

Attachment 4 - Preliminary hydrology assessment

Star of the South Offshore Wind Farm Project EES referral

Preliminary Hydrology Assessment

Preliminary Hydrology Assessment

Client: Star of the South

ABN: 68 239 717 297

Prepared by

AECOM Australia Pty Ltd

Level 10, Tower Two, 727 Collins Street, Melbourne VIC 3008, Australia

T +61 3 9653 1234 F +61 3 9654 7117 www.aecom.com

ABN 20 093 846 925

24-Mar-2020

Job No.: 60616204

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Quality Information

Document Preliminary Hydrology Assessment
 60616204

Ref \\aume11fp001.au.aecomnet.com\projects\606x\60616204\400_tech\462_referrals\attachments\attachment 4 - hydrology\draft 3 - for validation\preliminary hydrology assessment final 240320.docx

Date 24-Mar-2020

Prepared by Leila Kasraie

Reviewed by Melanie Collett

Revision History


Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
Final	24-March-2020		Leila Kasraie / Principal Water Resource Engineer	

Table of Contents

1.0	Executive summary	1
2.0	Introduction	2
	2.1 Project Overview	2
	2.2 Purpose of the report	2
3.0	Description of the Project	4
	3.1 EPBC referral	4
	3.2 EES referral	5
4.0	Method	7
	4.1 Desktop assessment	7
	4.2 Assumptions and limitations	7
5.0	Existing Conditions	8
	5.1 Regional Hydrology	8
	5.2 Local Hydrology	11
	5.2.1 South Gippsland Catchment	11
	5.2.2 Latrobe River	14
6.0	Hydrology and Ramsar Wetlands	16
7.0	Management and mitigation	18
8.0	Conclusion	19
9.0	References	20

1.0 Executive summary

Star of the South Wind Farm Pty Ltd is proposing an offshore wind farm to be located off the south-east coast of Gippsland, Victoria. The key components of Star of the South Project are:

- Offshore wind assets, including wind turbine generators (WTGs), substructures installed on foundations and a network of subsea cables connecting strings of WTGs together and connecting the WTGs to the offshore transmission assets.
- Offshore transmission assets, including substation platforms, substructures installed on foundations and subsea export cables to connect the wind farm to the Gippsland coast
- Onshore transmission infrastructure, including substations, to provide a connection to the National Electricity Market (NEM) in the Latrobe Valley
- Existing port and harbour modifications to support project construction and operations.

The report is a desktop hydrology assessment based on publicly available information. It has been prepared to support the preparation of referrals for the Star of the South project in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) and *Victorian Environment Effects Statement Act 1978* (EES) and assist with the further development of the design.

The report provides a summary of regional catchment hydrology, flood history, and beneficial uses of waterbodies within West Gippsland River Catchment. The hydrology assessment narrows down where the referral area intersects with the basin's waterways within the South Gippsland River and Latrobe River Basins. Proposed design considerations and mitigation measures are included in this report to prevent the potential impacts on water quality, flow, floodplain storage and beneficial uses during construction and operation phases. These objectives and measures assist in determining the level of stormwater management necessary to meet the *State Environment Protection Policy (Waters) (2018)* and would be developed further in the design and management of the Star of the South project.

2.0 Introduction

2.1 Project Overview

Star of the South (the Project) comprises an offshore wind farm, supporting electricity transmission assets required to transfer energy generated by the wind farm to the existing network, and modifications to existing ports and harbours required to support the construction and operation of the wind farm. The Project would supply renewable electricity to the Australian electricity market and play a key role in supporting Victoria's transition to a clean electricity supply.

The key components of the Project are:

- Offshore wind assets, including wind turbine generators (WTGs), substructures installed on foundations and a network of subsea cables connecting strings of WTGs together and connecting the WTGs to the offshore transmission assets.
- Offshore transmission assets, including substation platforms, substructures installed on foundations and subsea export cables to connect the wind farm to the Gippsland coast
- Onshore transmission infrastructure, including substations, to provide a connection to the National Electricity Market (NEM) in the Latrobe Valley
- Existing port and harbour modifications to support project construction and operations.

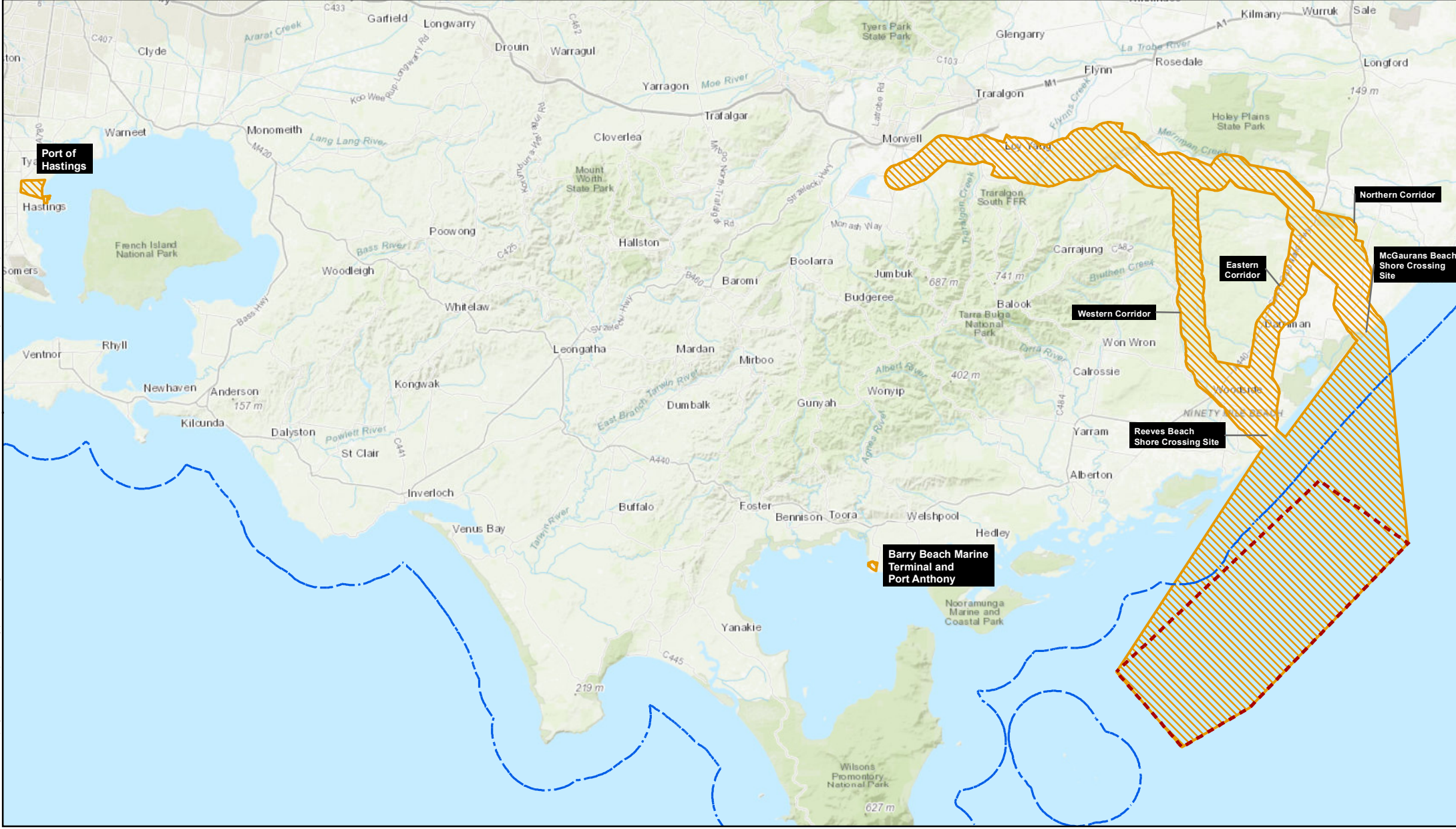
The Project would be located within Commonwealth and Victorian jurisdictions. The offshore wind farm, connecting subsea cables and offshore substations would be located in Commonwealth waters, within the boundary of the Exploration Licence Area (the Licence Area) (issued under an Exploration Licence granted by the Commonwealth Government in March 2019), Figure 1.

