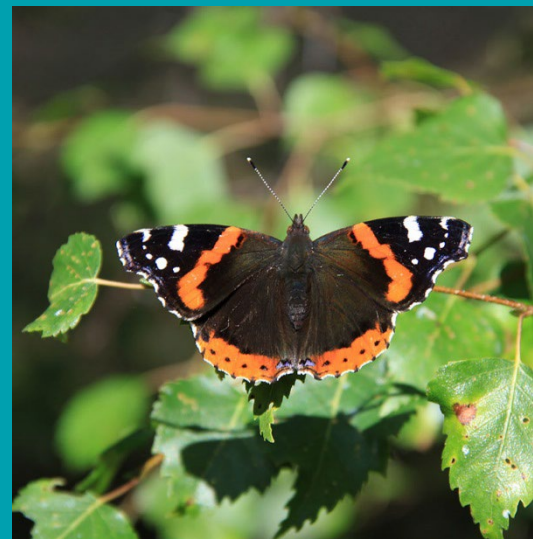


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Veolia

Avonmouth Hazardous Waste Transfer Station

Flood Risk Assessment



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Document revisions

No.	Details	Date
1	Draft report	28/03/2022
2	Final Report	31/03/2022

Executive summary

Wood Group UK Ltd ('Wood') have been commissioned by Veolia to undertake a Flood Risk Assessment (FRA) in support of a planning application for a new hazardous waste transfer station ("HWTS Site") within Veolia's existing Resource Processing and Management Facility in Avonmouth. A site-specific FRA is required as the HWTS Site located in Flood Zone 3a.

The HWTS Site is located on the Chitting Industrial Estate in Avonmouth. It covers an area of approximately 0.18 ha and is centred at National Grid Reference (NGR) ST 53076 81166. The key components proposed at the Site comprise: a WTS building containing five covered waste storage bays, each with a sump to collect hazardous waste runoff, a covered sorting area, an office/welfare/lab building and a hardstanding area for vehicle movements.

In accordance with NPPF requirements, the proposed development has been demonstrated to be compliant with the Sequential Test and Exception Test for Flood Risk.

The HWTS Site is underlain by low permeability geology comprising Tidal Flat Deposits over Mercia Mudstone. The Site and wider surrounding area are classified as Flood Zone 3a, the primary source of flood risk being tidal flooding from the Severn Estuary which lies about 810 m west of the Site. The Site is located within an area benefiting from flood defences. The existing flood defences (raised earth embankments) are being improved as part of the Avonmouth Severnside Enterprise Area (ASEA) Ecology Mitigation and Flood Defence Project with construction having commenced in 2019. An extensive network of rhines (watercourses and drains) is present within the vicinity of the site.

Tidal flooding from the Severn Estuary constitutes the most significant flood risk to the HWTS Site, particularly in combination with tide-locking, in which the rhines are unable to drain to the sea due to high tides. There is also a limited risk from groundwater, surface water and sewer sources of flooding at the HWTS Site. However, the proposed flood risk mitigation for tidal flood risk would also manage the risk from these sources.

Based on the ASEA Tidal Inundation Model, which aligns to updated UKCP18 guidance, a design flood level has been set based on a modelled flood level of 6.77 m AOD for the extreme case of breach of the ASEA flood defences under the 0.5% annual exceedance probability (AEP) plus climate change event (2098). A 300 mm freeboard has been applied to give a design level of **7.07 m AOD**.

In order to provide protection in the event of tidal flooding at the HWTS Site it is recommended that the finished floor levels (FFLs) of the proposed office/welfare/lab building, HWTS building and other sensitive development should be set at or above 7.07 m AOD (provided by a perimeter bund or ground raising). . Veolia will also consider the use of other flood resilient and resistant design measures for new sensitive development where appropriate.

During the construction and operational phases, the respective site managers will sign up to receive the EA's flood alert and warning service. A Flood Evacuation Plan including evacuation routes should be drawn up and implemented at the HWTS Site. Considering the vulnerability of the office/welfare/lab building and site use, these measures are considered appropriate to manage flood risk at the Site.

In summary, this FRA provides an assessment of flood risk at the HWTS Site and incorporates suitable flood mitigation measures in order to minimise the risk of flooding to the proposed development

and ensure no increase in flood risk to the surrounding area. The proposed development is therefore compatible with NPPF requirements as well as meeting Bristol City Council and Defra requirements on flood risk.

Contents

1.	Introduction	7
1.1	Purpose of this report	7
1.2	Context	7
1.3	Sources of data and information	7
1.4	Terminology	8
1.5	Report Structure	9
2.	Site description, development proposal and planning context	10
2.1	Site description	10
2.2	Hydrology and drainage	10
2.3	Geology, hydrogeology and soils	11
2.4	Development proposals	11
2.5	Planning context	12
3.	Flood risk appraisal	17
3.1	Summary of potential sources	17
3.2	Historical flooding	18
3.3	Fluvial and Tidal flooding	18
3.4	Surface water flooding	20
4.	Sources of flood risk requiring management and mitigation measures	21
4.1	Proposed Mitigations	21
5.	Conclusions and recommendations	23
5.1	Conclusions	23
5.2	Recommendations	23

Table 1.1	Data used to appraise flood risk	7
Table 1.2	Flood Zone definitions and associated annual exceedance probability	8
Table 2.1	Flood Zone definitions and associated annual exceedance probability	15
Table 3.1	Screening of all potential sources of flood risk	17
Table 3.2	Details of the existing tidal flood defences to the west of the HWTS Site along the coast of the Severn Estuary	19

Table 3.3 Modelled Flood Levels at the Site (ASEA Tidal Inundation Model)

19

Figure 2.1 Site Location Plan
Figure 2.2 Proposed Site Layout and Surface Water Drainage System
Figure 3.1 Environment Agency Flood Map for Planning
Figure 3.2 Environment Agency Surface Water Flood Map

Appendix A Site Topographical Survey
Appendix B Environment Agency Detailed Flood Risk Data
Appendix C Loss of floodplain storage (post-development)

1. Introduction

1.1 Purpose of this report

This report has been produced for the purpose of providing a Flood Risk Assessment (FRA) in support of a planning application for the provision of a new hazardous waste transfer station ('the HWTS Site') at Avonmouth Resource Recovery Facility and Depot ('the Avonmouth Site').

1.2 Context

In accordance with the National Planning Policy Framework¹ (NPPF, 2021) Paragraph 167 states that a site-specific FRA is required for development proposals that are:

- One hectare (ha) or greater located in Flood Zone 1;
- All proposals for new development located in Flood Zone 2 and 3;
- All proposals for new development located in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency, EA); and
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

In this case an FRA is required as the proposed development area lies within Flood Zone 3.

The main purpose of the FRA, as detailed in NPPF, is to demonstrate how flood risk to the proposed development and any increased flood risk to third parties due to that development, will be managed over the lifetime of the development, taking climate change into account.

1.3 Sources of data and information

Sources of data and other information used to inform the FRA are listed in **Table 1.1**. A data request was sent to the Environment Agency (EA), on 19/01/2022, to obtain relevant information for the FRA, e.g., modelled flood levels for the site, incidents of local historical flooding. Consultations with Bristol City Council (the Lead Local Flood Authority, LLFA and Local Planning Authority, LPA) have not been undertaken given that Bristol City Council have extensive online guidance with regards to flood risk and historical flooding.

Table 1.1 Data used to appraise flood risk

Data	Description	Body	Source
Environment Agency flood risk data	Flood risk maps for the Site	Environment Agency	https://flood-map-for-planning.service.gov.uk/ https://flood-warning-information.service.gov.uk/long-term-flood-risk/

¹ Department of Levelling Up, Housing and Communities. National Planning Policy Framework. London: Department of Levelling Up, Housing and Communities, 2021.

Data	Description	Body	Source
British Geological Survey Geology of Britain Viewer	Superficial and bedrock geology maps and borehole records	British Geological Survey	http://www.bgs.ac.uk/data/mapViewers/home.html
Soilscapes viewer	Soil mapping	Cranfield Soil and AgriFood Institute (CSAI)	http://www.landis.org.uk/soilscapes/
Magic Map Interactive viewer	Source Protection zones and aquifer designations	Department for Environment, Food & Rural Affairs (DEFRA)	https://magic.defra.gov.uk/magicmap.aspx
Environment Agency National LiDAR	1m resolution Lidar	Environment Agency	https://environment.data.gov.uk/DefraDataDownload/?Mode=survey

1.4 Terminology

Annual Exceedance Probability (AEP)

In this report, the probability of a flood occurring is expressed in terms of Annual Exceedance Probability (AEP), which is the inverse of the annual maximum return period. For example, the 100-year flood can be expressed as the 1% AEP flood, i.e., a flood that has a 1% chance of being exceeded in any year.

Table 1.2 is provided to clarify the use of the AEP terminology as well a description of the Flood Zone definitions as set out in the National Planning Policy Framework, Flood risk and coastal change guidance.

Table 1.2 Flood Zone definitions and associated annual exceedance probability

Flood Zones	Probability of flooding	AEP	Definition
Flood Zone 1	Low Probability	<0.1% AEP of river or sea flooding.	Land with less than 1 in 1,000 probability of flooding from rivers or the sea, in any given year.
Flood Zone 2	Medium Probability	1% - 0.1% AEP of river flooding. 0.5% – 0.1% AEP of sea flooding.	Land with between a 1 in 100 and 1 in 1,000 of river flooding; or land having between a 1 in 200 and 1 in 1,000 probability of sea flooding.
Flood Zone 3a	High Probability	> 1% AEP of river flooding. >0.5% AEP of sea flooding.	Land having a 1 in 100 or greater probability of river flooding in any year; or Land having a 1 in 200 probability or greater of sea flooding in any year.

