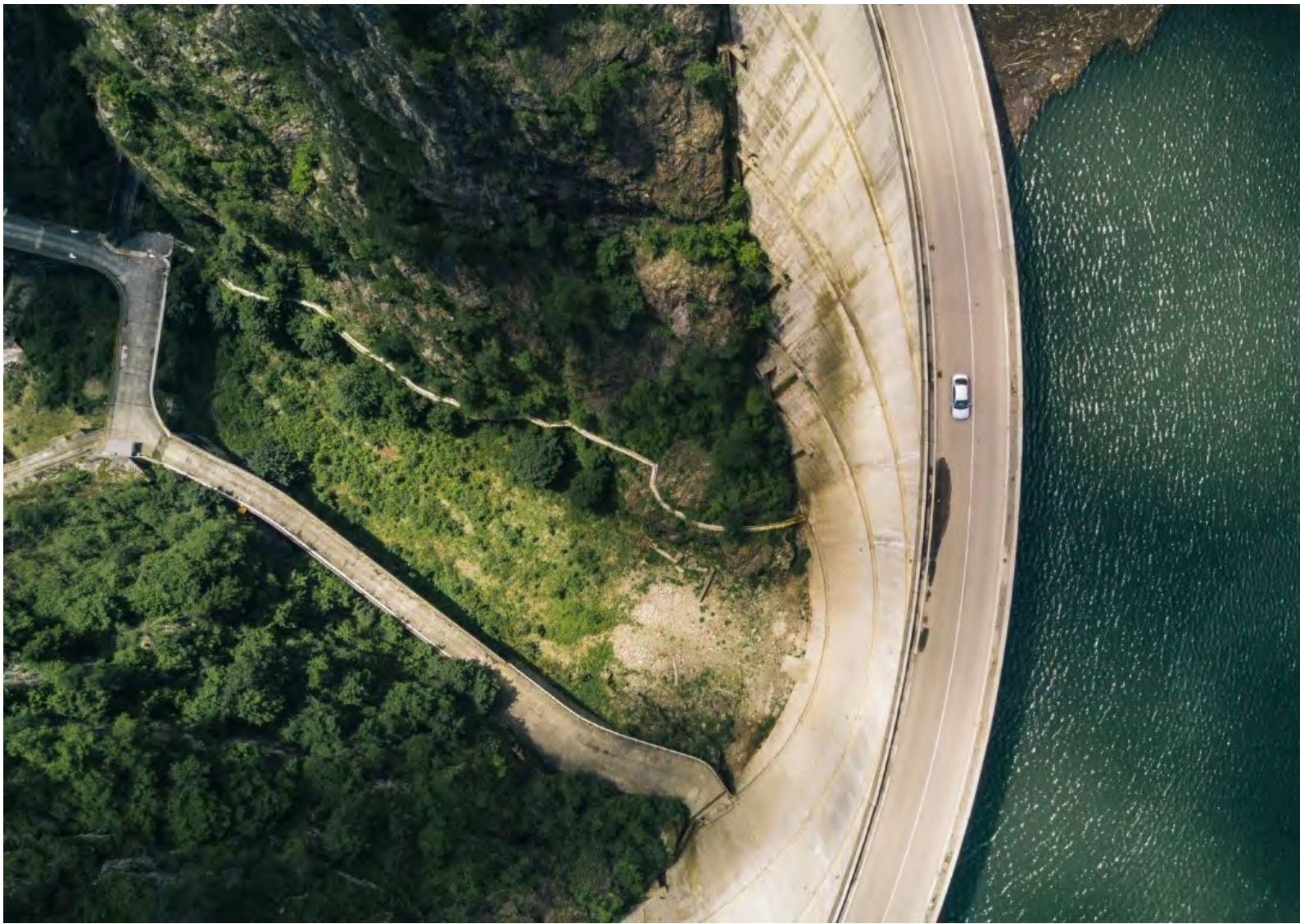
Control Building Drainage Management Plan

Havant Thicket Reservoir

Future Water

10 September 2025

→ The Power of Commitment



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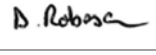
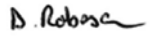
S3	P01	Rebecca Pedley	Daniel Roberson		Tom Grant	T.Grant	09.07.25
S3	P02	Rebecca Pedley	Daniel Roberson		Tom Grant	T.Grant	10.09.25

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1. Introduction

1.1 Purpose of this report

This Drainage Management Plan (DMP) supports a planning application to Havant Borough Council (HBC), on behalf of Future Water, for the development of a pumped storage reservoir and associated infrastructure (the Approved Scheme), on land at Havant Thicket (reference APP/20/0090). Specifically, this report is to address the Reserved Matters Application, which is applicable to the control building, within Phase 5 of the scheme.

The scheme is located adjacent to Sir George Staunton Country Park, Middle Park Way, Havant and involves the construction of a new winter storage reservoir, to provide the minimum required total storage capacity of 8,700 million litres. This will support the planned bulk supply transfer of at least 21 million litres per day in extreme drought conditions.

As part of the hybrid application, HBC, as Local Planning Authority, granted full planning permission on 16th October 2021, for construction of a reservoir, embankment, overflow discharge/spillway and new junctions on the B2149 Manor Lodge Road and Swanmore Road, subject to Planning Conditions. Additionally, outline planning was granted for a visitor centre, wetland, and access routes, subject to Reserved Matters Application and Planning Conditions.

The development is to be completed in nine phases (see Appendix A for the detailed phasing plan). This report is intended to outline the drainage strategy for the control building within Phase 5 of the scheme only, to satisfy planning condition 32 relating to flood risk, which is outlined below. It should be noted that this DMP will address the control building element within the second bullet point of the condition, identified by ***bold*** text:

Condition 32

"No phase of the development approved under Condition 4 shall commence until a detailed scheme, to ensure the development will not increase the risk of flooding, has been submitted to, and approved in writing by, the local planning authority. Specifically further details should be provided where relevant to the phase including:

- *A detailed drainage management plan that adequately details the management of the drainage associated with the phase.*
- ***Detailed information surrounding a number of permanent structural elements including the proposed dimensions and height of the embankment, associated spillway, control building and wetland retaining structure (including the proposed piped controls).***
- *Detailed information including the long-term maintenance scheduled for the proposed development*
- *Detailed information on the proposed location and design of the visitor centre, including proposed finished floor levels*
- *Should the proposed access routes to and from the visitor centre be situated within proximity to main river or within the flood zone then further details should be provided on the associated impacts on flood risk and the proposed mitigation measures.*

The scheme shall be fully implemented and subsequently maintained, in accordance with the scheme's timing/phasing arrangements, or within any other period as many subsequently be agreed, in writing, by the Local Planning Authority."

1.2 Scope and limitations

This report has been prepared by GHD for Future Water and may only be used and relied on by Future Water for the purpose agreed between GHD and Future Water.

GHD otherwise disclaims responsibility to any person other than Future Water arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

This report discusses the control building drainage only, within Phase 5 of the scheme. Drainage elements within other or future phases may be referenced and detailed as necessary, however there will be no additional information provided relating to these phases. This will be provided within the Drainage Management Plans for those specific phases, in due course.

This report will only address those drainage flows which are a direct consequence of precipitation and overland surface water flows. It will not include for those elements which originate from process, geological or structural features.

2. Development Site

2.1 Site Location

The development site is situated in the county of Hampshire and is located directly north of the town of Havant. Much of the eastern boundary is bordered by the B2149, with Stein Wood, Red Hill and Rowlands Castle located further east, beyond the B2149. The A3(M) and Waterlooville lie to the west of the site, with Sir George Staunton Country Park to the south. The control building, within Phase 5 of the scheme, is located to the east of Riders Lane Stream, partially embedded into the southern side of the embankment.

Figure 1 shows the location of the development and its surroundings, as well as the embankment and control building planning boundaries.

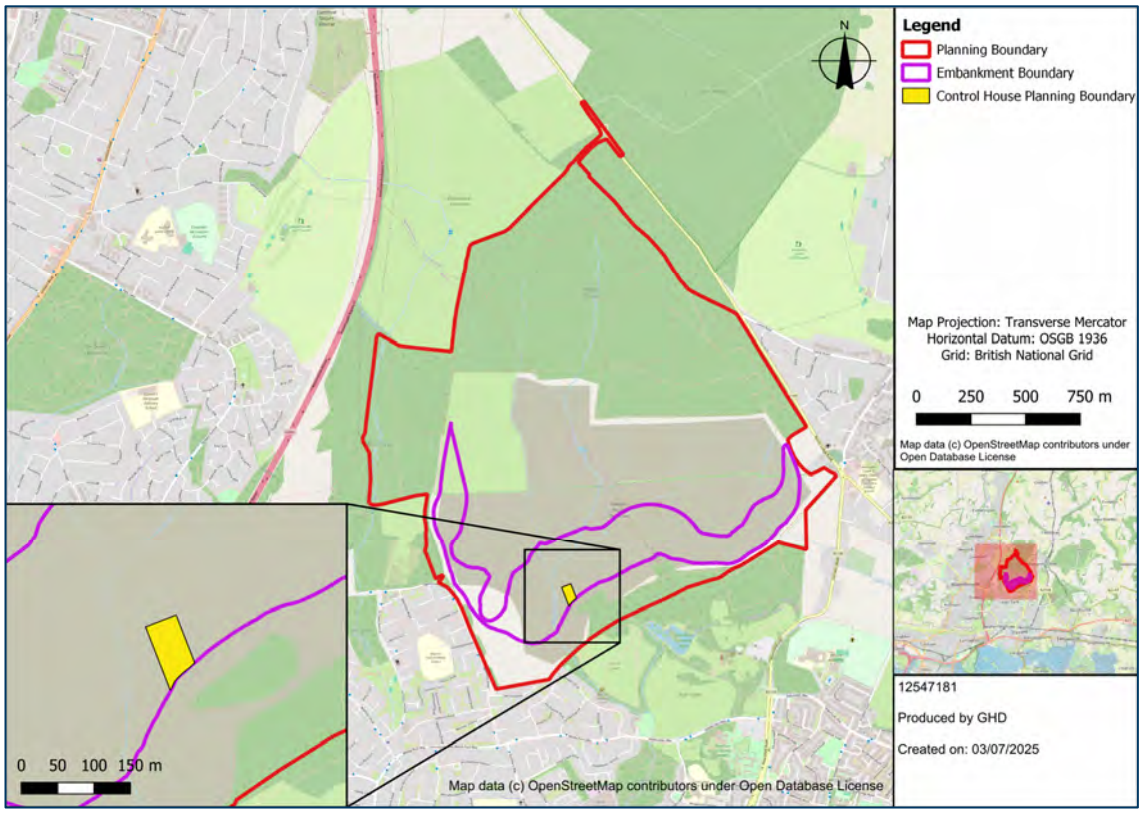


Figure 1 Site Location Overview

2.2 Proposed Control Building Development

A detailed phasing plan was prepared by Future Water for the works at Havant Thicket Reservoir (see Appendix A). This document is required to satisfy Condition 4 of the permissions:

> *"Prior to the commencement of development, a detailed phasing plan for the development shall be submitted to and approved by the Local Planning Authority. […]"*

In total, nine phases are proposed. Phase 5, which is the only phase this report will cover, encompasses the control building (refer also to Figure 1 for control building planning boundary location). The control building planning boundary includes the control room and associated service yard/courtyard. All other elements of the design are included within previous or subsequent phases and so will not be covered in detail in this document.

The control building will house the equipment needed to regulate the flows within the culvert running through the embankment, which will be used to discharge water from the reservoir during drawdown for maintenance or emergency purposes.

2.3 Existing Hydrological Features

South of the site boundary, there are five main rivers: the Park Lane Stream, Hermitage Stream, Riders Lane Stream, Durrants Stream, and Lavant Stream. Main rivers are typically larger watercourses, on which the Environment Agency are responsible for carrying maintenance and improvement works. Smaller rivers are referred to as Ordinary Watercourses, and the management of these watercourses from a flood risk perspective is carried out by the Lead Local Flood Authority or District Councils. Figure 2 shows the watercourses within and near to the planning boundary.

An assessment of existing watercourse catchment areas, show two watercourses originating from within the proposed reservoir site: Riders Lane Stream and Durrants Stream. Upstream of the proposed reservoir embankment, Riders Lane Stream, which is generally located in the western portion of the site, has a catchment area of c.215ha, whilst Durrants Stream to the east, is c.27ha. The upper catchment of the Riders Lane Stream includes five other ordinary watercourses, which are ephemeral in nature and so often run dry during periods of limited rainfall.

Most of the site area, including the proposed control building planning boundary, in the predevelopment scenario, discharges to Riders Lane Stream with a significant proportion of the remaining area discharging to Durrants Stream. There are two smaller catchments within the site boundary, to the extreme east and west, which discharge to the Lavant Stream and Park Lane Stream, respectively. The location and extent of these catchments are shown in Figure 3.

