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Murrumbidgee to Googong Water Transfer - Soil and Water Management Plan

BWA-M2G-EN-ECP-002-2

February 2012 - Annual Review

Delivered by the Bulk Water Alliance

Abigroup Constructing Australia's Future | ACTEW CORPORATION | GHD | John Holland

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Certificate of approval for issue of documents

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Abbreviations – List of Abbreviations

Abbreviation	
ACT	Australian Capital Territory
ECD	Enlarged Cotter Dam
CMS	Construction Method Statement
BWA	Bulk Water Alliance
CEMP	Construction Environment Management Plan
Iol NSW	Industry and Investment NSW
TAMS	Territory and Municipal Services
DECCW	Department of Environment, Climate Change and Water (NSW)
DECCEW	ACT Department of Environment, Climate Change, Energy and Water
EPA	Environmental Protection Authority
CESM	Community Engagement Stakeholder Management
ACTPLA	Australian Capital Territory Planning and Land Authority
M2G	Murrumbidgee to Googong Water Transfer Project
SWMP	Soil and Water Management Plan
NoW	NSW Office of Water

Environmental Commitments

Table 1.1 EIS Commitments

No.	Commitment	Reference within SWMP
EIS Commitment 3	The proponent will consult with the NSW Department of Water and Energy with regard to watercourse crossing methodologies and site-specific mitigation measures for watercourses that can then be incorporated into the CEMP.	Section 5.2.3
EIS Commitment 4	All construction discharges for the area of works will meet ACT EPA legislative requirements (for the Murrumbidgee River) and NSW DECCW legislative requirements for Burra Creek.	Sections 8
EIS Commitment 5	A standard operating procedure will be developed for access to the pipeline during maintenance activities, chemical/ fuel storage, and for pipe flushing that meets legislative requirements.	Section 5 and OEMP
EIS Commitment 9	A sediment and erosion control plan will be developed for the project as part of the CEMP. The plan will address the requirements associated with working in the riparian zone of the Murrumbidgee river and Burra Creek, as well as the requirements for the minor waterway crossings. The CEMP will include a provision for monitoring total dissolved solids, turbidity and pH (triggers will be based on the ANZECC 2004 guidelines or any seasonal site-specific triggers developed for Burra Ck) during construction and will be included in the aquatic ecology management sub-plan.	Sections 5.1.1, 5.2, 8 Appendices A, Stream Flow & Water Quality Monitoring Sub Plan
EIS Commitment 10	Regular review of water quality monitoring results for any trends towards significant impacts in the Murrumbidgee River, Burra Creek or Googong Reservoir. The monitoring and adaptive management plan will include actions required to address any identified trends in a timely manner.	Section 8, Stream Flow & Water Quality Monitoring Sub Plan
EIS Commitment 33	Should groundwater be intercepted during construction in a volume that will necessitate dewatering, the NSW Department of Water and Energy will be consulted to determine if approval under Part 5 of the Water Act 1912 is required.	Section 4.2.7
EIS Commitment 34	A soils management sub-plan will be prepared as part of the CEMP. It will be prepared consistent with relevant guidelines, including Managing Urban Stormwater: Soils and Construction.	SWMP
EIS Commitment 35	Clearing of the pipeline corridor will be minimised where practicable to the extent necessary for construction of the pipeline and will not exceed the 40 m construction corridor. Where the alignment passes through areas of good quality remnent vegetation the construction corridor will be reduced and the area of disturbance restricted to a narrow band (down to 15 m). Clearance activities will be conducted in accordance with specific work method statements that will be developed as part of the CEMP.	Sections 5.1, 5.2, ESCPs
EIS Commitment 36	The pipeline construction process will restore native topsoil so that following construction the site alignment can be rehabilitated, with impacted flora restored to original condition. Topsoil will be stockpiled along the alignment and spread in	Sections 5.2.8

No.	Commitment	Reference within SWMP
	accordance with the rehabilitation plan.	
EIS Commitment 37	A suitably qualified soil conservationist will be engaged to work on the construction of the preferred project. Erosion and Sediment Control Plans which will be adopted as a sub plan under the CEMP. The Erosion and Sediment Control Plans will be developed prior to construction commencing, and will be progressively updated. Soil testing will be conducted to determine soil types. All construction personnel will be trained on Erosion and Sediment Control Plans.	Sections 3.3.1, 5.1.1, Appendix A

Table 1.2 M2G Conditions of Approval (NSW)

No.	Condition	Reference within SWMP
Soil and Water Quality Impacts		
Condition 2.1	The Proponent shall comply with section 120 of the *Protection of the Environment Operations Act 1997* which prohibits the pollution of waters.	Sections 2.1, 2.2, 2.3, 2.4
Condition 2.2	Soil and water management controls shall be employed to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters during construction activities, in accordance with *Managing Urban Stormwater: Soils and Conservation* (Landcom, 2004).	Sections 5.1-5.2, 8, Appendix A
Condition 2.3	The Proponent shall design, construct, operate and maintain the project to avoid impacts on bank stability within the Burra Creek riverine corridor and Googong Reservoir outlet and does not increase local flooding risk.	Table 5.6, Appendix B
Environmental Monitoring And Auditing		
Morphological Monitoring - Condition 3.1	Prior to the commencement of construction the Proponent shall prepare and implement a **Geo-Morphological Monitoring Program** to monitor the impact of the project on the present morphology of Burra Creek at the pipeline outlet location and downstream to Googong Reservoir**.** The Program shall be developed in consultation with the DECCW and shall include but not necessarily be limited to: a) set out monitoring requirements in order to assess the impact of the project on the present geo-morphology of Burra Creek at the pipeline outlet location and downstream to Googong Reservoir. b) baseline monitoring prior to the introduction of flows through Burra Creek in order to establish any morphological changes resulting from the project. c) provisions for monitoring during construction, operational and non-operational phases; d) mechanisms for immediately investigating any anomalous monitoring results; e) mechanisms for the management and mitigation of any impacts on the waterways including cessation of flows where necessary; and f) details of how the monitoring results will be reported to the Director-General and the DECCW.	Section 8, Geomorphological Monitoring Sub Plan

No.	Condition	Reference within SWMP
	The Program shall be submitted for the approval of the Director-General no later than one month prior to the commencement of construction, or within such period otherwise agreed by the Director-General, accompanied by written evidence that the DECCW has been consulted and that the DECCW is satisfied with the Program. Construction shall not commence until written approval has been received from the Director-General.	
Water Qualilty Monitoring **Condition 3.2**	Prior to the commencement of construction, the Proponent shall prepare and implement a **Surface Water Monitoring Program** to monitor and manage the impact of the project on the waterways into which any extracted Murrumbidgee River water is discharged. The Program shall be prepared in accordance with sections 8.2.3.3 and 8.2.3.4 of *Australian and New Zealand Guidelines for Fresh and Marine Water Quality – Volume 2: Aquatic Ecosystems* (ANZECC & ARMCANZ, 2000) The Program shall be developed in consultation with the DECCW and shall include but not necessarily be limited to: a) the monitoring framework detailed in the documents referred to in condition 1.1; b) a baseline monitoring program; c) an evaluation of the discharges in terms of temporal and spatial scales; d) a comparison of discharge data with baseline data; e) sampling and data collection at representative sites, both impact (downstream of the discharge point) and control (upstream of the discharge point) sites; f) sampling and data collection for the discharges and immediate receiving environment to quantify the changes in ecosystem health and water quality with specific reference to phytoplankton, aquatic vegetation, macroinvertebrates, fish, temperature, salinity, dissolved oxygen, iron and manganese; g) provisions for the review of the Program within six months of commencement of the first full operational flow into Burra Creek; h) identification of key water parameters including but not limited to flow rate, temperature, ph, salinity, total dissolved solids and nutrient parameters for the operation of the project; i) management actions for the parameters identified in h) should they be breached; and j) details of how the monitoring results will be reported to the Director-General and DECCW. The Program shall be submitted for the approval of the Director-General no later than one month prior to the commencement of construction, or within such period otherwise agreed by the Director-General, accompanied by evidence that the DECCW has been consulted regarding the Program. Construction shall not commence until written approval has been received from the Director-General.	Section 8.2, Stream Flow & Water Quality Monitoring Sub Plan
Condition 6.3a	As part of the Construction Environmental Management Plan required under condition 6.2 of this approval, the Proponent shall prepare and implement the following: A **Surface and Groundwater Water Management Plan** to manage water quality impacts during construction. The Plan shall be prepared in consultation with the NOW and shall include, but not necessarily be limited	This SWMP Appendix B Appendix C Section 5.2.9 Section 4.2.7

No.	Condition	Reference within SWMP
	to: i. detailed engineering designs for the outlet structure; ii. detailed engineering designs for each category of watercourse crossing; iii. rehabilitation methodology of each category of watercourse crossing; iv. a description of any dewatering activities associated with groundwater interception; v. monitoring measures listed in condition 3.1 and 3.2; vi. a description of the quantity and source of all water supplies relating to construction, hydro-testing and operation; and vii. a description of any dewatering activities associated with groundwater interception along the pipeline easement that includes the quantity of groundwater to be used and a description of any expected impacts associated with the works.	Monitoring Sub Plans Section 4.2.6

Table 1.3 M2G DA Conditions (ACT)

No.	Condition	Reference within SWMP
Condition B6 (a)	A *Soils and Water Management sub-plan* that details the mitigation and management of impacts on soils, erosion, sedimentation, water quality and the hydrological environmental during construction and operation works endorsed by EPA.	Construction SWMP Operational SWMP
Condition B8	An Environmental Authorisation/ Agreement must be obtained from the EPA prior to the commencement of works. This may include the following: (a) Environment Authorisation under the provisions of the *Environment protection Act 1997* for ant activity on the site which is listed under Schedule 1 as a Class A activity; and (b) Environment Protection Agreement with the EPA for any activity on the site which is listed under Schedule 1 as a Class B activity of the *Environment Protection Act 1997*.	Section 2.4
Condition B8 (b)	A Waterways Works licence under the provision of the *Water Resources Act 2007* for any diversion of any works within a natural waterway must be obtained from the EPA prior to the commencement of works.	Section 2.4
Condition B8 (d)	An 'Exemption from the requirement for a licence to take water' to utilise non-potable water for construction purposes.	Section 2.4

Table 1.4 ACT Environmental Authorisation 802 Conditions (draft)

No.	Condition	Reference within SWMP
3.1	All plant and equipment installed or used in or on the site shall be maintained in a safe and good condition and in accordance with manufacturer's recommendations.	Table 5.1

No.	Condition	Reference within SWMP
3.2	Records of all maintenance and repairs performed on pollution control equipment including drainage systems, interceptors, separators and infrastructure shall be kept on site for a period of 2 years and made available to the Authority on request. "plant and equipment" includes drainage systems, infrastructure and pollution control equipment.	Section 8.5
6.1	Where there are fuel storage tanks on the site the Authorisation holder shall ensure the tanks and associated pipe work are maintained in good condition. The proposed method of demonstrating the integrity of the tanks and associated pipe should be incorporated into the Authorisation holders Environment Management Plan required under section 17 of this schedule.	Section 5.2.6
6.2	Further to the provisions of section 6.1, special requirements are applied to the abandonment of any aboveground or underground tanks and should the need arise, the Authorisation holder agrees to contact the Authority and: **Office of Regulatory Services** **Dangerous Substances and Workers' Compensation** Telephone: 02 6205 0200 Facsimile: 02 6205 0336 Block B, Level 3 Callam Offices Easty Street WODEN ACT 2606 (GPO Box 158, CANBERRA ACT 2601)	Section 5.2.6
15.1	Discharges from the site are only permitted from the sediment control ponds in accordance with Schedule 2, Table 3.	N/A – presently, no sediment control ponds to be used
18.2	Surface water monitoring (a) Water quality in the Murrumbidgee River shall be monitored daily during the construction of the lower lift pump, hi lift pump and associated infrastructure for the parameters set out in Schedule 2, Table 2, Condition 1.	Section 8.2.2
19.1	Water quality of all sediment control ponds shall be managed with the object of being within the limits for the parameters listed at Schedule 2, Table 3, Condition 3.	N/A – presently no sediment control ponds to be used
20.3	Where the Nephelometric Turbidity Units (NTU) at location 2 in Schedule 2, Table 2, Condition 1 is greater that 10NTU to that at location 1, the Authority must be notified as detailed in Section 7.	Section 8.2.2
21.1	All sample collection, analysis and associated paperwork under this Authorisation shall be conducted in accordance with Australian Standard/ New Zealand Standard 5667.1:1998, "Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples", and with the American Public Health Association, American Water Works Association, and the Water Pollution Control Federation *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 1989, or other standards and methods agreed to by the Authority.	Section 8.2.2

No.	Condition	Reference within SWMP
21.2	The sample collection shall be undertaken and documented by a suitably qualified person in accordance with clause 21.1. All required documentation shall be countersigned by a person authorised under clause 11.1 and shall be made available for inspection by the Authority. Sample analysis of parameters shall be conducted by a person employed as an analyst in any of the following organisations: (a) a Government laboratory; (b) an Australian university; (c) a laboratory where Australian parameters are accredited by the National Association of Testing Authorities; or (d) a laboratory approved by the Authority.	Section 8.2.2
Schedule 2 – Table 2 – Water Pollution		
1	Water quality in the Murrumbidgee River shall be monitored for turbidity. A water sample is to be taken daily during the construction of the low lift pump, hi lift pump and associated infrastructure from two locations: 1) Upstream approximately 50 metres from the area of construction; and 2) Downstream approximately 50 metres from the area of construction. Both samples are to be analysed for turbidity. A Turbidity Tube may be used and the Nephelometric Turbidity Units (NTU's) are to be recorded.	Section 8.2.2
2	The Authorisation holder shall manage the water catchments on the site so that pollutants and sediments are detained on site in accordance with an approved Environmental Management Plan (EMP).	Section 5.2
3	The Authorisation holder shall ensure all clear and uncontaminated stormwater does not enter sediment control ponds.	N/A – presently, no sediment control ponds to be used
4	The Authorisation holder shall ensure no fuels or oils are kept within a Riparian Management Zone and/or Exclusion Zone as defined in the ACT Forest Code of Practice, Version 1, August 2005.	Table 5.5
5	The Authorisation holder shall ensure no machinery is serviced or refuelled in a Riparian Management Zone and/or Exclusion Zone as defined in the ACT Forest Code of Practice, Version 1, August 2005.	Table 5.5
6	The Authorisation holder shall ensure that sediment control ponds; (a) are constructed in accordance with the Environment Protection Guidelines for Construction and Land Development in the ACT (August 2007); (b) are discharged where the water level is above 20% capacity; (c) are discharged in accordance with Table 3; and (d) have the sediment build up removed when the sediment reaches 10% capacity of the pond.	N/A – presently, no sediment control ponds to be used
Schedule 2 – Table 3 – Controlled Discharges		
1	The Authorisation holder shall record all discharges from sediment control ponds. These records are to be provided, on request, to the Authority.	N/A – presently, no sediment control ponds to be used. Will monitor discharges from

<table>
<tr><th>No.</th><th>Condition</th><th>Reference within SWMP</th></tr>
<tr><td></td><td></td><td>coffer dams (Sections 5.2.4, 5.2.5, 8 of SWMP)</td></tr>
<tr><td>2</td><td>The Authorisation holder shall ensure that no discharge from a sediment control pond causes erosion of the channels or banks leading to a waterway.</td><td>N/A – presently, no sediment control ponds to be used</td></tr>
<tr><td>3</td><td>Discharges from the sediment control ponds are only permitted when the water quality meets the standards detailed below for pH and turbidity or suspended solids.
Water Quality Standards<table><tr><th>Parameter</th><th>Criteria</th></tr><tr><td>pH</td><td>6.5 – 8.5</td></tr><tr><td>Suspended solids</td><td><25mg/L</td></tr><tr><td>Turbidity</td><td><10 NTU</td></tr></table></td><td>N/A – presently, no sediment control ponds to be used, however, water in the coffer dams in the Murrumbidgee River during construction will be monitored if to be discharged. (Sections 5.2.4, 5.2.5, 8 of SWMP)</td></tr>
</table>

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1 Introduction

1.2 Background

The Murrumbidgee to Googong (M2G) Water Transfer is one of the recommended options for delivering improved security to the water supply for the ACT and region. It involves pumping water from the Murrumbidgee River (within the ACT) and transferring it via a 12km pipeline to Burra Creek (in NSW), from where it would flow for approximately 13km to the Googong Reservoir. The proposed transfer of water will supplement natural inflows to the reservoir, which have decreased by about 85% from 2001 to 2009. Googong Reservoir supplies water to Queanbeyan and the ACT following treatment at the Googong Water Treatment Plant.

The project comprises of the following key features:

Infrastructure	Description
Intake/low lift pump station	The intake/low lift pump station will comprise a concrete box structure built into the riverbank. The low lift pump station will include a screen, grit collection and removal, pumps and valves and filtration to prevent fish transfer.
High lift pump station	The pump station will pump water to a high point at Gibraltar Range, from where it will run under gravity to the discharge point. The high lift pump station will consist of a building enclosing a pump hall and electrical services and an amenities area.
Pipeline	The pipeline will transfer the water from the low lift pump station to the high lift pump station, then onto the outlet structure. It will be constructed of 1016 mm diameter steel pipe. The pipeline will be approximately 12 km long, with the pipe located approximately 1.8 m to 4 m below ground level. Air valves and scour valves will be located at regular intervals along the pipeline to provide pressure relief and to allow cleaning.
Outlet structure	The outlet structure will take the form of a weir box arrangement located on the bank of Burra Creek. It will comprise a rectangular concrete box approximately 12 m along the creek bank with a 250 mm grated opening along the west bank of Burra Creek. Water will flow into the weir box from the pipeline and will discharge over the weir and run down the creek bank to the creek, which flows to Googong Reservoir. This method of discharge is designed to minimise scouring of the creek bed near the outlet.
Electric power supply	The electrical infrastructure will comprise a 132 kV/11 kV substation in Williamsdale and a single 11 kV cable from the mini hydro to the high lift pump station.
Mini-hydro power generator	Electricity provided by the grid will be supplemented by electricity generated by a mini-hydro electric power facility which will be constructed as part of the project. The mini-hydro power generator will have the capacity to recover approximately 18% (without Tantangara flows) and 20% (with Tantangara flows) of the 1,138 kWh/ML of electricity required for pumping activities.

The potential for erosion and sedimentation offsite will be increased significantly due to vegetation and topsoil removal, pipeline excavation, spoil stockpiling and the construction activities associated with the upper and lower pump stations. On-site erosion will generate coarse and suspended sediment that could adversely affect water quality in local and regional waterways, land and river use, and ecological systems.

Effective erosion, sedimentation and water quality control is critical to minimising any adverse water quality and sedimentation impacts on downstream waterways and adjacent environs. This Soil and Water Management Plan (SWMP) outlines how soil and water issues will be identified, planned, managed and monitored during the Project construction to minimise adverse impacts on the downstream environment. The SWMP will interrelate with Construction Environmental Management Plan (CEMP) and other relevant plans. It also satisfies the NSW Department of Planning's Condition of Approval 6.3a and the ACT's Development Application Condition B6 (b).

Project activities in addition to those that cause erosion, generate sedimentation, can also affect local watercourses and will therefore also be addressed in this SWMP. These activities include fuel and chemical storage and handling and hydrostatic pressure testing.

This plan has been designed to address client expectations and requirements, and adequately address risks and stakeholder concerns. The BWA is committed to providing the services it offers in a manner that conforms to the contractual requirements and to all relevant regulatory and legislative requirements.

The BWA will ensure that the controls are properly implemented and are regularly monitored and audited to assess their effectiveness. Changes to the stipulated controls will be instigated if they are not achieving their objectives.

1.3 Purpose of the SWMP

The purpose of developing and implementing this SWMP is to ensure the integration of all erosion, sedimentation and water quality issues (including groundwater and site wastewater), including plans and documents used during the term of the project in order to minimise erosion and off-site sedimentation and the impact of construction activities on downstream water quality. Mitigation measures to manage soil and water quality throughout the project will be implemented through this SWMP and progressive Erosion and Sediment Control Plans (ESCPs).