Flood Zones	Probability of flooding	AEP	Definition
Flood Zone 3b	Functional Floodplain	>5% AEP of river or sea flooding; or a designated area designed to flood.	Land having a 1 in 20 or greater probability of river or sea flooding in any year.

1.5 Report Structure

The structure of the report is as follows:

1. **Introduction** - this section establishes the purpose of this report, sources of data and information and the terminology used;
2. **Site Description, Development Proposal and Planning Context** – provides description of the Site, the proposed development and sets out the relevant planning context;
3. **Flood Risk Appraisal** – provides an appraisal of flood risk from all sources, including reports of historical flooding;
4. **Flood Risk Mitigation** – presents potential mitigation options that could be incorporated for the proposed development, to reduce the risk of flooding from identified sources;
5. **Conclusion and Recommendations** – provides the findings of the report and highlights recommendations to ensure flood risk is managed sustainably as part of the proposed development.

2. Site description, development proposal and planning context

2.1 Site description

The HWTS Site is located within Veolia's existing Avonmouth Resource Processing and Management Facility and Depot in Chittening Industrial Estate, Avonmouth, and is centred at National Grid Reference (NGR) 53076 81166. The Site location plan is shown on **Figure 2.1**. The HWTS Site covers an area of approximately 0.2 ha, in the southwestern corner of the wider Avonmouth Site (3.8ha). The key components of the HWTS Site comprise: a WTS building containing five covered waste storage bays, each with a sump to collect hazardous waste runoff, a covered sorting area, an office/welfare/lab building and a hardstanding area for vehicle movements.

The Site layout showing the Avonmouth Site and proposed components of the HWTS Site is shown on **Figure 2.2**. The topographic survey for the HWTS Site is provided in **Appendix A**. This shows that the HWTS Site is largely level with elevations ranging from 6.72 m AOD to 7.05 m AOD. Elevations in the wider Avonmouth Site range between 6.7 m AOD to 6.9 m AOD. Elevations along Chittening Road to the east of the HWTS Site vary from 7.04 m AOD to 6.81 m AOD.

2.2 Hydrology and drainage

There are no waterbodies within the HWTS Site boundary. The HWTS Site is within the Lower Severn Internal Drainage Board (IDB). An extensive network of rhines (watercourses and drains) is present within the vicinity of the site. Stuppill Rhine and Salt Rhine (Ordinary Watercourses) flow in a northwest direction towards the Severn Estuary, approximately 500 m northeast and 265 m southwest of the HWTS Site respectively. The Severn Estuary is located 810 m west of the HWTS Site.

The EA Flood Map for Planning shows a formal flood defence approximately 525m west of the HWTS Site (**Figure 3.1**). Information provided by the EA (**Appendix B**) indicates that the flood defences to the west of the HWTS Site comprise raised earth embankments and a reinforced concrete flood wall which were last assessed between November 2009 and November 2018, as in "good" to "fair" condition. The fluvial coastal crest level of the flood defences range between 9.10 m AOD and 10.67 m AOD.

South Gloucestershire Council, Bristol City Council and the EA are working together to improve the flood defences and create new habitats for important wildlife species as part of the Avonmouth Severnside Enterprise Area (ASEA) Ecology Mitigation and Flood Defence Project. The project proposes 17km of flood defences between Aust and Avonmouth by raising the height of existing flood banks and by building new, higher concrete flood walls and higher defences from steel sheet piles.

Construction of the defences to the west of the HWTS Site, at Severn Beach to Chittening Warth, stated in 2021 and is due to be complete in mid-2023². As part of this project a new coastal inundation model has been produced for the Avonmouth/Severnside area to represent the impact of the new flood defence.

² <https://www.asea-flood-ecology.co.uk/map-and-timeline/> (accessed 22/02/22)

The public drainage authority for the region is Wessex Water. The Avonmouth Site and the wider Chitting Industrial Estate are served by a sewer network. The surface water runoff for the wider Avonmouth Site (roof and yard runoff) is discharged via an oil interceptor into an unnamed drain which then discharges into Stuppill Rhine and ultimately into the Severn Estuary (**Figure 2.1**).

2.3 Geology, hydrogeology and soils

The BGS geological online mapping³ indicates that the HWTS Site is underlain by Tidal Flat Deposits (clay and silt). These superficial deposits overlie the Mercia Mudstone Group (Mudstone and Halite-stone). The Tidal Flat Deposits and Mercia Mudstone Group beneath the HWTS Site are classified by the EA as unproductive strata and Secondary B aquifer respectively.

- Secondary B aquifer – *“are mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers”*
- Unproductive Strata – *“are largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them”*.⁴

The Site does not lie within or near a Source Protection Zone⁵. Groundwater is assumed, due to the proximity of the site to the Severn Estuary, to flow in a westerly direction towards the Severn Estuary and is likely to be tidally influenced.

Online EA mapping⁶ and the LANDIS Soils Database⁷ indicates that the soils at the Site are loamy and clayey soils of coastal flats with naturally high groundwater.

The Bristol City Council Level 1 Citywide SFRA (2020) states that in lower lying areas in Avonmouth groundwater can get to within 1-2m of the ground surface.

2.4 Development proposals

The proposed HWTS Site has an area of 0.18ha and lies in the southeast corner of Veolia’s existing Resource Processing and Management Facility in Avonmouth. The proposed HWTS site layout is shown on **Figure 2.2** and includes:

- a new HWTS building containing five covered waste storage bays, each with a sump to collect runoff from the wastes;
- a covered waste sorting area;
- an office/welfare/lab building; and
- a hardstanding yard area for vehicle movements.

Surface water runoff from the HWTS Site building roofs and yard area will be managed as part of the existing surface water drainage system for the wider Avonmouth Site. (**Figure 2.2**), which is

³ <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> (accessed 22/03/21)

⁴ <https://www.gov.uk/government/publications/protect-groundwater-and-prevent-groundwater-pollution/protect-groundwater-and-prevent-groundwater-pollution> (accessed 22/03/22)

⁵ <https://magic.defra.gov.uk/MagicMap.aspx> (accessed 022/03/22)

⁶ <https://magic.defra.gov.uk/MagicMap.aspx> (accessed 09/03/2022)

⁷ [Soilscapes soil types viewer - National Soil Resources Institute. Cranfield University \(landis.org.uk\)](https://soilscapes.nisr.ac.uk/soilscapes-soil-types-viewer-national-soil-resources-institute-cranfield-university-landis.org.uk) (accessed 09/03/2022)

discharged via an oil interceptor into an unnamed drain which then discharges into Stuppill Rhine and ultimately into the Severn Estuary (**Figure 2.2**). The proposed discharge of runoff from the HWTS is supported by an environmental risk assessment (Wood, 2022)⁸. The HWTS storage bays will have sealed drainage and sumps to capture any spillages, which will subsequently be tankered off-site for treatment.

2.5 Planning context

Policy and relevant guidance to this FRA includes the following:

- Bristol City Council: Bristol Local Flood Risk Management Strategy, 2018: sets out the LLFA's vision for managing flood risk in Bristol. It explains the role and responsibilities of organisations involved in flood risk management and sets out objectives and an action plan for how these shall be undertaken alongside cost/ benefit analysis of delivering measures. It summarises flood risk across Bristol with tidal flooding as the most significant risk due to the River Severn Estuary having the second highest tidal range of any tidal waterbody in the world. Moreover, some areas are at risk of surface water and sewer flooding, but this appears to be determined on a local scale. Fluvial flood risk, even considering climate change, will likely remain low due to installed defences. Groundwater flood risk is considered to be low compared to risk from other sources, however it is noted that this risk is not as well understood.
- Bristol City Preliminary Flood Risk Assessment (PFRA), 2011 and addendum (2017): provides a review of past floods and the potential for future floods, as well as determining and reviewing the presence of any "areas of significant flood risk" (Flood Risk Areas) in Bristol City Council's administrative area. The Avonmouth Site area is identified as an area with a medium risk of surface water flooding. This report was updated with an addendum in 2017, and this states that Surface water risk in the city region remains high, the Central Area Flood Risk Assessment (CAFRA) has been updated and the FRA area has been updated for the purposes of the second planning cycle of the Flood Risk Regulations;
- Bristol City Council Level 1 – Citywide Strategic Flood Risk Assessment, 2020: provides a citywide assessment of flood risk from all sources, assessing present day and future risk, considering the predicted effects of climate change. This SFRA indicates that tide-locking is apparent in Avonmouth and the rhine network where the outfalls are influenced by the tides, due to the network's low topographic level, locality and proximity adjacent to the Severn Estuary The Proposed Development Site is not within the Functional floodplain. The Avonmouth region is particularly known for poor drainage characteristics and there are implications when considering any water management techniques for new development.
- Bristol City Council Strategic Flood Risk Assessment Level 1 SFRA, 2009: provides an appraisal of flood risk issues relating to development throughout Bristol, noting specifically risk of tidal flooding for Avonmouth. The majority of the Avonmouth/ Severnside SFRA area is considered at high risk of flooding. If there were no defences, it is predicted there would be extensive flooding of the low-lying land. Even with defences,

⁸ Wood, 2022. Avonmouth Hazardous Waste Transfer Station. Water Discharge Activity H1 Assessment

Avonmouth is considered susceptible to tidal/surge flooding via over topping of the tidal defences. It also notes that there are no records of groundwater flooding in the EA database and therefore considers groundwater flood risk unlikely to be significant in the Bristol City area;