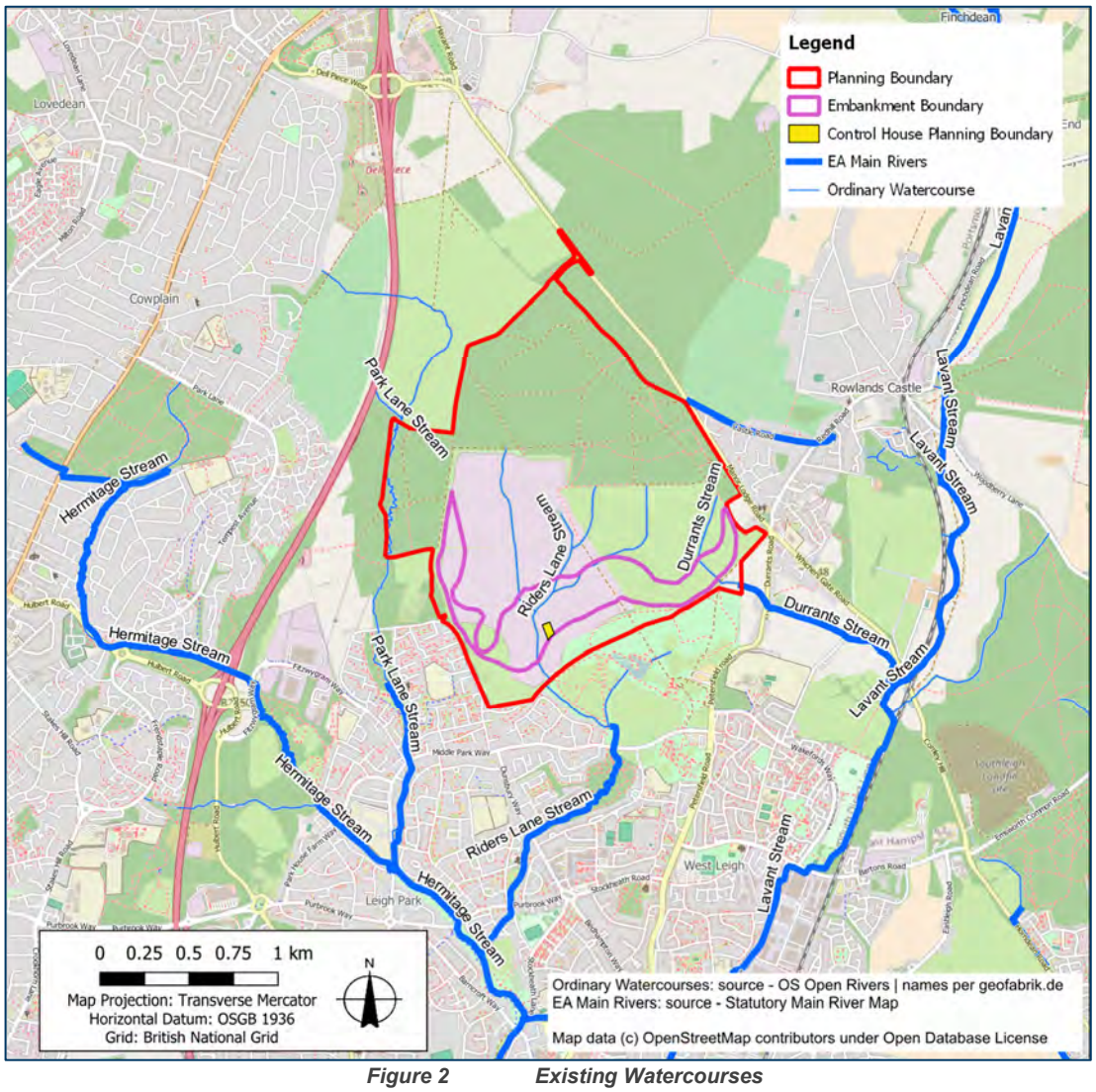


Figure 2 Existing Watercourses

The eastern catchment drains via small unnamed watercourses which are mainly ditch-like still-water headwaters that drain eastwards into the Lavant Stream. The western catchment drains to the Park Lane Stream (part of the Hermitage Stream catchment) which is classed as an Ordinary Watercourse for the reach upstream of the culvert, within Warren Park, East of St Clares Avenue, whereupon it becomes a main river. The confluence of the Park Lane Stream with the Hermitage Stream is just upstream of the confluence of the Hermitage Stream with the Riders Lane Stream.

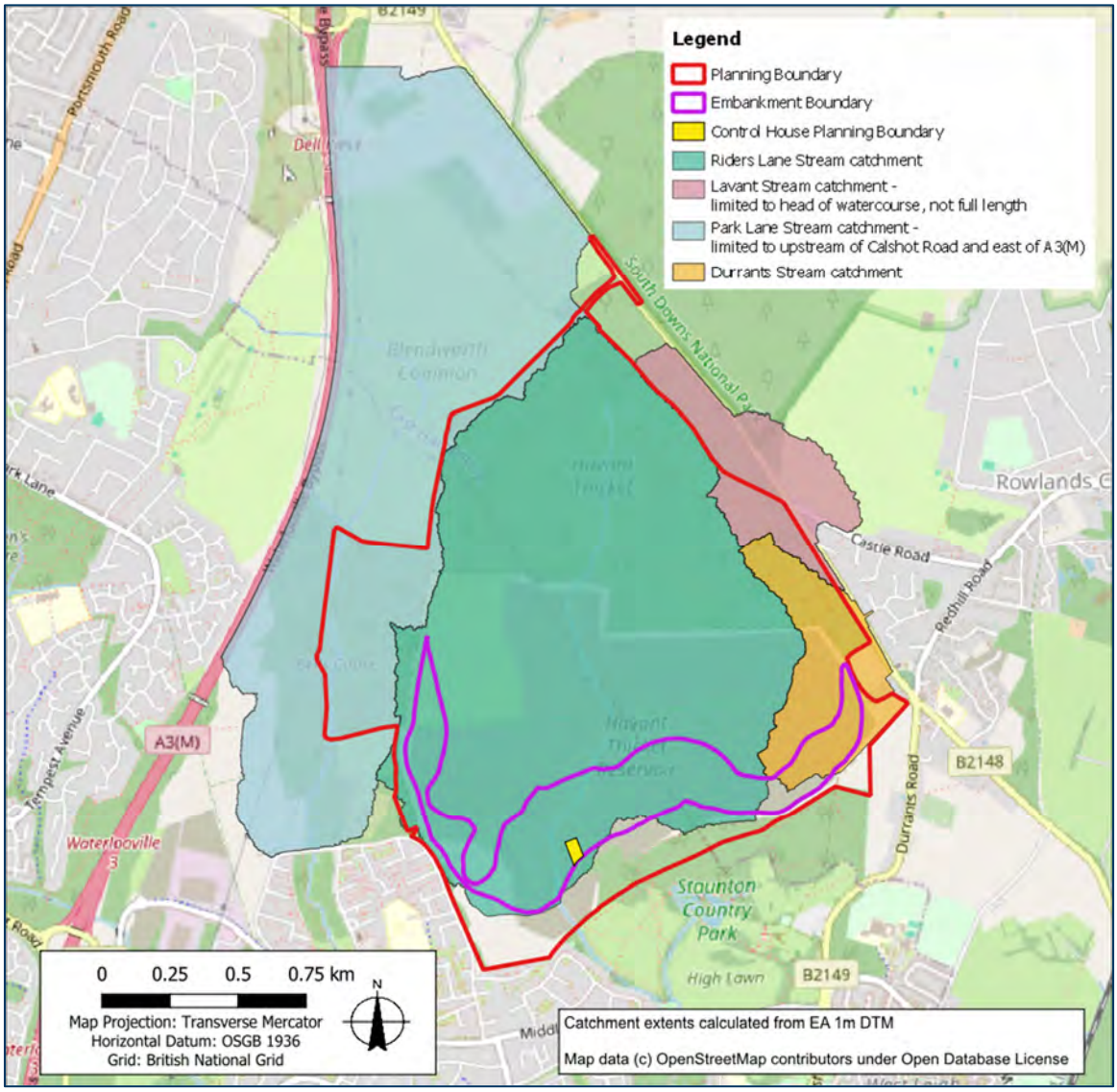


Figure 3 Catchments within the Planning Boundary

3. Planning Policy and Guidance

Every new development is obliged to be in accordance with the latest national and local planning policies regarding flooding and drainage. An overview of the latest and most relevant regulations in relation to drainage are presented in the following sections.

3.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) was first published in March 2012, and updated in July 2018, February 2019, July 2021, September 2023, December 2023 and most recently December 2024. This sets out the governments planning policies for England and how these are expected to be applied.

The NPPF states that major developments should incorporate sustainable drainage systems to control flow rate and reduce runoff volumes, and which are proportional to the nature and scale of the proposal unless there is clear evidence that this would be inappropriate. These should provide multifunctional benefits wherever possible, through facilitating improvements in water quality and biodiversity, as well as benefits for amenity. The systems should:

"a) take account of advice from the lead local flood authority.

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;"

3.2 Local Planning Policy

The proposed Havant Borough Local Plan 2036 was withdrawn for examination in March 2022. Therefore, the current adopted Local Plan ('Core Strategy – Local Development Framework' (2011)) will remain in place until the new plan is adopted. It sets out the planning framework for the community until 2026.

The adopted Local Plan contains one key policy relating to drainage:

Policy CS15 Flood and Coastal Erosion Risk:

"…All development will be required to ensure that there is no net increase in surface water runoff. Priority should be given to incorporating Sustainable Drainage Systems (SuDS) to main surface water drainage, unless that it is proven that SuDS are not appropriate. Where SuDS are provided arrangements must be put in place for their whole life management and maintenance."

A draft Local Plan, otherwise known as the 'Building a Better Future Plan', sets out how the council will decide, manage, and shape development within the borough. This plan was available for consultation between 6th May and 1st July 2025 and at the time of writing, has not been adopted. It does, however, illustrate the Councils intent for planning policy into the future.

The draft plan contains one key policy relating to drainage:

Policy 27: Drainage:

"Planning permission will be granted where current and future drainage needs, including for the expected climate change scenario, have been fully considered and:

a) The drainage needs of the site are met in full over the lifetime of the development and flood risk is not increased elsewhere.

b) The drainage strategy incorporates SuDS, unless there is clear evidence that this would be inappropriate, and is in line with the hierarchy of drainage options; and

c) *Adequate arrangements are in place for the lifetime maintenance of the surface water management systems*

In addition to criteria (a).- (c) above, on major development, planning permission will be granted only where:

d) The surface water management system ensures that the post development rate of flow is:

I. on greenfield sites: restricted to the greenfield run-off rate"...[....]

3.3 Local Flood and Water Management Strategy

Hampshire County Council (HCC) Local Flood and Water Management Strategy (LFWMS) sets out how local flood risks will be managed in the county by the authorities involved.

The strategy contains one policy that encompasses drainage:

Policy 4. To ensure successful and sustainable growth Hampshire County Council will support the planning process by encouraging resilient development:

"…Require developments to utilise Sustainable Drainage Systems (SuDS) and the drainage hierarchy based on current best practice and industry standards for water quality and quantity".

Further information relating to drainage and flood risk was found within the LFWMS under the heading **Advising on Sustainable Drainage Systems in new developments**, which looked at how surface water can be managed as close to the source as possible and how they will follow best practice requirements when responding to Surface Water Management consultations:

"Ensuring sufficient attenuation of surface water flood water, up to a 1 in 100-year event plus the appropriate extra percentage for the expected climate change. […]

…Ensuring that the drainage system consider the required water quality and is designed appropriately for the development use and the associated discharge point, including the wider sensitivity of these locations. […].

Also, within this chapter, HCC outlines its policy in relation to SuDS:

SuDS Policy 1:

"Underlying these options is the requirement to ensure that, post development, no greater volume of water leaves the site and/or no surface water leaves the site at a faster rate than occurred predevelopment or, preferably, the discharge rate is limited to greenfield runoff rates. The County Council will object to planning developments if the net effect on the flood risk in an area is too great".

Under the chapter **Climate Change**, the LFWMS outlines how climate resilience and mitigation can be promoted across the Council's key policies and sectors, and refers to drainage requirements:

…Hampshire County Council, as LLFA for Hampshire, accounts for Climate Change during the planning process by uplifting drainage requirements in line with the Environment Agency's Climate Change Allowances".

3.4 Strategic Flood Risk Assessment (SFRA)

The Partnership for South Hampshire Level 1 Strategic Flood Risk Assessment (SFRA) was commissioned by Portsmouth City Council (PCC) on behalf of ten planning authorities in South Hampshire, including Havant Borough Council. The SFRA was published in February 2024 and provides a summary of flood risk and directs development away from areas at highest risk of flooding within the area.

Section 3.7 **Assessing the cumulative impact of development** looks at the cumulative impacts in, or affecting, local areas susceptible to flooding. Section 3.7.2 is relevant to the management of surface water and is outlined below:

> *"When allocating land for development, or assessing planning applications, consideration must be given to the potential for development to impact flood risk elsewhere. The increase in impermeable surfaces and resulting increase in runoff increases the chances of surface water flooding if suitable mitigation measures, such as SuDS, are not put in place. Additionally, the increase in runoff may result in more flow entering watercourses, increasing the risk of fluvial flooding downstream. Whilst individual development with appropriate site mitigation measures should not result in measurable local effects with respect to hydrology and flood risk, the cumulative effect of multiple development may be more severe at downstream locations in the catchment. Locations where there are existing flood risk issues will be particularly sensitive to cumulative effects".*

4. Surface Water Drainage Strategy

Surface water flows generated within the control building planning boundary will be discharged into the wider drainage network, serving Phases 3 and 4 of the scheme, east of Riders Lane stream. To provide comfort that due consideration has been given to drainage and its potential impact on flood risk, Section 4 of this report will provide an overview of the surface water drainage design criteria that is to be applied when designing the drainage networks in prior and subsequent phases. This shall ensure that a complete picture is provided for those surface water flows generated within the control building boundary and how they are proposed to be intercepted, controlled, treated, and discharged in line with the planning policies and best practice. This will not extend to the provision of drainage designs and supporting hydraulic modelling, as this element of work is to be completed as part of the detailed design of the subsequent phases.

Prior to commencement of any design works of the receiving systems, HCC was consulted to review and confirm the fundamental elements of the surface water design criteria and principles that all aspects of the drainage design for the scheme will adhere to.

The design criteria outlined below was presented by GHD to HCC on 11th October 2023, who subsequently responded on 17th October 2023, confirming the design criteria was appropriate for the site and that they had no initial concerns. See Appendix B for the full correspondence with HCC.

4.1 Design Return Periods

HCC, as Lead Local Flood Authority (LLFA), is the statutory consultee on all major planning applications in Hampshire in relation to surface water drainage. The HCC 'Surface Water Checklist Guidance' document (no date) is designed to provide advice to developers and applicants and notes design return periods that major planning applications should follow. Calculations must show that the proposed run off rates do not exceed the existing run-off rates. This must be shown for the following events:

- 1 in 1 year (100% Annual Exceedance Probability, or AEP)
- 1 in 30 year (3.33% AEP)
- 1 in 100 year (1% AEP) with additional climate change allowance

4.2 Discharge Locations and Rates

Further correspondence was sent to HCC on 27th October 2023 to outline the proposed discharge rates and locations for the surface water drainage systems serving the proposed scheme. This was reviewed and the methodology agreed and accepted by HCC on December 20th, 2023. See Appendix C for the full correspondence with HCC. The following section provides further detail and rationale with respect to discharge locations and rates.

4.2.1 Discharge Location

The Building Regulations Part H sets out a hierarchy for the choice of a discharge point for a rainwater system. In order of priority, the possibilities are given as:

- 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.

The above hierarchy sets out the order in which surface water discharge points should be considered, the suitability of each is discussed below.

4.2.1.1 Discharge via Infiltration

A review of Soilscapes website suggests that soils are *'slowly permeable seasonally wet slightly acid but base-rich loamy and clayey* soils' with drainage described as being impeded. A review of the online British Geological Survey (BGS) maps indicates the area within the control building planning boundary to have a bedrock geology of '*London Clay Formation – Clay, silt and sand'*, with superficial deposits of *'Head – clay, silt, sand and gravel.'*

BGS online borehole records include records within the planning boundary. Several records from between 1977-1979 confirm the presence of red, light grey and brown silty clay with traces of silt, with groundwater reports of 1.3m and 2.1 bgl (below ground level) at two locations on the southern edge of the embankment.

Based on the information recorded by the BGS, infiltration is considered unsuitable on the basis that the site is characterised by clayey soils, the impeded infiltration of which would not permit the satisfactory discharge of surface water flows to ground. The presence of a high-water table as noted within the borehole records further limits the potential for satisfactory drainage via infiltration. Additionally, there are significant constraints on the use of infiltration drainage in the vicinity of an engineered embankment, such as the proposed dam structure on this scheme, due to the potential for interference with ground and structure stability.

