ABLEY LETCHFORD PARTNERSHIP
Consulting Engineers

LAND AT RUSTINGTON GOLF CENTRE, ANGMERING

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

BARRATT DAVID WILSON HOMES

03 FEBRUARY 2022

ARUN DISTRICT COUNCIL A/45/22/PL

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Executive Summary

A site walkover was conducted in order to establish the location of existing drainage apparatus within and surrounding the development.

The site drains predominantly by infiltration with no discernible onsite drainage features, although beyond the site boundaries established watercourses convey surface water runoff west, discharging to Black Ditch, a tributary of the River Arun.

The detailed flood map, for fluvial sources, provided by the Environment Agency show that the site area is located wholly within Flood Zone 1. There are no secondary flooding sources identified within the site.

In accordance with PPG ID: 7, the proposed development is classified as 'more vulnerable'. All development types are generally deemed acceptable in terms of flood risk in Flood Zone 1.

Based on the above, the site passes the Sequential Test with respect to NPPF and the Exception Test is not applicable.

The Assessment has considered the potential impact of the development on surface water runoff rates.

The surface water management strategy for the proposed development will manage and reduce the flood risk posed by the surface water runoff from the site.

The impermeable area of the proposed development has been calculated, including an allowance for Urban Creep with all drainage discharging into the ground by infiltration.

The attenuation requirements for the site could be met by attenuation basins situated in the lower portions of the development, alongside infiltration cellular storage. Due to the topography of the site attenuation requirements will be within various features as opposed to one large one. This would avoid the need to artificially create a fall on site and reduce the quantity of fill material required to develop the site.

Additionally, further SuDS techniques, such as swales and permeable paving, can be introduced over the wider site.

Through the provision of a positive drainage network attributed to the Development, pluvial flooding to offsite receptors will be significantly reduced.

Exceedance flows can be safely accommodated within the Development.

Foul water drainage can be discharged into the local Southern Water pumping station located just north of the development, although a further onsite pumping stations will be required to facilitate this.

Overall, the site should not be precluded on flood risk grounds as the Development will not be at risk from existing sources and will not result in an increase in flooding downstream.

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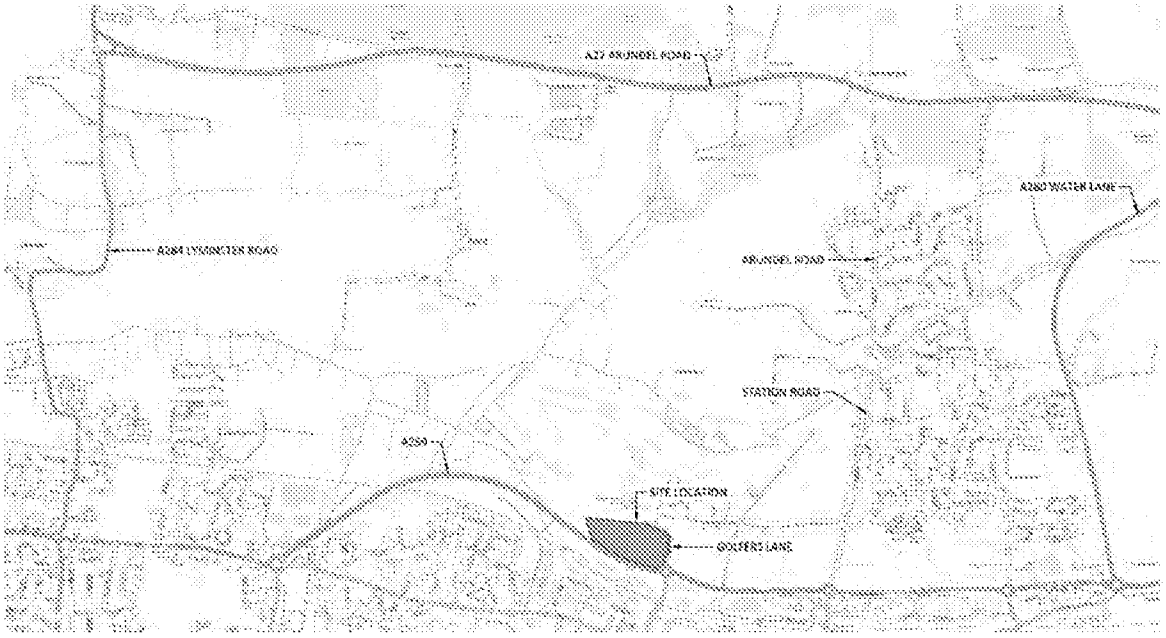
1.0 Introduction

Site Context

1.1. This report has been prepared by Abley Letchford Partnership Ltd, on behalf of Barratt David Wilson Homes (BDW), in relation to a hybrid planning application for the proposed residential development on land located at Rustington Golf Course, Angmering. The location of the site in its local geographical context is shown below.

Site Location Plan



Development Proposals

1.2. The proposals will comprise a hybrid planning application, for the erection of 167 dwellings, with matters regarding the access, principle internal roads and a first phase of development being considered in detail, with the remainder of the site being in outline and all other matters reserved.

Requirement for a Flood Risk Assessment (FRA)

1.3. The requirement for a Flood Risk Assessment is set out in Section 14 of the revised National Planning Policy Framework (NPPF) as revised in July 2021.

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1.4. The footnote accompanying Paragraph 167 states:

A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

1.5. The site is a Greenfield site, extends greater than 1 hectare in total; therefore, a site-specific flood risk assessment is required. To comply with an Outline Planning Application, matters related to flood risk and drainage are addressed within this report.

Report Aim and Formation

1.6. The principal aim of this report is to demonstrate the acceptability of the proposed development in respect to flood risk planning policy.

1.7. Consideration is given to the risks attributed to both the development itself and the users from all forms of flooding.

1.8. The report outlines the impacts the development could have on flood risk in the area by increasing flooding elsewhere resulting from increased surface water runoff, changes in flood routing or loss of flood plain storage and outlines the mitigation systems that will be implemented to minimise this risk.

1.9. The presented Drainage Strategy ensures that the guiding principles of Sustainable Drainage Systems (SuDS) are central to the disposal of surface water drainage from the proposed development ensuring a viable robust solution is implementable.

1.10. The report finishes by outlining provisions for wastewater disposal.

Report Structure

1.11. This report addresses the requirements of NPPF and considers the following aspects:

- Section 2: Policy and Sources of Information – a review of policy relevant to the assessment and sources of information.
- Section 3: Baseline Environmental Conditions – a description of the site location, its topography, geology and hydrology.
- Section 4: Flood Risk – the effect of flooding within the existing site layout from all sources.
- Sections 5 and 6: Drainage Strategy – offer appropriate mitigation measures to protect the site in the post development scenarios for surface and foul water drainage strategies.
- Section 7: Summary and Conclusions – a review of the suitability of the development proposals in the context of site vulnerability and the requirements of the NPPF.

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2.0 Policy and Sources of Information

Introduction

2.1. This chapter provides a review of policy relevant to the assessment and sources of information

National Planning Policy

2.2. National Planning Policy in relation to Flood Risk is set out in Section 14 of the National Planning Policy Framework (NPPF) and Planning Practice Guidance ID:7 for Flood Risk and Coastal Change (PPG). Flood Risk is discussed in Paragraphs 159-169 of the NPPF.

2.3. Paragraphs 159-166 discuss the Sequential approach. Paragraph 162 refers to a Strategic Flood Risk Assessment (SFRA) that would form the basis of applying the Sequential Test for local authorities to allocate development, whilst Paragraphs 163-166 relates to the Exemption Tests.

2.4. Paragraph 167 discusses the determination of planning applications stating:

When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood risk assessment. Development should only be allowed in areas at risk of flooding where, in light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

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

b) the development is appropriately flood resistant and resilient;

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

d) any residual risk can be safely managed; and

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

2.5. The development would be classed as Major Development providing more than 10 homes and the site is greater than 0.5 hectares. Paragraph 169 states:

Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a) Take account of advice from the lead local flood authority (LLFA);

b) Have appropriate proposed minimum operational standards;

c) *Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and*

d) *Where possible, provide multifunctional benefits.*

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The Sequential Test, Exception Test and Sequential Approach

2.6. The sequential test is an approach used to enable new developments to be designed in areas at lower risk of flooding in preference to sites at higher risk. All opportunities to direct development to reasonably available areas with little or no flood risk should be explored prior to deciding to build in higher flood risk areas. For strategic sites, this is applied by the Local Planning Authority by means of a Strategic Flood Risk Assessment (SFRA).

2.7. Dependent upon the type of development under consideration, there may be a subsequent requirement to carry out the Exception Test as depicted within Figure 1 below. The Exception Test ensures that any new developments implemented within areas of flood risk will only occur where flood risk is clearly outweighed by other sustainability drivers and it will ensure that the development can be made safe from flooding and not increase the flood risk elsewhere. The test considers the vulnerability of the new development to flood risk and in order to 'pass', must demonstrate that:

- The development provides wider sustainability benefits to the community that outweigh the flood risk;
- The development is sited on previously developed land, or if this is not the case, there are no other reasonable alternative sites; and
- The development is safe, does not increase flood risk elsewhere and where possible will reduce flood risk overall.

Figure 1 – Flood Risk Vulnerability Classification Table 3 PPG ID 7

Flood Risk Vulnerability classification (see Table 1 PPG ID: 7)	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1 Low Probability	Yes	Yes	Yes	Yes	Yes
Zone 2 Medium Probability	Yes	Exception test required	Yes	Yes	Yes
Zone 3a High Probability	Exception test required	No	Exception test required	Yes	Yes
Zone 3b Functional Floodplain	Exception test required	No	No	No	Yes

Key: Yes: Development is appropriate, No: Development should not be permitted.

Climate Change

2.8. National Planning Policy (NPPF and PPG) make it a requirement to account for climate change within any proposed development proposal. Research has shown that expected climate change will increase the peak rainfall intensity and river flow, which could result in more frequent and severe flood events.

2.9. PPG ID:7 for Flood Risk and Coastal Change Table 2 sets out anticipated changes in peak rainfall intensity in small catchments (less than 5km^2), or urbanised drainage catchment (as found within towns and cities. This is depicted below as Figure 2.

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Figure 2 – Peak rainfall intensity allowance in small catchments or urban drainage (Table 2 PPG ID 7)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

2.10. Underlying text supporting Table 2 states that Upper End climate change allowances should be used within the drainage design of all development types.

Environment Agency / GOV.UK

2.11. The Flood and Water Management Act 2010 provides the Environment Agency a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The Environment Agency is a statutory consultee with regards to flood risk and planning dependent upon criteria.

2.12. Environment Agency Standing Advice has been consulted and reviewed within this assessment.

2.13. The GOV.UK Flood Map for Planning, Long Term Flood Risk and Catchment Data Explorer websites have been interrogated in respect to flood risk extents and sources.

Local Authorities

2.14. The Site lies within the administrative area of West Sussex County Council and Arun District Council.

2.15. West Sussex County Council (WSCC) became a Lead Local Flood Authority (LLFA) under the Flood and Water Management Act 2010 and provide guidance to assess, manage and inform flood risk.

2.16. Planning guidance published by WSCC regarding flood risk was consulted to assess the mitigation policies in place. This includes the "West Sussex LLFA Policy for the Management of Surface water (November 2018)" which sets out the drainage strategies and surface water management provisions by which applications for development will be assessed. Furthermore, the document provides links to wider special strategy and flood risk documents, and these have been consulted in preparation of this assessment. These include, but are not restricted to:

- Water. People. Places. A guide for master planning sustainable drainage into developments.
- West Sussex Local Flood Risk Management Strategy Report.
- West Sussex Preliminary Flood Risk Assessment.

2.17. The Arun Local Plan was adopted on the 18th July 2018 and sets out a spatial vision, objectives and a sustainable strategy for delivering the needed growth of the District over the period 2011- 2031.

2.18. Chapter 18 of the Local Plan deals with Water within Arun. The strategic objectives set out are to:

- Plan for climate change and work in harmony with the environment.

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- Ensure water supply and quality are considered alongside wastewater.
- Avoid increasing (and where possible reduce) risks of, or from, all forms of flooding.
- Identify opportunities to include Sustainable Drainage Systems.

2.19. Having reviewed the key polices in the local plan the development site is considered to align with these primary objectives.

2.20. Aruns Supplementary Requirements for Surface Water Drainage Proposals set out local requirements for flooding and drainage including the Surface Water Proposals Checklist. These requirements have been included throughout the FRA and drainage proposals with the checklist provided as an appendix.

Southern Water

2.21. Southern Water is responsible for the disposal of waste water within the local area, and for the supply of clean water.

2.22. Information with regards to sewer and water main flooding contained within the SFRA has been consulted as part of this assessment. All Water Companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register.

Other Sources of Information

2.23. A desktop study of the Site was carried out using the following websites to ascertain local features, hydrology and soil characteristics:

- DEFRA's MAGIC portal,
- British Geological Survey (BGS) and
- Cranfield University Soilscapes portal.

2.24. A Site walkover conducted in 2021 allowed observation of existing topography, watercourses, and infrastructure.

2.25. Guidance with respect to Sustainable Drainage Systems (SuDS) is contained within DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, as well as CIRIA C753 The SuDS Manual, BS8582:2013 – Code of Practice for Surface Water Management for Development Sites and Approved Document H of the Building Regulations.

2.26. Additional guidance on development and flood risk is contained within CIRIA C624 Development and Flood Risk – Guidance for the Construction Industry which identifies several key aims for a development to ensure it is sustainable in flood risk terms.

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3.0 Baseline Environmental Conditions

Introduction

3.1. This chapter provides for a description of the site location, its topography, geology and hydrology.

Site Location and use

3.2. The site lies to the south west of Angmering centre on land to the north of the A259. The site is bound along its southern side by the A259 and Golfers Lane to the east. To the north is the existing Rustington Golf Club car park and facilities, while to the west is additional land making up the rest of the golf course.

3.3. Overall the site covers approximately 6.4 hectares (Ha) which comprises predominantly golf facilities green features such as fairways, bunkers and ponds. There are sporadic trees within the boundary with a prominent north south tree line splitting the site into two distinct east and west parcels.

3.4. The site lies within the administrative area of Arun District Council.

3.5. The National Grid Reference of the site is TQ 76441 05392.

Topography

3.6. The topography of the site is predominantly flat in nature with levels fluctuating between 8.00m AOD to 2.74m AOD across the site.

3.7. In the eastern parcel levels are predominantly flat at approximately 6.30m AOD, at the boundaries, with high and low points formed by manmade golf features in the parcel itself.

3.8. In the western parcel, subject to development, there is a noticeable fall from east to west with levels approximately 7.50m AOD at the tree line to the east falling to approximately 4.50m AOD in the west. The ground then falls away to the west predominantly to a low spot at approximately 2.74m. However, this area vis not subject to development.

Existing Drainage

3.9. The site currently drains by predominantly infiltration and evapotranspiration, with osmosis through the trees.

3.10. There is a manmade pond in the eastern parcel which is connected to the wider golf land drainage system which also takes water in times of heavy rainfall.

3.11. There are no surface water sewers, ditches or watercourses within the site itself. However, beyond the sites western boundary there is the continuation of a watercourse which takes overland flow, from land to the south and the wider golf course, to the Black Ditch. It is understood the golf course online network of ponds and land drainage also eventually ends up at the Black Ditch through an onsite drainage network, although the quantum is unknown at this time.

3.12. There is a Southern Water 450mm PVC foul water rising main within the eastern part of the site running north south connecting flows from the pumping station, located to the north of the site beyond Golfers Lane, to the wider foul sewer network.

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Geology and Hydrogeology

3.13. British Geological Survey mapping indicates the superficial geology beneath the site to comprise granular River Terrace Deposits. These are underlain by the bedrock geology of New Pit Chalk Formation. Site testing has confirmed the mapping to be predominantly correct although there are more clays in the superficial geology than envisaged.

3.14. The Cranfield University Soilscapes maps indicates the soil to be freely draining slightly acidic loamy soil.

3.15. Aquifer designations reflect the importance of aquifers in terms of groundwater as a resource and in their role in supporting surface water flows and wetland ecosystems.

3.16. Aquifer maps are split into two different types of aquifer designations namely; Superficial (Drift), which are permeable unconsolidated deposits e.g. sands, gravels, etc, and Bedrock, which are solid permeable formations e.g. Sandstone, chalk, etc.

3.17. Environment Agency (EA) mapping indicates the site lies within Principal aquifer designation for Bedrock and Secondary A for Superficial Drift.

3.18. Mapping confirms that the Site lies outside of any Groundwater Source Protection Zone (SPZ).

Hydrology

3.19. The site lies in the catchment of the Black Ditch located to the west of the site. The Black Ditch is a tributary to the River Arun, a tidal river located some 4km to the west of the site.

3.20. The Black Ditch was rated 'Poor' for Ecological Classification and 'Fail' for Chemical Classification in 2019.

Site Investigations

3.21. Intrusive ground investigations, groundwater monitoring and soakage testing to BRE DG365 has been undertaken to provide confirmation of the hydrogeology. These were undertaken in winter in accordance with Arun's Drainage Policy. They indicate infiltration type techniques are viable on the site and this tallies with the flood risk and the lack of existing surface water drainage features.

Groundwater Monitoring

3.22. Groundwater monitoring was completed to depths of 5m and 6m below ground level in March 2021 with three further groundwater monitoring visits during March 2021.

3.23. Groundwater strikes were encountered in three of the six monitoring wells but all strikes were 3.5m or greater below ground level. Full results are contained within the Appendix.

3.24. Further groundwater monitoring has been undertaken throughout the 2021 / 2022 winter and once complete will be forwarded as additional information with the results used to advise of any change, although none are expected.

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Infiltration Testing

3.25. Infiltration testing was carried out between the 22 to 24 March 2021. The scope of works comprised the mechanical excavation of eight trial pits and had a maximum of three soakage tests conducted in line with BRE365.

3.26. Tests were completed to depth of 2.40m to 2.70m below ground level and Groundwater was only found in one location, in the low spot of the site, some 1.80m below ground level. In this location a further pit was excavated to a depth of 1.40m below ground level and the tests conducted.

3.27. The results indicated infiltration type techniques are viable across the site but more suitable to the south and west. However, this should not preclude infiltration in the north and far east if required.

3.28. Winter testing in March 2021 resulted in infiltration rates of between 1.16 x 10^{-5} m/s and 6.17 x 10^{-5} m/s in locations TP02, 04, 05, 06 and 08, and rates of 1.47 x 10^{-6} m/s and 6.32 x 10^{-6} in TP01 and 03 respectively. TP07 in the far east of the site is unviable as is deep soakaways in the far west in the low spot where groundwater was encountered. Full results are contained within the Appendix.

3.29. Further infiltration testing has been undertaken throughout the 2021 / 2022 winter and once complete will be forwarded as additional information with the results used to advise of any change, although none are expected.

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4.0 Flood Risk

Introduction

4.1. This chapter assesses flood risk at the site from all sources including appropriate allowance for climate change required by relevant National and Local planning policy.

Flood Risk to the Site from Tidal Sources

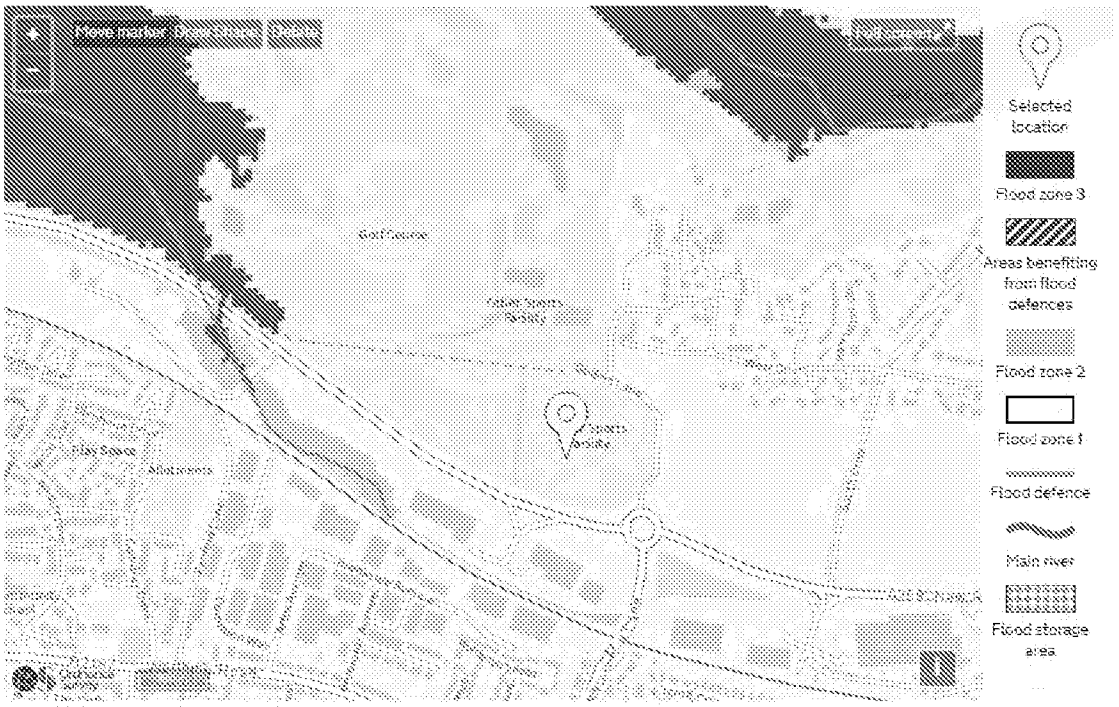
4.2. The site is at a low risk from tidal flooding due to its inland elevated location.

Flood Risk to the Site from Fluvial Flooding Sources

4.3. A review of the EA's Flood Map for Planning maps show the site to be located entirely within Flood Zone 1. This zone comprises land where flooding from rivers and the sea (fluvial) is very unlikely. There is less than a 0.1% (1 in 1000) chance of flooding occurring each year. The site is at a low risk of flooding from fluvial sources.

4.4. Extracts from the EA Flood Maps are included below.

Environment Agency's Flood Zone Map



Flood Risk to the Site from Pluvial Flooding Sources

4.5. The SFRA, EA and GOV.uk websites and local available documents indicate there is no history of flooding at the site from heavy rainfall events or overland flood routes. However, although the EA flood maps indicate a medium to high risk of surface water flooding on the site, this is confined to one location at the very low spot where no development is envisaged.

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4.6. Due to the flat nature of the site and no positive outfalls, it is assumed that any surface water flooding is generated by rainfall falling on-site and not be able to escape the site quickly enough.

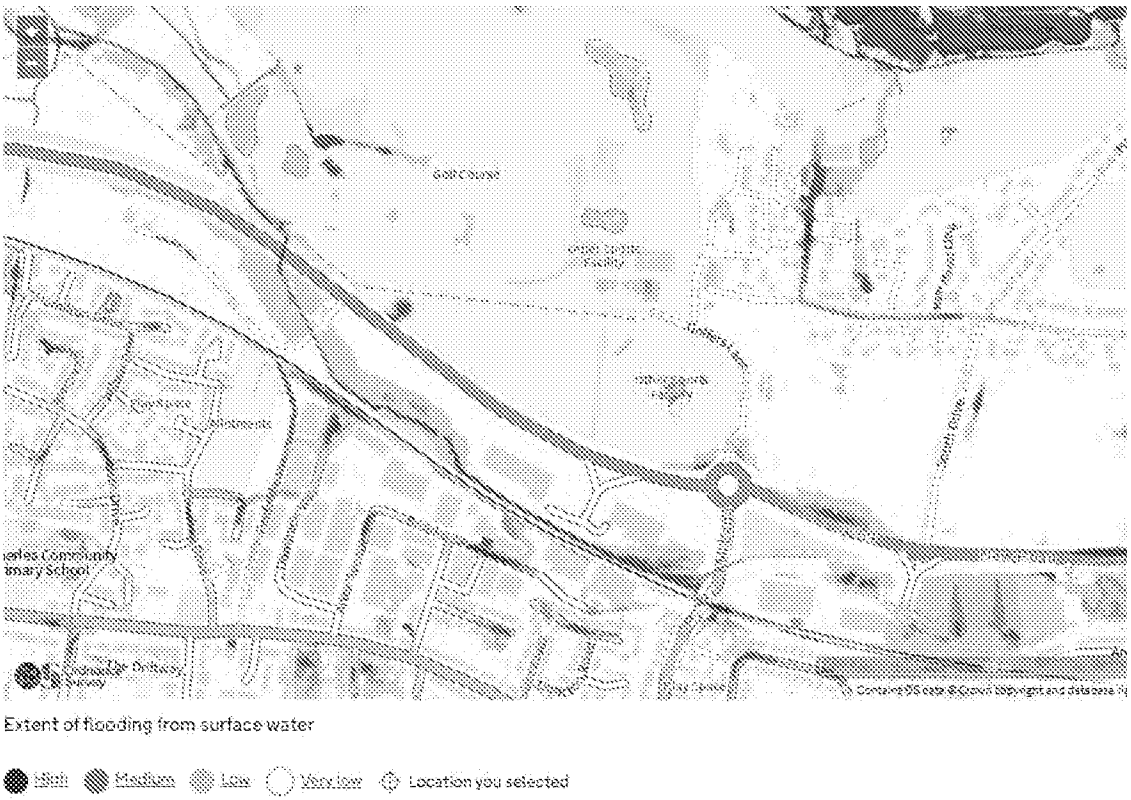
4.7. The proposed development will provide positive improvements to overland flow with surface water being intercepted, stored in attenuation areas and discharged at controlled rates or into the ground.

4.8. The remaining Greenfield areas will be managed with grass and vegetation providing a surface treatment more conducive to reductions in overland flow.

4.9. Not only will these measures assist in management of surface water on site, but also contribute to a reduction in flood risk downstream, as the discharge rate off site is controlled, restricted and attenuated on site. However, cognisance will be taken to ensure downstream receptors are suitably recharged.

4.10. Therefore, overall, the site is at a very low risk of flooding from pluvial sources.

Environment Agency's Surface Water Map



Flood Risk to the Site from Groundwater

4.11. Groundwater flooding has the potential to occur after prolonged periods of unusually high rainfall. During such periods, more water than usual infiltrates through the ground, raising the water table above its normal depth below the surface. Where the water table is at shallow depth in any case, the water table can reach the surface. This can cause ground water to merge with rainfall and cause localised flooding.

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4.12. On site ground water monitoring, during winter months provided a suite, of groundwater levels across the site with the groundwater predominantly 3.5m to 4.5m below ground level or non-existent. Only in one location was groundwater encountered during the onsite investigations and this was in the very low spot highlighted with the pluvial flood risk above. However, even this was some 1.8m below ground level and not in a location of development.

4.13. Groundwater flooding tends to occur sporadically in both location and time. Surface groundwater flooding has not been a risk on the site and there is no reason to believe it would present a problem and the test confirm this.

Flood Risk to the Site from Other Sources

4.14. The SFRA, EA and GOV.uk websites and local available documents indicate there is no existing flood risk from: reservoirs, sewers, canals or other artificial sources.

4.15. The site is deemed of low risk of flooding from these sources.

The Sequential Test

4.16. In the context of PPG Flood Risk and Coastal Change ID: 7 (Table 2) the proposed development has been identified as 'residential' development and therefore is classified as 'More Vulnerable'.

4.17. The proposed development is situated wholly within Flood Zone 1.

4.18. By applying the Flood Risk Vulnerability compatibility matrix under PPG Flood Risk Coastal Change ID:7 (Table 3), all development types are deemed to be accepted in Flood Zone 1 as depicted.

Flood Risk Vulnerability Classification Table 3 PPG ID 7

Flood Risk Vulnerability classification (see Table 1 PPG ID: 7)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	Yes	Yes	Yes	Yes	Yes
Zone 2	Yes	Yes	Exception test required	Yes	Yes
Zone 3a	Exception test required	Yes	No	Exception test required	Yes
Zone 3b 'Functional Floodplain'	Exception test required	Yes	No	No	No

Key: Yes: Development is appropriate, No: Development should not be permitted.

4.19. It is therefore considered that, within the context of Flood Risk, the Site passes the Sequential Test with respect to NPPF and is suitable for the type of development proposed.

