Environmental & Social Consultants

SOUTHERN WINDS OFFSHORE WIND PROJECT

Preliminary Hydrology Constraints Assessment

FINAL

November 2022

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Preliminary Hydrology Constraints Assessment

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
BlueFloat Energy

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Report No. 22526/R07B
Date: November 2022

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Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	Darren Lyons	18 July 2022	Caroline Funnell	20 July 2022
V2	Darren Lyons	26 September 2022	Caroline Funnell	09 October 2022
V3	Caroline Funnell	4 November 2022	Caroline Funnell	4 November 2022
V4	Caroline Funnell	28 November 2022	Caroline Funnell	28 November 2022

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Abbreviations

Abbreviation	Description
AAASS	Atlas of Australian Acid Sulfate Soils
ASS	Acid Sulfate Soil
BFE	BlueFloat Energy
CMA	Catchment Management Authority
DELWP	Department of Environment, Land, Water and Planning
GDEs	Groundwater Dependent Ecosystems
GW	Gigawatts
ha	Hectares
km	Kilometres
km^2	Square kilometres
LGA	Local Government Area
LiDAR	Light detection and ranging
m	Metres
MW	Megawatts
OWP	Offshore Wind Project
P&E Act	*Planning and Environment Act 1987*
PASS	Potential Acid Sulfate Soil
SA	South Australia (State of)
VCASS	Victorian Coastal Acid Sulfate Soil
VIC	Victoria (State of)

1.0 Introduction

1.1 Purpose

Umwelt has been engaged by BlueFloat Energy (BFE) to coordinate the planning and environmental approvals activities for Phase 1 of the development of Southern Winds Offshore Wind Project's (the Project) development. Umwelt has undertaken a desktop assessment for the Project to identify potential social and environmental impacts that may result from the construction, operation, and decommissioning of the Project, and to inform the Project's planning and approval strategy.

As part of the Phase 1 study, Umwelt has been engaged to undertake a preliminary hydrology constraints assessment to inform next steps for the Project in relation to design development, risk, mitigation and further studies. The primary objectives of the preliminary hydrology constraints assessment were to identify the likely impacts on flooding, hydrology, water quality and water supply for the onshore components, as well as identify any potentially impacted catchments and associated water sharing plans (surface water and groundwater) and review the Project impact area drainage and topography.

1.2 Project Description

The Project is located approximately 8-20 kilometres (km) off the coastline between Cape Douglas (South Australia) and Nelson (Victoria), approximately 60 km west of Portland (Victoria) township. **Figure 1.1** shows the Project Area which contains the offshore and onshore components of the Project, including the transmission line route, associated with its construction, operation and decommissioning.

Within the Project Area, the Project involves 77 'bottom-fixed' wind turbines1, two offshore substations and associated infrastructure with the capacity to generate up to 1.155 gigawatts (GW) of electricity. The wind turbines will have a capacity between 15 MW and 20 MW, hub heights between 165 m and 190 m and rotor diameters of 250 m to 275 m.

Two potential subsea cable and onshore transmission routes are being considered from the offshore substations to the proposed grid connection:

- Option 1 proposes subsea export cables to travel southeast from the more easterly offshore substation for approximately 72 km, landing near the north west corner of the Narrawong Coastal Reserve, approximately 1.5 km from the Portland Aluminium Smelter. The subsea cables would be connected to onshore cables in a transition joint bay. The onshore cables would then continue to the existing switchyard at the smelter site (connecting in via a new onshore substation located adjacent to the Portland Aluminium Smelter switchyard).

- Option 2 proposes subsea export cables to travel southeast from the more easterly offshore substation for approximately 42 km, landing near the south-eastern corner of the Glenelg Estuary and Discovery Bay Ramsar Wetlands Site at Cape Bridgewater (avoiding the Discovery Bay Marine National Park). The subsea cables would be connected to onshore cables in a transition joint bay. These onshore cables would then continue underground or overhead north-east through Gorae West for approximately 29 km to the existing Heywood Terminal Station (connecting in via a new onshore substation located adjacent to the terminal station). Transition to an overhead line, if applicable, would likely be located

[1] A bottom-fixed turbine is mounted on a structure fixed into the seabed.

within 5 km of the coast.

