5.00	85.018	1200	523296.928	234070.524	1.883	83.135
S33	0.070	5.00	84.506	1200	523302.864	234061.134	2.482	82.024
S34	0.070	5.00	83.487	1200	523309.723	234039.387	3.743	79.744
S35	0.070	5.00	83.473	1350	523285.943	234004.353	3.721	79.752
TANK 01		5.00	81.794	1350	523327.078	234027.913	4.839	76.955
S36	0.070	5.00	82.169	1500	523314.740	234010.461	5.529	76.640
S37	0.070	5.00	81.444	1500	523318.933	233989.884	4.856	76.588
S38	0.070	5.00	81.055	1500	523327.676	233959.783	4.546	76.509
S39-FC	0.070	5.00	80.704	1800	523335.724	233942.263	4.243	76.461
Ex S3951			80.130	1350	523343.015	233941.174	3.710	76.420

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S3	27.816	0.600	87.120	86.768	0.352	79.0	375	5.23	30.6
2.000	S2	S3	13.906	0.600	86.814	86.768	0.046	302.3	375	5.22	30.6
1.001	S3	S4	33.175	0.600	86.693	86.607	0.086	385.8	450	5.76	29.3
1.002	S4	S5	21.489	0.600	86.607	86.551	0.056	383.7	450	6.11	28.4
1.003	S5	BASIN-01	25.656	0.600	86.551	86.500	0.051	500.0	450	6.59	27.4
1.004	BASIN-01	S6-FC	19.699	0.600	86.500	86.470	0.030	656.6	450	7.00	26.5
1.005	S6-FC	S7	36.122	0.600	86.470	86.320	0.150	240.8	300	7.60	25.5
1.006	S7	S8	20.861	0.600	86.320	86.245	0.075	278.1	300	7.97	24.8
1.007	S8	S10	12.778	0.600	86.245	86.191	0.054	236.6	300	8.18	24.5
3.000	S9	S10	23.098	0.600	86.875	86.191	0.684	33.8	300	5.14	30.8
1.008	S10	S11	27.267	0.600	86.191	86.075	0.116	235.1	300	8.63	23.8
1.009	S11	S12	44.160	0.600	86.000	83.975	2.025	21.8	375	8.81	23.5
1.010	S12	S23	23.055	0.600	83.975	82.815	1.160	19.9	375	8.91	23.3
4.000	S13	S14	16.317	0.600	86.950	86.841	0.109	149.7	300	5.21	30.7
4.001	S14	S16	26.027	0.600	86.841	86.340	0.501	52.0	300	5.41	30.2
5.000	S15	S16	14.324	0.600	86.950	86.340	0.610	23.5	300	5.07	31.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.039	225.3	9.1	1.446	1.635	0.110	0.0	62	1.017
2.000	1.037	114.5	9.1	1.652	1.635	0.110	0.0	77	0.750
1.001	1.029	163.6	26.2	1.635	1.267	0.330	0.0	119	1.176
1.002	1.032	164.1	33.9	1.267	1.079	0.440	0.0	162	1.001
1.003	0.902	143.5	40.9	1.079	1.039	0.550	0.0	215	0.835
1.004	0.786	125.0	39.5	1.039	1.080	0.550	0.0	228	0.751
1.005	1.009	71.3	37.9	1.230	0.980	0.550	0.0	187	1.092
1.006	0.938	66.3	37.0	0.980	1.065	0.550	0.0	194	1.025
1.007	1.018	71.9	36.5	1.065	1.568	0.550	0.0	181	1.091
3.000	2.714	191.9	5.0	1.350	1.568	0.060	0.0	38	1.285
1.008	1.021	72.2	43.2	1.568	1.220	0.670	0.0	204	1.130
1.009	3.894	430.1	46.5	1.220	1.722	0.730	0.0	96	2.803
1.010	4.080	450.6	50.0	1.722	1.820	0.790	0.0	97	2.961
4.000	1.282	90.7	5.0	1.508	1.689	0.060	0.0	55	0.758
4.001	2.186	154.5	9.8	1.689	1.852	0.120	0.0	58	1.344
5.000	3.258	230.3	5.0	1.473	1.852	0.060	0.0	35	1.468

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.002	S16	S17	36.885	0.600	86.340	85.644	0.696	53.0	300	5.69	29.4
4.003	S17	S20	25.507	0.600	85.644	84.440	1.204	21.2	300	5.82	29.1
6.000	S18	S19	26.664	0.600	85.370	85.020	0.350	76.2	300	5.25	30.6
6.001	S19	S20	34.417	0.600	85.020	84.440	0.580	59.3	300	5.53	29.9
4.004	S20	S21	11.577	0.600	84.440	84.000	0.440	26.3	300	5.88	29.0
4.005	S21	S22	26.904	0.600	83.925	83.640	0.285	94.4	375	6.12	28.4
4.006	S22	S23	27.355	0.600	83.640	82.815	0.825	33.2	375	6.27	28.1
1.011	S23	S24	14.466	0.600	82.740	82.130	0.610	23.7	450	8.97	23.3
1.012	S24	S25	23.542	0.600	82.130	80.530	1.600	14.7	450	9.04	23.2
1.013	S25	S26	19.641	0.600	80.530	79.240	1.290	15.2	450	9.10	23.1
1.014	S26	S27	20.025	0.600	79.240	77.950	1.290	15.5	450	9.17	23.0
1.015	S27	S28	6.991	0.600	77.875	77.670	0.205	34.1	525	9.20	22.9
1.016	S28	BASIN-02	27.970	0.600	77.670	77.200	0.470	59.5	525	9.36	22.7
1.017	BASIN-02	S29-FC	21.234	0.600	77.200	77.000	0.200	106.2	525	9.52	22.5
1.018	S29-FC	S30	13.709	0.600	77.000	76.957	0.043	318.8	450	9.72	22.2
1.019	S30	S31	17.982	0.600	76.957	76.901	0.056	321.1	450	9.99	21.9
1.020	S31	S36	53.813	0.600	76.901	76.715	0.186	289.3	450	10.74	21.0
7.000	S32	S33	11.109	0.600	83.135	82.024	1.111	10.0	300	5.04	31.1
7.001	S33	S34	22.803	0.600	82.024	79.744	2.280	10.0	300	5.11	30.9
7.002	S34	S36	29.358	0.600	79.744	76.865	2.879	10.2	300	5.21	30.7
8.000	S35	S36	29.438	0.600	79.752	76.865	2.887	10.2	300	5.10	30.9
9.000	TANK 01	S36	21.373	0.600	76.955	76.865	0.090	237.5	300	5.35	30.3
1.021	S36	S37	21.000	0.600	76.640	76.588	0.052	403.8	525	11.06	20.7
1.022	S37	S38	31.345	0.600	76.588	76.509	0.079	396.8	525	11.53	20.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.002	2.164	153.0	18.4	1.852	1.509	0.230	0.0	82	1.617
4.003	3.430	242.5	22.1	1.509	1.613	0.280	0.0	72	2.389
6.000	1.803	127.4	4.1	1.491	1.494	0.050	0.0	46	0.961
6.001	2.044	144.5	8.1	1.494	1.613	0.100	0.0	58	1.249
4.004	3.077	217.5	29.8	1.613	1.509	0.380	0.0	90	2.412
4.005	1.865	206.0	33.9	1.509	1.678	0.440	0.0	121	1.522
4.006	3.156	348.5	38.1	1.678	1.820	0.500	0.0	97	2.289
1.011	4.188	666.1	85.1	1.820	1.605	1.350	0.0	124	3.154
1.012	5.320	846.1	87.9	1.605	1.696	1.400	0.0	112	3.788
1.013	5.230	831.8	90.7	1.696	1.683	1.450	0.0	115	3.771
1.014	5.179	823.7	93.4	1.683	1.647	1.500	0.0	117	3.781
1.015	3.844	832.2	96.4	1.647	1.516	1.550	0.0	135	3.209
1.016	2.907	629.3	98.6	1.516	1.075	1.600	0.0	162	2.320
1.017	2.173	470.4	97.6	1.075	1.275	1.600	0.0	188	1.870
1.018	1.133	180.2	96.5	1.350	1.912	1.600	0.0	321	1.191
1.019	1.129	179.5	94.9	1.912	2.472	1.600	0.0	317	1.186
1.020	1.190	189.2	91.1	2.472	5.004	1.600	0.0	303	1.183
7.000	4.999	353.4	5.9	1.583	2.182	0.070	0.0	31	2.086
7.001	4.999	353.3	11.7	2.182	3.443	0.140	0.0	42	2.549
7.002	4.950	349.9	17.5	3.443	5.004	0.210	0.0	52	2.874
8.000	4.950	349.9	5.9	3.421	5.004	0.070	0.0	31	2.086
9.000	1.016	71.8	0.0	4.539	5.004	0.000	0.0	0	0.000
1.021	1.108	239.9	109.2	5.004	4.331	1.950	0.0	285	1.301
1.022	1.118	242.0	110.4	4.331	4.021	2.020	0.0	340	1.136

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.023	S38	S39-FC	19.280	0.600	76.509	76.461	0.048	401.7	525	11.81	19.9
1.024	S39-FC	Ex S3951	7.372	0.600	76.461	76.420	0.041	179.8	375	11.91	19.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.023	1.111	240.5	112.6	4.021	3.718	2.090	0.0	345	1.138
1.024	1.348	148.9	115.8	3.868	3.335	2.160	0.0	261	1.599

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	27.816	79.0	375	1	88.941	87.120	1.446	88.778	86.768	1.635
2.000	13.906	302.3	375	1	88.841	86.814	1.652	88.778	86.768	1.635
1.001	33.175	385.8	450	1	88.778	86.693	1.635	88.324	86.607	1.267
1.002	21.489	383.7	450	1	88.324	86.607	1.267	88.080	86.551	1.079
1.003	25.656	500.0	450	1	88.080	86.551	1.079	87.989	86.500	1.039
1.004	19.699	656.6	450	1	87.989	86.500	1.039	88.000	86.470	1.080
1.005	36.122	240.8	300	1	88.000	86.470	1.230	87.600	86.320	0.980
1.006	20.861	278.1	300	1	87.600	86.320	0.980	87.610	86.245	1.065
1.007	12.778	236.6	300	1	87.610	86.245	1.065	88.059	86.191	1.568
3.000	23.098	33.8	300	1	88.525	86.875	1.350	88.059	86.191	1.568
1.008	27.267	235.1	300	1	88.059	86.191	1.568	87.595	86.075	1.220
1.009	44.160	21.8	375	1	87.595	86.000	1.220	86.072	83.975	1.722
1.010	23.055	19.9	375	1	86.072	83.975	1.722	85.010	82.815	1.820
4.000	16.317	149.7	300	1	88.758	86.950	1.508	88.830	86.841	1.689
4.001	26.027	52.0	300	1	88.830	86.841	1.689	88.492	86.340	1.852
5.000	14.324	23.5	300	1	88.723	86.950	1.473	88.492	86.340	1.852
4.002	36.885	53.0	300	1	88.492	86.340	1.852	87.453	85.644	1.509
4.003	25.507	21.2	300	1	87.453	85.644	1.509	86.353	84.440	1.613

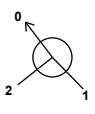
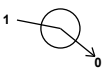
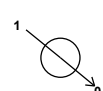
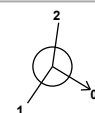
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	1200	Manhole	1	S3	1350	Manhole	1
2.000	S2	1200	Manhole	1	S3	1350	Manhole	1
1.001	S3	1350	Manhole	1	S4	1350	Manhole	1
1.002	S4	1350	Manhole	1	S5	1350	Manhole	1
1.003	S5	1350	Manhole	1	BASIN-01	1350	Manhole	1
1.004	BASIN-01	1350	Manhole	1	S6-FC	1350	Manhole	1
1.005	S6-FC	1350	Manhole	1	S7	1350	Manhole	1
1.006	S7	1350	Manhole	1	S8	1350	Manhole	1
1.007	S8	1350	Manhole	1	S10	1200	Manhole	1
3.000	S9	1350	Manhole	1	S10	1200	Manhole	1
1.008	S10	1200	Manhole	1	S11	1350	Manhole	1
1.009	S11	1350	Manhole	1	S12	1350	Manhole	1
1.010	S12	1350	Manhole	1	S23	1350	Manhole	1
4.000	S13	1200	Manhole	1	S14	1200	Manhole	1
4.001	S14	1200	Manhole	1	S16	1200	Manhole	1
5.000	S15	1350	Manhole	1	S16	1200	Manhole	1
4.002	S16	1200	Manhole	1	S17	1200	Manhole	1
4.003	S17	1200	Manhole	1	S20	1200	Manhole	1

