OPR TERRESTRIAL PORT DEVELOPMENT:
SURFACE WATER MANAGEMENT

Prepared for: Oakajee Port & Rail
Date of Issue: 29 October 2009
Our Reference: 1088/C1/003a
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<tr>
<td><strong>Originator</strong></td>
<td>Rhod Wright Principal Civil/Water Resources Engineer</td>
<td>29/10/09</td>
<td></td>
</tr>
<tr>
<td><strong>Reviewer</strong></td>
<td>Vince Piper Principal Water Resources Engineer</td>
<td>29/10/09</td>
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<tr>
<td><strong>Issuing Office</strong></td>
<td>Perth Suite 4, 125 Melville Parade, Como WA 6152 Tel: 08 9368 4044 Fax: 08 9368 4055</td>
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1 INTRODUCTION

1.1 BACKGROUND
Oakajee Port and Rail (OPR) is currently developing the Oakajee Port and Rail Development, which consists of:

- A deepwater port facility at Oakajee (north of Geraldton).
- Land based (terrestrial) port and iron ore handling infrastructure necessary to link the rail to the port.
- Development of approximately 523km of rail infrastructure extending from the Oakajee Port to the mining operations at Jack Hills, with a spur linking to the existing WestNet rail system, and another spur to Weld Range.

This report is concerned with the OPR Terrestrial Port Development.

The project and the facilities at Oakajee lie within the Shire of Chapman Valley, south of the Oakajee River mouth and north of the Buller River mouth, and approximately 24 km north of Geraldton. The Project extends along the coast for approximately 7km and reaches approximately 6km inland at its widest point.

OPR was established in September 2007 to pursue a joint venture between Murchison Metals, Mitsubishi Development and Crosslands Resources. OPR was established as an infrastructure provider to develop and coordinate the operation of rail and port infrastructure for iron ore sourced from the Midwest region. Federal and State Government funding will be used to develop the Common Use Infrastructure (such as the breakwater, dredged channel, tugs and navigational aids) associated with the project.

The proposed rail development will provide iron ore projects within the region access to the Oakajee Port for export, in turn providing benefits to the local area. OPR seeks to develop the project on a commercial basis, to promote open access to users of the port and rail infrastructure, and in particular to service mining operations in the Midwest, Gascoyne and Pilbara regions.

The OPR Terrestrial Port Development is shown in Figures 1.1, 1.2 and 1.3.

1.2 OBJECTIVES AND SCOPE
This surface water assessment considers surface water impacts in relation to the main surface flow paths, as well as surface water protective measures required for the proposed development areas. The scope of work includes:

- Review published maps, air photos and proposed port plans.
- Review published reports and data on the surface water resources in the study area.
- Characterisation and description of baseline drainage conditions (regional and local).
- Define surface water drainage patterns / characteristics.
- Preliminary assessment of the potential project development impacts on the natural drainage systems and sensitive vegetation communities.
- Strategies to minimise project impact on the natural drainage systems and vegetation.
- Prelim. assessment of the potential drainage systems impacts on proposed infrastructure.
- Site visit (14-17 September 2009).
- Liaison with Departments of Water, Environment and Conservation, and Agriculture and Food, and the Northern Agricultural Catchments Committee.
- Surface water management information for the proposed development areas (construction and operation).
- Completion of the surface water management report, suitable for inclusion as an Appendix to the project PER.
1.3 DEFINITIONS

- 100 year ARI flood - The flood having an average recurrence interval (ARI) of 100 years. It has a 1% chance of occurring or being exceeded in any one year, and at least a 50% chance of being experienced at least once in the average life span of a person. The 100 year ARI flood has been generally adopted in Australia and overseas as the basis for floodplain management planning.

- Floodplain - The portion of a river valley adjacent to the river channel which is covered with water when the river overflows its banks during floods. The term also applies to land adjacent to estuaries, which is subject to inundation during floods.

- Flood prone area - land which would be inundated as a result of the 100 year ARI flood.

- MSL (mean sea level) - The average level of the sea over a long period, or the average level which would exist in the absence of tides.

