# J840 – STC IED Containment

## Basingstoke STC – Containment Options Report

B22849AZ-JA-BASIS1ZZ-100-RP-C-0001

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**Thames Water**

Jacobs

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## Contents

# 1. Executive Summary

Thames Water is required by the Environment Agency to provide secondary containment to their sludge treatment centres (STC) to satisfy provisions of the Industrial Emissions Directive and to safeguard the operation of the adjacent sewage treatment works. Twenty-five sludge treatment centres have been identified where containment proposals are required. This report deals with the proposals for Basingstoke.

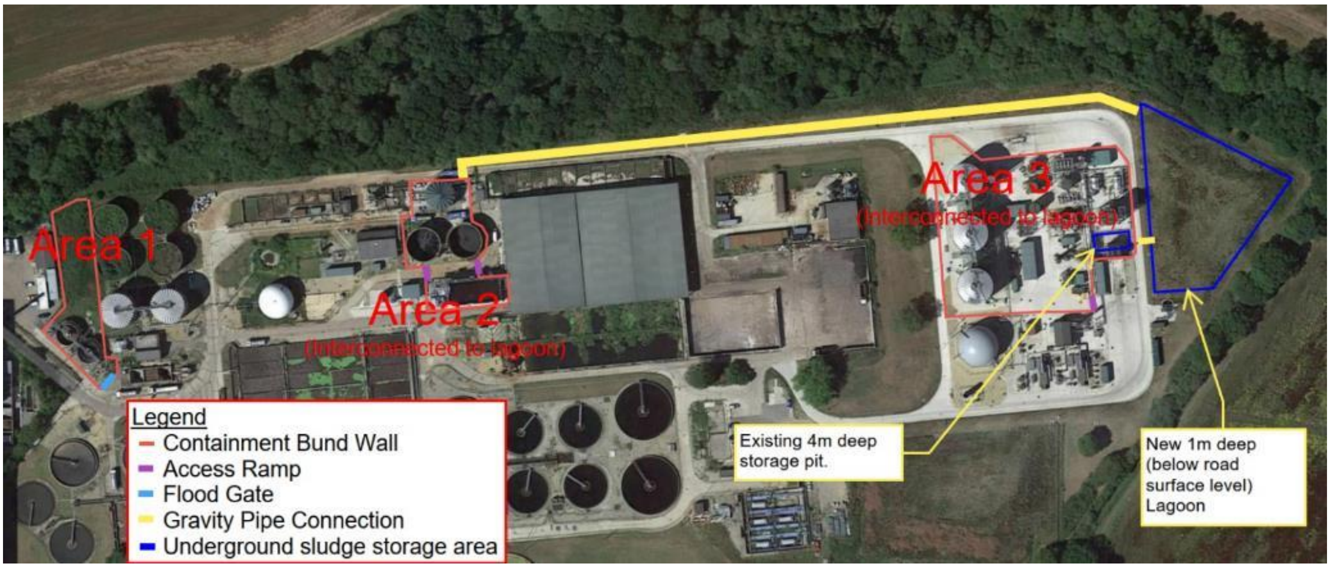
Basingstoke STW is in a rural area, approximately 5 km northeast of the town of Basingstoke, Hampshire and east of the village of Chineham and the A33. The Chineham Energy Recovery Facility is located immediately to the west of the STW. The site is further surrounded by open fields and strips of woodland. The STW serves a population equivalent to approximately 115,000 in the surrounding area.

Based upon the Anaerobic Digestion Bioresources Association (ADBA) containment assessment tool; the site carries an overall site risk rating of Medium meaning that Class 2 containment is needed.

One solution, Option 1, was developed in detail for sludge containment at Basingstoke STW, 3 containment areas, with lagoon storage available in Areas 2 and 3. This option will have a bund wall maximum height of 0.77m (inc. freeboard) in Area 1. For Areas 2 and 3, all critical spill volumes can be contained within the lagoon area and bunding is recommended for the purposes of jetting prevention. Areas 2 and 3 will be vehicle accessible via ramps. Area 1 will require entry via a Floodgate. Replacement of permeable surfaces will minimise clean-up time and effort.

Freeboard allowances and the profile of the containment bund wall provide mitigation against surge effects.

The general layout of the proposed solution:



# 2. Background

Following initial audits by the Environment Agency (EA) in 2019 that examined the primary, secondary, and tertiary containment provisions for Thames Water's anaerobic digestion (AD) process and associated tanks, the EA reported "there is no provision of secondary containment for the AD process at any of Thames Water's sites. Catastrophic tank failure may impact nearby receptors and the operation of adjacent sewage treatment activities". Jacobs was appointed to assess site risks and outline the options available for providing secondary containment of a catastrophic tank or digester failure across 25 Thames Water sites. Based on CIRIA C736 and ADBA risk assessment tools this containment report addresses the site-specific risks and outlines the options available for providing secondary containment in the event of a catastrophic tank or digester failure.

The current assessment identified gaps between the existing condition of the sludge assets in Basingstoke STW and the requirements to meet the industrial standard (i.e., CIRIA C736 and The Anaerobic Digestion and Bioresources Association Limited (ADBA)). Site-specific risks, credible failure scenario and design containment volume for the Basingstoke STW were identified through a desktop study, Light Detection and Ranging (LiDAR analysis and a site visit.

Basingstoke STW (

Figure 2-1), is in a rural area, approximately 5 km northeast of the town of Basingstoke, Hampshire and east of the village of Chineham and the A33. The Chineham Energy Recovery Facility is located immediately to the west of the STW. The site is further surrounded by open fields and strips of woodland. The STW serves a population equivalent to approximately 115,000 in the surrounding

area. The assets within the IED permit area, and the focus of containment for this report, are shown in Figure 2-2.

**Figure 2-1- Satellite view of Basingstoke Sewage Treatment Works**

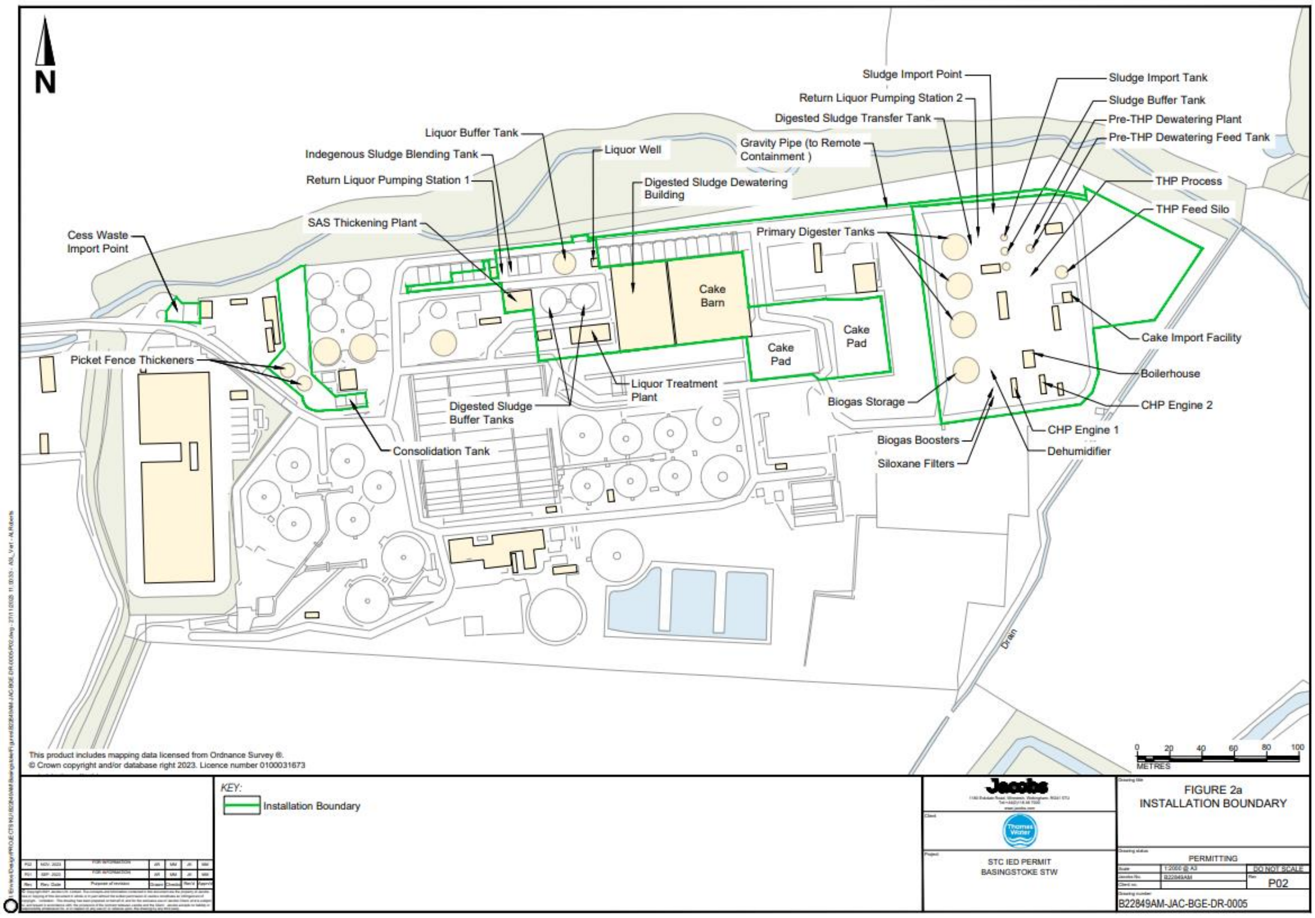



**Figure 2-2 - Boundary of the permitted IED area and the assets contained within Basingstoke STW**

# 3. Proposed Containment at Basingstoke STC

### 3.1 CIRIA C736

This containment option report has been prepared using CIRIA C736 as the basis of design and guidelines. Where a deviation from C736 has been recommended it is highlighted in the text.

