



## MOC Creek Diversion Plan

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## Table of Contents

<b>1</b>	<b>Commitment and Policy</b>	<b>4</b>
1.1	Background	4
1.2	Objectives of this Plan	4
1.3	Requirements of this Plan	4
1.3.1	Statutory Requirements	4
1.3.1.1	Development Consents	4
1.3.1.2	Environment Protection Licences	4
1.3.1.3	Water Licences	6
1.3.2	GCAA Requirements	7
1.4	Consultation	7
1.4.1	Consultation with Internal (Mount Owen) Stakeholders	7
1.4.2	Consultation with External Stakeholders	7
<b>2</b>	<b>Planning</b>	<b>8</b>
2.1	Vision Statement	8
2.2	Environment Baseline	9
2.2.1	Water Quality	10
2.2.2	Ecology	10
2.2.3	Hydrology	10
2.2.3.1	Bettys Creek	10
2.2.3.2	Swamp Creek	11
2.2.3.3	Yorks Creek	11
2.2.4	Geomorphology	12
2.2.4.1	Bettys Creek	12
2.2.4.2	Swamp Creek	12
2.2.4.3	Yorks Creek	12
2.3	Design of Diversions	12
<b>3</b>	<b>Implementation</b>	<b>14</b>
3.1	Construction Program	14
3.2	Revegetation Program	14
3.3	Maintenance and Rehabilitation	14
3.4	Training and Communication	14
<b>4</b>	<b>Measurement and Evaluation</b>	<b>15</b>
4.1	Performance and Completion Criteria	15
4.1.1	Ecology	16
4.1.2	Hydrology	16
4.2	Monitoring Program	16
4.2.1	Water Quality	16
4.2.2	Hydrology	16
4.2.3	MOC Diversion Monitoring Program	17
<b>5</b>	<b>Review and Improvement</b>	<b>18</b>
5.1	Reporting	18

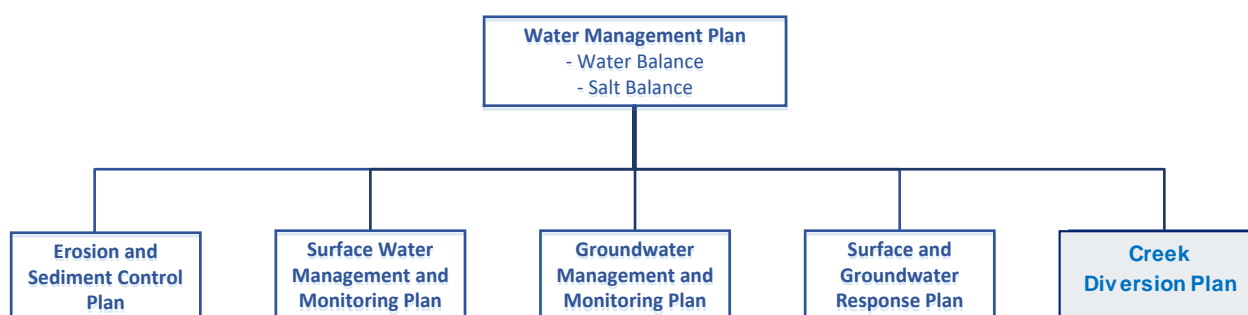
5.1.1	Annual Review.....	18
5.2	Plan Review.....	18
<b>6</b>	<b>Commitments.....</b>	<b>19</b>
<b>7</b>	<b>Accountabilities.....</b>	<b>20</b>
<b>8</b>	<b>Document Information.....</b>	<b>21</b>
8.1	Relevant Legislation.....	21
8.2	Related Documents.....	21
8.3	Reference Information.....	21
8.4	Change Information.....	22
<b>Appendix A - Creek Diversion Plan Consultation.....</b>		<b>23</b>
<b>Appendix B - Creek Diversion Plan Approval .....</b>		<b>25</b>
<b>Appendix C - Quarterly Diversion Inspection Template .....</b>		<b>27</b>

# 1 Commitment and Policy

## 1.1 Background

This Creek Diversion Plan is part of a set of documents that together form the Water Management Plan for Mt Owen Complex (MOC) (refer to **Figure 1-1**). The Water Management Plan is one of a series of Environmental Management Plans that together form the Environmental Management System (EMS) for MOC.

Current and approved operations within MOC consist of Mt Owen Mine (including the North Pit Continuation and Bayswater North Pit) and Glendell Mine. Mining operations at MOC include the integrated use of the Mt Owen coal handling and preparation plant, coal stockpiles and rail load-out facility.



**Figure 1-1 – MOC Water Management Plan Structure**

## 1.2 Objectives of this Plan

The objectives of this Plan are to satisfy regulatory requirements and approval conditions for clean water diversions. For the purpose of this Plan, creek relocation and diversion are considered synonymous.

## 1.3 Requirements of this Plan

### 1.3.1 Statutory Requirements

#### 1.3.1.1 Development Consents

Both the Mt Owen Mine (SSD-5850) and Glendell Mine (DA 80/952) development approvals stipulate requirements related to this Plan (refer to **Table 1-1**). Water management performance measures are specified by Mt Owen Mine SSD-5850 Schedule 3, Condition 25, which are listed in

**Table 1-2**. Relevant Statements of Commitments for Glendell Mine development approval are provided in **Table 1-3**.

#### 1.3.1.2 Environment Protection Licences

Condition L1.1 of Environment Protection Licence (EPL) 4460 (Mt Owen Mine) and EPL 12840 (Glendell Mine) requires compliance with Section 120 of the *Protection of the Environment Operations Act 1997*, which prohibits pollution of waters. The implementation of the management measures outlined in **Section 3** of this Plan facilitates achievement of this.