It is noted that the transmission line options proposed as part of the Project were identified prior to release of the Victorian State Governments Offshore Wind Implementation Statement 1 (DELWP October 2022c) and accordingly the location of the grid connection may be subject to further review and consideration.

The offshore wind farm component of the Project is located within the Territorial Sea and the Exclusive Economic Zone (both Commonwealth Waters), with the grid connection within the Glenelg Local Government Area (LGA) in Victoria. The offshore wind farm component for the Southern Winds OWP would encompass an area of approximately 290 km^2.

1.2.1 Study Area

As shown in **Figure 1.1**, the Study Area extends beyond the Project Area. The purpose of the Study Area is to provide additional context to the existing site conditions and for identification of potential impacts. It provides flexibility in siting and design as a response to the outcomes of Phase 1 and subsequent assessments.

The Study Area includes:

- A 5 km buffer around the offshore wind farm components (offshore wind turbines and offshore substations) and subsea export cable routes up to the shoreline.
- A 2.5 km buffer around the onshore overhead (or underground where needed) transmission line and the onshore substation (referred to as the transmission line corridor) except where alternatives are considered.

The following definitions apply within the Study Area:

- Offshore refers to all areas from the low water line along the coast out to sea. For the purpose of the Project, the Study Area and Project Area lie in Commonwealth and State Waters (see definitions below).
- Onshore refers to all land-based areas above the low water line.
- State Waters refers to area from the low water line along the coast up to 3 nautical miles seaward.
- Territorial Waters and Contiguous Zone (Commonwealth) refers to land from the State Water boundary up to 12 and 24 nautical miles respectively, from the low water line along to the coast.
- Exclusive Economic Zone extends from the Territorial Waters and Contiguous Zone up to 200 nautical miles from the low water line along to the coast.

This hydrology constraints assessment has considered only the onshore component of the Study.

1.3 Scope

The scope of work involved in this preliminary hydrology constraints assessment included the following:

- Review Project catchments, topography and drainage.
- Review of watercourse mapping.
- Identify potentially impacted catchments and associated water sharing plans (surface water and groundwater).
- Identify sensitive areas including groundwater dependent ecosystems that could be impacted by the Project.
- Identify and review Project Area soils.
- Identify potential flood risk within the Project Area.

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Legend

- Southern Winds Offshore Wind Project Study Area
- Southern Winds Onshore Wind Project Study Area

Southern Winds Offshore Wind Project Area consists of:

- Southern Winds Offshore Wind Project Boundary
- Onshore transmission route option 1
- Onshore transmission route option 2
- Subsea cabling option 1
- Subsea cabling option 2
- Potential turbine layout
- Substation
- Transition joint bay
- Heywood terminal station
- Portland aluminium smelter
- Portland airport
- Local Government Boundary
- State Forest, National Parks, Reserves
- Roads
- Drainage line
- Glenelg Estuary and Discovery Bay Ramsar Site
- VIC Coastal and Internal Waters
- Territorial Sea
- Exclusive Economic Zone (Amended by Perth Treaty 1997)

FIGURE 1.1

Study Area

Data source: VIC Data (2022)

2.0 Existing Environment

2.1 Surface Water Catchments and Hydrological Regimes

The onshore Study Area of the onshore transmission route options is located inland from the Portland and Cape Bridgewater coastlines towards Heywood in Victoria. The northern part of the onshore Study Area is located within the catchment system for Surry River and generally drains towards the north-east, discharging at Narrawong (refer to **Figure 2.1**). The southern part of the onshore Study Area is located within the catchment system for Wattle Hill Creek and drains generally toward the south-east, discharging at Portland. These catchments are part of the larger Portland Coast catchment system.

The Glenelg Estuary and Discovery Bay Ramsar Wetland is located within the Study Area as shown on **Figure 2.1**.

