WHITEHAVEN COAL MINING PTY LTD

ABN: 65 086 426 253

Belmont Coal Project

via Gunnedah

Surface Water Assessment

Including a

Surface Water Management Plan

Prepared by

Department of Lands – Soil Conservation Service

September, 2007

Specialist Consultant Studies Compendium
Part 6

Surface Water Assessment

Including a

Surface Water Management Plan

of the

Belmont Coal Project

Prepared for: R.W. Corkery & Co. Pty. Limited
PO Box 80
ORANGE NSW 2800

Tel: 02 6362 5411
Fax: 02 6361 3622
Email: mail@rwcorkery.com

On behalf of: Whitehaven Coal Mining Pty Ltd
1/895 Ann Street
PO Box 2440
FORTITUDE VALLEY QLD 4006

Tel: 07 3000 5693
Fax: 07 3000 5699
Email: kross@whitehaven.net.au

Prepared by: Department of Lands
Soil Conservation Service
PO Box 199A
108 Faulkner Street
ARMIDALE NSW 2350

Telephone: 02 6770 3112
Fax: 02 6772 8782
Email: david.howley@lands.nsw.gov.au

September, 2007

CONTENTS

CONTENTS

EXECUTIVE SUMMARY

This report presents the findings of a surface water assessment undertaken for R.W. Corkery & Co. Pty Limited on behalf of Whitehaven Coal Mining Pty Ltd for the proposed Belmont Coal Project.

The report forms part of a Specialist Consultant Studies Compendium accompanying an Environmental Assessment for the proposed Belmont Coal Project ("the Project"). The main aims of the assessment are to predict the likely impacts of the Project on the surface water within the Project Site and surrounds.

The results of the assessment can be summarised as follows.

The Project could potentially impact on:

- surface water quantity through:
  - flooding; and / or
  - water usage;
- surface water quality in the form of changes to water:;
  - pH;
  - suspended solids;
  - electrical conductivity;
  - heavy metal concentrations; and
  - oils (hydrocarbons);
- soil erosion; and
- dryland salinity.

A Surface Water Management Plan is included which provides recommendations for optimal management of water resources on and surrounding the site of the proposed Project ("the Project Site").

Recommendations to mitigate these impacts included in the Surface Water Management Plan are as follows.

- Diverting clean water around disturbed areas and capturing a proportion of this water within the harvestable right of the Project Site to meet the Project water requirements.
- Constructing transport routes at current ground levels and creek bed levels.
- Capturing dirty water, using it for dust suppression and other environmental purposes or treating it so that it can be discharged within acceptable guidelines. There would be limitations with providing sufficient water for the suppression of dust. This can be managed by limiting dust generation practices, maximising water storages, limiting evaporative losses and by supplementing water requirements from groundwater reserves.
- Maintaining and enhancing as much vegetation on-site as possible.
- Monitoring water, soil and vegetation parameters.

This page has intentionally been left blank

1 INTRODUCTION

1.1 Background

This Surface Water Assessment, which includes a Surface Water Management Plan (SWMP), has been produced by Soil Conservation Service, a Division of the NSW Department of Lands for R.W. Corkery & Co. Pty Limited on behalf of Whitehaven Coal Mining Pty Ltd. This document forms part of the Specialist Consultant Studies Compendium prepared in support of an Environmental Assessment for the proposed Belmont Coal Project ("the Project"), located approximately 25km north of Gunnedah (see **Figure 1**).

Soil Conservation Service was commissioned to describe the Project Site in relation to surface water characteristics and parameters and undertake a literature review identifying and discussing surface water studies previously undertaken, State and National legislation and best practice that is pertinent to surface water management to assess the constraints and opportunities to surface water management present. Based on this constraints and opportunities assessment, and a review of the proposed project development, soil services was requested to identify the potential impacts of the Project and through the development of a Surface Water Management Plan, provide recommendations for the most appropriate way to mitigate potential impacts associated with the proposed development.

Recommendations are also given for the long term management of the Project Site.

Please Note: When environment is referred to within this document, it pertains to the total environment, being the interaction of the physical, biological and social environments.

1.2 Objectives

The objectives of this surface water assessment and SWMP are to:

- describe the existing environmental factors and characteristics of the Project Site and surrounding drainage network;
- describe the impact that the proposed Project may have on these environmental factors and characteristics ;
- provide recommendations, in the form of the SWMP, as to appropriate controls and by which to mitigate any possible impacts. The design, function and location of these controls would focus on the following.
  - Diverting "clean" water flows additional to the maximum dam capacity of the Project Site, around the proposed areas of disturbance within the Project Site (thus reducing the potential for erosion), and to maintain existing water flows for the environment further down the catchment.
  - Divert water flows on the Project Site around areas that have high potential to erode.
  - Minimising disturbance to vegetation, particularly grasses, and promote the re-establishment of grass cover on disturbed areas of the Project Site.
  - Limiting erosion of soils within the Project Site via structural earthworks and other management practices.
  - Treat "dirty" water containing high sediment levels, contaminated or potentially contaminated water, to current acceptable guidelines before discharge into the surrounding environment.

