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255 Elaine-Blue Bridge Road, Elaine
STORMWATER MANAGEMENT STRATEGY

March 2024

DCE Ref: 23147

FOR

akaysha

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Executive Summary

This report presents the stormwater management strategy for the proposed Battery Energy Storage System (BESS) project at 255 Elaine-Blue Bridge Road, Elaine. The proposed project (subject site) comprises approximately 6.0 hectares (ha). Of that area, approximately 4.1 ha is planned to become the 311 MW / 1244 MWh BESS facility. The remainder of the site will remain undeveloped and be used as a transmission connection. The subject site is located within the Shire of Moorabool.

The stormwater management strategy (SWMS) for the proposed development addresses conditions raised in the previously issued permit. The SWMS

- Includes details and computations of how works on the land are to be drained, including stormwater drainage. See Section 4.2.3 and Appendix E.
- Includes details of how the drainage design will affect the continuation of existing overland flow paths and flood patterns across the land. See Sections 4.7 and 5.
- Assesses the impacts of on-site infiltration and surface water quality, including water quality in adjacent land and waterways. See Section 4.6.
- Includes details of how polluted or contaminated runoff will be managed. See Sections 4.4 and 4.5.
- Includes modelling of the existing open channel to determine the 1% annual exceedance probability (AEP) water levels within the swales adjacent to the subject site. See Section 5.
- Includes hydraulic modelling to determine the extent of tailwater impacts that extent upstream from the road reserve during a major rainfall event (such as the 1% AEP). See Section 5.

In the proposed condition:

- The subject site will be graded to slope down toward the west. Developed flows from the subject site will be conveyed by a vegetated swale with 1% annual exceedance probability (AEP) capacity along the western boundary of the subject site. Stormwater from the proposed project will be directed to the existing discharge point in the informal waterway at the south-west of the subject site.
- The development of the subject site will not change the total area draining to the existing western dam.
- External flows from the east and north of the subject site will be conveyed around the proposed development by dedicated overland flow paths. Preliminary hydraulic modelling using HEC-RAS 2D indicates that the proposed regrading of the subject site allows for conveyance of the external flows safely around the site. Stormwater from external catchments to the east and north of the subject site will be directed to the existing discharge point in the informal waterway at the south-west of the subject site.

The proposed grading of the site and methodology for managing internal and external stormwater has been developed to allow for stormwater quality treatment to be provided through green engineering methods.

This SWMS demonstrates that stormwater can be managed at the subject site as part of the proposed project. The SWMS has been developed to provide opportunities for stormwater quality treatment and minimise impacts on downstream properties and ensures that the development of the proposed project can be undertaken in a way that it causes no direct impact on water quality or the hydrology of the western dam.

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1. Introduction

This report presents the stormwater management strategy for the proposed Battery Energy Storage System (BESS) project at 255 Elaine-Blue Bridge Road, Elaine. The proposed project (subject site) comprises approximately 6.0 hectares (ha). Of that area, approximately 4.1 ha is planned to become the BESS facility. The remainder of the site will remain undeveloped and be used for a transmission connection. The areas proposed for the development and the transmission connection are shown in Figure 1. The subject site is located within Moorabool Shire.

Currently the subject site is rural and is zoned as a Farming Zone. The subject site is bounded by the Elaine Terminal Station to the east and undeveloped farmland to the north and west. An unnamed access road borders the southern boundary of the subject site.

The subject site grades from the north-western boundary to an existing open channel at the south of the property, at gradients ranging from approximately 1 in 50 at the western end, to approximately 1 in 100 at the middle of the property. A survey of the subject site and surrounding area was undertaken by Survey 4D Pty Ltd on 25 January 2023. The 0.5-m contour lines shown in Figure 2 are from the January 2023 survey. A PDF of the survey is included as Appendix B. Additional contour information has been provided and has been used for preliminary hydraulic modelling and catchment delineation.

Figure 1: Subject site in existing condition showing BESS facility and transmission connection

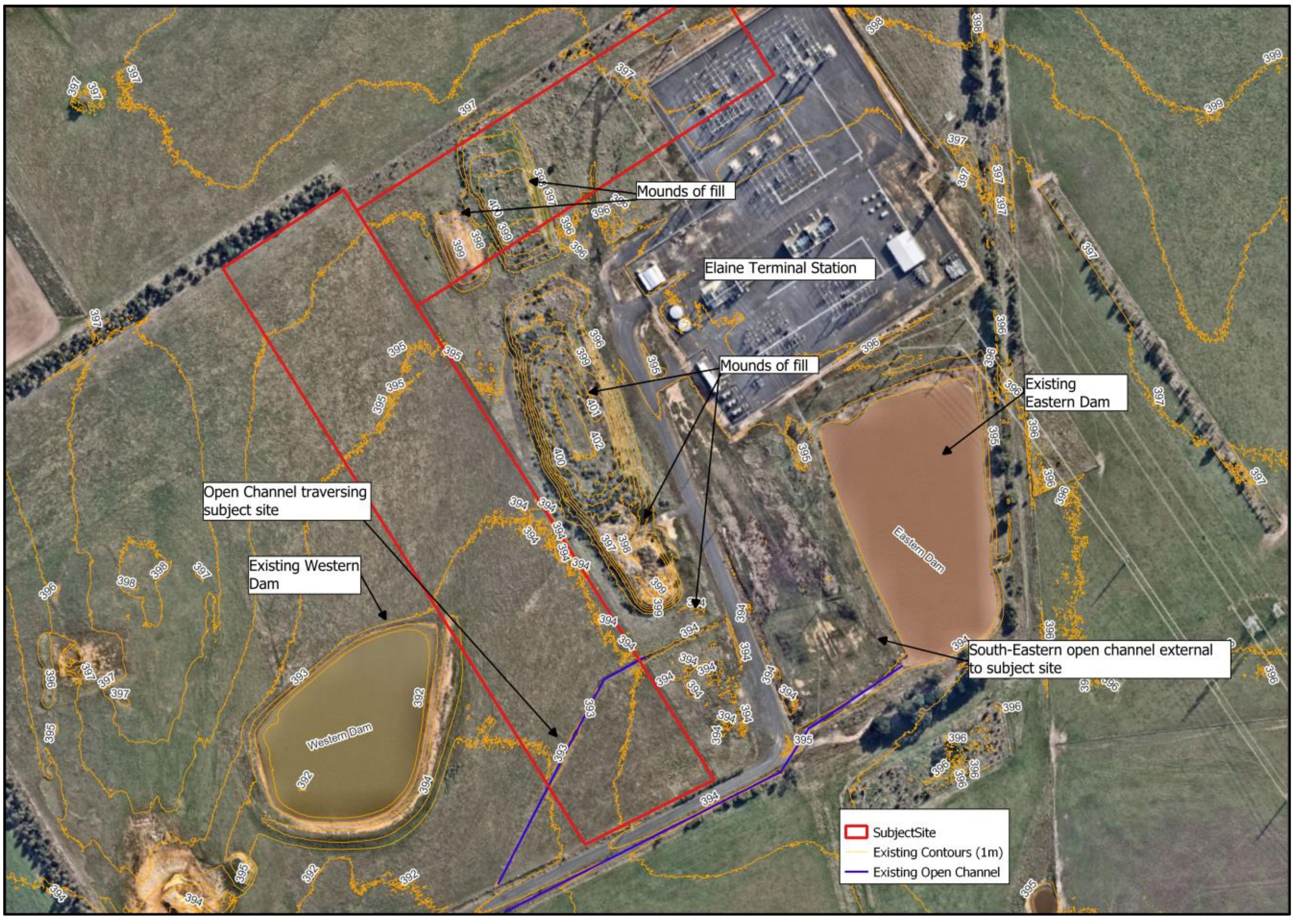

Figure 2: Subject site in existing condition

As the subject site is located within Moorabool Shire, the Infrastructure Design Manual (IDM) is the relevant guiding document for flow calculations and drainage design. All calculations and drainage design in this report are also compliant with *Australian Rainfall and Runoff 2019 (ARR19)* and reflect industry best practice approaches.

2. Site Overview

2.1 Subject Site

The subject site is generally flat. It grades down from north to south-west and is currently used to pasture stock. As shown in the aerial image included in Figure 2, a vegetation corridor exists at the north of the subject site.

To the east of the subject site, large mounds of earth restrict overland flow paths into the subject site. Additional information regarding external catchments is included in Section 2.5 of this report.

To the west of the subject site, a large farm dam with a surface area of more than 1 ha exists. The dam is currently used for watering stock and has no formal outlet. Based on the contour information, data, historic aerial imagery, and a site visit undertaken by DCE in July 2023, the catchment draining to the western dam has been defined. The catchment of the western dam is detailed in Section 2.4 of this report.

2.2 Existing Open Channel

The survey and aerial imagery clearly show the existing open channel (swale) traversing the site. The location of the open channel is shown in Figure 6. During the July 2023 site visit, it was noted that a minimal catchment drains to the open channel.

An analysis of the existing capacity in the open channel was undertaken. Cross-sections of the open channel within the subject site have been modelled using the software PC-Convey, using data from the *Elaine BESS: Level & Feature Survey* (Survey 4D, January 2023). PC-Convey results indicate that the capacity of the channel varies from approximately 0.8 m^3/s at the eastern, upstream property boundary, to approximately 0.4 m^3/s at the western boundary of the subject site. PC-Convey outputs for the existing open channel are included in Appendix C.

Figure 3 shows a photograph (July 2023) of the upstream (eastern) end of the open channel within the subject site. The flat grade of the channel and limited capacity are evident. It is likely that the channel is an ephemeral watercourse which conveys water only immediately following a rainfall event.

Ponded water was observed at the downstream end of the open channel during the July 2023 site visit, as shown in Figure 4. The photograph in Figure 4 was taken from the road, looking north towards the channel. Based on the July 2023 DCE site visit, it appears likely that the cause of the ponding is that there is no outlet for the channel. A culvert under the unnamed access road was not located. A local high point, shown in Figure 5, limits the available outflow capacity. The road, raised above the level of the adjacent land, acts as a flow barrier, causing water to pond within the open channel, before overtopping. Section 5 of this report details the preliminary hydraulic flood modelling undertaken to determine the impact of the lack of outlet on flood extents before and after development of the subject site.

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Figure 3: Existing Open Channel within subject site (DCE, July 2023)

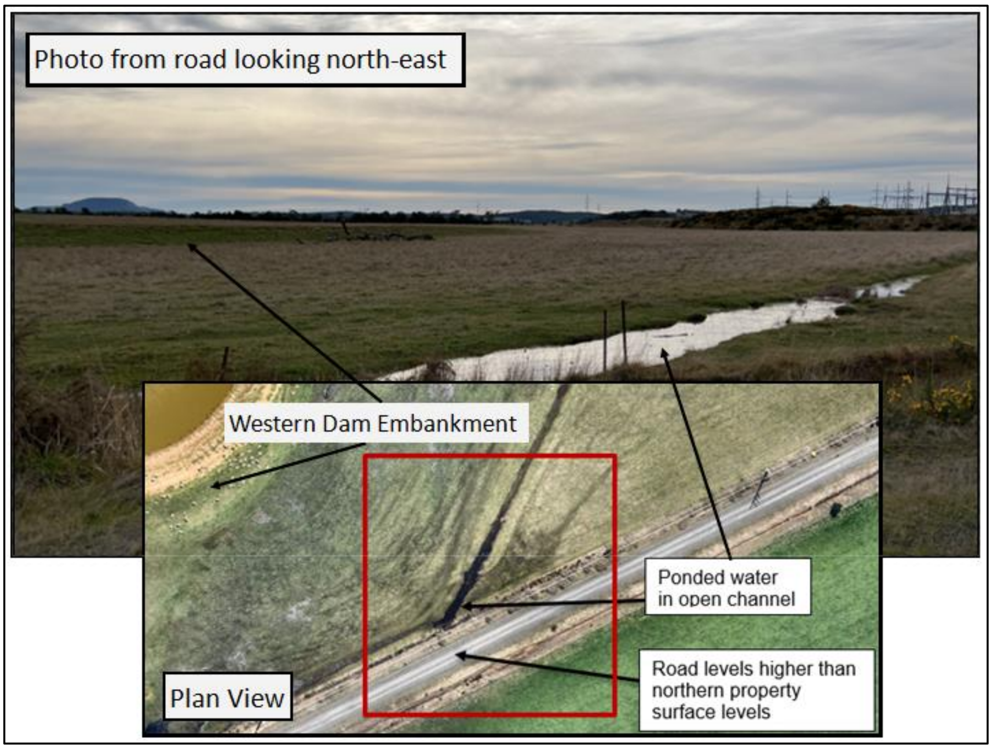

Figure 4: Downstream end of open channel showing ponding (DCE, July 2023)

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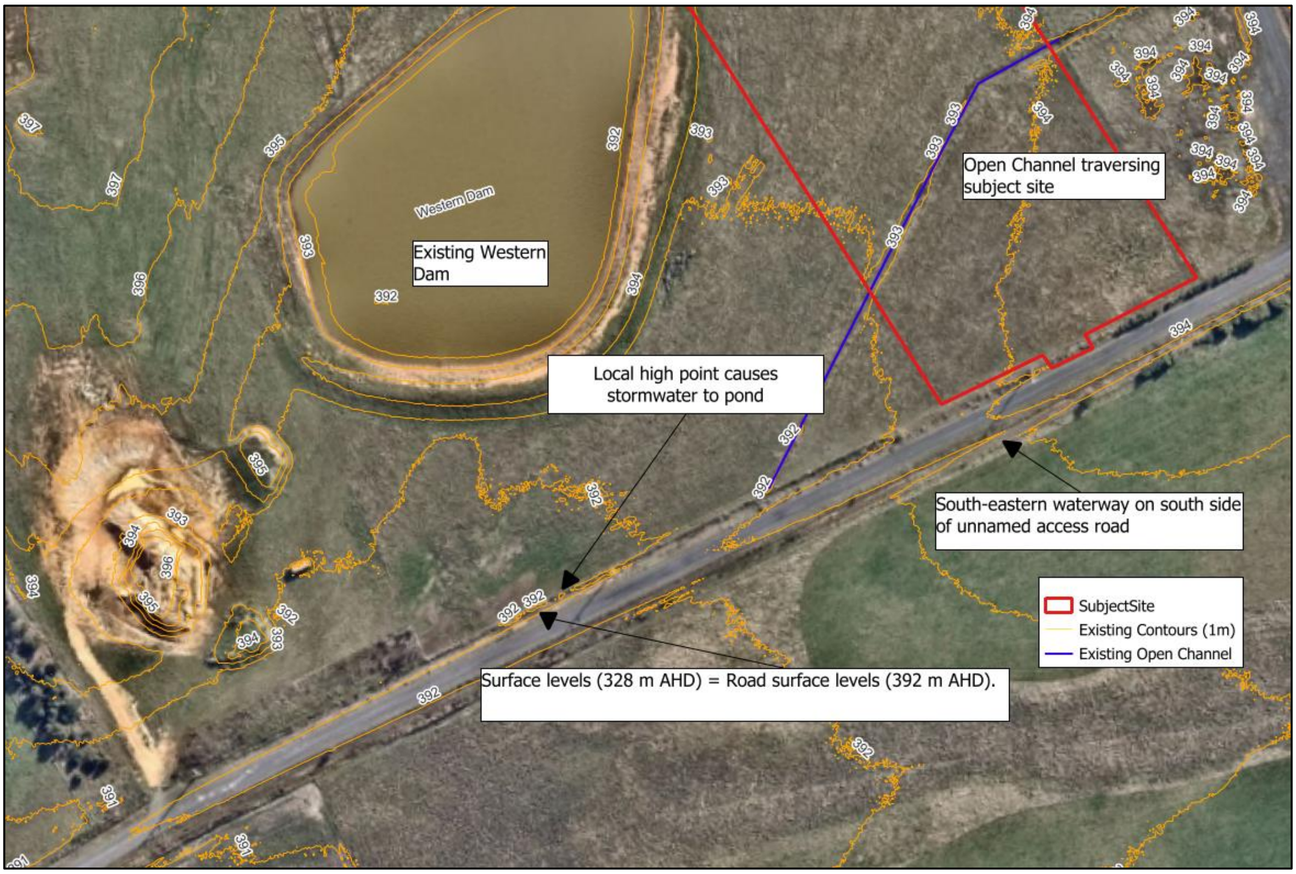

Figure 5: Local high point restricts downstream drainage

2.3 Existing Eastern Dam and South-Eastern Outlet

A large dam exists to the east of the subject site. Based on contours data, this dam appears to have a catchment that would, without the dam, discharge through the subject site. The catchment draining to the Eastern Dam is shown in Figure 8.

