EnergyCo

Waratah Super Battery – Munmorah

Appendix H - Water Impact Assessment

November 2022

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NSW GOVERNMENT

GHD Pty Ltd
133 Castlereagh Street, Level 15
Sydney, New South Wales 2000, Australia
T +61 2 9239 7100 | **F** +61 2 9239 7199 | **E** sydmail@ghd.com

Project manager	David Chubb
Client name	Energy Corporation of NSW
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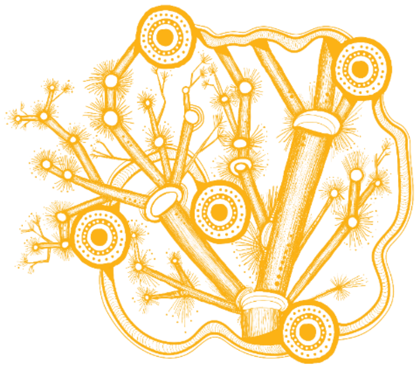
Acknowledgement of Country

Together, the NSW Department of Planning and Environment and GHD acknowledge Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water, and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience, and deep connections to Country. We pay our respects to Elders of the past, present, and future, as they hold the memories, knowledge, and spirit of Australia. The NSW Department of Planning and Environment and GHD are committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.



Artwork credit: Tyrown Waigana

Terms and abbreviations

Term/Abbreviations	Definition
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council Water Quality Guidelines
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
ARI	Average Recurrence Interval
ASS	Acid Sulfate Soils
BESS	Battery Energy Storage System
BOM	Bureau of Meteorology
CCUA	Central Coast Unregulated and Alluvial Water Sources 2022
CEMP	Construction Environmental Management Plan
CSSI	Critical State Significant Infrastructure
DGV	Default Guideline Value
DPE	Department of Planning and Environment
EC	Electrical conductivity
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EP&A	Environmental Planning and Assessment Act 1979
ESCP	Erosion and Sediment Control Plan
GDE	Groundwater dependent ecosystem
GPM	Generator Property Management Pty Ltd
ICOLL	Intermittently Closed and Open Lake or Lagoon
IPCC	Intergovernmental Panel on Climate Change
mBGL	Metres below ground level
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NCFP	North Coast Fractured and Porous Rock Groundwater Sources 2016
NEM	National Energy Market
NWQMS	National Water Quality Management Strategy
OWMP	Operational Water Management Plan
PIRMP	Pollution Incidence Response Management Plan
PMF	Probable Maximum Flood
POEO Act	Protection of the Environment Operations Act 1997
RCP	Representative Concentration Pathway
SEARs	Secretary’s Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SIPS	System Integrity Protection Scheme
SOPs	Standard Operating Procedures
SSGVs	Site-specific guideline values
SSI	State Significant Infrastructure
SWMP	Soil and Water Management Plan

Term/Abbreviations	Definition
TARP	Trigger Action Response Plan
TDS	Total dissolved solids
The Blue Book	*Managing Urban Stormwater, Soils and Construction, Volume 1 (Landcom, 2004)*
TSS	Total suspended solids
WM Act	Water Management Act 2000
WMP	Water Management Plan
WSP	Water Sharing Plan

Executive summary

Introduction

The Energy Corporation of NSW (EnergyCo) is proposing to develop a battery energy storage system within the former Munmorah Power Station at Colongra on the NSW Central Coast. As part of the Environmental Impact Statement (EIS), a Water Impact Assessment (this document) was undertaken to assess potential impacts to water from the proposed development. The water assessment identified the existing environment, the proposed development, a methodology to assess impacts, the potential impacts to water, and a suite of mitigation measures to manage potential impacts to water such that residual impacts are not anticipated.

Existing environment

The site is located within the catchment of the Tuggerah Lakes, which are a coastal lake system comprising of Tuggerah Lake, Budgewoi Lake, and Lake Munmorah that drain to the South-Pacific Ocean at 'The Entrance'. The proposed project is located at the former Munmorah Power Station, which is located between Lake Munmorah and Budgewoi Lake in an area used for loading materials for the power station. Elevations at this area are located at approximately 10-15 metres AHD, which is well above the downstream flooding levels predicted during extreme rainfall events and runoff from the site is currently discharged to Lake Munmorah. As a result of historical contamination at the site, the proposed project area has been remediated under an existing and separate approval.

Project description

The proposed facility will include construction of a battery energy storage system, as well as transmission and related infrastructure to connect the system to the energy grid. While detailed design is yet to be complete and will follow selection of a battery supplier, the site layout will primarily consist of a battery energy storage system – a graded pad with battery systems housed in enclosed containers, and a switchyard area containing transformers and infrastructure to enable connection of the battery systems to the electricity grid.

Construction will be undertaken to develop the rehabilitation site and would include earthworks, construction of a drainage network, installation of electrical components and construction of ancillary infrastructure. Once operational, minimal activities would be undertaken at the facility, and would generally involve the maintenance and management of the facility. Following operation, the site would be decommissioned, however details of this are not known at this stage.

Impact assessment, methodology and mitigation measures

Impacts with relation to water were identified and assessed, considering in-built water measures developed during concept definition, such as stormwater management and appropriate siting of the facilities. In addition, the assessment methodology also considered the fact that the final project specification is yet to be completed and would be dependent on the selected project supplier. These details include components such as the proposed battery details, proposed layouts, and foundation requirements. Accordingly, impacts were assessed based on the general nature of the proposed works, with mitigation and controls/requirements specified for future design development to provide assurance of the final project's environmental performance.

Four categories of impact were assessed: flooding, water sourcing, water quality, and groundwater. Assessment of these categories of impacts involved identification of potential sources of the impact, the potential receptors of relevant impacts, and the pathway by which sources could affect any receptors. Based upon the outcomes of an initial assessment, mitigation measures were developed to manage any risk, with the residual impact following implementation of these measures assessed to confirm that risk could be suitably managed.

Flooding

The impact assessment identified that the site is not flood prone and is generally well above current downstream flood levels and would continue to be above these levels despite any climate changes impacts to flooding. No significant impacts were identified from the proposed drainage network and flooding impacts from or on the site are not anticipated; however, detailed design should consider consultation and demonstrate compliance with relevant Council Guidelines and controls to manage flow rates and stormwater.

Water sourcing

Water would be required during construction and would be sourced from environmental management basins, or external sources. As part of the works, water services would be installed for the project via a new connection to existing services located at GPM offices within the former Munmorah Power Station. Water demands during construction are anticipated to be typical for civil projects of this magnitude and it is considered unlikely that water could not be sourced in the required quantities. Minor quantities of water would be required during operation and would be sourced via the new water connection.

No impacts to water sources were identified; however, prior to construction a detailed water balance should be undertaken based on the proposed construction methodology, with adjustments made to ensure a reliable supply can be maintained during the works.

Surface water quality

During construction, disturbance of the existing surface is required to permit construction. These activities pose a potential risk to downstream water quality associated with the mobilisation of sediment. The sources of sediment include 'typical' sediment from surficial soils placed during the site remediation, as well as 'non-typical' sediment from soils located at deeper depths that may be affected by previous site use and that may pose an enhanced risk to surface water quality. Another source of potential water quality risk during construction includes the handling of materials (such as hydrocarbons, metals, fuels, oils) that may be mobilised into waterways during construction.

Implementation of management plans and engineered controls are measures that are well understood and typical of works of this nature that can be used to effectively manage water quality impacts. In addition to details of water management, these plans would also include a monitoring and maintenance program, as well as a trigger action response plan to respond to unexpected or changing conditions at the site. Following implementation of these measures, no residual impact to water quality is anticipated during construction.

Following construction, operation of the facility poses a reduced risk to water quality compared to the construction phase, with key risks generally limited to the handling of higher risk materials. Potential impacts to water quality could occur from these materials, and the development of operational management plans and standard operating procedures were identified to manage this risk. Following implementation of these measures, no residual impact to water quality is anticipated during the site's operation; however, it was identified that detailed design should include consultation and demonstrate compliance with relevant Council Guidelines and controls to manage water quality impacts associated with increasing impervious areas as well as runoff during emergency conditions.

Groundwater

Groundwater levels at the site have been historically located between 4 and 8 metres below ground level and generally flow north towards the former Munmorah Power Station. While detailed design is yet to be completed, no excavation is anticipated at depths where interception or interference with local groundwater may occur. Impacts to groundwater water quality are not predicted, as the pathway to water quality impacts is primarily through surface water pathways. No significant impacts to groundwater are anticipated on this basis; however, it was identified that during detailed design, the proposed depths of excavation should be reviewed to confirm that excavations are not predicted to interact with groundwater.

Post operation

Details of the decommissioning and/or post-operational use of the site following closure are not known at this stage. The potential impacts post-closure of the facility are anticipated to be similar to those during construction, and at a lesser or similar extent due to an anticipated reduced disturbance of closure works, and handling of similar materials to the construction phase. Measures similar to those proposed for the construction and operational phase should be implemented for any post-closure works; and accordingly, no residual impact to surface or groundwater is anticipated.

Conclusion

A water impact assessment was undertaken to identify potential impacts to surface and groundwater during the construction, operation, and closure of a battery energy storage system in Colongra on the NSW Central Coast. The assessment identified that by implementing measures to manage potential risks to water by the project, that no unacceptable residual impact would be anticipated.

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Appendices

1. Introduction

1.1 Project overview

1.1.1 Background

The Energy Corporation of New South Wales (NSW) (EnergyCo), which forms part of the NSW Treasury, propose to develop a lithium-iron Battery Energy Storage System (BESS) capable of storing up to 850 megawatts (MW). The BESS would be supported by connecting transmission and related infrastructure to connect the proposed battery to the National Energy Market (NEM). Additional ancillary infrastructure would also be required to support the proposed BESS including access roads, site services, an administration building, maintenance building and storage yard, and signage and site security. The purpose of the proposed BESS is to reduce the chances of unscheduled power outages by reserving and then deploying power to support the electricity grid. It would form part of a System Integrity Protection Scheme (SIPS) for NSW. The proposed BESS would be located on a site within the former Munmorah Power Station at Colongra on the Central Coast of New South Wales.

The proposed BESS, connecting transmission and related infrastructure, and ancillary infrastructure is referred to as ‘the project’. The regional location of the project is shown in Figure 1.1. The final layout of the facility will be dependent on selection of the service provider, which is not yet complete. A concept design (Appendix A) has been used as the basis for the project, which is described in Section 3.

The project has been declared Critical State Significant Infrastructure (CSSI) in accordance with Section 5.13 of the Environmental Planning and Assessment Act 1979 (EP&A Act) and Schedule 1 of the Planning Systems State Environment Planning Policy (SEPP), as further discussed in Section 1.5.2.1. The Minister for Planning is the consent authority, and the project is to be assessed in accordance with the provisions of Division 5.2 of the EP&A Act.

1.1.2 Location

The project would be located on part of Lot 10/DP120141 within the former Munmorah Power Station at Colongra on the Central Coast of NSW (refer to Figure 1.1). The residential suburbs of Doyalson, San Remo, Buff Point, Budgewoi, and Halekulani are within the locality of the project.

1.1.3 Proposed infrastructure

The project is comprised of the following elements: :

– BESS (including batteries, inverters, transformers, and switchgear).

Connecting transmission and related infrastructure including:

- Switchyard.
- Overhead transmission line.

Ancillary infrastructure including:

- Upgraded access road.
- Site services, including power, water, sewage, stormwater drainage, and telecommunications.
- Administration building and light vehicle parking.
- Maintenance building, storage yard, and heavy vehicle parking.
- Signage and security.

A description of the battery energy storage system, the connecting transmission and related infrastructure and the ancillary infrastructure is provided in Section 3.

Paper Size ISO A4

0 2

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Energy Co
Waratah Super Battery - Munmorah
Water Impact Assessment

Regional location of proposed Waratah Super Battery

Project No. **12582669**
Revision No. **0**
Date **26/10/2022**

FIGURE 1.1

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12582669_WIA_001_Fig1_1_ProjectLocation
Print date: 26 Oct 2022 - 12:51

Data source: NPWS Reserves, Waterways - DFSI, 2022; Crown Land, Roads, Railways - DCS, 2022; World Street Map: Esri, HERE, Garmin, Foursquare, METI/NASA, USGS
World Street Map: Esri, HERE, Garmin, FAO, NOAA, USGS. Created by: mfredle

1.2 Purpose of this report

This report provides an assessment of water impacts associated with the project as an input to the EIS that will be assessed and determined by the NSW Department of Planning and Environment (DPE).

This water impact assessment has been prepared to address relevant Secretary's Environmental Assessment Requirements (SEARs) which were provided on 20 September 2022. The relevant SEARs for this report are included in Table 1.1.

Table 1.1 Relevant SEARs – Water Impact

SEARs – Water	Where it is addressed in this report
An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including watercourses traversing and surrounding the site, drainage channels, wetlands, riparian land, farm dams, groundwater dependent ecosystems and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;	Section 5
Details of water requirements and supply arrangements for construction and operation;	Section 5, Section 6.2
Where the project involves works within 40 metres of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the DPI Guidelines for Controlled Activities on Waterfront Land (2018) and (if necessary); and	Section 2.5.1
A description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom, 2004);	Section 6.3.1

1.3 Report structure

This report has been structured as per below.

- **Section 1:** Introduces the project, including relevant statutory context as well as the environmental assessment requirements.
- **Section 2:** Describes the existing environment, with a particular focus on environmental conditions related to water.
- **Section 3:** Details the project, including any built-in design components related to water management.
- **Section 4:** Outlines the methodology undertaken for assessing water related impacts from the project.
- **Section 5:** Details the potential impacts from the project regarding water related risks.
- **Section 6:** Outlines mitigation measures that are to be included in the project to reduce any relevant water related risks to the environment.
- **Section 7:** Summarises this report and outlines conclusions.