Therefore, infiltration is not considered suitable as a means of discharging surface water from the site.

4.2.1.2 Discharge to a Watercourse

With infiltration drainage discounted, the next point of surface water discharge as identified in Section 4.2.1, is to a watercourse. As previously discussed, mapping has identified two watercourses originating from within the proposed reservoir area: Riders Lane Stream to the west and Durrants Stream to the east. The coordinates of the outlet points (which also represent the point at which the proposed dam crosses the watercourse) are shown in Figure 4, together with the upstream catchment for that location. This represents the extent of upslope catchment which would have discharged (pre-development) to that location. Topographical data of the site in the pre-development condition shows that land falls south towards both Riders Lane Stream and Durrants Stream and so these are considered viable locations into which surface water flows could be discharged. Therefore, in line with the drainage hierarchy, discharge to a watercourse is proposed.

4.2.2 Discharge Rates

The SuDS Manual sets out two approaches for managing flows and volumes from a development site. The first approach requires that flows from attenuation storage are controlled at Qbar, for all rainfall events up to and including the 1 in 100-year rainfall event. The second approach requires that flow rates discharged from attenuation storage are controlled at a rate equivalent to the runoff from a greenfield site for a 1 in 1 year return period (whenever a 1 in 1 year rainfall event occurs), up to the equivalent runoff from a Greenfield site for a 1 in 100-year return period (whenever a 1 in 100-year rainfall event occurs). For the second approach, long term storage must be provided; whereby a specified volume of water is held on site for a longer period in comparison to the attenuated storage volume. For this site, providing long term storage is not practicable, given the suitable space available to accommodate the additional volume of runoff generated from variable discharge rates. Secondly, limiting all flows to Qbar, satisfies HBC's Local Planning Policy and the SFRA in ensuring that flood-risk off site is minimised. Therefore, it is proposed that all discharges are restricted to no more than the equivalent Qbar rate for all events.

The existing runoff rates were assessed using a range of methods. This is largely due to the size of Riders Lane catchment being more than 200 hectares but also allows for a comparison such that an appropriate discharge rate can be established. The methods used in assessing existing runoff rates from each catchment are tabulated below.

Table 1 Comparison of methods used in assessing existing runoff rates.

Method Used	Comment	Closest Return Period to Qbar and flow rate
Durrants Stream		
ICP SuDS	Used for the Durrants Stream catchment, as the area is less than 50 ha. SAAR (800mm) and soil value (0.47) taken from outlet location	**Qbar – 152.3 l/s**
Riders Lane Stream		
IH124	Applied to Riders Lane Stream despite catchment being over recommended upper limit of 200 ha. SAAR (800mm) and soil value (0.47) taken from outlet location.	**Qbar – 1,034.5 l/s**
FEH Rainfall Runoff	Based on FEH catchment descriptors modified to catchment area, with hand calculated storm duration and time to peak of 4.08 hours and 2.27 hours, respectively.	**1:2.4 year – 1,075 l/s**
ReFH2	Based on FEH catchment descriptors modified to catchment area, with software default storm duration of 4.5 hours and timestep of 30 minutes.	**1:2 year – 1,413 l/s**
FEH Statistical Method	Based on FEH catchment descriptors modified to catchment area, with pooling group that has 525 years of data for gauged catchments and donor adjusted QMED	**1:2 year – 1,183 l/s**

The calculated rate will represent the maximum allowable discharge rate for the proposed drainage serving the dam. For flow estimations other than for ICP SuDS or IH124 methodologies, Qbar is not a default return period and is broadly equivalent to the 1:2.4-year event. Where a fraction of a year was not able to be specified, the lower return period of 1:2 year (Qmed) was used.

As the IH124 method is recommended for catchments less than 200ha, it was discounted for Riders Lane Stream. Therefore, the ICP SUDS and FEH rainfall runoff methods offer the lowest existing runoff rates for Durrants Stream and Riders Lane Stream respectively.

Based on the above methodologies, the proposed peak discharge rates for the two outfalls are:

- **152.3 l/s to Durrants Stream**
- **1,075 l/s to Riders Lane Stream**

The lowest estimated rate is proposed, to ensure the design is conservative from a flood risk perspective.

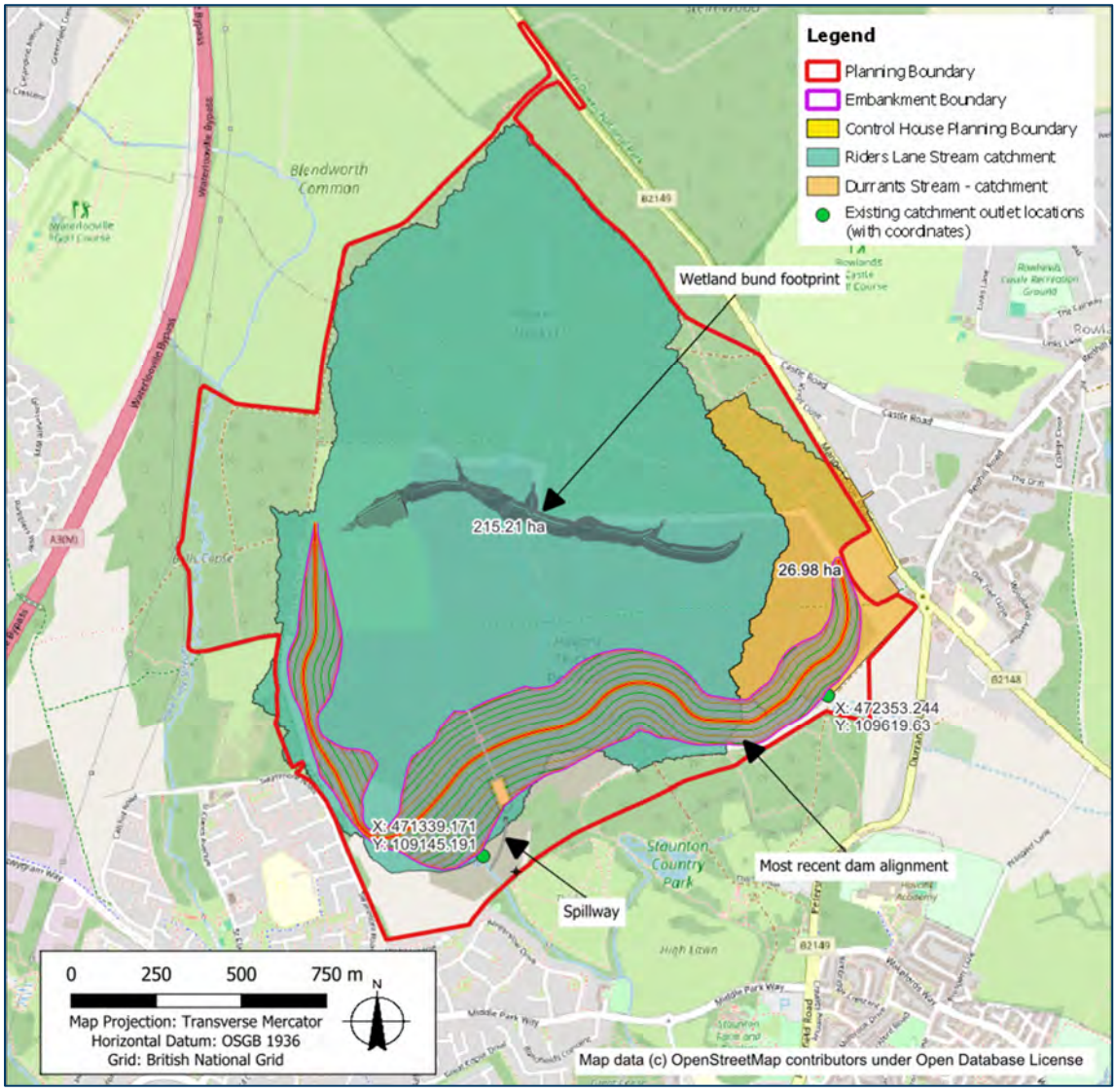


Figure 4 Drainage Catchments and Outlet Locations

4.2.2.1 Compensation Flows

There is a requirement for there to be a continual flow, or discharge, of water from the reservoir into Riders Lane Stream to maintain the ecological and habitat health of the watercourse downstream of the scheme. This will ensure that during prolonged periods of low rainfall volumes, the watercourse flows are maintained despite the impounding of the natural flows which would have occurred in the pre-development scenario. It will therefore be necessary to make allowances for those flows in relation to the proposed peak discharges from the surface water drainage. It is proposed that the surface water drainage discharging to the watercourse will be pro-rata reduced to ensure the combined flow rate (drainage discharges, plus compensation flow) will not exceed the equivalent pre-development Qbar rate.

In line with the Clients requirements document, the compensation flows for Riders Lane Stream are assumed to be 0.3m^3/s, equating to 300l/s. Therefore, the peak surface water discharges to Riders Lane Stream should not exceed 775l/s.

Given the relatively small size of the Durrants stream catchment compared to Riders Lane Stream (see Figure 4) and the proportionally small overall loss in catchment area, there is insufficient evidence to understand the natural flow variability of the stream and to suitably replicate this in the post-development scenario. It is also understood by GHD that Durrants Stream is seasonal and so currently dries up during prolonged periods of limited rainfall. As such, a design compensation flow for Durrant's stream has not been provided.

4.2.2.2 Riders Lane Stream discharge rate

Discharge to Riders Lane Stream will be from two discrete drainage networks, one from the east and one from the west. Therefore, it is important to determine the proportional discharge rates required of each drainage network. GIS analysis of the Riders Lane Stream catchment (Figure 5) shows the catchment split, with the eastern contribution at 68%, and the western contribution at 32%.

The Riders Lane Stream catchment has a greenfield Qbar rate of 1075l/s, and the available rate for permanent drainage discharge is 775l/s once the allowance for compensation flows is considered (See Section 4.3.2.1). Based on the division of the catchment, 68% to 32%, the resulting pro-rata maximum allowable discharge rates to Riders Lane Stream are:

- **East of Riders Lane Stream – 527l/s**
- **West of Riders Lane Stream – 248l/s**

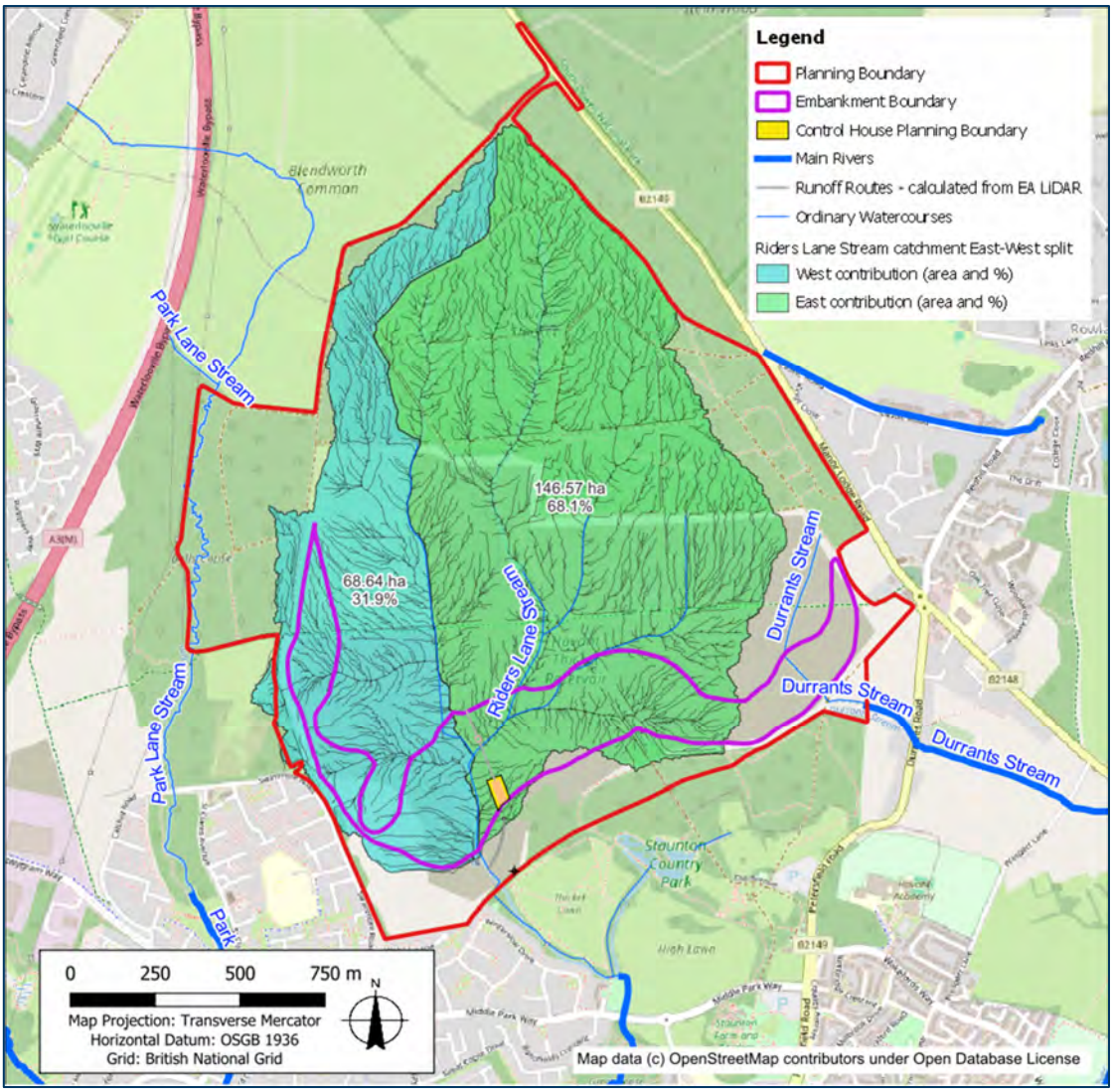


Figure 5 Riders Lane Stream catchment, east and west contribution

4.3 Climate Change Allowances

Climate Change allowances are included within all elements of the drainage design to increase resilience to flooding. HCC, as LLFA for Hampshire, accounts for Climate Change during the planning process by uplifting drainage requirements in line with the EA's Climate Change Allowances. EA guidance states that for site scale applications, such as drainage design, climate change allowances should be taken from the Peak Rainfall Allowances map, which shows the anticipated changes in rainfall intensity.

The design life of the control building shall be no less than 100 years. In accordance with the local planning policies, the DEFRA Peak Rainfall Allowances map has been used to define a range of suitable climate change values. The site falls within the East Hampshire Management Catchment, which have the following Climate Change allowances for developments for a lifetime between 2016 and 2125.

- 40% for the 3.3% (1 in 30 year) AEP rainfall event
- 45% for the 1% (1 in 100 year) AEP rainfall event

5. Proposed Surface Water Drainage

5.1 Proposed Surface Water Drainage Design

As outlined in Section 4, surface water flows generated within the control building planning boundary will drain/discharge to the wider drainage network, serving Phases 3 and 4 of the scheme, east of Riders Lane stream.