Analysis of aerial imagery, confirmed with a July 2023 site visit, indicate that a dedicated overflow exists for the eastern dam. When the dam reaches capacity, it discharges to a dedicated open channel south-east and external to the subject site, as shown in Figure 6. The south-eastern open channel crosses the unnamed access road via a box culvert and outlets to a roadside open channel which flows west on the south side of the unnamed road. This is detailed in Figure 6.

The overflows from the eastern dam are directed to the south. This is confirmed with historic aerial imagery and the July 2023 site visit. Flows from the eastern dam do not flow into the open channel that traverses the subject site. A layout plan showing existing features of the eastern dam is included as Figure 6. The preliminary hydraulic modelling results in Section 5 further support this.

Figure 6: Existing Layout Plan of eastern dam and open channels

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2.4 Existing Western Dam

To the west of the subject site, a large farm dam with a surface area of approximately 1 ha exists. In this report, the dam is referred to as the western dam. The dam is currently used for watering stock and has no formal outlet.

Based on the survey, contour information, historic aerial imagery, and a site visit undertaken July 2023, the catchment draining to the western dam has been defined. Figure 7 shows the catchment area of approximately 6.0 ha that drains to the western dam in the existing condition. Note that the catchment area has been updated based on improved contour information and it is different than the catchment presented in Revision D of the SWMS. Approximately 0.5 ha of the existing Western Dam catchment, 8% of the total area draining to the dam, drains through the subject site. Of that area, 0.4 ha are part of the subject site, and the additional 0.1 ha drains into the subject site from the north before entering the western dam.

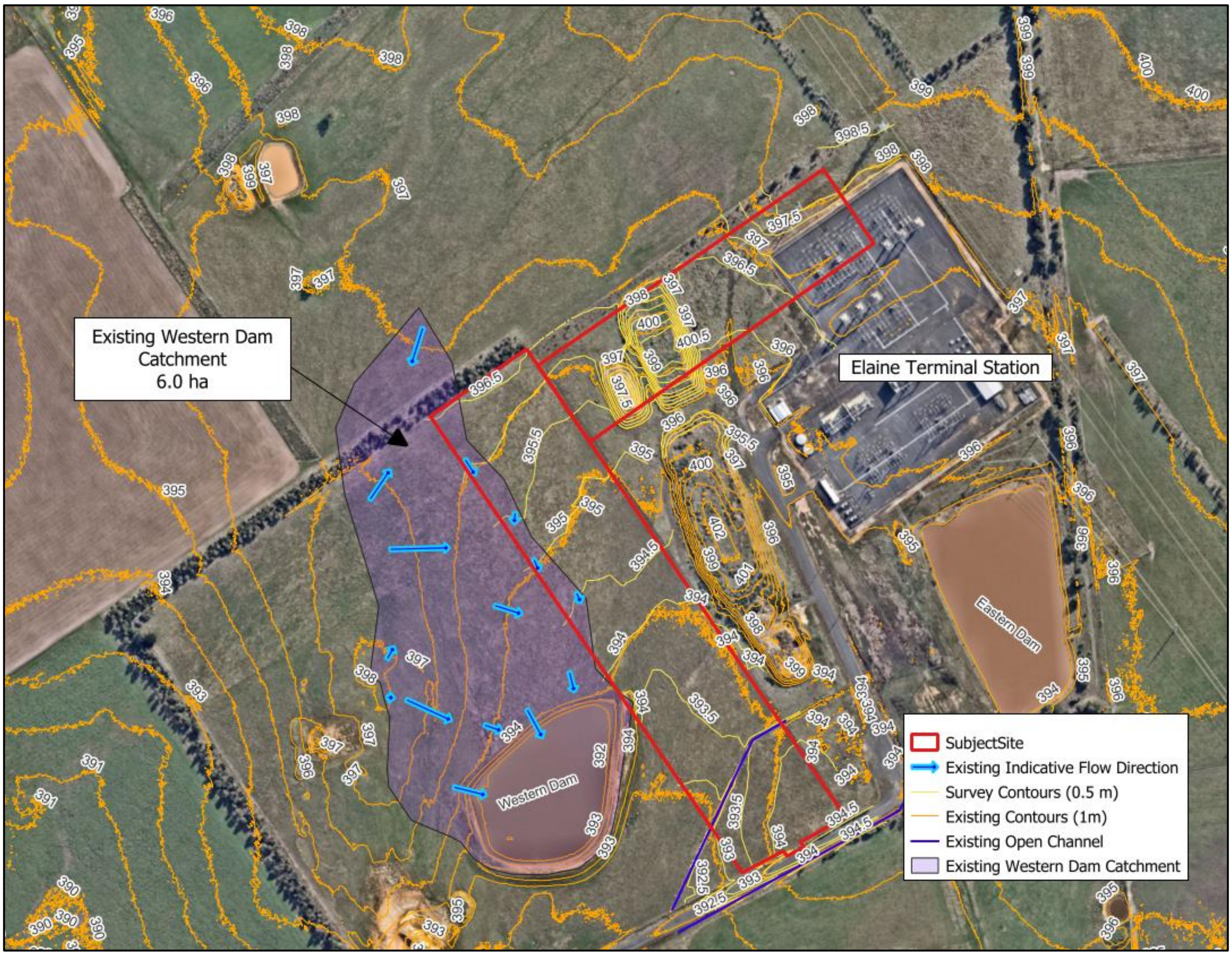

Figure 7: Catchment draining to the western dam in the existing condition

2.5 External Catchments

Owing to the flat grades at the subject site and within the surrounding area, the subject site is not isolated from external catchments. Stormwater from external catchments to the east drain through the subject site in the existing condition. Stormwater from external catchments and the subject site enters the western dam, as detailed in Section 2.4.

Figure 8 shows the external catchments in the vicinity of the subject site. Not all catchments drain through the subject site.

- Approximately 7.2 ha drains to the eastern dam without entering the subject site. The dedicated overflow from the eastern dam directs any overflow to the south and west, bypassing the subject site. Note that this catchment area has changed from Revision D of the SWMS.
- Approximately 90.2 ha drains, via the Elaine Terminal Station and the existing culvert across the access road detailed in Section 2.3, to the south-east, bypassing the subject site. Note that this catchment area has changed from Revision D of the SWMS.
- Approximately 17.5 ha drains through the subject site from the north-east. This area forms the existing catchment of the existing open drain. Most of the subject site is included in this catchment. Note that this catchment area has changed from Revision D of the SWMS.
- Approximately 6.0 ha drains to the western dam as discussed in Section 2.4. Note that this catchment area has changed from Revision D of the SWMS.

Figure 8 shows all external catchments based on survey and available contours. Owing to the size of the external catchments, a zoomed-in image focused on the subject site is included as Figure 9. In the existing condition, most of the subject site is part of the open drain catchment, and 0.4 ha of the subject site is part of the western dam catchment, as shown in Figure 9 and Section 2.4.

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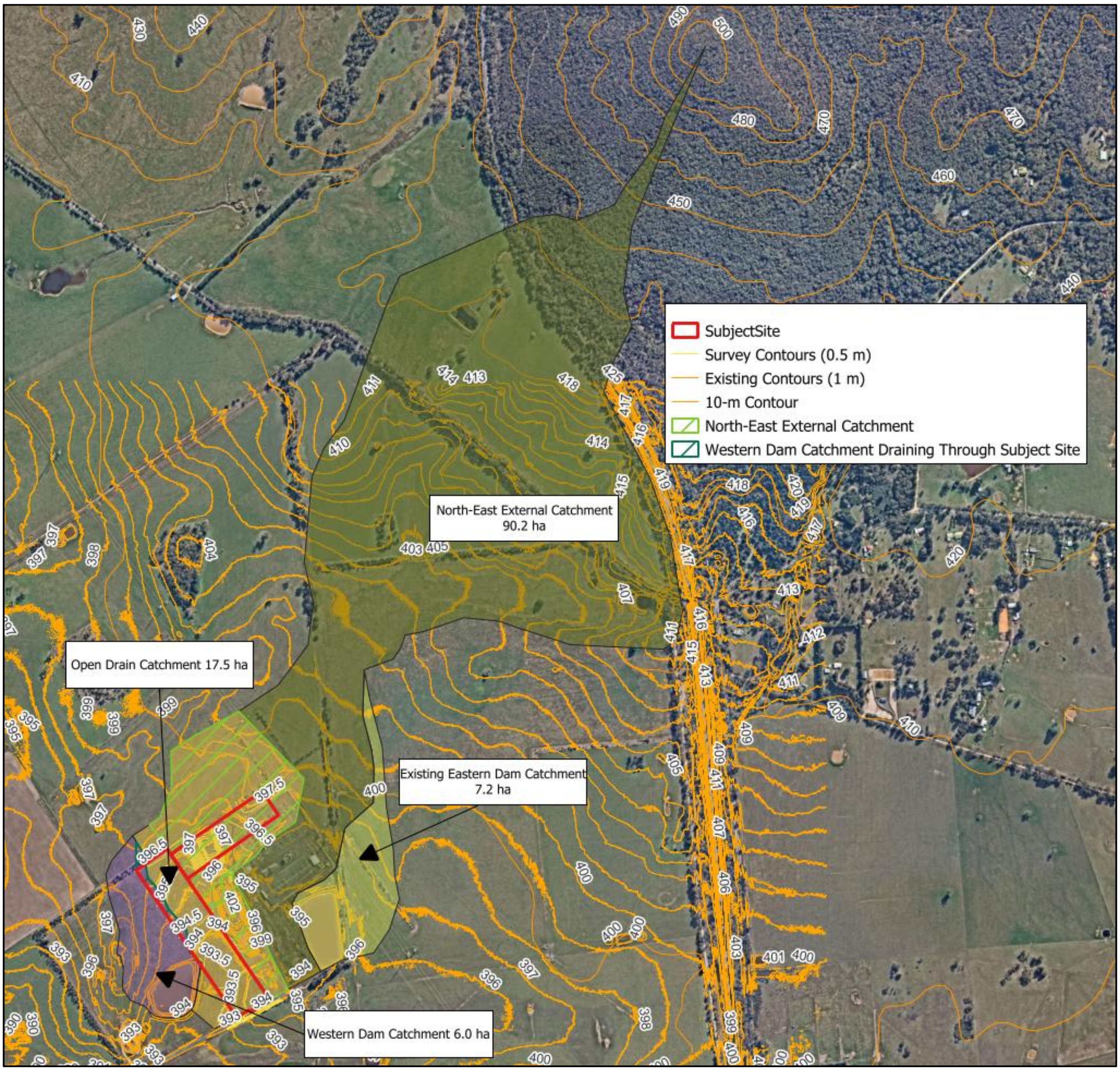

Figure 8: External Catchment Plan—Overview

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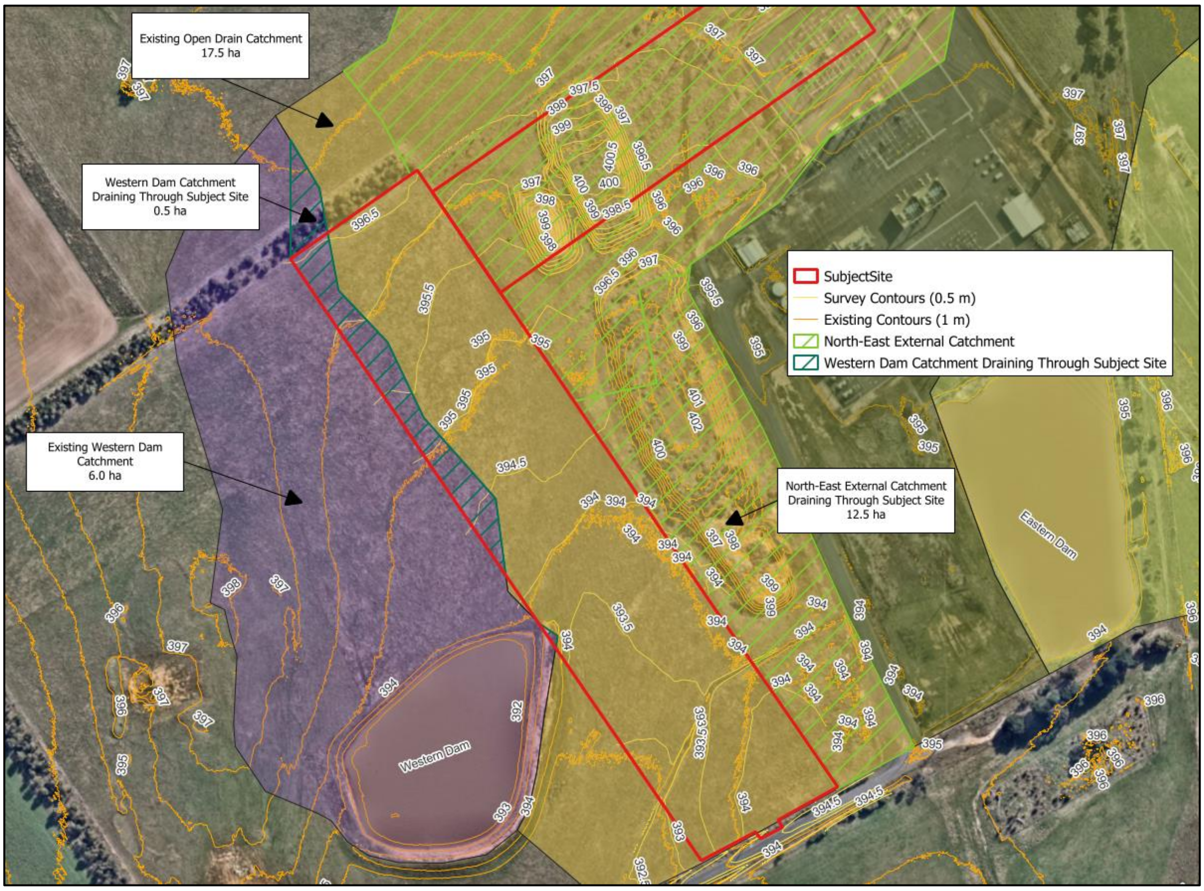

Figure 9: External Catchments--Detail

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3. Proposed Project

The proposed project layout plan is shown in Figure 10. A full-size plan is included as Appendix D. As shown in Figure 10, 4.1 ha of the subject site will be developed as a BESS facility. In addition to the BESS units, the facility includes an electrical substation at the north-west of the subject site. An access road and operations and maintenance building, including carparking, will be located at the south-east.

It is proposed that the subject site be regraded to slope down to the west. Grading the site allows external stormwater to be managed at the east of the subject site and internal stormwater to be managed at the west of the subject site. Separating the site's stormwater from external stormwater has potential environmental benefits, as discussed in Section 4.4.