- HAT and LAT (highest and lowest astronomical tide) - the highest and lowest levels which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions. These levels will not be reached every year. HAT and LAT are not the extreme levels which can be reached, as storm surges may cause considerably higher and lower levels to occur. King tides are higher high waters, but is a non-scientific term.

- Freeboard - describes a factor of safety above an estimated design flood level for flood protection or control works. Freeboard is intended to allow for the uncertainties in analysis, design and construction which cannot be fully or readily considered. These include uncertainty in, or allowances for, flood level estimates, non-uniform flow patterns, construction variations, king tides, wave action, sea-level rise, plus minor settlement and erosion of the bund which may reduce the bund height.
OAKAJEE

LEGEND

- Towns
- Roads
- Proposed Railway

FIGURE 1.1
GENERAL LOCATION PLAN

Scale: 1:10,000,000

Location: F:\Jobs\1088\MapInfo\Figure1.1_Location Map.wor
2  THE PROJECT

2.1  OAKAJEE INDUSTRIAL ESTATE
The proposed Oakajee Industrial Estate (including the buffer zone surrounding it), is bounded to
the north by Coronation Beach Road, to the east by the Moresby Ranges, the south by the
Buller River and to the west by the Indian Ocean. The Industrial Estate will include the OPR
proposed port and railway, and will ultimately cater for uses related to that infrastructure, and
possibly downstream processing of minerals and oil and gas sourced from the Midwest; and will
include:

▼ a ‘Strategic Industry Zone’ of 1134ha.
▼ general / support industry areas of 190ha.
▼ a coastal/port uses zone of 1002ha.
▼ an industrial buffer of 4071ha.

A services corridor is proposed along the northern boundary of the Industrial Estate, to
accommodate public utilities (e.g. roads, water, electricity, gas and telecommunications) that
may be required for the development of both the OPR facilities and the Industrial Estate.

2.2  OPR OAKAJEE RAIL AND ORE HANDLING FACILITIES
The OPR project within the Oakajee Industrial Estate, will include both terrestrial and marine
works (breakwater, harbour basin, two berths, approach channel and reclamation area).

The terrestrial site topography is characterised by a sloping escarpment, separating an
undulating plateau level (RL70-80m AHD) from the proposed port reclamation levels of
~RL8.5m along the foreshore (stockyard facilities base level RL15-21m).

The western part of the industry zone will contain the car dumper and car dumper arrivals yard
(about 2km long to the south of the car dumper).

The northern side of the industry zone will contain an administration area, rolling stock
workshop, fuel facilities, wash bay, workshops, effluent treatment facility, and a locomotive test
cell and provisioning facility. Access to this site will be gained from the North West Coastal
Highway, 4.5km east of the port, and around the north-eastern boundary of the Strategic
Industry Zone.

2.3  OAKAJEE PORT AND ORE HANDLING FACILITIES
The ore handling systems (stackers, reclaimers and ship loader) and port facilities are located
below the plateau area, and near sea level.

The facilities include the iron ore stockpiles (up to 6.5Mt), a lump re-screening plan, conveyor
circuits, plus various offices, laboratory, workshops, electrical substation, marine maintenance
and storage areas, quarantine waste storage area, roads, etc.

The main port access road will be routed from the North West Coastal Highway 6.5km south of
the port and near Buller River, then north along the seafront.

The stockyard area (~2000m x 300m) will be constructed of cut and fill materials, with
additional fill sourced from materials dredged for the marine works (approximately 2 Mm³ of
dredged material).

2.4  CONSTRUCTION CAMP
A temporary construction camp will be built to accommodate up to 700 workers at the peak of
the construction phase. The camp location will most likely be located on the cleared land within
the Industrial Estate.
2.5 QUARRY

A quarry will be constructed about 2km north of the rail facilities and 0.5 km south of Coronation Beach Road, in undulating farmland just west of North West Coastal Highway. The quarry site will be located between two tributaries to the Oakajee River. A quarry laydown area will be provided immediately to the south of the quarry, and will be linked by a haul road (which crosses the Oakajee River) to the port site.