The subsea export cables would be located in the Licence Area, Commonwealth waters, and Victorian coastal waters. The onshore transmission infrastructure and existing port and harbour modifications are proposed within Victorian jurisdiction. The onshore transmission infrastructure would be located within the Wellington Shire and/or City of Latrobe. The proposed port and harbour modifications are located within the South Gippsland and/or Mornington Peninsula Shires.

2.2 Purpose of the report

As the Project is located both within Victorian and Commonwealth jurisdictions, it is being referred under the *Environment Effects Act 1978* (Vic) ('EE Act') and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) ('EPBC Act'). The purpose of this report is to identify the key waterways and consider the potential impacts associated with the Project for the purposes of informing and supporting these referrals to determine the potential for significant environmental effects.

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



Star of the South **AECOM**

DATUM GDA94 MGA 55

0 10 20
Kilometres

1:625,000 (when printed at A4)

Legend

- - - Extent of Victorian Coastal Waters
- EPBC Referral Area
- Exploration Licence Area

Data Sources:
State Data © (VICMAP) 2019
Disclaimer:
Victoria State Government - Environment, Land, Water and Planning © (VICMAP) 2019

Star of the South

EPBC REFERRAL AREA

PROJECT #:	60616204
CREATED BY:	JB
LAST MODIFIED:	briereg; 19/03/2020
VERSION:	1

Figure
1

3.0 Description of the Project

As Star of the South would be located within both Commonwealth and Victorian jurisdictions, the following sections describe the key components of the Project and outline which are relevant to the EPBC and EES referral areas.

3.1 EPBC referral

For the EPBC referral, all key components of the project are relevant because of their potential to impact matters of environmental significance, including Commonwealth marine waters. This includes:

- Offshore wind assets which comprise of:
 - Up to 400 WTGs
 - Substructures each installed on foundations
 - A network of buried or mechanically protected (in areas where burial is not possible), subsea cables connecting strings of WTGs together and connecting the WTGs to the offshore transmission assets.
- Offshore transmission assets which comprise of:
 - Up to four Alternating Current (AC) substation platforms collecting the generated electricity and transforming the electricity for transmission to shore. These substations may also be linked to one another via connecting subsea cables
 - Substructures each installed on foundations
 - Up to 13 AC subsea export cables, buried or mechanically protected (in areas where burial is not possible), transmitting the electricity from the wind farm to the shore.
- Onshore transmission assets which comprise of:
 - Underground cable/combined underground cable and overhead powerlines
 - Up to four AC substations
 - Connection to the National Electricity Market (NEM) in the Latrobe Valley.
- Existing port and harbour modifications which comprise of:
 - Use of Port of Hastings, Barry Beach Marine Terminal (BBMT) and Port Anthony and/or other ports in the region for construction and operation of the project
 - Landside development at ports to prepare land for the manufacturing and storage facilities for the wind farm
 - Minor upgrades to the existing jetty at Port of Hastings may be required which could include works in the water in the immediate vicinity of the existing jetty
 - At BBMT structural improvements to a quay wall may be required however these works are anticipated to be undertaken from the landside area

The EPBC referral area is shown in Figure 1, and represents the area within which the Project components would be located. More detail on the proposed action can be found in Section 1.2 of the Star of the South Offshore Wind Farm EPBC Act Referral.