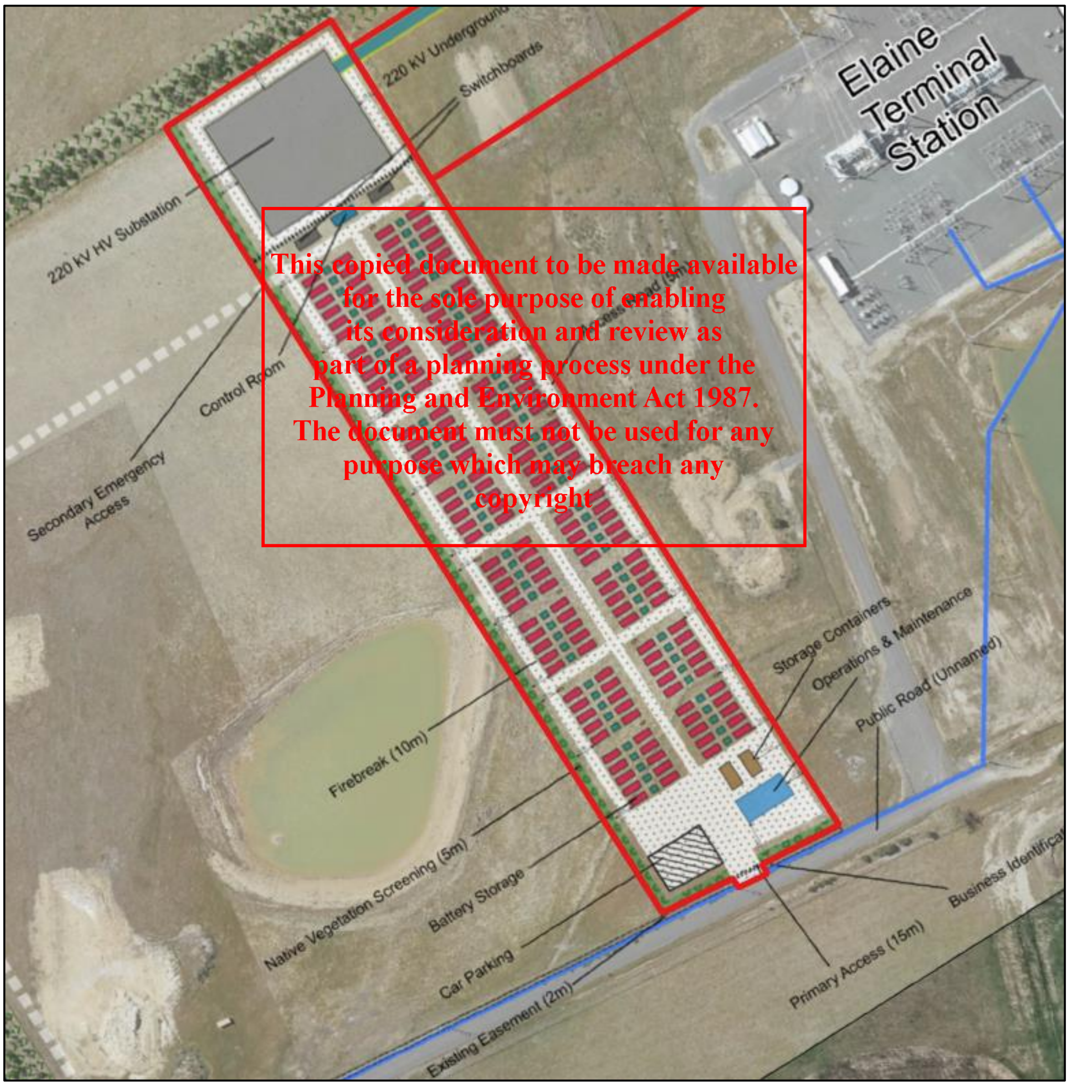

Figure 10: Proposed Project Layout Plan

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4. Stormwater Management

Stormwater can be effectively managed at the subject site in the proposed condition. Management of stormwater can both protect the project from major flows while causing minimal changes to existing flow regimes. Opportunities exist for integrated water management, in this case, stormwater quality treatment as part of stormwater management.

As shown in Figure 11, the existing open channel within the subject site will be filled to allow for development of the subject site. An alternative flow path for external flows will be provided by a new dedicated overland flow path along the eastern boundary of the subject site. Flows from the east of the site will be collected in a conveyance swale at the south of the subject site.

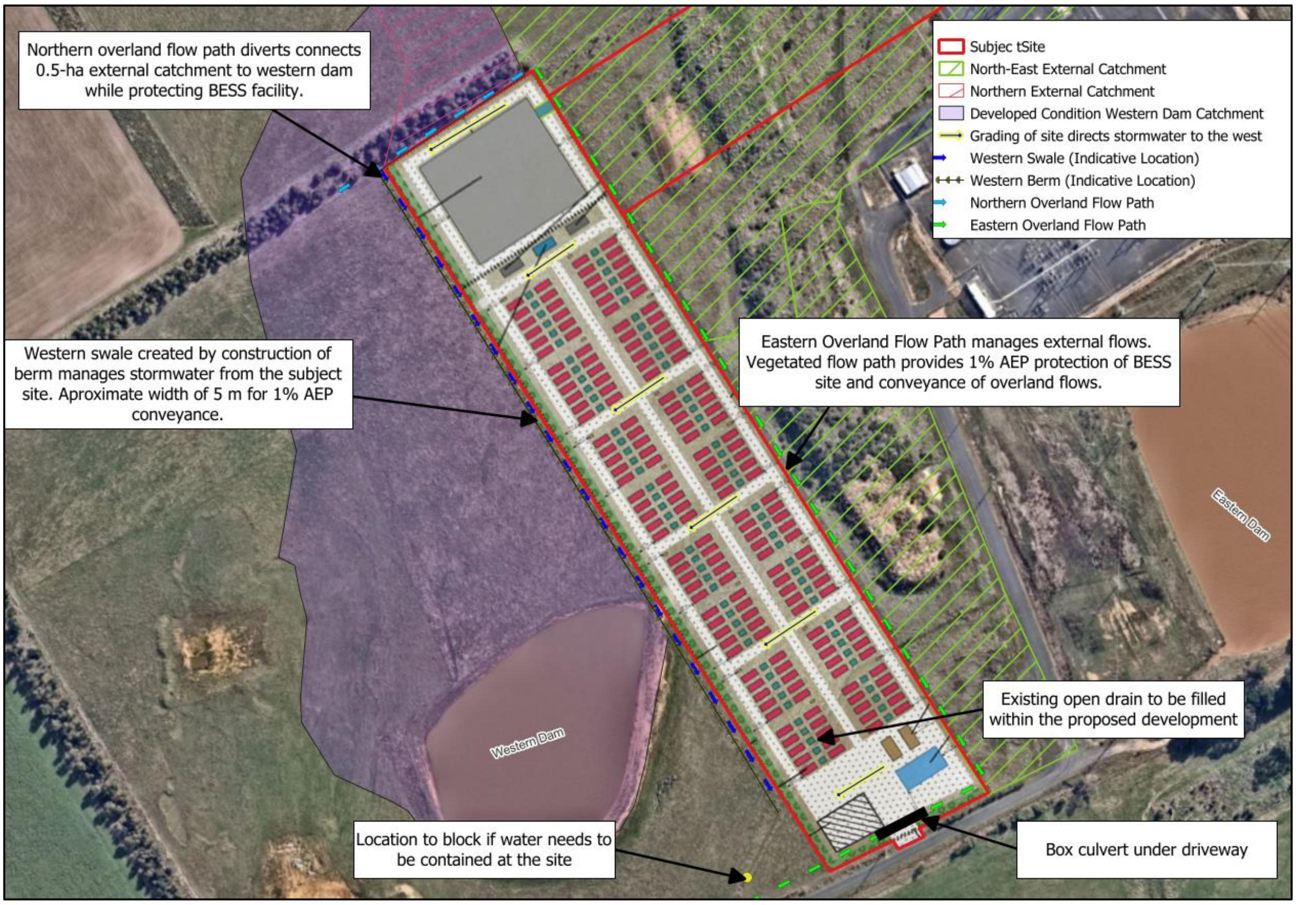

Figure 11: Proposed Stormwater Management Strategy Layout Plan

4.1 Subject Site Stormwater Management

As discussed in Section 3, the subject site will be graded to slope to the west. As shown in Figure 11, a vegetated swale, created by the filling of the subject site and construction of a berm within the adjacent property, can be located within or adjacent to the proposed fire break at the west of the subject site. The western swale will be sized to convey stormwater runoff up to and including the 1% AEP stormwater generated by the subject site. Rational Method computations have been used to calculate proposed flows and to inform sizing of the western swale. Peak flows from the developed subject site are shown in Table 1. Table 1 also includes existing peak flows for comparison purposes. Complete peak flow calculations are included in Appendix E.

PC-Convey modelling has been undertaken to indicatively size the conveyance swale. The modelling results are included in Appendix F. A swale with the properties detailed in Table 2 will sufficiently convey the post-developed 1% AEP flows from the subject site. The swale dimensions and construction methodology will be finalised during detailed design to ensure adequate freeboard is provided to the BESS.

Table 1: Peak flows at the subject site

Location	Upstream Catchment Area (ha)	Proposed 1% AEP Flow (m^3/s)	Existing 1% AEP Flow (m^3/s)
South-west of subject site	4.1	0.95	0.22

Table 2: Conveyance swale properties

Attribute	Value	Unit
Base width	2	m
Depth	0.5	m
Batters	1 in 3	n/a
Longitudinal Slope	1 in 200	m/m
TOTAL WIDTH	5	m
DEPTH OF FLOW	0.4	m

The maximum depth of water in the western swale in the 1% AEP must be below the finished surface level of the adjacent road and the concrete supports for the BESS units at the subject site to ensure that stormwater drains appropriately. A conceptual site cross-section is shown in Figure 12.

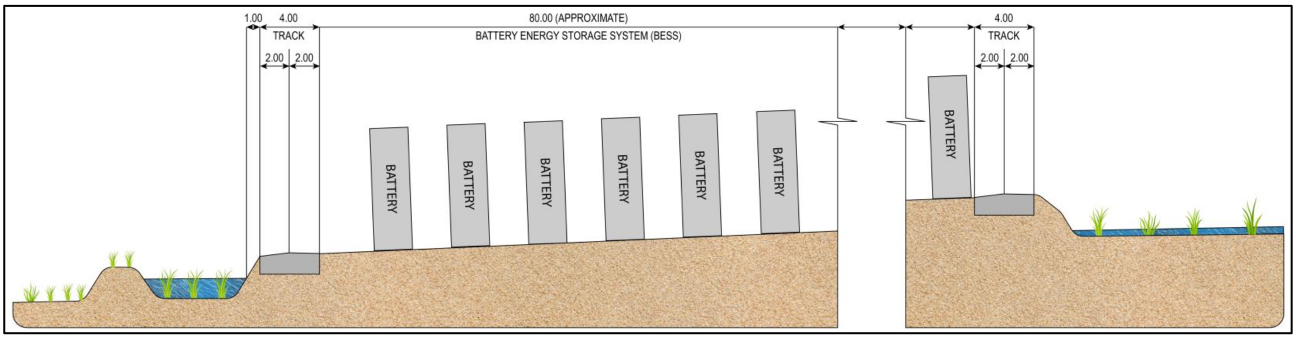

Figure 12: Conceptual cross-section

4.2 External Stormwater Management

As discussed in Section 3, the subject site will be graded to slope to the west. During the re-grading of the site, fill will be placed to raise the subject site above the existing surface. Raising the surface will ensure that no external flow enters the subject site.

Based on preliminary hydraulic modelling detailed in Section 5, raising the subject site with an appropriate batter to existing surface allows for overland flow to be safely directed around the subject site. At the south of the subject site, along the unnamed access road, an appropriately sized swale with a culvert crossing for site access will ensure that external flows are appropriately directed downstream of the subject site.

4.2.1 Eastern Overland Flow Path and Southern Swale

The eastern overland flow path will be located at the eastern boundary of the subject site. Preliminary hydraulic modelling detailed in Section 5 indicates that the overland flow path created by filling the site has minimal impact on 1% AEP flood levels in the property to the east of the subject site. Adopting an overland flow path at the east of the site has a benefit of simplifying a potential underground connection to the Elaine Terminal station.

At the south of the subject site, as shown in Figure 11, the vegetated overland flow path, constructed during the re-grading of the subject site, can become a vegetated swale, formed by the higher level of the unnamed access road and the regraded subject site. The exact configuration of the swale will be finalised during detailed design.

The maximum depth of water in the eastern overland flow path and the southern swale in the 1% AEP must be set below the finished surface level of the adjacent road and the concrete supports for the BESS units at the subject site to ensure that stormwater drains appropriately.

At the driveway access across the southern swale, preliminary calculations indicate that a box culvert with the dimensions 1.65 m (W) x 0.45 m (H) will be sufficient to convey the 1% AEP external catchment flows. It should be noted that the culvert will need to be constructed of non-conductive materials. Confirmation, and potentially refinement, of the culvert sizing will be undertaken during detailed design.

The eastern overland flow path will connect to the existing open drain west of the subject site. The eastern overland flow path manages 1% AEP stormwater generated by external catchments that drain to the subject site. Any portion of the overland flow path within the firebreak will be vegetated with grass that is regularly mown to ensure it functions as part of the firebreak.

4.2.2 Northern Overland Flow Path

As shown in Figure 11, raising the subject site will also create an overland flow path along the northern boundary of the subject site. The northern overland flow path will direct external flows around the subject site to the Western Dam. The northern external catchment is approximately 0.5-ha of rural land. The functionality of the northern overland flow path is included in the preliminary hydraulic modelling detailed in Section 5.

4.2.3 Flow Path Sizing

The overland flow paths have been assessed in a variety of ways. In previous revisions of the SWMS, Rational Method computations were used to calculate peak flows for swale sizing. The performance of the overland flow paths proposed to manage external flows have been confirmed with preliminary hydraulic modelling, as discussed in Section 5.

Detailed hydraulic modelling should be undertaken during detailed design to appropriately set the levels of the finished surface and confirm the preliminary results that show no substantial changes in flood levels in the adjacent property to the east of the subject site.

Peak flows calculated using the Rational Method from the external catchments in the developed condition are shown in Table 3. Complete peak flow calculations are included in Appendix E.

Table 3: External Catchment Inflows to Subject Site

Location	Upstream Catchment Area (ha)	Rational Method 1% AEP Flow (m^3/s)
Northern Inflow Location	0.5	0.04
North-Eastern Inflow Location	10.4	0.69
South-Eastern Inflow Location	2.1	0.15
TOTAL REQUIRED CAPACITY		0.74

4.3 On-Site Detention

On-site detention (OSD) is not currently proposed at the subject site. Clause 53.18 of the Victorian Planning Provisions, which sets the stormwater management objectives for new developments, indicates that the Clause does not apply for a utility installation. Since the proposed development is a utility installation, OSD will not be required.

The planned swale at the western boundary of the subject site does provide an opportunity for providing OSD. The swale can be widened to provide additional detention storage volume in addition to the conveyance for which it is sized. However, any use of the swale for OSD should be modelled during detailed design to ensure that peak water levels remain below the finished level of the access road and BESS.

4.4 Stormwater Quality Treatment

Stormwater quality treatment to achieve Best Practice Environmental Management Guidelines (BPEMG) standards is not applicable to the proposal, since the proposed development is a utility installation (refer to Section 4.3).

Nevertheless, the proposed stormwater management at the subject site provides an opportunity to integrate stormwater quality treatment into the engineering of the site at minimal additional cost. Vegetated swales provide stormwater quality treatment. The western swale, the swale that will collect stormwater from the subject site, will be vegetated and will provide stormwater quality treatment.

MUSIC modelling was undertaken to define the amount of treatment provided by the western swale. The 2022 Melbourne Water rainfall template for Melbourne Regional (1952-1961) was used due to its proximity to the project location (the western extent of this template extends to Mt. Wallace which is approximately 17 kilometres east of the subject site.) The MUSIC model schematic is shown in Appendix G. During detailed design, the exact treatment performance of the proposed swale can be assessed in additional detail. Stormwater quality treatment results are shown in Table 4.

Table 4: Stormwater Quality Treatment at the subject site

Pollutant	BPEM Target reduction %	Subject Site reduction %
Total Suspended Solids (TSS)	80%	89.4 %
Total Phosphorus (TP)	45%	64.5 %
Total Nitrogen (TN)	45%	33 %

The stormwater quality results are good for what is essentially a flow-on-effect of the proposed conveyance swale. Should additional end-of-line treatment be desired, the western swale collects all stormwater runoff from the subject site, and the runoff can receive additional treatment.

4.5 Water Quality Location

As shown in Figure 11, the subject site will be graded to fall to the west. The western swale will collect all runoff from the subject site. As all runoff from the subject site is collected in the western swale and isolated from external flows, the water quality from the subject site can be managed. Blocking the western swale at the location shown in Figure 11 will allow for stormwater from the subject site to be disconnected from the surrounding hydrological system.

An opportunity exists to provide an amount of water quality detention storage at the south-east of the subject site, before flows from the subject site join external flows in the existing informal waterway. Provision of water quality detention storage is not currently part of the development proposal.

4.6 Infiltration and Groundwater

The majority of the proposed BESS site is proposed to be crushed rock. A crushed rock surface allows continued permeability of the subject site. In addition, the proposed use of open swales for conveyance of stormwater both internal and external promotes infiltration and minimises impacts of the development on existing groundwater conditions.

If a detailed assessment of existing and proposed groundwater conditions is required, or if monitoring needs to be undertaken, a geotechnical professional should be engaged.

4.7 Catchment to the Western Dam

The proposed project will impact the catchment draining to the existing western dam. As shown in Figure 9, approximately 0.5 ha of the western dam catchment is part of the subject site. During development, the subject site will be re-graded, and the catchment draining to the western dam will change. However, the total catchment area will remain nearly the same size as in the existing condition. Figure 13 and Figure 14 show the detail of the change to the Western Dam Catchment.

In the existing condition, 0.5 ha of the 6.0-ha western dam catchment drain through the subject site. Of that area, 0.1 ha is external to the subject site, and 0.4 ha are contained within the subject site.