Pipeline Schedule

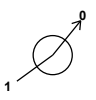
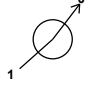
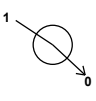
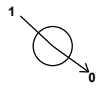
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.000	26.664	76.2	300	1	87.161	85.370	1.491	86.814	85.020	1.494
6.001	34.417	59.3	300	1	86.814	85.020	1.494	86.353	84.440	1.613
4.004	11.577	26.3	300	1	86.353	84.440	1.613	85.809	84.000	1.509
4.005	26.904	94.4	375	1	85.809	83.925	1.509	85.693	83.640	1.678
4.006	27.355	33.2	375	1	85.693	83.640	1.678	85.010	82.815	1.820
1.011	14.466	23.7	450	1	85.010	82.740	1.820	84.185	82.130	1.605
1.012	23.542	14.7	450	1	84.185	82.130	1.605	82.676	80.530	1.696
1.013	19.641	15.2	450	1	82.676	80.530	1.696	81.373	79.240	1.683
1.014	20.025	15.5	450	1	81.373	79.240	1.683	80.047	77.950	1.647
1.015	6.991	34.1	525	1	80.047	77.875	1.647	79.711	77.670	1.516
1.016	27.970	59.5	525	1	79.711	77.670	1.516	78.800	77.200	1.075
1.017	21.234	106.2	525	1	78.800	77.200	1.075	78.800	77.000	1.275
1.018	13.709	318.8	450	1	78.800	77.000	1.350	79.319	76.957	1.912
1.019	17.982	321.1	450	1	79.319	76.957	1.912	79.823	76.901	2.472
1.020	53.813	289.3	450	1	79.823	76.901	2.472	82.169	76.715	5.004
7.000	11.109	10.0	300	1	85.018	83.135	1.583	84.506	82.024	2.182
7.001	22.803	10.0	300	1	84.506	82.024	2.182	83.487	79.744	3.443
7.002	29.358	10.2	300	1	83.487	79.744	3.443	82.169	76.865	5.004
8.000	29.438	10.2	300	1	83.473	79.752	3.421	82.169	76.865	5.004
9.000	21.373	237.5	300	1	81.794	76.955	4.539	82.169	76.865	5.004
1.021	21.000	403.8	525	1	82.169	76.640	5.004	81.444	76.588	4.331
1.022	31.345	396.8	525	1	81.444	76.588	4.331	81.055	76.509	4.021
1.023	19.280	401.7	525	1	81.055	76.509	4.021	80.704	76.461	3.718
1.024	7.372	179.8	375	1	80.704	76.461	3.868	80.130	76.420	3.335

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
6.000	S18	1200	Manhole	1	S19	1200	Manhole	1
6.001	S19	1200	Manhole	1	S20	1200	Manhole	1
4.004	S20	1200	Manhole	1	S21	1350	Manhole	1
4.005	S21	1350	Manhole	1	S22	1350	Manhole	1
4.006	S22	1350	Manhole	1	S23	1350	Manhole	1
1.011	S23	1350	Manhole	1	S24	1350	Manhole	1
1.012	S24	1350	Manhole	1	S25	1350	Manhole	1
1.013	S25	1350	Manhole	1	S26	1350	Manhole	1
1.014	S26	1350	Manhole	1	S27	1350	Manhole	1
1.015	S27	1350	Manhole	1	S28	1350	Manhole	1
1.016	S28	1350	Manhole	1	BASIN-02	1350	Manhole	1
1.017	BASIN-02	1350	Manhole	1	S29-FC	1350	Manhole	1
1.018	S29-FC	1350	Manhole	1	S30	1350	Manhole	1
1.019	S30	1350	Manhole	1	S31	1350	Manhole	1
1.020	S31	1350	Manhole	1	S36	1500	Manhole	1
7.000	S32	1200	Manhole	1	S33	1200	Manhole	1
7.001	S33	1200	Manhole	1	S34	1200	Manhole	1
7.002	S34	1200	Manhole	1	S36	1500	Manhole	1
8.000	S35	1350	Manhole	1	S36	1500	Manhole	1
9.000	TANK 01	1350	Manhole	1	S36	1500	Manhole	1
1.021	S36	1500	Manhole	1	S37	1500	Manhole	1
1.022	S37	1500	Manhole	1	S38	1500	Manhole	1
1.023	S38	1500	Manhole	1	S39-FC	1800	Manhole	1
1.024	S39-FC	1800	Manhole	1	Ex S3951	1350	Manhole	1

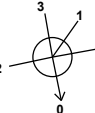
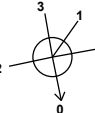
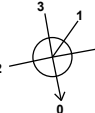
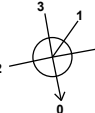
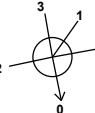
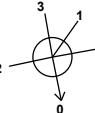
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S1	523165.209	234151.045	88.941	1.821	1200		0	1.000	87.120	375
S2	523196.724	234158.348	88.841	2.027	1200		0	2.000	86.814	375
S3	523187.020	234168.308	88.778	2.085	1350		1 2	2.000 1.000	86.768 86.768	375 375
S4	523166.921	234194.702	88.324	1.717	1350		0 1	1.001 1.001	86.693 86.607	450 450
S5	523184.471	234207.102	88.080	1.529	1350		0 1	1.002 1.002	86.607 86.551	450 450
BASIN-01	523185.552	234232.735	87.989	1.489	1350		0 1	1.003 1.003	86.551 86.500	450 450
S6-FC	523204.890	234228.980	88.000	1.530	1350		0 1	1.004 1.004	86.500 86.470	450 450
S7	523232.930	234206.208	87.600	1.280	1350		0 1	1.005 1.005	86.470 86.320	300 300
S8	523249.020	234192.930	87.610	1.365	1350		0 1	1.006 1.006	86.320 86.245	300 300
S9	523234.235	234161.180	88.525	1.650	1350		0	3.000	86.875	300
S10	523247.224	234180.279	88.059	1.868	1200		1 2	3.000 1.007	86.191 86.191	300 300
S11	523270.533	234166.130	87.595	1.595	1350		0 1	1.008 1.008	86.191 86.075	300 300
S12	523306.653	234140.724	86.072	2.097	1350		0 1	1.009 1.010	86.000 83.975	375 375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S13	523198.718	234100.741	88.758	1.808	1200		0	4.000	86.950	300
S14	523211.913	234110.339	88.830	1.989	1200		1	4.000	86.841	300
							0	4.001	86.841	300
S15	523216.833	234139.077	88.723	1.773	1350		0	5.000	86.950	300
S16	523228.331	234130.535	88.492	2.152	1200		1	5.000	86.340	300
							2	4.001	86.340	300
							0	4.002	86.340	300
S17	523258.683	234109.577	87.453	1.809	1200		1	4.002	85.644	300
							0	4.003	85.644	300
S18	523233.894	234051.272	87.161	1.791	1200		0	6.000	85.370	300
S19	523254.506	234068.187	86.814	1.794	1200		1	6.000	85.020	300
							0	6.001	85.020	300
S20	523278.198	234093.152	86.353	1.913	1200		1	6.001	84.440	300
							2	4.003	84.440	300
							0	4.004	84.440	300
S21	523286.679	234085.271	85.809	1.884	1350		1	4.004	84.000	300
							0	4.005	83.925	375
S22	523306.762	234103.174	85.693	2.053	1350		1	4.005	83.640	375
							0	4.006	83.640	375
S23	523323.404	234124.884	85.010	2.270	1350		1	4.006	82.815	375
							2	1.010	82.815	375
							0	1.011	82.740	450
S24	523335.480	234116.919	84.185	2.055	1350		1	1.011	82.130	450
							0	1.012	82.130	450
S25	523352.711	234100.878	82.676	2.146	1350		1	1.012	80.530	450
							0	1.013	80.530	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S26	523368.658	234089.412	81.373	2.133	1350		1	1.013	79.240	450
S27	523387.457	234082.512	80.047	2.172	1350		0	1.014	79.240	450
							0	1.015	77.875	525
S28	523391.397	234076.737	79.711	2.041	1350		1	1.015	77.670	525
BASIN-02	523402.451	234051.044	78.800	1.600	1350		0	1.016	77.670	525
							0	1.017	77.200	525
S29-FC	523394.821	234031.228	78.800	1.800	1350		1	1.017	77.000	525
S30	523385.643	234021.044	79.319	2.362	1350		0	1.018	77.000	450
							0	1.018	76.957	450
S31	523367.687	234020.074	79.823	2.922	1350		1	1.019	76.901	450
S32	523296.928	234070.524	85.018	1.883	1200		0	7.000	83.135	300
							0	7.001	82.024	300
S33	523302.864	234061.134	84.506	2.482	1200		1	7.000	82.024	300
S34	523309.723	234039.387	83.487	3.743	1200		0	7.001	79.744	300
							0	7.002	79.744	300
S35	523285.943	234004.353	83.473	3.721	1350		0	8.000	79.752	300
TANK 01	523327.078	234027.913	81.794	4.839	1350		0	9.000	76.955	300
S36	523314.740	234010.461	82.169	5.529	1500		1	9.000	76.865	300
							2	8.000	76.865	300
							3	7.002	76.865	300
							4	1.020	76.715	450
							0	1.021	76.640	525
										

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S37	523318.933	233989.884	81.444	4.856	1500		1	1.021	76.588	525
							0	1.022	76.588	525
S38	523327.676	233959.783	81.055	4.546	1500		1	1.022	76.509	525
							0	1.023	76.509	525
S39-FC	523335.724	233942.263	80.704	4.243	1800		1	1.023	76.461	525
							0	1.024	76.461	375
Ex S3951	523343.015	233941.174	80.130	3.710	1350		1	1.024	76.420	375

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	20.0		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
10	0	0	0
30	0	0	0
100	40	0	0

Node S6-FC Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	86.470	Product Number	CTL-SHE-0049-1200-1230-1200
Design Depth (m)	1.230	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.2	Min Node Diameter (mm)	1200

Node S39-FC Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	76.461	Product Number	CTL-SHE-0114-8000-2200-8000
Design Depth (m)	2.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	8.0	Min Node Diameter (mm)	1500

Node BASIN-02 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	77.200
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)
0.000	252.0	0.0	1.600	646.0	411.0

Node BASIN-01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	86.500
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)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	166.9	0.0	0.400	253.2	0.0	0.800	353.5	0.0	1.200	643.2	0.0
0.100	186.9	0.0	0.500	277.0	0.0	0.900	380.6	0.0	1.300	806.7	0.0
0.200	208.2	0.0	0.600	301.6	0.0	1.000	410.6	0.0	1.400	971.7	0.0
0.300	230.3	0.0	0.700	327.1	0.0	1.100	499.8	0.0	1.489	1120.0	0.0