CIRIA guidance document C736 *(Containment systems for the prevention of pollution – Secondary, tertiary, and other measures for industrial and commercial premises, 2014)* describes various options for the containment of spillages from a credible failure scenario. It refers to a key plan, reproduced below;

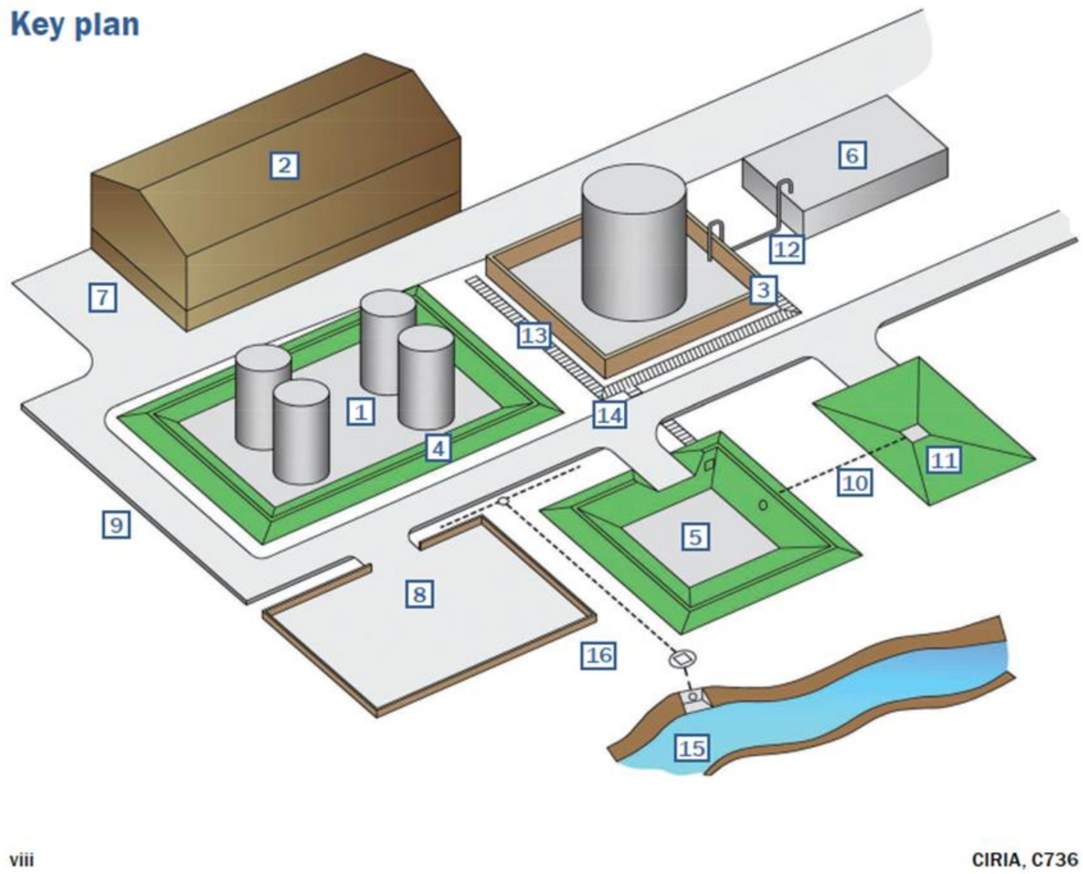



**Figure 3.3 - Diagram of primary, secondary and tertiary containment examples**

**-Primary containment** is provided by the actual tank or vessel [1]

-**Secondary containment** is provided by a bund immediately surrounding the primary vessel e.g. [3] and [4], or by a lagoon [5] or tank [6]. If containment is provided away from the primary vessels this is known as **remote containment** and may be considered as either **remote secondary** or **tertiary containment**.

-**Tertiary containment** can be provided by several means including lagoons [5], or impermeable areas such as car parks [8]. Roadways with high kerbing of sufficient height [9] can also form part of a tertiary containment system or the **transfer system** to the remote containment.

The distinction between *remote secondary* and *tertiary* containment is not always clear but, if properly designed, a combined system can be provided that is capable of providing the necessary degree of environmental protection. The overriding concern is not the terminology but the robustness and reliability of the system which depends on several factors such as;

- Its complexity – the more there is to go wrong, the greater the risk. Passive systems relying solely on gravity are more reliable than pumped.
- Whether manual intervention is relied on to make the system work or whether the system can be automated to include fail-safes and interlocks.
- The ease of maintenance and monitoring of the system's integrity, and repair of any defects.

During and after an incident any rainfall runoff from the secondary storage areas, from the spillage catchment areas and from the transfer systems must also be prevented from reaching any outfall(s) to surface water by the closure of control valve(s).

### 3.2 Objectives of secondary containment

The objectives of the secondary containment measures proposed in this report are to safely contain spillages from credible failure scenarios and prevent them from:

- escaping off-site
- entering surface waters
- percolating into groundwater
- being discharged to the inlet of the sewage works in an uncontrolled manner.

As the project is retrofitting the provisions of CIRIA 736 to an existing facility, the secondary containment may seek to maximise the use of existing impermeable surfaced areas.

The interface between the contained area and existing process/site drainage return systems is managed to protect the sewage treatment works from shock loads that might otherwise arise from a tank failure.

#### 3.2.1 Uncontained Spill modelling

Hydraulic modelling has been applied to assess the uncontained spill following a catastrophic failure of the largest digester tank within the site only (3,233 $m^3$), without any contribution from rainfall. The 2D model generated uses the TUFLOW software package (Version 2020-10-AC), which can be used for simulating depth-averaged, one and two-dimensional free-surface flows exhibited with floods and tides.

TUFLOW's implicit 2D solver, solves the full two-dimensional, depth-averaged, momentum and continuity equations for free-surface flow using a 2nd order semi-implicit matrix over a regular grid of square elements. Furthermore, it includes the viscosity or sub-grid scale turbulence term that other mainstream software omits.

The Digital Terrain Model (DTM) used in the model was of 1m resolution and the footprints of buildings and tanks were omitted from the model. The dimensions of the tank were used to calculate a constant flow of liquid in all directions from the circumference until it was emptied. Areas with different roughness coefficients were delineated using aerial imagery e.g., liquid would flow more easily over roads and paths as opposed to vegetated ground. The model outputs are 2m resolution with a timestep of one second. The model was run until the liquid front was no longer moving. Default parameters were used in the simulation and the model was stable with a mass balance error below the acceptable 1%.

The results of the sludge spill mapping of the uncontained event at Basingstoke STW (Figure 3-1 - Uncontained Spill Model Results), showed that in the event of catastrophic failure of one of the Primary Digesters, the spilt sludge will not be self-contained within the site and therefore passive containment needs to be implemented to safeguard the site and the nearby receptors. According to the modelling results, the spill will leave the site boundary (in the northeast site boundary) in approximately 6 minutes following the failure of one of the digesters.

The spilt content will immediately flow north and eastbound, covering the Thermal Hydrolysis Plants area. It is expected that the sludge will then leave the site boundary in the southeast direction where it will enter Petty's Brook located on the border of the site and follow the waterway and travel into the stream in a north-easterly direction. Most of the spill will flow over Petty's Brook reaching the crop field east of the site covering most of the area, then flows east and eventually reach the River Loddon, a Thames tributary.

