

Havant Thicket Reservoir

Construction Phase On-Site Emergency Flood Plan

Date 22/07/2024 P02

Document Reference: HTR-FUW-XX-00-PL-W-0541



Document Control

Revision	Date	Author	Reviewer	Approver	Details of Amendments (Include CEMAR Ref if applicable)
P01	06-06-2024	JH	JR	GL	
P02	22-07-2024	JH	JR	GL	Response to DS-206

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Date of plan	06/06/2024

Date for plan to be reviewed	06/12/2024
Date(s) for testing the plan	Bi-annually
How the plan will be tested	Audit/Desk-based run through and site walk over

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1. Introduction

1.1 Scope of Plan

To comply with the Defra Ministerial Direction issued April 2021, and define:

- What constitutes a reservoir safety incident
- Actions that would be taken in response to an incident
- Information to be provided to facilitate those actions

This plan is for the construction phase of the Havant Thicket Reservoir (HTR) project and is an interim document to be updated prior to completion and filling of the reservoir. The plan is provided to discharge condition 35 of Hybrid Permission APP/20/00990.

In this plan the term “onsite plan” is used to mean this flood plan, to clarify that it covers action taken by the Client (Portsmouth Water) on their land. This helps clarify the difference with “offsite plans” which are the responsibility of local authority emergency planners and Local Resilience Forum, under the Civil Contingencies Act 2004, and for which the Cabinet Office have produced a corresponding series of guidance at.

<https://www.gov.uk/government/publications/reservoir-off-site-plans-documents>

This onsite emergency flood plan supports the planning application submitted to Havant Borough Council (HBC) and East Hampshire District Council (EHDC) on behalf of Portsmouth Water. The application pertains to Reserved Matters and the fulfilment of Planning Conditions concerning the construction of the Main Reservoir Works, including the main embankment, wetlands embankment, wetland structures, cut-offs and Culvert, in association with the Hybrid Planning Permission (reference to APP/20/00990 and 51680/001). This permission relates to the construction of a reservoir and its associated infrastructure, known as the Approved Scheme, situated on land at Havant Thicket. This location is adjacent to Sir George Staunton Country Park and Middle Park Way in Havant. A Location plan including access to the site can be found in appendix D,

1.2 Structure of Flood Plan

The plan is split into two sections

- Main text – actions to manage an incident
- Appendices - information on the dam – see Contents list for structure

This plan is limited to key information likely to be needed in an incident.

1.3 Construction Sequence

The main access to the HTR site is via the Northern Access Road (NAR) from the B2149. Works to the B2149 junction commenced in August 2022 with the junction completed December 2022. Following the completion of the junction, construction then commenced on the NAR in March 2023 and was completed in Feb 2024. With the NAR route complete, the construction of the main project compound which contains the project offices and storage areas was completed.

Construction works on the main reservoir site are expected to commence in 2024 with a 3-4 year programme of earthworks & civil works expected followed by a 3-year commissioning programme. During the commissioning period the site hard and soft landscaping will also be completed.

Works to construct the main embankment culvert and valve tower, wetland structures and Ground Improvement Zone (GIZ) for the main embankment is scheduled to commence in July 2024. Commencement of the main embankment (above existing ground level) is scheduled to commence in 2025. Temporary drainage to manage flood events up to 1 in 30 years will be put in place prior to commencement. The culvert and valve tower will be utilised to control lower frequency flood events when the embankment blocks Riders Lane Stream.

2. Roles and Responsibilities

Figure 1 illustrates the overall dam safety surveillance and decision responsibilities for the duration of the Havant Thicket Reservoir Design and Construction. Lines of communication, reporting and advice are also indicated.

The roles and responsibilities of the key Future Water and Portsmouth Water personnel during the design and construction phase are shown below:

Principal Contractor, PC (Future Water MJJV)

To plan, manage, monitor and coordinate health & safety in the construction phase of the project; this includes liaison with client & PD; preparing the Construction Phase Plan CPP, organising cooperation between contractors and coordinating their work.

Principal Designer (PD) (Future Water MJJV)

Statutory duty of the PD is to plan, manage, monitor and coordinate health & safety in the pre-construction stage of the project, including identifying, eliminating or controlling foreseeable risk and ensuring designers carry out their duties. The PD should prepare and provide relevant information to other duty holders including to the PC to help them plan, manage, monitor and coordinate health & safety in the construction phase.

Designers (GHD, Bridges, Coffey, Royal Haskoning DHV, MJJV, etc):

When preparing / modifying designs, to eliminate, reduce or control foreseeable risks that may arise during construction and maintenance / use of the facility once constructed. Designers to provide information to other members of the project team to help them fulfil their duties.

The Construction Engineer (Dominic Molyneux - Binnies)

The role of the Construction Engineer is to ensure that the design, construction and operation of the reservoir will be safe and compliant with the requirements of the Reservoirs Act 1975. The Construction Engineer will discharge its duties under the Act through the issue of statutory certificates.

Geotechnical Advisor (Mark Wheeler – Binnies)

The role of the Geotechnical Advisor is to advise the Construction Engineer on specific matters relating to ground conditions, material properties, and dam construction, when called upon to assist the Construction Engineer in reaching a decision on a particular issue.

Design Guardian (Atkins)

The role of the Design Guardian is to ensure that the designs produced by the Contractor are compliant with the contract Scope, Client's Requirements, consents (including planning constraints), and regulatory requirements. Atkins previously developed the 'Reference Design' to end of Gate 3 (outline design).

Panel of Specialists (Mott MacDonald)

The role of the Panel of Specialist will be to independently scrutinise and challenge the design and construction of the HTR dam, and does not relieve the Construction Engineer of its responsibilities under the Act. The Panel of Specialist will comprise of a Reservoir Panel Engineer who will chair the Panel, and a geotechnical specialist. It is proposed that the Panel Chair will have a direct reporting line to the Board of PW. The Panel may be supplemented by other Subject Matter Experts for any particular issues that arise during the progression of the project. A Panel of Specialists represents industry best practise and was one of the recommendations made in the Coxon report on the failure of the Carsington Dam in 1986.