Node TANK 01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	76.955
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	348.5	0.0	1.600	348.5	0.0	1.601	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	87.183	0.063	14.4	0.1476	0.0000	OK
720 minute winter	S2	705	86.912	0.098	1.5	0.2175	0.0000	OK
720 minute winter	S3	705	86.912	0.219	4.5	0.5450	0.0000	OK
720 minute winter	S4	705	86.912	0.305	6.0	0.8279	0.0000	OK
720 minute winter	S5	705	86.912	0.361	7.2	1.0365	0.0000	OK
720 minute winter	BASIN-01	705	86.912	0.412	6.8	87.2334	0.0000	OK
720 minute winter	S6-FC	705	86.912	0.442	1.1	0.6327	0.0000	SURCHARGED
120 minute summer	S7	74	86.345	0.025	0.9	0.0360	0.0000	OK
15 minute winter	S8	11	86.286	0.041	1.1	0.0588	0.0000	OK
15 minute winter	S9	10	86.916	0.041	7.8	0.0882	0.0000	OK
15 minute winter	S10	11	86.285	0.094	15.5	0.1670	0.0000	OK
15 minute winter	S11	11	86.057	0.057	22.0	0.1247	0.0000	OK
15 minute winter	S12	11	84.041	0.066	29.4	0.1332	0.0000	OK
15 minute winter	S13	10	87.011	0.061	7.8	0.1090	0.0000	OK
15 minute winter	S14	10	86.904	0.063	15.5	0.1097	0.0000	OK
15 minute winter	S15	10	86.988	0.038	7.8	0.0791	0.0000	OK
15 minute winter	S16	11	86.433	0.093	29.5	0.1482	0.0000	OK
15 minute winter	S17	11	85.721	0.077	35.4	0.1299	0.0000	OK
15 minute winter	S18	10	85.415	0.045	6.5	0.0768	0.0000	OK
15 minute winter	S19	11	85.080	0.060	12.9	0.1005	0.0000	OK
15 minute winter	S20	11	84.546	0.106	48.3	0.1195	0.0000	OK
15 minute winter	S21	11	84.067	0.142	55.9	0.2935	0.0000	OK
15 minute winter	S22	11	83.753	0.113	63.4	0.2276	0.0000	OK
15 minute winter	S23	11	82.870	0.130	99.9	0.2556	0.0000	OK
15 minute winter	S24	11	82.241	0.111	106.1	0.2130	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S3	14.2	1.014	0.063	0.5112	
720 minute winter	S2	2.000	S3	1.5	0.395	0.013	0.4304	
720 minute winter	S3	1.001	S4	4.5	0.389	0.028	3.1688	
720 minute winter	S4	1.002	S5	5.7	0.358	0.035	2.6947	
720 minute winter	S5	1.003	BASIN-01	6.8	0.484	0.048	3.7005	
720 minute winter	BASIN-01	1.004	S6-FC	1.1	0.082	0.009	3.0526	
720 minute winter	S6-FC	1.005	S7	0.9	0.342	0.013	0.0973	
120 minute summer	S7	1.006	S8	0.9	0.343	0.014	0.0564	
15 minute winter	S8	1.007	S10	-1.1	0.347	-0.015	0.1578	
15 minute winter	S9	3.000	S10	7.7	0.690	0.040	0.2832	
15 minute winter	S10	1.008	S11	14.6	0.795	0.203	0.5017	
15 minute winter	S11	1.009	S12	22.0	1.856	0.051	0.5229	
15 minute winter	S12	1.010	S23	29.3	2.284	0.065	0.2955	
15 minute winter	S13	4.000	S14	7.7	0.734	0.085	0.1710	
15 minute winter	S14	4.001	S16	15.3	1.051	0.099	0.3814	
15 minute winter	S15	5.000	S16	7.7	0.691	0.034	0.1688	
15 minute winter	S16	4.002	S17	29.2	1.783	0.191	0.6055	
15 minute winter	S17	4.003	S20	35.6	1.969	0.147	0.4650	
15 minute winter	S18	6.000	S19	6.4	0.777	0.050	0.2210	
15 minute winter	S19	6.001	S20	12.7	0.818	0.088	0.5515	
15 minute winter	S20	4.004	S21	48.5	2.340	0.223	0.2398	
15 minute winter	S21	4.005	S22	56.0	1.698	0.272	0.8889	
15 minute winter	S22	4.006	S23	63.3	2.355	0.182	0.7351	
15 minute winter	S23	1.011	S24	99.9	2.924	0.150	0.4949	
15 minute winter	S24	1.012	S25	106.0	3.373	0.125	0.7399	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S25	11	80.647	0.117	112.2	0.2211	0.0000	OK
15 minute winter	S26	11	79.363	0.123	118.2	0.2338	0.0000	OK
15 minute winter	S27	11	78.043	0.168	124.1	0.3170	0.0000	OK
15 minute winter	S28	11	77.858	0.188	130.2	0.3613	0.0000	OK
30 minute winter	BASIN-02	25	77.371	0.171	100.1	46.8054	0.0000	OK
30 minute winter	S29-FC	27	77.405	0.405	81.3	0.5789	0.0000	OK
30 minute winter	S30	27	77.403	0.446	77.2	0.6383	0.0000	OK
30 minute winter	S31	26	77.389	0.488	80.4	0.6977	0.0000	SURCHARGED
15 minute winter	S32	10	83.168	0.033	9.2	0.0622	0.0000	OK
15 minute winter	S33	10	82.070	0.046	18.3	0.0780	0.0000	OK
15 minute winter	S34	10	79.801	0.057	27.4	0.0865	0.0000	OK
15 minute winter	S35	10	79.786	0.034	9.2	0.0608	0.0000	OK
360 minute winter	TANK 01	344	77.353	0.398	28.4	132.4831	0.0000	SURCHARGED
30 minute winter	S36	23	77.428	0.788	87.6	1.5925	0.0000	SURCHARGED
30 minute winter	S37	23	77.441	0.853	30.6	1.7525	0.0000	SURCHARGED
30 minute winter	S38	23	77.460	0.951	23.4	1.9724	0.0000	SURCHARGED
30 minute winter	S39-FC	23	77.476	1.015	15.4	2.9184	0.0000	SURCHARGED
15 minute winter	Ex S3951	12	76.475	0.055	7.0	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)	Discharge Vol (m³)
15 minute winter	S25	1.013	S26	112.0	3.317	0.135	0.6637	
15 minute winter	S26	1.014	S27	117.9	3.555	0.143	0.6645	
15 minute winter	S27	1.015	S28	124.0	1.977	0.149	0.4499	
15 minute winter	S28	1.016	BASIN-02	131.0	3.016	0.208	1.3418	
30 minute winter	BASIN-02	1.017	S29-FC	81.3	0.994	0.173	2.5166	
30 minute winter	S29-FC	1.018	S30	77.2	0.840	0.428	2.1138	
30 minute winter	S30	1.019	S31	80.4	0.884	0.448	2.8472	
30 minute winter	S31	1.020	S36	81.4	0.514	0.430	8.5263	
15 minute winter	S32	7.000	S33	9.1	1.669	0.026	0.0613	
15 minute winter	S33	7.001	S34	18.2	2.251	0.051	0.1849	
15 minute winter	S34	7.002	S36	27.0	2.925	0.077	1.1106	
15 minute winter	S35	8.000	S36	9.1	2.126	0.026	1.0715	
360 minute winter	TANK 01	9.000	S36	-28.4	-0.657	-0.396	1.5051	
30 minute winter	S36	1.021	S37	24.2	0.540	0.101	4.5367	
30 minute winter	S37	1.022	S38	17.0	0.497	0.070	6.7715	
30 minute winter	S38	1.023	S39-FC	12.1	0.284	0.050	4.1651	
30 minute winter	S39-FC	1.024	Ex S3951	7.0	0.677	0.047	0.0767	109.4

Results for 10 year Critical Storm Duration. Lowest mass balance: 99.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	87.211	0.091	30.4	0.2138	0.0000	OK
720 minute winter	S2	705	87.150	0.336	2.5	0.7446	0.0000	OK
720 minute winter	S3	705	87.150	0.457	7.4	1.1366	0.0000	SURCHARGED
720 minute winter	S4	705	87.150	0.543	9.3	1.4732	0.0000	SURCHARGED
720 minute winter	S5	705	87.150	0.599	11.2	1.7192	0.0000	SURCHARGED
720 minute winter	BASIN-01	705	87.150	0.650	10.7	155.3202	0.0000	SURCHARGED
720 minute winter	S6-FC	705	87.150	0.680	1.1	0.9731	0.0000	SURCHARGED
240 minute winter	S7	104	86.345	0.025	0.9	0.0360	0.0000	OK
15 minute winter	S8	11	86.337	0.092	2.2	0.1309	0.0000	OK
15 minute winter	S9	10	86.934	0.059	16.6	0.1273	0.0000	OK
15 minute winter	S10	11	86.335	0.144	33.0	0.2548	0.0000	OK
15 minute winter	S11	11	86.083	0.083	46.8	0.1807	0.0000	OK
15 minute winter	S12	11	84.068	0.093	62.5	0.1873	0.0000	OK
15 minute winter	S13	10	87.041	0.091	16.6	0.1630	0.0000	OK
15 minute winter	S14	10	86.934	0.093	32.9	0.1609	0.0000	OK
15 minute winter	S15	10	87.004	0.054	16.6	0.1139	0.0000	OK
15 minute winter	S16	10	86.482	0.142	62.8	0.2262	0.0000	OK
15 minute winter	S17	11	85.758	0.114	75.5	0.1915	0.0000	OK
15 minute winter	S18	10	85.436	0.066	13.8	0.1110	0.0000	OK
15 minute winter	S19	10	85.107	0.087	27.4	0.1468	0.0000	OK
15 minute winter	S20	11	84.608	0.168	101.8	0.1898	0.0000	OK
15 minute winter	S21	11	84.146	0.221	118.3	0.4575	0.0000	OK
15 minute winter	S22	11	83.814	0.174	134.7	0.3510	0.0000	OK
15 minute winter	S23	11	82.944	0.204	213.5	0.4001	0.0000	OK
15 minute winter	S24	11	82.299	0.169	226.7	0.3235	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S3	30.0	1.025	0.133	1.1129	
720 minute winter	S2	2.000	S3	2.4	0.428	0.021	1.4912	
720 minute winter	S3	1.001	S4	6.8	0.399	0.041	5.2564	
720 minute winter	S4	1.002	S5	8.7	0.350	0.053	3.4048	
720 minute winter	S5	1.003	BASIN-01	10.7	0.537	0.075	4.0650	
720 minute winter	BASIN-01	1.004	S6-FC	1.1	0.093	0.009	3.1212	
720 minute winter	S6-FC	1.005	S7	0.9	0.342	0.013	0.0973	
240 minute winter	S7	1.006	S8	0.9	0.343	0.014	0.0560	
15 minute winter	S8	1.007	S10	2.5	0.349	0.035	0.3290	
15 minute winter	S9	3.000	S10	16.4	0.826	0.086	0.4944	
15 minute winter	S10	1.008	S11	31.2	0.972	0.432	0.8754	
15 minute winter	S11	1.009	S12	46.9	2.383	0.109	0.8697	
15 minute winter	S12	1.010	S23	62.7	2.435	0.139	0.6339	
15 minute winter	S13	4.000	S14	16.4	0.897	0.181	0.2977	
15 minute winter	S14	4.001	S16	32.6	1.278	0.211	0.6668	
15 minute winter	S15	5.000	S16	16.5	0.828	0.072	0.2961	
15 minute winter	S16	4.002	S17	61.7	2.171	0.403	1.0530	
15 minute winter	S17	4.003	S20	75.2	2.328	0.310	0.8291	
15 minute winter	S18	6.000	S19	13.6	0.966	0.107	0.3775	
15 minute winter	S19	6.001	S20	26.9	0.959	0.186	0.9862	
15 minute winter	S20	4.004	S21	102.7	2.751	0.472	0.4320	
15 minute winter	S21	4.005	S22	119.0	2.022	0.578	1.5831	
15 minute winter	S22	4.006	S23	135.1	2.851	0.388	1.2969	
15 minute winter	S23	1.011	S24	213.7	3.447	0.321	0.8976	
15 minute winter	S24	1.012	S25	226.9	4.001	0.268	1.3352	