3.2 EES referral

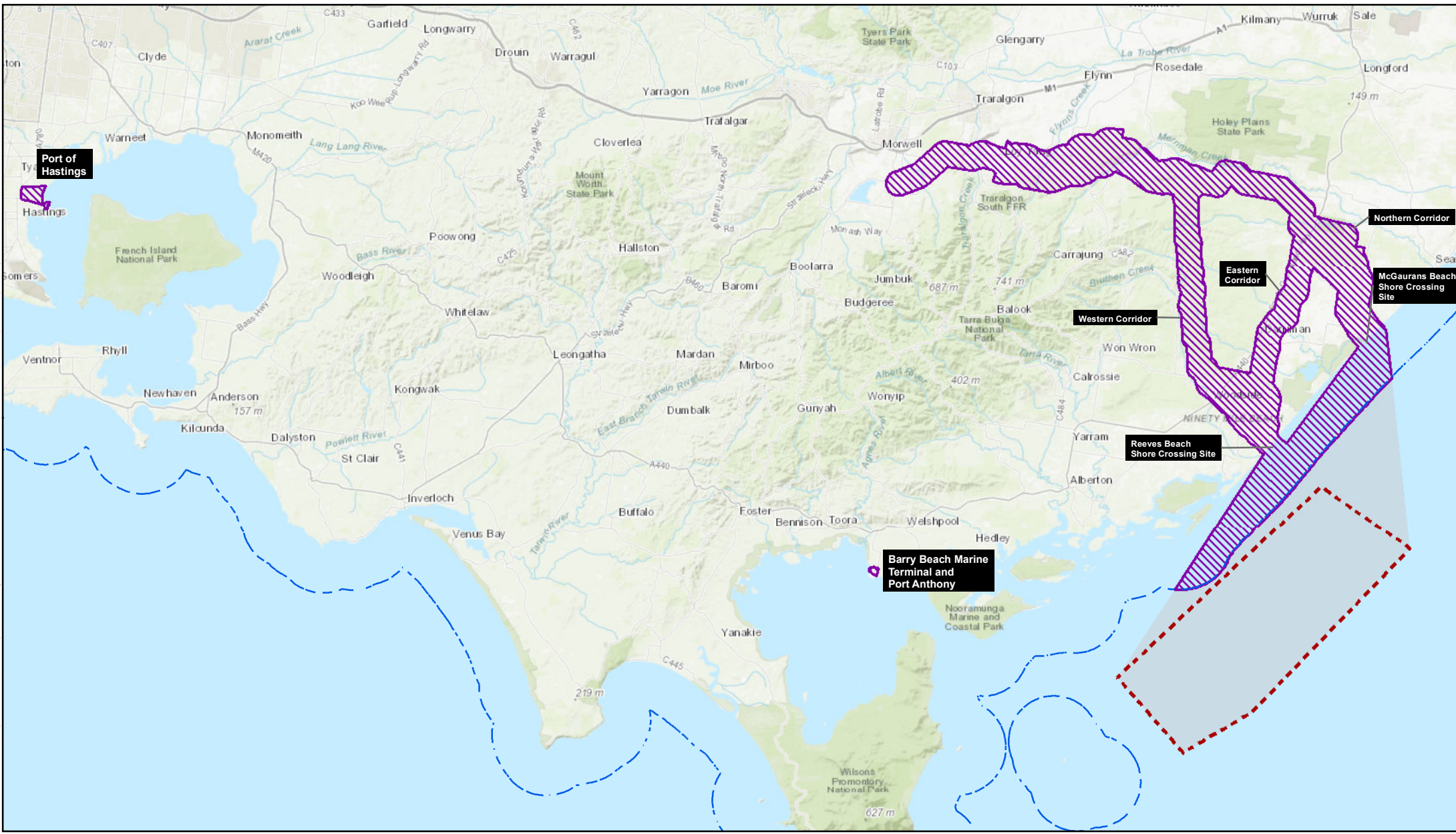
As part of the EES referral, it is the impacts within Victorian jurisdiction that are relevant. This would typically be limited to impacts caused by components that are located within Victorian jurisdiction, which include:

- Offshore transmission assets that occur within three nautical miles of shore (e.g. export cables connecting the offshore infrastructure to the shore)
- Onshore transmission assets
- Existing port and harbour modifications

There may be some cases where the infrastructure located within Commonwealth jurisdiction has the potential to result in indirect impacts on receptors within Victorian jurisdiction and these will be assessed where relevant.

The EES referral area is shown in Figure 2 includes the area within which all of the infrastructure will be located within Victorian jurisdiction. The Commonwealth jurisdiction is shown in grey because this area is outside of direct jurisdiction of the EE Act. More detail on the Project can be found in Part 1 of the Star of the South Offshore Wind Farm EES Referral.

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



Star of the South **AECOM**

DATUM GDA94 MGA 55

0 10 20
Kilometres

1:625,000 (when printed at A4)

Legend

- - - Extent of Victorian Coastal Waters
- EES Referral Area
- Exploration Licence Area
- Project Area within Commonwealth Jurisdiction

Star of the South

EES REFERRAL AREA

PROJECT #:	60616204
CREATED BY:	JB
LAST MODIFIED:	brierej: 19/03/2020
VERSION:	1

Figure
2

Data Sources:
State Data © (VICMAP) 2019
Disclaimer:
Victoria State Government - Environment, Land, Water and Planning © (VICMAP) 2019

4.0 Method

4.1 Desktop assessment

This desktop assessment used the following methodology:

- 1) Review the information available for the project to determine the referral area and potential surface water interactions;
- 2) Undertake a literature review to determine what data and information is available for the referral area;
- 3) Collate the publicly available data from the Department of Environment, Land, Water & Planning website (DELWP) into a Geographic Information System (GIS) database and determine how surface water interacts with the proposed area. This includes the following data:
 - Designated Water Supply Catchments (PWSC100).
 - Statewide watercourse network (VMLITE_HY_WATERCOURSE).
 - Ramsar sites, Significant Wetlands (Ramsar25).
 - 1 in 100 year flood extent (EXTENT_100Y_ARI).
 - Gippsland Lakes Local Coastal Hazard Assessment (LCHA).
 - Gippsland Lakes Coastal Hazard Extent (GL_COAST_HAZARD_EXTENT).
 - Gippsland Lakes Shore Erosion (GL_SHORE_EROSION_SUSCEPT).
- 4) Prepare a brief report (this report) on the findings of this investigation.

4.2 Assumptions and limitations

This report is developed based on publicly available information. No field-based investigation, flood modelling, or water quality sampling or assessment has been undertaken.

The report investigates the EPBC and EES referral areas to the extent as outlined in Figures 1 and 2. The ports (construction and operation) have been assessed with an additional buffer (see Figure 3). While these buffer areas are included in the below report for hydrological considerations, they are not part of the actual referral areas. Their inclusion is to capture the mobile and complex interactions of the hydrologic environment and port infrastructure.

The project has been introduced to councils and Catchment Management Authorities. Further consultation with these authorities will be followed on the hydrologic assessments in future design stages.

The flood extents shown are derived from the current planning scheme overlays and zones. In this area limited investigations have been undertaken to determine flood extents. Therefore, areas that are at risk of flooding may not have planning overlays.