The initial phase will include the stripping of overburden (topsoil and weathered rock) to the surface of the fresh rock (RL45-75m). The quarry will provide core material and armour rock for the construction of the breakwater and dredged material reclamation bunds, as well as materials for construction of the quarry haul road, sheeting of temporary stockpile areas, and fill and aggregate and ballast for the construction of the rail handling facilities. These will require a total estimated volume of material of ~3.2Mm³ (2.3Mm³ bank).

The quarry haul road will be ~6km long with a nominal 20 m wide running surface.

Topsoil will be stockpiled around the ultimate quarry limits to provide a safety bund and assist in visual and noise screening.
3 ENVIRONMENT

3.1 RAINFALL
The Midwest coast experiences a typical Mediterranean climate characterised by hot dry summers and mild wet winters. The higher and more reliable rainfall nearer the coast, as proximity to both moisture sources and reliable rain-producing weather systems improves and supports more intensive farming pursuits, and higher population densities.

The controlling climatic feature in summer is a subtropical belt of high pressure which directs hot dry easterly winds over the region. The summer months may also be influenced by the tropical cyclone period, which occasionally brings heavy localised rainfall to the area. Geraldton is affected by cyclones approximately once every 6-8 years (Bureau of Meteorology, 2009).

During winter, this belt moves northward, allowing cold fronts and associated low pressure systems from the southwest to direct cool moist winds over coastal areas of the region. Most rainfall falls between May and September, while historically, July is the wettest month.

3.2 TEMPERATURE
On the coast, temperatures tend to be moderated by the ocean, resulting in cooler summers and warmer winters than places inland. This is reflected in the lower annual temperature range of 11.3° at Geraldton (the difference between the average temperature of the hottest and coldest months).

Coastal areas tend to be the hottest in February (the average daily maximum temperature for Geraldton is 32.4°). Seasonal extremes can occur from north-easterly winds across the arid interior of the state bringing very hot summer days - the highest maximum temperature recorded is 46.4°.

Coastal areas are coldest in August. Geraldton has an average minimum temperature of 9° (and an average maximum temperature of 20°). Cold fronts moving from the Southern Ocean bring windy, winter days - the lowest minimum temperature recorded in winter is 0.8°C (Bureau of Meteorology, 2009).

3.3 EVAPORATION
Mean annual pan evaporation rate is about 2450mm at Geraldton. Average summer evaporation figures in January are 11mm/d, to typical winter evaporation of 3mm/d in July.

3.4 TERRAIN AND LAND USE
Oakajee lies on the coastal belt of limestone and sand dunes, which have developed along the coast north and south of Geraldton. The coastal limestone belt forms hills up to 130m high, and extends up to 8km inland.

The coastal strip has adequate rainfall for cropping, pasture, and sheep, meat and wool production. Most woodland has been cleared for agriculture, and native vegetation is highly fragmented and limited to nature reserves and remnant patches, predominantly on rocky uplands, riverine and coastal areas.

3.5 LOCAL WATER WAYS
The Oakajee River lies in the northern part of the Industrial Estate, just to the north of the proposed rail infrastructure, while Buller River lies in the southern part of the Industrial Estate. The proposed facilities generally lie at a distance greater than 1km from these defined watercourses, noting however, that the proposed quarry haul road will cross the Oakajee River.

Stream flow is directly in response to rainfall. The rivers are ephemeral, but may flow for limited periods after heavy rain.

The Oakajee River rises in the Moresby Range ~10km from the coast and has a contributing catchment area of ~35km², which lies generally north and north east of the industrial area. It has several tributaries that cross North West Coastal Highway in culverts, and join ~3km (direct...
distance) east of the river mouth. The river discharges to the ocean from a meandering course through hilly terrain, ~750m north of the proposed port infrastructure and 4km south of the Coronation Beach access road. The marine breakwater lies about 1.5 km offshore, opposite the mouth.