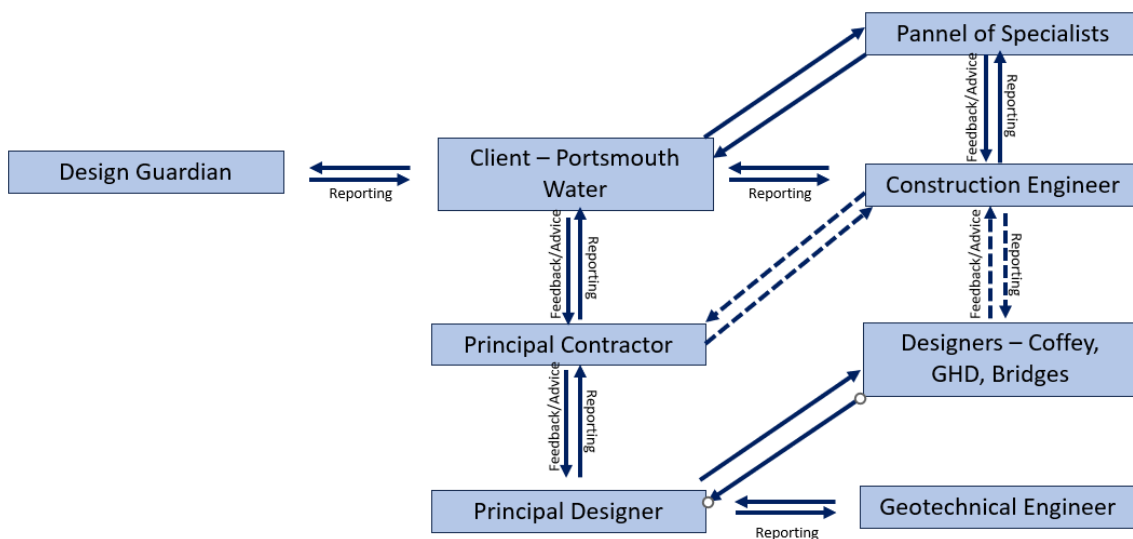


Figure 1 – Havant Thicket Reservoir – Dam Safety Structure

3. Risk Factors and Triggers For Activating The Flood Plan

3.1 General

If a suspected reservoir safety issue is identified the first step is to decide if it is reservoir safety, or some other form of incident e.g. leak of pipe external to the reservoir and unlikely to lead to collapse of a perimeter and release of the reservoir.

3.2 Incident Definition

For the purposes of this Construction Phase On-site Emergency Flood Plan, an Incident is any event that gives rise to concern that the safety of the embankment or ancillary works may be deteriorating such that action must be taken to prevent the development of an Emergency condition. An Emergency is a situation in which there is a clear possibility of dam failure. Dam failure is defined as any uncontrolled release from the dam.

As the main reservoir and wetlands reservoir are to be maintained empty through construction and temporary drainage will be installed to control floods up to 1 in 30 year event (0.012m³/s/Ha over 330mins (Min)), the only risk of uncontrolled release of water will be during a flood event greater than 1 in 30 year. Specific event situations that could lead to a critical condition during the construction phase of the Main Embankment at Havant Thicket Reservoir.

- Flood – Reservoir level predicted to rise above base of lowest excavation on embankment and threaten to overtop the works
- Slope Instability due to embankment construction loads
- Slope Instability due to a seismic event
- Uncontrolled seepage from the dam leading to a piping failure

Each of these events could result in development of a condition that warrants the declaration of an Incident or an Emergency that requires initiation of specific actions.

There are typical indicators of the start of each of these failure mechanisms. Depending on the severity of the indicator you observe, you should decide the incident level and the typical response (key action) required, and then act accordingly. Supporting information on identifying and classifying a reservoir safety incident is given in:

- Table 1 and Table 2, giving examples of the range of severity of indicators that are likely to be symptomatic of a serious structural problem.
- Appendix H provides a checklist of risk factors and examples of evaluating possible onsite actions.

Table 1 - Incident Declaration Identification

Danger of dam breach by:	Typical indicator	Typical severity of indicator (Assuming water is impounded or expected to be impounded)			
		Low -----High			
High Rainfall / Flood	Levels rising in wetlands or behind main embankment	Rainfall greater than 1 in 30 year event predicted	Water level rising and possibility of reaching top level of embankments	Overflow of embankment imminent and water level rising	Overflow leading to erosion
Slope instability	Cracking, mass movement, scarps	Abnormal instrumentation results recorded	Abnormal movement or cracking observed	Cracking, movement threatening embankment crest and potential for overtopping or initiated seepage	Movement resulting in overflows
Seismic event	Cracking, mass movement, scarps	Earthquake felt at site	Abnormal movement or cracking observed	Cracking, movement threatening embankment crest and potential for overtopping or initiated seepage	Movement resulting in overflows or active development of piping
Concentrated seepage	Wet areas, springs, dirty seepage	New leakage or wet areas	Increasing seepage or dirty flow	Active development of piping.	Active development of piping.
Incident Level:		Alert	Advisory	Alarm	Imminent failure
Equivalent for Environment Agency Flood information service		N/A	Flood Alert (flooding possible, be prepared)	Flood warning Flooding expected, immediate action required	Severe Flood warning (severe flooding danger to life)
Action Title		Engineering Advice	Precautionary Works	Emergency Works	Evacuation Downstream

Table 2 - Possible Incident Declaration Events

Observed Condition	Incident Declaration Criteria	Typical Severity
Signs of movement	Embankment slides or slumps	High
Prominent new cracking of crest or embankment shoulders	Cracks are more than 10m long (either continuous or discontinuous), open by at least 25mm and show vertical offsets of more than 10mm	High
Prominent new cracking of concrete structures.	Cracks form or increase by at least 2m in length (either continuous or discontinuous), open or offset by at least 10mm.	High
Reservoir vortices.	A reservoir whirlpool or vortex is observed.	High