It is designed as a practical guide for use during the construction phase of the project. This document is dynamic and if a non-conformance is detected in the plan, or if project implementation methodology changes, or if mitigation measures improve, the SWMP will be revised so it remains effective in managing environmental impacts arising from the project.

1.4 Objectives of the SWMP

This Plan provides a framework for procedures and techniques to ensure that the Bulk Water Alliance will establish mitigation and protection measures to achieve soil stability and protect local water quality. The objectives of the SWMP are to:

- present overall soil and water management principles and guidelines for the construction phase of the project;
- describe how the practical measures and best management practices will be implemented to prevent or mitigate potential downstream impacts relating to soil and water;
- outline the roles and responsibilities of those involved in the design and implementation of soil and water management controls;
- outline an effective monitoring, auditing and reporting framework to assess the effectiveness of the controls implemented;
- provide an organised, integrated and systematic approach to effectively address and monitor erosion, sedimentation and water quality issues during the term of the project; and

- go beyond a culture of business as usual (compliance) by demonstrating excellence in soil and water management.

1.5 Performance goals

The performance goals of this SWMP are:

- prevent degradation of the surrounding environment through the application of best management practices and innovation;
- no decrease in downstream water quality;
- all water discharged from the site is to comply with ACT and NSW discharge limits;
- sediment deposited offsite is kept to an absolute minimum;
- work areas will be kept to the minimum area necessary for safe working operations to minimise exposed surfaces.

2 Legislative & Regulatory Compliance

2.1 Relevant Legislation

The BWA will comply with all legislation, Conditions of Approval, permits, guidelines and standards relevant to the project activities.

Table 2.1 Legislation

Legislative Jurisdiction	Relevant Act
Commonwealth	*Environmental Protection and Biodiversity Conservation Act 1999*
Territory (ACT)	*Environmental Protection Act 1997* *Water Resources Act 2007*
New South Wales	*Protection of the Environment Operations Act (POEO Act 1997).* *Fisheries Management Act (1994)* *Water Management Act (2000)* *Water Act (1912)* *Dangerous Goods Act (1978)* *Local Government Act (1993)* *Catchment Management Act (1989)* *Environmentally Hazardous Chemicals Act (1985)*

2.2 Guidelines and Standards

The key reference materials relevant to management of soil and water during design and construction of construction projects include:

- Soils and Construction – Volume 1, 4th Edition (Landcom) March 2004;
- Managing Urban Stormwater: Soils and Construction, Volume 2C, Unsealed Road Construction (DECC, 2008);
- Managing Urban Stormwater: Soils and Construction, Volume 2A, Installation of Services (DECC, 2008);
- Environment Protection Guidelines for Construction and Land Development in the ACT, Environment Protection Authority, ACT, August, 2007;
- NSW EPA - Bunding and Spill Management, November 1997;
- AS1949 – The storage and Handling of Flammable and Combustible Liquids, Standards Association of Australia;
- NSW Fisheries, 1999. Policy and Guidelines for Bridges, Roads, Causeways, Culverts and Similar Structures;
- Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings – NSW Fisheries - January 2003;
- Fishnote – Policy and Guidelines for Fish Friendly Waterway Crossings - November 2003;
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000);

- NSW Waste Classification Guidelines 2008; and
- Preparation of Environmental Management Plan Guidelines (DIPNR 2004).
- Guidelines for Controlled Activities – Water Course Crossings Water Management Act 2000 NSW Government Department of Water and Energy February 2008

2.3 Conditions of Approval

The Conditions of Approval relevant to the management of soil and water (incl. groundwater) are detailed in **Tables 1.1 – 1.5** of this document.

2.4 Licences & Permits

Tables 2.2 and **2.3** identify the approvals, permits and licences relevant to soil and water that are required for the project.

Table 2.2 Approval Requirements for NSW

Approval Required	Relevant Legislation	Authority
Environment Protection Licence	*Protection of Environment Operations Act. 1997*	Department of Environment, Climate Change & Water (DECCW)
Translocation of native and threatened aquatic species	*Fisheries Management Act 1994 (Section 37, Miscellaneous Permit)*	Department of Industry and Investment NSW (NSW Fisheries)
Water extraction from watercourse	*Water Act 1912*	NSW Office of Water (NoW)

Table 2.3 Approval Requirements for the ACT

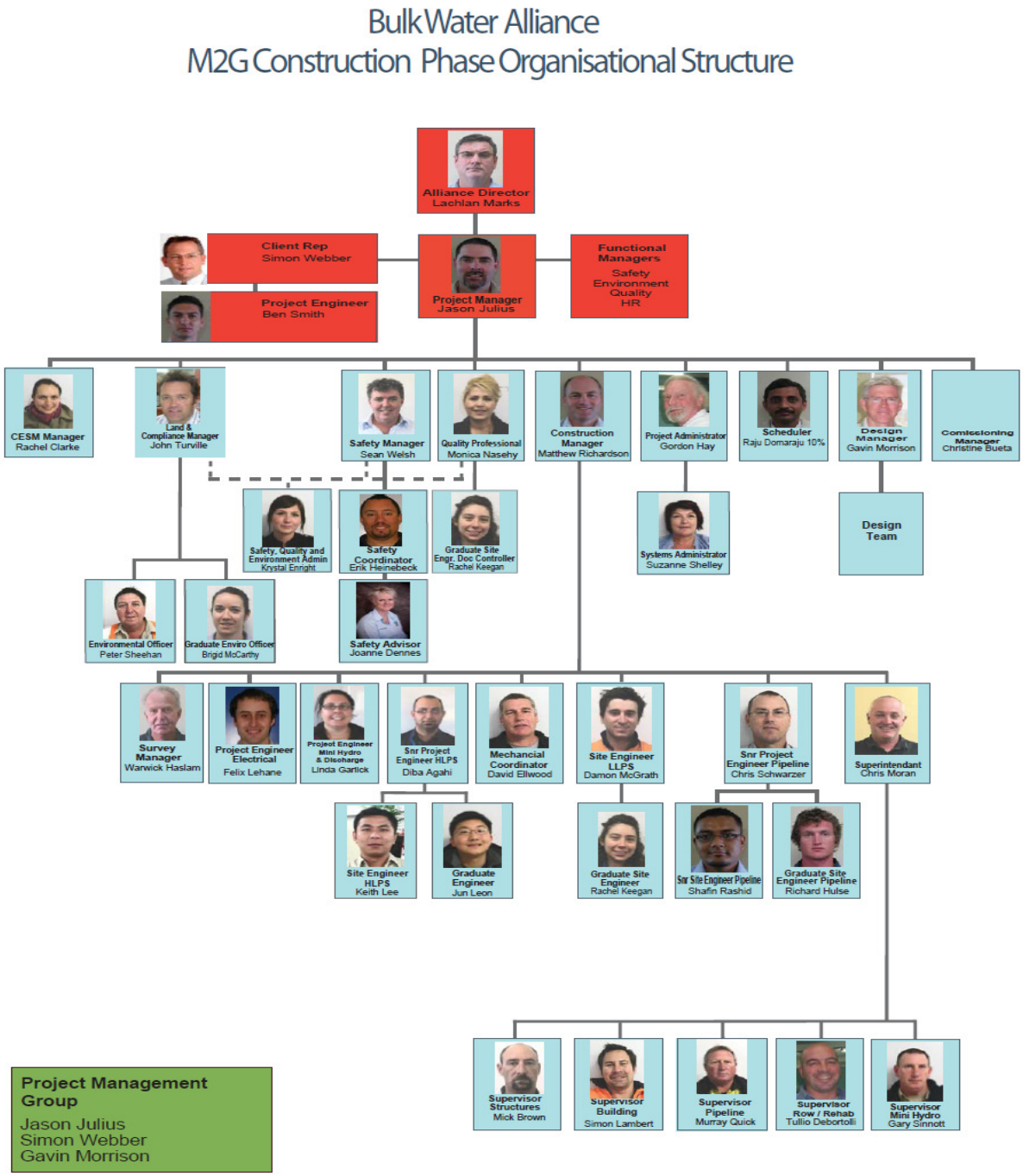
Approval required	Relevant Legislation	Authority
Environment Protection Agreement	*Environmental Protection Act 1997*	DECCEW (Environment Protection Authority)
Environment Authorisation	*Environmental Protection Act 1997*	DECCEW (Environment Protection Authority)
Water Extraction Exemption Licence	*Water Resources Act 2007*	DECCEW (Water Resources Unit)
Waterway Works Licence	*Water Resources Act 2007*	DECCEW (Water Resources Unit)

3 Structure and Responsibilities

3.1 Site Structure

The general project structure for the management of soil and water issues is shown in Figure 3.1 below.

Figure 3.1 Murrumbidgee to Googong Management Hierarchy



3.2 Roles and Responsibilities

The responsibility and authority pertaining to environmental performance of the M2G personnel and subcontractors are detailed below.

3.2.1 M2G Project Manager

The M2G Project Manager has the role of ensuring that the project is delivered on time, within budget and is consistent with the aims and objectives of the BWA. This role is accountable for all aspects of the project including safety, environment and heritage, quality, budget and overall delivery of the project. The M2G Environmental Manager will be working in conjunction with the M2G Project Manager to ensure that the BWA's prescribed environmental outcomes are achieved.

3.2.2 M2G Construction Manager

The M2G Construction Manager is responsible for delivery of the construction phase of the project to ensure that environmental and heritage impacts are minimised and specific obligations are met.

3.2.3 M2G Land and Compliance Manager

The M2G Land and Compliance Manager has overall responsibility for managing the environmental aspects of the M2G project and delivering the project in accordance with the approved environmental management plans and to relevant environmental legislation and to licence / approval conditions. Planning, management and reporting of monitoring conducted as part of construction.

3.2.4 M2G Environmental Officer

The M2G Environmental Officer has primary on-site responsibility for managing all aspects of environmental management and compliance for the construction phase of the project, as delegated by the M2G Land and Compliance Manager. This position reports directly to the M2G Project Manager and the M2G Land and Compliance Manager.

The key responsibilities of the M2G Land and Compliance Manager and Environmental Officer will be to:

- liaise with designers and construction manager with regard to construction program and Activities on site;
- review the SWMP prior to the start of construction;
- review the ESCP prior to the start of construction;
- implement the BWA Environmental Management System (EMS);
- maintain, assess and monitor the implementation of the SWMP, including Erosion and Sediment Control Plans (ESCPs);
- ensure that all project environmental obligations are met;
- ensure no work requiring a licence or permit is undertaken without such documentation;
- complete environmental checklists;
- provide input and advice to engineers on Environmental Work Method Statements (EWMS);
- identify and prepare environmental induction and training materials;

- liaise with government agencies and relevant stakeholders;
- provide a regular construction program identifying critical construction activities;
- manage the environmental budget;
- respond to environmental incidents;
- manage environmental sub-consultants;
- oversee the maintenance of environmental documents;
- prepare reports on compliance;
- monitor revegetation activities within the project boundary; and
- liaise with the CESM Manager to provide technical input to community engagement and stakeholder management activities.
- In situ and external monitoring

3.2.5 Engineers

Project and Site Engineers are responsible for ensuring that environmental considerations are integral to the decision making for all construction activities. Engineers will liaise closely with the M2G Environmental Officer to ensure that the environmental controls and procedures contained in the SWMP are implemented. Engineers will conduct regular checks of the site to ensure environmental controls such as sediment fences and dust suppression are functioning effectively.

Roles and responsibilities for both the Project and Site Engineers, in respect to environmental matters, will differ depending on the activity being undertaken. Specific details on particular environmental responsibilities are included in each EWMS.

Where applicable, the engineers will be responsible for ensuring that any work performed by external parties meets with the requirements of this SWMP including identifying and documenting the environmental risks of the proposed works.

3.2.6 Superintendent and Supervisors

Superintendents and Supervisors report to the Project Engineers and will have a direct role in the compliance and implementation of environmental procedures and controls on site. They will also be responsible for checking the site on a regular basis and ensuring that regular maintenance is undertaken to minimise environmental impacts and that personnel are provided with appropriate environmental training, prepared by the Environmental Team.

Where applicable the Superintendents/Supervisors will be responsible for ensuring that any work performed by external parties meets with the requirements of the SWMP, including identifying and documenting the environmental risks of the proposed works.

3.2.7 Subcontractors

The BWA recognises that it is often subcontractors that present the greatest environmental risks to a project due to:

- their detachment from the main construction delivery teams, and therefore the potential for poor communication regarding environmental risks;
- the large number of subcontractors on site; and

- subcontractors operating under a different management system from the BWA.

The BWA acknowledges its responsibility to ensure that all persons on the project including subcontractors and their employees comply with the relevant environmental requirements. As a minimum, subcontractors and their employees will be required to comply in full with the SWMP. All subcontractor personnel are considered equivalent to BWA personnel in all aspects of environmental management and control, and their responsibilities in this respect mirrors those of BWA personnel.

M2G environmental requirements will be included in the selection and management of subcontractors working on site. This will include appropriate references to site specific environmental management requirements within subcontract documentation.

Subcontractors working on the project will be required to:

- undertake the onsite induction and where required participate in relevant environmental training and toolbox sessions;
- observe subcontract and statutory requirements relating to environmental protection and other environmental legislation and to follow instructions issued by the BWA management and supervisory personnel;
- nominate site representatives to liaise with M2G site representatives with respect to environmental requirements associated with their activity. This representative must have the authority to administer and implement any outcomes/management strategies identified during such consultations;
- adhere to the BWA management system as it applies to their operations on site;
- co-operate fully with site emergency incident procedures and consultative arrangements;
- be familiar with, and adhere to, procedures incorporated in the SWMP and associated sub-plans with regards to environmental management and legislative compliance; and
- display a drive towards the implementation of “Best Management Practices” and the principles of sustainability during day-to-day operations.
- Inform Supervisor/Environmental Representative of any environmental irregularities or risks

The work of subcontractors will be monitored through the site inspection process detailed in Section 8 of this document. Observations will be made by relevant personnel (listed above) to assess the effectiveness of the environmental protection measures being used by the subcontractors and to determine compliance with the requirements of the SWMP. Any non-conformances or improvements identified during these inspections will be documented on an Environmental Maintenance, Observation and Action List for minor non-conformances/improvements or an Environmental Improvement Notice (EIN) for significant non-conformances.

3.3 Additional Specialist Support

3.3.1 Soil Conservationist

An appropriately qualified Soil Conservationist has been engaged to assist the Bulk Water Alliance with the development, implementation and review of all soil and water measures during the construction phase. She is responsible for the following:

- assist in the development and implementation of erosion and sediment control plans (ESCPs) in consultation with the Supervisor, Superintendent, Environmental Officer and Project Engineers;
- educating and advising construction staff on soil and water related issues such as site stabilisation, clean water diversion, erosion control and the capture of sediment on the construction site; and
- overall management of soil and water impacts during the construction phase of the project.

3.3.2 Resource Requirements

Adequate resources will be made available to ensure that environmental controls and mitigation measures detailed in the SWMP are effectively implemented on site.

Potential resources may include:

- personnel;
- erosion and sediment control products (e.g. sediment fences, sandbags, geotextile, spill kits, etc);
- plant and equipment (e.g. backhoe, etc);
- water distribution systems (such as water carts and sprinklers); and
- rumble grids and wheel washing facilities.

4 Environmental Aspects and Impacts

4.1 Environmental Aspect, Impact and Risk Identification

Environmental aspects as referred to in this document are those activities associated with the project that have the potential to cause, or result in, adverse environmental impacts. Due to the complexity of the project, it is conceivable that various aspects of the project would carry a varying degree of environmental risk which needs to be managed accordingly.

Effective environmental management should be proactive rather than reactive. In order to facilitate a proactive style of environmental management, a risk management style of assessment has been utilised to identify and assess environmental aspects associated with the project, and to implement appropriate mitigation strategies to minimise the likelihood of environmental risks associated with each aspect. This process involves:

1. Identifying the risk/aspect
2. Analysing the risk/aspect (determining likelihood and consequence)
3. Evaluating the risk/aspect
4. Treating the risk

All identified aspects are assessed based on the risk assessment matrix (**Table 4.1**). Risk assessment is based on (1) the likelihood of an impact occurring as a result of the aspect; and (2) the consequences of the impact if the event occurred. Following this assessment, each impact is assigned a risk category which ranges from “low” (low likelihood and consequence) to “extreme” (high likelihood and consequence). **Table 4.2** describes each level of risk.

A risk category identified as having an extreme or high risk (a significant impact) may be downgraded if appropriate environmental controls and measures are implemented and maintained. Proactive planning, installation and maintenance of appropriate environmental controls and ongoing monitoring will reduce the risks associated with each environmental impact identified for the project. **Table 4.3** details the environmental aspects identified for the project, the initial risk category prior to appropriate management strategies, the proposed management strategy and a revised risk category. Mitigation measures are detailed in Section 5 and in **Tables 5.1, 5.2, 5.3, 5.4, 5.5** and **5.6**.

Table 4.1 Risk Scoring Matrix

		Consequences				
	Likelihood	1	2	3	4	5
		Negligible discharge	Uncontrolled Discharges in minor quantities	Moderate breach of environmental Statutes	Major breach of environmental statutes	Shutdown of project due to Environmental breach
A	Almost Certain	H	H	E	E	E
B	Likely	M	H	H	E	E
C	Moderate	L	M	H	E	E
D	Unlikely	L	L	M	H	E
E	Rare	L	L	M	H	H

Table 4.2 Classification of Likelihood and Consequence

Level	Categorisation Of likelihood	Description
A	Almost certain	Is expected to occur during the project, 90% or > probability
B	Likely	Will probably occur during the project, ~50% probability
C	Moderate	Might occur at sometime during the project, ~10% probability
D	Unlikely	Could occur at some time during the project, ~1% probability
E	Rare	Only occur in exceptional circumstances, < 1% probability

4.1.2 Environmental Impacts and Risks

Tables 4.1 and **4.2** have been utilised to determine the risk on the proposed project.

Table 4.3 Identified soil and water quality impacts associated with the project.