An outline of a potential surface water drainage solution for the control building and courtyard, is shown in Appendix D, together with the supporting hydraulic modelling outputs. The proposed drainage network will intercept, covey and treat surface water runoff from the control building and associated service yard.

The SuDS Manual (CIRIA C753, 2015) details a wide range of drainage techniques, some of which will be incorporated into the proposed scheme to decrease the runoff rate, and volume where possible, across the site.

A green roof is proposed for the control building, which will intercept rainfall and reduce stormwater runoff by storing water in plants and substrate. Excess rainwater which has not stored or returned to the atmosphere via evapotranspiration, will percolate through the substrate and be discharged via downpipes on the front façade of the control building. Each downpipe will discharge to the below ground drainage network serving the courtyard.

There is the potential for flows to shed off the main embankment, towards the green roof of the control building. However, an upstand around the green roof and localised changes to embankment gradients are proposed, to direct water east and west, away from the roof. Runoff directed away from the roof will be intercepted by the surface water network at the toe of the embankment.

The control building courtyard is proposed to be comprised of a heavy duty, permeable paving system used for areas that require structural strength and sustainable drainage (Tarram Truckpave or similar). The permeable paving units are filled with clean angular aggregate gravel chipping, along with a graded granular material subbase, which will provide attenuation for surface water within the voids of the gravel. Two DN160 perforated pipes, one at the eastern and western boundaries, are proposed to collect and covey percolated surface water from within the gravel paving structure and any additional discharges direct from the green roof of the control building. The gravel media will also improve runoff water quality by reducing total suspended solids (TSS), copper, zinc, and other metals.

Surface water from the control building roof and courtyard is proposed to discharge unrestricted to the drainage network serving Phases 3 and 4 of the scheme, whereupon flow will be further treated and attenuated prior to discharge to Riders Lane Stream. The receiving network is to discharge at a rate not exceeding 527l/s, for all events up to and including the 1% AEP plus 45% Climate Change (see Section 4.2.2.2).

5.2 Treatment provision of Surface Water through SuDS

The SuDS Manual (CIRIA C753, 2015) states that to deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (PMI) that equals or exceeds the pollution hazard index (PHI).

Table 2 shows an extract from Table 26.2 from the SuDS Manual (CIRIA C753, 2015) of pollution hazard indices.

Table 2 Extract from Table 26.2 from SuDS Manual (CIRIA C753, 2015)

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk rads/motorways	Medium	0.7	0.6	0.7

In determining the land use classification of the control building planning boundary, consideration was given to its final use. Regular access to the site is likely to be infrequent, with one or two vehicle movements a day. The courtyard was considered most likely to have a medium pollution hazard level since an HGV vehicle is proposed to access the site for maintenance once every couple of years.

Table 3 shows the PMI for individual SuDS components and the total SuDS PMI for each pollution hazard, where the 'Truckpave' is described as permeable paving and where:

$$\textbf{Total SuDS PMI} = \textbf{mitigation index}_1 + 0.5\ (\textbf{mitigation index}_2)$$

Table 3 Pollution Mitigation Indices (PMI)

	Mitigation Indices		
Type of SuDS Component	**TSS**	**Metals**	**Hydrocarbons**
Permeable Paving	**0.7**	**0.6**	**0.7**

Table 3 demonstrates that the proposed permeable paving suitably treats the surface water from the control building planning boundary, such that it equals the necessary PMI values for TSS, Metals and Hydrocarbons, respectively.

6. Maintenance

This section outlines the principles of good practice for operation and maintenance of drainage features within the drainage network serving the control building and courtyard. This is to ensure the effectiveness and reliability of the system over the lifespan of the development. An outline of the surface water drainage network is discussed in Section 5.1.

6.1 Management of Surface Water Runoff during Construction

The construction of the proposed drainage infrastructure is to be undertaken by a competent Civil Engineering Contractor in accordance with their approved method statement(s). All drainage will need to be protected from sedimentation during the construction phase then fully inspected to ensure they function prior to completion.

The Principal Contractor shall be responsible for the collection, treatment, and disposal of surface waters to a suitable location. During construction phase there will be several activities, which could reduce surface water quality with respect to physical contaminants. These include but are not limited to; materials handling, storage, stockpiling, spillage and disposal, earthworks, construction of the proposed development and movement and use of plant/construction vehicles. These construction activities may lead to the disturbance and mobilisation of physical contaminants. During periods of heavy rainfall, vehicle movements resulting in damage to soil structures may generate increased sedimentation within surface water runoff.

During periods of dry, windy weather, wind-blown dusts generated by the excavation of soils have the potential to enter open or incomplete elements of the drainage network. These activities may therefore result in sediments directly or indirectly entering surface water features, influencing the physical, chemical, and biological quality of the surface water receptors in the surrounding area.

During construction of the surface water drainage system, additional measures are to be implemented:

- The Principal Contractor will ensure that no debris or silt enters the drainage system during construction.
    - They will take appropriate action to remove and dispose of any debris/ siltation, which does occur.
- All open ends of drains are to be capped off as the work proceeds using manufactures caps (not makeshift caps that could be flushed into the wider drainage network).
- All manholes will be cleaned out and have covers fitted as soon as they are constructed.
- Open landscaping should be constructed where possible at the end of the construction phase.
    - This will minimise erosion and sedimentation.
- The Principal Contractor will ensure all landscaping activities are carefully designed and carried out to prevent the deposition of topsoil, turf and other materials on the hard paved surfaces.

6.2 Maintenance Requirements

Havant Thickett Reservoir is owned and will be operated as an asset by Portsmouth Water, and as such all elements of the drainage network will be integrated into the maintenance and management of the scheme.

Visits should be made as often as is necessary to fulfil the required standard of maintenance. The required maintenance can be divided into two categories:

1. Regular maintenance: basic tasks done on a frequent and predictable schedule,
2. Supplementary maintenance: tasks that are likely to be required only periodically

- The client will be provided with a ‘Maintenance Record’ so that they are aware of the function and maintenance requirements of the drainage system.

Inspections of the drainage network are to be conducted as per the maintenance schedule and could be integrated with any relevant Landscape Management activities, like grass cutting or vegetation pruning, which may also be undertaken at similar intervals.

It is recommended that the frequency of inspections is to be increased during the first year of operation so that inspections are also conducted after every significant storm event to ensure that it is functioning correctly and if necessary, implement improvement works to optimise performance. Elements that are to be inspected are included in Table 4 below.

Table 4 Regular and Supplementary Maintenance Requirements

Regular Maintenance	Supplementary Maintenance
Inlets and outlets – ensure that inlets and outlets are clear and that flows in/out are not impeded. Any obstruction or build-up of material must be removed as soon as it is seen or reported.	To ensure the long-term effectiveness of the SuDS scheme, accumulated sediment should be periodically removed. The frequency will vary over the lifetime of the scheme.
Structure – a visual inspection of pipework to check for any seepages. Any defects are to be remediated as soon as practicably possible once it has been seen or reported.	Accumulation will be most acute during the construction period until the drainage catchment is well established, and all developments are complete. At this point, the amount of sediment entering the SuDS scheme will likely be reduced.
Water Quality – Is there evidence of poor water quality in the surface water systems, e.g. algae, oils or odours. If so, further inspection remedial actions are to be taken.	Until all development is complete, careful consideration should be given to sediment build up during the regular inspections outlined above. Following completion, the frequency at which sediment removal will be required could be between 15 to 25 years.
Sediment build-up by carrying out a visual inspection of the manholes and permeable paving to determine whether there is evidence of silt build up. Any evidence of silt build up is to be reported and inspected further by an appropriate engineer to determine whether silt removal is to be initiated	Sediment removal should be undertaken in such a way as to prevent damage to the SuDS features, minimise the impact on ecological systems and maintain aesthetic appearance. The method of removal will depend upon the SuDS feature, access, wildlife concerns and sediment depth.
Litter, debris or vegetation to be checked by carrying out a visual inspection of the permeable paving to determine the presence invasive vegetation and the overall health of the systems. Remedial actions are to be taken immediately when an appropriate engineer deems it necessary.	As these tasks are intermittent tasks that are required to be rectify this is likely to be due to unforeseen events, and therefore timings are difficult to predict. A contingency sum of 15-20% should be added to the annual maintenance costs to cover the risk in accordance with the recommendations of CIRIA C753.

6.3 Drainage Infrastructure Maintenance Requirements

6.3.1 Pipework, Manhole Access and General Maintenance

The following maintenance schedules are recommended:

- Local repair or local replacement of damaged pipes or other structures
- Cleaning and removal of sediments, obstructions etc. to restore hydraulic capacity.
- Jetting/vacuum of sewers to be undertaken as often as necessary to remove silts and ordinary debris.
- If any extraordinary issues are encountered during an inspection, further information may be required such as a CCTV survey report.
- Maintenance to be undertaken on a six-monthly schedule.
- All manhole covers should be lifted, and the manholes visually inspected for silt, debris and signs of blockages within the drainage system. Check manhole covers and frames for damage and ensure correctly bolted together (six monthly).

- Should any debris or blockages be detected, the manholes should be cleaned along with associated pipe runs using a high pressure jetter. On completion a CCTV surveyed should be undertaken to verify/identify that no further remedial works are required.
- To avoid damaging the pipe, PSI pressures need to be verified before jetting of plastic twin wall sewers. Cleaning of drainage systems may require the temporary sealing of the system and careful collection of the effluent for disposal off site.

6.3.2 Permeable Paving (Terram 'Truckpave' or similar)

The following maintenance should be considered:

- Debris – fallen leaves, sticks and other debris should be removed from the surface as needed.
- Weeds – ideally removed by hand or using a biodegradable weed killer once or twice a year.
- Gravel spread and settlement – regularly inspect areas of porous surfacing subject to regular turning and channelised traffic. Rake or brush the gravel back into the units or top up with fresh angular aggregate gravel chippings as required.
- Speed restrictions should be placed on all vehicles trafficking a porous surface as regular heavy braking and tight turning may cause some displacement of the units.

7. Foul Drainage

The source of foul flows from the control building are from welfare facilities, comprising a single toilet and washroom.

7.1 Discharge Location

In line with Building Regulations Part H, discharge of foul flows to a Southern Water adopted sewer was explored. Adopted sewers are located within the residential estate west of Swanmore Road, the eastern end of Well Meadow and within Winterslow Drive. There are no adopted sewers within the site. Connecting to these sewers would necessitate crossing Riders Lane Stream and by doing so, the drainage connection would be at a lower elevation than all the sewers that could receive the foul flows (see Figure 6). The drainage connection cannot be conveyed east of the control building as the drainage would be working against the gradient, and space is very limited. Therefore, a gravity connection to any of these existing sewers is not considered viable.

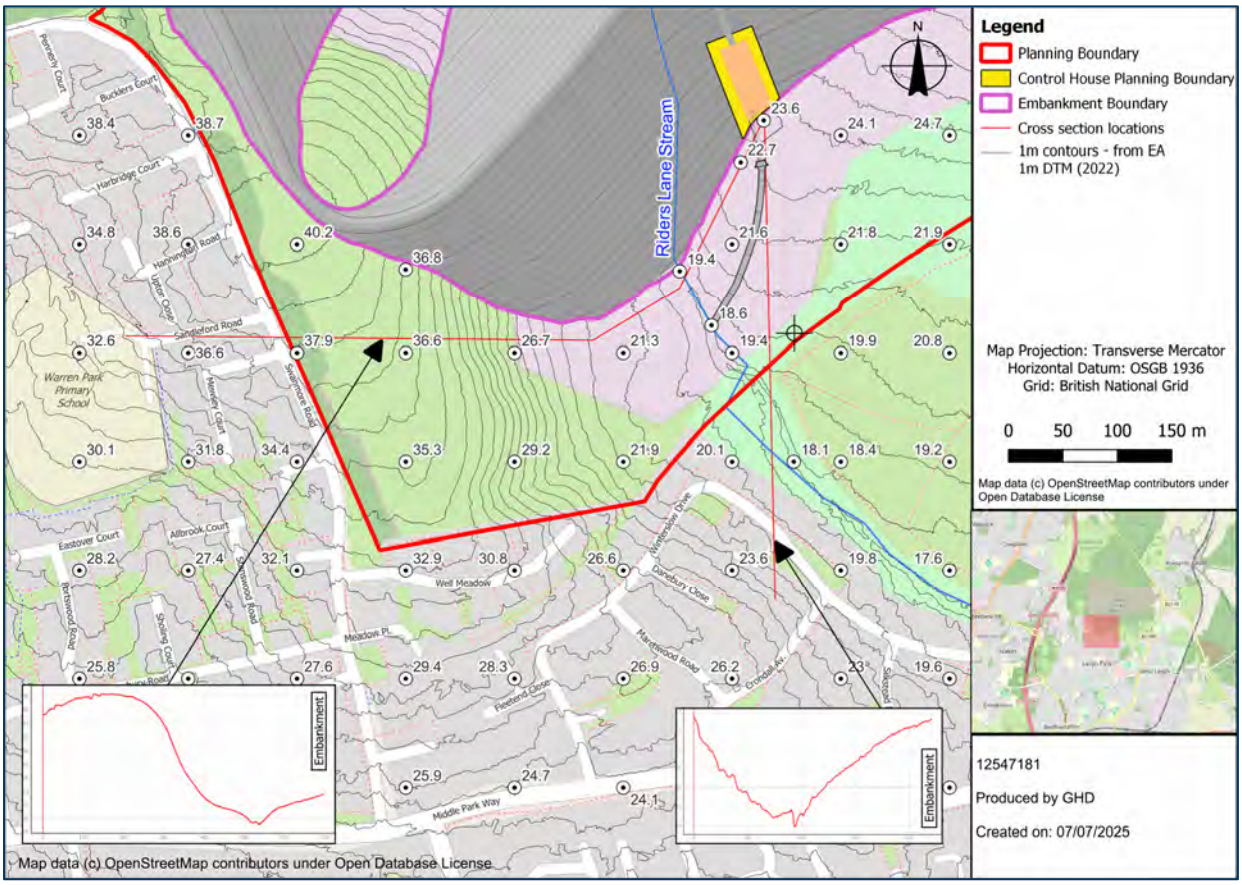


Figure 6 Levels south of the embankment.

The control building will not be permanently manned and so occasional and sporadic use of the welfare facilities is anticipated. Regulations suggest that where levels do not permit drainage by gravity, a pumping installation should be provided. However, due to the infrequent use of the welfare facilities and the minimal and occasional foul flows generated, a pumped system is unlikely to provide a cost-effective solution. More importantly, it could create long-term reliability, maintenance and septicity issues and so is not a viable option. Due to low flows and associated lack of microbial activity, a septic tank is also not a feasible solution. Therefore, a cesspool to store the foul water generated from the control building is proposed.