The Buller River also rises in the Moresby Range 5-6km inland from the coast, and has a contributing catchment area of ~33km², generally draining the area between the Moresby Range and North West Coastal Highway, east of the industrial area. Two tributaries cross North West Coastal Highway in culverts, and combine ~2km (direct distance) east of the mouth. The proposed port access road runs several hundred metres north of the river, following an existing unsealed road towards the river mouth, before turning north along the coast to the port. The Buller River discharges from its meandering course to the ocean, at a location ~3.5km south of the proposed stockpile area (and 5.5km south of the marine port). Drummond Cove lies 3km to the south.

On the raised plateau which forms the bulk of the industrial estate, the topography is rolling cleared farmland. Surface water generally infiltrates into the ground, and there are no incised surface water feature or watercourses visible. Where surface water runoff is generated, this drains either to the Indian Ocean directly from the site (over the escarpment), or via the Oakajee or Buller Rivers to the north and south.

3.6 OCEAN LEVELS

At Geraldton, the tidal range is relatively low 1.2m (HAT RL0.65m - LAT RL-0.55m). Mean Sea Level (MSL) is RL0.02m AHD (Australian Height Datum). The ocean or flood level for design of infrastructure adjacent to the coast (where the ocean impact on the flood protection works is direct) is dependent on the tide height, sea surge, wave height, wave set-up (breaking the waves produce a set-up or rise in the mean water level above the still-water elevation of the sea) and wave run-up are additional height requirements. Tsunami is an additional effect.

Storm surge is an offshore rise of water associated with a low pressure weather system (typically a tropical cyclone). Storm surge is caused primarily by high winds pushing on the ocean's surface. The wind causes the water to pile up higher than the ordinary sea level. Low pressure at the centre of a weather system also has a small secondary effect, as can the bathymetry of the body of water. It is this combined effect of low pressure and persistent wind over a shallow water body which is the most common cause of storm surge flooding problems.

On the west coast of WA, notable storm effects were recorded in May 1994, when the tidal elevation measured at Fremantle showed a storm surge of 0.98m above normal tide level. Similarly, a low passing near Busselton in May 2003 caused a storm surge of 0.8m at Fremantle at close to the time of high tide. The actual tide in this case was 0.5m above the HAT, and significant coastal erosion occurred due to tide and wind effects.

A strong westerly gale in July 1910 was reported to have caused damage along the west coast to as far north as Geraldton.

Geraldton was most impacted by the effects of the 2004 Indian Ocean tsunami. The tsunami visibly disturbed tidal movements for several days at most gauges on the west coast. No significant effects could be seen at Wyndham and Broome, with (residual) tidal effects from Pt Hedland to Carnarvon ~0.5m. The smallest amplitudes seen were at Exmouth Gulf. Geraldton was most impacted with residual tidal amplitudes up to 1.5m recorded (i.e. the tide level above normal tide level).

The 100 year ARI ocean water level at Geraldton has been estimated as RL1.35m (NTF Australia, 2000). The peak tide due to the tsunami (on the evening of 26 December 2004) was RL1.75m, 1.1m higher than the estimated HAT, and 0.6m greater than any previously recorded tide (Guria Consulting).

The 100 year ARI significant wave height offshore would probably be in the order of 10 m, while the equivalent in-shore heights would be about 40% of the off-shore heights, or 4m.

The height of the freeboard (i.e. the factor of safety) should reflect the risk or consequences of a breach occurring.
4 DESIGN RAINFALL AND FLOOD DISCHARGE ESTIMATION

4.1 DESIGN RAINFALL

Design Rainfall and Flood Discharge Estimation destination In order to compute design flood flows for ungauged catchments, a rainfall intensity and frequency and duration (IFD) relationship is required for the project area. The document “Australian Rainfall and Runoff” (ARR, revised 1998) is produced by the National Committee on Hydrology and Water Resources to provide information on design flood estimation and describes the procedures for determining IFD design rainfall information. There are a number of these programs used in Australian practice, all of which require the nine basic parameters obtained from Volume 2 of Australian Rainfall and Runoff.

The largest rainfall intensities are associated with tropical cyclones.