Overtopping		High
Anomalous readings are recorded by instrumentation.	Anomalous readings are confirmed to affect three or more adjacent instruments of the same type. OR to affect two adjacent instruments of different type. OR are maintained for three consecutive readings where there is a single instrument AND have been confirmed as correct by other means such as visual observation. Includes "new shear" zone as detected by inclinometer or unexplained blockage of inclinometer, standpipe piezometer or settlement gauge pipes.	Medium
Monitoring data indicate an increasing rate of deformation.	Survey points indicate an increasing rate over three consecutive sets of readings and reach or exceed specified Level 2 Alarm thresholds.	Medium
Monitoring data indicate increasing piezometric levels.	Piezometric levels indicate an increasing rate over three consecutive sets of readings and reach or exceed specified Level 2 Alarm threshold levels.	Medium
New or increased seepage at the embankment toe or an increase in seepage from structures.	Seepage, sinkholes or boggy areas are detected. OR Increased, or cloudy/turbid seepage is observed.	Medium
High reservoir level.	Reservoir level is predicted to rise or actually rises above the lowest level of excavation in the embankment or above the spillway crest level.	Medium
Vehicle Collision/Vandalism/Sabotage.	After such Incident has occurred and there is damage that could affect dam safety.	High
Malfunction of equipment.	Malfunction of valves, gates, or other mechanical or electrical systems.	Medium

3.3 Incident Notification

A reservoir safety incident and its level of severity will be declared by one or more of the personnel listed in Table 3, who would normally collaborate in assessing the incident. Once declared it will be escalated within Future Water as shown in Table 4. Personnel contact details are included in Appendix A..

Table 3 - Personnel who would normally be involved in declaring a reservoir incident

Order	Role	Organisation	Name
1	Responsible Manager for Dam Safety	Future Water	Terry Fuller
2	Contracts Manager	Future Water	Geraint Lloyd
3	Embankment Design Consultant	Coffey Geotechnics	Neil Mugford
4	Construction Manger	Future Water	James Hanson
5	Project Manager	Portsmouth Water	Jonathan Clarke
6	Construction Engineer	Binnies	Dominic Molyneux
7	CEO – Portsmouth Water	Portsmouth Water	Bob Taylor
8	Operative	Future Water	Mark Williams

Table 4 - Escalation of notification once a reservoir incident is declared

Level of Incident	Role	Organisation
Alert	Personnel familiar with dam (as per Table 3)	see Table 3
Advisory	Embankment Design Consultant , Construction Engineer	Coffey, Binnies
Alarm – Failure Possible	Local Authority (Emergency Planning)	Hampshire County Council
Failure Likely or Imminent	Emergency Services	Police

3.4 Instrumentation

Results for a given instrument are not intended to be interpreted in isolation. Rather, results should be interpreted in conjunction with other indicators, such as visual observation and in the context of the stage of the construction works.

Table 5 indicates the instrumentation to be installed through construction and the monitoring frequency for each instrument during construction. Additional survey benchmarks and points and inclinometers will be installed in the main embankment post construction.

Conditions that may result in the declaration of an Incident are outlined in Table 6 below. However, this table is not absolute and other conditions may also result in the declaration of an incident. Immediate actions required following Incident declaration are outlined in Section 4 for the events listed above.

Table 5 Instrumentation Monitoring Frequency

Instrument/Monitoring Type	Parameter Measured	Monitoring Frequency	Event		Comment
			Flood	Slope Stability	
Visual	Observable Changes – new seeps, cracks or deformation.	Daily	Twice Daily or Continuous Monitoring of Affected Area if continual change	Continuous Monitoring of Affected Area	Complete detailed inspection of embankment crest, slopes and downstream toe
Rain Gauge	Rainfall	Daily	Twice Daily	Daily	
Piezometers	Pore pressures	Weekly	Twice Daily	Daily	
Survey Points	Deformation	Monthly	Daily	Daily	
Forecast Review	EA/Met Office Flood alert	Daily	Continuous	Continuous	

Table 6 Instrumentation Inventory and Alarm Levels

Instrument	Tolerance	Alert	Advisory	Alarm
Piezometers (Pressure)	+/- 2kPa	+/- 5kPa	+/- 10kPa	+/- 20kPa
Piezometers (Level)	+/- 200 mm	+/- 500 mm	+/- 1000 mm	+/- 2000 mm
Survey Points	+/- 5 mm H +/- 5 mm V	10 mm	25 mm	50 mm

4. Actions to Prevent an Uncontrolled Release of Water

4.1 Introduction

When an incident is officially acknowledged, the necessary steps to address it will vary based on the nature and seriousness of the incident. Initially, actions are managed internally within Future Water; however, continual assessment is crucial. If uncertain, notification to the local resilience forum ([Local Resilience Forum | Hampshire County Council \(hants.gov.uk\)](https://www.hants.gov.uk/local-resilience-forum)) is advisable.

4.2 On-site roles and responsibilities

In the event of an incident, the incident management team will assemble and address the situation. The responsible party will designate an Incident Manager (IM) and Controller (IC) to fulfil the duties outlined in Table 7. It's important to note that the IC is empowered to authorise actions solely on Future Water site and should refrain from undertaking offsite actions, which are to be carried out by the Police or authorised personnel. The IC will assign individuals to fulfil specific site roles, and some may be tasked with multiple responsibilities. Additional personnel may need to be brought in to fulfil roles if necessary. If a role cannot be filled locally, the IC is responsible for sourcing assistance from a third party. A critical aspect of responding to an incident involves evaluating measures to mitigate risks, including those related to health, safety, and the environment associated with proposed actions.

Table 7 Roles and responsibilities for managing reservoir safety incident

Role	Undertaken by (or delegate)	Responsibilities Include
Incident manager (IM)	Future Water Project Director	Overall management of incident, including deciding 1. Obtain additional technical advice – appoint an All Reservoirs panel Engineer 2. when/ whether to notify LRF 3. liaison between site and LRF 4. dealing with media 5. Appoint someone to deal with impacts on Portsmouth water operation, in terms of water supply to the Public Liaison with Portsmouth water Control room to manage both the reservoir safety incident, and consequential impacts on PW water supply
Reservoir Panel Engineer	Construction Engineer	Provide advice to the Contractor on technical aspects of reservoir safety
Incident Controller (IC)	Future Water Construction Manager	6. Direction of ALL people associated with any aspect of the incident response. 7. Assesses the problem. 8. Agrees technical solutions with Panel Engineer and Incident Manager. 9. Agreement of overall response & recovery strategy with Incident Manager (Police to appoint). 10. Implement a range of measures to avert failure including the on-site plan. 11. Providing ongoing surveillance and situation assessments. 12. Communication with Incident Manager. 13. Overall H&S of all personnel addressing incident. 14. Notification of and liaison with emergency service leaders on site. 15. Maintaining a log. Record keeping.