7.2 Cesspool

A cesspool is a holding tank without an outlet or treatment and should be sized to store the foul water from the building until they are emptied. The removal of sludge and liquid from the unit should be carried out by a contractor holding the relevant permits to transport and dispose of such waste. The cesspool should be installed with a high-level probe to indicate when emptying is required. It should be adequately ventilated to prevent buildup and accumulation of gases.

7.2.1 Nominal size of cesspool

The control building has no permanent staff, with operatives visiting on an ad hoc basis. Therefore, the welfare facilities provided will be used only intermittently/sporadically with no regular flow with which to size the cesspool.

If two part time staff (assuming a 4 hr shift) occupied the control building every day, based on the latest edition of the British Water Flows and Loads document, the foul flows generated would be 90 litres per day (45 litres per person/day). Assuming a cesspool size of 2,800 litres, the approximate number of days service provided before it is required to be emptied, would be 31 days. Since it is not anticipated that the control building will have an occupancy of that frequency, the provision of a cesspool with a storage volume of 2,800 litres (or similar), is considered a conservative and appropriate approach.

8. Conclusion

GHD were asked to produce a DMP to support the Reserved Matters Application for the control building and associated courtyard, within Phase 5 of the Havant Thicket Reservoir scheme. This report aimed to satisfy planning condition 32 relating to flood risk, to demonstrate that the development will not increase the risk of flooding to the area.

An outline surface water drainage design has been developed as part of this DMP, which deals with runoff from the control building roof and courtyard. The system proposes to use a green roof for the control building and permeable paving for the courtyard. Surface water flows generated within the control building planning boundary will discharge unrestricted to a network located in other successive phases of the scheme (predominantly Phases 3 and 4), whereupon flow will be further treated and attenuated prior to discharge to Riders Lane Stream.

The use of permeable paving allows suitable treatment of pollutants to be provided for the runoff generated by the control building and courtyard, in accordance with the criteria set out in the SuDS Manual (CIRIA C753). Overall, there is no increased flood risk to the area because of the proposed control building development.

This DMP provides appropriate detail about the sustainable management of surface water from the control building and courtyard, such that local and national planning policies are deemed to be satisfied, together with the pertinent points of Planning Condition 32 which required a drainage management plan that adequately details the management of the drainage associated with this phase of the scheme.

Appendix A Detailed Phasing Plan

Future Water MJJV Ltd

Portsmouth Water

Havant Thicket Reservoir

Detailed Phasing Plan

For Reserved Matters Applications

23/06/25 | v11

Document Reference: HTR-FUW-RZ-RE-DP-W-0507

1.0 - Introduction

In 2021, planning permission (ref APP/20/00990 and 51680/001) was granted by Havant Borough Council (HBC) and East Hampshire District Council (EHDC) for development of a reservoir for raw water storage, subject to further planning conditions. Subsequently, a Section 73 application proposing a number of amendments to the design of the main embankment and related infrastructure was approved by both authorities in December 2024 (ref APP/24/00312 and 51680/012) and planning conditions are henceforth discharged against this planning permission.

This detailed phasing plan has been prepared by Future Water MJJV for the works at Havant Thicket Reservoir. This document is required to discharge Condition 4 of the permissions. The requirements of Condition 4 and where within this document the requirements are addressed are set out in **Table 1** below**.**

Condition 4 - Phasing	**Where Addressed**
Prior to the commencement of development, a detailed phasing plan for the development shall be submitted to and approved by the Local Planning Authority. The development shall be carried out in accordance with the approved phasing plan and no variation shall be made without the prior written approval of the Local Planning Authority. *Approval will not be given if in the reasonable opinion of the Local Planning Authority the proposed variations creates new environmental impacts which exceed the range or scale of those measured and assessed in the Environmental Statement (including the further information) and which the Local Planning Authority considers may require further or additional mitigation measures.*	*Section 1.0 – page 2* *Pages 3-5*

The Phasing Plan will remain a live document, being reviewed and updated as required. Each of these updated plans will be submitted to HBC & EHBC for approval prior to the implementation of any changes.

The changes in this version of the document are as follows:

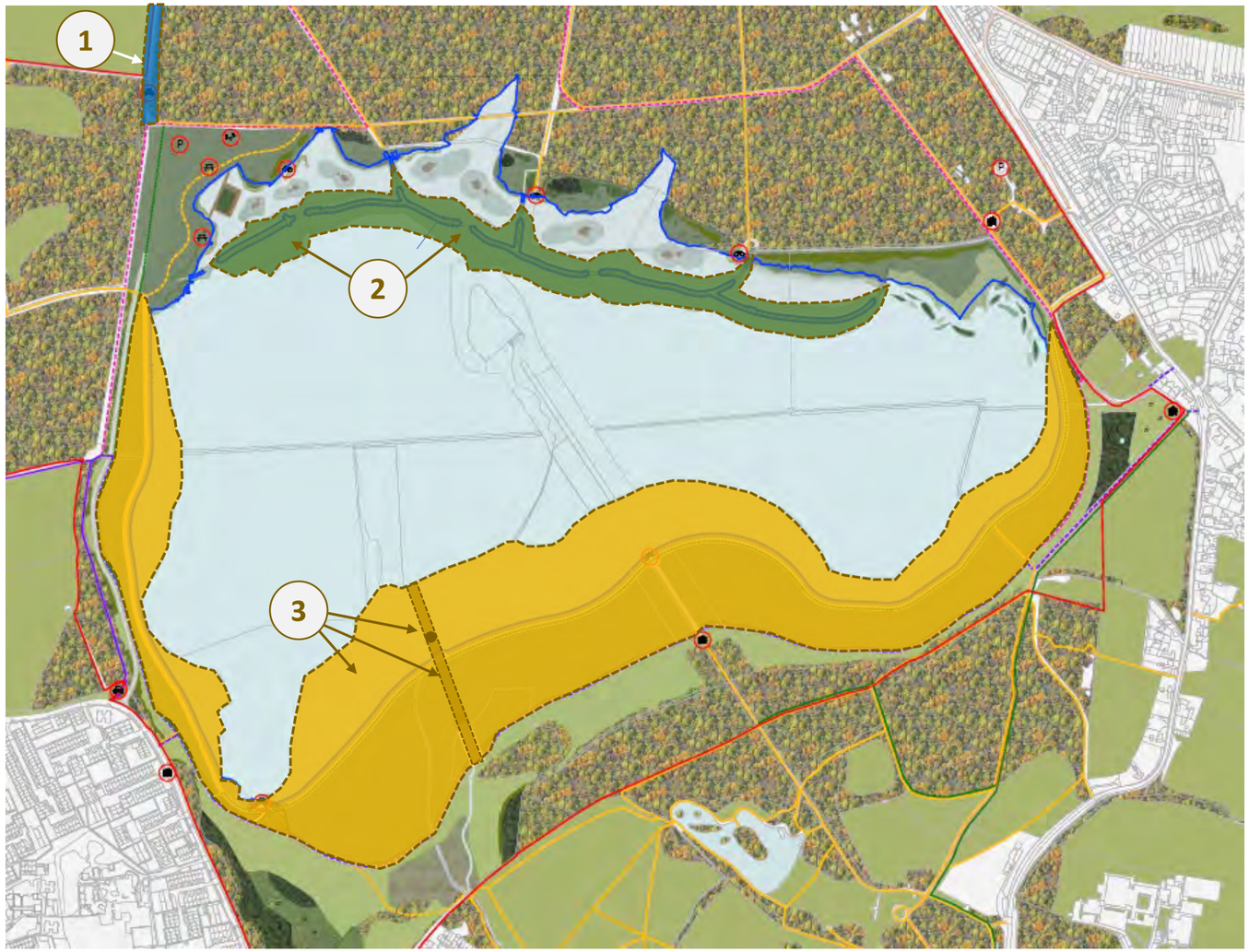
- Visualisations have been revised to include the approved Section 73 outline masterplan as the base map.
- Phases 1-3 have been updated to show their approved status.
- Timing of Phase 4-7 applications has been adjusted to allow sufficient time for pre-application consultation.
- Sequencing and subject matter of Phase 5-8 has been changed to allow for improvements to the Reserved Matters Application process

Explanatory Note:

The programme dates for submission of the reserved matters applications for the individual phases of the development are provided based on the development programme at the date of submission. The dates are given as periods of two quarters (e.g. Q1 – Q2 of 2023) and the target date for submission would fall into this period.

Should the timing for submission differ significantly then a variation to the Phasing Plan would be submitted for re-approval, however as an example, a submission one quarter earlier or later would not trigger the need for the phasing plan to be re-submitted.

Reserved Matters Phasing



Ref	Element Covered	Proposed Submission Timing	Additional Information
1	Northern access road		Approved Feb 2023
2	Wetland retaining earthworks and structures		Approved Sep 2024
3	Main embankment, culvert and valve tower		Approved December 2024

Dates subject to change following further schedule development

Reserved Matters Phasing

Dates subject to change following further schedule development

Ref	Element Covered	Proposed Submission Timing	Additional Information
4	Southern access road	Q3 2025	RM
5	Control house	Q3 2025	RM
6	Forestry England track culverts	Q4 2025	RM

Reserved Matters Phasing

Dates subject to change following further schedule development

Ref	Element Covered	Proposed Submission Timing	Additional Information
7	Spillway and bi-directional pipe*	Q2 2026	RM
8	Remaining areas of hard and soft landscaping, not approved during previous RMAs*	Q2 2026	RM

*applications to undertake public engagement together and be submitted in parallel due to their interlinked nature.

Reserved Matters Phasing

Dates subject to change following further schedule development

Ref	Element Covered	Proposed Submission Timing	Additional Information
9	Visitor centre and associated visitor amenities	Q3 2026	To be discharged by PW

Appendix B Response from HCC - 17th October 2023

From: [redacted]
Sent: Tuesday, October 17, 2023 12:17 PM
To: [redacted]
Cc: [redacted]
Subject: RE: Havant Thicket Reservoir - Surface Water Drainage Design Criteria

Dear [redacted]
Thank you for your email and apologies for the time taken to get back to you.

Having looked through the criteria, these look appropriate for the site and I don't have any issues to raise.

Regards
[redacted]

[redacted]
Flood and Water Management
[redacted]

Click here to chat to me on MS Teams

From: [redacted]
Sent: Wednesday, October 11, 2023 9:06 AM
To: [redacted]
Cc: [redacted]
Subject: RE: Havant Thicket Reservoir - Surface Water Drainage Design Criteria

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Hi [redacted]

I was just curious as to whether you have had the opportunity to review the email below?

If you need any further clarifications or wish to discuss specific elements of it, such that you can approve in principle, then please let [redacted] or I know.

Kind regards

[redacted]

GHD
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[redacted]

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Please consider the environment before printing this email

From: [redacted]
Sent: Friday, September 22, 2023 2:10 PM
To: [redacted]
Cc: [redacted]
Subject: Havant Thicket Reservoir - Surface Water Drainage Design Criteria

Hello [redacted]

Thank you for your time speaking to my colleague [redacted] with regards to the drainage design criteria for Havant Thicket Reservoir.

Based on the discussion you had with [redacted], we have summarised our proposed surface water drainage design criteria for the scheme. These networks will primarily intercept those flows from the dry side of the reservoir embankment, together with associated access roads, tracks and footways.

Would you be able to review the criteria below, and confirm whether you agree in principle to our proposals? We can then integrate these design requirements in to our next phase of design work.

Design return periods and performance criteria
From the Hampshire County Council Surace Water Checklist Guidance:

- 1 in 1 year (100% Annual Exceedance Probability, or AEP)
- 1 in 30 year (3.33% AEP). No drainage flooding permitted.
- 1 in 100 year (1% AEP) with climate change allowance. Flooding permitted, but to be retained within the site.

Climate change allowances
From the DEFRA Climate Change Allowances map:

- 40% for the 3.3%AEP and
- 45% for the 1%AEP

Discharge rate criteria
From the discussions undertaken with you, this could be equal to the equivalent Qbar discharge rate for all events up to the 1% AEP plus 45%CC storm.

Runoff co-efficient
Based on guidance documents from both the UK and internationally, the following peak Cv values are proposed. These vary depending upon the surface type/covering, and the proposed gradient or slope of the surface. Each drainage catchment area will have the relative Cv value applied, specific to its surface type.

Land use/ surface type	Cv value
Grass slopes of dam wall (>10% slope)	0.4
'Flat' (2-10% slope) grass areas	0.3
Gravel tracks, assumed to be generally flat	0.8
Tarmac (sealed) roads, assumed to be generally flat	0.9

Rainfall data
The FSR rainfall data, as built into InfoDrainage.

Water quality
Evidence that sufficient water treatment has been provided in accordance with the methodology in the Ciria SuDS Manual using the Simple index Criteria (Box 26.2).

I would be grateful if you could agree in principle to the above criteria. However, if you require anything further or wish to discuss them, please reach out to either [redacted] or myself.

Kind regards

[redacted]

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[redacted]

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Appendix C Response from HCC – 20th December 2023

From: [redacted]
Sent: Wednesday, December 20, 2023 11:52 AM
To: [redacted]
Cc: [redacted]
Subject: RE: Havant Thicket Reservoir - Surface Water Drainage. Discharge rates and locations

> Some people who received this message don't often get email from [redacted] Learn why this is important

Hi [redacted]
As discussed, your methodology makes sense and I have no issues with the information set out below.

I do have some queries which I appreciate are detailed and are still being discussed:
What happens in events beyond the design – I can't remember what you are designing to but would need an understanding of potential 'overtopping' points and there may be a need for localised low stops so flows can re-enter the watercourses safely and not back up / overflow in new locations.

The proposals below are reducing flows in the watercourse to Qbar. This would have a reduction in downstream flows during higher events so there may be other impacts in relation to ecology / biodiversity which are outside my remit.

From a LLFA perspective, we ask for no increase in flows from the pre-development situation so there is potential for complex flow control at the higher order events i.e. discharge at the 1:100 + cc can match Q100

Hope this helps

Regards

[redacted]

[redacted]
Flood and Water Management
[redacted]

Click here to chat to me on MS Teams

From: [redacted]
Sent: Wednesday, December 6, 2023 9:21 AM
To: [redacted]
Cc: [redacted]
Subject: RE: Havant Thicket Reservoir - Surface Water Drainage. Discharge rates and locations

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Hi [redacted]

I don't recall seeing a response to this, but apologies if I've missed it.

I'll give you a call to discuss; can you let me know which day and time this week suits you best?

Kind regards

[redacted]

GHD
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[redacted]

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From: [redacted]
Sent: Thursday, November 23, 2023 10:10 AM
To: [redacted]
Cc: [redacted]

[redacted]

Subject: RE: Havant Thicket Reservoir - Surface Water Drainage. Discharge rates and locations

Hi [redacted],

I was just curious as to whether you have had the opportunity to review the latest email, below?

If you need any further clarifications or wish to discuss specific elements of it, such that you can approve in principle, then please let [redacted] or I know.