An IFD relationship was determined for the Oakajee site. By way of example, the 100 year ARI, 1hr duration event has a rain intensity of 47mm/hr; the 6hr duration event has a rain intensity of 13mm/hr (total rainfall 78mm). The 100 year ARI 72 hour total rainfall is about 200mm.

4.2 FLOOD ESTIMATION

ARR divides Western Australia into various regions for the purposes of flood estimation. Geraldton and Oakajee lie in the “Wheatbelt Region”. ARR recommends the use of the Rational Method and Index Flood Method as most appropriate for the Wheatbelt Region.

The Rational Method calculates the 10 year ARI flood discharge, which can then be factored for larger or smaller flood events by “frequency factors”. The Index Flood Method calculates the 5 year ARI flood discharge which can similarly be factored. The accuracy of the flood estimates is low and the SEE (standard estimate of error) for the methods is high (the actual flow may reasonably be considered to lie within a range of 70-150% of the calculated estimate. Both methods (particularly the Rational Method) are considered to overestimate the flows.

The RORB runoff routing method (computer based program) is a general runoff and stream flow routing program used to calculate flood hydrographs from rainfall and other channel inputs, and is believed to be the most reliable method for flood discharge estimation, when using ARR parameters such as the Kc factor, and calibrated runoff coefficients for continuing rainfall losses. It is generally anticipated that flood discharge estimations produced from RORB would be the most accurate, and recommended where the computational effort can be justified. Alternatively, the Index Flood Method is considered to provide a reasonable (but less accurate) estimate of the flood discharge.

Neither the Oakajee River or the Buller River has a Department of Water gauging station.
5 POTENTIAL SURFACE WATER IMPACTS AND MANAGEMENT

5.1 POTENTIAL SURFACE WATER IMPACTS
Potential surface water impacts as a result of the terrestrial port construction and operation include:

▼ Interruption to existing surface water flow patterns.
▼ Changes to the surface water runoff volume & quality in the environment downstream.
▼ Discharge of chemicals, including hydrocarbons, etc.
▼ Pooling of water, growth of invasive vegetation in low-lying areas.
▼ Erosion from disturbed areas such as construction areas, stockpiles, laydown yards, borrow pits, access roads, other cleared areas, causing sedimentation in downstream areas.

5.2 GENERAL MANAGEMENT OBJECTIVES
The Midwest landscape is subject to heavy rainfall at times, and there is a risk of erosion on disturbed or degraded lands with resulting downstream sedimentation. Generally environmental approvals for projects that involve land disturbance require adherence to surface water protection objectives. The general objectives with regards to surface water management are to:

▼ Maintain the integrity, functions and environmental values of watercourses and sheet flow.
▼ Prevent or minimise impacts on the quality of surface water resulting from construction and operations, and contain any contaminated water on-site.
▼ Ensure that the quality of water returned to local and regional surface water resources will not result in significant deterioration of those resources.

Surface water management requires an integrated approach, starting with defining the discrete catchment/drainage areas and associated flow paths. This allows appropriate engineering solutions and site-specific surface water controls to be developed, including diversion and dispersion mechanisms, and erosion and sedimentation controls. Sediment basins need to be considered for each disturbed catchment/drainage area, to prevent sediment (and other contaminants) from entering natural flow paths. Areas of major erosion hazard should be avoided where practicable, or specific management measures implemented to reduce the erosion risk.

Applicable guidelines and standards include:

▼ ANZECC/ARMCANZ Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000).

5.3 WATER MANAGEMENT STRATEGIES
The project will incorporate site-specific surface water controls during and after construction activities including clearing; drainage works; removal and storage of topsoil and earthworks. A drainage management program will be provided prior to the commencement of work on-site to ensure no unacceptable detrimental effects from drainage of the disturbed site on the water quality of surrounding creek and the ocean. The surface water mitigation measures to be adopted include:

▼ Clearing, land disturbance and vehicle movements will be kept to a minimum to achieve the design function, and that necessary for safe working conditions. Existing tracks will be used where possible.
Approvals will be obtained from the relevant government agencies prior to disturbance within any named watercourse (e.g. permit to interfere with bed and banks as required by the RIWI Act). Construction in river floodplains or other natural flow paths will be planned for the dry season, where practicable.