Activity	Aspect	Potential Impact	Risk Category	Mitigation Measures (refer to Tables 5.1-5.6)	Revised Risk Category
Vegetation Clearing & Topsoil Stripping	Over clearing of vegetation.	Unnecessary exposure of erodible soil surfaces.	Medium	(S1) (S2), (S8) (S10) (S11) (S12)	Low
	Uncontrolled discharge of sediment laden water into a waterway.	Environmental degradation/ pollution of adjacent water body or land.	High	(S1) (S2) (S3) (S4) (S6) (S7) (S21) (S44-S48)	Medium
	Transportation of noxious weeds.	Propagation of invasive weeds offsite.	High	(S5) (S7) (S63) (S68)	Low
	Deterioration of topsoil quality due to inappropriate stockpiling techniques.	Unsuccessful revegetation.	Low	(S5) (S22) (66)	Low
	The inappropriate stockpiling of material (overburden, topsoil etc).	Sediment discharge into the receiving environment	High	(S1) (S2) (S13) (S17) (S22)	Medium
	Chemical / Fuel spills and leaks.	Environmental degradation/ pollution of adjacent water body or land.	High	(S49-S62)	Medium
	Slow implementation of erosion and sediment control measures.	Environmental degradation/ pollution of adjacent water body or land.	Extreme	(S2) (S17)	Low
	Implementation of inadequate or inappropriate erosion and sediment controls.	Ineffective management of sediment laden water during storm events	Extreme	(S3) (S4) (S5) (S6) (S12) (S13) (S17)	Medium
	Inadequate maintenance of erosion and sediment controls	Environmental degradation/ pollution of adjacent water body or land.	Extreme	(S3) (S4) (S5) (S6) (S17)	Medium
	Tracking of sediment onto public roads	Pollution of adjacent road side table drains	High	(S13)	Low

Activity	Aspect	Potential Impact	Risk Category	Mitigation Measures (refer to Tables 5.1-5.6)	Revised Risk Category
Bulk Earthworks Associated with Pumping Stations	Exposure of large areas of loose material susceptible to erosion.	Uncontrolled discharge of sediment laden water into a waterway compromising environmental quality.	Extreme	(S1) (S2), (S8) (S10) (S11) (S24) (S64) (S72)	Medium
	Interception of groundwater during excavation activities.	Contamination of groundwater during excavation works.	Low	SWMP Section 4.2.7	Low
	The commencement of bulk earthworks prior to the establishment of erosion and sediment controls on site.	Environmental degradation / water pollution.	Extreme	(S2)	Low
	Tracking of sediment onto public roads	Pollution of adjacent road side table drains	Medium	(S13)	Low
	Inadequate maintenance of erosion and sediment controls.	Environmental degradation	Extreme	(S3) (S4) (S5) (S6) (S17)	Medium
	Chemical/Fuel spills.	Environmental degradation/ pollution of adjacent water body or land.	Extreme	(S49-S62)	Medium
	Inappropriate management of coffer dams.	Uncontrolled discharge of sediment laden water into the receiving environment.	Extreme	(S19) (S44-S48)	Medium
	Inappropriate dewatering of coffer dams.	Pollution of adjacent water body or land.	High	(S19), (S20) (S26)	High
	Increased risk of erosion along disturbed section of bank of Murrumbidgee River.	Discharge of sediment laden water into the receiving environment.	High	(S1), (S2), (S8), (S15)	Medium
	Flooding of coffer dam	Discharge of sediment laden water into the receiving environment.	High	(S19), (S25)	Medium

Activity	Aspect	Potential Impact	Risk Category	Mitigation Measures (refer to Tables 5.1-5.6)	Revised Risk Category
Upfront Work and Stringing of pipes	Construction of Right of Way (ROW) commences prior to the installation of temporary erosion and sediment control measures	Environmental degradation/ pollution of adjacent water body or land.	Extreme	(S2)	Medium
	Installation of temporary watercourse crossings not complying with CMS – Temporary Water Way Crossing	Pollution of water course	Extreme	(S27-S33)	Medium
	Removal or damage to installed erosion and sediment control measures	Environmental degradation	High	(S2), (S4), (S17) (S18)	Medium
	Inadequate maintenance of erosion and sediment controls	Environmental degradation	High	(S3) (S4) (S5) (S6) (S13) (S15)	Medium
	Tracking of sediment onto public roads	Pollution of adjacent road side table drains	High	(S13)	Medium
	Chemical/Fuel spills.	Contamination of the natural environment	High	(S49-S62)	Medium
Pipeline installation (Trench Excavation, lower and lay and backfilling activities)	Removal or damage to installed erosion and sediment control measures.	Environmental degradation/ pollution of adjacent water body or land.	High	(S2), (S4), (S17)	Medium
	Slow implementation of erosion and sediment control measures.	Environmental degradation/ pollution of adjacent water body or land.	High	(S2) (S17)	Low
	Inappropriate stockpiling of excavated material.	Sediment discharge into the receiving environment	High	(S22)	Medium
	Inadequate maintenance of erosion and sediment controls.	Environmental degradation/ pollution of adjacent water body or land.	High	(S3) (S4) (S5) (S6) (S13) (S15)	Medium
	Inappropriate dewatering of trench.	Pollution of adjacent water body or land.	Extreme	(S39)	Medium
	Chemical/Fuel spills.	Contamination of the natural environment	High	(S49-S62)	Medium

Activity	Aspect	Potential Impact	Risk Category	Mitigation Measures (refer to Tables 5.1-5.6)	Revised Risk Category
	Hydrostatic pressure testing	Environmental degradation/ pollution of adjacent water body or land.	Medium	S(38)	Low
	Tracking of sediment onto public roads	Pollution of adjacent road side table drains	High	(S13)	Medium
Rehabilitation and Decommissioning	Decommissioning and removal of structures within the waterway (coffer dams, temporary diversions etc)	Uncontrolled discharge of sediment laden water into a waterway compromising environmental quality.	Extreme	Environmental Work Method Statement	Medium
	Decommissioning and removal of the coffer dams and other erosion and sediment control structures.	Uncontrolled discharge of sediment laden water into a waterway.	Extreme	Environmental Work Method Statement	Medium
	Slow implementation of rehabilitation activities.	Increased erosion risk and potential environmental degradation and/ or pollution of adjacent water body.	High	(S17) (S63 – S72)	Low
	Failed rehabilitation attempts.	Large areas of exposed surfaces prone to erosion.	High	(S63 – S72)	Low

Aspects identified as having an extreme or high risk (a significant impact) may be downgraded if appropriate controls and measures are put in place and maintained. The proactive planning, installation and maintenance of appropriate environmental controls will reduce the risks associated with each different project activity identified.

4.2 Project Description and Physical Characteristics

The following section describes the physical characteristics of the site.

4.2.1 Rainfall Characteristics

The nearest operational weather station is at Tuggeranong (Isabella Plains). **Table 4.4** details the rainfall characteristics for the area. The median annual rainfall is 547.6mm over an average of 65.7 rainy days. February, September, November, and December, are the wettest months with a median rainfall of 56mm, 67.1mm, 66.6mm, and 54.8mm, respectively.

Table 4.4 Rainfall data

Median Rainfall[1] (mm)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
44.2	56.0	34.0	17.2	16.4	38.3	34.5	41.6	67.1	54.3	66.6	54.8	547.6
Mean Number of Rain Days*												
5.0	5.4	4.1	3.5	3.4	5.8	5.5	5.6	6.8	6.6	7.9	6.1	65.7

*Source: Calculated values based on rainfall data from the Bureau of Meteorology weather station at Tuggeranong (Isabella Plains). * Rain ≥1mm – 10mm.*

The Landcom manual (2004 Ed.), 'Managing Urban Stormwater: Soils and Construction' (Blue Book) categorises the project area in rainfall distribution Zone 10. The rainfall erosivity is greatest between October and April with storm activity common during these months. The erosion hazard (calculated soil loss), calculated using Appendix A of the Blue Book is 700 and 1200 tonnes/ha/year which is high to very high. Figure 4.6 in the Blue Book indicates that the erosion hazard is high with an R factor of 1500 and an average slope gradient of approximately 17%.

4.2.2 Topography

The project predominately traverses in an east west direction. The topography along the project route ranges from gently undulating to steeply sloping.

4.2.3 Soils

The 1:100,000 Soil Landscape map of Michelago indicates the project is located on the following soil landscapes – Campbell, Williamsville and Burra Soil Landscapes (refer to Figure 4.1). Their characteristics and limitations are summarised below.

[1] The median rainfall has been used because it is the preferred measure of 'typical' rainfall. This is because the median rainfall (5th decile) takes into account the high variability of rainfall - one extreme rainfall event will have less affect on the median than it will have on the arithmetic mean.

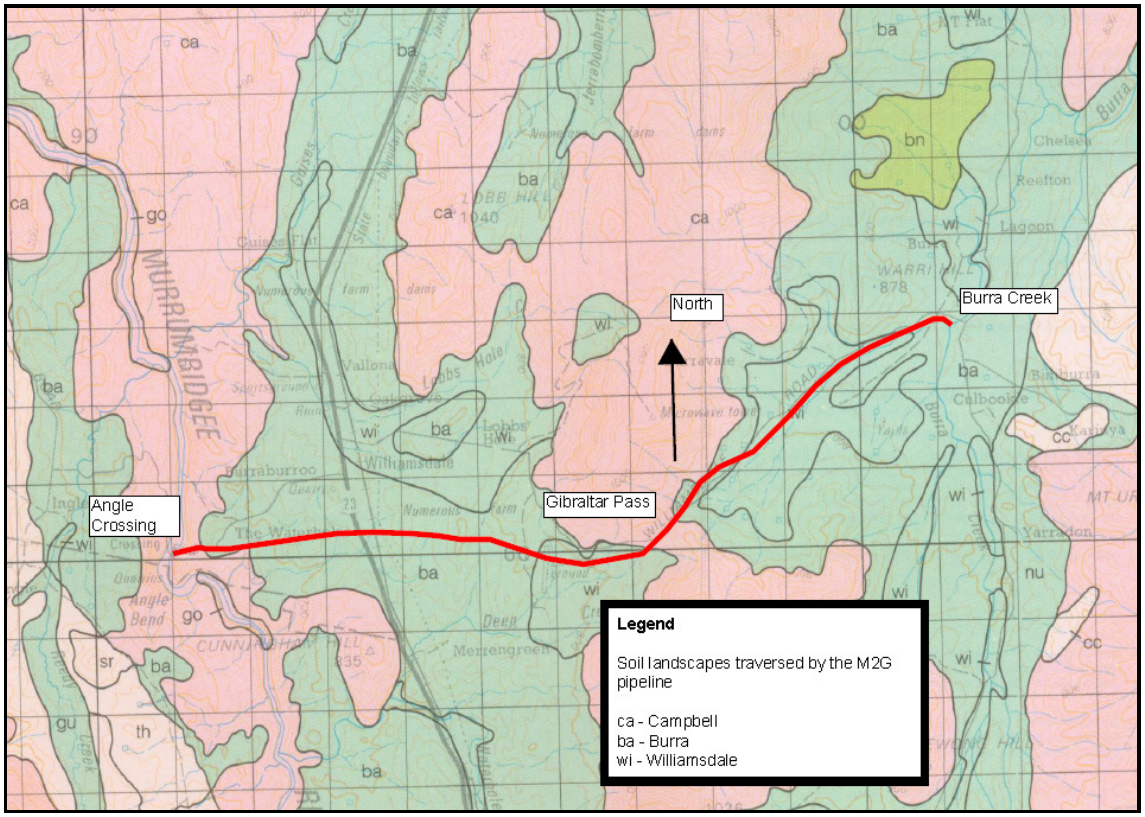


Figure 4.1 Extract from Michelago Soil Landscape Map (Department of Land and Water Conservation) showing approximate pipeline easement

Campbell

The soils of the Campbell soil landscape are found on steep to rolling hills and mountains with slopes >20%. The dominant soil materials consist of brownish black massive sandy loam (topsoil), bleached dull yellowish brown massive sandy clay loam, bright brown strongly pedal medium clay to mottled light grey strongly pedal medium clay.

Soil limitations include moderate to high erodibility, low fertility, low wet bearing strength, low permeability, hard setting, moderately sodic, low available water holding capacity and strongly acidic.

The soils of the Campbell soil landscape, for non-concentrated flows are highly erodible. For concentrated flows the erosion hazard is very high. Landscape limitations include permanently high water tables (springs) and moderate mass movement hazard.

Williamsdale

The soils of the Williamsdale soil landscape are found on gently undulating rises, fans, valley flats and depressions with gently inclined slopes to flats on <10% gradients. The dominant soil materials consist of brownish black massive loam (topsoil), dull yellowish brown massive sandy clay loam, bright brown moderately pedal clay, bleached dull brown massive sandy loam to bright yellowish brown strongly pedal sandy clay.

Soil limitations include moderate to high erodibility, low fertility, low wet bearing strength, low permeability, hardsetting, moderately sodic, low available water holding capacity, strongly acid in upper layers and strongly alkaline in the lowest B horizon soil layer.

The soils of the Williamsdale soil landscape, for non-concentrated flows are high. For concentrated flows the erosion hazard is high. Seasonal limitations include season waterlogging.

Burra

The soils of the Burra soil landscape are found on undulating to rolling low hills and alluvial fans with generally long (>300m) to moderately inclined (5-30%) waning slopes. The dominant soil materials consist of dark brown massive sandy loam, yellowish brown massive sandy loam, reddish brown strongly pedal sandy clay to orange strongly pedal light clay.

Soil limitations include high erodibility, low fertility, low wet bearing strength, low permeability, hardsetting, moderately sodic, low available water holding capacity and strongly acid. Localised limitations include springs and seasonal waterlogging.

The soils of the Burra soil landscape, for non-concentrated and concentrated flows are moderate.

4.2.4 Drainage Features

The project commences at the Murrumbidgee River and intersects Burra Creek. Approximately 15 minor watercourses and drainage lines are intersected along the project route with the majority of them unnamed (Figure 4.2). They are mostly ephemeral (i.e. only flow for short periods throughout the year). There are a number of dams in the area surrounding the pipeline route that potentially intercept a large proportion of the flows.

4.2.5 Sensitive Waterways

Sensitive waterways that the project impacts upon include the Murrumbidgee River and Burra Creek. There are a number of other minor water courses that the project traverses as stated in Section 4.2.4 above. Field confirmation by ACT EPA (Water Resources) will be required to identify all waterway crossings in the ACT as a part of the BWA's ACT Waterways Works License application.

4.2.6 Water Use

Water will be required from local sources for use in construction activities including drill and blasting, concreting, dust suppression and vehicle cleaning. It is proposed that water is pumped from the Murrumbidgee River for use in construction activities in the ACT and NSW. It is anticipated that the volume of water required from the Murrumbidgee River will be 70ML for construction purposes and hydrotesting over two years.

An Exemption (EX870) to extract water from the Murrumbidgee River has been obtained from the ACT EPA (Water Resources Unit), allowing a total of 70ML to be taken for the period of the exemption. Water will be transported along the project via water carts.

4.2.7 Groundwater

In the vicinity of the proposed pipeline route, recorded groundwater levels (or static water levels) vary from 1.2 m below ground level to 24 m below ground level. This depth range is typical for this environment, with the deeper water levels occurring under higher slopes, and the shallower water levels occurring under the lower slopes and valley floors (Figure 4.3).

Although some groundwater bores that are located within 20 to 550 m of the proposed pipeline route have a static water level within the proposed excavation depth, the depth of these groundwater bores (typically > 20 m depth) suggests that the groundwater bearing aquifer/s is at a depth that is well below the likely maximum trench excavation depth. This means that groundwater may not necessarily be intercepted within the excavations, as these are likely to be lower slope situations where the 'watertable' is commonly at greater depth than the groundwater pressure surface represented in the bore.

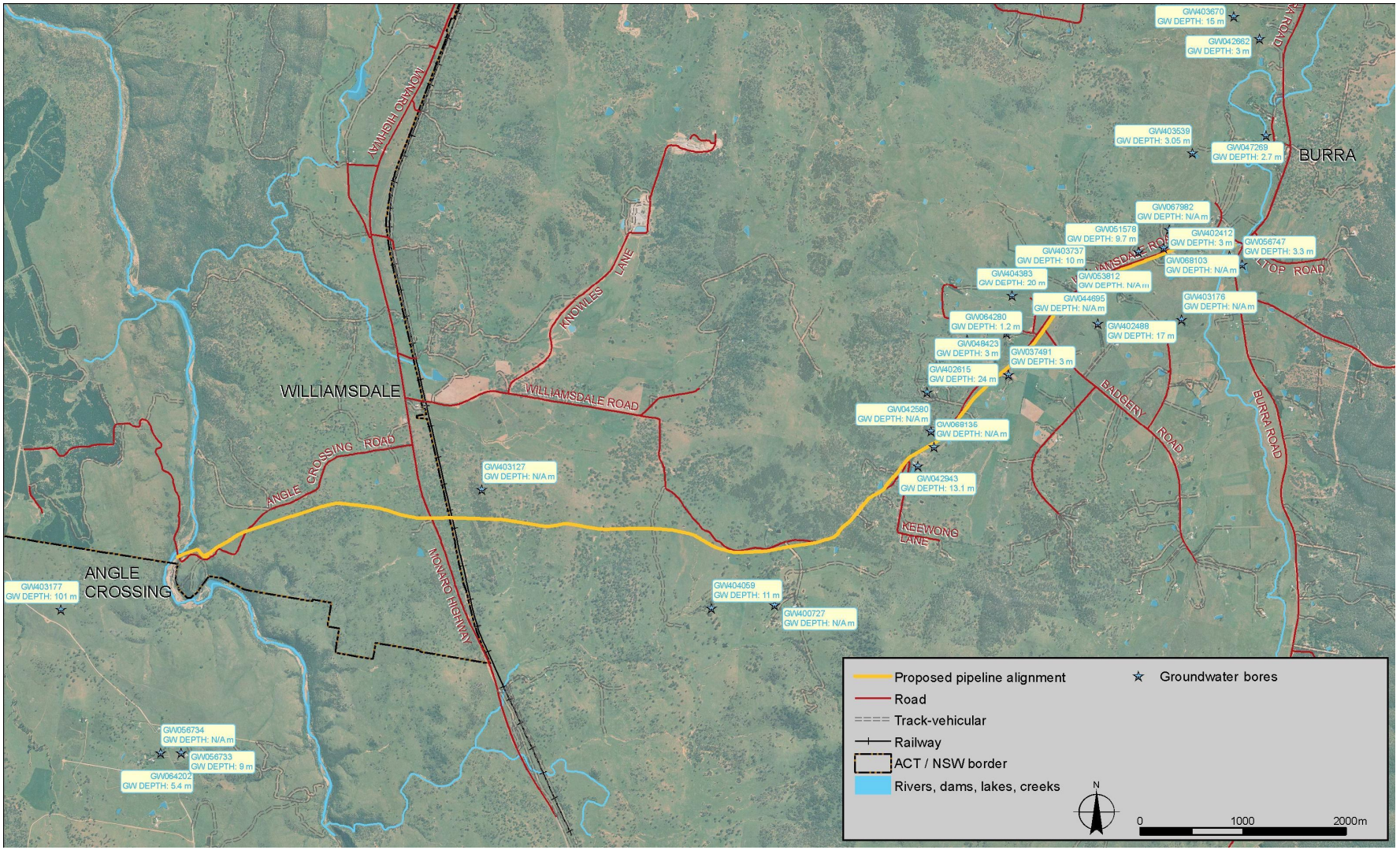
Groundwater bores in proximity to Burra Creek recorded static water levels of approximately 3 m below ground level. It is expected that static water levels at the intake will be relatively shallow (possibly < 1 m depth below ground level) due to their location close to Murrumbidgee River and Burra Creek respectively.

Based on the topography of the area, groundwater in the area to the south and west of Gibraltar Rise will likely flow toward the Murrumbidgee River (south-westerly direction), while groundwater in the area east of Gibraltar Rise will likely flow toward Burra Creek and Googong Reservoir (easterly direction).

Salinity of the groundwater recorded in fractured and unconsolidated rocks indicates that total dissolved solids are low (<500 mg/L) along most of the entire pipeline route and at the outlet location and associated structure. Total dissolved solids increases at the Burra Creek end of the pipeline to 500-1000 mg/L. No other physical or chemical groundwater data are available for the groundwater in the local area.

It is anticipated that there will no adverse impacts on groundwater if intercepted. It is currently unknown how much groundwater will be intercepted, but the probability of intercepting any is considered low given the recorded static water levels. However, any groundwater that is intercepted will be dewatered to a pre-determined area approved by the relevant agency. Dewatering of groundwater and/ or rainwater in the trench will involve any ponded water being drained to a temporary sump within the trench via a temporary drain where a hose inlet will be suspended in the sump. Water in the sump will be pumped to an approved location once the water is tested and determined to be of a quality acceptable to the NSW EPA and the ACT EPA (depending on the location of the area to be dewatered). This process will be documented with monitoring results recorded in accordance with Section 8 of this document.

Figure 4.2 Groundwater bore locations (taken from EIS, Chapter 16)



5 Environmental Controls and Mitigation Measures

The implementation of various environmental control measures during the course of construction can reduce the risk category of environmental aspects associated with the project (i.e. controlling the risk). In addition to implementing "best management practices" on site, the following environmental control measures will be implemented on site to minimise environmental impacts associated with construction activities.

5.1 General Mitigation Measures

Sections 5.1.1 to 5.1.4 outline the general mitigation measures that will be implemented on the project.

5.1.1 Extent of Excavation

As with most well planned construction projects, the area to be stripped of topsoil and thus exposed to erosion potential will be minimised as much as practically possible during the course of construction. It is envisaged that clearing and grubbing of vegetation and, thus, exposing the soil surface, will occur just prior to commencement of the trenching operation. The pipeline will be laid progressively and backfilled immediately. The area will then be progressively stabilised by a dedicated reinstatement crew.

With respect to the length of trench to be exposed at any point in time, it is envisaged that the maximum distance of trench left open overnight will not exceed 200 metres per crew.

Erosion and sediment control plans (ESCPs) will be implemented as a matter of necessity to manage exposed areas of ground and to minimise the impact of this activity on the receiving environment.