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Flood Risk Summary

4.20. An overall summary of the risk of flooding from all sources is provided below.

Flood Risk Summary

Source of Flooding	High	Medium	Low	Comments
Tidal			✓	The Site is elevated and inland.
Fluvial			✓	The Site is located wholly within Flood Zone 1.
Pluvial			✓	There is minor pluvial flood risk associated with the low spot on the site and the inability to continue off site beyond the western boundary of the development. The proposed development and mitigation will reduce any perceived flood risk.
Groundwater			✓	EA/GOV.UK mapping and onsite groundwater monitoring does not indicate the Site to be at risk.
Sewers			✓	The Site has no exposure to existing sewer assets, except the aforementioned foul water rising main, with no evidence of flooding.
Reservoirs, canals and other artificial sources			✓	EA/GOV.UK mapping does not indicate the Site to be at risk.

4.21. Based upon the above information, the Site is deemed to be at **LOW RISK OF FLOODING**. The Proposed Site Plan is therefore in full accordance with National and Local planning policy concerning Flood Risk and as such is suitable for residential development.

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5.0 Surface Water Strategy

Introduction

5.1. This chapter provides details on an indicative surface water drainage strategy and measures to drain the Development.

Overall Strategy

5.2. The proposed drainage strategy has been designed to exceed the requirements of the NPPF by providing a comprehensive drainage system which embraces the Sustainable Drainage Systems (SuDS) philosophy and key principles. The utilisation of SuDS not only provides the benefit of controlling waters at source and online treatment of collected surface water but also allows enhanced aesthetics through improved landscaping, biodiversity, and ecological opportunities.

5.3. These features offer a holistic treatment train and management system to the benefit of new residents, members of the wider community, downstream receptors and the environment.

5.4. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. Changes to land uses can have significant downstream impacts where existing drainage systems may not have sufficient capacity for any additional surface water flow.

5.5. A surface water management strategy is therefore required to manage and reduce the flood risk posed by the surface water runoff from the site. The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates to the pre-development scenario, unless specific off-site arrangements are made and result in the same net effect.

5.6. Sustainable water management measures (SuDS) should be introduced to control the surface water runoff from the proposed development site therefore, managing the flood risk to the site and surrounding areas from the surface water runoff.

5.7. The Construction Industry Research and Information Association, CIRIA's C690 states the following:

- **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing surfaces)
- **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting)
- **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one or several soakaways for the entire site)
- **Regional Control** – management of runoff from several sites, typically in a detention basin or wetland.

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5.8. The SuDS Manual 2015 (C753) provides best practice guidance on the planning, design, construction, operation and maintenance of SuDS. This document provides guidance to ensure that SuDS are planned and designed to maximise the opportunities and benefits of surface water management.

5.9. The four main categories of benefits that can be achieved by SuDS, referred to as the four pillars of SuDS design, are:

- **Water quantity** – control the quantity of runoff to support the management of flood risk, and maintain and protect the natural water cycle;
- **Water quality** – manage the quality of the runoff to prevent pollution
- **Amenity** – create and sustain better places for people
- **Biodiversity** – create and sustain better places for nature.

5.10. Supplemental to CIRIA guidance, Document H of the Building Regulations 2015 sets out three possible options to discharge surface water runoff. Rainwater shall discharge to one of the following, listed in order of priority:

- An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
- A watercourse; or where that is not reasonably practicable
- A sewer.

5.11. As infiltration is considered to be a viable method of disposal, the surface water drainage proposals will be designed to attenuate runoff with discharge into the ground.

5.12. Implementation of SuDS will ensure that flood risk downstream is not increased due to the proposed development. These features will also provide positive improvements to the quality of surface water runoff.

5.13. The following SuDS components are deemed applicable to the Site:

- Pervious surfacing systems – structural surfaces that allow water to penetrate into a granular layer thus providing storage and treatment, e.g. pervious paving.
- Infiltration systems – components that facilitate the infiltration of water into the ground, e.g. soakaways.
- Conveyance systems – components that convey flows to downstream storage systems, e.g. swales and filter drains.
- Storage systems – components that control flow, and possibly volumes, by storing water and releasing it slowly, e.g. geocellular units, attenuation basins and wetlands.
- Treatment systems – components that remove or facilitate the degradation of contaminants present in runoff, e.g. filter strips and proprietary treatment systems.

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Pre and Post Development Rates / Areas

5.14. To quantify any potential increase in surface water runoff, the existing Greenfield/Pre-Development runoff rate from the Site must be determined. The rates of runoff have been determined using the current 'industry best practice' guidelines as outlined in the Interim Code of Practice for SuDS. The recommended methodology for sites up to 50 hectares in area is the ICP SuDS method.

5.15. An assessment of existing surface water runoff has been undertaken, to determine the potential surface water options and attenuation requirements for the site utilising the following parameters.

- Catchment Area: 1 ha (to determine a l/s/ha discharge rate)
- Average Annual Rainfall (SAAR): 720mm/year
- Soil: 0.300
- Region No.: 7

5.16. Greenfield run off calculations for the existing site provided in the appendix show the following discharge rates:

Pre-Development Runoff Rates/Volumes

Annual Probability	Greenfield/Pre-Development Runoff Rate per Hectare (l/s/ha)
1 in 1 year event	1.60
QBar	1.88
1 in 30 year event	4.33
1 in 100 year event	6.01

5.17. The existing site is predominantly Greenfield. Therefore, any development will increase the impermeable area and surface water run off.

5.18. Based on the Illustrative Masterplan, it has been measured that the impermeable surfaces is approximately 2.70 ha.

5.19. Urban Creep is the conversion of permeable surfaces to impermeable over time through individual dwellings adding items such as extra parking spaces, extensions, conservatories, etc. In accordance with Arun Policy and The SuDS Manual (CIRIA 753) this can be up to 10% dependent on density applied to impermeable area within the property curtilage only. As a general rule by applying 5% to the total site impermeable area is far greater than just applying 10% to individual properties. Therefore, the inclusion of an additional 5% to the overall impermeable area in all calculations provides for all future Urban Creep. As the design develops this will be turned into a more accurate figure by applying Urban Creep to individual properties but, as this will be far less than the overall 5% provided, a robust assessment of rates and areas is provided at this time, in line with Arun DC Policy.

5.20. In order to comply with best practice as stipulated in EA Report SC030219 'Rainfall Runoff Management for Developments', proposed discharge rates should be restricted to one of two methods for all storms up to and including the 1 in a 100 year storm event plus a 40% upper end allowance for climate change.

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5.21. This is either the Variable Greenfield discharge rates, with Long Term Storage method or restricting all rates to the estimated mean greenfield runoff rate (QBar). This is the preferred method for Arun DC.

5.22. However, in the first instance, with infiltration a viable method according to the onsite investigations, all surface water drainage will discharge via infiltration, in line with Arun DC Policy.

Surface Water Proposals

5.23. A surface water management strategy for the proposed development has been developed to manage and reduce the flood risk posed by the surface water runoff from the site. The drainage system for the proposed development will manage and reduce the flood risk posed by the surface water runoff from the site.

5.24. It is proposed to provide a network of trapped gullies, pipes and Sustainable Drainage (SuDS) features to collect the surface water runoff from impermeable areas such as roads, roofs and driveways. The traditional system will work in combination with such features as permeable paving and attenuation features in tandem with cellular storage to provide attenuation storage and high-quality water benefits.

5.25. The banks of SuDS basins will be designed in accordance with the SuDS Manual C753 in respect to having a maximum gradient of 1 in 4 and an appropriate freeboard above the maximum water level. This allows landscaping of both wetland and wildflower mixes to provide an appropriate landscape context in the vicinity of the features through the provision of an aquatic shelf.

5.26. The development could utilise Source Control techniques (such as swales and granular strips) which assist with the reduction of larger attenuation storage features, should space allow as the design develops.

5.27. Open SuDS features will be designed so as not to compromise the safety of residents, visitors and their property. Generally open boundaries are provided, and perimeter planting could be utilised to define the extents of the features.

5.28. All conveyance systems will be designed to cater for the 1 in 30 year storm event, in accordance with industry standard, with all attenuation and infiltration features designed to allow for the 1 in 100 year storm event plus 40% climate change allowance.

5.29. In accordance with Arun DC Policy all infiltration devices are designed to allow the 1 in 10 year storm event plus climate change to be below the incoming pipe invert level, using FEH 13 rainfall data and the inclusion of a suitable Factor of Safety. Utilising a Cv of 0.75, as FEH rainfall is used, the factor of Safety is proposed to be 5 for areas in excess of 1,000m^3.

5.30. The proposals draw reference to the DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, as well as CIRIA C753 The SuDS Manual.

5.31. This proposal identifies the principal components of the surface water strategy and is subject to further detailed localised investigations as part of any subsequent Reserved Matters applications. These assumptions are subject to evolution as the design develops.

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Exceedance Flood Routing

5.32. Flows in excess of the above design storms, which may flood from the network, will be kept within the internal road network, until such time as they can be directed into adjacent landscaping areas. This ensures that onsite or offsite residential units are afforded an increased level of protection from flood waters until such time as the rain events become significant.

Water Quality Improvements

5.33. CIRIA report C753 The SuDS Manual outlines the methodology for assessing water quality risks associated with new development. This is a simple index approach which provides a high level scoping analysis of the land usage and gives guidelines for appropriate treatment stages.

5.34. This process identifies features necessary to provide adequate substance removal in line with Environment Agency requirements. This is a three step process of Allocation, Mitigation and Review.

5.35. Surfaces generating runoff are 'graded' on their potential to contribute to various harmful pollutants and gives each surface a risk of pollution from each element. An extract of Table 26.2 within the SuDS Manual is set out below.

Extract from Table 26.2 SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Other Roofs	Low	0.3	0.2-0.8	0.05
Low traffic residential roads and non-residential parking with infrequent change.	Low	0.5	0.4	0.4
Commercial yard, parking with frequent change, other roads,	Medium	0.7	0.6	0.7
Sites with heavy pollution	High	0.8	0.8	0.9

5.36. The use of non-mechanical features decreases the requirements for maintenance and increase natural biodiversity. That said, the SuDS Manual does not remove the possibility of utilising separators, so long as they are considered in partnership with a comprehensive overall SuDS regime.

5.37. Without adequate treatment, the pollutants would cause damage if they were to enter the watercourse or water table in large volumes. The use of SuDS features to slow down and degrade these pollutants is critical to the provision of an acceptable discharge.

5.38. The respective cleansing abilities of common SuDS features are given by corresponding mitigation indices within the SuDS Manual. An extract of Table 26.3 is set out below.

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Extract from Table 26.3 SuDS Manual

Type of SuDS component	Total Suspended Solids	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
Bioretention system	0.8	0.8	0.8
Permeable Paving	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

5.39. The individual pollution indices are totalled, with the first SuDS component utilising its full value and subsequent downstream SuDS features acting with 50% efficiency. This provides a realistic strategy which mimics the reduced cleansing effectiveness as the concentration of a pollutant decreases along the SuDS train.

5.40. In line with Environment Agency guidance, before the design phase is concluded, the proposals are reviewed and analysed in order to identify potential shortcomings and to ensure that adequate volume of SuDS features are provided to mitigate the risk of pollution from each source.

SuDS Maintenance Strategy

5.41. For the water treatment effects of SuDS features to remain effective, a comprehensive maintenance strategy should be implemented.

5.42. During construction, maintenance of SuDS features should be undertaken by the Contractor. Upon completion, the assets should be passed over to the Management Company, statutory authority, or community group commissioned to maintain the features in perpetuity.

5.43. As part of the strategy, a regular maintenance regime will be created, which consists of several primary measures required to ensure the longevity of the system. These should be undertaken on a regular basis to ensure consistent performance. Typical maintenance activities consist of:

- Inspecting and reporting; relatively regular review of the condition identifying issues and providing resolutions. Periodic review from the maintenance contractor;
- Litter and debris removal;
- Grass trimming, overall cutting and localised strimming preventing blockages;
- Weed and evasive plant control;
- Shrub management;

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- Aquatic and shoreline vegetation management;
- Sweeping pervious surfaces; and
- Oil removal from proprietary systems.

5.44. A remedial maintenance schedule would be recommended as part of the handover of the SuDS features, remedial maintenance is required to provide repairs to the system and monitor long term damage ensuring the system remains consistently productive. the schedule could consist of;

- Structure rehabilitation and repair;
- Infiltration surface rehabilitation;
- Scarifying to remove "Thatch";
- Spiking or Tining the soil, which assists with aeration;
- Air pressure treatment.

5.45. The maintenance schedule contents and timing will depend upon multiple factors including usage, contents of water utilising the system, location and biology. To this end, it is suggested that the schedule be finalised as part of detailed design; ensuring the most comprehensive maintenance schedule is incorporated for the phase in hand.

5.46. Community outreach can be undertaken as part of the development, which will raise awareness on the importance of SuDS to both flood risk and water quality in the local area. Imparting the new residents with knowledge on the risks associated with pollution to the surface water drainage system is key, as is the direct effect their actions may have on water quality and biodiversity in the area.

Adoption and Ownership

5.47. The drainage system is designed to the appropriate standards including the new Sewerage Sector Guidance (SSG), the Building Regulations and the requirement of the National Planning Policy Framework

5.48. The intention of adoption and ownership of drainage and SuDS is as follows:

- Surface water sewers within development parcels to be offered for adoption to Southern Water under the Section 104 process of the Water Industry Act.
- Surface water highway drains, gullies and leads within adopted roads to be maintained by the Highway Authority.
- Above ground attenuation (i.e. swales and basins) within development parcels to be offered for adoption to either the Local Authority or ownership under a management company.
- SuDS features serving single properties, for example, permeable paved driveways to single dwellings, will be owned and maintained by the owner of that property.

5.49. Suitable adoption and maintenance regimes for SuDS should be submitted in support of the Reserved Matters application.

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6.0 Foul Water Drainage

Introduction

6.1. This chapter provides details on the proposed foul water drainage strategy and measures to convey effluent.

Overall Strategy

6.2. Due to the topography of the site and location of the existing foul sewer point of connection, wastewater from the site will require pumping to the receiving public sewer.

6.3. The nearest current point of connection is likely to be into the existing pumping station to the north of the site in the existing gold complex. This is an adopted Southern Water pumping station which utilises the aforementioned 450mm rising main which flows in a north south direction through the eastern parcel.

6.4. Southern Water existing manhole 6502, which enters the pumping station from the east, is approximately 4m deep with similar cover levels to the eastern parcel. It is therefore likely a gravity connection is viable to serve the complete eastern parcel.

6.5. It is, however, unlikely the whole of the western parcel can enter manhole 6502 by gravity. It is proposed an onsite pumping station is located in the western parcel to pump flows, that cannot fall by gravity to the Southern Water pumping station, into the gravity system in the eastern parcel.

6.6. Discussions are ongoing with Southern Water regarding the extent of additional off-site sewers or improvements to existing sewers that will be required to provide sufficient capacity to service the development.

6.7. Notwithstanding this, the delivery of the proposed on-site foul water sewers will be designed in collaboration with Southern Water as approving body in accordance with the new Sewerage Sector Guidance (SSG) and will be offered to Southern Water for adoption under S104 Agreement of the Water Industry Act. The connection to the existing public sewer system will be made via a S106 Agreement of the Water Industry Act with Southern Water as part of the overall adoption process.

Adoption and Ownership

6.8. The drainage system is designed to the appropriate standards including the new Sewerage Sector Guidance (SSG), the Building Regulations and British Standards.

6.9. Foul water sewers within the development are to be offered for adoption to Southern Water under the Section 104 process of the Water Industry Act 1991.

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7.0 Development Suitability

Introduction

7.1. This chapter assesses the suitability of the development proposals in the context of on and off-site vulnerability.

Assessment

7.2. This site-specific Flood Risk Assessment demonstrates that the Development satisfies the requirements of NPPF and can be justified in the proposed location by:

- meeting the criteria set out in NPPF;
- assessing the risk posed to the site from flood events;
- assessing the risk posed to the site from the site storm water generation and the site storm water runoff management; and
- assessing the risk the site poses to increase in flooding elsewhere.

7.3. Specifically, it has demonstrated:

- The detailed Fluvial flood map, for fluvial sources, provided by the GOV.UK's Flood Map for Planning indicate that the site area is entirely located with Flood Zone 1; assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%).
- Whilst the detailed flood map provided by GOV.UK indicates minimal pluvial flooding within the site, any future risk of pluvial flooding will be mitigated by the development and drainage regime.
- That a detailed review of available data indicates a low risk from secondary flooding sources, such as groundwater, sewers, reservoirs or canal.
- Through the provision of a positive drainage network attributed to the Development, pluvial flooding to offsite receptors will be significantly reduced.
- Exceedance flows can be safely accommodated within the Development.

Conclusion

7.4. The proposed surface water drainage strategy will manage the flood risk posed by uncontrolled surface water runoff from the Site. Any increase in surface water run-off can be managed using SuDS source control techniques as well as attenuation features to provide storage in extreme storm events.

7.5. All surface water drainage systems will be designed to discharge surface water into the ground and store the balance of water for all events up to and including the 1 in 100 year event including allowance for a 40% increase in rainfall intensities as a result of climate change and urban creep.

7.6. The surface water design is fully compliant with Arun District Councils Policies and recommendations.

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7.7. The proposed foul water drainage strategy presents a robust, viable method of conveyance of effluent to the public sewerage system.

7.8. Overall, the Site should not be precluded on flood risk grounds as the Development will not be at risk from existing sources and will not result in an increase in flooding downstream.

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Appendices

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Appendix 1 – Drawings

Preliminary Drainage Strategy

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GENERAL NOTES:

1. Do not scale.
2. Refer to all other Project Drawings.
3. All sewers to comply with the requirements of the Design and Construction Guidance together with Southern Waters Addendum.
4. All public sewers are to be the subject of a Section 104 agreement of the Water Industry Act 1991.
5. Invert levels of existing manholes and sewers are to be checked on site before construction commences and results reported to engineers.
6. All manhole ironworks to comply with BS EN124, and be stamped with BSI Kitemark. Covers to suit loading as below;
   - -Carriageways and Roads - D400
   - -Driveways and Verges - C250
   - -Footways and Pedestrian Areas - B125
   - -Gardens/Landscaping - A15
7. All sewer pipes, up to, and including 225mm are to be vitrified clay to BS EN295. All sewer pipes 300mm diameter and above to concrete pipes to BS EN1916.
8. All drainage shall be installed and tested strictly in accordance with the Manufacturers' printed instructions, BS EN 752, BS EN 1601, Local Water Authority requirements and the Building Regulations.
9. All bedding shall be Class S unless noted otherwise.
10. All trenches under existing and proposed public highways are to be backfilled with thoroughly compacted Type 1 granular sub-base material.
11. Drainage laid beneath roads and areas of vehicular access (car parking etc) with less than 1200mm of cover shall be encased in concrete bed and surround with associated movement joints. Drainage laid beneath paths, footways and pedestrian areas with less than 900mm of cover shall be similarly treated.
12. Chambers with outgoing pipes greater than 600mm diameter shall be fitted with guard bars, safety chains or other approved safety devices.
13. The use of precast concrete products made with sulphate resisting cement is mandatory, unless a laboratory report proves such precautions are not necessary.
14. All gully connections to use a minimum diameter pipe of 150mm and to be surrounded by a minimum of 150mm of grade C8/C10 concrete over its full length (which should not exceed 15m) and its connection to the carrier system.
15. All laterals to be 150mm laid at 1:80 (surface), 1:60 (foul) unless otherwise noted.

DRAINAGE NOTES:

1. Do not scale.
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3. All drainage to be in accordance with Document H of the Building Regulations, together with NHBC Standards Chapter 5.3 & BS8301.
4. All private drains to be 100mm diameter unless stated otherwise.
5. Where pipes pass through footings, retaining or screen walls, lintels to be provided over drains.
6. Where inverts are less than 0.6m deep, inspection chambers (min dia 190mm) or access fittings (225x100mm) to be used, elsewhere proprietary plastic, brick or pcc ics to be used (sized in accordance with table 11 of Approved Document H).
7. All gullies connected direct to drains to be roddable.
8. Rainwater downpipes to be easily removable for rodding or to be provided with rodding access at ground level.
9. Unless noted otherwise FW ICs & REs to be 0.6m below DPC level, SW ICs & REs to be 0.45m.
10. Adequate precautions in accordance with Approved Document H and manufacturer´s recommendations to be taken to protect drains (particularly plastic) at shallow depths.

KEY

FOUL STORM

- Proposed adoptable sewer & MH
- Proposed Catchpit Manhole
- Highway gully and 150mmØ connection
- Rising Main
- Storage Crates
- Proposed road contours (major at 100mm intervals, minor at 25mm intervals)
- (G)42.50 Proposed DPC Level. (G) denotes Garage

Rev	Date	Description	Drawn	Checked
C	02.22	Updated as per latest layout	CB	SM
B	09.21	Updated following Arun D.C. comments	JS	SM
A	05.21	First Issue	CB	SM

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Project
RUSTINGTON GOLF
CENTRE, ANGMERING

Title
RESERVED MATTERS
DRAINAGE LAYOUT
SHEET 1

Status
PRELIMINARY

Scale	Date	Drawn	Checked
1:500 @ A1	MAY 2021	JS	SM

Drawing No: A351-PLN-1-4051
Revision: C

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KEY

FOUL STORM

Proposed adoptable sewer & MH

Proposed Catchpit Manhole

Highway gully and 150mmØ connection

Rising Main

Storage Crates

Proposed road contours (major at 100mm intervals, minor at 25mm intervals)

(G)42.50 Proposed DPC Level. (G) denotes Garage

Rev	Date	Description	Drawn	Checked
C	02.22	Updated as per latest layout	CB	SM
B	09.21	Updated following Arun D.C. comments	JS	SM
A	05.21	First Issue	CB	SM

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Title
RESERVED MATTERS
DRAINAGE LAYOUT
SHEET 2

Status
PRELIMINARY

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KEY

STORM

- Proposed adoptable sewer & MH
- Highway gully and 150mmØ connection
- Drainage areas assumed 55% impermeable
- Drainage areas assumed 100% impermeable

Gross .2292ha - Total Area
Net 0.127ha - Impermeable area
0.55 - impermeability factor
S2-2 - Manhole accomodating area

Rev	Date	Description	Drawn	Checked
B	02.22	Updated to latest layout	JS	SM
A	09.21	First issue	JS	SM

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Project
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Title
RESERVED MATTERS
DRAINAGE AREAS LAYOUT
SHEET 1

Status
PRELIMINARY

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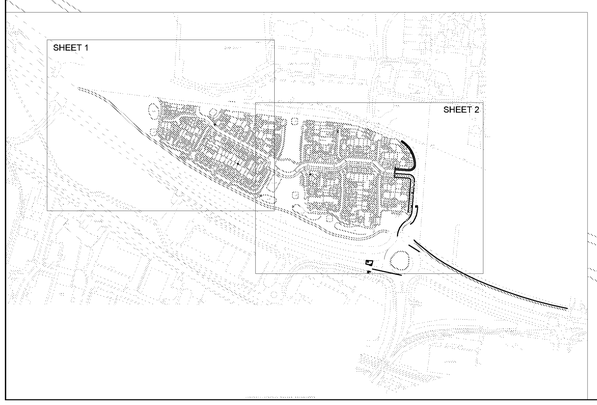

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   - -Footways and Pedestrian Areas - B125
   - -Gardens/Landscaping - A15
7. All sewer pipes, up to, and including 225mm are to be vitrified clay to BS EN295. All sewer pipes 300mm diameter and above to concrete pipes to BS EN1916.
8. All drainage shall be installed and tested strictly in accordance with the Manufacturers' printed instructions, BS EN 752, BS EN 1601, Local Water Authority requirements and the Building Regulations.
9. All bedding shall be Class S unless noted otherwise.
10. All trenches under existing and proposed public highways are to be backfilled with thoroughly compacted Type 1 granular sub-base material.
11. Drainage laid beneath roads and areas of vehicular access (car parking etc) with less than 1200mm of cover shall be encased in concrete bed and surround with associated movement joints. Drainage laid beneath paths, footways and pedestrian areas with less than 900mm of cover shall be similarly treated.
12. Chambers with outgoing pipes greater than 600mm diameter shall be fitted with guard bars, safety chains or other approved safety devices.
13. The use of precast concrete products made with sulphate resisting cement is mandatory, unless a laboratory report proves such precautions are not necessary.
14. All gully connections to use a minimum diameter pipe of 150mm and to be surrounded by a minimum of 150mm of grade C8/C10 concrete over its full length (which should not exceed 15m) and its connection to the carrier system.
15. All laterals to be 150mm laid at 1:80 (surface), 1:60 (foul) unless otherwise noted.

DRAINAGE NOTES:

1. Do not scale.
2. Refer to all other Project Drawings.
3. All drainage to be in accordance with Document H of the Building Regulations, together with NHBC Standards Chapter 5.3 & BS8301.
4. All private drains to be 100mm diameter unless stated otherwise.
5. Where pipes pass through footings, retaining or screen walls, lintels to be provided over drains.
6. Where inverts are less than 0.6m deep, inspection chambers (min dia 190mm) or access fittings (225x100mm) to be used, elsewhere proprietary plastic, brick or pcc ics to be used (sized in accordance with table 11 of Approved Document H).
7. All gullies connected direct to drains to be roddable.
8. Rainwater downpipes to be easily removable for rodding or to be provided with rodding access at ground level.
9. Unless noted otherwise FW ICs & REs to be 0.6m below DPC level, SW ICs & REs to be 0.45m.
10. Adequate precautions in accordance with Approved Document H and manufacturer´s recommendations to be taken to protect drains (particularly plastic) at shallow depths.

KEY

STORM

- Proposed adoptable sewer & MH
- Highway gully and 150mmØ connection
- Drainage areas assumed 55% impermeable
- Drainage areas assumed 100% impermeable

Gross .2292ha - Total Area
Net 0.127ha - Impermeable area
0.55 - impermeablity factor
S2-2 - Manhole accomodating area

Rev	Date	Description	Drawn	Checked
B	02.22	Updated to latest layout	JS	SM
A	05.21	First Issue	CB	SM

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Client
BARRATT
DAVID WILSON HOMES

Project
RUSTINGTON GOLF CENTRE, ANGMERING

Title
RESERVED MATTERS
DRAINAGE AREAS LAYOUT
SHEET 2

Status
PRELIMINARY

Scale	Date	Drawn	Checked
1:500 @ A1	MAY 2021	JS	SM

Drawing No: A351-PLN-1-4054
Revision: B

Appendix 2 – Documents

Arun District Council Surface Water Drainage Proposal Checklist

Ground Water Monitoring

Infiltration Testing

ARUN DISTRICT COUNCIL A/45/22/PL

Surface Water Drainage Proposal Checklist

Ground Investigation Results					
Results Required	**Results Provided?**				
Winter groundwater monitoring results (Please refer to guidance note 1 below)	**Yes**				
Period of winter groundwater monitoring Note 1	**From**	10/03/2021			
	To	25/03/2021			
Maximum recorded groundwater level	Various				**mAOD** **mBGL**
Winter infiltration test results Note 2	**Yes**				
Date of winter infiltration testing	22/10/03/2021				
Details of the location and depth of the infiltration testing Note 3	**Yes**				
Minimum infiltration rate Note 4	Various				**m/s**

Guidance Notes

1. A full winters groundwater monitoring should be undertaken, (October to March inclusive) to enable the peak annual groundwater levels to be established. The extent of winter monitoring for developments of less than 5 properties should be discussed with the council's Engineers.
2. Infiltration testing should be undertaken during the wet winter months (typically January) and in line with BRE365, or a similar approved method. Tests should be repeated 3x, to replicate saturated ground conditions. Please note that infiltration testing is to be carried out at a time and depth agreed with the Councils engineers.
3. Infiltration testing should be undertaken at the location and depth of any proposed infiltration structures. This must be above the maximum recorded groundwater level in that vicinity.
4. The minimum infiltration rate obtained at the location and depth of the proposed infiltration structures should be used to inform the design of the structures.

Proposed Method of Surface Water Disposal				
Infiltration On-site, via soak-away structures	**Yes**			
If on-site infiltration is not to be used, has justification for this been provided? Note 5	**Yes**		**No**	
Attenuation (on-site) with a **restricted discharge to a watercourse** on, or adjacent to, the site			**No**	
Attenuation (on-site) with a **restricted discharge to a surface water sewer** on, or adjacent to, the site			**No**	
Attenuation (on-site) with a **restricted discharge to a foul water sewer** on, or adjacent to, the site			**No**	

Guidance Notes

5. If on-site infiltration is not being used to drain the site you will need to provide evidence that demonstrates on-site infiltration is unviable.