Development of the subject site will remove the 0.4 ha, part of the subject site, from the western dam catchment. However, the northern overland flow path will connect the external western dam catchment area to the dam. In addition, the northern overland flow path will connect approximately 0.4 ha of land that formerly was part of the open drain catchment to the western dam. The total catchment area remains effectively the same following development.

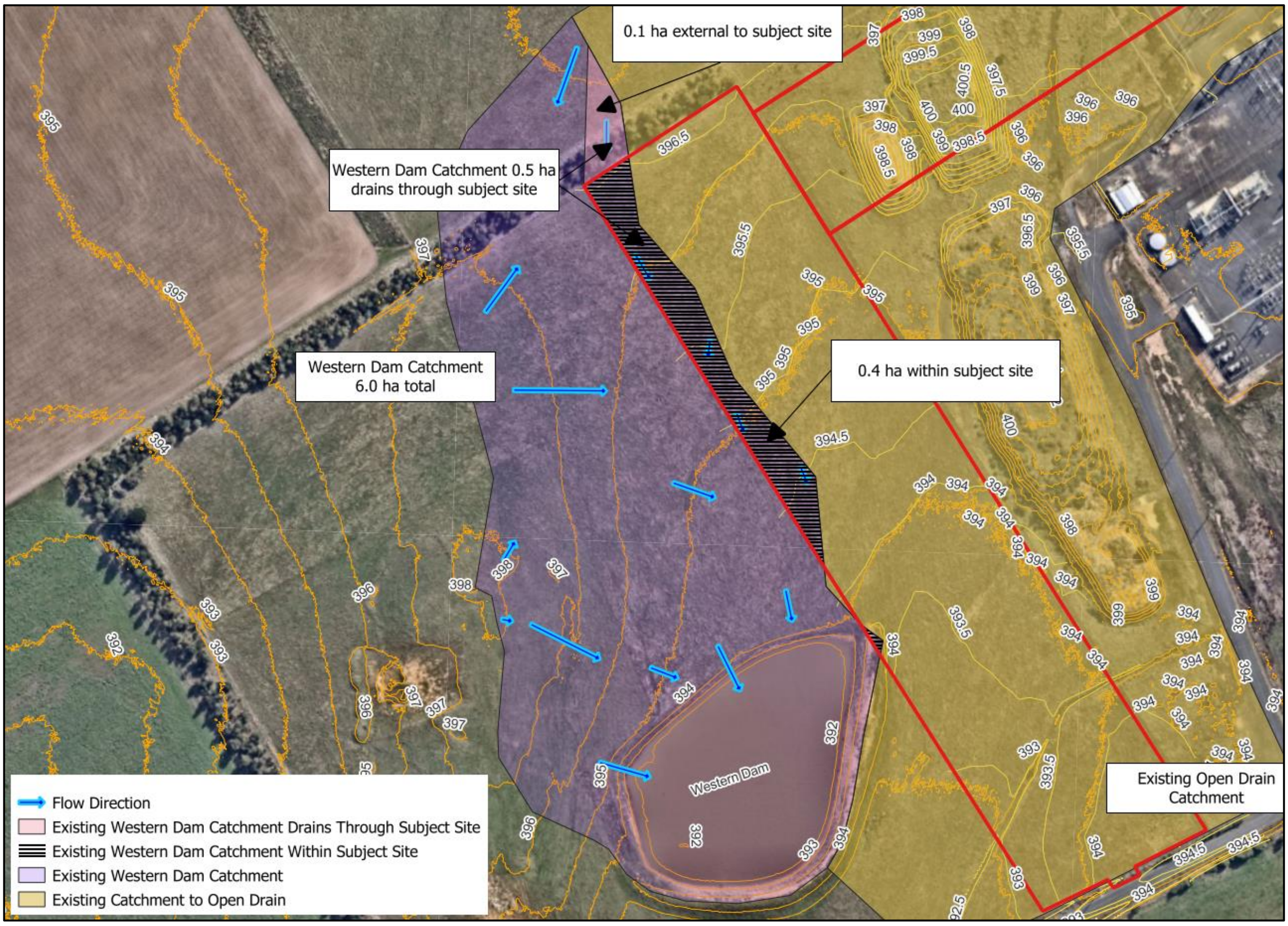

Figure 13: Existing Western Dam Catchment (detail)

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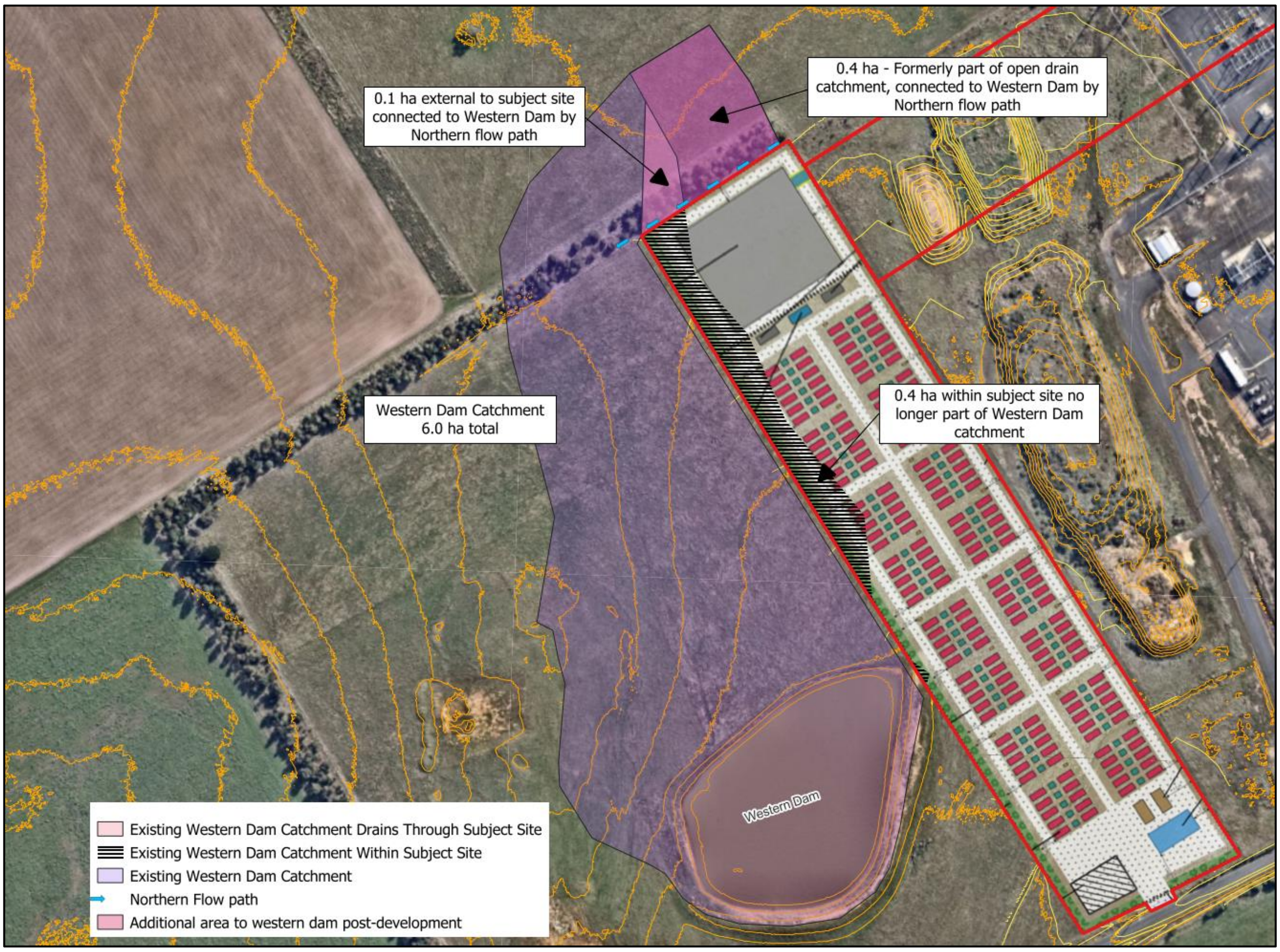


Figure 14: Post-Developed western dam catchment (detail)

4.8 Earthworks Adjacent to the Western Dam

The proposed project involves filling the subject site. As the subject site is immediately adjacent to the western dam, earthworks will occur in the vicinity of the dam. At the edge of the dam, in the location detailed in Figure 15, earthworks will occur on the cut edge, and potentially within the storage area of the dam.

The concept for the development proposal aims to minimise earthworks adjacent to the dam. The western swale will be constructed using a berm, with all fill to be vegetated to minimise erosion whilst providing stormwater quality treatment. The extent of earthworks adjacent to the dam will be finalised during detailed design.

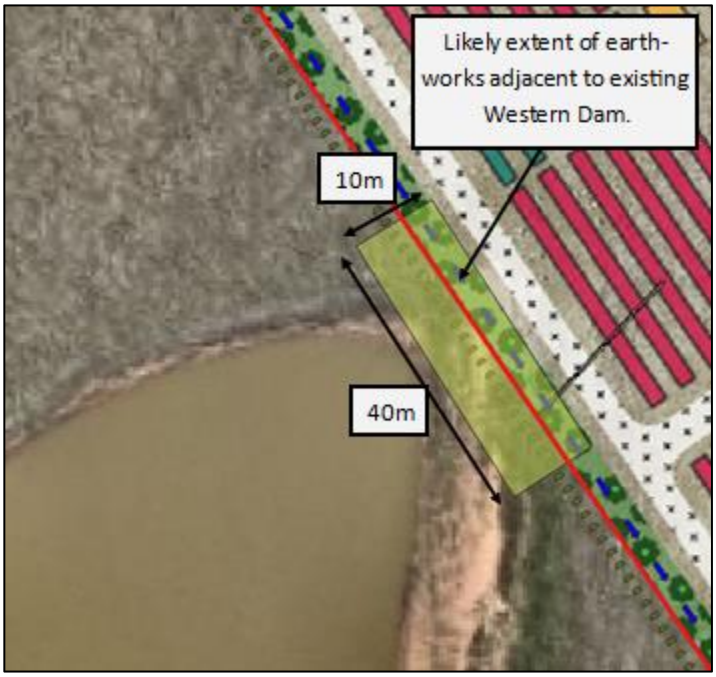


Figure 15: Indicative extent of earthworks adjacent to Western Dam

5. Preliminary Hydraulic Modelling

5.1 Initial investigations

As discussed in Section 2.2, historic aerial imagery, confirmed with a site visit, indicated ponded water where the existing open channel through the subject site meets the unnamed access road. This is likely due to the absence of an outlet structure for the open channel. The road levels are raised relative to the surrounding land and act as a flow barrier, which causes water to pond within the channel.

As part of this SWMS, the lack of an outlet for the channel was investigated to see if it results in water ponding at the subject site during a major rainfall event such as the 1% AEP.

5.2 HEC-RAS 2D modelling

The preliminary hydraulic modelling was undertaken using rain-on-grid modelling. Most of the external catchment terrain data is available as 10-m contours, and the results should be considered preliminary with detailed hydraulic modelling to be undertaken during detailed design.

Precipitation data was obtained from the Bureau of Meteorology, with loss data incorporated from the Australian Rainfall and Runoff Data Hub. Pre-burst was applied to the catchment prior to the rainfall bust being directly applied in HEC-RAS 2D.

To minimise the impact of potential errors in external catchment definition, a large area was simulated to ensure that all precipitation flows that could reach the site were accounted for. It was noted during the modelling that the available terrain information, especially the 10-m contour data upstream of the subject site is rough. This results in surface anomalies that are apparent as ‘flat’ areas in the digital elevation model (DEM) and in some cases result in unusual, and potentially non-existent, ponding in the model results. The existing condition DEM in the vicinity of the subject site, showing irregularities is included as Figure 16.

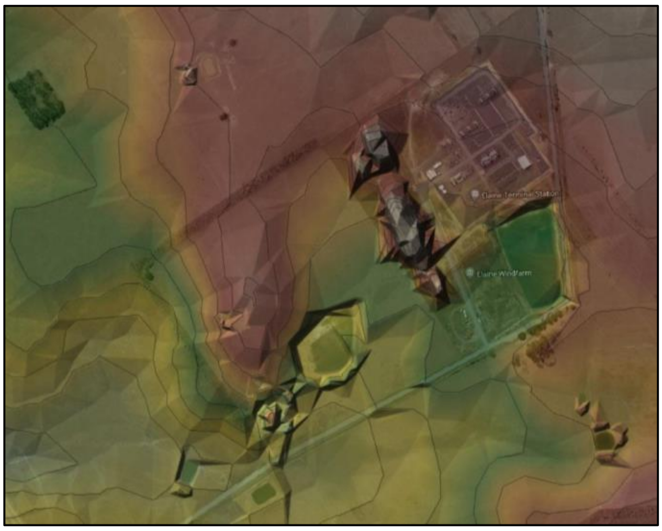


Figure 16: Existing Condition DEM showing contour anomalies in the vicinity of the subject site

5.2.1 Preliminary Existing Condition Modelling

Existing condition preliminary hydraulic modelling results are shown in Figure 17. Note that some ponding occurs at the subject site in the existing condition. Indicative flow direction arrows are shown in green for informative purposes.

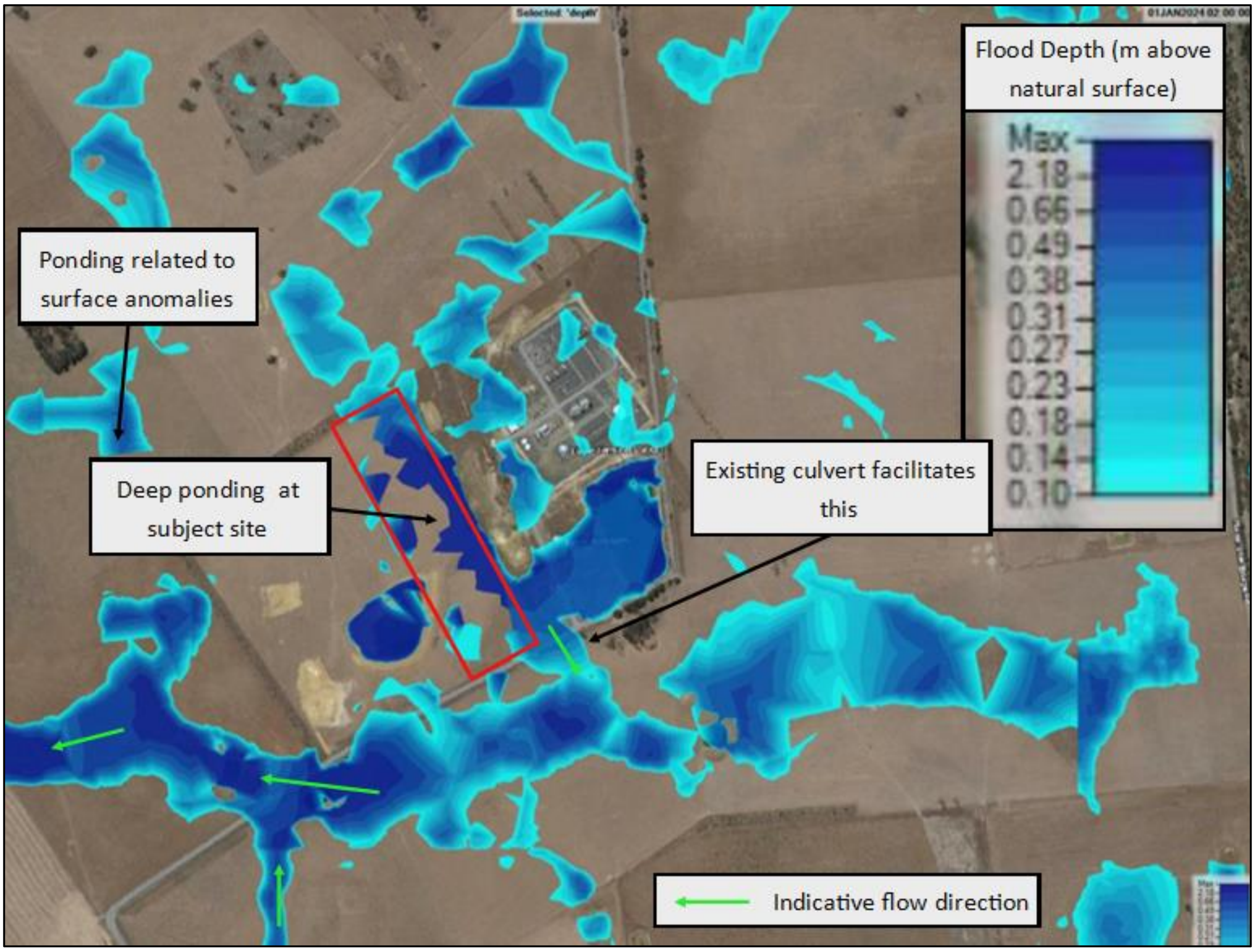


Figure 17: Existing Condition Preliminary Hydraulic Modelling Results

5.2.2 Preliminary Developed Condition Modelling

For the developed condition, the subject site was modelled as filled to 0.5-1.5 m above natural surface. The developed surface at the subject site, was based on the Elaine Bess Bench Plan (Sivcon, 20 Oct 2023). Modelling the developed surface reduced surface anomalies at the subject site, but it should be noted that the anomalies do exist elsewhere in the model. The developed condition preliminary hydraulic modelling results are shown in Figure 18.

