Memorandum

To: [redacted] **Date:** 20 July 2022

From: **Our Ref:** 4514777

Copy: **ABN: 85 004 974 341**

Subject: TTS Hydraulic Impact Assessment Memorandum

1. Executive Summary

To address the requirements of the LSIO and UFZ under the Planning Scheme, a hydraulic impact assessment has been completed to support the development of a Battery Energy Storage System (BESS) on land located adjacent to Edgars Creek in Thomastown, Victoria.

A hydraulic TUFLOW model was developed to simulate the behaviour of the Edgars Creek floodplain during significant storm events, and the model validated against designated 1% AEP flood extents within the LSIO. The model was found to provide a good representation of the floodplain and deemed suitable for use in impact analysis.

The proposed BESS works location was compared to both the LSIO extent and 1% AEP flood extent derived from the flood modelling and found to be located outside of both. As the proposed works are located outside of the 1% AEP flood extents, there is to be no impact upon the floodplain as a result of the works.

2. Introduction

The intent of this memorandum is to summarise the flooding investigation conducted to-date for the development at 15 High Street, Thomastown 3074, which involves the construction of a Battery Energy Storage System (BESS) on the existing Thomastown Terminal Station (TTS) site, located adjacent to Edgars Creek.

This study has been undertaken to confirm the flood flow behaviour of the existing Edgars Creek waterway and to establish a baseline for a hydraulic impact assessment of the impact of the proposed BESS and associated structures on the flood flow characteristics in Edgars Creek.

This memorandum has been prepared to provide a summary of the preliminary assessment and key findings of the study. The site and proposed works area are shown in Figure 1.

Figure 1 – Site location and proposed works area

The Thomastown Terminal Station (TTS) site is located 14 kilometres north-north-east of the Melbourne CBD, situated between the Metropolitan Ring Road to the north and Mahoneys Road to the south. High Street forms the site's eastern-most boundary, with the site being traversed by the Melbourne Water waterway Edgars Creek (Dr4420).

The Edgars Creek catchment covers a relatively large area of around 37 square kilometres, with around 30 square kilometres of this being located upstream of the TTS site. The Edgars Creek waterway flows in a generally south, west, south-westerly direction, converging with the Merri Creek in Coburg North, before flowing into the Maribyrnong River.

The TTS site is zoned as Industrial 1 Zone (IN1Z), with a small section of the site also being zoned as Urban Floodway Zone (UFZ). The Edgars Creek waterway is covered by a Land Subject to Inundation Overlay (LSIO), providing additional developmental controls to the site. The subject site as well as it's zoning and overlays is shown in Figure 2.

It is understood that there may also be some minor drainage works outside of the identified works area, in the form of either an underground pipe or swale. As the details of these works are still being finalised, and neither option is expected to impact the flooding behaviour of the Edgars Creek floodplain during a significant storm event, these have not been included within the modelling investigation.

