Burdekin River Pipeline EA Amendment

Guideline Response to Water

September 2014
preparing on behalf of
Evolution Mining - Mt Carlton Operations
Limitations of this Report

Client: Evolution Mining - Mt Carlton Operations
Prepared by Northern Resource Consultants (NRC)

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Executive Summary

The Mt Carlton Operation (MCO) proposed Burdekin River pipeline project is located within the Lower Burdekin River Sub-Basin and the Bowen River Sub-Basin (DNRM 2014). The proposed pipeline is a 39km long HDPE 225mm subterranean pipe running from pumping infrastructure at the Burdekin River to the main site water dam (MSWD) at Mt Carlton. The proposed pipeline will traverse a total of 20 creeks, nine of which are located in the already approved MCO mining lease MLA10343. The pipeline will be suspended from wire rope at each creek crossing.

The creeks located in the pipeline project area are ephemeral, with some perennial pools as a result of groundwater expression at points of low relief during the dry season. There are no perennial pools in the vicinity of the proposed pipeline creek crossings.

Environmental values of surface water and groundwater in the region include aquatic ecosystems, irrigation, stock watering, human consumption, drinking water and cultural and spiritual values (NQ Dry Tropics\textsuperscript{2} 2009, NQ Dry Tropics\textsuperscript{3} 2009, AGE 2010).

The pipeline construction is envisaged to take 18 weeks and the activity will involve minimal, short-term environmental disturbance. The pipeline will be buried to a depth of 300mm with the excavation, laying of the pipe and backfilling and grading of the trench being completed promptly.

This guideline response details how potential impacts from the construction and operation of the proposed project will be mitigated or managed to protect the environmental values of the Lower Burdekin River and Bowen River Sub-Basins.

Rehabilitation of the construction disturbance will be undertaken progressively. Rehabilitation of the pipeline area will include respreading and grading topsoil and a process of backfilling the pipeline trench promptly to facilitate nutrient retention in the stockpiled soil and ensure viable germination from the existing seed bank within the disturbed soil to facilitate revegetation.
Introduction

1. Background

The Mt Carlton Operation (MCO) is a gold, silver and copper mining project in North Queensland. The mine has been in operation since early 2013. Water used in processing at the site is sourced from pit dewatering bores and from rainfall across the lease that is collected in the main site water dam (MSWD).

As part of MCO’s ongoing water supply strategy, a 400 ML raw water allocation has been secured from an adjoining landholder of the project. Through negotiations with the landholder of Strathalbyn Station, which lies due west of ML10343 and underlies MLA10375, MCO have arranged to utilise the landholder’s existing water allocation from the Burdekin River up to 400ML annually.

This EA Amendment application is for the construction and operation of a 225mm subterranean HDPE pipeline and associated pumping infrastructure, to carry river water from the Burdekin River to the MSWD at MCO for processing. The proposed pipeline will be approximately 39km long. Approximately 15km of that pipeline will follow the existing pipeline corridor along MLA10375, which hosts the King Creek substation power line and under which the raw water pipeline is also approved as an external water pipeline infrastructure corridor as per Schedule A of the site’s EA EPML00982113. The remaining 24km of pipeline that is the subject of this application for a mining lease will branch off from Johnny Cake Road and then follow the Strathalbyn Station Access Driveway across Strathalbyn Station to the Burdekin River.

The proposed mining lease will be 8m wide along the remaining 24km, comprising an additional 19.2ha of disturbance under the site’s EA. Utilisation of pumping infrastructure already in place at the Burdekin River is included in the agreement between MCO and the landholder, though MCO intend to upgrade some of the pumping equipment to ensure most effective performance and monitoring of water uptake.

The excavation of the pipeline corridor, laying of the piping and rehabilitation of the excavation trench is expected to take 18 weeks in total and will be carried out in stages to minimise the risk of environmental harm. The proposed activity is considered to have a relatively low risk of environmental harm given the linear nature of the disturbance, the decision to bury the pipeline to a depth of approximately 300mm and the intent to rehabilitate the pipeline trench progressively.

This application to amend an Environmental Authority describes the environmental values of water in the region, the potential impacts to those values posed by the construction and subsequent operation of the proposed pipeline, and strategies to mitigate the risk of those potential impacts.
2. Objective

The objective of this report is to demonstrate that the proposed pipeline does not adversely impact the environmental values relating to water in the receiving environment. This report details the following aspects of surface water and groundwater with respect to the proposed pipeline corridor:

- Methodologies employed for assessing the water within the study area.
- The environmental values of water within the project area.
- Potential impacts of the project on water and recommendations for mitigating impacts.

This report has been prepared according to the requirements of guideline EM963, Application Requirements for Activities with Impacts to Water (DEHP¹, 2013) to support the EA amendment application.

3. Legislation

3.1 Environmental Protection Act 1994

The stated objective of the Environmental Protection Act 1994 (the EP Act) is: ‘To protect Queensland’s environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends’.

Under the EP Act all persons have a general environmental duty, which is stated under section 319: ‘A person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm.’

Section 320 of the EP Act makes it a requirement to notify the DEHP, the administering authority, if serious or material environmental harm has occurred. However, the requirements under Section 320 do not apply if the harm is authorised under an environmental authority.

3.2 Environmental Protection Regulation 2008

The Environmental Protection Regulation 2008 (EPR) defines the nature of Environmentally Relevant Activities (ERA), and the process required for the preparation and submission of Environmental Impact Statements (EIS), Terms of Reference (TOR) and Environmental Authority (EA) applications.

The EPR provides a decision-making framework for the determination of applications made under the EP Act, sets fees payable and requirements for financial assurance, identifies environmental values, waste and waste disposal requirements, addresses environmental nuisance and complaints management and process for appeal under the EP Act.
3.3 Environmental Protection (Water) Policy 2009

The *Environmental Protection (Water) Policy 2009* (the EPP (Water)) provides a framework for defining the environmental value of all inland water bodies (surface water, groundwater and coastal water bodies) in Queensland and sets guidelines for their water quality. The EPP (Water) aims to protect water to the designated environmental value.

3.4 Water Act 2000

The *Water Act 2000* (the Water Act) regulates the interference with, and extraction of, any water in Queensland. It provides a regulatory framework for sustainable extraction and management of water resources in the state. Section 19 of this Act declares that all rights to the use, flow and control of all water in Queensland are vested in the state. Section 808 makes it an offence to take, supply, or interfere with water without authority. Permissible scenarios for withdrawal or interference with water without water entitlement are listed in section 20 of the Act. Part 3 of the Water Act designates authority to formulate basin specific water resource plans and regulates their implementation.