5.1.2 Progressive Erosion and Sediment Control Plans (ESCPs)

Appropriate planning is crucial to effective management of erosion and sedimentation on site. ESCPs are planning documents which clearly show the approximate location of erosion and sediment control structures on site.

ESCPs will be developed for all work areas prior to commencing activities. A typical/ concept ESCP for the site is located in Appendix A and will form the basis of any future progressive ESCPs. ESCPs will be regularly reviewed as site conditions change hence their progressive nature.

These documents are designed for use as a practical guide and may be produced in conjunction with an Environmental Work Method Statement (EWMS') for more sensitive construction activities. The concept of EWMS' is detailed in Section 5.1.3 below.

The procedure for the development of ESCPs is contained within Lotus Notes and available to all site personnel.

5.1.3 Environmental Work Method Statements (EWMS')

A detailed description of EWMS' and their application is detailed in the Murrumbidgee to Googong Transfer CEMP. However in summary, EWMS' are documents detailing proposed work procedures and specific environmental control measures for activities which require more detailed attention than general ESCPs.

Potential EWMS' will include the following activities:

- Clearing and Grubbing;
- Topsoil Stripping and Stockpiling;
- Temporary Waterway Crossings;

- Temporary Waterway Diversion;
- Removal of Temporary Waterway Diversions;
- Working in Watercourse Areas;
- General Dewatering Procedures;
- Scour Protection in Waterways;
- Chemical Storage and Use; and
- Refuelling Operations
- Water monitoring methods.

5.1.4 Erosion and Sediment Control (ERSED) crews and resources

Effective erosion and sediment control on site is contingent on the effective installation and maintenance of erosion and sediment control structures as detailed in the ESCPs. In order to ensure that erosion and sediment controls are implemented effectively on site and maintained in an operational manner during construction, a fully equipped erosion and sediment control crew will be established on site at all times under the direction of the Superintendent and Supervisors. ESCPs will be developed in consultation with the Site Soil Conservationist and implemented onsite prior to the commencement of construction activities in the vicinity.

5.2 Specific Mitigation Measures

In addition to the above, the following specific mitigation measures will be implemented on site to manage erosion and sediment control issues associated with the project activities.

Mitigation measures and safeguards to minimise and manage environmental risks identified in **Table 4.3** are detailed in **Tables 5.1 - 5.6** below.

Table 5.1 Proposed Mitigation Measures

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S1	Prepare progressive ESCPs for all impacted areas that comply with : • Soils and Construction – Volume 1, 4th Edition (Landcom) March 2004; • Managing Urban Stormwater: Soils and Construction, Volume 2C: Unsealed Roads (DECC, 2008); • Environmental Protection Guidelines for Construction and Land Development in the ACT (EPA, 2007) • Relevant EWMSs (eg. Stockpiling)	Environmental Officer Land and Compliance Manager Soil Conservationist Engineer
S2	Works will not commence prior to an ESCP being developed and adequately implemented on site. This may include the development and implementation of EWMSs for high risk activities	Superintendent Supervisors

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S3	Erosion and sediment controls will be inspected prior to predicted rainfall, prior to long work breaks and after rainfall events to ensure they are fully functional. If required, initiate any repair or maintenance requirements	Superintendent/ Supervisors Environmental Officer ERSED crews
S4	ESCP's will be progressively updated as construction activities change and distributed to relevant site personnel for reference and implementation.	Engineer Environmental Officer Soil Conservationist
S5	Site personnel (in particular ERSED crews) will be provided with training on sound environmental practice and the implementation of effective Erosion and Sediment Control structures.	Environmental Officer Soil Conservationist
S6	Specific site personnel will be trained and/or toolboxed on correct coffer dam management prior to any discharge.	Environmental Officer Supervisors
S7	Site personnel will be kept informed of relevant environmental issues through the implementation of environmental training and toolboxes.	Land and Compliance Manager Environmental Officer
S8	Clearing and grubbing limits will be established and clearing will be undertaken in a controlled manner to limit areas of disturbance	Project Engineer Supervisor
S9	Silt curtains will be installed in the Murrumbidgee River and Burra Creek around the coffer dams.	Superintendent/ Supervisors Environmental Officer ERSED crews
S10	Where possible, felled vegetation will be utilised as erosion and sediment control or placed as Coarse Wood Debris (CWD) for animal habitat.	Environmental Officer Supervisor
S11	Access tracks will be delineated and sign posted to prevent unnecessary ground disturbance.	Superintendent Supervisor
S12	Vehicular access and the bed and banks of the Murrumbidgee River and Burra Creek will be limited.	Superintendent Environmental Officer
S13	Control measures will be implemented at site exits to minimise tracking of sediment onto public roads and identified in relevant ESCP's	Superintendent Environmental Officer
S14	Water carts will be used to suppress dust along the project route.	Superintendent/ Supervisors Environmental Officer ERSED crews
S15	Changes to runoff flow paths to the Murrumbidgee River and Burra Creek will remain unchanged or be minimised as much as practical, with disturbed banks of the Murrumbidgee River and Burra Creek to be lined with geotextile to prevent erosion.	Superintendant/ Supervisors Environmental Officer
S16	The excavation, lower and lay and backfilling of the pipe line will be undertaken progressively.	Superintendent

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
		Supervisors
S17	Regular inspections will be undertaken, at least weekly, to ensure erosion and sediment control structures are effective (including following significant rain events). If improvements are identified, these will be documented in an inspection report which is to be closed out within designated times frames.	Project engineer Environmental Officer Soil Conservationist Supervisor
S18	Records regarding water quality and functionality of erosion and sediment control devices will be kept, including details of rain events, use of flocculants, sediment removal and dewatering activities. A checklist will be completed prior to when treated water is to be discharged from the coffer dams.	Environmental Officer ERSED crew
S19	The coffer dams will be inspected after each rain event (greater than 20 ml in 24 hours), flocculated and discharged or pumped into containers, as required. All appropriate recording will be undertaken prior to discharge. Inside the coffer dams will be kept as clean as possible (eg. Machinery, equipment or excess dirt will not be stored in the coffer dams) to minimise flood damage and potential pollution of the River).	Superintendent/Supervisor ERSED Crew Environmental Officer
S21	Where appropriate, water from the coffer dams will be utilised for construction purposes, such as compaction and dust suppression.	Project Engineers/Superintendents
S22	Stockpiles (Topsoil/ spoil) will be located away from drainage lines, including the Murrumbidgee River and Burra Creek.	Supervisor Environmental Officer
S23	Sediment fences will be installed below stockpiles to manage erosion, clean water diversion drains constructed upslope of stockpiles where there is medium to large catchment upslope and stockpiles will be stabilised as soon as practical.	Supervisor Environmental Officer
S24	Progressive rehabilitation will occur during construction activities to stabilise exposed areas and minimise erosion potential.	Supervisor Environmental Officer
S25	Records regarding water quality and functionality of erosion and sediment control devices will be kept, including details of rain events, use of flocculants, discharge, sediment removal and dewatering activities with controls updated if ineffective.	Environmental Officer ERSED crew
S26	A coffer dam checklist will be completed whenever treated water is to be discharged from the coffer dams.	Environmental Officer

5.2.2 Stockpiles

Material and stockpiling areas will be located within the allocated construction corridor or other approved areas in close proximity to site compounds and equipment lay down areas. These areas will be within the construction boundary easement and be fenced off to the public. Suitable storage and stockpile sites will generally be selected to occupy existing cleared areas based on the following criteria:

- safe access to equipment lay down and construction areas;

- safe access off public roads;
- proximity to construction localities; and
- environmental considerations, including away from drainage lines, identified heritage areas, protected vegetation and whether the area has been cleared previously.

5.2.3 Crossing Watercourses

The project proposes to cross 15 minor watercourses and drainage lines. The NoW, DECCW, NSW and ACT EPA will be consulted during the design phase to determine the most appropriate way to cross the various waterways with any required approvals/ licences obtained prior to works commencing. As part of the ACT Waterway Works License, field confirmation by the ACT EPA (Water Resources) will be required to identify all waterway crossings in the ACT. The watercourse crossings will be temporary and the sites rehabilitated upon their removal. A Landscape Rehabilitation Management Plan has been developed to specifically detail how the construction activities and structures within or in proximity to riparian areas would be appropriately designed and managed to ensure the integrity, function and condition of these areas. The measures in Table 5.2 will also be observed where work is to be conducted in or adjacent to a watercourse.

The BWA will design, construct, operate and maintain the pipeline so that it doesn't reduce bank stability within the Burra Creek riverine corridor and does not increase local flooding risk. Appendix B provides a draft engineering design of the outlet structure at Burra Creek. The plan shown in Appendix B will be updated once the design of the scour protection is finalised. The scour protection works will be designed to minimise any adverse impacts on the geomorphology of Burra Creek during the operational phase and incorporate riparian vegetation requirements.

Appendix C provides draft details on the engineering design for each category of watercourse crossing. The Appendix will be updated once design is finalised.

Table 5.2 Proposed mitigation measures – Crossing Watercourses

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S27	All work in or adjacent to watercourses must be undertaken in compliance with EWMS-006 – Working in Watercourse areas.	Project Engineers/Superintendents Environmental Officer
S28	All temporary crossings must be undertaken in compliance with EWMS-003 – Temporary Waterway Crossings General.	Project Engineers/Superintendents Environmental Officer
S29	All temporary diversions of waterways must be undertaken in compliance with EWMS-003 – Temporary Waterway Crossings.	Project Engineers/Superintendents Environmental Officer
S30	All installations of temporary water crossings must be undertaken in compliance with EWMS-003 – Temporary Waterway Crossings.	Project Engineers/Superintendents Environmental Officer
S31	Waterway crossings will not be constructed during periods of heavy rain and flooding.	Project Engineers/Superintendents Environmental Officer

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S32	A contingency plan will be implemented if heavy rain and/ or flooding occur during the installation of a temporary waterway crossing.	Project Engineers/Superintendents Environmental Officer
S33	A landscape rehabilitation program would be instigated immediately following construction utilising appropriate stabilisation products and species endemic to the area. Restoration may also involve the provision of in-stream habitat features such as riffles, pools and snags.	Land and Compliance Manager Environmental Officer

5.2.4 Wastewater Management

Wastewater generated on-site is likely to be derived from:

- site amenities waste;
- runoff water collected in sediment traps;
- concreting activities;
- truck and concrete agitator wash-down bays;
- runoff water collected in excavations or low points on site; and
- groundwater inflows into the coffer dams at the Murrumbidgee River and Burra Creek during construction.

The following measures will be applied to the management of wastewater:

Table 5.3 Proposed Mitigation Measures – Wastewater Management

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S34	Staff will be trained through site inductions and tool box talks in relation to management of wastewater, the potential impact on water ways and made aware of their responsibilities and penalties under *the ACT Environment Protection Act (1997)* and the NSW *Protection of the Environment Operations Act (1997)* in relation to water pollution.	Land and Compliance Manager Environmental Officer
S35	Unplanned wastewater discharges will be reported to the Environmental Manager who will notify Regulatory Authorities if required.	Environmental Officer Superintendents/Supervisors
S36	Wastewater from site amenities will be treated by an approved treatment system onsite or removed by a licensed contractor to an appropriate disposal facility with the approval of EPA, PCL and/ or DECCW.	Supervisors Environmental Officer
S37	Discharges from the coffer dams will be undertaken in compliance with EWMS-005 – Dewatering LLPS Coffer Dam.	Environmental Officer ERSED Crew
S38	Hydrostatic pressure testing will occur progressively.	Superintendent Supervisors

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S39	Water collected in excavations, the pipeline trench or low points on site will be pumped to containers, used on site for dust suppression or be managed following the EWMS-007 – Dewatering Excavations.	Environmental Officer ERSED Crew Supervisors
S40	Concreting and curing operations will be undertaken in compliance with EWMS-010 – Concrete Works.	Environmental Officer ERSED Crews Supervisors
S41	Concrete washout areas/pits will be adequately sized, located away from drainage lines and waterways and maintained regularly. Activities will be undertaken in compliance with EWMS-010 – Concrete Works.	Superintendents/Supervisors Environmental Officer
S42	Where possible opportunities for water reuse/ recycling will be initiated	Construction Manager Land and Compliance Manager
S43	Water captured in bunded areas will be assessed for contamination prior to discharge. Contamination will be removed using appropriate absorbent material and disposed of in a licensed waste management facility.	Supervisors Environmental Officer

5.2.5 Coffer Dams

Coffer dams will be located in the Murrumbidgee River and, potentially, in Burra Creek. On completion of the works in the Murrumbidgee River and Burra Creek, the coffer dams will be removed and the areas rehabilitated to its pre-existing condition. An Environmental Work Method Statement and an ESCP will be prepared for the installation and removal of the coffer dams. Inside of the coffer dams will be kept free of machinery, equipment and excess dirt in case of flooding. Following a flood event, the coffer dams will be inspected and rectification works implemented if necessary to minimise any adverse impact on the downstream environment.

A fully resourced and trained crew of workers (ERSED crew) will undertake the maintenance of the coffer dams. Management and maintenance measures will be adopted to ensure effective functioning and compliance with the NSW Environment Protection Licence (EPL) and ACT Environmental Authorisation (EA).

Table 5.4 Proposed Mitigation Measures – Coffer Dams

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S44	Construct the coffer dams in accordance with EWMS-004 – Construction of Low Lift Pump Station and specific ESCP.	Project Engineers Land and Compliance Manager Soil Conservationist

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S45	Manage the coffer dams in accordance with EWMS – Dewatering LLPS Coffer Dam.	Environmental Officers Soil Conservationist Supervisor/ERSED crews
S46	Where appropriate, water from the coffer dams will be utilised for construction purposes, such as compaction and dust suppression.	Project Engineers/Superintendent
S47	Records regarding quantity of extracted water, water quality and functionality of erosion and sediment control devices will be kept, including details of rain events, use of flocculants, discharge, sediment removal and dewatering activities.	Environmental Officers ERSED crew
S48	A coffer dam checklist will be completed whenever treated water is to be discharged from the coffer dams.	Environmental Officers

5.2.6 Fuel and Chemical Management

On-site Management

Soil contamination and water quality impacts as a result of fuel and chemical spills can result in significant environmental degradation and impacts on waterways and land adjacent to the project. The predominant causes of spills and leaks on site can occur as a result of plant breakdowns, inappropriate storage of fuels and chemicals, and inappropriate use/application of compounds and chemicals. During the construction process the principle of "prevention rather than remediation" will be applied to fuel and chemical management on site.

The following management strategies will be implemented on site to minimise the potential of spills and leaks.

Table 5.5 Proposed Mitigation Measures – Fuel and Chemical Spills

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S49	Site personnel undergo training on appropriate spill management and emergency response procedures.	Land and Compliance Manager
S50	Works involving the use of chemicals, dangerous goods or other potential contaminants, will be planned and implemented to minimise the possibility of spillage	Engineers / Superintendent Environmental Officer
S51	The use and storage of chemicals and dangerous goods will be strictly in accordance with relevant legislation, manufacturers instructions, MSDS and the relevant Safe Work Method Statements	Engineer
S52	Adequate quantities of emergency response materials such as oil spill kits, absorbent materials, sand bags, flocculating agents and pH buffer solutions will be readily available and kept in designated compounds. Hydrocarbon spill kits will also be kept in emergency response vehicles,	Engineer Superintendent Environmental Officer

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
	Superintendent's vehicles, Environmental Officer's vehicle and other vehicles that carry substantial quantities of chemicals (e.g. subcontractors).	
S53	Temporary bunding will be provided for all refuelling or maintenance of plant and equipment or any other activity onsite that could result in spillage of a chemical, fuel or lubricant (especially where the activity is undertaken in a location with direct drainage to a waterway or environmentally sensitive area).	Supervisors
S54	Where chemical drums (greater than 20 litres) are removed from bunded areas, they will be placed in temporary bunds and returned to the bunded area by the end of the day.	Supervisors
S55	Machinery, pumps and other equipment will be checked regularly for excessive wear and leaks, and if required, repaired promptly.	Supervisors Operators
S56	Permanent storage of fuels and chemicals will only occur within impervious bunded areas with a capacity of at least 120% of the total capacity of the largest vessel stored and roofed with 10° overhang.	Supervisors
S57	Bunded areas will be located in an area at least 30m from a Riparian Management Zone or Exclusion Zone as defined in the ACT Forest Code of Practice.	Supervisors
S58	Water captured in a bunded area will be monitored and drained (if uncontaminated) after each rain event to ensure bund capacity is maintained at all times. If contamination is evident the contaminant will be absorbed using remediation products (absorbent pads, etc) and disposed to an appropriate waste management facility.	Environmental Officer Supervisors
S59	Records of water quality checks, discharges and any remedial actions taken will be recorded.	Environmental Officer
S60	Where safe to do so, containment measures such as sandbags, booms, earth bunds or cut drains will be installed to capture and retain spilled material and prevent it from leaving site, entering any watercourse or impacting on vegetation stands.	All Personnel
S61	Spill kits will be maintained in emergency response vehicles and at identified site facilities where significants spills may occur (e.g. workshops)	Environmental Officer Supervisors
S62	No refuelling will occur within 30m of a riparian management zone or in a location where fuel may enter a water body.	Environmental Officer Supervisors

It is not anticipated that any more than 1,000L of fuel will be stored on site. It will stored in a container that complies with Australian Standards AS1657, AS1940 and AS1692. To prevent any leaks/spills as a result of refuelling, temporary bunds will be used at the fuelling points to capture any inadvertent spills. Spill kits will be located at the tank to immediately remediate any spills. The tank will be bunded to 120% capacity.

In addition to above, fuel storage areas and the fuel tank will be assessed for spill and worn components on a weekly basis through the Environmental Inspection Checklist to ensure the tanks and associated pipe work

are maintained in good condition. Any worn components or signs of spills will be documented in an Observation and Action list and rectified/ remediated accordingly. No fuel storage tanks will be left onsite on completion of the project.

5.2.7 External Notification

All environmental emergencies will be managed in accordance with the Emergency and Incident Response Management Plan (EIRMP).

In the event that an incident has caused, is causing, or is likely to cause material or serious environmental harm, whether the harm occurs on or off the site, the M2G Environmental Manager will report the incident to the ACT EPA, DECCW and ActewAGL in the following manner:

- Notify the ACT EPA by telephoning Canberra Connect on 132281 during and outside business hours if a spill occurs within the ACT or NSW DECCW on 131 555 if it occurs with NSW.
- Notify ActewAGL on either of the following numbers in order of priority. It is vital that personal communication is attained to initiate immediate shutdown of the Cotter Pumping Station supplying water to Mount Stromlo Water Treatment Plant (WTP) for subsequent potable water to Canberra.

  Do not leave a phone message or email, which may not be acted upon immediately.

- Stromlo WTP – 6248 3642
- Water Distribution Services – 0414 511 719
- Lower Molonglo – 6248 3457
- Googong WTP – 6248 3212

5.2.8 Stabilisation and Rehabilitation

While principles of minimal disturbance will be implemented on site, soil disturbance associated with the project is unavoidable. Progressive stabilisation of disturbed areas significantly assists the management of erosion and sediment control on site by:

- absorbing the impact of raindrops;
- Reducing the volume and velocity of runoff;
- binding the soil through root structures;
- protecting soil from the erosive effects of wind (reduces dust); and
- providing a natural filter mechanism.

The following measures in **Table 5.6** will be adopted to progressively stabilise and restore disturbed areas as a result of construction activities. Reference should be made to the Landscape Rehabilitation Management Plan (LRMP) for further details of site rehabilitation.