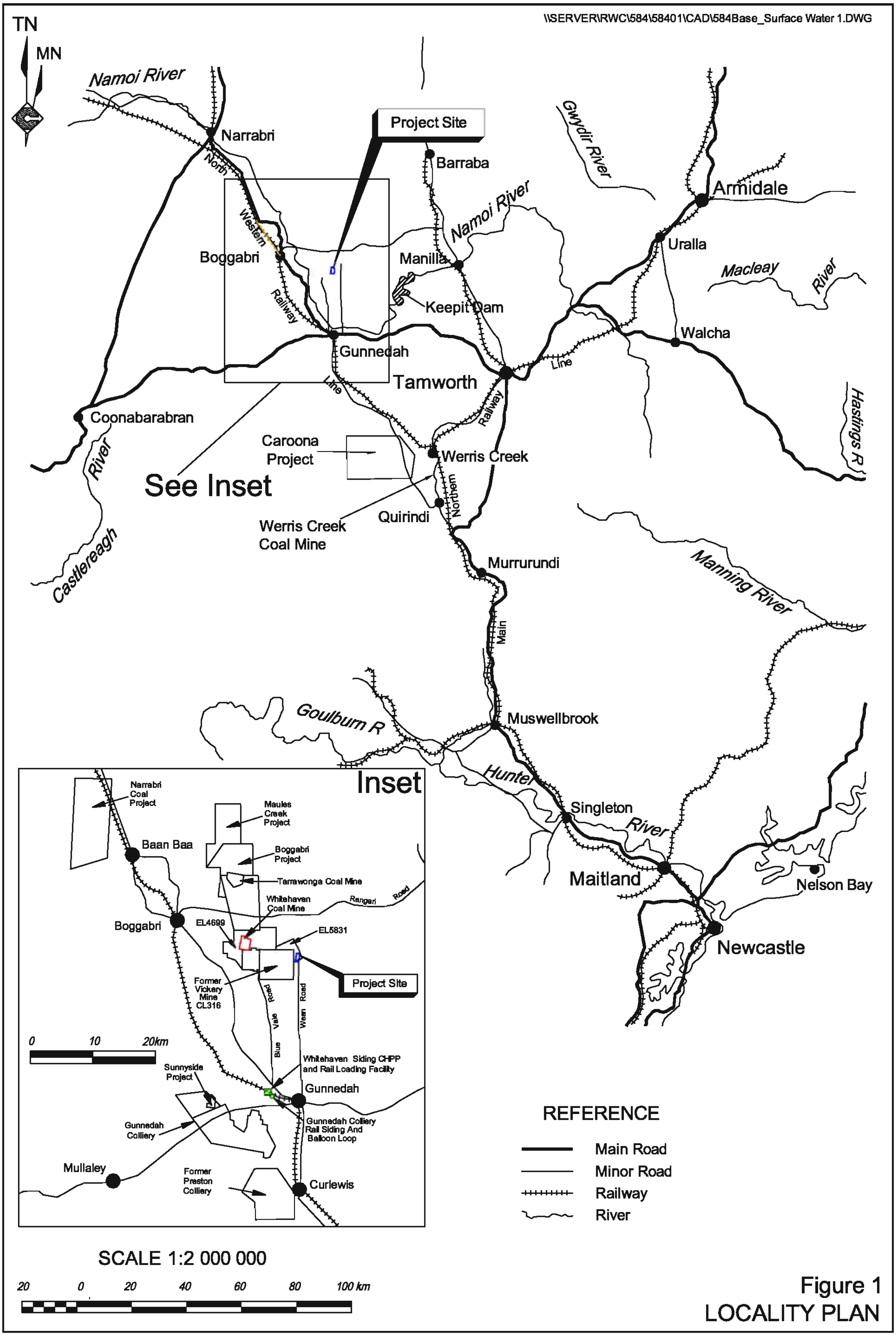

Figure 1
LOCALITY PLAN

2 PROJECT SITE

2.1 Site Description

The Project Site has an approximate area of 366ha, of which approximately 50ha is contained within the Driggle Draggle Creek catchment. Surface water flows are to the north into Driggle Draggle Creek and then westerly into Barbers Lagoon, before flowing into the Namoi River approximately 25km from the Project Site. The remainder of the Project Site, approximately 316ha, is within an unnamed flow depression catchment with surface water flowing in a generally southerly direction to a central drainage depression then westerly into the Namoi River approximately 10km from the Project Site.

The Project Site and surrounds has been divided into 4 separate sub-catchments with these described in **Table 1** and presented on **Figure 2**.

Table 1
Catchments of the Project Site

Catchment No.	Approximate Area	Description of Catchment
1	59	This catchment falls northerly towards Driggle Draggle Creek.
2 (North)	67	This catchment generally falls east then southerly into the Project site
2 (West)	155	This catchment generally falls south easterly into the Project Site.
2 (East)	773	This catchment falls westerly then southerly through the southern end of the Project Site.
Total	**1 014ha**	

2.2 Existing Water Storage and Harvestable Right

Eight dams occur within the Project Site. **Table 2** lists their approximate capacity with their location presented on both **Figure 2** and **Figure 3**.

Table 2
Dam Capacities and Locations

Dam Number	Capacity (m^3)
1	800
2	900
3	2000
4	1000
5	1500
6	5000
7	5000
8	1000
Total	17200

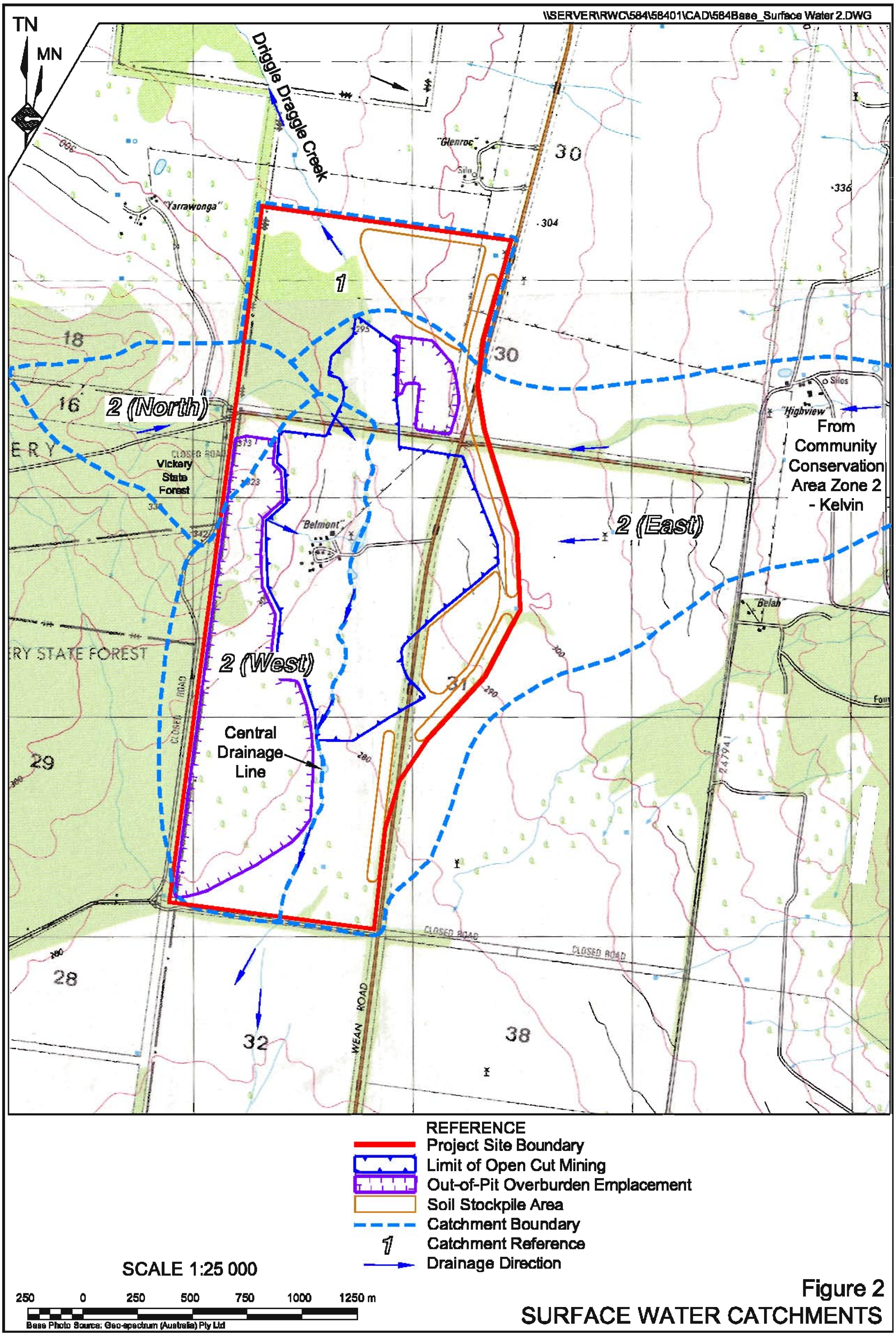

Figure 2
SURFACE WATER CATCHMENTS

The capacity of existing water storages on the Project Site is approximately 17,200m^3. Throughout the life of the Project, 3 of these dams would be removed as they are within the limit of open cut mining. There would be approximately 14,200m^3 of water storage retained and available for use once the open cut area and overburden emplacements are at their fullest extents.

The maximum dam capacity of the Project Site is determined by the following calculation.

Maximum Dam Capacity = Catchment Area x Multiplier Value
= 366 x 0.07
= 25.6ML

This calculation is based on the determination of the maximum dam capacity (MDC) using the folder supplied by Department of Land and Water Conservation (DLWC) now Department of Water and Energy (DWE) titled *Rural Production and Water Sharing Landholders Information Package*. Given that the MHRDC is 25.6ML, there is potential to store, through the construction of additional dams, an additional 11.4ML (25.6ML minus 14.2ML) on the Project Site which can be used for any purpose. It should be noted that the remaining areas of the properties on and surrounding the Project Site and owned by Whitehaven Mining Pty Ltd have not been included in the MHRDC calculations. If the additional area of land owned by Whitehaven Coal Mining on land outside the Project Site but within the affected catchments on the ‘Belmont’, ‘Glenroc’, ‘Yarrari’, Belah’, ‘Brentry’, ‘Stratford’ and ‘Rosebery’ properties (approximately 3 000ha) were considered then there would be an additional maximum dam capacity of in excess of 210ML/year available (3 000ha – 366ha = 2 634 x 0.07).