The landholder of Strathalbyn Station holds current water allocation title reference 46012734 created on 14 December 2009. The allocation is for 400ML per annum to be used for any purpose. MCO has reached agreement with the landholder to utilise that water allocation.

3.5 Wild Rivers Act 2005

The Queensland Parliament passed the *Wild Rivers Act 2005* in October 2005. The purpose of the Act is to preserve the natural values of wild rivers. It does this by regulating most future development activities within a declared wild river and its catchment area.

The Burdekin River is not declared a wild river under the Wild Rivers Act 2005.

4. Water Impacts Assessment Methodology

In order to investigate the potential impacts to water that the Burdekin River Pipeline project may cause, the following methodology was undertaken:

A desktop analysis of previous water studies and guidelines of the local area were reviewed and relevant findings were evaluated with respect the proposed pipeline corridor. Reports include:

- Mt Carlton Receiving Environmental Monitoring Program (MCO 2014)
- Burdekin Water Quality Improvement Plan (NQ Dry Tropics 2009)
- Mt Carlton Gold Project Environmental Management Plan (AGE 2010)
- Creek ecology and water quality: Mount Carlton Project (AARC 2009)

A field survey was undertaken to evaluate the proposed pipeline project area. Northern Resource Consultants (NRC) in cooperation with Evolution Mining investigated each creek bed
that the proposed pipeline will cross (refer to the creek crossing map in the mapping appendix of this document). Photographs were taken upstream and downstream of each creek in April 2014 to show the conditions of the creek beds at the end of the wet season. These photographs are included in the appendices of this report.

The wetlands in the vicinity of the proposed pipeline project area were also surveyed to determine the status of the ecosystems, plant species and whether the wetlands are of environmental significance or are vegetation management wetlands.
Environmental Values

1. Guidelines

This section of the application aligns with EHP’s guideline for application requirements for activities with impacts to water (EM963). Environmental impacts on water in Queensland are regulated under the EPA 1994 and subordinate legislation including:

- Environmental Protection Regulation 2008
- Environmental Protection (Water) Policy 2008 (EPP (Water)).

The EPP (Water) aims to protect Queensland’s waters while allowing for ecologically sustainable development. The EPP framework includes the identification of environmental values (EV) and water quality guidelines (WQG) for aquatic ecosystems and human uses such as consumption, recreation, industrial use and farm supply. Environmental values and water quality guidelines are based on the National Water Quality Management Strategy (NWQMS, 2000), Implementation Guidelines (1998) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) (DEHP1 2013).

There are some inconsistencies between the Department of Natural Resources and Mines (Queensland Globe) (DNRM 2014) and the NQ Dry Tropics Regions (Burdekin Water Quality Improvement Plan) (NQ Dry Tropics 2009) mapping of sub-catchment/basins in the Burdekin River Catchment. The DNRM, Queensland Globe mapping has been assumed to take precedence and has been referred to in this report for basin and sub-basin mapping (refer to the Drainage Basins map in the mapping appendix of this document). Regardless of the inconsistencies in catchment boundaries, the project area is located within both catchments at different sections of the pipeline. The proposed pipeline is located in the North Queensland (NQ) Dry Tropics Region within the Lower Burdekin River Sub-Basin and the Bowen River Sub-Basin (refer to the Drainage Basins map in the mapping appendix of this document).

EVs and WQGs for the NQ Dry Tropics Region are currently under development. Environmental values and water quality guidelines for this document will also be based on the Burdekin Water Quality Improvement Plan (NQ Dry Tropics² 2009, NQ Dry Tropics³ 2009) and the Queensland Water Quality Guidelines (2009).

2. Site Plan

The proposed water transfer pipeline between the Burdekin River and Mount Carlton Operations (MCO) mine site will be predominantly subterranean and approximately 39km in length (refer to the project location map in the mapping appendix of this document). The proposed route of the pipeline will track from MCO’s main site water dam, southwest along the MCO power line corridor. The pipeline then tracks northwest along Johnny Cake Road, where it branches off and follows the Strathalbyn Station access road to meet the Burdekin River on Strathalbyn Station.
The proposed pipeline corridor overlies two pastoral holdings, Strathbogie Station and Strathalbyn Station. The primary use on all of these properties is cattle grazing, as well as the existing mining operation on Lot 4899 and SB765.

Table 1: Lot on plan for the underlying pastoral stations along the pipeline

<table>
<thead>
<tr>
<th>STATION</th>
<th>LOT ON PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strathbogie Station</td>
<td>4899 SB7665</td>
</tr>
<tr>
<td>Strathalbyn Station</td>
<td>7 SB730</td>
</tr>
<tr>
<td></td>
<td>507 SP17655</td>
</tr>
</tbody>
</table>

There are a number of pre-existing disturbances along the pipeline route including land clearing, cattle grazing, exotic pasture grasses and weed invasion. Furthermore, the entire length of the pipeline route utilises previously cleared areas for existing infrastructure such as power line corridors, service roads, and access tracks.

The Lower Burdekin River Sub-Basin is a mostly dry, ephemeral creek system drained by King Creek, which flows into the Burdekin River; and Herbert Creek, a tributary of the Bogie River (NQ Dry Tropics3 2009). Dominant land use in this sub-catchment is grazing.

The Bowen River Sub-Basin has largely sandy, ephemeral creek systems. A major source of sediment and particulate nutrients affecting water quality is hillslope erosion (NQ Dry Tropics2 2009).

The proposed pipeline traverses a total of 20 creeks, nine of which are located in the already approved MCO mining lease, MLA10375. The pipeline will be suspended from wire rope, anchored by concrete plinths at each creek crossing. The pipeline is positioned to avoid any impact on surrounding wetlands of importance (refer to the mapping appendix of this document).

The project site is located on the lower northern foothills of the Herbert Range, formed by Mount Wickham Rhyolite (comprising predominantly basalt and andesite), which represent intrusive remnants within the regional Lizzie Creek Volcanics.

Groundwater in the region comprises shallow perched aquifers (AGE 2010). Recharge to the aquifer systems occurs by direct infiltration of rainfall, primarily in higher and steeper topographic areas where there is outcrop of the volcanics and shallow soil cover. Groundwater flow is from the higher topography in areas of the proposed southern lease to the north, with discharge to the creeks.