Table 5.6 Proposed Mitigation Measures – Stabilisation and Rehabilitation

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S63	Establish a program for the implementation of revegetation and topsoiling works along the site and in/adjacent to water courses (Landscape Rehabilitation Management Plan).	M2G Land and Compliance Manager

Ref	Mitigation Measures	Responsibility (implement/ coordinate)
S64	Undertake progressive reshaping and rehabilitation works in conjunction with the completion of bulk excavation and land shaping, and in accordance with the Landscape Rehabilitation Management Plan	Environmental Officer Project Engineer Superintendents/Supervisors
S65	Graded banks on a 2-3% grade will be constructed across the easement or mulched rip lines installed where the easement is perpendicular to the existing ground slope to reduce the potential for erosion. The spacing between the graded banks/ mulched rip lines will be determined by the gradient of the existing topography and range from 15m to 40m apart. The graded banks will also be located so as to outlet onto a stable surface.	Environmental Officer Project Engineer Superintendents/Supervisors
S66	Topsoil will be reused in areas as close as possible to its source location to maximise the benefits available from the existing seed bank.	Superintendents/ Supervisors
S67	Vegetated filter traps will be established or other measures implemented quickly where possible to minimise erosion and offsite sedimentation.	Superintendents/ Supervisors
S68	Weed management strategies will be implemented in newly rehabilitated areas to control weed infestation and propagation	Superintendents/ Supervisors
S69	Appropriate endemic and native species will be used wherever possible particularly those that will provide future habitat for endangered fauna	M2G Land and Compliance Manager
S70	A program of seed collection will be implemented to bolster endemic and native seed stores which can be later used for final rehabilitation works	M2G Land and Compliance Manager
S71	Felled vegetation may be positioned in a manner that prevents erosion (i.e. positioned in windrows along contour banks) or can be mulched to assist in erosion control and rehabilitation works	Superintendent Supervisors
S72	Rehabilitation of waterway crossings or areas in and adjacent to the Murrumbidgee River or Burra Creek will occur as soon as works are complete in that area.	Environmental Officer Project Engineer Superintendents/Supervisors

5.2.9 Rehabilitation Methodology for Watercourse Crossing

The rehabilitation of watercourse crossings will be categorised by the Strahler System of stream order classification. The pipeline crosses 5 first order watercourses, 7 second order watercourses, 1 third order and 2 fourth order streams. Burra Creek is classified as a fifth order stream where the pipeline intersects it but there will be no formal crossing of this watercourse. **Table 5.7** outlines the rehabilitation methodology of watercourse crossings for each identified stream order.

Table 5.7 Rehabilitation Methodology for Watercourse Crossings for Identified Stream Orders

Stream Order	Rehabilitation Methodology	Responsibility (implement/ coordinate)
First order	• Topsoil, line drainage line with erosion matting and plant with native grasses as recommended in the Landscape Rehabilitation Management and Property Plans.	M2G Land and Compliance Manager

Stream Order	Rehabilitation Methodology	Responsibility (implement/ coordinate)
	• Stream bed profile to tie in with existing upstream and downstream profile.	
Second Order	• Topsoil, line drainage line with erosion matting and plant with native grasses as recommended in the Landscape Rehabilitation Management and Property Plans. • Stream bed profile to tie in with existing upstream and downstream profile.	M2G Land and Compliance Manager
Third Order	• Topsoil, line drainage line with erosion matting and plant with native grasses as recommended in the Landscape Rehabilitation Management and Property Plans. • Stream bed profile to tie in with existing upstream and downstream profile.	M2G Land and Compliance Manager
Fourth order	• Protect pipeline with rock covering over backfill. • Stream bed profile to tie in with existing upstream and downstream (except in the instance where there is active erosion occurring – then the bed profile will be shaped to prevent further erosion. • Topsoil and revegetate with native grasses/ groundcovers as recommended in the Landscape Rehabilitation Management and Property Plans.	M2G Land and Compliance Manager
Fifth Order	• Protect pipeline with rock covering over backfill. • Stream bed profile to tie in with existing upstream and downstream (except in the instance where there is active erosion occurring – then the bed profile will be shaped to prevent further erosion. • Topsoil and revegetate with native grasses/ groundcovers as recommended in the Landscape Rehabilitation Management and Property Plans.	M2G Land and Compliance Manager

6 Communication & Consultation

6.1 Community Engagement and Stakeholder Management

Close community liaison will be maintained to ensure that local residents are aware of the times and durations when they may be affected by construction work and to provide an avenue for communication between the community and the Bulk Water Alliance.

All communication and consultation will be undertaken in accordance with the project Community Engagement and Stakeholder Management (CESM) Plan. The CESM Manager is responsible for the interface with the community. This includes (but is not limited to) notification of construction activity, notification of temporary road closures, community engagement regarding construction (including soil and water related activities) and the complaints process. The CESM Manager reports to the M2G Client representative whilst working in conjunction with the M2G Project Manager, M2G Construction Manager, Site Superintendent, M2G Environmental Manager and Project Engineers.

In addition, consultation with government agencies will be undertaken regularly as described in the CEMP with the intention of reviewing the effectiveness of the SWMP, site management practices, monitoring results and any other relevant issues.

Table 6.1 Communication Network

Communication	Action
Project personnel including sub-contractors/suppliers	• A site induction and environmental training will be provided to all personnel and sub-contractors engaged to work on the site. • Feedback on environmental matters, new legislation etc. will be provided and encouraged. • Close communication will be maintained between the Construction Manager, M2G Environmental Manager, Supervisors and Environmental Officer.
Government agencies	**ACT** • Environmental Protection Authority (EPA) • Parks, Conservation and Lands (TAMS) • ACT Heritage Unit **NSW** • Environmental Protection Authority (EPA) • Department of Planning (DoP) • Australian Rail Track Corporation (ARTC)
Community and Landholders	• Individual Landholders will be informed in advance of construction activity affecting them in accordance with the CESM Plan • Project information will be made available to the community in accordance with the CESM Plan through advertisements, community notices and newsletters. • A protocol for registering and responding to complaints will be established as detailed in the Complaints Management Procedure

Communication	Action
	and CESM Management Plan.

6.2 Complaints Management Strategy

The Bulk Water Alliance is committed to managing soil and water related complaints from affected residents or stakeholders in a proactive and conciliatory manner.

Relevant community and stakeholder groups will be progressively informed of the various stages of construction by the Community Engagement and Stakeholder Management (CESM) team, particularly prior to significant construction generating activities related to soil and water management.

The community and stakeholder groups identified in the CESM Plan will be informed of the duration of the works, what impacts that they are likely to expect and they will be given a 1800 toll free number to contact the BWA CESM team should they wish to register a complaint regarding any aspect of the construction project, not just soil and/or water related impacts.

The BWA CESM team will automatically implement a process for registering and responding to the lodged complaint as per the Complaints Management Procedure. The CESM Manager will report back to the project team on impact and mitigation effectiveness on a weekly basis.

The Water Security Hotline phone number (6248 3563) is available during business hours for general questions, project updates and to provide feedback. A toll free number (1800 211 242) is available 24 hours a day for emergencies. Complaints and comments can also be sent via email to watersecurity@actew.com.au.

7 Training, Awareness and Competence

Three main forms of training will be implemented on site:

- site induction;
- environmental management training; and
- "toolbox" training

Records of all site inductions and on site training will be kept on a database, including details of the training topic(s) presented, participants and training dates. All participants will be required to "sign-off" that they have been informed and understand their environmental obligations at the conclusion of each training session.

Training will generally be prepared and delivered by the Environmental Officer, or by personnel delegated by the M2G Environmental Manager.

7.1 Site Induction

Prior to working on site, all personnel and subcontractors will undertake a site induction detailing significant environmental and OHS requirements associated with the M2G project. The will include, but not be limited to, the following environmental components.

- the EMS and CEMP (purpose, objectives, etc) and the requirements of the SWMP;
- legal requirements including due diligence, duty of care and potential consequences of infringements;
- environmental responsibilities;
- conditions of licences, permits and approvals;
- BWA policies (including the Shared Road Policy);
- significant environmental issues and areas of the site, including the identification of project boundaries, location of refuse bins, washing, refuelling and maintenance of vehicles, plant and equipment;
- environmental management techniques for key environmental elements (soil and water, waste and recycling, flora and fauna, heritage etc) e.g. EWMS;
- incident management and emergency plans;
- reporting process for environmental harm/incidents;
- protection and maintenance of environmental controls; and
- BWA sustainability objectives.

7.2 Environment Management Training

Targeted environmental management training will be provided to individuals responsible for environmental management on site, or groups who are undertaking activities which have been identified as "high risk". This environmental training is designed to achieve a level of awareness and competence appropriate to their assigned activities.

Specific links will be made between environmental objectives and sustainability principles during training sessions (where possible). A comprehensive overview of sustainability may also need to be included (i.e. social, economic and environmental aspects, and inter-generational equity).

Erosion and Sediment Control training will be provided by a qualified Soil Conservationist and will include the following aspects:

- principals of erosion and sediment control;
- impacts of poor erosion and sediment control management on site;
- Relevant legislation and approvals;
- techniques of erosion and sediment control planning, implementation and maintenance; and
- on-site field planning.

Records will be maintained on site of all training sessions conducted and personnel attendance. These records will be maintained by the Environmental Officer.

7.3 Toolbox Training

Toolbox training will help to ensure that relevant information is communicated to the workforce and that feedback can be provided on issues of interest or concern. Toolbox training will generally be prepared and delivered by the Project Engineers, Superintendent, Site Supervisors and/or the Environmental Officer and will reflect risks and concerns associated with construction Activities occurring on site.

EWMS' will draw reference to specific toolboxes based on risks associated with the proposed construction Activity. The toolboxes will complement the SWMP by providing additional details on the management and mitigation of identified environmental impacts. Environmental toolbox training topics may include but are not limited to:

- working within or in close proximity to waterways;
- clearing and grubbing procedures;
- concrete washout procedures;
- dust control;
- protecting waterways and riparian zones;
- wastewater control;
- spills and leaks (including the application of remediation products);
- emergency response procedures;
- wet weather procedures and inspections;
- changes to recent legislation; and
- other general site issues.

8 Inspection, Auditing & Monitoring

8.1 Environmental Site Inspections

As outlined in the CEMP, site inspections will take place on a regular basis to ensure appropriate mitigation measures and controls are implemented and that they are fully operational and effective. A variety of site inspections will be initiated for the project. These include:

8.1.1 Event Based Inspections

Event based inspections will occur prior to predicted rainfall events, following significant rain event (>10mm / 24 hour period) and prior to extended site shutdowns (e.g. Christmas) by the Environmental Officer. This inspection will assess whether erosion and sediment controls installed on site are sufficient or have operated effectively for rain event up to and including the design rainfall capacity. Any maintenance observations, areas of concern or improvements will be recorded on an Environmental Maintenance Actions and Observation Checklist for actioning by the construction crew.

8.1.2 Informal Daily Inspections

Informal visual checks of all erosion and sediment controls will be undertaken daily on work days by the Supervisors and ERSED crews. Any maintenance requirements identified can be actioned prior to Environmental Maintenance Action and Observation Checklist being issued by the Environmental Officer.

8.1.3 Environmental Authorisation 802

In accordance with the ACT Environmental Authorisation 802, monitoring of turbidity of the Murrumbidgee River upstream and downstream of the works site will occur on a daily basis, whilst construction is being undertaken as well as during and following storm events (generally when rainfall exceeds 20mm in a 24 hour period). Refer also to Section 8.2.2. Environmental Authorisation 802 also refers to monitoring of noise, vibration and air quality at specific compliance points. This monitoring will occur as per the CEMP and the corresponding Compliance Tracking Plan (Appendix A of CEMP). The Environmental Manager will contact the EPA if there are any non-compliances to the monitoring stipulated within the Environmental Authorisation 802.

8.1.4 Weekly Site Inspections

Inspections by Environmental Officer will occur on a weekly basis or more frequently if specified in an Environmental Authorisation (ACT) or EPL (NSW) using the Site Environmental Inspection Checklist. Issues will then be documented on an Environmental Maintenance Action & Observation Checklist. Issues raised during this inspection will be closed out by the construction team within an allocated time frame depending on level of environmental risk.

8.1.5 Specialised Inspections

Periodic specialised inspections will be conducted by the Site Soil Conservationist to ensure that erosion and sediment controls are effectively established and implemented as per the ESCP. These inspections will focus on newly exposed areas or areas considered especially sensitive. A report similar to the Environmental Maintenance Action & Observation Checklists will be issued to the construction team for actioning.

8.1.6 External Inspections

External inspections will be held in consultation with the ACT EPA, NSW DECCW and other Regulatory Authorities to inspect the site and operating procedures. These inspections will be documented with all agreed outcomes documented in an Environmental Maintenance Action & Observation Checklist for actioning

8.1.7 Independent Auditor / Environmental Representative (IER)

Details of the independent auditor / environmental representative (IER) have been summarised within the CEMP. In general, the IER will assess compliance against project conditions and licences during the course of construction as well as adherence and compliance with the Construction EMP and related sub-plans.

8.2 Environmental Monitoring

The following environmental monitoring will be conducted on site during the construction phase of the project:

8.2.1 Rainfall

Rainfall quantities will be recorded daily to maintain an accurate account of precipitation on site.

8.2.2 Water quality monitoring

The Murrumbidgee River will be monitored daily, 50m upstream and downstream of the works area, during the construction of both the high and low lift pump stations and associated infrastructure. Water quality in Burra Creek will be monitored after rain, upstream and downstream of the works area. Parameters that will be monitored include turbidity, pH and oil and grease (visually).

If water is to be discharged from the coffer dams into the Murrumbidgee River or Burra Creek, it will be tested and treated, if required, until the water quality is of a standard that complies with ACT EPA and NSW DECCW requirements prior to discharge, with the process being documented. It is envisaged that water from the coffer dams will be used on site for dust suppression purposes.

8.2.3 Groundwater monitoring

The quantity and quality of any intercepted groundwater will be documented prior to dewatering of any groundwater in the pipeline trench and/or coffer dams.

8.2.4 Geo-morphological Monitoring Sub-Plan

The Geo-morphological Monitoring Sub-plan will be implemented to monitor the impact of the project on the morphology of Burra Creek at the pipeline outlet location and downstream to Googong Reservoir. The monitoring program includes:

- monitoring requirements in order to assess the impact of the project on the present morphology of Burra Creek at the pipeline outlet location and downstream to Googong Reservoir;
- baseline monitoring prior to the introduction of flows through Burra Creek in order to establish any morphological changes resulting from the project;
- provisions for monitoring during construction, operational and non-operational phases;
- mechanisms for immediately investigating any anomalous monitoring results;

- mechanisms for the management and mitigation of any impacts on the waterways including cessation of flows where necessary; and
- details of how the monitoring results will be reported to the Director-General of Department of Planning (DoP) and the NoW.

8.2.5 Stream Flow and Water Quality Monitoring Sub-Plan

The Stream Flow and Water Quality Monitoring Sub-plan will be implemented to monitor and manage the impact of the project on the waterways associated with the project. The sub-plan has been prepared in accordance with sections 8.2.3.3 and 8.2.3.4 of *Australian and New Zealand Guidelines for Fresh and Marine Water Quality – Volume 2: Aquatic Ecosystems* (ANZECC & ARMCANZ, 2000). It includes

- the monitoring framework detailed in the following documents:
  - Major Project Application 08_0160;
  - the *Murrumbidgee to Googong Water Transfer Environmental Assessment* for the project dated 7 August 2009;
  - the *Murrumbidgee to Googong Water Transfer Environmental Impact Statement incorporating the Preferred Project Report* for the project dated 21 December 2009;
  - the NSW DoP Conditions of Approval; and
  - the ACT Development Application conditions.
- a baseline monitoring program;
- an evaluation of the discharges in terms of temporal and spatial scales;
- a comparison of discharge data with baseline data;
- sampling and data collection at representative sites, both impact (downstream of the discharge point) and control (upstream of the discharge point) sites;
- sampling and data collection for the discharges and immediate receiving environment to quantify the changes in ecosystem health and water quality with specific reference to phytoplankton, aquatic vegetation, macro invertebrates, fish, temperature, salinity, dissolved oxygen, iron and manganese;
- provisions for the review of the Program within six months of commencement of the first full operational flow into Burra Creek;
- identification of key water parameters including but not limited to flow rate, temperature, ph, salinity, total dissolved solids and nutrient parameters for the operation of the project;
- management actions for the parameters identified in the point above should they be breached; and
- details of how the monitoring results will be reported to the Director-General and NoW.

8.3 Auditing

Periodic audits of the SWMP are detailed within the CEMP Audit Schedule.

Audits will include:

- a full site inspection;
- compliance with legislative requirements and project approvals;

- compliance with this SWMP;
- compliance with ESCPs;
- full review of environmental records (e.g. checklist and inspections);
- review of monitoring results;
- closure of non-conformances and previous audit findings;
- an assessment of the suitability of the SWMP with regards to current construction activities. This may initiate a SWMP review/revision; and
- recommendations for further improvements.

8.4 Non-conformance, Preventative and Corrective Actions

8.4.1 Environmental Actions Lists and Improvement Notices

The M2G Environmental Officer will issue Environmental Maintenance Observation and Action Lists or an Environmental Improvement Notice (EIN) as required. Environmental Maintenance Observation and Action Lists will be issued to the Superintendent and/or Supervisors for deficiencies that are minor in nature but require rectification. An Environmental Improvement Notice (EIN) will be issued for more serious deficiencies which pose a greater level of environmental risk, or for when a reprimand is required for poor performance.

8.4.2 Resolving Non-conformances and implementing Corrective Actions

The process for managing environmental non-conformances will be as follows:

- When an environmental non-conformance is detected, the nature of the issue will be evaluated by the BWA Land and Compliance Manager and/or M2G Environmental Officer and the requirement for new or additional controls will be discussed to prevent reoccurrences. Corrective actions will subsequently be identified and entered into the Environmental Action Register (EAR) for reference. This EAR will detail the non-conformance, corrective and/or preventative action, timing and the personnel responsible for implementing the action. The non-conformance will remain “Open” until corrective actions have been implemented.
- Once the corrective action has been implemented, the EAR will be updated to “Closed” status with details of the closure date attached.
- The EAR will be reviewed regularly by the Environmental Team to ensure actions are being completed in a timely manner. Any issues arising from these reviews will be discussed between the BWA Environmental Manager and relevant construction personnel.

8.5 Environmental Records

The Land and Compliance Manager with the assistance of the Environmental Officer will maintain the following records:

- the SWMP;
- relevant approvals, regulatory licences and permits;
- inspection records and checklists;
- environmental monitoring results and chain-of-custody forms;
- environmental accident/incident/emergency reports;

- environmental Non-conformance and EIN documentation;
- audit reports;
- management review minutes and action taken.

Where hard copy records are provided they will be scanned and made available electronically. Each set of records will be allocated a register/index for easy reference and filing. Records will be maintained for at least 5 years after the date of final completion and will be available to ACTEW Representatives and Regulatory Agencies as required.

Records of all maintenance and repairs performed on pollution control equipment including drainage systems, interceptors, separators and infrastructure shall be kept on site for a period of 2 years and will be made available to the ACT EPA and NSW DECCW on request.

8.6 Document and Data Control

All environmental documentation associated with this management plan will be documented and maintained on site in accordance with "*document and data control"* requirements detailed in the CEMP.

9 Review and Improvement of the SWMP

The outcomes of inspections, monitoring, audits and the completion of checklists will facilitate the identification of problems, recurring issues or areas for improvement. Where identified, the effectiveness of the SWMP will be reviewed and opportunities for improvement will be identified and discussed with site personnel.

A system for the review and improvement of the environmental management system is described within the CEMP.