Both overhead transmission route options traverse the watercourses of Wattle Hill Creek and Surry River and their tributaries. The identified watercourse alignments within the Project Area were classified for their Strahler Stream Order. Strahler Stream Order is used to describe the hierarchy of stream from the top to the bottom of a catchment. A 1st order stream has no other streams flowing into it and when two streams of the same order join, the resulting stream has the next highest order. Surry River was classified as a 4th order watercourse, and Wattle Hill Creek as a 3rd order watercourse. Unnamed watercourses in proximity to the overhead transmission route options vary between 1st, 2nd and 3rd order watercourses.

In the *Assessment of Victoria's Estuaries Using the Index of Estuary Conditions: Results 2021* (DELWP, 2021), Surry River and Wattle Hill Creek both have ratings of 'Excellent' for water quality.

Legend

- Southern Winds Offshore Wind Project Study Area
- Southern Winds Onshore Wind Project Study Area

Southern Winds Offshore Wind Project Area consists of:

- Onshore transmission route option 1
- Onshore transmission route option 2
- Subsea cabling option 1
- Subsea cabling option 2
- Ramsar Site
- DELWP Important Wetlands
- State Forest, National Parks, Reserves
- Heywood terminal station
- Transition joint bay option 1
- Transition joint bay option 2
- Portland aluminium smelter
- Roads
- Drainage line

FIGURE 2.1

Hydrological Context

Image Source: ESRI Basemap (2022) Data source: VIC Data (2022); DELWP (2022)

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2.2 Soil Landscape and Acid Sulfate Soils

A review of Victorian soil type mapping (Agriculture Victoria, 2016) indicated that the proposed transmission line routes vary between multiple soil types as shown on **Figure 2.2**. The main soil types found in the Study Area are Chromosols, Podosols and texture contrast soils with deep sandy surface horizons and other sand soils (Tenosols & Rudosols) and texture contrast soils with deep sandy surface horizons.

Coastal acid sulfate soils (CASS) occur naturally along many parts of Victoria's coastal zone, including Gippsland, and are largely benign if left undisturbed. However, if disturbed they can react with oxygen and produce sulfuric acid. This can be detrimental to the environment through impacts such as acidification of water and soil, de-oxygenation of water, and poor water quality. The generation of acid through inappropriate management of acid sulfate soils can also result in damage to concrete and steel. Coastal acid sulfate soils may be encountered onshore and offshore depending on geological and historical conditions.

A review of the Victorian Coastal Acid Sulfate Soil (VCASS) maps for Portland Coast indicates the coastline within the onshore Study Area has potential to contain coastal acid sulfate soils, as this area is mapped as 'prospective'. **Figure 2.3** shows the location of prospective coastal acid sulfate soils within the Study Area. Additionally, a review of the National ASS Atlas (CSIRO, 2013) indicates that there is a low to extremely low probability of other Potential Acid Sulfate Soils (PASS) within the Study Area.

