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Winton Renewable Energy Stability & Storage Terminal (WRESST)

HYDROLOGY AND STORMWATER MANAGEMENT

May 2026

DCE Ref: 26009

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Executive Summary

This report presents the hydrology desktop investigation and stormwater management strategy for the proposed Battery Energy Storage System (BESS) utility installation at 576 Winton-Glenrowan Road, Winton VIC 3673. The study area comprises approximately 26 hectares (ha), which includes the Glenrowan Terminal Station and the associated 15 ha development area. The proposed BESS development footprint occupies approximately 6.5 ha.

The study area is located within the Rural City of Benalla and the Goulburn Broken Catchment Management Authority (CMA).

The BESS project will have a 400 MW/1600 MWh capacity. The project includes:

- BESS components including batteries, inverters, and transformer units
- Underground 220kV transmission connection to the Glenrowan Terminal Station
- Maintenance buildings
- Vegetation removal
- Landscaping
- Access points and tracks
- Water tanks
- Retention pond
- Security Fencing
- Fire protection equipment
- Earthworks

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In the existing condition, the western part of the study area is used as rural residential for lifestyle purposes. It contains one dwelling and associated sheds. There is an existing 220kV transmission line to the east and transmission connection to the Winton Solar Farm to the south. The Winton Wetlands are located downstream of the study area and have therefore been considered as part of this assessment from both a hydrology and water quality perspective.

The desktop hydrology investigation and stormwater management strategy (SWMS) for the utility installation:

- Describes the existing hydrology of the study area in the existing condition, and external catchments
- Includes details and computations of peak flows in the developed condition
- Provides a conceptual stormwater management plan for the development demonstrating how stormwater and surface runoff will be managed in the developed condition.
- Demonstrates how existing overland flow paths and flood patterns will be maintained.
- Discusses impacts to on-site infiltration and surface water quality, including water quality in adjacent land and waterways.
- Includes details of how polluted or contaminated runoff can be managed.

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In the developed condition:

- The BESS development footprint will be graded towards two internal swales which will drain the facility to the retention pond, located in the north-west corner of the study area.
- Bypass swales will be used around the BESS facility to divert any external flows away from key infrastructure.
- Key infrastructure to be set above the 1% AEP flood level + freeboard. This will be confirmed with detailed flood modelling at the next stages of design.
- The proposed retention pond provides an opportunity to support firewater management within the development footprint. In the event of a fire emergency, the pond may act as a temporary storage and containment measure for firewater runoff and may also provide an accessible water source for firefighting purposes. It is anticipated that the outlet structure could incorporate isolation measures (e.g. shut-off valve) during detailed design to minimise the potential discharge of contaminated runoff to downstream receiving environments, including the Winton Wetlands.

The stormwater management strategy proposed for the utility installation includes grading of the BESS development footprint and methodology for managing internal and external stormwater. The strategy has been developed to allow for stormwater quality treatment to be provided through green engineering methods.

This report demonstrates that the proposed utility installation can be developed with minimal impact on existing hydrological conditions, and minimal impact on Winton Wetlands downstream. In addition, stormwater management at the study area can manage stormwater to council and CMA requirements. The conceptual stormwater management plan allows for CFA requirements for containment of surface water to be achieved. The proposed stormwater management provides green engineering solutions that treat stormwater to improve downstream water quality beyond statutory requirements.

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1. Introduction

This report presents the stormwater management strategy for the proposed Battery Energy Storage System (BESS) project at 576 Winton-Glenrowan Road, Winton VIC 3673. The study area comprises approximately 26 hectares (ha), which includes the Glenrowan Terminal Station and the associated 15 ha BESS area. The proposed BESS development footprint occupies approximately 6.5 ha.

The BESS project will have a 400 MW/1600 MWh capacity. The project includes:

- BESS components including batteries, inverters, and transformer units
- Underground 220kV transmission connection to the Glenrowan Terminal Station
- Maintenance buildings
- Vegetation removal
- Landscaping
- Access points and tracks
- Water tanks
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2. Study Area Overview

2.1 Location

The study area comprises approximately 26 hectares (ha), which includes the Glenrowan Terminal Station and the associated 15 ha development area. The BESS development footprint occupies approximately 6.5 ha. The BESS development footprint will be located west of the Glenrowan Terminal Station.

The study area is located in northern Victoria, approximately 230 km north-east of Melbourne near the rural town of Winton. The study area is located within a broader renewable energy precinct, with several existing and proposed solar farm and Battery Energy Storage System (BESS) developments located within the surrounding area. Existing renewable energy infrastructure in the vicinity includes the Winton Solar Farm adjacent to the study area, the Glenrowan BESS approximately 500 m to the south-east, and the Glenrowan West Solar Farm further to the south-east, together with other renewable energy developments within the broader Glenrowan and Winton area.

The study area is located within the Rural City of Benalla and the Goulburn Broken CMA. As the study area is located within the Rural City of Benalla, the *Infrastructure Design Manual (IDM)* is the relevant guiding document for flow calculations and concept drainage design. All calculations and conceptual drainage designs in this report are also compliant with *Australian Rainfall and Runoff v.4.2* and reflect industry best practice approaches.

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The Hume Freeway is located ~130m to the north of the study area.

The Winton Wetlands, an ecologically significant wetland system, are located downstream of the study area, approximately 3 km north of the Hume Freeway. Given the environmental significance of the wetlands, potential downstream hydrology and water quality impacts have been considered as part of this assessment.

2.2 Site Visit

A site visit was undertaken on 24 April 2026 to inspect the study area, assess potential flooding behaviour, and obtain indicative measurements of key drainage infrastructure.

During the inspection, discussions were held with the landowner regarding historical flooding behaviour within the area. The landowner advised that they have resided at the property for approximately 30–40 years and have not observed floodwaters overtopping Winton–Glenrowan Road adjacent to the study area.

The landowner noted that, during a significant flood event in 1983, flood depths of approximately 1 m were experienced at the property driveway; however, floodwaters reportedly remained below the Winton-Glenrowan Rd crest level.

Observed and anecdotal evidence also suggests that ponding generally occurs on the southern side of the road. While substantial inflows are understood to enter the area via the upstream gully system, flooding and ponding behaviour appears to be generally linear and contained along the roadway corridor.

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2.3 Existing Land Use

The study area comprises approximately 26 ha and includes a rural residential property containing an existing dwelling and associated sheds within the western portion of the Bess area (15ha). The study area also includes the Glenrowan Terminal Station along the eastern boundary and the Winton–Glenrowan Road reserve along the northern extent of the study area.

Surrounding land uses are characterised by rural and renewable energy infrastructure developments. Key surrounding features include the Winton Solar Farm immediately south of the study area and the Glenrowan West Solar Farm further to the south-east, as shown in Figure 1. The Hume Freeway is located north of Winton–Glenrowan Road.

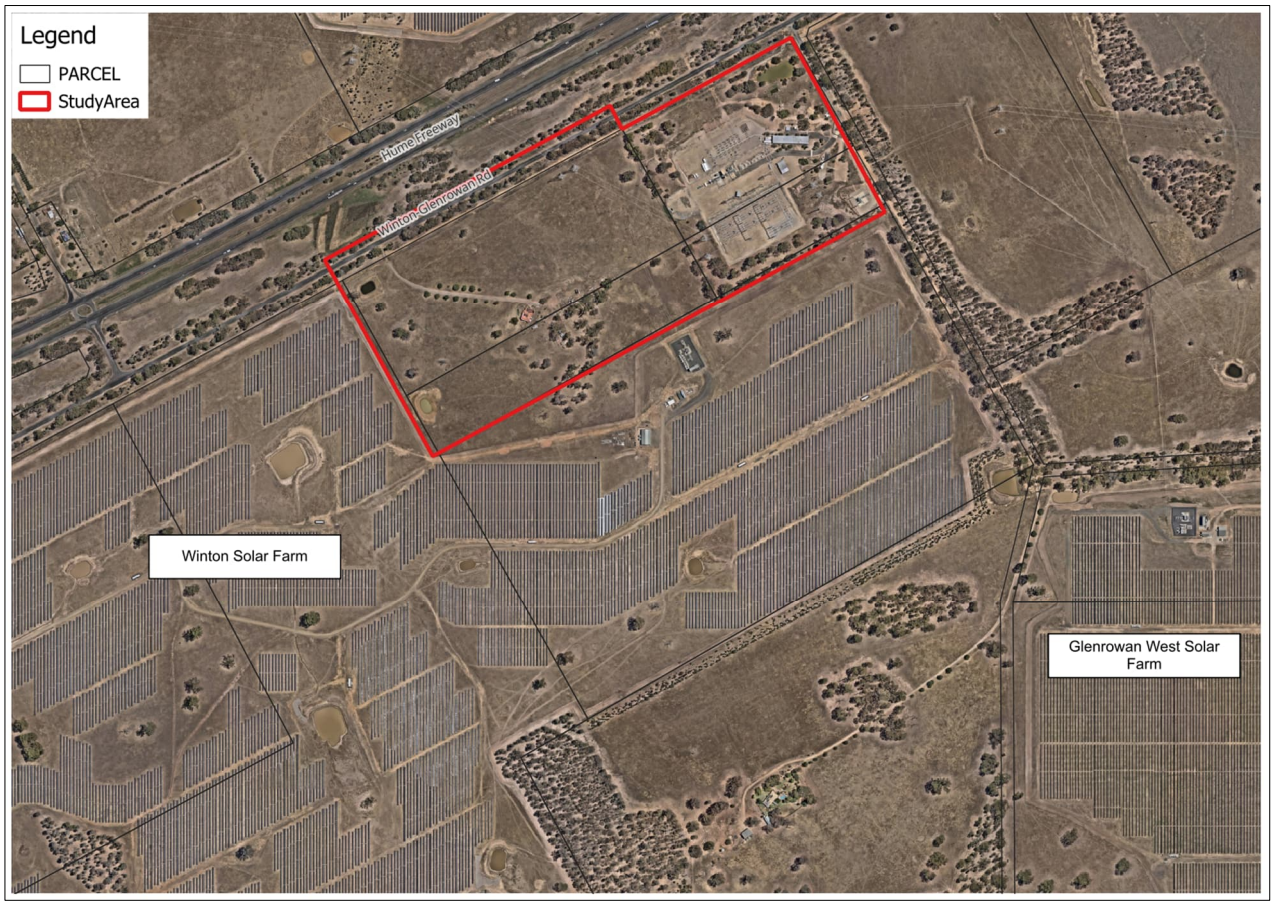

Figure 1: Study area in the existing condition

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2.4 Existing Planning Zones and Overlays

The study area is located within the Farming Zone (FZ). The surrounding land is characterised by rural and agricultural uses, together with existing renewable energy infrastructure.