1.4 Limitations

This report: has been prepared by GHD for Energy Corporation of NSW and may only be used and relied on by Energy Corporation of NSW for the purpose agreed between GHD and Energy Corporation of NSW as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Energy Corporation of NSW arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Energy Corporation of NSW and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.5 Statutory context

1.5.1 Introduction

This chapter outlines the relevant statutory requirements for the project. It identifies:

– The legal pathway under which approval is sought, why the pathway applies, and who the decision-maker is.
– Relevant state approvals (outlining approvals that are not required for approved Critical State Significant Infrastructure (CSSI) and approvals that are required and that should be substantially consistent with approved CSSI).
– Relevant state and local environmental planning instruments that have been considered but are not a mandatory consideration for CSSI.
– Relevant federal approvals.

1.5.2 NSW legislation

1.5.2.1 Environmental Planning and Assessment Act 1979

The Environmental Planning and Assessment (EP&A) Act 1979, administered by the NSW Department of Planning and Environment, is the core legislation relating to planning and development activities in NSW and provides the statutory framework under which development proposals are assessed. The EP&A Act aims to encourage the proper management, development and conservation of resources, environmental protection, and ecologically sustainable development.

Part 5, Division 5.2 of the EP&A Act provides for declaration, assessment, and approval of SSI and CSSI. The process for environmental assessment and approval of SSI and CSSI is set out as follows:

– Application for approval of the Minister to carry out development
– Development of Planning SEARs
– Preparation of an EIS
– Public exhibition of the EIS
– Response to submission(s) received during public exhibition of the EIS
– Preparation of Planning Secretary’s Assessment Report
– Determination regarding the development by the Minister.

The project has been declared CSSI in accordance with Section 5.13 of the EP&A Act and Schedule 1 of the Planning Systems State Environment Planning Policy (SEPP). The Minister for Planning is the consent authority, and the project is to be assessed in accordance with the provisions of Division 5.2 of the EP&A Act.

1.5.2.2 Protection of the Environment Operations Act 1997

The Protection of the Environment Operations Act 1997 (POEO Act) is administered by the EPA, which is an independent statutory authority and the primary environmental regulator for NSW. The objectives of the POEO Act are to protect, restore and enhance the quality of the environment. Some of the mechanisms that can be applied under the POEO Act to achieve these objectives include programs to reduce pollution at the source and monitoring and reporting on environmental quality. The POEO Act regulates and requires licensing for environmental protection, including in some cases for waste generation and disposal and for water, air, land, and noise pollution.

The POEO Act also is the relevant legislation in regard to the discharge of waters. Section 120 of the POEO Act makes a statement that it is an offence to pollute waters.

1.5.2.3 Water Management Act 2000

Water Management Act

The *Water Management Act 2000* (WM Act) is intended to ensure that water resources are conserved and properly managed for sustainable use benefitting both present and future generations. It is also intended to provide a formal means for the protection and enhancement of the environmental qualities of waterways and their catchments.

The WM Act controls the extraction and use of water, the construction of works such as dams and weirs, and the carrying out of activities in or near water sources in NSW. ‘Water sources’ are defined very broadly to include any river, lake, estuary, or place where water occurs naturally on or below the surface of the ground and NSW coastal waters.

Part 2 of the WM Act applies to the requirement to obtain a licence for the “taking of water” from a water source. An access licence entitles its holder to specified shares in the available water within a specified water management area or from a specified water source. It enables the licence holder to take water from the environment in accordance with specified rates and conditions under the terms of the licence.

Provisions within Water Sharing Plans (WSPs) provide water to support the ecological processes and environmental needs of groundwater dependent ecosystems (GDEs) and waterways. WSPs also provide how the water available for extraction is shared between the environment, basic landholder rights, town water supplies and commercial uses.

The following WSPs made under Section 50 of the WM Act are relevant to the project:

- Central Coast Unregulated and Alluvial Water Sources 2022 (CCUA WSP)
- North Coast Fractured and Porous Rock Groundwater Sources 2016 (NCFP WSP).

Central Coast Unregulated and Alluvial Water Sources Water Sharing Plan

For surface water, the site is located within the Central Coast WSP which came into force in 2022. The project is located within the Tuggerah Lakes Water Source.

North Coast Fractured and Porous Rock Groundwater Sources Water Sharing Plan

For groundwater, the site is located within the NCFP WSP, which became operational in 2016. The site is located within the Sydney Basin – North Coast Groundwater Source of the NCFP WSP.

1.5.2.4 NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy explains the role and requirements of the Minister administering the *Water Management Act 2000* in the water licensing and assessment processes for aquifer interference activities under the *Water Management Act 2000* and other relevant legislative frameworks.

The term ‘aquifer’ is commonly understood to mean a groundwater system that is sufficiently permeable to allow water to move within it, and which can yield productive volumes of groundwater.

The *Water Management Act 2000* describes an aquifer interference activity as that which involves any of the following:

- The penetration of an aquifer
- The interference with water in an aquifer
- The obstruction of the flow of water in an aquifer
- The taking of water from an aquifer
- The disposal of water from an aquifer.

The NSW Aquifer Interference Policy describes the assessment required when considering potential impacts on groundwater sources, including their users and GDEs, when an activity interferes with an aquifer (as described in *Water Management Act 2000*).

1.5.2.5 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The National Water Quality Management Strategy (NWQMS) provides a national framework for improving water quality in Australia's waterways. The main policy objective of the NWQMS is to achieve sustainable use of the nation's water resources, protecting and enhancing their quality, while maintaining economic and social development.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC (2000) and ANZG (2018), are the benchmark documents of the NWQMS which provides a guide for assessing and managing ambient water quality in a wide range of water resource types and according to specified environmental values, such as aquatic ecosystems, primary industries, recreation and drinking water. ANZECC (2000) provide a framework for determining appropriate guideline values or performance criteria to evaluate the results of water quality monitoring programs.

The ANZECC (2000) Guidelines present numerical guidelines which can be used as a basis to assess the impact of the project against defined objectives or values for the receiving waters.

The core concept of the ANZECC (2000) Guidelines relates to managing water quality for environmental values. For each environmental value, the guidelines identify particular water quality characteristics or 'indicators' that are used to assess whether the condition of the water supports that value. The environmental values expressed as water quality objectives provide goals to assist in the selection of the most appropriate management options within a catchment. The guiding principles include that:

- Where the environmental values are being achieved in a waterway they should be protected.
- Where the environmental values are not being achieved in a waterway, all activities should work towards their achievement over time.

The environmental values expressed as water quality objectives provide goals to assist in the selection of the most appropriate management options within a catchment. The ANZECC (2000) Guidelines also advocate an 'issues-based' approach to assessing ambient water quality, rather than the application of rigid numerical criteria without an appreciation of the context. This means that the guidelines focus on:

- The environmental values we are seeking to achieve or maintain
- The outcomes being sought
- The ecological and environmental processes that drive any water quality issue.

It should also be noted that the environmental values and respective numerical indicator values apply to ambient background water quality and are not intended to be applied to stormwater discharges or mixing zones associated with a release from a site. Discharges therefore need to be considered in recognition of other land uses within the catchment which also influence water quality.

The ANZECC (2000) guidelines adopt a risk-based approach to assessing ambient water quality by providing the framework to tailor water quality guidelines to local environmental conditions. Guideline values (GVs) provided by ANZECC (2000) and ANZG (2018) can be modified into regional, local, or site-specific guideline values (SSGVs) by considering factors such as the variability of the particular ecosystem, soil types, rainfall, and level of exposure to contaminants. It should be noted that guideline values are applied to the receiving environment at the edge of the mixing zone and do not apply to the point of discharges.

1.5.2.6 Approved Methods for the Sampling and Analysis of Water Pollutants in NSW

The document Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA, 2022) lists the sampling and analysis methods to be used when acquiring water samples for compliance with environmental protection legislation, a relevant licence or relevant notice.

1.5.2.7 Managing Urban Stormwater, Soils and Construction

Managing Urban Stormwater, Soils and Construction, Volume 1 (Landcom,2004) 'The Blue Book' provides guidance and performance standards with relation to the control of erosion and sediment. Throughout NSW the performance standards of *Landcom, 2005* are commonly used to assess the suitability of proposed controls and residual risk and are commonly included by the EPA in relevant regulatory requirements.

1.5.2.8 Resilience and Hazards State Environmental Planning Policy (2021)

The Resilience and Hazards SEPP 2021 implements the objectives of the *NSW Coastal Management Act 2016*. This SEPP establishes coastal wetlands and littoral rainforest areas, coastal vulnerability areas, coastal environment areas and coastal use areas. Each area has limitation on the development, or impact assessment requirements to be considered.

For the proposed development, a small portion to the north of the site is defined as being in the 'Coastal Environment Area'. Within this area, development must consider a range of impacts associated with ecological values, water quality, public access, and aboriginal cultural impacts.

2. Existing environment

2.1 Site description

The site is located within the former Munmorah Power Station at Colangra, in the Central Coast Local Government Area (the project site). Entrance to the site is via Station Road, off Central Coast Highway, NSW, 2262.

The former Munmorah Power Station comprises multiple land parcels, with a total combined land area of approximately 727.2 hectares. The proposed site (shown on Figure 1.1) comprises part of Lot 10 in DP120141 and has an area of approximately 14 hectares.

The project site has previously been mostly cleared (except for some small patches of native vegetation as well as planted pine trees) and was heavily disturbed from its previous use as a coal stockpile area for the former Munmorah Power Station. The project site is currently vacant and is subject to rehabilitation, remediation and maintenance works by Generator Property Management (GPM).

The project site has been specifically chosen to avoid or minimise environmental impacts as it is located on a ‘brownfield’ site which is largely clear of significant vegetation and other environmental constraints.

2.2 Site history

The former Munmorah Power Station operated for a period of approximately fifty years prior to its closure in June 2012. In 2016, the former power station and its surrounding land area was transferred to Generator Property Management Pty Ltd. GPM is a NSW government-owned company with, amongst other things, responsibility for decommissioning, demolition and remediation of power stations remaining in public ownership in NSW. GPM has been responsible for decommissioning, demolition, and remediation of Munmorah Power Station.

GPM has previously managed the demolition and rehabilitation of the former power station, and is undertaking further rehabilitation, remediation and maintenance works in accordance with its existing approvals.

The project site area was previously used as a coal stockpile area for the power station and, as a result, the site is largely cleared and disturbed.

GPM has removed most of the coal stockpile infrastructure, however some infrastructure remains, and GPM is currently undertaking further rehabilitation on the project site under its existing approvals. These works will include removal of remaining infrastructure (including the coal bunker and some stormwater detention and drainage infrastructure), surface ripping to mix soils, removing the remaining coal residue, contouring the landscape, installing erosion control measures, and weed management including removal of exotic pine trees. The site will then be revegetated with stabilising grasses.

2.3 Topography

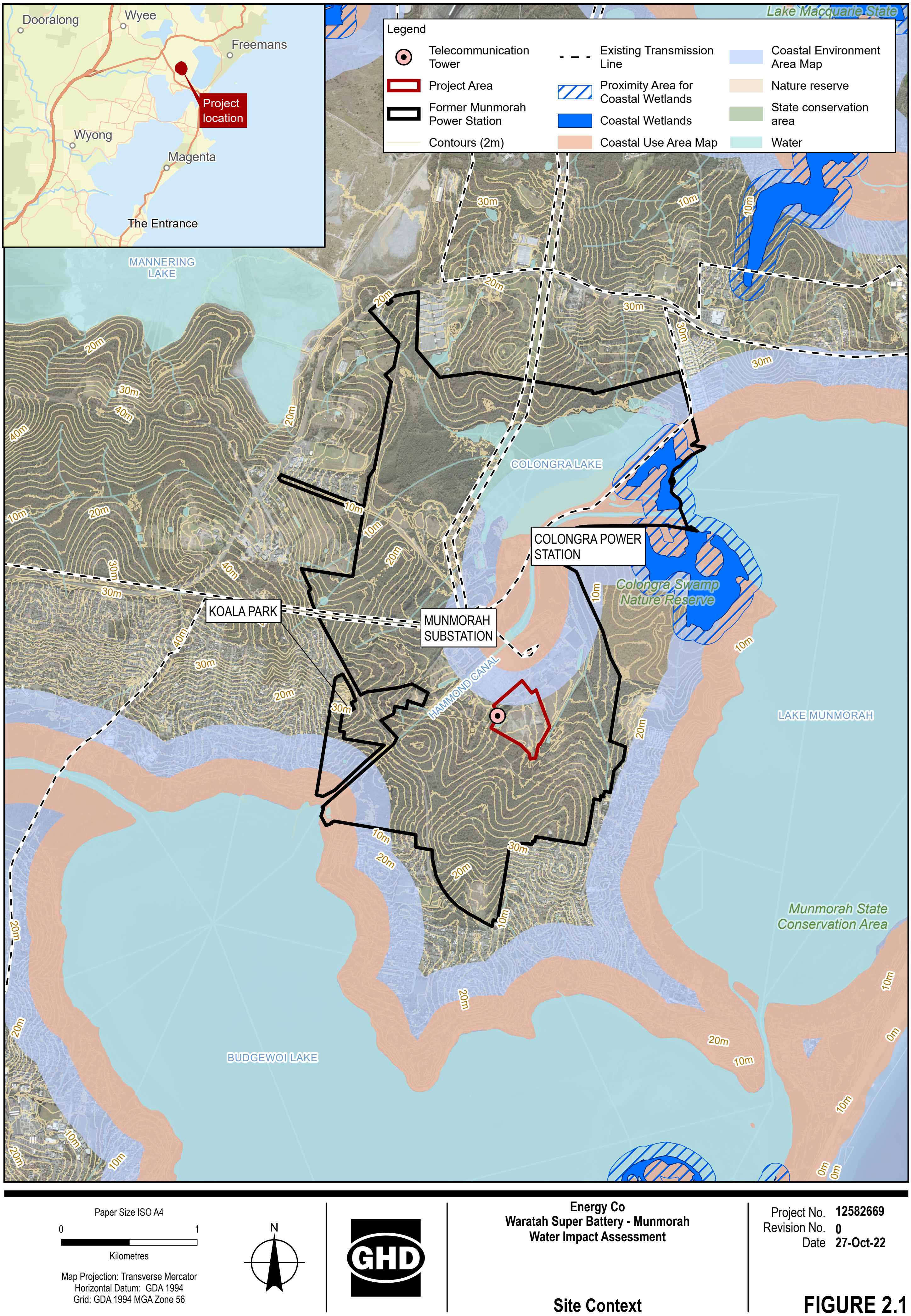
The site’s catchment generally falls towards the north, towards Hammond Canal which is connected to Lake Munmorah. Local topographic features are shown in Figure 2.1. A ridge line, located to the south of the site, forms the southern boundary of the catchment draining towards Hammond Canal and Lake Munmorah. The ridgeline is located approximately 20 to 35 metres AHD and falls to the north towards the project site, which is located at 10 to 15 metres AHD.