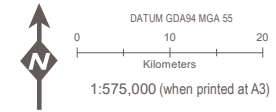
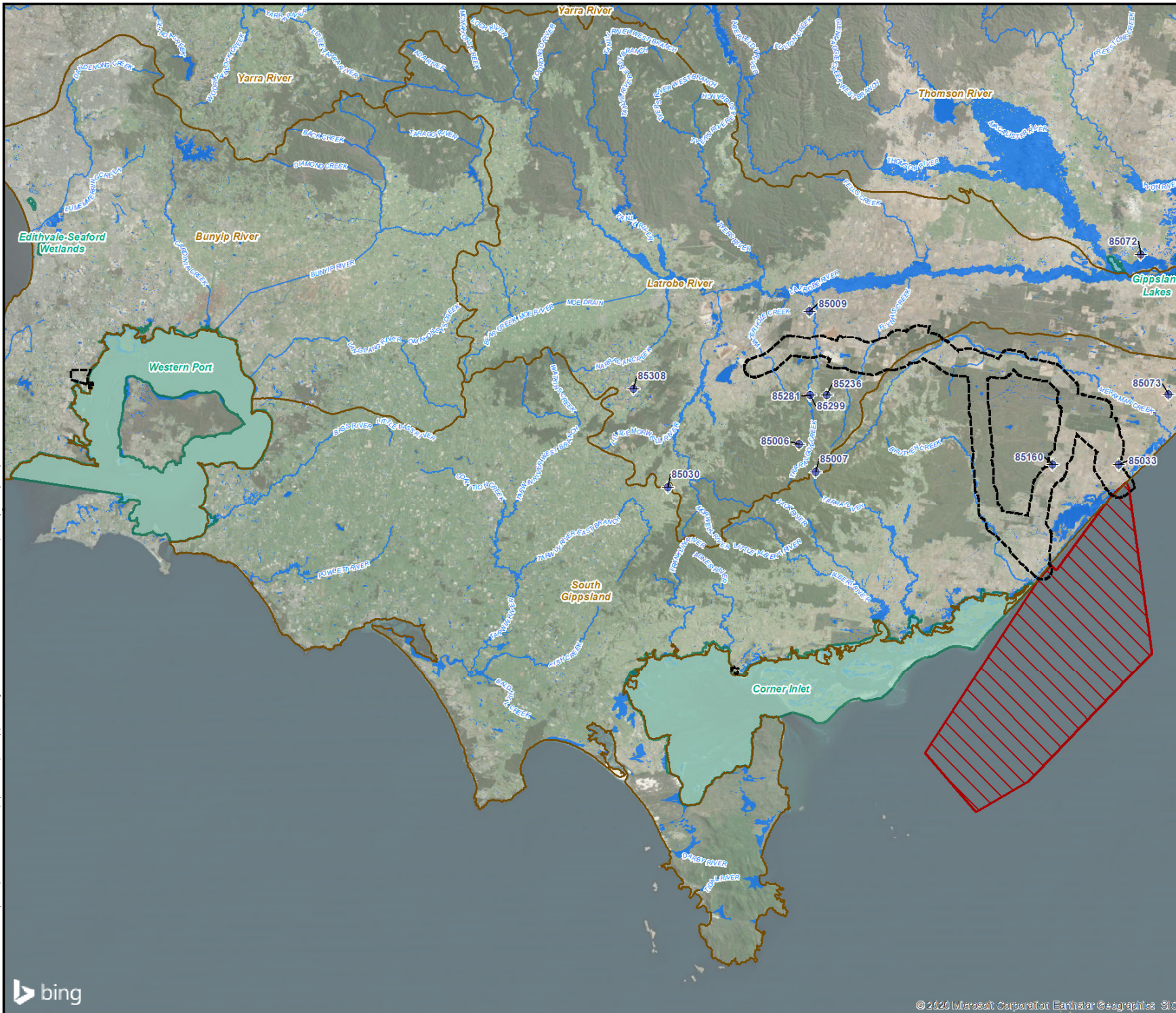
5.0 Existing Conditions

5.1 Regional Hydrology

The referral area is located in eastern Victoria and interacts with the catchments of the Latrobe River, South Gippsland and Bunyip River. Figure 3 shows the referral area and major waterways and wetlands.

Data from Bureau of Meteorology (BOM) shows mean annual rainfall ranges from less than 700 mm at Sale to over 1300 mm at Erica. West Gippsland receives higher rain rates during winter than in summer while the mean rainfalls in East Sale and Maffra remain relatively constant during the year. Table 1 shows the monthly and annual average rainfall totals for key locations within or near the referral area.

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, omissions, or inaccuracies in the information.



- LEGEND**
- Area of Investigation
 - Offshore Infrastructure
 - Rainfall Key Locations (BOM, 2020)
 - Watercourses
 - River Basin
 - Ramsar Sites
 - Waterbodies

Data Sources:
 State Data © (VICMAP) 2019

Disclaimer:
 Victoria State Government - Environment, Land, Water and Planning © (VICMAP) 2019

Environmental Referrals
 Star of the South

RAMSAR SITES	
PROJECT #:	60616204
CREATED BY:	JB
LAST MODIFIED:	brierej; 24/03/2020
VERSION:	1

Figure
3



Table 1. Mean Rainfall at key locations (BOM, 2020)

Gauge No.	Year opened	Location	Mean Rainfall (mm)												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
85009	1999	Traralgon EPA	40	42	41	47	45	51	54	62	55	54	62	56	612
85033	1906	Giffard	40	40	49	42	45	49	43	44	47	52	55	52	560
85072	1943	East Sale Airport	45	42	48	48	50	47	41	46	50	56	62	54	590
85073	1898	Seaspray (Burong)	44	41	53	48	49	52	44	45	49	55	57	56	595
85160	1952	Darriman (Tarralangi)	48	42	53	45	56	57	53	54	57	58	66	62	663
85236	1956	Callignee North	52	43	53	58	82	85	89	93	90	78	75	66	859
85281	1953	Traralgon Creek at Koornalla	40	43	43	61	70	81	81	101	73	64	63	52	772
85299	1994	Koornalla Traralgon Ck Rd	52	48	51	65	81	88	93	106	91	79	81	62	896
85007	1999	Balook	69	78	90	117	120	150	146	146	127	108	114	97	1350
85030	2002	Boolarra South	57	61	73	83	98	102	114	117	109	90	90	75	1067
85308	2009	Thorpdale Peak	52	53	72	60	80	75	84	103	77	63	79	62	852

5.2 Local Hydrology

The referral area intersects with the following key waterways:

- South Gippsland Catchment
 - Merriman Creek
 - Monkey Creek
 - Little Monkey Creek
 - Long Creek
 - Bayliss Gully
 - Morris Creek
 - Warrigal Creek
 - Hoddinott Creek
 - Bruthen Creek
 - Toms Cap Creek
 - Reedy Creek
 - Unnamed Creeks (UFI: 77428, 77414, 77435, 77425)
- Latrobe River Catchment
 - Waterhole Creek
 - Traralgon Creek
 - Flynns Creek
 - Bennetts Creek
 - Plough Creek
 - Boyds Creek
 - Sheepwash Creek
 - Blind Joe Creek
- Bunyip River Catchment
 - Olivers Creek

5.2.1 South Gippsland Catchment

Figure 4 shows the key waterways within the South Gippsland catchment. Due to the prevalence of steep land, both in the ranges and farmland upstream of the flat coastal lowlands, erosion and landslip associated with heavy rainfall are a significant risk (WGCMA, 2019; WGCMA, 2018).