It is noted that the maximum dam capacity does not include storages that are to be used for environmental purposes. For the Project, environmental purposes include the capture of predominantly “dirty” or sediment-laden water. The water within these storages can be used for dust suppression and watering rehabilitated areas.

The flooding issues that are considered relevant for the Project Site is the water that flows from east to west out of the Community Conservation Area Zone 2 - Kelvin. This has potential to interfere with the mining operations within the Project Site. Any flooding would be restricted to localised runoff and would recede within approximately 24hrs to minor flows after rain cessation. The proposed diversions of clean waters would largely alleviate this localised flooding issue. There could also be minimal localised runoff from the south out of Vickery State Forest which could possibly temporarily interfere with the transport of coal from the Project Site to the Whitehaven Coal Handling and Preparation Plant.

3 LITERATURE REVIEW

This section details literature that is pertinent to the surface water management of the Project. It discusses State and national legislation and best management practice guidelines.

The following legislation was reviewed to ascertain how the management of surface water on the Project Site would affect the intent of each Act.

- *Fisheries Management Act 1994*;
  - This act deals with the management of fisheries and how they are regulated. Works associated with the constructed / upgraded section of the proposed transport route would cross a number of external drainage lines flowing from Vickery State Forest and therefore input and comment from Department of Primary Industries (NSW Fisheries) may be required.

- *Protection of the Environment Operations Act 1997*;
  - This act is concerned with the control of various polluting activities. Such activities must be licensed if they meet specified thresholds. Even if not licensed the activity may be required to comply with orders issued by the Department of Environment and Conservation (DEC) or local council. Often the works undertaken that have potential to pollute require an exemption or at least a notification to the DEC who administer this act. An Environment Protection Licence would be required for the Project.

- *Water Act 1912*;
  - This act principally deals with water licensing and water allocations. Sections of it have been repealed and replaced with sections of the *Water Management Act 2000*. A groundwater extractive licence from the Department of Natural Resources (DNR) may be required for the Project.

- *Water Management Act 2000*;
  - This act deals with a whole variety of issues associated with the management of water. The issues that are pertinent here refer to the construction of water holding structures, water diverting structures and water pumping devices. Management of harvestable rights is governed by the *Water Management Act 2000* and would apply to the Project.

- *Contaminated Land Management Act 1997*:
  - This act establishes a system in NSW for investigation and remediation of land contamination which presents significant public health or environmental risks. This would only apply if there is lingering contamination caused by the spillage of pollutants or if the nature (salinity, acidity and heavy metal contents etc) of the earth being uncovered is outside those acceptable levels as prescribed. Based on a review of GCNRC (2007b), a study of the Project Site soils, this Act is unlikely to apply to the Project.

- *Soil Conservation Act 1938*;
  - This act covers the issues involved in soil conservation within the State. By diverting clean water onto stable ground and by treating and capturing dirty water, soil erosion would be minimised. The issue of development consent and the grant of a mining lease would supersede the requirements of this act.

- *Environmental Planning and Assessment Act 1979* ;
    - The principal objectives of this act are to co-ordinate policies, programs and activities as they relate to total catchment management, and to achieve active community participation in natural resource management. The Namoi Catchment Blueprint produced by the Namoi Catchment Management Board has been reviewed and its issues and targets have been considered within this document.
- *Local Government Act 1993*
    - The principal objectives of this act are to provide the legal framework for an effective, efficient, environmentally responsible and open system of local government in New South Wales. To regulate the relationships between the people and bodies comprising the system of local government in New South Wales. To encourage and assist the effective participation of local communities in the affairs of local government. The issues raised by Gunnedah Council have been considered in the development of the SWA.
- *Rivers and Foreshore Improvement Act 1948*;
    - An act to provide for the carrying out of works for the removal of obstructions from and the improvement of rivers and foreshores and the prevention of erosion of lands by tidal and non-tidal waters. Works involved with the construction of the proposed transport route may require the application for a permit under Part 3A of this Act from the DNR.

A number of other documents have been reviewed and issues that have been identified relating to surface water on the Project Site and the ramifications that has for the receiving waters environment are:

- water quantity – both downstream availability of surface water for local landholders and environmental flows, and impacts on local flooding patterns;
- water quality – as it impacts on downstream water users, vegetation and quality criteria for the Namoi River Catchment;
- soil erosion; and
- dryland salinity.

These identified issues are discussed in greater detail in Section 5.

4 OVERVIEW OF THE PROJECT

4.1 The Project Site

The area of land on which mining and mining-related activities are proposed is referred to throughout this document as the “Project Site”. The Project Site covers an area of approximately 366ha within Exploration Licence (EL) 5831 and Consolidated Lease (CL) 316 incorporates parts of the “Belmont”, “Glenroc” and “Roseberry” properties.

The Project Site lies within the Parish of Tulcumba and incorporates all or part of:

- Lots 1 and 2, DP 787417;
- Lot 30, DP 754950; and
- Council roads and road reserves.

4.2 The Transport Route

The transport route from the Project Site to an established coal transport route (Hoad Lane / Blue Vale Road / Kamilaroi Highway) to the Whitehaven CHPP would incorporate a 3.6km section of a "purpose-built" haul road from the southwestern corner of the Project Site to the east-west running Shannon Harbour Road (SR 93). This section of road would be constructed to accommodate the movement of 40t capacity B-double coal trucks. The transport route would then incorporate an upgraded section of the currently closed Shannon Harbour Road (2.5km) before intersecting with Hoad Lane. The transport route would then join an established transport route along Hoad Lane (0.2km), Blue Vale Road (17.2km) and Kamilaroi Highway (0.5km) before entering the Whitehaven CHPP.

4.3 Project Description

The Project, if approved, would involve the following activities.

- Coal mining by open cut mining methods over the area defined by the "limit of mining" (114.1ha). The limit of open cut mining has been defined by drilling and a review of economic, geological and environmental considerations as described in Section 2.3. The area proposed for auger mining is identified beyond the western limit of open cut mining and incorporation of this into the mine plan would be determined primarily by economic factors at the time.
- Open cut mining would be by the conventional haulback method involving the sequential removal of soil and overburden / interburden materials above and within the coal seams, coal removal, and progressive backfilling and rehabilitation of the mined-out areas. Open cut mining may be supplemented by auger mining, to a distance of 200m beyond the western limit of the open cut.
- Annual ROM coal production would increase from an initial level of approximately 0.75Mtpa to a maximum annual rate of 1.5Mtpa.
- Programmed placement of overburden and interburden materials from the open cut area to a combination of out-of-pit and in-pit overburden emplacements.
- On-site size reduction of the ROM coal using a crushing plant positioned within the Coal Handling and Processing Area.
- Relocation of a section of Wean Road.
- Upgrading sections of Shannon Harbour Road and its intersection with Hoad Lane to be incorporated into the transport route.
- Transportation of coal from the Project Site to the Whitehaven CHPP for washing and/or despatch to export markets via rail to Port Newcastle. At least 85% of the Project ROM coal would require washing.

- Backloading of coarse and fine reject material from the Whitehaven CHPP for placement in the mined-out areas within the limit of mining.
- Installation of a range of services, structures and transportable buildings.
- Progressive shaping and rehabilitation of the areas of disturbance within the Project Site.

In addition to these activities, the Project would be operated with comprehensive systems to manage groundwater, surface water, noise, blasting, air quality, visibility, Aboriginal heritage, flora and fauna.

Figure 3 presents the proposed Project Site layout.