- Bristol City Council, South Gloucestershire Council, Lower Severn Drainage Board SFRA Level 2 Avonmouth/Sevenside, 2011: provides flood risk information to strategic planners during the land use allocation process, assists with development control decisions and also informs the wider community in matters relating to development and flood risk in the Avonmouth / Sevenside area. Whilst this report notes the poor condition and low standard of protection of some sections of the tidal defence, the report has now been superseded by the construction of the upgraded tidal defences (due for completion later in 2022). Should a defence breach occur land adjacent to the defences (including the Site) would be vulnerable to rapid inundation, high flood depths and velocities;
- Surface Water Management Plan, Phase 1 (SWMP), 2012: outlines the preferred surface water management strategy in a given location. In this context, surface water flooding refers to flooding from sewers, drains, groundwater, runoff from land, small watercourses, and ditches that occur as a result of heavy rainfall. This Phase 1 assessment comprises: preparation of the SWMP project; Integrated Urban Drainage (IUD) modelling; identification of areas at high risk of flooding; and a series of plans to be utilised for flood risk management. Appendix A shows series of rhines to the east of the site, which drain into Stuppill Rhine, are shown as being within the "high risk" area. High Risk Rank areas are classified as being at risk of surface water flooding during a critical duration 1 in 30-year rainfall event;
- Severn Tidal Tributaries Catchment Flood Management Plan, 2009: indicates that much of the flat coastal floodplain upon which the Site is situated is below high-tide level. The report states that the most significant source of flooding within the area comes from tide-locking, in which high tides prevent watercourses from draining into the tidal estuary. The report indicates that tidal flooding from the Severn Estuary presents the main risk to Avonmouth / Sevenside. Fluvial flooding from the rhine network also presents a flood risk – mainly in the vicinity of the M49 corridor to the south of the Site.

The Sequential Test

The NPPF and the accompanying Technical Guidance⁹ state that only where there are no reasonably available sites in lower risk Flood Zones (i.e., Flood Zones 1 and 2) should development be permitted in Flood Zone 3. The Sequential Test (NPPF paragraph 161 and 162) aims to direct new development to the areas of lowest flood risk by a process of appraising other reasonable available sites within a suitable 'area of search'. Only when it is confirmed that there are no other suitable sites will development be permitted in areas of Flood Zone 3. Even then, the development must account for the flood risk vulnerability of the proposed land use and to apply the Exception Test if required.

Policy 11 of the West of England Joint Waste Core Strategy (2011)¹⁰ states that planning permission will not be granted for waste related development in Flood Zone 3b or in areas where the level of

⁹ See: <https://www.gov.uk/guidance/national-planning-policy-framework> (accessed 22/03/22)

¹⁰ <https://www.southglos.gov.uk/documents/Joint-Waste-Core-Strategy.pdf>

flood risk is considered to be unsuitable for the type (vulnerability classification) of development proposed.

The EA's Flood Map for Planning (FMfP) in **Figure 3.1** shows that the HWTS Site, Chittening Industrial Estate and most of the area to the west of Bristol lie within Flood Zone 3. The Level 2 SFRA shows that the HWTS Site (and wider area) lies within Flood Zone 3a and not within the functional floodplain (Flood Zone 3b dominated by the predicted fluvial flooding that could be generated by the rhine system in low lying land as the tidal defences prevent significant tidal flooding at the present time).

Although the proposed HWTS is within Flood Zone 3a the development area is considered to be a suitable location with no reasonably available alternative suitable sites at a lower risk of flooding for the reasons below, and as such passes the NPPF's Sequential Test.

- The HWTS Site is not within Flood Zone 3b;
- The HWTS Site is within the existing Avonmouth Resource Processing and Management Facility and will use much of the same equipment and staff. The HWTS Site lies within the Chittening Industrial Estate which has low sensitivity to the existing and future waste operations on Site and vehicle movements and has good existing site access directly onto the A403, with nearby links to the M4 and M5;
- The Avonmouth/Sevenside area is of huge importance to the local economy, accommodating a wide range of businesses, especially in the areas of storage, distribution, energy and waste, with residential development generally outside this area. The nearest area of Flood Zone 2 to the HWTS Site is in the area around Poplar Way West. This area is already heavily developed with warehouses operated by the Co-op to the North of the road, and BCA marketplace to the South. Within the Bristol City Region, the majority of the land outside of the Flood Zones 2 and 3 is already developed or protected from development.

The Exception Test

The Exception Test, as set out in paragraph 163 and 164 of the NPPF, is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

Under the NPPF Annex 3 and the accompanying Technical Guidance¹¹, the proposed development is classified as '*More Vulnerable*' (landfill and sites used for waste management facilities for hazardous waste). **Table 2.1**, reproduced from the NPPF online flood risk matrix, indicates that, for '*More Vulnerable*' development within Flood Zone 3a the Exception Test need to be applied.

¹¹ The Technical Guidance currently (<https://www.gov.uk/government/collections/planning-practice-guidance>; Accessed 09/03/2022) refers to the NPPF published on 20 July 2021 and will, where necessary, be updated in due course to reflect the revised NPPF published on 24 July 2018.

Table 2.1 Flood Zone definitions and associated annual exceedance probability

Flood Risk Vulnerability Classification	Essential Infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test required	✓	✓	✓
Flood Zone 3a	Exception Test required*	X	Exception Test required	✓	✓
Flood Zone 3b	Exception Test required**	X	X	X	✓**

Development is appropriate

X Development should not be permitted

*In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

** In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to remain operational and safe for users in times of flood; result in no net loss of floodplain storage; not impede water flows and not increase flood risk elsewhere.

Wider Sustainability benefits

Part 1 of the Exception Test requires the HWTS Site to provide wider sustainability benefits to the community that outweigh flood risk.

The HWTS Site would contribute, in line with the overall UK government policy and the West of England Joint Waste Core Strategy (2011)¹², to managing waste as high up the waste hierarchy considering waste as a resource from which to recover some value and looking to disposal as the last option. The HWTS Site has a predicted hazardous waste input of 7,000 tonnes/yr which will be repackaged and prepared for treatment and recycling in the southwest region. This will reduce the volume of waste being sent to landfill. It is therefore concluded that the Proposed Development has passed Part 1 of the Exception Test.

Flood Risk

Part 2 of the Exception Test requires that the HWTS Site would be safe, without increasing flood risk elsewhere (subject to the exception below) and, where possible, would reduce flood risk overall.

Part 2 of the Exception Test is considered to be passed, without the need for any additional mitigation on the basis that:

- The WTS Facility is considered to be safe for its lifetime (25 years). As discussed in **Section 3.3**, tidal modelling indicates the HWTS Site would remain dry during the overtopping of flood defences event 0.5% AEP plus climate change. The HWTS Site is though predicted to flood during the 0.1% AEP plus climate change overtopping event;

¹² <https://www.southglos.gov.uk/documents/Joint-Waste-Core-Strategy.pdf>

- The residual flood risk can be mitigated. The HWTS Site is predicted to flood if there were to be a breach of the flood defences (0.5% AEP plus climate change event). The flood risk management measures set out in **Section 4.1** (provision of a perimeter bund) would ensure the HWTS Site would remain dry during the breach event;
- The HWTS Facility would not increase flood risk elsewhere due to the potential loss of floodplain storage. The proposed FFL of 7.07mAOD (by raising ground level or construction of a perimeter bund) is estimated to remove 0.18ha (0.138%) from the flood cell¹³. This is estimated to raise flood levels across this area by less than 0.5mm and therefore the potential for loss of floodplain storage is considered negligible (calculations in **Appendix C**).
- The HWTS Site would not increase flood risk elsewhere due to potential increase in surface runoff from the HWTS Site . The total impermeable area of the Avonmouth Resource Processing and Management Facility will not be increased by the proposed HWTS Site as this area is currently impermeable. Surface water runoff from the HWTS will be managed as part of the existing drainage system for the Avonmouth Resource Processing and Management Facility (which discharges into an unnamed drain and ultimately to the Severn estuary).

¹³ 'Flood cell' is the contiguous sub-area of the wider floodplain that tidal flood water entering via a flood defence breach would rapidly and primarily accumulate within.

3. Flood risk appraisal

3.1 Summary of potential sources

Table 3.1 provides an initial screening of all potential flood risk across the HWTS Site. Those that are screened in as posing a potential flood risk are then considered further in the subsequent sections.