Upstream surface water flows will be diverted around structures, with appropriate grades, into adjacent or downstream surface water courses; sediment reduction control measures will be designed and implemented as required.

No untreated runoff from disturbed and operational areas will be permitted to enter any water course or the ocean. All onsite rainfall runoff from the disturbed areas will be prevented from leaving site, and directed via diversion drains to onsite basins that will temporarily store the water before use in dust suppression, processing or disposal. It is important therefore to segregate flows that originate from disturbed areas, from flows that originate from undisturbed areas (e.g. vegetated areas), which would typically have lower sediment levels.

Bunds and drainage diversion works around the perimeter of all infrastructure areas (including all ore handling and stockyard areas) will separate “clean water” (i.e. runoff from undisturbed areas which may discharge directly to watercourses or to the ocean) from runoff from disturbed areas, to reduce the volume of water to be treated; diversion drains and onsite channels will be constructed to ensure that they are stable, and do not of themselves cause downstream erosion.

The disruption to natural drainage patterns will be minimised, outside those directly affected by rail, ore handling and quarrying activities. No physical interference with the Oakajee or Buller Rivers will be permitted during development or operational phases (except at the haul road crossing of the Oakajee River). To this end, a minimum 100m buffer zone will be maintained to any defined watercourse.

On-site solid waste disposal will be minimised and properly managed. Controlled wastes, as defined by the Environmental Protection (Controlled Waste) Regulations, will be properly handled prior to removal from the site; process and wash down water will be collected and re-used.

Emergency response procedures will be used to manage events involving hazardous substances. Hazardous substances will be stored in properly bunded sites to minimise the potential for land, surface water or groundwater contamination.

Any runoff likely to contain oil contamination will be treated to remove such contaminants. The quality of water leaving the project area will be monitored by regular sampling.

Access and haul roads and other infrastructure which, because of their comparatively high run-off coefficients, have the potential to accelerate the transport of sediments and contaminants into creek systems, if management is inadequate. Roads will be constructed with a camber to drain water off the road surface and table drains constructed alongside to collect and drain this water away. These drains will be ‘turned out’ regularly and discharged into the natural surrounds (i.e. close to source). No sediment traps will be provided at these discharge points due to the small catchment areas.

Mitigation strategies should be capable of accommodating at least the design rainfall event, selected according to risk, but a minimum of the 10 year ARI flood event. Where control works are only to separate dirty and clean water circuits, with no flooding consequences if the control works are overtopped, then a lower design flow event (e.g. 10yr ARI) may be appropriate, with a nominal freeboard (0.3-0.5m).

Riprap (rock armour) or other protection will be used to protect earthworks and bunds against scouring and erosion by wave or flood flow action as required.

5.4 SEDIMENT BASINS

Sediment basins will be located at low points in the drainage system, and be predominantly constructed by forming earth bunds. The trap size (permanent pool settling zone) will be calculated to match the settling velocity of the target sediment size (medium sized silt particles...
> 20µm or 0.02mm) with the design flow (10 year ARI 6hr design rainfall event). The sediment trap is expected therefore to be effective in removing sand and medium to coarse silt which will be stored in the ‘sediment storage zone’.

The outlet structure can consist of a spillway only (normally full with the level reduced by seepage or evaporation only); or a ‘control’ outlet that allows continuous seepage from the basin (normally empty).

A control outlet, at the opposite end to the inlet, may consist of a perforated overflow pit / pipe system, outlet pipe(s) situated or a rock filter dam or filter weir arrangement. Where discharge pipework is to be included, consideration must be given to ease of cleaning of pipes that may become blocked with sediment.

Smaller flow events will thus be fully contained within the trap, and remain in the basin (drops sediment) for up to a day while the water seeps out. Larger events up to the design storm will pass through the trap and over a 100 year ARI capacity spillway. For these larger events, the basin will have a lower trapping efficiency, but there will be a commensurate dilution effect due to the large volume of water discharged. Alternatively, the sedimentation basin can be offline, so that large floods do not pass through it.