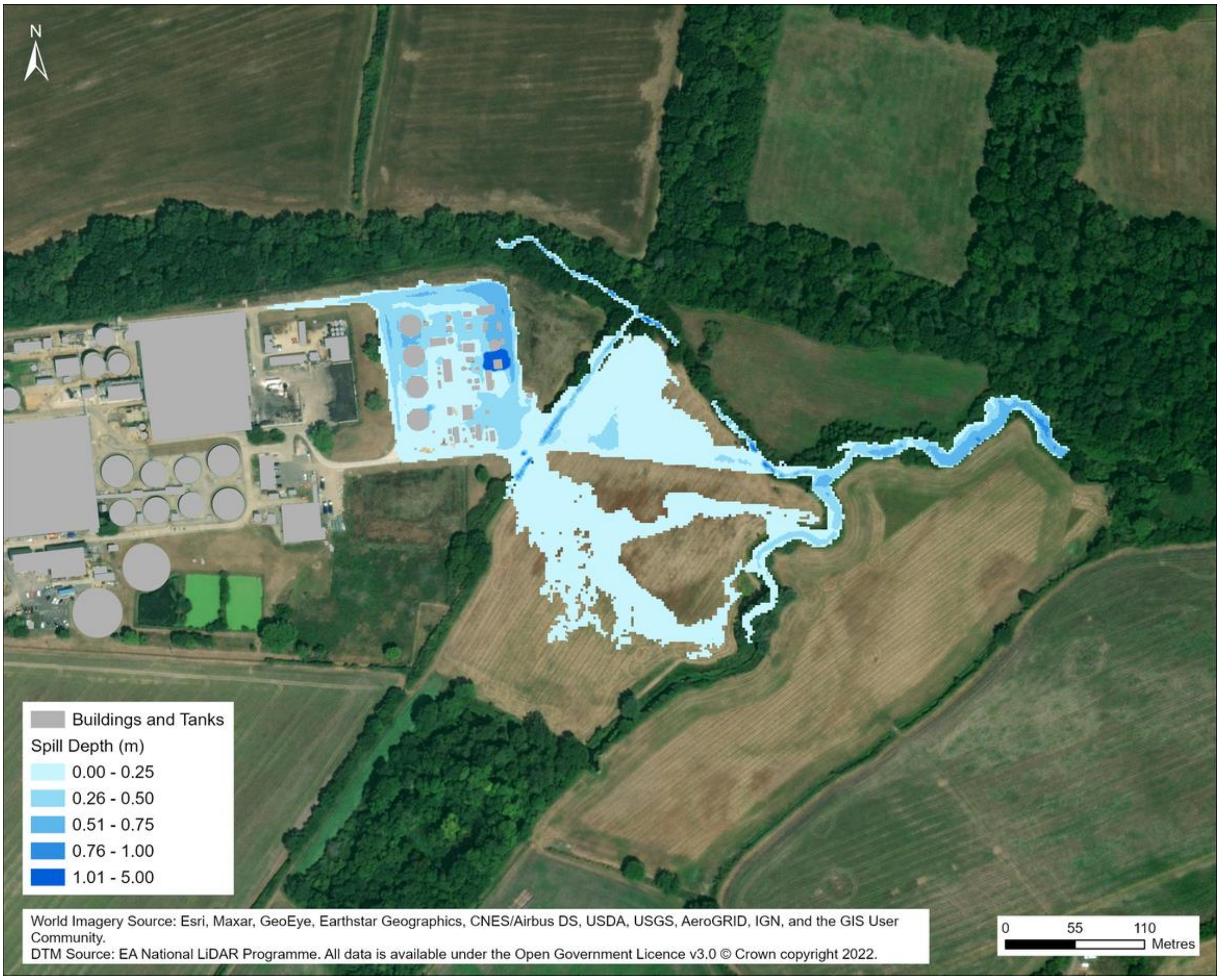



**Figure 3-1 - Uncontained Spill Model Results**

### 3.3 Site Classification

Based on the use of the ADBA risk assessment, considering the source, pathway and receptor risk Basingstoke site hazard rating is deemed to be High. When considering the mitigated likelihood as low, a class 2 secondary containment is required.

| Source Risk | Pathway Risk | Receptor Risk | Site Hazard Rating | Likelihood | Overall Site Risk Rating |
|---|---|---|---|---|---|
| High | Medium | High | High | Low | Medium (Class 2) |

Refer to Appendix 1 for a more detailed summary of the ADBA risk assessment tool.

### 3.4 Summary of Containment Volumes and Assets

There are 24 tanks in total containing sludge on site, of which 23 are above ground and require containment. The tanks onsite are constructed from steel or concrete, with a total contained sludge volume of approximately 17,350m$^3$.

The principal sludge holding volumes at Basingstoke contained within the IED permitted area are detailed in Table 3-1.

Table 3-1– Basingstoke Sludge Tank Volumes

| Tank Purpose | Number | Operational Volume (m³) | Total Volume (m³) | Construction | Comments |
|---|---|---|---|---|---|
| Picket Fence Thickener | 2 | 410 | 820 | Steel | |
| Consolidation Tank | 1 | 136 | 136 | Concrete | Below ground |
| Indigenous Sludge Blending Tank | 1 | 42 | 42 | Steel | |
| Sludge Import Tank | 1 | 86 | 86 | Steel | |
| Sludge Buffer Tank | 1 | 152 | 152 | Steel | |
| Pre-THP Dewatering Feed Tank | 1 | 152 | 152 | Steel | |
| Primary Digester Tank | 3 | 3,233 | 9,699 | Steel | |
| Digested sludge Transfer Tank | 1 | 62 | 62 | Steel | |
| Digested Sludge Buffer Tanks | 2 | 1,587 | 3,174 | Concrete | |
| Liquor Buffer Tank | 1 | 1000 | 1000 | Steel | |
| Sludge Holding Tank | 2 | 1,587 | 3,174 | Concrete | |
| LTP Reactor Tank | 1 | 1,640 | 1,640 | Concrete | |
| THP Feed Silo | 1 | 507 | 507 | Steel | |
| THP Process | 1 | Consisting of the following: | | | |
| THP Process - THP Pulper tank | 1 | 15 | 15 | Steel | |
| THP Process - THP Reactor tank | 4 | 5 | 5 | Steel | |
| THP Process -THP Flash tank | 1 | 12 | 12 | Steel | |

### 3.5 Containment Area – Option 1

The proposed Option 1 Containment Area for Basingstoke involves 3 individual bunded containment areas and the construction of a large lagoon area, refer to Figure 3-2. The lagoon can act as a sludge containment area for Area 2 or 3. Area 3 also utilises the existing below-ground storage area that surrounds the cake import facility.

The lagoon has the capacity to hold the largest arising spill, some 3,764m$^3$ associated with area 3. The lagoon is not sized to deal with simultaneous failure from all areas. Areas 2 and 3 are separated by over 200m giving them resilience against a single event triggering failure in both areas.

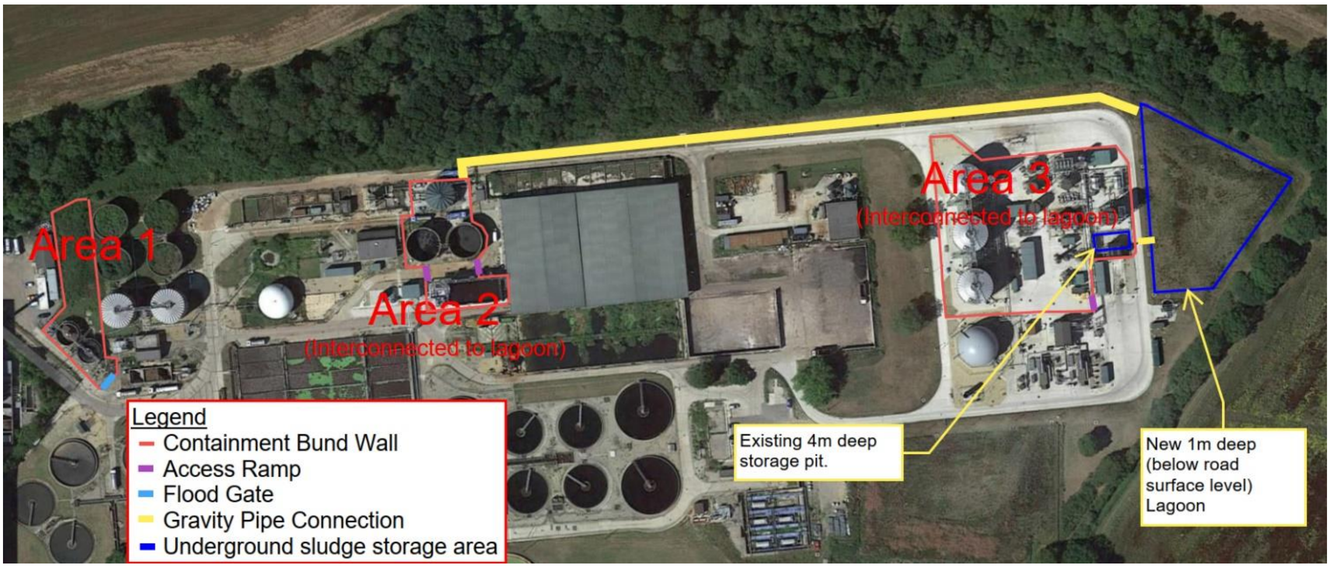



Figure 3-2 – Option 1 - Basingstoke Containment Areas

### 3.6 Containment Area – Option 2

The variation in Option 2 centres around Area 1 and the connection to the gravity pipework which allows for the transfer of sludge into the eastern storage lagoon, refer to Figure 3-3.