**Table 1-1 – Relevant Development Consent Conditions**

Mt Owen Continued Operations (SSD 5850)	Glendell Mine (DA 80/952, Schedule 4)	Condition	Relevant Section of Plan
–	30	The Bettys Creek and Swamp Creek Diversion Plan/s must include:	This plan
–	30 (a)	a vision statement for the creek relocation;	<b>Section 2.1</b>
–	30 (b)	an assessment of the water quality, ecological, hydrological and geomorphic baseline conditions in the creek;	<b>Surface Water Management and Monitoring Plan</b> <b>Section 2.2.2</b> <b>Section 2.2.3</b> <b>Section 2.2.4</b>
–	30 (c)	the detailed design specifications for the creek relocation;	<b>Section 2.3</b>
–	30 (d)	a construction program for the creek relocation, describing how the work would be staged, and integrated with mining operations;	<b>Section 3.1</b>
–	30 (e)	a revegetation program for the relocated creek using a range of suitable native species;	<b>Section 3.2</b>
–	30 (f)	water quality, ecological, hydrological and geomorphic performance and completion criteria for the creek relocation based on the assessment of baselines conditions; and	<b>Surface Water Management and Monitoring Plan</b> <b>Section 4.1.2</b> <b>Section 4.1.2</b>
–	30 (g)	a program to monitor and maintain the water quality, ecological, hydrological and geomorphic integrity of the creek relocation	<b>Surface Water Management and Monitoring Plan</b> <b>Section 4.2.2</b> <b>Section 4.2.2</b>
24	–	The Applicant must construct, maintain and rehabilitate any approved creek diversions associated with the development, including the diversion of Bettys Creek around the proposed Eastern Rail Pit and into Main Creek, to the satisfaction of the Secretary.	<b>Section 3.3</b>

**Table 1-2 – Water Management Performance Measures**

Feature	Performance Measure	Relevant Section of Plan
Creek realignment and restoration works	<ul style="list-style-type: none"> <li>Diverted creek lines are hydraulically and geomorphologically stable.</li> </ul>	<b>Section 4.1.2</b> <b>Section 2.3</b>
	<ul style="list-style-type: none"> <li>Incorporate erosion control measures based on vegetation and engineering revetments.</li> </ul>	<b>Section 3.1</b>
	<ul style="list-style-type: none"> <li>Incorporate persistent/permanent pools for aquatic habitat.</li> </ul>	<b>Section 2.3</b>
	<ul style="list-style-type: none"> <li>Revegetate with suitable native species.</li> </ul>	<b>Section 3.2</b>

**Table 1-3 – Statement of Commitments for Glendell Mine**

Commitment	Relevant Section of Plan
The proposed diversions of Swamp and Bettys Creeks will be designed and constructed in accordance with the conceptual designs developed in the water resources assessment.	<b><i>These diversions have already been constructed as part of past approvals</i></b>

### 1.3.1.3 Water Licences

MOC holds water access licences (WALs) and approvals under the *Water Management Act 2000* for the diversions of Bettys Creek and Swamp Creek (Jerrys Water source, under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*), which are summarised in **Table 1-4**.

**Table 1-4 – Water Licences held by MOC under Water Management Act 2000**

Licence Number	Approval Number	Licensed/Approved Activity
<b>Unregulated River Licences (Jerrys Water Source)</b>		
WAL18310	20WA210993	Licence to take 200 units within the upper diversion of Swamp Creek (i.e. Yorks Creek Diversion)
<b>Additional Water Supply Works Approvals (Jerrys Water Source)</b>		
N/A	20WA211429	Diversion dam on Yorks Creek
N/A	20WA211425	Middle diversion of Swamp Creek
N/A	20WA211430	Lower diversion of Swamp Creek
N/A	20WA212187	Upper and middle diversion of Bettys Creek
N/A	20WA212660	Lower diversion of Bettys Creek

## 1.3.2 GCAA Requirements

The Glencore Coal Assets Australia (GCAA) **Water Management Protocol** (CAA HSEC PCL 0022 11.03) outlines the following principles, which focus on effective water management which is critical to supporting operations. Water management planning assists in managing a number of aspects, such that:

- our environmental obligations are met;
- we can demonstrate to external stakeholders that the local and regional surface and groundwater water resources are used efficiently;
- our operations are protected from flooding; and
- adequate water supplies are available for mining and processing operations.

## 1.4 Consultation

### 1.4.1 Consultation with Internal (Mount Owen) Stakeholders

This Plan has been reviewed by members of the Mt Owen EMS Committee and endorsed at the meeting of 28 November 2016. Details of Training and Communication arrangements are outlined in **Section 3.4**.

### 1.4.2 Consultation with External Stakeholders

This Plan was prepared following approval of the Mt Owen Continued Operations SSD-5850 in consultation with the NSW Environment Protection Authority (EPA) and NSW Department of Primary Industries – Water (DPI – Water). A copy of the consultation records is provided in **Appendix A**.

The final draft of the current revision of the Plan was submitted to Department of Planning and Environment (DP&E) in January 2017. A copy of the DP&E approval of the WMP is provided in **Appendix B**.



## 2 Planning

### 2.1 Vision Statement

There have been several historical and more recent creek diversions (or creek relocations) constructed at MOC to divert flows around operational areas including the:

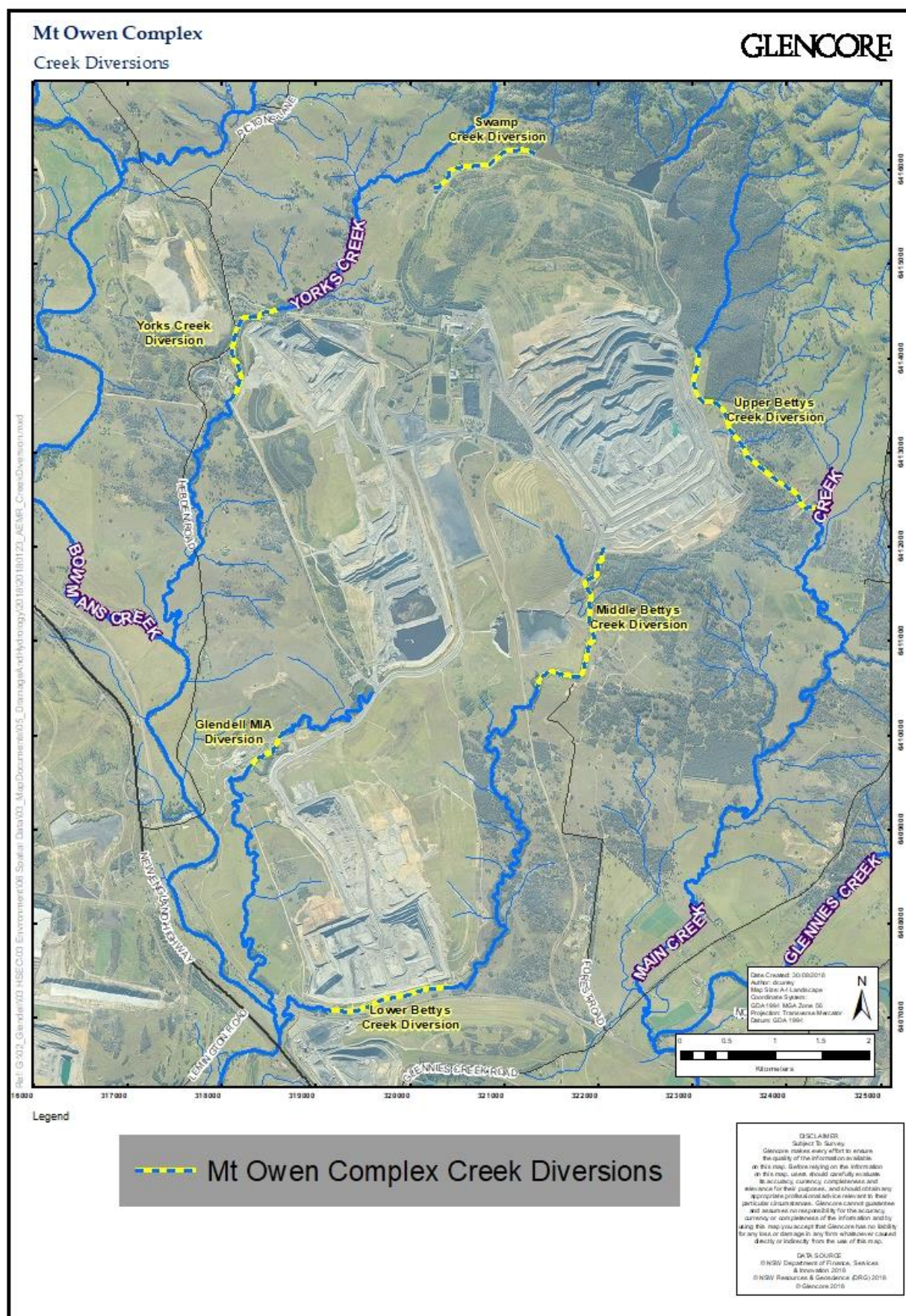
- Bettys Creek Upper Diversion;
- Bettys Creek Middle Diversion;
- Bettys Creek Lower Diversion;
- Yorks Creek Diversion (a.k.a. Diversion dam on Yorks Creek);
- Swamp Creek Diversion (a.k.a. Middle Diversion of Swamp Creek); and
- Glendell Mine Infrastructure Area (MIA) Diversion (a.k.a. Lower Diversion of Swamp Creek).

The locations of the diversions are shown in *Error! Reference source not found.* and the vision statements for each of the diversions are summarised in **Table 2-1**.

**Table 2-1 – Vision statements for Creek Diversions at MOC**

Diversion	Vision Statement
<b>Upper Bettys Creek (Stage 2)</b>	To prevent inundation of North Pit in the event of a major flood event by diverting flows from Bettys Creek to Main Creek, while minimising the impact on Swamp Creek and the surrounding environment.
<b>Middle Bettys Creek (Stage 1)</b>	To prevent inundation of Eastern Rail Pit and ensure stability of Western out of Pit (WOOP) Dump, while minimising the impact of Bettys Creek and the surrounding environment.
<b>Lower Bettys Creek (Stage 3)</b>	To prevent inundation of Barrett Pit in the event of a major flood event, while minimising the impact on Bettys Creek and the surrounding environment.
<b>Yorks Creek Diversion</b>	Diversion of Yorks Creek around the original Swamp Creek mining area.
<b>Swamp Creek</b>	To divert Swamp Creek into Yorks Creek north of Mt Owen Mine.
<b>Glendell MIA</b>	To provide access to Glendell Mine infrastructure for life of mine and to prevent inundation of the Barrett Pit in the event of a major flood event, while minimising the impact on Swamp Creek and the surrounding environment.





Figure

2-1 – Mt Owen Complex Creek Diversions

## 2.2 Environment Baseline

### 2.2.1 Water Quality

Baseline water quality of Bettys Creek, Yorks Creek and Swamp Creek is described in the MOC **Surface Water Management and Monitoring Plan**.

### 2.2.2 Ecology

Vegetation around MOC near Bettys Creek, Yorks Creek and Swamp Creek has been heavily modified due to previous clearing and disturbance for agricultural purposes. Plant diversity is considered moderate, with the riparian buffer in part containing Central Hunter Swamp Oak Forest. The adjacent floodplain consists of a mixture of native and introduced grasses. No threatened flora species were identified in the vicinity of the creek diversion.

Two fauna habitat areas were identified in the vicinity of the creek diversion, namely creekline and grassed habitats. The creekline habitat consists of swamp oak communities that provide habitat for woodland birds, a number of which were recorded within MOC. No roosting/nesting habitats were observed in the creekline habitat due to a lack of hollow bearing trees. The grassland habitat dominates MOC and provides foraging habitat for birds, bats and macropods. (Parsons Brinkerhoff 2008)

### 2.2.3 Hydrology

#### 2.2.3.1 Bettys Creek

Three diversions have been constructed on Bettys Creek (see **Figure 2.1**). The first (middle Bettys Creek diversion) was constructed to divert flow around the approved mining operations within the Eastern Rail Pit (ERP). The second (upper Bettys Creek) diverted the upper catchment areas of Bettys Creek into the adjacent Main Creek, reducing the catchment contributing to flow within the Bettys Creek channel downstream of the upper Bettys Creek diversion (URS 2012). The results of the baseline hydrological assessment for the upper Bettys Creek diversion (Parsons Brinkerhoff 2007) are summarised in **Table 2-2**.

