Prepared for
Cleve Wind Farm Pty Ltd
ABN: 70 664 155 104

AECOM

Cleve Wind Farm

Stormwater impact assessment

17-Jan-2025

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Abbreviations

Abbreviation	Expansion
AECOM	AECOM Australia Pty Ltd
AEP	Annual exceedance probability
AHD	Australian Height Datum
ANZG	Australian and New Zealand Guidelines
ARI	Average recurrence interval
ARR	Australian Rainfall and Runoff
ASS	Acid sulfate soils
BoM	Bureau of Meteorology
CEMP	Construction Environmental Management Plan
The Code	Planning and Design Code
Council	The District Council of Cleve
DO	Dissolved oxygen
ESCP	Erosion and Sediment Control Plan
EIA	Environmental impact assessment
EP Act	*Environment Protection Act 1993*
ha	Hectare
HRE Act	*Hydrogen and Renewable Energy Act*
PDI Act	*Planning, Development and Infrastructure Act 2016*
km	Kilometre
kV	Kilovolt
LGA	Local Government Area
m	Metre
MW	Megawatt
O&M	Operation and maintenance
PMF	Probable Maximum Flood
SARIG	South Australian Resources Information Gateway
SWMP	Soil and Water Management Plan
TN	Total nitrogen
TP	Total phosphorus
Vestas	Vestas Development Australia Pty Ltd
WTG	Wind turbine generator

Definitions

Term	Definition
Annual Exceedance Probability (AEP)	The probability or likelihood of a storm event occurring or being exceeded within any given year, usually expressed as a percentage.
Australian Height Datum (AHD)	The official vertical datum for Australia, and thereby serves as the benchmark to which all height measurements are referred. The datum approximately corresponds to the mean sea level.
Average Recurrence Interval (ARI)	A statistical estimate of the average period in years between the occurrence of a flood of a given size or larger. The ARI of a flood event gives no indication of when a flood of that size will occur again.
Catchment	An area of land from which rainfall on the surface would drain to the same location of interest (i.e., the catchment outlet / discharge point).
Ephemeral watercourse	A watercourse which flows only after rain and has no baseflow or permanent inflow component.
Flood	An overflow of water that inundates land that is usually dry, including inundation caused by intense rainfall or high ocean levels.
Perennial watercourse	A watercourse, or specific reach of a watercourse, that exhibits continuous baseflow during a typical rainfall year.
Probable Maximum Flood (PMF)	The largest flood that could conceivably be expected to occur at a particular location, which is often caused by the Probable Maximum Precipitation in combination with worst case catchment conditions.

1.0 Introduction

1.1 Background

AECOM Australia Pty Ltd (AECOM) has been engaged by Cleve Wind Farm Pty Ltd (being a related entity of Vestas Development Australia Pty Ltd [Vestas]) to submit a Licence Application under the *Hydrogen and Renewable Energy Act 2023* (HRE Act) for the construction and operation of a 500-megawatt (MW) grid-connected wind farm in Cleve, South Australia – referred to as the Cleve Wind Farm (the Project).

AECOM Australia Pty Ltd (AECOM) has been engaged by Vestas to prepare an environmental impact assessment (EIA) in support of this Licence Application. The EIA must address the Project's potential environmental impacts and outline the extent to which these impacts can be managed.

This stormwater impact assessment has been prepared to form part of the overarching EIA. This assessment reviews the regulatory framework, identifies the potential stormwater impacts that may result from the Project, and establishes a series of measures to mitigate and/or manage any potential impacts.

1.2 Project description

The Project is located on the Eyre Peninsula, approximately 3 kilometres (km) north-west of the Cleve township and covering a total area in the order of 23,900 hectares (ha). The Project extents are shown in Figure 1-1.

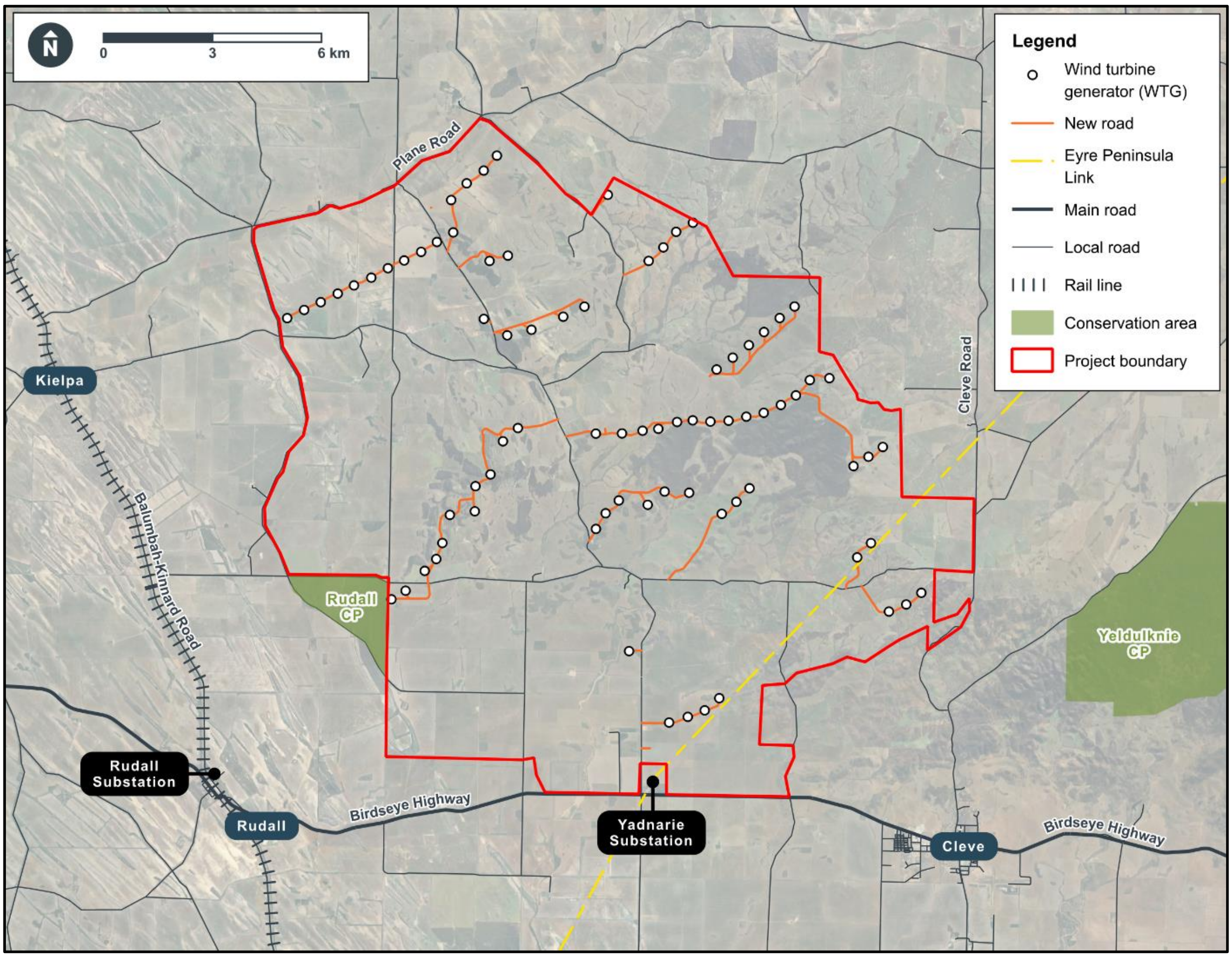

Figure 1-1 Locality plan

The Project area is bounded by the Birdseye Highway to the south, Cleve Road to the east, Plane Road and Evans Gum Flat Road to the north, and Old Drake Peak Road to the west. A number of unsealed local roads bisect the Project area.

There is an existing 275 kilovolt (kV) transmission line (currently operating at 132 kV – Eyre Peninsula Link) that cuts through the south-eastern portion of the Project and connects to the Yadnarie Substation which is located along the southern boundary of the Project. It is proposed that the Project would connect to this existing Yadnarie Substation.

1.2.1 Proposed development

The Project is considered a large-scale renewable energy generation and storage project and would comprise the following elements:

- 500 MW wind farm, consisting of approximately 80 wind turbine generators (WTGs). The WTGs are proposed to be manufactured and supplied by Vestas and their dimensions can be within the following ranges:
  - Blade length – 57.2 to 84 metres (m)
  - Hub Height – 80 to 150 m
  - Overall Height – 137.2 to 250 m
- 240 MW battery storage facility
- substation
- associated on-site facilities and infrastructure, including:
  - construction compounds
  - concrete batch plant
  - crane hard stands pads (for construction)
  - turbine pads
  - internal road network upgrades and new roads to accommodate turbine transport and maintenance
  - operation and maintenance (O&M) building
- transmission connections to the Yadnarie Substation.

1.2.2 Timeline

Vestas is planning to commence Project construction in 2027 to enable energisation by the target Commercial Operation Date in the last quarter of 2029.

1.3 This report

The purpose of this impact assessment is to review the elements of the Project and identify any stormwater impacts that could potentially arise from the construction and operational activities of the Project.

The assessment recognises the relevant policies and guidelines, looks at the surrounding environment, identifies how and if the Project would impact on existing stormwater conditions, then determines whether any mitigation and/or management measures would be required to minimise any potentially adverse impacts on the surrounding environment.