Marshalling Officer (MO)	Operative/Site Manager	16. All people arriving on site must 'check in' with the marshalling officer and 'check-out' when leaving. 17. Checking on continuity of response i.e. that if someone is leaving site their responsibilities are either fully executed or properly handed over. 18. Providing of safe approach routes to the emergency services. 19. Assists in information flows to incident team via the Information Officer. 20. Establishing an emergency control location and monitoring personnel requirements.
Practical works	Future Water or External Contractors	21. Erect barriers, control traffic, prevent public access, 22. Arrange overpumping and digging ditches, as instructed by MO or IC.

4.3 Mitigation Measures

4.3.1 Flood

During construction, the embankments may experience extreme floods and the consequences of overtopping and/or piping. While the risk of such events occurring during the construction period will be low, Future Water shall put in place the following flood control measures prior to construction commencing, to cater for such occurrences:

During the course of construction, the Contracts Manager and Construction Manger will review weekly lookahead forecasts. In the event that a rain event likely to be greater than a 1 in 30 year event is predicted, the Contracts Manager and Construction Manger will review daily weather forecast information. In the event that a 1 in 30 year event is imminent, the Incident Manager will be informed of a potential incident and this will be escalated to the relevant parties referenced in Table 7.

During a flood event, the Marshalling Officer will ensure the implementation of flood control measures, such as the use of temporary barriers, sandbags, and dewatering pumps, to mitigate flood impact in line with normal H&S requirements. The Incident Controller will engage experienced engineers to assess the situation and determine the most effective flood control methods. Regular monitoring of water levels and adjustment to flood control measures will be implemented accordingly by the Incident Controller.

After a flood event, the Construction Engineer shall then make the decision on whether to continue the works with a modified construction methodology, continue to hold works or commence mitigation works. The decision will be made in consultation with the Future Water and Portsmouth Water Project Manager and will be based on the status of the works and pending weather conditions.

4.3.2 Slope Instability and Deformation

If the embankment experiences significant deformation during construction or significant cracking of the embankment occurs, this shall be considered to be an Incident. Significant cracking would be comprised of:

- Prominent new cracks more than 10 m long (either continuous or discontinuous), open by at least 25mm and show vertical offsets of more than 10 mm.

Enhanced dam deformation monitoring and visual monitoring will be conducted during construction (See Section 3.4 for Instrumentation and Monitoring) . The purpose of the

enhanced monitoring is to detect any localised or deep seated deformation problems and then to take appropriate action to prevent such problems developing instability. Deformation measured by survey points with an increasing rate over several sets of readings would also constitute an Incident. In the event of an Incident, the following actions are to be taken:

- The Responsible Manager for Dam Safety are to be notified immediately of the incident.
- Any exposed clay core shall have close visual monitoring implemented during construction by the Responsible Manager for Dam Safety.

In such an event, or of any cracking being noticed around batters, the following emergency response action shall be initiated:

- Construction traffic and physical work shall cease either above or below any excavated slopes and the areas shall be cordoned off to prevent equipment or personnel entering.
- The Responsible Manager for Dam Safety shall arrange for the Embankment Design Consultant or Construction Engineer to immediately visit site and they shall carry out a joint inspection of any cracks, other slope instability or seepage. Sealing of cracks using a method approved by the Embankment Design Consultant shall be undertaken immediately to prevent ingress of water and the Embankment Design Consultant will advise on what other measures are required to ensure the safety of the structure and of personnel.
- The Responsible Manager for Dam Safety shall immediately arrange for instrumentation in the vicinity of the cracking, or as requested by the Embankment Design Consultant to be monitored.
- The Responsible Manager for Dam Safety will determine whether it will be safe to proceed with construction in consultation with the Construction Engineer, or whether other action is required.

5. Escalation to Major Incident – Involvement of LRF

5.1 Introduction

Once an incident has been declared serious enough that a complete or partial breach may occur then the emergency services should be involved. Future Water Project Director would contact the Local Resilience Forum (LRF, <https://www.gov.uk/guidance/local-resilience-forums-contact-details>), to inform them of the problem and ask for assistance on site.

Where there is a significant risk of failure of the dam and release of the reservoir then the action would escalate, with the LRF deciding whether to close roads, evacuation etc. (as Future Water (Contractor) does not have legal powers to take action off their site).

5.2 Local Resilience Forum

Although emergency planning is carried out by the Emergency planning officer at the local council, once an incident has been declared operational control passes to the Police.

For a serious incident the Police can obtain assistance from other emergency services, and would mobilise and manage these through a Local Resilience Forum (LRF), which includes:

- Category 1 responders – Police, Local Authority, Ambulance, Fire & Rescue, Military
- Category 2 responders – Utility companies, NHS trusts.

Depending on the potential geographical extent of the impact, and magnitude of resources required to mitigate its impact, the Police would establish a command structure of strategic/tactical/operational (Gold/Silver/Bronze) groups, corresponding broadly to Regional/ County and Borough. Generic off-site plans for dealing with a reservoir incident as prepared by the local authority emergency planning officer.

Potential actions will depend on the seriousness of the situation, as shown in Table 2.1. Further information on the emergency services is available in the Hampshire County Council Major Incident Plan, available on the website at <https://www.hants.gov.uk/community/emergencyplanning>

The following appendices are examples of what may be included with information provided to the Police/LRF as briefing information:

Appendix B	Reservoir Data
Appendix C	Features in area downstream of Service Reservoir
Appendix D	Access routes to site and site facilities

5.3 Emergency Control Centre

Following discussions between the IM and appropriate members of the LRF, the location of an emergency control centre would be agreed. This location ideally would be suitably equipped for use as a Bronze Control by the Category 1 responders. For this the emergency control centre is to be equipped with rooms with desks, multiple fixed telephone and Wi-Fi, toilets, rest and refreshment rooms, as appropriate. Possible buildings are included in Appendix D. If these are not available then mobile units can be requested from the LRF e.g. from the military

5.4 Off-Site Actions to Control or Mitigate an Uncontrolled Release

These would normally be determined by the LRF, based on advice and support from the Local Authority and Emergency Services, Construction Engineers etc. (as Future Water and Portsmouth Water does not have legal powers to take action off their site). Table 8 to Table 10 show potential actions

Table 8 Action & Trigger Levels at Standby Stage (Dam Breach Possible)