5 WATER MANAGEMENT ISSUES

5.1 Introduction

When considering the potential impacts that the Project could have on the surface water of the Project Site and surrounds, water quantity and quality must be considered. Substantial changes in either of these factors beyond what are recognised to be natural variations in both would potentially be detrimental to the Project Site and/or surrounding environment. There are a number of potential sources associated with the Project that could change the Project Site's surface water characteristics. The sources that can affect both quantity and quality of surface water on-site and ultimately entering the surrounding environment include:

- run-off from any area that has been denuded of vegetation;
- run-off from stockpiles of topsoil, subsoil, overburden and raw and processed coal;
- discharge of groundwater which accumulates in the open cut area;
- runoff into the open cut void;
- run-off from hardstand areas including roads, processing areas, site facilities and stockpiles of coal and other materials; and
- leaking or spillage of hydrocarbon products.

5.2 Water Quantity

The Project could potentially increase the amount of run-off leaving the site due to the disturbance of vegetation and increases in hardstand areas. This increase in water quantity could increase the soil erosion of the Project Site and surrounding environment.

It is also possible that the development of the open cut area void, coupled with the construction of additional water storages or the Project Site and significant ater use by the Project may decrease the volume of water available for downstream landholders and environmental flows.

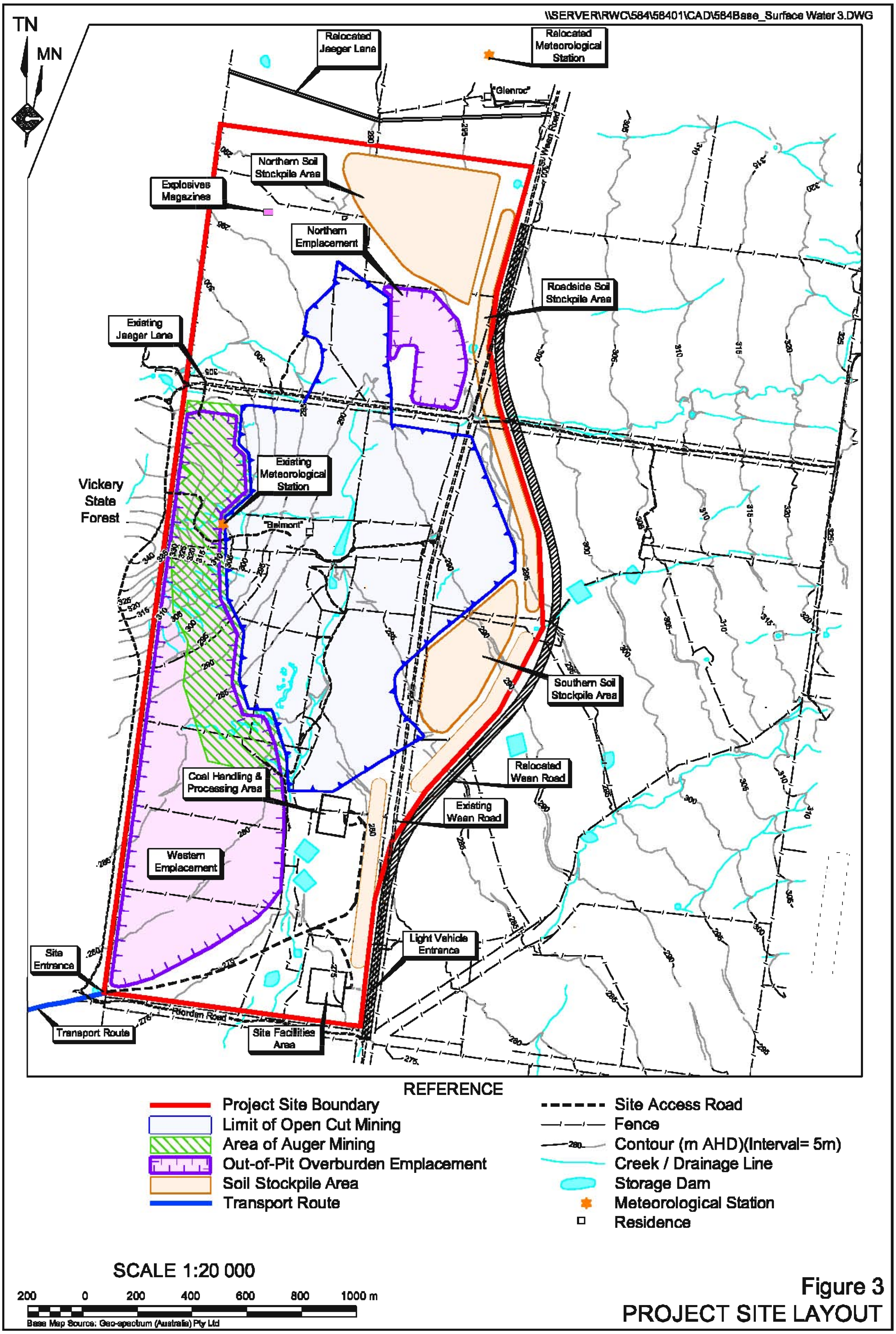

Figure 3
PROJECT SITE LAYOUT

Note: A Colour Version of this figure is available on the project CD

5.3 Water Quality

Water quality parameters that are most likely to be affected by the potential sources identified in Section 5.1 include:

- pH;
- suspended solids;
- electrical conductivity;
- heavy metal concentrations; and
- hydrocarbon products (fuel, oil and lubricants).

Water that has a suspended solids concentration equal to or lower than that specified within **Table 3** is referred to as “clean water”. Water that has a suspended solids concentration greater than those specified within **Table 3** is referred to as “dirty water”. Water that displays substantial changes in pH, electrical conductivity or contains concentrations of heavy metals or hydrocarbons above nominated levels is referred to as “contaminated water”.

Table 3
Discharge Parameter Limits

Parameter	50^{th} Percentile Limit	70^{th} Percentile Limit	100^{th} Percentile Limit
pH	-	-	6.5 to 8.5
Suspended Solids (mg/L)	≤ 20	≤ 35	≤ 50
Grease and Oil (mg/L)	-	-	≤ 10
Electrical Conductivity (µS/cm)	-	-	350µS/cm*
* Based on the ANZECC in-stream criterion for waterways in this area of <350us/cm.			

GCNRC (2007b) undertook comprehensive soil sampling program on the Project Site and analysed the chemical and physical properties of the sampled soil. Generally it was found that the topsoil material [to 15cm depth] and the subsoil [to about 65cm total depth below the original soil surface] have minor to moderate erosion potential. However the lower subsoil material has limitations imposed by high dispersibility, moderate salinity and generally very high pH. In particular, its dispersive nature dictates that its erosion potential could be rated as moderate to high.

Assuming disturbance to the potentially saline soils is minimised and/or managed as recommended by GCNRC (2007b), the impact on water quality from changes in acidity, electrical conductivity and heavy metal concentrations is likely to be low. The parameters that are of particular importance are therefore suspended solids and hydrocarbon products.

The current water quality parameters that are appropriate for the assessment of impacts associated with the activities proposed within the Project Site and their current acceptable guidelines are presented in **Table 3** (as prescribed by the Department of Environment and Climate Change (DECC)).

5.4 Soil Erosion

Surface water flows can cause sheet, rill and gully erosion, all of which have been identified within a number of reference documents as of significance. Wind may also lead to soil erosion or transportation of soil from its origin. Although erosion is a natural occurrence, changes in vegetative cover and concentration of water accelerates its occurrence and its severity. The lost soil reduces the productive capacity of the land and through the discharge of elevated concentrations of suspended solids, change the environmental characteristics of receiving waters and catchments. The Project would alter the vegetative cover and concentrated flow of water so it could potentially lead to increased erosion. The SWMP (Section 6) addresses this issue via a variety of management practices.

