IRON ROAD

CHAPTER 15
SURFACE WATER

15 Surface Water 15-1

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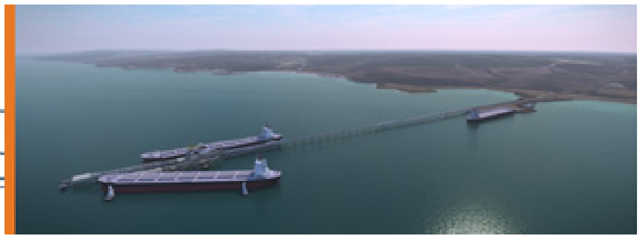

15 Surface Water

This chapter provides an overview of the existing environment relevant to surface water at the proposed CEIP Infrastructure site, including a review of existing surface water characteristics and water quality.

Earthworks and the establishment of hardstand areas have the potential to alter the hydrology of an area, including the quality and quantity of surface water available to support existing environmental values. These changes to the landscape will alter surface water flow regimes at the CEIP Infrastructure site during construction and operation. The scale of effects on existing environmental values is discussed in this chapter, and, where relevant, management and/or mitigation measures are identified that would minimise impacts and risks.

15.1 Applicable Legislation and Standards

The key relevant legislation relating to surface water at the CEIP Infrastructure site is the *Environment Protection Act 1993* (EP Act) and the *Natural Resources Management Act 2004* (NRM Act). The EP Act establishes a general environmental duty which requires that persons undertaking an activity take all reasonable and practicable measures to prevent or minimise any environmental harm

The EP Act establishes specific Environment Protection Policies which outline enforceable requirements or standards. The Environment Protection (Water Quality) Policy (Water Quality EPP) together with the EP Act forms the legislative framework which regulates activities likely to affect surface water.

Specifically, the Water Quality EPP specifies the following environmental values to be protected:

- Fresh water aquatic ecosystems
- Human water use, including:
  - Recreational use
  - Aesthetic value
  - Drinking water
  - Agricultural water use (including irrigation and livestock)
  - Industrial water use

The EP Act also identifies Water Protection Areas within South Australia that have been delineated for the purposes of providing them with special environmental protection. The CEIP Infrastructure is not located within any defined Water Protection Areas.

The NRM Act promotes sustainable and integrated management of the State's natural resources and provides for their protection. It includes provisions relating to the sustainable extraction of water resources and provides for prescription of water resources to protect against over use and to minimise adverse effects from development.

Water Affecting Activities (WAA) are regulated under Section 127 of the NRM Act. To undertake most types of WAA, a permit is required from the relevant authority, which in most cases is the Minister for Sustainability, Environment and Conservation through the South Australian Government Department of Environment, Water and Natural Resources (DEWNR) or the relevant Regional Natural Resources Management Board (NRM Board). To obtain a permit, the applicant must demonstrate that the WAA will be appropriately managed to protect environmental values.

The proposed CEIP Infrastructure is located within the Eyre Peninsula NRM Board region. Under Section 129(1) of the NRM Act, a permit will generally not be required for CEIP Infrastructure WAA authorised under the *Development Act 1993* as part of this EIS. Any WAA not covered or anticipated by this EIS may also need WAA permits as part of a secondary approval process.

15.2 Assessment Method

Existing surface water characteristics at the proposed CEIP Infrastructure site were assessed by a desktop review of publically available information. The investigation included a review of the following documents and information sources:

- CEIP Mine Site Hydrology Study (RPS, 2013). The hydrology study provided a detailed analysis of climate data and baseline surface water run-off studies at the proposed mining lease and northern end of the infrastructure corridor. The study methodology included, site inspection, limited soils permeability testing, and landowner survey and interview to establish historic run-off patterns during heavy rainfall events.
- Natural Resources Management Plan for the Eyre Peninsula Natural Resources Management Region (Eyre Peninsula Natural Resources Management Board 2009)
- Eyre Peninsula Water Supply Interim Report “Under the lens” (Natural Resources Committee 2012)
- Surface water stream flow measurement data for the Tod River (Australian Natural Resources Atlas 2002)
- Long Term Plan For Eyre Region: Summary (SA Water 2008)
- River Health on Eyre Peninsula (Ausrivas 1999)
- Eyre Peninsula Demand and Supply Statement (Department for Water 2011)
- Climate records for the Warramboo weather station (018090), Darke Peak station (018174), Rudall station (018174), Wharminda station (018113) and Port Neill station (018072) (BoM 2014c)
- WaterConnect data portal (DEWNR 2013b)
- Stream flow paths as shown in the Australian Hydrological Geospatial Fabric (Geofabric) hosted by the Bureau of Meteorology
- Aquatic ecosystem condition reports: Driver River, near Verran (EPA 2010)
- Australian Rainfall and Runoff: A guide to flood estimation (Engineers Australia 2003)

Field investigations were not undertaken with respect to surface water. The surface waterways in the CEIP Infrastructure area are ephemeral, and between rain events the landscape is typically dry. As such, the information that is able to be obtained from field investigations was not considered critical for a comprehensive assessment.

15.3 Existing Environment

The following section provides an overview of the existing environment in the region surrounding the proposed CEIP Infrastructure in relation to surface water. Existing drainage patterns and watercourses are identified, as well as any known users of surface water.

15.3.1 Rainfall

Mean annual rainfall on the Eyre Peninsula ranges from 263 mm at inland areas such as Wudinna, to 381 mm at coastal locations such as Port Lincoln (BOM 2013). Yearly rainfall is typically about 360 mm (BoM station 018116 at Cleve), 65% of Adelaide’s average yearly rainfall (BoM station 023090 at Kent Town).

Rainfall predominately occurs in winter months of May to September as illustrated in Figure 15-1, although major rainfall events can also occur in December, January and February during summer storms when in rare circumstances intense daily rainfalls can occur. The largest single rainfall event was recorded in February 1938 when 88.9 mm of rain fell in 24 hours and 114 mm fell in a 72 hour period (RPS 2013).