Figure 3-3 – Option 2 - Basingstoke Containment Areas

### 3.7 Identification of Preferred Option

The preferred containment solution is Option 1, with Area 1 not connected to the lagoon. Option 2 remains an opportunity that will require further survey and contractor involvement at detail design stage to confirm viability. Option 2 has the potential benefit of reduced concrete hardstanding footprint for

Area 1 and the smaller footprint may allow for better future development potential of the redundant digester tanks area when additional treatment plant capacity is required. It is these associated issues that may give the differentiation if a constructable pipe route exists for Option 2.

Other bund wall alignments were initially discussed with Thames Water, notably, a lagoon to the west of primary digesters but this was ruled out because of potential future infrastructure plans in this area. In addition, the decommissioned above-ground sludge storage concrete tanks to the north of the cake barn were considered but given the unknown structural integrity of these tanks, the lagoon option is preferred.

### 3.8 Total Spill Volumes

Each of the three containment areas (as per Option 1) has been evaluated for the critical spill scenario individually, as summarised in Table 3-2.

**Table 3-2 - Critical Spill Volumes**

| Containment Area | 25% Scenario ($m^3$) | 110% Scenario ($m^3$) | Largest Tank + Rainfall Scenario ($m^3$) | Critical Spill Volume ($m^3$) |
|---|---|---|---|---|
| **Area 1** | 205 | 451 | 525 | 525 |
| **Area 2** | 1349 | 1746 | 1653 | 1746 |
| **Area 3** | 2522 | 3556 | 3610 | 3764 |

### 3.9 Constrained Spill Modelling

Modelling outputs for the three containment areas in Option 1 have been generated.

For Area 1, the Top level (spill height), seen in Figure 3-4 is 65.75 mAOD.

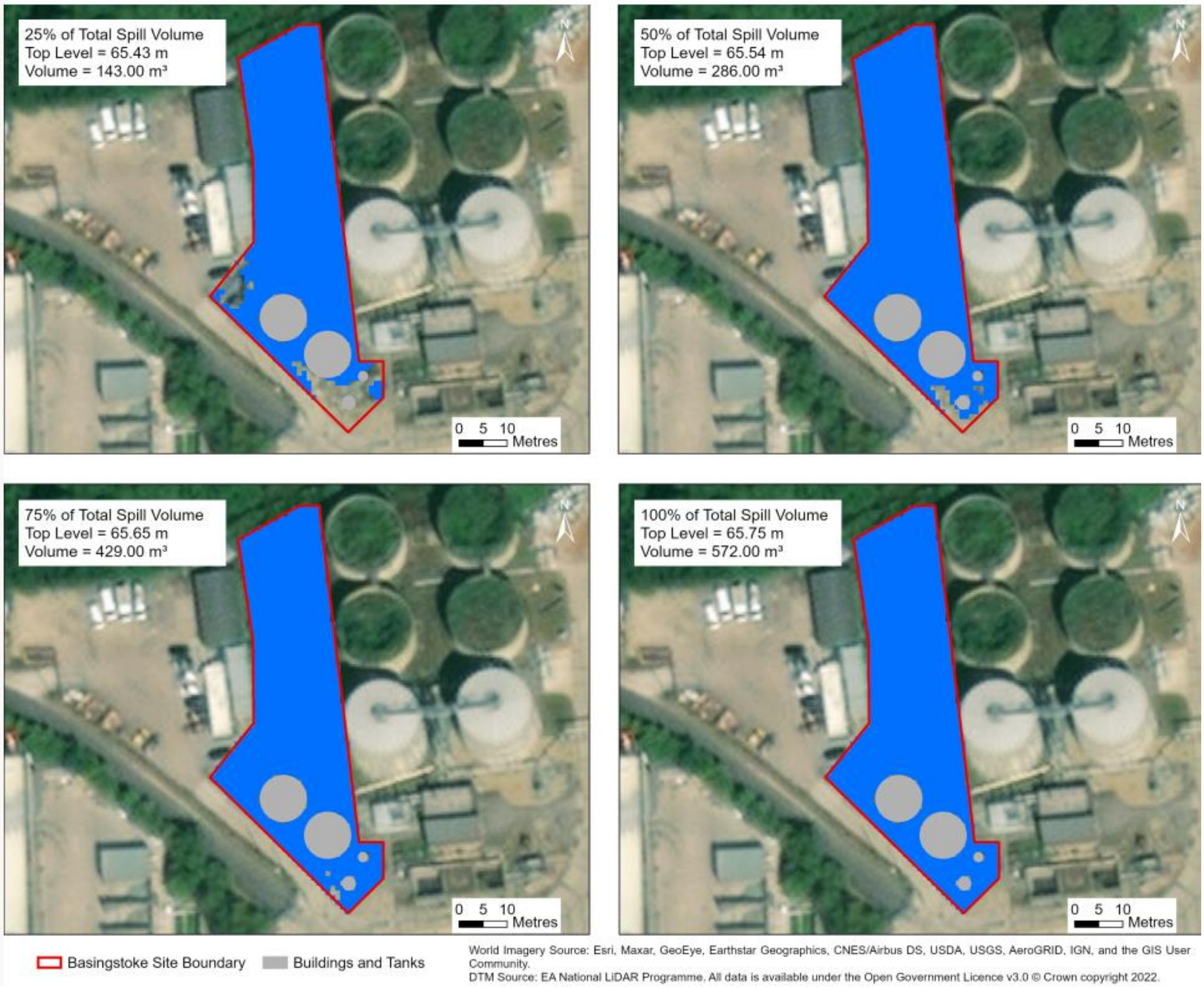



**Figure 3-4 – Area 1 Spill Scenarios**

For Area 2, an open channel (to represent a gravity pipe) was modelled to connect the containment area to the proposed lagoon in the northeast of the site. The final spill height was 62.50 mAOD, refer to Figure 3-6. Note that the lagoon will only fill to a depth of 0.5m (50% of the lagoon's capacity) in the critical spill scenario for Area 2, refer to Figure 3-5.

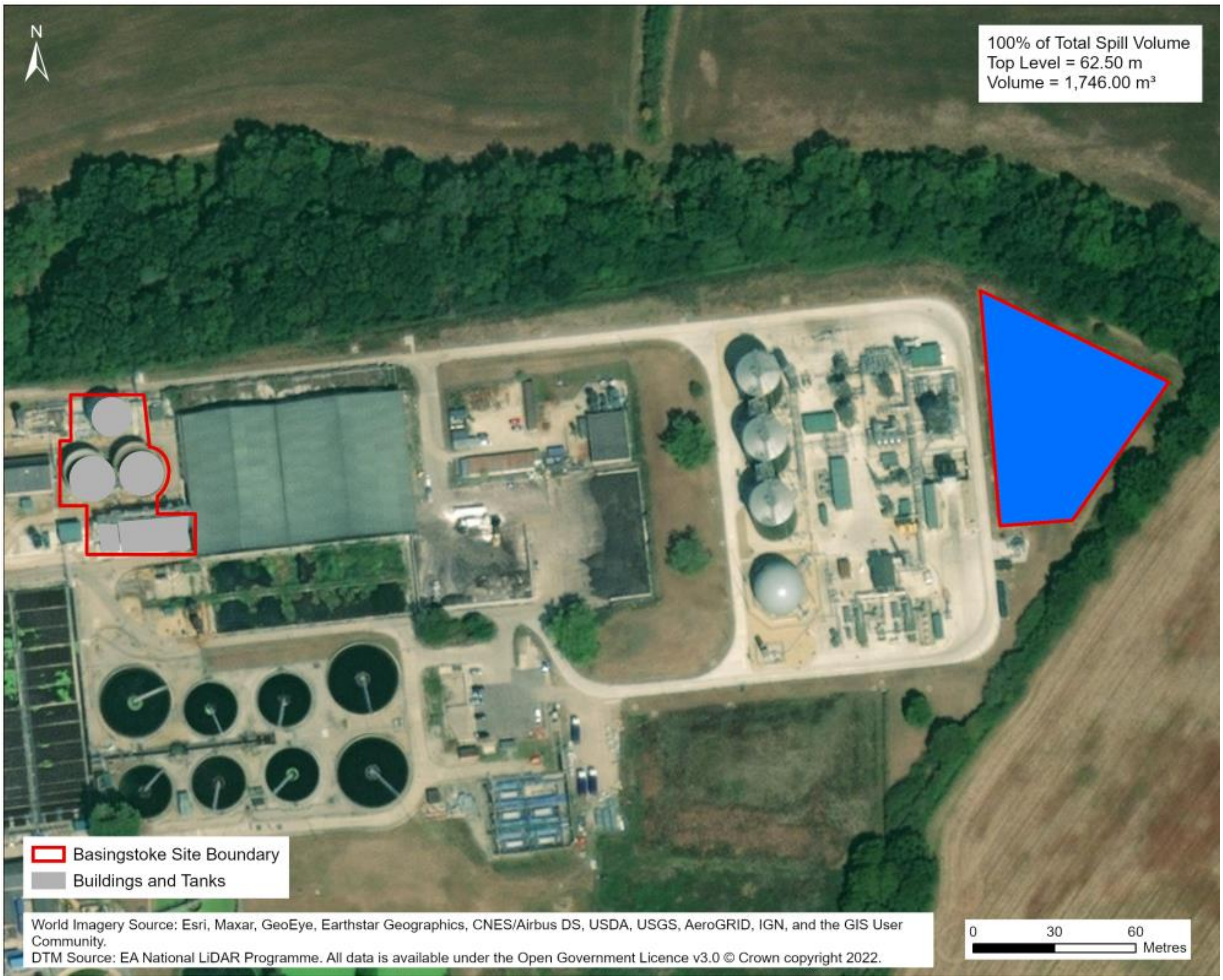



**Figure 3-5 – Area 2 Modelling Schematic**


**Figure 3-6 – Area 2 Spill Scenarios**

For Area 3, a connection to the proposed 1m deep lagoon was modelled, along with a 4m depth of storage space at the cake hopper, refer to Figure 3-7. The lagoon was modelled at 1m below the elevation of the road, the average ground level around this area is about 63 mAOD. A large amount of above-ground fill in addition to the depth of the lagoon will need to be removed during the construction process of the lagoon. This fill is long-standing. The top of lagoon bund level will be reviewed to confirm it remains above any potential flood level.