Results for 10 year Critical Storm Duration. Lowest mass balance: 99.71%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S25	11	80.710	0.180	239.9	0.3417	0.0000	OK
15 minute winter	S26	11	79.425	0.185	253.0	0.3518	0.0000	OK
15 minute winter	S27	11	78.151	0.276	266.1	0.5219	0.0000	OK
15 minute winter	S28	11	77.950	0.280	279.3	0.5372	0.0000	OK
360 minute winter	BASIN-02	360	77.680	0.480	42.9	150.0150	0.0000	OK
360 minute winter	S29-FC	360	77.680	0.680	37.1	0.9730	0.0000	SURCHARGED
360 minute winter	S30	360	77.680	0.723	35.4	1.0345	0.0000	SURCHARGED
360 minute winter	S31	360	77.680	0.779	34.1	1.1146	0.0000	SURCHARGED
15 minute winter	S32	10	83.182	0.047	19.3	0.0885	0.0000	OK
15 minute winter	S33	10	82.090	0.066	38.5	0.1123	0.0000	OK
15 minute winter	S34	10	79.825	0.081	57.6	0.1226	0.0000	OK
15 minute winter	S35	10	79.799	0.047	19.3	0.0857	0.0000	OK
360 minute winter	TANK 01	360	77.680	0.725	44.0	241.0032	0.0000	SURCHARGED
15 minute winter	S36	12	77.695	1.055	124.2	2.1314	0.0000	SURCHARGED
360 minute winter	S37	360	77.680	1.092	9.9	2.2434	0.0000	SURCHARGED
15 minute summer	S38	12	77.712	1.203	40.2	2.4954	0.0000	SURCHARGED
15 minute summer	S39-FC	12	77.740	1.279	30.5	3.6778	0.0000	SURCHARGED
120 minute winter	Ex S3951	40	76.475	0.055	7.0	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)	Discharge Vol (m³)
15 minute winter	S25	1.013	S26	240.0	3.978	0.289	1.1852	
15 minute winter	S26	1.014	S27	253.1	3.962	0.307	1.3004	
15 minute winter	S27	1.015	S28	266.3	2.345	0.320	0.8103	
15 minute winter	S28	1.016	BASIN-02	280.6	3.330	0.446	3.2149	
360 minute winter	BASIN-02	1.017	S29-FC	37.1	0.715	0.079	4.4916	
360 minute winter	S29-FC	1.018	S30	35.4	0.609	0.197	2.1721	
360 minute winter	S30	1.019	S31	34.1	0.612	0.190	2.8491	
360 minute winter	S31	1.020	S36	32.4	0.582	0.171	8.5263	
15 minute winter	S32	7.000	S33	19.2	2.080	0.054	0.1033	
15 minute winter	S33	7.001	S34	38.3	2.848	0.108	0.3075	
15 minute winter	S34	7.002	S36	57.2	3.297	0.164	1.2604	
15 minute winter	S35	8.000	S36	19.2	2.426	0.055	1.1413	
360 minute winter	TANK 01	9.000	S36	-44.0	-0.631	-0.614	1.5051	
15 minute winter	S36	1.021	S37	-52.4	0.699	-0.219	4.5367	
360 minute winter	S37	1.022	S38	8.2	0.316	0.034	6.7715	
15 minute summer	S38	1.023	S39-FC	-20.6	0.331	-0.086	4.1651	
15 minute summer	S39-FC	1.024	Ex S3951	7.0	0.676	0.047	0.0767	102.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	S1	720	87.283	0.163	3.1	0.3819	0.0000	OK
720 minute winter	S2	720	87.283	0.469	3.1	1.0399	0.0000	SURCHARGED
720 minute winter	S3	720	87.283	0.590	9.1	1.4680	0.0000	SURCHARGED
720 minute winter	S4	720	87.283	0.676	11.4	1.8348	0.0000	SURCHARGED
720 minute winter	S5	720	87.283	0.732	13.9	2.1017	0.0000	SURCHARGED
720 minute winter	BASIN-01	720	87.283	0.783	13.5	199.7157	0.0000	SURCHARGED
720 minute winter	S6-FC	720	87.283	0.813	1.1	1.1639	0.0000	SURCHARGED
15 minute winter	S7	11	86.367	0.047	2.7	0.0672	0.0000	OK
15 minute winter	S8	11	86.361	0.116	2.7	0.1662	0.0000	OK
15 minute winter	S9	10	86.943	0.068	21.8	0.1458	0.0000	OK
15 minute winter	S10	11	86.359	0.168	43.4	0.2976	0.0000	OK
15 minute winter	S11	11	86.095	0.095	60.7	0.2064	0.0000	OK
15 minute winter	S12	11	84.082	0.107	81.3	0.2140	0.0000	OK
15 minute winter	S13	10	87.056	0.106	21.8	0.1898	0.0000	OK
15 minute winter	S14	10	86.948	0.107	43.3	0.1857	0.0000	OK
15 minute winter	S15	10	87.012	0.062	21.8	0.1302	0.0000	OK
15 minute winter	S16	10	86.508	0.168	82.6	0.2677	0.0000	OK
15 minute winter	S17	11	85.776	0.132	99.3	0.2224	0.0000	OK
15 minute winter	S18	10	85.445	0.075	18.1	0.1273	0.0000	OK
15 minute winter	S19	10	85.120	0.100	36.0	0.1693	0.0000	OK
15 minute winter	S20	11	84.642	0.202	133.8	0.2289	0.0000	OK
15 minute winter	S21	11	84.192	0.267	155.4	0.5515	0.0000	OK
15 minute winter	S22	11	83.847	0.207	176.9	0.4171	0.0000	OK
15 minute winter	S23	11	82.983	0.243	279.6	0.4764	0.0000	OK
15 minute winter	S24	11	82.328	0.198	297.0	0.3795	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	S1	1.000	S3	3.1	0.664	0.014	2.1742	
720 minute winter	S2	2.000	S3	2.9	0.434	0.025	1.5338	
720 minute winter	S3	1.001	S4	8.3	0.378	0.051	5.2564	
720 minute winter	S4	1.002	S5	10.8	0.336	0.066	3.4048	
720 minute winter	S5	1.003	BASIN-01	13.5	0.566	0.094	4.0650	
720 minute winter	BASIN-01	1.004	S6-FC	1.1	0.110	0.009	3.1212	
720 minute winter	S6-FC	1.005	S7	1.0	0.350	0.014	0.1021	
15 minute winter	S7	1.006	S8	2.4	0.336	0.037	0.3358	
15 minute winter	S8	1.007	S10	3.8	0.345	0.053	0.4198	
15 minute winter	S9	3.000	S10	21.6	0.874	0.113	0.6008	
15 minute winter	S10	1.008	S11	40.2	1.041	0.557	1.0518	
15 minute winter	S11	1.009	S12	60.8	2.560	0.141	1.0496	
15 minute winter	S12	1.010	S23	81.6	2.429	0.181	0.8485	
15 minute winter	S13	4.000	S14	21.5	0.962	0.237	0.3649	
15 minute winter	S14	4.001	S16	42.8	1.363	0.277	0.8206	
15 minute winter	S15	5.000	S16	21.7	0.878	0.094	0.3648	
15 minute winter	S16	4.002	S17	81.2	2.318	0.531	1.2967	
15 minute winter	S17	4.003	S20	98.8	2.463	0.407	1.0258	
15 minute winter	S18	6.000	S19	17.9	1.043	0.140	0.4595	
15 minute winter	S19	6.001	S20	35.4	1.008	0.245	1.2211	
15 minute winter	S20	4.004	S21	134.9	2.774	0.620	0.5678	
15 minute winter	S21	4.005	S22	156.4	2.133	0.759	1.9658	
15 minute winter	S22	4.006	S23	177.5	3.032	0.509	1.6018	
15 minute winter	S23	1.011	S24	279.9	3.626	0.420	1.1169	
15 minute winter	S24	1.012	S25	297.3	4.217	0.351	1.6600	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S25	11	80.743	0.213	314.4	0.4044	0.0000	OK
15 minute winter	S26	11	79.456	0.216	331.8	0.4108	0.0000	OK
15 minute winter	S27	11	78.209	0.334	349.1	0.6324	0.0000	OK
15 minute winter	S28	10	77.997	0.327	366.5	0.6286	0.0000	OK
360 minute winter	BASIN-02	360	77.853	0.653	53.1	217.9996	0.0000	SURCHARGED
360 minute winter	S29-FC	360	77.853	0.853	36.8	1.2206	0.0000	SURCHARGED
360 minute winter	S30	360	77.853	0.896	35.4	1.2820	0.0000	SURCHARGED
360 minute winter	S31	360	77.853	0.952	34.2	1.3620	0.0000	SURCHARGED
15 minute winter	S32	10	83.189	0.054	25.4	0.1013	0.0000	OK
15 minute winter	S33	10	82.100	0.076	50.7	0.1289	0.0000	OK
15 minute winter	S34	10	79.838	0.094	75.8	0.1413	0.0000	OK
15 minute winter	S35	10	79.806	0.054	25.4	0.0980	0.0000	OK
360 minute winter	TANK 01	360	77.853	0.898	44.6	298.5697	0.0000	SURCHARGED
15 minute winter	S36	11	77.863	1.223	204.1	2.4711	0.0000	SURCHARGED
15 minute winter	S37	11	77.857	1.269	82.4	2.6072	0.0000	SURCHARGED
360 minute winter	S38	360	77.853	1.344	9.1	2.7882	0.0000	SURCHARGED
15 minute summer	S39-FC	11	77.860	1.399	27.1	4.0231	0.0000	SURCHARGED
30 minute winter	Ex S3951	13	76.475	0.055	7.0	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)	Discharge Vol (m³)
15 minute winter	S25	1.013	S26	314.7	4.218	0.378	1.4655	
15 minute winter	S26	1.014	S27	331.9	3.984	0.403	1.7003	
15 minute winter	S27	1.015	S28	349.4	2.444	0.420	0.9998	
15 minute winter	S28	1.016	BASIN-02	367.9	3.443	0.585	4.3174	
360 minute winter	BASIN-02	1.017	S29-FC	36.8	0.718	0.078	4.5872	
360 minute winter	S29-FC	1.018	S30	35.4	0.603	0.196	2.1721	
360 minute winter	S30	1.019	S31	34.2	0.621	0.190	2.8491	
360 minute winter	S31	1.020	S36	32.3	0.592	0.171	8.5263	
15 minute winter	S32	7.000	S33	25.3	2.253	0.072	0.1256	
15 minute winter	S33	7.001	S34	50.4	3.080	0.143	0.3743	
15 minute winter	S34	7.002	S36	75.4	3.250	0.215	1.3098	
15 minute winter	S35	8.000	S36	25.2	2.393	0.072	1.1638	
360 minute winter	TANK 01	9.000	S36	-44.6	-0.637	-0.621	1.5051	
15 minute winter	S36	1.021	S37	-83.6	0.724	-0.349	4.5367	
15 minute winter	S37	1.022	S38	-58.4	0.635	-0.241	6.7715	
360 minute winter	S38	1.023	S39-FC	7.2	0.211	0.030	4.1651	
15 minute summer	S39-FC	1.024	Ex S3951	7.0	0.675	0.047	0.0764	99.6

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.35%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	S1	945	87.697	0.577	4.1	1.3500	0.0000	SURCHARGED
960 minute winter	S2	945	87.697	0.883	4.1	1.9572	0.0000	SURCHARGED
960 minute winter	S3	945	87.697	1.004	11.8	2.4974	0.0000	SURCHARGED
960 minute winter	S4	945	87.697	1.090	15.7	2.9577	0.0000	SURCHARGED
960 minute winter	S5	945	87.697	1.146	19.6	3.2896	0.0000	SURCHARGED
960 minute winter	BASIN-01	945	87.697	1.197	19.5	383.3181	0.0000	FLOOD RISK
960 minute winter	S6-FC	945	87.697	1.227	1.2	1.7562	0.0000	SURCHARGED
15 minute winter	S7	11	86.450	0.130	6.9	0.1855	0.0000	OK
15 minute winter	S8	11	86.445	0.200	9.1	0.2867	0.0000	OK
15 minute winter	S9	10	86.965	0.090	38.6	0.1948	0.0000	OK
15 minute winter	S10	11	86.444	0.253	76.9	0.4485	0.0000	OK
15 minute winter	S11	11	86.128	0.128	106.7	0.2787	0.0000	OK
15 minute winter	S12	11	84.118	0.143	142.9	0.2870	0.0000	OK
15 minute winter	S13	10	87.099	0.149	38.6	0.2683	0.0000	OK
15 minute winter	S14	10	86.994	0.153	76.7	0.2661	0.0000	OK
15 minute winter	S15	10	87.032	0.082	38.6	0.1735	0.0000	OK
15 minute winter	S16	10	86.598	0.258	146.5	0.4116	0.0000	OK
15 minute winter	S17	11	85.902	0.258	176.4	0.4352	0.0000	OK
15 minute winter	S18	10	85.473	0.103	32.2	0.1739	0.0000	OK
15 minute winter	S19	12	85.358	0.338	64.2	0.5712	0.0000	SURCHARGED
15 minute winter	S20	12	85.247	0.807	221.3	0.9125	0.0000	SURCHARGED
15 minute winter	S21	12	84.525	0.600	252.8	1.2409	0.0000	SURCHARGED
15 minute winter	S22	11	83.936	0.296	288.3	0.5965	0.0000	OK
15 minute winter	S23	11	83.098	0.358	467.3	0.7018	0.0000	OK
15 minute winter	S24	11	82.408	0.278	497.5	0.5333	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	S1	1.000	S3	3.9	0.616	0.017	3.0680	
960 minute winter	S2	2.000	S3	4.0	0.412	0.035	1.5338	
960 minute winter	S3	1.001	S4	11.6	0.345	0.071	5.2564	
960 minute winter	S4	1.002	S5	15.5	0.351	0.095	3.4048	
960 minute winter	S5	1.003	BASIN-01	19.5	0.605	0.136	4.0650	
960 minute winter	BASIN-01	1.004	S6-FC	1.2	0.116	0.010	3.1212	
960 minute winter	S6-FC	1.005	S7	1.2	0.370	0.017	0.1163	
15 minute winter	S7	1.006	S8	-6.1	0.337	-0.092	0.8254	
15 minute winter	S8	1.007	S10	9.2	0.343	0.128	0.7243	
15 minute winter	S9	3.000	S10	38.3	1.009	0.200	0.9313	
15 minute winter	S10	1.008	S11	70.2	1.221	0.973	1.5700	
15 minute winter	S11	1.009	S12	106.4	2.971	0.247	1.5825	
15 minute winter	S12	1.010	S23	142.8	2.481	0.317	1.4743	
15 minute winter	S13	4.000	S14	38.2	1.073	0.421	0.5818	
15 minute winter	S14	4.001	S16	75.9	1.485	0.491	1.3104	
15 minute winter	S15	5.000	S16	38.4	0.959	0.167	0.5737	
15 minute winter	S16	4.002	S17	144.6	2.481	0.945	2.3596	
15 minute winter	S17	4.003	S20	174.9	2.546	0.721	1.7212	
15 minute winter	S18	6.000	S19	32.0	1.185	0.251	1.1800	
15 minute winter	S19	6.001	S20	66.6	1.085	0.461	2.4236	
15 minute winter	S20	4.004	S21	220.2	3.128	1.013	0.8152	
15 minute winter	S21	4.005	S22	252.9	2.350	1.228	2.7387	
15 minute winter	S22	4.006	S23	288.0	3.281	0.826	2.4967	
15 minute winter	S23	1.011	S24	467.2	3.906	0.701	1.7219	
15 minute winter	S24	1.012	S25	497.4	4.622	0.588	2.5418	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.35%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S25	11	80.832	0.302	527.8	0.5730	0.0000	OK
15 minute winter	S26	12	79.585	0.345	558.8	0.6549	0.0000	OK
15 minute winter	S27	12	78.698	0.823	584.3	1.5572	0.0000	SURCHARGED
480 minute winter	S28	480	78.457	0.787	102.9	1.5122	0.0000	SURCHARGED
480 minute winter	BASIN-02	480	78.457	1.257	71.3	513.2361	0.0000	SURCHARGED
480 minute winter	S29-FC	480	78.457	1.457	28.4	2.0852	0.0000	SURCHARGED
480 minute winter	S30	480	78.458	1.501	27.3	2.1473	0.0000	SURCHARGED
480 minute winter	S31	480	78.457	1.556	26.3	2.2265	0.0000	SURCHARGED
15 minute winter	S32	10	83.207	0.072	45.1	0.1354	0.0000	OK
15 minute winter	S33	10	82.126	0.102	90.0	0.1732	0.0000	OK
15 minute winter	S34	10	79.882	0.138	134.7	0.2078	0.0000	OK
15 minute winter	S35	10	79.824	0.072	45.1	0.1303	0.0000	OK
480 minute winter	TANK 01	480	78.457	1.502	45.6	499.4167	0.0000	SURCHARGED
15 minute winter	S36	11	78.476	1.836	337.4	3.7077	0.0000	SURCHARGED
15 minute winter	S37	11	78.499	1.911	122.5	3.9262	0.0000	SURCHARGED
15 minute winter	S38	11	78.529	2.020	78.9	4.1923	0.0000	SURCHARGED
15 minute winter	S39-FC	11	78.545	2.084	54.6	5.9918	0.0000	SURCHARGED
15 minute winter	Ex S3951	11	76.477	0.057	7.7	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)	Discharge Vol (m³)
15 minute winter	S25	1.013	S26	528.5	4.498	0.635	2.3883	
15 minute winter	S26	1.014	S27	553.9	3.788	0.672	2.8910	
15 minute winter	S27	1.015	S28	577.9	2.675	0.694	1.5103	
480 minute winter	S28	1.016	BASIN-02	71.3	1.551	0.113	6.0424	
480 minute winter	BASIN-02	1.017	S29-FC	28.4	0.722	0.060	4.5872	
480 minute winter	S29-FC	1.018	S30	27.3	0.631	0.151	2.1721	
480 minute winter	S30	1.019	S31	26.3	0.652	0.147	2.8491	
480 minute winter	S31	1.020	S36	24.8	0.605	0.131	8.5263	
15 minute winter	S32	7.000	S33	44.9	2.644	0.127	0.1900	
15 minute winter	S33	7.001	S34	89.6	3.509	0.254	0.6020	
15 minute winter	S34	7.002	S36	133.4	3.441	0.381	1.4981	
15 minute winter	S35	8.000	S36	44.9	2.544	0.128	1.2276	
480 minute winter	TANK 01	9.000	S36	-45.6	-0.647	-0.634	1.5051	
15 minute winter	S36	1.021	S37	-126.9	0.757	-0.529	4.5367	
15 minute winter	S37	1.022	S38	-82.8	0.680	-0.342	6.7715	
15 minute winter	S38	1.023	S39-FC	-38.9	0.323	-0.162	4.1651	
15 minute winter	S39-FC	1.024	Ex S3951	7.7	0.693	0.052	0.0819	90.0