Recorded annual rainfall is variable, with wet and dry cycles ranging from 5 to 15 years in duration. The highest recorded annual rainfall in the region was more than three times the lowest recorded annual rainfall, with no discernible trend or overall tendency shown in the last century (RPS 2013).

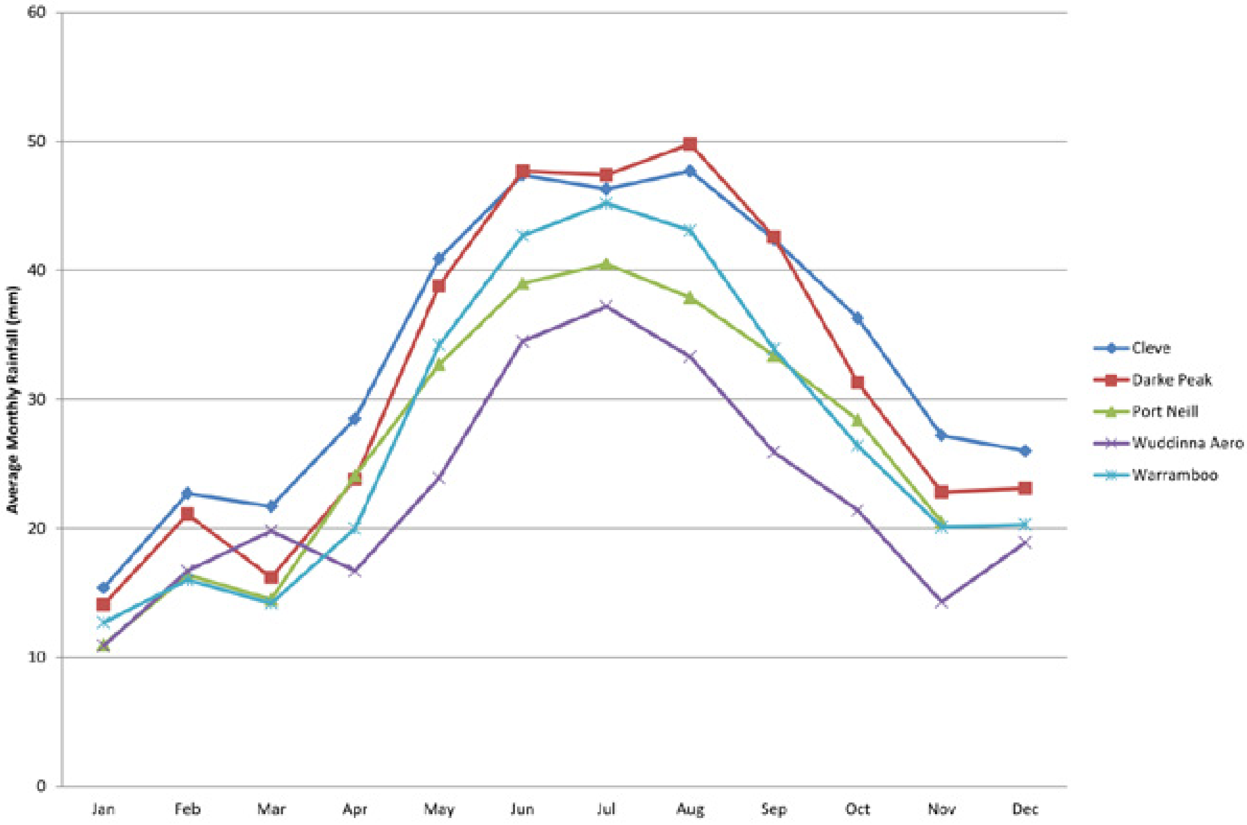

Figure 15-1 Mean Monthly Rainfall at Meteorology Gauges near the CEIP Infrastructure

15.3.2 Existing Drainage and Watercourses

The landscape incorporating the CEIP Infrastructure is characterised by two surface water catchment types:

- South of Cleve (southern infrastructure corridor and port site) the surface water environment is typically characterised by ephemeral creek systems draining water toward the coastline.
- North and west of Cleve (northern infrastructure corridor and long-term employee village) the surface water environment is typified by dunes that capture rainfall in natural swales.

The locations of surface water features in the vicinity of the CEIP Infrastructure are shown in Figure 15-2.