The simulation for the spill modelling in Area 3, refer to Figure 3-8, results in a final spill final height of 62.82 m AOD. This will be entirely contained at 0.82m depth in the lagoon. The bund wall in Area 3 hence is only needed for flow direction and jetting prevention. In the 4m deep cake hopper storage area, the spill will be 3.82m deep.

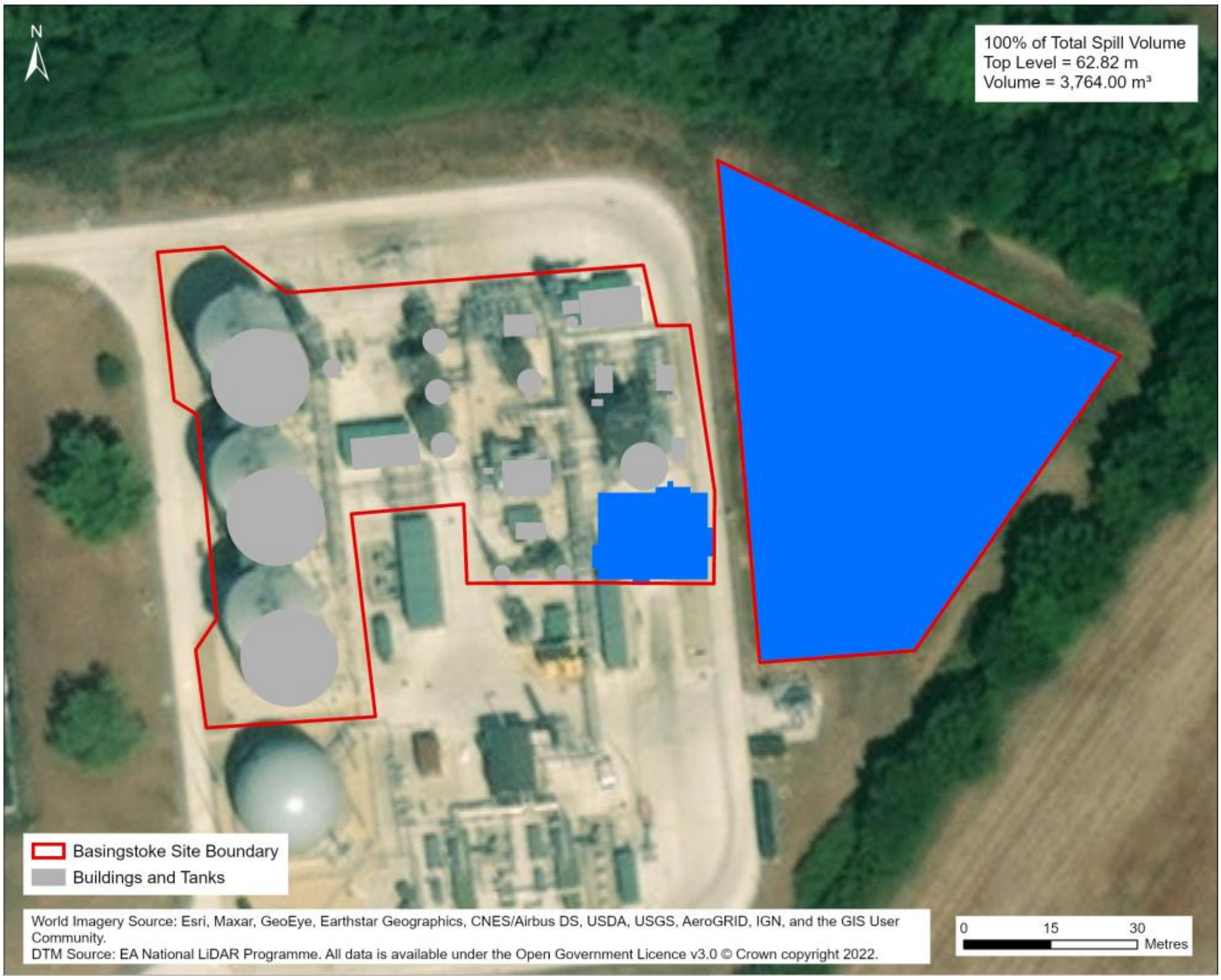



Figure 3-7 – Area 3 Modelling Schematic


**Figure 3-8 – Area 3 Spill Scenarios**

### 3.10 Site Topography

The Basingstoke site generally gently slopes from west to east, allowing a gravity pipe connection from the containment areas to the lagoon in the east, refer to Figure 3-9. Currently, there is a local high point in the lagoon area, caused by mounded site fill; a large amount of excavation and fill removal is necessary to create a lagoon and low point in this area.

Figure 3-10, Figure 3-12 and Figure 3-11 show the contours within the bunded areas. Areas 2 and 3 will have a consistent bund height because the bunding will not need to act as a sludge retention barrier. Area1 will have a variation in the bund height, with the highest wall on the north western section.