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	1	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		

1 Link Type

Template	Freeform Carrier	Auto Increment (mm)	75
Shape	Circular	Follow Ground	x
Barrels	1		

Available Diameters (mm)

100

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
S1	0.110	5.00	88.941	1200	523165.209	234151.045	1.821	87.120
S2	0.110	5.00	88.841	1200	523196.724	234158.348	2.027	86.814
S3	0.110	5.00	88.778	1350	523187.020	234168.308	2.085	86.693
S4	0.110	5.00	88.324	1350	523166.921	234194.702	1.717	86.607
S5	0.110	5.00	88.080	1350	523184.471	234207.102	1.529	86.551
BASIN-01			87.989	1350	523185.552	234232.735	1.489	86.500
S6-FC			88.000	1350	523204.890	234228.980	1.530	86.470
S7			87.600	1350	523232.930	234206.208	1.280	86.320
S8			87.610	1350	523249.020	234192.930	1.365	86.245
S9	0.060	5.00	88.525	1350	523234.235	234161.180	1.650	86.875
S10	0.060	5.00	88.059	1200	523247.224	234180.279	1.868	86.191
S11	0.060	5.00	87.595	1350	523270.533	234166.130	1.595	86.000
S12	0.060	5.00	86.072	1350	523306.653	234140.724	2.097	83.975
S13	0.060	5.00	88.758	1200	523198.718	234100.741	1.808	86.950
S14	0.060	5.00	88.830	1200	523211.913	234110.339	1.989	86.841
S15	0.060	5.00	88.723	1350	523216.833	234139.077	1.773	86.950
S16	0.050	5.00	88.492	1200	523228.331	234130.535	2.152	86.340
S17	0.050	5.00	87.453	1200	523258.683	234109.577	1.809	85.644
S18	0.050	5.00	87.161	1200	523233.894	234051.272	1.791	85.370
S19	0.050	5.00	86.814	1200	523254.506	234068.187	1.794	85.020
S20			86.353	1200	523278.198	234093.152	1.913	84.440
S21	0.060	5.00	85.809	1350	523286.679	234085.271	1.884	83.925
S22	0.060	5.00	85.693	1350	523306.762	234103.174	2.053	83.640
S23	0.060	5.00	85.010	1350	523323.404	234124.884	2.270	82.740
S24	0.050	5.00	84.185	1350	523335.480	234116.919	2.055	82.130
S25	0.050	5.00	82.676	1350	523352.711	234100.878	2.146	80.530
S26	0.050	5.00	81.373	1350	523368.658	234089.412	2.133	79.240
S27	0.050	5.00	80.047	1350	523387.457	234082.512	2.172	77.875
S28	0.050	5.00	79.711	1350	523391.397	234076.737	2.041	77.670
BASIN-02			78.800	1350	523402.451	234051.044	1.600	77.200
S29-FC			78.800	1350	523394.821	234031.228	1.800	77.000
S30			79.319	1350	523385.643	234021.044	2.362	76.957
S31			79.823	1350	523367.687	234020.074	2.922	76.901

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
S32	0.070	5.00	85.018	1200	523296.928	234070.524	1.883	83.135
S33	0.070	5.00	84.506	1200	523302.864	234061.134	2.482	82.024
S34	0.070	5.00	83.487	1200	523309.723	234039.387	3.743	79.744
S35	0.070	5.00	83.473	1350	523285.943	234004.353	3.721	79.752
TANK 01		5.00	81.794	1350	523327.078	234027.913	4.839	76.955
S36	0.070	5.00	82.169	1500	523314.740	234010.461	5.529	76.640
S37	0.070	5.00	81.444	1500	523318.933	233989.884	4.856	76.588
S38	0.070	5.00	81.055	1500	523327.676	233959.783	4.546	76.509
S39-FC	0.070	5.00	80.704	1800	523335.724	233942.263	4.243	76.461
Ex S3951			80.130	1350	523343.015	233941.174	3.710	76.420

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S3	27.816	0.600	87.120	86.768	0.352	79.0	375	5.23	30.6
2.000	S2	S3	13.906	0.600	86.814	86.768	0.046	302.3	375	5.22	30.6
1.001	S3	S4	33.175	0.600	86.693	86.607	0.086	385.8	450	5.76	29.3
1.002	S4	S5	21.489	0.600	86.607	86.551	0.056	383.7	450	6.11	28.4
1.003	S5	BASIN-01	25.656	0.600	86.551	86.500	0.051	500.0	450	6.59	27.4
1.004	BASIN-01	S6-FC	19.699	0.600	86.500	86.470	0.030	656.6	450	7.00	26.5
1.005	S6-FC	S7	36.122	0.600	86.470	86.320	0.150	240.8	300	7.60	25.5
1.006	S7	S8	20.861	0.600	86.320	86.245	0.075	278.1	300	7.97	24.8
1.007	S8	S10	12.778	0.600	86.245	86.191	0.054	236.6	300	8.18	24.5
3.000	S9	S10	23.098	0.600	86.875	86.191	0.684	33.8	300	5.14	30.8
1.008	S10	S11	27.267	0.600	86.191	86.075	0.116	235.1	300	8.63	23.8
1.009	S11	S12	44.160	0.600	86.000	83.975	2.025	21.8	375	8.81	23.5
1.010	S12	S23	23.055	0.600	83.975	82.815	1.160	19.9	375	8.91	23.3
4.000	S13	S14	16.317	0.600	86.950	86.841	0.109	149.7	300	5.21	30.7
4.001	S14	S16	26.027	0.600	86.841	86.340	0.501	52.0	300	5.41	30.2
5.000	S15	S16	14.324	0.600	86.950	86.340	0.610	23.5	300	5.07	31.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.039	225.3	12.2	1.446	1.635	0.110	0.0	62	1.017
2.000	1.037	114.5	12.2	1.652	1.635	0.110	0.0	77	0.750
1.001	1.029	163.6	34.9	1.635	1.267	0.330	0.0	119	1.176
1.002	1.032	164.1	45.2	1.267	1.079	0.440	0.0	162	1.001
1.003	0.902	143.5	54.5	1.079	1.039	0.550	0.0	215	0.835
1.004	0.786	125.0	52.7	1.039	1.080	0.550	0.0	228	0.751
1.005	1.009	71.3	50.6	1.230	0.980	0.550	0.0	187	1.092
1.006	0.938	66.3	49.3	0.980	1.065	0.550	0.0	194	1.025
1.007	1.018	71.9	48.6	1.065	1.568	0.550	0.0	181	1.091
3.000	2.714	191.9	6.7	1.350	1.568	0.060	0.0	38	1.285
1.008	1.021	72.2	57.6	1.568	1.220	0.670	0.0	204	1.130
1.009	3.894	430.1	62.0	1.220	1.722	0.730	0.0	96	2.803
1.010	4.080	450.6	66.7	1.722	1.820	0.790	0.0	97	2.961
4.000	1.282	90.7	6.6	1.508	1.689	0.060	0.0	55	0.758
4.001	2.186	154.5	13.1	1.689	1.852	0.120	0.0	58	1.344
5.000	3.258	230.3	6.7	1.473	1.852	0.060	0.0	35	1.468

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.002	S16	S17	36.885	0.600	86.340	85.644	0.696	53.0	300	5.69	29.4
4.003	S17	S20	25.507	0.600	85.644	84.440	1.204	21.2	300	5.82	29.1
6.000	S18	S19	26.664	0.600	85.370	85.020	0.350	76.2	300	5.25	30.6
6.001	S19	S20	34.417	0.600	85.020	84.440	0.580	59.3	300	5.53	29.9
4.004	S20	S21	11.577	0.600	84.440	84.000	0.440	26.3	300	5.88	29.0
4.005	S21	S22	26.904	0.600	83.925	83.640	0.285	94.4	375	6.12	28.4
4.006	S22	S23	27.355	0.600	83.640	82.815	0.825	33.2	375	6.27	28.1
1.011	S23	S24	14.466	0.600	82.740	82.130	0.610	23.7	450	8.97	23.3
1.012	S24	S25	23.542	0.600	82.130	80.530	1.600	14.7	450	9.04	23.2
1.013	S25	S26	19.641	0.600	80.530	79.240	1.290	15.2	450	9.10	23.1
1.014	S26	S27	20.025	0.600	79.240	77.950	1.290	15.5	450	9.17	23.0
1.015	S27	S28	6.991	0.600	77.875	77.670	0.205	34.1	525	9.20	22.9
1.016	S28	BASIN-02	27.970	0.600	77.670	77.200	0.470	59.5	525	9.36	22.7
1.017	BASIN-02	S29-FC	21.234	0.600	77.200	77.000	0.200	106.2	525	9.52	22.5
1.018	S29-FC	S30	13.709	0.600	77.000	76.957	0.043	318.8	450	9.72	22.2
1.019	S30	S31	17.982	0.600	76.957	76.901	0.056	321.1	450	9.99	21.9
1.020	S31	S36	53.813	0.600	76.901	76.715	0.186	289.3	450	10.74	21.0
7.000	S32	S33	11.109	0.600	83.135	82.024	1.111	10.0	300	5.04	31.1
7.001	S33	S34	22.803	0.600	82.024	79.744	2.280	10.0	300	5.11	30.9
7.002	S34	S36	29.358	0.600	79.744	76.865	2.879	10.2	300	5.21	30.7
8.000	S35	S36	29.438	0.600	79.752	76.865	2.887	10.2	300	5.10	30.9
9.000	TANK 01	S36	21.373	0.600	76.955	76.865	0.090	237.5	300	5.35	30.3
1.021	S36	S37	21.000	0.600	76.640	76.588	0.052	403.8	525	11.06	20.7
1.022	S37	S38	31.345	0.600	76.588	76.509	0.079	396.8	525	11.53	20.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.002	2.164	153.0	24.5	1.852	1.509	0.230	0.0	82	1.617
4.003	3.430	242.5	29.5	1.509	1.613	0.280	0.0	72	2.389
6.000	1.803	127.4	5.5	1.491	1.494	0.050	0.0	46	0.961
6.001	2.044	144.5	10.8	1.494	1.613	0.100	0.0	58	1.249
4.004	3.077	217.5	39.8	1.613	1.509	0.380	0.0	90	2.412
4.005	1.865	206.0	45.2	1.509	1.678	0.440	0.0	121	1.522
4.006	3.156	348.5	50.8	1.678	1.820	0.500	0.0	97	2.289
1.011	4.188	666.1	113.5	1.820	1.605	1.350	0.0	124	3.154
1.012	5.320	846.1	117.1	1.605	1.696	1.400	0.0	112	3.788
1.013	5.230	831.8	120.9	1.696	1.683	1.450	0.0	115	3.771
1.014	5.179	823.7	124.6	1.683	1.647	1.500	0.0	117	3.781
1.015	3.844	832.2	128.5	1.647	1.516	1.550	0.0	135	3.209
1.016	2.907	629.3	131.4	1.516	1.075	1.600	0.0	162	2.320
1.017	2.173	470.4	130.2	1.075	1.275	1.600	0.0	188	1.870
1.018	1.133	180.2	128.6	1.350	1.912	1.600	0.0	321	1.191
1.019	1.129	179.5	126.6	1.912	2.472	1.600	0.0	317	1.186
1.020	1.190	189.2	121.5	2.472	5.004	1.600	0.0	303	1.183
7.000	4.999	353.4	7.9	1.583	2.182	0.070	0.0	31	2.086
7.001	4.999	353.3	15.6	2.182	3.443	0.140	0.0	42	2.549
7.002	4.950	349.9	23.3	3.443	5.004	0.210	0.0	52	2.874
8.000	4.950	349.9	7.8	3.421	5.004	0.070	0.0	31	2.086
9.000	1.016	71.8	0.0	4.539	5.004	0.000	0.0	0	0.000
1.021	1.108	239.9	145.5	5.004	4.331	1.950	0.0	285	1.301
1.022	1.118	242.0	147.3	4.331	4.021	2.020	0.0	340	1.136

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.023	S38	S39-FC	19.280	0.600	76.509	76.461	0.048	401.7	525	11.81	19.9
1.024	S39-FC	Ex S3951	7.372	0.600	76.461	76.420	0.041	179.8	375	11.91	19.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.023	1.111	240.5	150.1	4.021	3.718	2.090	0.0	345	1.138
1.024	1.348	148.9	154.4	3.868	3.335	2.160	0.0	261	1.599