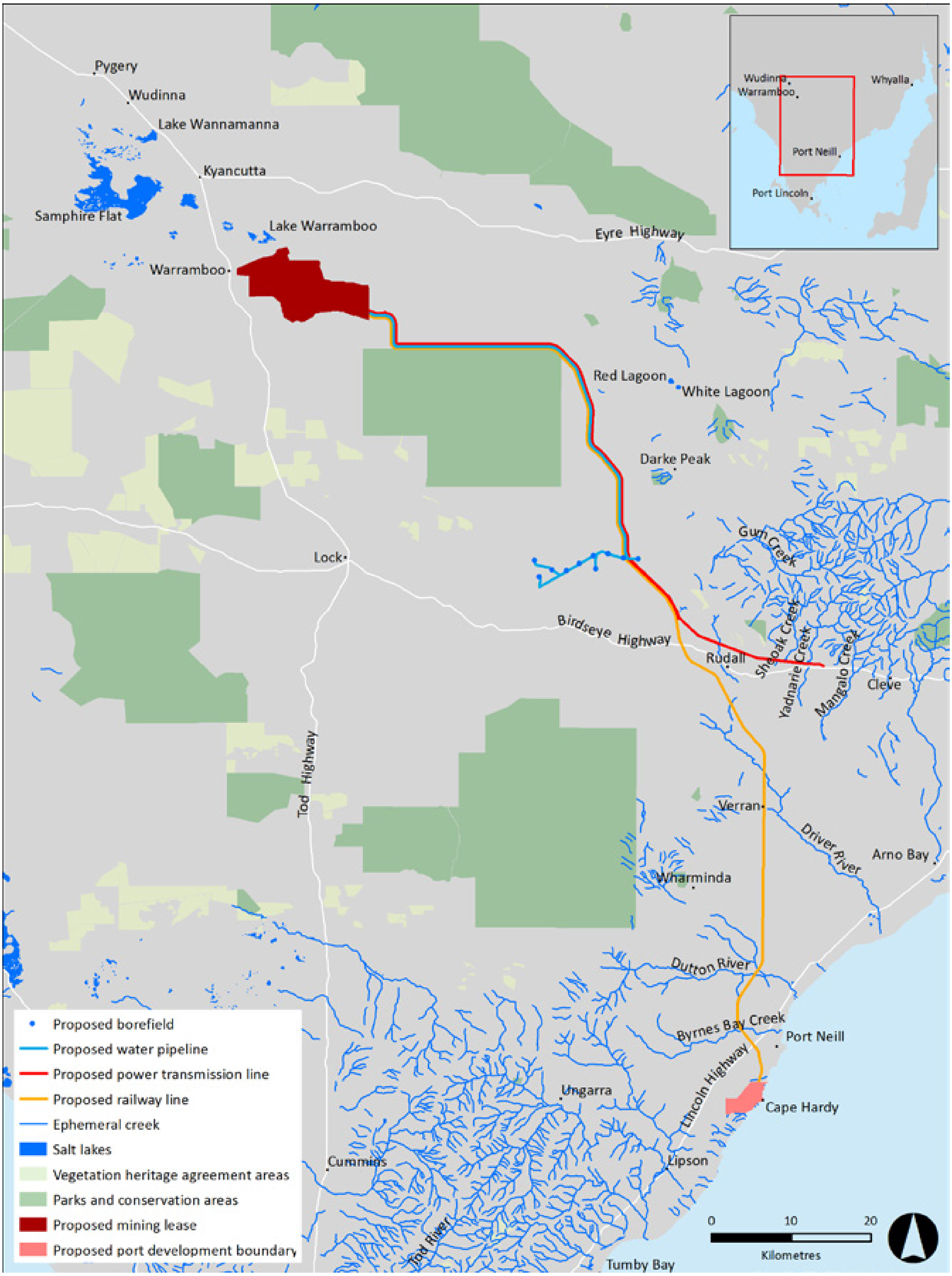

Figure 15-2 Surface Water Features in the Vicinity of the CEIP Infrastructure

Port Site

At the port site, the surface water environment is typically characterised by ephemeral creek systems draining water towards the coast, as illustrated in Plate 15-1.

The coast line in the vicinity of the proposed port is characterised by low hills with elevations 20-50 m above sea level, stony bluffs and sandy bays. After rainfall, runoff from the coastal hills flows to the coast via the ephemeral creeks.

The existing natural drainage lines present at the proposed port site are shown in Figure 15-3. Plate 15-1 illustrates the channel of a large ephemeral creek which flows through the proposed port site to the coast. The creek depicted in Plate 15-1 meets the coast at the approximate location of the jetty. A moderate level of scour and erosion of the creek bed can be observed within the drainage line. This scour and erosion is most likely attributed to increased runoff from the landscape due to clearing of native vegetation and the introduction of agricultural practices.

An Aboriginal Heritage Survey completed for CEIP Infrastructure has also identified a spring-fed creek located 2 km from the coast (refer to Chapter 19 Aboriginal Heritage and Native Title). It is noted that although the spring-fed creek is outside the proposed development area, a corridor will be established along the creek to protect cultural heritage values.