Portions of the project interface with land within the Transport Zone 3 (TRZ3), associated with the proposed access arrangements, and the Special Use Zone Schedule 4 (SUZ4), associated with the proposed cable alignment.

The study area has one overlay in the existing condition. The siting of the utility installation has been undertaken to minimise impacts and respect the existing planning overlays.

A Vegetation Protection Overlay (VPO3) is in place across the entire study area (Figure 3). This overlay is intended to specifically to protect habitat for the endangered Regent honeyeater. The study area has been selected to minimise impact on any mature trees, in particular Mugga Ironbark, White Box, and Blakeley's Red Gum which are specifically protected by the overlay.

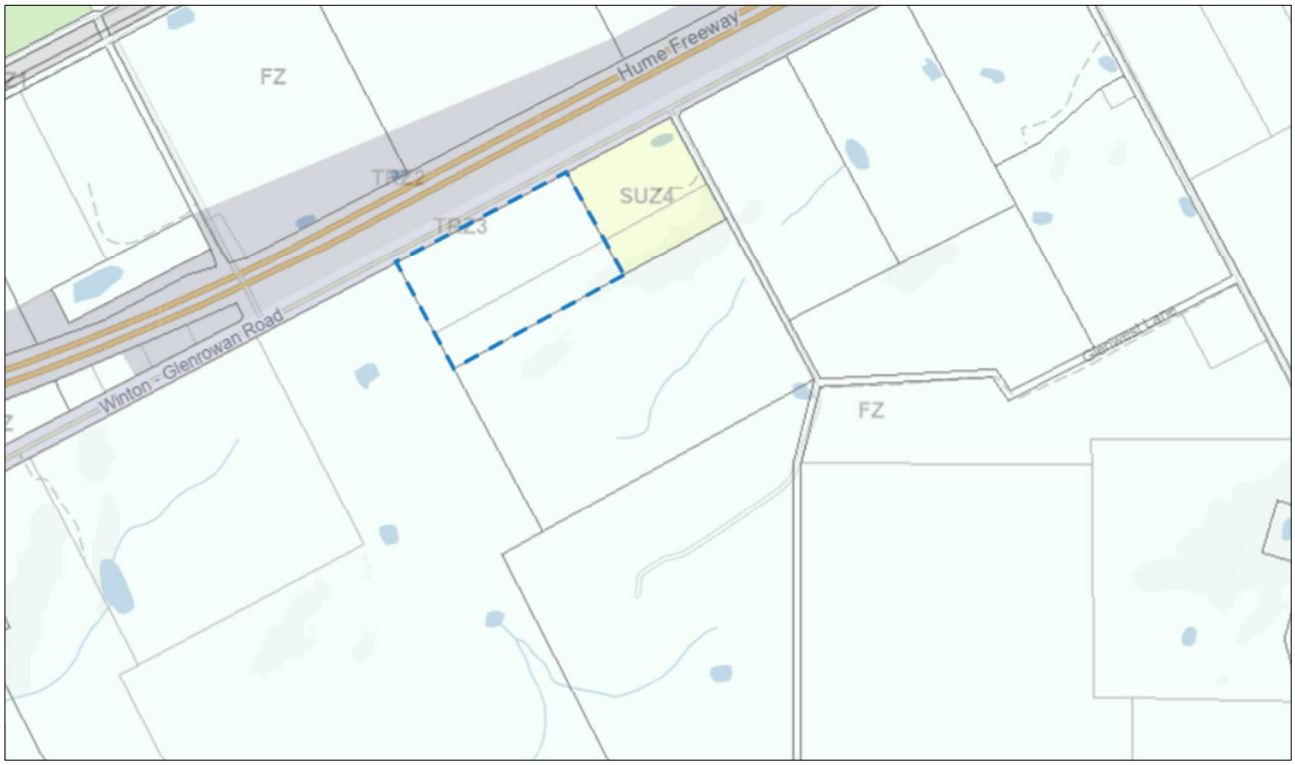

Figure 2: Planning zones for the study area and surrounds

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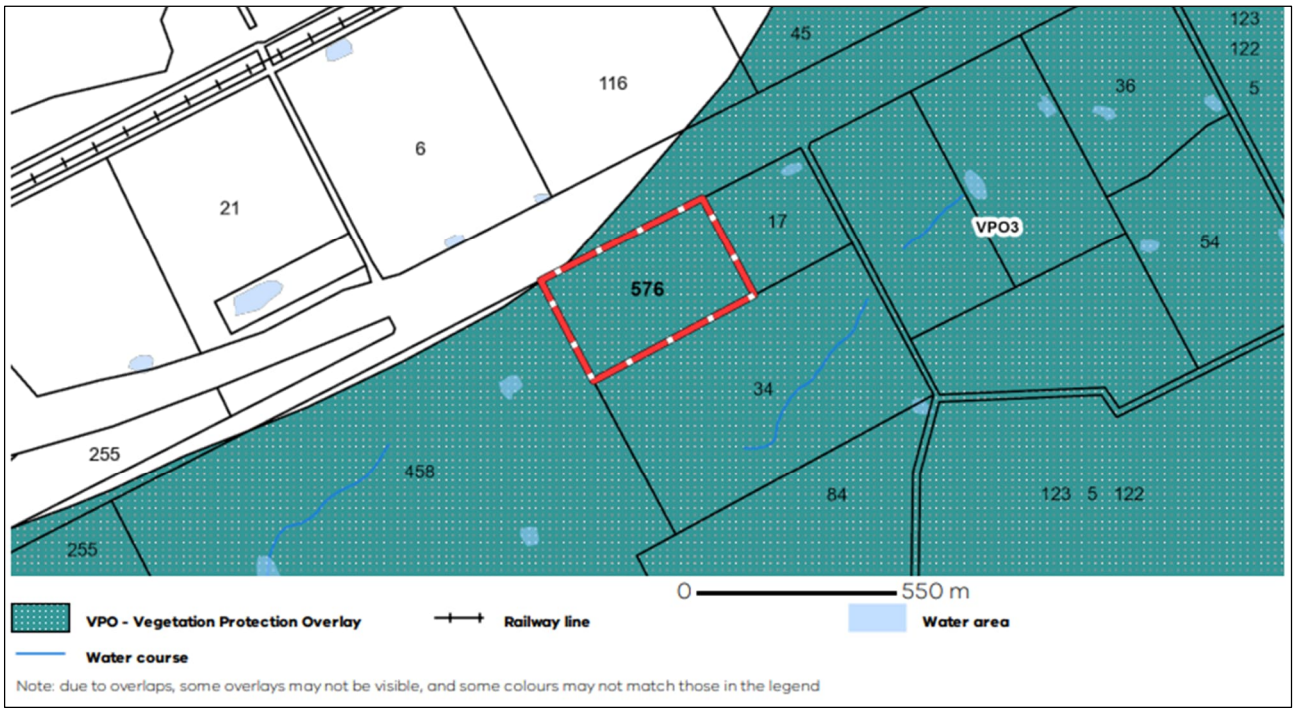

Figure 3: Vegetation Protection Overlay

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2.5 Existing Topography

The study area includes an area of relatively higher elevation to the east, with the proposed BESS infrastructure located within the lower-lying western portion of the site. LiDAR flown in 2022, used under license from the Victorian Government Department of Transport and Planning (DTP), was used to represent the topography of the study area and surrounds (Figure 4)