Version 3.0 (20.11.2019)

Drainage Design: Supporting Calculations						
	Calculations Required	Calculations Provided?				
Infiltration Structures	Half-drain time for 10 year event (plus climate change allowance)	Yes				
		Various				Hours
	Half-drain time for 100 year event (plus climate change allowance)	Yes				
		Various				Hours
	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7	Yes				
	Lowest base level of infiltration structure	Various				mAOD mBGL
	Has the design sought to provide treatment of potential contaminants? E.g. hydrocarbons.	Yes				
Attenuation and Subsequent Restricted Discharge	Pre-development run-off rate calculations	Yes				
						l/s
	Proposed discharge rate Note 6					l/s
	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7	Yes				
	Has the design sought to provide treatment of potential contaminants? E.g. hydrocarbons.	Yes				
	If your proposed scheme incorporates any impermeable lined attenuation features we require calculations to demonstrate that appropriate resistance to floatation (due to groundwater levels) is catered for in the design			No		
	If you propose discharging into or altering an ordinary watercourse; have you sought Ordinary Watercourse/Land Drainage Consent? Note 8			No		
	If discharging to a watercourse, piped system or the sea, has the proposed drainage network been modelled against predicted top water levels for the 1 in 100 year storm event plus climate change allowance, within the existing system? Note 9			No		

Guidance Notes

6. Any proposed discharge rate must be less than, or equal to, the pre-development rate. Greenfield sites must use the mean flow rate (Qbar) and be based upon the area occupied by the development, ignoring significant open spaces. Please note that the minimum acceptable discharge rate is 2l/s when using formal flow control devices, unless otherwise agreed. Additionally, if you are developing a brownfield site, we expect you to provide fully detailed plans of the existing surface water drainage arrangements on site, including impermeable areas, gullies, outfalls, pipes & diameters, manholes, etc. We generally seek 50% betterment in terms of run off from brownfield sites.

7. The appropriate factor of safety from the table below must be applied to your calculations to ensure your design is fully in accordance with CIRIA R156/ CIRIA C753.

Factor of Safety Table						
Size of Area to be Drained	Consequences of failure					
	No damage or inconvenience		Minor inconvenience, e.g. surface water on car park		Damage to buildings or structures or roads.	
	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75
<100 m^2	1.5	2	2	3	10	13
100m^2 to 1000m^2	1.5	2	3	4	10	13
>1000m^2	1.5	2	5	6.5	10	13

8. Ordinary Watercourse/Land Drainage Consent will need to be sought, ideally in parallel with planning permission, if you propose discharging into, culverting or altering a watercourse.
9. Modelling is required to ensure that problems, such as surcharged outfalls, are addressed.

Plans/Drawings/Diagrams				
Required	**Provided?**			
Plan detailing the location of groundwater monitoring and infiltration testing	**Yes**			
Detailed drainage layout plan Note 10	**Yes**			
Construction detail plans Note 11	**Yes**			
Exceedance flow route plans Note 12			**No**	
Impermeable area plan			**No**	
If ground levels are being raised ≥ 300mm above existing levels and is unavoidable, have fully detailed plans been provided, together with drainage proposals, to address any potential drainage related issues.	**Yes**			

Guidance Notes

10. Drainage layout plans should include:

- All surface water drainage pipes labelled with; diameters, pipe materials, falls and invert levels.
- All infiltrating and attenuating structures (including permeable paving) labelled with; dimensions, invert and cover levels.
- All manholes labelled with; cover levels, invert levels, cover types detailed.
- All silt traps clearly labelled with sump depths.
- Control structures with outflow rates and invert levels.
- Proposed/existing levels of any areas subject to ground raising, together with suitable measures/detailed drawings for the associated management of surface water runoff. Please note that ground raising should be avoided unless there are exceptional circumstances.

11. Site specific construction detail plans should be supplied if your proposed drainage scheme includes any of the following elements: pipe bed and surround; infiltrating structures; attenuating structures; manholes; catch-pits/silt traps; control devices; permeable paving; headwalls.

12. Unless specifically requested by the council's drainage engineers 'Exceedance Flow Route Plans' are only required for developments of more than 5 residential properties or more than 0.5ha of commercial development .

RSK Unit 28
Abbey Enterprise Centre
Premier Way
Romsey
SO51 8AQ
UK

[redacted]

Our Ref: 3050199 L02 (00)

27th May 2021

BDW House
Guildford
Surrey
GU1 4 SW

For the attention of Mr Sean Havis

Dear Sean,

RE: RUSTINGTON GOLF COURSE, SUPPLEMENTARY GROUNDWATER MONITORING

1. INTRODUCTION

RSK Environment Limited (RSK) was commissioned by Barratt David Wilson (BDW) Southern Counties to carry out supplementary groundwater monitoring at the Rustington Golf Course, Angmering, West Sussex.

The Site location and current site layout are shown on **Figures 1** and **2**, respectively. The Site covers an area of c. 7.5 hectares. It is currently occupied by the Rustington Golf Centre. The golf centre infrastructure itself is located immediately north of the site in question.

British Geological Survey (BGS) mapping indicates the site is underlain by the River Terrace Deposits Undifferentiated, comprising sand, silt and gravel, over the New Pit Chalk Formation. The Raised Beach Deposits, composed of sand and gravel, are also shown to overlie the River Terrace Deposits in the west of the site.

This letter report is subject to the service constraints laid out in **Appendix A**.

2. SITE INVESTIGATION METHODOLOGY

RSK carried out intrusive investigation work on 4th March 2021, which comprised advancing 6No. window sample boreholes to depths of 5 m and 6 m bgl and groundwater monitoring wells were installed within all locations.

Subsequently RSK have undertaken three groundwater monitoring visits during the period of March 2021 to provide indicative information on winter groundwater levels, and this letter summarises the findings.

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3. GROUND CONDITIONS

The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, list of samples taken, field observations of soil and groundwater and details of monitoring well installations are included on the exploratory hole records presented in **Appendix B**.

The ground conditions encountered during the fieldworks are summarised in **Table 1** with the strata discussed in subsequent subsections.

Table 1 General succession of strata encountered

Stratum	Exploratory holes encountered	Depth to top of stratum m bgl	Thickness (m)
River Terrace Deposits Undifferentiated / Raised Beach deposits	All	GL	1.15 to 4.10
New Pit Chalk Formation	All	1.15 to 4.10	1.90 to 3.85 *
*thickness not proven			

3.1 River Terrace Deposits Undifferentiated / Raised Beach deposits

Superficial deposits of the River Terrace Deposits Undifferentiated / Raised Beach deposits were encountered to depths ranging between 1.15 m and 4.10 m. Generally, in the west of the site (WS01 to WS03) the superficial deposits comprised Light brown slightly clayey slightly gravelly sandy SILT (WS01 where clay was absent) or Brown orange and black mottled slightly gravelly slightly sandy SILT over Light brown orange and black mottled slightly sandy slightly gravelly CLAY. In the east of the site (WS04 to WS06) the superficial deposits generally comprised dark brown slightly sandy SILT interbedded with Brown black mottled slightly clayey silty fine SAND, grading into Light orangish brown very gravelly fine to coarse SAND.

Due to the nature of the superficial deposits on the site, it was not possible to differentiate between the River Terrace Deposits Undifferentiated and the Raised Beach Deposits without further classification testing.

3.2 New Pit Chalk Formation

The New Pit Chalk Formation generally comprised Light brownish cream CHALK recovered as sandy gravelly SILT and rare flint, becoming slightly silty sandy very angular to subangular fine to coarse GRAVEL of frequent chalk and rare flint. In the east of the site, the sandy gravelly SILT component of the New Pit Chalk Formation was largely absent and may be associated with the deeper overlying superficial deposits in this area.

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4. GROUNDWATER

4.1 Groundwater during intrusive investigation

Groundwater was encountered within borehole locations WS01, WS05 & WS06 during the intrusive investigation.

Table 2 summarises the groundwater strikes during the fieldworks.

Table 2 Groundwater strikes

Location	m bgl (mAOD)
WS01	3.57 (1.60)
WS02	Not Observed
WS03	Not Observed
WS04	Not Observed
WS05	3.52 (2.88)
WS06	4.11 (2.58)

5. MONITORING WELL INSTALLATION

Monitoring wells were installed within each of the intrusive locations and comprised a 50 mm plain/slotted pipe with geosock and gravel anulus.

Table 3 summarises the response zones for each monitoring well installation.

Table 3 Monitoring Well Response Zone

Location	Top of Response Zone Depth m (Level mAOD)	Base of Response Zone Depth m (Level mAOD)	Base of Well Installation Depth m (Level mAOD)	Response Zone Stratum
WS01	2.00 (3.17)	5.00 (0.17)	5.00 (0.17)	Chalk
WS02	2.00 (3.62)	5.00 (0.62)	5.00 (0.62)	Base of clay / Chalk
WS03	2.00 (4.84)	5.00 (1.84)	5.00 (1.84)	Base of clay / Chalk
WS04	2.00 (4.80)	5.00 (1.80)	5.00 (1.80)	Sand / Chalk
WS05	2.00 (4.40)	6.00 (0.40)	6.00 (0.40)	Silt / Sand / Chalk
WS06	2.00 (4.00)	5.00 (1.00)	5.00 (1.00)	Silt / Chalk

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6. RETURN MONITORING VISIT RESULTS

Table 4 summarises the groundwater levels encountered during the three return groundwater monitoring visits over the course of a two-week period during March 2021.

Table 4 Groundwater monitoring results

Location (Ground elevation mAOD)	13/03/21 m bgl (mAOD)	17/03/21 m bgl (mAOD)	25/03/21 m bgl (mAOD)
WS01 (5.17)	3.61 (1.55)	3.38 (1.78)	Not accessible
WS02 (5.62)	4.00 (1.62)	4.00 (1.62)	3.73 (1.89)
WS03 (6.84)	DRY	DRY	DRY
WS04 (6.80)	DRY	DRY	DRY
WS05 (6.40)	4.58 (1.82)	4.15 (2.25)	4.57 (1.83)
WS06 (6.00)	4.12 (1.88)	3.65 (2.35)	4.1 (1.90)

We trust that the information provided above meets your requirements. Should you have any queries or require additional information, please do not hesitate to contact the undersigned.

Yours sincerely,

For RSK Environment Limited

[redacted]

Caroline Anderson

Principal Geotechnical Engineer

Nigel Austin

Director

Enc.

Figure 1	Site Location Plan
Figure 2	Exploratory Hole Location Plan
Appendix A	Service Constraints
Appendix B	Exploratory Hole Logs

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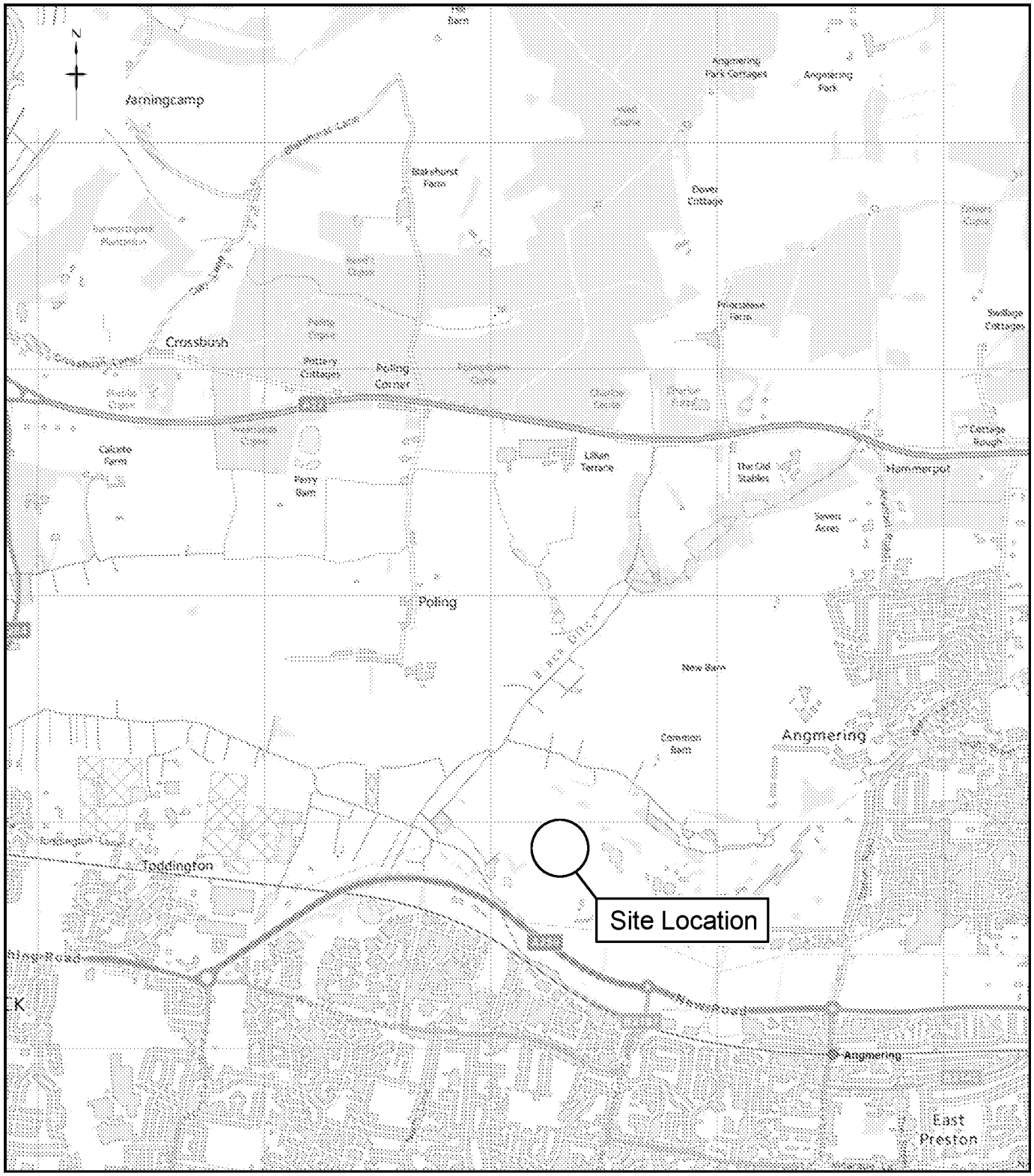
FIGURES



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Client: BDW SOUTHERN COUNTIES

Project Title: RUSTINGTON GOLF COURSE, ANGMERING

Drawing Title: SITE LOCATION PLAN

Rev	Drawn	Date	Checked	Date	Approved	Date
01	HG	14.04.21	RJ	14.04.21	RJ	14.04.21

Dimensions	Scale	Original Size
m	1:25,000	A4

Project Number	Drawing File	Drawing Number
305199 - R01 (00)	305199 (R01-00) Figure 1.dwg	FIGURE 1

LEGEND

- Site Boundary
- Window Sample Location

N

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client

BDW HOMES SOUTHERN COUNTIES

Project Title

RUSTINGTON GOLF COURSE

Drawing Title

EXPLORATORY HOLE LOCATION PLAN

Drawn Date	Checked Date	Approved Date
DD 14/05/21	PRELIMINARY	PRELIMINARY

Scale	Orig Size	Dimensions
N/A	A3	

Project No.	Drawing File
305199	305199-RGC-EHLP-1(00)

Drawing No.	Rev.
305199-RGC-EHLP-1(00) Sheet 1 of 1	

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APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Barratt David Wilson Southern Counties (the "Client") in accordance with the terms of a contract between RSK and the Client. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.
2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas, persistent, bioaccumulative or toxic chemicals (including PFAS/ PFOS) or other radioactive or hazardous materials, unless specifically identified in the Services.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation,

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obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.

b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.

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

10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.

12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

ARUN DISTRICT COUNCIL A/45/22/PL

APPENDIX B
EXPLORATORY HOLE LOGS

ARUN DISTRICT COUNCIL A/45/22/PL

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**5.17**	**E:505302.1 N:103517.2**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							Grass over soft brown slightly sandy SILT with rare subangular to subrounded fine to coarse gravel of flint and occasional rootlets. Sand is fine. (TOPSOIL)	4.77	(0.40) 0.40	
	0.50 0.50	ES1	ES PID	0.0ppm			Light brown slightly clayey slightly gravelly sandy SILT. Sand is fine. Gravel is subangular to subrounded fine to coarse flint. (RIVER TERRACE DEPOSITS)		(0.75)	
	1.00 1.00	ES2	ES PID	545.5ppm				4.02	1.15	
							Structureless CHALK recovered as light brownish off white sandy gravelly SILT. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse frequent chalk and rare flint. (NEW PIT CHALK FORMATION)		(1.45)	
	2.00 2.00	ES3	ES PID	90.2ppm				2.57	2.60	
							Structureless CHALK recovered as slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse chalk and rare flint. (NEW PIT CHALK FORMATION)		(2.40)	
	3.00 3.00	ES4	ES PID	1.2ppm						
	4.00 4.00	ES5	ES PID	55.9ppm						

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Location cleared using GPR and a CAT and genny prior to breaking ground.
2. Inspection pit hand dug to 1.20mbgl.
3. Groundwater encountered during drilling at 3.57mbgl.
4. 50mm diameter groundwater monitoring well complete with flush protective cover installed to 5.00m depth on completion. Response zone 1.50m to 5.00m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	AGS

GEOTECHNICAL_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log WINDOW SAMPLE LOG - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 27/05/21 - 14:04 | WC2 |

FINAL

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**5.17**	**E:505302.1 N:103517.2**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							Structureless CHALK recovered as slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse chalk and rare flint. (NEW PIT CHALK FORMATION) *(stratum copied from 2.60m from previous sheet)*	0.17	5.00	
	5.00 5.00	ES6	ES PID	2.5ppm			Borehole terminated at 5.00mbgl.			

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**5.62**	**E:505426.9 N:103405.4**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
	0.50 0.50	ES1	ES PID	0.5ppm			Grass over orangish brown mottled dark brown slightly gravelly slightly sandy SILT with occasional rootlets. Sand is fine. Gravel is angular to subrounded fine to coarse flint. (TOPSOIL)	4.67	(0.95) 0.95	
	1.00 1.00	ES2	ES PID	0.4ppm			Light orangish brown mottled dark brown slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is subangular to subrounded fine to medium flint. (RIVER TERRACE DEPOSITS)		(1.45)	
	2.00 2.00	ES3	ES PID	73.8ppm				3.22	2.40	
							Structureless CHALK recovered as light brown slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse occasional flint and frequent chalk. (NEW PIT CHALK FORMATION)		(0.70)	
	3.00 3.00	ES4	ES PID	10.4ppm				2.52	3.10	
							Structureless CHALK recovered as off white slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subrounded chalk and rare flint. (NEW PIT CHALK FORMATION)			
	4.00 4.00	ES5	ES PID	16.8ppm					(1.90)	

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Location cleared using GPR and a CAT and genny prior to breaking ground.
2. Inspection pit hand dug to 1.20mbgl.
3. No groundwater encountered.
4. 50mm diameter groundwater monitoring well complete with flush protective cover installed to 5.00m depth on completion. Response zone 1.50m to 5.00m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	AGS

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**5.62**	**E:505426.9 N:103405.4**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							Structureless CHALK recovered as off white slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subrounded chalk and rare flint. (NEW PIT CHALK FORMATION) *(stratum copied from 3.10m from previous sheet)*	0.62	5.00	
	5.00 5.00	ES6	ES PID	0.1ppm			Borehole terminated at 5.00mbgl.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	AGS

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**6.84**	**E:505491.0 N:103493.3**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
	0.50 0.50	ES1	ES PID	0.2ppm			Grass over orangish brown mottled dark brown slightly gravelly slightly sandy SILT with occasional rootlets. Sand is fine. Gravel is angular to subrounded fine to coarse flint. (TOPSOIL)		(1.10)	
	1.00 1.00	ES2	ES PID	0.9ppm				5.74	1.10	
							Light orangish brown mottled dark brown slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is subangular to subrounded fine to medium flint. (RIVER TERRACE DEPOSITS)		(1.55)	
	2.00 2.00	ES3	ES PID	0.4ppm				4.19	2.65	
							Structureless CHALK recovered as light brown slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse occasional flint and frequent chalk. (NEW PIT CHALK FORMATION)		(0.65)	
	3.00 3.00	ES4	ES PID	4.9ppm				3.54	3.30	
							Structureless CHALK recovered as off white slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subrounded chalk and rare flint. (NEW PIT CHALK FORMATION)			
	4.00 4.00	ES5	ES PID	0.7ppm					(1.70)	

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Location cleared using GPR and a CAT and genny prior to breaking ground.
2. Inspection pit hand dug to 1.20mbgl.
3. No groundwater was encountered.
4. 50mm diameter groundwater monitoring well complete with flush protective cover installed to 5.00m depth on completion. Response zone 1.50m to 5.00m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**6.84**	**E:505491.0 N:103493.3**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							Structureless CHALK recovered as off white slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subrounded chalk and rare flint. (NEW PIT CHALK FORMATION) *(stratum copied from 3.30m from previous sheet)*	1.84	5.00	
	5.00 5.00	ES6	ES PID	0.3ppm			Borehole terminated at 5.00mbgl.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	AGS

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS04**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**6.80**	**E:505524.5 N:103420.7**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
	0.50 0.50	ES1	ES PID	0.0ppm			Grass over dark brown slightly sandy SILT with rare angular fine to coarse flint and occasional rootlets. Sand is fine to coarse flint. Sand is fine. (TOPSOIL)	6.20	(0.60) 0.60	
	1.00 1.00	ES2	ES PID	0.1ppm			Brown mottled dark brown slightly clayey silty fine SAND. (RIVER TERRACE DEPOSITS) . . . Becoming light brown from 1.10m bgl.		(1.70)	
	2.00 2.00	ES3	ES PID	0.6ppm				4.50	2.30	
	3.00 3.00	ES4	ES PID	0.8ppm			Light orangish brown very gravelly fine to coarse SAND. Gravel is fine to coarse angular to subrounded l flint and chalk. (RIVER TERRACE DEPOSITS)	3.60	(0.90) 3.20	
	4.00 4.00	ES5	ES PID	0.6ppm			Structureless CHALK recovered as off white slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subrounded chalk and rare flint. (NEW PIT CHALK FORMATION)		(1.80)	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Location cleared using GPR and a CAT and genny prior to breaking ground.
2. Inspection pit hand dug to 1.20mbgl.
3. No groundwater was encountered.
4. 50mm diameter groundwater monitoring well complete with flush protective cover installed to 5.00m depth on completion. Response zone 1.50m to 5.00m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS04**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**6.80**	**E:505524.5 N:103420.7**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							Structureless CHALK recovered as off white slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subrounded chalk and rare flint. (NEW PIT CHALK FORMATION) *(stratum copied from 3.20m from previous sheet)*	1.80	5.00	
	5.00 5.00	ES6	ES PID	0.2ppm			Borehole terminated at 5.00mbgl.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	AGS

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**6.40**	**E:505697.4 N:103460.8**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
	0.50 0.50	ES1	ES PID	0.0ppm			Grass over dark brown silty fine SAND with rare angular fine to coarse gravel of flint and occasional rootlets. (TOPSOIL)	5.60	(0.80) 0.80	
	1.00 1.00	ES2	ES PID	0.0ppm			Light brown very sandy SILT with rare subangular fine to coarse gravel of flint. Sand is fine. (RIVER TERRACE DEPOSITS)	4.20	(1.40) 2.20	
	2.00 2.00	ES3	ES PID	1.0ppm						
	3.00 3.00	ES4	ES PID	0.0ppm	▼1		Light greyish brown sandy gravelly SILT. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint and chalk. (RIVER TERRACE DEPOSITS)	2.80	(1.40) 3.60	
	4.00 4.00	ES5	ES PID	0.7ppm			Orangish brown very clayey fine to medium SAND. (RIVER TERRACE DEPOSITS)	2.30	(0.50) 4.10	
							Description on next sheet			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Location cleared using GPR and a CAT and genny prior to breaking ground.
2. Inspection pit hand dug to 1.20mbgl.
3. Groundwater encountered during drilling at 3.52mbgl.
4. 50mm diameter groundwater monitoring well complete with flush protective cover installed to 6.00m depth on completion. Response zone 1.50m to 5.00m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	AGS

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**6.40**	**E:505697.4 N:103460.8**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
	5.00 5.00	ES6	ES PID	1.6ppm			Structureless CHALK recovered as off white slightly silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subrounded chalk and rare flint. (NEW PIT CHALK FORMATION) *(stratum copied from 4.10m from previous sheet)*		(1.90)	
	6.00 6.00	ES7	ES PID	15.8ppm			Borehole terminated at 6.00mbgl.	0.40	6.00	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	AGS

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS06**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**6.00**	**E:505683.0 N:103351.3**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Reduced Level	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
	0.50 0.50	ES1	ES PID	0.0ppm			Grass over: Dark brown slightly gravelly silty fine SAND with frequent rootlets. Gravel is subangular to rounded fine to coarse flint. (TOPSOIL) . . . becoming more silty with depth.		(1.30)	
	1.00 1.00	ES2	ES PID	0.5ppm				4.70	1.30	
	2.00 2.00	ES3	ES PID	0.3ppm			Brown mottled dark brown slightly gravelly sandy SILT. Sand is fine. Gravel is subangular to subrounded fine to coarse flint. Sand is fine. (RIVER TERRACE DEPOSITS)		(0.90)	
	3.00 3.00	ES4	ES PID	1.5ppm				3.80	2.20	
							Light orangish brown mottled dark brown slightly sandy slightly clayey SILT. Sand is fine. (RIVER TERRACE DEPOSITS)		(1.40)	
	4.00 4.00	ES5	ES PID	0.6ppm	▼1			2.40	3.60	
							Structureless CHALK recovered as off white slightly silty very sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subrounded chalk and rare flint. (NEW PIT CHALK FORMATION)		(0.65)	
								1.75	4.25	
							Description on next sheet			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Location cleared using GPR and a CAT and genny prior to breaking ground.
2. Inspection pit hand dug to 1.20mbgl.
3. Groundwater encountered during drilling at 4.11mbgl.
4. 50mm diameter groundwater monitoring well complete with flush protective cover installed to 5.00m depth on completion. Response zone 1.50m to 5.00m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	AGS

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WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Rustington Golf Course, Angmering	**BDW Southern Counties**	**WS06**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**04.03.21** End: **04.03.21**	**6.00**	**E:505683.0 N:103351.3**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
							Structureless CHALK recovered as off white silty sandy GRAVEL. Sand is fine to coarse. Gravel is very angular to subrounded chalk and rare flint. (NEW PIT CHALK FORMATION) *(stratum copied from 4.25m from previous sheet)*	1.00	(0.75) 5.00	
	5.00 5.00	ES6	ES PID	0.4ppm			Borehole terminated at 5.00mbgl.			

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Tracked window sampling	**Premier rig**	**P J Drilling**	**WCook**	AGS

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19 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT
UK

[redacted]

Our Ref: 305199L01
16th April 2021

BDW House
Guildford
Surrey
GU1 4 SW

For the attention of Mr Sean Havis

Dear Gordon,

RE: RUSTINGTON GOLF COURSE – INFILTRATION TESTING

1. INTRODUCTION

RSK Environment Limited (RSK) was commissioned by Barratt David Wilson (BDW) Homes to undertake supplementary infiltration testing for the development site at the Rustington Golf Course, Angmering, West Sussex.

1.1 Objectives

The objective of this assessment is to undertake a supplementary infiltration assessment in targeted locations within areas proposed for infiltration drainage.

1.2 Limitations

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and which therefore could not be taken into account.

This report is subject to the RSKs service constraints given in **Appendix A**.

2. SITE LOCATION AND DESCRIPTION

The Site location and current site layout are shown on Figures 1 and 2, respectively. The Site covers an area of c. 7.5 hectares. It is currently occupied by the Rustington Golf Centre. The golf centre infrastructure itself is located immediately north of the site in question.

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3. GEOLOGY

Published geological records predict the superficial geology beneath the site to comprise granular River Terrace Deposits. These are underlain by the New Pit Chalk Formation.

5. PROPOSED DEVELOPMENT

The proposed development comprises low-rise residential housing with associated infrastructure, private / communal gardens and areas of soft landscaping.

6. PREVIOUS WORK

The following works have been undertaken:

- RSK Environment Ltd, Preliminary Risk Assessment, Report Ref 305199-R01 (00), Dated March 2021; and
- RSK Environment Ltd – ongoing groundwater monitoring (results for 11 March to 25 March 2021 currently).

RSKs preliminary risk assessment highlights that the use of pit soakaways may be suitable within the superficial deposits/chalk depending upon the depth to the chalk bedrock and/or groundwater. However, soakage testing was recommended in order to confirm this conclusion.