An Index of Stream Condition (ISC) assessment was undertaken in 2010 by DELWP. This showed that most waterways are classified as “moderate” condition. They generally score lower in hydrology and water quality.

The basin contains nine designated water supply catchments. The designated water supply catchment for Merriman Creek is in place to protect the potable water supply for the township

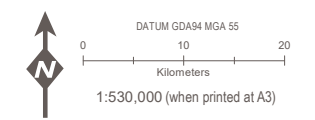
of Seaspray. All other water supply catchments are for either stock and domestic use or irrigation.

The Gippsland Lakes Local Coastal Hazard Assessment (LCHA, 2018) shows potential risk of erosion exists within the boundary of Lake Wellington and Gippsland Lakes Coastal Park. The coastal shoreline erosion boundary finishes at the adjacent of the South Gippsland Basin and therefore, no area susceptible to erosion was captured within the basin (LCHA, 2018).

Based on (LCHA, 2018), sea level rise susceptibility was identified under 0.0m, 0.2m, 0.4m and 0.8m mean sea level rise scenarios as a result of climate change (Figure 4). The coastal hazard zones were determined using a range of methods, and include hazards associated with storm erosion, longshore sediment transport gradients, equilibrium profile adjustment and wave overwash processes.

Figure 4 shows South Gippsland Catchment boundary and the referral area intersecting with rivers as well as designated water areas, Coastal sea level rise, flood extent and floodways within the South Gippsland Catchment

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, omissions, defects, or inaccuracies in the information.



LEGEND

- Area of Investigation
- Offshore Infrastructure
- Key Waterways
- Watercourses
- South Gippsland Basin
- Designated Catchment Extent
- 1% AEP Flood Extents
- Floodway Extent
- Coastal Hazard Extent
- Waterbodies

Key Waterways in the Area of Investigation

No.	Name	No.	Name
1	Bennetts Creek	11	Morris Creek
2	Flynns Creek	12	Traralgon Creek
3	Boyd's Creek	13	Bruthen Creek
4	Sheepwash Creek	14	Long Creek
5	Blind Joe Creek	15	Plough Creek
6	Olivers Creek	16	Merriman Creek
7	Warrigal Creek	17	Waterhole Creek
8	Bayliss Gully	18	Reedy Creek
9	Monkey Creek	19	Toms Cap Creek
10	Little Monkey Creek	20	Hoddinott Creek

Data Sources:
State Data © (VICMAP) 2019

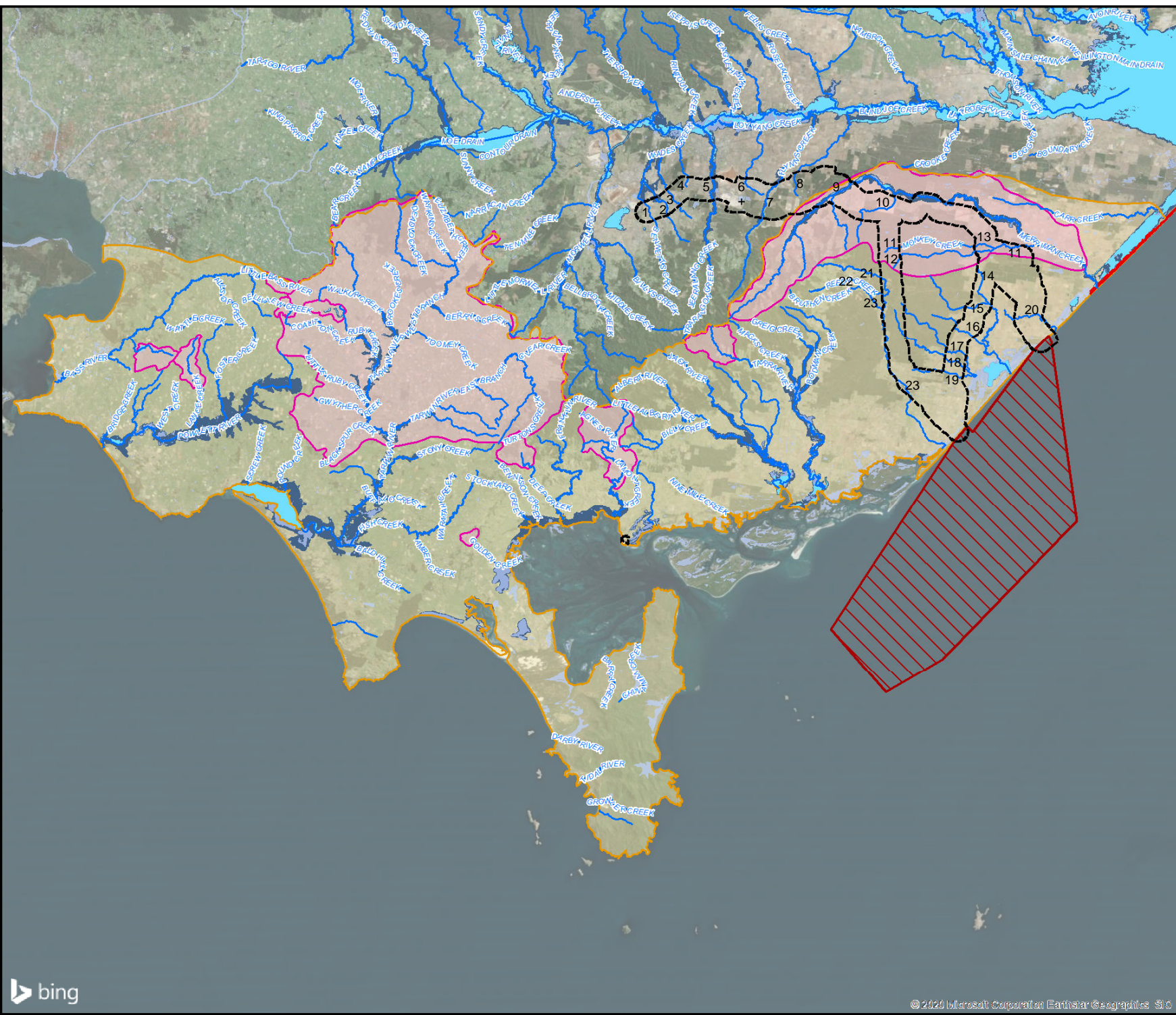
Disclaimer:
Victoria State Government - Environment, Land, Water and Planning © (VICMAP) 2019