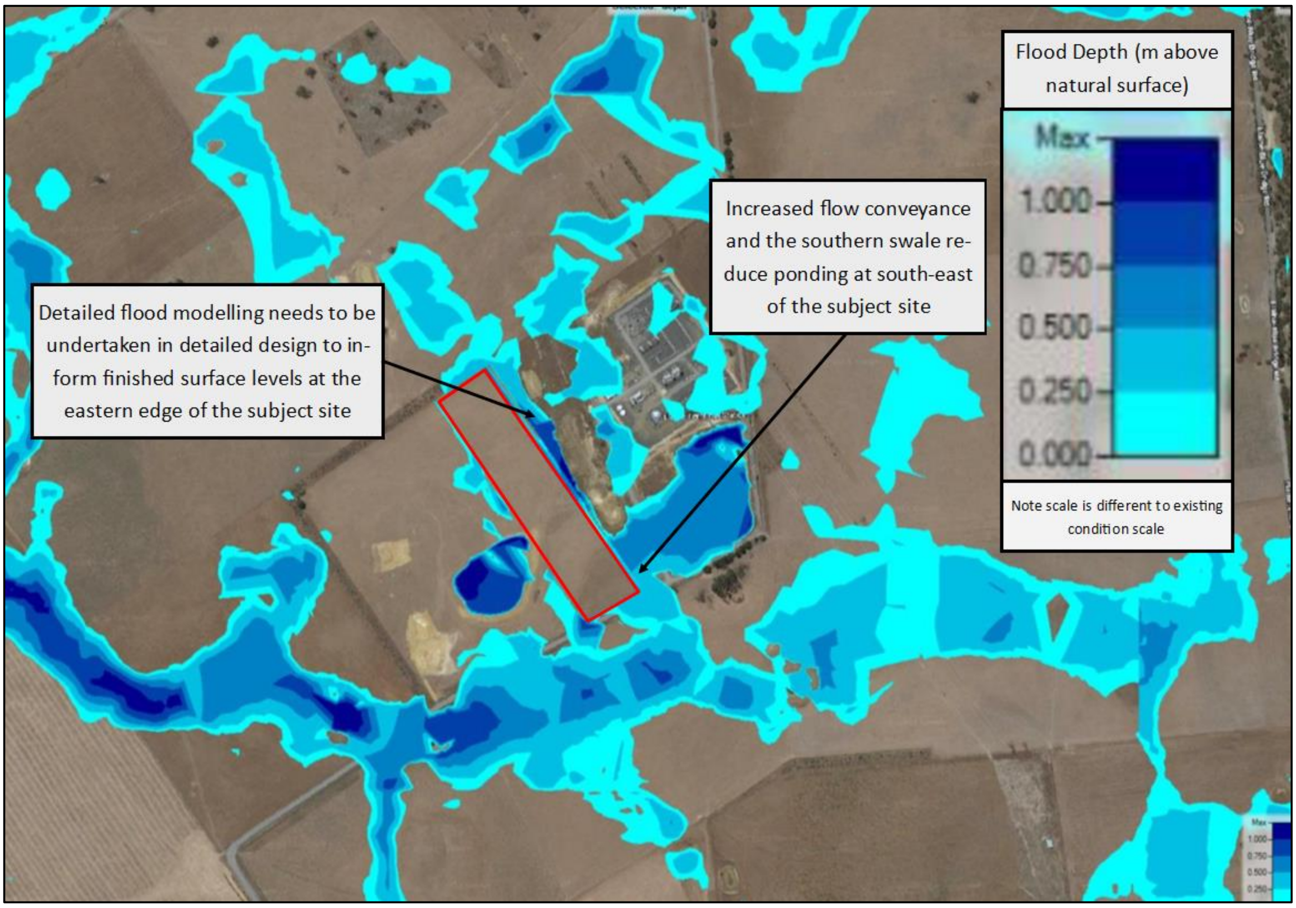


Figure 18: Preliminary Developed Condition Hydraulic Modelling Results

5.2.3 Potential Impact of Development

The preliminary 2D hydraulic modelling results show that filling the subject site to protect it from flooding and providing conveyance for external flows around the site results in a change to the flood conditions. The impact of the developed condition is shown in Figure 19. While the results are preliminary, it is clear that when development increases flood conveyance around the east of the subject site, flood levels are reduced to the east of the site, and increases in flood extent are seen downstream of the subject site.

Figure 19: Preliminary Flood Impact Assessment

5.2.4 Potential Mitigation Option

The preliminary modelling results indicate that there is a minor impact on downstream properties if the subject site is developed and stormwater is managed as discussed in the SWMS.

However, opportunities exist to mitigate downstream impacts while providing increased flood protection to the unnamed access road. The preliminary existing condition modelling results indicate that the unnamed access road is inundated in the 1% AEP event in the existing condition.

The preliminary modelling suggests that providing a viable flow path, by extending the existing open drain along the access road to the downstream waterway will likely mitigate the increased local ponding associated with the development of the subject site. There won't be additional ponding, because, potentially, the ponding can be avoided altogether.

This option must be confirmed with detailed flood modelling during detailed design to ensure that provision of a more efficient overland flow path does not negatively impact downstream properties.

It is suggested that discussions with the access road owner commence to discuss provision of a dedicated overland flow path along the road. If the road is owned privately, discussions with the adjacent landowners, emphasizing the benefits the drain will provide to them, should commence.

Conclusion

This report presents the SWMS for the proposed BESS project at 255 Elaine-Blue Bridge Road, Elaine. The proposed project (subject site) comprises approximately 6.0 hectares (ha). Of that area, approximately 4.1 ha is planned to become the BESS facility. The remainder of the site will remain undeveloped and be used as a transmission connection.

The SWMS has been prepared to address items in the Department of Transport and Planning's Request for Further Information (16 June 2023) and conditions of the issued planning permit. The stormwater management strategy demonstrates that stormwater can be managed appropriately by the project.

In the proposed condition, the subject site will be graded to slope down toward the west. Developed flows from the subject site will be conveyed by a swale with 1% annual exceedance probability (AEP) capacity. Stormwater from the proposed project will be directed to the existing discharge point in the informal waterway at the south-west of the subject site. Separating stormwater from the subject site provides the opportunity to provide stormwater quality treatment through the use of a vegetated swale.

External flows from the east and north will be conveyed by dedicated overland flow paths. Northern flows will be directed to the west and will enter the existing western dam. Eastern flows will be directed around the site, and a swale at the south of the site will connect the eastern flows to the existing open drain.

No change to water quality in the western dam in owing to a change in catchment size or upstream land use should occur as a result of the proposed development. The proposed grading of the subject site and methodology for managing internal and external stormwater has been developed to allow for stormwater quality treatment to be provided through green engineering methods.

The preliminary hydraulic investigation indicates that the subject site can be protected from 1% AEP external flows by raising the subject site. The preliminary hydraulic investigation also highlights the need for additional downstream works to provide an outlet via a continuation of the open drain.

This SWMS demonstrates that stormwater can be managed at the subject site as part of the proposed project. The SWMS has been developed to provide opportunities for stormwater quality treatment and minimise impacts on downstream properties. The vegetated swales proposed for stormwater management also provide an integrated water management benefit as they will provide stormwater quality treatment that otherwise would not be required.

During detailed design, it is recommended that detailed hydraulic modelling be undertaken to set finished levels and to ensure that drainage improvements have no adverse impact on neighbouring properties.

DALTON CONSULTING ENGINEERS

Appendices

ADVERTISED PLAN

Appendix A Feature and Level Survey

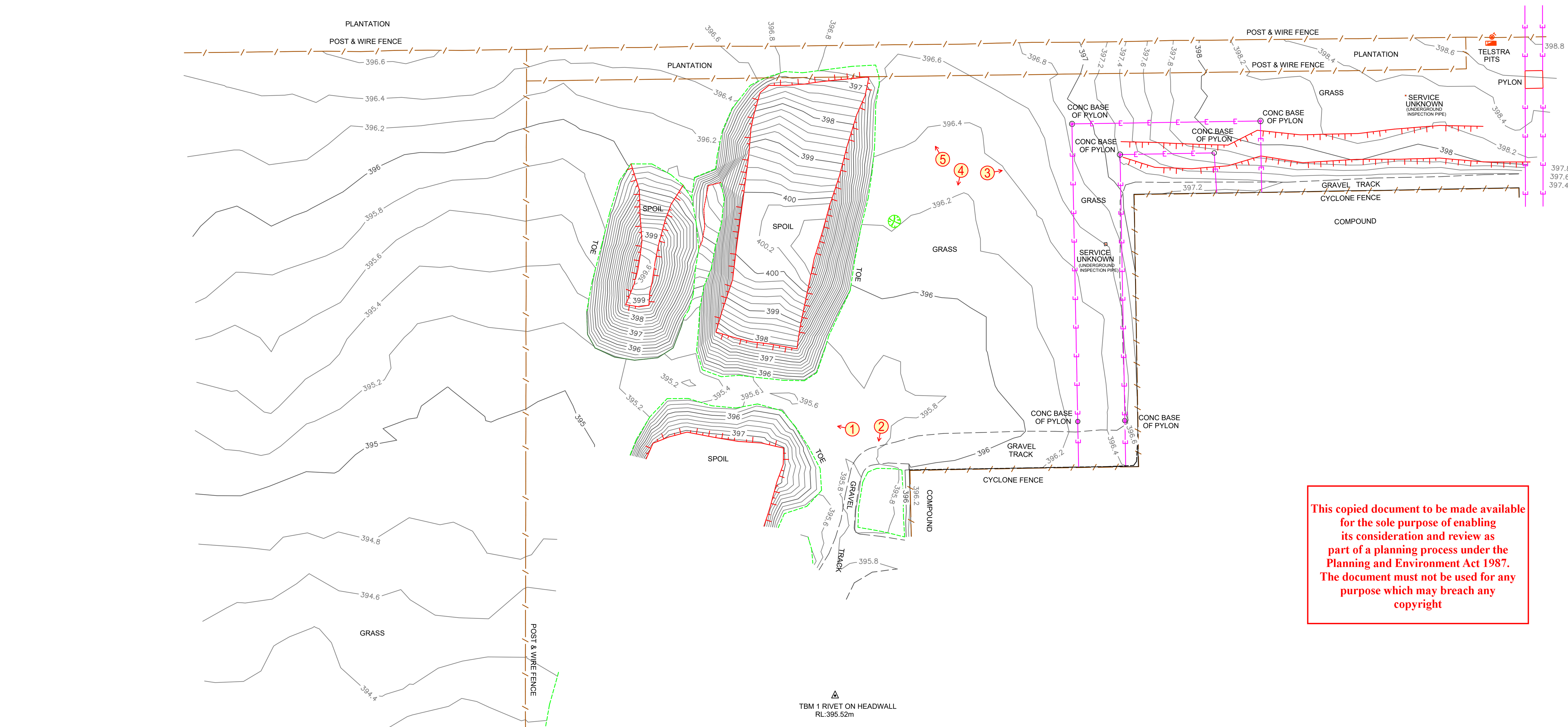
PHOTO.1

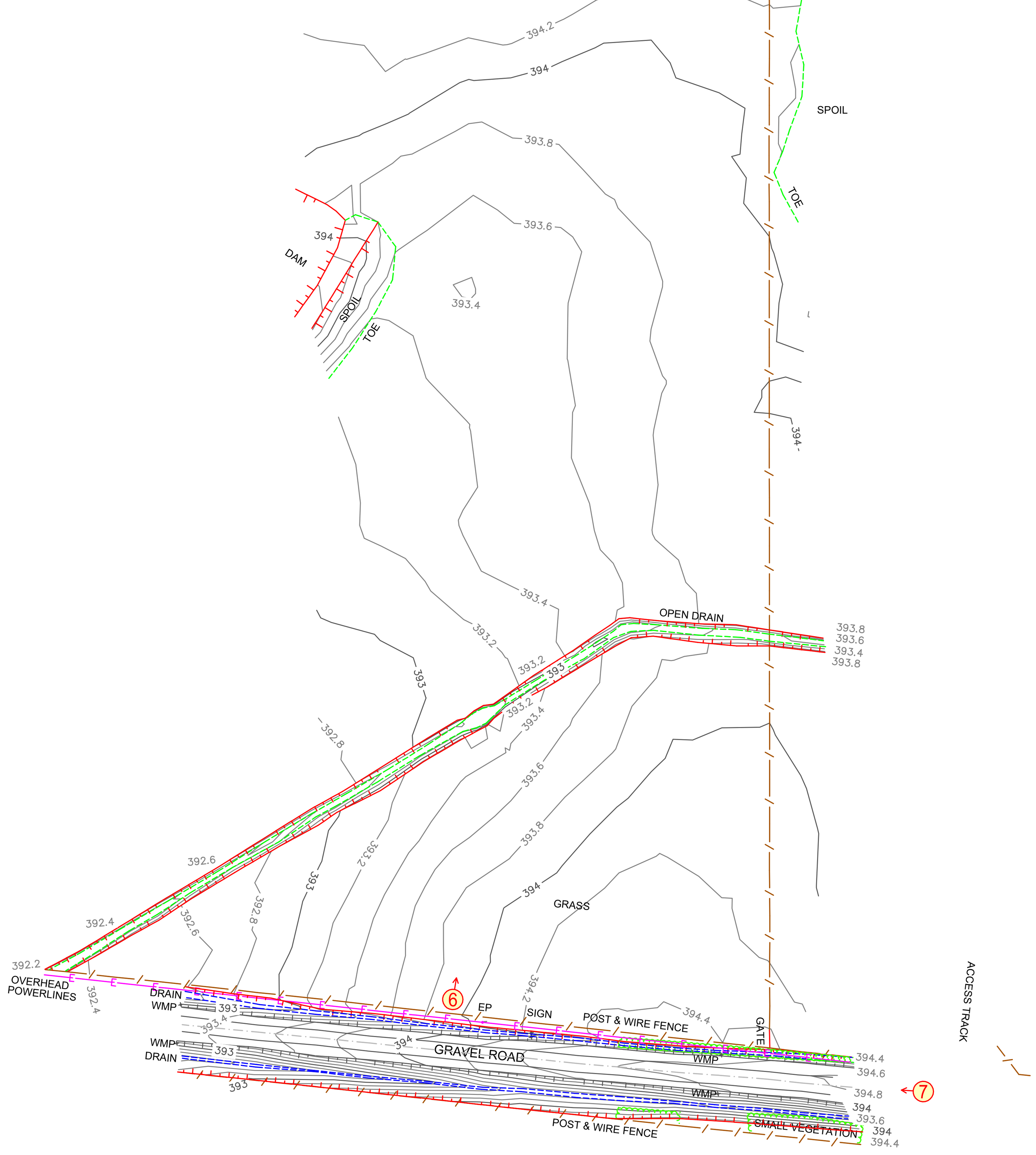
PHOTO.2

PHOTO.3

PHOTO.4

MGA2020 ZONE 55





ADVERTISED PLAN

PHOTO.5

PHOTO.6

PHOTO.7

LEGEND

WMP : WHITE MARKER POST
EP : ELECTRICITY POLE
: OVERHEAD ELECTRICITY LINE
3 PHOTO LOCATION/DIRECTION
× 2.35 Defines ground level unless specified.

NOTATIONS

Lengths shown are in metres.
Levels are to A.H.D. and position to M.G.A 2020 vide NARMBOOL PM 2 with registered RL : 407.966m.
TBM 1 has been used for localised MGA position. (CSF : 1.0003957)
Contour Interval is 0.20 metres.
Date of survey : 22/12/2022.
Refer to AutoCAD.dwg file for additional level & triangle mesh information.
No underground services have been located as part of this survey.
Features and Levels shown on this plan are for general design works only - any critical dimensions required should be requested independently of this plan. Prior to any demolition, excavation or construction on this site the relevant Authorities should be contacted to ascertain detailed locations of all existing services and the possible locations of future services.