Plate 15-1 Ephemeral Creek at Proposed Port Site

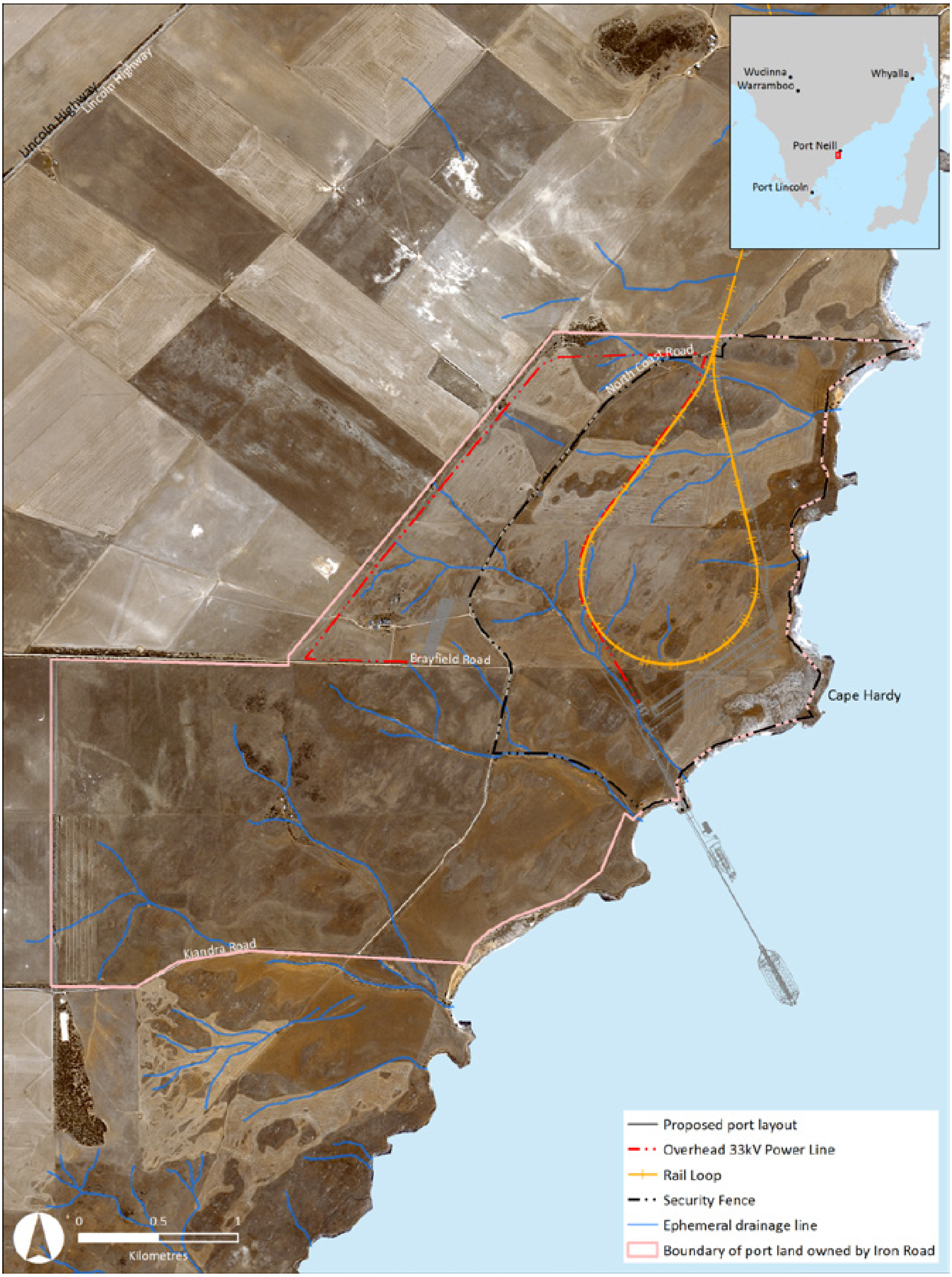

Figure 15-3 Port Site Natural Drainage

Infrastructure Corridor

As previously outlined, the landscape of the proposed infrastructure corridor is characterised by two surface water catchment types. The area south of Cleve is characterised by ephemeral creek systems draining toward the coastline.

Three creek catchments are crossed by the infrastructure corridor south of Cleve; the Driver River, the Dutton River, and the Byrnes Bay Creek running north of Port Neill, as illustrated in Figure 15-4. There are no public stream gauge records for any of these watercourses, however the EPA aquatic ecosystem monitoring programme includes the Driver River near Verran, which was sampled in 2010. The Driver River (Plate 15-2) rises between Verran and Rudall, flowing in a south-easterly direction and discharging in a coastal swamp approximately 12 km southwest of Arno Bay.

Plate 15-2 Driver River, near Verran

The area north of Cleve is characterised by dunes and natural swales, with most rainfall infiltrating directly to the soil. During rare prolonged heavy rainfall events, typically during the summer months, runoff may be generated and collect in the swales. This captured water either infiltrates to the groundwater table, or is stored in top-soils and sub-soils until it is used by plants or evaporates (RPS 2013).

A landowner survey undertaken as part of the CEIP Hydrology Study (RPS 2013) at the proposed mine site identified minor local flooding to a depth of less than 0.5 m in 1956, 1968 and 1992. In typical years, summer rains infiltrate or evaporate, while winter rains fill swales between the dunes to a depth of less than 0.3 m for several weeks during winter (RPS 2013). Landowners report that overtopping of swales and subsequent overland flow has not occurred in living memory, although 1968 rainfall was calculated to have filled the available swale storage to near-full capacity due to the combined effect of high total rainfall and the distribution of rainfall (wet antecedent conditions followed by a wet winter when there is low evaporation) (RPS 2013).

Stormwater runoff from local roads and impervious areas is currently managed by the local Councils through the use of shallow excavated drainage channels that direct flows towards low lying areas within road reserves for infiltration.