**Table 2-2 – Baseline Hydrology at Junction of Upper Bettys Creek Diversion and Main Creek**

Event	Pre-diversion (m <sup>3</sup> /s)	Post-diversion (m <sup>3</sup> /s)
1 EY <sup>1</sup>	5.1	5.0
39% AEP <sup>2</sup> (2 year ARI <sup>3</sup> )	8.3	7.8
18% AEP (5 year ARI)	12.7	13.0
10% AEP (10 year ARI)	15.4	16.5
5% AEP (20 year ARI)	19.3	21.1
2% AEP (50 year ARI)	24.0	25.6
1% AEP (100 year ARI)	28.0	29.5

Adapted from Parsons Brinkerhoff (2007)

1. EY – exceedances per year

2. AEP – annual exceedance probability

3. ARI – average recurrence interval

The results of the baseline hydrological assessment for the lower Bettys Creek diversion (URS 2012) are summarised in **Table 2-3**.

**Table 2-3 – Baseline Hydrology in the Lower Bettys Creek Diversion**

	Event	Pre-diversion	Post-diversion	ACARP guidelines for incised	ACARP guidelines for bedrock
Stream power (Nms)	39% AEP	9	54	60	100
	2% AEP	9	111	150	350
Velocity (m/s)	39% AEP	0.7	1.2	1.5	1.8
	2% AEP	0.9	1.5	2.5	3
Shear (N/m <sup>2</sup> )	39% AEP	34	46	40	55
	2% AEP	39	77	100	120

Adapted from URS (2012)

### 2.2.3.2 Swamp Creek

The hydrology of Swamp Creek catchment is highly modified due to extensive mining activity. The pre-mining catchment area of Swamp Creek at the confluence of Swamp and Bowmans Creek is approximately 2,370 ha, which is estimated to be reduced to approximately 670 ha as a result of the diversion and mining operations.

Modifications to the Swamp Creek catchment include:

- diversion of Swamp Creek head waters into the adjacent Yorks Creek; and
- presence of the Mt Owen Mine and Glendell Mine.

Two diversions have been constructed within the current catchment of Swamp Creek: Swamp Creek Diversion; and Glendell MIA Diversion (see *Error! Reference source not found.*).

The 1 % AEP peak flow estimates for Swamp Creek at the confluence with Bowmans Creek for the pre-diversion and post-diversion conditions (Parsons Brinckerhoff 2008) are summarised in **Table 2-4**.

**Table 2-4 – Baseline Hydrology at Junction of Swamp Creek and Bowmans Creek**

Event	Pre-diversion (m <sup>3</sup> /s)	Post-diversion (m <sup>3</sup> /s)
1% AEP (100 year ARI)	102	39

Adapted from ParsonsBrinckerhoff (2008)

### 2.2.3.3 Yorks Creek

Yorks Creek Diversion refers to the diversion of the upper catchment areas of Swamp Creek into Yorks Creek to the north-west of MOC as part of the mine development. The diversion was constructed over forty years ago as part of past approvals and as such there is no detailed design documentation available that summarises the pre and post hydrology conditions for the creek.



## 2.2.4 Geomorphology

### 2.2.4.1 Bettys Creek

Bettys Creek is an ephemeral fourth order<sup>1</sup>, Schedule 2 stream with flows occurring in the creek during storm events or after prolonged rain.

The original Bettys Creek catchment drained the forested hills of the Ravensworth State Forest on the northeast side of the Hunter Valley. The whole catchment covered approximately 20km<sup>2</sup> and the meandering stream course would have been about 15km long, winding between the low hills of the Hunter Valley floor. The creek's valley was relatively broad and shallow, but it only developed a small floodplain downstream 3km (URS, 2012)

The upper reaches of Bettys Creek are forested, with little to no riparian vegetation adjacent to the moderately to highly degraded creek lines. Slopes in the Bettys Creek catchment vary between 25% in the upper areas down to 2.5% in the vicinity of the diversion. Pools or depressions for ponding of water are generally absent in the upstream reaches of Bettys Creek (Parsons Brinckerhoff 2007).

The lower reaches of Bettys Creek include a small stream with well vegetated and stable banks, with an invert level that is well below the adjacent floodplain (URS 2012). The alluvial channel does not carry significant sand or gravel bedload, with the meandering channel form being consistent with mud dominated sediment load (URS 2012). Small erosion gullies on the banks and floodplain are consistent with a high fine sediment content in the channel bank and floodplain materials (URS 2012).

The original lower reach of Bettys Creek had a sinuosity index of 1.47. The valley sides rose approximately 40m at a 15° slope and the valley width was about 1km wide. The channel of Bettys Creek formed a deep slot cut into the floodplain. It had a top width of 20-30m and a base width of 2-5m (URS, 2012).

Pools of permanent or semi-permanent water exist in the downstream reaches of the creek, however water in these pools is saline. Riparian vegetation is well-established (EarthTech, 2006).

The channel formed discharge (bank full-flow) is infrequent, potentially less frequent than an average of 1 in 10 years (URS 2012). Since the diversion of the upper reaches, the channel has the characteristics of a partly underfit stream (i.e. flows are disproportionally low compared to the channel geometry) (URS 2012).

### 2.2.4.2 Swamp Creek

Swamp Creek is an ephemeral fourth order<sup>2</sup>, Schedule 2 watercourse that includes a meandering creekline with adjacent low-lying floodplain areas. Elevations in the catchment vary from 460m Australian Height Datum (AHD) at its headwaters, down to 80m AHD at the proposed Glendell MIA, and slopes vary from 50% down to 5%. Swamp Creek through the mining area consists primarily of a wide open channel with some minor vegetation with the banks.

### 2.2.4.3 Yorks Creek

Yorks Creek is an ephemeral third or fourth order<sup>2</sup>, Schedule 2 watercourse. Yorks Creek typically has a defined channel several metres in width and approximately 1 to 1.2m in depth, with a relatively wide floodplain. The creek varies from highly vegetated and sinuous, to some sections that are hydraulically steep with limited vegetation. The catchment is relatively natural, receiving flows from Yorks Creek and the upper Swamp Creek catchment upstream of mining activity and from rehabilitated overburden areas.

## 2.3 Design of Diversions

The design criteria for diversions are to:

- produce stable channel, which is unlikely to undergo significant geomorphic change over time;
- reduce the need for ongoing maintenance where possible; and

<sup>1</sup> Strahler watercourse ordering classification

<sup>2</sup> Strahler watercourse ordering classification

- ensure sufficient capacity to convey the estimated peak flow from the 1% AEP storm event;

Where practical the diversions have been designed to incorporate persistent pools to assist in sustaining aquatic habitats.