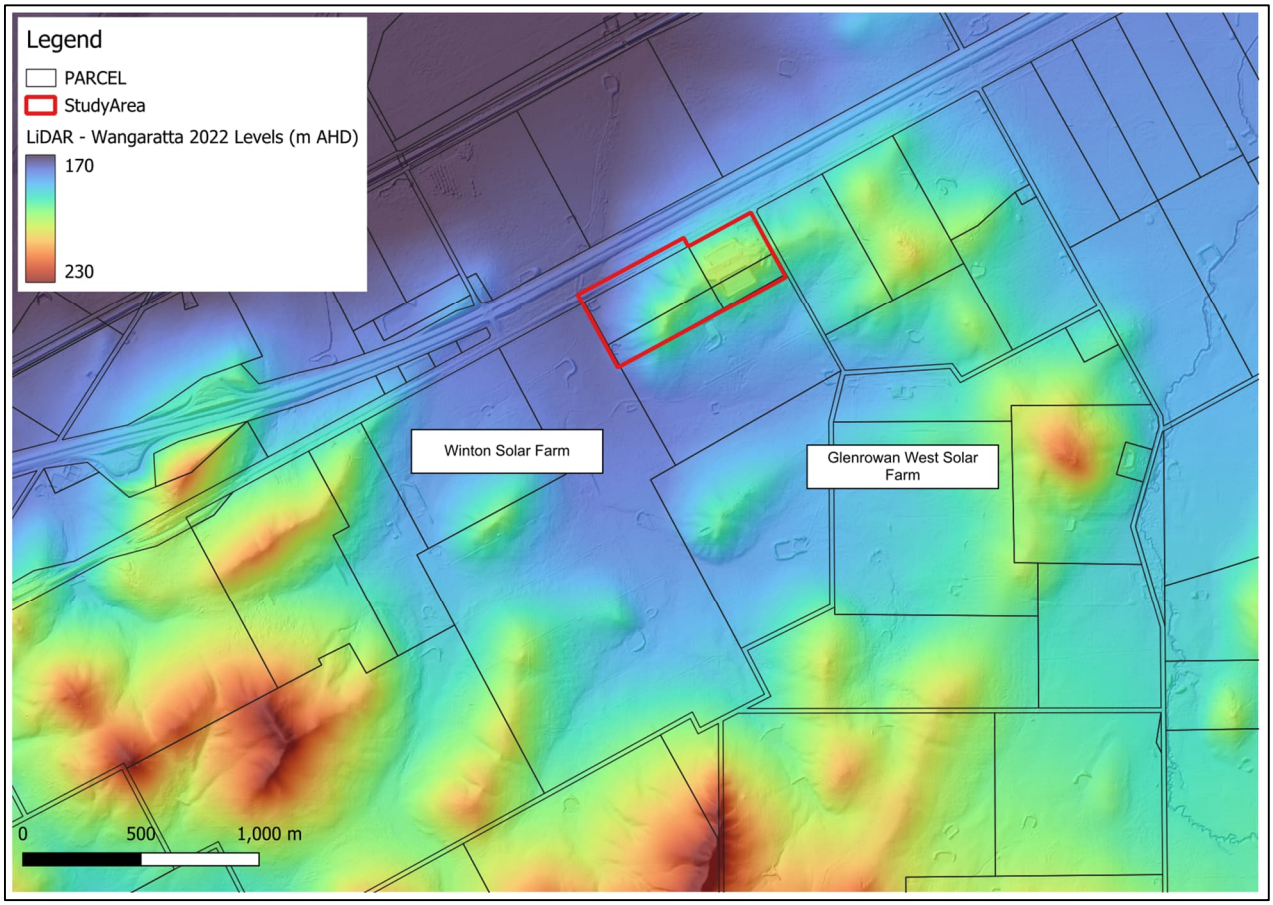

Figure 4: Existing topography

2.6 Existing Winton-Glenrowan Road Culverts

The western corner of the study area is adjacent to a set of culverts under Winton-Glenrowan Rd (See Figure 5). Based on the site visit, the culverts were measured to be 1.2 m (wide) x 0.9 m (high) x 8 cells.

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Figure 5: Location and photos of culverts

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3. Existing Condition Hydrology Investigation

The study area forms part of a wider catchment. An investigation has been undertaken to assess the site hydrology in the existing condition to ensure that hydrological performance can be retained in the developed condition.

3.1 Study Area Catchments

Catchments at the study area, including external catchments, have been defined based on 2022 LiDAR Data.

Existing condition catchments and area in hectares (ha) for the study area are shown in Figure 6. Catchments 2 and 4 drain to dams within the study area. Dam storage and outflows have not been included in this investigation to support a conservative estimate of existing conditions where both dams are full and do not contribute to reducing peak stormwater flows.

All catchments eventually drain to the culverts crossing Winton – Glenrowan Road, near the western point of the study area.

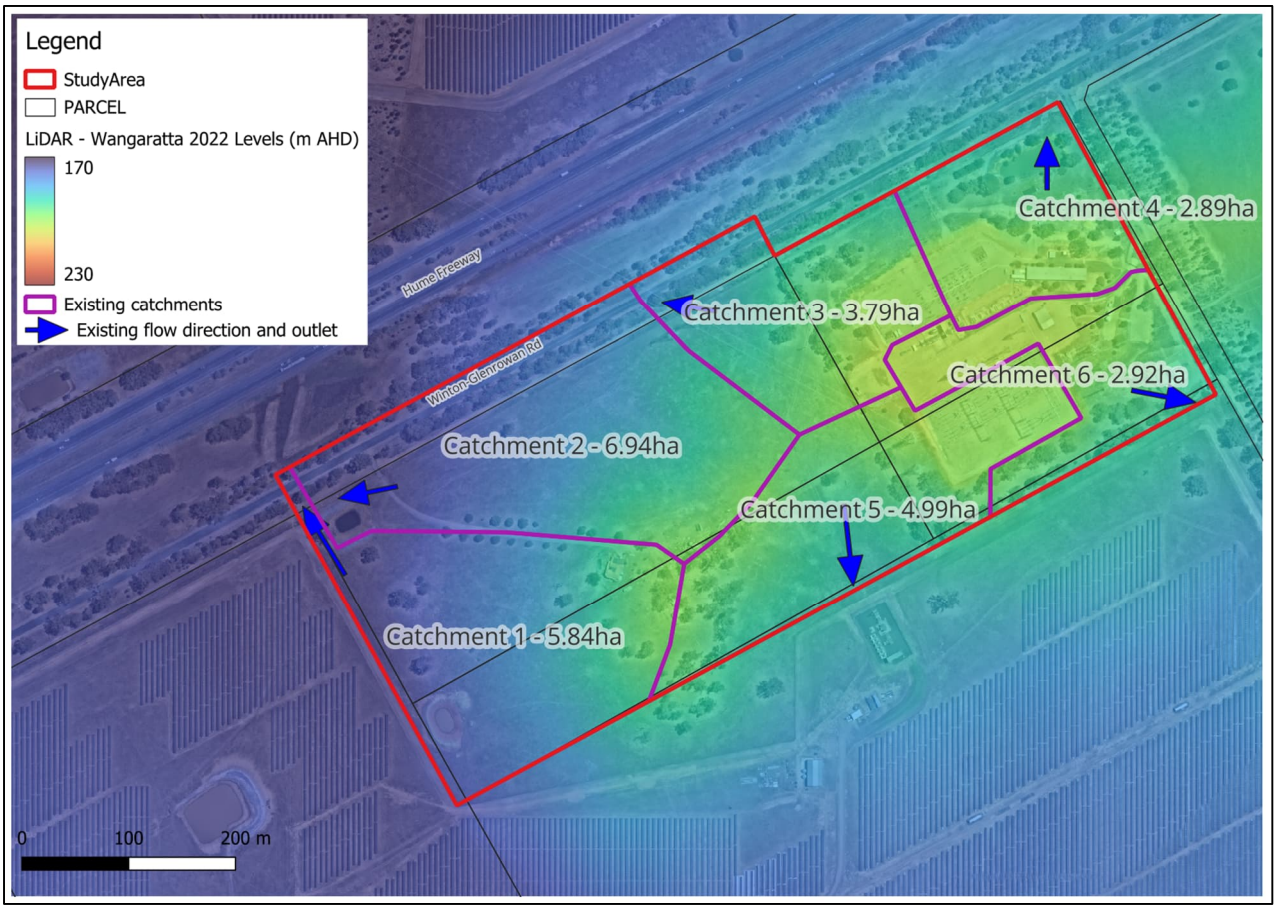

Figure 6: Existing Stormwater Catchments

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3.2 Winton - Glenrowan Rd Culvert Catchment

A significant catchment of approximately 885 ha drains to the existing culverts under Winton-Glenrowan Road. A preliminary assessment of the culverts has been undertaken as part of this investigation to estimate their hydraulic capacity and assess the potential influence of upstream surface water on the BESS development footprint.

The site visit found minor culverts (300 – 450mm dia) along Winton-Glenrowan Rd (near the north-east study area boundary), however the inlets were degraded and their effectiveness for conveyance is potentially reduced. As such, these minor culverts have been ignored in the delineation of the larger Winton-Glenrowan Rd culvert catchment (Figure 7).

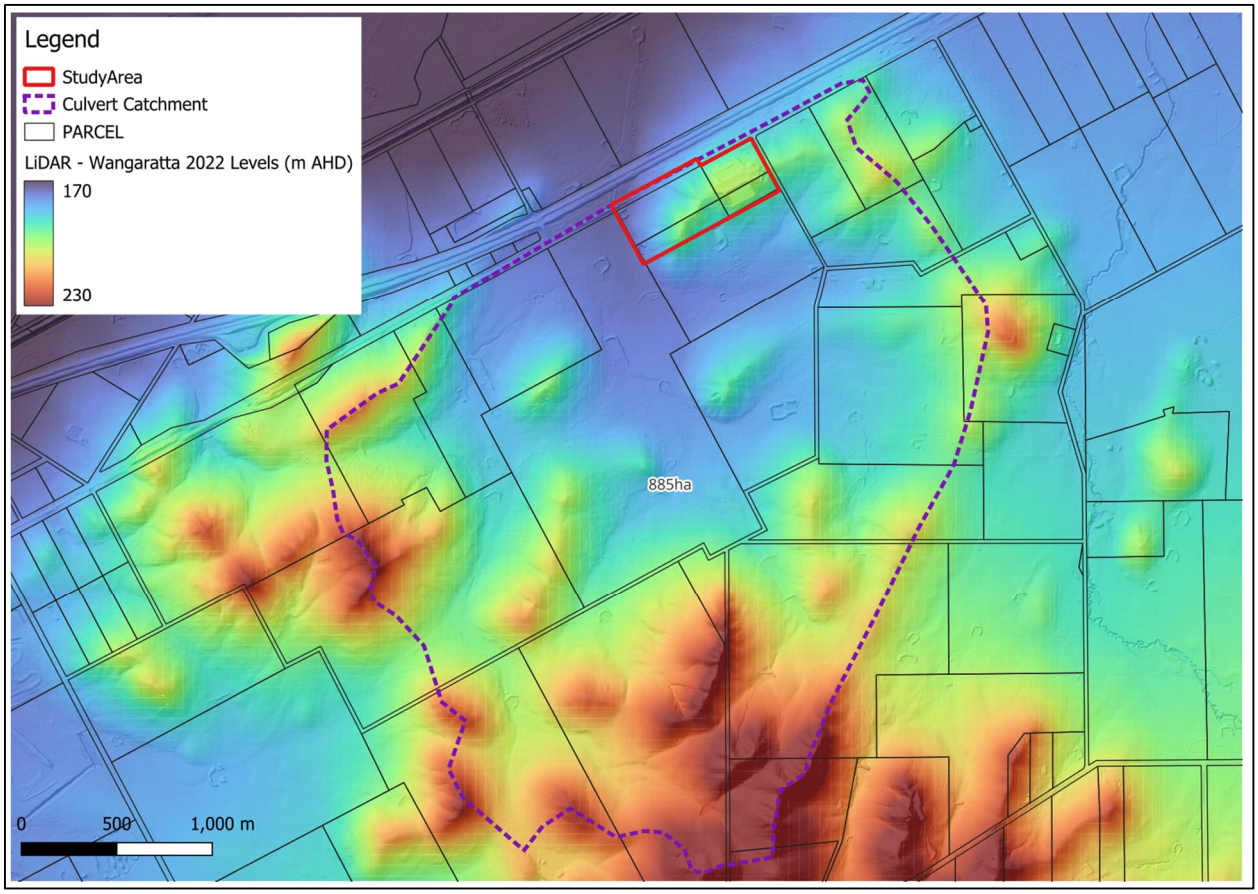

Figure 7: Culvert catchment

3.3 Peak flows

For the purposes of this report, peak minor flows have been defined as 10% annual exceedance probability (AEP) flows, and peak major flows have been defined as 1% AEP flows. Climate change was assessed using projections to 2060 under the SSP3 (Shared Socioeconomic Pathway 3) scenario, *Australian Rainfall and Runoff version 4.2* (Engineers Australia, 2024). Peak flows calculated for both 10% and 1% AEPs incorporate climate change conditions.