The project site itself is relatively flat and generally falls in a northerly direction. Areas north of the site are lower and fall towards Hammond Canal, which is hydraulically connected to Lake Munmorah.

2.4 Climate

The average annual climatic data for the site was sourced from SILO Long Paddock patched point grid data which provides a spatially and temporally continuous climatic data. SILO data is shown below in Figure 2.2, which identifies that:

- The hottest months occur typically during summer and early autumn, from December – March, with coldest months typically in winter from June – August. Typical maximum daily temperatures range from 17 to 28 degrees Celsius through the year, with typical minimum daily temperatures ranging from 8 to 20 degrees Celsius through the year.
- Average monthly rainfall ranges typically between 50-100 mm and is relatively consistent.
- The driest months are typically in late winter and early spring (August – October) and the wetter months are typically in late summer, autumn, and early winter (February – June). Wettest months have been observed in Summer, Autumn, and early Winter, with 158.5 mm historically observed in February.
- Generally, potential evapotranspiration exceeds precipitation with annual total precipitation typically around 1200mm and generally ranging from 900-1600mm per annum. Annual total potential evapotranspiration is generally around 1600-1800mm per annum.
- Potential evapotranspiration is normally greater than precipitation for all months, excluding the months of May and June.



Energy Co
Waratah Super Battery - Munmorah
Water Impact Assessment

Project No. 12582669
Revision No. 0
Date 27-Oct-22

Site Context

FIGURE 2.1

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12582669_WIA_005_Fig2_1_SiteContext
Print date: 27 Oct 2022 - 10:59

Data source: Flood Inundation - Central Coast Council 2022; NPWS Reserves, Waterways - DFSI, 2022; Crown Land, Roads, Railways - DCS, 2022; Metromap Tile Service:
World Street Map: Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS. Created by: mfredle

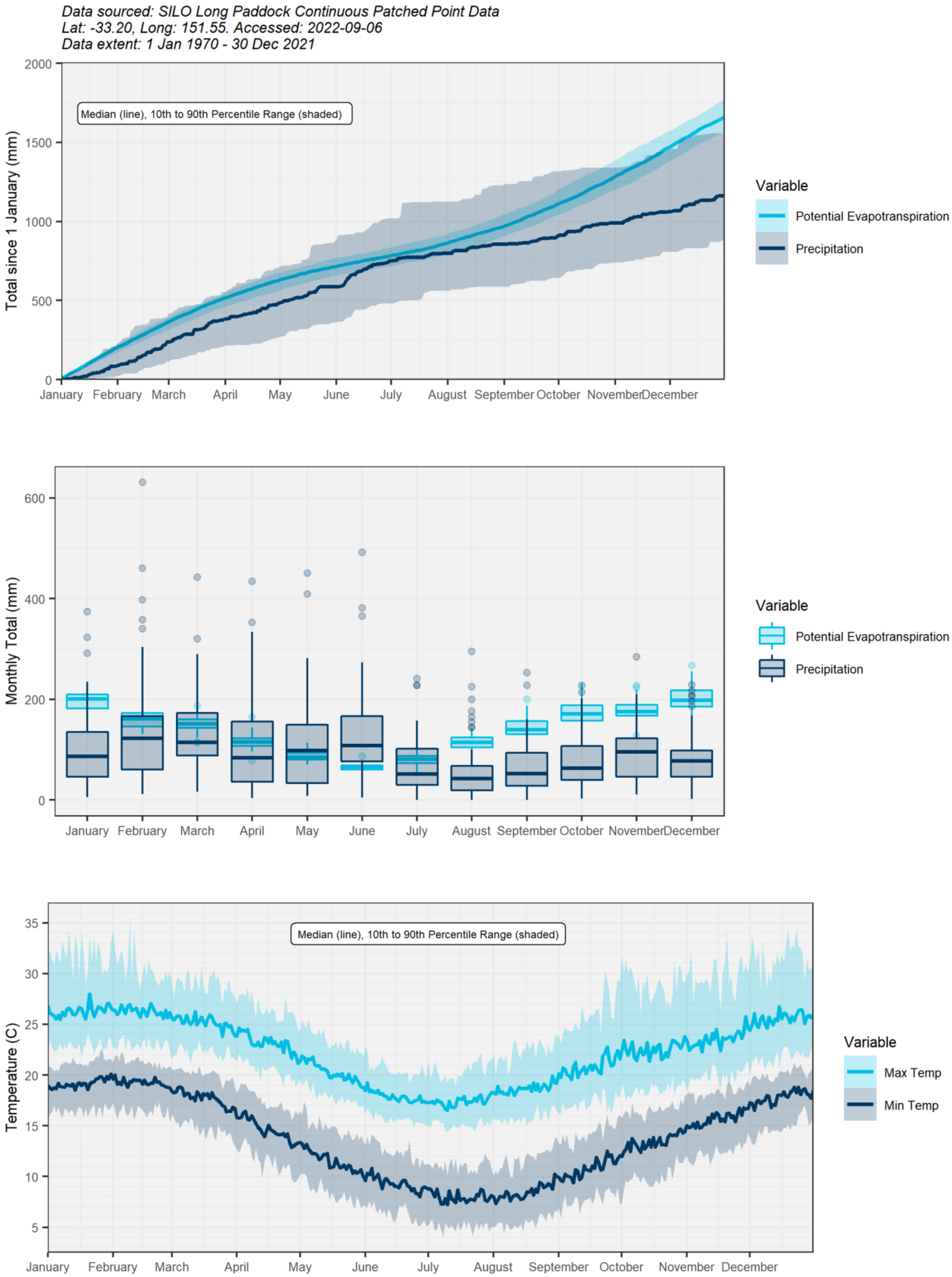


Figure 2.2 Local climate data

2.5 Hydrology and hydrogeology

2.5.1 Hydrology

Catchment Hydrology

The site is located within the Macquarie Tuggerah regional catchment (refer Figure 2.3). This regional catchment has an approximate catchment area of 1,630 km^2 and covers a large portion of the central coast bounded by the Hunter catchment (to the north and north-west) and Hawkesbury Nepean catchment (to the south and south-west). The main waterways within the Macquarie Tuggerah catchment are Dora Creek, which runs south-east to meet Lake Macquarie, and Wyong River and Ourimbah Creek which both run south-east to meet Tuggerah Lake at Tacoma and Chittaway respectively (NSW Department of Planning and Environment, 2022).

The main water bodies near to the project site are Tuggerah Lake (approximately 5.6 km south-west of the site), Lake Budgewoi (approximately 2 km south of the site), and Lake Munmorah (approximately 1.1 km east of the site). The three lakes, collectively referred to as the 'Tuggerah Lakes', are a series of hydraulically connected coastal lagoons, linked by shallow and narrow channels, with one narrow connection to the South Pacific Ocean at 'The Entrance', located in the south-east of Tuggerah Lakes. The lakes are drained by several main tributaries, namely Wallarah Creek, Spring Creek, Jillby Jillby Creek, Wyong River, Ourimbah Creek, Tumbi Creek, and Saltwater Creek (refer Figure 2.3). The majority of the lakes' catchment is rural or bushland, with some urban development primarily situated around the perimeter of the lakes. Within the Tuggerah Lakes and Lake Macquarie systems there are several scattered coastal wetlands and littoral rainforests, the closest to the site being Colongra swamp which is located about 650 metres north-east of the project site in Munmorah Lake. It is listed as an important coastal wetland under *State Environment Planning Policy (Biodiversity and Conservation) 2021.*

The Tuggerah Lakes system is an Intermittently Closed and Open Lake or Lagoon (ICOLL) which alternates between being open (during wetter periods) and closed (during dry periods) to the ocean. A berm, which is influenced by the movement and redistribution of sand and sediments by waves, tides, flood flows and winds, separates the lakes from the ocean. Within the last 100 years, the estuary has only closed 13 times, with the longest recorded period of closure being three years (Central Coast Waterways, 2022).

Flushing and cleansing of the lake rely upon several mechanisms, one of which is the intermittent opening and closing. In recent years, development and management has affected the natural opening and closing regime of the lake, as the estuary is generally kept open. This action of closing allows water to rise within the lake system until the barrier is removed causing an outflow to the ocean and a 'flushing' effect.

Due to the narrow ocean opening, and large extent of the lake system, the average retention times of the lakes, being the amount of time that water typically stays in each lake before being flushed out, are driven by the level of disconnection from the ocean. Areas that are relatively more connected, such as Tuggerah Lake, which receives flow from Tuggerah and Wyong, is most quickly flushed, with an average retention time of approximately 220 days (Central Coast Council, 2020). With a relatively smaller catchment for Budgewoi Lake, and an even smaller catchment for Munmorah Lake, the average retention time increases to 460 days and 520 days respectively (Central Coast Council, 2020). These relatively long average retention times enhance potential risks to water quality due to the limited dilution from tidal waters and relatively smaller catchments.

Local Hydrology

Located around 320 metres to the north-west of the project site is Hammond Canal, a man-made constructed channel that historically connects into Lake Munmorah and Budgewoi Lake (refer Figure 2.4). Hammond Canal was opened in 1966 and was historically used as a water-cooling canal for the Munmorah Power Station with water taken from Lake Munmorah and discharged to Lake Budgewoi via an underground pipe network. The Munmorah Power Station is not currently operational.

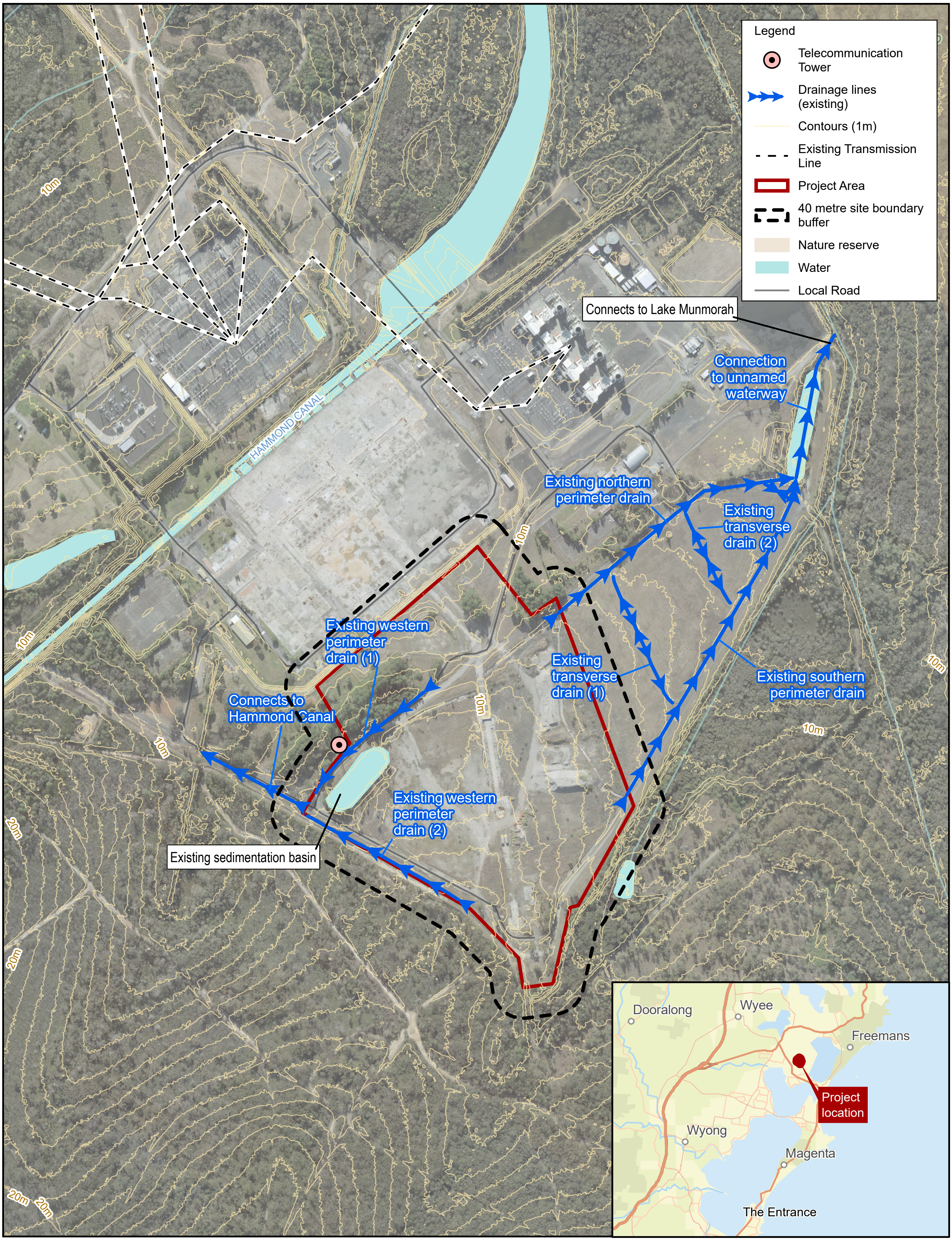
Runoff at the site is contained by a number of channels surrounding the site due to its previous use as a coal loader and coal stockpile area; these drain into Hammond Canal or Lake Munmorah.