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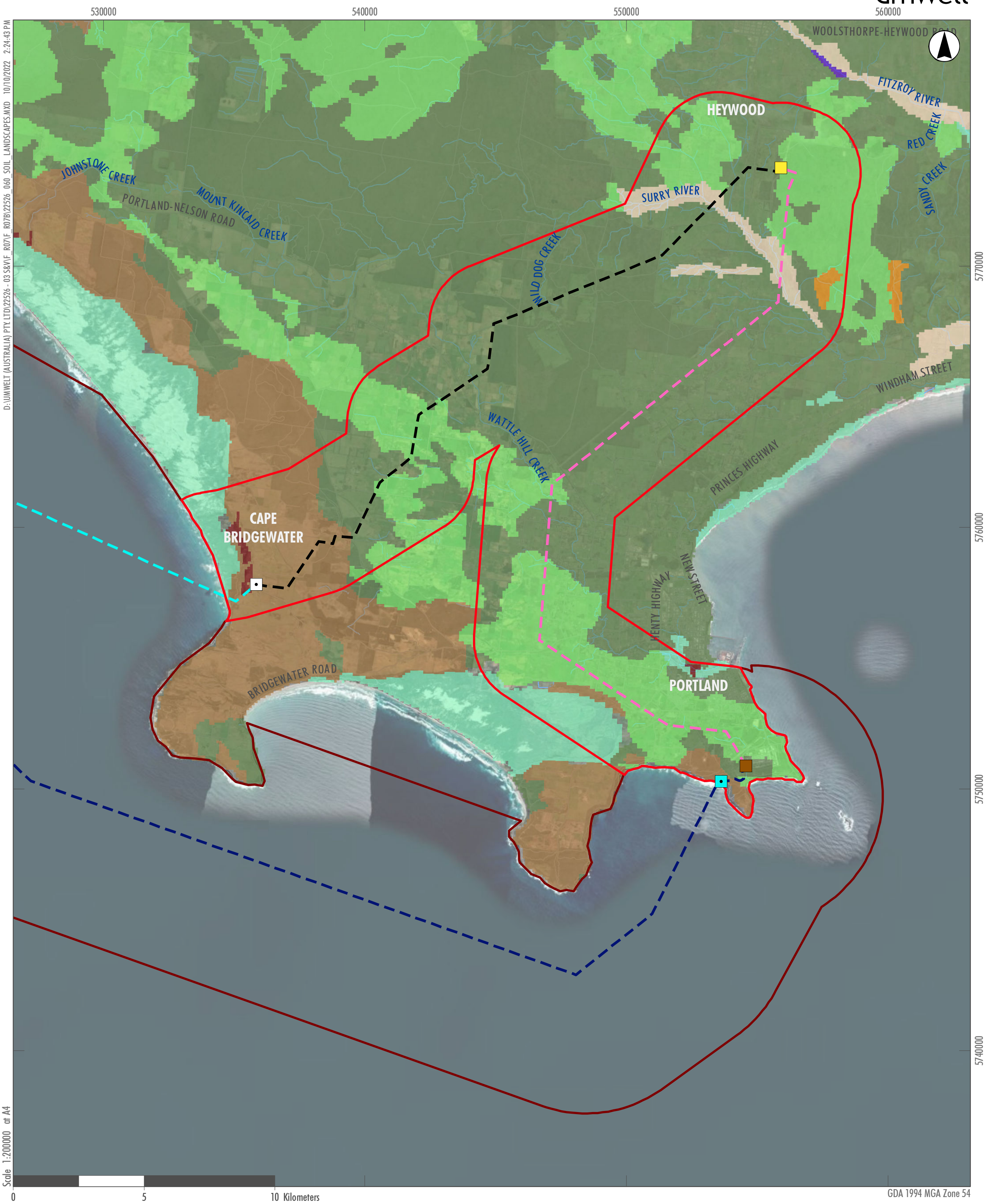

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GDA 1994 MGA Zone 54

Legend

- Southern Winds Offshore Wind Project Study Area
- Southern Winds Onshore Wind Project Study Area

Southern Winds Offshore Wind Project Area consists of:

- Onshore transmission route option 1
- Onshore transmission route option 2
- Subsea cabling option 1
- Subsea cabling option 2
- Heywood terminal station
- Transition joint bay option 1
- Transition joint bay option 2
- Portland aluminium smelter
- Roads
- Drainage line

Soil Landscapes

- Chromosols
- Dermosols
- Kurosols
- N/A
- Podosols
- Rudosols
- Tenosols
- Vertosols

FIGURE 2.2

Soil Landscapes

Image Source: ESRI Basemap (2022) Data source: VIC Data (2022); DELWP (2022)

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0 1 2 Kilometers

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Legend

- Southern Winds Offshore Wind Project Study Area
- Southern Winds Onshore Wind Project Study Area

Southern Winds Offshore Wind Project Area consists of:

- Onshore transmission route option 1
- Onshore transmission route option 2
- Subsea cabling option 1
- Subsea cabling option 2
- Prospective coastal acid sulfate soils
- State Forest, National Parks, Reserves
- Transition joint bay option 1
- Transition joint bay option 2
- Portland aluminium smelter
- Roads
- Drainage line

FIGURE 2.3

Acid Sulfate Soils

Image Source: ESRI Basemap (2022) Data source: VIC Data (2022)

2.3 Groundwater Dependent Ecosystems (GDEs)

The onshore Study Area was assessed to determine whether any sensitive areas were located within the vicinity of the Project. Groundwater Dependent Ecosystems (GDEs) that could be impacted by the Project were identified and are shown on **Figure 2.4**. The proposed transmission line route option 1 (if works are required beyond Portland Aluminium Smelter switchyard) and option 2 interact with low, moderate and high potential GDEs (BOM, 2017).