A range of hydrological estimation methods were used to estimate the minor and major peak flows of the study area, with details included in Appendix A. (See Table 1). Overall, there was good agreement between the estimation methods, with the proposed hydrological methods to be adopted:

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- Regional Flood Frequency Estimation (RFFE) minimum range flow rate adopted for 10% and 1% AEP for Winton-Glenrowan culvert catchment only. The minimum or lower range was adopted rather than 'expected' range as the peak flows aligned better with other estimation methods, such as Melbourne Water's rule of thumb for rural catchments.
- Kinematic Wave equation adopted for smaller site catchments in the existing condition in the major storm (1% AEP) and minor storm (10% AEP)

An existing case imperviousness of 5% was adopted for all rural catchments. The existing paved areas at the Glenrowan Terminal Station were assumed be 100% impervious.

Detailed calculations are included in Appendix A

Table 1: Summary of peak flows for minor and major storms, inclusive of climate change (SSP3 scenario to 2060)

Description	Area (ha)	Adopted 10% AEP Flow (m^3/s) – Kinematic wave and RFFE	Adopted 1% AEP Flow (m^3/s) – Kinematic wave and RFFE
Winton – Glenrowan Culverts	885	12.6'	26.3 [1]
Catchment 1,2,3,4	19.46	0.9	2.0
Catchment 1	5.84	0.4	0.8
Catchment 2	6.94	0.6	1.1
Catchment 3	3.79	0.5	1.0
Catchment 4	2.89	0.5	0.9
Catchment 5	4.99	0.7	1.3
Catchment 6	2.92	0.5	1.0

[1] RFFE's 1% AEP peak flow adopted for Winton – Glenrowan Culvert catchment

3.4 Potential for Flooding

The study area is located approximately 2.4 km west of Eleven Mile Creek. Given the distance and the topography, riverine flooding from Eleven Mile Creek is not a concern at the study area.

However, the study area may be subject to overland flow flooding, particularly in the vicinity of the Winton–Glenrowan Road culverts, which represent a local low point within the catchment. A preliminary culvert assessment was undertaken using HY-8, with LiDAR data used to estimate key culvert and roadway levels.

The assessment indicates that the existing culverts (1.2 m × 0.75 m, 8 cells) have an estimated combined capacity of approximately 5 m^3/s, which is significantly lower than the modelled minor and

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major peak flows of 12.6 m³/s and 26.3 m³/s, respectively (refer Figure 8). As a result, localised ponding is expected at the culvert location during design events.

While preliminary results suggest potential road inundation depths of up to approximately 2 m, this assessment is based on simplified assumptions. It is therefore recommended that the results be confirmed using 2D hydraulic modelling to better represent flow distribution and conveyance behaviour through this area.

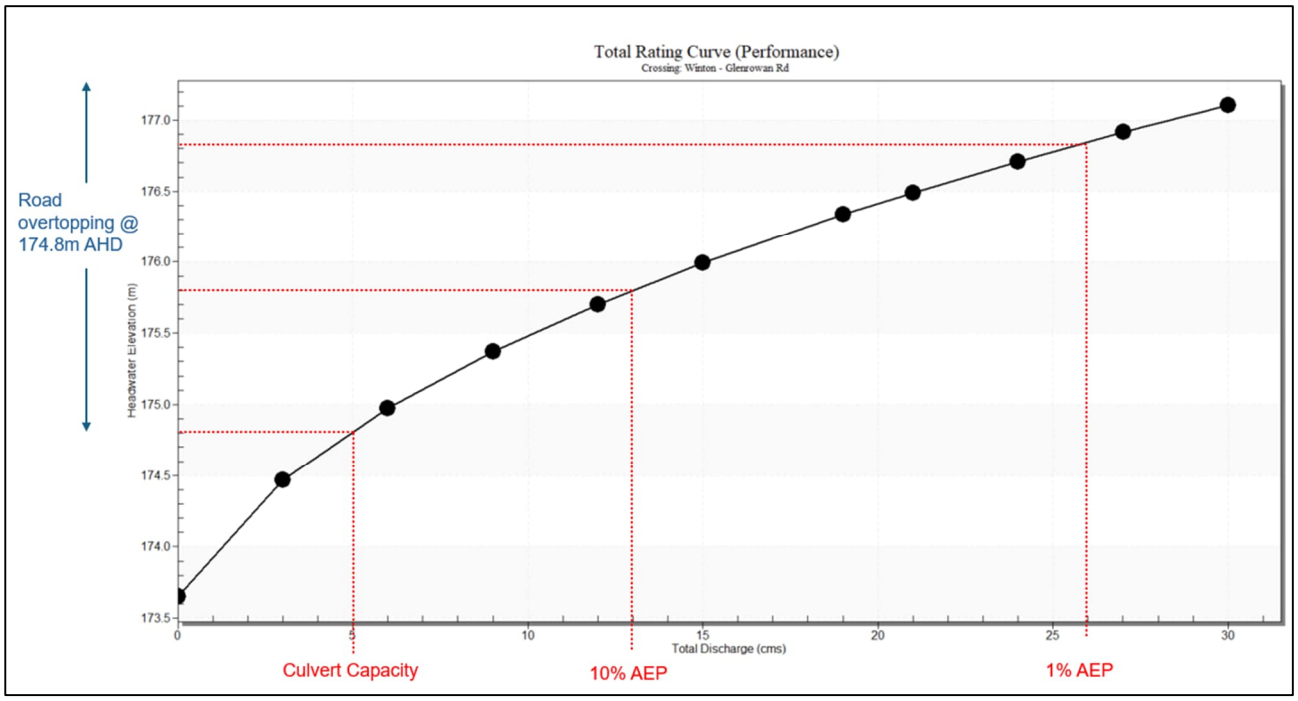

Figure 8: Stage-discharge curve of the Winton-Glenrowan Rd Culverts

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4. Proposed Project

The proposed project layout plan is shown in Figure 9. A full-size plan is included as Appendix B. Note that the project layout is still conceptual and subject to change. Stormwater management infrastructure is shown in the next section.

The BESS project will have a 400 MW/1600 MWh capacity. The BESS development footprint includes:

- BESS components including batteries, inverters, and transformer units
- Underground 220kV transmission connection to the Glenrowan Terminal Station
- Maintenance buildings
- Vegetation removal
- Landscaping
- Access points and tracks
- Water tanks
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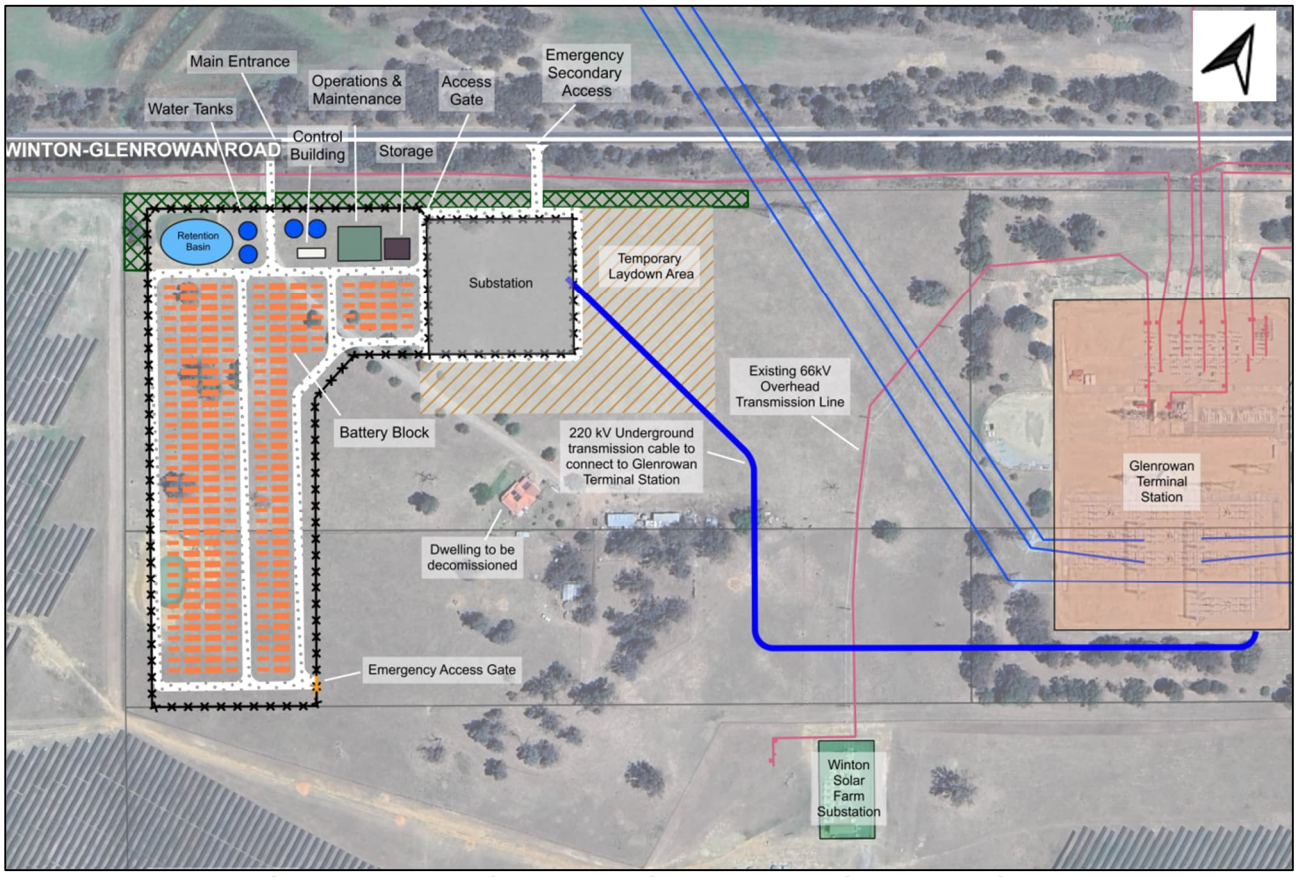

Figure 9: Proposed BESS Development Footprint Layout Plan

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5. Stormwater Management

Stormwater can be effectively managed at the study area in the developed condition. Management of stormwater can both protect the installation from major flows and ensure that there are minimal changes to existing flow regimes. Opportunities exist for integrated water management and green infrastructure to be incorporated into the design of the proposed utility installation. An overview stormwater management plan is included in Figure 10. The components of the plan are detailed in this section of the report.