Currently, there is an existing settling basin to the west of the project site, constructed as a sediment control structure for the former coal stockpile area. The settling basin discharges into a constructed drainage channel that runs to the eastern perimeter of the site. Upgradient catchments are diverted around the power station site into Hammond Canal or Lake Munmorah.

There are no rivers, lake or wetlands (collectively waterfront land) within the site or within forty metres of the site. The site boundary, forty metre buffer zone, and waterfront land is shown in Figure 2.4.

Within the project area, water flows at the project site from south to north, owing to the existing topography (refer Section 2.3). There is an existing drainage channel along the eastern and north-western perimeter of the site that is the primary drainage line. Water captured in these drainage lines flows north into an unnamed waterway, alongside Hammond Canal, which correspondingly drains into Munmorah Lake and Budgewoi Lake. Figure 2.4 identifies existing drainage at the project site.

Figure 2.3 ***Lake Macquarie and Tuggerah Lakes Catchments (NSW Water Quality and River Flow Objectives, accessed 15 August 2022)***



Paper Size ISO A4

0 50 100 150

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

Department of Planning Industry & Environment
Waratah Super Battery - Munmorah
Water Impact Assessment

Project No. **12582669**
Revision No. **0**
Date **26/10/2022**

Project Site Water Impact

FIGURE 2.4

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12582669_WIA_002_Fig2_4_WaterImpactSite
Print date: 26 Oct 2022 - 12:50

Data source: Flood Inundation - Central Coast Council 2022; NPWS Reserves, Waterways - DFSI, 2022; Crown Land, Roads, Railways - DCS, 2022; Metromap Tile Service:
World Street Map: Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS. Created by: mfredle

2.5.2 Flooding

As described in Section 2.3, the site is relatively elevated, ranging from approximately 10 to 15 metres above sea level, whereas elevation of the Tuggerah Lake system is typically only around 0.2 – 0.3 metres above sea level. Due to the higher elevations of the site, it is not affected by regional flooding associated with elevated lake levels and the site is not within the Flood Planning Area outlined in Northern Lakes Floodplain Risk Management Study and Plan developed for Central Coast Council (Glatz and McPherson, 2020). The 1 in 100 Annual Exceedance Probability (AEP) was sourced from the Central Coast Council online mapping portal. As shown in Figure 2.5, sections of the Hammond Canal, particularly the northern portion, as well as Munmorah and Budgewoi Lakes are identified as high flooding hazard, flood storage and flood planning areas, and floodway. The site is not within the 1 in 100 AEP extent, shown in Figure 2.5.

Flooding levels for the Tuggerah Lakes identified in WMA Water (2014) are presented below, identifying that even in extreme rainfall events such as the Probable Maximum Flood (PMF), the level in the Tuggerah Lake system is not predicted to exceed 2.70 metres, well below the elevation of the site.

Table 2.1 Tuggerah Lake Design flood levels (Source: WMA Water, 2014)

Design Event	Flood Level (metres AHD)
Probable Maximum Flood	2.70
1 in 100 AEP	2.23
1 in 20 AEP	2.23
1 in 5 AEP	1.36
1 in 2 AEP	0.91

2.5.3 Hydrogeology

Previous investigations by CES (2019), identified a number of groundwater bores within the project area. As part of this study, an investigation into groundwater levels and quality was undertaken. The hydrogeology investigated by CES (2019) identifies that local groundwater conditions are relatively shallow and of low permeability due to the soil profile of clays and sandy clays. The depth of groundwater varies but has generally been recorded at levels between 4 – 8 metres below ground level (mBGL).

Groundwater flow direction for the project site is expected to be in a northerly direction towards the Munmorah Power station based upon investigations by CES (CES, 2022a).

Figure 2.5 Regional 1 in 100 AEP Flood Extent (blue shade) and the proposed site boundary (red). Source: Central Coast Council – Online Mapping Tool (2022)

2.6 Soils and geology

Soils and geology at the site are influenced by historic development, with fill forming the upper soil layers of the local geology due to the former use of the site, which used to be a coal loading facility.

A review of soil and geologic mapping identified surface soils in the area are generally of Anthropocene deposits associated with development, with some natural alluvial valley deposits to the east of the site. A review of lithology – logs (Table 2.2) by ERM (2014) and CES (2019b), identified surface soils are generally sandy clays and clayey sands, typically to 7 – 8 metres of depth. Underlying these sand – clay deposits, regional geological maps identify the presence of Munmorah conglomerate sandstone as the underlying bed – rock.

GPM is in the process of undertaking rehabilitation, remediation and maintenance works in accordance with its existing approvals within the project site (and surrounds). These works include (but are not limited to) removing the remaining coal residue and other debris and implementing required erosion control measures.

Table 2.2 Subsurface profile identified in CES (2019b)

Geological unit	Approximate depth to base of unit (metres)	Approximate thickness (metres)	Typical description
Unit 1: Fill	0.3 – 1.2	0.3 – 1.2	Gravelly sand, medium to coarse, dark grey. Gravel is fine, dark grey, angular, Occasional traces of coal tailings. Moist or dry. Occasional diesel odours, no staining observed.
Unit 2: Residual	7.2 – 7.9	6.3 – 6.7	Sandy clay, low to medium plasticity, mottled pale grey/reddish yellow/reddish brown/red. Moisture content equal to or greater than plastic limit. Firm to very stiff. Occasional diesel odours and dark grey/grey staining OR Silty clay, high plasticity, mottled pale grey/reddish brown or pale grey. Moisture content equal to plastic limit. Firm to stiff. Occasional diesel odours and dark grey/grey staining.
Unit 3: Munmorah Conglomerate	Not proven	Greater than 8.7	Highly weathered conglomerate: Sandy clay, medium plasticity, dark grey/reddish yellow. Moisture content greater than plastic limit. Occasional slight diesel odour. No staining observed.

2.7 Environmental site investigation

An Environmental Site Investigation Report was prepared in 2022 by Consulting Earth Scientists (CES) (CES, 2022b). This report built upon previous studies by CES to inform the remediation required to provide a suitable site for locating the project. This report, currently in draft form (dated 30 September 2022), outlines contamination requiring remediation and/or management during the current rehabilitation works. Particular contaminants of concern requiring remediation include:

– Residual coal fragments on the site surface requiring removal.
– Asbestos in surficial soils requiring removal.
– Asbestos in buried services that require further work to identify potential risks during works at the site.
– Stockpiled materials including contaminants of concern such as PFAS, asbestos, metals, metalloids, BTE, TRH, PAH, OCP/OPP and PCBs. While an assessment is being undertaken it is assumed that these materials will be appropriately managed under the current remediation scope of works.
– While high concentrations of PFAS were identified in select groundwater, these were concluded by CES (CES, 2022b) to be unlikely to pose a risk to future site users.
– PFAS impacted soils require further assessment as per HEPA 2022.
– Contaminated sediment in the western settling basin located within the project area.

The Environmental Site Investigation Report (CES, 2022b) identified a number of sources of contamination that require remediation in order to provide a suitable site for the project. It is assumed that the recommendations made in Consulting Earth Scientists (2022b) will be employed under the current remediation work, with sources of contamination remediated, appropriate managed and removed. Further assessment should be undertaken if sources of remediation on site cannot be effectively managed.

2.8 Water quality

2.8.1 Surface water

The regional water conditions in the Tuggerah Lakes catchment has changed in recent decades, with activities such as timber harvesting, vegetation clearing of floodplains, urban development and increase of industry have significantly changed land-use. These developments have water quality impacts for the Tuggerah Lake system as identified by Central Coast Council (2020), including:

– Loss of riparian vegetation has resulted in streambank erosion throughout the Lakes' extensive network of surrounding streams, creeks, and rivers. This has resulted in an increased sediment load into Tuggerah Lakes.
– Foreshore modification, including reclamation and construction of seawalls, has negatively affected water quality around the Lake margins.
– Increased impervious surfaces in the Lakes' catchment has increased the volume of typical urban pollutants discharging into the Lakes, namely being nutrients (nitrogen and phosphorus), sediment, and gross pollutants such as gravel, litter, and plastics. Nutrient sediment loads are currently between 150 – 400% of what would naturally occur.
– Heavy metals in the waters of Tuggerah Lakes are thought to have increased as a result of industrial activities in the surrounding catchment.

As identified in Section 2.5, the hydrology of the Tuggerah Lake system is affected by limited tidal exchange with the ocean, and local inflows from nearby catchment. Average retention time for the northern lakes is relatively long, in the order of hundreds of days. This affects the opportunities for the lake system to be flushed, with contaminants potentially staying within the lake system for large periods of time.

The Central Coast Council administers an Estuary Management Plan for the Tuggerah Lakes (Bio-Analysis Pty Ltd, 2006) with goals established to protect the health and sustainability of the lake system. The goals include improving stormwater quality, ensuring water quality for beaches, stabilising the foreshore and streambanks, and encouraging sustainable use of water. For improving stormwater quality, key goals include:

– Maintaining natural nutrient and sediment loads and water flows after a new development
– Reducing nutrient and sediment loads from existing developments
– Maintaining and monitoring pollutant traps.

A conceptual site model for the historical Munmorah Power (CES, 2018) identified a range of potential contamination sources that may have influenced regional water quality, including hydrocarbons, metals, salts, asbestos as well as potential changes in acidity. During the period that the Munmorah power station operated (1967-2012), a study by CSIRO was undertaken to assess physio-chemical conditions in Tuggerah Lakes and identified that apart from minor temperature and salinity changes, the water quality was relatively unchanged during the operation of the facility. The expert panel review of water quality in Tuggerah Lakes (W C Glamore et al, 2020), also identified that some metal concentrations (copper, lead, and zinc) were observed in some sediments, however suggested that metal contamination from the Munmorah Power station was unlikely.

2.8.2 Groundwater

Limited studies on regional groundwater within the Tuggerah Lakes have been undertaken and complex hydrogeological processes drive groundwater quantities with interactions between lake level, sea-level and topography. In W C Glamore et al. (2020), a review of available information was undertaken identifying further studies are required to better understand conditions, however identified that nutrient concentrations in groundwater are relatively high and could be contributing to nutrient loading the lake system.

Localised groundwater at the site (as described in Section 2.5.3) occurs within a shallow, unconfined aquifer with relatively low permeability. CES (2018) also suggested that some portions of groundwater may be impacted by development of the site. In 2019, a groundwater monitoring report was completed by CES (2019) to investigate groundwater quality at the former Munmorah Power Station site and included the proposed project area which historically was utilised for coal processing. Analytical results of the samples collected were compared against the groundwater health screening levels for commercial/industrial land use and toxicant default guidelines values outlined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018). This assessment identified that:

- Groundwater quality was generally similar in the areas investigated
- Low levels of Benzene, Toluene, Ethylbenzene, Xylene (BTEX), Volatile Organic Compounds (VOC), and dissolved lead concentrations were observed. However, in some areas, BTEX and VOC concentrations exceeded the site assessment criteria
- Light Non-Aqueous Phase Liquids (LNAPLs: e.g., petroleum oils, gasoline, diesel) in some monitoring wells at depths up to 1.4 metres below ground level were observed.

Additional investigations (CES, 2022b) identified concentrations of PFOS above PFAS NEMP 2.0 Freshwater 95% protection species in select areas. PFAS contamination is anticipated to be the result of fire-fighting activities at the site. Exceedances of PFAS concentrations occurred generally in the north of the proposed site.

Potential impacts to groundwater quality were likely to be the result of historical power station operations.

3. Project description

The following Sections outline key aspects of the project, with a focus on aspects relevant to assessment of water. More information can be found in the main EIS document.

3.1 Overview

EnergyCo, which forms part of the NSW Treasury, propose to develop a lithium-iron battery energy storage system (BESS) capable of storing up to 850 MW. The BESS would be supported by connecting transmission and related infrastructure to connect the proposed battery to the NEM. Additional ancillary infrastructure would also be required to support the project including access roads, site services, an administration building, maintenance building and storage yard, and signage and site security. The purpose of the proposed battery energy storage system is to reduce the chances of unscheduled power outages by reserving and then deploying power to support the electricity grid. It would form part of a SIPS for NSW.

3.2 Design

Relevant proposed infrastructure to be developed as part of the project is outlined in the following Sections. The detail described in this report is based upon the current concept design configuration. Final project specifications are yet to be completed and will be dependent on selected project supplier. These specifications would include battery details, proposed layout, and foundation. The concept design drawings for the site have been included in Appendix A, which forms the basis for this assessment.

3.2.1 Surface water drainage system

Surface water at the site is designed to generally flow in a northerly direction, consistent with the natural topography of the site, discharging either into Hammond Canal which is currently connected to Munmorah Lake or via waterway into Lake Munmorah.

There are two main catchment areas within the site: runoff from the proposed battery pad catchment, and runoff from the switchyard and surrounding areas. Surface water at the site will be managed by collecting and conveying stormwater away from infrastructure and towards Hammond Canal. The proposed drainage system at the site is depicted below in Figure 3.1.

Management of the battery pad area is on the following basis:

- The battery pad would be constructed and graded to promote surface water runoff. The pad would be graded with the northern area falling towards the east, and the southern area falling towards the south. Minor drainage on the pad would be included to collect and convey runoff.
- The existing drainage network, as described in Section 2.5.1, would remain with some minor reprofiling. The north and southern perimeter drainage channels collect run-off from the site and run-on to the site and drains to the north via an unnamed waterway directly into Lake Munmorah. The western perimeter drainage channel intercepts run-on from the west of the pad and drains directly to the Hammond Canal which is hydraulically connected to Lake Munmorah.
- Extensions to the existing drainage network, specifically the northern and southern perimeter drains, would occur to convey runoff from the pad to the existing drainage network which discharges into Lake Munmorah.
- A new transverse drain to the east of the pad would direct runoff into the north and south perimeter drains.