2.4 Water Usage and Source

The Victorian Water Resource Plans do not incorporate the Study Area, as the water catchments related to the Project are not within the Murray-Darling Basin catchment system. The Study Area is located within the Glenelg Hopkins Catchment Management Authority and is subject to the objectives of the Glenelg Hopkins Regional Catchment Strategy (GHCMA, 2021). The Regional Catchment Strategy helps to provide direction for how the region's land, water and biodiversity should be managed. The Glenelg Hopkins Catchment Management Authority will need to be consulted with respect to water usage approval in subsequent phases of the project.

2.5 Flooding

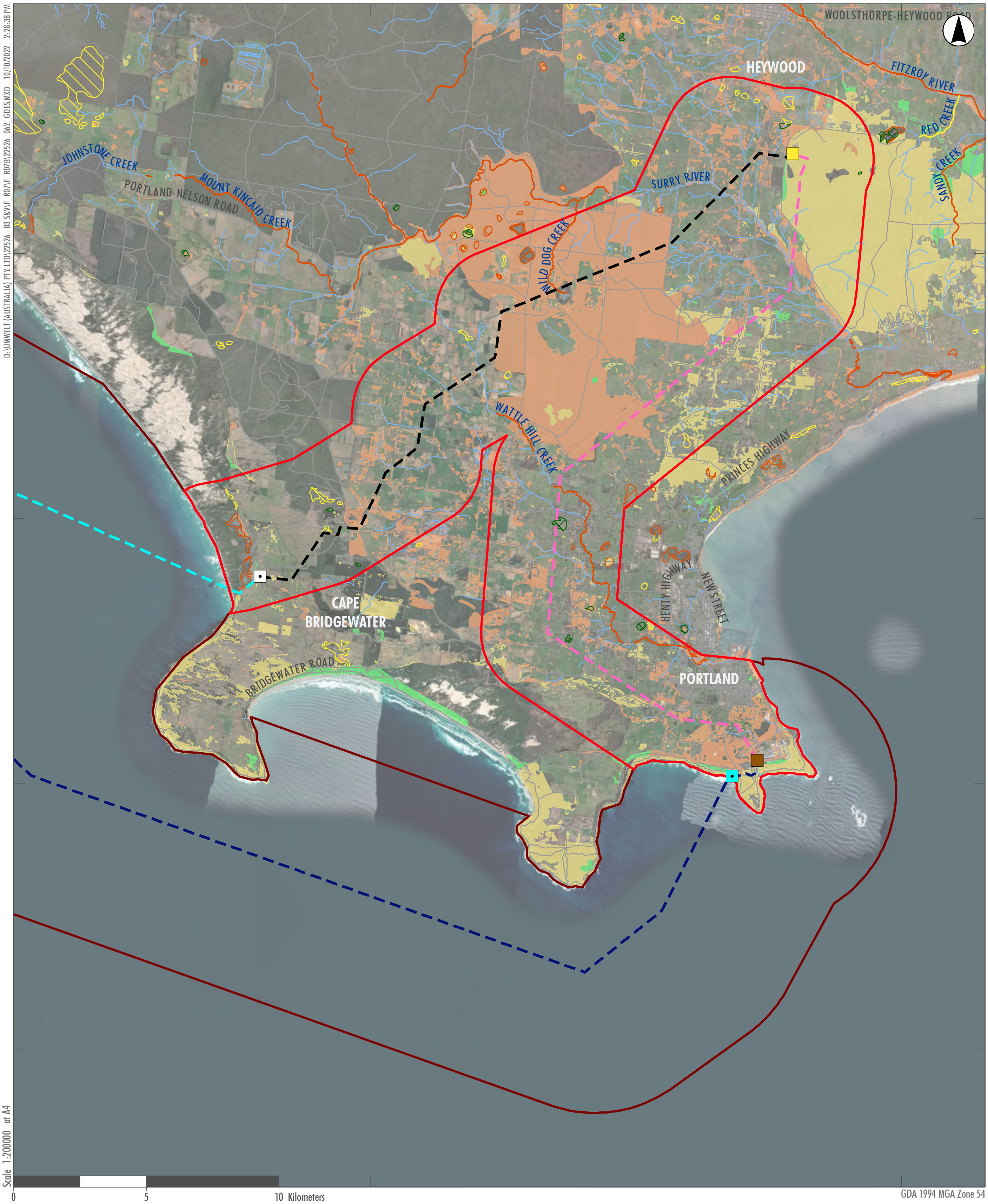
Existing flood studies undertaken in the vicinity of the onshore Study Area include the following:

- *Surry River Estuary Flood Study* (Water Technology, 2008): Hydrology was undertaken for the Surry River catchment and flood modelling was undertaken for the Surry River Estuary which is located downstream of the Study Area.
- *Portland Flood Study* (Cardno, 2011). Flood modelling was undertaken for Wattle Hill Creek downstream of the Study Area.

While both existing flood studies do not incorporate flood mapping of the Study Area, the flood studies were reviewed alongside the 10 m resolution Vicmap Digital Elevation Model (DEM) of the area (State Government of Victoria, 2021) and stream gauge data for Surry River in order to understand potential flood risk in the onshore Study Area. It is expected that Surry River has the potential to spread out into a floodplain approximately 1 km wide, while it is expected that flow within Wattle Hill Creek and other tributaries to be relatively contained within localised riparian corridors along the channel alignments.

With respect to the limited scope of this high-level flood risk assessment, the following may be undertaken in subsequent project phases to provide a comprehensive flood risk assessment for proposed development once further design development is complete and to support the planning submission:

- A flood model of the onshore Study Area is developed with LiDAR survey data in accordance with the latest Australian Rainfall and Runoff 2019 guidelines to establish critical design flood conditions across the catchment.
- Modelled design flows are validated against alternative methods (e.g. Regional Flood Frequency Estimation (RFFE)) and calibrated to record stream gauge levels where available (one gauge exists within Surry River).
- Full suite of mapping including flood depth, velocity and hazard distributions across the study for a range of design flood magnitudes to assess risk to infrastructure and potential impacts of proposed works.



Legend

- Southern Winds Offshore Wind Project Study Area
- Southern Winds Onshore Wind Project Study Area

Southern Winds Offshore Wind Project Area consists of:

- Onshore transmission route option 1
- Onshore transmission route option 2
- Subsea cabling option 1
- Subsea cabling option 2
- Heywood terminal station
- Transition joint bay option 1
- Transition joint bay option 2
- Portland aluminium smelter
- Roads
- Drainage line

Aquatic GDEs

- High potential for GW interaction
- Moderate potential for GW interaction
- Low potential for GW interaction

Terrestrial GDEs

- High potential for GW interaction
- Moderate potential for GW interaction
- Low potential for GW interaction

FIGURE 2.4

Groundwater Dependent Ecosystems

Image Source: ESRI Basemap (2022) Data source: VIC Data (2022); Bureau of Meteorology (2017)

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3.0 Potential Impacts to Surface Water

Following definition of the existing environmental context of the onshore Study Area and surrounds, potential surface water and hydrology impacts have been identified with consideration of the Project design, construction, operation, and decommissioning activities. An overview of these potential impacts is provided in **Table 3.1**.

The principal water resources related impacts are expected during construction and decommissioning of the Project (namely trenching through waterways if required) and are associated with surface water quality risks, mainly at the intersection of the construction works with watercourses and a general risk of erosion as a result of disturbed or exposed soils. Trenching may be restricted by flooding impacts as well as riparian zone offset requirements. These risks may be most significant along Surry River and Wattle Hill Creek.