Table 3.1 Screening of all potential sources of flood risk

Flood Source	Potential Connection to Proposed Development area	Screened In?
Fluvial/Tidal	The HWTS Site (and the Avonmouth Site) is located within Flood Zone 3a. This is due to the proximity of the Severn Estuary, 810 m west of the Site. The flood risk is exacerbated by tide-locking, due to high-tides restricting the ability of rhines to drain out to the sea. Fluvial/tidal flood risk is considered further in Section 3.3.	Yes
Groundwater	The local geology at the Site comprises Tidal Flat Deposits (unproductive strata comprising clays and silts) overlying Mercia Mudstone which is a Secondary B aquifer. BGS borehole ST58SW127 in the surrounding industrial estate (NGR 352980, 181200), approximately 90m west of the Site, recorded a groundwater level strike at 3.0 m below ground level (bgl) within the Tidal Flat Deposits. This suggests that although groundwater emergence in the Tidal Flat Deposits is possible, given the low permeability nature of these deposits any water present is likely to be perched within the clay and silt deposits therefore any emergent flows would be small. The proposed HWTS drainage system and setting of appropriate raising of flood sensitive equipment above finished ground levels will manage the residual risk. On this basis groundwater flooding is not considered to be a significant risk and is not considered further in the FRA.	No
Surface water run-on	The EA's Surface Water Flood Risk Map shows that the HWTS Site (and most of the Avonmouth Site) is at very low risk from this source. This is likely due to the extensive drainage network provided by the IDB drains, which allow surface water to drain from the fields into the nearby channels. This indicates that, for the most part, it will be surface water runoff originating from the HWTS Site which will be the primary surface water consideration. Nevertheless, the low risk posed to the proposed development from surface water run-on is discussed further in Section 3.4.	Yes
Surface water runoff	As discussed above, effective management of surface water runoff originating from the HWTS Site will be the primary surface water consideration. Surface water runoff is considered further in Section 3.4.	
Piped drainage systems (sewers)	<p>The level 2 SFRA does not report any specific risk of sewer flooding in proximity to the HWTS Site. The HWTS Site is located within an industrial estate and therefore whilst the potential for sewer flooding could exist, the risk at the Site is considered to be low. Any water that surcharged would likely remain within the Site due to the flat topography.</p> <p>However, the proposed drainage system and setting of appropriate raising of flood sensitive equipment above finished ground levels would manage the risk. On this basis sewer flooding is not considered to be a significant risk and is not considered further in the FRA.</p>	No

Flood Source	Potential Connection to Proposed Development area	Screened In?
Artificial Sources	The EA's Flood Risk from Reservoirs Mapping shows that no part of the HWTS Site or wider area is not at risk of flooding from this source. The nearest area of flooding from reservoirs when river levels are normal is approximately 2.6km southwest of the site. The closest extent, when there is also flooding from rivers, is approximately 750m west of the Site. There are no other artificial sources of flooding near the HWTS Site. On this basis flooding from artificial sources is not considered to be a significant risk and is not considered further in the FRA.	No

3.2 Historical flooding

The EA's Historic Flood Map reports historic flooding at a fuel storage depot approximately 0.54 km west from HWTS Site but does not highlight historic flooding at the Site. The SFRA (2011) reports severe flooding in 1981 and less severe flooding in 1990, 1995, 1999 and 2000 in the Avonmouth area.

Veolia indicated that no flooding has occurred at the HWTS Site and wider Avonmouth Site since they have owned the Site (approximately 6 years) other than temporary ponding of surface waters as a consequence of blocked drains.

3.3 Fluvial and Tidal flooding

The Level 2 Avonmouth / Severnside SFRA states that Tidal overtopping flooding from the Severn Estuary presents the main flood risk to Avonmouth / Severnside. The report also states that the risk will increase in the future as a result of climate change. Future flooding for more extreme events is expected to only slightly increase the extent (due to steep edges of the floodplain) however flood depths are shown to increase significantly.

The primary source of fluvial flood risk in Avonmouth is from the Rhine network. It is anticipated that sea level in the Severn Estuary will rise by approximately 1.21 m between 2000 to 2125¹⁴. The SFRA (2011) states that this rise in sea level will increase the risk of tidal flooding and fluvial flooding (by affecting the time available for discharge between high tides leading to longer periods of tide-locking in the Rhine network. The predicted increase in severe storm events may also affect the performance of the Rhine network.

The EA FMfP¹⁵ (**Figure 3.1**) shows that the HWTS Site (and the wider Avonmouth Site) is located within Flood Zone 3 and an area benefitting from flood defences. This area is defined for planning purposes in the 2020 Citywide Level 1 SFRA as Flood Zone 3a (not 3b "functional floodplain"). Information provided by the EA (**Appendix B**) indicates that the tidal flood defences adjacent and to the west of the site comprise a raised earth embankments and a reinforced concrete flood wall. Details on these flood defences in **Table 3.2**.

¹⁴ Flood risk assessments: climate change allowances. Available at: Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk). Accessed 10/03/2022.

¹⁵ Environment Agency Flood Map for Planning. Available at: <https://flood-map-for-planning.service.gov.uk>. Accessed 15/05/19.

Table 3.2 Details of the existing tidal flood defences to the west of the HWTS Site along the coast of the Severn Estuary

Map Reference	Asset Description	Approximate length (m)	Actual fluvial coastal crest height (mAOD)	Most recent inspection	Overall condition
5	Earth embankment incorporating Mitchells Outfall	570	9.44 (+/-1-5cm)	24/11/2018	Good
11	Reinforced concrete flood wall defence	20.45	9.10mAOD (+/->5-15)	22/11/2018	Fair
2	Embankment	220	9.22mAOD (+/-1-5cm)	24/11/2009	Fair
10	Embankment	580.88	10.67 (+/-1-5cm)	24/11/2009	Fair

The Tidal Severn Strategy (TSS) was commissioned by the EA after the 2000 fluvial and repeated tidal flooding during high tides throughout the 1990's. The TSS aimed to provide a longer-term framework for flood risk management and a more imminent plan for investment in flood defence infrastructure. More recently, South Gloucestershire Council, Bristol Council and the EA have submitted a planning application to improve flood defences and create new wetland habitat as part of the ASEA Project. The proposed scheme will deliver a 1:200-year Standard of Protection¹⁶ with an allowance for climate change up to 2098. Construction began in 2019 and sections of the scheme have already been completed¹⁷.

As part of the ASEA project, a new coastal inundation model has been produced for the Avonmouth/Sevenside area. This includes modelled flood levels post development (ASEA flood defences) scenarios in 2098 and for a post development breach scenario in 2098 using the 2018 allowances for climate change (CC). The data is summarised in **Table 3.3** and shows that:

- Post development (ASEA flood defences) scenario: flood level for the 0.1% AEP with CC considering the proposed ASEA flood defences is 7.53 m AOD. No flooding is predicted for the 0.5% AEP; and
- Post development (breach of the ASEA flood defences) scenario: flood level for the flood level for the 0.5% AEP with CC is 6.77 m AOD.

Table 3.3 Modelled Flood Levels at the Site (ASEA Tidal Inundation Model)

Scenario	Modelled Flood Levels	
	0.5% AEP (2098)	0.1% AEP (2098)
Post-development (ASEA flood defences)	no flooding predicted	7.53mAOD 1.11m flood depth

¹⁶ <https://sites.southglos.gov.uk/insouthglos/wp-content/uploads/sites/241/2020/07/Frequently-Asked-Questions-v3.pdf>

¹⁷ [Innovation in techniques: A new flood defence wall with special features- stone render finish and built-in habitats for plants – Avonmouth and Sevenside Enterprise Area \(asea-flood-ecology.co.uk\)](https://www.asea-flood-ecology.co.uk/innovation-in-techniques-a-new-flood-defence-wall-with-special-features-stone-render-finish-and-built-in-habitats-for-plants-avonmouth-and-sevenside-enterprise-area)

Scenario	Modelled Flood Levels	
	0.5% AEP (2098)	0.1% AEP (2098)
Post-development (breach of ASEA flood defences)	6.77 m AOD* 0.35 m flood depth	

Notes: * Breach flood level was not provided for the breach flood event. The elevation for the 0.5% AEP event was calculated from flood depth provided by the EA and the modelled Site ground level used by the EA (6.42 m AOD)

3.4 Surface water flooding

Surface water flooding occurs when the intensity of rainfall is greater than the local drainage and infiltration capacity, causing water to flow overland. Where low-points or barriers to flow are present, particularly deep areas of flooding may occur. These areas are not limited to river corridors or floodplains.

The Bristol Local Flood Risk Management Strategy (2018) recognises Bristol as one of the UK's top 10 Flood Risk Areas susceptible to surface water flooding. This Strategy identified a number of areas within Bristol which are at particular high risk of flooding from surface water, shown in online mapping¹⁸. None of these High-risk areas are identified in close proximity to the Site, with the closest approximately 4km to the east in Henbury.

The EA Surface Water Flooding Map (**Figure 3.2**) shows that the entirety of the HWTS Site is at very low risk (i.e., <0.1% AEP) of flooding from this source, however a small area in the Centre of the wider Resource Processing and Management Facility is at low risk of flooding (i.e., 0.1% to 1% AEP). The wider area is at low to high risk of flooding from the Rhine network but this is constrained close to the channel.

There will be no significant increase in impermeable areas on the wider Avonmouth Site as a result of the HWTS. New facilities will connect to the existing surface water and foul drainage system which serves the wider Avonmouth Site.

On this basis the risk of surface water flooding at the proposed development area is considered to be low.

¹⁸ <https://maps.bristol.gov.uk/bfrm/>

4. Sources of flood risk requiring management and mitigation measures

The EA's FMfP, 2009 and 2020 SFRAs show the HWTS Site is within Flood Zone 3a. The main flood mechanism at the Site is from tidal flooding from the Severn Estuary, particularly in combination with tide-locking, in which the rhines are unable to drain to the sea due to high tides. Flood risk sources such as groundwater, sewers, surface water and flooding from artificial sources pose a more limited risk.

4.1 Proposed Mitigations

Setting of Finished Floor Levels

The ASEA Coastal Inundation model predicts no flooding of the HWTS Site for the 0.5% AEP plus CC scenario, but a flood depth of 1.11m (7.53mAOD) for the 0.1% AEP with CC event. Breach of the new SEA flood defences is predicted to cause flooding at the Site, with a modelled flood depth of 0.35m (calculated at 6.77mAOD) for the 0.5% AEP plus CC scenario (2098). Given the Site design life of 25 years it is considered conservative to use the CC to 2098 scenario.