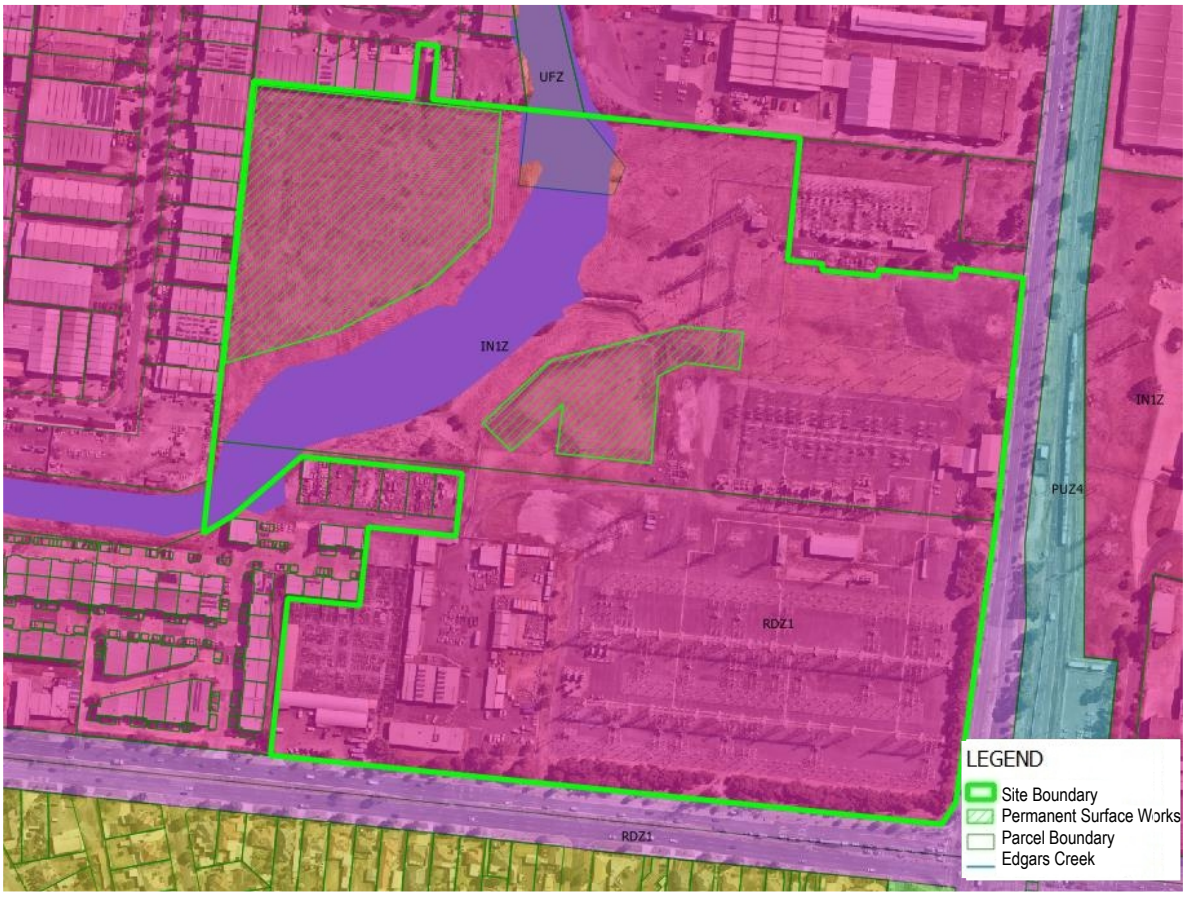

Figure 2 – Site Location and overlays

The requirements of the Urban Floodway Zone (UFZ) and the Land Subject to Inundation Overlay (LSIO) are addressed below:

- To meet the requirements of **LSIO** the Project needs to:
  - maintain the free passage and temporary storage of floodwaters, minimise flood damage, respond to the flood hazard and local drainage conditions, and not cause any significant rise in flood level or flow velocity.
  - minimise the potential flood risk to life, health and safety associated with the development
  - protect water quality
  - maintain or improve river, marine health
- To meet the requirements of **UFZ** the Project needs to:
  - provide a flood risk report to satisfy the responsible authority (Melbourne Water / Whittlesea council), taking into consideration the below:
    - The existing use and the development of the land
    - Whether the proposed use or development could be located on flood free land or lesser flood hazard land
    - The susceptibility of the development to flooding and flood damage
    - Potential flood risk to life, health and safety associated with the scheme which includes
      - frequency, duration, extent, depth and velocity of flooding of the site
      - flood warning time
      - danger to the occupants of the development, other flood plain residents and emergency personnel
    - If the site or accessway is flooded

- The effect of the development on redirecting or obstructing floodwater, stormwater or drainage water and the effect of the development on reducing flood storage and increasing flood levels and flood velocities
- Effect on environmental values such as natural habitat, stream stability, erosion, water quality and sites of scientific significance[1].

3. Data Collection and review

A data collection process has been undertaken to identify and gather information relative to the site, and to understand the characteristics of the Edgars Creek floodplain. Melbourne Water were attempted to be contacted as part of this process (Ref: MWA-1245752, Lodged 24 March 2022), however no response has been received at the time of the production of this memorandum.