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	27.816	79.0	375	1	88.941	87.120	1.446	88.778	86.768	1.635
2.000	13.906	302.3	375	1	88.841	86.814	1.652	88.778	86.768	1.635
1.001	33.175	385.8	450	1	88.778	86.693	1.635	88.324	86.607	1.267
1.002	21.489	383.7	450	1	88.324	86.607	1.267	88.080	86.551	1.079
1.003	25.656	500.0	450	1	88.080	86.551	1.079	87.989	86.500	1.039
1.004	19.699	656.6	450	1	87.989	86.500	1.039	88.000	86.470	1.080
1.005	36.122	240.8	300	1	88.000	86.470	1.230	87.600	86.320	0.980
1.006	20.861	278.1	300	1	87.600	86.320	0.980	87.610	86.245	1.065
1.007	12.778	236.6	300	1	87.610	86.245	1.065	88.059	86.191	1.568
3.000	23.098	33.8	300	1	88.525	86.875	1.350	88.059	86.191	1.568
1.008	27.267	235.1	300	1	88.059	86.191	1.568	87.595	86.075	1.220
1.009	44.160	21.8	375	1	87.595	86.000	1.220	86.072	83.975	1.722
1.010	23.055	19.9	375	1	86.072	83.975	1.722	85.010	82.815	1.820
4.000	16.317	149.7	300	1	88.758	86.950	1.508	88.830	86.841	1.689
4.001	26.027	52.0	300	1	88.830	86.841	1.689	88.492	86.340	1.852
5.000	14.324	23.5	300	1	88.723	86.950	1.473	88.492	86.340	1.852
4.002	36.885	53.0	300	1	88.492	86.340	1.852	87.453	85.644	1.509
4.003	25.507	21.2	300	1	87.453	85.644	1.509	86.353	84.440	1.613

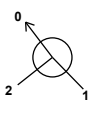
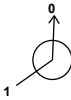
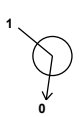
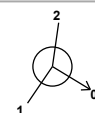
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1.000	S1	1200	Manhole	1	S3	1350	Manhole	1
2.000	S2	1200	Manhole	1	S3	1350	Manhole	1
1.001	S3	1350	Manhole	1	S4	1350	Manhole	1
1.002	S4	1350	Manhole	1	S5	1350	Manhole	1
1.003	S5	1350	Manhole	1	BASIN-01	1350	Manhole	1
1.004	BASIN-01	1350	Manhole	1	S6-FC	1350	Manhole	1
1.005	S6-FC	1350	Manhole	1	S7	1350	Manhole	1
1.006	S7	1350	Manhole	1	S8	1350	Manhole	1
1.007	S8	1350	Manhole	1	S10	1200	Manhole	1
3.000	S9	1350	Manhole	1	S10	1200	Manhole	1
1.008	S10	1200	Manhole	1	S11	1350	Manhole	1
1.009	S11	1350	Manhole	1	S12	1350	Manhole	1
1.010	S12	1350	Manhole	1	S23	1350	Manhole	1
4.000	S13	1200	Manhole	1	S14	1200	Manhole	1
4.001	S14	1200	Manhole	1	S16	1200	Manhole	1
5.000	S15	1350	Manhole	1	S16	1200	Manhole	1
4.002	S16	1200	Manhole	1	S17	1200	Manhole	1
4.003	S17	1200	Manhole	1	S20	1200	Manhole	1

Pipeline Schedule

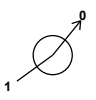
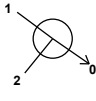
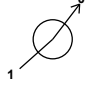
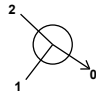
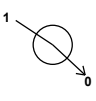
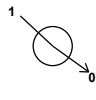
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.000	26.664	76.2	300	1	87.161	85.370	1.491	86.814	85.020	1.494
6.001	34.417	59.3	300	1	86.814	85.020	1.494	86.353	84.440	1.613
4.004	11.577	26.3	300	1	86.353	84.440	1.613	85.809	84.000	1.509
4.005	26.904	94.4	375	1	85.809	83.925	1.509	85.693	83.640	1.678
4.006	27.355	33.2	375	1	85.693	83.640	1.678	85.010	82.815	1.820
1.011	14.466	23.7	450	1	85.010	82.740	1.820	84.185	82.130	1.605
1.012	23.542	14.7	450	1	84.185	82.130	1.605	82.676	80.530	1.696
1.013	19.641	15.2	450	1	82.676	80.530	1.696	81.373	79.240	1.683
1.014	20.025	15.5	450	1	81.373	79.240	1.683	80.047	77.950	1.647
1.015	6.991	34.1	525	1	80.047	77.875	1.647	79.711	77.670	1.516
1.016	27.970	59.5	525	1	79.711	77.670	1.516	78.800	77.200	1.075
1.017	21.234	106.2	525	1	78.800	77.200	1.075	78.800	77.000	1.275
1.018	13.709	318.8	450	1	78.800	77.000	1.350	79.319	76.957	1.912
1.019	17.982	321.1	450	1	79.319	76.957	1.912	79.823	76.901	2.472
1.020	53.813	289.3	450	1	79.823	76.901	2.472	82.169	76.715	5.004
7.000	11.109	10.0	300	1	85.018	83.135	1.583	84.506	82.024	2.182
7.001	22.803	10.0	300	1	84.506	82.024	2.182	83.487	79.744	3.443
7.002	29.358	10.2	300	1	83.487	79.744	3.443	82.169	76.865	5.004
8.000	29.438	10.2	300	1	83.473	79.752	3.421	82.169	76.865	5.004
9.000	21.373	237.5	300	1	81.794	76.955	4.539	82.169	76.865	5.004
1.021	21.000	403.8	525	1	82.169	76.640	5.004	81.444	76.588	4.331
1.022	31.345	396.8	525	1	81.444	76.588	4.331	81.055	76.509	4.021
1.023	19.280	401.7	525	1	81.055	76.509	4.021	80.704	76.461	3.718
1.024	7.372	179.8	375	1	80.704	76.461	3.868	80.130	76.420	3.335

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
6.000	S18	1200	Manhole	1	S19	1200	Manhole	1
6.001	S19	1200	Manhole	1	S20	1200	Manhole	1
4.004	S20	1200	Manhole	1	S21	1350	Manhole	1
4.005	S21	1350	Manhole	1	S22	1350	Manhole	1
4.006	S22	1350	Manhole	1	S23	1350	Manhole	1
1.011	S23	1350	Manhole	1	S24	1350	Manhole	1
1.012	S24	1350	Manhole	1	S25	1350	Manhole	1
1.013	S25	1350	Manhole	1	S26	1350	Manhole	1
1.014	S26	1350	Manhole	1	S27	1350	Manhole	1
1.015	S27	1350	Manhole	1	S28	1350	Manhole	1
1.016	S28	1350	Manhole	1	BASIN-02	1350	Manhole	1
1.017	BASIN-02	1350	Manhole	1	S29-FC	1350	Manhole	1
1.018	S29-FC	1350	Manhole	1	S30	1350	Manhole	1
1.019	S30	1350	Manhole	1	S31	1350	Manhole	1
1.020	S31	1350	Manhole	1	S36	1500	Manhole	1
7.000	S32	1200	Manhole	1	S33	1200	Manhole	1
7.001	S33	1200	Manhole	1	S34	1200	Manhole	1
7.002	S34	1200	Manhole	1	S36	1500	Manhole	1
8.000	S35	1350	Manhole	1	S36	1500	Manhole	1
9.000	TANK 01	1350	Manhole	1	S36	1500	Manhole	1
1.021	S36	1500	Manhole	1	S37	1500	Manhole	1
1.022	S37	1500	Manhole	1	S38	1500	Manhole	1
1.023	S38	1500	Manhole	1	S39-FC	1800	Manhole	1
1.024	S39-FC	1800	Manhole	1	Ex S3951	1350	Manhole	1

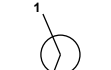
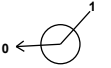
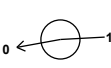
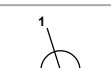
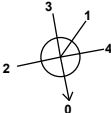
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S1	523165.209	234151.045	88.941	1.821	1200		0	1.000	87.120	375
S2	523196.724	234158.348	88.841	2.027	1200		0	2.000	86.814	375
S3	523187.020	234168.308	88.778	2.085	1350		1	2.000	86.768	375
							2	1.000	86.768	375
S4	523166.921	234194.702	88.324	1.717	1350		0	1.001	86.693	450
							1	1.001	86.607	450
S5	523184.471	234207.102	88.080	1.529	1350		1	1.002	86.607	450
							0	1.002	86.551	450
BASIN-01	523185.552	234232.735	87.989	1.489	1350		1	1.003	86.551	450
							0	1.003	86.500	450
S6-FC	523204.890	234228.980	88.000	1.530	1350		1	1.004	86.500	450
							0	1.004	86.470	450
S7	523232.930	234206.208	87.600	1.280	1350		1	1.005	86.470	300
							0	1.005	86.320	300
S8	523249.020	234192.930	87.610	1.365	1350		1	1.006	86.320	300
							0	1.006	86.245	300
S9	523234.235	234161.180	88.525	1.650	1350		1	1.007	86.245	300
							0	3.000	86.875	300
S10	523247.224	234180.279	88.059	1.868	1200		1	3.000	86.191	300
							2	1.007	86.191	300
S11	523270.533	234166.130	87.595	1.595	1350		0	1.008	86.191	300
							1	1.008	86.075	300
S12	523306.653	234140.724	86.072	2.097	1350		1	1.009	86.000	375
							0	1.009	83.975	375
							0	1.010	83.975	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S13	523198.718	234100.741	88.758	1.808	1200		0	4.000	86.950	300
S14	523211.913	234110.339	88.830	1.989	1200		1	4.000	86.841	300
							0	4.001	86.841	300
S15	523216.833	234139.077	88.723	1.773	1350		0	5.000	86.950	300
S16	523228.331	234130.535	88.492	2.152	1200		1	5.000	86.340	300
							2	4.001	86.340	300
							0	4.002	86.340	300
S17	523258.683	234109.577	87.453	1.809	1200		1	4.002	85.644	300
							0	4.003	85.644	300
S18	523233.894	234051.272	87.161	1.791	1200		0	6.000	85.370	300
S19	523254.506	234068.187	86.814	1.794	1200		1	6.000	85.020	300
							0	6.001	85.020	300
S20	523278.198	234093.152	86.353	1.913	1200		1	6.001	84.440	300
							2	4.003	84.440	300
							0	4.004	84.440	300
S21	523286.679	234085.271	85.809	1.884	1350		1	4.004	84.000	300
							0	4.005	83.925	375
S22	523306.762	234103.174	85.693	2.053	1350		1	4.005	83.640	375
							0	4.006	83.640	375
S23	523323.404	234124.884	85.010	2.270	1350		1	4.006	82.815	375
							2	1.010	82.815	375
							0	1.011	82.740	450
S24	523335.480	234116.919	84.185	2.055	1350		1	1.011	82.130	450
							0	1.012	82.130	450
S25	523352.711	234100.878	82.676	2.146	1350		1	1.012	80.530	450
							0	1.013	80.530	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S26	523368.658	234089.412	81.373	2.133	1350		1	1.013	79.240	450
						0	1.014	79.240	450	
S27	523387.457	234082.512	80.047	2.172	1350		1	1.014	77.950	450
						0	1.015	77.875	525	
S28	523391.397	234076.737	79.711	2.041	1350		1	1.015	77.670	525
						0	1.016	77.670	525	
BASIN-02	523402.451	234051.044	78.800	1.600	1350		1	1.016	77.200	525
						0	1.017	77.200	525	
S29-FC	523394.821	234031.228	78.800	1.800	1350		1	1.017	77.000	525
						0	1.018	77.000	450	
S30	523385.643	234021.044	79.319	2.362	1350		1	1.018	76.957	450
						0	1.019	76.957	450	
S31	523367.687	234020.074	79.823	2.922	1350		1	1.019	76.901	450
						0	1.020	76.901	450	
S32	523296.928	234070.524	85.018	1.883	1200		0	7.000	83.135	300
S33	523302.864	234061.134	84.506	2.482	1200		1	7.000	82.024	300
						0	7.001	82.024	300	
S34	523309.723	234039.387	83.487	3.743	1200		1	7.001	79.744	300
						0	7.002	79.744	300	
S35	523285.943	234004.353	83.473	3.721	1350		0	8.000	79.752	300
TANK 01	523327.078	234027.913	81.794	4.839	1350		0	9.000	76.955	300
S36	523314.740	234010.461	82.169	5.529	1500		1	9.000	76.865	300
						2	8.000	76.865	300	
						3	7.002	76.865	300	
						4	1.020	76.715	450	
						0	1.021	76.640	525	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S37	523318.933	233989.884	81.444	4.856	1500	1 0	1	1.021	76.588	525
							0	1.022	76.588	525
S38	523327.676	233959.783	81.055	4.546	1500	1 0	1	1.022	76.509	525
							0	1.023	76.509	525
S39-FC	523335.724	233942.263	80.704	4.243	1800	1 0	1	1.023	76.461	525
							0	1.024	76.461	375
Ex S3951	523343.015	233941.174	80.130	3.710	1350	1	1	1.024	76.420	375

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	20.0		

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node S6-FC Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	86.470	Product Number	CTL-SHE-0049-1200-1230-1200
Design Depth (m)	1.230	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.2	Min Node Diameter (mm)	1200

Node S39-FC Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	76.461	Product Number	CTL-SHE-0114-8000-2200-8000
Design Depth (m)	2.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	8.0	Min Node Diameter (mm)	1500

Node BASIN-02 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	77.200
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)
0.000	252.0	0.0	1.600	646.0	411.0