Environmental Referrals
Star of the South

SOUTH GIPPSLAND BASIN

PROJECT #: 60616204
 CREATED BY: JB
 LAST MODIFIED: brierej; 24/03/2020
 VERSION: 1

Figure
4



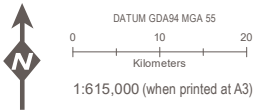
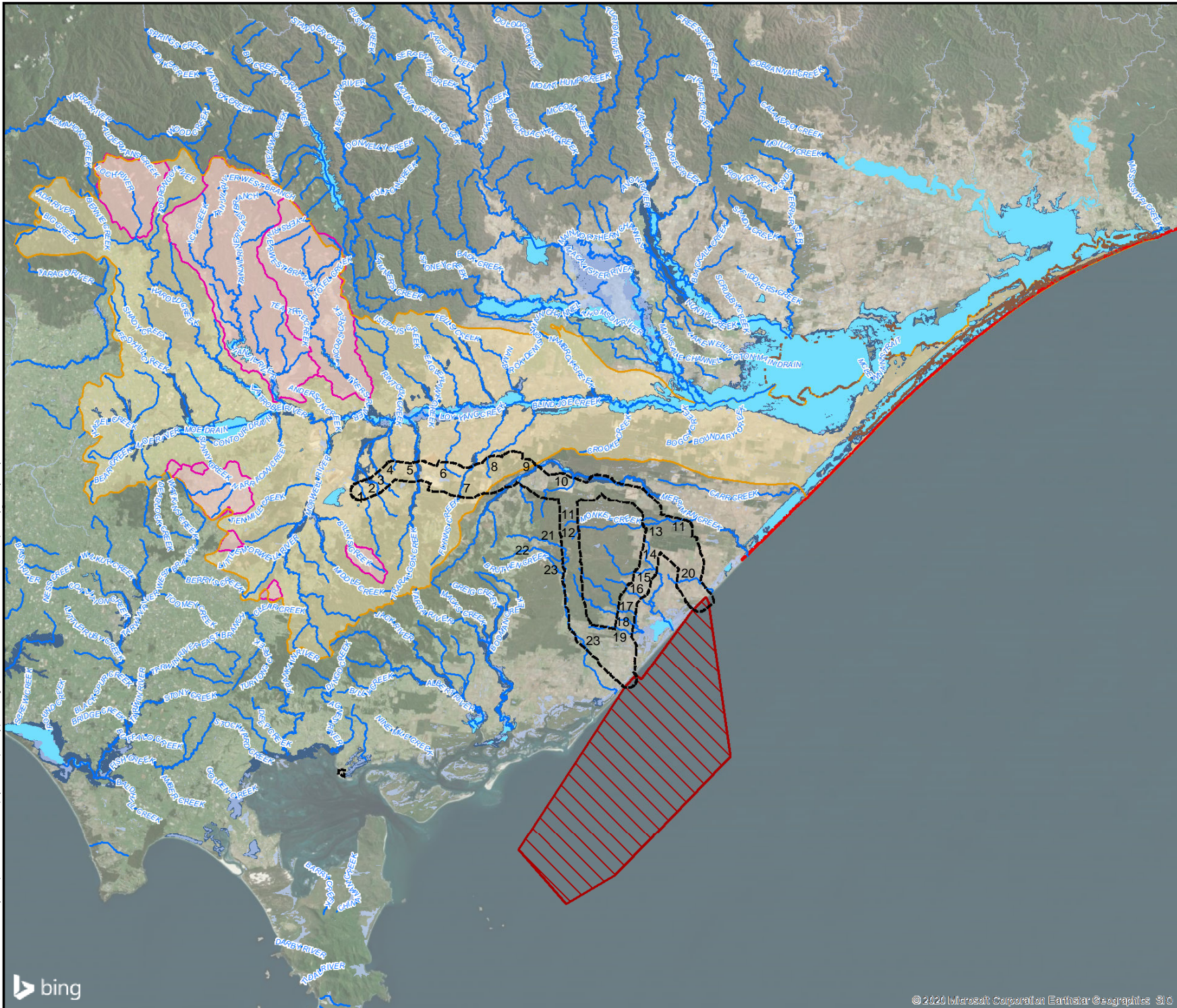
5.2.2 Latrobe River

Figure 5 shows the key waterways within the Latrobe River catchment. The Latrobe River, originating from the little Yarra River, is the longest waterway in the West Gippsland catchment, flowing for 270 km. Key waterways within the Latrobe River catchment also include the Loch River, Tooronga River, Tanjil River, Tyers River, Morwell River, Moe River, Traralgon Creek, and the Thomson River flowing to the Latrobe River and ultimately to Lake Wellington in the Gippsland Lakes. Blue Rock Dam and Moondarra Reservoir are two major storages on the Latrobe River tributary, with Lake Narracan located on the Latrobe itself just upstream of the Yallourn power station.

An ISC assessment was undertaken in 2010 by DELWP. This showed that most waterways are classified as being in excellent to moderate condition. They generally score lower in hydrology and water quality.

The Latrobe River experienced significant flooding in 1978, 1993 and 2012. The historical flood extents show that affected areas are mostly located across the Latrobe River and its tributary floodways (WGCMA, 2018). The existing flood zones and overlays show that the referral area intersects at Flynn Creek floodways, Latrobe River and Waterhole Creek.

Figure 5 shows the Latrobe River Catchment boundary and the referral area intersecting with rivers as well as the location of designated water areas, susceptible areas to erosion and sea level rise, flood extent and floodways within the South Gippsland Catchment.



- LEGEND**
- Area of Investigation
 - Offshore Infrastructure
 - Key Waterways
 - Watercourses
 - Latrobe Basin
 - Designated Catchment Extent
 - 1% AEP Flood Extents
 - Floodway Extent
 - Coastal Hazard Extent
 - Suspected Shore Erosion
 - Waterbodies

Key Waterways in the Area of Investigation

No.	Name	No.	Name
1	Bennetts Creek	11	Morris Creek
2	Flynn's Creek	12	Traralgon Creek
3	Boyds Creek	13	Bruthen Creek
4	Sheepwash Creek	14	Long Creek
5	Blind Joe Creek	15	Plough Creek
6	Olivers Creek	16	Merriman Creek
7	Warrigal Creek	17	Waterhole Creek
8	Bayliss Gully	18	Reedy Creek
9	Monkey Creek	19	Toms Cap Creek
10	Little Monkey Creek	20	Hoddinott Creek

Data Sources:
 State Data © (VICMAP) 2019
 Disclaimer:
 Victoria State Government - Environment, Land, Water and Planning © (VICMAP) 2019

Environmental Referrals
 Star of the South

LATROBE RIVER BASIN	
PROJECT #:	60616204
CREATED BY:	JB
LAST MODIFIED:	brirej; 24/03/2020
VERSION:	1

Figure
5

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



6.0 Hydrology and Ramsar Wetlands

There are two declared Ramsar wetlands sites within the referral area; Corner Inlet and Western Port. The locations of these Ramsar sites are shown in Figure 3.