2.0 Relevant policies and guidelines

The Project and its potential impacts on the surrounding stormwater environment have been assessed in accordance with the relevant policies and guidelines. These include but are not limited to:

- *Hydrogen and Renewable Energy Act 2023* (HRE Act)
- *Planning, Development and Infrastructure Act 2016* (PDI Act)
- State Planning Policy 14: Water Security and Quality
- *Environment Protection Act 1993* (EP Act)
- *Environment Protection (Water Quality) Policy 2015*
- Stormwater Pollution Prevention – Code of Practice for Local, State and Federal Government (EPA, 1998)
- Water Affecting Activities Control Policy under the South Australian Landscape Board for the Eyre Peninsula (Landscape South Australia Eyre Peninsula, 2022).

The key stormwater requirements coming from these relevant policies and guidelines have been summarised in the following sections.

2.1 Planning and Design Code

The *Planning, Development and Infrastructure Act 2016* (PDI Act) is South Australia's core legislation dealing with the planning and development system. The Act requires the State Planning Commission (the Commission) to prepare and maintain the Planning and Design Code (the Code).

The Code sets out a comprehensive set of policies, rules and classifications for developments within South Australia. It captures the development requirements outlined in many of the relevant policies and guidelines listed at the beginning of this section. The key stormwater requirements relevant to the Project and its location are summarised in Table 2-1.

Table 2-1 Planning and Design Code stormwater requirements

Description	Requirement
General	The development shall be sited and designed to maintain natural hydrological systems without negatively impacting the quantity and quality of stormwater, the depth and direction of stormwater flows.
Maintain existing hydrology or flow regime	Any development shall avoid interfering with the existing hydrology or water regime other than to improve on existing conditions.
Flow conveyance	Maintain the conveyance function and natural flow paths of watercourses to assist with the management of floodwaters and stormwater runoff.
Modifications to existing watercourses	Damage or modification to existing watercourses and floodplains (up to the 1% AEP flood extent) should be avoided so they are retained in their natural state, except where modifications are required for essential access or maintenance purposes.
Avoid obstructions within existing watercourses	Development that would result in depositing or placing an object or solid material (obstruction) within a watercourse should be avoided and only occur where it involves the construction of erosion control measures, devices used for scientific purposes, or for the rehabilitation of a watercourse.
Increases to stormwater runoff	Any development that increases stormwater runoff shall incorporate measures to filter runoff and reduce the impact on native aquatic ecosystems and minimise erosion leading to the downstream watercourses.

Description	Requirement
Erosion control	Watercourses and floodplains (up to the 1% AEP flood extents) are to be protected and enhanced by stabilising watercourse banks and reducing sediments and nutrients entering the watercourse.
Stormwater quality	The development likely to result in significant risk of export of litter, oils or greases includes stormwater management systems designed to minimise pollutants entering stormwater systems. Water discharged from a development site is to be of physical, chemical and biological condition equivalent to or better than its pre-developed state. Protection of the quality of stormwater considering adverse water quality impacts associated with climate change.
Hazardous materials	Buildings and structures that are to store hazardous materials must be designed to prevent spills or leaks leaving the confines of the building/ structure.
Polluted waters	Areas for activities including loading and unloading, storage of waste, or wash-down areas used for cleaning vehicles, plant or equipment must be: • designed to contain all wastewater likely to pollute stormwater within a bunded and roofed area to exclude the entry of external stormwater runoff • paved with an impervious material to facilitate wastewater collection of sufficient size to prevent 'splash-out' or 'over-spray' of wastewater from the wash-down area • designed to drain wastewater to either a treatment device such as a sediment trap and coalescing plate oil separator with a subsequent disposal to sewer, or a holding tank for subsequent removal off-site.
Soft landscaping	Where possible, soft landscaping should be incorporated into the development to maximise stormwater infiltration.
Protection of native vegetation	Areas of native vegetation are to be protected, retained and restored in order to sustain biodiversity, threated species and vegetation communities, fauna habitat, ecosystem services, carbon storage and amenity values.
Flooding impacts	The development shall adopt a precautionary approach to mitigate potential impacts on people, property, infrastructure and the environment from potential flood risk through the appropriate siting and design of the development.
Flood protection	The development shall be sited, designed and constructed to minimise the risk of entry of potential floodwaters where the entry of floodwaters is likely to result in undue damage to or compromise ongoing activities. Buildings must have a finished floor level at least 300 mm above the highest point of natural ground level at the primary street boundary where there is no kerb.

2.2 Water quality guidelines

The *Environment Protection (Water Quality) Policy 2015*, made under the EP Act, is designed to achieve the sustainable management of the South Australia's waters by protecting and enhancing water quality while still allowing for economic and social use of the resource. The policy establishes a set of environmental values for South Australia's inland waters, including aquatic ecosystems, recreation and aesthetics, and water quality for primary industries such as irrigation, livestock drinking water, aquaculture and human consumption of aquatic foods.

There is considered to be a low risk to these environmental values where default trigger values can be met. The policy makes reference to default trigger values included in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality which was prepared by ANZECC & ARMCANZ (2000).

The ANZECC & ARMCANZ (2000) guidelines have since been replaced by the Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality (ANZG, 2018). ANZG (2018) provides the latest default trigger values for physical and chemical stressors across the nation's river systems. However, in the absence of available trigger values for the South Australian Gulf, the previously published values included in the ANZECC & ARMCANZ (2000) guidelines are recommended for use.

While the Project discharges to upland watercourses, with an altitude above 150 mAHD, the ANZECC & ARMCANZ (2000) guidelines do not have default trigger values available for these upland river systems. Therefore, default trigger values for South Australia's lowland watercourses have been adopted and are presented in Table 2-2.

Table 2-2 Default trigger values for South Australia's lowland rivers (ANZECC & ARMCANZ, 2000)

Indicator	Default trigger value
Chlorophyll-a	-
Total phosphorus (TP)	100 µg/L
Filterable reactive phosphate	40 µg/L
Total nitrogen (TN)	1000 µg/L
Oxides of nitrogen (NO_X)	100 µg/L
Ammonium (NH_4^+)	100 µg/L
Dissolved oxygen (DO)	>90% (as a percentage of saturation)
pH	6.5-9.0
Salinity	100-5000 µS/cm
Turbidity	1-50 NTU

2.3 Water affecting activities

The Landscape Board for the Eyre Peninsula region has developed a Water Affecting Activities Control Policy under the provisions of the *Landscape South Australia Act 2019* (Landscape Board South Australia Eyre Peninsula, 2022).

Water affecting activities are activities and works that can adversely impact on the health and condition of water resources, water dependant ecosystems and other water users. Under the *Landscape South Australia Act 2019*, a permit is required to undertake a water affecting activity. Relevant activities related to the proposed development that may require a Water Affecting Activities Control Policy include:

- obstructing a watercourse or lake which may include planting vegetation
- destroying vegetation in a watercourse or floodplain
- constructing or modifying a weir or diversion structure within a priority catchment
- the construction or modification of a structure or building in a watercourse or floodplain, which may include:
  - constructing or modifying a culvert, causeway, ford or bridge
  - constructing or modifying stormwater infrastructure
  - constructing or modifying a monitoring device
  - constructing or modifying a grade control structure
- draining or discharging water into a watercourse
- excavating rock, sand or soil from a watercourse or floodplain.

Possible controls to avoid or minimise the amount of water affecting activities that would occur as part of the Project have been considered as part of this assessment.

3.0 Existing environment

3.1 General

The Project is located on the Eyre Peninsula in South Australia. It is situated in between the townships of Rudall (to the west) and Cleve (to the east) and is located immediately north of the highway connecting these two townships, Birdseye Highway.

The Project is located within the District Council of Cleve (Council) local government area (LGA).

The allotments within and surrounding the Project area generally consist of cleared farming land with development limited to associated dwellings and farm buildings scattered throughout. There are patches of native vegetation that exist, mostly within the central and north-eastern portions of the Project.

3.2 Topography

The Project area and surrounding land feature an undulating landscape with land generally falling from east to west. The difference between the highest and lowest elevations across the Project is approximately 285 m. Ridge lines along the eastern boundary reach elevations of up to 410 mAHD (Australian Height Datum) while the lowest elevation of 125 mAHD occurs at the south-western corner of the Project. As a result of the undulating characteristics, numerous watercourses exist throughout the Project area.

Like the fall of the land, these watercourses generally grade in a somewhat westerly direction. The undulating terrain and defined watercourses are predominantly confined to the upstream (eastern) portions of the Project. As these watercourses fall towards the west, they gradually become less defined, and the surrounding land becomes flatter which is likely to spread flows across the much wider and flatter topography.

The longitudinal grade of these existing watercourses is relatively constant and ranges between 1-2% through the Project and past Project extents. The surrounding land falling towards these watercourses can range anywhere from 8-10% within steeper regions down to near nothing (flat) across the downstream (south-west) regions.

3.3 Soils

The South Australian Resources Information Gateway (SARIG) tool was used to provide a brief description of existing soils across the Project. This desktop review found the most common soil type in the Project area to be calcareous soils and hard red-brown siliceous sands. The calcareous soils and siliceous sands are described as having a low water holding capacity and generating little runoff. This suggests that local soils are likely to have high infiltration rates.

The surface geology in the area is noted to be predominately Pooraka Formation, which is a clayey sand that is silty with gravel lenses.