STATUS	DETAILS OF TRIGGER(S)	CONTRACTORS ACTIONS (as Table 3, plus as below)	LOCAL RESPONDERS' ACTIONS
ALERT	Behaviour of the reservoir outside normal limits, and advice sought from Construction Engineer	1. Arrange immediate visit by Engineer Design Consultant or Construction Engineer. 2. Increase frequency of readings and surveillance.	
ADVISORY	Temporary drainage controls are overwhelmed and flooding over construction works occurs.	a) Future Water (Contractor) reports details of incident to Police. b) Future Water (Contractor) implements On-site Plan and relevant actions in conjunction with Construction Engineer.	If/ when informed a) Police decide whether to contact relevant Cat 1 (Local Authority, EA etc.) and Cat 2 partners to place on standby. b) Police, in conjunction with Cat 1 partners, consider possible activation of Tactical (Silver) Control on precautionary basis to review procedures, undertake relevant forward planning including evacuation, public information and warning. c) Police, in conjunction with Cat 1 partners, consider possible activation of Strategic Coordinating Group (Gold Control) on precautionary basis to review procedures and undertake relevant forward planning including evacuation, public information and warning.

Table 9 Site Action & Trigger Levels at Implementation Stage (dam breach imminent/ in progress)

STATUS	DETAILS OF TRIGGER(S)	CONTRACTORS ACTIONS	LOCAL RESPONDERS' ACTIONS
ALARM	Water is being retained behind the embankments and/or erosion of permanent works is occurring.	Future Water (Contractor) continues to implement On-site Plan in conjunction with relevant panel Engineer.	a) Police activate and implement Off-Site Plan in conjunction with partners and undertake all necessary migratory actions.
IMMINENT FAILURE	Control of the reservoir has been lost and failure is highly likely/ inevitable.		b) Police implement all relevant multi-agency command and control arrangements with participation of Future Water (Contractor) and relevant Engineers.
FAILED	The reservoir has failed, and large uncontrolled release of water has occurred.		

Table 10 Site Action & Trigger Levels at Stand Down Stage (floodwaters subsided or return to properties permitted)

STATUS	DETAILS OF TRIGGER(S)	CONTRACTORS ACTIONS	LOCAL RESPONDERS' ACTIONS
POST – STANDBY	Serious problem averted.	Future Water (Contractor) agrees and implements any urgent recommendations from the relevant Engineers.	a) 'All clear' given. b) Cat 1s review plans in light of response and any ensuing recommendations.

**POST-
IMPLEMENTATION**

Water flows from the reservoir are minimal and efforts are focussed on consequences in zones of total and partial devastation.

Report incident to Environment Agency (Reservoirs act section 21B)
<https://www.gov.uk/guidance/reservoirs-owner-and-operator-requirements#report-an-incident>

Cat 1s focus on on-going response and recovery operations affecting the needs of local populations, buildings, critical infrastructure etc.

Appendix A – Key Contact Details

A.1 Roles and Phone Numbers

Role	Contact Name	Contact email	Contact Telephone Numbers	
			Mobile	Office
Responsible Manager for Dam Safety (FW)	Terry Fuller			
Contracts Manager (FW)	Geraint Lloyd			
Embankment Design Consultant	Neil Mugford			
Construction Manger (FW)	James Hanson			
Project Director (FW)	Ruari Maybank			
Project Manager (PW)	Jonathan Clark			
Construction Engineer	Dominic Molyneux			
CEO – Portsmouth Water	Bob Taylor			
Operative (FW)	Mark Williams			

A.2 Address for Key Contacts

Office	Address	Office (reception) phone
Portsmouth Water Ltd Head Office	West St Havant Hampshire PO9 1LG	02392 499888 24 hrs 02392 477999
Embankment Design Consultant	Coffey Atlantic House, Atlas Business Park, Wythenshawe Manchester M22 5PR	Neil Mugford Ed Barret Peter Cowsill
Construction Engineers	Binnies UK Ltd 60 High St	Dominic Molyneux Mark Wheeler

	Redhill RH1 1SH	
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A.3 External Organisations

Contact Name/ Role	Address	Contact Telephone Numbers
Hampshire County Council	The Castle, Winchester Hampshire SO23 8UJ	<u>0300 555 1375</u>

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Appendix B – Reservoir Data

B.1 Key Data

A summary of the key features of the main reservoir is given below in Table 11 and the wetland structure in Table 12.

Table 11 Main reservoir key details

Feature	Description
General	
Reservoir Name	Havant Thicket Reservoir
Reservoir Location	Havant Thicket, Havant.PO9 4ET SU 71480 09751 What3words ///brother.dugouts.liners
Dam Embankment	
Embankment type:	Zoned earthfill with central clay core, chimney filter and blanket filter with finger drains
Embankment slopes:	1V:9H upstream / downstream where height greater than 10m 1V:8H upstream / downstream where height lower than 10m.
Design Crest Level (DCL)	40.5 mAOD
Embankment height (above D/S Toe):	20.0 m
Build height (above lowest foundation level):	23.0 m (above lowest foundation – estimated)
Embankment length	2850 m
Reservoir	
Top Water Level (TWL)	39.5 mAOD
Minimum Operating Level (MOL)	29.0 mAOD
Lowest level of reservoir	~22.0 mAOD
Storage at TWL	9000 ML
Operation storage at TWL	7200 ML
Drawdown from FSL to MDL (with no inflow)	133 days
Surface Area (FSL)	105 ha
Catchment Area	2.0 km ²
Spillway	
Location	CH 910 (Approx)
Spillway type	Concrete inlet structure with 3m crest directing flows to ND700 pipe to Riders Lane Stream (in detail design)
Crest level	39.5 mAOD
Spillway pipe length	450 m
Spillway capacity at DCF	70 m ³ /s
Outlet Works	
Location	CH 1365
Outlet type	Concrete valve tower with upper draw-off located within the upstream shoulder of the embankment. Upstream culvert from upstream toe directing water to middle draw-off at bulkhead in