A flooding assessment has been conducted for the major water courses in the vicinity of the proposed pipeline, including the Burdekin River, King Creek and Herbert Creek. An indication of areas potentially at threat of inundation by flooding was assessed using the Queensland Floodplain Assessment Overlay (DNRM 2014). The estimated flood boundaries are presented in the mapping appendix of this document. There is potential for flooding to occur in the proposed pipeline area near King Creek at the Burdekin River end of the Pipeline. If there is a flood event, there is no potential for the pipeline and wiring across creeks to be damaged or for debris to be trapped because the pipeline will be suspended above the historical flood level at all creek crossings. Where the pipeline will be subterranean, buried to a depth of approximately 300mm, there will be no impacts due to flooding.
The MCO project area is located within the traditional homelands of the Birri People. The Birri People have a registered Native Title claim over the project (Claim No. QUD6244/98) and have an existing Indigenous Land Use Agreement for mineral exploration. A comprehensive field survey was carried out over the proposed mine site and corresponding power line corridor in 2004 and a total of 93 Aboriginal cultural heritage sites and values were recorded. These findings included stone artefact scatters, isolated artefact finds, scarred trees and a large (andesite) rock platform with axe grinding grooves.

3. Surface Water

The proposed project comprises the construction and operation of a water transfer pipeline. The project will have no envisaged discharges or releases to the environment. The pipeline will transport raw water; there is no transfer of mine water containing contaminants. The pipeline construction is scheduled to start and finish within the dry season with the possibility of extending into the early wet season, before the heavy rainfall events that characterise the wet season in the region.

3.1 Background Water Quality

There is no data available for surface water quality in the pipeline project area sub-basins. However, MCO monitor the water quality of four reference sites upstream of the mining operations. These sites are at Bogie River (BR1 and BR2) and Herbert Creek (HC1 and HC2) (refer to the surface water map in the mapping appendix of this document). The water of the watercourses in the project area and the surrounding area runs off the lower northern foothills of the Herbert Range. The water quality from these watercourses is an indication of the type of water quality of the surrounding pipeline area.

The physicochemical parameters at reference sites (BR1, BR2, HC1, HC2) on MCO’s mining lease were monitored during 2013 to 2014. pH at the reference monitoring locations exhibit neutral to slightly alkaline conditions, ranging from 7.0 – 8.4 (Figure 1). These readings were all within the MCO EA limits (as shown in the figure), however, during a number of the monitoring events the pH was recorded above pH 8, the ANZECC guidelines upper limit for aquatic ecosystems. Figure 2 presents the electrical conductivity (EC) at the reference monitoring locations. The EC at the reference sites varied significantly from <200µS/cm to >1800µS/cm with readings consistently higher than ANZECC water quality guidelines for aquatic ecosystems.

Surface water quality characteristics within the reference area can exceed the Australian and New Zealand Environment and Conservation Council (ANZECC 2000) guidelines (protection of aquatic ecosystems) at background concentrations. The water quality from the reference locations BR1, BR2, HC1 and HC2 are however, all within the ANZECC guidelines Livestock...
drinking water, irrigation and aquaculture limits. The water quality in the reference area is fit for stock watering, irrigation of moderately tolerant crops and human consumption (ANZECC 2000).

Figure 1: pH of surface water at Bogie River and Herbert Creek
3.2 Stream Orders

Stream order is a technique for classifying streams based on their relative size and location within a catchment. Streams are classified based on the number of tributaries upstream as the physical characteristics are modified, streams are connected and ultimately become rivers (Healthy Waterways 2014).

The proposed pipeline corridor crosses a number of first and second order streams along the proposed route, as well as the more significant King Creek, which is a fourth order stream. Given the prevalence of low stream order watercourses in the area, it was not possible to avoid the need for the pipeline to traverse watercourses to reach its destination.

The stream orders in the pipeline project area are as follows (refer to the mapping appendix of this document):

- No watercourses have a stream order of 5
- Two watercourses have a stream order of 4
- One watercourse has a stream order of 3
- Eight watercourses have a stream order of 2
- 14 watercourses have a stream order of 1.

There are three watercourses in the project area that have a stream order equal to or greater than 3. The pipeline is proposed to be constructed in the dry season when there is the least
chance of a flow in the creeks. This will ensure minimal impact on the creek eco-hydrology during construction. No impacts on creek hydrology is envisaged during the operational phase of the pipeline project as it will carry raw water.

The concrete plinths from which the wire rope will be suspended will be set back from the riparian zones at the top of the creek banks, avoiding any impacts to creek hydrology. Construction in the dry season, using an approach of prompt backfilling of construction trenches, will ensure minimal exposure of stockpiled topsoil to potential wind and rain erosion, thereby mitigating the risk of sediment runoff from construction areas.

3.3 Water Quality Guidelines

Water quality guidelines relevant to the Burdekin River pipeline project area are the Burdekin Water Quality Improvement Plan (2009), the Queensland Water Quality Guidelines (2009) and the ANZECC guidelines (2000). The specific Environmental values and Water Quality Objectives for the NQ Dry Tropics area are under development.

3.4 Draft Environmental Values

The aquatic ecosystems of the Lower Burdekin River Sub-Basin and Bowen River Sub-Basin are considered to be slightly to moderately disturbed due to land uses including cattle grazing (NQ Dry Tropics³ 2009, NQ Dry Tropics² 2009). The biological communities are thought to remain in a healthy condition. Environmental values of human use include stock watering and cultural and spiritual values. Human environmental uses may also include recreation, irrigation, human consumption, drinking and cultural/spiritual values (NQ Dry Tropics² 2009). No high ecological value waters have been identified in the pipeline project area (NQ Dry Tropics² 2009, NQ Dry Tropics³ 2009).

There are no environmental values of visual, primary or secondary recreation in the project area. The pipeline project is located on private property, with no public access to the project area.

Based on the draft environmental values defined by NQ Dry Tropics (2009) and the known water quality of the surrounding areas, the environmental values fit for surface water in the proposed project area are aquatic ecosystems, irrigation, stock water, human consumption, drinking water and cultural/spiritual values. Definitions of the environmental values of the project area are provided in Table 2.