In respect to ground conditions, the preliminary findings of an intrusive site investigation carried out on 4 March 2021 by RSK appear to confirm the stratigraphical succession. The borehole logs revealed that the site is underlain by topsoil encountered between the ground level and 0.4 m bgl, overlying superficial deposits of the River Terrace with the Chalk at depth. The superficial deposits encountered at 0.4 m bgl, varied in thickness between 0.75 m and 3.20 m and were typically described as brown to orange brown clayey silt/silty clay with variable proportions of sand and flint gravel. Locally, sand with gravel of flint and chalk was encountered within these deposits. The Chalk, underlying these superficial deposits, was recorded between 1.15 m and 4.10 m and recovered as weathered brownish cream chalk comprising sandy gravelly silt or possibly structured white chalk of silty sandy gravel towards base.

Groundwater seepages were encountered within three of the six locations during the investigation at depths of between 3.50 m and 4.10 m bgl.

Groundwater monitoring has been carried out on 3 occasions (11/3/21, 17/3/21, 25/3/21 within borehole standpipe installations and the results indicate groundwater at variable depths below 3.38 m at a number of locations, although there was some installations that remained dry (>4 m depth).

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7. SITE WORKS

The supplementary investigation was carried out between the 22nd to 24th March 2021. The scope of works comprised the mechanical excavation of eight trial pits, and had a maximum of three soakage tests conducted in line with BRE365.

The positions and proposed depth of the exploratory holes were determined by BDW Homes and the landowner. The locations are identified in **Figure 2**.

8. GROUND CONDITIONS

The results of the intrusive investigation and subsequent geo-environmental and geotechnical laboratory analysis undertaken are detailed below.

The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, list of samples taken, field observations of soil and groundwater, in-situ testing and details of monitoring well installations are included on the exploratory hole records presented in **Appendix B**.

The trial pits revealed that the site is underlain by a variable thickness of made ground over Clay with Chalk encountered at depth. This appears to confirm the stratigraphical succession described within the preliminary CSM.

For the purpose of discussion, the ground conditions encountered during the fieldworks are summarised in **Table 1** with the strata discussed in subsequent subsections.

Table 1 General succession of strata encountered

Stratum	Exploratory holes encountered	Depth to top of stratum m bgl	Proven thickness (m)
Made ground/Topsoil	TP01, TP02, TP03, TP04, TP05, TP06, TP06(B), TP07, TP08	Ground level	0.4-0.5
River Terrace Deposits	TP01, TP02, TP03, TP04, TP05, TP06, TP06(B), TP07, TP08	0.4-0.5	0.8-2.1
New Pit Chalk Formation	TP03, TP05, TP06, TP06(B),	1.3-2.4	Not proven

10.1 Made ground/Topsoil

The made ground/topsoil generally comprised a dark brown silt with rare flint and ranged in thickness from 0.4 m to 0.5 m.

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10.2 River Terrace Deposits

This stratum was encountered from beneath the made ground/topsoil and comprised a layer of soft to firm orangish light brown silty clay between 0.8 m and 2.1 m in thickness. In TP02 at 2.30 m bgl a slightly clayey slightly gravelly sand was encountered. In trial pits 01, 03, 04, 05, 06, 06(B) and 07 the clay becomes slightly gravelly on its boundary with the underlying chalk.

10.3 New Pit Chalk Formation

This stratum was encountered in TP 03, 05, 06 and 06(B) between 1.3 m and 2.4 m below ground level with its thickness not being proven. The chalk is described as an off-white clayey gravel with occasional cobbles of chalk and flint.

10.4 Visual/olfactory evidence of soil contamination

Absence of any visual olfactory evidence of contamination within made ground/topsoil deposits and underlying natural strata.

10.5 Groundwater encountered during intrusive works

Groundwater was encountered during the intrusive investigation works as detailed on the logs in Appendix B. Water strike at 1.80 m bgl in TP06 with water rising 100 mm in 5 minutes.

9. INFILTRATION DRAINAGE

The results of soakaway testing are summarised in **Table 2** and full details included in **Appendix C.**

Table 2: Infiltration test results

Trial pit (Base of Test m)	Geological units tested	Test number and Average Infiltration Rate m/s (Based upon no of tests)
TP01 (2.70 m)	River Terrace Deposits (within clays throughout)	3.04×10^{-6} (2)
TP02 (2.50 m)	River Terrace Deposits (Clay to 2.30m, then gravelly sand)	1.16×10^{-5} (2)
TP03 (2.50 m)	River Terrace Deposits/weathered Chalk (Clay to 2.40m then chalk)	6.32×10^{-6} (2)
TP04 (2.70 m)	River Terrace Deposits/very weathered Chalk (Clay to 2.40m then chalk)	1.47×10^{-5} (2)

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TP05 (2.40 m)	River Terrace Deposits/very weathered Chalk - becoming less weathered (Clay to 0.85m then chalk)	6.17×10^{-5} (3)
TP06 (2.10 m)	River Terrace Deposits/ weathered Chalk (Clay to 1.35m then chalk) Groundwater at 1.80m	Not applicable
TP06 (b) (1.40 m)	River Terrace Deposits/ weathered Chalk (Clay to 1.35m then chalk)	5.85×10^{-5} (3)
TP07 (2.60 m)	River Terrace Deposits (within clays throughout)	5.67×10^{-7} (1)
TP08 (2.60 m)	River Terrace Deposits (within clays throughout)	1.30×10^{-5} (2)

Results are variable and generally dependent as would be expected upon the strata into which the soakaway test was carried out.

Based on the ground conditions recorded, the River Terrace Deposits suitability for infiltration appears to be marginal with TP01 and TP07 showing infiltration within them at these locations is unlikely to be feasible. In TP02 and TP08, there was however some infiltration.

For the remainder of the locations (TP03, 04, 05, 06b) the infiltration rate (m/s) ranged between 6.32×10^{-6} and 6.17×10^{-5}, which would be feasible to allow shallow soakaway drainage. The depth to measured groundwater also means that there is a 2 m freeboard of unsaturated ground at most locations. In TP06/06b, however at the lowest part of the site, groundwater was encountered at 1.80 m and therefore discharge is not possible at this location.

In summary the central and southern parts of the site would appear to be suitable for shallow soakaways, provided the base is into the weathered chalk. In the northern third where clay is thicker, either deeper soakaways will be required, or connection to a positive drainage system will be required. One potential system could be to utilise the existing system of drainage from the pond upon the site to the ponds to the east of the development site (within the golf course) ensuring that appropriate interceptor measures were in place.

We trust that our comments sufficient for your immediate needs, however, please do not hesitate to contact the undersigned if you require any further information.

ARUN DISTRICT COUNCIL A/45/22/PL

Yours faithfully

[redacted]

Nigel Austin
Director

Encl. Figure 1 Site location plan
Figure 2 Exploratory hole location plan

Appendix A Service constraints
Appendix B Exploratory hole records
Appendix C Infiltration testing results

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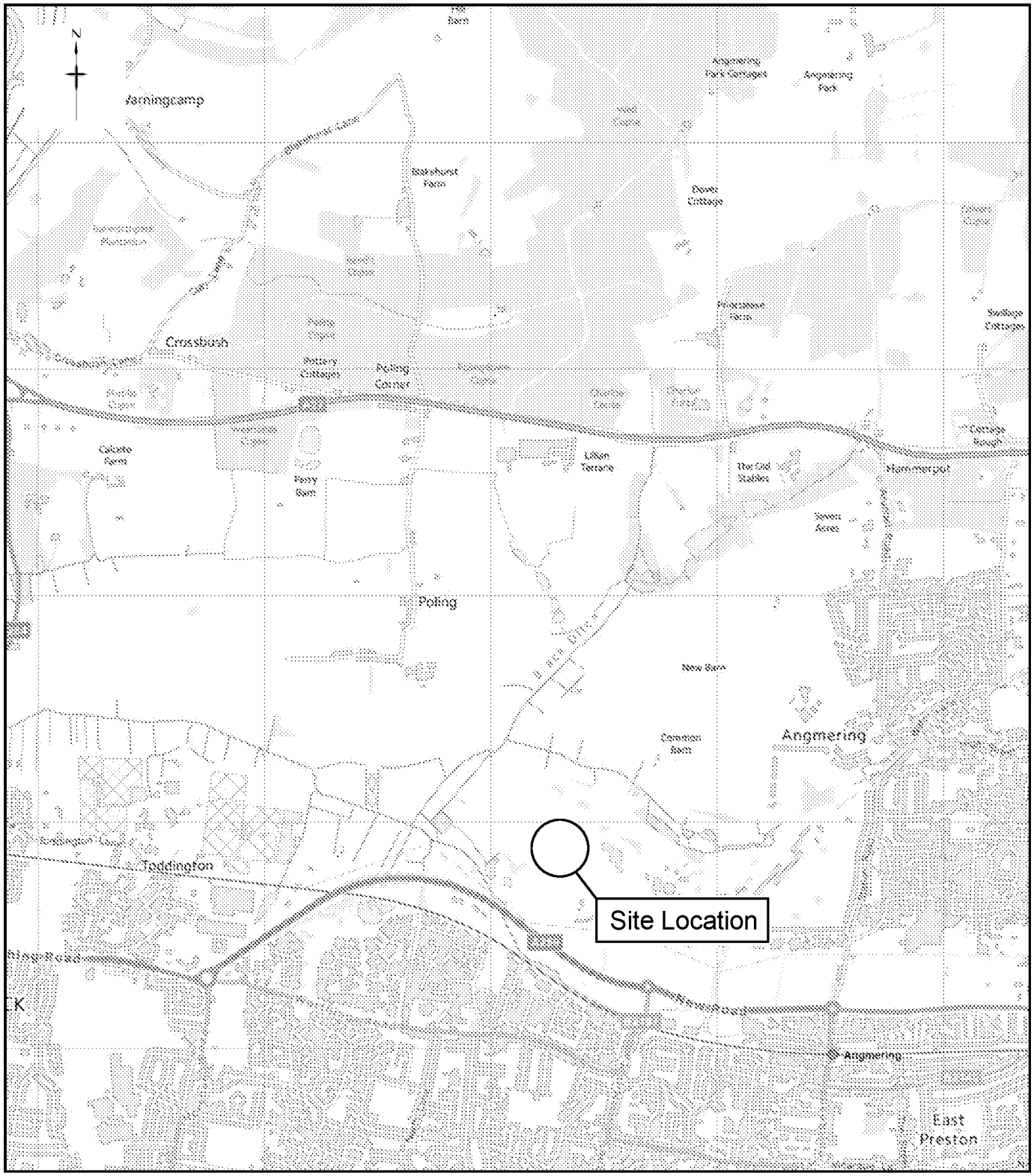
FIGURES



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Web: www.rsk.co.uk

Client: BDW SOUTHERN COUNTIES

Project Title: RUSTINGTON GOLF COURSE, ANGMERING

Drawing Title: SITE LOCATION PLAN

Rev	Drawn	Date	Checked	Date	Approved	Date
01	HG	14.04.21	RJ	14.04.21	RJ	14.04.21

Dimensions	Scale	Original Size
m	1:25,000	A4

Project Number	Drawing File	Drawing Number
305199 - R01 (00)	305199 (R01-00) Figure 1.dwg	FIGURE 1

LEGEND

Trial Pit Location

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P1	14.04.21	First Issue	HG	RJ	RJ

RSK

18 Progmore Road
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Web: www.rsk.co.uk

Client

BDW SOUTHERN COUNTIES

Project Title

RUSTINGTON GOLF COURSE
ANGMERING

Drawing Title

EXPLORATORY HOLE
LOCATION PLAN

Drawn	Date	Checked	Date	Approved	Date
HG	14.04.21	RJ	14.04.21	RJ	14.04.21

Scale	Orig Size	Dimensions
NTS	A3	M

Project No.	Drawing File
305199 - R01 (00)	305199 (R01-00) Figure 2.dwg

Drawing No.	Rev.
FIGURE 2	P1

APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for David Barratt Wilson Homes Limited (the "Client") in accordance with the terms of a contract between RSK and the Client. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.

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

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

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

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

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

7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

    a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.

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b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.

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

10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.

12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

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APPENDIX B
EXPLORATORY HOLE RECORDS

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FINAL

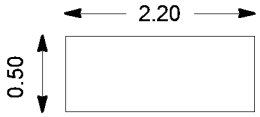
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Rustington Golf Course, Angmering	**BDW Southampton**	**TP01**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**22.3.21**	**---**	**---**	**1** of **1**
	End: **22.3.21**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Grass over: Dark brown silt with frequent rootlets		0.10	
						Soft light brown slightly gravelly silty clay. Gravel is of fine sub rounded chalk		(0.30)	
								0.40	
						Soft orangish light brown silty CLAY		(2.10)	
								2.50	
						Soft orangish brown slightly gravelly silty CLAY. Gravel is of fine to medium sub rounded chalk		2.70	
						Trial pit terminated at 2.70m depth			

Plan (Not to Scale)



General Remarks

1. Service clearance completed
2. Pit walls remained stable
3. Backfilled with arisings

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**8 Ton Tracked Excavator**	**RJones**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log XCUSTOM - 563029 - TRIAL PIT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 14/4/21 - 13:07 | RJ1 |
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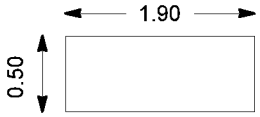
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Rustington Golf Course, Angmering	**BDW Southampton**	**TP02**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**22.3.21**	**---**	**---**	**1** of **1**
	End: **22.3.21**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Grass over: Dark brown silt with frequent rootlets		(0.40) 0.40	
						Soft orangish light brown silty CLAY		(1.60) 2.00	
						Soft orangish light brown slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is of fine to coarse sub rounded to sub angular chalk and flint		(0.30) 2.30	
						Orangish light brown slightly clayey slightly gravelly SAND. Sand is fine to medium. Gravel is of fine to coarse sub rounded to sub angular chalk and flint		2.50	
						Trial pit terminated at 2.50m depth			

Plan (Not to Scale)



General Remarks

1. Service clearance completed
2. Pit walls remained stable
3. Backfilled with arisings

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**8 Ton Tracked Excavator**	**RJones**	

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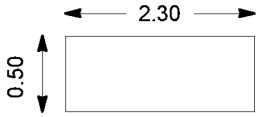
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Rustington Golf Course, Angmering	**BDW Southampton**	**TP03**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**22.3.21**	**---**	**---**	**1** of **1**
	End: **22.3.21**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Grass over: Dark brown silt with frequent rootlets		(0.40)	
								0.40	
						Soft orangish light brown silty CLAY Becoming firm		(1.30)	
								1.70	
						Soft orangish light brown slightly sandy silty CLAY		(0.40)	
								2.10	
						Soft off white gravelly CLAY. Gravel is of fine to coarse sub rounded to sub angular chalk and flint		(0.30)	
								2.40	
						CHALK: Off white clayey GRAVEL with occasional cobbles of chalk and flint. Gravel is of fine to coarse sub rounded to sub angular chalk and flint		2.50	
						Trial pit terminated at 2.50m depth			

Plan (Not to Scale)



General Remarks

1. Service clearance completed
2. Pit walls remained stable
3. Backfilled with arisings

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**8 Ton Tracked Excavator**	**RJones**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log XCUSTOM - 563029 - TRIAL PIT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01.
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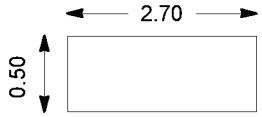
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Rustington Golf Course, Angmering	BDW Southampton	TP04

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	23.3.21	---	---	1 of 1
	End: 23.3.21			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Grass over: Dark brown silt with frequent rootlets and rare medium sub angular flint		(0.50)	
								0.50	
						Firm orangish light brown silty CLAY		(1.90)	
								2.40	
						Soft off white to light brown gravelly CLAY. Gravel is of fine to coarse sub rounded to sub angular flint and chalk		(0.30)	
								2.70	
						Trial pit terminated at 2.70m depth			

Plan (Not to Scale)



General Remarks

1. Service clearance completed
2. Pit walls remained stable
3. Backfilled with arisings

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	8 Ton Tracked Excavator	RJones	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log XCUSTOM - 563029 - TRIAL PIT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 14/4/21 - 13:07 | RJ1 |
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FINAL

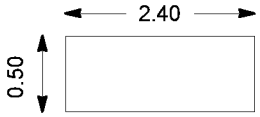
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Rustington Golf Course, Angmering	**BDW Southampton**	**TP05**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**23.3.21**	**---**	**---**	**1** of **1**
	End: **23.3.21**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Grass over: Dark brown slightly gravelly silt with frequent rootlets. Gravel is of fine to medium sub rounded to sub angular flint		(0.40) 0.40	
						Firm orangish light brown slightly gravelly silty CLAY. Gravel is of fine to medium sub rounded to sub angular flint		(0.45) 0.85	
						Soft off white gravelly CLAY. with occasional cobbles of chalk. Gravel is of fine to coarse sub rounded to angular chalk		(0.65) 1.50	
						CHALK: Soft off white very clayey GRAVEL with frequent cobbles of chalk. Gravel is of fine to coarse sub rounded to sub angular chalk and rare coarse angular flint		(0.90) 2.40	
						Trial pit terminated at 2.40m depth			

Plan (Not to Scale)



General Remarks

1. Service clearance completed
2. Pit walls remained stable
3. Backfilled with arisings

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**8 Ton Tracked Excavator**	**RJones**	

GEOTECHNICAL LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log XCUSTOM - 563029 - TRIAL PIT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01.
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FINAL

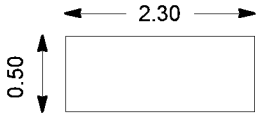
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Rustington Golf Course, Angmering	**BDW Southampton**	**TP06**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**23.3.21**	**---**	**---**	**1** of **1**
	End: **23.3.21**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Grass over: Dark brown slightly gravelly silt with frequent rootlets. Gravel is of fine to medium sub rounded to sun angular flint and chalk.		(0.50) 0.50	
						Firm light brown slightly gravelly silty CLAY. Gravel isof fine to coarse sub rounded to sub angular flint and chalk		(0.85) 1.35	
						CHALK: Off white very clayey GRAVEL with frequent cobbles of chalk and occasional boulders of chalk. Gravel is of fine to coarse sub rounded to sub angular chalk Water strike		(0.75) 2.10	
						Trial pit terminated at 2.10m depth			

Plan (Not to Scale)



General Remarks

1. Service clearance completed
2. Pit walls remained stable
3. Backfilled with arisings
4. Rapid water inflow at 1.80m. Water risen 10cm in 5 minutes

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**8 Ton Tracked Excavator**	**RJones**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log XCUSTOM - 563029 - TRIAL PIT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 14/4/21 - 13:08 | RJ1 |

FINAL

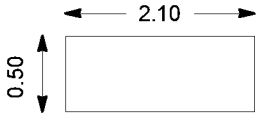
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Rustington Golf Course, Angmering	**BDW Southampton**	**TP06(B)**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**23.3.21**	**---**	**---**	**1** of **1**
	End: **23.3.21**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Grass over: Dark brown slightly gravelly silt with frequent rootlets. Gravel is of fine to medium sub rounded to sub angular flint and chalk		(0.50) 0.50	
						Firm light brown slightly gravelly silty CLAY. Gravel is of fine to coarse sub rounded to sub angular flint		(0.80) 1.30	
						CHALK: Off white very clayey GRAVEL with occasional cobbles of chalk. Gravel is of fine to coarse sub rounded to sub angular chalk		1.40	
						Trial pit terminated at 1.40m depth			

Plan (Not to Scale)



General Remarks

1. Service clearance completed
2. Pit walls remained stable
3. Backfilled with arisings

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**8 Ton Tracked Excavator**	**RJones**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log XCUSTOM - 563029 - TRIAL PIT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 14/4/21 - 13:08 | RJ1 |
ARUN DISTRICT COUNCIL/45/22/PL

FINAL

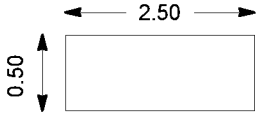
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Rustington Golf Course, Angmering	BDW Southampton	TP07

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	24.3.21	---	---	1 of 1
	End: 24.3.21			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Grass over: Dark brown slightly gravelly silt with frequent rootlets. Gravel is of fine to coarse sub rounded to angular flint		(0.50)	
								0.50	
						Firm orangish light brown fissured silty CLAY.			
								(1.95)	
						Becoming soft			
								2.45	
						Soft orangish light brown gravelly CLAY. Gravel is of fine to medium sub rounded to sub angular chalk and flint		2.60	
						Trial pit terminated at 2.60m depth			

Plan (Not to Scale)



General Remarks

1. Service clearance completed
2. Pit walls remained stable
3. Backfilled with arisings

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	8 Ton Tracked Excavator	RJones	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log XCUSTOM - 563029 - TRIAL PIT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 14/4/21 - 13:08 | RJ1 |
ARUN DISTRICT COUNCIL/45/22/PL

FINAL

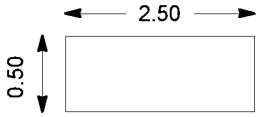
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
Rustington Golf Course, Angmering	**BDW Southampton**	**TP08**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
305199	**24.3.21**	**---**	**---**	**1** of **1**
	End: **24.3.21**			

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Grass over: Dark brown slightly gravelly silt with frequent rootlets and 1-1.5cm thick roots. Gravel is of fine to coarse sub rounded to angular flint		(0.50)	
								0.50	
						Soft orangish brown silty CLAY		(2.10)	
								2.60	
						Trial pit terminated at 2.60m depth			

Plan (Not to Scale)



General Remarks

1. Service clearance completed
2. Pit walls remained stable
3. Backfilled with arisings

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	**8 Ton Tracked Excavator**	**RJones**	

GEOTECHNICAL_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Log XCUSTOM - 563029 - TRIAL PIT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01.
RSK Environment Ltd, 18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT. Tel: 01442 437500, Fax: 01442 437550, Web: www.rsk.co.uk. | 14/4/21 - 13:08 | RJ1 |
ARUN DISTRICT COUNCIL/45/22/PL

APPENDIX C
INFILTRATION TESTING RESULTS

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SCALE SOAKAWAY TEST

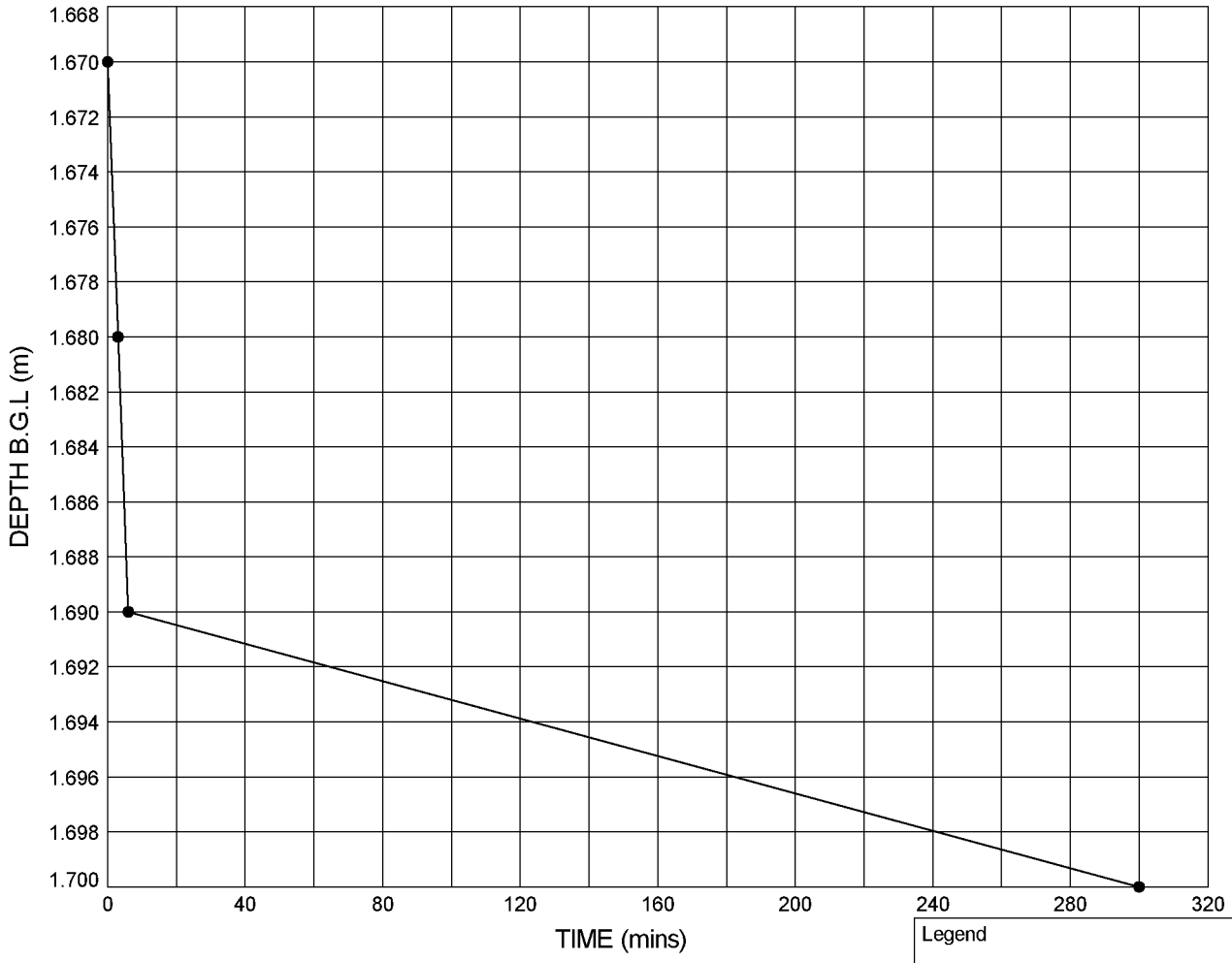
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP01**

Ground Level (m AOD): ---

National Grid Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME

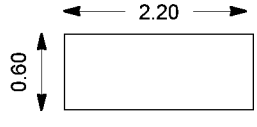


Legend

● Test 1 (22.03.21)

Pit start depth:	=	*1.67*	m
Pit final depth:	=	*1.70*	m
Effective depth, De	=	*0.03*	m
Effective storage volume, V_{p75-25}	=	*0.0198*	m^3
Surface area, a_{p50}	=	*1.4040*	m^2
Time, t_{p75-25}	=	*4635*	secs
Infiltration rate, *f*	=	*3.04x10^{-6}*	m/s

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd 18 Frogmore Road Hemel Hempstead Hertfordshire HP3 9RT	Compiled By	Date	Checked By	Date
	[redacted]	16/04/21		
	Contract: **Rustington Golf Course, Angmering**		Contract Ref: **305199**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph I - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01. | 16/04/21 - 09:55 | ES6 |