Kind regards

[redacted]

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[redacted]

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Please consider the environment before printing this email

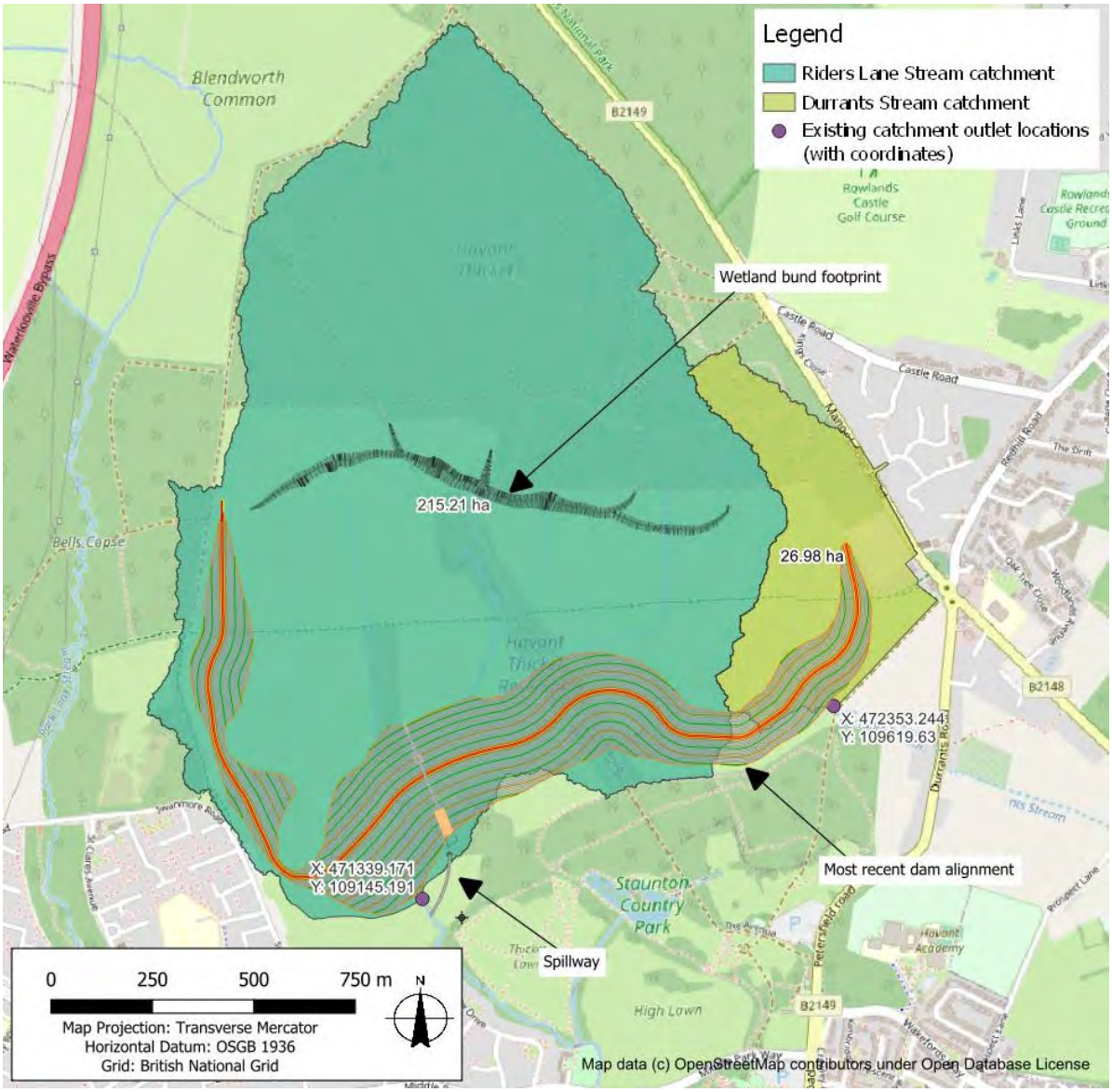
From: [redacted]
Sent: Friday, October 27, 2023 5:16 PM
To: [redacted]
Cc: [redacted]
Subject: Havant Thicket Reservoir - Surface Water Drainage. Discharge rates and locations

Hi [redacted],

Further to our last email regarding the Havant Thickett Reservoir design criteria, we have now completed an assessment of the existing catchment areas in order to derive the pre-development discharges rates. These will therefore represent the maximum peak flows which are to be used in the surface water drainage design. There are two watercourses originating from within the proposed reservoir area, these are:

- Riders Lane Stream, to the west, covering 215.21 hectares
- Durrants Stream, to the east, covering 26.98 hectares

The coordinates of the outlet points (which also represent the point at which the proposed dam crosses the watercourse) are shown below, together with the corresponding upstream catchment for that location. This represents the extent of upslope catchment which will would have discharged (pre-development) to that location.



The existing runoff rates have been assessed using a range of methods. This was largely due to the size of the Riders Lane Stream catchment, being in excess of 200 hectares, but also allows for a comparison such that an appropriate discharge/flow rate can be established. The methods used in assessing existing runoff rates from each catchment are tabulated below for ease of review.

Method used	Comment	Closest return period to Qbar and flow rate
Durrants Stream		
ICP SuDS	Used for the Durrants Stream catchment, as the area is less than 50 hectares. SAAR (800mm) and soil value (0.47) taken from outlet location.	Qbar – 152.3 litres per second
Riders Lane Stream		
IH124	Applied to Riders Lane Stream despite catchment being over recommended upper limit of 200 hectares. SAAR (800mm) and soil value (0.47) taken from outlet location.	Qbar – 1034.5 litres per second
FEH rainfall runoff	Based on FEH catchment descriptors modified to catchment area, with hand calculated storm duration and time to peak of 4.08 hours and 2.27 hours respectively.	1:2.4 year – 1075 litres per second

ReFH2	Based on FEH catchment descriptors modified to catchment area, with software default storm duration of 4.5 hours and timestep of 30 minutes.	1:2 year – 1413 litres per second
FEH statistical method	Based on FEH catchment descriptors modified to catchment area, with pooling group that has 525 years of data for gauged catchments and donor adjusted QMED.	1:2 year – 1183 litres per second

As can be seen in the above table, a range of methods were used to establish what (if any) variability there was, across the differing methods of peak flow estimation for the full catchment area.

The calculated rate will represent the maximum allowable discharge rate for the proposed drainage serving the dam, for all events up to an including the 1% AEP, plus 45% climate change, rainfall event. As outlined in our earlier email regarding the design criteria, it is proposed that all discharges are restricted to no more than the equivalent 'Qbar' rate for all events. For flow estimations other than for ICP SUDS or IH124 methodologies, Qbar is not a default return period. For the purposes of this assessment, Qbar is considered to be broadly equivalent to the 1:2.4 year event. Where a fraction of a year was not able to be specified, the lower return period of 1:2 year (Qmed) was used.

Since the IH124 method is recommended for catchments less than 200ha, it has been discounted for Riders Lane Stream. Therefore, the ICP SUDS and FEH rainfall runoff methods offer the lowest existing runoff rates for Durrants Stream and Riders Lane Stream respectively.

Based on the above methodologies, the proposed peak discharge rates for the two outfalls for all rainfall events up to and including the 1% AEP plus 45% climate change allowance is:

- **152.3 litres per second to Durrants Stream**
- **1075 litres per second to Riders Lane Stream**

The lowest estimated rate is proposed, in order to ensure the design is conservative from a flood risk perspective, as was discussed a little while ago with Duncan.

It should be noted that for Riders Lane Stream, the Qbar rate will also include the compensation flows from the proposed reservoir. Therefore, the surface water drainage discharging to the watercourse will be pro-rata reduced to ensure the combined flow rate (drainage discharge plus compensation flow) is not exceeded for the Qbar event.

The proposed drainage designs and calculations will include for any areas of existing green space from the catchment, that will continue to drain to the outfall but via the proposed positive drainage network (and not be intercepted by the dam). This will avoid duplication of runoff areas and will ensure that the two streams are not deprived of existing flows during 'day to day' rainfall events.

I would be grateful if you could agree in principle to the above catchment area and runoff rate assessment. However, if you require anything further or wish to discuss them, please feel free to reach out.

Kind Regards

[redacted]

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[redacted]

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Connect

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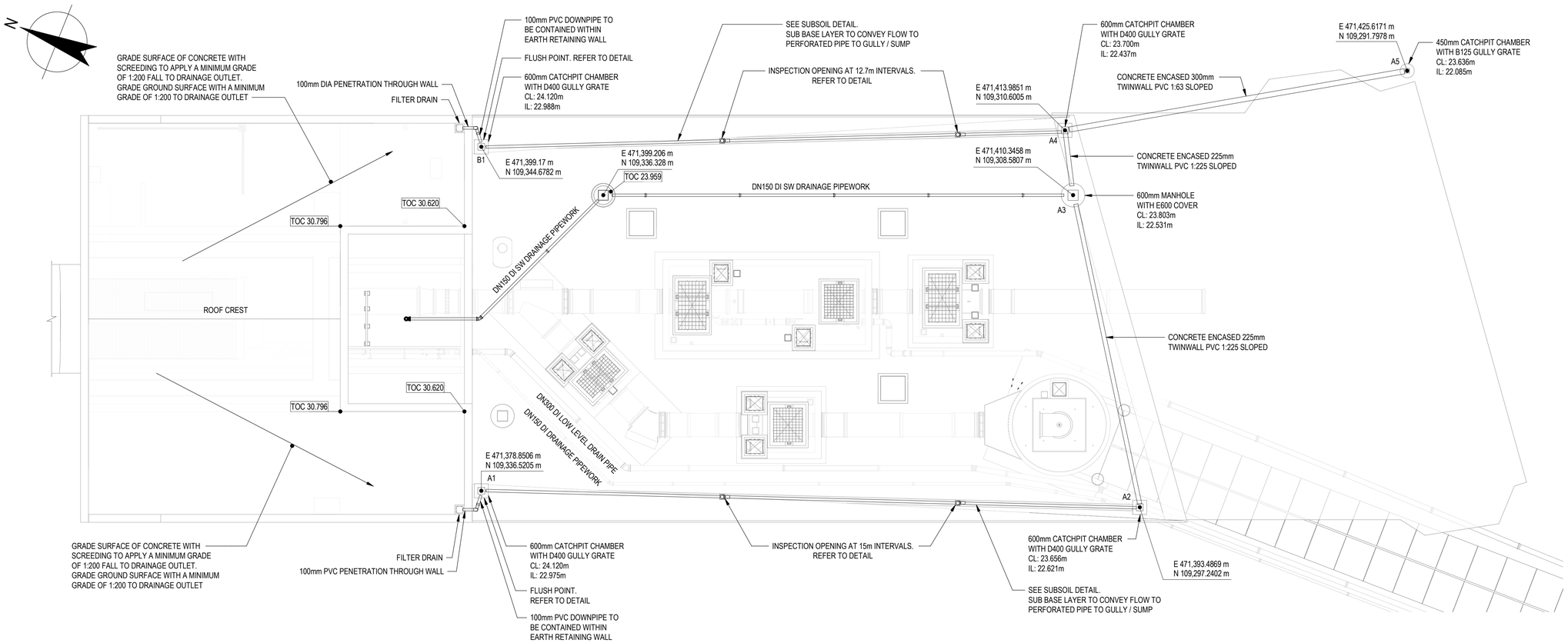
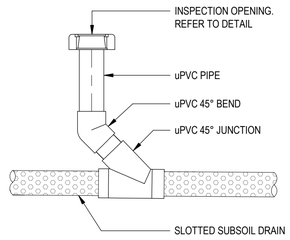
Appendix D Control Building & Courtyard Indicative Surface Water Drainage Network & InfoDrainage Outputs



COURTYARD DRAINAGE GENERAL ARRANGEMENT PLAN

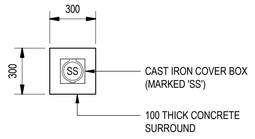
SCALE 1 : 150



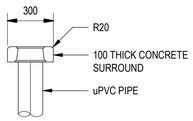
ELEVATION - IN LINE

SUBSOIL DRAIN FLUSHING POINT (FP)

SCALE 1 : 20



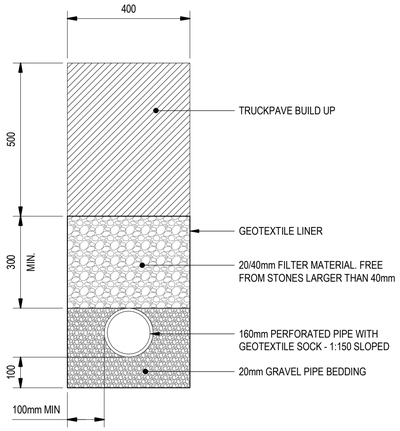
PLAN



ELEVATION

INSPECTION OPENING DETAIL

SCALE 1 : 20



SUBSOIL DRAIN DETAIL

SCALE 1 : 10

GENERAL NOTES

1. ALL DIMENSIONS RELEVANT TO SETTING OUT AND OFF-SITE WORK SHALL BE VERIFIED BY THE CONTRACTOR.
2. WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE LATEST EUROCODES AND CODES OF PRACTICE AND ALL RELEVANT CURRENT STATUTORY AUTHORITY REQUIREMENTS
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATIONS, AND ALL RELEVANT ENGINEERING PROJECT DOCUMENTATION.
4. ALL PROPRIETARY PRODUCTS TO BE USED STRICTLY IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
5. ALL EQUIPMENT PROVIDED SHALL BE SUITABLE FOR USE IN A POTABLE WATER.
6. ALL PIPELINE MATERIALS SHALL HAVE DWI APPROVAL.
7. DENSO TYPE TAPE WRAP (OR SIMILAR APPROVED) SHALL BE FIXED AROUND ALL BURIED FLANGE JOINTS/FITTINGS.
8. FENCING AND ACCESS DOORS AND GATES SPECIFICATIONS PENDING SEMD RATING.
9. CONFINED SPACES - CHAMBERS ARE CLASSED AS NC 2. REFER TO HTR-GHD-CU-RC-RA-HS-0002 FOR FURTHER DETAILS.
10. DRAWPITS SHOWN INDICATIVELY. DUCTING AND SUPPLY TO BE PROVIDED BY OTHERS. NOT SHOWN ON DRAWING FOR CLARITY.
11. REFER TO GENERAL NOTES DRAWINGS (HTR-GHD-ZZ-RE-DR-Z-0021 & HTR-GHD-ZZ-RE-DR-Z-0022) FOR CIVIL AND STRUCTURAL DESIGN UNLESS SPECIFIED OTHERWISE.

LEVELS AND DIMENSIONS

1. DIMENSIONS ARE NOT TO BE SCALED. THE DIMENSIONS PROVIDED ON THIS DRAWINGS ARE FOR REFERENCE ONLY DURING DESIGN DEVELOPMENT.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. ALL LEVELS ARE SHOWN IN METRES ABOVE ORDNANCE (mAOD)
4. ALL COORDINATES ARE IN METRES TO OS GRID.
5. ALL EXISTING DIMENSIONS AND LEVELS ARE TO BE CONFIRMED ON SITE.