Table 2: Environmental value definitions (Greiner et al 2006)

<table>
<thead>
<tr>
<th>ENVIRONMENTAL VALUE</th>
<th>SYMBOL</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic ecosystems</td>
<td>🐠</td>
<td>A community of organisms living within or adjacent to water including intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas</td>
</tr>
<tr>
<td>Irrigation</td>
<td>🌫</td>
<td>Water supply for irrigating crops, pastures, parks and gardens</td>
</tr>
</tbody>
</table>
### Environmental Values

<table>
<thead>
<tr>
<th>ENVIRONMENTAL VALUE</th>
<th>SYMBOL</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock water</td>
<td>🐮</td>
<td>Water to be used for the production of livestock</td>
</tr>
<tr>
<td>Human consumption</td>
<td>🍅</td>
<td>Consumption of wild of stocked fish, crustaceans and shellfish</td>
</tr>
<tr>
<td>Drinking water</td>
<td>🥧</td>
<td>Water to be directly consumed by humans for drinking with minimal treatment</td>
</tr>
<tr>
<td>Cultural and spiritual</td>
<td>🕉</td>
<td>Values of traditional owners including lifestyles, landmarks, artefacts, aesthetic, historical, scientific, social or other significance, to the present generation or past or future generations.</td>
</tr>
</tbody>
</table>

### 3.5 Water Quality Objectives

The water quality objectives for the pipeline project area are presented in Table 3; limits are included for pH, electrical conductivity, turbidity and total dissolved solids. These limits are from the ANZECC guidelines (2000) triggers for slightly disturbed aquatic ecosystems in Tropical Australia.

#### Table 3: Water quality objectives for pipeline project area

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6-8</td>
</tr>
<tr>
<td>EC (µs/cm)</td>
<td>20-250</td>
</tr>
<tr>
<td>TDS (mg/L)</td>
<td>15-170</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>2-15</td>
</tr>
</tbody>
</table>

Note: It is recommended that these values be inserted into the EA as trigger limits for monitoring during construction of the pipeline project.

### 4. Groundwater

#### 4.1 Background water quality

There are a number of registered groundwater bores located within and surrounding the pipeline project area (DNRM 2014). These bores are listed in Table 4. The bores are primarily used by farmers for stock water and farm supply. No water quality results are available for these bores.
Table 4: Registered bores in the pipeline area and surrounds (DNRM 2014)

<table>
<thead>
<tr>
<th>BORE NUMBER</th>
<th>BORE NAME</th>
<th>DETAILS</th>
<th>COORDINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN 38509</td>
<td>Queens Creek Bore</td>
<td>Sub-Artesian, Depth 12.2m, Outside diameter 152mm, Date 9/5/1972</td>
<td>543535, 7753850</td>
</tr>
<tr>
<td>RN 38511</td>
<td>Near Mount Pollux</td>
<td>Sub-Artesian, Depth 19.50m, Outside diameter 900mm, Date 9/5/1972</td>
<td>547135, 7746320</td>
</tr>
<tr>
<td>RN 70372</td>
<td>Pandanas Yards Bore</td>
<td>Sub-Artesian, Depth 25.50m, Outside diameter 125mm, Date 3/6/1987</td>
<td>534895, 7756080</td>
</tr>
<tr>
<td>RN 38499</td>
<td>King Creek Bore</td>
<td>Sub-Artesian, Depth 15m, Outside diameter 152mm, Date 1/1/1926</td>
<td>544705, 7755910</td>
</tr>
<tr>
<td>RN 31877</td>
<td></td>
<td>Sub-Artesian, Depth 33.5m, Outside diameter 152mm, Date 15/1/1970</td>
<td>549685, 7755450</td>
</tr>
<tr>
<td>RN 39952</td>
<td></td>
<td>Sub-Artesian, Depth 45.70m, Outside diameter 152mm, Date 27/9/1975</td>
<td>556335, 7755419</td>
</tr>
</tbody>
</table>

The closest relevant bores that have water quality records are MCO reference bores, MB1, MB2 and MB3. These bores are located between 2km and 27km from the pipeline. Results from reference bores MB1, MB2 and MB3 are being utilised because they are located upstream of the mining project and they provide an indication of groundwater quality in the surrounding areas of the pipeline project.

Figure 3 presents the pH of groundwater sampled at reference bores throughout 2010 to 2014. pH ranges from 6.77 to 8.3, slightly basic to slightly acidic. Electrical conductivity of groundwater monitored at the MCO reference bores ranges from 1500µS/cm to 5750µS/cm, as presented in Figure 4.

Major ion analysis was undertaken for the reference bores, the main water types for MB1, MB2 and MB3 are Na-Ca-HCO3-Cl, Na-Ca-Mg-HCO3-Cl and Na-Ca-SO4-Cl-HCO3, respectively. The ionic composition of groundwater at the bores has been relatively similar over time.
Figure 3: pH of groundwater reference bores

Figure 4: Electrical conductivity of groundwater reference bores
4.2 Environmental Values of Groundwater

The current uses of groundwater are stock water, farm supply, and irrigation (primarily used for beef cattle). During periods of drought, landowners rely heavily on bores for stock water supply and irrigation. Based on the project areas and surrounds groundwater regime and current knowledge of groundwater occurrence and discharge in the area, groundwater dependent ecosystems (GDE’s) may be associated with waters in the pipeline project area. GDE’s are communities of organisms whose life processes are dependent on groundwater; they are likely to be animals, species of plants, and other organisms (AGE 2010).

Environmental values of the project area are believed to be aquatic ecosystem protection, stock water, irrigation and farm supply.

4.3 Water Quality Objectives

There will be no impacts to groundwater from the proposed pipeline project. The pipeline is transporting raw water. There is no groundwater uptake associated with the pipeline project. There are no planned releases or unplanned discharges that will impact on groundwater. Therefore no groundwater quality objectives will be specified for the proposed project area.
Possible Impacts to Environmental Values

1. Potential Impacts

There are two stages of the proposed pipeline project, construction and operation. Construction of the pipeline has some potential to impact the environmental values of water identified in and surrounding the project area and as such construction activities need to be managed appropriately. The possible impacts to environmental values are outlined below.

2. Discharges and Releases

The pipeline will be mainly subterranean with no planned discharges or releases to the surrounding areas. During operation, it is unlikely that water will leak from the pipeline, if this does occur there will be no additional impacts to environmental values through contamination, as the leak will only be raw water.

3. Water Infrastructure

There are no water storage dams associated with this EA amendment. The project comprises a pipeline that will cross over 20 creeks, including King Creek and Herbert Creek. During the construction phase of the pipeline, no impacts on these creeks, due to water infrastructure is expected. The pipeline will be supported by a wire rope, which will be anchored with concrete plinths on either side of each creek crossing. The concrete plinths will be set back from the riparian zones at the tops of the creek banks. Additional infrastructure, which will be constructed as part of the proposed pipeline includes the upgrade of pumping equipment at the Burdekin River.