Runoff from the switchyard pad is treated as a separate catchment to manage ‘switchyard pad contact water’. Management of this area is on the following basis:

- This catchment is managed separately to allow for the management of any oil contaminated water.
- The switchyard area would be bunded and a new drainage channel on the pad conveys water towards the north-west.

– The existing sedimentation basin in the north-west of the site would be decommissioned and partially filled to allow for the switchyard pad to be constructed. This basin then would be reinstated and utilised as an oil-water pond, with engineered controls to allow for the separation of oil from oil-water where it can be collected and safely disposed.

3.2.2 Battery energy storage system

The proposed battery energy storage system would consist of hundreds of battery units (shipping containers or modular containers) arranged within the proposed battery storage area. Each battery unit would contain a group of lithium-iron batteries, housed within fully enclosed storage cabinets. The battery energy storage system would also contain inverters, medium voltage transformers, switchgear, and associated control systems. The battery energy storage system would be capable of storing up to 850 MW. The size of the individual battery units could be as large as 3.3 metres high, 1.6 metres wide, and 2.5 metres deep. Each battery unit would be mounted on concrete footings or constructed foundations or piles and would be connected via underground cables to a control room located in the administration building.

The pad is to be constructed on the existing remediated surface at the site and a 3-metre-wide light vehicle access track will be constructed around the perimeter of the battery pad. The battery pad runoff drains into a series of channel drains, as described in Section 3.2.1, which connect to the existing site drainage system. The runoff drains directly into Lake Munmorah via an unnamed waterway.

3.2.3 Connecting transmission and related infrastructure

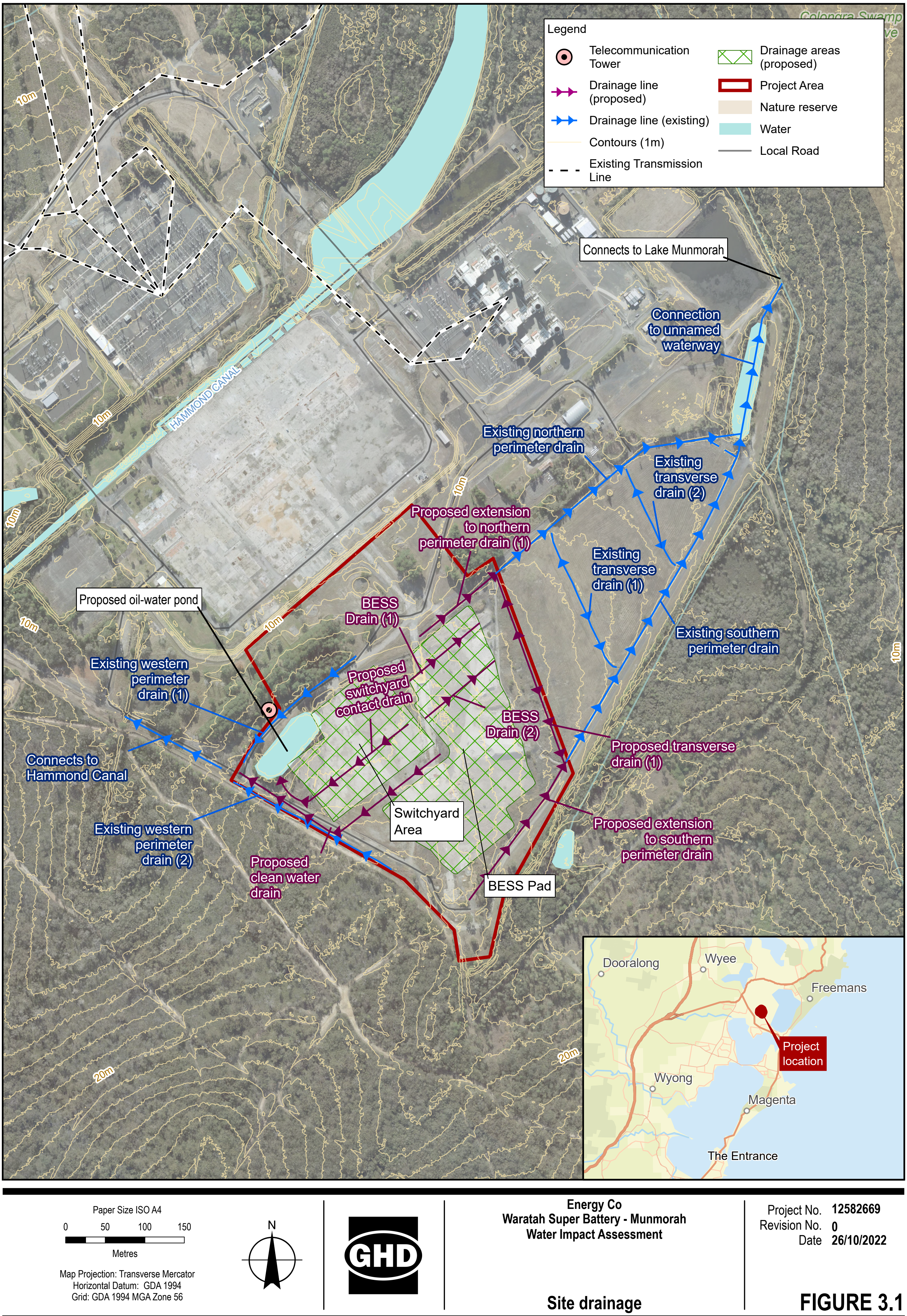
The proposed switchyard would provide the connection between the battery energy storage system and the transmission line to the Munmorah Substation. The switchyard would be installed to the north-east, and directly adjacent to, the proposed battery energy storage system and would comprise gas insulated switchgear (switches, power circuits, power transformer, breakers, and other auxiliary equipment) housed within four switchyard buildings. Each switchyard building would be approximately six metres wide by 24 metres long and would be constructed out of prefabricated lightweight type material.

Runoff from the transformer area is to be managed as transformer pad contact water due to potential hazards associated with oil within transformers, as described in Section 3.2.1. A separate drainage line for transformer pad contact water is proposed to convey flow generated within the switchyard into the oil water management system. The intention of the oil water separator pond is to allow runoff to be collected, with oil separated and disposed of offsite to prevent mixing with the clean surface water from surrounding areas.

3.2.4 Ancillary infrastructure

Ancillary infrastructure would be required to support the project. This ancillary infrastructure would include:

- An upgraded access road
- Site services, including:
  - Power supplied to the site via a connection to Munmorah Substation.
  - Water and telecommunications supplied to the site via connection to the Munmorah Power Station.
- An administration building and light vehicle parking
- Maintenance building, storage yard, and heavy vehicle parking
- Signage
- Security.



Energy Co
Waratah Super Battery - Munmorah
Water Impact Assessment

Project No. 12582669
Revision No. 0
Date 26/10/2022

Site drainage

FIGURE 3.1

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12582669_WIA_004_Fig3_1_SiteDrainage
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Data source: Flood Inundation - Central Coast Council 2022; NPWS Reserves, Waterways - DFSI, 2022; Crown Land, Roads, Railways - DCS, 2022; Metromap Tile Service:
World Street Map: Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS. Created by: mfredle

3.3 Construction

3.3.1 Site preparation, construction, and commissioning

3.3.1.1 Site preparation

Site preparation works would involve:

- Upgrading the construction access road from the existing internal access road to the project site, including clearing, grading, and compacting for upgrading. The road would then be constructed on top of the compacted surface with a road sub-base, road base, and road surface.
- Establishment of areas for temporary laydown of materials and equipment to be removed as construction progresses and permanent facilities are constructed.
- Establishment of temporary site offices and facilities.
- Clearing and grubbing, to be undertaken progressively over the project site in parallel with other site preparation activities to minimise the areas of exposed ground and to reduce the potential for erosion. Where vegetation is removed, it would be stockpiled. Subsurface vegetation would be grubbed to a depth suitable to facilitate construction of the proposed infrastructure.
- Earthworks and grading, to provide a flat surface for construction and to provide adequate drainage. Topsoil and subsoil would be stripped and stockpiled separately. Topsoil would be stockpiled and maintained for redistribution at the surface. Subsoil would be stockpiled for use as road subbase or as backfill at the project site.
- Installation or relocation (if necessary) of utilities and services during site preparation and construction, including power, water, communications, waste collection, water management, and lighting.
- Installation of asset protection zones to protect the project site from bushfires.
- Installation of security to secure the project site.

3.3.1.2 Construction

Construction would involve:

- Construction/installation of the battery energy storage system, including:
  - Establishment of concrete slabs or foundations to support the battery containers/modules, power conversion systems, and transformers.
  - Installation and electrical fit out of the battery modules, power conversion systems, and transformers.
  - Establishment of the battery energy storage pad. This would be graded to promote surface runoff to the drainage system described in Section 3.2.1
  - Construction of the new series of channel drains to the north of the battery storage pad and tie-in of these new drains to the existing eastern and western perimeter drains.
  - Extension of the eastern perimeter channel to capture southern pad runoff.
- Construction/installation of connecting transmission and related infrastructure, including:
  - Installation of a switchyard adjacent to the battery energy storage system, including:
    - Reprofiling of the existing formed earth clean water southern diversion drain such that collected runoff flows in a westerly direction to tie in with the existing site clean water drainage system.
    - Tie in of the existing western clean water drain to the existing site clean water drainage system.
    - Partially infilling the existing sediment pond and repairing the pond lining and instead developing an oil water pond to capture transformer pad runoff (as described in Section 3.2.3).
    - Establishment of a new separated drainage line for the transformer pad contact water runoff from within the switchyard, to flow into the proposed oil water pond.
  - Installation of an overhead transmission line from the switchyard/battery energy storage system to the existing Munmorah Substation.

– Construction/installation of ancillary infrastructure (as outlined in Section 3.2.4)

All buildings would be constructed in accordance with the relevant industry and regulatory standards including the Building Code of Australia.

Construction materials would comprise fill (soil and rock) sourced either on-site, or locally, and other materials such as wood, steel, glass, and concrete that would be delivered to the project site, as needed.

Waste generated during construction would include construction waste, domestic waste, and wastewater. Construction waste and domestic waste would be managed by collecting, separating, and storing waste according to its potential for reuse, recycling, recovery, treatment and/or disposal. Waste would be stored in appropriate containers such as industrial bins or drums in dedicated waste collection areas for collection by appropriately licenced waste contractors. Wastewater would be managed on-site via regular truck removal.

3.3.1.3 Commissioning

Commissioning would include final inspection and testing of all proposed facilities to ensure they operate as intended.

3.4 Operation

3.4.1 Site operation

The following activities would be carried out during operation of the project:

– Maintenance and management of equipment.
– General office activities.
– Receipt of goods.
– Waste removal
– Maintenance and management of the oil and water pond and on-site sewer system to prevent contamination of the clean water with oil polluted water.

3.5 Decommissioning and rehabilitation

Upon final closure, all infrastructure, utilities, and disturbed areas would be decommissioned and returned to the pre-existing land use in consultation with relevant stakeholders.

A detailed decommissioning and rehabilitation plan would be prepared prior to decommissioning of the project.

4. Assessment methodology

Impacts in relation to water were identified and assessed generally based on the following approach:

– General consideration of water related risks was undertaken through the concept development resulting in measures in-built into the proposal (Section 3) with relation to water management, such as provision of appropriate stormwater collection, conveyance, and appropriate siting of the project location.
– Based on the nature of the proposed works, the site location, surrounding environment and relevant legislation; potential risks for assessment were identified with relation to the following areas:
  - Flooding, in terms of impact on and impact from the proposal
  - Water sourcing
  - Surface water quality, during both construction and operation
  - Groundwater.
– The above were assessed firstly through identification of potential direct sources of the above impacts, following through to identification of the potential location and magnitude of impact, as well as the relevant potentially affected receptors.
– Mitigation measures were developed based on the above and the residual impact after implementation of mitigation predicted.

Key aspects of the assessment approach relevant to this proposal are:

– The assessment methodology was developed with consideration that the final project specification is yet to be completed and dependent on selected project supplier. Components of the project such as the battery details, proposed layout, and foundation requirements are therefore to be confirmed. Accordingly, the methodology to assess water related impacts was developed based on the general nature of the proposed works, proposing mitigation and controls/requirements on future design and project definition stages where required to provide assurance of final project environmental performance.
– The site is currently undergoing remediation works under other approvals. The baseline scenario against which to assess the potential impacts of this proposal was taken as the point in time after the remediation but before implementation of the proposal. Once remediated, remanent surficial contamination would be largely removed and overlying soil materials installed and vegetated, however some contamination at increased depth may still be present.
– Therefore, potential impacts of disturbing these deeper materials during construction requires assessment. This has a close relation with the Contamination Assessment undertaken for the proposal. Impacts with relation to this are therefore undertaken in the Contamination Assessment but referenced and summarised in this assessment where applicable.
– It is noted that no instream works are proposed, with no marked watercourses traversing the site and there are no direct impacts to waterways anticipated.

5. Impact assessment

An assessment of water related impacts is provided in the following Sections, based on the assessment approach outlined in Section 4.

5.1 Flooding

Flooding was assessed based on the potential of the project to change the behaviour of floods or be impacted by floods. Existing flooding conditions were assessed based on existing flood mapping, a review of catchments and topography. An understanding of flooding and lake hydrodynamics was based on a review of the following documents:

– Tuggerah Lakes Floodplain Risk Management Study and Plan (WMA Water, 2014)
– Central Coast Council – Online Mapping Tool (Accessed August 2022)
– Tuggerah Lakes Water Quality – Independent Expert Panel Review (Glamore et.al, 2020).