REFERENCE DRAWINGS:

HTR-GHD-ZZ-RE-DR-Z-0020 - SITE LOCATION FOR FULL LIST OF DRAWINGS
HTR-GHD-PZ-RC-DR-M-0006 - COURTYARD AREA PIPING OUTLET MAIN PLAN AND SECTIONS
HTR-GHD-CB-RE-DR-S-0008 - EMERGENCY DISCHARGE GUARD VALVE CHAMBER PLAN AND SECTIONS
HTR-GHD-CB-RE-DR-S-0009 - OUTLET FM AND COMPENSATION LINE CHAMBER PLAN AND SECTIONS
HTR-GHD-CB-RE-DR-C-0010 - EMERGENCY DISCHARGE FLOWMETER CHAMBER PLAN AND SECTIONS
HTR-GHD-CB-RE-DR-C-0011 - OUTLET LINE VALVE CHAMBER PLAN AND SECTIONS
HTR-GHD-CB-RE-DR-C-0012 - EMERGENCY DISSIPATION CHAMBER PLAN AND SECTIONS
HTR-GHD-CB-RE-DR-C-0013 - RETAINING WALLS
HTR-GHD-CB-RE-DR-D-0001 - DRAINAGE
HTR-GHD-ZZ-RE-DR-Z-0021 - CULVERT AND VALVE TOWER GENERAL NOTES SHEET 1
HTR-GHD-ZZ-RE-DR-Z-0022 - CULVERT AND VALVE TOWER GENERAL NOTES SHEET 2
HTR-GHD-CU-RC-RA-HS-0001 - RISK REGISTER

SAFETY, HEALTH & ENVIRONMENTAL (SHE) INFORMATION
IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:
CONSTRUCTION DEEP EXCAVATIONS AND TALL STRUCTURES - FALLS FROM HEIGHT AND LAND SUBSIDENCE.
MAINTENANCE/CLEANING DRAINAGE TO BE PLACED ON MAINTENANCE REGISTER ACCESS COVERS AND BEAMS MUST BE MECHANICALLY LIFTED. DAVITS PROVIDED TO ASSIST. NO CRANES WITHIN COURTYARD. REFER TO LIFTING STRATEGY.
DECOMMISIONING/DEMOLITION CONFINED SPACE - ALL CHAMBERS SEE HTR-GHD-CU-RC-RA-HS-0002.

0 100 200 300 400 500 mm
SCALE 1:10 AT ORIGINAL SIZE

0 200 400 600 800 1000 mm
SCALE 1:20 AT ORIGINAL SIZE

0 1500 3000 4500 6000 7500 mm
SCALE 1:150 AT ORIGINAL SIZE

Rev	Description	Checked	Approved	Date
P01	FOR APPROVAL	RS	AW	09.09.25

Author SS | Drafting Check PM | Reg No.
Designer AW | Design Check RS | Date

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REGISTERED IN ENGLAND No. 2536455

Portsmouth Water

Future Water MJJV Ltd

GHD

Project No. 12547181

Client PORTSMOUTH WATER

Project HAVANT THICKET RESERVOIR

Status FOR APPROVAL | Status Code S4

Drawing Title OUTLET WORKS CONTROL BUILDING COURTYARD DRAINAGE GENERAL ARRANGEMENT PLAN

Size A1

Drawing No. HTR-GHD-CB-RE-DR-D-0001 | Rev P01

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

Gravel Courtyard (West)

Type : Porous Paving

Dimensions

Exceedance Level (m)	24.120
Depth (m)	1.060
Base Level (m)	23.060
Paving Layer Depth (mm)	100
Membrane Percolation (m/hr)	0.4
Porosity (%)	30
Length (m)	46.817
Long. Slope (1:X)	150.00
Width (m)	11.582
Total Volume (m³)	156.747

Under Drain

Height Above Base (m)	0.100
Diameter (mm)	150
No. of Barrels	1
Release Height (m)	0.000
Friction Scheme	Manning's n
n	0.015

Inlets

Inlet

Inlet Type	Lateral Inflow
Incoming Item(s)	Catchment Area (West)
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	1.000
Outlet Type	Under Drain

Advanced

Conductivity (m/hr)	250.0

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

Gravel Courtyard (East)

Type : Porous Paving

Dimensions

Exceedance Level (m)	24.120
Depth (m)	1.060
Base Level (m)	23.060
Paving Layer Depth (mm)	100
Membrane Percolation (m/hr)	0.4
Porosity (%)	30
Length (m)	43.549
Long. Slope (1:X)	150.00
Width (m)	11.354
Total Volume (m³)	142.936

Under Drain

Height Above Base (m)	0.100
Diameter (mm)	150
No. of Barrels	1
Release Height (m)	0.000
Friction Scheme	Manning's n
n	0.015

Inlets

Inlet

Inlet Type	Lateral Inflow
Incoming Item(s)	Catchment Area (East)
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	2.000
Outlet Type	Under Drain

Advanced

Conductivity (m/hr)	250.0

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Network Design Criteria Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

Flow Options

Peak Flow Calculation	(UK) Modified Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30

Pipe Options

Lock Slope Options	None
Design Level	Level Soffits
Min. Cover Depth (m)	1.200
Min. Slope (1:X)	500.00
Max. Slope (1:X)	40.00
Min. Velocity (m/s)	1.0
Max. Velocity (m/s)	3.0
Use Flow Restriction	☐
Reduce Channel Depths	☐

Pipe Size Library

Default

Add. Increment (mm)	75

Diameter (mm)	Min. Slope (1:X)	Max. Slope (1:X)
100	0.00	0.00
150	0.00	0.00

Manhole Options

Apply Offset	☐
An error has occurred while processing TextBox 'txtSynchroniseManholeInvertLevelsHeader': The expression contains object 'SynchroniseManholeInvertLevelsTitle' that is not defined in the current context.	

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Title:	Company Address:		
Rainfall Analysis Criteria	GHD 41-51 Grey Street Newcastle Upon Tyne		

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Reduced
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform No Discharge Analysis	☐

Rainfall

FSR

Type: FSR

Region	England And Wales
M5-60 (mm)	19.7
Ratio R	0.332
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
1.0	0.000
30.0	0.000
100.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by: RP	Checked by: DR	Approved By: DR
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
Catchment Area (West)	FSR: 1 years: +0 %: 15 mins: Summer	0.05	8.9	3.888
Green Roof (Western Half)	FSR: 1 years: +0 %: 60 mins: Summer	0.02	1.2	2.005
Green Roof (Eastern Half)	FSR: 1 years: +0 %: 60 mins: Summer	0.02	1.2	2.005
Catchment Area (East)	FSR: 1 years: +0 %: 15 mins: Summer	0.05	8.1	3.546

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by: RP	Checked by: DR	Approved By: DR
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
Catchment Area (West)	FSR: 30 years: +0 %: 15 mins: Summer	0.05	21.7	9.519
Green Roof (Western Half)	FSR: 30 years: +0 %: 60 mins: Summer	0.02	2.9	6.329
Green Roof (Eastern Half)	FSR: 30 years: +0 %: 60 mins: Summer	0.02	2.9	6.329
Catchment Area (East)	FSR: 30 years: +0 %: 15 mins: Summer	0.05	19.8	8.679

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by: RP	Checked by: DR	Approved By: DR
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
Catchment Area (West)	FSR: 100 years: +45 %: 15 mins: Summer	0.05	41.0	17.839
Green Roof (Western Half)	FSR: 100 years: +45 %: 60 mins: Summer	0.02	5.5	12.668
Green Roof (Eastern Half)	FSR: 100 years: +45 %: 60 mins: Summer	0.02	5.5	12.668
Catchment Area (East)	FSR: 100 years: +45 %: 15 mins: Summer	0.05	37.3	16.264

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Outflow

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
A4	FSR: 1 years: +0 %: 120 mins: Summer	23.700	22.437	22.463	0.026	2.2	0.007	0.000	2.2	5.651	OK
A2	FSR: 1 years: +0 %: 120 mins: Summer	23.656	22.621	22.649	0.028	1.1	0.008	0.000	1.1	2.827	OK
A3	FSR: 1 years: +0 %: 120 mins: Summer	23.803	22.531	22.559	0.028	1.1	0.008	0.000	1.1	2.824	OK
A5	FSR: 1 years: +0 %: 120 mins: Summer	23.636	22.085	22.111	0.026	2.2	0.000	0.000	2.2	5.651	OK
A1	FSR: 1 years: +0 %: 120 mins: Summer	24.120	22.975	23.003	0.028	1.1	0.008	0.000	1.1	2.827	OK
B1	FSR: 1 years: +0 %: 120 mins: Summer	24.120	22.988	23.013	0.025	1.1	0.007	0.000	1.1	2.828	OK

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Outflow

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
A4	FSR: 30 years: +0 %: 60 mins: Summer	23.700	22.437	22.479	0.042	5.7	0.012	0.000	5.7	13.374	OK
A2	FSR: 30 years: +0 %: 60 mins: Summer	23.656	22.621	22.665	0.044	2.8	0.013	0.000	2.8	6.693	OK
A3	FSR: 30 years: +0 %: 60 mins: Summer	23.803	22.531	22.577	0.046	2.8	0.013	0.000	2.8	6.670	OK
A5	FSR: 30 years: +0 %: 60 mins: Summer	23.636	22.085	22.126	0.041	5.7	0.000	0.000	5.7	13.374	OK
A1	FSR: 30 years: +0 %: 60 mins: Summer	24.120	22.975	23.021	0.046	2.9	0.013	0.000	2.8	6.708	OK
B1	FSR: 30 years: +0 %: 60 mins: Summer	24.120	22.988	23.028	0.040	2.9	0.011	0.000	2.8	6.721	OK

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Outflow

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
A4	FSR: 100 years: +45 %: 120 mins: Summer	23.700	22.437	22.520	0.083	22.0	0.024	0.000	22.0	74.645	OK
A2	FSR: 100 years: +45 %: 120 mins: Summer	23.656	22.621	22.713	0.092	11.1	0.026	0.000	11.1	38.289	OK
A3	FSR: 100 years: +45 %: 120 mins: Summer	23.803	22.531	22.626	0.096	11.1	0.027	0.000	11.1	38.266	OK
A5	FSR: 100 years: +45 %: 120 mins: Summer	23.636	22.085	22.165	0.080	22.0	0.000	0.000	22.0	74.645	OK
A1	FSR: 100 years: +45 %: 120 mins: Summer	24.120	22.975	23.077	0.102	11.1	0.029	0.000	11.1	38.305	OK
B1	FSR: 100 years: +45 %: 120 mins: Summer	24.120	22.988	23.074	0.086	10.9	0.024	0.000	10.9	36.396	OK

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by: RP	Checked by: DR	Approved By: DR
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Outflow

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Gravel Courtyard (West)	FSR: 1 years: +0 %: 1440 mins: Winter	23.413	23.172	0.041	0.112	0.6	14.067	0.000	0.000	0.2	15.094	91.026	OK
Gravel Courtyard (East)	FSR: 1 years: +0 %: 1440 mins: Summer	23.402	23.172	0.052	0.112	0.8	12.908	0.000	0.000	0.2	13.742	90.970	OK

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by: RP	Checked by: DR	Approved By: DR
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Outflow

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Gravel Courtyard (West)	FSR: 30 years: +0 %: 480 mins: Summer	23.480	23.201	0.108	0.141	4.1	20.441	0.000	0.000	1.6	18.084	86.959	OK
Gravel Courtyard (East)	FSR: 30 years: +0 %: 480 mins: Summer	23.461	23.199	0.111	0.139	3.7	18.540	0.000	0.000	1.4	16.546	87.029	OK

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by: RP	Checked by: DR	Approved By: DR
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Outflow

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Gravel Courtyard (West)	FSR: 100 years: +45 %: 240 mins: Summer	23.510	23.272	0.138	0.212	12.2	27.723	0.000	0.000	7.3	32.168	82.314	OK
Gravel Courtyard (East)	FSR: 100 years: +45 %: 240 mins: Summer	23.488	23.267	0.138	0.207	11.1	24.898	0.000	0.000	6.9	29.349	82.581	OK

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.002	FSR: 1 years: +0 %: 120 mins: Summer	Pipe	A2	A3	23.656	22.649	0.028	2.827	0.4	0.03	1.1	OK
1.003	FSR: 1 years: +0 %: 120 mins: Summer	Pipe	A3	A4	23.803	22.559	0.027	2.824	0.4	0.03	1.1	OK
1.004	FSR: 1 years: +0 %: 120 mins: Summer	Pipe	A4	A5	23.700	22.463	0.026	5.651	0.7	0.02	2.2	OK
1.001	FSR: 1 years: +0 %: 120 mins: Summer	Pipe	A1	A2	24.120	23.003	0.028	2.827	0.5	0.08	1.1	OK
2.001	FSR: 1 years: +0 %: 120 mins: Summer	Pipe	B1	A4	24.120	23.013	0.025	2.828	0.6	0.06	1.1	OK
2.000	FSR: 1 years: +0 %: 1440 mins: Summer	Pipe	Gravel Courtyard (East)	B1	24.120	23.147	0.013	13.622	0.4	0	0.2	OK
1.000	FSR: 1 years: +0 %: 1440 mins: Winter	Pipe	Gravel Courtyard (West)	A1	24.120	23.146	0.013	14.974	0.3	0.01	0.2	OK

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 30 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.002	FSR: 30 years: +0 %: 60 mins: Summer	Pipe	A2	A3	23.656	22.665	0.045	6.693	0.5	0.08	2.8	OK
1.003	FSR: 30 years: +0 %: 60 mins: Summer	Pipe	A3	A4	23.803	22.577	0.044	6.670	0.5	0.08	2.8	OK
1.004	FSR: 30 years: +0 %: 60 mins: Summer	Pipe	A4	A5	23.700	22.479	0.041	13.374	1.0	0.04	5.7	OK
1.001	FSR: 30 years: +0 %: 60 mins: Summer	Pipe	A1	A2	24.120	23.021	0.045	6.708	0.6	0.2	2.8	OK
2.001	FSR: 30 years: +0 %: 60 mins: Summer	Pipe	B1	A4	24.120	23.028	0.040	6.721	0.8	0.15	2.8	OK
2.000	FSR: 30 years: +0 %: 480 mins: Summer	Pipe	Gravel Courtyard (East)	B1	24.120	23.185	0.028	16.422	0.6	0.03	1.4	OK
1.000	FSR: 30 years: +0 %: 480 mins: Summer	Pipe	Gravel Courtyard (West)	A1	24.120	23.186	0.032	17.959	0.6	0.04	1.6	OK

Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

FSR: 100 years: Increase Rainfall (%): +45: Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.002	FSR: 100 years: +45 %: 120 mins: Summer	Pipe	A2	A3	23.656	22.713	0.094	38.289	0.7	0.32	11.1	OK
1.003	FSR: 100 years: +45 %: 120 mins: Summer	Pipe	A3	A4	23.803	22.626	0.091	38.266	0.7	0.32	11.1	OK
1.004	FSR: 100 years: +45 %: 120 mins: Summer	Pipe	A4	A5	23.700	22.520	0.082	74.645	1.4	0.16	22.0	OK
1.001	FSR: 100 years: +45 %: 120 mins: Summer	Pipe	A1	A2	24.120	23.077	0.100	38.305	0.9	0.77	11.1	OK
2.001	FSR: 100 years: +45 %: 120 mins: Summer	Pipe	B1	A4	24.120	23.074	0.084	36.396	1.1	0.59	10.9	OK
2.000	FSR: 100 years: +45 %: 240 mins: Summer	Pipe	Gravel Courtyard (East)	B1	24.120	23.228	0.064	29.225	1.0	0.16	6.9	OK
1.000	FSR: 100 years: +45 %: 240 mins: Summer	Pipe	Gravel Courtyard (West)	A1	24.120	23.230	0.073	32.042	0.9	0.18	7.3	OK

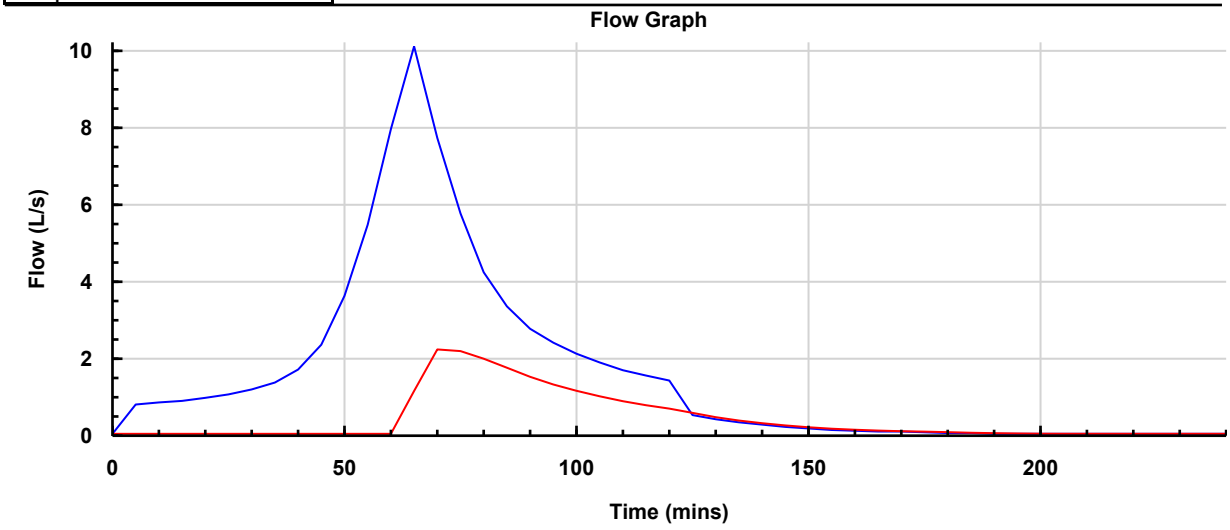
Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Phase Management Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

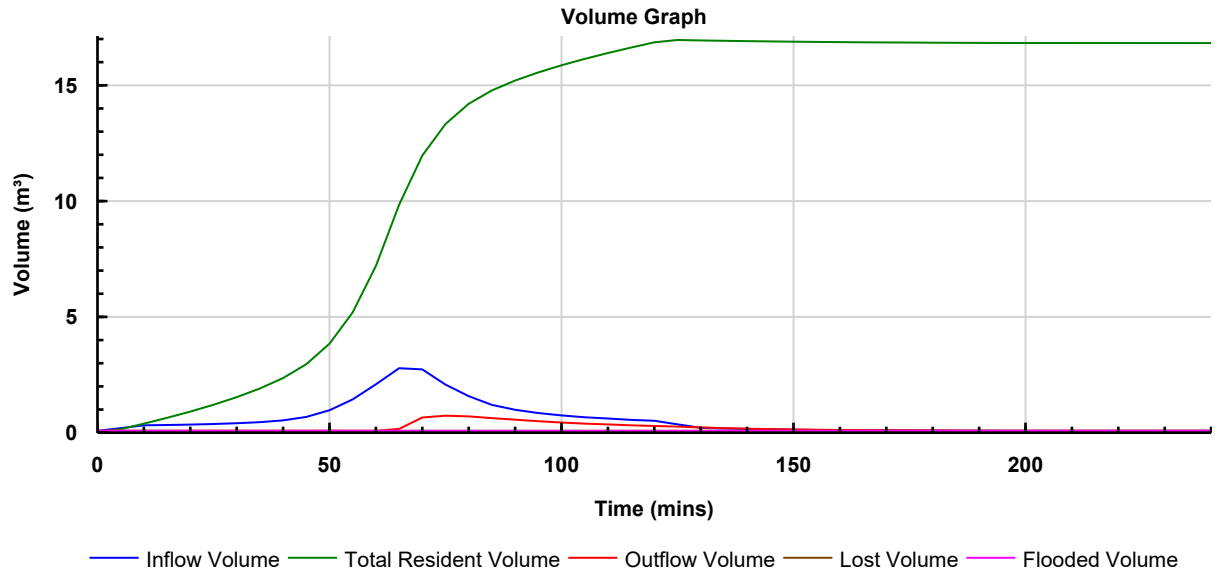
Phase
FSR: 1 years: Increase Rainfall (%): +0: 120 mins: Summer

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
A5			2.2	5.651
TOTAL	10.1	22.442	2.2	5.651

Graphs





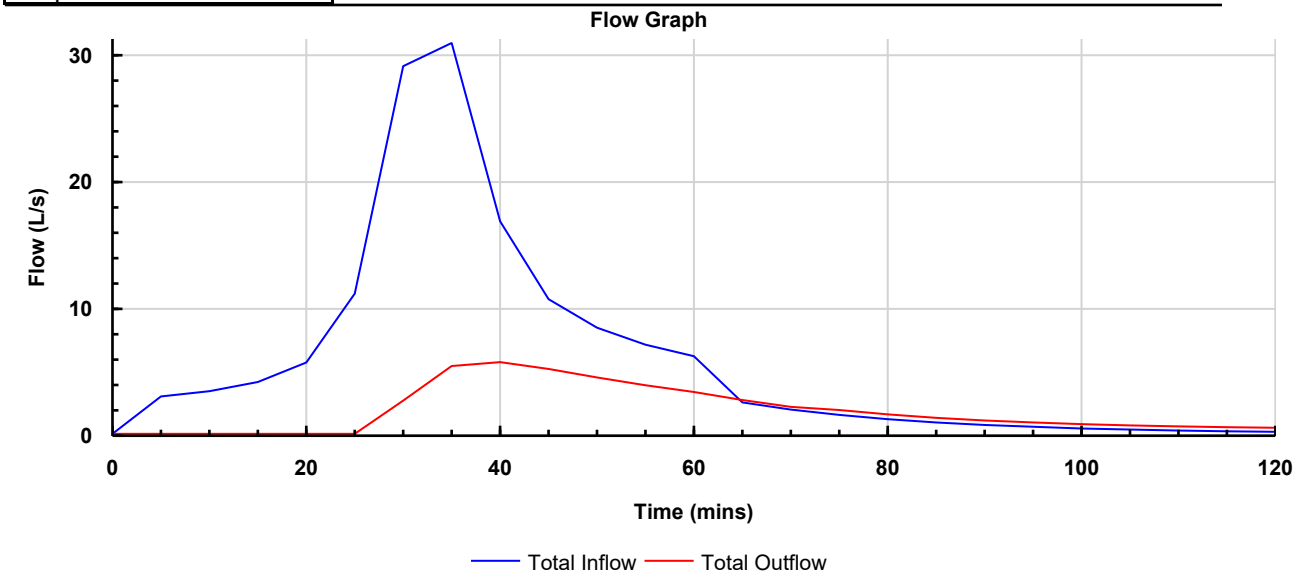
Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Phase Management Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

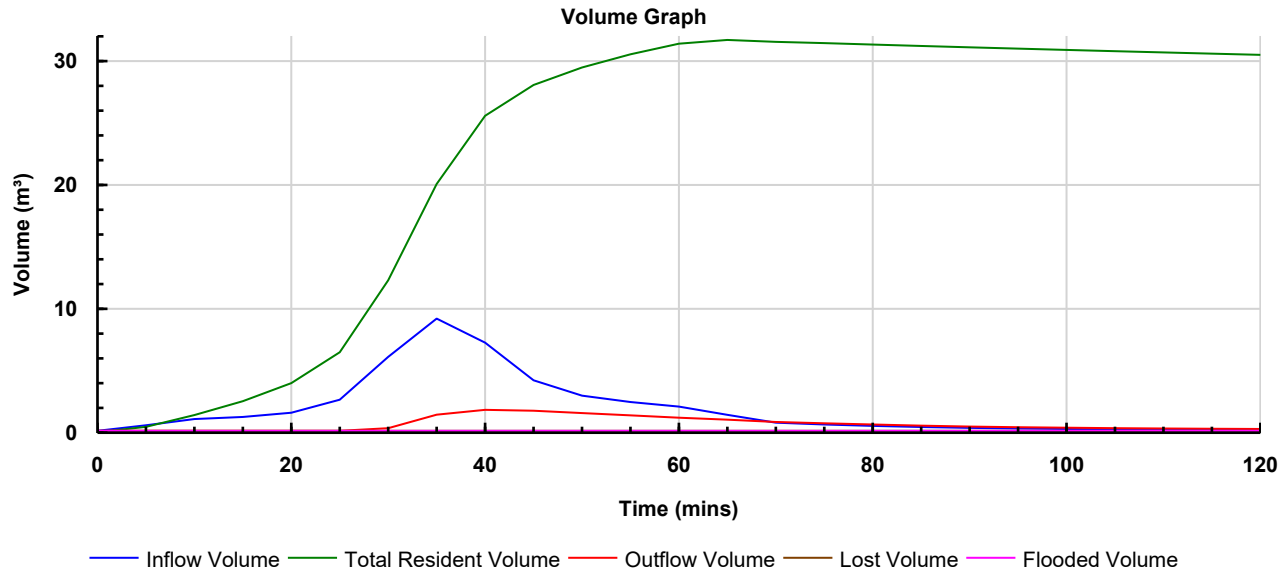
Phase
FSR: 30 years: Increase Rainfall (%): +0: 60 mins: Summer

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
A5			5.7	13.374
TOTAL	31.0	44.098	5.7	13.374

Graphs





Project:	Date:		
Havant Thicket Reservoir Control Building	09/09/2025		
	Designed by:	Checked by:	Approved By:
	RP	DR	DR
Report Details: Type: Phase Management Storm Phase: Phase	Company Address: GHD 41-51 Grey Street Newcastle Upon Tyne		

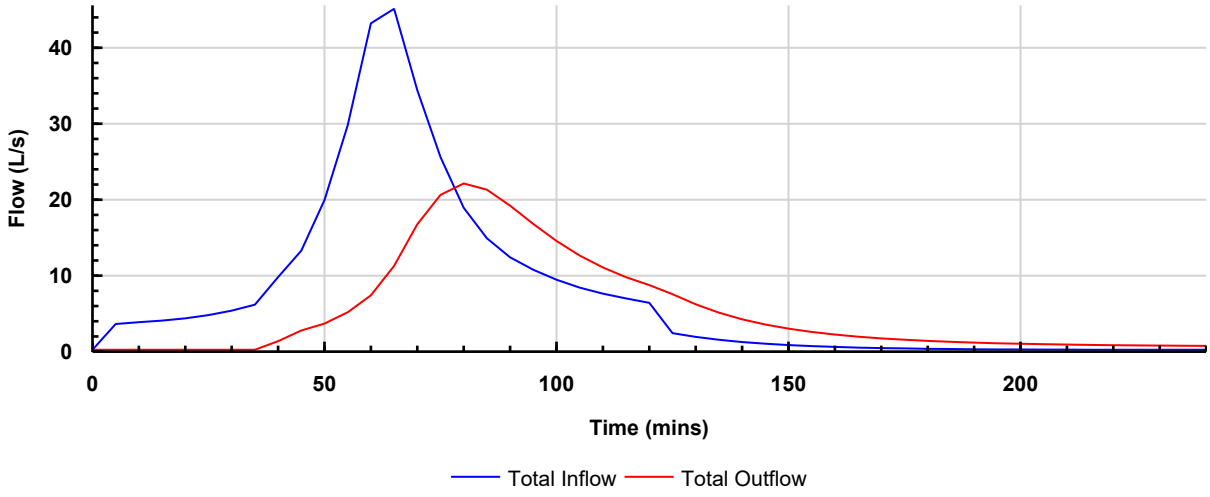
Phase
FSR: 100 years: Increase Rainfall (%): +45: 120 mins: Summer

Tables

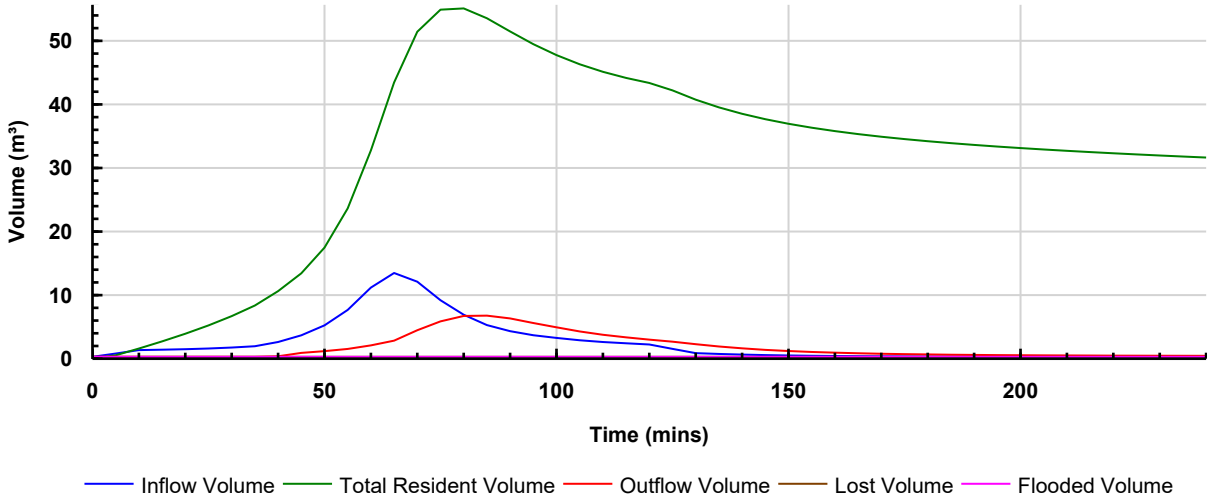
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
A5			22.0	74.645
TOTAL	45.1	106.507	22.0	74.645

Graphs

Flow Graph



Volume Graph



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