The following data sources and information has been used in the development of the Edgars Creek hydraulic model:

- Land Vic Planning layers associated with waterways and flooding
- Topographic LiDAR obtained from DEWLP, LiDAR 2018
- NearMap aerial imagery
- Melbourne Water available information
    - Flow Values (peak flows only)
    - Flood studies

4. Technical requirements

The assessment methodology aims to satisfy the technical requirements of the study and is as generally directed by the *Guidelines for Development in Flood Affected Areas (DEWLP),* and the *Whittlesea Planning Scheme requirements.* Hydraulic flood modelling has been with reference to *Australian Rainfall & Runoff 2019* processes and Melbourne Water's *AM STA 6200* guidelines, noting that flood flow information has been adopted directly as part of this investigation.

5. Hydrologic Information

The development of the Edgars Creek base case assessment has been undertaken using the available peak flow information from Melbourne Water's Edgars & Central Creek flood mapping project RORB model, (AECOM, 2014). The following peak flows were adopted for this assessment:

AEP	ARI	FLOW (m^3/s)
1%	1-in-100 year	72.74
2%	1-in-50 year	66.23
5%	1-in-20 year	58.51
10%	1-in-10 year	50.28
20%	1-in-5 year	44.71

Full hydrographs for this information have been requested from Melbourne Water, however this information has not been made available to the Project at the time of this memorandum being produced. As the floodplain behaviour is dominated conveyance as opposed to storage, a synthetic triangular hydrograph was adopted using these flows. Flows have been applied into the model as a simple QT boundary. To allow water to exit the model, a HT boundary has been applied as the model's downstream boundary, set to a normal grade based on LiDAR information and cross referenced against the hydraulic grade line of the water surface during significant flow events. Inflow and outflow locations are summarised in Figure 4.

[1] Investigation into the effect of the project upon environmental values such as natural habitat, stream stability, erosion, water quality and sites of environmental significant is not included within the scope of this investigation.

6. Hydraulic Model Development

The existing scenario model has been developed to form the baseline against which a proposed development scenario can be assessed. The model us a 2D-only model and has adopted the CLASSIC solver (Version 2020-10-AA iDP) for the purpose of this investigation.

A digital elevation model (DEM) of the terrain surrounding Edgars Creek was obtained for the project using DELWP LiDAR information and has been used as the basis for the hydraulic model. The DEM at the site location is illustrated in Figure 3.

Figure 3 – Surface representation

The 2D cell size and the 2D timestep adopted for this model are 2 metres and 0.5 seconds respectively. The extent of the model's 2D domain is illustrated in Figure 4.

As the floodplain behaviour is dominated conveyance as opposed to storage, a synthetic triangular hydrograph was adopted using these flows. Flows have been applied into the model as a simple QT boundary. A nominal duration of 4 hours has been adopted for full event duration, allowing peak flood flows to pass through the model.

To allow water to exit the model, a HT boundary has been applied as the model's downstream boundary, set to a normal grade based on LiDAR information and cross referenced against the hydraulic grade line of the water surface during significant flow events. Inflow and outflow locations are summarised below in Figure 4.