FULL SCALE SOAKAWAY TEST

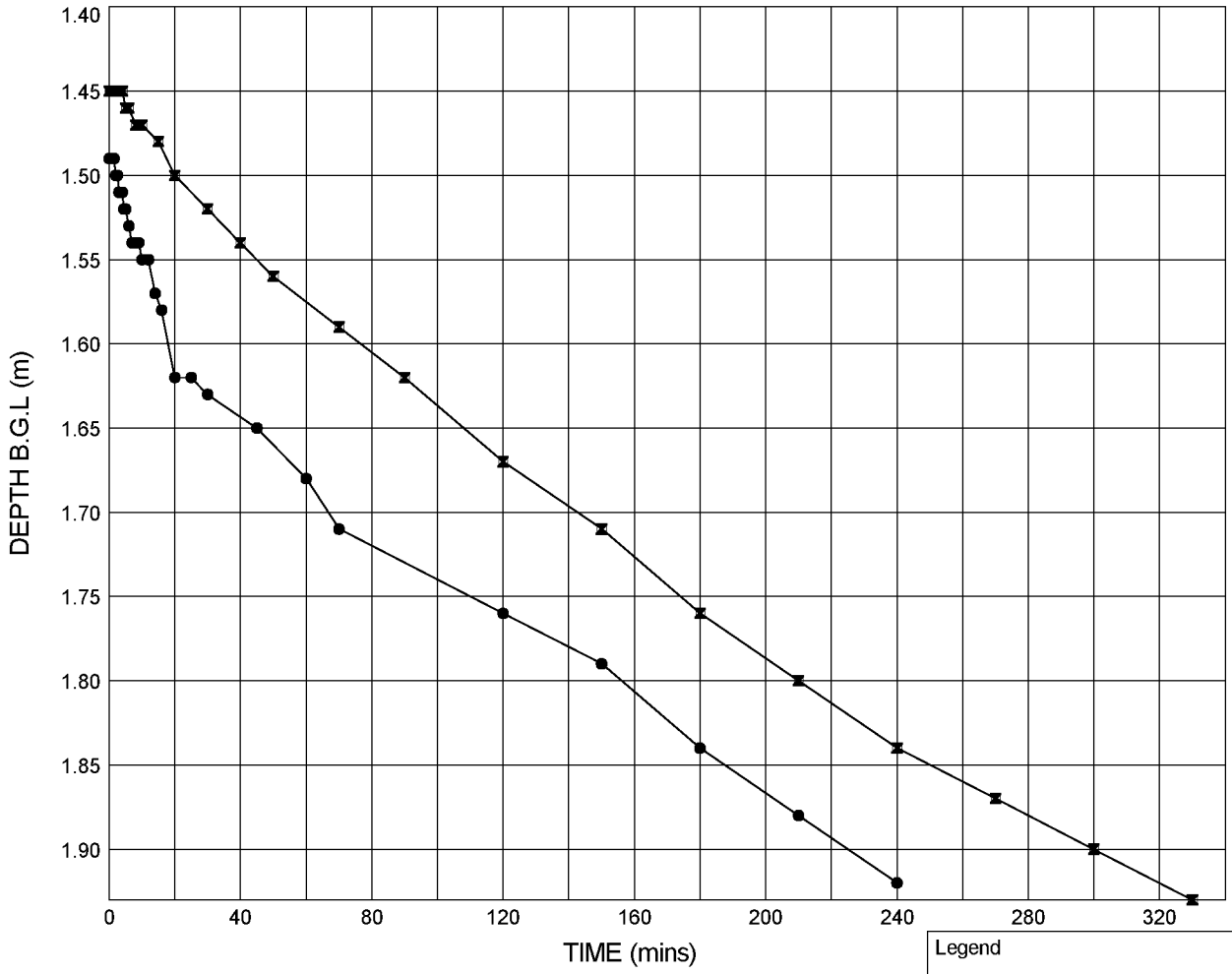
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP02**

Ground Level (m AOD): ---

National Grid Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



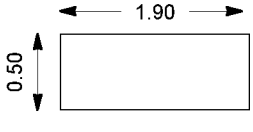
		Test 1	Test 2	
Pit start depth:	=	*1.49*	*1.45*	m
Pit final depth:	=	*1.92*	*1.93*	m
Effective depth, De	=	*0.43*	*0.48*	m
Effective storage volume, V_{p75-25}	=	*0.2043*	*0.2280*	m^3
Surface area, a_{p50}	=	*1.9820*	*2.1020*	m^2
Time, t_{p75-25}	=	*8745*	*9650*	secs
Infiltration rate, *f*	=	$1.18x10^{-5}$	$1.12x10^{-5}$	m/s

Legend

● Test 1 (22.03.21)

⧗ Test 2 (23.03.21)

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date
[redacted]	16/04/21		

Contract	Contract Ref:
Rustington Golf Course, Angmering	**305199**

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph I - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01. | 16/04/21 - 09:56 | ES6 |

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SCALE SOAKAWAY TEST

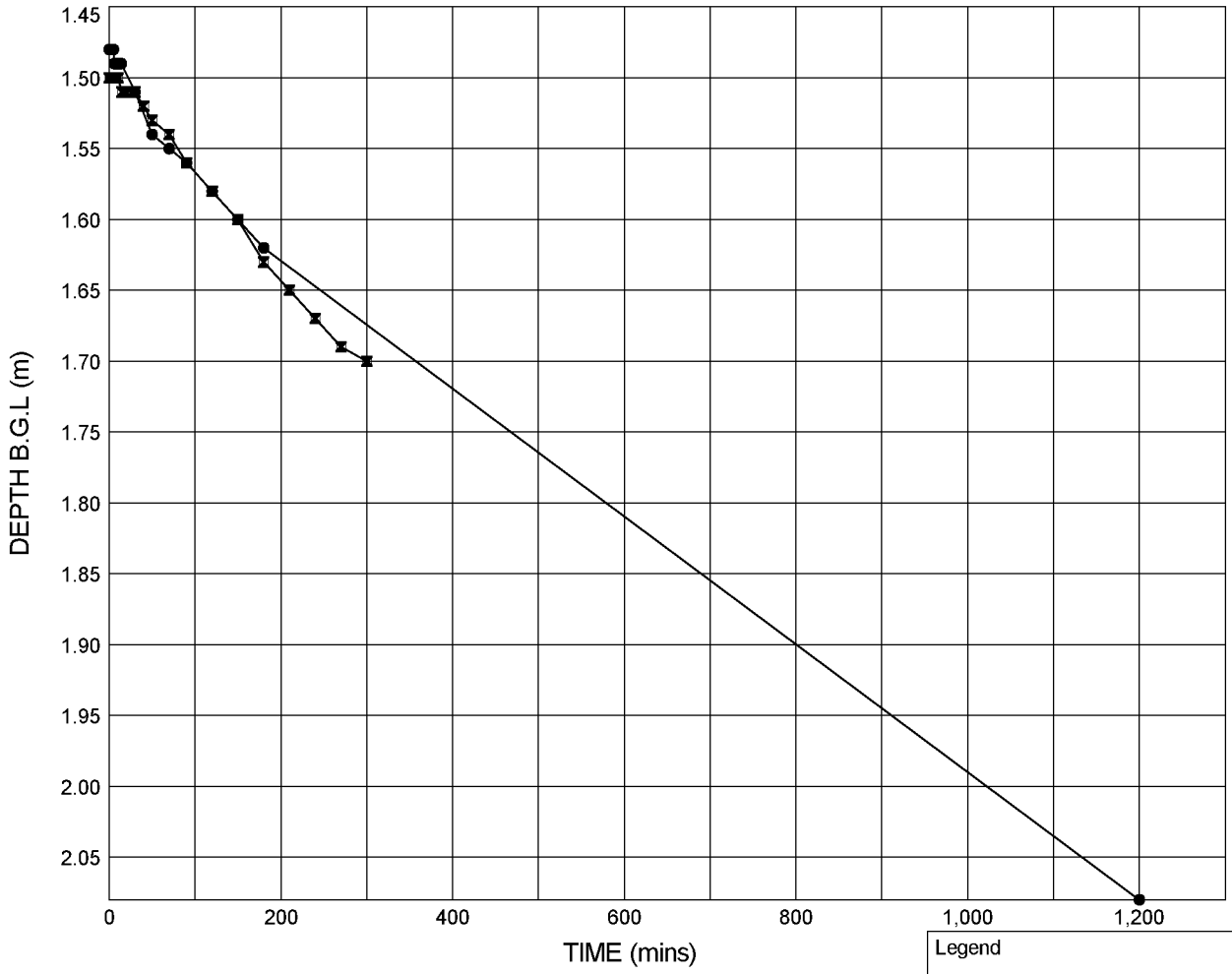
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP03**

Ground Level (m AOD): ---

National Grid Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



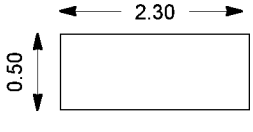
Legend

● Test 1 (22.03.21)

⧗ Test 2 (23.03.21)

		Test 1	Test 2	
Pit start depth:	=	*1.48*	*1.50*	m
Pit final depth:	=	*2.08*	*1.70*	m
Effective depth, De	=	*0.60*	*0.20*	m
Effective storage volume, V_{p75-25}	=	*0.3450*	*0.1150*	m^3
Surface area, a_{p50}	=	*2.8300*	*1.7100*	m^2
Time, t_{p75-25}	=	*39913*	*7800*	secs
Infiltration rate, *f*	=	$3.05x10^{-6}$	$8.62x10^{-6}$	m/s

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date
[redacted]	16/04/21		

Contract: **Rustington Golf Course, Angmering**

Contract Ref: **305199**

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph I - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01. | 16/04/21 - 09:59 | ES6 |

FULL SCALE SOAKAWAY TEST

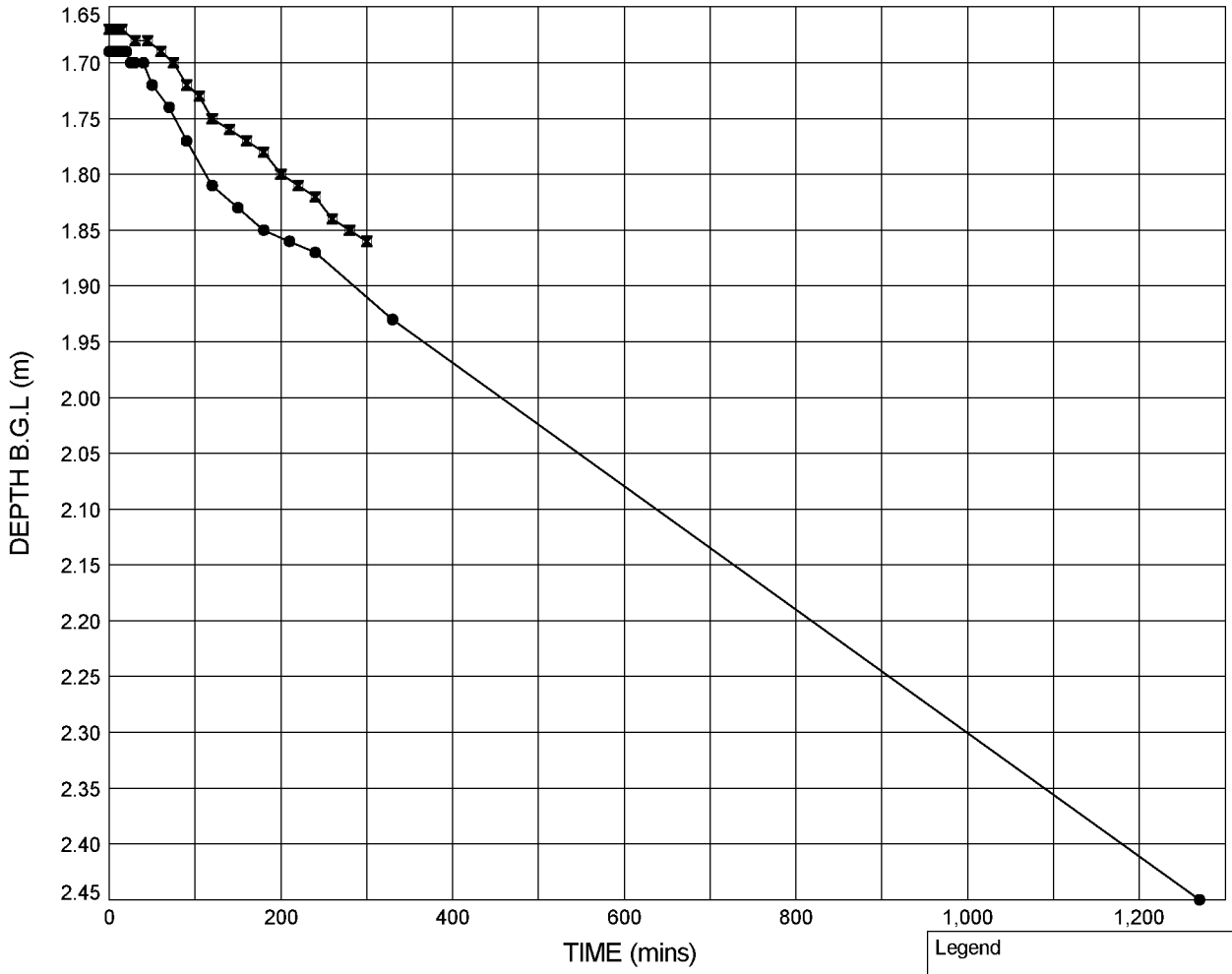
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP04**

Ground Level (m AOD): ---

National Grid Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



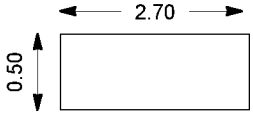
Legend

● Test 1 (23.03.21)

⧗ Test 2 (24.03.21)

		Test 1	Test 2	
Pit start depth:	=	*1.69*	*1.67*	m
Pit final depth:	=	*2.45*	*1.86*	m
Effective depth, De	=	*0.76*	*0.19*	m
Effective storage volume, V_{p75-25}	=	*0.5130*	*0.1283*	m^3
Surface area, a_{p50}	=	*3.7820*	*1.9580*	m^2
Time, t_{p75-25}	=	*40292*	*8213*	secs
Infiltration rate, *f*	=	$3.37x10^{-6}$	$7.98x10^{-6}$	m/s

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date
[redacted]	16/04/21		

Contract: **Rustington Golf Course, Angmering**

Contract Ref: **305199**

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph I - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01. | 16/04/21 - 10:02 | ES6 |

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SCALE SOAKAWAY TEST

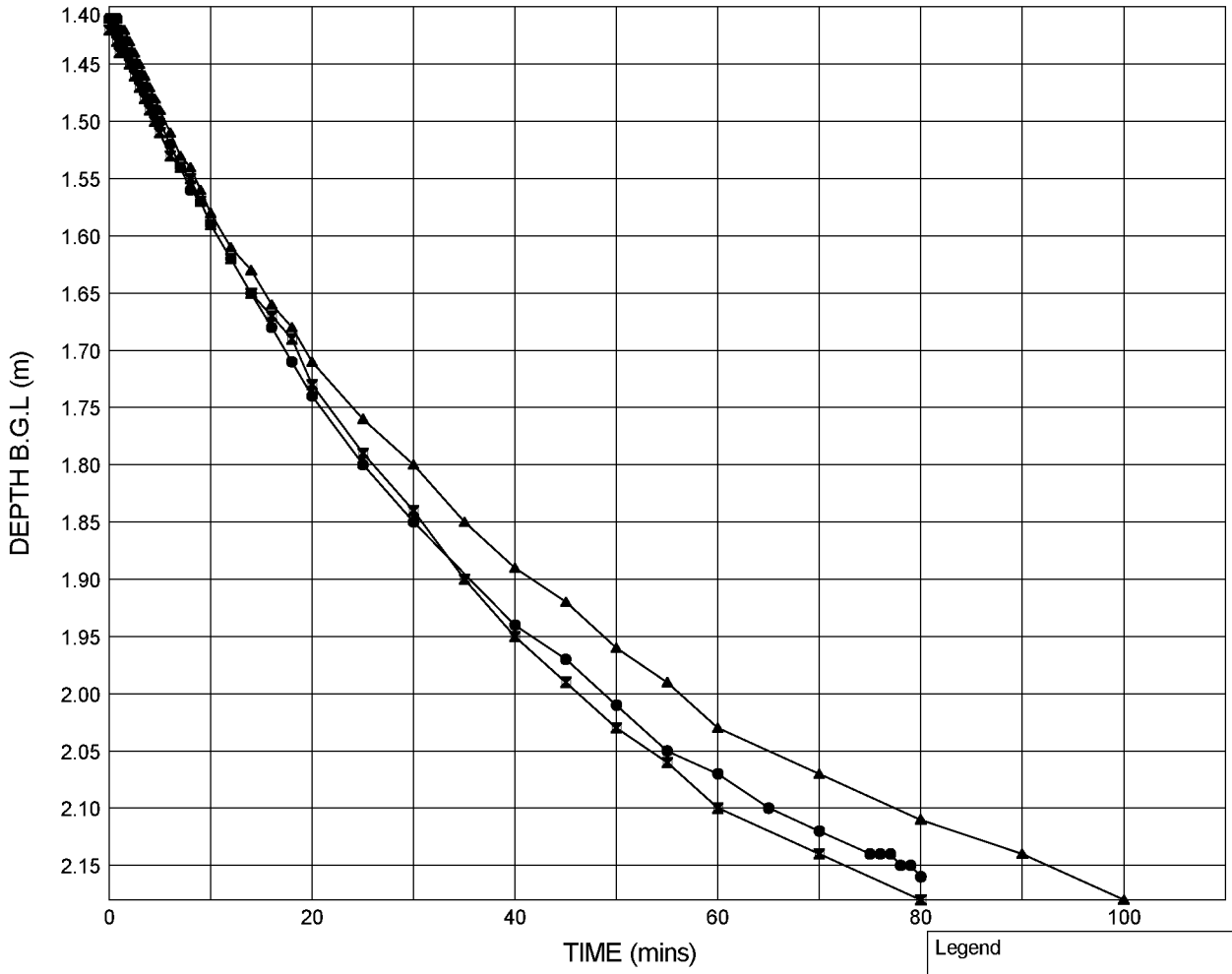
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP05**

Ground Level (m AOD): ---

National Grid Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME

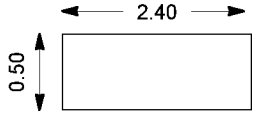


		Test 1	Test 2	Test 3	
Pit start depth:	=	*1.41*	*1.42*	*1.41*	m
Pit final depth:	=	*2.16*	*2.18*	*2.18*	m
Effective depth, De	=	*0.75*	*0.76*	*0.77*	m
Effective storage volume, V_{p75-25}	=	*0.4500*	*0.4560*	*0.4620*	m^3
Surface area, a_{p50}	=	*3.3750*	*3.4040*	*3.4330*	m^2
Time, t_{p75-25}	=	*2089*	*2020*	*2585*	secs
Infiltration rate, *f*	=	$6.38x10^{-6}$	$6.63x10^{-6}$	$5.21x10^{-5}$	m/s

Legend

●	Test 1	(23.03.21)
⧗	Test 2	(24.03.21)
▲	Test 3	(25.03.21)

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date
[redacted]	16/04/21		

Contract: **Rustington Golf Course, Angmering**

Contract Ref: **305199**

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph I - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01. | 16/04/21 - 10:06 | ES6 |

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SCALE SOAKAWAY TEST

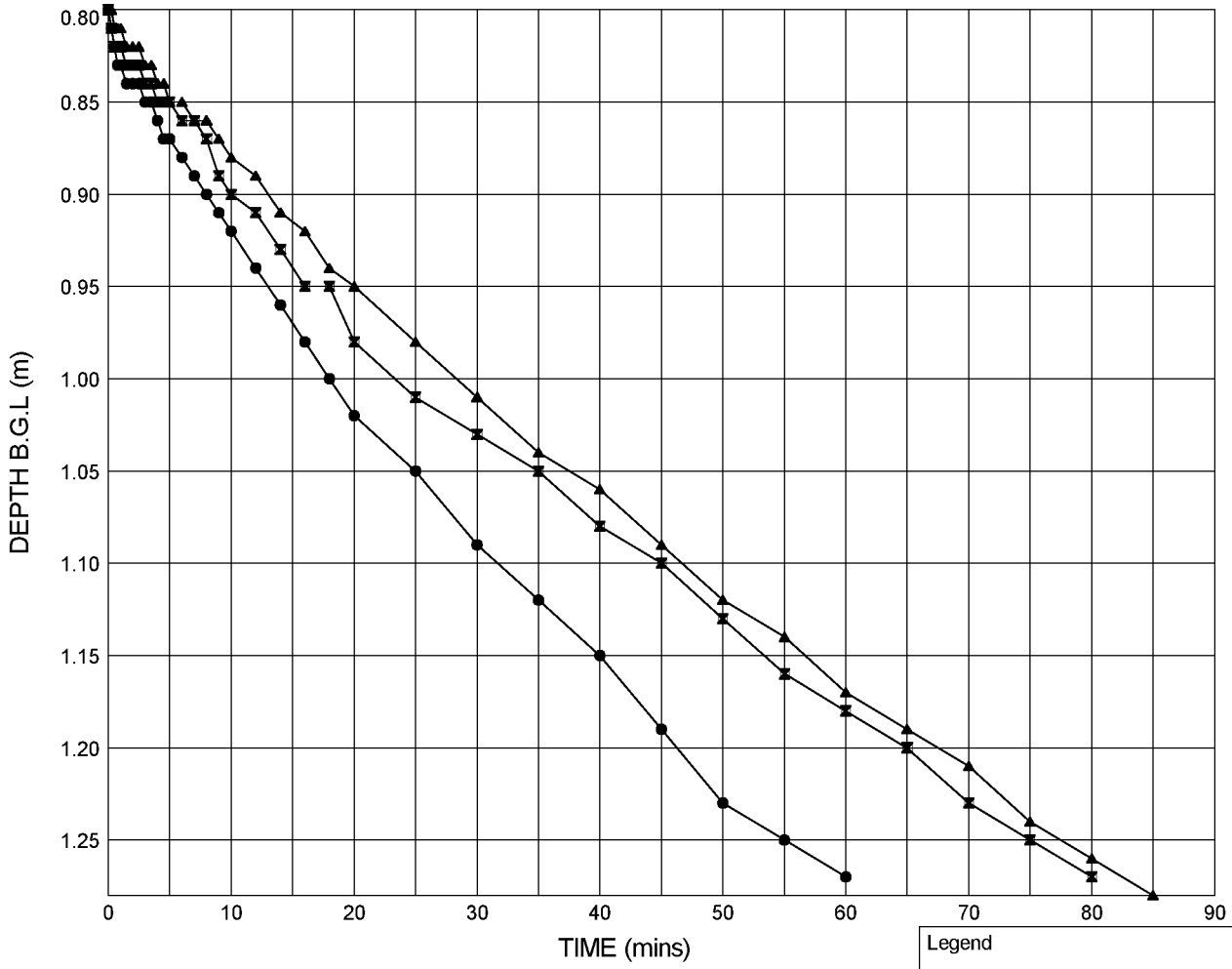
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP06(B)**

Ground Level (m AOD): ---

National Grid Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME

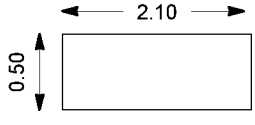


		Test 1	Test 2	Test 3	
Pit start depth:	=	*0.80*	*0.80*	*0.80*	m
Pit final depth:	=	*1.27*	*1.27*	*1.28*	m
Effective depth, De	=	*0.47*	*0.47*	*0.48*	m
Effective storage volume, V_{p75-25}	=	*0.2468*	*0.2468*	*0.2520*	m^3
Surface area, a_{p50}	=	*2.2720*	*2.2720*	*2.2980*	m^2
Time, t_{p75-25}	=	*1834*	*2460*	*2540*	secs
Infiltration rate, *f*	=	$5.92x10^{-5}$	$4.41x10^{-5}$	$4.32x10^{-5}$	m/s

Legend

●	Test 1	(23.03.21)
⧓	Test 2	(23.03.21)
▲	Test 3	(24.03.21)

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date
[redacted]	16/04/21		

Contract	Contract Ref:
Rustington Golf Course, Angmering	**305199**

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph I - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01. | 16/04/21 - 10:09 | ES6 |

ARUN DISTRICT COUNCIL A/45/22/PL

FULL SCALE SOAKAWAY TEST

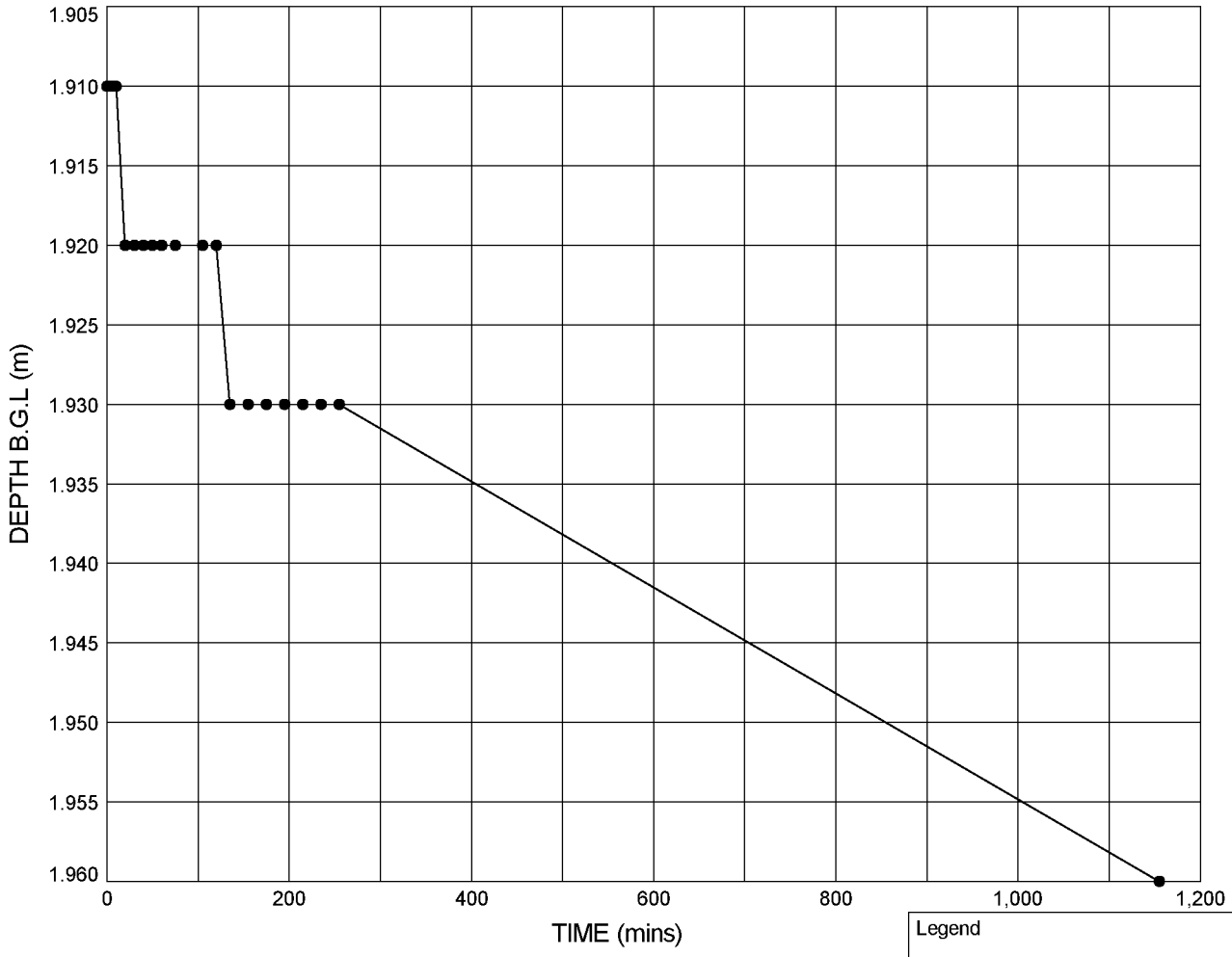
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP07**

Ground Level (m AOD): ---

National Grid Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME

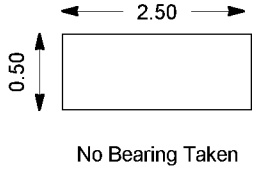


Pit start depth:	=	*1.91*	m
Pit final depth:	=	*1.96*	m
Effective depth, De	=	*0.05*	m
Effective storage volume, V_{p75-25}	=	*0.0313*	m^3
Surface area, a_{p50}	=	*1.4000*	m^2
Time, t_{p75-25}	=	*39375*	secs
Infiltration rate, *f*	=	*5.67x10^{-7}*	m/s

Legend

● Test 1 (24.03.21)

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd 18 Frogmore Road Hemel Hempstead Hertfordshire HP3 9RT	Compiled By	Date	Checked By	Date
	[redacted]	16/04/21		
	Contract **Rustington Golf Course, Angmering**		Contract Ref: **305199**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph I - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01. | 16/04/21 - 10:11 | ES6 |