A ramp into the trap will allow sediment removal by machine and sediment traps will be cleaned out prior to the commencement of the wet season. Material removed from the trap will be contained so it cannot be transported in the next storm event, back into the sediment trap or to the downstream environment.

5.5 LICENCE TO DISCHARGE WATER

Certain industries with a significant potential to pollute the environment must hold a Works Approval (for construction) and a Licence or Registration (for operation) under the Environmental Protection Act 1986. These are known as ‘prescribed premises’.

Licences and Works Approvals are issued with binding conditions and are intended to prevent or minimise the potential for pollution. Registrations are issued to premises that are managed through industry-generic Regulations and Codes of Practice.

Licensing may include conditions relating to stormwater management, vehicle wash-down areas, water quality monitoring and reporting. For water discharge purposes, under 2004 Department of Environment and Conservation (DEC) guidelines, the quarry operation is one such premise. Licensing requirements will be determined in consultation with the DEC.

The management objective is to allow only suitably treated water to discharge into the creek or ocean and runoff should at least meet the ANZEC95% protection level environmental values for ‘recreation and aesthetics’ (i.e. runoff should not detract from the receiving water quality).

5.6 PERFORMANCE INDICATORS

Surface water performance indicators may include:

- Compliance with water management requirements of licences issued under the RIWI Act and the Environmental Protection Act.
- Monthly reports, current water monitoring data.
- Comparison of monitoring data against historical monitoring data.
- Any breaches of environmental licence conditions.
- Management of controlled waste (liquid waste, asbestos, clinical waste, tyres, etc).

5.7 SURFACE WATER MONITORING

Surface water monitoring will be carried out, and a monitoring and reporting program will generally include the following features:

- Water sampling procedures in accordance with Australian Standards.
- Records maintained of water quality sampling results, including any discharges occurring above water quality criteria and the duration for which the discharge was maintained.
A database kept of meteorological data, river flow and ocean data.

Personnel on site inducted regarding water quality management on-site.

Key stakeholders identified and consulted routinely.

If negative impacts attributable to the activities are detected, a report identifying contingency actions and timing will be implemented.

Remediation strategies will be implemented as required (e.g. remedying the source of contaminant, on-site interception, further erosion and sedimentation measures, etc).

Monitoring results will be included in the annual environmental report, identifying opportunities for improvement.

Regulators will be consulted on ongoing monitoring, management and contingency actions identified.

Regular site inspections will check for evidence of potentially polluting activities (e.g. seepages, erosion, non-captured ‘dirty water’ runoff).

Management systems will record environmental incidents, track and manage corrective actions resulting from incidents or community complaints; and record audit outcomes.

Internal auditing and compliance will be carried out.

The monitoring and auditing plan will be internally reviewed at least on an annual basis.
6 CONCLUSIONS AND RECOMMENDATIONS

Oakajee Port and Rail (OPR) is currently developing the Oakajee Port and Rail Development, which consists of a deepwater port facility at Oakajee (north of Geraldton), terrestrial port rail facilities and rail infrastructure from Oakajee Port to Jack Hills, with a spur linking to the existing WestNet rail system and another to Weld Range.

The OPR project is contained within part of the Oakajee Industrial Estate. The OPR site will include both terrestrial and marine port works. This report is concerned with the terrestrial port works.

The site topography is characterised by a sloping escarpment, separating an undulating plateau from the proposed port reclamation levels nearer sea level.

Within the industrial estate on the plateau area, the OPR facilities will include a car dumper and arrivals yard, as well as a rail administration area and other train facilities on the northern side, with access from North West Coastal Highway east of the site. The ore handling and terrestrial port facilities are located below the plateau area, and nearer sea level, with access from North West Coastal Highway south of the site. The terrestrial port facilities include stockpiles, processing and various offices and workshops. A temporary construction camp will also be built.