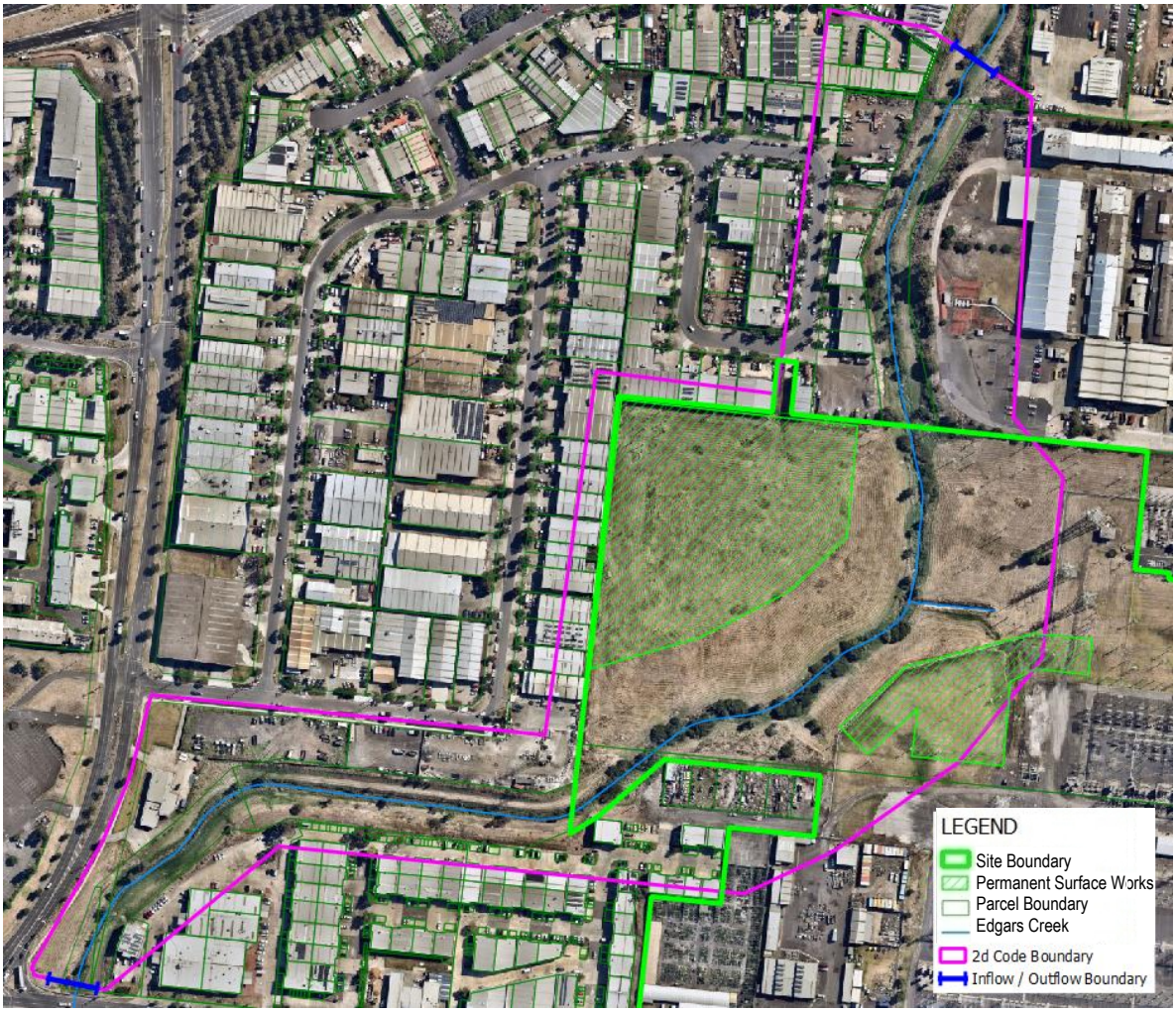

Figure 4 - Boundary conditions and model domain

Surface roughness characteristics have been selected based on Planning Scheme Zoning and validated against aerial imagery. Where discrepancy was found, roughness based on aerial imagery was adopted. The final Manning's n values have been adopted for the modelling and are shown spatially in Figure 5. While further refinement of the roughness values could be conducted, the delineation of areas is considered appropriate for this investigation given the flood flow behaviour.

Land Use	Manning's n
Carpark / Road	0.025
Open Pervious Area	0.050
Commercial	0.500