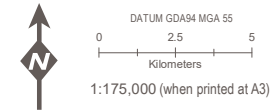
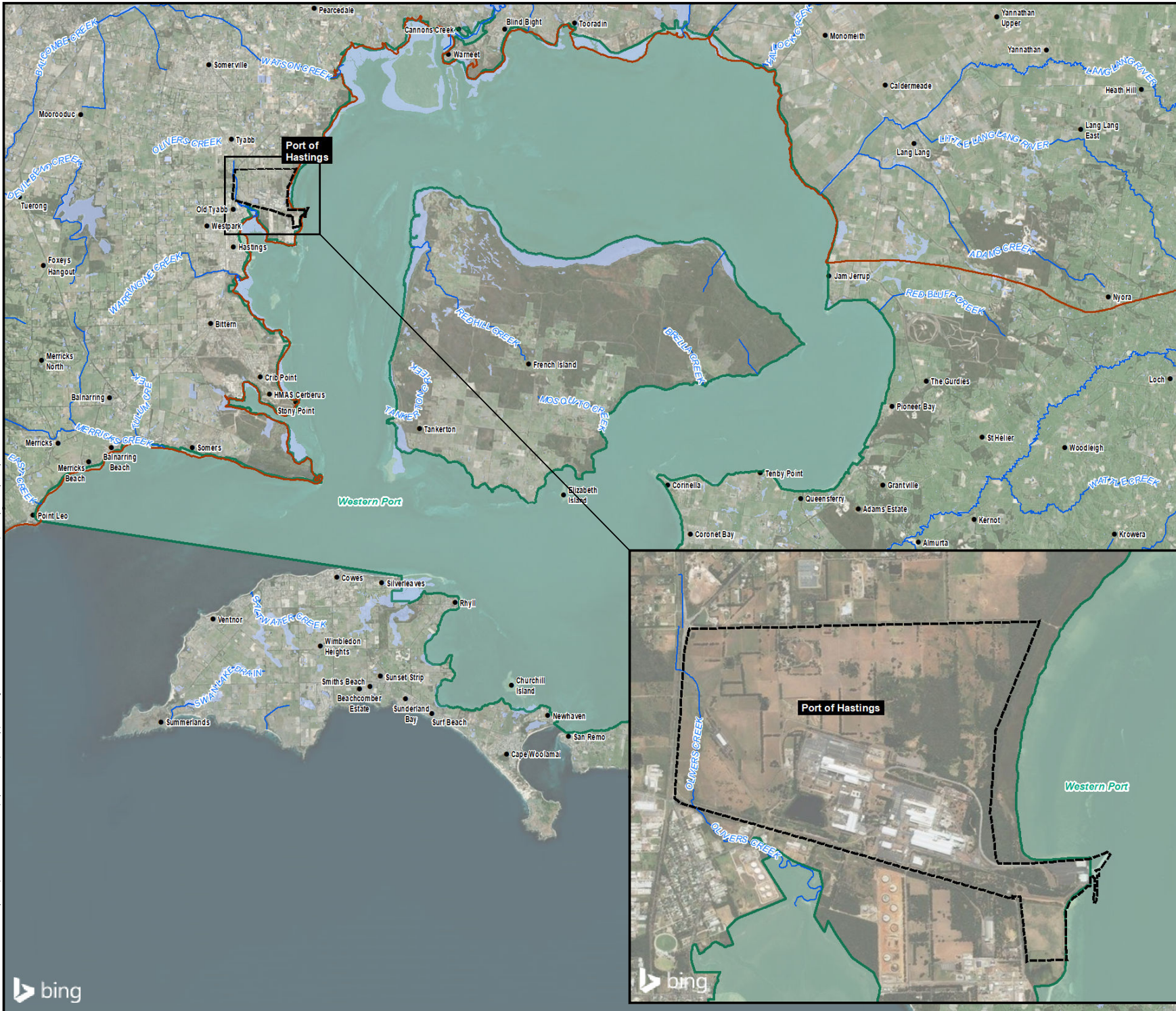
The Corner Inlet site, with a catchment area of 2,300 km² receives 13% of total flow within the West Gippsland catchment. The Bruthen Creek, Tarra River, Albert River, Nine Mile Creek, Shady Creek, Agnes River, Franklin River, Bennison Creek, Stockyard Creek and Chinaman Creek are all key waterways flowing into Corner Inlet (WGCMA, 2019). The referral area contributes to less than 5% of the catchment flowing to the Corner Inlet site. Agnes River at the adjacent of the Port Anthony site and Bruthen Creek at the referral area - Section 1 are rivers that flow to Corner Inlet.

The potential shore crossing at Reeves Beach is located three kilometres further away from the western border of the Corner Inlet site. The shore crossing would be conducted by trenchless construction methods to reduce potential impacts to water quality, flow regime and habitats.

Bass River, Lang Lang River, Yallock Creek, Bunyip River, Deep Creek and Merricks Creek are major waterways which flow to the Western Port Ramsar site. Oliver Creek, with a small catchment, interfaces with the corridor of the referral area at Port Hastings and covers less than 1% of the contributing area flowing into the Western Port site (Figure 6).

Construction at Port Hastings and Port Anthony would be at the adjacent of Ramsar Sites. The Western Port Ramsar Site may require some minor works in the immediate vicinity of the existing disturbed jetty area. Barry Beach Marine Terminal and Port Anthony are adjacent to the Corner Inlet Ramsar Site. There is potential that there may be some minor works within the boundary of these wetlands, however it is anticipated that construction and operational environmental management measures would be adopted to avoid detrimental effects.

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



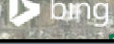
- LEGEND**
- Area of Investigation
 - Bunyip River Catchment
 - Key Watercourses
 - Watercourses
 - Ramsar Sites
 - Waterbodies

Data Sources:
State Data © (VICMAP) 2019

Disclaimer:
Victoria State Government - Environment, Land, Water and Planning © (VICMAP) 2019

Environmental Referrals
Star of the South

WESTERN PORT SITE	
PROJECT #: 60616204	Figure
CREATED BY: JB	6
LAST MODIFIED: briereg; 24/03/2020	
VERSION: 1	



7.0 Management and mitigation

Waterways, wetlands and estuaries

The three transmission corridor options are located in areas that contain around 25 key waterways across the Latrobe River and South Gippsland catchments with most of these waterways considered to be designated waterways by the local Catchment Management Authorities (CMAs). The main waterways within the area are Merriman Creek, which starts near Balook and flows more than 80 kilometres to the coast at Seaspray, and Bruthen Creek, which originates near Carrajong Lower and reaches its estuary around 30 kilometres away near Mcloughlins Beach. The Bruthen Creek sub-catchment is linked to the Corner Inlet Ramsar site. The remainder of the named waterways are tributaries of the Latrobe River, Merriman Creek or Bruthen Creek or smaller streams.