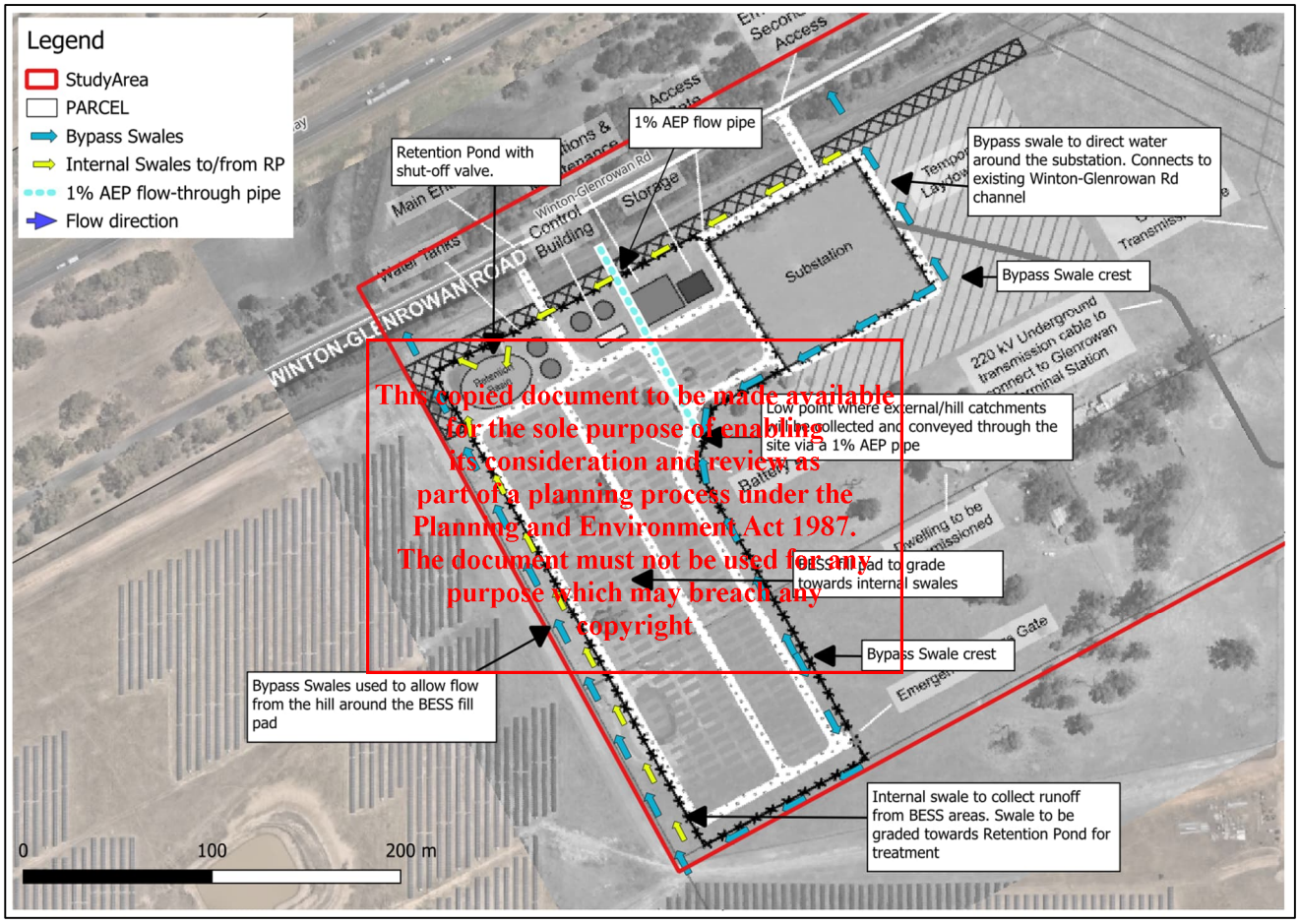

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Figure 10: Stormwater Management Overview Plan

5.1 Site grading

The grading of the study area is a key component of the overall stormwater management strategy. Site grading will be designed to protect the BESS infrastructure from external overland flows and ensure that runoff generated within the development area is appropriately managed. As part of the stormwater strategy, the development area is to be graded to drain towards the proposed retention pond, located at the western corner of the project, for water quality treatment. Figure 11 illustrates the proposed surface flow paths across the study area and surrounds, including the general westerly grading of the project area towards the retention pond.

The BESS platform is required to be relatively level to accommodate the operational and structural requirements of the battery units and associated electrical infrastructure. While the platform will

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maintain relatively shallow grades compared to the existing topography, minor grading will still be required to promote surface drainage, manage local runoff, and prevent ponding within the development area. Relatively level grading also supports constructability, equipment stability, and internal access across the BESS development footprint.

It is recommended that vegetated swales be constructed around the perimeter of the BESS development footprint to intercept and convey external catchment flows away from BESS infrastructure (See Figure 10 or Figure 11). Additional detail regarding the bypass swales is included in Section 5.4.

The design of stormwater or other assets must be sensitive to the environmental significance of any existing vegetation on the study area. It is expected that the earthworks for the study area, including final levels and the design of all swales, will be finalised during detailed civil design.

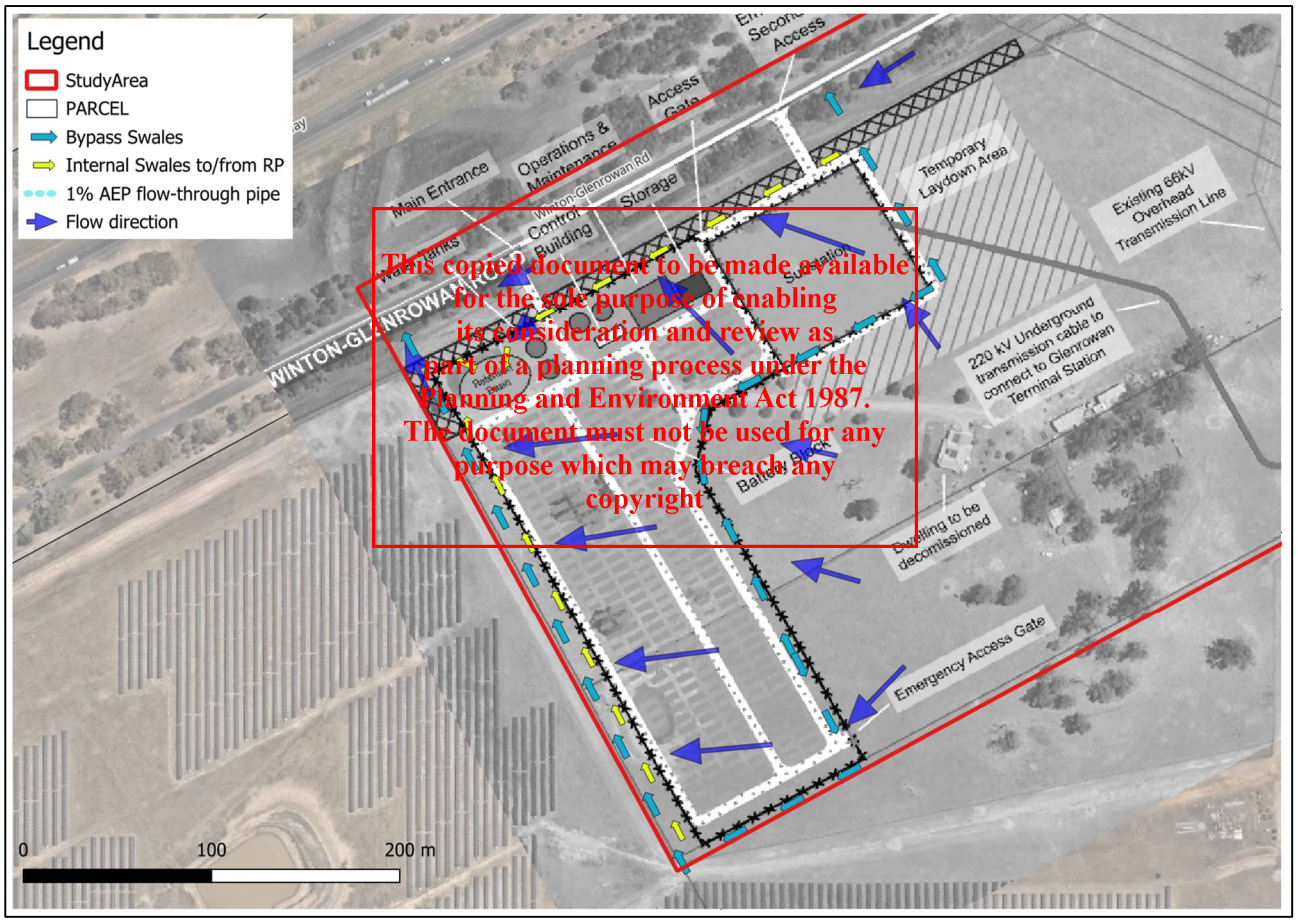

Figure 11: Flow direction

5.2 Developed conditions peak flows

Catchments for the developed case were defined based on the proposed stormwater management strategy and swale layout (see Figure 12). Development of the BESS area is expected to increase imperviousness and an average imperviousness of 50% was adopted for developed areas.