DIAL BEFORE YOU DIG

SCALE	DATUM	DATE
1:1000@A1	MGA 2020 / AHD	25/01/2023
10 0 10 20 30 40 LENGTHS ARE IN METRES	SURVEYOR: EF COMPUTER FILES: 22086-FL	Version: 2
	JOB No: 22086	

Survey 4D PTY LTD
A.C.N. 604 861 323 A.B.N. 33 604 861 323
Phone: 0433 281 219
Email: survey@survey4d.net

TITLE: ELAINE BESS
LEVEL & FEATURE SURVEY

CLIENT: AKAYSHA ENERGY PTY LTD

Appendix B Existing Open Channel Capacity

PROJECT: UpstreamCrossSection
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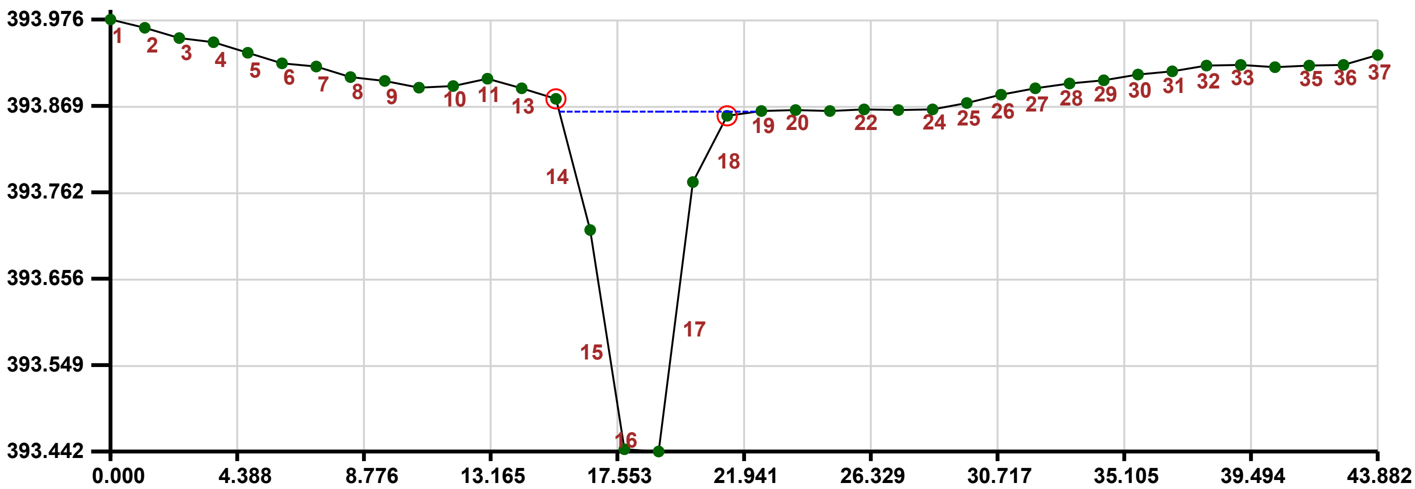
Print-out date: 11/07/2023 - Time: 11:14
Data File: UpstreamCrossSection.dat

1. CROSS-SECTION



2. DISCHARGE INFORMATION

1% AEP storm event
Design discharge after construction of retarding basin

Required overland / channel / watercourse discharge = 1 cumec

3. RESULTS Water surface elevation = 393.862 m

High Flow Channel grade = 1 in 120, Main Channel / Low Flow Channel grade = 1 in 120.

	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.000	0.825	0.000	0.826
D(Max) = Max. Depth (m):	0.000	0.420	0.005	0.420
D(Ave) = Ave. Depth (m):	0.000	0.217	0.003	0.217
V = Ave. Velocity (m/s):	0.000	0.653	0.034	0.652
D(Max) x V (cumecs/m):	0.000	0.274	0.000	0.274
D(Ave) x V (cumecs/m):	0.000	0.142	0.000	0.142
Froude Number:	0.000	0.447	0.215	0.437
Area (m^2):	0.000	1.263	0.002	1.266
Wetted Perimeter (m):	0.000	5.902	0.989	6.891
Flow Width (m):	0.000	5.813	0.989	6.802
Hydraulic Radius (m):	0.000	0.214	0.003	0.184
Composite Manning's n:	0.000	0.050	0.050	0.050
Split Flow?	-	-	-	No

4. CROSS-SECTION DATA

	LEFT HAND POINT		RIGHT HAND POINT		
SEGMENT NO.	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	MANNING'S N
1	0.000	393.976	1.186	393.966	0.050
2	1.186	393.966	2.372	393.953	0.050
3	2.372	393.953	3.558	393.948	0.050
4	3.558	393.948	4.744	393.935	0.050
5	4.744	393.935	5.930	393.922	0.050
6	5.930	393.922	7.116	393.918	0.050
7	7.116	393.918	8.302	393.905	0.050
8	8.302	393.905	9.488	393.900	0.050
9	9.488	393.900	10.674	393.892	0.050
10	10.674	393.892	11.860	393.894	0.050
11	11.860	393.894	13.046	393.903	0.050
12	13.046	393.903	14.232	393.891	0.050
13	14.232	393.891	15.418	393.878	0.050
14	15.418	393.878	16.604	393.716	0.050

4. CROSS-SECTION DATA (continued)

SEGMENT NO.	LEFT HAND POINT CHAINAGE (m)	LEFT HAND POINT R.L. (m)	RIGHT HAND POINT CHAINAGE (m)	RIGHT HAND POINT R.L. (m)	MANNING'S N
15	16.604	393.716	17.790	393.445	0.050
16	17.790	393.445	18.976	393.442	0.050
17	18.976	393.442	20.162	393.775	0.050
18	20.162	393.775	21.348	393.857	0.050
19	21.348	393.857	22.534	393.863	0.050
20	22.534	393.863	23.720	393.864	0.050
21	23.720	393.864	24.906	393.863	0.050
22	24.906	393.863	26.092	393.865	0.050
23	26.092	393.865	27.278	393.864	0.050
24	27.278	393.864	28.464	393.865	0.050
25	28.464	393.865	29.650	393.873	0.050
26	29.650	393.873	30.836	393.883	0.050
27	30.836	393.883	32.022	393.891	0.050
28	32.022	393.891	33.208	393.897	0.050
29	33.208	393.897	34.394	393.901	0.050
30	34.394	393.901	35.580	393.908	0.050
31	35.580	393.908	36.766	393.912	0.050
32	36.766	393.912	37.952	393.919	0.050
33	37.952	393.919	39.138	393.920	0.050
34	39.138	393.920	40.324	393.917	0.050
35	40.324	393.917	41.510	393.919	0.050
36	41.510	393.919	42.696	393.920	0.050
37	42.696	393.920	43.882	393.932	0.050

PROJECT: MidCrossSection
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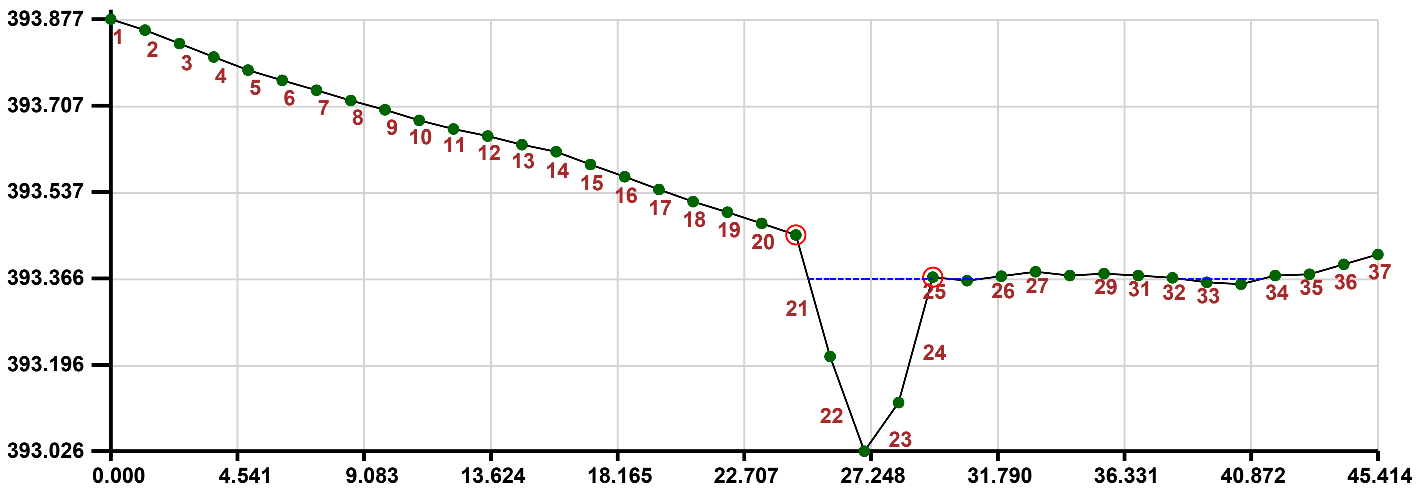
Data File: MidCrossSection.dat

1. CROSS-SECTION



2. DISCHARGE INFORMATION

1% AEP storm event
Design discharge after construction of retarding basin

Required overland / channel / watercourse discharge = 1 cumec (the cross-section cannot carry this discharge)

3. RESULTS Water surface elevation = 393.366 m

High Flow Channel grade = 1 in 120, Main Channel / Low Flow Channel grade = 1 in 120.

	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.000	0.529	0.001	0.530
D(Max) = Max. Depth (m):	0.000	0.340	0.011	0.340
D(Ave) = Ave. Depth (m):	0.000	0.195	0.005	0.195
V = Ave. Velocity (m/s):	0.000	0.609	0.054	0.596
D(Max) x V (cumecs/m):	0.000	0.207	0.001	0.203
D(Ave) x V (cumecs/m):	0.000	0.119	0.000	0.116
Froude Number:	0.000	0.440	0.241	N/A
Area (m^2):	0.000	0.869	0.021	0.890
Wetted Perimeter (m):	0.000	4.510	4.220	8.730
Flow Width (m):	0.000	4.453	4.220	8.673
Hydraulic Radius (m):	0.000	0.193	0.005	0.102
Composite Manning's n:	0.000	0.050	0.050	N/A
Split Flow?	-	-	-	Yes

4. CROSS-SECTION DATA

	LEFT HAND POINT		RIGHT HAND POINT		
SEGMENT NO.	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	MANNING'S N
1	0.000	393.877	1.227	393.856	0.050
2	1.227	393.856	2.455	393.829	0.050
3	2.455	393.829	3.682	393.803	0.050
4	3.682	393.803	4.910	393.777	0.050
5	4.910	393.777	6.137	393.757	0.050
6	6.137	393.757	7.364	393.737	0.050
7	7.364	393.737	8.592	393.717	0.050
8	8.592	393.717	9.819	393.699	0.050
9	9.819	393.699	11.047	393.678	0.050
10	11.047	393.678	12.274	393.661	0.050
11	12.274	393.661	13.501	393.647	0.050
12	13.501	393.647	14.729	393.630	0.050
13	14.729	393.630	15.956	393.616	0.050
14	15.956	393.616	17.184	393.591	0.050

4. CROSS-SECTION DATA (continued)

	LEFT HAND POINT		RIGHT HAND POINT		
SEGMENT NO.	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	MANNING'S N
15	17.184	393.591	18.411	393.567	0.050
16	18.411	393.567	19.638	393.542	0.050
17	19.638	393.542	20.866	393.518	0.050
18	20.866	393.518	22.093	393.497	0.050
19	22.093	393.497	23.321	393.475	0.050
20	23.321	393.475	24.548	393.452	0.050
21	24.548	393.452	25.775	393.213	0.050
22	25.775	393.213	27.003	393.026	0.050
23	27.003	393.026	28.230	393.122	0.050
24	28.230	393.122	29.457	393.369	0.050
25	29.457	393.369	30.685	393.362	0.050
26	30.685	393.362	31.912	393.371	0.050
27	31.912	393.371	33.140	393.380	0.050
28	33.140	393.380	34.367	393.372	0.050
29	34.367	393.372	35.594	393.376	0.050
30	35.594	393.376	36.822	393.372	0.050
31	36.822	393.372	38.049	393.368	0.050
32	38.049	393.368	39.277	393.359	0.050
33	39.277	393.359	40.504	393.355	0.050
34	40.504	393.355	41.731	393.372	0.050
35	41.731	393.372	42.959	393.375	0.050
36	42.959	393.375	44.186	393.394	0.050
37	44.186	393.394	45.414	393.414	0.050

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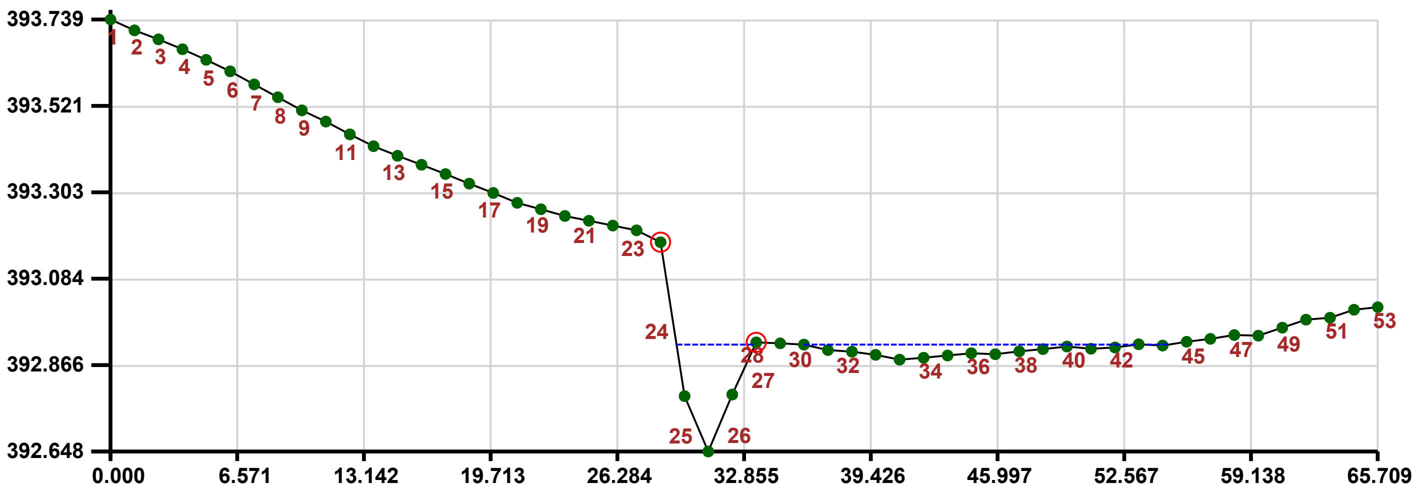
1. CROSS-SECTION



2. DISCHARGE INFORMATION

1% AEP storm event
Design discharge after construction of retarding basin

Required overland / channel / watercourse discharge = 1 cumec

3. RESULTS Water surface elevation = 392.918 m

High Flow Channel grade = 1 in 120, Main Channel / Low Flow Channel grade = 1 in 120.