The pumping infrastructure will comprise a two-part infrastructure solution with river extraction pumps and bank-based pumps working in tandem. The extraction pumps will be Sakuragawa UCF-2206 model heavy duty dewatering pumps. Two of these pumps will be pontoon mounted over the river, sucking water from the surface of the river. The extraction pipes have a mesh aperture to ensure only small suspended solids enter the pumping infrastructure. The riverbank pumps will be Stalker 80x50 – 315 CRI/CRI/SS model pumps. The riverbank infrastructure will be set back 100m from the bank of the Burdekin River. There will be a single 73kL water storage tank included in the pumping station infrastructure.
4. **Groundwater**

The pipeline will be subterranean, buried at a depth of approximately 300mm. The pipeline will be transporting raw water, no transport of mine water containing contaminants will occur. There is no planned release or unplanned discharges that will impact on groundwater. There is no intake of groundwater. There will be no impacts to groundwater from the proposed pipeline project; therefore no groundwater modelling has been conducted in the vicinity of the proposed project area.

5. **Wetlands**

The *Flora and Fauna Technical Report* (NRC 2014) included with this EA Amendment as an appendix of the Guideline Response to EM961 *Application Requirements for Activities with Impacts to Land* (NRC 2014) identifies several referable wetlands mapped in the vicinity of the proposed pipeline corridor near the Burdekin River. These wetlands are, however, at least 1.5km from the nearest section of the proposed pipeline and all construction works will be significantly outside the 200m protection zone buffer that is typically applied to such wetlands. It is therefore unlikely that the values of these referable wetlands will be affected in any way by the proposed pipeline.

There are several areas mapped as wetlands on the vegetation management wetlands map near the Burdekin River in close proximity to the proposed pipeline. Ground-truthing surveys revealed that these areas are highly disturbed and modified with existing impacts from:

- An access road and powerline corridor,
- Vegetation clearing,
- Cattle grazing,
- Invasion by numerous exotic plant species included several declared class two pest species,
- Modified hydrology from the construction of a small dam and other earthworks.

In some areas, the existing disturbance is so significant that the vegetation present is not considered to be of remnant status. This is particularly the case for the existing power line corridor and access road, which are collocated where the mapped vegetation management wetlands occur. The proposed pipeline will follow the route of the existing linear infrastructure corridor at this location, utilising the areas of existing disturbance. The construction and operation of the proposed pipeline is highly unlikely to have any further impact on any area mapped as a vegetation management wetland.

6. Ecology and Hydrology

The pipeline will be a 39km, mainly subterranean structure that utilises previously cleared areas, roads and access tracks. The project will not alter the flow of any creeks, negligible vegetation cover will be removed, the runoff in the project area will not be altered and there will be no uptake from any watercourses that the pipeline transverses. It is therefore reasonable to expect that the proposed pipeline will have no impact on the hydrology of the project areas and its surrounds.

Although the construction is planned in the dry season, in the event of rainfall during construction, there is a potential of very low level impacts on aquatic ecosystems from sedimentation. In order for this impact to occur, there would have to be sustained, heavy rainfall event, sufficient to cause flow in the creeks, erosion of stockpiled soil and runoff from the pipeline area to the receiving waterways. In order to avoid such a weather event, the construction manager should check the weather daily during construction and take precautionary measures in the event of a heavy rainfall event being forecast, e.g. backfilling open trenches to ensure the trenches do not become waterlogged and mitigate the risk of sediment runoff from stockpiled soil.

The riparian zone and banks of each creek also have the potential to be impacted by machinery during the pipeline construction. The Flora and Fauna Technical Report of the Land Guideline Response for the Burdekin Pipeline EA Amendment (NRC 2014) identifies a species listed as vulnerable under the EPBC Act and the NC Act, Black Ironbox (Eucalyptus raveretiana), located along the banks of King Creek and some smaller tributaries in the area.

The Flora and Fauna Technical Report includes a management plan to avoid impacts to this species. Adherence to this management plan should be sufficient to avoid impacts to Black Ironbox trees in the vicinity of the pipeline.

Impacts to the riparian zone and banks of the creeks in the project area will be avoided by utilising existing disturbance from the access road and avoiding disturbance to the ground between the top banks. The pipeline sections that traverse over creeks in the project area will be supported by wire rope, anchored to concrete plinths set back from the riparian zones at the tops of each creek bank.

The construction of the pipeline will be undertaken during the dry season, therefore minimising the potential impacts, as most of the creeks are ephemeral. Undertaking construction during the dry season minimises the chance of a rainfall event that may contribute to erosion of disturbed earth and cause some sediment runoff. Prompt backfill and grading of the pipeline trench during construction should be sufficient to mitigate the chance of erosion and sedimentation as a result of pipeline construction.


7. Wild Rivers

There are no declared wild river areas along the pipeline transect (refer to the wild rivers map in the mapping appendix of this document). There will be no impact to wild river areas from the construction and operation of the proposed pipeline.
8. Hazards and Risk Assessment

The following risk assessment follows Evolution Mining's own corporate risk assessment methodology applied across all sites. The pipeline construction and operation project is a relatively low risk activity in terms of potential impacts to the receiving environment. However, there are elements involved in the construction of the pipeline and the design of the creek crossings that merit a clear mitigation strategy to ensure the project progresses without incident.

Operationally, the risk of environmental impact from the operation of the pumping station infrastructure and the pipeline itself is very low. The pipeline is designed to transfer raw water from the Burdekin River to the MSWD at MCO ML10343, and even in the event of an integrity failure in the pipeline and pumping infrastructure, the water released will be raw river water and therefore will not pose a risk of environmental harm through release of contaminants.

The risk assessment matrix used to define different risk consequences is presented in Table 5. The risk assessment tools used in devising this risk register are presented in Table 6. Risks posed by the proposed pipeline project are addressed in Table 7.

Table 5: Risk assessment matrix as applied to Environmental Risk (Evolution Mining 2014)

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Risk</th>
<th>Environmental Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Catastrophic</td>
<td>Significant and permanent environment damage or effect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 10,000 L Hydrocarbon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;50,000 L Mine Water, Slurry, Tailings etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suspension of operations</td>
</tr>
<tr>
<td>4</td>
<td>Major</td>
<td>Widespread and long-term (&gt;3 year) environmental damage or effect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,000-10,000L Hydrocarbon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10,000-50,000L Mine Water, Slurry, Tailings etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fine by statutory authorities</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
<td>Medium-term (&lt;3 year) environment damage or effect to a small area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>250- 1,000 L Hydrocarbon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5,000 - 10,000 L Mine Water, Slurry, Tailings etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reportable</td>
</tr>
<tr>
<td>2</td>
<td>Minor</td>
<td>Short-term (&lt;1 year) environment damage or effect to a small area</td>
</tr>
<tr>
<td>RISK ASSESSMENT MATRIX</td>
<td>ENVIRONMENT</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-250 L Hydrocarbon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100-5,000 L Mine Water, Slurry, Tailings etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-reportable</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>No lasting environment damage of effect</td>
<td></td>
</tr>
<tr>
<td>Very Minor</td>
<td>0-20 L Hydrocarbon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0-100 L Mine Water, Slurry, Tailings etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-reportable</td>
<td></td>
</tr>
</tbody>
</table>
Table 6: Risk assessment parameters used in establishing the environmental risk register (Evolution Mining, 2014).