**Figure 3-9 – Entire Basingstoke Site Contour Map**

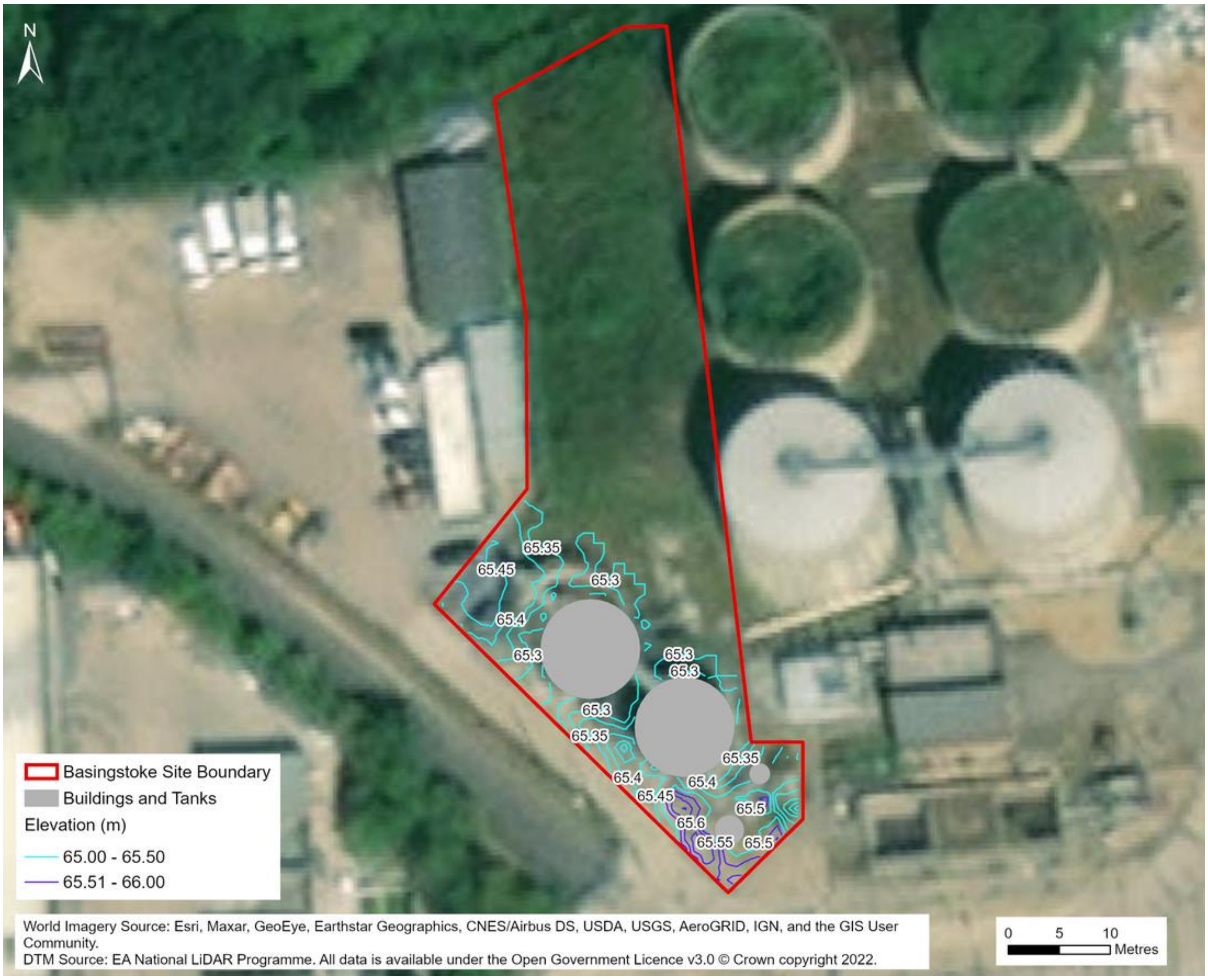



**Figure 3-10 – Area 1 Topography**

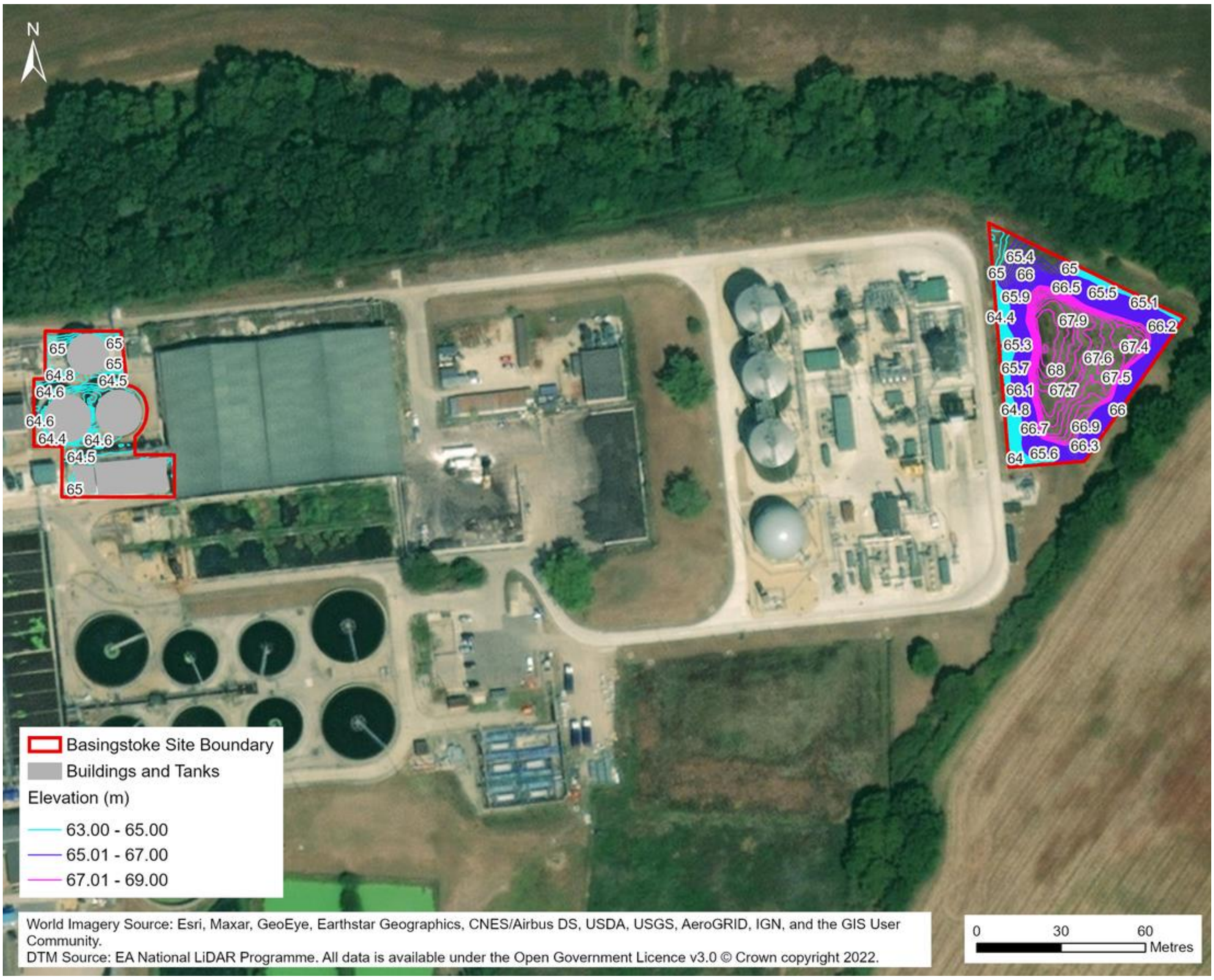



**Figure 3-11 – Area 2 Topography**


Figure 3-12 – Area 3 Topography

## 3.11 Bund Wall Heights

The maximum and minimum bund wall heights have been calculated and are shown in Table 3-3. Note that the bund wall height in Area 1 will require flood gates to access the area. For Areas 2 and 3, the spill scenarios are contained within the lagoon, hence the minimum bund height of 0.25-0.50m are proposed for the purpose of flow direction and jetting prevention.

Table 3-3 – Bund Wall Heights Summary

| Containment Area | Final Spill Height, Top Water Level<br><br>(mAOD) | Typical Ground Level in containment area<br><br>(mAOD) | Containment bund wall level (typically TWL+0.25m)<br><br>(mAOD) | Typical Bund Wall Height inc. freeboard<br><br>(m) |
|---|---|---|---|---|
| **Area 1** | 65.75 | 65.63 | 66.00 | 0.60 |
| **Area 2** | 62.50<br>(all spill sits in the lagoon) | 64.75 | 65.25<br>(GL + 0.5m) | 0.50<br>(flow guide) |
| **Area 3** | 62.82<br>(all spill sits in the lagoon) | 63.07 | 63.57<br>(GL + 0.5m) | 0.50<br>(flow guide) |

# 4. Identified Constraints

## 4.1 Operational Constraints

Areas 2 and 3 will be accessible via low (0.25m) access ramps. Area 1 will require a low (~maximum 0.77m height) floodgate to access Area 1.

A benefit of having the lagoon connection is that spills from Areas 2 and 3 will be entirely contained within the lagoon which will enable operation flexibility in the event of sludge spill clean-ups. The bund height in Area 1 is relatively low (maximum 0.77m) which will have minimal, if any, impact on site visibility, movement of fresh air and dispersion of natural light.

The existing ground surfaces within Area 1 and Area 2 will need to be replaced with impermeable surfaces e.g., concrete from which sludge can be cleared up easily. TW operation has stated that it would be difficult to clean up sludge from gravel areas as the gravel would also suck up the sludge.

The time to recovery and return site back to operation has been set at 3-4 days following direction by Thames Water. The containment volume, when not dictated by the 110% or 25% containment rules allows for three days of rain during the recovery period and one day of rain immediately preceding an event.

The sludge cake barn has not been included in the proposed containment area. Any spills onto the dried sludge cake would be difficult to clean up and take a long time, the sludge cake would need to be passed through a centrifuge again to dry it and re-thicken it or sent back to the head of the works.

## 4.2 Geotechnical and Environmental Constraints

Constructing the lagoon area will involve the excavation and removal of up to 8m (high) of existing fill, which may be potentially contaminated. The ground conditions beneath the surface are not known and will require some geotechnical and structural input.

Very little vegetation removal (if any beyond grassed surfaces) is required as part of this solution. With careful planning of the gravity pipeline to the north, impacts to the nearby dense vegetation should be avoided.

## 4.3 Other Constraints

Due to the brownfield nature and lack of open space of the Basingstoke treatment site, several existing assets will need to be established or modified to install the proposed bund arrangements, notably:

- Existing underground pipework along the northern section of the site could clash with the proposed gravity pipeline. Service tracing is recommended to confirm the optimal alignment of the proposed gravity pipe in this area.

- The gravity connection between Area 3 and the lagoon will need to be pipe jacked under the existing concrete surface. Underground services in this area are currently unknown.

- The bund alignment for Area 1 encompasses the existing return liquors pumping station due to space constraints. The existing pump station is currently covered by a steel grate, this will need to be replaced with a watertight cover to prevent inflow into this asset in the event of a sludge spill. The cover selection to consider ease of operation and a vent stack will be required.

- There is an existing electrical building in Area 3. This building sits on a low concrete plinth. No flood protection to this building will be necessary as part of these works, as all sludge will be routed and contained entirely within the lagoon.

### 4.4 Design allowance for rainfall

The design allowance for rainfall comprises a 4-day-one-in ten-year-rainfall event, which allows for three days of rain during the recovery period and one day of rain immediately preceding an event. For Basingstoke, this equates to approximately 75mm of rain arising in the four-day period.

The critical spill scenarios for Areas 1 and 3 are driven by the impact of the site-specific rainfall.

For Area 2 the 110%-rule sets the containment volume.

The lagoon shall have a small package stormwater pump station to enable rain collected within the lagoon to be removed. The existing underground storage area near the cake hopper already has existing stormwater drainage and no additional rainfall allowance or considerations are needed for this area.