Feature	Description
	the base of the tower. Downstream culvert to control house at downstream toe of the reservoir.
Valve Tower	8 m internal diameter concrete tower for upper draw-off. Internal access stairs and platforms over full height
Upstream and downstream culvert	Horseshoe / "D" shape concrete, cut and cover type culvert. Internal height 3.75m and base width 5.1m. Design grade of 1% to downstream with drainage chase to collect and transport seepage downstream to Control House.
Draw-off invert levels	High draw-off: 34.0 mAOD Low draw-off: 27.7 mAOD
Outlet pipe size	High draw-off: ND700 mm diameter ductile iron pipe in tower connecting to main ND1400 mm outlet Middle draw-off: ND1400/1600 mm diameter ductile iron pipe to bi-furcation for emergency drawdown and to reservoir boundary. Then ND1200 mm diameter to Bedhampton Pumping Station
Emergency Discharge size	ND 1400 mm to submersible valve in Control House
Guard valves	1 x 700 mm diameter – gate valve 1 x 700 mm diameter – butterfly valve 1 x 1400 mm diameter – gate valve 1 x 1400 mm diameter – butterfly valve
Scour pipe size	ND 300 mm diameter ductile iron pipe from bulkhead to downstream toe of embankment
Inlet Pipe	
Location	CH 900
Inlet pipe size	ND 800 ductile iron pipe from Bedhampton to the embankment crest, ND 800 HDPE pipe through the embankment and into the reservoir

Table 12 Wetland structure key details

Feature	Description
General	
Wetlands Minimum Operating Level (WMOL) / Spillway Crest Levels	38.8 m AOD
Main Reservoir Top Water Level (TWL)	39.5 m AOD
General	
Embankment type	Homogeneous clay
Wetlands Minimum Operating Level (WMOL) / Spillway Crest Levels	38.8 m AOD
Main Reservoir Top Water Level (TWL)	39.5 m AOD
Design Crest Level (DCL)	40.0 m AOD
Compartments	4
Intercompartment Spillway Crest Level	38.7 mAOD (38.8 mAOD between Compartment 1/2)
Catchment Area	0.861 km ²
TWL Storage Volume @39.5mAOD	155.0 ML
TWL Storage Area @39.5mAOD	90,034m ²



Feature	Description
Compartment 1	
Height (Max.)	2.5 m
Penstock Inlet Invert	37.5 m AOD
WMOL Volume / TWL Volume	7.2 ML / 17.2 ML
TWL Area	12,081m ²
Compartment 2	
Height (Max.)	6.4 m
Penstock Inlet Invert	34.6 m AOD
WMOL Volume / TWL Volume	32.6 ML / 55.7 ML
TWL Area	31,028m ²
Compartment 3	
Height (Max.)	4.9 m
Penstock Inlet Invert	35.1 m AOD
WMOL Volume / TWL Volume	30.6 ML / 49.3 ML
TWL Area	22,323m ²
Compartment 4	
Height (Max.)	4.0 m
Penstock Inlet Invert	36.0 m AOD
WMOL Volume / TWL Volume	15.2 ML / 32.7 ML
TWL Area	24,602m ²

B.2 Scheme Overview

B.2.1 General

The proposed Havant Thicket Reservoir (HTR) will be a new reservoir to be built in Havant, which is approximately 10km north of Portsmouth.

The operating capacity of the reservoir is 8,700 ML, including borrow pits but not including water below the lowest draw off level or retained in the wetland. The top water level (TWL) is 39.5 m AOD, and the lowest operating level is 29.0 m AOD. The lowest 20% of the total volume is considered dead storage, i.e. the minimum level before the reservoir operationally fails.

B2.2 Main reservoir embankment

The main reservoir embankment is 2,850 m long with a height of 20 m at an embankment crest level of 40.5 m AOD. This is 1 m above the top water level and therefore the reservoir has 1 m of freeboard as required by the Reservoir Flood Study. The embankment consists of a zoned earthen embankment with the following zones:

- A central, low permeability clay core as the main water retention zone (Zone 1)
- Chimney filter and blanket filter/drain to control seepage through the embankment (Zone 2)



- Upstream and downstream shoulders to support the clay core and maintain stability (Zone 3)

The upstream and downstream shoulders are sloped at 1V:9H where the height of the embankment is greater than 10m, and 1V:8H where the height of the embankment is less than 10m. The crest is protected with a gravel pavement for vehicle access.

The spillway is at 39.5 m AOD, with a reference design consisting of a 3 m long weir, with a 700 mm diameter pipe, which gives a 1.3 m³/s discharge at a head of 0.4 m. The 700 mm diameter pipe will discharge into Riders Lane Stream downstream of the dam toe.

The embankment will have a toe drain around its entire downstream edge, which will collect the surface water run-off from the embankment and channel it into either the Riders Lane Stream or Durrants Stream (to the River Lavant). A small section of the Riders Lane Stream catchment (0.03 km²) may be diverted out of the catchment and into the Lavant Headwaters by the toe drain. The Lavant Headwaters catchment area is still reduced, however, as the embankment will intercept a proportion of the baseline catchment, reducing the overall area from approximately 0.50 km² to 0.38 km².

B2.3 Wetland structure

The wetland comprises two embankments, the Wetland Retaining Structure (WRS) and Wetland Retaining Bund (WRB). The WRS encircles three compartments (numbered 2 to 4) that capture the three main streamlines into the reservoir. The WRB extends from the WRS to create Compartment 1. The WRS has a length of approximately 1075 m and the WRB a length of 375 m along the northern shoreline at an average distance 60-80 m away from where the TWL would cover.

This is planned to facilitate wetland habitat development, provide resilience to reservoir level changes and to ensure viable habitat that meets biodiversity net gain requirements.

The crest level of the bund that separates the wetlands from the main reservoir is set at 40.0 m AOD. At TWL (39.5 m AOD) the wetland area will be approximately 9.0 ha, however at retained water level (38.8 m AOD) it will be approximately 6.2 ha. The retained wetland level is the level at which the retaining structure starts to hold back water within the wetland area as reservoir levels fall.

The water level in the wetland will be actively managed through the provision of piped controls at strategic locations along the retention structure, which connect the retained wetland to the main body of the reservoir at naturally occurring low points in the topography. These outlet structures consist of DN900 conduits in each compartment with a penstock control on the wetlands side to allow the flow of water both ways in operation.

The wetlands is programmed to be completed before the end of the main reservoir embankment. Flood control during construction is obtained by the maintaining the outlet structures open to pass any inflows and completion of the overbank, rock lined spillways. The flood risk is lower after the construction of the main reservoir embankment and so the overbank spillways completed for construction are adequate to maintain sufficient flood capacity. Five overbank spillways exist along the main retaining bund crest, consisting of a lowering in the crest level to the spillway crest level of 38.8 m AOD. Rock lining is placed on the flow path over the embankment material to prevent erosion from occurring in flood.