3.4 Catchments

The catchments and smaller subcatchments across the Project are shown in Figure 3-1 and have been described in the following sections.

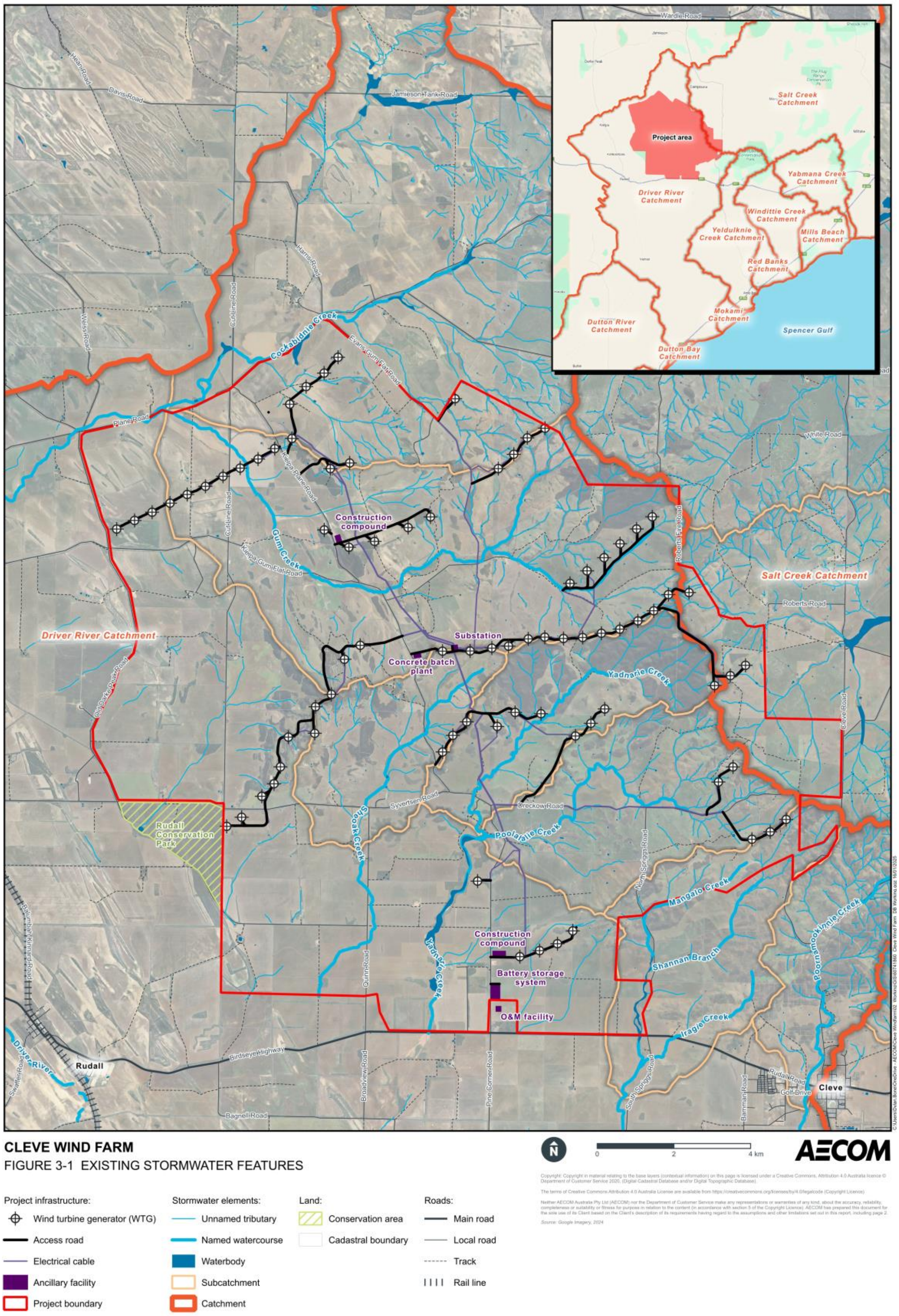

Figure 3-1 Existing stormwater features

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3.4.1 Driver River

The majority (approximately 96%) of the Project site is part of the wider Driver River catchment. Stormwater runoff from this catchment generally drains from east to west across the Project site via several different watercourses/ drainage lines. Outside of Project extents, these defined watercourses dissipate and transition from channelised flow to shallow overland flow spread across the very flat and wide floodplain.

As described in the previous section, it is suggested that local soils have high infiltration rates and distributing these channelised flows across the wide downstream floodplain would likely result in a lot of overland flow infiltrating these soils and through to groundwater.

Despite the lack of definition with downstream overland flow paths, review of topography has indicated that this flow continues to head south-west until reaching Driver River which is located approximately 10-12 km downstream of the Project. Driver River changes the direction of flow and conveys it south-east towards an intermittent coastal swamp south-west of Arno Bay before discharging to the Spencer Gulf. The coast is located approximately 35 km downstream of the Project's southern boundary.

The several creeks and their subcatchments that pass through the Project and drain to Driver River are summarised in Table 3-1 (listed in order, from north to south across the Project). The table also includes a brief description of the creek/ subcatchment, the portion of the Project draining to each creek, the number of WTGs and other Project infrastructure located within these subcatchments.

Table 3-1 Driver River subcatchments

Subcatchment	Description	Project area within subcatchment (ha)	Project infrastructure within subcatchment
Cockabidnie Creek	Located at the northern end of the Project and draining in a south-westerly direction. It combines with Gum Creek at the north-western corner of the Project boundary before reaching Driver River. The creek is an ephemeral watercourse. While mapping shows there to be some relatively small waterbodies along the creek, a review of aerial imagery does not indicate any permanent water pools within these waterbodies. The catchment is almost entirely cleared and modified for agricultural land uses, including many small farm dams along the upstream (eastern) tributaries. There appears to be little remaining native vegetation across the subcatchment and is generally limited to small patches of land and along the full length of the main watercourse.	1,780	9x WTGs
Gum Creek	Located immediately south of Cockabidnie Creek and draining in a north-westerly direction until combining with Cockabidnie Creek at the north-western corner of the Project. The creek is an ephemeral watercourse. Much of the catchment has been cleared and modified for agricultural land uses	6,280	34x WTGs, northern construction compound, substation and the concrete batch plant

Subcatchment	Description	Project area within subcatchment (ha)	Project infrastructure within subcatchment
	and there are many farm dams scattered throughout. There is a heavily vegetated/ forested area at the upstream end of the catchment. There also appears to be some patches of native vegetation across the subcatchment, within upstream tributaries and upstream reaches of the main watercourse. The downstream end of Gum Creek appears to be largely cleared of native vegetation.		
Sheoak Creek	Relatively small subcatchment located in the centre of the Project area and draining south before dissipating at Old Darke Peak Road. The creek is an ephemeral watercourse. Most of the catchment comprises cleared farming land with farm dams scattered throughout. There is also a farm dam located on the main creek line, near Syvertsen Road. While native riparian vegetation remains along most of the watercourse and its upper reaches/ tributaries, there is little vegetation downstream of this on-line farm dam. There are also some densely vegetated/ forested areas in the upstream areas of the subcatchment as well as some localised patches of native vegetation.	1,600	7x WTGs
Yadnarie Creek	Another subcatchment located in the centre of the Project area, nestled in between Gum Creek (to the north) and Poolalie Creek (to the south). The Yadnarie Creek drains south-east and accepts flows from Poolalie Creek south of Dreckow Road before continuing to head south and dissipating at Birdseye Highway. The creek is an ephemeral watercourse. While mapping shows a relatively large waterbody along the southern section of the creek and downstream of the Poolalie Creek confluence, a review of aerial imagery does not indicate any perennial reaches within the subcatchment. There is a large, densely vegetated area at the upstream end of the catchment and there remains native riparian vegetation along the main creek line, outside of adjacent cleared farming land	2,000	6x WTGs

Subcatchment	Description	Project area within subcatchment (ha)	Project infrastructure within subcatchment
	extents. There is also small farm dams located across this adjacent farming land.		
Poolalie Creek	Located near the southern boundary of the Project and draining in a westerly direction towards the confluence with Yadnarie Creek. The creek is an ephemeral watercourse. Most of the subcatchment is cleared and modified for agricultural land uses, with farm dams scattered throughout. There does remain some small patches of native vegetation. The main creek line and all of its tributaries appear to have their native riparian vegetation.	2,500	4x WTGs
Mangalo Creek	Located at the south-eastern end of the Project area and draining in a southerly direction before combining with Shannan Branch and also Iragie Creek. The creek is an ephemeral watercourse. While mapping shows a waterbody located on Mangalo Creek, between the Shannan Branch and Iragie Creek confluences, a review of aerial imagery does not indicate any perennial reaches within the subcatchment. Most of the catchment comprises cleared farming land. Although this subcatchment does not have as many farm dams compared to the others. While native vegetation has been largely cleared, there remains some – limited to small patches of land and along sections of the main watercourse and its tributaries.	650	2x WTGs

The remainder of the Project area forming part of the Driver River catchment (8,150 ha) drains directly to the Driver River as shallow overland flow. There are estimated to be 15 WTGs, the southern construction compound, battery storage system and O&M facility that are part of this remaining area and therefore drain directly to Driver River.

Review of aerial imagery indicated that native riparian vegetation along the Driver River is sparse, as it appears to have been largely cleared or disrupted by agricultural practices.