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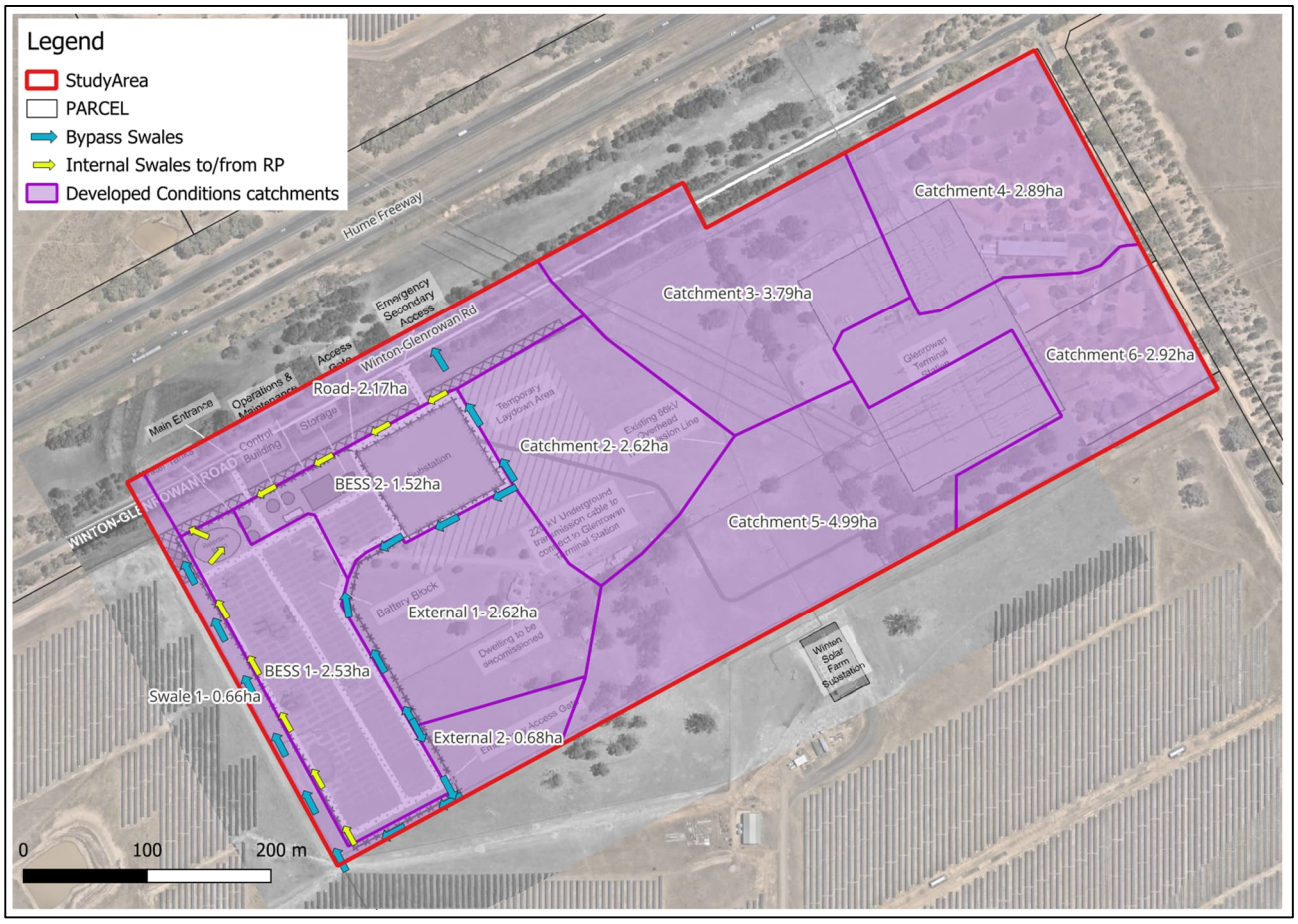

Figure 12: Developed conditions catchment delineation with area shown

The Rational Method was used to calculate peak flows for the developed case. To maintain consistency with the existing case hydrology, the kinematic wave equation was adopted for the minor and major storm event. See Table 2 for a summary of calculated peak flows.

As with existing case hydrology, climate change was assessed using projections to 2060 under the SSP3 (Shared Socioeconomic Pathway 3) scenario, as per *Australian Rainfall and Runoff version 4.2* (Engineers Australia, 2024).

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Table 2: Summary of developed conditions peak flow rates

Catchment from Figure 12	Area (ha)	10% AEP (with CC) storm (m^3/s)	1% AEP (with CC) storm (m^3/s)	Comments
External 1	2.62	0.2	0.5	
Catchment 2	2.62	0.3	0.5	
External 2	0.68	0.1	0.1	
BESS 1	2.53	0.4	0.9	Used to size BESS flow conveyance swale – Internal Swale 1, Table 3
BESS 2	1.52	0.3	0.6	Used to size BESS flow conveyance swale – Internal Swale 2, Table 3
Total BESS Development footprint (BESS 1 + BESS 2)	4.05	0.8	1.7*	
Swale 1 + External 2	1.34	0.07	0.2	Used to size bypass swale 1, Table 4
Road	2.17	0.3	0.7	
Undeveloped BESS	4.05	0.3	0.7	1% AEP retention target flow rate

* The peak flow calculation does not include retention in the retention pond.

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5.3 BESS flow conveyance swale

Two swales are proposed to convey runoff from the BESS development footprint to the retention pond (refer Figure 14 for location). The swales generally drain west – north-west for "Internal 1" swale and south-west for "Internal 2" swale. The preliminary swale design parameters are summarised in Table 3 and have been sized to convey the full post-development 1% AEP flow from the BESS area.

The swales have been designed to convey the 1% AEP flow, including an allowance for climate change. A consistent cross-sectional geometry has been adopted, comprising a 0.1 m base width and 1 in 4 side slopes. Variations in swale dimensions (depth and top width) are based on the anticipated flow rates along each reach. It is assumed that short vegetation, like short grass or lawn grass, be used for swales however this could be revised at detailed design stages.

The final swale dimensions and construction methodology will be refined during detailed civil design to optimise cut–fill balance and confirm that adequate freeboard is maintained relative to the BESS infrastructure.

Table 3: BESS conveyance swale properties

Attribute	Internal Swale 1	Internal Swale 2
Design (1% AEP) Flow (m^3/s)	0.9	0.6
Length (m)	270	205
Base width (m)	0.1	0.1
Batters	1 in 4	1 in 4
Longitudinal Slope (m/m)	1 in 50	1 in 33.3

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Attribute	Internal Swale 1	Internal Swale 2
Depth of flow (m)	0.45	0.4
Width of flow (m)	3.7	3.3
Freeboard (m)	0.3	0.3
Total top width (m)	6.1	5.7
Total depth (m)	0.75	0.7

The maximum depth of water in the conveyance swale in the 1% AEP (CC) storm must be below the finished surface level of the adjacent road and the concrete supports for the BESS units to ensure that stormwater drains appropriately. A conceptual BESS development footprint cross-section is shown in Figure 13.

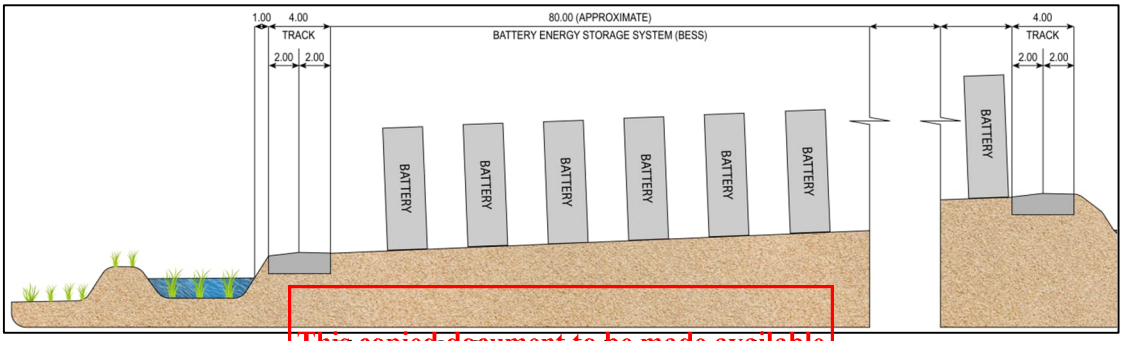

Figure 13: Conceptual cross-section

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5.4 Bypass swales for external flows

The proposed bypass swales are intended to intercept and divert external overland flows around the BESS development footprint towards the Winton-Glenrowan Rd culverts, where they naturally drain in existing conditions. Stormwater from the bypass swales do not need to be treated by the retention pond as the catchment is not developed.

These bypass swales are required in response to the earthworks needed to achieve a level platform for the BESS units. (See Figure 14). The catchments draining to these swales are small. The swales are proposed only to divert stormwater around and, via the proposed pipe detailed in Section 5.5, through the BESS facility.

Similarly to the Internal swales, the shape of the swales comprised of a 0.1 m base width and 1 in 4 side slopes. It is assumed that short vegetation, like short grass or lawn grass, be used for swales however this could be revised at detailed design stages.

Note that the exact location and geometry of the swale will depend on the proposed earthworks and subsequent batter slope extents at the BESS development footprint. Prior to detailed civil engineering design, a complete flora and fauna investigation should be undertaken to ensure that any interface with the existing trees at the study area is appropriate.

Table 4: Bypass swale properties

Attribute	Swale 1	External 1 Swale	Catchment 2 Swale
Design (1% AEP) Flow (m^3/s)	0.2	0.5	0.5
Length (m)	470	300	90
Base width (m)	0.1	0.1	0.1
Batters	1 in 4	1 in 4	1 in 4

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Longitudinal Slope (m/m)	1 in 125	1 in 30	1 in 16
Depth of flow (m)	0.35	0.35	0.3
Width of flow (m)	2.9	2.9	2.5
Freeboard (m)	0.3	0.3	0.3
Total top width (m)	5.3	5.3	4.9
Total depth (m)	0.65	0.65	0.6

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Figure 14: Location of proposed swales

5.5 1% AEP flow pipe

A 525 mm diameter pipe is proposed to convey runoff from the External 1 swales to the existing channel along Winton–Glenrowan Road. This is indicative only and may be changed at detailed design stage to suit the design of the BESS development footprint. As the contributing catchment is undeveloped, the runoff does not require treatment and may be discharged directly to the channel.

The proposed pipe will collect inflows from External 1 Swale at the low point. The inlet to the proposed pipe should be designed to ensure appropriate protection of the BESS facility whilst directing external flows to the proposed pipe.