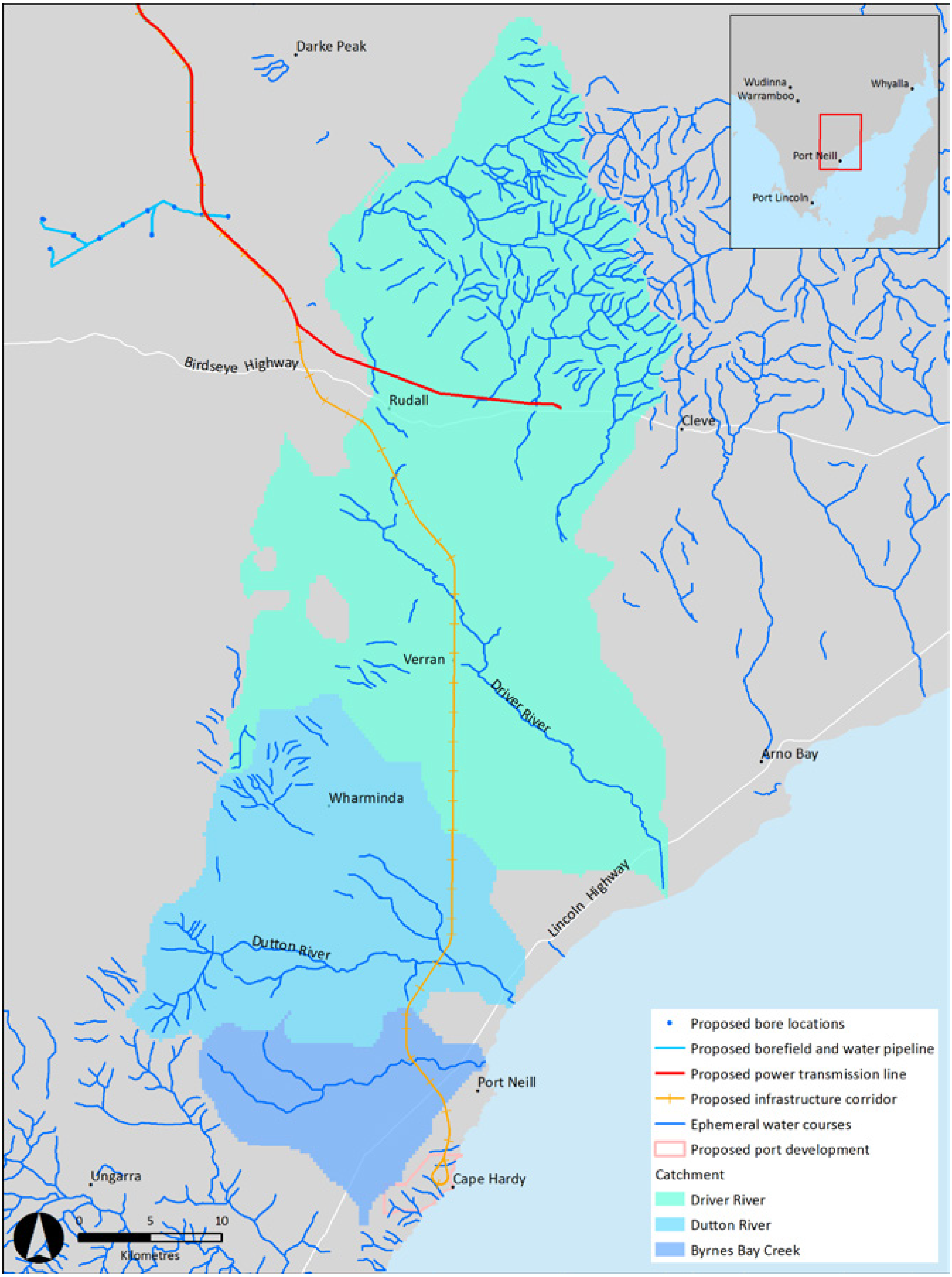

Figure 15-4 Creek Catchments within the Southern Infrastructure Corridor

It is noted that there are a small number of salt lakes to the northeast of the proposed infrastructure corridor and south of the proposed long-term employee village at Wudinna. These salt lakes are more than 5 km outside of the construction footprint of the CEIP Infrastructure and will not be impacted by changes to hydrology associated with the project. These salt lakes were within the study area defined for the Groundwater Impact Assessment modelling completed for the CEIP Infrastructure (Chapter 16) and are considered in more detail as part of the Mining Proposal.

Long-Term Employee Village

The landscape of the proposed long-term employee village site is comparable to the northern infrastructure corridor and also characterised by dunes, which capture rain water in natural swales. This captured rain water either infiltrates to the groundwater table, or evaporates. In rare large storm events, rain water collected in the dune swales may flow overland as sheet flow towards the south west, but there is little to no evidence of flow channels across this environment or that is visible in analysis of aerial photography.

The nearest surface water features to the proposed long-term employee village are a number of salt lakes located south of Wudinna, including Lake Wannamanna and Samphire Flat (shown in Figure 15-2). Wudinna is surrounded on all sides by agricultural land that is predominately cleared of native vegetation and there are no apparent drainage lines to transport surface water runoff to these lakes.

The proposed long-term employee village site is also currently utilised for agricultural purposes, is cleared of vegetation, and has no surface water features within or adjacent to the site boundaries.

15.3.3 Water Protection Areas

No elements of the proposed CEIP Infrastructure include or extend into any defined Water Protection Areas. There are 10 Water Protection Areas on the Eyre Peninsula, all of which are located on the south-west coast. The nearest Water Protection Area is the Polda Water Protection Area, approximately 40 km southwest of the proposed CEIP Infrastructure.

15.3.4 Water Users

The majority of the landscape within and surrounding the proposed CEIP Infrastructure has been cleared for agricultural purposes. Dams are not a common feature within the region due to the limited rainfall, with piped water being the primary water source for livestock (SA Water 2008). Crops in the region are rain-fed, and as such low water requirement varieties (such as non-irrigated wheat) are typically utilised.

Review of the available information sources showed that there is no current use of surface water for potable, agriculture, or industrial purposes within the area affected by the CEIP Infrastructure. For this reason, this chapter focusses on changes to flow regimes and water quality which could foreseeably affect either freshwater ecosystems or terrestrial ecosystems that utilise surface water.

15.3.5 Water Quality

There is limited publicly available water quality data for surface water within, or adjoining the proposed CEIP Infrastructure area. The only available information is for the Driver River, which was given an ecological condition rating of "poor" by the EPA (2010), with the site described as:

> *" the site sampled showed evidence of major changes in ecosystem structure and moderate changes to the way the ecosystem functions. There was considerable evidence of human disturbance, including nutrient enrichment, fine sediment deposition, bank erosion and poor riparian habitat. High salinity and acidity clearly contribute to the degraded condition of this stream."*

Although not recorded by the EPA, similar conditions have been identified at the Dutton River (Plate 15-3) and the Byrnes Bay Creek crossed at the southern end of the infrastructure corridor.

At locations north of Cleve (the northern infrastructure corridor and long-term employee village), rainfall runoff entering salinas and salt lakes is expected to become saline prior to evaporation or infiltration.

Plate 15-3 Dutton River, near Lincoln Highway

15.3.6 Summary of Key Environmental Values

The desktop review and CEIP Hydrology study indicated that there is no current capture or retention of surface water for potable, agricultural or industrial purposes within catchments crossed by the CEIP Infrastructure. Crops in the region are rain-fed, utilising rain falling directly onto the land.

The watercourses crossed by the CEIP Infrastructure are ephemeral. Three creek catchments are intersected by the infrastructure corridor south of Cleve; the Driver River, Dutton River and the Byrnes Bay Creek to the north of Port Neill. The Driver River is considered to be in a poor ecological condition, with considerable evidence of human disturbance resulting in major changes to the ecosystem structure, including high salinity and high acidity contributing to the degraded condition. Both the Dutton River and the Byrnes Bay Creek have also been observed to be highly affected by human disturbance.

North of Cleve, rainfall is captured by dunes in natural swales with most rainfall infiltrating directly to the soil. Runoff is typically limited to extreme summer rainfall events, which saturate the soil in a short period of time, generating runoff that could last for several hours and temporary ponding of water (in the order of a few hours or days) (RPS 2013).