A portion of this remaining area draining directly to Driver River, estimated to be in the order of 1,700 ha, directs overland flow through the Rudall Conservation Park before reaching Driver River. There is estimated to be four WTGs that would drain towards the Rudall Conservation Park.

The Rudall Conservation Park is located in the south-eastern corner of the Project and bounded by Syvertsen Road (to the north), Cut Line Road (to the east) and Old Darke Peak Road (along the south-western side). Flow entering the Rudall Conservation Park is directed to a small dam/ waterbody at the south-eastern end of the park, known as the Broombush Reservoir.

3.4.2 Salt Creek

There is a very small (approximately 4%) portion of the Project area that sits within the Salt Creek catchment. There are only three WTGs proposed to be located within the Salt Creek catchment, along with a few short sections of new access roads leading to these WTGs.

The Salt Creek catchment is the largest of all watercourses on the Eyre Peninsula, with a total catchment area in the order of 2,200 km^2. The small portion of the Project located within the Salt Creek catchment is less than 0.5% of the total catchment area.

The Project is part of the Salt and Cumbrutle Creeks subcatchment, draining directly to Salt Creek. Runoff from the three WTGs would head in a north-easterly direction towards Salt Creek which would then continue in this same direction along the creek until making a turn at Lincoln Highway, located approximately 60 km east of the Project. Salt Creek then drains in a southerly direction for almost 30 km before it reaches the coastal outfall north of the Cowell township. This outfall discharges to a bay area encapsulated by the Franklin Harbor Marine Park.

Project runoff heading along Salt Creek is shown to pass through a series of waterbodies along the creek. However, a review of aerial imagery does not indicate any permanent water pools within these waterbodies. The creek appears to be an ephemeral watercourse. The creek also passes through the Plug Range Conservation Park which is located approximately 25 km east of the Project.

Similar to the Driver River catchment, the Salt Creek catchment has been largely cleared of native vegetation for farming purposes and there is limited native vegetation that remains across the catchment. Native vegetation is generally limited to conservation areas and along riparian zones.

3.5 Receiving environment

Existing catchments on the southern and eastern sides of the Eyre Peninsula have been extensively developed for agriculture, thereby modifying the hydrology, water quality and ecology of the catchment. Most watercourses and their tributaries are naturally ephemeral, experiencing peak flows during winter and often ceasing to flow by late spring or early summer. There are a significant number of small farm dams that have been constructed along these ephemeral drainage lines to hold water for domestic, agricultural, horticultural and industrial uses. Some of these small dams are shown in Figure 3-1.

Runoff from portions of the Project would drain to some of these farm dams – particularly, where Project infrastructure is located along ridge lines or near natural high points in the terrain.

Existing dwellings and local roads are also located downstream of proposed Project infrastructure. There is estimated to be in the order of 20 dwelling across the Project area. Numerous public and private roads also traverse the Project to provide access for these dwellings and across agricultural land. Some of these roads cross existing main watercourses.

As previously mentioned, the Rudall Conservation Park is located downstream, at the south-western corner of the Project. The subcatchment draining to the park and the Broombush Reservoir residing within the par is estimated to be in the order of 1,700 ha. The conservation park is a protected area that was proclaimed in 1973 under the State's *National Parks and Wildlife Act 1972*. It preserves a relatively small area of native vegetation, including a mallee/ broombush association in addition to some pure broombush.

Despite only a very small portion of the Project draining to the Salt Creek catchment, this small portion is likely to contribute to flows moving through The Plug Range Conservation Park which is located approximately 25 km downstream of the Project's eastern boundary. This conservation park was proclaimed in 2012 under the State's *National Parks and Wildlife Act 1972*. This park is dominated by a relatively undisturbed mallee forest and woodland associations with a Melaleuca shrub understorey. They provide important habitat for the Malleefowl populations and contain some other rare vegetive species.

Based on a desktop review of the receiving environment, its current condition, and the use of water resources across the region, the following environmental values have been established for the broader catchment:

- The ecological condition of watercourses, waterbodies and riparian zones should be maintained or improved over the long-term, for both conserved areas and highly disturbed areas. Water resources across the broader catchment have been heavily impacted by human disturbances, which is why continual improvement is needed towards restoring the ecological condition of aquatic ecosystems across the catchment.
- Aesthetics of watercourses and waterbodies should be maintained or improved – particularly at those used for recreational purposes and where scenic qualities are important, such as near picnicking, bushwalking and sightseeing locations.
- Stormwater quality should be maintained or improved for primary industry uses, such as for irrigating crops, farm use, livestock drinking water, water for aquaculture and the human consumption of aquatic foods.

3.6 Drainage

Stormwater runoff from the Project and broader catchment areas move as overland flow towards the nearest watercourse/ creek and continue along these watercourses until reaching the coast. As previously mentioned, the largely sandy soils are likely to result in a lot of rainfall and shallow flows infiltrating through the surface and reaching groundwater, thereby reducing the amount of overland flow across the Project.

Review of aerial imagery and topographical information shows there to be many farm dams and dredged channels leading to these dams for agricultural purposes. These channels and farm dams capture overland flow and permanently hold water, unless incoming flows were to cause the dams to spill and overflow towards the downstream watercourse or another downstream dam. Dredged channels leading to these dams have slightly altered the natural overland flow paths, and dams would have also altered the volume and timing of flows heading along catchment-wide watercourses.

There is very minimal formal drainage infrastructure across the Project. Local roads and tracks are unkerbed such that pavement runoff would sheet towards the adjacent land. Formal drainage infrastructure is likely limited to road crossings, where culverts or fords are used to safely convey flow beneath and/or across these roads.

3.7 Flooding

Due to the rural nature of the Project area, there is no existing flood modelling/ mapping available across the region. It is however generally considered that locating Project infrastructure away from defined watercourses and near local high points/ ridge lines would help to prevent this infrastructure from being impacted by or having any adverse impacts on existing flooding conditions.

It is recommended that flood modelling is conducted at a later stage, as part of this Project, to establish existing flooding extents and assist with the siting and design of Project infrastructure to ensure they can achieve the desired level of flood protection. It would also be useful identifying and mitigating any potentially adverse flooding impacts caused by the Project.

3.8 Water quality

There is limited available information on the existing quality of surface water across the Project and broader catchment area. The most recent water quality investigations on Driver River and Salt Creek were completed over a decade ago – between 2010 and 2015 – and were conducted by the South Australian Environment Protection Authority (EPA). The results from these investigations are summarised on the EPA's website, however there is no detail available regarding the specific sampling results, sampling dates or number of samples (EPA, 2025).

The Driver River and Salt Creek water quality investigations were conducted at the following monitoring sites:

- Driver River – the monitoring site (Site No. C0204) was located immediately downstream of the Balumbah Kinnard Road crossing, near Verran, which is approximately 14 km south of the Project.

Investigations were initially conducted in 2010 and later again in 2015. The number of data points collected during these two years is unknown.

- Salt Creek – there were two monitoring sites located downstream of the Project: one near Mangalo (Site No. C0188) and another near the Sheoak Hill Conservation Reserve (Site No. C0199). The Mangalo site was located approximately 15 km east of the Project and the Sheoak Hill Conservation Park site was located approximately 40 km east of the Project. Monitoring at both of these sites was conducted throughout 2010. The number of data points collected during this year is unknown.

These monitoring sites were all located more than 10 km downstream of the Project and are therefore unlikely to be representative of water quality within the Project area. The monitoring results would only be representative of the ultimate receiving environment, where there are additional upstream areas influencing the quality of stormwater. The date of these monitoring results (i.e., more than a decade ago) is also not likely to be representative of current conditions.

Nonetheless, these previous investigations provide the only data-based insight into existing water quality across the Project and broader catchment area.

Previous monitoring results along both Driver River and Salt Creek showed very similar findings – the condition of stormwater at all sites was assigned a rating of ‘poor’ or ‘very poor’ and showed no improvement over time. In fact, the testing along Driver River showed the condition get worse over the five-year period in between testings.

The poor stormwater quality condition ratings were due to the following observations:

- water samples showed evidence of major changes in ecosystem structure and a significant breakdown to the way the ecosystem functions – largely due to human disturbance, including salinisation, nutrient enrichment from agricultural activities, fine sediment deposition and poor riparian habitat
- high salinity and acidic water clearly contributed to the degraded condition of streams, which lacks plants despite the presence of nutrients in the water and only supports a few, highly tolerant and mobile macroinvertebrates
- waters were found to be saline, well oxygenated, acidic, slightly turbid, and having very high nutrient concentrations (i.e., namely nitrogen and phosphorus)
- there was observed to be significant sediment depositions along stream beds of up to 50-100 mm in depth and the sediments were dominated by clays, detritus, sand, pebbles, gravel and silt
- river banks often showed some signs of erosion – particularly after flooding events and due to the lack of vegetative cover.

Some of the recorded values for key water quality indicators, such as for nitrogen, pH levels and salinity, exceeded the ANZECC & ARMCANZ (2000) default trigger values for South Australia’s inland streams, as presented in Table 2-2.

It was evident from the monitoring results that these two creeks and their ecosystems are under pressure from livestock having direct access at the monitoring site and upstream areas in the catchment, causing sediment erosion and adding excessive nutrients to streams. The creeks are under pressure from limited natural riparian vegetation along the creek and at upstream areas in the catchment, providing minimal buffer protection from catchment land uses. The salinity of waters was also a major issue for these watercourses as a result of salt wash-off and saline groundwater inflow.