FULL SCALE SOAKAWAY TEST

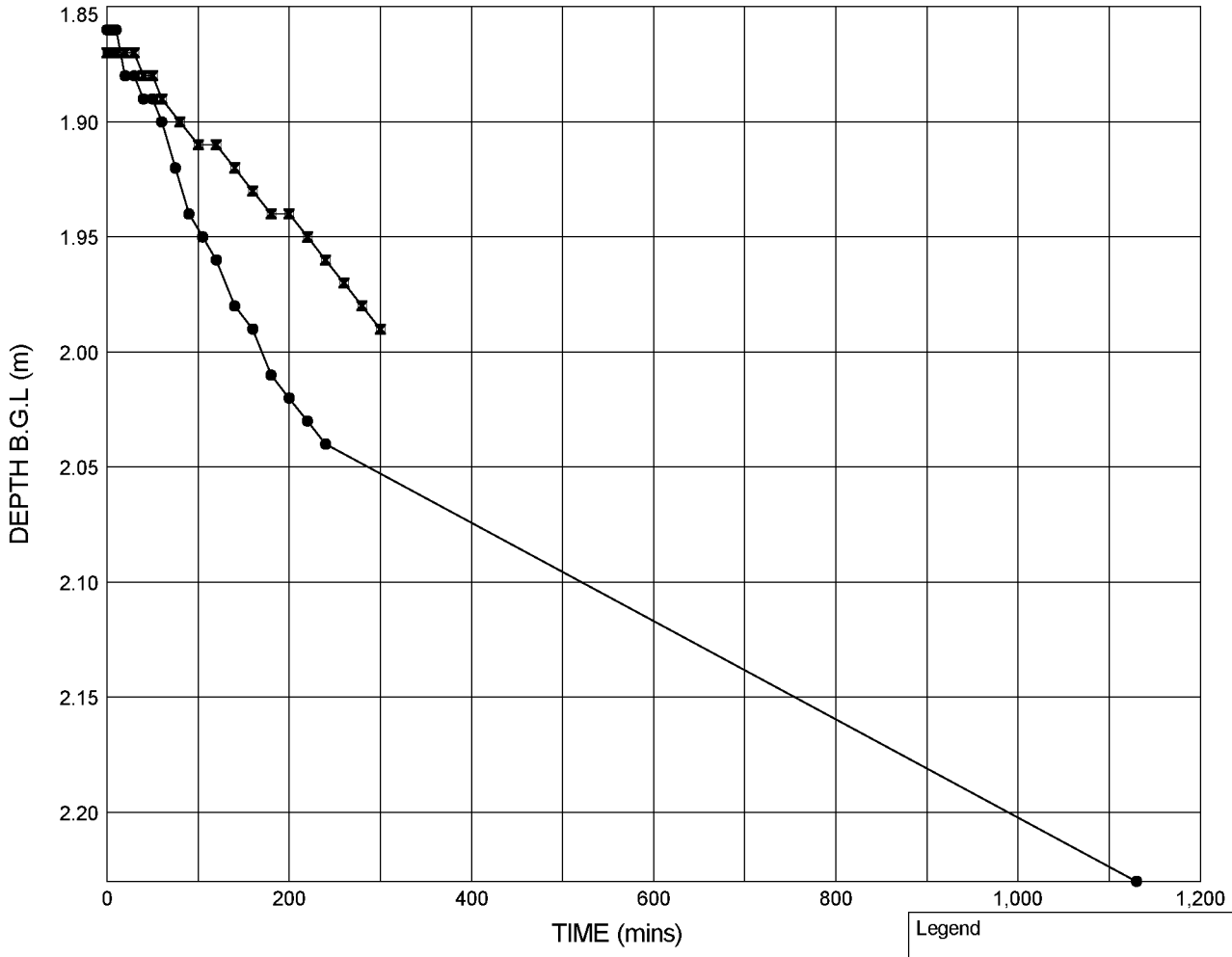
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP08**

Ground Level (m AOD): ---

National Grid Co-ordinates: ---

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME

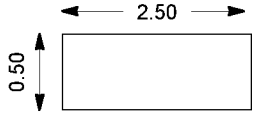


Legend

● Test 1 (24.03.21)

Pit start depth	=	1.87	m
Pit final depth	=	1.99	m
Effective depth, De	=	0.13	m
Effective storage volume, V_{p75-25}	=	0.0813	m^3
Surface area, a_{p50}	=	1.6400	m^2
Time, t_{p75-25}	=	3825	secs
Infiltration rate, f	=	1.30×10^{-5}	m/s

Plan (Not to scale)



No Bearing Taken

RSK Environment Ltd 18 Frogmore Road Hemel Hempstead Hertfordshire HP3 9RT	Compiled By	Date	Checked By	Date
	[redacted]	16/04/21		
	Contract **Rustington Golf Course, Angmering**		Contract Ref: **305199**	

GINT_LIBRARY_V10_01.GLB LibVersion: v8_07_001 PrjVersion: v8_07 | Graph I - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 305199-RUSINGTON-GOLF-COURSE.GPJ - v10_01. | 16/04/21 - 10:12 | ES6 |

Appendix 3 – Calculations

QBar Calculation

Full Drainage Modelling Calculations

ARUN DISTRICT COUNCIL A/45/22/PL

Greenfield runoff rate estimation for sites

[redacted]reenfield runoff tool

Calculated by:	Shaun Letchford
Site name:	Rustington Golf Club
Site location:	Angmering

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

Site Details

Latitude:	50.82096° N
Longitude:	0.50325° W
Reference:	3144954767
Date:	May 26 2021 16:53

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	720	720
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.88	1.88
1 in 1 year (l/s):	1.6	1.6
1 in 30 years (l/s):	4.33	4.33
1 in 100 year (l/s):	6.01	6.01
1 in 200 years (l/s):	7.04	7.04

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

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1-1	0.089	5.00	6.889	1350	505500.914	103490.948	1.498
S1-2	0.056	5.00	6.683	1200	505499.113	103465.283	1.519
S1-3	0.048	5.00	6.842	1200	505493.161	103448.949	1.749
S1-4			6.779	1200	505488.260	103439.620	1.730
S1-5	0.013	5.00	7.036	1200	505462.378	103453.595	2.108
S1-6	0.059	5.00	6.718	1200	505446.880	103483.655	1.487
S1-7	0.097	5.00	6.600	1350	505438.073	103466.657	1.860
S1-8	0.041	5.00	6.485	1350	505401.877	103486.208	1.872
S1-9	0.055	5.00	6.481	1350	505386.614	103495.587	1.924
S1-10	0.030	5.00	6.524	1350	505399.270	103514.831	1.495
S1-11	0.032	5.00	6.368	1350	505389.069	103505.428	1.454
S1-12	0.016	5.00	6.367	1350	505381.196	103504.244	1.842
S1-13	0.049	5.00	6.233	1350	505371.649	103510.676	1.744
S1-14	0.025	5.00	5.883	1350	505346.949	103513.847	1.650
S1-15	0.038	5.00	5.755	1350	505332.467	103512.135	1.713
S1-16	0.055	5.00	5.599	1350	505319.233	103505.153	1.650
S1-17			5.200	1350	505299.837	103507.317	2.150
S1-18	0.055	5.00	5.770	1350	505392.038	103414.758	1.484
S1-19	0.053	5.00	5.637	1350	505384.092	103422.905	1.425
S1-20	0.027	5.00	5.317	1350	505359.540	103436.154	1.450
S1-21	0.058	5.00	6.093	1350	505374.370	103484.132	1.425
S1-22	0.028	5.00	5.572	1350	505362.641	103461.861	1.571
S1-23	0.026	5.00	5.256	1200	505353.327	103446.071	1.549
S1-24	0.030	5.00	5.069	1200	505339.003	103455.257	1.571
S1-25	0.045	5.00	4.937	1200	505321.570	103461.231	1.515
S1-26	0.012	5.00	5.109	1350	505304.394	103470.637	1.767
S1-27	0.032	5.00	4.950	1200	505296.246	103485.171	1.677
S1-28			5.200	1500	505293.490	103503.359	2.003
S1-29			5.200		505293.852	103508.010	2.106
S1-29_OUT	0.053		5.200		505287.613	103512.933	2.139

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)
1.014	S1-29	S1-29_OUT	7.047	0.600	3.061	3.061	0.000	240.8	300	5.98	50.0
1.013	S1-17	S1-29	4.025	0.600	3.550	3.163	0.387	10.4	225	6.85	50.0
4.008	S1-28	S1-29	4.665	0.600	3.197	3.169	0.028	166.6	225	7.11	50.0
4.007	S1-27	S1-28	16.396	0.600	3.273	3.197	0.076	242.0	300	7.05	50.0
4.006	S1-26	S1-27	16.662	0.600	3.342	3.273	0.069	241.5	300	6.75	50.0
4.005	S1-25	S1-26	19.563	0.600	3.422	3.342	0.080	244.8	300	6.47	50.0
4.004	S1-24	S1-25	18.428	0.600	3.498	3.422	0.076	242.5	300	6.14	50.0
4.003	S1-23	S1-24	17.016	0.600	3.797	3.498	0.298	57.1	300	5.84	50.0
4.002	S1-20	S1-23	11.792	0.600	3.867	3.782	0.085	137.9	225	5.68	50.0
5.001	S1-22	S1-23	18.332	0.600	4.001	3.767	0.234	62.8	300	5.36	50.0
5.000	S1-21	S1-22	25.171	0.600	4.668	4.076	0.592	42.5	225	5.21	50.0
4.001	S1-19	S1-20	27.399	0.600	4.212	3.867	0.345	80.8	225	5.50	50.0
4.000	S1-18	S1-19	11.389	0.600	4.286	4.212	0.074	153.8	225	5.18	50.0
1.012	S1-16	S1-17	19.516	0.600	3.949	3.550	0.399	48.9	450	9.82	50.0
1.011	S1-15	S1-16	14.967	0.600	4.042	3.949	0.093	161.7	450	9.71	50.0
1.010	S1-14	S1-15	14.587	0.600	4.253	4.042	0.191	76.2	450	9.55	50.0

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)
1.014	1.009	213.9	139.3	1.806	1.839	1.028	0.0	177	1.072
1.013	2.703	394.2	92.2	1.425	1.806	0.680	0.0	73	2.703
4.008	1.010	120.5	47.1	1.778	1.806	0.347	0.0	98	0.951
4.007	1.006	71.1	47.1	1.377	1.703	0.347	0.0	178	1.073
4.006	1.007	71.2	42.7	1.467	1.377	0.315	0.0	168	1.052
4.005	1.000	70.7	41.1	1.215	1.467	0.303	0.0	164	1.036
4.004	1.005	71.0	35.0	1.271	1.215	0.258	0.0	149	1.001
4.003	1.741	123.0	30.8	1.249	1.271	0.227	0.0	102	1.458
4.002	1.111	44.2	18.2	1.225	1.249	0.135	0.0	101	1.059
5.001	1.995	141.0	9.0	1.271	1.249	0.067	0.0	51	1.136
5.000	2.012	80.0	5.2	1.200	1.271	0.038	0.0	38	1.135
4.001	1.456	57.9	14.6	1.200	1.225	0.107	0.0	77	1.219
4.000	1.052	41.8	7.4	1.259	1.200	0.055	0.0	64	0.796
1.012	2.912	463.1	92.2	1.200	1.200	0.680	0.0	135	2.289
1.011	1.596	253.8	84.7	1.263	1.200	0.625	0.0	179	1.443
1.010	2.331	370.7	80.2	1.200	1.263	0.592	0.0	141	1.875

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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	S1-13	S1-14	28.993	0.600	4.483	4.383	0.181	157.6	225	6.45	50.0
1.006	S1-12	S1-13	11.512	0.600	4.525	4.489	0.036	319.9	375	6.18	50.0
1.007	S1-9	S1-12	10.213	0.600	4.557	4.525	0.032	316.1	375	7.09	50.0
3.001	S1-11	S1-12	7.982	0.600	4.904	4.875	0.029	281.2	225	5.25	50.0
3.000	S1-10	S1-11	13.874	0.600	5.029	4.904	0.115	121.1	225	5.18	50.0
1.005	S1-8	S1-9	17.910	0.600	4.613	4.557	0.056	319.9	375	7.52	50.0
1.005	S1-7	S1-8	41.139	0.600	4.740	4.613	0.127	323.9	375	7.52	50.0
1.004	S1-5	S1-7	27.581	0.600	4.928	4.815	0.113	244.2	300	6.84	50.0
2.000	S1-6	S1-7	19.184	0.600	5.231	4.890	0.341	56.1	225	5.38	50.0
1.003	S1-4	S1-5	29.414	0.600	5.049	4.928	0.121	243.1	300	6.38	50.0
1.002	S1-3	S1-4	10.553	0.600	5.085	5.049	0.036	293.5	300	5.89	50.0
1.001	S1-2	S1-3	17.385	0.600	5.164	5.085	0.079	220.9	300	5.72	50.0
1.000	S1-1	S1-2	28.729	0.600	5.391	5.259	0.132	169.3	225	5.43	50.0

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)
1.009	1.543	170.4	76.8	1.369	1.200	0.566	0.0	176	1.503
1.008	1.008	111.3	70.1	1.467	1.369	0.518	0.0	216	1.063
1.007	1.009	111.4	59.6	1.549	1.467	0.440	0.0	195	1.025
3.001	2.276	90.5	8.4	1.229	1.467	0.062	0.0	46	1.438
3.000	1.187	47.2	4.0	1.270	1.229	0.030	0.0	44	0.730
1.006	1.007	111.3	51.8	1.497	1.549	0.382	0.0	180	0.990
1.005	1.001	110.6	46.2	1.485	1.497	0.341	0.0	169	0.957
1.004	1.001	70.8	27.7	1.808	1.485	0.205	0.0	130	0.943
2.000	1.749	69.5	5.3	1.262	1.485	0.039	0.0	42	1.040
1.003	1.004	71.0	25.7	1.430	1.808	0.190	0.0	125	0.925
1.002	1.011	71.5	25.7	1.449	1.430	0.190	0.0	125	0.932
1.001	1.000	70.7	19.5	1.219	1.449	0.144	0.0	108	0.858
1.000	1.002	39.8	11.9	1.273	1.219	0.088	0.0	84	0.876

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)
1.014	7.947	240.8	300	Triple	5.200	3.094	1.806	5.200	3.061	1.839
1.015	6.025	15.8	225	Triple	5.200	3.550	1.425	5.200	3.168	1.806
4.008	4.663	166.6	225	Triple	5.200	3.197	1.778	5.200	3.169	1.806
4.007	18.396	242.9	300	PH1	4.950	3.273	1.377	5.200	3.197	1.703
4.006	16.462	241.5	300	PH1	5.109	3.642	1.467	4.950	3.273	1.377
4.005	10.583	264.8	300	PH1	4.937	3.422	1.215	5.109	3.642	1.467
4.004	18.828	242.5	300	PH1	5.069	3.498	1.271	4.937	3.422	1.215
4.003	17.016	81.7	300	PH1	5.256	3.707	1.249	5.069	3.498	1.271
4.002	11.792	197.9	225	PH1	5.317	3.867	1.225	5.256	3.782	1.249
5.001	18.352	62.3	300	PH1	5.572	4.001	1.271	5.256	3.787	1.249
5.000	25.171	82.5	225	PH1	6.093	4.668	1.200	5.572	4.070	1.271
4.001	27.889	89.6	225	PH1	5.637	4.212	1.200	5.317	3.667	1.225
4.000	11.380	155.8	225	PH1	5.770	4.286	1.259	5.637	4.012	1.200
1.012	19.016	48.9	450	PH1	5.599	3.949	1.200	5.200	3.950	1.200
1.011	14.963	101.7	450	PH1	5.755	4.042	1.263	5.599	3.949	1.200
1.010	16.583	76.2	450	PH1	5.883	4.233	1.200	5.755	4.042	1.263
1.009	24.903	137.6	375	PH1	6.233	4.480	1.369	5.883	4.303	1.200

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.014	S1-29		Junction		S1-29_OUT		Junction	
1.013	S1-17	1500	Manhole	Adoptable	S1-29		Junction	
4.008	S1-28	1500	Manhole	Adoptable	S1-29		Junction	
4.007	S1-27	1200	Manhole	Adoptable	S1-28	1500	Manhole	Adoptable
4.006	S1-26	1350	Manhole	Adoptable	S1-27	1200	Manhole	Adoptable
4.005	S1-25	1200	Manhole	Adoptable	S1-26	1350	Manhole	Adoptable
4.004	S1-24	1200	Manhole	Adoptable	S1-25	1200	Manhole	Adoptable
4.003	S1-23	1200	Manhole	Adoptable	S1-24	1200	Manhole	Adoptable
4.002	S1-20	1350	Manhole	Adoptable	S1-23	1200	Manhole	Adoptable
5.001	S1-22	1350	Manhole	Adoptable	S1-23	1200	Manhole	Adoptable
5.000	S1-21	1350	Manhole	Adoptable	S1-22	1350	Manhole	Adoptable
4.001	S1-19	1350	Manhole	Adoptable	S1-20	1350	Manhole	Adoptable
4.000	S1-18	1350	Manhole	Adoptable	S1-19	1350	Manhole	Adoptable
1.012	S1-16	1350	Manhole	Adoptable	S1-17	1500	Manhole	Adoptable
1.011	S1-15	1350	Manhole	Adoptable	S1-16	1350	Manhole	Adoptable
1.010	S1-14	1350	Manhole	Adoptable	S1-15	1350	Manhole	Adoptable
1.009	S1-13	1350	Manhole	Adoptable	S1-14	1350	Manhole	Adoptable

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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)
1.008	11.512	319.9	375	PH1	6.367	4.865	1.467	6.233	4.683	1.369
1.007	10.213	319.1	375	PH1	6.481	4.887	1.549	6.367	4.725	1.467
3.001	7.962	35.2	225	PH1	6.368	4.914	1.229	6.367	4.675	1.467
3.000	13.874	121.1	225	PH1	6.524	5.029	1.270	6.368	4.914	1.229
1.006	17.936	319.9	375	PH1	6.485	4.813	1.497	6.481	4.557	1.549
1.005	41.159	323.9	375	PH1	6.600	4.780	1.485	6.485	4.613	1.497
1.004	27.593	241.2	300	PH1	7.036	4.928	1.808	6.600	4.815	1.485
2.000	19.144	56.1	225	PH1	6.718	5.231	1.262	6.600	4.890	1.485
1.003	28.414	243.1	300	PH1	6.779	5.049	1.430	7.036	4.928	1.808
1.002	10.539	239.5	300	PH1	6.842	5.693	1.449	6.779	5.049	1.430
1.001	17.385	244.9	300	PH1	6.683	5.164	1.219	6.842	5.693	1.449
1.000	25.726	189.3	225	PH1	6.889	5.391	1.273	6.683	5.239	1.219

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.008	S1-12	1350	Manhole	Adoptable	S1-13	1350	Manhole	Adoptable
1.007	S1-9	1350	Manhole	Adoptable	S1-12	1350	Manhole	Adoptable
3.001	S1-11	1350	Manhole	Adoptable	S1-12	1350	Manhole	Adoptable
3.000	S1-10	1350	Manhole	Adoptable	S1-11	1350	Manhole	Adoptable
1.006	S1-8	1350	Manhole	Adoptable	S1-9	1350	Manhole	Adoptable
1.005	S1-7	1350	Manhole	Adoptable	S1-8	1350	Manhole	Adoptable
1.004	S1-5	1200	Manhole	Adoptable	S1-7	1350	Manhole	Adoptable
2.000	S1-6	1200	Manhole	Adoptable	S1-7	1350	Manhole	Adoptable
1.003	S1-4	1200	Manhole	Adoptable	S1-5	1200	Manhole	Adoptable
1.002	S1-3	1200	Manhole	Adoptable	S1-4	1200	Manhole	Adoptable
1.001	S1-2	1200	Manhole	Adoptable	S1-3	1200	Manhole	Adoptable
1.000	S1-1	1350	Manhole	Adoptable	S1-2	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1-1	505500.914	103490.948	6.889	1.498	1350	0	1.000	5.391	225
S1-2	505499.113	103465.283	6.683	1.519	1200	1 0	1.000 1.001	5.239 5.164	225 300
S1-3	505493.161	103448.949	6.842	1.749	1200	1 0	1.001 1.002	5.079 5.093	300 300
S1-4	505488.260	103439.620	6.779	1.730	1200	1 0	1.002 1.003	5.049 5.049	300 300
S1-5	505462.378	103453.595	7.036	2.108	1200	1 0	1.003 1.004	4.928 4.928	300 300
S1-6	505446.880	103483.655	6.718	1.487	1350	0	2.000	5.231	225
S1-7	505438.073	103466.657	6.600	1.860	1350	1 2 0	2.000 1.004 1.005	4.890 4.815 4.740	225 300 375
S1-8	505401.877	103486.208	6.485	1.872	1350	1 0	1.005 1.006	4.613 4.613	375 375
S1-9	505386.614	103495.587	6.481	1.924	1350	1 0	1.006 1.007	4.557 4.557	375 375
S1-10	505399.270	103514.831	6.524	1.495	1350	0	3.000	5.029	225

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1-11	505389.069	103505.428	6.368	1.454	1350	1	1.000	4.914	225
						0	3.001	4.814	225
S1-12	505381.196	103504.244	6.367	1.842	1350	1	3.001	4.675	225
						2	1.007	4.525	375
						0	1.008	4.525	375
S1-13	505371.649	103510.676	6.233	1.744	1350	1	1.008	4.489	375
						0	1.009	4.489	375
S1-14	505346.949	103513.847	5.883	1.650	1350	1	1.009	4.309	375
						0	1.010	4.259	450
S1-15	505332.467	103512.135	5.755	1.713	1350	1	1.010	4.042	450
						0	3.011	4.042	450
S1-16	505319.233	103505.153	5.599	1.650	1350	1	1.011	3.949	450
						0	1.012	3.948	450
S1-17	505299.837	103507.317	5.200	2.150	1500	1	1.012	3.550	450
						0	3.013	3.550	225
S1-18	505392.038	103414.758	5.770	1.484	1350	0	4.000	4.286	225
S1-19	505384.092	103422.905	5.637	1.425	1350	1	4.000	4.212	225
						0	4.001	4.212	225
S1-20	505359.540	103436.154	5.317	1.450	1350	1	4.001	3.967	225
						0	4.002	3.867	225
S1-21	505374.370	103484.132	6.093	1.425	1350	0	5.000	4.668	225
S1-22	505362.641	103461.861	5.572	1.571	1350	1	5.000	4.076	225
						0	5.001	4.001	300
S1-23	505353.327	103446.071	5.256	1.549	1200	1	5.001	3.707	300
						2	4.002	3.782	225
						0	4.003	3.707	300
S1-24	505339.003	103455.257	5.069	1.571	1200	1	4.003	3.498	300
						0	4.004	3.198	300
S1-25	505321.570	103461.231	4.937	1.515	1200	1	4.004	3.422	300
						0	4.005	3.422	300
S1-26	505304.394	103470.637	5.109	1.767	1350	1	4.005	3.342	300
						0	4.006	3.342	300
S1-27	505296.246	103485.171	4.950	1.677	1200	1	4.006	3.273	300
						0	4.007	3.273	300
S1-28	505293.490	103503.359	5.200	2.003	1500	1	4.007	3.197	300
						0	4.008	3.197	225

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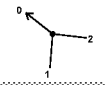
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1-29	505293.852	103508.010	5.200	2.106		1	4.000	3.169	225
						2	1.013	3.169	225
						0	1.014	3.094	300
S1-29_OUT	505287.613	103512.933	5.200	2.139		1	1.013	3.061	300



Simulation Settings

Rainfall Methodology	FEH-13	Drain Down Time (mins)	240
Summer CV	0.750	Additional Storage (m³/ha)	20.0
Winter CV	0.840	Check Discharge Rate(s)	x
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	40	0	0
100	40	0	0

Node S1-29_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.15552	Porosity	0.95
Side Inf Coefficient (m/hr)	0.15522	Invert Level (m)	2.250
Safety Factor	2.0	Time to half empty (mins)	342

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	450.0	450.0	1.200	450.0	518.8	1.201	0.0	518.8

Node S1-29_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	3.900
Safety Factor	2.0	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	26.0	0.0	1.300	330.0	0.0

Node S1-29_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30
Side Inf Coefficient (m/hr)	0.15552	Invert Level (m)	3.450
Safety Factor	2.0	Time to half empty (mins)	84

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	300.0	0.0	0.450	300.0	73.1	0.451	0.0	73.1

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ARUN DISTRICT COUNCIL A/45/22/PL

Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	S1-1	20	5.580	0.189	31.3	0.4940	0.0000	OK
30 minute summer	S1-2	19	5.521	0.357	51.2	0.6669	0.0000	SURCHARGED
30 minute summer	S1-3	19	5.492	0.399	66.4	0.6608	0.0000	SURCHARGED
30 minute summer	S1-4	19	5.458	0.409	61.8	0.4627	0.0000	SURCHARGED
30 minute summer	S1-5	19	5.369	0.441	64.4	0.5600	0.0000	SURCHARGED
30 minute summer	S1-6	18	5.299	0.068	13.8	0.1118	0.0000	OK
30 minute summer	S1-7	19	5.259	0.519	107.6	1.2865	0.0000	SURCHARGED
30 minute summer	S1-8	19	5.131	0.518	112.0	0.9708	0.0000	SURCHARGED
30 minute summer	S1-9	19	5.048	0.491	130.2	0.9983	0.0000	SURCHARGED
30 minute summer	S1-10	18	5.104	0.075	10.5	0.1378	0.0000	OK
30 minute summer	S1-11	18	4.990	0.075	21.9	0.1407	0.0000	OK
30 minute summer	S1-12	19	4.968	0.443	155.7	0.7095	0.0000	SURCHARGED
30 minute summer	S1-13	19	4.847	0.358	171.5	0.7137	0.0000	OK
30 minute summer	S1-14	19	4.508	0.275	178.4	0.4790	0.0000	OK
30 minute summer	S1-15	19	4.354	0.312	188.8	0.5681	0.0000	OK
30 minute summer	S1-16	19	4.201	0.252	206.7	0.5280	0.0000	OK
30 minute summer	S1-17	19	3.679	0.129	206.9	0.2281	0.0000	OK
30 minute summer	S1-18	18	4.406	0.120	19.4	0.2600	0.0000	OK
30 minute summer	S1-19	19	4.378	0.166	38.1	0.3596	0.0000	OK
30 minute summer	S1-20	19	4.284	0.417	47.3	0.7535	0.0000	SURCHARGED
30 minute summer	S1-21	18	4.732	0.064	13.6	0.1266	0.0000	OK
30 minute summer	S1-22	20	4.192	0.191	23.7	0.3430	0.0000	OK
30 minute summer	S1-23	20	4.186	0.480	75.7	0.7056	0.0000	SURCHARGED
30 minute summer	S1-24	19	4.099	0.601	75.7	0.9130	0.0000	SURCHARGED
30 minute summer	S1-25	19	3.983	0.561	89.5	0.9682	0.0000	SURCHARGED
30 minute summer	S1-26	19	3.811	0.469	92.8	0.7360	0.0000	SURCHARGED
30 minute summer	S1-27	19	3.647	0.373	102.6	0.5652	0.0000	SURCHARGED
30 minute summer	S1-28	19	3.401	0.204	102.0	0.3607	0.0000	OK
30 minute summer	S1-29	19	3.375	0.281	308.3	0.0000	0.0000	OK
240 minute winter	S1-29_OUT	236	3.084	0.023	84.6	356.5822	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	S1-1	1.000	S1-2	31.3	1.059	0.785	0.9707
30 minute summer	S1-2	1.001	S1-3	50.1	0.798	0.709	1.2242
30 minute summer	S1-3	1.002	S1-4	61.8	1.020	0.864	0.7421
30 minute summer	S1-4	1.003	S1-5	59.2	1.016	0.834	2.0713
30 minute summer	S1-5	1.004	S1-7	65.5	1.017	0.925	1.9431
30 minute summer	S1-6	2.000	S1-7	13.8	1.149	0.198	0.4766
30 minute summer	S1-7	1.005	S1-8	100.0	0.907	0.904	4.5375
30 minute summer	S1-8	1.006	S1-9	112.4	1.019	1.010	1.9761
30 minute summer	S1-9	1.007	S1-12	130.3	1.181	1.169	1.1265
30 minute summer	S1-10	3.000	S1-11	10.5	0.904	0.223	0.1611
30 minute summer	S1-11	3.001	S1-12	21.9	1.408	0.242	0.2044
30 minute summer	S1-12	1.008	S1-13	155.7	1.412	1.399	1.2594
30 minute summer	S1-13	1.009	S1-14	170.2	1.701	0.999	2.5383
30 minute summer	S1-14	1.010	S1-15	178.1	1.636	0.480	1.5970
30 minute summer	S1-15	1.011	S1-16	188.9	1.816	0.744	1.5600
30 minute summer	S1-16	1.012	S1-17	206.9	3.248	0.447	1.2550
30 minute summer	S1-17	1.013	S1-29	206.9	2.382	0.525	0.5568
30 minute summer	S1-18	4.000	S1-19	19.4	0.839	0.464	0.2949
30 minute summer	S1-19	4.001	S1-20	37.7	1.152	0.651	0.9918
30 minute summer	S1-20	4.002	S1-23	43.2	1.175	0.979	0.4654
30 minute summer	S1-21	5.000	S1-22	13.6	1.484	0.170	0.3535
30 minute summer	S1-22	5.001	S1-23	23.0	0.763	0.163	1.0801
30 minute summer	S1-23	4.003	S1-24	68.3	1.096	0.555	1.1983
30 minute summer	S1-24	4.004	S1-25	76.3	1.084	1.074	1.2977
30 minute summer	S1-25	4.005	S1-26	88.8	1.261	1.256	1.3790
30 minute summer	S1-26	4.006	S1-27	92.5	1.314	1.300	1.1733
30 minute summer	S1-27	4.007	S1-28	102.0	1.625	1.435	1.1174
30 minute summer	S1-28	4.008	S1-29	102.2	0.975	0.849	0.5315
30 minute summer	S1-29	1.014	S1-29_OUT	307.8	1.561	1.439	1.5592
240 minute winter	S1-29_OUT	Infiltration		10.7			
240 minute winter	S1-29_OUT	Infiltration		0.0			