As the ASEA Project has already included for future climate change, no additional site-specific raising allowance to account for CC is proposed. It is recommended that a freeboard of 300 mm is applied to account for uncertainty in flood estimation. This gives a design level of **7.07 m AOD** for the Site. On this basis, the FFL of the proposed office/welfare/lab building, HWTS building, sorting area and other sensitive development should be set at or above 7.07 m AOD (provided by a perimeter bund or ground raising);

In addition to the specified FFL, Veolia should consider the use of other flood resilient and resistant design measures for sensitive new development, where appropriate, in accordance with Department for Communities and Local Government advice outlined in the Improving the flood performance of new buildings: flood resilient construction (DCLG, 2007). For instance, any electrical sockets or ring mains required within site office/welfare/lab would be installed at the highest practicable level, and sensitive non-mobile equipment should be set at height on walls or mounted on plinths.

As discussed in Section 2.5, floodplain compensation is not required at the HWTS Site.

Surface water runoff

There will be no increase in total impermeable areas on the Site as a result of new HWTS Site, as the existing site is completely hardstanding. Surface runoff from the HWTS yard and building roofs will be connected to the wider Avonmouth Site's existing surface water drainage network. For this reason, no modifications, such as the addition of Sustainable Urban Drainage System (SuDS) to the existing drainage system are proposed. Existing pollution control measures (oil interceptor) will remain in use, and new elements added where required in support of the proposed new development.

Flood evacuation plan

The HWTS Site is within an EA Flood Warning area. A flood warning is issued by the EA when flooding is expected and is intended to allow recipients to be prepared for flooding and to take action. As site workers will be travelling to Site, it is advised that during times of severe weather, they check weather forecasts and EA flood alerts before setting off and regularly whilst on Site. The Site manager would be signed up to the EA Flood Warning service and would check for these warnings regularly.

A Flood Evacuation Plan including evacuation routes will be drawn up and implemented at the Site. This Plan is designed for workers who may be on site in the event of a flood alert or flood event. In the event of forecast flooding, vehicles would be moved from the Site in advance of flooding. As part of Site operating procedures, and staff briefings all staff would be briefed on the risk of flooding and the actions to take, including the evacuation route/place of refuge. Notices will be displayed on site.

5. Conclusions and recommendations

5.1 Conclusions

In accordance with NPPF requirements the proposed HWTS Site has been demonstrated to be compliant with the NPPF Sequential Test and Exception Test.

Following an assessment of flooding from all sources it is concluded that tidal flooding from the Severn Estuary constitutes the most significant flood risk to the HWTS Site, particularly in combination with tide-locking, in which the rhines are unable to drain to the sea due to high tides. The Site currently benefits from flood defences (raised earth embankments) which are being improved as part of the ASEA Project. This will further reduce the risk of flooding at the HWTS Site. There is also a limited risk from groundwater, surface water and sewer sources of flooding at the Site. However, the proposed flood risk mitigation for tidal flood risk would also manage the risk from these sources.

Based on the ASEA Tidal Inundation Model, a design flood level has been set based on a modelled flood level of 6.77 m AOD for the extreme case of breach of the ASEA flood defences (corresponding to the 0.5% AEP plus CC event (2098)). A 300 mm freeboard has been applied to give a design level of **7.07 m AOD**.

The HWTS Site, with the flood risk management measures recommended below, would not be subject to an unacceptable level of flood risk, nor would it increase flood risk elsewhere.

5.2 Recommendations

The following recommendations are made:

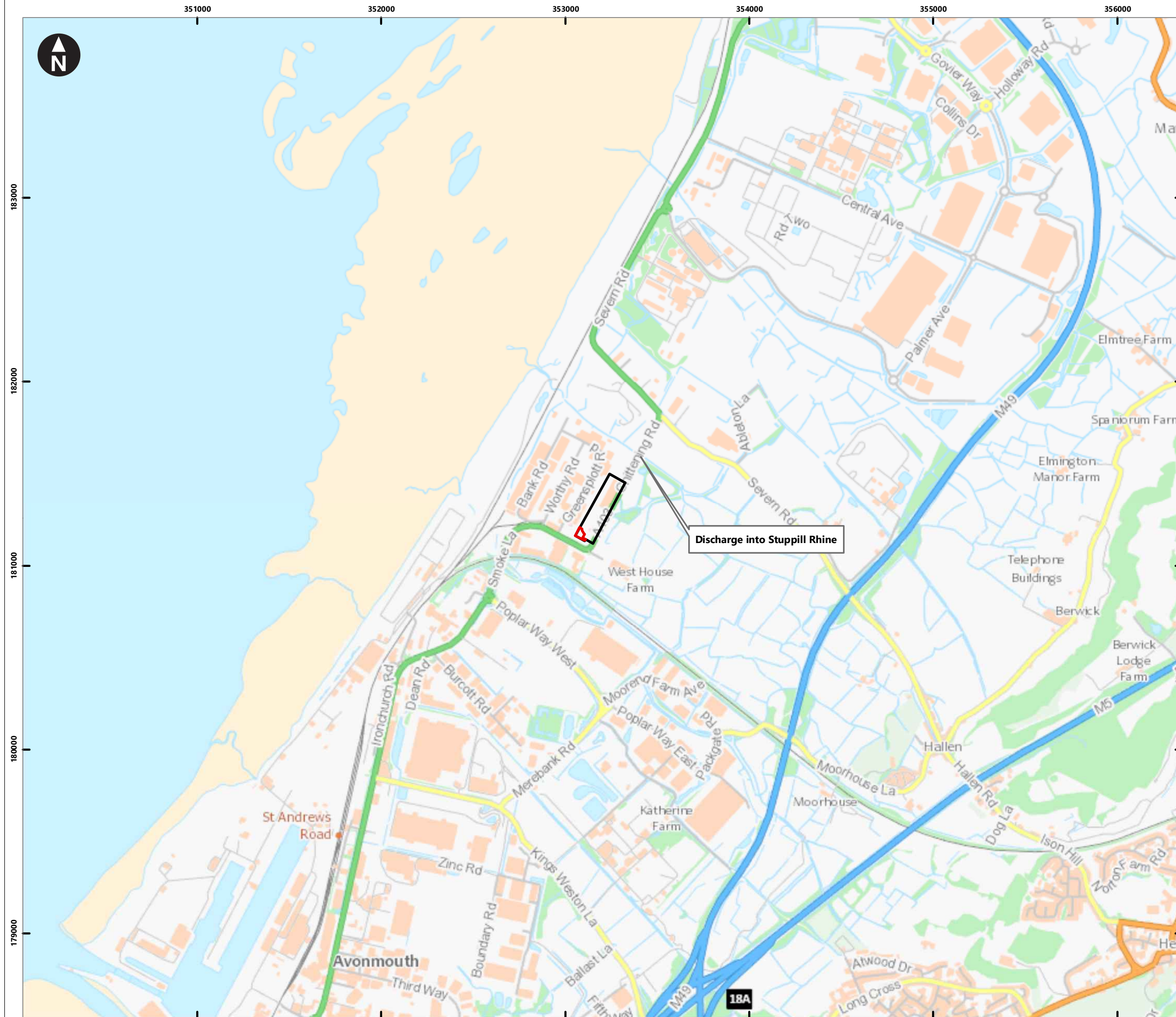
- The FFL of the proposed office/welfare/lab building, HWTS building, sorting area and other sensitive development should be set at or above 7.07 m AOD (provided by a perimeter bund or ground raising);
- The use of other flood resilient and resistant design measures for new sensitive development should be considered, where appropriate;
- All new pollution control measures (i.e., oil interceptor) should be maintained for the operational lifetime of the HWTS Site;
- A flood evacuation plan including evacuation routes should be drawn up and implemented at the HWTS Site. The evacuation plan is designed for workers who may be on site in the event of a flood alert or flood event; and
- Surface water runoff from the HWTS Site yard and building roofs should be connected to the existing surface water drainage system for the wider Avonmouth Site.

The above recommendations are in-line with the NPPF, Bristol City Council and Defra requirements on flood risk.

On this basis, it is concluded that the HWTS Site, with the proposed mitigations, would be compatible with the identified level of flood risk at the HWTS Site. The proposed flood mitigation measures

would ensure the safety of staff at the HWTS Site, minimising the risk of flooding to the HWTS Site and ensure no increase in flood risk to the surrounding area.