4.0 Impact assessment

This section identifies the potential stormwater impacts that could result from the construction and operation of the Project. The assessment was based on a qualitative, high-level review of the proposed works and how these works may potentially impact existing stormwater conditions, as described in the previous Section 3.0.

The assessment found that the Project would most likely impact existing stormwater conditions in the following ways:

- **Increased impervious surfaces** would cause localised increases in stormwater runoff which could potentially overload existing downstream drainage systems
- Proposed earthworks, trenching and temporary stockpiling has the potential to **obstruct and/or alter existing overland flow paths** across the Project area
- Newly impervious surfaces and any flow diversion works are likely to **concentrate/ channelise flows** which could potentially increase the risk of scouring and erosion
- The above impacts could potentially alter the quantity and quality of **water supply** to existing farm dams and downstream watercourses/ waterbodies
- Project infrastructure would need to be protected against **flooding** and the above impacts associated with this infrastructure could potentially impact existing flood extents and/or increase the risk of flooding to existing infrastructure or private properties across the broader catchment
- The **quality of stormwater** entering downstream watercourses/ waterbodies may be adversely impacted by an influx of pollutants carried by stormwater runoff from the Project, most likely as a result of exposed soils increasing the chance for sediment mobilisation and transportation and/or from leaks and spills of any hazardous substances required for Project works.

Review of these potential impacts is provided in the following sections.

4.1 Increased impervious surfaces

Increasing impervious surfaces across the Project area would also increase the amount of stormwater runoff as there would be less opportunity for rainfall to infiltrate the surface (i.e., more rainfall would be converted to stormwater runoff). An increase in stormwater runoff could potentially overload existing drainage systems, such as watercourses or transverse culvert crossings beneath roads. This would have the potential to create localised flooding issues that would also increase the risk of scouring and sediment mobilisation/ transportation.

The total amount of impervious area that is likely to be introduced during both construction and operational phases of the Project has been summarised in Table 4-1.

Table 4-1 Newly impervious surfaces

Component	Description	Impervious area (ha)	
		Construction	Operation
Wind turbines	Total of 80 WTG locations, with each comprising: • Foundation/ maintenance hardstand area to remain after construction (~1,500 m^2) • Temporary laydown areas only required for construction (~2,000 m^2)	28.0	12.0
Access roads	60 km of new unsealed/ compacted gravel roads for access to the WTGs during both operation and construction.	30.0	30.0
	Temporary construction compound located on the eastern side of Kielpa-Plane Road, approximately	1.8	-

Component	Description	Impervious area (ha)	
		Construction	Operation
Construction compounds	1.2 km north of the intersection with Kielpa-Gum Flat Road.		
	Temporary construction compound located on the eastern side of Syvertsen Road, approximately 2.0 km north of the intersection with Birdseye Highway.	3.6	-
Concrete batch plant	Temporary concrete batch plant to facilitate construction works. The plant is to be located on the eastern side of Kielpa-Gum Flat Road, approximately 1.5 km south of intersection with Evans-Gum Flat Road	1.5	-
Substation	Permanent substation located along the proposed access track and approximately 800 m east of the temporary concrete batch plant.	1.4	1.4
Battery storage facility	Permanent 240 MW battery storage facility located on the eastern side of Syvertsen Road, approximately 1.2 km north of the intersection with Birdseye Highway (i.e., where the existing Yadnarie Substation is located).	8.0	8.0
O&M facility	Adjacent (immediately south) of the proposed battery storage system.	1.0	1.0
Total impervious area:		***75.3***	***52.4***
Percentage of Project area:		***0.32%***	***0.22%***
Percentage of Driver River catchment area:		***0.07%***	***0.05%***

There is expected to be a larger increase in impervious area during the construction phase as there would be temporary hardstand areas introduced for the two construction compounds and concrete batch plant. It is assumed that these hardstand areas would be removed and returned to natural state following the completion of construction works.

Newly impervious areas of 75 ha during construction and 52 ha during operation would be less than 0.35% of the total Project area, which is in the order of 23,900 ha. These impervious areas would comprise an even smaller percentage (less than 0.07%) of the broader Driver River catchment area. The total increase in impervious area and resulting increase in stormwater runoff would also be spread across the many watercourses that exist within the Project area. This would reduce the chances of any one watercourse being overloaded with a sudden, isolated increase in inflows.

The largest increase in impervious area would occur from the construction of approximately 60.5 km of new access roads. These access roads would be unkerbed such that any stormwater runoff from the pavement would move as shallow sheet flow towards the side of the roads and across adjacent vegetated land. Vegetative buffer strips adjacent to these roads would be reestablished following the completion of construction works.

This process of distributing pavement runoff across the adjacent vegetated land would help to minimise downstream flows and reduce the potential for erosion/ scour as much as possible by encouraging the infiltration of pavement runoff prior to reaching defined watercourses/ drainage lines.

On the other hand, permanent hardstand pads at the proposed WTG locations, substation, battery storage system, operation and maintenance facility are more likely to cause a localised increase in stormwater discharge, as stormwater runoff from the pad would be captured and conveyed towards one (or several) discharge points via an internal drainage system. However, this increase in discharge would be small in comparison to the total flow within downstream watercourses and the proposed internal drainage system would be designed to reduce the potential for erosion/ scour (e.g., by spreading discharge flows and providing scour protection measures at outlets).

On this basis, the relatively small increase in impervious area and stormwater flows is likely to have a negligible impact on the condition and hydraulic performance of existing downstream watercourses and drainage systems.

4.2 Altered flow paths

The Project has the potential to obstruct and/or alter existing overland flow paths both temporarily during construction and permanently once construction works are completed. Some possible causes for flow obstruction and altered flow paths include:

- Temporary flow diversion measures around construction sites
- Stockpiling from trenching and proposed earthworks
- Filling required for raised pad levels
- Raised access roads crossing watercourses, drainage lines or overland flow paths.

These potential causes of flow obstruction/ alteration are discussed in the following sections.

4.2.1 Temporary flow diversions

Temporary flow diversion measures may be required to direct upstream flows around any construction sites or trenching routes that would be at risk of water ingress/ inundation during a rainfall event. This may include works located within major watercourses.

If not carefully designed and constructed, these diversion measures could accidentally direct flow onto nearby private properties, farm dams or to other watercourses. To prevent these impacts from occurring, any temporary flow diversions would be designed to ensure that upstream flows are safely conveyed around construction sites and back towards the same drainage route, so as to prevent these flows from being redirected elsewhere.

4.2.2 Stockpiling

Trenching along cabling routes that traverse existing watercourses would require temporary stockpiling within or close to these watercourses. The stockpiles could potentially obstruct existing overland flow paths if these works were to coincide with a large rainfall event. This has the potential to cause upstream flows to accumulate/ pool around these stockpiles and spill to alternate drainage paths.

It is recommended that trenching works within watercourses are scheduled during dry periods and are completed in stages to ensure there remains a safe path for water around the proposed works. It is also required that safe evacuation management procedures are established prior to completing these works.

Alternatively, flow diversion measures – as described in the previous section – may be required to direct upstream flows around active trenches.

Stockpiling at all other locations (e.g., along the remaining cabling routes, access roads and at proposed hardstand pads) could potentially obstruct overland flow paths. This would similarly cause upstream flows to accumulate around the stockpile and potentially cause flows to head elsewhere. To prevent this from occurring, all stockpiles would be located away from drainage lines and overland flow paths – preferably, near a high point in the local terrain.

4.2.3 Raised pad levels

The construction compounds, concrete batch plant, WTG sites, substations, battery storage systems, O&M facility would all require earthworks to achieve raised and level hardstand pad areas. Filling required for these raised hardstand pads could potentially obstruct existing overland flow paths.

While the proposed hardstand pads are located away from main watercourses, they may still obstruct local overland flow routes. This would cause water to accumulate/ pool along the upstream side of the pad. Pooled waters could then potentially reach a level that encroaches on the pad and risks the inundation of critical infrastructure.

Design of these raised pads would therefore incorporate upstream catch drains and/or diversion drains to capture and convey any upstream flows around the site. These diversion drains would travel around the site and tie back in with the same existing flow route at a downstream location, so as to avoid redirecting these flows elsewhere.

4.2.4 Access roads

Proposed access roads would cross watercourses and overland flow paths at a number of locations. The locations where proposed access roads cross main watercourses included in the state-wide mapping data are shown in Figure 4-1 and listed in Table 4-2. Figure 4-1 also includes the locations where proposed access roads would cross minor watercourses/ drainage lines.

Table 4-2 Watercourse crossing locations

ID	Watercourse
01	Unnamed creak upstream of Birdseye Highway
02	Poolalalie Creek Tributary
03	Yadnarie Creek Tributary
04	Gum Creek
05	Cockabidnie Creek Tributary

These access tracks would initially be installed to facilitate construction works and would then be retained permanently for ongoing maintenance works.

Road crossings at major/ main watercourses would likely need to be raised in order to protect the road from floodwaters and maintain a certain level of flood immunity. These raised road crossings have the potential to obstruct flows and cause water levels to rise on the upstream side of the road. To prevent water from accumulating on the upstream side of the road, the raised road crossings would incorporate transverse drainage structures to convey frequent flows beneath the road.