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ARUN DISTRICT COUNCIL A/45/22/PL

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	S1-1	19	6.889	1.498	52.8	3.9068	0.4178	FLOOD
30 minute summer	S1-2	19	6.683	1.519	71.8	2.8390	1.6346	FLOOD
30 minute summer	S1-3	19	6.636	1.543	86.8	2.5534	0.0000	FLOOD RISK
30 minute summer	S1-4	19	6.552	1.503	79.7	1.6997	0.0000	FLOOD RISK
30 minute summer	S1-5	19	6.369	1.441	86.8	1.8294	0.0000	SURCHARGED
30 minute summer	S1-6	19	6.195	0.964	23.3	1.5934	0.0000	SURCHARGED
30 minute summer	S1-7	19	6.166	1.426	154.2	3.5342	0.0000	SURCHARGED
30 minute summer	S1-8	20	5.882	1.269	171.6	2.3768	0.0000	SURCHARGED
30 minute summer	S1-9	20	5.690	1.133	200.3	2.3037	0.0000	SURCHARGED
30 minute summer	S1-10	20	5.567	0.538	17.8	0.9835	0.0000	SURCHARGED
30 minute summer	S1-11	20	5.552	0.637	33.3	1.1945	0.0000	SURCHARGED
30 minute summer	S1-12	20	5.507	0.982	236.1	1.5714	0.0000	SURCHARGED
30 minute summer	S1-13	20	5.226	0.737	261.1	1.4689	0.0000	SURCHARGED
30 minute summer	S1-14	20	4.675	0.442	273.8	0.7687	0.0000	OK
30 minute summer	S1-15	20	4.504	0.462	287.8	0.8408	0.0000	SURCHARGED
240 minute winter	S1-16	240	4.306	0.357	85.1	0.7494	0.0000	OK
240 minute winter	S1-17	240	4.306	0.756	85.1	1.3360	0.0000	SURCHARGED
30 minute summer	S1-18	20	5.585	1.299	32.8	2.8191	0.0000	FLOOD RISK
30 minute summer	S1-19	20	5.554	1.342	52.6	2.9124	0.0000	FLOOD RISK
30 minute summer	S1-20	20	5.302	1.436	59.8	2.5913	0.0000	FLOOD RISK
30 minute summer	S1-21	20	5.158	0.490	22.9	0.9636	0.0000	SURCHARGED
30 minute summer	S1-22	20	5.128	1.127	39.6	2.0200	0.0000	SURCHARGED
30 minute summer	S1-23	20	5.110	1.404	95.4	2.0650	0.0000	FLOOD RISK
30 minute summer	S1-24	20	4.936	1.438	107.5	2.1844	0.0000	FLOOD RISK
30 minute summer	S1-25	20	4.697	1.275	127.0	2.2013	0.0000	FLOOD RISK
30 minute summer	S1-26	20	4.347	1.005	132.2	1.5778	0.0000	SURCHARGED
240 minute winter	S1-27	236	4.307	1.033	43.4	1.5645	0.0000	SURCHARGED
240 minute winter	S1-28	240	4.306	1.109	43.4	1.9596	0.0000	SURCHARGED
240 minute winter	S1-29	240	4.306	1.212	128.4	0.0000	0.0000	SURCHARGED
240 minute winter	S1-29_OUT	240	4.306	1.245	132.6	584.0177	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	S1-1	1.000	S1-2	41.3	1.062	1.037	1.0232
30 minute summer	S1-2	1.001	S1-3	59.4	0.843	0.840	1.2242
30 minute summer	S1-3	1.002	S1-4	79.7	1.132	1.115	0.7421
30 minute summer	S1-4	1.003	S1-5	82.1	1.165	1.157	2.0713
30 minute summer	S1-5	1.004	S1-7	90.7	1.288	1.281	1.9431
30 minute summer	S1-6	2.000	S1-7	19.5	1.152	0.281	0.7614
30 minute summer	S1-7	1.005	S1-8	149.4	1.354	1.351	4.5375
30 minute summer	S1-8	1.006	S1-9	169.9	1.541	1.528	1.9761
30 minute summer	S1-9	1.007	S1-12	197.7	1.793	1.775	1.1265
30 minute summer	S1-10	3.000	S1-11	15.8	0.929	0.334	0.5518
30 minute summer	S1-11	3.001	S1-12	30.3	1.359	0.335	0.3167
30 minute summer	S1-12	1.008	S1-13	236.4	2.144	2.124	1.2697
30 minute summer	S1-13	1.009	S1-14	259.9	2.356	1.525	2.7386
30 minute summer	S1-14	1.010	S1-15	272.9	1.784	0.736	2.3057
30 minute summer	S1-15	1.011	S1-16	288.1	2.052	1.135	2.0910
240 minute winter	S1-16	1.012	S1-17	85.1	2.741	0.184	2.8623
240 minute winter	S1-17	1.013	S1-29	85.1	2.305	0.216	0.7189
30 minute summer	S1-18	4.000	S1-19	23.3	0.856	0.557	0.4526
30 minute summer	S1-19	4.001	S1-20	45.1	1.199	0.778	1.1096
30 minute summer	S1-20	4.002	S1-23	56.2	1.413	1.272	0.4654
30 minute summer	S1-21	5.000	S1-22	22.6	1.524	0.283	1.0011
30 minute summer	S1-22	5.001	S1-23	32.5	0.763	0.230	1.2909
30 minute summer	S1-23	4.003	S1-24	95.7	1.359	0.778	1.1983
30 minute summer	S1-24	4.004	S1-25	108.1	1.536	1.522	1.2977
30 minute summer	S1-25	4.005	S1-26	126.9	1.802	1.795	1.3790
30 minute summer	S1-26	4.006	S1-27	132.3	1.879	1.858	1.1733
240 minute winter	S1-27	4.007	S1-28	43.4	1.445	0.610	1.2954
240 minute winter	S1-28	4.008	S1-29	43.4	0.906	0.360	0.5566
240 minute winter	S1-29	1.014	S1-29_OUT	128.5	1.112	0.601	1.6789
240 minute winter	S1-29_OUT	Infiltration		11.2			
240 minute winter	S1-29_OUT	Infiltration		1.6			

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Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S2-1	0.050	5.00	6.034	1200	505412.795	103403.788	1.425
S2-2	0.038	5.00	6.164	1200	505424.637	103401.552	1.626
S2-3	0.026	5.00	6.448	1200	505447.129	103389.618	2.060
S2-4	0.009	5.00	6.501	1200	505451.987	103387.263	2.145
S2-5	0.031	5.00	6.938	1200	505483.487	103430.940	1.465
S2-6	0.042	5.00	6.571	1200	505461.224	103389.126	2.271
S2-6_OUT	0.000		6.500		505470.171	103384.778	2.259

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)
1.004	S2-6	S2-6_OUT	9.947	0.600	4.309	4.241	0.059	169.6	225	6.04	50.0
1.003	S2-4	S2-6	8.423	0.600	4.356	4.300	0.056	166.3	225	5.87	50.0
2.000	S2-5	S2-6	47.371	0.600	5.473	4.300	1.173	40.4	225	5.38	50.0
1.002	S2-3	S2-4	5.399	0.600	4.538	4.356	0.032	168.7	225	5.71	50.0
1.001	S2-2	S2-3	25.462	0.600	4.588	4.388	0.150	169.7	225	5.62	50.0
1.000	S2-1	S2-2	12.051	0.600	4.609	4.538	0.071	169.7	225	5.28	50.0

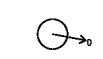
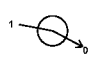
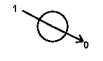
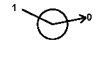
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.004	1.004	39.9	27.4	2.046	2.034	0.202	0.0	137	1.078
1.003	1.005	40.0	17.5	1.920	2.046	0.129	0.0	104	0.972
2.000	2.064	82.1	4.2	1.240	2.046	0.031	0.0	35	1.099
1.002	1.004	39.9	16.9	1.835	1.920	0.124	0.0	102	0.964
1.001	1.000	39.8	12.0	1.401	1.835	0.089	0.0	85	0.879
1.000	1.000	39.8	6.8	1.200	1.401	0.050	0.0	63	0.751

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)
1.004	9.947	169.6	225	PH1	6.571	4.309	2.046	6.500	4.241	2.034
1.003	8.423	166.3	225	PH1	6.501	4.356	1.920	6.571	4.309	2.046
2.000	47.371	40.4	225	PH1	6.938	5.473	1.240	6.571	4.309	2.046
1.002	5.399	168.7	225	PH1	6.448	4.538	1.835	6.501	4.356	1.920
1.001	25.462	169.7	225	PH1	6.164	4.588	1.401	6.448	4.388	1.835
1.000	12.051	169.7	225	PH1	6.034	4.609	1.200	6.164	4.538	1.401

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.004	S2-6	1200	Manhole	Adoptable	S2-6_OUT		Junction	
1.003	S2-4	1200	Manhole	Adoptable	S2-6	1200	Manhole	Adoptable
2.000	S2-5	1200	Manhole	Adoptable	S2-6	1200	Manhole	Adoptable
1.002	S2-3	1200	Manhole	Adoptable	S2-4	1200	Manhole	Adoptable
1.001	S2-2	1200	Manhole	Adoptable	S2-3	1200	Manhole	Adoptable
1.000	S2-1	1200	Manhole	Adoptable	S2-2	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S2-1	505412.795	103403.788	6.034	1.425	1200		0	1.000	4.609	225
S2-2	505424.637	103401.552	6.164	1.626	1200		1	1.000	4.538	225
							0	1.001	4.588	225
S2-3	505447.129	103389.618	6.448	2.060	1200		1	1.001	4.388	225
							0	1.002	4.538	225
S2-4	505451.987	103387.263	6.501	2.145	1200		1	1.002	4.356	225
							0	1.003	4.356	225

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S2-5	505483.487	103430.940	6.938	1.465	1200	 0	2.000	5.473	225
S2-6	505461.224	103389.126	6.571	2.271	1200	 1 2 0	2.000 1.003 1.004	4.300 4.500 4.300	225 225 225
S2-6_OUT	505470.171	103384.778	6.500	2.259		 1	1.004	4.241	225

Simulation Settings

Rainfall Methodology	FEH-13	Drain Down Time (mins)	240
Summer CV	0.750	Additional Storage (m³/ha)	20.0
Winter CV	0.840	Check Discharge Rate(s)	x
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	40	0	0
100	40	0	0

Node S2-6_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	5.200
Safety Factor	2.0	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	55.0	0.0	1.300	265.0	0.0

Node S2-6_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03103	Porosity	0.95
Side Inf Coefficient (m/hr)	0.03103	Invert Level (m)	3.500
Safety Factor	2.0	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	275.0	275.0	0.400	275.0	275.0	0.401	0.0	275.0

Node S2-6_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	3.900
Safety Factor	2.0	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	55.0	0.0	1.300	55.0	0.0	1.301	0.0	0.0

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Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 98.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	S2-1	19	4.892	0.283	17.9	0.5206	0.0000	SURCHARGED
30 minute summer	S2-2	19	4.876	0.338	28.9	0.5408	0.0000	SURCHARGED
30 minute summer	S2-3	19	4.784	0.396	39.7	0.5844	0.0000	SURCHARGED
30 minute summer	S2-4	19	4.726	0.370	41.2	0.4351	0.0000	SURCHARGED
30 minute summer	S2-5	18	5.528	0.055	11.0	0.0860	0.0000	OK
30 minute summer	S2-6	19	4.637	0.337	64.8	0.5048	0.0000	SURCHARGED
360 minute winter	S2-6_OUT	360	3.861	-0.380	13.5	94.4403	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	S2-1	1.000	S2-2	16.1	0.720	0.404	0.4793
30 minute summer	S2-2	1.001	S2-3	28.2	0.778	0.710	1.0127
30 minute summer	S2-3	1.002	S2-4	39.6	0.995	0.992	0.2147
30 minute summer	S2-4	1.003	S2-6	41.0	1.032	1.027	0.3748
30 minute summer	S2-5	2.000	S2-6	11.0	0.386	0.134	1.1214
30 minute summer	S2-6	1.004	S2-6_OUT	64.6	1.625	1.618	0.3865
360 minute winter	S2-6_OUT	Infiltration		1.2			

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	S2-1	19	5.640	1.031	30.2	1.8965	0.0000	SURCHARGED
30 minute summer	S2-2	19	5.597	1.059	47.8	1.6967	0.0000	SURCHARGED
600 minute winter	S2-3	585	5.446	1.058	7.4	1.5627	0.0000	SURCHARGED
600 minute winter	S2-4	585	5.446	1.090	7.7	1.2829	0.0000	SURCHARGED
30 minute summer	S2-5	18	5.545	0.072	18.5	0.1122	0.0000	OK
600 minute winter	S2-6	585	5.446	1.146	12.0	1.7190	0.0000	SURCHARGED
600 minute winter	S2-6_OUT	585	5.446	1.205	13.6	144.8160	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	S2-1	1.000	S2-2	26.1	0.721	0.657	0.4793
30 minute summer	S2-2	1.001	S2-3	45.8	1.153	1.153	1.0127
600 minute winter	S2-3	1.002	S2-4	7.4	0.679	0.185	0.2147
600 minute winter	S2-4	1.003	S2-6	7.7	0.619	0.193	0.3748
30 minute summer	S2-5	2.000	S2-6	18.5	0.612	0.225	1.2023
600 minute winter	S2-6	1.004	S2-6_OUT	12.0	0.870	0.301	0.3956
600 minute winter	S2-6_OUT	Infiltration		1.2			

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Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S3-1	0.035	5.00	7.040	1350	505534.296	103482.802	1.425
S3-2	0.051	5.00	6.685	1350	505533.069	103466.866	1.467
S3-3	0.018	5.00	6.704	1200	505531.026	103443.108	1.627
S3-44	0.012	5.00	7.080	1200	505585.256	103428.895	1.511
S3-5	0.091	5.00	6.885	1200	505543.493	103431.123	1.638
S3-6	0.054	5.00	6.991	1200	505534.298	103429.940	2.069
S3-7	0.023	5.00	7.218	1200	505510.695	103415.607	1.300
S3-8	0.014	5.00	6.980	1200	505531.577	103424.139	2.085
S3-9	0.040	5.00	6.866	1200	505537.628	103412.910	2.024
S3-10	0.011	5.00	6.735	1200	505537.747	103399.961	1.946
S3-11	0.029	5.00	6.350	1500	505538.056	103385.389	2.121
S3-11_OUT	0.046		6.300		505535.606	103359.404	1.725

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)
1.007	S3-11	S3-11_OUT	26.100	0.600	4.729	4.575	0.154	169.5	225	6.06	50.0
1.006	S3-10	S3-11	14.575	0.600	4.789	4.729	0.060	242.9	300	6.52	50.0
1.005	S3-9	S3-10	12.950	0.600	4.842	4.789	0.053	244.3	300	6.28	50.0
1.004	S3-8	S3-9	12.786	0.600	4.895	4.842	0.053	240.7	300	6.07	50.0
1.003	S3-6	S3-8	6.407	0.600	4.922	4.895	0.027	237.3	300	5.86	50.0
3.000	S3-7	S3-8	22.558	0.600	5.319	5.085	0.234	97.4	150	5.25	50.0
1.002	S3-3	S3-6	13.508	0.600	5.077	4.997	0.080	168.9	225	5.75	50.0
2.001	S3-5	S3-6	9.271	0.600	5.247	4.922	0.325	28.6	300	5.75	50.0
2.000	S3-44	S3-5	41.822	0.600	5.569	5.322	0.247	169.3	225	5.70	50.0
1.001	S3-2	S3-3	23.046	0.600	5.218	5.077	0.141	168.1	225	5.53	50.0
1.000	S3-1	S3-2	15.987	0.600	5.615	5.218	0.397	40.3	225	5.13	50.0

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)
1.007	1.001	119.4	48.2	1.396	1.500	0.356	0.0	100	0.950
1.006	1.004	71.0	44.3	1.646	1.321	0.327	0.0	172	1.057
1.005	1.001	70.8	42.7	1.724	1.646	0.315	0.0	168	1.047
1.004	1.009	71.3	36.5	1.785	1.724	0.269	0.0	152	1.014
1.003	1.016	71.8	31.4	1.769	1.785	0.232	0.0	139	0.983
3.000	1.479	11.6	3.2	1.200	1.785	0.023	0.0	36	1.258
1.002	1.001	39.8	12.9	1.402	1.769	0.095	0.0	87	0.893
2.001	2.952	208.7	13.9	1.338	1.769	0.103	0.0	52	1.695
2.000	1.002	39.8	1.6	1.286	1.338	0.012	0.0	31	0.496
1.001	1.002	39.9	10.4	1.242	1.402	0.076	0.0	78	0.843
1.000	2.066	82.2	3.4	1.200	1.242	0.025	0.0	31	1.030

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	26.100	169.5	225	Triple	6.350	4.729	1.396	6.300	4.575	1.500
1.006	14.575	242.9	300	PH1	6.735	4.789	1.646	6.350	4.729	1.321
1.005	12.950	244.3	300	PH1	6.866	4.842	1.724	6.735	4.789	1.646
1.004	12.786	240.7	300	PH1	6.980	4.895	1.785	6.866	4.842	1.724
1.003	6.407	237.3	300	PH1	6.991	4.922	1.769	6.980	4.895	1.785
3.000	22.558	97.4	150	PH1	7.218	5.918	1.200	6.980	5.095	1.785
1.002	13.508	168.9	225	PH1	6.704	5.077	1.402	6.991	4.597	1.769
2.001	9.271	28.6	300	PH1	6.885	5.247	1.338	6.991	4.922	1.769
2.000	41.822	169.3	225	PH1	7.080	5.569	1.286	6.885	5.322	1.338
1.001	23.046	168.1	225	PH1	6.685	5.218	1.242	6.704	5.077	1.402

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	S3-11	1500	Manhole	Adoptable	S3-11_OUT		Junction	
1.006	S3-10	1200	Manhole	Adoptable	S3-11	1500	Manhole	Adoptable
1.005	S3-9	1200	Manhole	Adoptable	S3-10	1200	Manhole	Adoptable
1.004	S3-8	1200	Manhole	Adoptable	S3-9	1200	Manhole	Adoptable
1.003	S3-6	1200	Manhole	Adoptable	S3-8	1200	Manhole	Adoptable
3.000	S3-7	1200	Manhole	Adoptable	S3-8	1200	Manhole	Adoptable
1.002	S3-3	1200	Manhole	Adoptable	S3-6	1200	Manhole	Adoptable
2.001	S3-5	1200	Manhole	Adoptable	S3-6	1200	Manhole	Adoptable
2.000	S3-44	1200	Manhole	Adoptable	S3-5	1200	Manhole	Adoptable
1.001	S3-2	1350	Manhole	Adoptable	S3-3	1200	Manhole	Adoptable

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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	15.000	49.3	225	PH1	7.040	5.615	1.200	6.685	5.218	1.242

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S3-1	1350	Manhole	Adoptable	S3-2	1350	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S3-1	505534.296	103482.802	7.040	1.425	1350	0	1.000	5.615	225
S3-2	505533.069	103466.866	6.685	1.467	1350	1 0	1.000 1.001	5.218 5.218	225 225
S3-3	505531.026	103443.108	6.704	1.627	1200	1 0	1.001 1.002	5.077 5.077	225 225
S3-44	505585.256	103428.895	7.080	1.511	1200	0	2.000	5.569	225
S3-5	505543.493	103431.123	6.885	1.638	1200	1 0	1.000 2.001	5.322 5.247	225 300
S3-6	505534.298	103429.940	6.991	2.069	1200	1 2 0	2.001 1.002 1.003	4.922 4.997 4.922	300 225 300
S3-7	505510.695	103415.607	7.218	1.300	1200	0	3.000	5.918	300
S3-8	505531.577	103424.139	6.980	2.085	1200	1 2 0	3.000 1.003 1.004	5.095 4.895 4.895	300 300 300
S3-9	505537.628	103412.910	6.866	2.024	1200	1 0	1.004 1.005	4.892 4.842	300 300
S3-10	505537.747	103399.961	6.735	1.946	1200	1 0	1.005 1.006	4.789 4.789	300 300
S3-11	505538.056	103385.389	6.350	2.121	1500	1 0	1.006 1.007	4.729 4.729	300 225
S3-11_OUT	505535.606	103359.404	6.300	1.725		1	1.007	4.575	225

Simulation Settings

Rainfall Methodology	FEH-13	Drain Down Time (mins)	240
Summer CV	0.750	Additional Storage (m³/ha)	20.0
Winter CV	0.840	Check Discharge Rate(s)	x
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

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 %)
10	40	0	0
100	40	0	0

Node S3-11_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03103	Porosity	0.95
Side Inf Coefficient (m/hr)	0.03103	Invert Level (m)	3.750
Safety Factor	2.0	Time to half empty (mins)	874

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	300.0	300.0	0.800	300.0	300.0	0.801	0.0	300.0

Node S3-11_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	5.000
Safety Factor	2.0	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	76.0	0.0	1.300	450.0	0.0

Node S3-11_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.550
Safety Factor	2.0	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	75.0	0.0	0.450	75.0	0.0	0.451	0.0	0.0

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Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	S3-1	18	5.665	0.050	9.0	0.0895	0.0000	OK
30 minute summer	S3-2	19	5.552	0.334	27.1	0.7107	0.0000	SURCHARGED
30 minute summer	S3-3	19	5.490	0.412	30.2	0.5598	0.0000	SURCHARGED
30 minute summer	S3-44	18	5.618	0.049	4.3	0.0638	0.0000	OK
30 minute summer	S3-5	19	5.433	0.186	36.4	0.4154	0.0000	OK
30 minute summer	S3-6	19	5.429	0.506	71.7	0.7402	0.0000	SURCHARGED
30 minute summer	S3-7	18	5.981	0.063	8.3	0.0935	0.0000	OK
30 minute summer	S3-8	19	5.375	0.480	83.3	0.6089	0.0000	SURCHARGED
30 minute summer	S3-9	19	5.266	0.423	97.6	0.6699	0.0000	SURCHARGED
30 minute summer	S3-10	19	5.114	0.325	100.9	0.4054	0.0000	SURCHARGED
30 minute summer	S3-11	19	4.902	0.173	109.8	0.3679	0.0000	OK
720 minute winter	S3-11_OUT	705	4.402	-0.174	13.6	185.7853	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	S3-1	1.000	S3-2	9.0	0.565	0.110	0.3703
30 minute summer	S3-2	1.001	S3-3	24.2	0.834	0.608	0.9484
30 minute summer	S3-3	1.002	S3-6	32.1	0.864	0.806	0.5396
30 minute summer	S3-44	2.000	S3-5	4.3	0.631	0.107	0.5365
30 minute summer	S3-5	2.001	S3-6	34.0	0.680	0.163	0.5387
30 minute summer	S3-6	1.003	S3-8	72.2	1.026	1.005	0.4512
30 minute summer	S3-7	3.000	S3-8	8.3	1.429	0.711	0.1466
30 minute summer	S3-8	1.004	S3-9	83.4	1.185	1.170	0.8983
30 minute summer	S3-9	1.005	S3-10	97.2	1.381	1.374	0.9119
30 minute summer	S3-10	1.006	S3-11	100.4	1.715	1.415	0.8196
30 minute summer	S3-11	1.007	S3-11_OUT	109.6	1.159	0.918	2.4670
720 minute winter	S3-11_OUT	Infiltration		1.3			

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	S3-1	20	6.428	0.813	15.2	1.4537	0.0000	SURCHARGED
30 minute summer	S3-2	20	6.417	1.199	38.8	2.5507	0.0000	FLOOD RISK
30 minute summer	S3-3	20	6.285	1.208	42.9	1.6401	0.0000	SURCHARGED
30 minute summer	S3-44	20	6.201	0.632	19.2	0.8159	0.0000	SURCHARGED
30 minute summer	S3-5	20	6.185	0.938	62.4	2.0988	0.0000	SURCHARGED
30 minute summer	S3-6	20	6.156	1.233	109.8	1.8030	0.0000	SURCHARGED
30 minute summer	S3-7	20	6.692	0.774	14.0	1.1530	0.0000	SURCHARGED
30 minute summer	S3-8	20	6.035	1.139	123.3	1.4456	0.0000	SURCHARGED
30 minute summer	S3-9	20	5.791	0.948	145.5	1.5014	0.0000	SURCHARGED
30 minute summer	S3-10	20	5.455	0.666	149.5	0.8311	0.0000	SURCHARGED
960 minute winter	S3-11	945	5.390	0.661	14.5	1.4057	0.0000	SURCHARGED
960 minute winter	S3-11_OUT	945	5.390	0.814	16.3	290.2555	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	S3-1	1.000	S3-2	13.5	0.561	0.164	0.6357
30 minute summer	S3-2	1.001	S3-3	35.4	0.890	0.888	0.9484
30 minute summer	S3-3	1.002	S3-6	45.1	1.134	1.133	0.5396
30 minute summer	S3-44	2.000	S3-5	12.9	0.639	0.323	1.6633
30 minute summer	S3-5	2.001	S3-6	54.0	0.767	0.259	0.6529
30 minute summer	S3-6	1.003	S3-8	107.0	1.520	1.490	0.4512
30 minute summer	S3-7	3.000	S3-8	10.3	1.400	0.885	0.1765
30 minute summer	S3-8	1.004	S3-9	123.6	1.755	1.733	0.8983
30 minute summer	S3-9	1.005	S3-10	144.5	2.053	2.043	0.9119
30 minute summer	S3-10	1.006	S3-11	150.2	2.133	2.116	1.0264
960 minute winter	S3-11	1.007	S3-11_OUT	14.5	0.682	0.121	3.1141
960 minute winter	S3-11_OUT	Infiltration		1.3			

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Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S4-1	0.059	5.00	6.435	1350	505705.532	103417.972	1.338
S4-2	0.075	5.00	7.018	1200	505662.985	103421.137	2.173
S4-3	0.055	5.00	6.872	1350	505659.312	103414.353	2.223
S4-4	0.078	5.00	6.615	1350	505657.739	103390.597	2.040
S4-5	0.119	5.00	6.269	1350	505658.839	103359.308	1.866
S4-6	0.048	5.00	6.165	1350	505657.769	103348.896	1.788
S4-7	0.028	5.00	6.000	1350	505655.817	103325.537	1.681
S4-8			6.000	1350	505650.228	103323.919	1.696
S4-9	0.069	5.00	7.120	1350	505657.582	103468.047	1.570
S4-10	0.059	5.00	6.868	1350	505655.560	103442.578	1.469
S4-11	0.044	5.00	6.889	1200	505651.161	103433.708	1.624
S4-12	0.060	5.00	6.776	1350	505643.122	103436.368	1.549
S4-13	0.040	5.00	6.874	1200	505608.154	103438.713	1.791
S4-14	0.053	5.00	6.936	1350	505593.918	103489.216	1.425
S4-15	0.028	5.00	7.064	1200	505592.921	103476.582	1.628
S4-16	0.055	5.00	7.137	1200	505590.793	103454.669	1.831
S4-17	0.014	5.00	7.031	1200	505592.531	103447.681	1.768
S4-18	0.056	5.00	7.054	1350	505597.637	103435.949	2.091
S4-19	0.034	5.00	7.054	1350	505593.406	103430.134	2.114
S4-20	0.049	5.00	6.842	1350	505599.121	103411.635	1.962
S4-21	0.045	5.00	6.627	1350	505598.612	103390.883	1.811
S4-22	0.064	5.00	6.282	1350	505595.588	103356.705	1.635
S4-23	0.044	5.00	6.300	1350	505564.303	103355.189	1.425
S4-24	0.021	5.00	6.365	1200	505580.228	103353.421	1.585
S4-25	0.057	5.00	6.224	1350	505590.634	103346.454	1.668
S4-26	0.042	5.00	6.000	1350	505614.679	103336.167	1.425
S4-27	0.007	5.00	6.094	1200	505603.540	103338.298	1.586
S4-28	0.062	5.00	6.000		505589.074	103338.002	1.925
S4-28_OUT			6.000		505586.082	103328.326	1.946