5.1.1 Impacts of proposed local drainage

As described in Section 3.2.1, a stormwater drainage network is proposed to allow runoff generated at the site to be managed. The proposed drainage network includes utilising the existing drainage network to allow for separation of catchments and to ensure that clean water is directed away from any works areas or infrastructure. Detailed design of the drainage would consider final alignments, sizing, and details of the perimeter drainage system to manage impacts associated with the local drainage network in accordance with Council requirements.

Implementation of appropriate drainage design during the detailed design (Section 6) in accordance with relevant Council controls should be undertaken. Management of runoff is considered feasible utilising both existing and proposed drainage. Unacceptable impacts from the local drainage network are not anticipated from the proposal.

5.1.2 Impact on the site from regional flooding

As described in Section 2.5.2, the flood level for Tuggerah Lakes is up to 2.7 metres AHD during the PMF, and as the site is located approximately 10 to 15 metres above sea level, the site is not considered to be flood prone.

As a result of the changing climate, potential risks to flooding are two-fold. Rainfall intensity may increase at the site, with current predictions for 2050 suggesting a potential increase in rainfall intensity by 9.04 per cent (Geoscience Australia, 2022), based upon Representative Concentration Pathway (RCP) 8.5, which may lead to higher flood levels, both locally and within the Tuggerah Lake System. Secondly, sea-level rise is predicted with the Intergovernmental Panel on Climate Change (IPCC) 6th report (IPCC, 2022) suggesting a rise of up to approximately 1 metre by 2100 (excluding the low-likelihood, high-impact ice-sheet instability process).

Current guidance states that the PMF remains the highest rainfall intensity and a higher flood level during a PMF event would then be driven predominantly by tailwater (sea-level) conditions. This could conservatively result in flood level being around one-metre higher. Even in this conservative scenario, the site would be over five metres higher than downstream flooding levels.

On this basis, the project is not anticipated to be impacted from any magnitude of regional flooding, including under the potential impacts of climate change.

5.1.3 Impact of the site on downstream flooding

Changes to catchment properties by increasing the impervious area of the facility is anticipated to result in changes to the runoff quantity (volume and timing) from the site. Potential changes to runoff quantity include increasing the peak flow of rainfall-runoff response, that is runoff can occur quicker and with a higher intensity for a catchment with a higher impervious fraction. This has the potential to impact on flooding conditions downstream. This impact may be reduced by the close proximity of the site to receiving lakes, however, could still result in impact without appropriate consideration and mitigation.

Central Coast Council specifies general requirements for the redevelopment of existing sites. For industrial sites, the post-redevelopment peak flow is required to be lesser than or equal to the pre-redevelopment leaving the relevant lot(s) for the 1 in 100 AEP major storm event, the 1 in 20 AEP minor storm event, as well as for both the 1 in 5 AEP and 1 in 1 AEP event.

Stormwater retention, detention or other control would therefore be considered during detailed design, and this is stipulated in Section 6. Indicative sizes of stormwater detention for catchments of this nature are in the order of 500 m^3/ha and could be located at eastern end of the northern and southern perimeter drainage line within the site boundary. For the entirety of the battery pad (approximately 3.85 ha), the detention volume would be in the order of 2 ML of storage, with provision of this storage volume considered realistic based on available land and topography. Any detention could be coupled with consideration of any water quality controls (refer Section 5.3).

Implementation of appropriate controls during the detailed design (Section 6) in accordance with relevant Council controls, is therefore considered feasible and thus unacceptable impacts with relation to impact on downstream flooding is not anticipated from the proposal.

5.2 Water sourcing and security

Sourcing of water is not proposed to directly occur from any licensed surface water resources or groundwater resources for either the construction or operation.

During construction, water will be required for various uses such as:

– Bulk earthworks
– Environmental management (e.g., dust suppression)
– Maintaining haul roads and access roads
– Concreting
– Workshop and vehicle washdown.

Details of the construction staging are currently unknown and would be finalised during detailed design, however, are anticipated to be typical for civil projects of this nature and size. During detailed design (Section 6), construction water demand would be calculated based on the proposed construction staging, however is estimated to be 30ML for dust suppression and compaction, and 0.5ML potable water for construction staff drinking water, cribs rooms, toilets etc. The construction staging plan would also identify potential supply limitations. This would include estimates of the quantity of potential run-off that could be re-used at the site, to identify the deficit that would be supplied from other sources. Water would be obtained from various sources including the on-site dam, re-use from on-site environmental management basins, carting to site from external sources, or reticulated supply systems. Supply of water is considered feasible noting that water has been historically supplied to the site to operate the power station, as well as to construct the Colongra Power Station, and to complete the decommissioning and remediation of the Munmorah Power Station – on this basis, unacceptable impacts with relation to water sources is not anticipated from the proposal.

During operation, minor water requirements are anticipated for onsite facilities, any maintenance, or to maintain volumes for fire-water management. This water will be sourced externally, with a majority supplied to the site via the new connection through the GPM offices located at the former Munmorah Power Station.

No impacts to water sources during operation are predicted on this basis.

5.3 Surface water quality

5.3.1 Construction phase surface water quality

Works associated with the construction include various activities that have the potential to impact surface water quality. These activities include:

– Earthworks, excavation and disturbing of soils. These have the potential to mobilise surface sediments resulting in impacts associated with erosion and sedimentation as well as impacts associated with in-situ sediments.

– Handling hazardous materials such as fuels for plant, batteries, and oils for transformers.

Erosion and sedimentation

Disturbing of in-situ soils have the potential to result in erosion and sedimentation. Potential activities that could result in erosion and sedimentation include earthworks, excavation, clearing and grubbing, and any activities where the existing surface is disturbed. Once disturbed, this sediment is prone to being mobilised into downstream waterways primarily from rainfall derived runoff, resulting a potential risk to downstream water quality.

Broadly, two distinct erosion and sedimentation risks have been identified:

1. Where the upper surface of the existing remediated area is disturbed, this risk to downstream water quality is anticipated to characteristic of typical construction development, with the primary pollutant of concern being suspended solids (i.e., turbidity). As the site will have been surface remediated prior to the works of this project, this mobilisation of surface soils is anticipated to result in a risk associated with 'typical' sedimentation from disturbed sites, as opposed to mobilisation of contaminated soils.
2. Some construction activities required for the project may include excavation to deeper depths including activities to install utilities and services or to provide foundations for proposed infrastructure. Proposed depths of excavation are subject to detailed design based on the proposed layout and system configuration. Where excavation is required at deeper depths, mobilisation of contaminated material may occur and could pose a risk to downstream waterways with relation to a number of contaminants, rather than turbidity generally.

With relation to the first item above, whilst a significant risk, this applies to most major construction projects and can be appropriately managed through the implementation of appropriate strategies in accordance with the well-established and widely accepted *Managing Urban Stormwater, Soils and Construction* (Section 1.5.2.7). The site does not pose any particular additional erosion and sediment control risks such as steep slopes, particularly erosive rainfall conditions or lack of cleared area to provide sediment basins. In particular, the proposed works include the collection of site runoff in a set of clearly established surface water drains that could be directed to appropriately sized sediment basins.

Therefore, implementation of mitigation measures is required as stipulated in the plans required and outlined in Section 6. With the implementation of these plans, which are to be developed in accordance with *Managing Urban Stormwater, Soils and Construction* (Landcom, 2004), the project is not anticipated to result in an unacceptable downstream impact with relation to Item 1 above.

With relation to Item 2, a site remediation assessment was undertaken by CES (2022b) as described in Section 2.7. It is understood that potential sources of contamination, including: PFAS contaminated soils, coal fragments, asbestos containing materials, and various stockpiles would be remediated, managed, or removed as part of the remediation works being currently undertaken.

Handling of high-risk materials with water quality risks

The handling of materials hazardous to downstream waterways (excluding those associated with erosion and sedimentation) is required to permit construction of the project. Potential activities where handling of hazardous materials could occur, may include:

– Maintenance and refuelling of plant (e.g., hydrocarbons)
– Handling and installation of concrete slabs (e.g., alkalinity)
– Handling of battery components (e.g., metals)
– Accidental spills of stored materials (e.g., fuels, oils)
– Accidental spills during the installation of transformed and batteries (e.g., mineral oils).

The potential impact associated with the handling of these components includes the potential mobilisation into downstream waterways either via direct flow of the material itself, or through washing from either rainfall derived runoff, or from applied water (e.g., during dust suppression). Once mobilised into downstream waterways, impacts to both flora and fauna are likely and vary would in terms of persistence and severity.

The risk of handling these materials is typical of works of this nature and well understood control measures are commonly used, such as bunding, safely storing hazardous materials and visual inspection of the works area and waterways are commonly employed during implementation of Construction Environmental Management Plans

(CEMPs) and Soil and Water Management Plans (SWMPs) which are stipulated as required mitigation in Section 6. On this basis, with the specified future development of required mitigation and plans the project is not anticipated to result in unacceptable water quality risks during construction with relation to handling of high-risk materials.

5.3.2 Operational phase surface water quality

Potential water quality risks during operation were assessed and identified in the following two categories:

– Risks associated with the specific nature of the proposed works (e.g., transformer oil, battery metals) ('specific risks') that are not necessarily applicable to urbanisation activities more generally.
– Risks associated generally with the addition of relatively large impervious areas ('general risks') that apply to most activities associated with increasing urbanisation.

Separate consideration of these risks is important because the management methods and relevant guidelines applying to them differs. For example, for general risks Council stipulated controls may be more appropriate, whereas industry specific guidance may be more appropriate for the specific risks.

Specific risks

The proposed works are relatively low risk with relation to these specific risks. The battery and transformer units would be fully enclosed without the generation of leachate or other process wastewaters. Notwithstanding this, handling of materials that pose enhanced water quality risks will occur, although infrequently, during the site's operation. These potential risks include:

– Potential risks associated with handling of fuels and hydrocarbons
– Leakage from site infrastructure such as oil from transformers
– Exposure of materials during catastrophic conditions (e.g., battery fires).

The potential impacts associated with handling and managing these materials may result in potential mobilisation of materials into downstream waterways either via direct flow of the material itself, or through washing from either rainfall derived runoff, or from applied water (e.g., during fire-fighting activities). Once mobilised into downstream waterways, impacts to both flora and fauna are likely and would vary in terms of persistence and severity.

Typical control measures are commonly used, such as bunding, safely storing hazardous materials and visual inspection of the works area and waterways are commonly employed during implementation of CEMPs and SWMPs with these stipulated as required mitigation in Section 6. Additionally, an oil water separator pond will be used as a control measure to manage transformer pad contact water (as described in Section 3.2.3). Other standards apply to the facility and compliance would be subject to detailed design of the facility, including compliance to relevant standards (such as Australian power grid requirements for oil-water management). Other management plans such as a Pollution Incidence Response Management Plan (PIRMPs) can be utilised to manage these impacts.

Development of the detailed hazard assessment will include appropriate responses during emergency management – such as during battery fires. It is understood that potential risks are dependent on the final design, including the battery supplier. Design measures to manage runoff and water quality, may be utilised to capture fire-water runoff during an extreme rainfall event. This may include a manual shut-off system to allow the capturing of fire-water runoff where it can be tested prior to appropriate discharge, with this to be investigated as a mitigation measure stipulated in Section 6. With implementation of this the proposal is not anticipated to result in unacceptable impacts with relation to specific surface water quality risks.

General risks

Changes to the catchment land-use and properties can result in impacts to water quantity and water quality in downstream catchments associated with typical urban development. Developments where the land-use is changed, such as increasing the fraction of impervious areas, can result in changes to water quantity and water quality. The project proposes to construct new impervious areas to house the battery pad and switchyard area, which would increase the impervious area of the local catchment by approximately 0.06 km^2. To provide context with the local and regional hydrology; the local catchment to the south of the site drains an area of approximately 0.9 km^2, and the catchment for the Tuggerah Lake system drains 710 km^2.

Changes to the catchment properties can increase potential water quality impacts, for example by increasing the impervious fraction. Potential changes to runoff quality include increases in annual loading of key pollutants, such as total nitrogen (TN), total phosphorous (TP) and gross pollutants (GP). These have the potential to add to cumulative catchment impacts and worsen water quality in downstream waterways in particular, nutrients can lead to increases in the likelihood of algal bloom and changes to dissolved oxygen can result in impacts to aquatic flora and fauna.

Historical impacts associated with urbanisation and increasing impervious fractions, have resulted in a significant impact on water quality in the Tuggerah Lake system. This effect of urbanisation, coupled with the relatively long average retention time of the northern lakes enhances the risk to water quality. Accordingly, the Central Coast Council specifies general requirements for developments that would need to be followed during detailed design to manage water quality risks during operation. For sites of this nature, reductions in Total Suspended Solids (TSS) of 80%, TN of 45%, TP of 45% and GP of 90% (>5mm diameter) are specified based upon mean annual loading rates. Measures that would be considered during detailed design may include grassed swales and/or bioretention systems. As specified in Section 6 detailed design is to include these and they are to be sized using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) to confirm compliance with the above targets. Areas required to provide optimal bioretention systems are generally in the order of 2% of the impervious catchment area. For the entirety of the battery pad (approximately 3.85 ha), the bioretention size could make up a footprint in the order of 775 square metres which is considered feasible within the available space constraints.

With implementation of the above, the project is not anticipated to result in unacceptable risks with relation to general surface water quality.

5.4 Groundwater

An assessment of groundwater was undertaken to identify where impacts to groundwater conditions both in terms of interaction with the localised aquifer and where water quality risks to groundwater are anticipated. This study was based on a desktop assessment utilising existing studies, including:

- Groundwater Monitoring Report – Former Munmorah Power Station, Doyalson, NSW (CES, 2019)
- Sampling And Analysis Quality Plan - Environmental Site Investigation - Waratah Super Battery Site, 301 Scenic Drive, Doyalson, NSW 2262 (CES, 2022a).

Characterisation of groundwater levels and flow direction was undertaken to identify whether the existing aquifer would be interfered with in accordance with the NSW Aquifer Interference Policy. Where groundwater conditions are below potential excavated levels, no interference with the local aquifer would be anticipated and impacts to the quantity or flow of the aquifer is not expected.