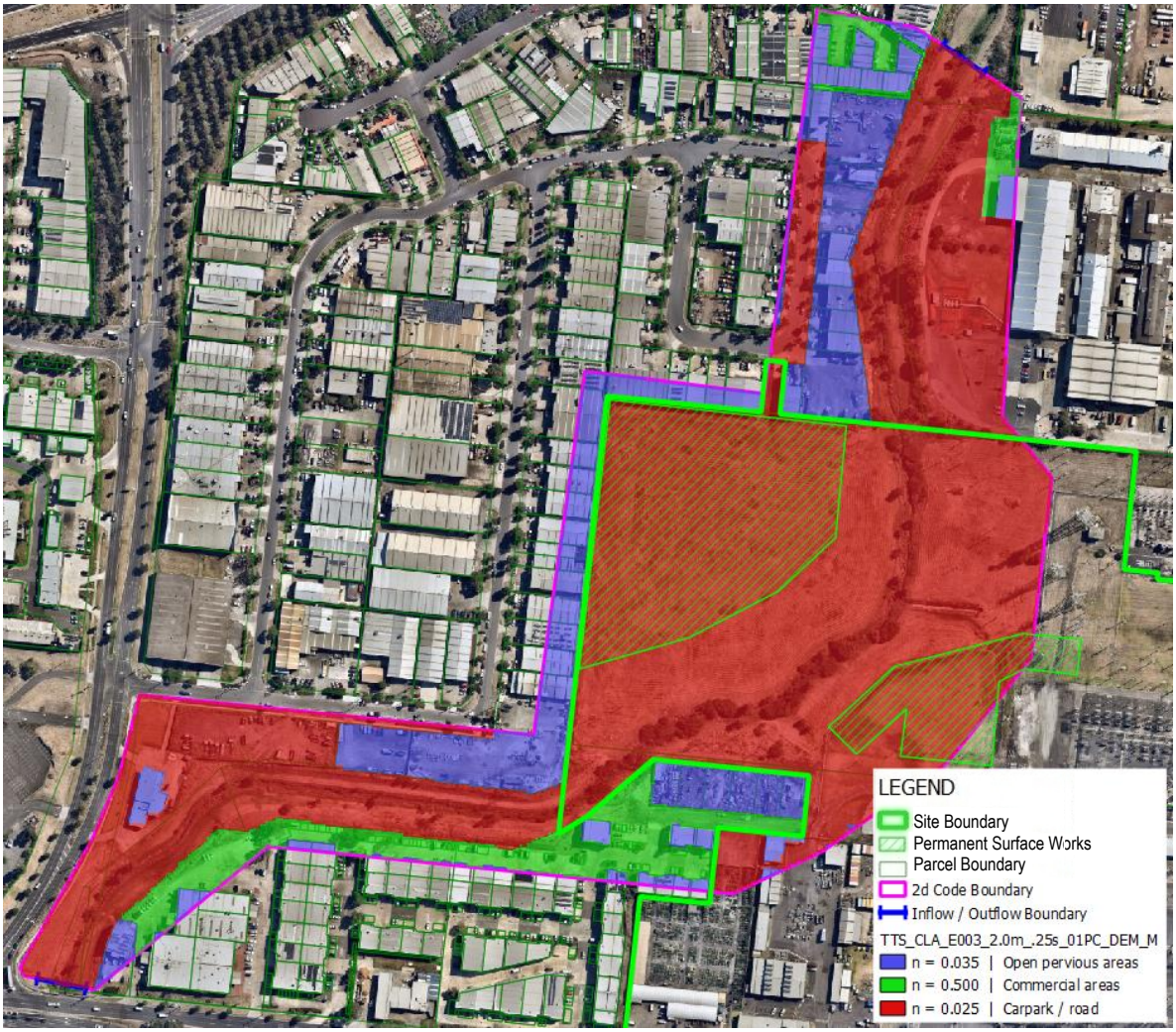

Figure 5 – Manning's n roughness application

The results of the model have been validated against the existing LSIO Planning Scheme overlay. As the investigation work provides a reasonable match with expected flood behaviours, the modelling work can be adopted for the purposes of the impact investigation.

The extent of flooding in 1% AEP event is shown in Figure 6, shown against the site boundary and designated LSIO extents.