The key design details for the existing MOC diversions are given in **Table 2-5** below. Refer to the associated detailed design reports for further information. There is no available detailed design information for either the Yorks Creek Diversion or Swamp Creek Diversion.

**Table 2-5 Key Diversion Design Details**

Diversion	Length (km)	Typical Cross-Section			Longitudinal Slope	In-stream Structures	Design Report
		Shape	Base Width (m)	Channel Slope			
Upper Bettys Creek Diversion	~2	Trapezoidal	6-8	1(V):3(H)	0.25%	Four rock-lined drop structures	Parsons Brinckerhoff, 2007
Middle Bettys Creek Diversion	2.5	Trapezoidal	6	1(V):3(H) - 1(V):5(H)	0.58%-0.94%	Three rock-ramp drop structures	EarthTech, 2006
Lower Bettys Creek Diversion	1.4	Trapezoidal with Benches	10	1(V):3(H)	0.44%	Nil	URS, 2012
Glendell MIA Diversion	0.5	Trapezoidal	3	1(V):3(H)	0.5%	Culverts beneath haul road and rock-lined stilling basin at outlet	Parsons Brinckerhoff, 2008

## 3 Implementation

### 3.1 Construction Program

All six existing creek diversions at MOC have already been constructed as part of approved operations. There are no future creek diversions approved as part of either the Mount Owen or Glendell Mines and therefore there are no specific future construction programs for creek diversions at MOC.

### 3.2 Revegetation Program

All six existing diversions at MOC have already been constructed as part of approved operations. There are no future creek diversions approved as part of either the Mount Owen or Glendell Mines and therefore there are no specific future revegetation programs for diversions at MOC.

For the existing diversions, the revegetation of the land disturbed by diversion works was undertaken in three stages:

- Stage one:
  - spreading of topsoil and the establishment of a cover crop (grasses) to stabilise exposed surfaces and minimise sediment generation during rainfall events; and
  - direct seeding and planting of native tubestock within defined vegetation zones;
- Stage two:
  - ongoing removal of weeds and supplementary seeding and planting where necessary; and
  - inspection and maintenance where necessary
- Stage 3:
  - an evaluation of the revegetation, with stage 2 repeated as necessary.

Where practical, diversions were revegetated with suitable native species, with a preference for:

- locally endemic species; and
- fast growing species that allow for rapid soil cover and erosion protection.

Where the success of the above program has been impacted by other factors such as the physical and chemical constraints of the site soils, the continued stability and establishment of vegetation for the diversions will be ensured through the ongoing creek diversion monitoring program in which any remediation requirements will be identified and implemented.

### 3.3 Maintenance and Rehabilitation

MOC will undertake works necessary and maintain all diversions listed in **Section 2.1**. MOC will undertake works necessary to repair and rehabilitate any diversion listed in **Section 2.1** that fail to meet the performance criteria described in **Section 4.1** as identified through the monitoring program described in **Section 4.2**.

### 3.4 Training and Communication

Generic training on the aspects of this Plan is provided to all employees and contractors through the GCAA **Generic Surface Induction** and the **Site Familiarisation** process.

Selected site personnel whose duties directly involve the management of water at the MOC will undertake specific training in regards to site Operational Procedures which incorporate water management measures. This training will be undertaken annually and when there is a change in personnel in key roles.

## 4 Measurement and Evaluation

### 4.1 Performance and Completion Criteria

The performance and completion criteria for the water quality, ecology, hydrology and geomorphology of the creek diversions are outlined in Table 4-1 with further descriptions provided in the sections below.

**Table 4-1 Performance Criteria and Indicators for MOC Creek Diversions**

Aspect	Performance Measure	Indicator
Water Quality	Performance and completion criteria for the water quality associated with the creek diversions are the same as those outlined for the creeks in their entirety and are therefore described in the MOC <u><b>Surface Water Management and Monitoring Plan</b></u> .	
Ecology	Condition of riparian vegetation	No evidence of significant weed growth or death of vegetation
	Condition of diversion groundcover	Maintain greater than 80% groundcover relative to reference creek, in areas subject to ongoing erosion
	General diversion ecological condition	No evidence of feral animals
Hydrology	Condition of channel bank	No evidence of significant rill erosion, undercutting or slumping
	Condition of channel invert and outlet	No evidence of significant scour or erosion
	Condition of channel invert and outlet of culverts (where applicable)	No evidence of significant scour or erosion
	Condition of in-stream structures where applicable (e.g. drop structure)	Structure is stable
	Condition of vegetation: no evidence of significant weed growth or death of vegetation	No evidence of significant weed growth or death of vegetation
	Deposition of sediment and debris	No evidence of significant accumulation or degradation, large blockages in channel
Geomorphology	Condition of channel bank	No evidence of significant rill erosion or slumping
	Condition of channel invert	No evidence of significant geomorphically unstable erosion and sediment deposition
	Condition of in-stream pools	No evidence of significant erosion headcuts
	Condition of vegetation	No evidence of significant weed growth or death of vegetation
	Condition of channel grade	No evidence of significant aggradation or degradation
	Deposition of sediment and debris	No evidence of significant accumulation or reduced waterway access
	General conditions	No evidence of significant hazards presented to the public, poor aesthetics or feral animals, or geomorphic instability



## 4.1.1 Ecology

The diversion designs have aimed to recreate a 'natural' reach of the associated creek channel that will be self-sustaining over the long term. To achieve this, the designs aimed to create a system modelled on the observed naturally occurring riparian vegetation communities found in undisturbed areas of the original creek systems. While the revegetation plan for each diversion focused on reinstating native plants that would potentially survive within the diversion, natural ecological processes will facilitate the establishment of many more species over time. In this way, the ecology of the diversion will progress naturally towards equilibrium. It must be noted that this process will take time, however, and it may be more than 50 years before the revegetated diversion has similar floristics, structure and biodiversity levels to that of remnant vegetation (Parsons Brinckerhoff, 2008).

## 4.1.2 Hydrology

The diversions were designed and constructed to be hydraulically stable according to the design criteria described in **Section 2.2.3**.

## 4.2 Monitoring Program

The monitoring program of the MOC creek diversions is designed to regularly monitor and inspect the water quality, ecology, hydrology and geomorphic integrity of each diversion to ensure identification of any issues and efficient remediation can be actioned where required.

