Addendum: Industrial Emissions Directive – Ellesmere Port Sludge Treatment Centre (STC)

Secondary Containment Modelling Assessment (Group 5)

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Contents

1 EXECUTIVE SUMMARY

The Ellesmere Port WwTW 2D InfoWorks ICM hydraulic model has been updated to represent the failure of Group 5, the Raw Sludge Tanks, and the resulting overland flow path for the spilled flow. The aim of the modelling was to predict where the tank contents would flow to and to determine the settled sludge depths. Subsequently, how a containment solution would affect these to meet the requirements set in the permit application.

The hydraulic model has been edited and updated to best represent the likely path of overland flow and a model simulation has been carried out for Group 5 representing the release of 110% of the largest tank.

Solution modelling has been undertaken with a revised alignment of the bund at the West side of the group area and a bund to the North to indicate how the overland flow and ponding could be contained. The extent of the spill was significantly reduced and contained by these proposed solution wall and bunds.

2 INTRODUCTION

Spill analysis has been undertaken as part of the industrial emissions directive (IED) for the Raw Sludge Tanks at Ellesmere Port Wastewater treatment Works (WwTW). The modelling approach is based on uncontained spill from a selected failed tank and then a solution that would contain this.

This report details the 2D hydraulic modelling that has been carried out to assess the failure of the process vessel, subsequent overland flow path of the contents and a solution to halt and contain the flow.

The assets for the WwTW have been grouped into 5 areas as shown in Figure 1. For this assessment, the containment requirements for Group 5 have been calculated in accordance with CIRA c736 and documented in Table 1 and shown in Figure 1. Raw Sludge Tanks 3 and 4 have not been modelled due to no possible mode of failure as they are below ground.

Table 1: Assets

Group	Asset Description	No of Units	Total Capacity (m3)	110% of largest tank	25% of aggregate
5	Digested sludge Buffer Tank	1	30	107	56.5
	Raw Sludge tank 1	1	98		
	Raw Sludge tank 2	1	98		
	Raw Sludge tank 3	1	Below Ground	0	0
	Raw Sludge tank 4	1	Below Ground		