As described in Section 2.5.3, groundwater levels vary at the site, however, are relatively low with an approximate depth of 4 – 8 metres below ground level at the site. While exact details of the final design layout and foundation requirements are to be developed during detailed design, it is likely that works will include some surface excavation to permit slab installation and foundations as well as trenching to install services. It is unlikely that depths of any earthworks would exceed 4 – 8 metres of depth below the ground level and, accordingly, interaction with the local aquifer is not anticipated. Following construction, the operation of the site is not anticipated to have any interaction with the local aquifer.

Following remediation of the existing site (which is currently being undertaken) to prepare for the Project, the existing surface will be filled, graded, and vegetated. Following this, installation of the surface materials for the Project (e.g., concrete slabs, hardstand areas) are expected to decrease the permeability of the surface and reduce infiltrating waters. As described in Section 2.7, there a history of contamination at the site and exposure of groundwater has potentially resulted in increased groundwater contamination, as described in Section 2.8.2. While it is unknown as to extent by which the current remediation may affect or improve local groundwater quality, installation of an impermeable surface has the potential to result in a positive improvement by disconnecting infiltrating waters to the underlying fill materials which may be contaminated. On this basis, direct impacts to groundwater quality were not quantitatively assessed.

Fill materials associated with the site's previous operation remain located at the site below the remediated surface.

No direct impacts or interaction with local groundwater conditions are anticipated. Any impacts to groundwater are anticipated to be indirect and associated with any changes to localised surface water that exchanges with the local aquifer. This impact to surface water is assessed in Section 5.3. Similarly, relevant mitigation measures identified from surface water are likely to provide indirect benefit to groundwater, and these are discussed further in Section 6.

5.5 Post operation

Following decommissioning of the site, existing infrastructure will be removed. Any impacts associated with decommissioning or post operation are not anticipated to be worse than during construction or operation either for surface water or groundwater. The basis of this is that:

- The duration of the decommissioning works is anticipated to be lesser than during construction.
- The extent and duration of soil disturbance would be significantly lesser than during construction as no significant earthworks are anticipated, reducing the water risk associated with the mobilisation of sediment.
- While handling of high-risk materials that pose a water quality risk would occur, the risk is not anticipated to be worse than during construction.
- Similar mitigation and management measures would be employed, for example: construction environmental management plans and surface water management plans.

On this basis the proposal is not anticipated to result in additional risks post-operation beyond those documented in this assessment for the construction and operation stages.

6. Mitigation

The following Sections detail the mitigation required, in addition to the measures in-built into the project as outlined in Section 3. The mitigation measures are required based on the assessment outlined in Section 5.

The impact assessment and identification of mitigation measures was developed with consideration that final project specification is yet to be completed and is dependent on selected project supplier. As the selection of the project supplier is not complete, key components of the project are to be confirmed. Identification of mitigation measures were developed with consideration of controls/requirements for future design and project staging, as well as specifying management measures and plans to provide assurance of final project environmental performance.

6.1 Flooding and hydrology

As described in Section 5.1.1, the site is not anticipated to be impacted from any magnitude of regional flooding, including under the impacts of climate change.

As outlined in Section 5.1.3, the increase in the impervious area owing to the project and resulting changes to runoff quantities from the site has the potential to impact on downstream flooding conditions. To manage localised stormwater, drainage design controls consistent with Central Coast Council are feasible at the site and will be considered during detailed design.

Thus, to address these requirements and manage localised downstream flooding, detailed design will consider:

- Locating the site above the 1 in 100 AEP flood level with a suitable freeboard.
- Including perimeter drainage designed to divert runoff around the site.
- Incorporating climate change impacts associated with increased rainfall intensity when sizing and locating infrastructure.
- Implementing controls, such as detention systems, to manage peak flow for a range of events as per Central Coast Council guidelines for major and minor storms.
- Identifying where water quality controls could be coupled with engineered controls to manage stormwater flow rates and quality (refer Section 6.3.2).

Following implementation of the proposed mitigation measures to manage floodwaters and stormwater at the facility, no residual impact from flooding, or residual impact to flooding conditions are anticipated for this project.

6.2 Water sourcing and security

As described in Section 5.2, there are not anticipated to be any impacts on licenced water sources, however, during development of detailed design and construction staging, development of a detailed construction water balance should be undertaken to ensure the works are staged appropriately such that water can be sourced in the required quantities. Where a shortfall is identified, the staging should be adjusted.

Following implementation of the proposed mitigation measures to ensure water can be sustainably sourced during construction and operation, no residual impact to water sourcing is anticipated for this project.

6.3 Surface water quality

6.3.1 Construction phase surface water quality

Erosion and sedimentation

Surface water quality risks during construction include erosion and sedimentation, outlined in Section 5.3.1. During the construction phase of the project, works associated with earthworks, excavation, and disturbing soils may mobilise surface sediments resulting in erosion and sedimentation, affecting the downstream water quality. Two primary erosion and sedimentation risks were identified, including ‘typical’ erosion and sedimentation, as well as mobilisation of sediment from remnant soils or fill materials located deeper within the soil profile.

Managing erosion and sedimentation risk for either type of sediment would be undertaken utilising similar controls, albeit while observing a higher level of precaution arising from deeper soils that may potentially be disturbed during deeper excavation (for example during service trenching). The overall risk of erosion and sedimentation can be effectively managed through the implementation of appropriate strategies in accordance with the well-established and widely accepted *Managing Urban Stormwater, Soils and Construction* (The Blue Book) (refer Section 1.5.2.7), as outlined below.

To address the erosion and sedimentation risk, a detailed Soil and Water Management Plan would be developed in accordance with ‘The Blue Book’ prior to construction or operation of the project. This SWMP would be developed as an addendum to a CEMP that would address risks to the environment from a multitude of sources, including water. The plans for managing waters would be developed in accordance with the specific requirements of a SWMP in the ‘Blue Book’ guidelines. The plans should consider:

– Opportunistically enlarging collection systems to further reduce potential impacts considering historical contamination at the site.
– Measures to minimise and manage erosion and sediment transport both within the construction footprint and off-site, including requirements for the preparation of an Erosion and Sediment Control Plan (ESCP) for construction.
– Processes for dewatering the existing sediment basin and for managing any proposed sediment basins required during the works. These processes should consider:
  - Identification of sampling and analysis to confirm water quality is suitable for re-use and/or discharge
  - The methodology for dewatering including use of ecologically friendly flocculation and pH balancing agents
  - Required approvals prior to dewatering and/or discharge.
– Measures to manage accidental spills and litter, including the requirement to maintain materials such as spill kits.
– Measures to manage any potential Acid Sulfate Soils (ASS) found in excavated fill material, in accordance with relevant Acid Sulfate Soil Guidelines.
– Opportunities to minimise the duration and extent of disturbance as far as practicable.
– The required details of runoff controls to enable separation of sediment laden and clean water in rainfall events up to the 20-year Average Recurrence Interval (ARI) event.
– Measures required to appropriate manage stockpiles, including where they are located.
– Requirements for vehicle access and egress, including where vehicles would be washed down and how wash-down water would be managed.
– Details of surface water quality monitoring to be undertaken prior to throughout and following construction (refer to section 6.3.1 for more details).
– Details of incident reporting and management systems.
– Site responsibilities and daily erosion and sediment control checklists.

In addition to the above requirements, in response to the higher level of precaution that is to be followed as a result of the site's historic contamination, additional measures should be developed and documented that include:

- Developing of a Trigger Action Response Plan (TARP) for water quality impacts. Minimum requirements of TARP are included below.
- Implementing an unexpected find procedure, including making control materials available to effectively isolate any material or materials that are suspected of being 'non-typical'.
- Conducting regular water quality monitoring for signs of potential contamination associated with 'non-typical' sediments.

Handling of hazardous materials with water quality risks

As outlined in Section 5.3.1, the potential impacts to surface water associated with handling of hazardous materials (such as fuels for plant, batteries, and oils for transformers) includes the potential mobilisation of the materials into downstream waterways. Mitigation measures to minimise impacts associated with handling hazardous materials should include:

- Scheduling works to avoid forecasted rainfall during handling of hazardous materials.
- Bunding of potentially hazardous areas to capture any spills.
- Safely storing all fuels and other hazardous liquids and materials (e.g., collected transformer oil) on ground level away from existing stormwater drainage systems and waterways. These would be stored in a sealed bunded area within the construction site.
- Limiting plant and battery refuelling and minor maintenance activities to designated areas with established spill capture and management controls.
- Prepare a Pollution Incidence Response Management Plan as an addendum to the CEMP.
- Regular visual inspections of the works area and waterways to identify any potential water quality issues, as per the implementation of the CEMP and SWMP.
- Installing and maintaining control measures such as silt fencing, oil-water separators, and gross pollutant traps.

Monitoring and maintenance program

During the construction phase of the project, a monitoring and maintenance program at the site should be developed as part of the CEMP and SWMP. Development of this monitoring and maintenance program should include:

- Frequent inspections of erosion and sedimentation control devices
- Regular monitoring of potential impacts that are associated with sedimentation
- Where sedimentation is a result of increased turbidity and/or total suspended solids, sampling, and analysis to confirm that erosion and sedimentation of 'non-typical' sediments is not occurring at the site.

Water quality monitoring would be undertaken, and a program identified using Table 6.1, Table 6.2, and Table 6.3 as a guideline. Monitoring should be undertaken to assess the ongoing performance of the site controls. Sampling is to be undertaken with the NSW EPA approved methods (NSW EPA, 2022). Sampling locations are described in Table 6.3.

Table 6.1 Monitoring and maintenance program

Monitoring and maintenance categories	Frequency
Visual inspections for the project and downstream waterways to identify signs of erosion, sedimentation and presence of oil and grease (i.e., films). Visual inspection of stormwater infrastructure and erosion/sedimentation control devices.	Weekly and within 24 hours following rainfall that results in runoff occurring.

Monitoring and maintenance categories	Frequency
Primary surface water quality monitoring. Sampling and analysis of parameters per Table 6.2. All locations specified in Table 6.3.	Monthly and within 24 hours following rainfall depths greater than 26.8 mm* at a maximum frequency of once per month and based upon any requirement of a Trigger Action Response Plan. ** The 75th percentile, 5-day storm depth is recommended as the basis for sizing sedimentation basins for most construction sites where the duration of disturbance is lesser than 6 months. The 75th percentile, 5-day storm depth for the closest site is 26.8mm.*
Full surface water quality monitoring. Sampling and analysis of parameters per Table 6.2. All locations specified in Table 6.3.	Based upon any requirement of a Trigger Action Response Plan.

Table 6.2 Water quality monitoring analytes

Suite	Analytes
Primary surface water quality suite	Sampling and analysis of field parameters including turbidity, EC, and pH. Plus: – Total suspended solids (TSS) – Total dissolved solids (TDS) – Oil and grease
Full surface water quality suite	Sampling and analysis of field parameters including turbidity, EC, and pH. Plus: – Total suspended solids (TSS) – Total dissolved solids (TDS) – Metals – Major cations and anions, alkalinity – Nutrients – Hydrocarbons – Oil and grease

Table 6.3 Water quality monitoring locations

Monitoring item	Location	Location (lat- long approx.)	Purpose
Background water quality	Lake Munmorah near Halekulani	-33.2210, 151.5556	Background water quality and impact assessment as a basis for quality conditions in Hammond Canal
Upstream location	Unnamed waterway discharging to Lake Munmorah upstream of the site discharge point	-33.2115, 151.5484	Impact assessment
Downstream location (1)	Hammond Canal	-33.2134, 151.5372	Impact assessment
Downstream location (2)	Unnamed waterway discharging to Lake Munmorah downstream of the Colongra Power Station (when flowing)	-33.2095, 151.5484	Background water quality and impact assessment
At project site	At drainage discharge locations from the project boundary (when flowing). Locations TBC Storage ponds (e.g., oil-water pond, sedimentation basins etc.). Locations TBC	TBC during project staging and development of the SWMP	Impact assessment

Trigger Action Response Plan

A Trigger Action Response Plan is proposed to identify trigger values and criteria and provide appropriate response actions if impacts during construction are identified through the monitoring program (refer section 6.3.1). The TARP is presented below in Table 6.4 and identifies the minimum responses to a range of triggers. It should be noted that the TARP should be referenced in the CEMP developed by the Contractor and may involve ongoing liaison with the Principal, as well as with the relevant Engineering and/or Designer authority.