<table>
<thead>
<tr>
<th>RISK ASSESSMENT TOOLS</th>
<th>LIKELIHOOD / PROBABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Highly Improbable</td>
<td>Once per 100 years or Practically Impossible or Conceivable, but only in extreme circumstances</td>
</tr>
<tr>
<td>Unlikely / Improbable</td>
<td>Once per 10 years or Unlikely to occur or Has occurred elsewhere in the mining industry in the last 10 years</td>
</tr>
<tr>
<td>Possible</td>
<td>Once per year or Could occur or Has occurred elsewhere in the mining industry in the last year</td>
</tr>
<tr>
<td>Likely / Probable</td>
<td>Once per month or Likely to occur</td>
</tr>
<tr>
<td>Highly Probable</td>
<td>Once per week or Will occur or Common or frequent occurrence</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consequence</th>
<th>1 Very Minor</th>
<th>2 Minor</th>
<th>3 Moderate</th>
<th>4 Major</th>
<th>5 Catastrophic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 (Low)</td>
<td>2 (Low)</td>
<td>6 (Moderate)</td>
<td>9 (Moderate)</td>
<td>16 (High)</td>
</tr>
<tr>
<td>2</td>
<td>3 (Low)</td>
<td>4 (Low)</td>
<td>7 (Moderate)</td>
<td>14 (High)</td>
<td>17 (High)</td>
</tr>
<tr>
<td>3</td>
<td>5 (Low)</td>
<td>8 (Moderate)</td>
<td>13 (High)</td>
<td>15 (High)</td>
<td>23 (Extreme)</td>
</tr>
<tr>
<td>4</td>
<td>9 (Moderate)</td>
<td>14 (High)</td>
<td>15 (High)</td>
<td>21 (Extreme)</td>
<td>24 (Extreme)</td>
</tr>
<tr>
<td>5</td>
<td>16 (High)</td>
<td>17 (High)</td>
<td>23 (Extreme)</td>
<td>24 (Extreme)</td>
<td>25 (Extreme)</td>
</tr>
<tr>
<td>ESTABLISH CONTEXT</td>
<td>IDENTIFY HAZARDS</td>
<td>ASSESS THE RISK</td>
<td>IDENTIFY EXISTING CONTROLS</td>
<td>EVALUATE THE RISKS</td>
<td>TREAT THE RISK</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------</td>
<td>----------------</td>
<td>---------------------------</td>
<td>-------------------</td>
<td>---------------</td>
</tr>
<tr>
<td><strong>Company / Business Area / Activity</strong></td>
<td><strong>Task / Activity / Aspect</strong></td>
<td><strong>What could go wrong?</strong></td>
<td><strong>Why could it happen?</strong></td>
<td><strong>Inherent Risk</strong></td>
<td><strong>Controls</strong></td>
</tr>
<tr>
<td>Pipeline Construction</td>
<td>Erosion</td>
<td>Erosion of stockpiled soil, causing sediment runoff into waterways</td>
<td>Rain or wind erosion of stockpiled soil during construction</td>
<td>Possible</td>
<td>Minor</td>
</tr>
<tr>
<td>Pipeline Construction</td>
<td>Vehicle Movement</td>
<td>Risk of fuel or oil spill resulting from blown hose or other machinery malfunction</td>
<td></td>
<td>Possible</td>
<td>Very Minor</td>
</tr>
<tr>
<td>Pipeline Construction / Pipeline Operation</td>
<td>Pumping</td>
<td>Leak along the pipeline</td>
<td>Improperly fused pipeline joints. Movement and settling of earth after backfilling places stress on pipeline joints. Integrity failure in pipeline at creek crossings.</td>
<td>Possible</td>
<td>Very Minor</td>
</tr>
<tr>
<td>Pipeline Operation</td>
<td>Erosion</td>
<td>Erosion or sediment runoff at Burdekin River pumping station</td>
<td>Hose uncoupling at pumping station causes river water to release at pumping station</td>
<td>Possible</td>
<td>Minor</td>
</tr>
</tbody>
</table>

BURDEKIN RIVER PIPELINE EA AMENDMENT – GUIDELINE RESPONSE TO WATER
prepared by: Northern Resource Consultants Pty Ltd
### Establish Context

<table>
<thead>
<tr>
<th>Company / Business Area / Activity</th>
<th>Task / Activity / Aspect</th>
<th>What could go wrong?</th>
<th>Why could it happen?</th>
<th>Inherent Risk</th>
<th>Controls</th>
<th>Residual Risk</th>
<th>Additional Action / Control Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline Operation</td>
<td>Environmental</td>
<td>Flooding along the Burdekin River causes damage to the pumping station</td>
<td>A rapid rise in river height / increase in river flow / flood event may cause damage to the riverside pumping infrastructure at the Burdekin River</td>
<td>Possible Minor Moderates</td>
<td>Communication with the landholder regarding conditions at the pumping station in the case of an extreme weather event. Monitoring of pumping infrastructure performance to allow early identification of leaks. Cessation of pumping in the event of a suspected pumping station infrastructure failure. Prompt repair of the infrastructure if damaged.</td>
<td>Possible Minor Moderates</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Identify Hazards

### Assess the Risk

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Consequence</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible</td>
<td>Minor</td>
<td>Moderates</td>
</tr>
</tbody>
</table>

### Identify Existing Controls

### Evaluate the Risks

<table>
<thead>
<tr>
<th>Residual Likelihood</th>
<th>Residual Consequence</th>
<th>Residual Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible</td>
<td>Minor</td>
<td>Moderates</td>
</tr>
</tbody>
</table>

### Treat the Risk

<table>
<thead>
<tr>
<th>Additional Action / Control Required</th>
<th>Responsibility</th>
<th>Due By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>
9. Irrigation, Stock Water, Human Consumption and Drinking Water

There are 20 creeks located in the pipeline project area, nine of which are in the already approved MCO mining lease. These creeks are ephemeral, however, some creeks in the project area may have groundwater expressions during the dry season. The waters in the project area are used mainly for stock watering.