15.4 Design Measures to Protect Environmental Values

The following design control measures have been incorporated to minimise impacts and risks to surface water as a result of the construction and operation of the proposed CEIP Infrastructure:

- Hydrocarbon and chemical storage facilities will be designed in accordance with Australian Standards, relevant legislation and best practice guidelines.
- Water sensitive urban design principles will be incorporated into the port and long-term employee village sites, including the collection of roof run-off in rainwater tanks for use on site.
- Light vehicles fuel and lubricant storage and dispensing facilities will be designed and installed in accordance with:
  - AS 1940-2004: The storage and handling of flammable and combustible liquids
  - AS 1692-2006: Steel tanks for flammable and combustible liquids
  - Relevant South Australian legislation
  - Best practice guidelines including the Building Code of Australia (BCA)
- Vehicle washdown areas will be designed in accordance with EPA information sheet EPA 517/04: Stormwater Management for Wash Bays (2004). Vehicle washdown areas will be bunded, with washwater recycled within the washdown area.
- Internal rail and road infrastructure will be constructed with culverts at low points to allow natural movements of surface water runoff.
- Rock armour will be installed downstream of culverts to minimise soil erosion.
- Dust management measures outlined in Chapter 10 will be implemented to minimise deposition of sediments into surface water flows.
- Where practical, runoff will be directed to vegetated swales for infiltration and evaporation in accordance with Water Sensitive Urban Design principles (Department of Planning and Local Government 2010). The swales also capture sedimentation, preventing it from being deposited in creeks, drainage lines or the marine environment. The location of the swales will be confirmed during final site landscaping plans.
- Following construction, temporary hardstand areas will be deep ripped and returned to cropping or native vegetation where practical and appropriate.

The design of surface water management controls has been undertaken with the overarching aim of maintaining the natural flow regime, minimising sediment runoff and restricting flows into the marine environment from the proposed CEIP Infrastructure.

Further detailed design of culverts will be undertaken to ensure that they comply with appropriate flood design requirements and minimise surface water impacts during both construction and operations. The appropriateness of culvert design standards and guidelines (including the need for fish passage) will be considered in discussions with the Eyre Peninsula NRM Board.

The design and operational measures incorporated into the project to manage the risk of extreme rainfall events and flooding associated with sea level rise are addressed in Chapter 11 – Greenhouse Gas and Climate Change.

Design measures specific to project components have also been incorporated and are detailed below.

15.4.1 Port Site

The proposed materials handling infrastructure and rail loop extends across an unnamed creek and several minor drainage lines. Culverts will be installed at creek crossing locations to allow runoff to pass underneath the constructed infrastructure during rainfall events of up to 1 in 20 year flows. As the creek lines currently exhibit scour, rock armour will be installed downstream of the culverts to minimise potential further erosion.

Rainfall running off the stockpile, module laydown areas and hardstand at the rail unloading facility will be directed to sedimentation basins (as shown in Figure 4-34) which will allow any mobilised concentrate and suspended solids to settle and for water to evaporate, rather than being discharged to the environment. Sediment will be periodically removed from sedimentation ponds to maintain performance and will be disposed of appropriately in accordance with EPA requirements.

Road runoff will be directed to roadside swales, which will be top-dressed with topsoil to encourage vegetation growth. In the immediate vicinity of inlet structures and locations of high velocity, swales will be rock-lined to slow flows and minimise soil erosion. These swales have been shown to capture and retain suspended solids, which are considered likely to constitute the majority of the contaminants from this run-off.

Areas which pose a contamination risk to stormwater (such as light vehicle re-fuelling) will be bunded (as outlined above), with disposal of waste by a licensed contractor.

Rainfall on areas of the port site undisturbed by development will be allowed to follow existing natural drainage paths. It is not intended that this water be harvested or treated. Natural flows within existing drainage lines will be diverted around or through port infrastructure into the creeks or natural drainage areas which normally receive the stormwater, with appropriate sedimentation structures prior to discharge.

15.4.2 Infrastructure Corridor

The proposed infrastructure corridor crosses the Driver River, Dutton River, the Byrnes Bay Creek and several small ephemeral drainage lines between the proposed port site and mining lease. At each of these locations, culverts will be used to allow water to cross below the infrastructure corridor. At flow locations culverts will be installed with capacity to accommodate a minimum of 1 in 20 year rainfall flows. Over the length of the infrastructure corridor, an estimated 400 culverts will be installed at creek crossings, ephemeral drainage lines and local low points to allow movement of water across the infrastructure corridor and maintain natural flows during storm events. As previously outlined rock armour will be installed immediately downstream of culverts to reduce erosion.

15.4.3 Long-Term Employee Village

The long-term employee village is proposed to be located adjacent to the town of Wudinna and will utilise town water (SA Water) supplies, with sewage incorporated into the town Community Wastewater Management Scheme. Harvested stormwater and reused wastewater is utilised by Wudinna DC for irrigation of public open space (Wudinna DC 2013).

Where practical, rainfall runoff from the long-term employee village will be directed into the existing Council stormwater management system for open space irrigation purposes. Where connection to the Council stormwater management system is not practicable, runoff will be directed to swales for infiltration and evaporation as per existing natural processes.

15.5 Impact Assessment

Activities undertaken during construction and operation of the proposed CEIP Infrastructure represent a number of impacts and risks to the existing environmental values of the area. Impacts to surface water were identified as a result of altered surface water flow regimes. Altered surface water regimes can occur via vegetation clearance, construction of water retaining structures, hardstand areas, internal roads, buildings, earthworks and other site infrastructure.

This section assesses surface water impacts that would result from the construction and operation of the proposed CEIP Infrastructure. Impacts have been assessed in accordance with the impact assessment methodology outlined in Chapter 9. A summary table of key impacts is provided in Section 15.5.5.

15.5.1 Altered Surface Water Regimes in Existing Creeks and Drainage Lines

Due to the provision of culverts, the flow regime of existing creek and drainage lines running through the port site and southern infrastructure corridor will not be altered in rainfall of up to 1 in 20 year flow events. During higher flow events, the culverts will restrict flow, reducing the downstream peak flow rate and extending the length of time during which the creek would flow. Restricting flows will result in temporary localised pooling of surface water immediately upstream of the culverts, with approximate equivalent total volumes of runoff eventually passing through the culvert and reaching the coast. As the temporary pooling of surface water will be limited within the port site and southern infrastructure corridor and not result in diminished total volumes of runoff, the impact is considered to be **low**.