5.5 Dryland Salinity

Dryland salinity is the accumulation of salts within the soil profile that hinder plant growth, ultimately denude areas and increase the salt concentration in surface water flows into creeks and rivers. Dryland salinity has been identified as an issue within the Namoi Valley (NCMB 2003). The acceleration of dryland salinity is a result of a reduction in the number of deep rooted vegetation species that keep the water table lower within the soil profile and thus not allow the salts to accumulate. Vegetation would be disturbed by the Project although it is recognised that a substantially greater number of trees are to be planted on the Project Site than are to be removed. This additional planting of vegetation could also be planned so as to provide wind breaks particularly over bare earth areas so as to reduce the likelihood of wind erosion. The management of vegetation would aid in reducing any dryland salinity issues that may develop as a result of the Project. Similarly the replacing of soils back within their current profile positions will increase the success of land rehabilitation and the limitation of offsite movement of the natural accumulation of salts within the soils.

6 SURFACE WATER MANAGEMENT PLAN

6.1 Introduction

Section 6 provides a series of recommendations against the potential impacts outlined in Section 5.

When managing water within and around any Project that would disturb vegetation and soil, the key principles are to:

(i) divert “clean” water away from the disturbed area;

(ii) capture “dirty” water and treat it so that it can be discharged to meet accepted guidelines; and

(iii) maintain as much vegetation (particularly grass), on the Project Site as possible.

The SWMP firstly considers management of water quantity (see Section 6.2) followed by the water quality aspects (see Section 6.3), contingency plans (see Section 6.4), monitoring and long term management of the landforms within the Project Site (see Section 6.5). The SWMP has been designed on the basis of the worst case scenario, that being the Project being in full operation with the overburden emplacements at their fullest extent and without any vegetative cover. The design criteria, design procedures and data sources are shown in **Appendix 1**. The specification of control measure (banks, dams, basins) positions and sizes provided is indicative, these specifications may vary with specific mine management requirements, the progression of the mine void and embankments and a desire to capture all dirty water that is generated by the Project.

6.2 Water Quantity

6.2.1 Project Site Catchment Yields

Based on the harvestable rights for the Project Site, there is provision to capture and use 25.6ML of clean surface water. This water storage would lengthen the time of concentration thus reducing any localised flooding impact associated with the increase in peak discharge that may occur with the increased surface water flows from the denuded and hardstand areas. Further assessment and discussion of flooding issues for the Project Site and proposed transport route is discussed within Section 6.2.3.

Catchment 2 (North) identified in Section 2.1, **Table 1** and **Figure 2** slopes to the east and then south off the Project Site. For the duration of the Project, the water that flows witin this catchment will have to be diverted north into Driggle Draggle Creek to prevent this water flowing into the void, thereby significantly hampering mining operations and increasing the amount of water that would need to be handled and possibly treated before discharge. This diversion would require approval from DWE. Once the mining void progresses south and a drainage line to the south is re-established around the open cut void, this catchment could be redirected south. This would re-establish the current watersheds and equitable allocation of water to other users.

It is proposed that the water required annually by the Project would be between 75ML and 95ML. Once the Project Site is fully committed in capturing its harvestable right there would be 25.6ML available annually (subject to availability) to use. **Table 4** summarises the catchment yield calculations for the Project Site and individual sub-catchments.

Based on the calculations of Project Site sub-catchment yields, the maximum harvestable right of 25.6ML/yr could be easily obtained through the construction of appropriately placed storage dams. The remaining water requirement for the Project (69.4ML i.e. 95ML – 25.6ML) could be obtained from one of four sources:

- capture of dirty water which flows over exposed surfaces within the Project Site;
- extraction of groundwater from one or more existing or constructed bores;
- from groundwater and surface water retained within the mine void; and
- utilising the proponents right to harvest water on other sections and whole adjioning properties owned by the Proponent.

It would also be possible for the Proponent to obtain a licence to capture and use additional clean water and thereby increase the maximum dam capacity, however, given the other opportunities available to obtain the required volume of water, this is not considered necessary.

Table 4
Annual Catchment Yields for Individual Catchments

Rainfall Event (mm)	Decile 1 Rainfall (373.6mm)	Mean Rainfall (616.4mm)	Decile 9 Rainfall (843.4mm)
Catchment 1 (59ha) Yield (ML/year)	28.0	46.2	63.3
Catchment 2 (North) (67ha) Yield (ML/year)	41.5	68.4	93.6
Catchment 2 (West) (155ha) Yield (ML/year)	108.7	179.4	245.4
Catchment 2 (East) (773ha) Yield (ML/year)	347.4	573.3	784.4
TOTAL (ML/year)	525.6	867.3	1186.7

6.2.2 Water Balance

The site water balance calculates the volume of water that would be captured within each of the site water catchments (see **Figure 2**) and has been prepared for dry years (10^{th} percentile rainfall), wet years (90^{th} percentile rainfall) and for the Median Year (50^{th} percentile rainfall). The site water balance has been prepared to assess the following:

- whether sufficient surface water is available for capture onsite during dry years for the water requirements outlined; and
- if significant discharge would be required in wet years.

Table 5 outlines the catchment yields under varying rainfall events, the type of water captured and the water storages associated with these catchments. These catchments reflect the surface water management controls presented with the SWMP (see **Figure 4)**.

Even during dry years (10^{th} percentile rainfall), sufficient water would be available from a combination of dirty water (including the open cut area) and clean water sources to meet operational water requirements. Given the catchment yields exceed water storage volumes in dry years (10^{th} percentile), the average years (50^{th} percentile) and wet years (90^{th} percentile), it is expected that a discharge of surface water may occur.

6.2.3 Local Flooding

The Proponent is intending to construct the proposed transport route at current ground level and/or as specified by Gunnedah Shire Council and the NSW Roads and Traffic Authority and wherever necessary cross any gullies via concrete or pipe causeways. This type of gully crossing and road construction would not inhibit the overland flow of water and thus would not impact on localised flooding of the area.

Table 5
Annual Catchment Yields for Various Rainfall Events and Associated Water Balance

Catchment	Area (ha)	Yield (10th Percentile 373.6mm) (ML/year)	Yield (50th Percentile 619.9mm) (ML/year)	Yield (90th Percentile 843.4mm) (ML/year)	Associated Water Storage (ML)
"Dirty" water from northern emplacement	9	3.36	5.58	7.59	2
"Dirty" water from western emplacement and ROM	74	27.65	45.87	62.41	13
Open cut area	60	22.42	37.19	50.60	11
Groundwater inflow	Negligible				
Total Dirty Water		**53.42**	**88.65**	**120.61**	**26.00**
"Clean" water falling south	888	331.76	550.47	748.94	23.60
"Clean" water falling north	50	18.68	31.00	42.17	2
Other properties harvestable rights	634	236.86	393.02	534.72	44.40
Total Clean Water		**587.30**	**974.48**	**1325.82**	**70**
Total Clean and Dirty Water		**640.72**	**1063.13**	**1446.43**	**96**
Mine Water Requirements		**95**	**85**	**75**	
Total Balance		**545.72**	**978.13**	**1371.43**	**96**

7 WATER QUALITY

7.1 Diversion of Clean Waters

The diversion of clean waters away from disturbed areas would reduce erosion and its potential for contamination. This would be achieved by constructing diversion banks and storage dams. The positions of these structures are shown on **Figure 4** and their specifications listed in **Tables 6** and **7**. There is a requirement in this area to divert a catchment to the north, this will be achieved by constructing a small dam within the catchment gully and associated diversion banks (DB1 and DB2). There is also a requirement to construct a waterway that runs parallel to the Project Site boundary on the western side (WW1). Similarly there is a requirement to construct an easterly waterway to direct waters that enter the Project site from the east; this will link with 2 westerly waterway systems.