It is assumed that all transverse drainage culverts would have the capacity to convey flows in a 10% AEP design storm event whilst preventing these flows from overtopping the road. These transverse culverts would also be designed with an allowance for potential blockage from sediments and debris. Appropriate scour protection would be provided at crossings to minimise the likelihood of erosion and scouring.

Ford crossings or floodways may also be a viable solution at minor watercourse crossings, allowing flows to overtop the road.

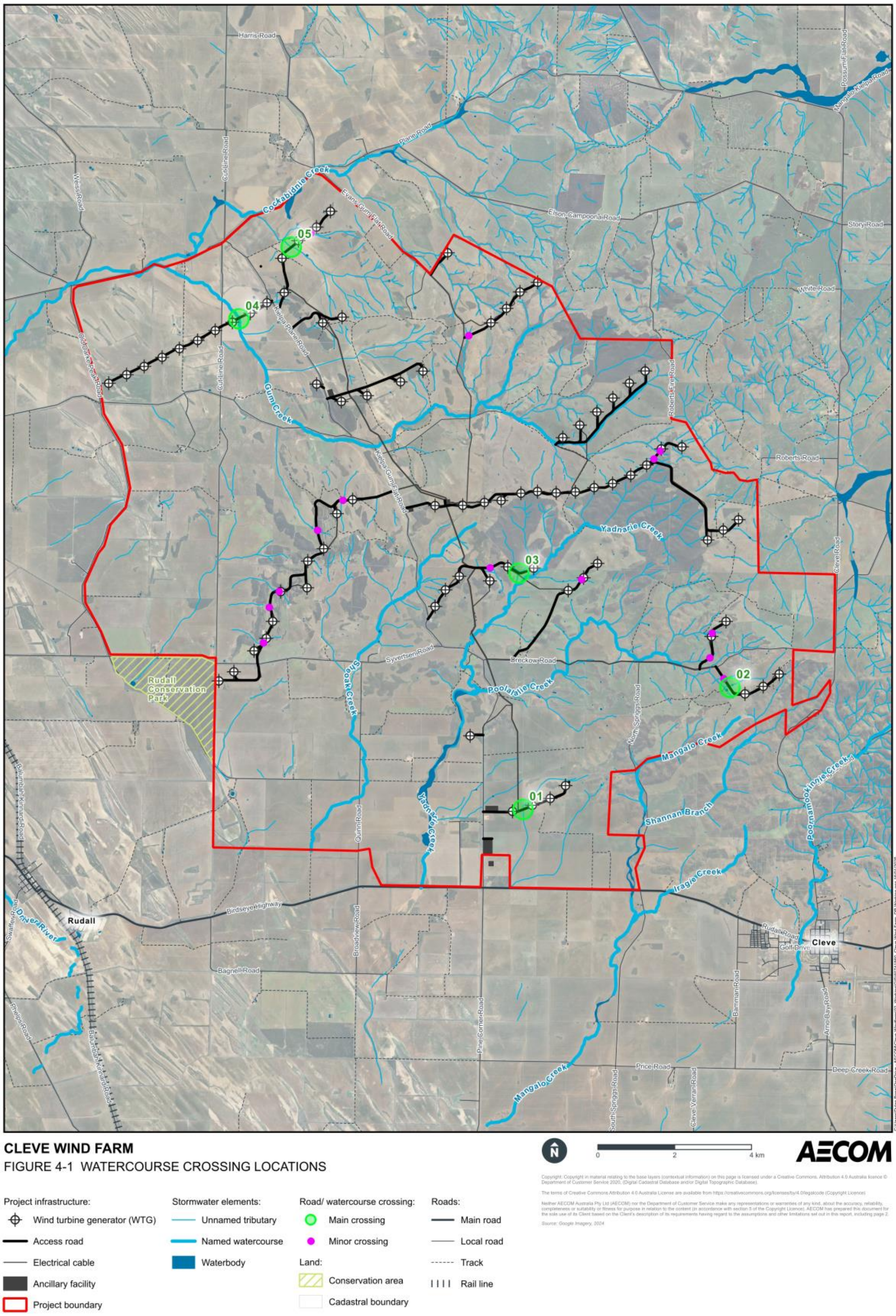

Figure 4-1 Watercourse crossing locations

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4.3 Concentrated flows

The Project has the potential to concentrate/ channelise flows at a number of locations, including:

- Along temporary/ permanent flow diversion measures
- Downstream of newly impervious surfaces
- At the outlet of internal drainage systems for proposed hardstand pads
- At the upstream and downstream ends of proposed transverse culverts crossings beneath access roads.

Concentrated flows tend to have higher flow depths and velocities which can increase the risk of scouring and eroding along the channel or where these concentrated flows discharge to surrounding land. This could result in changes to the existing geomorphology of watercourses or increase sediment mobilisation and transportation along downstream watercourses.

Suitable scour and erosion protection measures would be required where flows are concentrated as a result of the Project. It is also likely that flow spreaders would be required at any new drainage discharge points, to distribute flows across the wider profile of existing, natural watercourses.

4.4 Water supply

There are many existing farm dams across the Project area. These farm dams are located downstream of natural drainage lines to accept and store stormwater runoff during rainfall events.

Previously mentioned increases in stormwater runoff and potential obstructions/ alterations to existing flow paths has the potential to alter the amount of water being supplied to these farm dams. For example, diversion drains around proposed hardstand pads could potentially divert upstream flows and stormwater runoff from the hardstand pad away from or around a downstream farm dam.

However, any localised obstructions/ flow diversions are not likely to significantly alter existing flow paths. The proposed flow diversions would only locally divert upstream flows around Project infrastructure until they match back into existing flow paths at a downstream location. The proposed construction works would also ensure not to dam, redirect or extract flows from watercourses.

As detailed in Section 4.1, the overall increase in impervious surfaces and resulting increase in stormwater runoff would be negligible relative to the wider Project and catchment areas. Therefore, there is unlikely to be any significant changes to the amount of flow entering downstream waterbodies and aquatic ecosystems.

4.5 Flooding

Project infrastructure has the potential to not only impact existing flooding conditions across the catchment but could also be impacted by floodwaters. It is important that Project infrastructure is protected against flooding and it is also important that the Project does not adversely impact existing flooding conditions. Both of these flood-related impacts have been discussed in the following sections.

4.5.1 Flood protection

The location of most WTG sites and ancillary facilities have been proposed along ridge lines or near local high points, away from existing watercourses. These proposed locations would help to protect Project infrastructure from large flows heading along the watercourses. Hardstand pads would also be raised above surrounding surface levels to provide additional flood protection against local overland floodwaters.

As stated in Section 3.7, there has been no previous flood modelling undertaken across the Project area. Therefore, the level of flood protection that would be achieved with the current design cannot be assessed and any necessary relocation of critical infrastructure to be outside existing flood extents cannot be determined. It is recommended that flood modelling be completed at a later stage, once the Project design layout has been finalised, to confirm the desired level of flood resilience/ immunity can be achieved at all locations.

At this stage, the following flooding design standards have been assumed:

- It is assumed that the proposed WTGs would be capable of withstanding flooding at the base of the turbine and up to several metres in depth (up to the access door), such that these WTGs could be located within the floodplain without suffering permanent damage or critical failure. Some WTGs may need to be relocated if the maximum flood depth in the Probable Maximum Flood (PMF) event is exceeded.
- The proposed substation and battery storage system are considered to be critical infrastructure and would therefore need to remain free of inundation in all events up to and including the PMF event. This would be achieved through a combination of filling and raising the hardstand pad levels in addition to elevating any critical infrastructure, such as battery storage units, on-site.
- The O&M facility would be located outside the 1% AEP flood extents and/or set at least 0.5 m above the 1% AEP design flood levels. This could be achieved by filling and raising hardstand pad levels and further elevating any building floor levels. This level of flood protection is consistent with typical planning controls for residential developments.
- The temporary construction compounds and concrete batch plant would aim to be located outside of the 1% AEP design flood extents, with an additional 0.5 m of freeboard above peak flood levels. It may be considered acceptable to achieve a lesser flooding design standard due to the temporary state of this infrastructure.
- Access roads would be raised above main watercourses and incorporate transverse drainage culverts to remain free of inundation during a 10% AEP design flood event.
- The Project must have a safe evacuation route or on-site refuge area during the 1% AEP and PMF events, in accordance with the flood hazard assessment criteria outlined in the latest ARR guidelines (Ball et al., 2019).

The above design standards would also need to account for changes in climate (e.g., increased rainfall intensities) over the full design life of these assets.

4.5.2 Flooding changes

The previously mentioned increases in stormwater runoff, obstructed/ altered flow paths, and concentrated flows all have the potential to locally impact existing flood extents across the Project area and wider catchment area. Potential flooding impacts resulting from these changes are likely to include:

- Larger flood extents immediately downstream of newly impervious areas, where increased flow is released at a concentrated location.
- Increased flood levels upstream of raised hardstand areas proposed around the WTGs and at other ancillary facilities, where these raised levels create a partial obstruction to existing overland flow paths and reduce existing floodplain storage.
- Newly inundated areas along permanent diversion drains around the proposed WTGs and other ancillary facilities.
- Increased flood levels on the upstream side of access roads where they cross existing watercourses/ drainage lines.