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Key

- Site boundary
- Planning application boundary

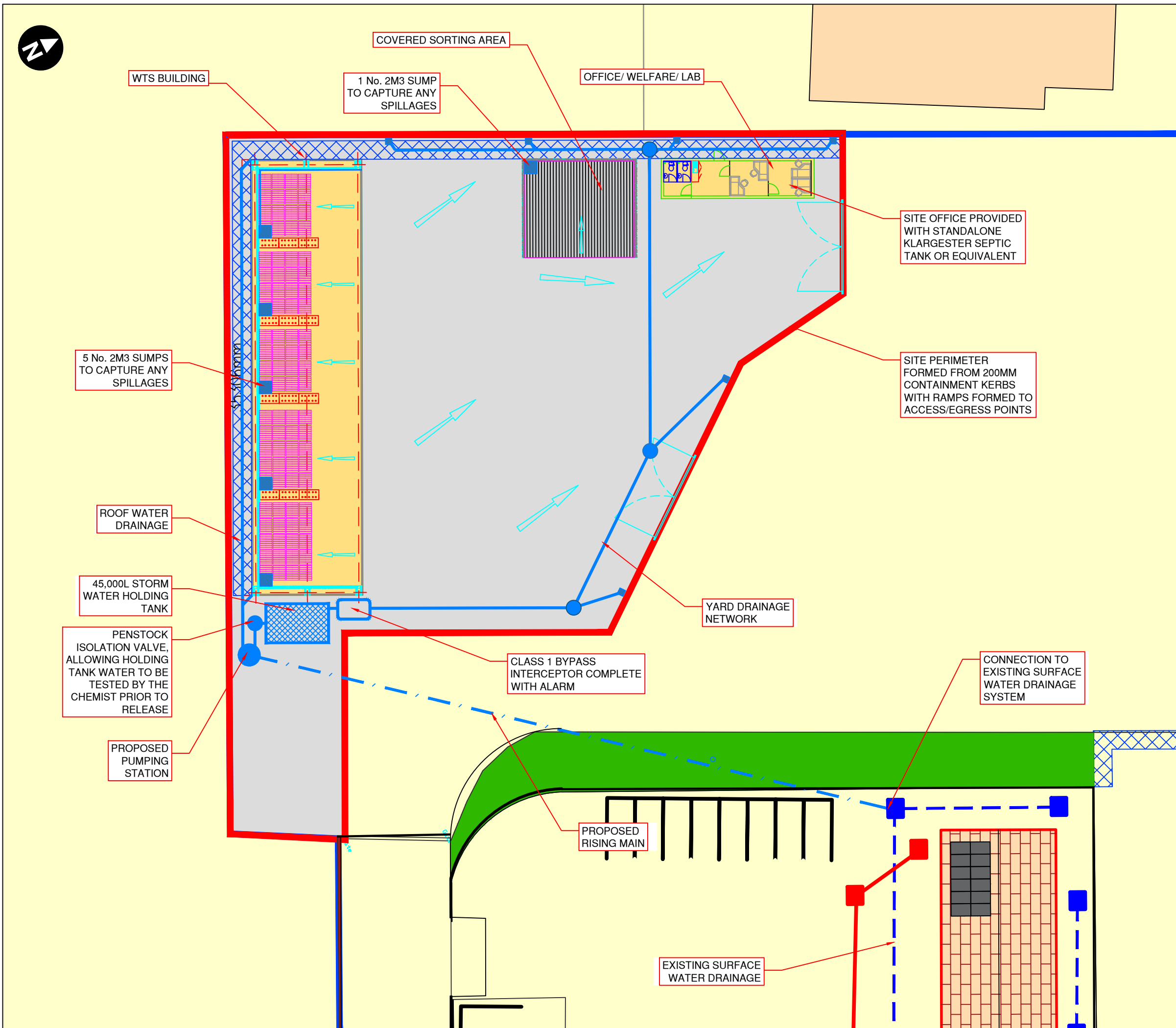
0 200 400 600 800 1,000 1,200 m
 Scale at A3: 1:20,000
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Avonmouth Resource Processing and Management Facility
 Hazardous Waste Transfer Station
 Flood Risk Assessment

Figure 2.1
Site location plan

March 2022





Key

- Veolia Resource Recovery Operational Area
- Planning application boundary
- ↗ Slab cross falls

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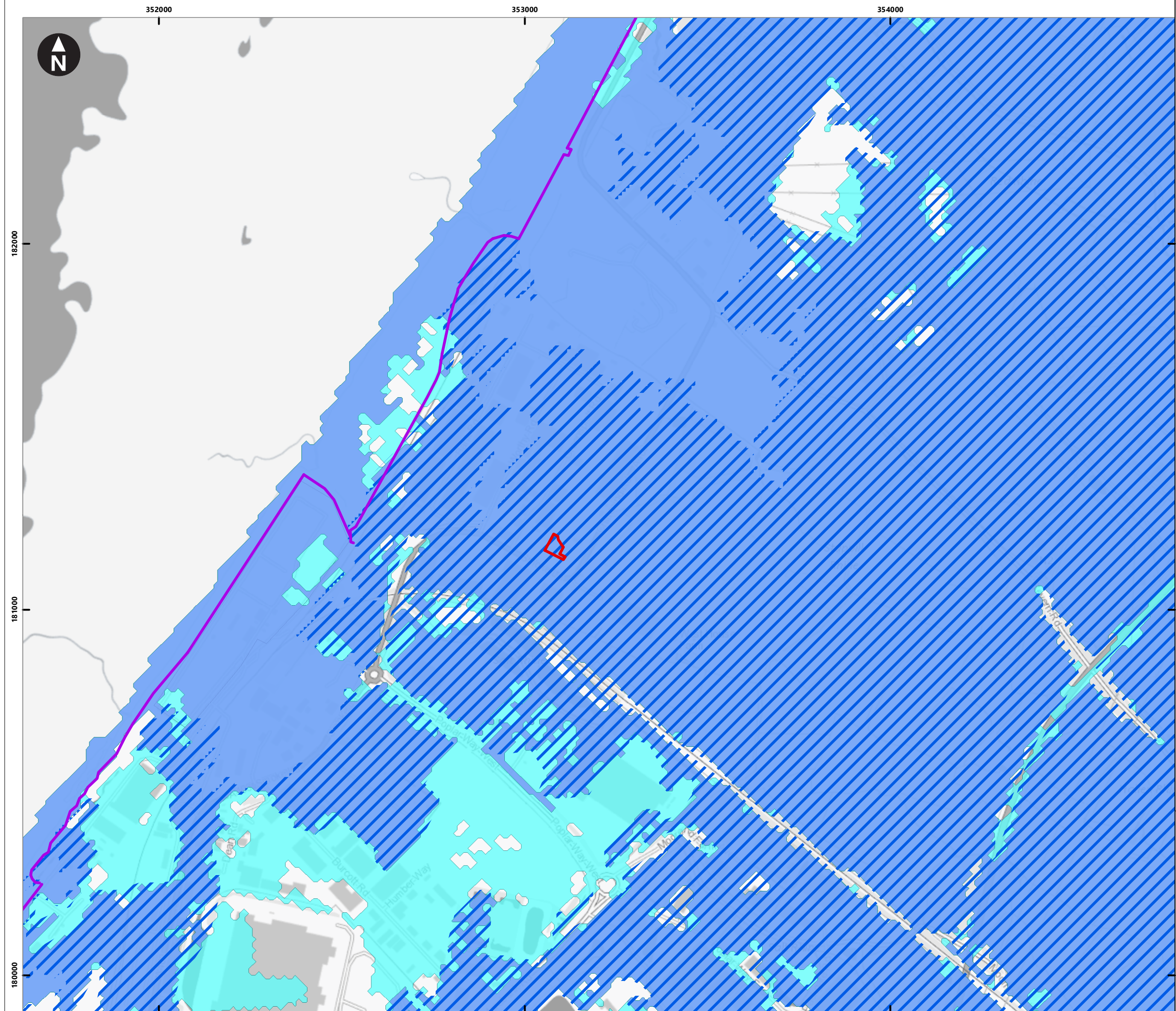
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Avonmouth Resource Processing and Management Facility
Hazardous Waste Transfer Station
Flood Risk Assessment

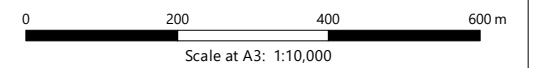
Figure 2.2
Site layout plan

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Key

- Planning application boundary
- Flood defence
- Areas benefiting from flood defences
- Environment Agency Flood Zone 3
- Environment Agency Flood Zone 2



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Avonmouth Resource Processing and Management Facility
Hazardous Waste Transfer Station
Flood Risk Assessment

Figure 3.1
Environment Agency flood map for planning

March 2022



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352000 353000 354000

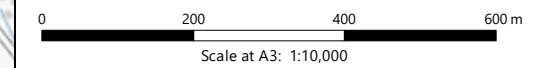
182000

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Key

- Planning application boundary
- >3.3% AEP - High risk of surface water flooding
- 1-3.3% AEP - Medium risk of surface water flooding
- 0.1-1% AEP - Low risk of surface water flooding
- <0.1%AEP - Very low risk of surface water flooding



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Avonmouth Resource Processing and Management Facility
Hazardous Waste Transfer Station
Flood Risk Assessment

Figure 3.2
Environment Agency surface water flood map

March 2022





Appendix A

Site Topographical Survey



GREENSPLOTT ROAD

518800m

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Chitening Industrial Estate

CHITENING ROAD



JOB DESCRIPTION
Veolia - Bristol
Chitening Rd
Bristol

SUPERVISOR
DAVE MOTHERSHAW

TITLE
Site Plan - Topographical

CADITAL Ltd
FACILITY MANAGEMENT SERVICES
LANSHIRE HOUSE
LANSHIRE BUSINESS PARK
SOUTHAMPTON PORTFRONT
WEST YORKSHIRE
SO16 6AA

AREA BRISTOL **SCALE** 1:500
DATE DM 2ND MAY 2016

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DRG. No. BRI/03/03/11/01

HP-T1100 A1

Appendix B

Environment Agency Detailed Flood Risk

Data

Our ref: 248631-WX
Date: 16 February 2022

Dear

Thank you for your enquiry which was received on 19th January 2022.

Abstract

Name	Product 4
Description	Detailed Flood Risk Assessment Map for Resource Recovery Facility, Chittening Industrial Estate, Avonmouth, BS11 0YB
Information Warnings	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply.</i>
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Flood Map for Planning

The Flood Map for Planning is now classed as Open Data. It can be downloaded free of charge under an open data licence from the following weblink:

<https://data.gov.uk/publisher/environment-agency>

If you search for the 'flood map for planning' in the search box the following datasets will be available for you select and download the data:

- Flood Map for Planning (Rivers and the Sea) – Flood Zones 2 and 3
- Flood Map for Planning (Rives and Sea) – Areas Benefiting from Defences
- Flood Map for Planning (Rivers and Sea) Flood Storage Areas
- Flood Map for Planning – Spatial Flood Defences (without Standard attributes)
- Recorded Flood Outlines
- Historic Flood Map
- Risk of Flooding from Surface Water Extent for:
 - 3 percent annual chance
 - 1 percent annual chance
 - 0.1 percent annual chance

Customer & Engagement, Wessex
 Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
 Phone: 02030 250 376
 Email: wessexenquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

If you have requested this information to help inform a development proposal, then you should also note the detail in the attached advisory text on the use of Environment Agency Information and Further Guidance for FRAs.