The dimensions for each diversion bank are based on the upslope catchment area and topography. Generally the following should be followed for each bank, namely:

- the channel of the bank is to be trapezoidal;
- bank batters between 1:3 to 1:6 (Vertical : Horizontal);
- channel batters are to be 1:6 (V:H);

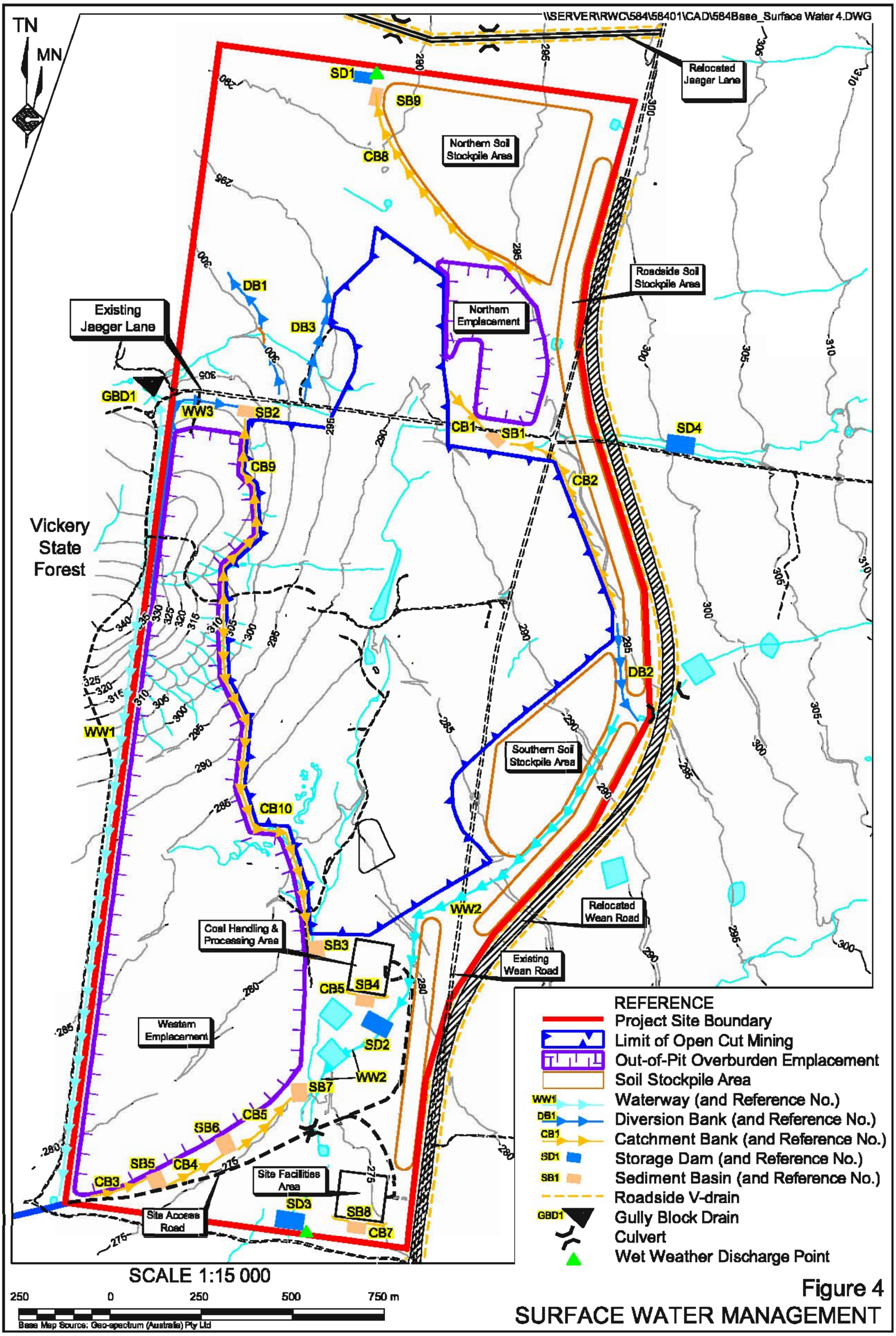

Figure 4
SURFACE WATER MANAGEMENT

Table 6
Diversion Bank and Waterway Specifications

Structure ID	Catchment Area (ha)	Channel Bottom Width (m)	Channel Grade (%)	Bank Height (m)	Sill Width (m)	Slope Below Sill (%)
Northern Emplacement including Mining Void						
DB1	40	4	0.2	0.8	8	3
DB2	15	3	0.2	0.8	6	2
Western Emplacement and Eastern Waterway Diversion						
	Waterway Width (m)			**Bank Height (m)**		
WW1	12			0.7		
WW2	25 initially extended to 35 once it links with large existing waterway coming in from the east, adjacent ROM.			0.8 – 1.0		

- channel grade 1 : 400 (5cm/20m) if channel is bare;
- channel grade 1 : 200 (10cm/20m) if channel is to kept well grassed;
- level sill outlet to each channel;
- stable grass cover to be maintained below sill outlets; and
- sill width approximately 1.5 x channel base width.

Table 7
Additional Storage Dam Specifications

Structure ID	Catchment Area (ha)	Volume (m^3)	Depth (m)	Dimensions length x width (mxm)	Outlet Width (m)	Sill Width (m)
Northern Catchment						
Gully Block	60	1000	3	28x26	4	8
SD1 – At Northern Site Boundary	124	1400	3	30x30	6	9
Southern Catchment						
SD2 – Below WW2	590	5000	3	50x50	15	35
SD3 – Southern Boundary of Site	888	5000	3	50x50	20	40
Upstream of Relocated Wean Road at crossing of Jaeger lane	177 [1]	2 000	3	30x30	4	8
Note 1: The majority of the rainfall and runoff is diverted away from the dam to the south via existing contour banks. The effective catchment is estimated to be <30ha.						

The requirements for each storage dam would consist of the following, namely:

- excavation and dam bank batters to be at least 1:3 (V:H);
- crest width to be a minimum 3m wide;
- freeboard to be a minimum 1m above top water level up to a wall height of 3m above that there should be an allowance made of 0.1m/m increase in wall height;
- inlet and outlet channel batters are to be 1:6 (V:H);

- outlet channel grade 1 : 400 (5cm/20m) if channel is bare;
- outlet channel grade 1 : 200 (10cm/20m) if channel is to be kept well grassed;
- level sill outlet to each channel;
- stable grass cover to be maintained below sill outlets; and
- sill width of approximately 1.5 x channel base width.

SD1 and SD3 represent discharge points for surface water from the Project Site. These points would be nominated as discharge points on an Environment Protection Licence to be obtained by the Proponent following project approval. The Proponent is commited to maintaining water quality at tehse points to meet DECC licence criteria, expected to be as follows.

- Electrical conductivity <350µS/cm.
- TSS <50mg/L.
- pH 5.5 to 8.5.
- Oil and grease <10mg/L

7.1.1 Capture of Dirty Water

7.1.1.1 Design Specifications

The capture of dirty or sediment-laden water aims to collect water that may have suspended solids concentrations that would be outside the range of those prescribed by DEC guidelines (see **Table 3**). Hydrocarbon products are considered in Section 6.3.2.4.

Cunningham (2007b) classified the dispersibility of the soils within the Project Site as predominantly moderate to high dispersibility particularly in relation to subsoils. This corresponds to Type D soils based on the Landcom manuals classification (2004, p. 6.12). As the majority of soil types are Type D, sediment basins have been designed based on the soil Type D design basin which would have a designated settling zone volume and a sediment storage zone volume. This would allow water that is potentially laden with suspended solids or sediments to settle. Flocculants would have to be used in all sediment basins where water is required to be discharged to expedite the settlement process as Type D soils are dispersible.