Table 3.1 Potential Surface Water and Hydrology Impacts

Environment Aspect	Description of Potential Impact
Surface Water Quality – Erosion and Sedimentation	Construction and decommissioning activities such as vegetation removal, earthworks (including disturbance of acid sulfate soils) and movement of heavy vehicles have the potential to impact the surface water quality of watercourses and sensitive waterbodies (i.e. wetlands) within the Study Area and result in soil erosion and sedimentation in downstream waterways. Discharge of sediments (both air and water borne) from exposed ground during construction resulting in adverse impacts on receiving environment surface water quality.
Surface Water Quality - Trenching	Trenching of ephemeral watercourses (potential for onshore buried cable from coastal landing to substation) and movement of heavy vehicles have the potential to impact the surface water quality of watercourses and sensitive waterbodies (i.e. wetlands) within the Study Area and result in soil erosion and sedimentation in downstream waterways.
Surface Water Quality – Spills, Leaks and Litter	Fuel or chemical spills, or inappropriate material storage, leads to contamination of groundwater and/or nearby waterways and sensitive waterbodies (i.e. wetlands), resulting in environmental degradation and implications under the Environment Protection Act 2018.
Groundwater	Impacts to groundwater resources including Groundwater Dependent Ecosystems (GDEs).
Surface Water Quality	Fuel or chemical spills, fire management systems or inappropriate material storage, leads to contamination of groundwater and/or nearby waterways and sensitive waterbodies (i.e. wetlands), resulting in environmental degradation and fines under the Environment Protection Act 2018.
Surface Water Quality	Discharge of stormwater from the Study Area during operation resulting in adverse impacts on receiving environment surface and groundwater water quality.
Surface Water Geomorphology	Discharge of stormwater from the Study Area during operational phase resulting in adverse impacts on receiving environment surface water geomorphology (e.g. stream bank erosion and scouring) or hydroecology.

4.0 Recommendations

Based on the outcomes of the impact assessment undertaken to identify potential impacts of hydrology, relevant design constraints that have the potential to affect the Project site have been identified. A summary of the identified mitigation recommendations is provided in **Table 4.1**.

Table 4.1 Recommended Mitigation Measures

Environment Aspect	Recommended Mitigation Measures
Surface Water Quality – Erosion and Sedimentation	Works in waterways not to be undertaken in wet weather. Consider boring techniques for cables at waterway crossings where possible to limit open trenching works in sensitive environments. Overhead transmission lines should not require trenching. Works on Waterways Permits will be required and design of waterway crossings for roads and cables etc will adhere to the permit conditions and design requirements of the Glenelg Hopkins Catchment Management Authority. Industry best practice Construction Environmental Management Plan (CEMP) to be implemented that includes a Waste Management Plan that addressed the storage and stockpiling of raw materials, transport of materials to site, and disposal of materials, as well as measures to manage any potential Acid Sulfate Soils found in excavated fill material, in accordance with the Acid Sulfate Soil Guidelines. Erosion and sediment control measures to be detailed in a CEMP including establishment of appropriate drainage during construction, sediment controls such as sediment sumps and fencing, stockpile management, oil booms and/or sediment traps applied during works in waterways, and reinstatement measures such as reseeding and revegetation after construction works are complete. A construction management plan will be developed for the Project which will incorporate an Erosion and Sediment Control Plan and detail methods for minimizing sediment laden runoff in accordance with the International Erosion Control Association's (IECA) Best Practice Erosion and Sediment (BPESC) guidelines (IECA, 2008). Water will be used for dust suppression in order to minimize airborne contaminants.

Environment Aspect	Recommended Mitigation Measures
Surface Water Quality - Trenching	• Trenching will be avoided where possible in favour of boring techniques for waterway crossings, to be considered further as design develops. • Watercourses only to be traversed by trenching if the bed is dry. • Work is not to be undertaken in wet weather. • Vehicle access to the river bed is to be confined to the easement. • Trenching of a watercourse bank is to start at the top of the slope and work downwards. • Temporary bunding, silt fencing, and sediment dam installation are to be constructed if required. • Watercourse walls are to re-established to a stable slope consistent with the 'natural' slope. Shaping should remove irregularities that would interfere with flows. • Where the watercourse has a surface layer of coarse material (rocks, pebbles, gravel) care should be taken to restore this surface layer. • Rock armouring of the bed and base of wall is to be undertaken.
Surface Water Quality – Spills, Leaks and Litter	• Industry best practice CEMP to be implemented that includes a Waste Management Plan that addressed the storage and stockpiling of raw materials, transport of materials to site, and disposal of materials. • Appropriate storage and bunding of hazardous goods and fuels to be in accordance with best practice and safety sheets as detailed in a CEMP. • Location of site sheds/storage areas and construction vehicle parking to be located away from sensitive areas including a buffer distance from waterways. • Spill Management Protocol to be implemented if any spills occur in the Project Area.
Groundwater	• Groundwater table is not intercepted during construction. • A dewatering procedure is prepared and incorporated into the CEMP in the event that ephemeral or temporary groundwater is encountered during construction works. • Industry best practice CEMP to be implemented that includes a Waste Management Plan that addresses the storage and stockpiling of raw materials, transport of materials to site, and disposal of materials. • Appropriate storage and bunding of hazardous goods and fuels to be in accordance with best practice and safety sheets as detailed in a CEMP. • Spill Management Protocol to be implemented if any spills occur in the Project Area.