Node BASIN-01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	86.500
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)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	166.9	0.0	0.400	253.2	0.0	0.800	353.5	0.0	1.200	643.2	0.0
0.100	186.9	0.0	0.500	277.0	0.0	0.900	380.6	0.0	1.300	806.7	0.0
0.200	208.2	0.0	0.600	301.6	0.0	1.000	410.6	0.0	1.400	971.7	0.0
0.300	230.3	0.0	0.700	327.1	0.0	1.100	499.8	0.0	1.489	1120.0	0.0

Node TANK 01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	76.955
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	348.5	0.0	1.600	348.5	0.0	1.601	0.0	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.51%

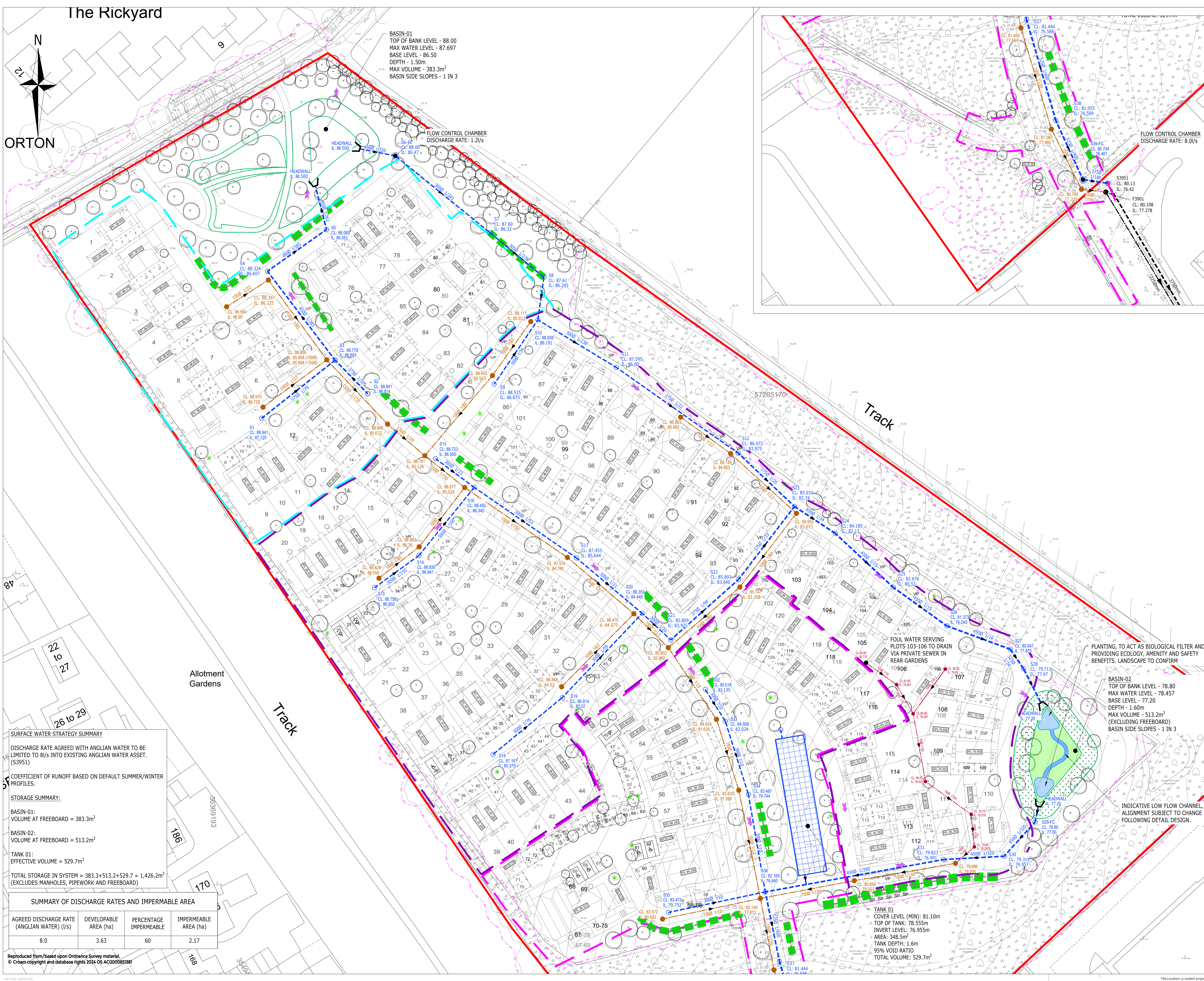
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	11	88.204	1.084	89.8	2.5359	0.0000	SURCHARGED
15 minute summer	S2	11	88.177	1.363	89.8	3.0202	0.0000	SURCHARGED
15 minute summer	S3	11	88.137	1.444	254.2	3.5914	0.0000	SURCHARGED
15 minute summer	S4	11	87.865	1.258	338.2	3.4131	0.0000	SURCHARGED
960 minute winter	S5	945	87.818	1.267	23.6	3.6372	0.0000	FLOOD RISK
960 minute winter	BASIN-01	960	87.818	1.318	23.5	472.8232	0.0000	FLOOD RISK
960 minute winter	S6-FC	960	87.818	1.348	1.2	1.9294	0.0000	FLOOD RISK
15 minute summer	S7	12	86.518	0.198	11.9	0.2836	0.0000	OK
15 minute summer	S8	11	86.517	0.272	15.3	0.3899	0.0000	OK
15 minute summer	S9	10	86.977	0.102	48.9	0.2208	0.0000	OK
15 minute summer	S10	11	86.517	0.326	97.7	0.5785	0.0000	SURCHARGED
15 minute summer	S11	11	86.144	0.144	133.3	0.3154	0.0000	OK
15 minute summer	S12	11	84.137	0.162	179.9	0.3254	0.0000	OK
15 minute summer	S13	12	87.555	0.604	48.9	1.0851	0.0000	SURCHARGED
15 minute summer	S14	12	87.525	0.684	97.3	1.1859	0.0000	SURCHARGED
15 minute summer	S15	12	87.390	0.440	48.9	0.9275	0.0000	SURCHARGED
15 minute summer	S16	12	87.365	1.025	177.1	1.6363	0.0000	SURCHARGED
15 minute summer	S17	12	86.584	0.940	187.6	1.5825	0.0000	SURCHARGED
15 minute summer	S18	12	85.902	0.532	40.7	0.8992	0.0000	SURCHARGED
15 minute summer	S19	12	85.874	0.854	76.6	1.4412	0.0000	SURCHARGED
15 minute summer	S20	12	85.731	1.291	244.6	1.4605	0.0000	SURCHARGED
15 minute summer	S21	12	84.849	0.924	285.9	1.9117	0.0000	SURCHARGED
15 minute summer	S22	12	84.126	0.486	322.0	0.9792	0.0000	SURCHARGED
15 minute summer	S23	11	83.205	0.465	537.0	0.9122	0.0000	SURCHARGED
15 minute summer	S24	12	82.472	0.342	576.9	0.6562	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.000	S3	84.1	1.017	0.373	3.0680	
15 minute summer	S2	2.000	S3	84.2	0.764	0.736	1.5338	
15 minute summer	S3	1.001	S4	252.4	1.593	1.543	5.2564	
15 minute summer	S4	1.002	S5	336.8	2.126	2.053	3.4048	
960 minute winter	S5	1.003	BASIN-01	23.5	0.626	0.164	4.0650	
960 minute winter	BASIN-01	1.004	S6-FC	1.2	0.150	0.010	3.1212	
960 minute winter	S6-FC	1.005	S7	1.2	0.375	0.017	0.1199	
15 minute summer	S7	1.006	S8	12.8	-0.345	0.193	1.2121	
15 minute summer	S8	1.007	S10	18.1	0.350	0.252	0.8794	
15 minute summer	S9	3.000	S10	48.7	1.080	0.254	1.0517	
15 minute summer	S10	1.008	S11	86.4	1.269	1.197	1.7474	
15 minute summer	S11	1.009	S12	133.0	3.139	0.309	1.8717	
15 minute summer	S12	1.010	S23	179.5	2.421	0.398	1.7981	
15 minute summer	S13	4.000	S14	48.4	1.105	0.534	1.1490	
15 minute summer	S14	4.001	S16	92.4	1.474	0.598	1.8328	
15 minute summer	S15	5.000	S16	46.9	1.014	0.204	1.0087	
15 minute summer	S16	4.002	S17	148.4	2.414	0.970	2.5974	
15 minute summer	S17	4.003	S20	178.7	2.579	0.737	1.7962	
15 minute summer	S18	6.000	S19	37.8	1.192	0.296	1.8777	
15 minute summer	S19	6.001	S20	66.1	1.129	0.458	2.4236	
15 minute summer	S20	4.004	S21	244.6	3.474	1.125	0.8152	
15 minute summer	S21	4.005	S22	283.4	2.570	1.376	2.9674	
15 minute summer	S22	4.006	S23	325.2	3.294	0.933	3.0172	
15 minute summer	S23	1.011	S24	537.9	3.958	0.808	2.0805	
15 minute summer	S24	1.012	S25	572.4	4.666	0.676	3.3871	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.51%

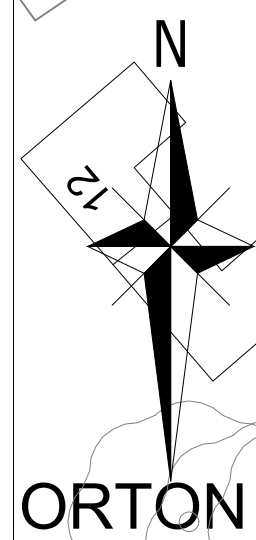
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S25	12	81.360	0.829	612.1	1.5736	0.0000	SURCHARGED
15 minute summer	S26	12	80.307	1.067	637.4	2.0267	0.0000	SURCHARGED
30 minute summer	S27	20	79.143	1.268	631.9	2.3987	0.0000	SURCHARGED
30 minute summer	S28	20	78.824	1.154	659.7	2.2163	0.0000	SURCHARGED
720 minute winter	BASIN-02	705	78.798	1.598	59.8	719.6050	0.0000	FLOOD RISK
720 minute winter	S29-FC	705	78.798	1.798	21.4	2.5733	0.0000	FLOOD RISK
720 minute winter	S30	705	78.798	1.841	20.6	2.6348	0.0000	SURCHARGED
720 minute winter	S31	705	78.798	1.897	20.0	2.7148	0.0000	SURCHARGED
15 minute summer	S32	10	83.217	0.082	57.1	0.1544	0.0000	OK
15 minute summer	S33	10	82.140	0.116	114.1	0.1968	0.0000	OK
15 minute summer	S34	11	79.945	0.201	170.9	0.3018	0.0000	OK
15 minute summer	S35	10	79.833	0.081	57.1	0.1469	0.0000	OK
720 minute winter	TANK 01	705	78.798	1.843	36.0	532.5228	0.0000	SURCHARGED
15 minute summer	S36	11	78.948	2.308	437.5	4.6615	0.0000	SURCHARGED
15 minute summer	S37	11	78.997	2.409	161.1	4.9499	0.0000	SURCHARGED
15 minute summer	S38	11	79.020	2.511	103.6	5.2110	0.0000	SURCHARGED
15 minute summer	S39-FC	11	79.020	2.559	57.1	7.3559	0.0000	SURCHARGED
15 minute summer	Ex S3951	11	76.480	0.060	8.5	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)	Discharge Vol (m³)
15 minute summer	S25	1.013	S26	600.4	4.417	0.722	3.1120	
15 minute summer	S26	1.014	S27	631.5	3.986	0.767	3.1728	
30 minute summer	S27	1.015	S28	626.8	2.902	0.753	1.5103	
30 minute summer	S28	1.016	BASIN-02	654.5	3.030	1.040	6.0424	
720 minute winter	BASIN-02	1.017	S29-FC	21.4	0.697	0.045	4.5872	
720 minute winter	S29-FC	1.018	S30	20.6	0.598	0.114	2.1721	
720 minute winter	S30	1.019	S31	20.0	0.633	0.111	2.8491	
720 minute winter	S31	1.020	S36	19.0	0.565	0.100	8.5263	
15 minute summer	S32	7.000	S33	57.0	2.805	0.161	0.2269	
15 minute summer	S33	7.001	S34	113.8	3.532	0.322	0.8496	
15 minute summer	S34	7.002	S36	166.3	3.421	0.475	1.7683	
15 minute summer	S35	8.000	S36	56.9	2.297	0.163	1.2630	
720 minute winter	TANK 01	9.000	S36	-36.0	-0.511	-0.501	1.5051	
15 minute summer	S36	1.021	S37	-164.5	-0.761	-0.686	4.5367	
15 minute summer	S37	1.022	S38	-109.9	0.665	-0.454	6.7715	
15 minute summer	S38	1.023	S39-FC	-53.9	0.332	-0.224	4.1651	
15 minute summer	S39-FC	1.024	Ex S3951	8.5	0.713	0.057	0.0880	94.3

Appendix J – Proposed Drainage Strategy



The Rickyard



ORTON

BASIN-01
TOP OF BANK LEVEL - 88.00
MAX WATER LEVEL - 87.697
BASE LEVEL - 86.50
DEPTH - 1.50m
MAX VOLUME - 383.3m³
BASIN SIDE SLOPES - 1 IN 3

FLOW CONTROL CHAMBER
DISCHARGE RATE: 1.2l/s

FLOW CONTROL CHAMBER
DISCHARGE RATE: 8.0l/s

SURFACE WATER STRATEGY SUMMARY

DISCHARGE RATE AGREED WITH ANGLIAN WATER TO BE LIMITED TO 8l/s INTO EXISTING ANGLIAN WATER ASSET. (S3951)

COEFFICIENT OF RUNOFF BASED ON DEFAULT SUMMER/WINTER PROFILES.