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)
1.008	S4-28	S4-28_OUT	10.128	0.600	4.075	4.054	0.021	482.3	525	9.62	50.0
1.007	S4-8	S4-28	62.755	0.600	4.301	4.150	0.151	407.5	450	9.45	50.0
5.001	S4-27	S4-28	14.449	0.600	4.503	4.375	0.128	108.8	225	5.38	50.0
2.010	S4-25	S4-28	8.595	0.600	4.556	4.225	0.331	26.0	375	7.86	50.0
4.001	S4-24	S4-25	12.523	0.600	4.780	4.706	0.074	169.2	225	5.47	50.0
2.009	S4-22	S4-25	11.393	0.600	4.687	4.556	0.081	125.7	375	7.84	50.0
2.008	S4-21	S4-22	34.312	0.600	4.816	4.647	0.170	202.1	375	7.72	50.0
2.007	S4-20	S4-21	20.758	0.600	4.890	4.826	0.064	324.3	375	7.27	50.0
2.006	S4-19	S4-20	19.362	0.600	4.940	4.880	0.060	322.7	375	6.83	50.0
2.005	S4-18	S4-19	7.191	0.600	4.943	4.940	0.003	312.7	375	6.80	50.0
1.004	S4-13	S4-18	10.874	0.600	5.083	5.058	0.045	241.6	300	6.45	50.0
3.003	S4-17	S4-18	12.735	0.600	5.263	5.113	0.150	85.5	225	5.85	50.0
3.002	S4-16	S4-17	7.201	0.600	5.306	5.269	0.042	167.5	225	5.79	50.0
3.001	S4-15	S4-16	22.016	0.600	5.436	5.306	0.130	169.4	225	5.58	50.0
3.000	S4-14	S4-15	12.478	0.600	5.511	5.436	0.075	169.0	225	5.21	50.0
2.003	S4-12	S4-13	25.047	0.600	5.227	5.053	0.184	243.4	300	6.21	50.0
2.002	S4-11	S4-12	8.468	0.600	5.265	5.227	0.038	225.2	300	5.72	50.0

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)
1.008	1.013	219.3	184.8	1.400	1.421	1.364	0.0	371	1.130
1.007	1.001	159.1	61.9	1.246	1.400	0.457	0.0	195	0.941
5.001	1.253	49.8	6.6	1.361	1.400	0.049	0.0	55	0.873
2.010	3.367	394.0	107.9	1.293	1.400	0.796	0.0	134	3.060
4.001	1.002	39.8	8.7	1.360	1.293	0.064	0.0	72	0.808
2.009	1.615	178.3	91.5	1.260	1.293	0.675	0.0	190	1.623
2.008	1.271	140.3	82.8	1.436	1.260	0.611	0.0	208	1.321
2.007	1.000	110.5	76.7	1.587	1.436	0.566	0.0	230	1.077
2.006	1.003	110.8	70.1	1.739	1.587	0.517	0.0	217	1.060
2.005	1.019	112.6	65.5	1.716	1.739	0.483	0.0	205	1.056
2.004	1.007	71.2	37.9	1.491	1.716	0.280	0.0	156	1.022
1.003	1.414	56.2	20.0	1.543	1.716	0.148	0.0	93	1.298
3.002	1.007	40.1	18.2	1.606	1.543	0.134	0.0	106	0.982
3.001	1.002	39.8	10.7	1.403	1.606	0.079	0.0	80	0.852
3.000	1.003	39.9	7.2	1.200	1.403	0.053	0.0	65	0.764
2.003	1.003	70.9	31.4	1.249	1.491	0.232	0.0	140	0.974
2.002	1.043	73.7	23.3	1.324	1.249	0.172	0.0	116	0.928

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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)
3.001	S4-10	S4-11	9.901	0.600	5.393	5.340	0.053	187.9	225	5.59	50.0
3.000	S4-9	S4-10	28.548	0.600	5.550	5.393	0.157	169.2	225	5.42	50.0
4.000	S4-23	S4-24	16.023	0.600	4.875	4.780	0.095	168.7	225	5.27	50.0
5.000	S4-26	S4-27	13.341	0.600	4.575	4.508	0.067	199.1	225	5.19	50.0
1.006	S4-7	S4-8	5.819	0.600	4.339	4.308	0.015	387.9	450	7.43	50.0
1.005	S4-6	S4-7	23.480	0.600	4.277	4.219	0.058	404.1	450	7.32	50.0
1.004	S4-5	S4-6	10.467	0.600	4.403	4.377	0.026	402.6	450	6.93	50.0
1.003	S4-4	S4-5	21.308	0.600	4.575	4.478	0.097	219.8	375	6.75	50.0
1.002	S4-3	S4-4	23.608	0.600	4.649	4.575	0.074	321.7	375	6.23	50.0
1.001	S4-2	S4-3	7.715	0.600	4.845	4.799	0.046	167.7	225	5.84	50.0
1.000	S4-1	S4-2	42.665	0.600	5.097	4.845	0.252	169.3	225	5.71	50.0

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)
3.001	1.006	40.0	17.4	1.244	1.324	0.128	0.0	104	0.974
3.000	1.002	39.8	9.4	1.345	1.244	0.069	0.0	74	0.823
4.000	1.004	39.9	5.9	1.200	1.360	0.044	0.0	58	0.724
5.000	1.002	39.8	5.7	1.200	1.361	0.042	0.0	57	0.710
1.006	1.026	163.2	61.9	1.231	1.246	0.457	0.0	192	0.958
1.005	1.005	159.8	58.1	1.338	1.231	0.429	0.0	188	0.929
1.004	1.007	160.1	51.7	1.416	1.338	0.381	0.0	175	0.901
1.003	1.003	110.8	35.5	1.665	1.416	0.262	0.0	145	0.895
1.002	1.004	110.9	25.5	1.848	1.665	0.188	0.0	122	0.821
1.001	1.007	40.0	18.1	1.948	1.848	0.133	0.0	106	0.981
1.000	1.002	39.8	7.9	1.113	1.948	0.059	0.0	68	0.786

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)
1.006	10.128	482.3	525	PH1	6.000	4.079	1.400	6.000	4.054	1.421
1.007	62.758	407.5	450	PH1	6.000	4.304	1.246	6.000	4.150	1.400
5.001	14.463	169.9	225	PH1	6.094	4.509	1.361	6.000	4.375	1.400
2.010	6.595	26.0	375	PH1	6.224	4.556	1.293	6.000	4.225	1.400
4.001	12.522	169.2	225	PH1	6.365	4.780	1.360	6.224	4.706	1.293
2.008	11.385	125.7	375	PH1	6.282	4.647	1.260	6.224	4.556	1.293
2.060	34.611	202.1	375	PH1	6.627	4.816	1.436	6.282	4.647	1.260
2.007	20.758	124.3	375	PH1	6.842	4.890	1.587	6.627	4.816	1.436
2.006	19.362	322.7	375	PH1	7.054	4.940	1.739	6.842	4.890	1.587
2.005	7.191	312.7	375	PH1	7.054	4.963	1.716	7.054	4.940	1.739
2.004	10.874	241.6	300	PH1	6.874	5.083	1.491	7.054	5.038	1.716
2.003	12.785	65.5	225	PH1	7.031	5.266	1.543	7.054	5.116	1.716
2.002	7.201	187.5	225	PH1	7.137	5.306	1.606	7.031	5.266	1.543
2.001	22.916	169.4	225	PH1	7.064	5.436	1.403	7.137	5.306	1.606
2.000	12.673	169.0	225	PH1	6.936	5.511	1.200	7.064	5.436	1.403
2.009	35.047	243.8	300	PH1	6.776	5.327	1.249	6.874	5.093	1.491
2.002	8.468	225.2	300	PH1	6.889	5.265	1.324	6.776	5.227	1.249
2.001	9.901	187.8	225	PH1	6.868	5.393	1.244	6.889	5.340	1.324
2.000	28.548	169.2	225	PH1	7.120	5.550	1.345	6.868	5.399	1.244

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.008	S4-28		Junction		S4-28_OUT		Junction	
1.007	S4-8	1350	Manhole	Adoptable	S4-28		Junction	
5.001	S4-27	1200	Manhole	Adoptable	S4-28		Junction	
2.010	S4-25	1350	Manhole	Adoptable	S4-28		Junction	
4.001	S4-24	1200	Manhole	Adoptable	S4-25	1350	Manhole	Adoptable
2.009	S4-22	1350	Manhole	Adoptable	S4-25	1350	Manhole	Adoptable
2.008	S4-21	1350	Manhole	Adoptable	S4-22	1350	Manhole	Adoptable
2.007	S4-20	1350	Manhole	Adoptable	S4-21	1350	Manhole	Adoptable
2.006	S4-19	1350	Manhole	Adoptable	S4-20	1350	Manhole	Adoptable
2.005	S4-18	1350	Manhole	Adoptable	S4-19	1350	Manhole	Adoptable
2.004	S4-13	1200	Manhole	Adoptable	S4-18	1350	Manhole	Adoptable
3.003	S4-17	1200	Manhole	Adoptable	S4-18	1350	Manhole	Adoptable
3.002	S4-16	1200	Manhole	Adoptable	S4-17	1200	Manhole	Adoptable
3.001	S4-15	1200	Manhole	Adoptable	S4-16	1200	Manhole	Adoptable
3.000	S4-14	1350	Manhole	Adoptable	S4-15	1200	Manhole	Adoptable
2.003	S4-12	1350	Manhole	Adoptable	S4-13	1200	Manhole	Adoptable
2.002	S4-11	1200	Manhole	Adoptable	S4-12	1350	Manhole	Adoptable
2.001	S4-10	1350	Manhole	Adoptable	S4-11	1200	Manhole	Adoptable
2.000	S4-9	1350	Manhole	Adoptable	S4-10	1350	Manhole	Adoptable

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.000	14.033	163.7	225	PH1	6.300	4.875	1.200	6.365	4.780	1.360
5.000	11.341	169.3	225	PH1	6.000	4.575	1.200	6.094	4.509	1.361
1.006	5.819	387.9	450	PH1	6.000	4.519	1.231	6.000	4.304	1.246
1.005	28.440	404.1	450	PH1	6.165	4.377	1.338	6.000	4.519	1.231
1.004	10.467	402.6	450	PH1	6.269	4.403	1.416	6.165	4.277	1.338
1.003	31.300	322.0	375	PH1	6.615	4.575	1.665	6.269	4.470	1.416
1.002	23.893	321.7	375	PH1	6.872	4.648	1.848	6.615	4.575	1.665
1.001	7.715	167.7	225	PH1	7.018	4.845	1.948	6.872	4.799	1.848
1.000	42.685	169.3	225	PH1	6.435	5.097	1.113	7.018	4.845	1.948

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	S4-23	1350	Manhole	Adoptable	S4-24	1200	Manhole	Adoptable
5.000	S4-26	1350	Manhole	Adoptable	S4-27	1200	Manhole	Adoptable
1.006	S4-7	1350	Manhole	Adoptable	S4-8	1350	Manhole	Adoptable
1.005	S4-6	1350	Manhole	Adoptable	S4-7	1350	Manhole	Adoptable
1.004	S4-5	1350	Manhole	Adoptable	S4-6	1350	Manhole	Adoptable
1.003	S4-4	1350	Manhole	Adoptable	S4-5	1350	Manhole	Adoptable
1.002	S4-3	1350	Manhole	Adoptable	S4-4	1350	Manhole	Adoptable
1.001	S4-2	1200	Manhole	Adoptable	S4-3	1350	Manhole	Adoptable
1.000	S4-1	1350	Manhole	Adoptable	S4-2	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S4-1	505705.532	103417.972	6.435	1.338	1350	0	1.000	5.097	225
S4-2	505662.985	103421.137	7.018	2.173	1200	1	1.000	4.945	225
						0	1.001	4.845	225
S4-3	505659.312	103414.353	6.872	2.223	1350	1	1.001	4.799	225
						0	1.002	4.648	375
S4-4	505657.739	103390.597	6.615	2.040	1350	1	1.002	4.575	375
						0	1.003	4.575	375
S4-5	505658.839	103359.308	6.269	1.866	1350	1	1.003	4.478	375
						0	1.004	4.403	450
S4-6	505657.769	103348.896	6.165	1.788	1350	1	1.004	4.377	450
						0	1.005	4.377	450
S4-7	505655.817	103325.537	6.000	1.681	1350	1	1.005	4.319	450
						0	1.006	4.319	450
S4-8	505650.228	103323.919	6.000	1.696	1350	1	1.006	4.304	450
						0	1.007	4.304	450
S4-9	505657.582	103468.047	7.120	1.570	1350	0	2.000	5.550	225
S4-10	505655.560	103442.578	6.868	1.469	1350	1	2.000	5.399	225
						0	2.001	5.399	225
S4-11	505651.161	103433.708	6.889	1.624	1200	1	2.001	5.349	225
						0	2.002	5.265	300

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S4-12	505643.122	103436.368	6.776	1.549	1350	1	2.002	5.227	300
						0	2.003	5.227	300
S4-13	505608.154	103438.713	6.874	1.791	1200	1	2.003	5.083	300
						0	2.004	5.083	300
S4-14	505593.918	103489.216	6.936	1.425	1350				
						0	3.005	5.511	225
S4-15	505592.921	103476.582	7.064	1.628	1200	1	3.000	5.436	225
						0	3.001	5.436	225
S4-16	505590.793	103454.669	7.137	1.831	1200	1	3.001	5.306	225
						0	3.002	5.306	225
S4-17	505592.531	103447.681	7.031	1.768	1200	1	3.002	5.263	225
						0	3.003	5.263	225
S4-18	505597.637	103435.949	7.054	2.091	1350	1	3.003	5.113	225
						2	2.004	5.038	300
						0	2.005	4.963	375
S4-19	505593.406	103430.134	7.054	2.114	1350	1	2.005	4.940	375
						0	2.006	4.940	375
S4-20	505599.121	103411.635	6.842	1.962	1350	1	2.006	4.880	375
						0	2.007	4.880	375
S4-21	505598.612	103390.883	6.627	1.811	1350	1	2.007	4.816	375
						0	2.008	4.816	375
S4-22	505595.588	103356.705	6.282	1.635	1350	1	2.008	4.647	375
						0	2.009	4.647	375
S4-23	505564.303	103355.189	6.300	1.425	1350				
						0	4.009	4.875	225
S4-24	505580.228	103353.421	6.365	1.585	1200	1	4.000	4.780	225
						0	4.001	4.780	225
S4-25	505590.634	103346.454	6.224	1.668	1350	1	4.001	4.706	225
						2	2.009	4.556	375
						0	2.010	4.556	375
S4-26	505614.679	103336.167	6.000	1.425	1350				
						0	5.010	4.575	225
S4-27	505603.540	103338.298	6.094	1.586	1200	1	5.000	4.508	225
						0	5.001	4.508	225
S4-28	505589.074	103338.002	6.000	1.925		1	5.001	4.375	225
						2	2.010	4.225	375
						3	1.007	4.150	450
						0	1.008	4.075	525
S4-28_OUT	505586.082	103328.326	6.000	1.946		1	1.008	4.054	525

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Simulation Settings

Rainfall Methodology	FEH-13	Drain Down Time (mins)	240
Summer CV	0.750	Additional Storage (m³/ha)	20.0
Winter CV	0.840	Check Discharge Rate(s)	x
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	40	0	0
100	40	0	0

Node S4-28_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.04680	Porosity	0.95
Side Inf Coefficient (m/hr)	0.04680	Invert Level (m)	3.350
Safety Factor	2.0	Time to half empty (mins)	464

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	850.0	850.0	0.800	850.0	950.0	0.801	0.0	950.0

Node S4-28_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.700
Safety Factor	2.0	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	100.0	0.0	1.300	615.0	0.0

Node S4-28 OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.150
Safety Factor	2.0	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	100.0	0.0	0.550	100.0	0.0	0.551	0.0	0.0

Node S4-9 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.95
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	5.550
Safety Factor	2.0	Time to half empty (mins)	14

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	100.0	0.0	0.400	100.0	0.0	0.401	0.0	0.0

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Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	S4-1	18	5.211	0.114	20.8	0.2631	0.0000	OK
30 minute summer	S4-2	18	5.090	0.245	47.2	0.4462	0.0000	SURCHARGED
30 minute summer	S4-3	19	4.906	0.257	66.5	0.4959	0.0000	OK
30 minute summer	S4-4	19	4.876	0.301	91.1	0.6483	0.0000	OK
30 minute summer	S4-5	19	4.810	0.407	129.8	1.1031	0.0000	OK
30 minute summer	S4-6	19	4.779	0.402	142.3	0.7893	0.0000	OK
30 minute summer	S4-7	19	4.720	0.401	149.8	0.7065	0.0000	OK
30 minute summer	S4-8	19	4.675	0.371	149.3	0.5312	0.0000	OK
30 minute summer	S4-9	21	5.670	0.120	34.3	11.6887	0.0000	OK
30 minute summer	S4-10	19	5.672	0.273	29.6	0.6104	0.0000	SURCHARGED
30 minute summer	S4-11	18	5.676	0.411	39.7	0.6867	0.0000	SURCHARGED
30 minute summer	S4-12	18	5.673	0.446	52.7	0.9811	0.0000	SURCHARGED
30 minute summer	S4-13	19	5.610	0.527	64.4	0.8770	0.0000	SURCHARGED
30 minute summer	S4-14	19	5.830	0.319	18.8	0.6936	0.0000	SURCHARGED
30 minute summer	S4-15	19	5.815	0.379	27.9	0.5503	0.0000	SURCHARGED
30 minute summer	S4-16	19	5.759	0.453	40.6	0.7850	0.0000	SURCHARGED
30 minute summer	S4-17	19	5.690	0.427	44.3	0.5494	0.0000	SURCHARGED
30 minute summer	S4-18	19	5.566	0.603	118.7	1.1854	0.0000	SURCHARGED
30 minute summer	S4-19	19	5.512	0.571	128.6	1.0020	0.0000	SURCHARGED
30 minute summer	S4-20	19	5.395	0.514	144.5	0.9925	0.0000	SURCHARGED
30 minute summer	S4-21	19	5.240	0.423	159.0	0.8162	0.0000	SURCHARGED
30 minute summer	S4-22	19	4.979	0.333	179.7	0.7355	0.0000	OK
30 minute summer	S4-23	18	4.977	0.102	15.6	0.2092	0.0000	OK
30 minute summer	S4-24	18	4.911	0.131	22.9	0.1825	0.0000	OK
30 minute summer	S4-25	19	4.801	0.245	220.4	0.5175	0.0000	OK
30 minute summer	S4-26	18	4.676	0.101	14.8	0.2030	0.0000	OK
30 minute summer	S4-27	17	4.602	0.094	17.4	0.1143	0.0000	OK
30 minute summer	S4-28	19	4.550	0.475	404.8	0.3043	0.0000	OK
480 minute winter	S4-28_OUT	472	4.069	0.015	63.7	580.4420	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	S4-1	1.000	S4-2	20.8	0.626	0.521	1.2793
30 minute summer	S4-2	1.001	S4-3	47.0	1.206	1.173	0.2854
30 minute summer	S4-3	1.002	S4-4	64.9	0.782	0.585	2.0878
30 minute summer	S4-4	1.003	S4-5	87.5	0.942	0.790	3.0991
30 minute summer	S4-5	1.004	S4-6	125.7	0.870	0.785	1.5713
30 minute summer	S4-6	1.005	S4-7	140.8	0.969	0.881	3.4991
30 minute summer	S4-7	1.006	S4-8	149.3	1.066	0.915	0.8407
30 minute summer	S4-8	1.007	S4-28	148.0	1.047	0.930	9.0638
30 minute summer	S4-9	2.000	S4-10	21.4	0.805	0.537	0.7833
30 minute summer	S4-10	2.001	S4-11	33.6	1.013	0.840	0.3938
30 minute summer	S4-11	2.002	S4-12	42.4	0.784	0.574	0.5963
30 minute summer	S4-12	2.003	S4-13	53.2	0.836	0.750	2.4680
30 minute summer	S4-13	2.004	S4-18	62.4	0.956	0.878	0.7657
30 minute summer	S4-14	3.000	S4-15	18.6	0.778	0.467	0.5040
30 minute summer	S4-15	3.001	S4-16	24.5	0.750	0.616	0.8756
30 minute summer	S4-16	3.002	S4-17	40.7	1.094	1.016	0.2864
30 minute summer	S4-17	3.003	S4-18	45.7	1.262	0.813	0.5089
30 minute summer	S4-18	2.005	S4-19	117.6	1.066	1.044	0.7931
30 minute summer	S4-19	2.006	S4-20	128.7	1.167	1.162	2.1356
30 minute summer	S4-20	2.007	S4-21	144.5	1.311	1.308	2.2895
30 minute summer	S4-21	2.008	S4-22	159.1	1.447	1.134	3.6665
30 minute summer	S4-22	2.009	S4-25	180.1	2.020	1.010	1.0226
30 minute summer	S4-23	4.000	S4-24	15.6	0.751	0.391	0.3330
30 minute summer	S4-24	4.001	S4-25	22.9	1.000	0.574	0.2867
30 minute summer	S4-25	2.010	S4-28	220.6	2.777	0.560	0.7643
30 minute summer	S4-26	5.000	S4-27	14.8	0.919	0.372	0.1857
30 minute summer	S4-27	5.001	S4-28	17.4	1.064	0.350	0.3445
30 minute summer	S4-28	1.008	S4-28_OUT	404.4	2.045	1.844	1.9975
480 minute winter	S4-28_OUT	Infiltration		6.1			

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ARUN DISTRICT COUNCIL A/45/22/PL

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	S4-1	19	6.109	1.012	35.1	2.3344	0.0000	SURCHARGED
30 minute summer	S4-2	19	5.950	1.105	69.7	2.0084	0.0000	SURCHARGED
30 minute summer	S4-3	19	5.733	1.084	98.4	2.0873	0.0000	SURCHARGED
30 minute summer	S4-4	19	5.653	1.078	138.0	2.3237	0.0000	SURCHARGED
600 minute winter	S4-5	600	5.542	1.139	22.7	3.0872	0.0000	SURCHARGED
600 minute winter	S4-6	600	5.542	1.165	25.5	2.2884	0.0000	SURCHARGED
600 minute winter	S4-7	600	5.542	1.223	27.1	2.1553	0.0000	SURCHARGED
600 minute winter	S4-8	600	5.542	1.238	27.1	1.7719	0.0000	SURCHARGED
30 minute winter	S4-9	22	6.403	0.853	90.6	40.0207	0.0000	SURCHARGED
30 minute winter	S4-10	23	6.333	0.934	56.9	2.0906	0.0000	SURCHARGED
30 minute summer	S4-11	19	6.296	1.031	53.6	1.7212	0.0000	SURCHARGED
30 minute summer	S4-12	19	6.297	1.070	61.3	2.3556	0.0000	SURCHARGED
30 minute summer	S4-13	19	6.283	1.199	70.1	1.9970	0.0000	SURCHARGED
30 minute summer	S4-14	20	6.918	1.407	31.7	3.0579	0.0000	FLOOD RISK
30 minute summer	S4-15	20	6.878	1.442	37.8	2.0929	0.0000	FLOOD RISK
30 minute summer	S4-16	20	6.737	1.431	64.4	2.4787	0.0000	SURCHARGED
30 minute summer	S4-17	20	6.563	1.300	68.8	1.6717	0.0000	SURCHARGED
30 minute summer	S4-18	19	6.254	1.291	141.2	2.5390	0.0000	SURCHARGED
30 minute summer	S4-19	19	6.178	1.237	157.6	2.1701	0.0000	SURCHARGED
30 minute summer	S4-20	19	6.005	1.124	182.4	2.1702	0.0000	SURCHARGED
30 minute summer	S4-21	19	5.761	0.944	205.3	1.8209	0.0000	SURCHARGED
600 minute winter	S4-22	600	5.542	0.895	39.9	1.9784	0.0000	SURCHARGED
600 minute winter	S4-23	600	5.542	0.667	2.6	1.3658	0.0000	SURCHARGED
600 minute winter	S4-24	600	5.542	0.762	3.8	1.0595	0.0000	SURCHARGED
600 minute winter	S4-25	600	5.542	0.986	47.1	2.0839	0.0000	SURCHARGED
600 minute winter	S4-26	600	5.542	0.967	2.5	1.9519	0.0000	SURCHARGED
600 minute winter	S4-27	600	5.542	1.034	2.9	1.2638	0.0000	SURCHARGED
600 minute winter	S4-28	600	5.542	1.467	80.7	0.9390	0.0000	SURCHARGED
600 minute winter	S4-28_OUT	600	5.542	1.488	80.7	887.7203	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	S4-1	1.000	S4-2	32.2	0.809	0.808	1.6968
30 minute summer	S4-2	1.001	S4-3	69.8	1.755	1.743	0.3068
30 minute summer	S4-3	1.002	S4-4	99.2	0.899	0.894	2.6260
30 minute summer	S4-4	1.003	S4-5	137.5	1.247	1.241	3.4532
600 minute winter	S4-5	1.004	S4-6	22.7	0.618	0.142	1.6584
600 minute winter	S4-6	1.005	S4-7	25.5	0.659	0.160	3.7139
600 minute winter	S4-7	1.006	S4-8	27.1	0.709	0.166	0.9218
600 minute winter	S4-8	1.007	S4-28	27.1	0.766	0.170	9.9431
30 minute winter	S4-9	2.000	S4-10	[illegible]	[illegible]	[illegible]	1.0161
30 minute winter	S4-10	2.001	S4-11	49.8	1.252	1.244	0.3938
30 minute summer	S4-11	2.002	S4-12	55.7	0.929	0.756	0.5963
30 minute summer	S4-12	2.003	S4-13	64.5	0.982	0.910	2.4680
30 minute summer	S4-13	2.004	S4-18	70.3	1.107	0.988	0.7657
30 minute summer	S4-14	3.000	S4-15	24.9	0.778	0.625	0.5040
30 minute summer	S4-15	3.001	S4-16	38.5	0.969	0.968	0.8756
30 minute summer	S4-16	3.002	S4-17	62.8	1.580	1.568	0.2864
30 minute summer	S4-17	3.003	S4-18	71.6	1.799	1.272	0.5089
30 minute summer	S4-18	2.005	S4-19	142.0	1.288	1.262	0.7931
30 minute summer	S4-19	2.006	S4-20	159.6	1.447	1.441	2.1356
30 minute summer	S4-20	2.007	S4-21	184.0	1.668	1.665	2.2895
30 minute summer	S4-21	2.008	S4-22	206.6	1.873	1.472	3.7845
600 minute winter	S4-22	2.009	S4-25	39.9	1.471	0.223	1.2557
600 minute winter	S4-23	4.000	S4-24	2.6	0.485	0.065	0.6373
600 minute winter	S4-24	4.001	S4-25	3.8	0.625	0.095	0.4981
600 minute winter	S4-25	2.010	S4-28	47.1	2.348	0.119	0.9480
600 minute winter	S4-26	5.000	S4-27	2.5	0.563	0.063	0.4510
600 minute winter	S4-27	5.001	S4-28	2.9	0.685	0.058	0.5754
600 minute winter	S4-28	1.008	S4-28_OUT	80.7	1.125	0.368	2.1880
600 minute winter	S4-28_OUT	Infiltration		6.2			

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Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Plots 112-129	0.127	6.050	505420.645	103440.040	2.050

Simulation Settings

Rainfall Methodology	FEH-13	Drain Down Time (mins)	240
Summer CV	0.750	Additional Storage (m³/ha)	20.0
Winter CV	0.840	Check Discharge Rate(s)	x
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	40	0	0
100	40	0	0

Node Plots 112-129 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.22212	Porosity	0.95
Side Inf Coefficient (m/hr)	0.22212	Invert Level (m)	4.000
Safety Factor	13.0	Time to half empty (mins)	1211

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	150.0	150.0	0.800	150.0	150.0	0.801	0.0	150.0

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Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Plots 112-129	352	4.358	0.358	7.5	51.4264	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
360 minute winter	Plots 112-129	Infiltration	0.7

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Plots 112-129	472	4.600	0.600	9.1	86.1863	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
480 minute winter	Plots 112-129	Infiltration	0.7

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ARUN DISTRICT COUNCIL A/45/22/PL

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