The proposed pipe conveys external flows that must be kept separate from the internal runoff within Internal 2 Swale. The proposed 1% AEP pipe should be installed beneath the swale invert, and its

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outlet should be located north of Internal 2 Swale. Detailed civil engineering design will be required to confirm levels and ensure there are no conflicts between the 1% AEP pipe and Internal 2 Swale.

5.6 Retention Pond

A retention pond is proposed at western corner of the study area, where there is currently an existing dam. For stormwater management, it is suggested that the pond provide retention storage and act like a retarding basin. However, the pond will fulfill multiple stormwater management purposes, beyond retention of peak flows.

The available storage provided by the pond allows the pond to retain peak stormwater flows so peak outflows in events up to the 1% AEP are limited to those experienced in the existing condition. The sizing of the retention volume has been undertaken using Boyd's Method. Complete calculations are included in Appendix A. A storage volume of approximately 230 m^3 is required to limit 1% AEP (CC) storm outflows from the 4.02ha developed area to those from 4.02 ha of undeveloped area.

While 230m^3 is required for retention of runoff from the BESS development footprint, the size of the pond may be influenced by the CFA for firefighting purposes, resulting in a larger retention pond volume on the BESS development footprint.

The retention pond will ultimately discharge to the Winton-Glenrowan Rd culverts. The outlet from the retention pond should be appropriately sized to ensure that peak outflows are limited to those experienced in the existing condition. It is suggested that the design of the pond outflow incorporate methods to disperse flows so that concentrated outflows from the pond do not contribute to downstream erosion.

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5.7 Intercept Dam

The retention pond also serves an important role in surface water management at the study area. In case of an environmental incident, the pond will collect surface water from the utility installation keeping any contaminated runoff on-site and separate to downstream waterways.

It is recommended that the design of the outlet be undertaken so that the outlet can be easily blocked (in the case of an outlet pipe) or closed (in the case of an outlet valve) to facilitate protection of downstream waterways in the event of an environmental incident.

Consideration of firewater runoff management is consistent with Section 4.2.6.4 of the CFA Design Guidelines and Model Requirements for Renewable Energy Facilities (v4, 2023), which identifies the need to appropriately manage contaminated firewater runoff generated during emergency response events. The proposed retention pond and potential outlet isolation measures may assist in temporarily containing runoff and reducing the risk of uncontrolled discharge to downstream receiving environments, including the Winton Wetlands. It is understood that provision of an intercept dam achieves CFA requirements for fire water storage.

5.8 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.

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The proposed stormwater management approach for the study area provides an opportunity to incorporate water quality treatment with minimal additional cost. Runoff from the BESS will be collected and conveyed via vegetated swales, which will also provide passive stormwater quality treatment.

MUSIC modelling was undertaken to define the amount of treatment provided by the swale directing surface runoff to the retention pond. A 10-year rainfall template from Wangaratta Aerodrome for April 2011 to April 2021 was adopted. The mean rainfall in this period is 596 mm. The MUSIC model schematic is shown in Figure 15. Stormwater quality treatment results are compared to BPEMG targets in Table 5.

Half of the length of the proposed swale was input to the MUSIC model to account for stormwater entering the swale along its length. A vegetation height of 0.1 m was adopted to simulate well-maintained mowed vegetation. If the swale is located within a fire break, vegetation within the swale must be mowed and maintained. If the swale is not located within a fire break, taller, uncut vegetation is appropriate. The taller vegetation will provide additional stormwater quality treatment. If taller vegetation is proposed, it is recommended that the MUSIC modelling be updated to more accurately quantify the stormwater quality treatment provided.

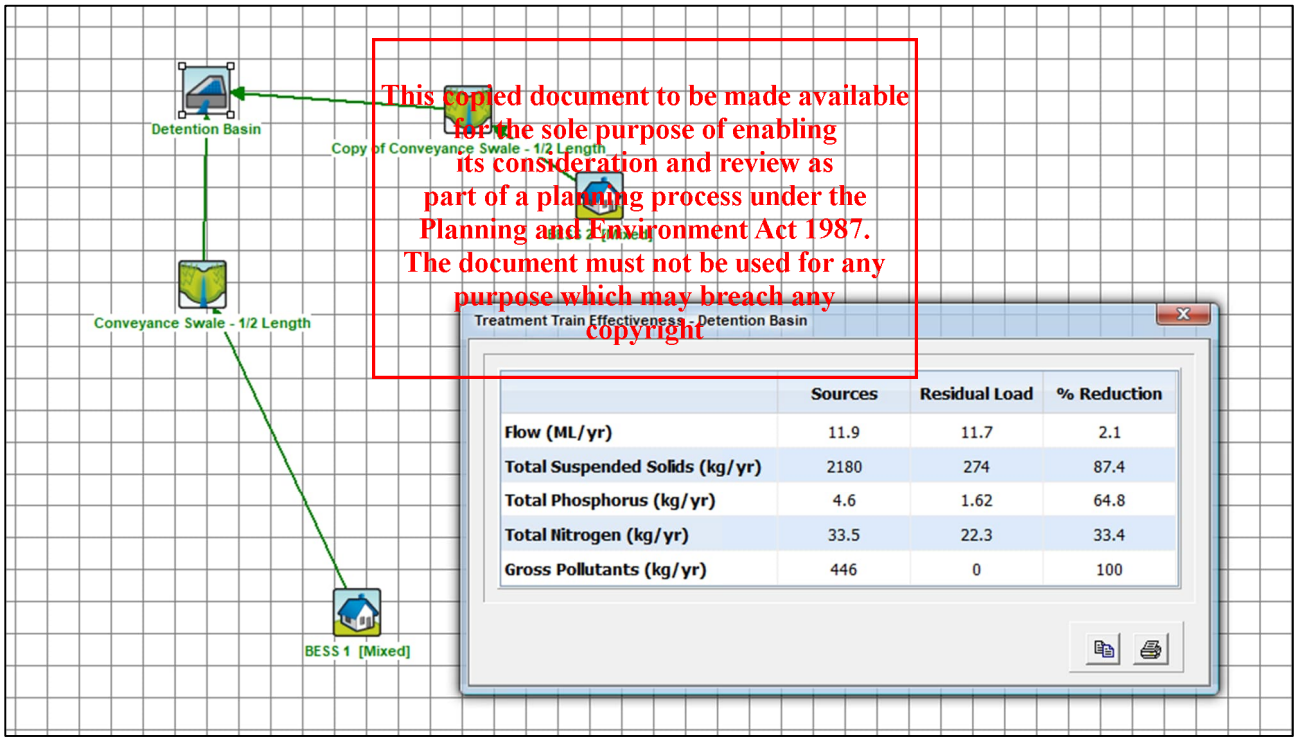

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Figure 15: MUSIC modelling schematic and results

Table 5: Stormwater Quality Treatment

Pollutant	BPEM Target reduction %*	Project reduction %
Total Suspended Solids (TSS)	80%	87.4 %
Total Phosphorus (TP)	45%	64.8 %
Total Nitrogen (TN)	45%	33.4 %

*There is no requirement to achieve the target owing to the type of development proposed

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The stormwater quality results are good for what is essentially a flow-on-effect of the proposed conveyance swale, and there is no stormwater treatment requirement for a utility installation. Should additional end-of-line treatment be desired, it is recommended that the opportunity to incorporate regenerative stormwater conveyance (e.g bioretention swale) in line with the *IDM sustainable infrastructure guidelines* be considered. Regenerative stormwater conveyance can provide additional stormwater quality treatment whilst also achieving the required stormwater management performance.

5.9 Infiltration and Groundwater

Most of the proposed BESS development footprint surface is projected to be crushed rock. A crushed rock surface allows continued permeability of the study area. In addition, the proposed use of open swales for conveyance of both internal and external stormwater 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.

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6. Conclusion

The study area comprises approximately 26 hectares (ha), which includes the Glenrowan Terminal Station and the associated 15 ha development area. The proposed BESS development footprint occupies approximately 6.5 ha. The BESS development footprint will be located west of the Glenrowan Terminal Station.

While the study area is not subject to riverine flooding, potential flooding caused by limited culvert capacity at the Winton–Glenrowan Road crossing, adjacent to the study area, may result in water ponding within the study area. A preliminary assessment indicates that both the minor and major design storms significantly exceed the capacity of the existing culverts, resulting in potential overtopping and localised inundation, despite anecdotal evidence from the landowner citing no road overtopping. Further assessment using two dimensional (2D) hydraulic modelling will be undertaken to better define the performance of the culvert during a major rainfall event. The modelling will also establish a 1% AEP flood level. The BESS facility's design will be above this level to provide protection of proposed assets. The current layout will elevate and fill in existing flood/low-lying areas, however this will be confirmed at detailed design stage.

A stormwater management strategy was developed for the study area to ensure that the existing hydrology is maintained after development. Furthermore, the Winton Wetlands are located downstream of the study area and have therefore been considered as part of this assessment from both a hydrology and water quality perspective.

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Key components of the stormwater management strategy include:

- Indicative grading of the BESS development footprint to protect the utility installation from 1% AEP overland flows from the south and east.
- Construction of bypass swales around the study area to direct external flows around the BESS development footprint
- A 1% AEP pipe to convey external flows from a small upstream catchment under the proposed BESS installation.
- Internal conveyance swales to collect all surface runoff from the utility installation and direct it west-ward to the retention pond and intercept dam.
- Construction of a retention pond at the western corner of the study area through the modification and integration of the existing dam. The retention pond will:
    - Provide a retention volume to reduce peak flows for events up to and including the 1% AEP to those experienced in the existing condition
    - Provide an intercept dam that can isolate surface runoff generated from the study area to protect downstream waterways in case of a fire or other environmental incidents

Stormwater management can be achieved during development of the utility installation. The stormwater management methodology of adopting vegetated swales to collect surface runoff from the BESS development footprint has the added benefit of providing stormwater quality treatment in excess of any statutory requirements. MUSIC modelling demonstrates that the proposed vegetated swale results in stormwater quality treatment that achieves best practice environmental management guidelines standards for suspended solids and phosphorus removal.