Environment Aspect	Recommended Mitigation Measures
Surface Water Quality	• Industry best practice CEMP to be implemented that includes a Waste Management Plan that addresses the storage and stockpiling of raw materials, transport of materials to site, and disposal of materials. • Location of site shed/storage areas and vehicle parking to be identified in CEMP away from sensitive areas including a buffer distance from waterways. • Spill Management Protocol to be implemented if any spills occur in the Project Area.
Surface Water Quality	• Operation phase mitigation measures will be guided by an operational management plan developed for the Project, which will detail methods for minimizing sediment loss from the Study Area in accordance with best practice guidelines. • Stormwater runoff from the Project Area during the operational phase will be discharged diffusely across the Study Area via vegetated surfaces wherever practicable, and will collect and direct stormwater to nearby drainage systems or watercourses.
Surface Water Geomorphology	• Project Area drainage works will aim to minimize potential impacts on the existing overland flow paths and stormwater will be discharged diffusely across the Study Area via vegetated surfaces wherever practical. Project Area drainage works will aim to minimize potential impacts on the existing overland flow paths. • Although peak flows of stormwater runoff from the Project are expected to increase slightly post-development at locations where surfaces are made impervious or less pervious, these increases are not expected to impact the downstream environment because only a very small proportion of the catchment will be subject to development (largely only transition joint bay and transmission tower base areas) and this runoff is expected to form a very small percentage of peak flow in each receiving watercourse. • Additional specific mitigation measures to control stormwater discharge from the Study Area are not considered necessary given the small volume discharged in the context of each receiving catchment. The proposed mitigation measures are considered to reduce any impacts to stream water quality and geomorphology.

5.0 Conclusions and Recommendations

This preliminary hydrology constraints assessment has reviewed information and data to understand the potential impacts of the Project on water resources within the Project Area. With respect to potential constraints on the proposed development, the most significant issues relate to flood risk and waterway riparian corridors.

A risk assessment of potential impacts to water resources during construction, operation and decommissioning phases of the Project identified the principal water resources related impacts are expected during construction of the Project (namely if trenching through waterways is required for underground cabling) and are associated with surface water quality risks, mainly at the intersection of the construction works with watercourses and Groundwater Dependent Ecosystems and a general risk of erosion as a result of disturbed or exposed soils. Trenching or boring for underground cabling is considered for a short distance of 1-2 km from the subsea export cable landing to the onshore transition joint bays for both options, and for the short distance onwards for Option 1 from here to the Portland Aluminium Smelter switchyard. Where possible, boring techniques will be considered which would reduce if not eliminate the surface water risks identified here from trenching techniques. Trenching is therefore included as a conservative and worst-case risk of the project to the receiving environment.

With respect to the limited scope of this preliminary assessment, it is recommended that the following is undertaken in subsequent project phases to complete the surface water and hydrology assessment for proposed development:

- Flood modelling is undertaken in subsequent project phases and LiDAR data is obtained for the Study Area.
- The assessment is refined and updated when further detail is confirmed on the construction methodology (e.g. underground cable construction) and locations of infrastructure (i.e. transition joint bays, overhead transmission line, access tracks, etc.).
- The Glenelg Hopkins Catchment Management Authority is consulted with respect to water usage approval.

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