### 4.2.1 Water Quality

The monitoring of water quality in the creek diversions forms part of the monitoring program described in the **Surface Water Management and Monitoring Plan**.

If any unsatisfactory performance is identified, the actions and follow up required will be recorded as part of the monitoring observations and as described in the **Surface Water Management and Monitoring Plan**.

### 4.2.2 Hydrology

Due to the difficulty in accurately estimating the AEP of flood events due to timing, safety and accurate measurement, the hydrology of the diversions will be assessed through the monitoring of the water quality, ecological and geomorphological condition of the diversions which infer the hydraulic stability of the diversions over time. The correlations of monitoring parameters are explained below and correspond to the hydrology performance measures outlined in Section 4.1.

- Monitoring of the channel bank, channel inverts and channel bed condition for evidence of erosion and/or scouring indicates elevated stream velocities and/or stream power which may be related to the establishment and/or condition of riparian vegetation.
- Monitoring of diversion vegetation for evidence of insufficient groundcover and/or riparian vegetation could contribute to increased erosion and instability of the diversion channel which will limit the ability of the diversion to meet its design hydraulic performance criteria.
- Monitoring of sediment transfer within the channel for evidence of significant sediment aggradation, deposition or degradation indicate the diversion is not meeting its design hydraulic performance criteria; and
- Monitoring of in-stream structures for evidence of instability or failure of the structures will likely mean the diversion is not meeting its hydraulic design criteria and may be contributing to downstream instability or sediment transfer issues.

## 4.2.3 MOC Diversion Monitoring Program

Each diversion will be inspected on a quarterly basis to assess that the following components of the diversion are performing satisfactorily against the geomorphic, hydrological and ecological performance criteria. The monitoring will encompass a full walk through visual inspection and photographs. A record of monitoring observations will include:

- condition of channel bank;
- condition of channel bed and any in-stream pools;
- condition of channel and culvert inverts;
- condition and species of vegetation;
- condition of groundcover percentage;
- sediment transfer and significant aggradation and/or degradation;
- deposition of sediment and debris; and
- other general conditions.

A template of the quarterly monitoring requirements is included in **Appendix C**.

If any unsatisfactory performance is identified, the actions and follow up required will be recorded as part of the monitoring observations.

Issues identified within the quarterly inspections, will inform the focus of an additional annual inspection for the MOC creek diversions. This annual inspection will provide a detailed assessment of the diversion stability and stream health and is conducted by suitably qualified experts. The monitoring will include survey and photographic records at selected locations based on observations of stream and riparian vegetation cover, bed condition, active erosion points and potential areas of instability determined by the quarterly inspections. A summary of the results of the monitoring will be incorporated into the Annual Review.

## 5 Review and Improvement

### 5.1 Reporting

#### 5.1.1 Annual Review

The MOC will report any significant findings regarding the implementation of this Plan in the Annual Review.

The Annual Review will be provided to DP&E and will be available on the MOC website.

### 5.2 Plan Review

This Plan will be reviewed in accordance with the MOC ***Environmental Management Strategy*** (XMO SD EXT 0122) and will occur within three months of:

- the submission of an Annual Review;
- the submission of an incident report;
- the submission of an independent environmental audit; or
- any modification to the conditions of development consent for Mt Owen Mine (SSD-5850) or Glendell Mine (DA 80/952).

Glencore will review and if necessary, revise this Creek Diversion Plan where required. The Creek Diversion Plan will reflect any changes in environmental requirements, technology and operational procedures.

## 6 Commitments

All commitments outlined within this Plan are detailed in **Table 6-1** below. Management commitments requiring actioning will be entered into the Mt Owen Complex Compliance Management system (CMO) and actioned. Records of documentation associated with the management commitments will also be maintained within CMO.

**Table 6-1 – Management Plan Commitments**

No.	Commitment	Relevant Section of Plan
1	MOC will undertake works necessary and maintain or repair and rehabilitate any diversion listed in Section 2.1 that fail to meet the performance criteria described in Section 4.1 as identified through the monitoring program described in Section 4.2.	<b>Section 3.3</b>
2	Generic training on the aspects of this Plan is provided to all employees and contractors through the GCAA Generic Surface Induction and the Site Familiarisation process.	<b>Section 3.4</b>
3	Selected site personnel whose duties directly involve the management of water at the MOC will undertake specific training in regards to site Operational Procedures which incorporate water management measures. This training will be undertaken annually and when there is a change in personnel in key roles.	<b>Section 3.4</b>
4	The diversions will be inspected on a quarterly basis to assess that the components are performing satisfactorily against the performance criteria set out in Table 4.1	<b>Section 4.2.3</b>
5	Issues identified within the quarterly inspections, will inform the focus of an additional annual inspection for the MOC creek diversions. This annual inspection will provide a detailed assessment of the diversion stability and stream health and is conducted by suitably qualified experts. The monitoring will include survey and photographic records at selected locations based on observations of stream and riparian vegetation cover, bed condition, active erosion points and potential areas of instability determined by the quarterly inspections. A summary of the results of the monitoring will be incorporated into the Annual Review.	<b>Section 4.2.3</b>
6	Any significant findings regarding the implementation of this Plan will be reported in the Annual Review.	<b>Section 4.2.3 &amp; 5.1</b>

## 7 Accountabilities

**Table 7-1** outlines the accountabilities associated with this Plan.

**Table 7-1 – Accountabilities**

Role	Accountabilities for this document
Operations Manager	Provide adequate resources for the implementation of this Plan.
Environment and Community Manager	<p>Implement this Plan.</p> <p>Responsible for ensuring that monitoring, periodic environmental inspections and visual assessments after high rainfall events are undertaken.</p> <p>Oversee the planning, construction, inspection, maintenance and repair of the diversions at MOC.</p> <p>Provide that the Training and Communication, Monitoring and Review and Improvement requirements of this Plan are met.</p> <p>Investigate and report all incidents involving the failure or damage to diversions.</p>
Environment and Community Coordinator / Officer	<p>Assist the E&amp;C Manager as required in implementation of this Plan.</p> <p>Investigate and report all incidents involving the failure or damage to diversions.</p>
Task Coordinators	<p>Provide that the requirements of this Plan are met through compliance with GDP procedures.</p> <p>Report all incidents involving the failure or damage to diversions.</p>
All contractors	<p>Undertake works in accordance with the objectives and principles of this Plan and GDP (where relevant).</p> <p>Report all incidents involving the failure or damage to diversions</p>
All personnel	<p>Undertake works in accordance with the objectives and principles of this Plan and GDP (where relevant).</p> <p>Report all incidents involving the failure or damage to diversions.</p>

## 8 Document Information

### 8.1 Relevant Legislation

The following legislation is relevant to this Plan:

- *Environmental Planning and Assessment Act 1979*;
- *Protection of the Environment Operations Act 1997*;
- *Water Management Act 2000*; and
- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*.