B2.4 Inlet and Outlet Flow Control

The pipework arrangement consists of two pipelines; a DN1400/DN1600 diameter pipeline to provide a common outlet, and drawdown main, plus an independent 300mm diameter scour/compensation main. A new DN 800 inlet pipe has been added that takes water from the Bedhampton Pumping Station into the reservoir over the embankment in the southwestern corner (not included as part of this submission).

The outlet pipe consists of a DN1400 opening in the bulkhead at the base of the valve tower and stays as a DN1400 pipe through the main guard valves. The outlet pipe then enlarges to DN1600 through the downstream culvert before reducing to DN1400 at the bi-furcate to the emergency drawdown pipe. The outlet pipe continues as a DN1400 to the site boundary before reducing to a DN1200 on the route to Bedhampton. The DN1400 emergency drawdown pipe is regulated by a submersible valve that releases the flow into an open channel Riders Lane Stream.

The outlet and scour pipework passes through the embankment in a reinforced concrete culvert that is 5.1 m wide and 3.75 m high internally. The dimensions of the culvert have been designed to allow installation of all the internal pipework and fittings in construction and if required to be replaced in the dam's operational life. Access to the culvert is through the valve tower and control building.

Appendix C – Features in area downstream of the dam

A flood inundation map was generated by Atkins for the Flood Risk Assessment Report (HTR-ATK-XX-XX-RP-Z-0042), reproduced below as Figure C1. The inundation extent was produced for the reservoir at top water level (39.5 mAOD) without coincident flooding in the natural catchments. During construction, this represents the likely maximum limits of the flood extent as the dam will not be able to fill to this level.



Figure C1 Inundation Plan - "Dry day" breach flood extent (from HTR-ATK-XX-XX-RP-Z-0042)

Appendix D – Access Routes to Site and Site Facilities

D.1 Access to Site

The reservoir site, comprising the main reservoir embankment, wetlands embankment, wetland structures, and outlet works is located to the north of the town of Havant, in Hampshire. The Main Reservoir Works lie within the two local planning authorities of Havant Borough Council (HBC) and East Hampshire District Council (EHDC).

Access to the main site compound is from the B2149 via the Northern Access Route (NAR). The B2149 can be accessed from the A3 near Horndean or from Havant.

If access to the NAR is cut, alternative access to the southwest corner of the site can be made from Swanmore Road in Havant. However access in this area may be restricted and would require Future Water personnel to open security gates.

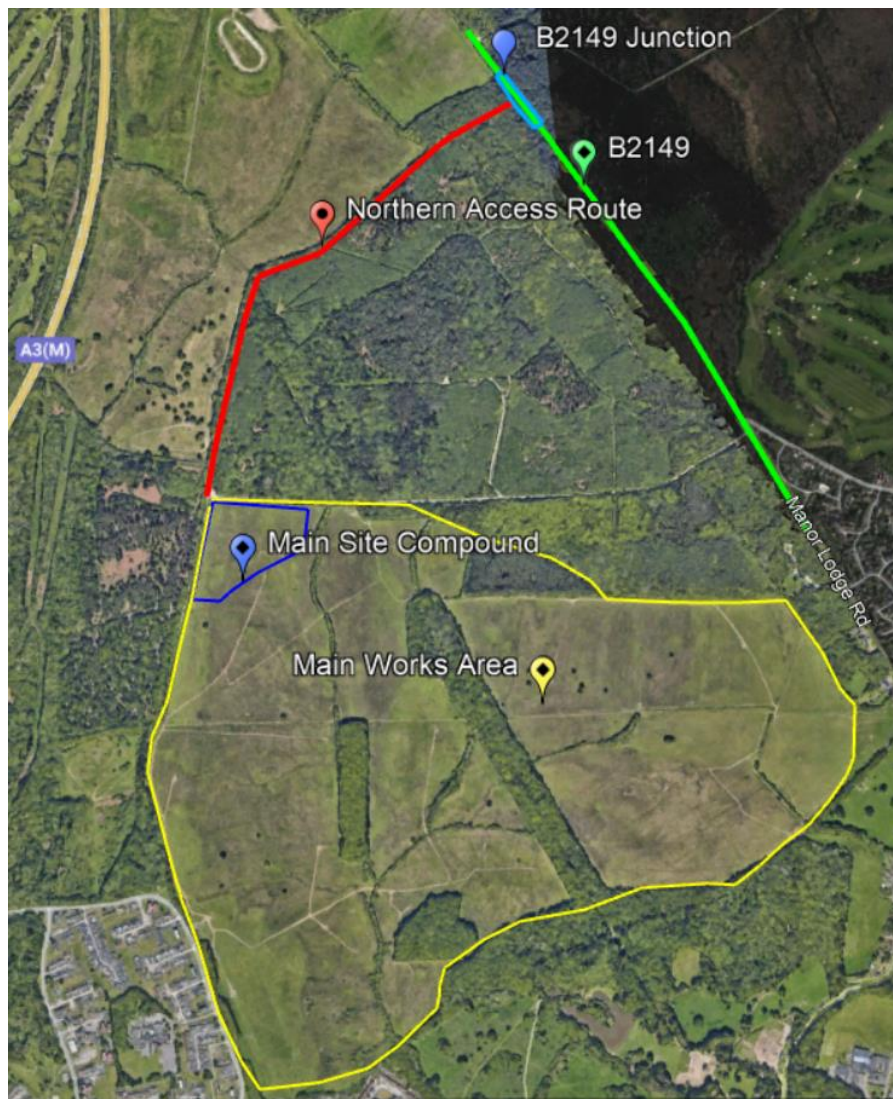


Figure D1 – Main access to Havant Thicket Reservoir



D.2 Access within site

From the main site compound, all weather access roads lead to key areas of the main embankment and wetland structures. All weather access is not available to all areas of the site from Swanmore Road.

D.3 Mobile phone signal at site

Phone reception is generally good.

D.4 Buildings that may be suitable as local Control centre

The site office in the main site compound has all facilities required for a local Control Centre..

D.5 Marshalling Point

The site office has suitable car parking facilities to act as a marshalling point.