	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.000	0.299	0.038	0.337
D(Max) = Max. Depth (m):	0.000	0.270	0.038	0.270
D(Ave) = Ave. Depth (m):	0.000	0.146	0.017	0.146
V = Ave. Velocity (m/s):	0.000	0.502	0.121	0.371
D(Max) x V (cumecs/m):	0.000	0.136	0.005	0.100
D(Ave) x V (cumecs/m):	0.000	0.073	0.002	0.054
Froude Number:	0.000	0.420	0.296	N/A
Area (m^2):	0.000	0.595	0.313	0.908
Wetted Perimeter (m):	0.000	4.120	18.310	22.431
Flow Width (m):	0.000	4.077	18.310	22.388
Hydraulic Radius (m):	0.000	0.144	0.017	0.040
Composite Manning's n:	0.000	0.050	0.050	N/A
Split Flow?	-	-	-	Yes

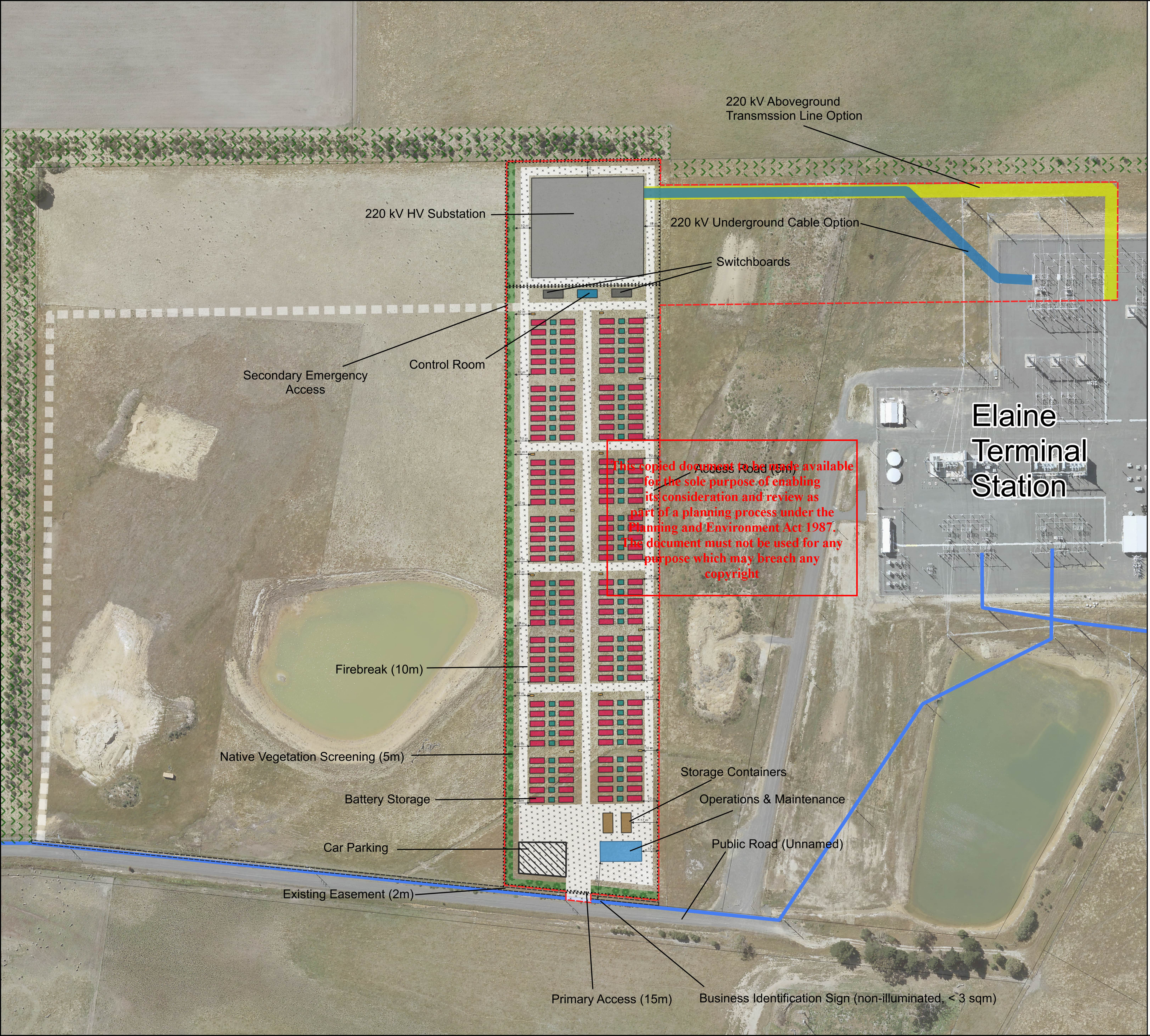
4. CROSS-SECTION DATA

	LEFT HAND POINT		RIGHT HAND POINT		
SEGMENT NO.	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	MANNING'S N
1	0.000	393.739	1.240	393.712	0.050
2	1.240	393.712	2.480	393.689	0.050
3	2.480	393.689	3.719	393.664	0.050
4	3.719	393.664	4.959	393.637	0.050
5	4.959	393.637	6.199	393.608	0.050
6	6.199	393.608	7.439	393.575	0.050
7	7.439	393.575	8.679	393.543	0.050
8	8.679	393.543	9.918	393.510	0.050
9	9.918	393.510	11.158	393.481	0.050
10	11.158	393.481	12.398	393.449	0.050
11	12.398	393.449	13.638	393.419	0.050
12	13.638	393.419	14.878	393.395	0.050
13	14.878	393.395	16.117	393.372	0.050
14	16.117	393.372	17.357	393.349	0.050

4. CROSS-SECTION DATA (continued)

SEGMENT NO.	LEFT HAND POINT CHAINAGE (m)	R.L. (m)	RIGHT HAND POINT CHAINAGE (m)	R.L. (m)	MANNING'S N
15	17.357	393.349	18.597	393.325	0.050
16	18.597	393.325	19.837	393.301	0.050
17	19.837	393.301	21.077	393.276	0.050
18	21.077	393.276	22.316	393.260	0.050
19	22.316	393.260	23.556	393.243	0.050
20	23.556	393.243	24.796	393.231	0.050
21	24.796	393.231	26.036	393.219	0.050
22	26.036	393.219	27.276	393.207	0.050
23	27.276	393.207	28.515	393.177	0.050
24	28.515	393.177	29.755	392.788	0.050
25	29.755	392.788	30.995	392.648	0.050
26	30.995	392.648	32.235	392.792	0.050
27	32.235	392.792	33.475	392.924	0.050
28	33.475	392.924	34.714	392.921	0.050
29	34.714	392.921	35.954	392.918	0.050
30	35.954	392.918	37.194	392.904	0.050
31	37.194	392.904	38.434	392.900	0.050
32	38.434	392.900	39.674	392.892	0.050
33	39.674	392.892	40.913	392.880	0.050
34	40.913	392.880	42.153	392.885	0.050
35	42.153	392.885	43.393	392.891	0.050
36	43.393	392.891	44.633	392.896	0.050
37	44.633	392.896	45.873	392.894	0.050
38	45.873	392.894	47.112	392.901	0.050
39	47.112	392.901	48.352	392.907	0.050
40	48.352	392.907	49.592	392.913	0.050
41	49.592	392.913	50.832	392.908	0.050
42	50.832	392.908	52.072	392.911	0.050
43	52.072	392.911	53.311	392.919	0.050
44	53.311	392.919	54.551	392.916	0.050
45	54.551	392.916	55.791	392.925	0.050
46	55.791	392.925	57.031	392.933	0.050
47	57.031	392.933	58.271	392.942	0.050
48	58.271	392.942	59.510	392.941	0.050
49	59.510	392.941	60.750	392.961	0.050
50	60.750	392.961	61.990	392.981	0.050
51	61.990	392.981	63.230	392.986	0.050
52	63.230	392.986	64.470	393.006	0.050
53	64.470	393.006	65.709	393.013	0.050

Appendix C Project Plan



akaysha

cogency

Concept Layout Plan

2226 - Elaine BESS

Proposed Layout

- Project Area
- Battery Storage
- Transformer
- Switch Gear
- 220kV HV Substation
- Fence
- Storage Containers
- O&M Facility
- Control Room
- Switchboard
- 220 kv Aboveground Transmission Line Option
- 220 kV Underground Transmission Line Option
- Car Parking
- Access Roads
- Emergency Access
- Proposed Native Vegetation Screening
- Existing Vegetation Screening

Existing Features

- 132 kV Existing Transmission Line
- Power Supply (Underground) Easement
- Property Cadastre

*All areas and dimensions are indicative and subject to change

Version: 5.1

Date: 11/12/2022

0 20 40 60 80 m

Appendix D Peak Flow Calculations

DALTON CONSULTING ENGINEERS

Stormwater Calculations

Elaine BESS

Revision C - February 2024

ADVERTISED PLAN

akaysha

DALTON CONSULTING ENGINEERS

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Richmond VIC 3121

T +61 3 9813 7400
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W dceng.com.au

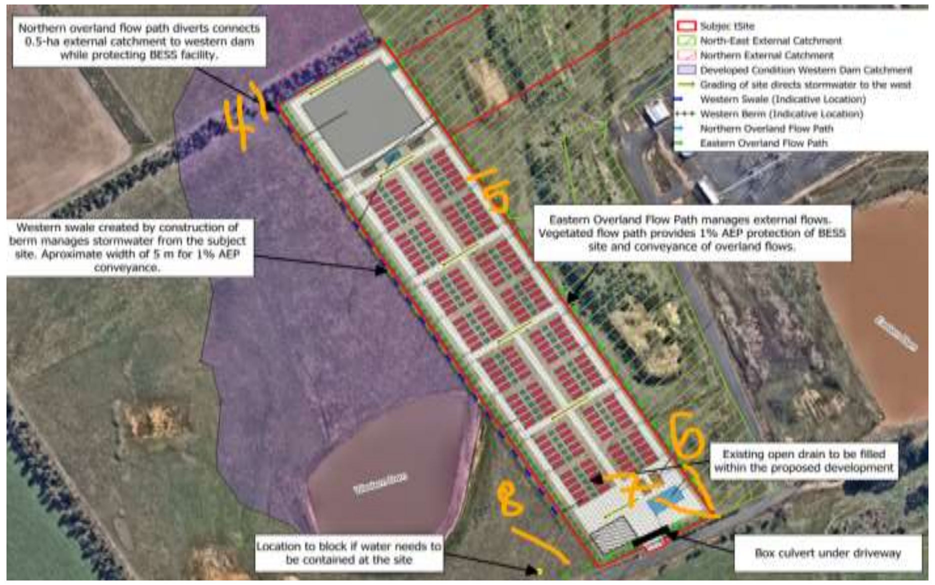
ABN 78 429 221 049

MAJOR STORM EVENT CATCHMENT PLAN

PROJECT DETAILS	
Job Description:	Elaine BESS SWMS
Job Number:	23147
Compiled by:	JMB
Date:	08-02-24

External Catchment Plan

Developed Internal catchment at subject site



MAJOR STORM EVENT HYDROLOGY COMPUTATIONS

PROJECT DETAILS	
Job Description:	Elaine BESS SWMS
Job Number:	23147
Compiled by:	JMB
Date:	08-02-24
Council:	OTHER
Minor Storm Frequency 1:	4EY
Minor Storm Frequency 2:	10% AEP
Major Storm Frequency:	1% AEP
Blockage Factor (%):	0%

RAINFALL DATA							
Source	Copyright Commonwealth of Australia 2016 Bureau of Meteorology (ABN 92 637 533 532)						
Latitude	-37.732153	Longitude	144.0122	Zone	0	Date	27-07-23

TIME OF CONCENTRATION
Based on the Kinematic Wave Equation:

$$To\ I^{0.4} = 6.94\frac{(L\ x\ n)^{0.6}}{S^{0.3}}$$

Where….

- T = Overland Flow Time (min)
- I = Rainfall Intensity, (mm/hr)
- L = Length of flow path, (m)
- n = Manning
- S = Slope, (m/m)

C'10	0.111881907

TIME OF CONCENTRATION
Based on the Kinematic Wave Equation:

$$To\ I^{0.4} = 6.94\frac{(L\ x\ n)^{0.6}}{S^{0.3}}$$

Where….

- T = Overland Flow Time (min)
- I = Rainfall Intensity, (mm/hr)
- L = Length of flow path, (m)
- n = Manning
- S = Slope, (m/m)

PEAK FLOW
Based on the Rational Method:

$$Q = CIA$$

Where….

- Q = Peak Flow (cu.m/s)
- C = Co-Efficient of Runoff
- I = Rainfall Intensity, (mm/hr)
- A= Area (hectares)

CATCHMENT DETAILS (ALL AREAS IN HECTARES)

	Sub-Catch 1	Sub-Catch 2	Sub-Catch 3	Sub-Catch 4	Sub-Catch 5				
Name	Rural	BESS	Drainage Reserve	Local Roads	Industrial				
Fraction Imp. (f)	0.1	0.7	0.25	0.7	0.9				
C'10	0.191	0.664	0.309	0.664	0.821				
C Minor 1	0.153	0.531	0.247	0.531	0.657				
C Minor 2	0.191	0.664	0.309	0.664	0.821				
C Major	0.229	0.796	0.371	0.796	0.985	Minor 1/2?	Minor 1 Ae	Minor 2 Ae	Major Ae
EXG to Western Dam (inc. Subject Site)	6.0					1	0.915	0.000	1.373
EXG to Open Drain (inc. Subject Site)	17.5					1	2.670	0.000	4.005
EXG Subject Site	4.1					1	0.625	0.000	0.938
Swale flow EXT North to Western Dam	0.5					1	0.076	0.000	0.114
Swale flow to Open Drain EXT NE	8.4				2.0	1	2.582	0.000	3.873
Swale flow to Open Drain EXT SE	2.1					1	0.320	0.000	0.481
DEV Subject Site		4.100				1	2.176	0.000	3.265
EXT to Open Drain SW of Subject Site	0.700					1	0.107	0.000	0.160

ToC = initial time + average velocity of swale flow (0.5 m/s)

FLOW CALCULATIONS

Section	Contributing Catchments: EXG to Western Dam (inc. Subject Site)	EXG to Open Drain (inc. Subject Site)	EXG Subject Site	Swale flow EXT North to Western Dam	Swale flow to Open Drain EXT NE	Swale flow to Open Drain EXT SE	DEV Subject Site	EXT to Open Drain SW of Subject Site	Length (m)	Initial T (min)	Surface	n	S = Slope (m/m)	Major ToC (min)	Major I (mm/hr)	Major Ae (ha)	Major Q (m3/s)
1	Y								500	7	Grass Channel	0.035	0.013	30.608	74.182	1.373	**0.28**
2		Y							650	7	Grass Channel	0.035	0.013	36.319	65.037	4.005	**0.72**
3			Y						370	7	Grass Channel	0.035	0.014	25.030	84.147	0.938	**0.22**
4				Y					50	7	Earth Channel	0.025	0.013	10.551	140.741	0.114	**0.04**
5					Y				950	7	Earth Channel	0.025	0.013	37.393	63.739	3.873	**0.69**
6						Y			200	7	Earth Channel	0.025	0.013	16.051	111.165	0.481	**0.15**
7					Y	Y			1020	7	Earth Channel	0.025	0.013	39.263	61.299	4.354	**0.74**
8							Y		400	5	Earth Channel	0.025	0.007	18.333	103.774	3.265	**0.94**

RAINFALL DATA

Source	Copyright Commonwealth of Australia 2016 Bureau of Meteorology (ABN 92 637 533 532)								
Latitude	-37.732153	Longitude	144.0122	Zone		Date	27-07-23		

Annual Exceedance Probability (AEP) Coefficients

	4EY	2EY	1EY	0.2EY	50% AEP#	20% AEP*	10% AEP	5% AEP	2% AEP	1% AEP
C0	-0.33005372	-0.01254866	0.26773164	0.82415044	0.41790423	0.80434775	1.01863370	1.20346340	1.42079820	1.57112920
C1	0.69579542	0.65213186	0.58689839	0.49616748	0.56072992	0.49616802	0.45212826	0.41378036	0.32937562	0.27059612
C2	0.07723608	0.15800737	0.25403523	0.34307352	0.27975997	0.34307304	0.38854685	0.42832121	0.52326107	0.58959109
C3	-0.06763030	-0.10772429	-0.15008771	-0.17736174	-0.15790679	-0.17736158	-0.19310179	-0.20707878	-0.24496828	-0.27160645
C4	0.01467664	0.02278534	0.03066769	0.03349028	0.03144034	0.03349026	0.03575450	0.03784480	0.04469679	0.04956520
C5	-0.00132977	-0.00205914	-0.00271809	-0.00274988	-0.00271954	-0.00274987	-0.00288707	-0.00302515	-0.00360524	-0.00402339
C6	0.00004330	0.00006760	0.00008802	0.00008195	0.00008585	0.00008195	0.00008461	0.00008789	0.00010660	0.00012033

NOTE:

The coefficients can be applied to estimate the design rainfall depth for a full range of durations from 1 minute to 7 days.

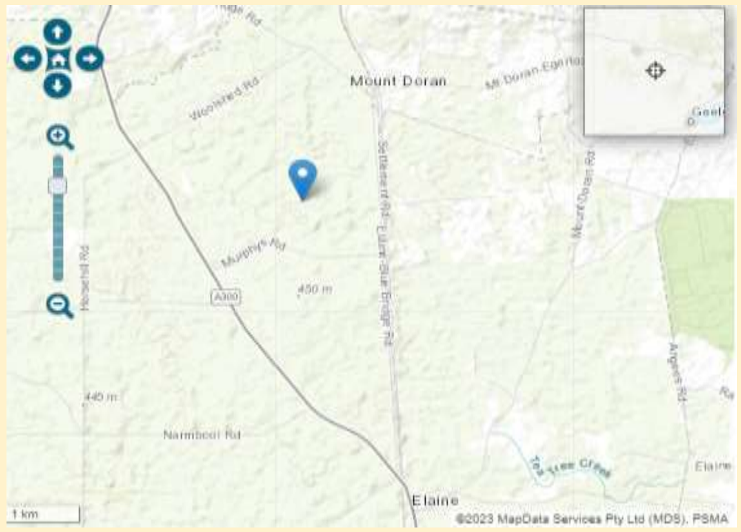
It is recommended that only three significant figures are used when undertaking calculations using design rainfalls generated in this way.