Wherever possible, it is proposed that all raised hardstand areas are located outside of main flow conveyance zones and close to natural ridge lines or local high points, where there is little upstream catchment. This would help to locate proposed earthworks away from existing flood extents, thereby minimising the risk of flow obstruction and reduction in existing floodplain storage.

There would however be some locations where proposed WTGs are located within low-lying areas surrounding the main conveyance zones (i.e., within the wider floodplain). These WTGs are likely to be located within existing flood extents during large/ rare rainfall events, such as the 1% AEP or PMF event, when floodwaters break the banks of channels and spread across the wider floodplain.

These impacts are all expected to be relatively minor given their size in comparison to the likely floodplain extents. For example, the width of WTG sites (approximately 30-60 m) would be relatively minor in comparison to the overall floodplain width along main conveyance zones, which are estimated to be up to 500 m wide at some locations due to the flat nature of the floodplain and little definition of existing watercourses. Therefore, this relatively small obstruction is likely to have minimal impact on existing flood extents.

All of these flooding impacts are likely to be localised, such that they would only cause a relatively minor increase in flood levels at the source location and would have a negligible impact on existing flood extents further downstream and across the broader catchment.

On this basis, it is considered unlikely that any of these flooding impacts would adversely impact flooding conditions at existing dwelling locations, given the large distances between Project works and existing dwellings.

As previously mentioned, it is recommended that flood modelling be completed at a later stage, once the Project design layout has been finalised. Modelling both existing and proposed design scenarios would be used to identify any unacceptable flooding impacts across the Project and nearby private properties. It would also be able to assist in resolving any unacceptable flooding impacts.

4.6 Stormwater quality

Pollution of stormwater within downstream watercourses and waterbodies may occur from contaminated water leaving Project sites. This can have harmful and potentially detrimental impacts on sensitive receptors such as downstream aquatic ecosystems.

Build-up and wash-off are the key mechanisms for generating contaminated stormwater runoff from construction sites and impervious surfaces. Build-up is the process where dry deposition accumulates on the surface, and wash-off is the process where this deposition is removed by rainfall and carried into downstream watercourses.

The potential for pollutants to enter downstream watercourses would vary across the construction and operational phases of the Project. The following sections discuss the potential stormwater quality impacts that could occur as a result of both construction and operational activities.

4.6.1 Construction phase

Proposed construction activities are likely to disturb or expose existing surfaces and temporarily store soils and other materials on-site. These loose and exposed materials, as well as accidental leaks or spills, are vulnerable to wash-off during periods of rainfall, transporting an array of pollutants into downstream ecosystems, which could have harmful effects. If unmanaged, construction activities with the most potential to impact the quality of stormwater runoff include:

- Vegetation clearing/ trimming
- Civil earthworks
- Trenching and backfilling
- Stockpiling
- Concreting, which may require gravel to be sourced from nearby gravel pits
- Use of heavy machinery and vehicle movements to and from construction sites
- Transporting excess spoil off-site.

The key pollutants of concern during construction would be sediments, oils and greases and pH levels. Other pollutants such as nutrients may also be bound to sediments or present in dissolved form. Based on available data, and as described in Section 3.8, the existing quality of stormwater in watercourses across the broader catchment area is poor and under pressure from sediment and nutrient input due to agriculture practices as well as salinisation in the area.

While much of the Project infrastructure aims to avoid existing watercourses, some components such as access tracks and trenching required for underground cables cannot completely avoid watercourses. Construction works within watercourses present a higher risk to the pollution of downstream watercourses/ waterbodies as there is more chance for flows to mobilise sediments and other pollutants, resulting in poor water quality immediately downstream. Work occurring outside of these watercourses can also indirectly impact downstream receivers from mobilisation of sediment and pollutants via wind and rain, if not appropriately managed during construction.

Potential impacts to stormwater quality during construction of the Project include:

- Sediment-laden runoff from exposed surfaces and stockpiled materials could enter receiving watercourses, which would result in increased turbidity/ suspended solids, potentially resulting in adverse effects to aquatic habitat and increasing the potential for blockage of downstream drainage infrastructure such as channels and transverse culverts. There is also an increased risk of sediment-laden runoff contaminating downstream waters due to the previous land uses causing soil contamination with salinisation, fine sediment deposition and little vegetation surrounding the river banks.
- Increased nutrient concentrations (phosphorus and nitrogen) in stormwater runoff from exposed surfaces and stockpiled materials, which has the potential to stimulate the growth of algae and other nuisance plants in downstream watercourses/ waterbodies.
- Mobilised sediments may contain elevated concentrations of metals and other contaminants, which can negatively impact aquatic life, as well as reduce the suitability of water for other beneficial uses such as drinking, irrigation and recreation.
- Leaks and spills of chemicals, heavy metals, oils and greases during the use and operation of machinery, which can result in oily films on the surface of waterbodies and harm the health of aquatic organisms due to increased concentrations of toxicants.
- The above risks are all exacerbated by the movement and operation of heavy machinery/ vehicles which can disturb soils and transfer soils across the site and into downstream watercourses.
- Tannin leachate from clearing and mulching of vegetation, which can result in dark-coloured water being discharged into downstream water systems. This reduces visual amenity, alters pH levels, reduces visibility and light penetration through the water column. It can also decrease dissolved oxygen in waters and impact the health of aquatic ecosystems.
- Accidental release of alkaline concrete wash water, which may cause localised soil or stormwater contamination and possibly impact downstream ecological systems.

The construction phase would incorporate an array of temporary controls that aim to minimise the risk of contaminated waters entering downstream watercourses/ waterbodies. Most of the above impacts would be managed/ mitigated through the implementation of erosion and sediment control measures – to be established as the first step in commencement of construction activities.

4.6.2 Operational phase

Risks to surface water quality during the operational phase would be primarily associated with the establishment of new permanent impervious surfaces, increased risk of scour/ erosion due to increased runoff and concentrating flows, continual work at the O&M facility and the use of internal access tracks to, from and between WTGs for ongoing maintenance works. The volume of traffic that could transport sediments across Project sites and access roads during operation would however be minimal and far lower than during construction.

The key pollutants of concern during operation would be sediments and contaminants such as oils and greases. Other pollutants such as nutrients may also be bound to sediments or present in dissolved form.

Sediment mobilisation and transportation into the downstream watercourses would most likely occur as a result of stormwater flows scouring and eroding the earth.

Risks of scour and erosion would be increased as a result of the Project due to increases in stormwater runoff caused by newly impervious surfaces, discharge of these increased flows at concentrated locations, and proposed diversion drains/ paths that would channelise overland flows. The design and implementation of permanent scour and erosion protection measures would help to minimise these risks. Some measures that are likely to be installed include vegetative cover, rock protection at culvert inlets/ outlets, and flow spreaders (or other flow distribution techniques) where swales or diversion drains terminate.

The contamination of stormwater could also result from inappropriate storage of materials or from oil and grease leaks or spills from maintenance vehicles/ machinery. Due to the large distance between Project sites and the nearest watercourse (more than 200 m) and with the installation of bunds and/or sumps and other controls, the risk to surface water quality could be greatly reduced.

5.0 Mitigation and management measures

A series of mitigation and management measures have been established to reduce the potential impacts outlined in Section 4.0 and ensure that the Project has no (or negligible) impact on stormwater across the receiving environment during both construction and operation.

Most of these mitigation and management measures would be captured in the overarching construction and operational environmental management plans. These are used to enforce safe practices and procedures during construction and operation. These plans include a subset of technical management plans and environmental safeguards.

The list of stormwater mitigation and management measures are provided in Table 5-1.

Table 5-1 Stormwater mitigation and management measures

ID	Impact	Measure	Timing
SW01	Poor stormwater quality during construction	A Soil and Water Management Plan (SWMP) would be prepared as part of the Construction Environmental Management Plan (CEMP). The SWMP would include, at a minimum: • Measures to minimise/ manage erosion and sediment transportation across the Project area, including requirements for the preparation of a Project-specific Erosion and Sediment Control Plan (ESCP) for construction, as per SW02. • Stormwater management strategy for the construction phase, including measures to prevent the obstruction of existing watercourses and requirements for temporary flow diversions around construction sites. • Measures to manage the location and treatment of stockpiles, as per SW04. • Measures to manage accidental leaks and spills, including the requirement to maintain on-site spill kits, as per SW05. • Measures to manage any potential acid sulfate soils (ASS), if found in excavated material. • Details of surface water quality monitoring to be undertaken prior to, throughout and following construction works, as per SW06.	Pre-construction and construction
SW02	Erosion and sedimentation during construction	An ESCP would be prepared as part of the SWMP in accordance with Best Practice Erosion and Sediment Control guidelines (IECA, 2008). The ESCP would detail the specific erosion and sediment control measures to be implemented during construction across the Project area. Some typical measures would include, but not be limited to: • Erosion protection on exposed batters • Dust suppression • Vehicle vibration pads at entry and exit points from large construction sites • Sediment capture measures, such as sediment basins, traps or fences downstream of large construction sites • Scour protection along drainage paths and flow diversion paths that would be subject to concentrated flows • Flow spreaders/ distributors at discharge points	Pre-construction and construction