Catch banks/drains should be constructed to divert potentially sediment-laden waters into sediment basins below sites that can potentially generate significant quantities of sediment laden water. Often a number of these catch banks/drains are directed directly downslope and in these circumstances these banks are to be back push banks so that no vegetation is disturbed within the bank channel. These banks effectively would act as a one-sided waterway. Another recommended structure noted in **Table 8** is a waterway (WW3) which will be a grassed buffer adjacent the WW1 and direct dirty water into SB 5. This structure is to be constructed early and allowed to vegetate. A grass buffer at leats 12m wide will have to be left on the eastern side of the western emplacement to allow dirty water to run into SB 3. The positions of all of these structures are shown on **Figure 4** and their specifications are listed in **Tables 8** and **9**.

The dimensions for each catch bank are based on the upslope catchment area and topography. Generally the following should be followed for each bank, namely:

- the channel of the bank is to be trapezoidal;
- bank batters between 1:3 to 1:6 (V:H);

Table 8
Catch Bank/Drain Specifications

Structure ID	Catchment Area (ha)	Channel Bottom Width (m)	Channel Grade (%)	Bank Height (m)	Sill Width (m)	Slope Below Sill (%)
Northern Emplacement						
CB1	4	3	0.3	0.7	6	2
CB2	4	3	0.3	0.7	6	2
Western Emplacement						
CB3a & 3	25	3	0.2	0.7	6	2
CB4a & 4	30	4	0.2	0.7	8	2
CB 5,6,7 & 8	4	3	0.3	0.7	6	2
	Waterway Width (m)			**Bank Height (m)**		
WW3	12			0.7		

- channel batters are to be 1:6 (V:H);
- channel grade 1 : 400 (5cm/20m) if channel is bare;
- channel grade 1 : 200 (10cm/20m) if channel is to be kept well grassed;
- level sill outlet to each channel;
- stable grass cover to be maintained below sill outlets; and
- sill width approximately 1.5 x channel base width.

The requirements for each sediment basin would consist of the following, namely:

- excavation and dam bank batters to be at least 1:3 (V:H);
- crest width to be a minimum 3m wide;
- freeboard to be a minimum 1m above top water level up to a wall height of 3m above that there should be an allowance made of 0.1m/m increase in wall height;
- inlet and outlet channel batters are to be 1:6 (V:H);
- outlet channel grade 1 : 400 (5cm/20m) if channel is bare;
- outlet channel grade 1 : 200 (10cm/20m) if channel is to be kept well grassed;
- level sill outlet to each channel;
- stable grass cover to be maintained below sill outlets; and
- sill width of approximately 1.5 x channel base width.

7.1.1.2 Transport Route

The transport route from the Project Site to the Hoad Lane should be constructed with a crown. This road is going to be constructed at ground level with causeways used to cross flow depressions along the proposed route. The Site Access Road into the Project Site should be constructed with a crown over its entire length so that any water that falls on the road is directed either side of the roadway. This would limit roadside erosion. Roadside batters of this road are to be topsoiled and seeded so that vegetation can limit their erosion. Concrete causeways or pipe causeways should also be used to traverse the waterway depressions that exist on the Project Site.

Table 9
Sediment Basin Specifications

Structure ID	Catchment Area (ha)	Volume (m^3)	Depth (m)	Dimensions length x width (mxm)	Outlet Width (m)	Sill Width (m)
Northern Emplacement						
SB1	9	2000	3	35x35	3	6
Western Emplacement						
SB2	10	2000	3	35x35	3	6
SB3	25	2000	3	35x35	3	6
SB4	4	1000	3	27x27	3	6
SB5	25	2000	3	35x35	3	6
SB6	30	2000	3	35x35	4	8
SB7	35	3000	3	40x40	4	8
SB8 follows the facilities area, shown in final location.	4	1000	3	27x27	3	6
Open Cut Void Storage						
Open Cut Void Storages must be 11,000m^3 in capacity there can be any number of storages or one large one provided the total capacity is reached. These storages will migrate south as the void moves south.						

7.1.1.3 Management of Hydrocarbon Products and Storage Areas

Water that discharges from areas where mine plant, equipment and vehicles may be used or serviced may potentially contain hydrocarbons. These areas on the Project Site would include:

- the coal handling and processing area;
- the site facilities area;
- any fuel, oil and grease storage; and
- refuelling bays.

These areas should be managed by the following means.

(i) All water from these areas should be directed to oil separators and containment systems for treatment / decontamination.

(ii) Storage tanks should have an impermeable surface and bunding so as to contain at least 110% of its storage capacity of the largest tank.

(iii) All hydrocarbon products should be securely stored.

(iv) There should be a designated refuelling, oiling and greasing area.

7.1.2 Maintenance of Vegetation on the Project Site

The maintenance of vegetation, in this instance ground cover, would be a critical factor in the containment, and where possible improvement in water quality. It reduces the erosion of soil and also reduces the quantity of suspended solids being transported by filtering the water. As a general rule a ground cover should be maintined on all the land that is not being used for project related activities. While this value would fluctuate with seasonal conditions a 70% cover should be aimed for.

Vegetation, particularly trees, also reduces the potential for dryland salinity by reducing the depth of the water table relative to the root zone of plants. This reduction in water table depth keeps salts within the soil profile further from the surface thus reducing the potential for dryland salinity and loss of productive lands. By maintaining and/or enhancing as much vegetation on the Project Site as possible, particularly trees, the potential for dryland salinity would be reduced.

The critical areas are those that would be subjected to large quantities of diverted water and large quantities of potentially dirty water. Greass cover should be retained at 70% or better. In order to limit soil erosion and to improve water quality, it is imperative that these areas are well maintained. Buffer areas between the overburden emplacements, catch banks and sediment basins should be a minimum of 50m.

7.1.3 Sewage

Sewage effluent is a factor which has the potential to contaminate surface water. As a result, a sewage management system should be installed and managed based on the requirements of the Gunnedah Shire Council and DEC.

7.2 Contingency Plans

A contingency plan should be implemented for surface water management if the following occur.

(i) Discharges from the various sediment basins exceed the discharge parameter limits in **Table 3**. If this occurs, one or more of the following actions should be implemented.

- Add flocculants to expedite settlement of sediments.
- Enlarge the sediment basins or construct additional ones.
- Monitor water quality both upstream and downstream of the confluence of the discharged waters.

(ii) A major hydrocarbon spill. In the event of this occurring the following should be implemented.

- Recover as much as possible at the source by collecting the contaminated ground. This should be put under cover on an impermeable surface to be later remediated and/or transported to an approved waste depot.
- Excavate one or more holes within or around the spill site to create a hydraulic gradient so that soil water and the spilled material would congregate within the holes thus enabling pumping outl
- Monitor groundwater for any continued contamination. Treat this water or utilise this water on-site provided that process is under a DEC licence.

7.3 Long Term Surface Water Management and Final Landform

The installation of all storage dams, diversion banks, catch banks and sediment basins should occur before any other soil disturbance works are undertaken in the respective catchments. The disturbance of vegetation associated with any works should be limited and should be staged so that the maximum vegetation cover is retained for as long as possible. The overburden emplacements should be rehabilitated as the mine progresses thus reducing the amount of denuded earth exposed to rainfall and thus potential erosion. The rehabilitation of the overburden emplacements should be commenced as soon as practicable and completed in stages as the final landform develops.

By designing the water diversion and water storage structures for the worst case scenario, all the structures would need to be in place before the mine becomes operational. These structures should be maintained for the duration of the mine and until the landform is fully revegetated. The sediment basins should be cleaned when their capacity is reduced by 20% and any erosion repaired throughout the life of the mine and subsequent maintenance period.

It is recommended that the final landform of the overburden emplacements be designed to drain as much water as possible into the void area. The remaining waters should be directed upon the overburden emplacement via graded banks into large rock flumes. The graded banks should be equally spaced down the overburden emplacements. Some basic specification for these graded banks are:

- maximum grade of 0.25% or 1 in 400;
- a channel width of not less than 1m;
- bank height of not less than 500mm;
- channel is to be parabolic in shape; and
- excavation batters are to be at least 1 : 4 (V:H).