In the event of a heavy rainfall event during construction, there is a potential risk of impacts due from erosion and sediment runoff. Construction will be conducted and managed in a way that mitigates these potential risks. The construction will occur during the dry season, therefore minimising the potential impacts, as most of the creeks are ephemeral. Erosion and sedimentation will also be minimised, as the pipeline sections that traverse creeks will be supported by wire rope, anchored by concrete plinths set back from the riparian zones on either side of the top of banks at each creek crossing.

During operation of the pipeline, no additional impacts on irrigation, stock watering, human consumption and drinking water will occur, as the pipeline will be mainly subterranean with no discharges to the surrounding areas.

10. Cultural and Spiritual Values

Given the route of the proposed pipeline is an 8m corridor starting at the edge of the existing access roads and mostly disturbing pre-cleared verges vegetated with introduced pasture grass species, the disturbance associated with construction of the corridor is not expected to have any cultural and spiritual impacts.

11. Discharges to Groundwater and Groundwater Impact Assessment

There is no proposed action for direct discharge of contaminants to groundwater or surface water. As the activities for the proposed project do not pose any of impacting groundwater, a groundwater impact assessment is deemed unnecessary for this application.

12. Mixing Zones

There is no discharge of wastewater as part of this EA amendment, therefore mixing zones are not relevant.
Mitigation Measures and Management Plans

1. Mitigation

The proposed pipeline project may have low impacts on the environmental values of water. These impacts will be mitigated or managed to protect the environmental values of the Lower Burdekin River and Bowen River Sub-Basins.

The site will continue to operate under current Water Management Plans and Erosion and Sediment Control Plans.

2. Management Hierarchy

The project will utilise the management hierarchy when implementing mitigation strategies to protect the environmental values of water. Prevention of impacts include completing the construction of the pipeline during the dry season. This will prevent wet season rain events from causing flooding and erosion and sedimentation in the project area. The pipeline will be constructed in already disturbed areas including access roads and a power line corridor. Any impacts to referrable wetlands have been prevented by ensuring that the pipeline is outside the 200m buffer zone. The pipeline is being constructed as a subterranean structure to prevent erosion and sedimentation. Where the pipeline crosses creeks, it will be supported by wire rope, anchored by concrete plinths on either side of each creek outside the riparian zone to prevent impacts to the riparian zones and mitigate the chance of sediment from construction entering the watercourses within the project area.

Table 8 presents the preventative strategies and control measures that will be implemented for the pipeline project.

Table 8: Project preventative strategies and control measures

<table>
<thead>
<tr>
<th>MITIGATION MEASURE</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction during dry season</td>
<td>Only construct the pipeline during the months of April through to September to avoid the wet season.</td>
</tr>
<tr>
<td>Subterranean pipeline</td>
<td>The entire length of the pipeline will be subterranean from the MWSD to the Burdekin River except for all creek crossings.</td>
</tr>
<tr>
<td>Pipeline constructed over creeks</td>
<td>The pipeline will be supported by wire, anchored to concrete stumps located outside the top of bank on each side of the watercourse.</td>
</tr>
</tbody>
</table>
Progressive construction and rehabilitation | The pipeline trench will be backfilled and graded promptly after the pipeline is laid.
---|---
Equipment and vehicle servicing | Equipment and vehicles being utilised for the pipeline project will be serviced regularly.
Skilled vehicle operators | All vehicle operators will be appropriately trained and/or licenced in operation of said vehicle.
Spill Kits | Spill kits will be carried in vehicles and equipment on site during the construction of the pipeline.
Utilises previously cleared tracks and roads | The construction of the pipeline project will be completed in previously cleared tracks and roads. If additional clearing is required, it will be a maximum of 8 metre width from the pipeline.
Inspections and maintenance of pipeline | Inspections and maintenance of the pipeline will be completed regularly, where necessary.
Placement of bedding sand under pipeline during construction. | Bedding sand will be placed under the pipeline during construction where required.

3. Unavoidable Discharges

All discharges of water from the pipeline are intended to be into the MSWD for mine operation. There are no additional water release systems on the pipeline. In the event of a leak along the pipeline, leak detection will be through monitoring of the pumping performance and volumes or reports of surface expression along the pipeline course. Investigation into any potential leaks will be initiated within 24 hours of the evidence of a leak being identified. In the event of a leak, cessation of pumping should mitigate the chance of an unavoidable discharge.

4. Unplanned Releases

Pumping along the pipeline will not be initiated until the link from the pumping infrastructure to the MSWD has been completed. There should be no unplanned releases of water from the pipeline, and there are no release points along the pipeline other than that at the MSWD. Leaks or releases caused by incidents such as a hose uncoupling or failure in integrity of the pipeline can be managed through cessation of pumping in the first instance, and treatment of the release point. Any water released from the pipeline will be raw water, suitable for release into the receiving environment.

5. Storage

Fuel will be stored at MCO’s mine site. MCO’s current fuel and chemical storage management plans will continue to be implemented.
6. Minimise Potential Hazards

The pipeline infrastructure is proposed to be subterranean and to utilise previously cleared power corridor, roads and access tracks. This will minimise erosion and sedimentation in the project area. The timing of pipeline construction should be limited to the dry season, to avoid additional sediment loading into creeks and streams in the case that rains cause flooding around the project area. If there is a rain event during construction, efforts should be made to limit work in areas that have flowing creeks.

The pipeline project will be managed in accordance with MCO’s Erosion and Sediment Control Plan and Water Management Plans. Specific management strategies related to the pipeline project include the use of erosion controls such as sand bags and sediment fencing if a rain event occurs during construction. These preventative and control measures will minimise the hazards and impacts to environmental values of water.

7. Proposed Limits

No releases to water will occur during the construction or operation of the pipeline project. MCO’s water management plans will continue to be implemented. In the event of flow in any creek during construction, upstream and downstream water quality should be measured. Table 9 presents the recommended surface water monitoring parameters and trigger limits for any flowing creeks in the proposed project area during construction.

Table 9: Surface water quality limits for pipeline project area

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guideline</td>
<td>pH</td>
</tr>
<tr>
<td>Aquatic Ecosystem limit (ANZECC Guidelines)</td>
<td>6-8</td>
</tr>
</tbody>
</table>

Note: It is recommended that these values be inserted into the EA as trigger limits for monitoring during construction of the pipeline project.

8. Stormwater Management

The pipeline project will not impact stormwater runoff, as the pipeline will be mainly subterranean. Therefore, stormwater management does not apply to this EA amendment.