ID	Impact	Measure	Timing
SW03	Soil exposure and disturbance	To avoid any impacts on water quality and downstream receptors such as native vegetation and aquatic ecosystems, the following measures would be implemented: • Minimise the total area of bare earth exposed at any time. • Employ erosion and sediment control measures as per SW02. • Employ interim rehabilitation strategies to minimise dust generation, soil erosion and weed incursion on parts of the Project are that cannot yet be permanently rehabilitated. • Where required, rehabilitate all areas of the Project that are not proposed for future operations as soon as is practicable following construction.	Construction
SW06	Sediment transfer from stockpiles	Stockpiles would be managed in a manner that minimises the potential for mobilisation and transportation of dust, sediment and leachate in stormwater runoff. This would include: • Minimising the number of stockpiles, area used for stockpiles and time that they are left exposed. • Locating stockpiles away from watercourse, drainage lines, and/or where they may be susceptible to wind erosion. • Stabilising stockpiles, establishing appropriate sediment controls and suppressing dust as required.	Construction
SW05	Hazardous leaks, spills and littering during construction	Project-specific controls and procedures would be developed and implemented as part of the SWMP to reduce the risk of leaks, spills and litter entering downstream watercourses during construction. The SWMP would include the following measures, at a minimum: • All fuels, chemicals and liquids would be stored on level ground away from watercourse and would be stored in a sealed, bunded area within the construction compound. • Refuelling and minor maintenance activities would be limited to designated areas with established spill capture and management controls. • An emergency spill response plan would be prepared as part of the SWMP. • Regular visual water quality checks (for oil and grease spills/ slicks, turbid plumes and other water quality issues) would be carried out at downstream waterbodies in proximity to constructions areas, such as at existing farm dams. • Installing and maintaining control measures such as sediment fencing and gross pollutant traps during construction.	Construction
SW06	Exacerbating existing stormwater quality issues in downstream watercourses/ waterbodies	A surface water monitoring program would be implemented as part of the SWMP prior to, during and following construction. This would ensure the Project does not worsen existing stormwater quality conditions across broader catchment watercourses and aquatic ecosystems, since they are already under pressures from pollution due to existing agricultural land use practices.	Pre-construction, construction, and post-construction

ID	Impact	Measure	Timing
		The monitoring program would, at a minimum, include: • Visual assessment and routine monitoring of physio-chemical parameters and contaminants of concern at downstream waterbodies to ensure compliance with applicable guidelines. • Visual assessment of surface water quality control structures regularly and also following wet weather during construction to ensure controls are operating effectively for their designed purpose.	
SW07	Release of concrete wash water	To avoid concrete waste material being washed into downstream watercourses, the CEMP would outline procedures to capture, contain and appropriately dispose of any concrete waste from concrete work, including designated lined, bunded and controlled concrete washdown areas.	Construction
SW08	Flow obstructions	Design of flow diversion measures around raised hardstand pads and transverse culverts beneath access roads at watercourse crossings to provide an alternate path for obstructed watercourses/ overland flow routes, prevent the accumulation of water upstream of these obstructions, and maintain drainage of upstream flows.	Detailed design
SW09	Scouring and erosion during operation	Increased risk of scouring and erosion due to increased stormwater runoff and the discharge of concentrated flows would be managed through the design and implementation of appropriate scour and erosion protection measures, such as vegetative cover, rock mattresses at culvert inlets/ outlets and flow spreaders where swales terminate. Monitoring of receiving watercourses and drainage lines following wet weather would be undertaken to identify any evidence of channel erosion and scour.	Detailed design and operation
SW10	Water supply to farm dams and downstream waterbodies	During detailed design, the Project would be further refined with the following considerations to minimise impacts to surface water resources where possible: • Minimising changes to runoff and natural flow regime by minimising infrastructure in existing overland flow paths. • Constructing Project facilities, hardstand areas and access tracks in such a manner that does not reduce inflows to farm dams and other surface water resources. • Provision of culverts/ bridges at road crossings to maintain conveyance of low flows. Potential impacts to flow paths associated with Project infrastructure in proximity to existing farm dams will be discussed and management measures (such as diversions) will be confirmed in consultation with landowners to avoid impacts to farm dam inflows.	Detailed design
SW11	Flooding of Project infrastructure	The design would ensure that Project infrastructure is set above design flood levels to achieve the desired level of protection against floodwaters. The following flood immunity standards have been assumed, but may be altered as the design is further refined:	Detailed design

ID	Impact	Measure	Timing
		• WTGs are allowed to be located within 1% AEP and PMF flooding extents, as they can withstand flooding at the base of the turbine up to several metres in depth (to be determined). • Substation and battery storage systems would be set above PMF levels. • The operation and maintenance facilities would be set at least 0.5 m above the 1% AEP design flood levels. • Temporary construction compounds would also aim to achieve 0.5 m above the 1% AEP design flood levels. • Access roads would be free of inundation during the 10% AEP flood even at main watercourse crossings. The above can be achieved by filling/ raising hardstand pad levels in addition to elevating any critical infrastructure such as batter storage units. Flow diversion measures and internal drainage systems would also be designed to achieve the desired level of flood protection. Additionally, the Project must have a safe evacuation route or on-site refuge area during both 1% AEP and PMF events.	
SW12	Adverse impacts to existing flooding conditions	During detailed design, the Project would be further refined with the following considerations to minimise impacts to existing flooding extents, where possible: • Minimising the filling of hardstand areas proposed across WTGs that are located within the existing 1% AEP floodplain. • Locating Project infrastructure outside of the 1% AEP flood extents, where possible, to minimise any flow obstructions and reduction in floodplain storage. • Design any catch drains and diversion drains to safely convey upstream flows around raised hardstand pads and back towards the existing overland flow route, so as to prevent directing these flows elsewhere. • Design transverse culverts at watercourse crossings to maintain flow conveyance beneath the access road and manage any upstream flooding impacts so as not to adversely impact any neighbouring private properties.	Detailed design
SW13	Hazardous leaks and spills during operation	Permanent controls and procedures would be developed to reduce the risk of releasing potentially harmful chemicals into downstream watercourses due to accidental leaks and spills. This would include: • Appropriate storage of equipment and hazardous substances during operation • Operational procedures for emergency response to spills and leaks from equipment or maintenance activities, including the requirements for having on-site spill kits.	Operation

6.0 Summary

The purpose of this stormwater assessment for construction and operation of the Project was to define existing stormwater conditions across the Project area, review the proposed schedule of works in order to identify any potential stormwater impacts to the receiving environment, and develop a series of suitable mitigation and management measures that would help to reduce these impacts.

The assessment was based on a qualitative review of preliminary design details for the Project and other available information, including but not limited to: topographical information, aerial imagery, past studies and investigations, applicable policies and guidelines.

The assessment found that the Project has the potential to impact existing stormwater conditions in the following ways:

- Increased impervious surfaces can cause localised increases in stormwater runoff which could potentially overload existing downstream drainage systems
- Proposed earthworks, trenching and temporary stockpiling has the potential to obstruct and/or alter existing overland flow paths across the Project area
- Newly impervious surfaces and any flow diversion works are likely to concentrate/ channelise flows which could potentially increase the risk of scouring and erosion
- The above impacts could potentially alter the quantity and quality of water supply to existing farm dams and downstream watercourses/ waterbodies
- Project infrastructure would need to be protected against flooding and the above impacts associated with this infrastructure could potentially impact existing flood extents and/or increase the risk of flooding to existing infrastructure or private properties across the broader catchment
- The quality of stormwater entering downstream watercourses/ waterbodies may be adversely impacted by an influx of pollutants carried by stormwater runoff across the Project.

A series of mitigation and management measures were developed as part of this assessment to address the above impacts. The key measures include:

- The impacts of construction activities on stormwater quality leaving the Project would be managed through the development of a Project-specific SWMP that would form part of the CEMP. The SWMP would include, but would not be limited to:
  - Measures to minimise/ manage erosion and sediment transportation across the Project area, including requirements for the preparation of an ESCP.
  - Stormwater management strategy for the construction phase, including measures to prevent the obstruction of existing watercourses and requirements for temporary flow diversions around construction sites.
  - Measures to manage the location and treatment of stockpiles.
  - Measures to manage accidental leaks and spills, including the requirement to maintain on-site spill kits.
  - Measures to manage any potential acid sulfate soils, if found in excavated material.
  - Details of surface water quality monitoring to be undertaken prior to, throughout and following construction works.
- Flow diversion measures around raised hardstand pads and transverse culverts beneath raised access roads to maintain safe drainage paths for flows that would otherwise be blocked/ obstructed by the proposed works.
- Appropriate permanent scour and erosion protection measures to manage the discharge of increased flows from newly impervious surfaces as well as protect against concentrated flows along flow diversion routes.

- Ensuring the design of Project infrastructure does not significantly alter water supply to existing farm dams and other water resources.
- Locating and raising Project infrastructure to achieve the desired level of protection against floodwaters.
- Design of Project infrastructure would aim to minimise any flooding impacts by locating large infrastructure outside of the existing 1% AEP flood extents, where possible, minimising the amount of fill within existing flood extents, and maintaining existing flow paths or providing alternate paths where necessary.
- Incorporate Spills and emergency management.

The Project is expected to have a negligible impact on stormwater and the receiving environment with the recommended mitigation and management measures in place.

6.1 Further recommendations

It is recommended that flood modelling is undertaken to inform the preparation of a stormwater management plan that would later feed into detailed design of the Project. The flood modelling would assist with locating and setting finished surface levels of Project infrastructure, to ensure that this infrastructure can achieve the desired level of flood immunity and has minimal impact on existing flooding conditions.

7.0 References

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