The 50% AEP IFD does not correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.

* The 20% AEP IFD does not correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

Duration (mins)	4EY	2EY	1EY	0.2EY	50% AEP	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP
1	43.133	59.252	78.420	136.797	91.127	134.114	166.165	199.898	248.425	288.725
2	35.559	48.699	63.717	108.021	73.437	105.903	129.463	153.939	186.770	213.475
3	31.594	43.707	57.761	98.337	66.655	96.409	118.108	140.696	171.510	196.681
4	28.747	40.057	53.395	91.563	61.747	89.767	110.343	131.828	161.710	186.250
5	26.514	37.112	49.774	85.910	57.668	84.225	103.838	124.374	153.359	177.267
6	24.688	34.645	46.661	80.965	54.145	79.378	98.095	117.737	145.755	168.943
7	23.154	32.536	43.943	76.570	51.053	75.069	92.943	111.733	138.739	161.146
8	21.841	30.707	41.547	72.632	48.315	71.208	88.290	106.272	132.256	153.855
9	20.702	29.102	39.418	69.083	45.872	67.729	84.070	101.291	126.268	147.060
10	19.700	27.680	37.514	65.872	43.679	64.580	80.230	96.736	120.739	140.741
11	18.812	26.412	35.801	62.954	41.701	61.719	76.724	92.561	115.631	134.871
12	18.018	25.273	34.252	60.292	39.908	59.110	73.514	88.725	110.908	129.419
13	17.303	24.242	32.844	57.855	38.275	56.720	70.566	85.192	106.536	124.353
14	16.654	23.306	31.560	55.616	36.782	54.525	67.850	81.930	102.482	119.642
15	16.063	22.451	30.382	53.552	35.411	52.502	65.341	78.910	98.716	115.255
16	15.522	21.666	29.299	51.645	34.148	50.633	63.017	76.108	95.312	111.165
17	15.024	20.944	28.299	49.878	32.981	48.900	60.859	73.502	91.945	107.346
18	14.564	20.276	27.374	48.235	31.900	47.289	58.850	71.073	88.894	103.774
19	14.138	19.657	26.514	46.704	30.894	45.788	56.976	68.805	86.038	100.429
20	13.741	19.081	25.714	45.274	29.957	44.386	55.224	66.682	83.364	97.290
21	13.372	18.544	24.967	43.936	29.082	43.074	53.582	64.691	80.852	94.341
22	13.026	18.042	24.268	42.681	28.262	41.844	52.041	62.820	78.489	91.565
23	12.702	17.571	23.612	41.501	27.493	40.688	50.592	61.060	76.264	88.949
24	12.397	17.129	22.996	40.391	26.770	39.599	49.226	59.400	74.165	86.481
25	12.110	16.713	22.416	39.344	26.089	38.572	47.937	57.834	72.182	84.147
26	11.839	16.320	21.869	38.354	25.446	37.602	46.719	56.352	70.306	81.939
27	11.583	15.949	21.351	37.418	24.838	36.684	45.566	54.949	68.528	79.847
28	11.340	15.598	20.862	36.531	24.262	35.815	44.472	53.618	66.842	77.861
29	11.110	15.265	20.398	35.689	23.716	34.989	43.435	52.354	65.241	75.976
30	10.892	14.948	19.957	34.889	23.198	34.205	42.448	51.153	63.718	74.182
31	10.683	14.648	19.538	34.128	22.705	33.459	41.510	50.009	62.268	72.475
32	10.485	14.361	19.140	33.403	22.236	32.748	40.615	48.920	60.886	70.847
33	10.296	14.088	18.759	32.711	21.789	32.070	39.762	47.880	59.568	69.294
34	10.115	13.827	18.397	32.051	21.362	31.423	38.947	46.887	58.309	67.811
35	9.942	13.578	18.050	31.420	20.954	30.804	38.168	45.937	57.106	66.394
36	9.776	13.340	17.719	30.816	20.564	30.212	37.423	45.029	55.954	65.037
37	9.617	13.112	17.402	30.238	20.190	29.645	36.709	44.159	54.851	63.739
38	9.465	12.893	17.098	29.684	19.832	29.102	36.025	43.325	53.794	62.494
39	9.318	12.683	16.806	29.152	19.489	28.581	35.369	42.524	52.779	61.299
40	9.177	12.481	16.526	28.642	19.159	28.080	34.738	41.756	51.806	60.153
41	9.042	12.287	16.257	28.151	18.842	27.599	34.132	41.017	50.870	59.051
42	8.911	12.100	15.999	27.679	18.537	27.137	33.550	40.307	49.970	57.992
43	8.785	11.920	15.750	27.225	18.244	26.691	32.989	39.623	49.104	56.973
44	8.664	11.747	15.510	26.788	17.961	26.262	32.449	38.964	48.270	55.992
45	8.547	11.580	15.279	26.366	17.689	25.849	31.928	38.330	47.467	55.046
46	8.434	11.418	15.056	25.959	17.426	25.450	31.426	37.717	46.692	54.135
47	8.324	11.262	14.840	25.566	17.173	25.065	30.941	37.126	45.944	53.256
48	8.218	11.112	14.632	25.187	16.928	24.693	30.473	36.556	45.223	52.407
49	8.116	10.966	14.432	24.821	16.691	24.334	30.021	36.005	44.525	51.587
50	8.016	10.825	14.237	24.466	16.462	23.987	29.584	35.472	43.851	50.795
55	7.563	10.183	13.354	22.857	15.422	22.409	27.598	33.052	40.794	47.203
60	7.171	9.630	12.595	21.475	14.528	21.054	25.893	30.976	38.175	44.129
65	6.827	9.147	11.934	20.275	13.752	19.877	24.415	29.176	35.908	41.469
70	6.523	8.721	11.355	19.223	13.070	18.846	23.120	27.600	33.925	39.147
75	6.252	8.344	10.841	18.293	12.466	17.934	21.975	26.209	32.178	37.101
80	6.009	8.005	10.383	17.465	11.928	17.122	20.957	24.972	30.625	35.285
85	5.789	7.701	9.971	16.722	11.444	16.394	20.045	23.864	29.237	33.663
90	5.589	7.425	9.599	16.052	11.008	15.737	19.222	22.867	27.988	32.205

ARR16 IFD MAP CHECK



CONSTANTS

Council	C'10
CARDINIA	0.11508008
CASEY	0.11508008
HUME	0.16031382
MELTON	0.15445632
WHITTLESEA	0.16031382
WYNDHAM	0.15445632
OTHER	0.11188191

	Frequency Factor
4EY	0.80
2EY	0.80
1EY	0.80
0.2EY	0.95
50% AEP	0.85
20% AEP	0.95
10% AEP	1.00
5% AEP	1.05
2% AEP	1.15
1% AEP	1.20

Y or N?
Y
N

1or 2?
1
2

Zone	Frac. Impervious
Lot <450sq.m	0.8
Lot 450-600sq.m	0.7
Lot 600-1000sq.m	0.6
Lot 1000-4000sq.m	0.3
Major Roads	0.8
Local Roads	0.7
Drainage Reserve	0.25
Rural	0.1
Schools	0.7
BESS	0.7
Industrial	0.9
Medium Density	0.9
Health/Community	0.7
Impervious	1

Surface	FR
Smooth Concrete	0.013
Asphalt	0.015
Road Reserve	0.02
Earth Channel	0.025
Grass Channel	0.035
OTHER	

Pipe Type	Mannings
PE	0.01
PP	0.01
PVC	0.01
RC	0.013
VC	0.015

Pipe Sizes	No. of Pipes
225	1
300	2
375	3
450	4
525	5
600	
675	
750	
825	
900	
1050	
1200	
1350	
1500	
1650	
1800	

Pit Type	
SEP	
GEP	

Storm
Minor 1
Minor 2
Major
Overland

Co-Ordinate Type	
Easting	Latitude
Northing	Longitude

Appendix E Western (Subject Site) Swale Sizing

PROJECT: InternalSwale
Created by pasting data from clipboard
Print-out date: 05/02/2024 - Time: 11:49
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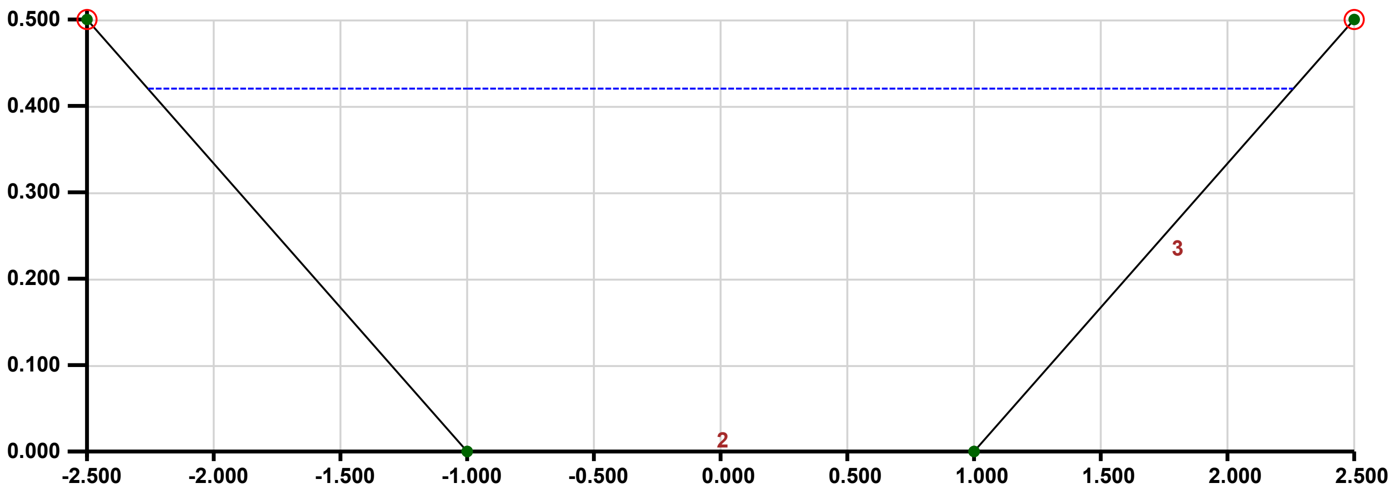
1. CROSS-SECTION



2. DISCHARGE INFORMATION

1% AEP storm event
Design discharge after construction of retarding basin

Required overland / channel / watercourse discharge = 0.94 cumecs

3. RESULTS Water surface elevation = 0.420 m

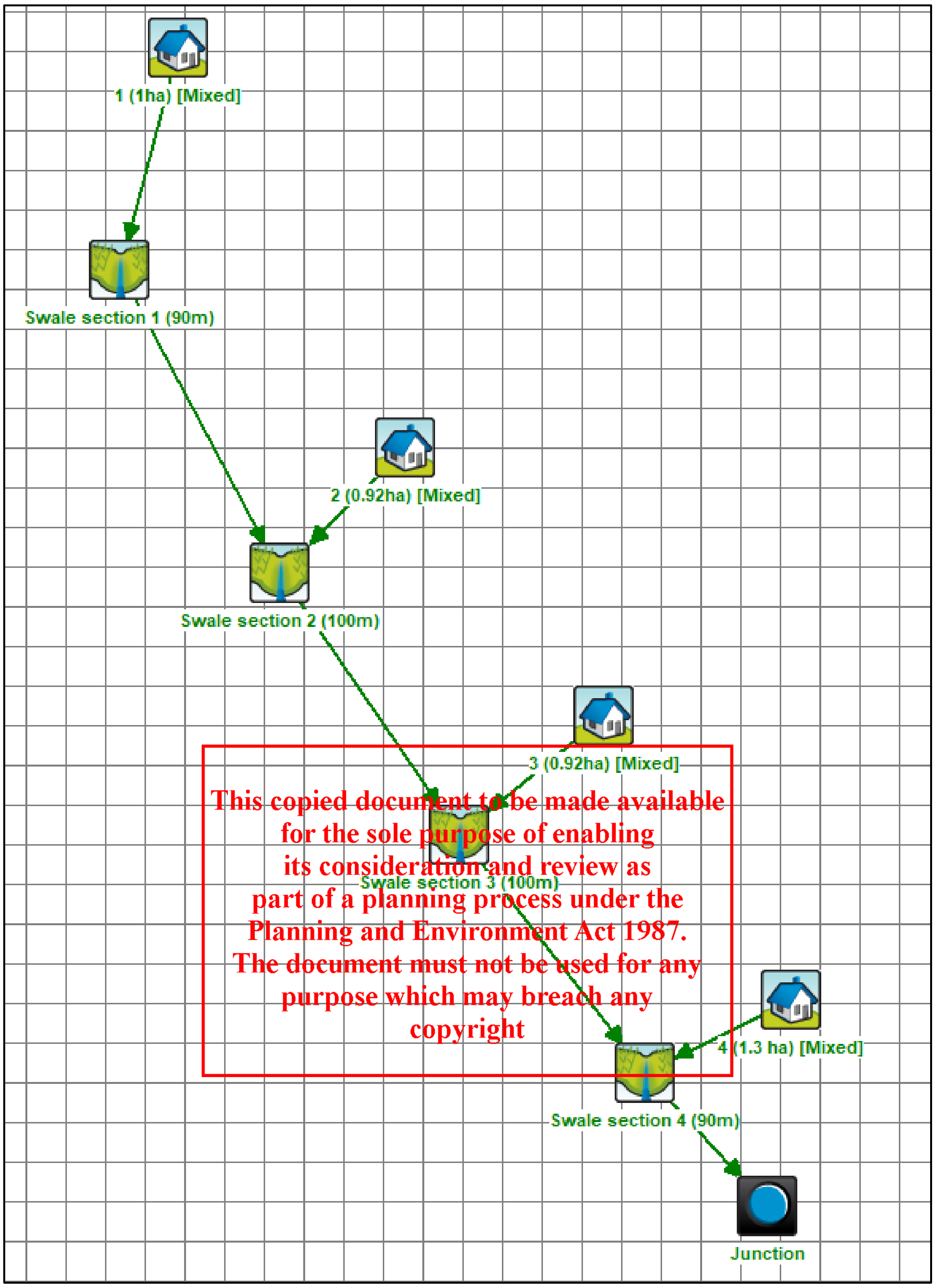
High Flow Channel grade = 1 in 200, Main Channel / Low Flow Channel grade = 1 in 200.

	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.000	0.951	0.000	0.951
D(Max) = Max. Depth (m):	0.000	0.420	0.000	0.420
D(Ave) = Ave. Depth (m):	0.000	0.303	0.000	0.303
V = Ave. Velocity (m/s):	0.000	0.695	0.000	0.695
D(Max) x V (cumecs/m):	0.000	0.292	0.000	0.292
D(Ave) x V (cumecs/m):	0.000	0.210	0.000	0.210
Froude Number:	0.000	0.403	0.000	0.403
Area (m^2):	0.000	1.369	0.000	1.369
Wetted Perimeter (m):	0.000	4.656	0.000	4.656
Flow Width (m):	0.000	4.520	0.000	4.520
Hydraulic Radius (m):	0.000	0.294	0.000	0.294
Composite Manning's n:	0.000	0.045	0.000	0.045
Split Flow?	-	-	-	No

4. CROSS-SECTION DATA

	LEFT HAND POINT		RIGHT HAND POINT		
SEGMENT NO.	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	MANNING'S N
1	-2.500	0.500	-1.000	0.000	0.045
2	-1.000	0.000	1.000	0.000	0.045
3	1.000	0.000	2.500	0.500	0.045

Appendix F MUSIC Modelling Schematic



Treatment Train Effectiveness - Junction

	Sources	Residual Load	% Reduction
Flow (ML/yr)	18.6	18.6	-0.1
Total Suspended Solids (kg/yr)	3570	379	89.4
Total Phosphorus (kg/yr)	7.38	2.62	64.5
Total Nitrogen (kg/yr)	52.6	35.2	33
Gross Pollutants (kg/yr)	701	0	100