9. Extraction near a Watercourse

The landholder of Strathalbyn Station holds current water allocation title reference 46012734 created on 14 December 2009. The allocation is for 400ML per annum to be used for any purpose. MCO has reached agreement with the landholder to utilise that water allocation. Impacts relating to extraction from a watercourse, bank stability and riparian vegetation have
been assessed by Sunwater as part of granting that water allocation. No further impact assessment with regards to the extraction of water from the Burdekin River is required.

10. Monitoring Program

There should be minimal disturbance to the receiving environment during construction of the pipeline as there are no planned discharges and the pipeline will be primarily subterranean with the pipeline being supported by wire, anchored to concrete stumps over each creek. There will be no additional impacts during operation.

The pipeline project will be managed in accordance with MCO’s Erosion and Sediment Control Plan and Water Management Plans to ensure that the health of the freshwater ecosystems is upheld.

MCO will monitor erosion and sediment control on a regular basis, to minimise impact on the receiving environment water quality and subsequent degradation of the downstream freshwater ecosystems. Any potential for sedimentation of water and subsequent impact to environmental values will be mitigated through the implementation of these mitigations and management plans.

11. Rehabilitation

Rehabilitation of the pipeline excavation will be conducted progressively in accordance with the current approved Plan of Operations and Rehabilitation Plan for MCO. Progressive rehabilitation will be undertaken promptly during construction of the pipeline. The pipeline trench will be backfilled and graded promptly after the pipeline is laid. Establishment of vegetation will take place from within the existing seed bank of the returned soil. Revegetation is expected to take place during the wet season. Natural revegetation of the pipeline from seeds in the disturbed soil should minimise the potential for erosion and mitigate the chance of watercourse sedimentation.


Department of Natural Resources and Mines (DNRM), (2014). Queensland Globe.


Healthy Water, DEHP, (2013). Establishing draft environmental values, management goals and water quality objectives.


Appendix summary

Appendix A       Maps
Appendix B       Site Photographs
Appendix A

Maps
Bogie River
Burdekin River
King Creek
Herbert Creek
Lower Burdekin River
Sub-Basin
Bowen River
Sub-Basin

Notes:
Mine Lease boundary extracted from ml.shp, from IRTM © State of Queensland.
Imagery from ArcGIS Basemaps.

Legend
- Mine Lease
- Proposed Pipeline
- Watercourses (Stream Order 3 and above)
- Burdekin River Drainage Basin
- Sub-Basin
  - Lower Burdekin River
  - Bowen River

Scale: 1:200,000 at A3

Chapter Title: BURDEKIN WATER PIPELINE EA AMENDMENT

DRAINAGE BASIN AND SUB-BASINS

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 21/07/2014

Source Credits: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Notes:
Mine Lease boundary extracted from ml.shp, from IRTM © State of Queensland.
Imagery from ArcGIS Basemaps.
MOUNT CARLTON OPERATIONS

BURDEKIN WATER PIPELINE EA AMENDMENT

GROUND WATER MONITORING BORE LOCATIONS

Legend
- Mine Lease
- Proposed Infrastructure
- Proposed Pipeline
- Watercourse
- Ground Water Monitoring Bore
  - Monitoring Bore
  - Reference Bore

Notes:
Imagery sourced through ArcGIS Basemaps.
Mining Lease boundary extracted from ml.shp from RTM© State of Queensland 2014.
Proposed pipeline sourced from client (26524-02301.dwg).
Watercourse from: IQ_VM_WATERCOURSE_MAP_100K_250K.shp.
Ground water monitoring bore sites sourced from Environmental Authority.

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 21/07/2014

Scale: 1:30,000 at A3
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External contributors (non-government parties) of the data for this product are: Great Barrier Reef Marine Park Authority and Pitney Bowes Software

Regional ecosystem mapping (remnant biodiversity status) may incorporate amendments, resulting from property level assessments, to the release version of the mapping available on QGIS.

NOTE TO USER: Themes presented in this map are indicative only. Field survey may be required to verify the "true" spatial extent and value. Not all environmentally sensitive areas are presented in this map. A user should refer to the particular circumstances relevant to their situation to assess the "completeness" of themes provided.

The user should note that some boundaries and indicated values are ambient and may change over time (e.g. regional ecosystem boundaries and conservation status, watercourse mapping etc).

The user should be aware that due to multiple overlapping themes/layers present, some themes/layers may be obscured by others. Ordering in the Legend does not accurately reflect the order by which themes/layers are displayed.
Notes:
Mining Lease boundary extracted from ml.shp, from IRTM© State of Queensland 2012.
Proposed pipeline sourced from client (26524-02301.dwg).
Rock Unit extracted from QLD_GEOLOGY_2012_EDN_ROCK_UNIT.shp © State of Queensland 2012.
Structural Geology extracted from STATE_EXT_DETAILED_NOV2011\STATE_STRUCTURE.shp
Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 21/07/2014
Notes:
MRO Site boundary extracted from ml.shp, from RTM© State of Queensland 2012.
Proposed pipeline sourced from client (26524-02301.dwg).
Notes:
- Imagery sourced through ArcGIS Basemaps.
- MRO Site boundary extracted from ml.shp, from IRTM© State of Queensland 2012.
- Proposed pipeline sourced from client (26524-02301.dwg).
- Dominant soils from QLD_Soils_Dominant.shp © State of Queensland 2012.

Scale: 1:100,000

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 21/07/2014

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend
- Mine Lease
- Proposed Infrastructure
- Proposed Pipeline
- Dominant Soils
  - CHROMOSOLS
  - SODOSOLS
  - VERTOSOLS
Mount Carlton Operations
Burdekin Water Pipeline EA Amendment
Surface Water Monitoring Locations

Legend
- Mount Carlton ML 10343
- Proposed Infrastructure
  - Proposed Pipeline
  - Watercourse
- Surface Water Monitoring Site
  - Downstream
  - Upstream

Notes:
Imagery sourced through ArcGIS Basemaps.
Mining Lease boundary extracted from ml.shp from RTM© State of Queensland 2014.
Proposed pipeline sourced from client (26524-02301.dwg).
Watercourse from IQ_VM_WATERCOURSE_MAP_100K_250K.shp
Surface water monitoring site sourced from Environmental Authority.

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Date: 21/07/2014
Scale: 1:70,000 at A3
Appendix B

Site Photographs
The photographs in Table 10 provide an upstream and downstream visual of each watercourse that will be crossed by the proposed pipeline. The surface water map refers to the watercourse location in the project area (see the mapping appendix of this document).

Table 10: Photographs of watercourses that are crossed by the pipeline

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