For the western transmission corridor option, the transmission alignment may intersect Traralgon Creek, Flynn's Creek, Merriman Creek and Bruthen Creek. For the eastern and northern corridor options, the transmission alignments may intersect Traralgon Creek, Flynn's Creek and Merriman Creek.

While a preferred transmission corridor hasn't been selected, it is likely that a number of these waterways would be traversed by the project. Potential impacts could include removal of habitat, erosion, bank instability, sedimentation, reduced water quality and localised changes in stream flow. Any effects on waterway flows and water quality would be expected to be temporary and of short duration.

Effects on waterways can be minimised by selection of a route which avoids waterway crossings wherever possible. Where waterway crossings are unavoidable, potential impacts could be minimised by mitigation measures including use of trenchless construction methods where important ecological values exist along riparian corridors. Best-practice construction activities will be adopted throughout the Project and implemented in accordance with the CEMP. The CEMP would include measures to manage runoff and sedimentation that would otherwise result in downstream impacts to significant waterways, wetlands and estuaries. The CEMP will ensure the project meets the requirements of the SEPP (Waters) and include measures consistent with EPA Victoria publications *480 Environmental Guidelines for Major Construction Sites* and *275 Construction Techniques for Sediment Pollution Control*. This is particularly important with respect to any works at Bruthen Creek, which is linked to the Corner Inlet Ramsar site.

Coastal estuarine wetlands (e.g. Jack Smith Lake), wetland swamps, ephemeral wetlands associated within the lowland plains and wetlands at the headwaters of named waterways exist in the vicinity of the referral area. The Jack Smith Lake area will be avoided for the shore crossing and the transmission asset alignment and construction methods will be selected to minimise impacts on wetland features.

For the proposed construction and operation of port sites, where landside development is proposed, limited surface water features exist. One designated waterway, Oliver's Creek, passes through the western edge of the referral area at the Port of Hastings whilst the BBMT and Port Anthony site do not contain any named waterways. The Port of Hastings site and the BBMT and Port Anthony site are adjacent to the Western Port and Corner Inlet Ramsar sites respectively, although very limited works are proposed within these marine environments. Similar to construction for the onshore transmission assets, works at the port sites will be undertaken in accordance with a CEMP established to monitor and control potential impacts of the works.

8.0 Conclusion

This desktop hydrology assessment prepared to support the preparation of referrals for the Star of the South Wind Farm project in accordance with the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC) and *Victorian Environment Effects Statement Act 1978* (EES) and assist with the further development of the project design.

It provides a summary of regional catchment hydrology, flood history, quality and beneficial uses of waterbodies within West Gippsland River Catchment. The hydrology assessment narrows down to where the referral area intersects with the waterways within South Gippsland River Basin and Latrobe River Basin. Design considerations and mitigation measures are included in this report to prevent the potential impacts on waterbodies quality and flow and beneficial uses.

9.0 References

West Gippsland Catchment Management Authority (WGCMA, 2019), ANNUAL REPORT 2018-19 from <https://www.wgcma.vic.gov.au/wp-content/uploads/2019/10/WGCMA-AR2019-full-final-proof-LR-5.pdf>

West Gippsland Catchment Management Authority (WGCMA, 2018), West Gippsland Floodplain Management Strategy 2018 – 2027 from <https://www.wgcma.vic.gov.au/wp-content/uploads/2016/08/WGCMA-FloodplanMan-final-FULL.pdf>

Department of Environment, Land, Water & Planning (DELWP, 2018a). Index of Stream Condition. The Third Benchmark of Victorian River Condition ISC3, West Gippsland Region from https://www.water.vic.gov.au/__data/assets/pdf_file/0022/34816/ISC_Part8_West_Gippsland.pdf

Department of Environment, Land, Water & Planning (DELWP, 2018b). Designated Water Supply Catchments (PWSC100). Victoria.

Department of Environment, Land, Water & Planning (DELWP, 2019c). Statewide watercourse network (VMLITE_HY_WATERCOURSE). Victoria.

Water Watch Victoria. (2020). Waterwatch Map Portal. Retrieved from http://www.vic.waterwatch.org.au/water_watch_map.php?view=10262_1d95264

Department of Sustainability and Environment (DSE, 2011), Gippsland Region Sustainable Water Strategy, Melbourne from https://www.water.vic.gov.au/__data/assets/pdf_file/0026/52883/DSE_GRWS_accessible_linked.pdf

Gippsland Water. Annual Water Outlook December 2019 (Gippsland Water, 2019) from https://www.gippswater.com.au/application/files/5115/7500/3012/GW_Annual_Water_Outlook_2019_FINAL.pdf

Department of Environment, Land, Water & Planning. (DELWP, 2018d). 1 in 100 year flood extent (EXTENT_100Y_ARI). Victoria.

Department of Environment, Land, Water & Planning (DELWP, 2019e). Ramsar sites, Significant Wetlands from <https://www.water.vic.gov.au/waterways-and-catchments/rivers-estuaries-and-waterways/wetlands/significant-wetlands>

Bureau of meteorology (BOM, 2020) <http://www.bom.gov.au/climate/data/?ref=fr>

Gippsland Lakes Coastal Hazard Extent (GL_COAST_HAZARD_EXTENT). The Gippsland Lakes Local Coastal Hazard Assessment (LCHA, 2018). Department of Environment, Land, Water & Planning. (DELWP) from \\aume11fp001.au.aecomnet.com\Projects\606X\60616204\400_TECH\472_Surface water\GIS\Downloads\SDM681648\ANZVI0803005608.mhtml

Gippsland Lakes Shore Erosion (GL_SHORE_EROSION_SUSCEPT). The Gippsland Lakes Local Coastal Hazard Assessment (LCHA, 2018). Department of Environment, Land, Water & Planning (DELWP) from \\aume11fp001.au.aecomnet.com\Projects\606X\60616204\400_TECH\472_Surface water\GIS\Downloads\SDM681648\ANZVI0803005609.mhtml

Corner Inlet Ramsar Site, Ecological Character Description (2011). Department of Sustainability, Environment, Water & Population and Communities (SEWPAC, 2011) from www.environment.gov.au/water/publications/environmental/wetlands/13-ecd.html