Table 6.4 Proposed Trigger Action Response Plan

<table>
<tr><th>ID</th><th>Trigger</th><th>Response</th></tr>
<tr><td>TARP01</td><td>Erosion and sedimentation controls are not functioning as designed or have failed.</td><td>Rectify, remediate, and replace controls if needed.
Visually inspect downstream waterways for signs of films, oils, turbidity in waterways immediately downstream of the site.</td></tr>
<tr><td>TARP02</td><td>Visual observation of films, oils, turbidity in waterways immediately downstream of the site.</td><td>Review surface water management measures specified in the CEMP, SWMP and ESCP.
Conduct a single round of monitoring at the water quality monitoring locations (refer Table 6.3) for the primary surface water quality suite (refer Table 6.2).</td></tr>
<tr><td>TARP03</td><td>Results of primary surface water monitoring:
– Parameters exceed the Default Guideline Value (DGV) AND those parameters that exceed the DGV have:
• A 10% higher concentration downstream of the site than upstream of the site. AND
• A 10% higher concentration downstream of the site than background measurements.
– Where parameters do not have a specified DGV, these parameters have:
• A 10% higher concentration downstream of the site than upstream of the site. AND
• A 10% higher concentration downstream of the site than background measurements.</td><td>Continue to review surface water management measures specified in the CEMP, SWMP and ESCP.
Continue to monitor surface water quality. Conduct water quality monitoring at a frequency of once every 14 days for the full surface water quality suite (refer Table 6.2) for the locations specified in Table 6.3.</td></tr>
<tr><td>TARP04</td><td>Uncontrolled discharge from the site occurs.</td><td>Conduct a single round of monitoring at the water quality monitoring locations (refer Table 6.3) for the full surface water quality suite (refer Table 6.2).</td></tr>
<tr><td>TARP05</td><td>Results of full water quality monitoring:
– Parameters exceed the Default Guideline Value AND those parameters that exceed the DGV have:
• A 10% higher concentration downstream of the site than upstream of the site. AND
• A 10% higher concentration downstream of the site than background measurements.
– Where parameters do not have a specified DGV, these parameters have:
• A 10% higher concentration downstream of the site than upstream of the site. AND
• A 10% higher concentration downstream of the site than background measurements.</td><td>Continue to review surface water management measures specified in the CEMP, SWMP and ESCP.
Continue to monitor surface water quality in accordance with TARP03 at a frequency of once every 14 days.</td></tr>
</table>

ID	Trigger	Response
TARP06	TARP05 is continuously triggered (i.e., a water quality impact may be suspected) for the same parameter(s) over three consecutive monitoring rounds. OR Release of a known contaminant has occurred (e.g., a spill) or is suspected to have occurred.	Contact the NSW EPA and comply with POEO Act where applicable. Follow guidance from the NSW EPA. Where applicable conduct bunding of relevant contaminant and/or cover exposed materials to reduce risk of contact with waters. If mobilisation into downstream waterways has occurred conduct a single round of full surface water quality monitoring.
TARP07	During earthworks, an unsuspected find occurs (e.g., contaminant fill, suspected contaminant fill, asbestos, waste).	Follow obligations in the CEMP and SWMP. Conduct bunding of unsuspected find and/or cover exposed materials to reduce risk of contact with waters. If mobilisation into downstream waterways is suspected, conduct a single round of full surface water quality monitoring.

Conclusion

Following implementation of the mitigation measures described above to manage potential risks to surface water quality during the construction phase, no residual surface water quality impacts are anticipated.

6.3.2 Operational phase surface water quality

Management Plans and Standard Operating Procedures

To appropriately manage surface water quality during the operation of the site, appropriate management plans, such as an Operational Water Management Plan (WMP), and relevant Standard Operating Procedures (SOP) should be developed and apply during the operation phase.

Management plans, such as the Operational WMP, are required to address:

- Operational activities that may pose a risk to water quality
- Management and maintenance of the oil-water separator and the associated oil-water pond
- Identification of emergency response actions that would be undertaken to manage water quality at the site, e.g., battery fires and any associated water quality impacts.
- Identification of any ongoing monitoring of water quality at the site
- Maintenance of stormwater, sewer, erosion, and sedimentation controls to ensure serviceability
- Emergency response actions undertaken to manage water quality at the site, e.g., battery fires and any associated water quality impacts
- Accountability and responsibilities of key staff.

SOPs should be developed for all activities or emergencies that pose a water quality risk, for example:

- Emergency responses during fires. This should consider potential collection of fire-water runoff, including testing and discharge requirements.
- Conducting maintenance on components within the switchyard that may house oil or hydrocarbons.
- Conducting maintenance on battery components that may house materials that pose a water quality risk.
- Maintaining and operating the oil-water management pond, including how oil will be collected, stored, and legally disposed of.

Water quality control infrastructure

The details of water quality control infrastructure will be developed following final product specification based on the selected project supplier. Potential infrastructure and engineered controls required should be confirmed during the detailed hazard assessment as part of the detailed design process. Design and development of infrastructure and engineered control should consider the following processes:

- Consultation with Central Coast Council on required water control controls to manage general risks associated with increases in impervious areas. As described in Section 5.3.2, there are opportunities and locations where infrastructure could be installed, including opportunities to construct grassed swales, or bioretention facilities. Infrastructure should be developed with consideration to Central Coast Council's guidelines for civil developments.
- Design of oil-water management controls within the main switchyard area should consider relevant Australian Standards, as well as any requirements of electricity distributors.
- Design of stormwater infrastructure, such as drainage channels, detention basins or bioretention basins, should consider the potential for impoundment of runoff during emergency events such as fires. Design of this infrastructure should consider opportunities of a dual-purpose drainage system following the outcomes of the detailed hazard assessment to manage day-to-day as well as emergency conditions.

Conclusion

Following implementation of the mitigation measures described above for potential specific and general risks to surface water quality during the operational phase, no residual surface water quality impacts are anticipated.

6.4 Groundwater

As identified in Section 5.4, no direct impacts or interaction with local groundwater conditions are expected. Surface water quality impacts are anticipated to be the primary mechanism of potential quality risks to water and accordingly, the controls identified in Section 6.3 would provide a potential benefit for groundwater quality.

The basis of limited groundwater interaction is due to the relatively low depth of groundwater at the site, which is generally 4 – 8 metres below ground level, and the limited excavation anticipated to be required during construction. Detailed design of the facility is not yet complete and is dependent on the selected battery supplier. Detailed design of the facility should consider groundwater observations and excavation depths should be limited to avoid groundwater. Where depths are proposed below previously observed groundwater levels, the groundwater assessment should be reviewed.

Once operational, no ongoing interaction with groundwater is anticipated. Installation of the battery pad, switchyard and associated infrastructure is anticipated to reduce the quantity of infiltrating water which may have otherwise interacted with potentially contaminated materials below the ground surface. No ongoing monitoring of groundwater for operation of this project is proposed on this basis, however it is identified that investigations regarding groundwater quality is likely to continue at the site for the purpose of identifying impacts associated with historical operation of the power station.

Following implementation of the controls described within this section, including the triggers required to reassess potential groundwater impacts, no residual impact to groundwater is anticipated for this project.

6.5 Post operation

As described in Section 5.5, while the decommissioning methodology and potential post-operation of the facility is unknown; potential water impacts during decommissioning or post-operation are anticipated to be lesser than or similar to those experienced during construction. As such, relevant mitigation measures specified for the construction and operational phases (Sections 6.3.1 and 6.3.2 respectively) are to be implemented for any post-operation or decommissioning activities.

Following implementation of the controls described within this section and the above sections to manage potential impacts following closure of the facility, no residual impact to surface or groundwater is anticipated for this project.

6.6 Summary of mitigation measures

The mitigation and management measures proposed within this Section are summarised in the following table. Each measure is assigned an identifier (ID) and the measure is briefly summarised. Full details are provided in the above sections.

Table 6.5 Summary of Mitigation Measures for Water Impacts

Flooding (FL)

ID	Measure
FL01	Detailed design of the facility should consider drainage stormwater drainage requirements to allow stormwater to be appropriately managed considering the site's location. Consideration of climate change should be undertaken during this activity.
FL02	Controls should be implemented following consultation with Central Coast Council to manage peak flow rates in accordance with relevant guidelines.

Surface Water (SW)

ID	Measure
SW01	A Construction Environmental Management Plan and a Soil and Water Management Plan (SWMP) should be developed to manage potential impacts during construction on water quality. These plans should include a monitoring and maintenance program, an unexpected finds procedure, as well as a Trigger Action Response Plan
SW02	An Operational Water Management Plan (OWMP) and relevant Standard Operating Procedures (SOPs) should be developed to address activities and emergencies that pose a water quality risk during operation of the facility.
SW03	Controls should be implemented following consultation with Central Coast Council to manage water quality associated with the addition of relatively large impervious areas in accordance with relevant guidelines. Following the detailed hazard assessment, these controls should consider opportunities for a dual-use system to also manage runoff quality risks during emergencies such as fire.
SW04	Post-operation or during decommissioning of the facility, SW01 (for construction activities including decommissioning) and/or SW02 (for post-operational phases) should be followed where applicable. Risks should be re-assessed based on proposed activities following operation.
SW05	During detailed design, a detailed construction water balance should be undertaken to ensure the works are staged appropriately such that water can be sourced in the required quantities.

Groundwater (GW)

ID	Measure
GW01	Excavations should be limited to depths above the observed groundwater levels. Where deeper excavation is required, the groundwater assessment should be reviewed.

7. Conclusion

A Water Impact Assessment has been prepared to address the water related impacts associated with a new battery energy storage system in Colongra on the Central Coast of NSW. The project involves construction of a new battery energy storage system, as well as a switchyard and ancillary infrastructure to connect the battery system to the electricity grid.

Potential water related risks have been considered including the following water management measures in-built to the project:

- The site is to be developed as a ‘brownfield development’.
- The site is located above downstream 1 in 100 AEP flood levels, and can utilise existing stormwater measures to convey stormwater around the site.
- Nearby services such as a water and wastewater at the former power station will be connected to, in order to provide essential services.
- The switchyard area will be managed as a ‘contact water’ catchment and the existing sediment basin can be re-used as an oil-water management pond to reduce the risk of oil related pollution to downstream waterways.

The site is currently being remediated and sources of contamination such as coal fragments, asbestos containing materials, stockpiled materials, PFAS impacted soils and contaminated sediments will be appropriately managed and removed in accordance with ongoing investigation by Consulting Earth Scientists.

The water assessment undertaken found that including the measures in-built to the project, it could be undertaken appropriately with relation to water related impacts, with the implementation of the following additional mitigation measures:

- Detailed design of the facility should consider locating the site appropriately and development of drainage to convey stormwater. Consideration of climate change should be undertaken during this activity.
- Controls should be implemented following consultation with Central Coast Council to manage peak flow rates in accordance with relevant guidelines.
- A Construction Environmental Management Plan and a Surface Water Control Plan should be developed to manage potential impacts during construction on water quality. These plans should include a monitoring and maintenance program as well as a Trigger Action Response Plan.
- An Operational Water Management Plan should be developed to address activities and emergencies that pose a water quality risk during operation of the facility.
- Controls should be implemented following consultation with Central Coast Council to manage water quality associated with urbanisation in accordance with relevant guidelines. Following the detailed hazard assessment, these controls should consider opportunities for a dual-use system to manage runoff during emergencies such as fire.
- Post-operation or during decommissioning of the facility, SW01 (for construction activities including decommissioning) and/or SW02 (for post-operational phases) should be followed where applicable. Risks should be re-assessed based on proposed activities following operation.
- Development of a detailed construction water balance to ensure the works are staged appropriated such that the water can be sourced in the required quantities.
- Excavations should be limited to depths above the observed groundwater levels. Where deeper excavation is required, the groundwater assessment should be reviewed.

The assessment identified that by implementing measures to manage potential risks to water by the project, that no unacceptable residual impact would be anticipated.

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Appendix A

Concept Design Drawing

ITEM	CUT	FILL	BALANCE
BATTERY PAD	6,500m^3	7,500m^3	1000m^3
SWITCHING PAD	2,500m^3	2000m^3	-500m^3
TRANSFORMER PAD	1000m^3	2000m^3	1000m^3

NOTES:
1. PAD WITH 1% GRADE REQUIRED FOR THE WHOLE SWITCH YARD.
2. MINIMUM NUMBER OF BATTERIES REQUIRED IS 225
3. BATTERY SHOULD OPTIMALLY BE IN GROUPS OF 7.
4. ASSUME BUNKER BREAK DOWN TO APPROX RL14.3 OVER THE WHOLE SITE.
5. 45m OFFSET FROM THE CADASTRAL BOUNDARY TO THE NEAREST BATTERY, FENCE, EARTHWORKS AND DRAINS WILL BE WITHIN THE 45m.
6. DESIGN EARTHWORKS VOLUMES ROUNDED TO NEAREST 500M^3.
7. THESE VOLUMES ARE BASED ON THE SURVEY REFERENCE M&P "DETAIL SURVEY OF MUNMORAH COAL STACKS AREA MUNMORAH POWER STATION" REV 2 27/07/2022 AND INDICATIVE DESIGN PRESENTED IN THIS DRAWING.
8. NO ALLOWANCE HAS BEEN MADE FOR TOP SOIL STRIPPING, CLEARING OR GRUBBING.
9. NO ALLOWANCE HAS BEEN MADE FOR TEMPORARY WORKS OVER EXCAVATION SUCH AS FOR BUNKER DEMOLITION OR DRAINAGE CONSTRUCTION ETC.
10. VOLUMES ARE MEASURED TO THE FINISHED DESIGN SURFACE INCLUDING TOP OF PADS AND TOP OF ROADS.
11. THE DESIGN DOES NOT INCLUDE EARTHWORKS FOR THE OPTION OF REDUCING 45M OFFSET FROM BOUNDARY
12. THE VOLUMES DO NOT INCLUDE FILLING BUNKER OR USE OF STOCKPILED MATERIAL ON SITE.

Rev	Description	Checked	Approved	Date
D	FOR INFORMATION		T.L.	01/08/22
C	FOR INFORMATION		T.L.	28/07/22
B	FOR INFORMATION		T.L.	28/07/22
A	FOR INFORMATION		T.L.	27/07/22

Author C.HASWELL Drafting Check Reg No.
Designer A.GAUTHIER Design Check Date

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

GHD
Level 8, 180 Lonsdale Street, Melbourne VIC 3000 Australia
T 61 3 8687 8000 F 61 3 8687 8111
E melmail@ghd.com.au W www.ghd.com
www.ghd.com

Project No. 12582669

Client DEPARTMENT OF PLANNING INDUSTRY & ENVIRONMENT

Project

Status CONCEPT DESIGN

Status Code

Drawing Title BESS ARRANGEMENT COAL STORAGE AREA INDICATIVE ONLY GENERAL ARRANGEMENT PLAN

Size A1

Drawing No. 12582669-C002

Rev D

Plot Date: 1 August 2022 - 10:10 AM Plotted by: Conor Haswell File Name: G:\21\12582669\CADD\Drawings\Only_Coal_Storage_Area\RA DESN EWKS OCSA.dwg

EnergyCo

GPO Box 5469,
Sydney, NSW 2001.

E: contact@energyco.nsw.gov.au

W: www.energyco.nsw.gov.au

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