STORAGE SUMMARY:

BASIN-01:
VOLUME AT FREEBOARD = 383.3m³

BASIN-02:
VOLUME AT FREEBOARD = 513.2m³

TANK 01:
EFFECTIVE VOLUME = 529.7m³

TOTAL STORAGE IN SYSTEM = 383.3+513.2+529.7 = 1,426.2m³
(EXCLUDES MANHOLES, PIPEWORK AND FREEBOARD)

SUMMARY OF DISCHARGE RATES AND IMPERMEABLE AREA			
AGREED DISCHARGE RATE (ANGLIAN WATER) (l/s)	DEVELOPABLE AREA (ha)	PERCENTAGE IMPERMEABLE	IMPERMEABLE AREA (ha)
8.0	3.63	60	2.17

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- NOTES:
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 - ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES UNLESS OTHERWISE STATED.
 - ALL DIMENSIONS, LEVELS AND SURVEY GRID CO-ORDINATES ARE TO BE CHECKED ON SITE AND THE ENGINEER NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF THE WORKS.
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- KEY
- SITE BOUNDARY
 - DRAINAGE CATCHMENT BOUNDARIES
 - PROPOSED SW SEWER & MANHOLE
 - PROPOSED FW SEWER & MANHOLE
 - PROPOSED PRIVATE FW SEWER & MANHOLE
 - EXISTING SW SEWER & MANHOLE
 - EXISTING FW SEWER & MANHOLE
 - PROPOSED HEADWALL
 - PROPOSED ATTENUATION BASIN
 - UNDERGROUND ATTENUATION TANK
 - PROPOSED SWALE WITH UNDERDRAIN
 - TREET ROOT PROTECTION AREA
 - PROPOSED GRADIENT
 - POTENTIAL LOCATION FOR BIO RETENTION OR RAIN GARDENS



FOUL WATER SERVING PLOTS 103-106 TO DRAIN VIA PRIVATE SEWER IN REAR GARDENS

PLANTING, TO ACT AS BIOLOGICAL FILTER AND PROVIDING ECOLOGY, AMENITY AND SAFETY BENEFITS. LANDSCAPE TO CONFIRM

BASIN-02
TOP OF BANK LEVEL - 78.80
MAX WATER LEVEL - 78.457
BASE LEVEL - 77.20
DEPTH - 1.60m
MAX VOLUME - 513.2m³
(EXCLUDING FREEBOARD)
BASIN SIDE SLOPES - 1 IN 3

INDICATIVE LOW FLOW CHANNEL, ALIGNMENT SUBJECT TO CHANGE FOLLOWING DETAIL DESIGN.

TANK 01
COVER LEVEL (MIN): 81.10m
TOP OF TANK: 78.555m
INVERT LEVEL: 76.955m
AREA: 348.5m²
TANK DEPTH: 1.6m
95% VOID RATIO
TOTAL VOLUME: 529.7m³

F	SITE LAYOUT UPDATED	MCE	EF	BB	12.05.26
E	SITE LAYOUT UPDATED	MCE	EF	BB	11.05.26
D	SITE LAYOUT UPDATED	MCE	EF	BB	08.05.26
C	SITE LAYOUT UPDATED	MAC	TR	BB	26/11/25
B	PLANNING SUBMISSION	KC	TR	BB	31/10/25
A	PRELIMINARY ISSUE	DC	TR	BB	08/09/25
Rev	Description	Drn	Chk	App	Date
Purpose:				Status:	
FOR PLANNING				NOT YET APPROVED	

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Client:
**BARRATT DAVID WILSON HOMES
NORTH THAMES**

Project Title:
LAND AT TALBOT WAY, LETCHFORD

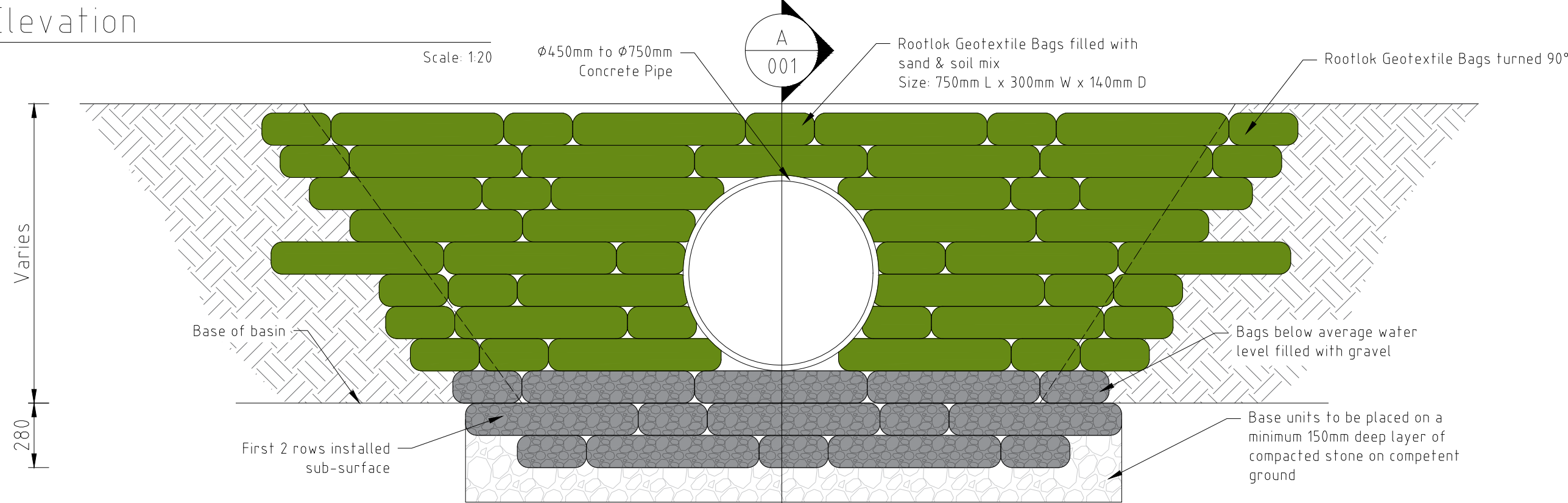
Drawing Title:
DRAINAGE STRATEGY

Drawn by DC	Checked by TR	Approved by BB	Revision F
Scale 1:500@A0	Date SEPT 2025		
Drawing Number 2502330-ACE-XX-00-DR-C-0151			

Appendix K – Rootlok Vegetated Headwall Detail

1

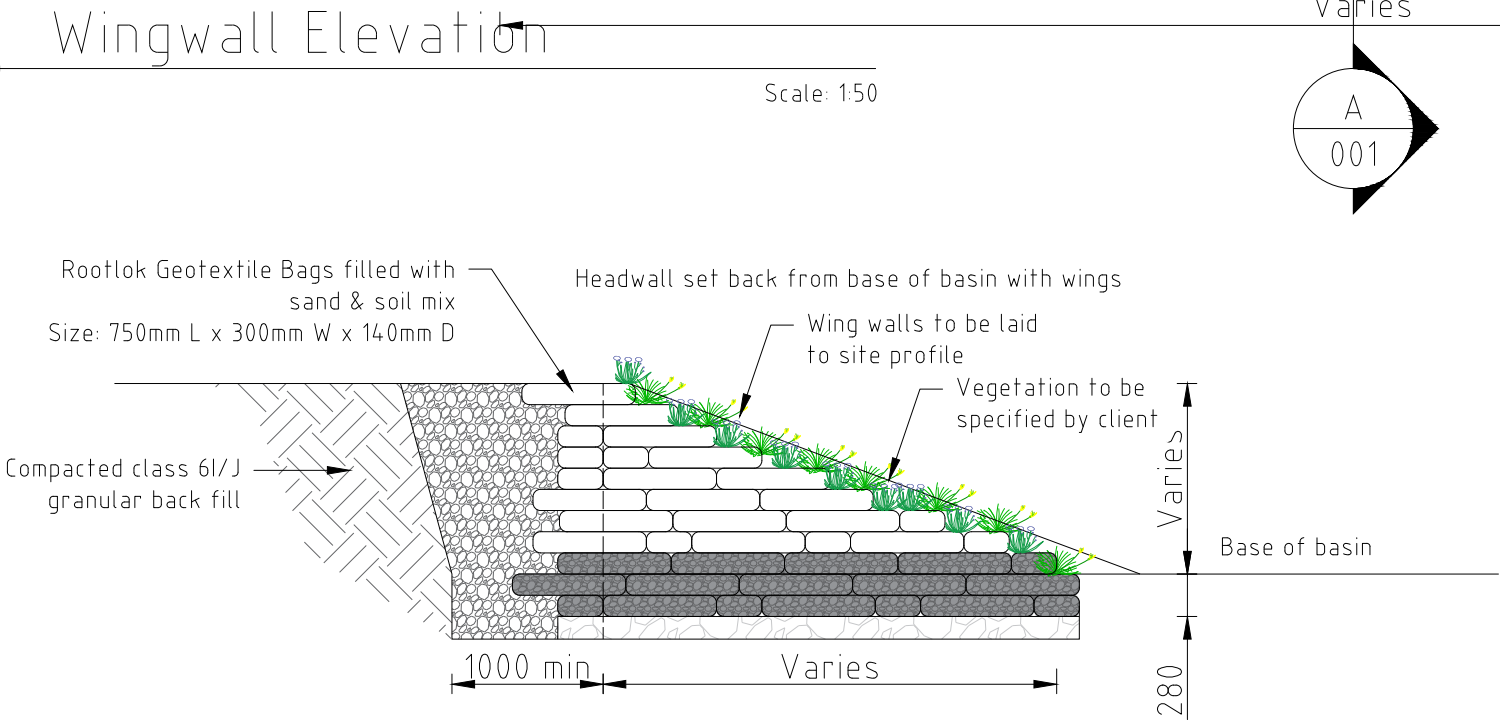
Elevation



2

Wingwall Elevation

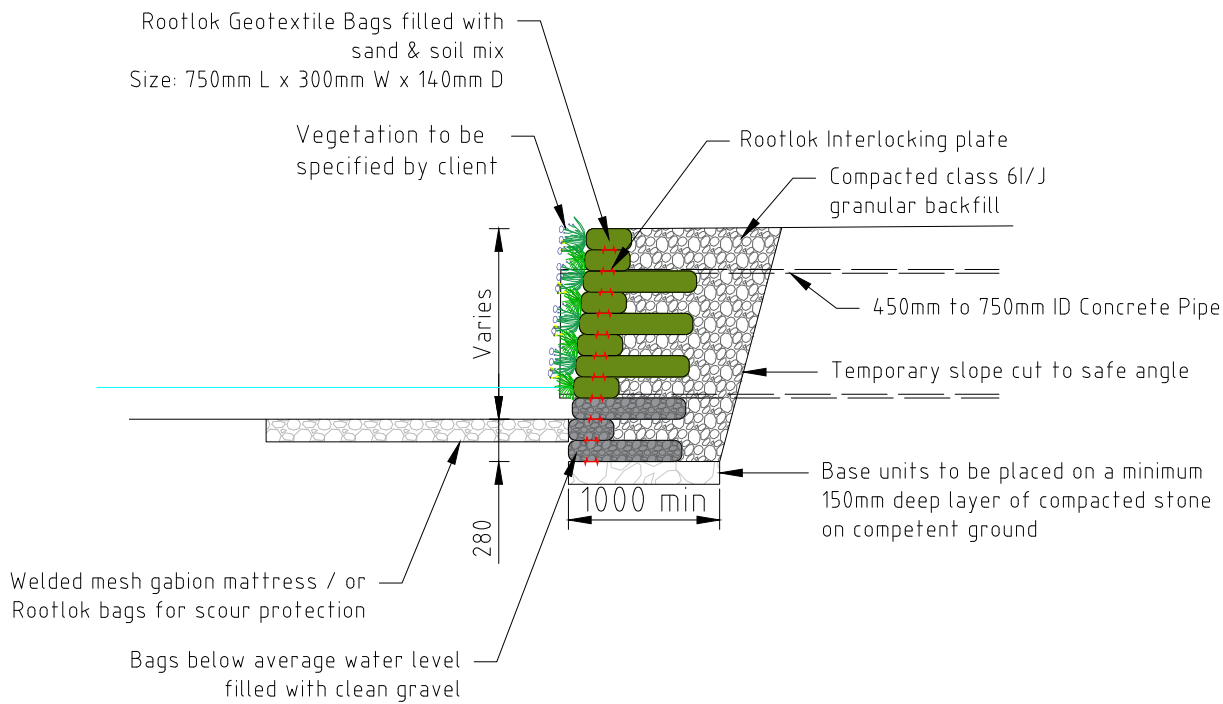
Scale: 1:50



3

Typical Section

Scale: 1:50



Notes.

INDICATIVE DRAWING ONLY
NOT FOR CONSTRUCTION

GeoGrow®

Rootlok® Vegetated Wall System

GeoGrow Ltd
5 Crompton Court,
Attwood Road,
Burntwood,
WS7 3GG

						Drawing No. IN0000_001	Scale 1:50
						Client/Project Geogrow Ltd	Drawn PN
							Date 11/03/2024
						Drawing Title Rootlok Winged Headwall Ø450 - Ø750mm Pipe	Revision A
A	Initial Design	PN	DR	11/03/2024			
No.	Amendment	By	Auth	Date	Checked By	DR	