### 8.2 Related Documents

Related documents, listed in **Table 8-1** below, are internal documents directly related to or referenced from this document. Internal procedures have not been reviewed or endorsed by DPE and Glencore is responsible for verifying these procedures are in accordance with this management plan and generally in accordance with the Project Approval.

**Table 8-1 – Related documents**

Number	Title
<b>GCAA</b>	
11.01	Annual Environment and Community Risk Assessments
11.03	Water Management
11.05	Dams and Diversions
11.06	Erosion and Sediment Control
<b>Mt Owen</b>	
XMO SD EXT 0111	Water Management Plan
XMO SD EXT 0116	Erosion and Sediment Control Plan
XMO SD EXT 0117	Surface Water Management and Monitoring Plan
XMO SD EXT 0118	Groundwater Management and Monitoring Plan
XMO SD EXT 0119	Surface and Groundwater Response Plan
XMO SD EXT 0122	Environmental Management Strategy
MGOOC-1779562647-11389	Biodiversity and Offset Management Plan

### 8.3 Reference Information

Reference information, listed in **Table 8-2** below, is information that is directly related to the development of this document or referenced from within this document.

**Table 8-2 – Reference information**

Reference	Title
EarthTech 2006	<i>Mt Owen Mine Bettys Creek Diversions Design Report (86869 Final)</i>
Parsons Brinckerhoff 2007	<i>Betty's Creek Diversion: Detailed Design Report (2118590F-PR_0477)</i>
Parsons Brinckerhoff 2008	<i>Swamp Creek Diversion: Detailed Design Report (2118813A-PR_0026 Rev B)</i>

URS 2012	<i>Bettys Creek Diversion No. 3 (43207398/F1/03 Final)</i>
Umwelt 2014	<i>Surface Water Assessment Mount Owen Continued Operations Project Final (3109/R05/V6)</i>
Umwelt 2015	<i>Environmental Impact Statement Mount Owen Continued Operations Project Final (3109/R02/Final)</i>

## 8.4 Change Information

A summary of the document history is provided in **Table 8-3** below.

**Table 8-3 – Change information**

Version	Date	Review team (consultation)	Change Summary
1	December 2016	MOC EMS Steering Committee	Prepared to address the Mt Owen Continued Operations development consent (SSD-5850) conditions and revised development consent for Glendell Mine (DA 80/952 MOD 3).
2	September 2017	MOC E+C Manager MOC E+C Coordinator	Management plan edited to incorporate feedback from regulators (DPE and DPI Water).
New SharePoint Version History			
1	March 2018	MOC E+C Manager	Updates to commitment register and associated plan text to streamline commitments.
2	November 2018	MOC E+C Manager, DPE	Approved by DPE
3	May 2019	MOC E+C Coordinator	Review period updated to 2021.



## Appendix A - Creek Diversion Plan Consultation

### Consultation with Department of Planning and Environment

<i>Creek Diversion Plan – DA 80/952 – Condition 30, Schedule 3</i>	<b>Satisfactory (Yes/No/Partial)</b>	<b>Comment</b>	<b>Action Required</b>
The Bettys Creek and Swamp Creek Diversion Plan/s must include:			
(a) a vision statement for the creek relocation;	Yes	Satisfied – Section 2.	-
(b) an assessment of the water quality, ecological, hydrological and geomorphic baseline conditions in the creek;	Partial	See Section 2.2 – Please provide further details from the Surface Water Management and Monitoring Plan. Alternatively, provide a hyperlink to the document.	To note comments and amend the plan accordingly.
(c) the detailed design specifications for the creek relocation;	Partial	See Section 2.3 – Please append or provide hyperlinks to the design reports in table 2-5.	To note comments and amend the plan accordingly.
(d) a construction program for the creek relocation, describing how the work would be staged, and integrated with mining operations;	Yes	Satisfied – Section 3.1.	-
(e) a revegetation program for the relocated creek using a range of suitable native species;	Yes	Satisfied – Section 3.2.	-
(f) water quality, ecological, hydrological and geomorphic performance and completion criteria for the creek relocation based on the assessment of baseline conditions; and	Partial	See Section 4.1 – Please provide further details from the Surface Water Management and Monitoring Plan. Alternatively, provide a hyperlink to the document.	To note comments and amend the plan accordingly.
(g) a program to monitor and maintain the water quality, ecological, hydrological and geomorphic integrity of the creek relocation.	Partial	See Section 4.2 – Please provide further details from the Surface Water Management and Monitoring Plan. Alternatively, provide a hyperlink to the document.	To note comments and amend the plan accordingly.
<b>General Comments</b>			

#### Attachment A MOC – Post Approval

- See Figure 2-1 – Please update to be clearer and more descriptive.



Department of  
Primary Industries  
Water

Contact Hannah Grogan

Phone 02 4904 2516

Email [hannah.grogan@dpi.nsw.gov.au](mailto:hannah.grogan@dpi.nsw.gov.au)

Our ref V15/3875-2#18 & OUT17/20871

Mount Owen Complex

Email: [vicki.mcbride@glencore.com.au](mailto:vicki.mcbride@glencore.com.au)

**Attention: Vicki McBride**

Dear Ms McBride,

### **Mount Owen Complex – Water Management Plan Suite**

I refer to your email dated 17 January 2017 seeking the Department of Primary Industries – Water's (DPI Water) comments on the Water Management Plan Suite (WMP) for the Mt Owen Continued Operations Project (SSD 5850). DPI Water has reviewed the WMP and our comments are as follows. Detailed comments are outlined in **Attachment A**.