Flooding History

We no longer produce pdf copies of the Historic Flood Map. This information is available to search select, and download free of charge as part of the Government's 'open data' as

- Recorded Flood Outlines
- the Historic Flood Map

These are GIS layers and can be download from: <https://data.gov.uk/publisher/environment-agency>

If you have requested this information to help inform a development proposal, then you should also note the detail in the attached advisory text on the use of Environment Agency Information and Further Guidance for FRAs.

ASEA Coastal Inundation model

South Gloucestershire Council, Bristol City Council and the Environment Agency are working together to improve flood defences and create new habitats for important wildlife species as part of the Avonmouth Severnside Enterprise Area (ASEA) Ecology Mitigation and Flood Defence Project. For further details about this project, including progress to date, please see the following link: <https://www.asea-flood-ecology.co.uk/>

Contractors BMMjv have been on site since summer 2019 and have commenced work at each sub section area and are programmed to complete of Area 1 (Old Passage down to southern end of Severn Beach) by autumn 2022.

As part of this project, a new coastal inundation model has been produced for the Avonmouth/Severnside area to represent the impact of the new flood defence.

This includes pre development (i.e. existing defences in place) and post development (representing the impact of the proposed defences) scenarios, for both present day and future dates (2076 and 2098) to be referred to in FRA's for commercial development. A scenario representing the breach of the proposed flood defences in 2098 has also been modelled. Please let us know if you wish to obtain a copy of the modelling report or model.

However, please note a future design scenario allowing for 100 years of Sea Level Rise (i.e. beyond 2098), which would be required to support 'More Vulnerable¹' development proposals, has not been produced in this model.

The version of the model produced in 2020 simulating present day and future post development scenarios (representing the impact of the proposed defences) following the updated sea level rise guidance in accordance with UKCP18.

Due to changes in the flood defence design and a need to re-run breach scenarios in the Bristol City Council local authority boundary, we are only supplying post development 2098 depths and levels and post development 2098 breach scenarios as this is currently the best available data.

¹ As defined in Table 2 on the following webpage: <https://www.gov.uk/guidance/flood-risk-and-coastal-change#flood-zone-and-flood-risk-tables>

A further update of the ASEA model is planned for early 2022 with post-development scenarios representing the final detailed design of the flood defence scheme in the present day and future epochs (likely to be 2080, 2098 and 2120) and breach. The model will include the updated sea level rise guidance in accordance with UKCP18.

We understand that in due course the SFRA Level 2 will be updated by the Local Planning Authority but currently there are no timescales for this.

Flood Levels

From the ASEA model we have provided the flood level and depth for the post development 2098 and breach 2098 for your proposed site:

Post Development 2098 (new defences in place)

Post Development 2098 0.5% (1 in 200 year) AEP Depth	0.00m	Depth
Post Development 2098 0.1% (1 in 1000 year) AEP Depth	1.11m	Depth
Post Development 2098 0.5% (1 in 200 year) AEP Level	0.00mAOD	Level
Post Development 2098 0.1% (1 in 1000 year) AEP Level	7.53mAOD	Level

Post Development Breach of new defences 2098

Post Development 2098 0.5% (1 in 200 year) AEP Depth (Breach Composite)	0.35m	Depth
---	-------	-------

Levels and depths have been extracted based upon the site boundary plan provided.

Strategic Flood Risk Assessment (SFRA)

When preparing your Flood Risk Assessment (FRA) to support the planning application, you should also refer to Bristol City Council's Level 1 and Level 2 SFRA's available to download via the following link: <https://www.bristol.gov.uk/planning-and-building-regulations/planning-policy/planning-evidence>

As outlined above we understand that in due course the SFRA Level 2 for Bristol will be updated by the Local Planning Authority but currently there are no timescales for this.

In particular you should refer to the Avonmouth/Sevenside SFRA Level 2, which currently gives the best available flood risk information for planning purposes for 'More Vulnerable' development proposals. Figure 7.3a of this document defines the future (2110) situation, which should be the design scenario used for 'More Vulnerable' development proposals.

Planning

If you have questions regarding the planning nature of your enquiry, or require advice on floor levels, please contact our Sustainable Places team on NWX.SP@environment-agency.gov.uk. Please be aware that we now charge for planning advice when consulted on pre-application enquiries. This new approach provides advice to developers in two ways. Firstly there is the provision of 'free' advice available to everyone where we give a preliminary opinion on a proposed development. This sets out the environmental constraints together with any issues this raises for

us. Should you wish us to review in detail any of these issues then we can do this through a chargeable scheme aimed at recovering our costs.

Environmental Permit for Flood Risk Activities

In addition to any other permission(s) that you may have already obtained e.g. planning permission, you may need an environmental permit for flood risk activities (formerly known as Flood Defence Consent prior to 06 April 2016) if you want to do work:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence

For further information and to check whether a permit is required please visit:

<https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>.

For any further advice, please contact your local Environment Agency Office, at

bridgwater.frap@environment-agency.gov.uk.

Further Information

We advise that you also contact the Flood Risk Management Team, on 01179 223206, or by email, flood.data@bristol.gov.uk, at Bristol City Council, City Hall, PO Box 3399, Bristol BS1 9NE. For an interactive webmap showing flood risk information in Bristol please visit

<http://maps.bristol.gov.uk/bfrm/>. Also contact the Civil Engineer, James Thomas, at Lower Severn Internal Drainage Board at Waterside Buildings, Oldbury Naite, Thornbury, South Glos, BS35 1RF, email: admin@lowersevern.org.uk, telephone 01454 413 340 as they may be able to provide further advice with respect to localised flooding and drainage issues.

Further details about the Environment Agency information supplied can be found on our website:

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

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

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

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

We hope you find this information helpful and it is provided subject to the guidance below, which we strongly recommend you read.

Yours sincerely

Customer & Engagement, Wessex
Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
Telephone number: 02030 250 376
Email: wessexenquiries@environment-agency.gov.uk

Enc: Use of Environment Agency Information for Flood Risk Assessments (below)
Defence Map
Defence Data

Customer & Engagement, Wessex
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Phone: 02030 250 376
Email: wessexenquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

Use of Environment Agency Information for Flood Risk Assessments (FRAs)

Important

Use of Environment Agency data: you should note that

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but the use of Environment Agency information does not constitute such an assessment on its own.
2. As part of your data request, we have provided all of the modelled data we hold for your location. Please note that some of our modelled information may have been produced for purposes other than for flood zone generation. This may mean that some of the modelled data you have been provided with has a lower confidence level, and has not been used in producing our flood map, nor definitively reflects the predicted flood water level at the property/development site scale. To check the suitability of the use of this information in your FRA please contact your local Partnership & Strategic Overview (PSO) team.
3. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or surface water runoff. The information produced by the Local Planning Authority and the Lead Local Flood Authority (LLFA) may assist in assessing other sources of flood risk.
4. Where a planning application requires a FRA and this is not submitted or deficient, the Environment Agency may well raise an objection.
5. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your Local Planning Authority.

Pre-Planning Advice from the Environment Agency

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:

Pre-application Preliminary Opinion:

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

Pre-application Charged Service:

<https://www.gov.uk/government/publications/planning-advice-environment-agency-standard-terms-and-conditions>

Depending on the enquiry we may also provide advice on other issues related to our responsibilities, including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

Flood Risk Assessment (FRA) Guidance

You should refer to the Planning Practice Guidance of the National Planning Policy Framework (NPPF) and the Environment Agency's Flood Risk Standing Advice for information about Flood Risk Assessment (FRA) for new development in the different Flood Zones. These documents can be accessed via:

National Planning Policy Framework Planning Practice Guidance:

<http://planningguidance.planningportal.gov.uk/>

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Environment Agency advice on FRAs:

<https://www.gov.uk/flood-risk-assessment-for-planning-applications#when-to-follow-standing-advice>

<https://www.gov.uk/government/publications/planning-applications-assessing-flood-risk>

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Product 4 - AIMS Information