D.6 Keys etc needed for access

Security guards man the entrance to the NAR and site office 24 hours, 7 days a week. Access will require to be arranged with Future Water.

Secondary access from Swanmore Road may be unmanned and restricted. Access would require Future Water personnel to open security gates.

Appendix E – Emergency Drawdown

During construction it is intended that any flows from rainfall events less frequent than a 1 in 30 year event will be able to pass through the wetlands embankment and main embankment through uncontrolled spillways. Therefore, there are no procedures for emergency drawdowns prior to commencement of filling.

Appendix F – Contact Details for Pumps, Equipment and Contractors

Future Water will have extensive resources on site and access to resources when required.

Contact Name/ Role	Address	Contact Telephone Numbers
Philip Coxon, Strategic Account Manager	Selwood Ltd, Bournemouth Road, Chandlers Ford, Eastleigh, Hampshire, SO53 3ZL	023 8025 0200 07785 731129

Appendix G – Testing the Flood Plan

G.1 Testing the flood plan

(Given in the format required for a Direction under Section 12AA(4))

Testing should be proportionate to the level of risk posed to the public by the reservoir and follow Portsmouth Water guidelines. As a Category A dam, the guidance on www.gov.uk appears should be followed. However, as this plan is only for construction and prior to filling, the following has been assumed.

Element Of Flood Plan	Manner Of Testing	Interval Between Tests	Reporting						
Review	Bi-annual desk-based review of plan by Future Water (Contractor) to be submitted to Construction Engineer for approval. • Ensure contacts and other details in the plan are up to date. • Ensure all references to equipment are correct. • Ensure all relevant procedures and actions are still appropriate. Site walkover and confirmation of on-site actions with key personnel.	Minimum Bi-Annually	-						
Test equipment	Test the operation of any existing equipment on site when installed and if required to be used in a reservoir drawdown scenario. Eg <table><tr><td>Emergency Discharge Valves</td><td>10% capacity or as agreed</td></tr><tr><td>Control Valves</td><td>10% capacity or as agreed</td></tr><tr><td>Wetlands Penstocks</td><td>Full open</td></tr></table>	Emergency Discharge Valves	10% capacity or as agreed	Control Valves	10% capacity or as agreed	Wetlands Penstocks	Full open	Bi -annually	-
Emergency Discharge Valves	10% capacity or as agreed								
Control Valves	10% capacity or as agreed								
Wetlands Penstocks	Full open								
Test plan by Site attendance	Attendance of key staff (as table 2.2., including Supervising Engineer) to exercise (discuss) the plan against “a scenario” to agree response/actions that would prevent an uncontrolled release; including covering a) Deployment of site staff and assignment of roles and responsibilities; b) Communications with contractors regarding required equipment / material to confirm availability during an emergency; c) Involvement of an ARPE; and d) Share any Lessons learnt from full site simulation by another Contractor	Only carried out if concern from the Contractor or Construction Engineer about the effectiveness of the plan.	Note 2						
Full Site simulation	Rely on simulations and lessons learnt from simulations on other PW reservoirs and by other Contractors.	Only carried out if concern from the Contractor or Construction Engineer about the effectiveness of the plan.	Note 2						
Notes									
1. N/A									
2. Reports under row 3 and 4 should									

- a) include personnel present, scenario considered, any lessons learnt and suggested improvement to the plan

G.2 Plan updates and review

The review and update of this onsite plan should be undertaken as follows;

Element Of Flood Plan	Revision Required	Timing
Contact details and references to equipment	Check these aspects are up to date	Minimum Bi-Annually
Reservoir details, risk factors and actions	Update if there has been any modifications to the dam	Following any modifications to the dam
Procedures and actions	Update with any lessons learnt following every test and exercise of the plan	Minimum annually or on significant change of personnel
Whole plan including risk factors, trigger levels and actions	Review in consultation with the inspecting engineer	As required

If the plan is updated significantly, i.e. more than just updating contact details, it should be reissued to the Construction Engineer.

Appendix H – Failure Modes

H.1 Risk Assessment and Hazard Identification

This section describes the Risk factors for the reservoir – e.g. weather events, flooding, earthquake, internal erosion, deformation.

H.2 Weather Events

Several Meteorological hazards have been identified that could pose risk to the reservoir during construction and operation:

- Blizzards and Periods of extreme cold - Freezing temperatures could cause pipeline burst
- Storms could cause high winds and heavy rain causing damage to infrastructure and property.
- High winds - High winds causing waves to erode the embankment.

H.3 Flooding

- Fluvial flooding from streams flowing into reservoir, rainwater directly falling on the reservoir and surface water runoff. Surface water flooding (also referred to as pluvial flooding) can be caused by overland flow / runoff, and includes water flowing over the ground that has not reached a natural or artificial drainage channel. All structure are to be designed to pass extreme rainfall events, although through construction, large floods may result in damage to the works.
- Major change to groundwater levels - Extreme rainfall could result in a rise in groundwater levels leading to increased spring flows. These may arise from the Palaeogene deposits or could potentially also receive Chalk baseflow at higher groundwater levels at locations along the Chalk-Palaeogene contact. This could result in localised groundwater flooding and could place some additional pressure on the embankments surrounding the reservoir and/or the drainage schemes in place (to re-route existing drainage channels).
- High flows through temporary openings in the embankment can lead to erosion, unravelling of earthworks and damage to permanent works that requires careful remediation.

H.4 Geological

- Earthquakes - The site is in a low geologically active area and as such catastrophic events have an extremely low probability.
- Sinkholes - There is the potential for natural cavities such as swallow holes and sinkholes to be present beneath the Scheme associated with karst dissolution features within the underlying White Chalk Sub-Group. However, the presence of sinkholes was not identified within any of the aerial photography or geomorphological field mapping undertaken for the reservoir site. No sinkholes are recorded within the reservoir site and pipeline corridor.

H.5 Slope Instability and Deformation

- Ground instability - Risk of instability of existing ground due to existing shear planes in clay under proposed embankment.
- Construction loading – Risk of build-up of pore pressures in the embankment from addition of compacted fill, leading slope instability.
- Drawdown – rapid reduction of water impounded against the embankment resulting in excess pore pressures and removal of support causing slope instability.
- Piping / Internal Erosion – defects in the embankment or foundation allow concentrated seepage to occur that can lead to erosion and enlargement of the defect.