Table 9.1 Register of significant changes to the SWMP

Reference	Amendment Required	Status
Distribution copies	Names to be updated in the table.	Closed
EIS Commitments and Conditions	References to be amended.	Closed
Section 4.1 Rainfall	Change nearest weather station to Tuggeranong and update statistics.	Closed
Section 4.2.6	Update wording to reflect conditions of Exemption (EX 870).	Closed
Tables 5.2, 5.3, 5.4	Update EWMS references to correct titles.	Closed

Appendix A **Typical Erosion and Sediment Control Plans**

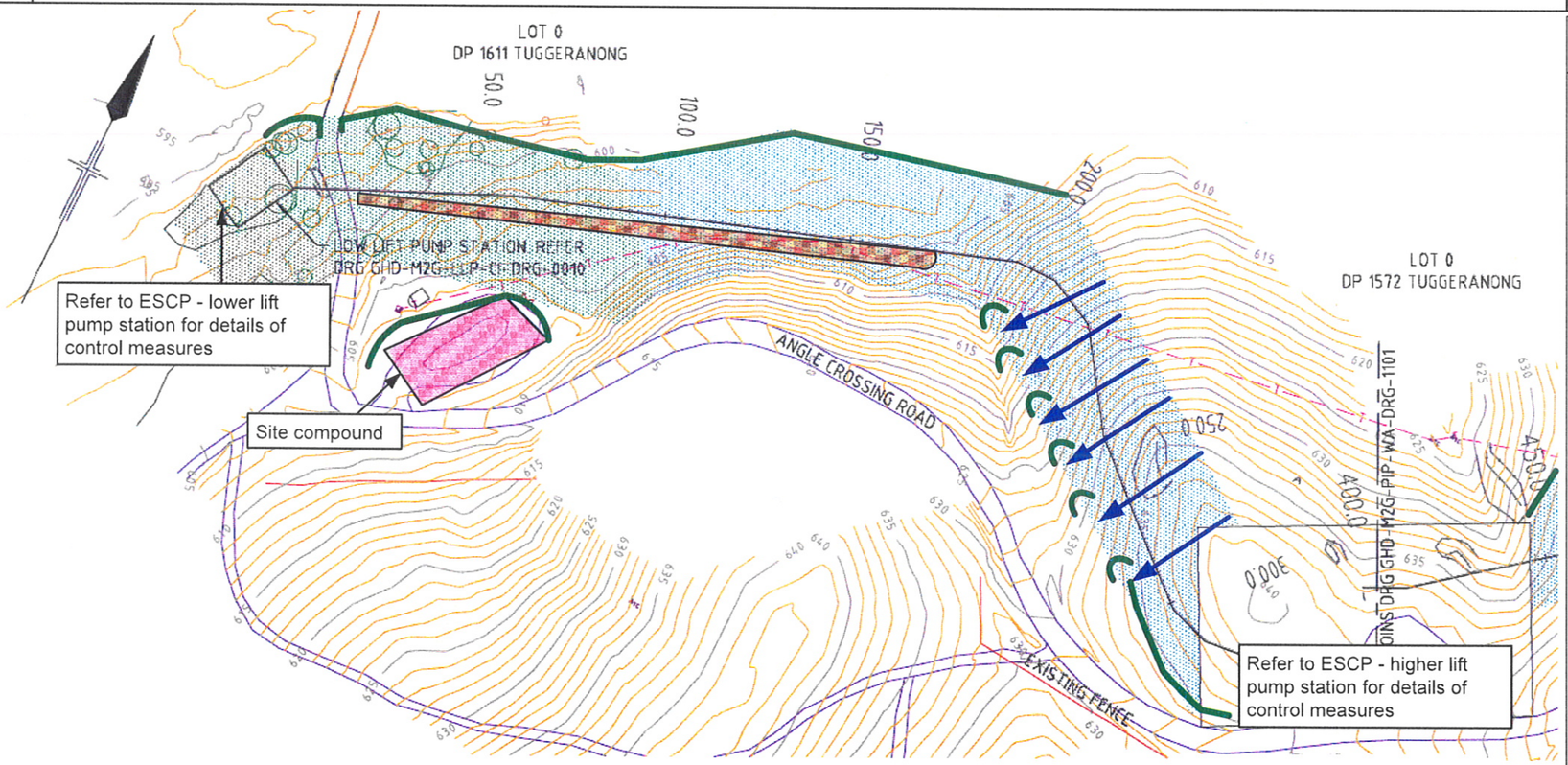
ACTEW CORPORATION

Concept Erosion and Sediment Control Plan

M2G – GENERAL ESCP

Document Number: BWA-M2G-EN-ESP-001-0

Revision: 0



PLAN
SCALE 1:1000

GENERAL NOTES

1. Erosion and sediment controls will be installed as per the "Environmental Protection Guidelines for Construction and Land Development in the ACT (2007), the manuals – Managing Urban Stormwater: Soils and Construction (2004 ed.) and Managing Urban Stormwater: Soils and Construction Volume 2A – Installation of Services and 2C Unsealed Roads.
2. Run on water will diverted away from the easement where practical.
3. Topsoil and spoil will be stockpiled along the easement boundary in separate windrows away from construction activities and water courses.
4. Trench stops will be installed in the trench to trap sediment and slow any runoff in the trench on steep or long slopes.
5. Controls will be reinstated during each stage of pipeline construction to reflect the activities in that stage.
6. Progressive erosion and sediment control plans will be prepared for each pipeline stage if the configuration of controls is varied significantly.
7. Controls will be inspected weekly and after significant rain events (>10mm/24h) and maintained as required.
8. Stabilised accesses will be installed to minimise the tracking of mud onto adjacent sealed roads.
9. Temporary V-drains/ roll over banks will be installed to reduce length of run along the easement and to direct runoff to sediment controls at key locations.
10. Water carts will be used for dust suppression.
11. Additional controls will be installed if required.
12. The easement will be progressively stabilised/ rehabilitated.

LEGEND

- Sediment fence
- Earth windrow
- Rollover bank/ temporary V drain
- Geotextile

- 15m - CONSTRUCTION CORRIDOR WIDTH
- 20m - CONSTRUCTION CORRIDOR WIDTH
- 25m - CONSTRUCTION CORRIDOR WIDTH
- 30m - CONSTRUCTION CORRIDOR WIDTH
- 35m - CONSTRUCTION CORRIDOR WIDTH
- 40m - CONSTRUCTION CORRIDOR WIDTH

CONSTRUCTION METHODOLOGY

1. Lower pump station construction commences.
2. Upper pump station construction commences.
3. Fencing and clearing of pipeline easement.
4. Construction of Right of Way and stringing of pipes.
5. Trenching commences.
6. Lower and lay and backfilling commences.
7. Progressive rehabilitation of backfilled trench and easement.

EPA APPROVAL

Developed By: [signature] Date: 29/07/10

Approved By: [signature] Date: 11/8/2010

ACTEW CORPORATION

Progressive Erosion and Sediment Control Plans

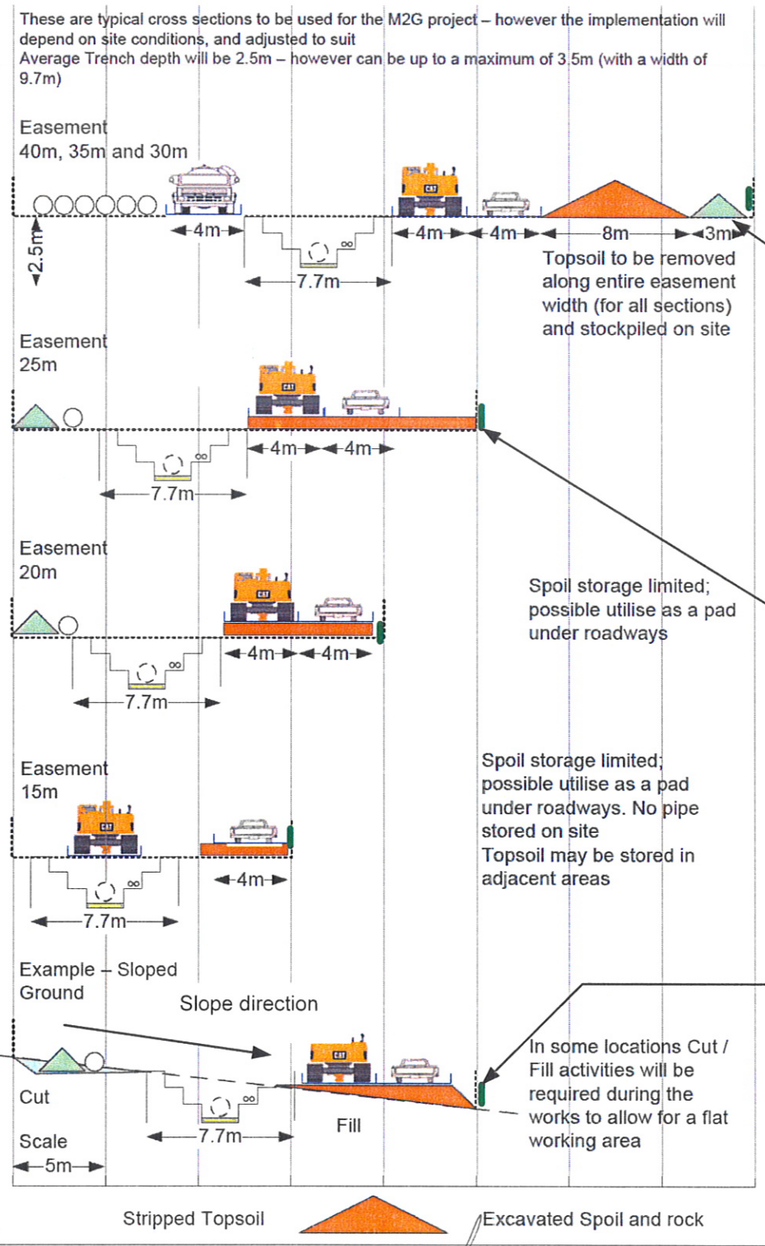
M2G – GENERAL ESCP

Document Number: BWA-M2G-EN-ESP-001-0

Revision: 0

Bulk Water Alliance – Murrumbidgee to Googong
Typical Pipeline Easement Layouts

These are typical cross sections to be used for the M2G project – however the implementation will depend on site conditions, and adjusted to suit
Average Trench depth will be 2.5m – however can be up to a maximum of 3.5m (with a width of 9.7m)



Gaps will be left in the topsoil stockpile at regular intervals with sediment fence or mulch filtering any sediment that is transported through the gap.

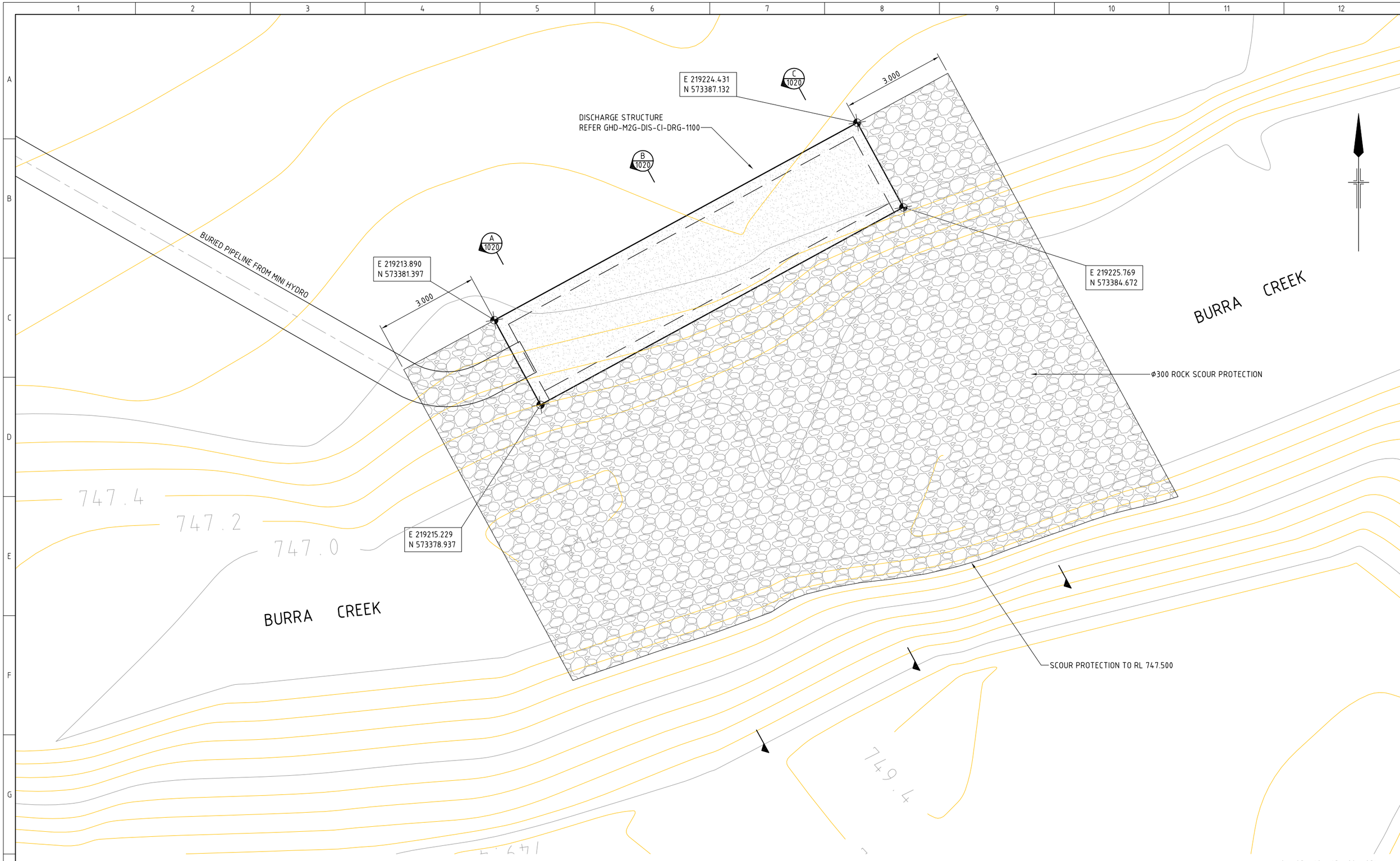
Control along lower easement boundary will be either a sediment fence or mulch windrow depending upon availability of mulch/ vegetation.

Control along lower easement boundary will be either a sediment fence or mulch windrow depending upon availability of mulch/ vegetation.

Developed By: [signature] Date: 29/07/10

Approved By: [signature] Date: 11/8/2010.

Appendix B **Engineering Design of the Outlet Structure at Burra Creek**



SITE PLAN
SCALE 1:200

0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:50 AT ORIGINAL SIZE

FOR CONSTRUCTION

No.	REVISION	DATE	CKD	AUTH
0	ISSUED FOR CONSTRUCTION	27.08.2010	GM	RF

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: P.BOYAN	Designed: M.RODD		
Checked: G. COUPLAND	Checked: G. MORRISON		
Program Design Manager: R. FROST		30.08.2010	
Contractor's Drawing No.: GHD-M2G-DIS-CI-DRG-1010			
ACTEW - Owner's Chief Engineer: J. THIRKELL		01.09.2010	

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
DISCHARGE STRUCTURE
SITE PLAN

Scale: AS SHOWN	Date: APR 2010	Sheet No.:
ACTEW Project No.:	Tender No.:	
MURRUMBIDGEE TO GOOGONG		
A1	ActewAGL Drg. No.	Rev. 0

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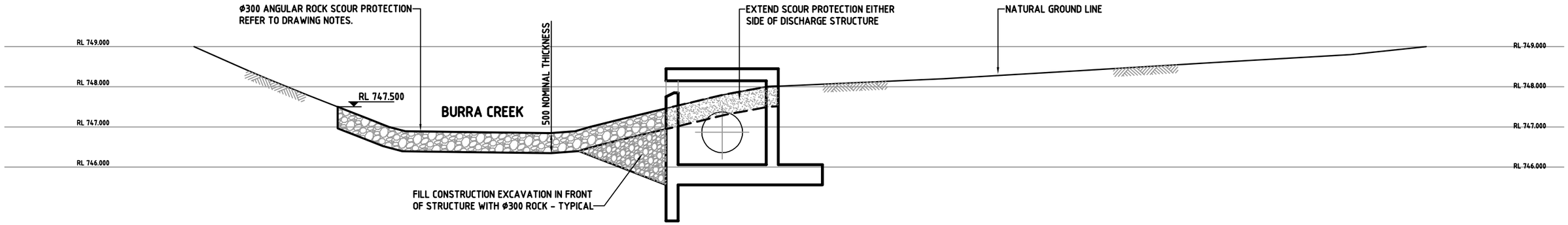

A 1010 SECTION
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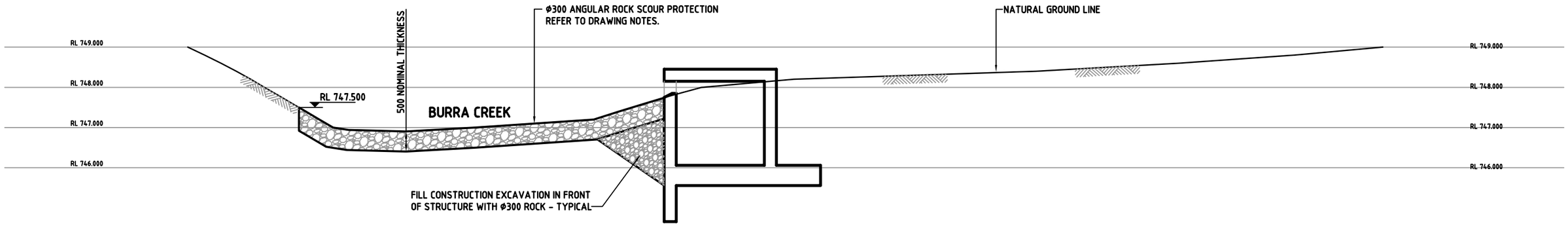

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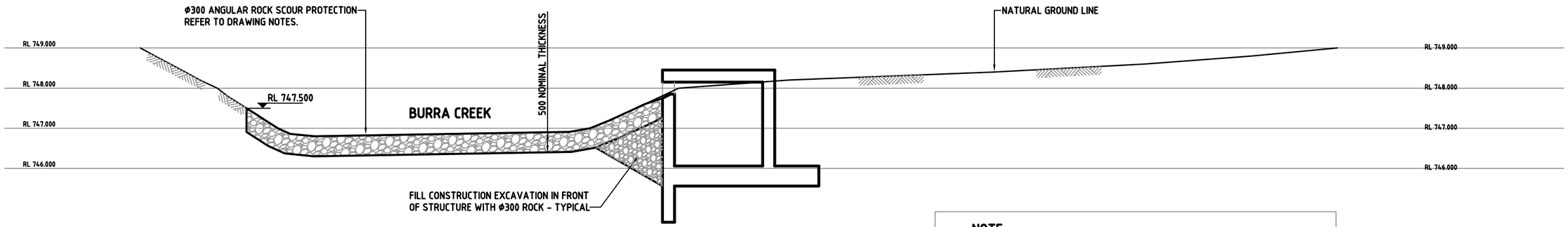


C 1010 SECTION
SCALE 1:50

NOTE:
ROCK SCOUR PROTECTION F.S.L. TO MATCH N.S.L. WHERE ROCK IS PRESENT IN ZONE OF 500mm BELOW N.S.L.
LEAVE IN PLACE AND REDUCE SCOUR PROTECTION THICKNESS TO SUIT - TYPICAL