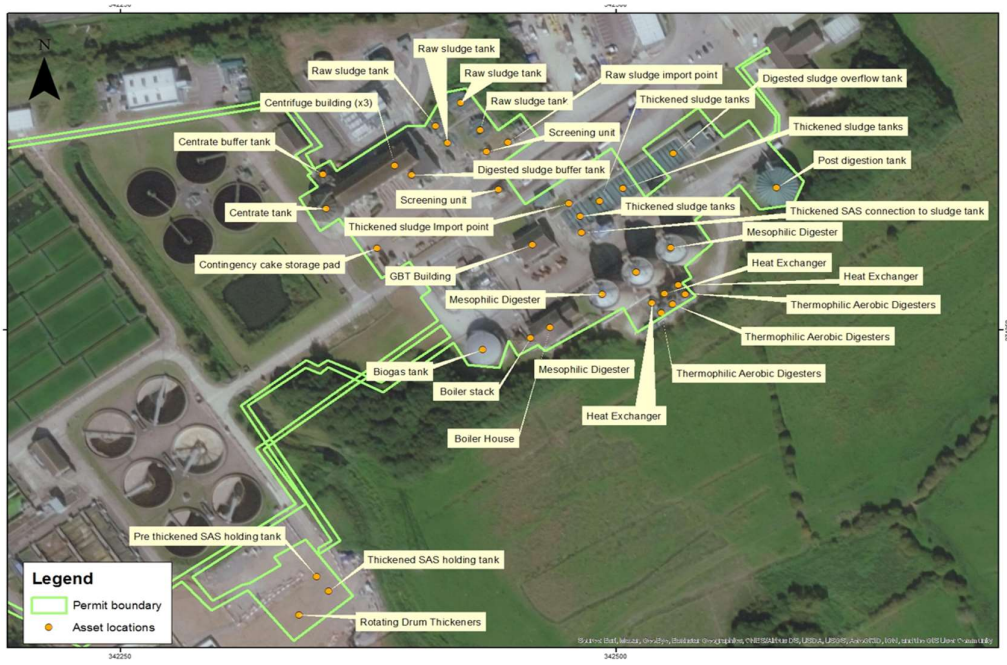

Figure 1: Ellesmere Port STC Asset Plan

3 HYDRAULIC MODEL BUILD

Use of a 2D hydraulic model allows the failure of a containment vessel to be represented, including the subsequent overland flow and ponding of settled sludge. A 2D model of the Ellesmere Port WwTW site has previously been built in InfoWorks ICM by Stantec and presented in the *Industrial Emissions Directive – Ellesmere Port Sludge Treatment Centre, Secondary Containment Modelling Assessment* report provide during the permit application process. Figure 2 below shows the extent of the 2D hydraulic model both in terms of the receptors and the grouped source assets.

Figure 2 Ellesmere Port WwTW Extent of Infoworks ICM 2D Model updated from the Secondary Containment Modelling Assessment Report prepared by Stantec.

The 2D hydraulic model uses 2metre Light Detection and Ranging (LiDAR) Digital Terrain Model (DTM) data downloaded from the DEFRA Survey Data Download site. The LiDAR data provides elevation data at 2m spacings and has vertical accuracy of +/-15cm.

4 HYDRAULIC MODEL ASSESSMENT

4.1 METHODOLOGY AND ASSUMPTIONS

The following methodology has been adopted to assess the impact of asset failures and the potential subsequent discharge of contents at the site.

- Assets have been modelled under a catastrophic failure scenario. For the assets identified in Section 2, 110% of the largest tank capacity closest to a watercourse receptor have been modelled. The tank contents will be modelled with an inflow file and assumed to empty instantaneously via a 2D point source that links to the model mesh in line with CIRIA c736. Buildings and structures where the spill flow path will be diverted are represented in the model as voids. To represent a complete failure of the chosen tank, there is no void at the failure location, so the initial spill flow is not impeded.

- No allowance for rainfall has been made at this time However, as the 110% scenario has been modelled so this takes into account potential rainfall.

- No allowance for fire-fighting water will be made, on the assumption that most of the assets being modelled contain sludge which has a low combustible nature. Digesters could require fire-fighting water in the eventuality of an explosion on the headspace that communicates with the gas system, but in such a scenario the main pollution is likely to be to air.

- No allowance for river levels have been accounted for in the modelling.

4.2 MODELLING LIMITATIONS

ICM is designed to model the overland flow of water; as such it is not able to account for the typically higher viscosities associated with sludge. This results in a larger modelled inundation extent than would be expected. Therefore, the modelled outputs are a worst-case inundation scenario resulting from sludge spills at Ellesmere Port WwTW.

5 MODEL SIMULATION RESULTS

5.1 GROUP 5: RAW SLUDGE TANKS

The raw sludge tanks each have an above ground capacity of 98m^3. The tank with the closest proximity to the receptor was selected for failure analysis. An inflow file of 107m^3 (110% of the 98m^3 tank volume) was created and applied to the model mesh via a 2D point source at the centre of the tank location. Figure 3 below shows the modelled point of discharge for the inflow file. This represents the release of flow from the raw sludge tank in the current uncontained scenario with the settled sludge depths indicated by the legend colours.