A quarry will be constructed about 2km north of the rail facilities and 0.5 km south of Coronation Beach Road, in undulating farmland just west of North West Coastal Highway. A haul road will link the quarry to the port area, crossing the Oakajee River.

The Midwest coast experiences a typical Mediterranean climate characterised by hot dry summers and mild wet winters.

The project is bounded in the north and south by the Oakajee and Buller Rivers respectively. On the plateau area, which forms the bulk of the industrial estate, the topography is rolling cleared farmland. Surface water generally infiltrates into the ground, and there are no incised surface water feature or watercourses visible. Where surface water runoff is generated, this drains either to the Indian Ocean directly from the site (over the escarpment), or via the Oakajee or Buller Rivers.

Geraldton was the most impacted area of the WA coastline by the 2004 Indian Ocean tsunami with a surge level of 1.5m recorded, resulting in the highest tide recorded at Geraldton (RL1.75m). This was 0.4m higher than the previously estimated 100 year ARI sea level (RL1.35m).

The height of adopted sea freeboards (i.e. the factor of safety) should reflect the risk or consequences of a breach occurring.

Water discharged off-site, to creek or the ocean, should meet stipulated ANZECC protection guidelines. Surface water monitoring will be carried out, as required with a monitoring and reporting program installed.

The general objectives with regards to surface water management include the maintenance of the integrity, functions and environmental values of watercourses and sheet flow, and to maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected.

As such engineering designs will incorporate site-specific surface water controls as required, including diversion and dispersion mechanisms, and erosion and sedimentation controls. Areas of major surface water flow and/or quality change will be identified and avoided where practicable, or specific management measures implemented to minimise its risk.
7 REFERENCES

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APPENDIX A    PHOTOS
From plateau looking west over proposed stockpile and port site

Within the Strategic Industrial Zone, looking east to Moresby Range
Farmland on plateau within the Strategic Industrial Zone

Farmland in the vicinity of the proposed quarry site
Looking south over the proposed quarry site from Coronation Road
In Australia
Perth
Suite 4
125 Melville Parade
Como WA 6152
Australia
Tel +61 8 9368 4044
Fax +61 8 9368 4055
perth@aquaterra.com.au

Adelaide
Ground Floor
15 Bentham Street
Adelaide SA 5000
Australia
Tel +61 8 8410 4000
Fax +61 8 8410 6321
adelaide@aquaterra.com.au

Sydney
Suite 9
1051 Pacific Highway
Pymble NSW 2073
Australia
Tel +61 2 9440 2666
Fax +61 2 9449 3193
sydney@aquaterra.com.au

In the UK
Lewes
Cobbe Barns
Beddingham, Lewes
East Sussex BN8 6JU
United Kingdom
Tel +44 1273 858 223
Fax +44 1273 858 229
lewes@aquaterra.uk.com

In Mongolia
Ulaanbaatar
701 San Business Center
7th khoroo
Sukhbaatar district
Ulaanbaatar
Mongolia
Tel +976 95854921
mongolia@aquaterra.mn

In Australia
Perth
Suite 4
125 Melville Parade
Como WA 6152
Australia
Tel +61 8 9368 4044
Fax +61 8 9368 4055
perth@aquaterra.com.au

Adelaide
Ground Floor
15 Bentham Street
Adelaide SA 5000
Australia
Tel +61 8 8410 4000
Fax +61 8 8410 6321
adelaide@aquaterra.com.au

Sydney
Suite 9
1051 Pacific Highway
Pymble NSW 2073
Australia
Tel +61 2 9440 2666
Fax +61 2 9449 3193
sydney@aquaterra.com.au

In the UK
Lewes
Cobbe Barns
Beddingham, Lewes
East Sussex BN8 6JU
United Kingdom
Tel +44 1273 858 223
Fax +44 1273 858 229
lewes@aquaterra.uk.com

In Mongolia
Ulaanbaatar
701 San Business Center
7th khoroo
Sukhbaatar district
Ulaanbaatar
Mongolia
Tel +976 95854921
mongolia@aquaterra.mn