248631-WX

Date: 28/01/2022

Map Ref	Asset ID	Asset Type	Asset Description	Approx length (m)	Right or left bank	Actual fluvial downstream crest level (mAOD)	Actual fluvial downstream crest level accuracy	Actual fluvial upstream crest level (mAOD)	Actual fluvial upstream crest level accuracy	Actual fluvial coastal crest level (mAOD)	Actual fluvial coastal crest level accuracy	NGR	Most recent inspection	Overall condition
1	184339	embankment	Embankment Defence formed from rail embankment	635.19	coastal	9.44	+/->75cm	9.44	+/->75cm	9.49	+/->5 to 15cm	ST5341382824	18/02/2019	2
2	25167	embankment	Embankment	220.47	coastal	11.00	+/->75cm	10.00	+/->75cm	9.22	+/- 1 to 5cm	ST5247981301	24/11/2009	3
3	25168	embankment	Earth Embankment Defence	172.35	coastal	9.50	+/->75cm	9.50	+/->75cm	9.90	+/- 1 to 5cm	ST5280781842	22/11/2018	2
4	25169	embankment	Earth Embankment Defence, around rail opening	70.93	coastal	9.39	+/->75cm	9.53	+/->75cm	9.33	+/- 1 to 5cm	ST5344782837	18/02/2019	2
5	39397	embankment	Earth Embankment Defence incorporating Mitchells O/F	569.20	coastal	9.50	+/->75cm	9.50	+/->75cm	9.44	+/- 1 to 5cm	ST5273381581	22/11/2018	2
6	39398	embankment	Earth Embankment Defence	72.02	coastal	9.00	+/->75cm	9.00	+/->75cm	9.12	+/- 1 to 5cm	ST5296382020	18/02/2019	3
7	39557	wall	Floodwall... Roadside concrete curb/barrier raised to height with courses of dense aggregate blocks	173.67	coastal	8.38	+/->75cm	9.02	+/->75cm	9.50	+/->5 to 15cm	ST5143679954	22/11/2018	3
8	39558	wall	Floodwall... Roadside concrete curb/barrier raised to height with courses of breeze blocks	368.57	coastal	10.00	+/->75cm	10.00	+/->75cm	9.50	+/->5 to 15cm	ST5153780063	22/11/2018	2
9	39559	embankment	Embankment	246.20	coastal	11.00	+/->75cm	11.00	+/->75cm	10.80	+/- 1 to 5cm	ST5198480771	24/11/2009	3
10	39595	embankment	Embankment	580.88	coastal	11.00	+/->75cm	11.00	+/->75cm	10.67	+/- 1 to 5cm	ST5239681369	24/11/2009	3
11	39596	wall	RC Flood Wall Defence	20.45	coastal	9.00	+/->75cm	9.00	+/->75cm	9.10	+/->5 to 15cm	ST5252581186	22/11/2018	3
12	51386	embankment	Embankment	548.21	coastal	10.00	+/->75cm	10.00	+/->75cm	8.73	+/- 1 to 5cm	ST5175780449	24/11/2009	3
13	51387	embankment	Embankment Defence formed from rail embankment	260.76	coastal	9.06	+/->75cm	9.40	+/->75cm	9.49	+/->5 to 15cm	ST5310682244	18/02/2019	2
14	55699	embankment	Earth Embankment Defence	177.45	coastal	9.00	+/->75cm	9.00	+/->75cm	9.64	+/- 1 to 5cm	ST5285981947	22/11/2018	3
15	75211	embankment	Embankment Defence formed from rail embankment	251.34	coastal	7.40	+/->75cm	7.98	+/->75cm	9.49	+/->5 to 15cm	ST5342782852	18/02/2019	2
16	77118	embankment	Earth Embankment Defence, around rail opening	43.92	coastal	9.65	+/->75cm	9.65	+/->75cm	9.48	+/- 1 to 5cm	ST5312282248	18/02/2019	3
17	178813	high_ground	Warth	1505.36	coastal	DNR	DNR	DNR	DNR	9.50	+/->75cm	ST5095279529	02/03/2010	3

Notes

* Overall Condition has been taken from the most recent inspection

* Inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset

* Condition 1 = very good, Condition 2 = good, Condition 3 = fair, Condition 4 = poor, Condition 5 = very poor

DNR = data not recorded

Current Flood Defences centred on NGR ST 53188 81311 created 28/01/2022 Ref: 248631-WX



Scale: 1:20,000

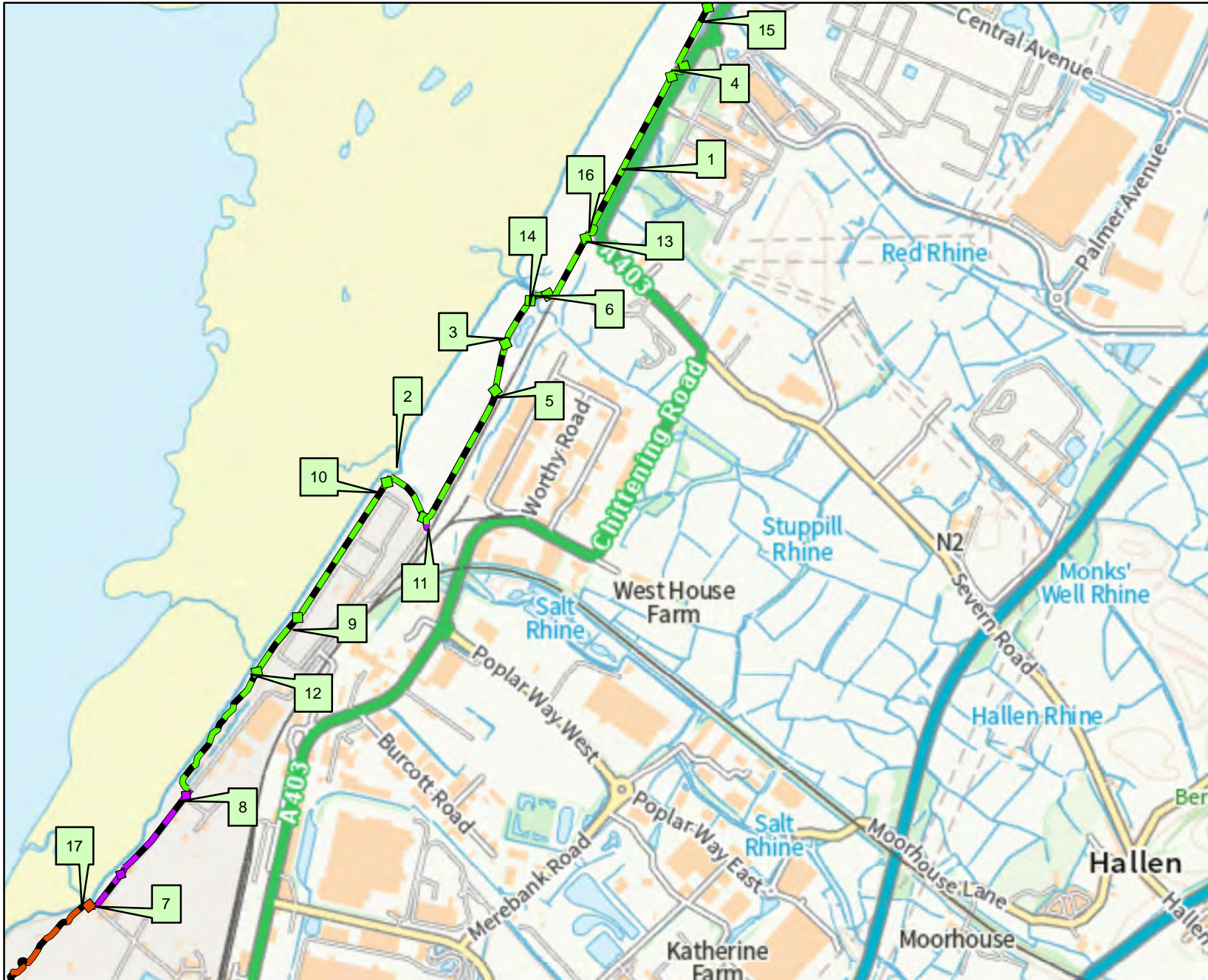


Legend

Defences

- bridge_abutment
- barrier_beach
- cliff
- demountable
- embankment
- flood_gate
- high_ground
- promenade
- quay
- wall
- beach
- dunes

This data has been extracted from the Asset Information Management System (AIMS) which was created to draw various data sources into one database and has been populated with information of varying quality.





Appendix C

Loss of floodplain storage (post-development)



Data	Value	Data source
Total flood cell area (m2)	1337738	see note 1
Depth of flooding (m)	0.34	See note 2
Total flood cell volume (m3)	454831	See note 3
mean baseline ground level of flood cell (mAOD)	6.43	Lidar data
Baseline flood level of flood cell (mAOD)	6.77	EA flood data for 0.5% AEP breach of flood defences with climate change to 2095
HWTS footprint area (m2)	1849	Site plan
HWTS baseline ground level (mAOD)	6.42	Lidar data
Baseline flood depth at proposed HWTS (m)	0.34	EA flood data
Volume of floodplain lost to HWTS (m3)	629	calculated
Volume of water in floodplain after loss (m3)	454831	See note 4
footprint of floodplain after loss (m2)	1335889	Total flood cell area-volume of water - HWTS footprint area
Depth of Water after loss of floodplain (m)	0.3405	volume of water in floodplain after loss/footprint of floodplain after loss
Increase in flood depth (mm)	0.4707	depth of water after loss of floodplain - depth of flooding
With development flood level (mAOD)	6.7705	Baseline flood level of flood cell + with development flood level
% of floodplain lost	0.138%	HWTS footprint area / total flood cell area
Increase in flood depth (mm)	0.47	depth of water after loss of floodplain - depth of flooding

Notes

1 - 'Flood cell' is the contiguous sub-area of the wider floodplain that tidal flood water entering via a breach would rapidly and primarily accumulate within. The flood cell is defined by the EA flood level of 6.77mAOD (0.5% AEP breach of defences with climate change to 2095) and is flanked by surrounding higher ground (to the north, industrial units to the north of Severn Road; to the east, the M49 motorway; to the south the Henbury loop (Filton to Avonmouth) railway line; to the west, the Chittening Industrial estate, which slopes down to the east)

2 - = 6.77 (Flood Level mAOD for 0.5% AEP breach of flood defences with climate change to 2095) - 6.43 (baseline Flood cell Level mAOD)

3- this assumes an average depth of 0.34m based on the average baseline ground level of the cell (calculated from provided flood depth and Level)

4- Water is not lost from the flood cell but displaced (upwards) as it can not enter the HWTS