# 5. Secondary Containment

The constituent parts of secondary containment are;

- The contained area itself.
- The transfer system.
- Isolation of the drainage from both the contained area and from the transfer system.

For Basingstoke, where possible, existing features of the site (e.g., suitable structures and impermeable surfaces) are used as much as possible to provide secondary containment to reduce cost. The options considered, modifications and their functionality are listed below:

- Bund/walls to contain liquid. The heights of bund/walls incorporate a 250mm freeboard consideration for potential surge and an overall minimum height of 500m to reflect the planned use of concrete walls with a recurved profile to return flow on itself by CIRIA.
- Lagoon storage area (and connecting gravity pipework) to direct sludge spills away from critical assets and operation areas and minimise bund height.
- Using existing underground storage areas; cake hopper import area.
- Floodgates to isolate the close containment areas while still providing operational access when necessary.

### 5.1 Permeable Surfaces within Containment Areas

All grass and gravel areas within the proposed containment areas will be excavated and replaced with concrete to mitigate seepage into the local ground and soil and aids cleaning procedures following a spill.

### 5.2 Jetting and Surge Flows

There is a small risk of jetting occurring onsite as is often the case with close containment areas. In the rare event that jetting was to occur in this location, the site roads would act as tertiary storage and conveyance.

Freeboard allowances and the profile of the containment bund wall provide mitigation against surge effects.

### 5.3 Flooding

According to the UK Government's Flood Map for Planning, the sludge area is in Flood Zone 1, as shown in Figure 5-1. The lagoon bund wall levels will be set to avoid inundation when excavating through the existing high ground as seeming to sit within both Flood Zones 2 and 3.

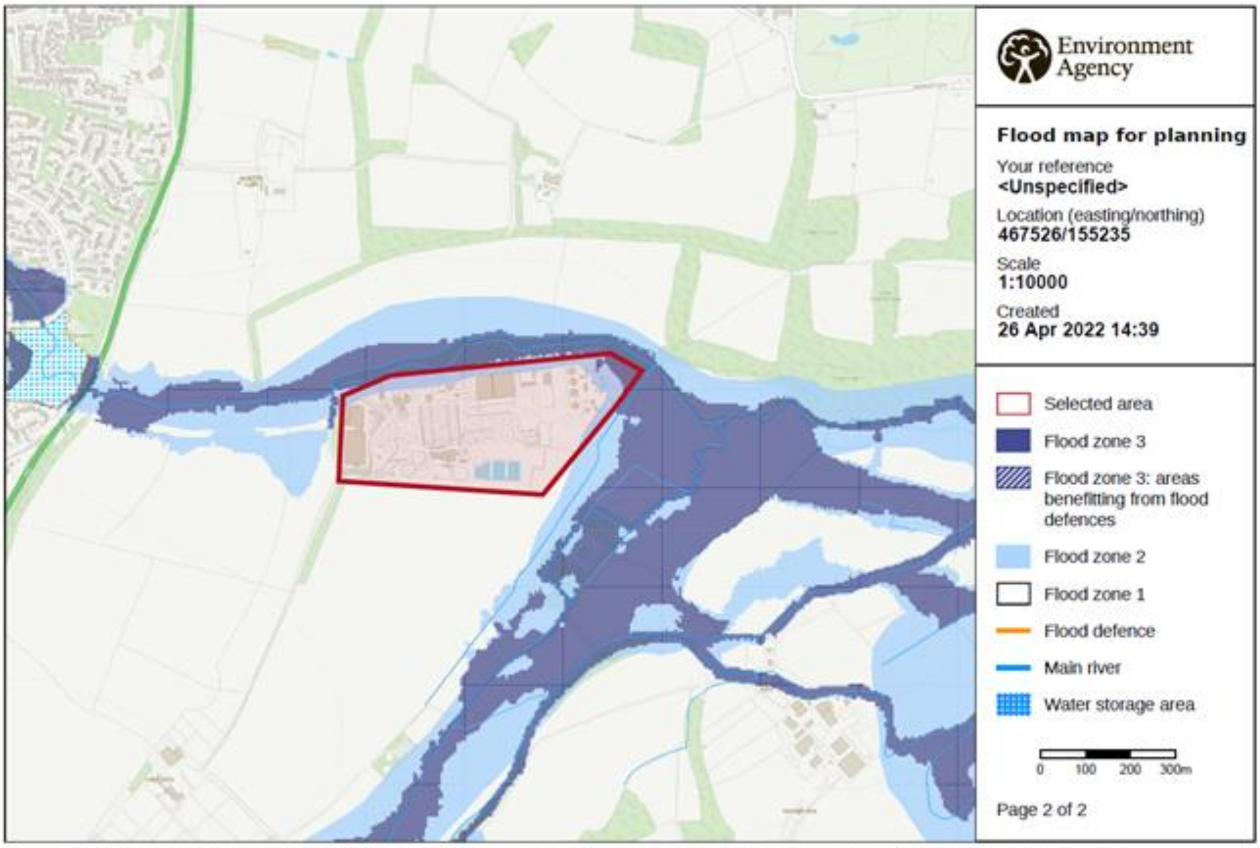





**Figure 5-1 - Extent of Fluvial flooding in Basingstoke due to extreme weather events**

### 5.4 Potential issues for solution detail (Inc H&S)

- The inlet pump station in Area 1 will only be accessible via floodgate entry. If a pump lift is required via crane, this will need to be done outside the 0.77m bund wall.
- Constructing the lagoon area will involve the excavation and removal of up to 8m (above road level) of existing fill, which is potentially contaminated. The ground conditions beneath the surface are not known and will require some geotechnical and structural input.
- Close containment bund walls will inhibit or complicate the ability to maintain or upgrade the assets within the bund e.g. limited room (if any) for machinery movement around the assets or for scaffolding to be erected within the bund. This is mostly an issue for Area 1, as the bund height is minimal for Areas 2 and 3.
- Potential service clashes along the proposed gravity pipe connection route are currently unknown, particularly along the northern length of the site. Feasibility and operational impacts of potential relocating major existing services.
- To aid spill clean-up permeable areas within the wide containment area are proposed to be replaced with concrete. This will have long terms implications for maintenance and emergency access to underground services.