15.5.2 Hardstand and Roofed Areas Increasing the Proportion of Rainfall Runoff

Hardstand and roofed areas will increase the proportion of rainfall runoff, and are likely to decrease the proportion of rainfall infiltrating into the soil. In comparison to the volumes of rainfall which naturally runoff the local catchments, the increase in total runoff volume reaching the coast at this location due to hardstands and roofs will be negligible. As such, it is expected that detectable changes to the surface water regime will be insignificant. Therefore, altered surface water runoff and infiltration regimes at the port site are considered to represent a **negligible impact**.

The application of rock armour downstream of culverts will minimise erosion and subsequent sedimentation of surface water flows. Similarly, vegetated swales will also capture sedimentation, preventing it from being deposited in creeks, drainage lines or the marine environment.

15.5.3 Erosion

Significant earthmoving activity during construction of the CEIP Infrastructure will increase the potential for erosion, particularly during periods of heavy rainfall. Alterations to surface water flows from the development may also increase erosion and lead to water quality impacts.

Standard soil and erosion management practices will be implemented, meaning that erosion during construction and operation is expected to be limited to within the footprint of the CEIP Infrastructure, with identified issues able to be immediately rectified. As such, impact on water quality as a result of erosion is considered to be **low**.

15.5.4 Restriction of Overland Flow

The infrastructure corridor (in particular the railway line) will form a barrier to sheet flow (in the event of a rare occurrence) in the dune plains northwest of Cleve. Although culverts will allow the movement of water across the railway line at local low points, sheet flows will only be able to cross the railway line at point locations. Locations immediately downstream of overland flows blocked by the railway line between the culverts will receive less runoff following construction of the railway line. This effect will be isolated to small areas adjacent to the railway line as all locations with significant catchments (i.e. identifiable drainage lines) will have flows retained by culverts. As previously outlined, overland sheet flows are uncommon due to low levels of rainfall, permeable soils and the storage capacity of natural swales. It is expected that detectable changes to the surface water regime and surface water quality will be limited to the CEIP Infrastructure study area and within regulatory limits. As such, surface water impacts associated with the impeding of overland sheet flow is considered to be **low**.

Rain landing on the roofs and paved areas of the long-term employee village will be harvested and provided to the Council stormwater management system for open space irrigation purposes. This will provide a net benefit to Wudinna by reducing reliance on mains (SA Water) water. The capture and reuse of runoff from the proposed long-term employee village will be available to Wudinna throughout the life of the project and therefore considered to represent a (medium) **benefit**.

15.5.5 Summary of Impacts

Impacts relating to surface water as a result of the construction and operation of the proposed CEIP Infrastructure are summarised in Table 15-1. Through the implementation of design and management controls, all impacts have been categorised as 'low' or 'negligible' and were considered as low as reasonably practicable. As such, the impacts do not warrant specific control measures beyond standard environmental management controls.

Table 15-1 Summary of Impacts: Surface Water

Impact	Comment	Level of Impact
Altered surface water regimes in existing creeks and drainage lines.	Due to the provision of culverts at creeks, drainage lines and natural low points, there will be no change to existing flow patterns during the majority of rain events. During higher flow events, the culverts will restrict flow resulting in temporary localised pooling of surface water upstream of the culverts, reducing the downstream peak flow rate and extending the length of time during which the creek will flow.	Low
Hardstand and roofed areas increasing the proportion of runoff and reducing infiltration to soil.	Compared to natural runoff from local catchments, alterations to flow regimes as a result of additional hardstands and roofed areas will be minimal and not result in significant alterations to downstream water quality or quantity.	Negligible
Erosion and subsequent sedimentation of surface water.	The utilisation of rock armour downstream of culverts and the use of vegetated swales will reduce the velocity of surface water flows and capture sedimentation. Standard environmental management practices will be implemented to minimise erosion during construction and operation across the CEIP Infrastructure.	Low
Restriction of overland flows as a result of the construction of the railway.	Overland flow movements across the railway will be limited to point locations (culverts), reducing flows to isolated small areas downstream of the railway. Significant catchments with identifiable drainage lines will have flows retained.	Low
Rainfall captured at the long-term employee village utilised for irrigation within Wudinna.	Rainfall on roofed and hardstand areas will be harvested and provided to Council's stormwater management system for use in open space irrigation purposes. To be available for the life of the project.	Benefit

15.6 Control and Management Strategies

In order to minimise the impact on, and potential risks to surface water during construction and operation, a series of control strategies and management approaches will be incorporated into the Construction Environmental Management Plan (CEMP) or Operations Environmental Management Plan (OEMP) and implemented for each project component. Key control and management strategies are summarised in Table 15-2. Chapter 24 provides a framework for implementation of these strategies. A draft CEMP is contained in Appendix AA and a draft OEMP is contained in Appendix BB, which include proposed monitoring.

It is noted that the construction erosion control strategies outlined in Table 15-2 will apply to all components of the proposed CEIP Infrastructure.