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Appendix A Drainage calculations

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Summary of existing major flows from a range of hydrology methodologies - 1% AEP with climate change (SSP3 scenario to 2060)

Description	Area (ha)	Kinematic Wave (m^3/s)	Bransby Williams (m^3/s)	Velocity Equation (m^3/s)	MW Rule of thumb (m^3/s)	Regional Flood Frequency Estimation (m^3/s)	
Winton – Glenrowan Culverts	885	24.8	24.1	34.2	26.6	26.3*	61.8**
Catchment 1,2,3,4	19.46	2.0	1.7	2.4	n/a	2.7*	6.4**
Catchment 1	5.84	0.8	0.6	0.8	n/a	1.3*	3.1**
Catchment 2	6.94	1.1	0.9	1.0	n/a	1.5*	3.5**
Catchment 3	3.79	1.0	0.9	0.9	n/a	1.0*	2.5**
Catchment 4	2.89	0.9	0.8	0.8	n/a	0.9*	2.2**
Catchment 5	4.99	1.3	1.2	1.3	n/a	1.3*	3.0**
Catchment 6	2.92	1.0	0.9	1.0	n/a	0.9*	2.1**

* Minimum/lower quantiles – 5% Confidence limit

** Expected quantiles

[1] RFFE's 1% AEP peak flow adopted for Winton – Glenrowan Culvert catchment

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Summary of existing minor flows from a range of hydrology methodologies - 10% AEP with climate change (SSP3 scenario to 2060)

Description	Area (ha)	Kinematic Wave (m^3/s)	Bransby Williams (m^3/s)	Velocity Equation (m^3/s)	Regional Flood Frequency Estimation (m^3/s)
Winton – Glenrowan Culverts	885	11.5	13.4	18.8	12.6*
Catchment 1,2,3,4	19.46	0.9	0.9	1.3	1.3*
Catchment 1	5.84	0.4	0.3	0.4	0.6*
Catchment 2	6.94	0.6	0.5	0.6	1.5*
Catchment 3	3.79	0.5	0.5	0.5	1.1*
Catchment 4	2.89	0.5	0.4	0.4	0.9*
Catchment 5	4.99	0.7	0.7	0.7	1.3*
Catchment 6	2.92	0.5	0.5	0.5	0.9*

*5% Confidence Limit

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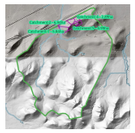

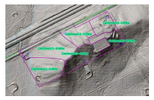

MAJOR STORM EVENT HYDROLOGY COMPUTATIONS

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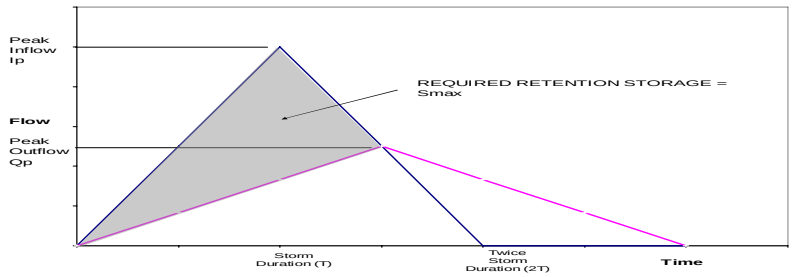
BOYDS FORMULA

This spreadsheet has been developed by Valerie Mag of Stormy Water Solutions (March 2007)

Stormy Water Solutions does not accept any responsibility for any errors contained within the spreadsheet or for any assumptions made by any future user.
The user accepts full responsibility in relation to the use and verification of the calculations detailed within the spreadsheet.

This spreadsheet has been provided to Melbourne Water employees as part of a course entitled "Drainage System Design"
The spreadsheet cannot be passed onto any third party (eg Melbourne Water consultants or contractors) without prior written permission by Valerie Mag of Stormy Water Solutions.



$$S_{max} = V_1 (1 - Q_p/I_p)$$

S_{max} = Maximum Volume of temporary Storage (m^3)
V_1 = Volume of inflow flood (m^3)
I_p = Peak discharge of inflow hydrograph (m^3/s)
Q_p = Peak discharge of outflow hydrograph (m^3/s)

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To be input by user
Calculated by spreadsheet

Catchment Area (A) =	4.02	ha
Runoff Coefficient (100 Year) =	0.655	
100 Year Effective Catchment Area = ∑CA =	2.63	ha
Restricted outflow requirement =	0.7	m^3/s

Storage requirement is highest value of S_{max} calculated in the table below
Critical storm duration is the storm duration when S_{max} occurs

Continue table until a clear Smax is calculated

Storm Duration (min)	100 Year Intensity (mm/hr)	I_p (m^3/s)	Q_p (m^3/s)	V_1 (m^3)	S_{max} (m^3)
1	291.2	2.13	0.70	128	86
2	234.9	1.72	0.70	206	122
3	214.1	1.57	0.70	282	156
4	199.4	1.46	0.70	350	182
5	187.2	1.37	0.70	411	201
6	176.6	1.29	0.70	465	213
7	167.3	1.22	0.70	514	220
8	159.0	1.16	0.70	558	**222**
9	151.5	1.11	0.70	598	220
10	144.7	1.06	0.70	635	215
11	138.5	1.01	0.70	669	207
12	132.9	0.97	0.70	700	196
13	127.7	0.93	0.70	729	183
14	123.0	0.90	0.70	756	168
15	118.6	0.87	0.70	781	151
16	114.5	0.84	0.70	804	132
17	110.7	0.81	0.70	826	112
18	107.2	0.78	0.70	847	91
19	104.0	0.76	0.70	867	69
20	100.9	0.74	0.70	885	45
21	98.0	0.72	0.70	903	21
22	95.3	0.70	0.70	920	-4
23	92.8	0.68	0.70	936	-30
24	90.4	0.66	0.70	952	-56
25	88.1	0.64	0.70	966	-84
26	85.9	0.63	0.70	981	-111
27	83.9	0.61	0.70	994	-140
28	82.0	0.60	0.70	1007	-169
29	80.1	0.59	0.70	1020	-198
30	78.4	0.57	0.70	1032	-228

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Appendix B Concept Layout Plan

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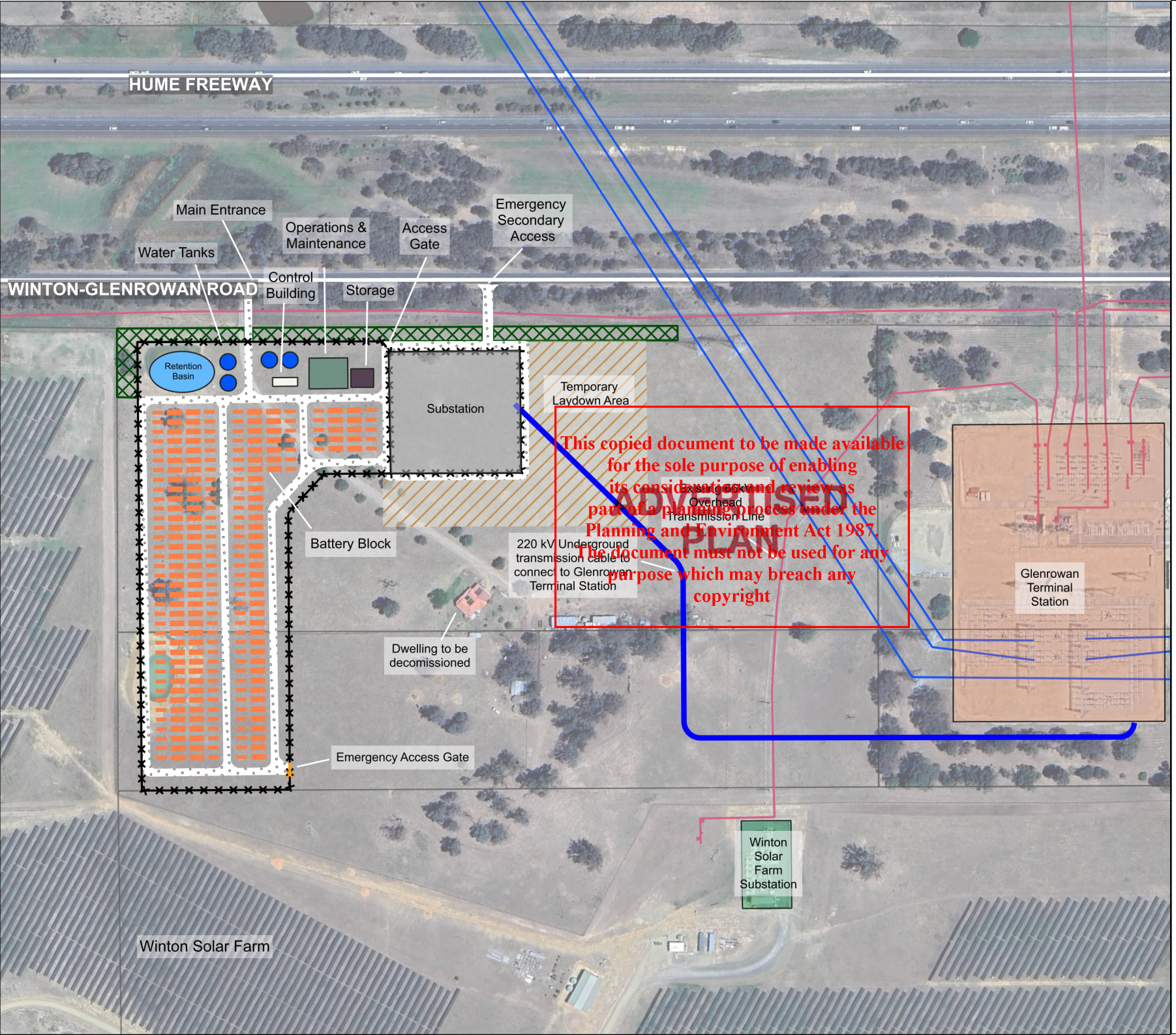

Preliminary Concept Layout Plan

2545 - WRESST

LEGEND

Proposed Features

- BESS Components
- Substation
- 220kV Underground Transmission Cable
- Fencing
- Emergency Access Gate
- Storage Shed
- O&M Building
- Control Building
- Internal Access Roads
- Temporary Laydown Area
- Native Vegetation Buffer
- Water Tanks
- Retention Basin

Existing Features

- Winton SF Substation
- Glenrowan Terminal Station
- 220 kV Transmission Line
- 66 kV Transmission Line
- Cadastre

Version: 1.0

Date: 08/05/2026

Disclaimer: This plan is preliminary and subject to detailed studies and approval.

0 50 100 m