# 6. Site Drainage and Liquor Returns

## 6.1 Process Flow and Liquor Return Diagrams

The Process Flow Diagram for Bracknell STW is shown below, refer to Figure 6-1

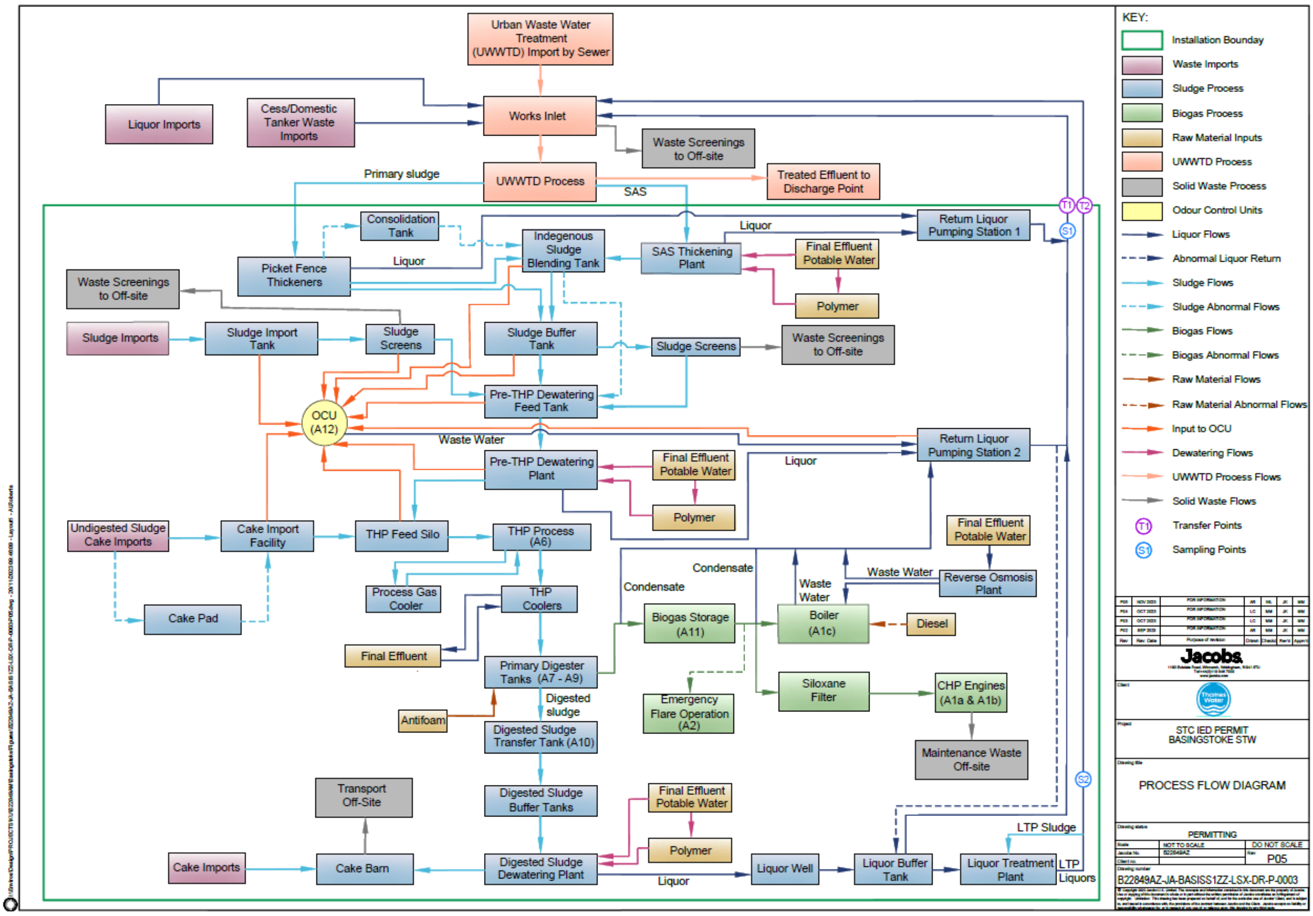



**Figure 6-1 – Basingstoke Process Flow Diagram**

## 6.2 Foul, Process and Effluent Drainage

The site drainage plan (BASIS1ZZ-DPL-001) shows foul water pipes and surface water pipes but a minimal indication of the direction of flow and point. There is also missing information on combined sewers, gullies, soakaways etc., particularly around the sludge holding tanks so an in-depth survey is being requested for Basingstoke. A copy is shown overleaf.

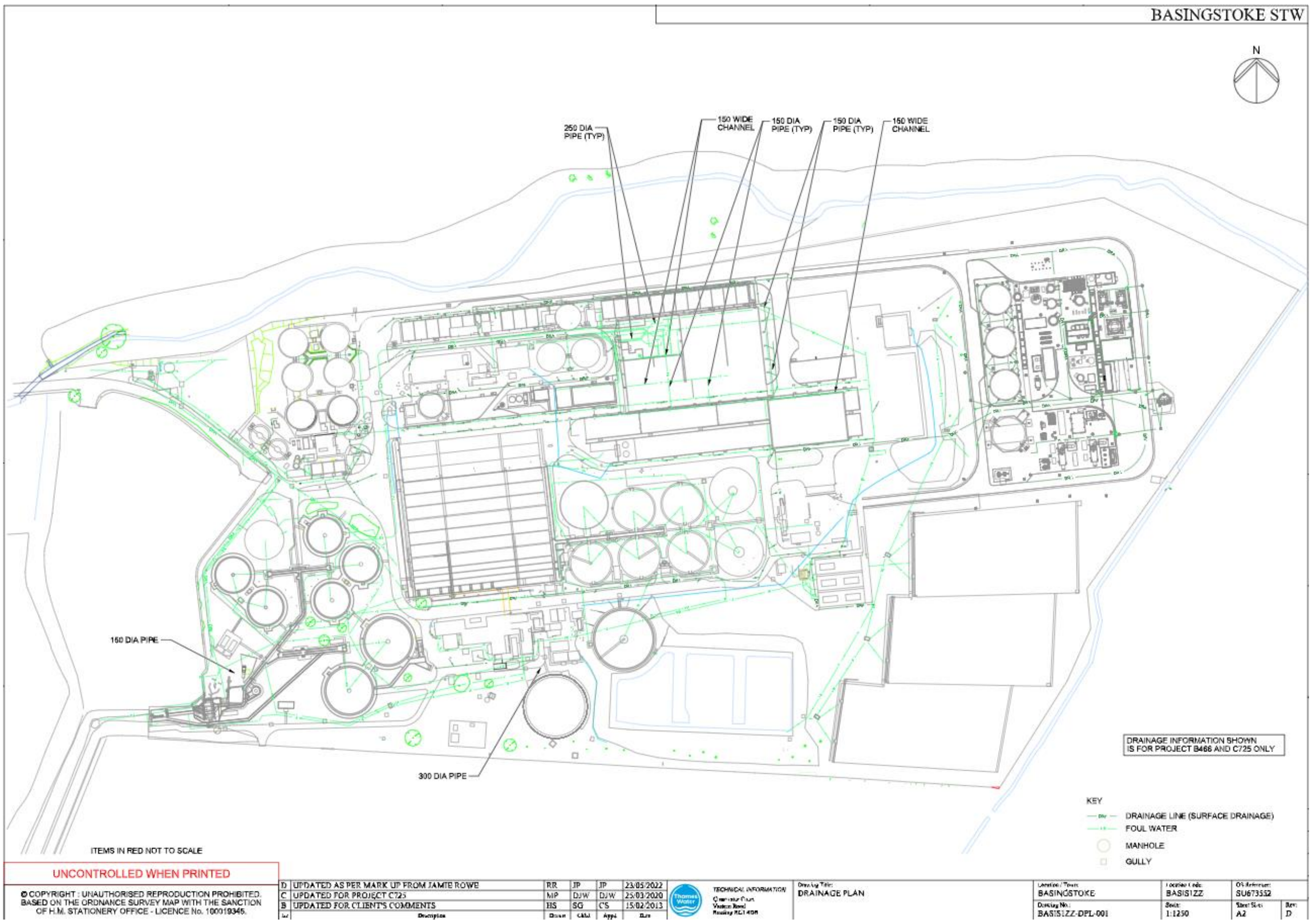



**Figure 6-2 – Copy of Drainage Plan**

### 6.3 Automatic Isolation Valves – Site Drainage and Tanks

For the catastrophic loss of containment scenarios for digester area discussed, such a loss could be automatically detected by the level sensors in the tanks. A catastrophic failure would be identified by the rate of change in tank level being larger than expected at normal operation. The signal from the sensors would be used to generate an alarm.

In the event of a catastrophic sludge spill, flows entering the head of the works via the drainage pipes could adversely impact the sewage works treatment process. Therefore, in the event of a catastrophic loss of containment, this line should be isolated.

It is recommended that float operated isolation valves are installed on all outgoing drainage lines from the containment area. These valves will remain normally open but will close when high levels in the existing drainage system are encountered. This drainage configuration will have the following impacts:

- In heavy or intense rain events these drainage isolation valves may be triggered, and operators onsite will need to manual operate these valves to release flows into the existing drainage network.
- In minor or slow flow tank spill events, the sludge spill will flow into the existing drainage network (and into the head of the works) unless operators intervene to isolate the drainage networks. Due to the flow to full treatment at Basingstoke being large, minor spill flows will not adversely impact the process.
- In most locations, to accommodate the new isolation valves, new manholes need to be constructed over the existing drainage lines.

# 7. Conclusions

This section summarises the findings of the containment assessment options report for Basingstoke STC.

Based upon the Anaerobic Digestion Bioresources Association (ADBA) containment assessment tool; the site carries an overall site risk rating of Medium meaning that Class 2 containment is needed.

This assessment focuses on site-specific risks and outlines the options available for providing secondary containment of a catastrophic tank or digester failure.

One option was developed in detail for sludge containment at Basingstoke STW – 3 containment areas, with lagoon storage available in Areas 2 and 3. This option will have a bund wall maximum height of 0.77m (inc. freeboard) in Area 1. For Areas 2 and 3, all critical spill volumes can be contained within the lagoon area and bunding is recommended for the purposes of jetting prevention, not for sludge retention. Areas 2 and 3 will be vehicle accessible via ramps. Area 1 will require entry via a Floodgate. Replacement of permeable surfaces will minimise clean-up time and effort.

Freeboard allowances and the profile of the containment bund wall partially provide mitigation against surge effects. Jetting escape is a residual risk for this site due to space constraints but any flows are contained within the site.

## Appendix 1 - ADBA Site Hazard Risk Assessment Summary for Basingstoke STW

ADBA Industry Guide and CIRIA C736 state how the site hazard rating and, the site risk and classification are to be calculated. A summary of the hazard risks for Basingstoke STC are as follows:

**Source** – Two sources have been identified:

1. Domestic and trade effluent Wastewater sludges, both in a raw, semi-treated and treated state.
2. Polyelectrolyte chemicals (such as Ferric Sulphate) for sludge thickening.

The Source Hazard rating was determined as **High**.

**Pathway** – One significant pathway has been identified:

1. The sludge treatment centre is integrated with the sewage treatment works

The Pathway Hazard rating was determined as **Medium.**

**Receptor** – There is one significant potential receptor which has been identified:

1. Petty's Brook and the river Loddon are within 100m of the sludge facilities.

The Receptor Hazard rating was determined as **High**.

**Likelihood** –
Post-mitigation measures, including bunding, operational failures were re-scored as **Low** likelihood.

Based on the information above the overall site risk rating was calculated to be **Medium** which means that Class 2 secondary containment is required.

| Source Risk | Pathway Risk | Receptor Risk | Site Hazard Rating | Likelihood | Overall Site Risk Rating |
|---|---|---|---|---|---|
| High | Medium | High | High | Low | Medium (Class 2) |