0 500 1000 1500 2000 2500mm
SCALE 1:50 AT ORIGINAL SIZE

FOR CONSTRUCTION

No.	REVISION	DATE	CKD	AUTH
0	ISSUED FOR CONSTRUCTION	27.08.2010	GM	RF

BULK WATER ALLIANCE

ACTEW CORPORATION

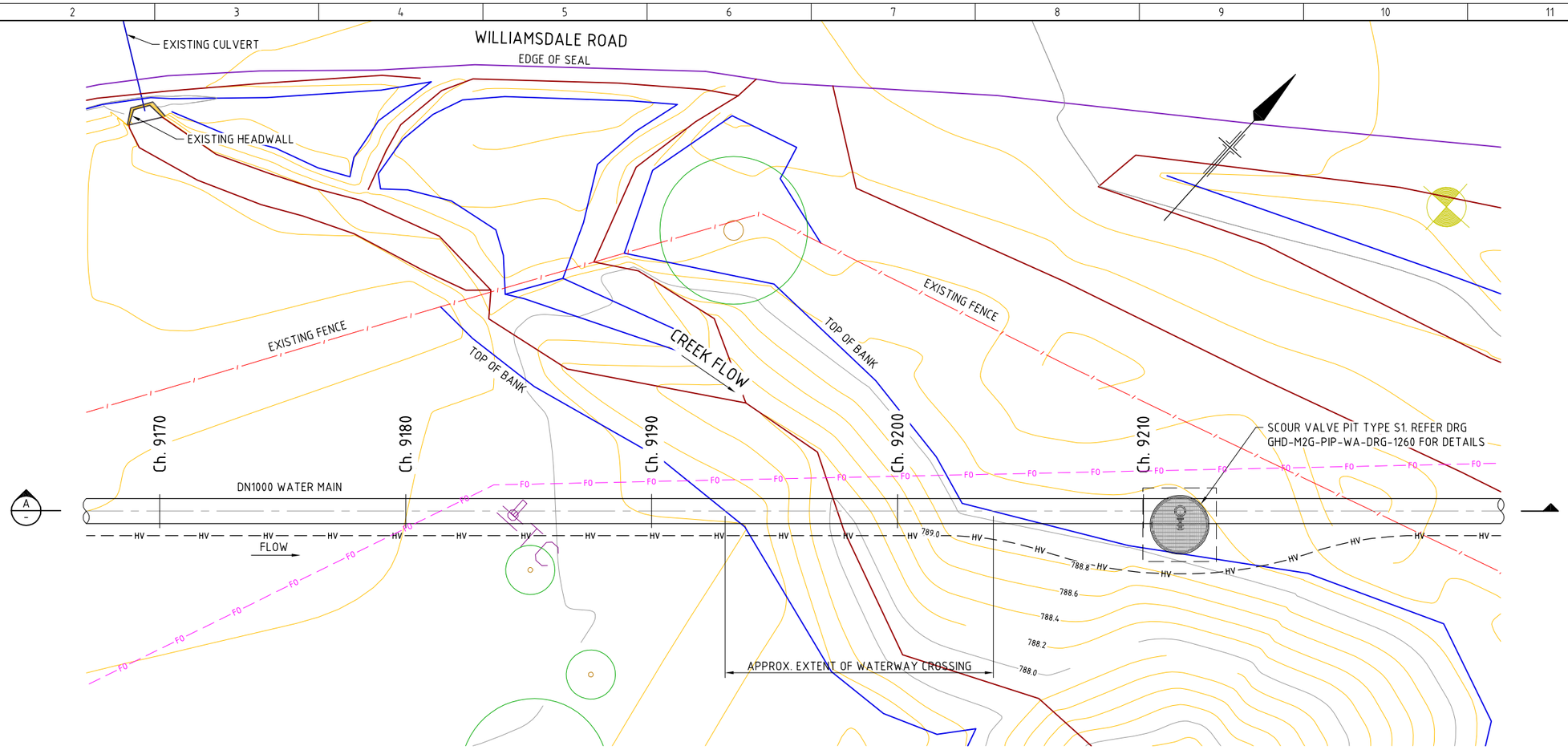
Drawn: P.BOYAN	Designed: M.RODD		
Checked: G. COUPLAND	Checked: G. MORRISON		
Program Design Manager: R. FROST	30.08.2010		
Contractor's Drawing No.: GHD-M2G-DIS-CI-DRG-1020			
ACTEW - Owner's Chief Engineer: J. THIRKELL	01.09.2010		

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
DISCHARGE STRUCTURE
SITE SECTIONS

Scale: AS SHOWN	Date: JULY 2010	Sheet No.:
ACTEW Project No.:	Tender No.:	
MURRUMBIDGEE TO GOOGONG		
A1	ActewAGL Drg. No.	Rev. 0

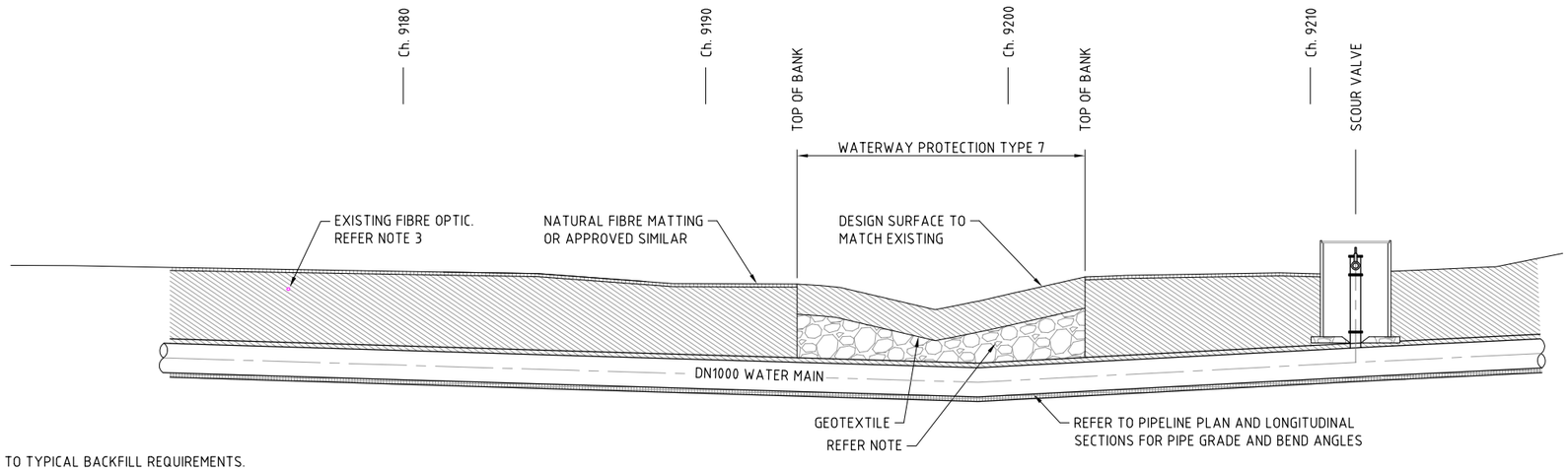
CADD File Name: C:\Arenkum_Projects\23-12615_BWA\CADD\DRAWINGS\M2G\GHD-M2G-DIS-CI-DRG-1028.dwg

Appendix C **Engineering Design for each Category of Watercourse Crossing**



PLAN - WATERWAY CROSSING Ch. 9200

SCALE 1:100



NOTE:

1. FOR BACKFILL MATERIAL TYPES REFER TO TYPICAL BACKFILL REQUIREMENTS.
2. FOR WATERWAY CROSSING PROTECTION TYPE 1 ON DRGS GHD-M2G-PIP-WA-DRG-1300 AND GHD-M2G-PIP-WA-DRG-1301
3. LOCATION OF EXISTING SERVICES TO BE CONFIRMED ON SITE, REFER DRG GHD-M2G-PIP-WA-1011.

A - SECTION

SCALE 1: 100

0 1000 2000 3000 4000 5000mm

SCALE 1:100 AT ORIGINAL SIZE

FOR CONSTRUCTION

No.	REVISION	DATE	CKD	AUTH
0	ISSUED FOR CONSTRUCTION	01.09.2010	* GM	* RF

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn:	G. JONES	Designed:	A. CAMPBELL
Checked:	G. COUPLAND *	Checked:	M. RODD *
Program Design Manager:	R. FROST *		01.09.2010
Contractor's Drawing No.:	GHD-M2G-PIP-WA-DRG-1305		
ACTEW - Owner's Chief Engineer:	J. THIRKELL *		03.09.2010

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
DN1000 PIPELINE - ANGLE CROSSING TO BURRA CREEK
WATERWAY CROSSING No. 4
DETAILS

Scale: AS SHOWN	Date: SEP 09	Sheet No.:
ACTEW Project No.:	Tender No.:	

MURRUMBIDGEE TO GOOGONG

A1 ActewAGL Drg. No. | Rev. 0

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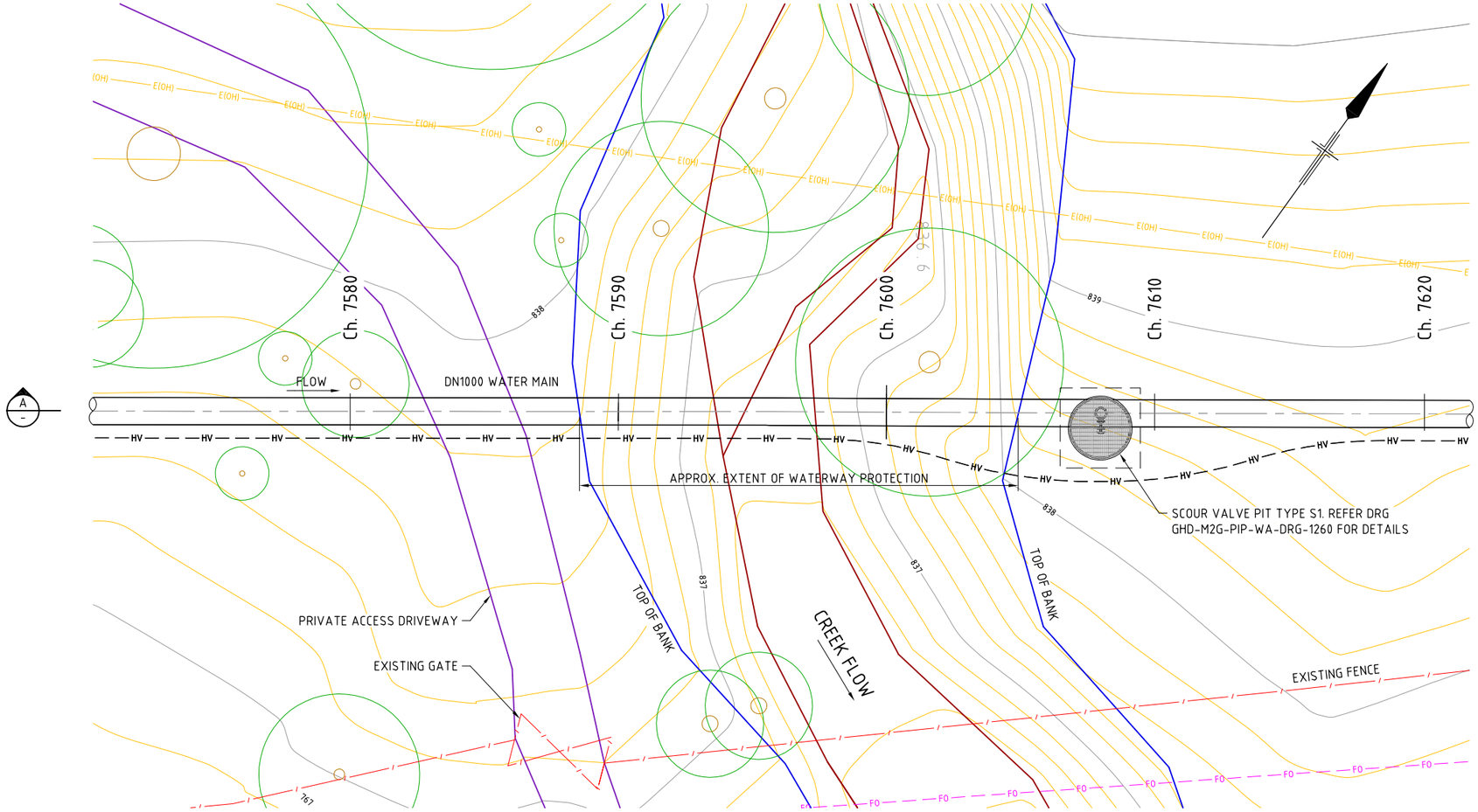
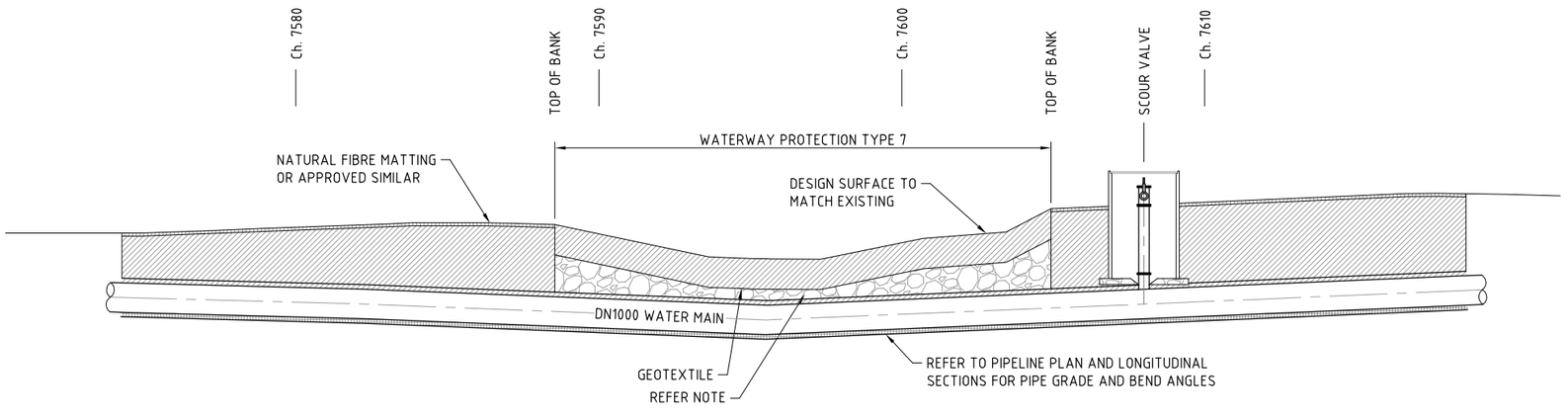


PLAN
SCALE 1:100



A - SECTION
SCALE 1: 100

NOTE:

1. FOR BACKFILL MATERIAL TYPES REFER TO TYPICAL BACKFILL REQUIREMENTS.
2. FOR WATERWAY CROSSING PROTECTION TYPE 1 ON DRGS GHD-M2G-PIP-WA-DRG-1300 AND GHD-M2G-PIP-WA-DRG-1301
3. LOCATION OF EXISTING SERVICES TO BE CONFIRMED ON SITE, REFER DRG GHD-M2G-PIP-WA-1011.

0 1000 2000 3000 4000 5000mm
SCALE 1:100 AT ORIGINAL SIZE

FOR CONSTRUCTION

No.	REVISION	DATE	CKD	AUTH
0	ISSUED FOR CONSTRUCTION	01.09.2010	✱ GM	✱ RF

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: G. JONES	Designed: A. CAMPBELL		
Checked: G. COUPLAND ✱	Checked: M. RODD ✱		
Program Design Manager: R. FROST ✱		01.09.2010	
Contractor's Drawing No.: GHD-M2G-PIP-WA-DRG-1304			
ACTEW - Owner's Chief Engineer: J. THIRKELL ✱		03.09.2010	

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
DN1000 PIPELINE - ANGLE CROSSING TO BURRA CREEK
WATERWAY CROSSING No. 3
DETAILS

Scale: AS SHOWN	Date: SEP 09	Sheet No.:
ACTEW Project No.:	Tender No.:	

MURRUMBIDGEE TO GOOGONG

A1 ActewAGL Drg. No. | Rev. 0

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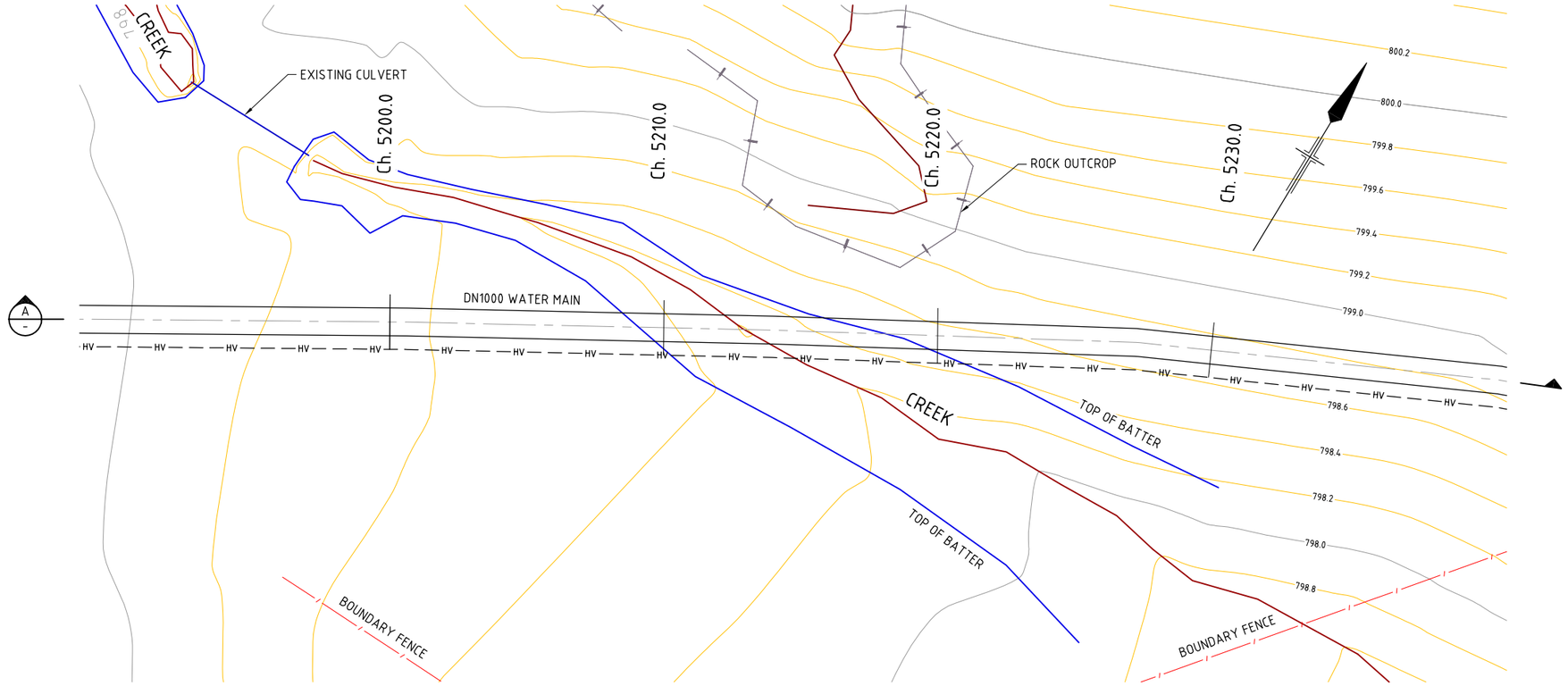
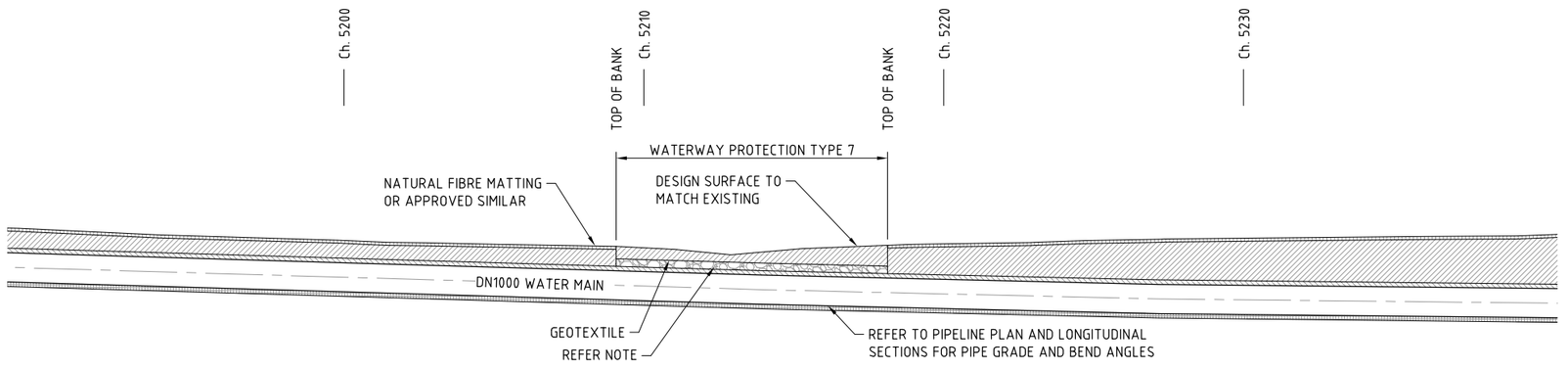


PLAN - WATERWAY CROSSING APPROX. Ch. 5200

SCALE 1:200



A SECTION

SCALE 1: 100

NOTE:

1. FOR BACKFILL MATERIAL TYPES REFER TO TYPICAL BACKFILL REQUIREMENTS.
2. FOR WATERWAY CROSSING PROTECTION TYPE 1 ON DRGS GHD-M2G-PIP-WA-DRG-1300 AND GHD-M2G-PIP-WA-DRG-1301
3. LOCATION OF EXISTING SERVICES TO BE CONFIRMED ON SITE, REFER DRG GHD-M2G-PIP-WA-1011.