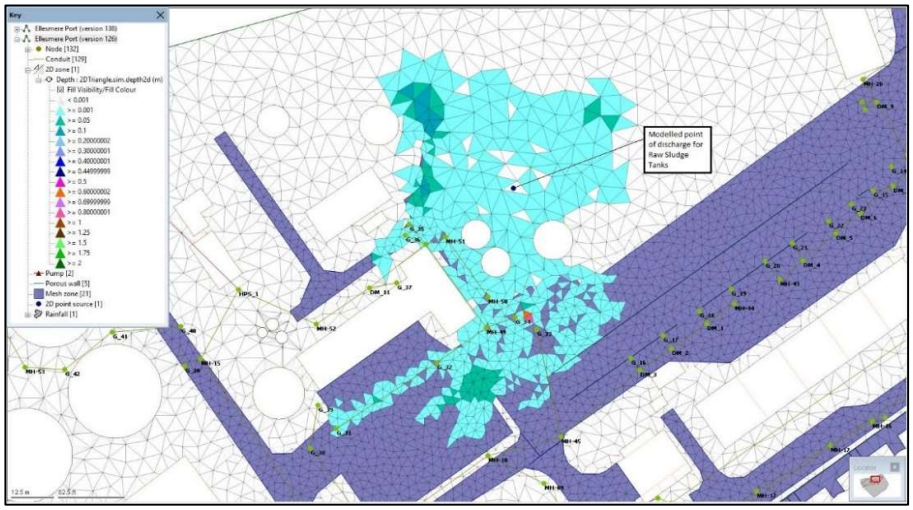

Figure 3 Ellesmere Port WwTW Modelled Point of and Predicted Uncontained Flow Paths for Group 5: Raw Sludge Tank failure

The simulation indicates that the failure causes overland flow to the North, East and centre of the WwTW to the South of this group. Settled sludge depths are greatest to the North where ponding occurs.

The results for the contained scenario with the proposed solution walls built into the model is shown in Figure 4 below. The settled sludge depth for this simulation shows that the resulting flow from this failure could be contained and diverted by a 300mm bund along the North edge of the WwTW site. A proposed 300mm bund along the edge of the road also maintains road access and diverts the spill flow path away from the building adjacent.

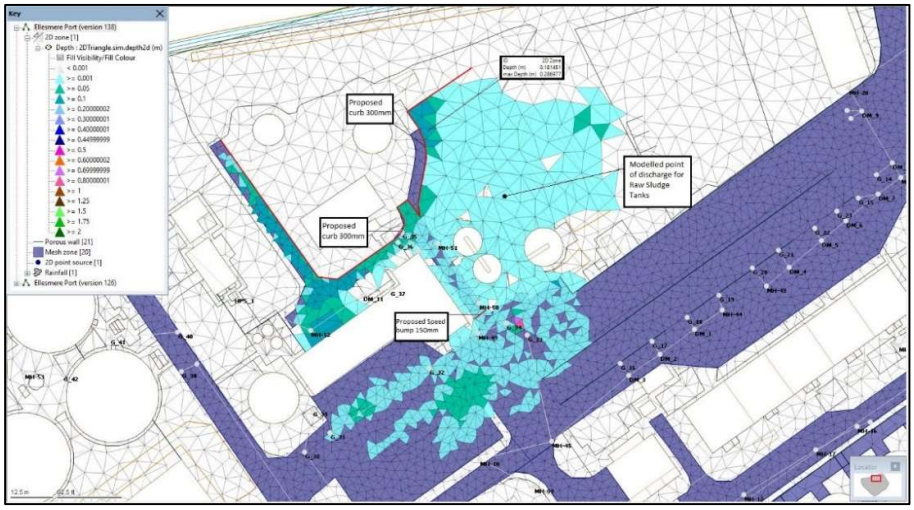

Figure *4* Ellesmere Port WwTW Modelled Containment Scenario for Group 5: Raw Sludge Tank failure

6 CONCLUSIONS

The 2D InfoWorks ICM hydraulic model for Ellesmere Port WwTW has been updated to represent the failure of the Raw Sludge Tanks in Group 5. The aim of the modelling was to predict where the tank contents would flow to and to determine the settled depths at ponding locations.

The tank failures resulted in overland flow to the North, East and centre of the WwTW to the South. The greatest settled depths for the uncontained scenario were seen to the North of the WwTW site.

Solution modelling has subsequently been undertaken with a revised alignment of the bund at the West side of the group area and an additional bund to the North. These adequately contain and divert the overland flow and ponding.