Table 15-2 Control and Management Strategies: Surface Water

Control and Management Strategies	EMP ID
Ground disturbance footprints will be minimised by utilising existing tracks and designated tracks established for the project.	SD_C1
Sediment and erosion management using industry standard practices such as hay baling, temporary sediment traps, dust generation management and bunding of stockpiles. Detailed and site-specific erosion and drainage control strategies will be developed in accordance with the Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry (EPA 1999), as required (and incorporated in the CEMP).	SD_C2
Disturbed areas will be revegetated as soon as practicable to support erosion control.	SD_C3
Dust from the internal unsealed roads will be suppressed using water trucks. Roadside swales will be maintained to collect any surface water run-off.	SD_C4
Locating stockpiles away from surface water flows and trafficked areas.	SD_C5
Restriction of vegetation clearance to the project footprint and undertaking progressive rehabilitation where practicable to minimise erosion.	SD_C6

Soil management procedures will be implemented to manage soil compaction and loss of soil quantity, including:
· Vehicle movements limited to predetermined haul routes and light vehicle roads to minimise vehicle compaction of soil.
· Deep ripping of soils beneath compacted areas during site rehabilitation to facilitate nutrient cycling and biological processes to support agriculture or revegetation.
· Minimising off-road driving and access to non-designated areas.
· Stripping topsoil prior to disturbance and stockpiling outside the area of disturbance at a height of no greater than 2 m to minimise compaction and ensure the soil does not have to be repeatedly moved throughout the life of the project.
· Developing and maintaining a topsoil inventory, detailing:
  · Original location of the topsoil
  · Likely seedbank properties within stockpiles
  · The volume of topsoil stockpiled
  · Stockpile location
· Topsoil progressively distributed on rehabilitated surfaces where practical.
	SD_C7

Detailed and site-specific measures to minimise soil loss from stockpiles due to wind and water will be developed with reference to the Guideline for stockpile management: Waste and waste derived products for recycling and reuse (EPA 2010), and incorporated into the CEMP.	SD_C8

Control and Management Strategies	EMP ID
For appropriate storage and handling of hydrocarbons and chemicals during construction and operation, the following measures will be implemented: · Develop and implement chemical and fuel storage, handling and emergency response procedures in accordance with AS 1940-2004. · Develop and implement a regular inspection programme to audit and monitor fuel and chemical storage areas to ensure integrity, housekeeping and correct use. · Maintain appropriate spill kit/clean up material, as required by the developed procedures.	CHS_C8 CHS_C9
During operations, rainfall runoff from undeveloped portions of the site will be allowed to flow to the natural low points and swales where it has historically evaporated/infiltrated. Where these flow paths are crossed by infrastructure, armoured channels and culverts will be installed to support natural flows.	SD_O1

15.7 Residual Risk Assessment

This section identifies and assesses surface water risks that would not be expected as part of the normal operation of the CEIP Infrastructure, but could occur as a result of faults, failures and unplanned events. Although the risks may or may not eventuate, the purpose of the risk assessment process was to identify management and mitigation measures required to reduce the identified risks to a level that is as low as reasonably practicable and therefore acceptable. A summary of the residual environmental risks after management and control strategies are applied is presented in Section 15.7.3.

The surface water management and mitigation measures identified are presented in Section 15.3.6 and form the basis of the Environmental Management Framework presented in Chapter 24.

Through the adoption of design modification or specific mitigation measures, all identified risks were categorised as 'negligible' or 'low', and were considered to be as low as reasonably practical and do not warrant specific control measures other than standard environmental management measures. The key environmental risks will be monitored through the CEIP environmental management framework.

15.7.1 Erosion

In heavy rain events, rainfall runoff may erode soil, especially where that soil is exposed and unprotected. Erosion is most likely to occur at locations of uncontrolled flow concentration such as drainage gullies, near culverts and on slopes.

As previously outlined, the following measures will be implemented to minimise erosion:

- Drainage gullies and culvert outlets will be armoured to reduce the risk of soil erosion.
- Vegetated swales and revegetation of disturbed areas would be established as soon as practical.
- Sediment and erosion controls detailed in the EMP will be adopted for construction activities to minimise and capture mobile sediment during rainfall runoff events through the construction phase of the project.

Where erosion does occur, sediment-laden runoff will largely be contained within bunds, swales and ponds. The consequences of reduced water quality from erosion in this situation may impact on receivers outside of the CEIP Infrastructure site for a short duration and are considered to be **minor**. Despite the implementation of the proposed design controls and management methods, localised erosion of made surfaces due to high rainfall runoff events is considered to be **possible.** As such, the overall risk is considered to be **low**.

15.7.2 Contamination of Surface Water

Chemicals and hydrocarbons will be kept within designated storage/refuelling areas bunded to prevent the accidental discharge of contaminants to soil or water resources. A storm event exceeding the capacity of the storage area could result in the contamination of surface water flows by hazardous materials. The consequences of contaminating surface water are considered to be **minor**. This is based on:

- The ephemeral nature of surface water flows in the region
- The absence of identified surface water capture or retention by agricultural users (see Section 15.3.4)
- The distance of more than 5 km to the nearest identified ecological receptor (salt lakes)

The bunding of hazardous materials storage area(s)/refuelling areas is designed to retain surface water flows during a 1 in 100 year flood event. A flood event exceeding the capacity of the storage area is considered **possible** during construction or operation of the CEIP Infrastructure. As such, the overall risk is considered to be **low**.

15.7.3 Summary of Risks

A summary of each of the identified risks is provided in Table 15-3 below. All identified risks are categorised as 'low', were considered as low as reasonably practicable and do not warrant specific control measures beyond standard environmental management controls.

Table 15-3 Residual Risk Assessment Outcomes: Surface Water

Risk Event	Pathway	Receptor	Project Phase	Consequence	Likelihood	Residual Risk
Erosion of exposed and unprotected soil resulting in sedimentation	High rainfall events beyond design limits causing erosion	Surface water quality/ quantity	Construction Operation	Minor	Possible	Low
Contamination of land	Uncontrolled releases of hydrocarbons and chemicals	Surface water quality/ quantity	Construction Operation	Minor	Possible	Low

15.8 Findings and Conclusion

No significant change to the surface water regime or water quality that would adversely affect ecosystems and/or water users dependent on surface water flows is anticipated as a result of the construction or operation of the proposed CEIP Infrastructure, with all identified impacts considered to be low or negligible.

The capture and harvest of stormwater at the proposed long-term employee village will support the irrigation of open space and ovals within Wudinna and is considered to represent a medium benefit to the community.

Risks to surface water will be alleviated wherever possible through the implementation of control and management strategies. The release of contaminated water and erosion of unprotected soil during high rainfall events was assessed as a low risk.

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