0 1000 2000 3000 4000 5000mm

SCALE 1:100 AT ORIGINAL SIZE

FOR CONSTRUCTION

No.	REVISION	DATE	CKD	AUTH
0	ISSUED FOR CONSTRUCTION	01.09.2010	✱ GM	✱ RF

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: G. JONES		Designed: A. CAMPBELL	
Checked: G. COUPLAND	✱	Checked: M. RODD	✱
Program Design Manager: R. FROST	✱	01.09.2010	
Contractor's Drawing No.: GHD-M2G-PIP-WA-DRG-1302			
ACTEW - Owner's Chief Engineer: J. THIRKELL	✱	03.09.2010	

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
DN1000 PIPELINE - ANGLE CROSSING TO BURRA CREEK
WATERWAY CROSSING No. 1
DETAILS

Scale:	Date:	Sheet No.:
AS SHOWN	MAY 2010	
ACTEW Project No.:	Tender No.:	

MURRUMBIDGEE TO GOOGONG

A1 | ActewAGL Drg. No. | Rev. 0

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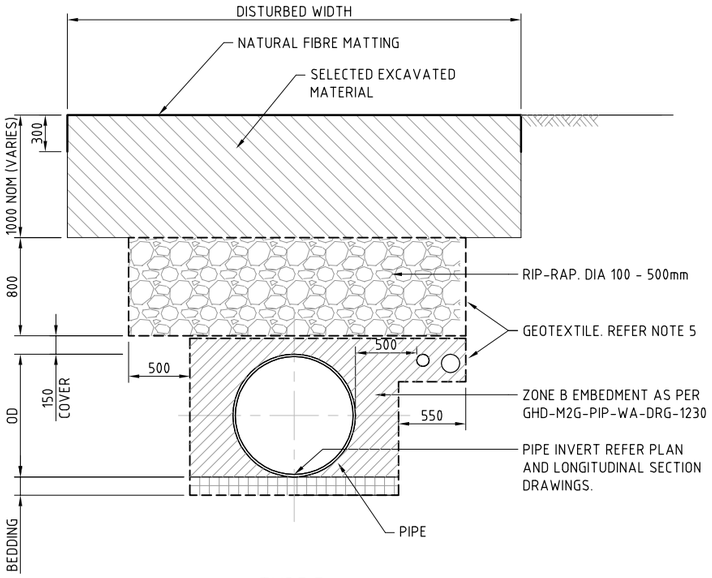
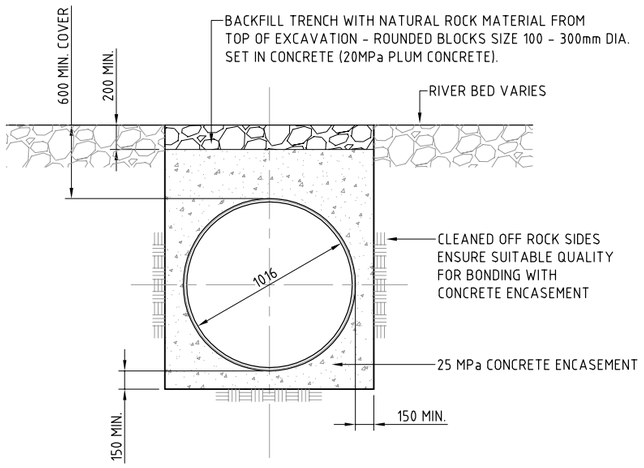


TYPE 7
WATERWAY CROSSING PROTECTION

SCALE 1:25

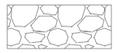


TYPE 8
WATERWAY CROSSING PROTECTION

SCALE 1:25

NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH SPECIFICATION DOCUMENTS.
2. ENVIRONMENTAL CONTROLS AS PER ENVIRONMENTAL MANAGEMENT PLAN.
3. NATURAL FIBRE MATTING AND RIPARIAN REVEGETATION AS PER WATERWAY REVEGETATION PLANS. FOR LENGTH REFER TO PIPELINE PLAN AND LONGITUDINAL SECTION.
4. FOR TRENCH AND BACKFILL TYPE REFER TO PIPELINE PLAN AND LONGITUDINAL SECTIONS AND DRG GHD-M2G-PIP-WA-DRG-1230.
5. GEOTEXTILE SHALL BE GEOTEXTILE BIDIM A44 OR EQUIVALENT.
6. ROCKWORK



LINING ROCKS D_{50}=300mm, WELL GRADED (REFER TO TABLE BELOW) WITH 0 - 150 WELL GRADED VOID INFILL MIX ABOVE GEOTEXTILE LAYER.

LINING ROCKS	
NOMINAL ROCK SIZE (mm)	MIN % OF ROCK LARGER THAN NOMINAL SIZE
500	0
300	50
100	90

a. ROCK SHALL BE HARD, DENSE, DURABLE, RESISTANT TO WEATHERING, ANGULAR, FREE FROM SPOIL AND ORGANIC MATTER.
b. ROCK SHALL NOT BE LAMINATED, FRACTURED, POROUS OR OTHERWISE PHYSICALLY WEAK.
c. ROCKS SHALL BE EMBEDDED INTO UNDISTURBED MATERIAL. THE GROUND SHALL BE BOXED-OUT BEFORE THE GEOTEXTILE BEFORE THE GEOTEXTILE LAYER AND LINING ROCKS ARE PLACED.
d. ROCKS SHALL BE WELL GRADED MIX TO MINIMISE VOIDS BETWEEN ROCKS AND ROCK WORK SHALL BE WELL SEALED WITH SMALL GRADED ROCK.
e. ROCKS SHALL BE FINISHED FLUSH WITH SURROUNDING GROUND.
f. ROCKS SHALL BE CAREFULLY PLACED INTO POSITION, NOT DUMPED DIRECTLY.

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

FOR CONSTRUCTION

No.	REVISION	DATE	CKD	AUTH
0	ISSUE FOR CONSTRUCTION	01.09.2010	* GM	* RF

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: G.JONES		Designed: A. CAMPBELL	
Checked: G. COUPLAND *		Checked: M. RODD *	
Program Design Manager: R. FROST *	01.09.2010		
Contractor's Drawing No.: GHD-M2G-PIP-WA-DRG-1301			
ACTEW - Owner's Chief Engineer: J. THIRKELL *	03.09.2010		

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
DN1000 PIPELINE - ANGLE CROSSING TO BURRA CREEK
WATERWAY CROSSING DETAILS
SHEET 2 OF 2

Scale: AS SHOWN	Date: SEP 09	Sheet No.:
ACTEW Project No.:	Tender No.:	

MURRUMBIDGEE TO GOOGONG

A1 | ActewAGL Drg. No. | Rev. 0

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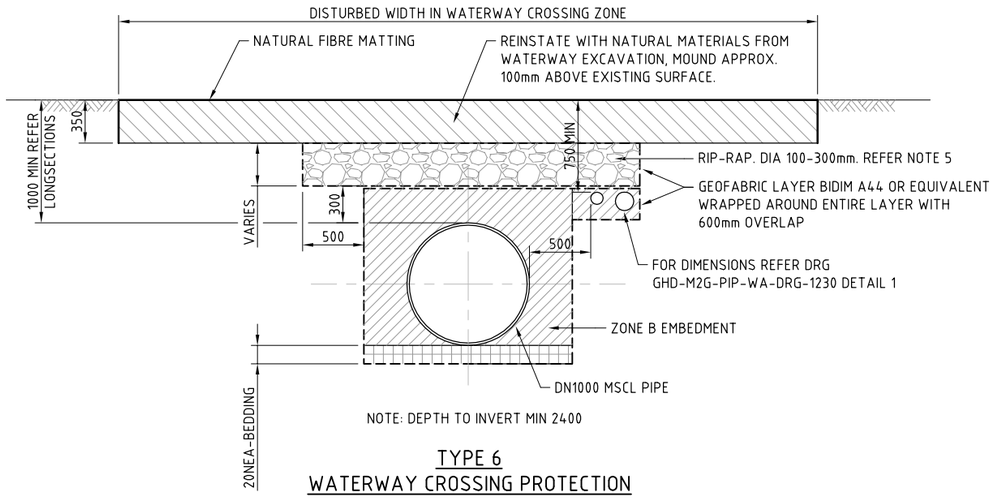

NOTE: DEPTH TO INVERT MIN 2400

TYPE 6
WATERWAY CROSSING PROTECTION

SCALE 1:25

WATERWAY CROSSING CHAINAGE START	PROTECTION TYPE	MIN. COVER	APPROX. CATCHMENT U/S OF REF. PIPELINE CROSSING (ha)	EIS REF.
1490	8	600mm	N/A	N/A
2320	6	1m	N/A	N/A
2500	7	1.5m	N/A	N/A
5280	6	1m	68.59	1
DAM EMBANKMENT	TBC		55.55	2
7500	7	1.5m	DAM SPILLWAY	N/A
7591	7	1.5m	50.23	N/A
9200	7	1.5m	76.93	3
10010	NOT REQUIRED		188.86	4
10350	7	1.5m	313.55	5

HOLD

NOTE: ONLY MAJOR WATERWAY CROSSINGS SHOWN IN TABLE. SOME MINOR CROSSINGS REQUIRING PROTECTION SHOWN ON PLAN AND LONG SECTIONS.

NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH SPECIFICATION DOCUMENTS.
2. ENVIRONMENTAL CONTROLS AS PER ENVIRONMENTAL MANAGEMENT PLAN.
3. NATURAL FIBRE MATTING AND RIPARIAN REVEGETATION AS PER WATERWAY REVEGETATION PLANS. FOR LENGTH REFER TO PIPELINE PLAN AND LONGITUDINAL SECTION.
4. FOR TRENCH AND BACKFILL TYPE REFER TO PIPELINE PLAN AND LONGITUDINAL SECTIONS AND DRG GHD-M2G-PIP-WA-DRG-1230.
5. ROCKWORK

LINING ROCKS D_{50}=200mm, WELL GRADED (REFER TO TABLE BELOW) WITH 0 - 150 WELL GRADED VOID INFILL MIX ABOVE GEOTEXTILE LAYER.

LINING ROCKS	
NOMINAL ROCK SIZE (mm)	MIN % OF ROCK LARGER THAN NOMINAL SIZE
300	0
200	50
100	90

a. ROCK SHALL BE HARD, DENSE, DURABLE, RESISTANT TO WEATHERING, ANGULAR, FREE FROM SPOIL AND ORGANIC MATTER.
b. ROCK SHALL NOT BE LAMINATED, FRACTURED, POROUS OR OTHERWISE PHYSICALLY WEAK.
c. ROCKS SHALL BE EMBEDDED INTO UNDISTURBED MATERIAL. THE GROUND SHALL BE BOXED-OUT BEFORE THE GEOTEXTILE LAYER AND LINING ROCKS ARE PLACED.
d. ROCKS SHALL BE WELL GRADED MIX TO MINIMISE VOIDS BETWEEN ROCKS AND ROCK WORK SHALL BE WELL SEALED WITH SMALL GRADED ROCK.
e. ROCKS SHALL BE FINISHED FLUSH WITH SURROUNDING GROUND.
f. ROCKS SHALL BE CAREFULLY PLACED INTO POSITION, NOT DUMPED DIRECTLY.

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

FOR CONSTRUCTION

No.	REVISION	DATE	CKD	AUTH
0	ISSUED FOR CONSTRUCTION	25.08.2010	✱ GM	✱ RF

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: G. JONES		Designed: A. CAMPBELL	
Checked: G. COUPLAND	✱	Checked: M. RODD	✱
Program Design Manager: R. FROST	✱	26.08.2010	
Contractor's Drawing No.: GHD-M2G-PIP-WA-DRG-1300			
ACTEW - Owner's Chief Engineer: J. THIRKELL	✱	03.09.2010	

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
DN1000 PIPELINE - ANGLE CROSSING TO BURRA CREEK
WATERWAY CROSSING DETAILS
SHEET 1 OF 2

Scale: 1:25m	Date: DEC 08	Sheet No.:
ACTEW Project No.:	Tender No.:	

MURRUMBIDGEE TO GOOGONG

A1 | ActewAGL Drg. No. | Rev. 0

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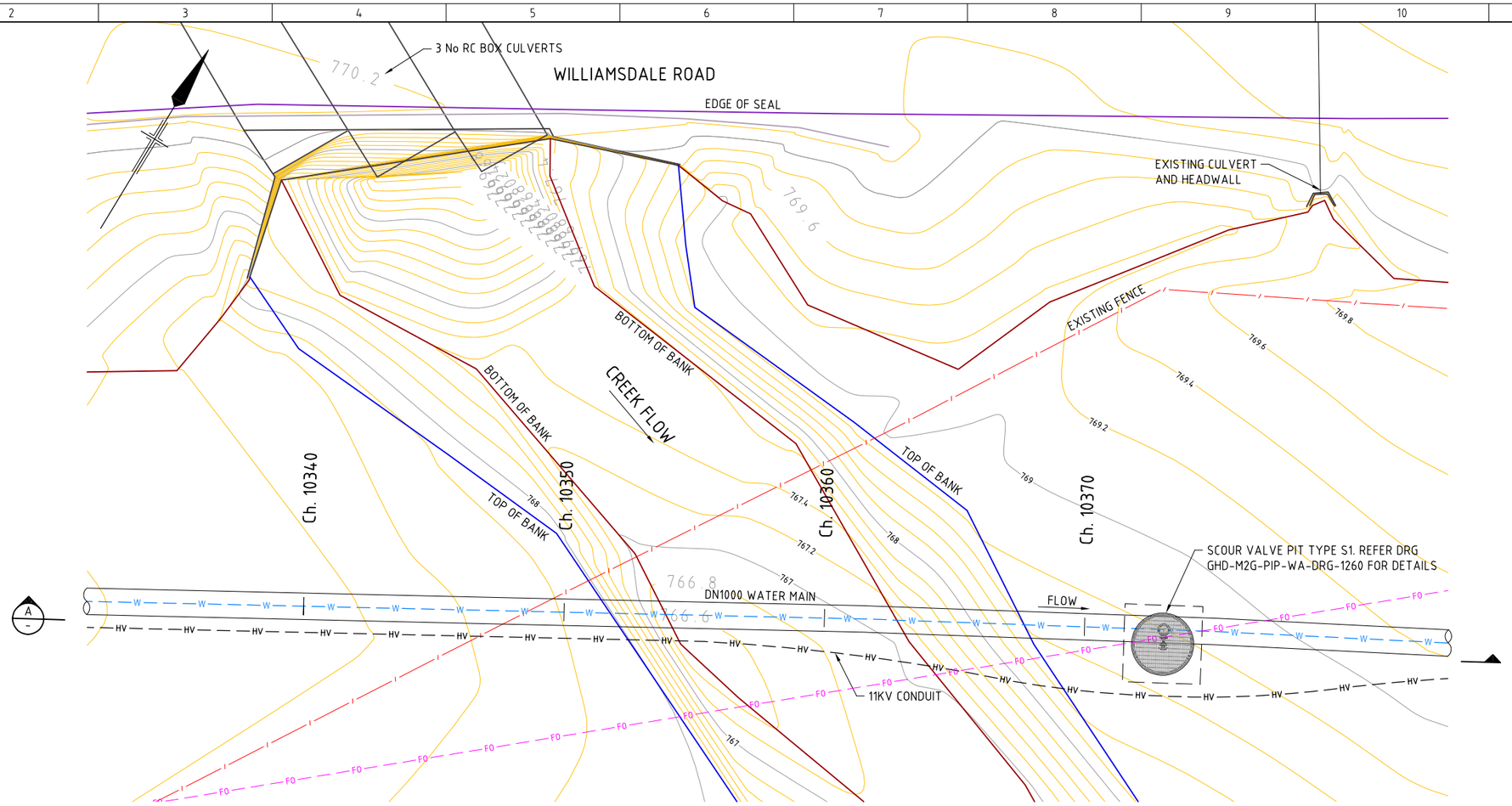
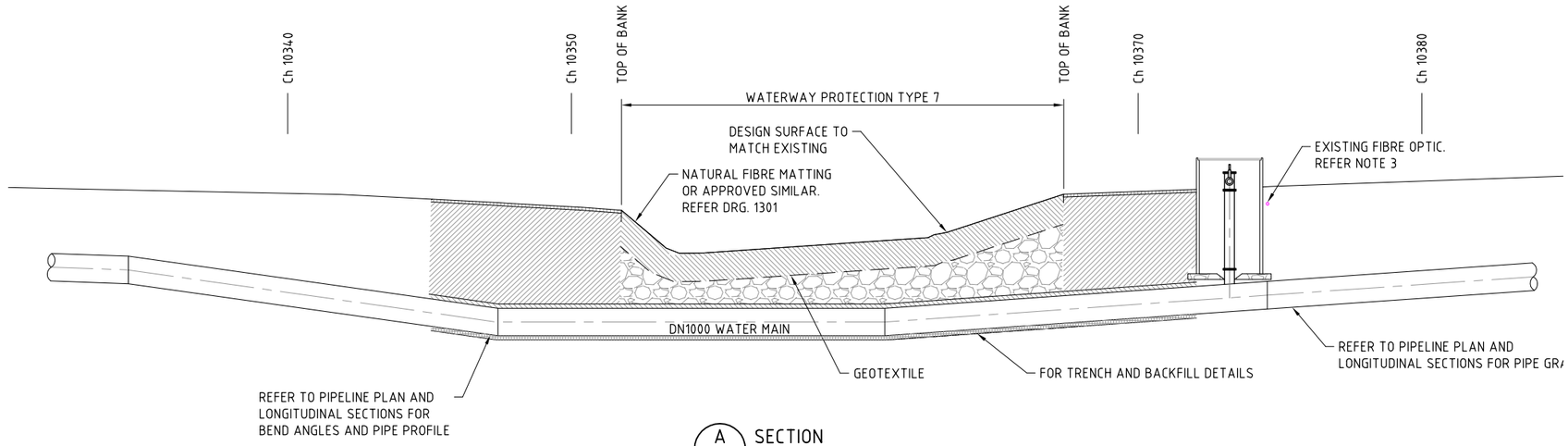


PLAN - WATERWAY CROSSING Ch. 10350

SCALE 1:100



A / - SECTION

SCALE 1: 100

NOTE:

1. FOR BACKFILL MATERIAL TYPES REFER TO TYPICAL BACKFILL REQUIREMENTS.
2. FOR WATERWAY CROSSING PROTECTION TYPE 1 ON DRGS GHD-M2G-PIP-WA-DRG-1300 AND GHD-M2G-PIP-WA-DRG-1301
3. LOCATION OF EXISTING SERVICES TO BE CONFIRMED ON SITE, REFER DRG GHD-M2G-PIP-WA-1011.

0 1000 2000 3000 4000 5000mm

SCALE 1:100 AT ORIGINAL SIZE

FOR CONSTRUCTION

No.	REVISION	DATE	CKD	AUTH
0	ISSUED FOR CONSTRUCTION	01.09.2010	✱ GM	✱ RF

BULK WATER ALLIANCE

ACTEW CORPORATION

Drawn: G. JONES		Designed: A. CAMPBELL	
Checked: G. COUPLAND	✱	Checked: M. RODD	✱
Program Design Manager: R. FROST	✱	01.09.2010	
Contractor's Drawing No.: GHD-M2G-PIP-WA-DRG-1307			
ACTEW - Owner's Chief Engineer: J. THIRKELL	✱	03.09.2010	

MURRUMBIDGEE TO GOOGONG WATER TRANSFER PROJECT
DN1000 PIPELINE - ANGLE CROSSING TO BURRA CREEK
WATERWAY CROSSING No. 6
DETAILS

Scale: AS SHOWN	Date: SEP 09	Sheet No.:	
ACTEW Project No.:	Tender No.:		

MURRUMBIDGEE TO GOOGONG

A1 | ActewAGL Drg. No. | Rev. 0

CADD File Name: C:\Arenium_Projects\23-12615_BWA\CADD\DRAWINGS\M2G\GHD-M2G-PIP-WA-DRG-1307.dwg