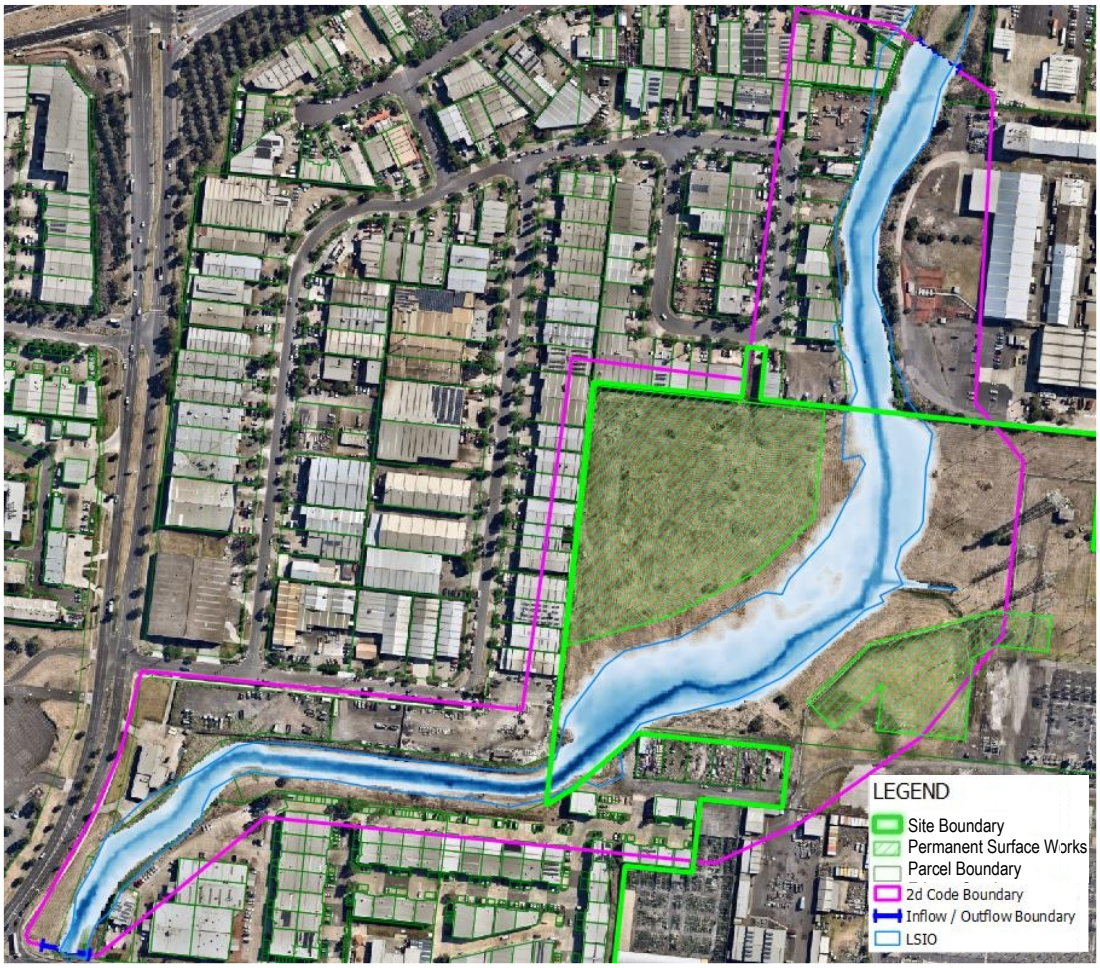

Figure 6 – 1% AEP flood depths shown against LSIO extent

7. Conclusions

The intent of this work is to identify any impacts resulting from the proposed BESS project works adjacent to the Edgars Creek floodplain, and to provide appropriate mitigation strategies such that the requirements of the UFZ and LSIO are satisfied.

A baseline flood model has been developed using TUFLOW to assess the impact of the project works, validated against the extents within the Planning Scheme.

The results of the baseline modelling found that while the overall TTS site is subject to flooding during a significant storm event, that the location of the proposed works remains unaffected by flooding during the 1% AEP flood event. The proposed works meet the requirements of the UFZ and LSIO under the Planning Scheme.

Should authority access be required adjacent to the waterway, access tracks will be designed to result in no net reduction to cross sectional flow area or reduction in floodplain storage. These principles will also be applied to the discharge connection from the site to the waterway. Following any enabling works or installation of underground services, the finished surface levels within the floodplain will be returned to pre-development levels, and any remaining excavated materials removed from the floodplain.

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