DPI Water considers that the groundwater assessment criteria require further development to ensure that objects and principles of the *Water Management Act 2000* are met. This is important to ensure that the beneficial use class of the alluvial aquifer is maintained and monitored.

In addition it is recommended that further consultation occurs regarding proposed diversion design to ensure long term geomorphic function.

### **Recommendations:**

DPI Water recommends that:

1. Water dependent assets (including GDEs, groundwater users and the associated surface water systems) within and around the Mount Owen Complex (MOC) will have different impact risk including proximity to open cut pits, void structures and emplacement areas. The groundwater assessment criteria needs to be further developed in consultation with DPI Water. The criterion is to consider water quality and water level triggers for investigating any potentially adverse groundwater impacts. The proponent should address these different risks and set the trigger levels based on representative data for the appropriate area, noting a decline in salinity can be an equally important indicator for a change in hydrological connection between aquifers.
2. The WMP has used the term 'significant' or 'significantly' to define a level of impact change relating to mine inflows and alluvial seepage. These terms require a

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prescriptive definition that warrants an investigation so that there is no ambiguity between the proponent and regulator.

3. It is noted in the Groundwater Management and Monitoring Plan (GMMP) Table 2.1 'Mine Inflows' that there is a sharp increase in pit inflows at the Glendell Mine for year 2020. Clarification is requested as to the driver for the sharp increase in inflow in year 2020 and any additional licensing requirements that may arise subject to the source of increased inflows.
4. As the overall salinity in the alluvium is reported to be higher than the hardrock/coal aquifers, which is a peculiarity, a check of the bore log construction, history of data observations and mining should be undertaken to evaluate the representativeness of a trigger site before selection. DPI Water recommends the provision of downhole salinity EC profiles and charge balance error assessments for major ions to assist in the alluvial aquifer resource conceptualisation and data validity. This will assist DPI Water in providing advice on the groundwater assessment criteria.
5. Further clarification is required within the GMMP to demonstrate how groundwater monitoring links with the Biodiversity Plan and how this will assist in the management and protection of GDEs.
6. Further detail is required to understand the extent of discrepancy required between water balance and evaporative losses that would lead to triggering an investigation of water losses from storages and tailings emplacements. Consideration should be given to linking this trigger to the bore water quality and level monitoring.
7. It is recommended that the proposed diversion be redeveloped in consultation with DPI Water. It is considered that the currently proposed hydraulically smooth channel, grass lined and over-steepened channel bed is not sufficient for promoting geomorphic processes and preventing erosion and scour. This review must include increased channel roughness elements such as large woody debris tied to rock bed level controls. This is important to protect revegetation of the channel bed and banks and to form elements to capture and incorporate sediment transported from upstream into channel geomorphic features and hydraulic elements including runs, glides and pools.
8. Revegetation of the diversion should be designed in accordance with DPI Water Guidelines for Controlled Activities on Waterfront Land (2012).
9. Commitment 19 should consider appropriate indicators of geomorphic change.

Please contact Hannah Grogan, Water Regulation Officer (Newcastle) on (02) 4904 2516 or [Hannah.grogan@dpi.nsw.gov.au](mailto:Hannah.grogan@dpi.nsw.gov.au) if you have further enquiries regarding this matter.

Yours sincerely,



Irene Zinger  
**Regional Manager - Metro  
Water Regulatory Operations**

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## Appendix B - Creek Diversion Plan Approval



Planning Services  
Resource Assessments  
Contact: Jack Murphy  
Phone: (02) 8217 2016  
Email: [jack.murphy@planning.nsw.gov.au](mailto:jack.murphy@planning.nsw.gov.au)

Mr Ned Stephenson  
Environment and Community Manager  
Glencore Australia Holdings Pty Ltd  
Level 44, Gateway 1 Macquarie Place  
Sydney NSW 2000

Email: [ned.stephenson@glencore.com.au](mailto:ned.stephenson@glencore.com.au)

Dear Mr Stephenson,

**Mt Owen Complex (SSD 5850 / DA80/952)  
Environmental Management Plans**

I refer to your email dated 8 November 2018 submitting the revised management plans for the Mt Owen Complex. The Department has reviewed the following documents:

- Erosion and Sediment Control Plan dated November 2018 (condition 26, Schedule 3 of SSD 5850 and condition 32, Schedule 3 of DA80/952);
- Creek Diversion Plan dated November 2018 (condition 24, Schedule 3 of SSD 5850 and condition 30, Schedule 3 of DA80/952); and
- Water Management Plan dated November 2018 (condition 26, Schedule 3 of SSD 5850 and conditions 29 and 31, Schedule 3 of DA80/952).

I can advise that the Secretary approves the Creek Diversion Plan. Please ensure a finalised copy of this plan is made available on the company's website.

The Department considers that the remaining documents have not adequately addressed the relevant requirements of the respective conditions. The Department's comments on these documents are provided in **Attachment A**.

The Department requests that these documents are updated and re-submitted no later than **22 November 2018**.

Should you have any enquiries in relation to this matter, please contact Jack Murphy.

Yours sincerely,

A handwritten signature in blue ink that reads 'Jessie Evans' followed by the date '13.11.18'.

Jessie Evans  
A/Director  
Resource Assessments  
As nominee of the Secretary

## Appendix C - Quarterly Diversion Inspection Template

DIVERSION NAME:		Date:	Inspection By:		
Diversion Structure and component	Checklist		Comments	Actions Taken (including Date)	Follow up required
	No work required	Work Required			
<b>Channel Section</b>					
Overall condition of channel and meteorological conditions previous to and at the time of the inspection.					
Condition of channel banks (rill erosion, slumping etc)					
Condition of channel invert (erosion, sediment deposition etc)					
Condition of Vegetation					
Deposition of sediment and debris (General Accumulation / Reduced Waterway Access)					
Other (specify)					
<b>Rock Bars and Rock Lined Drop Structures</b>					
Conditions of Banks and Inverts (erosion and slumping etc)					
Sediment Build Up					
Debris Accumulation					
Vegetation and Weed Growth					
Other (specify)					
<b>Other areas / Comments</b>					
Base of channel condition.					
Debris Accumulation					
Condition of vegetation					
Weed Growth					
Condition of turfed areas					
Public hazards					
Community complaints					
Aesthetics					
Feral Animals					
Other (specify)					