Each catchments rock flume would direct water from the top of the emplacement batter down to the original ground level. This water can then be directed into the existing sediment basin system. The flumes should be constructed to have the following minimum specifications.

- Parabolic shape with minimum 1m turn up either side.
- 80% of rock used must be >200mm in diameter.
- Minimum 10m width.

8 ASSESSMENT OF IMPACTS

This SWMP and assessment has been undertaken for the Belmont Coal Project. It considers the environmental characteristics of the Project Site and surrounding areas. The plan has identified the sources that are likely to cause impacts to the Project Site and surrounds as the following.

- From any area that has been denuded of vegetation.
- Surface water flows from stockpiles of topsoil, subsoil, overburden and raw and processed material.
- Discharge of groundwater which accumulates within the open cut void.
- Surface water flows from hardstand areas including roads, processing areas, site facilities and stockpile areas.
- Leaking or spillage of hydrocarbon products.

Based on an assessment of the existing surface water characteristics, the proposed project design and recommendations for surface water management it is concluded that the Project could potentially impact on:

- surface water quantity through:
  - flooding; and / or
  - water usage;
- surface water quality in the form of changes to water:;
  - pH;
  - suspended solids;
  - electrical conductivity;
  - heavy metal concentrations; and
  - oils (hydrocarbons);
- soil erosion; and
- dryland salinity.

A Surface Water Management Plan is included which provides recommendations for optimal management of water resources on and surrounding the site of the proposed Project (“the Project Site”).

Recommendations to mitigate these impacts included in the Surface Water Management Plan are as follows.

- Diverting clean water around disturbed areas and capturing a proportion of this water within the harvestable right of the Project Site to meet the project water requirements.
- Constructing transport routes at current ground levels and creek bed levels.
- Capturing dirty water, using it for dust suppression and other environmental purposes or treating it so that it can be discharged within acceptable guidelines. There would be limitations with providing sufficient water for the suppression of dust. This can be managed by limiting dust generation practices, maximising water storages, limiting evaporative losses and by supplementing water requirements from groundwater reserves.
- Maintaining and enhancing as much vegetation on-site as possible.
- Monitoring water, soil and vegetation parameters.

9 RECOMMENDED MONITORING

The following monitoring is recommended, ie. parameters and locations. It is recognised that only parameters likely to change as a result of the Proponent's activities in the respective catchment need to be monitored.

- Parameters to monitor:
  - electrical conductivity;
  - pH;
  - suspended solids;
  - hydrocarbons;
  - heavy metals;
  - nutrients; and
  - water usage.
- Locations to monitor:
  - selection of representative storage dams;
  - selection of representative sediment basins;
  - water within the open cut void;
  - any groundwater sources used; and
  - upstream and downstream of the confluence of the northern catchment into Driggle Draggle Creek and the southern catchment into the unnamed flow depression.

Details of the selected locations should be incorporated in the water monitoring program compiled for the Project.

The frequency of monitoring would reflect the parameters to be monitored, the locations to be monitored and the potential for environmental impact. **Table 10** presents the recommended monitoring schedule.

The monitoring results should be reviewed on an annual basis and the frequency, locations and/or parameters re-assessed to ensure meaningful data is being collected. All monitoring results should be presented in the relevant AEMR.

Table 10
Recommended Surface Water Monitoring

Location	**Parameter**	**Frequency**
Selected Storage Dam and Sediment Basins	EC, pH, suspended solids, hydrocarbons	Quarterly or in the event of a significant rain event
Selected Storage Dam and Sediment Basins	EC, pH, suspended solids, hydrocarbons, heavy metals, nutrients.	Annually
Void water	EC, pH, suspended solids, hydrocarbons	Quarterly
Void water	EC, pH, suspended solids, hydrocarbons, heavy metals, nutrients.	Annually
Catchment confluence points of Driggle Draggle Creek and unnamed flow depression south of Project Site	EC, pH, suspended solids, hydrocarbons, heavy metals, nutrients.	Annually or in the event of a significant rain event

Monitoring of soil erosion and vegetative cover should also be undertaken. In the event any soil erosion greater then 300mm deep for a maximum of 10m long is identified, this should be corrected via conservation earthworks and or re-vegetation. If rehabilitated areas with groundcover <70% are identified, these areas should be reseeded, fertilised and watered so that percentage groundcover can be maintained.

10 REFERENCES AND BIBLIOGRAPHY

ANZECC (Australian and New Zealand Environment and Conservation Council) and NH&MRC (National Health and Medical Research Council) 1992. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites. Australian and New Zealand Environment and Conservation Council. Canberra.

Geoff Cunningham Natural Resource Consultants (GCNRC) (2007). Belmont Coal Project – Soils and Land Capability Assessment. Specialist Consultant Studies Compendium Part 7.

Department of Land and Water Conservation (DLWC) (1999). *Rural Production and Water Sharing Landholders Information Package.* Department of Land and Water Conservation, Sydney.

Environment Protection Authority (1999). *Water Quality and River Flow Interim Environmental Objectives: Guidelines for River, Groundwater and Water Management Committees: Namoi River Catchment*. Environment Protection Authority, Sydney.

Institution of Engineers (1987). *Austrian Rainfall and Run-off: A Guide to Flood Estimation*. Institution of Engineers, Australia, Barton, ACT.

Namoi Catchment Management Board (NCMB) (2003). *Namoi Catchment: a blueprint for the future*. Department of Land and Water Conservation.

Landcom (2004). *Managing Urban Stormwater: Soils and Construction, 4th Edition.* Landcom, NSW, Sydney.

NWQMS (National Water Quality Management Strategy) 1996*. Australian Drinking water Guidelines Summary*. National Health and Medical Research Council and Agricultural and Resource Management Council of Australia and New Zealand. Canberra.

NWQMS (National Water Quality Management Strategy) 2000*. Australian and New Zealand Guidelines for fresh and Marine Waters. Section 3.4 Water Quality Guidelines for Toxicants. Section 3.5 Sediment Quality Guidelines.* National Water Quality Management Strategy.

Soil Conservation Service (SCS) (1980). Gunnedah *Technical Manual*. Soil Conservation Service of NSW.

Soil Conservation Service (SCS) (1989). *Farm Water Supplies Manual. Technical Handbook No. 7*. Soil Conservation Service of NSW.

Soil Conservation Service (SCS) (1990). *Design Manual for Soil Conservation Works. Technical Handbook No. 5*. Soil Conservation Service of NSW.

APPENDICES

(No. of pages excluding this page = 1)

Appendix 1: Design Procedures and Data Sources

This page has intentionally been left blank

APPENDIX 1

(No. of pages excluding this page = 1)

Design Procedures and Data Sources

This page has intentionally been left blank

Run-off Estimation and Catchment Yields

Peak discharges were calculated using both the deterministic and statistical rational method. As described in the design manual by the SCS (1990) and the Institution of Engineers (1987). An Intensity/Frequency/Distribution (IFD) table for the Project Site was created using the rainfall information from SCS (1990) and the Rainer computer program. The design storms for all channels and structures with outlet channels, unless stated, are for a 1 in 10 Average Recurrence Interval (ARI). Catchment yields were determined by utilising Bureau of Meteorology web site (http://www.bom.gov.au/climate/averages/tables/ca_nsw_names.shtml) and design information within SCS (1990).

Diversion, Catch Bank and Storage Dam Design

The design of diversion and catch banks was undertaken by using the procedures within SCS (1990) and Soil Services' design computer. The quantities allowed for water storages were ascertained by the harvestable right allowance policy (DLWC 1999), this allowed for the Project Site to harvest MLpa.

Sediment Basin Design

The sediment basins were designed according to the procedures within Landcom (2004) and SCS (1990).

This page has intentionally been left blank