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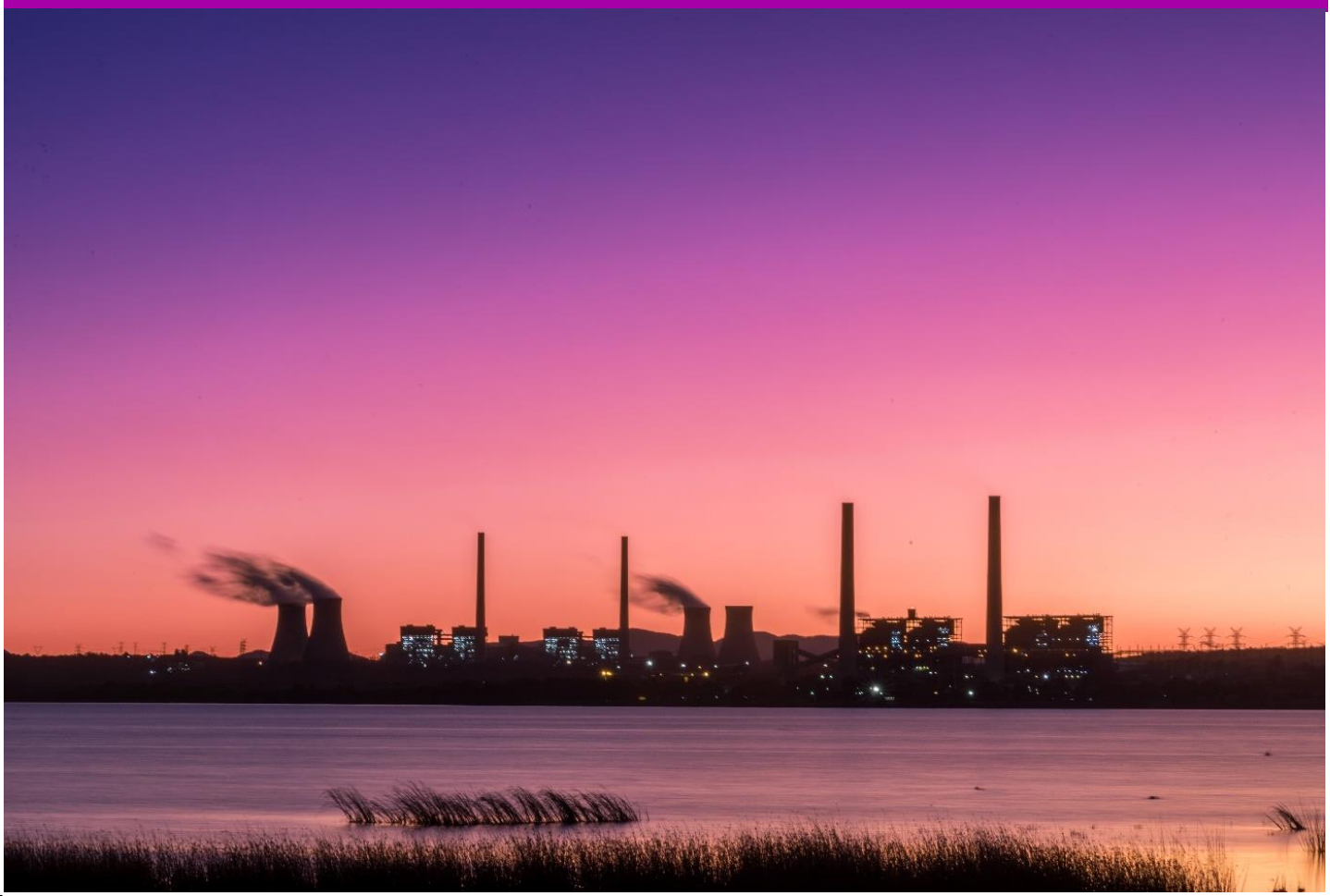
Stage 3 Bayswater Ancillary Works - Soil and Water Management Plan

AGL Macquarie Limited

SSD Post Approval Documentation
8 December 2023



Stage 3 Bayswater Ancillary Works - Soil and Water Management Plan

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Acronyms and abbreviations

Term	Definition
AEC	Areas of Environmental Concern
AGLM	AGL Macquarie Pty Limited
ALUM	Australian Land use and Management Classification
ANZG Water Quality Guidelines	*Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018*
Bayswater	Bayswater Power Station
BAW	Bayswater Ancillary Works
CEMP	Construction Environment Management Plan
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ESCP	Erosion and Sediment Control Plan
LBBAWP	Liddell Battery and Bayswater Ancillary Works Project
LEP	Local Environment Plan
MW	Megawatt
NEM	National Electricity Market
NSW	New South Wales
POEO Act	*Protection of the Environment Operations Act 1997*
QA	Quality Assurance
QC	Quality Control
The Project	Stage 3 Bayswater Ancillary Works
SEARs	Secretary's Environmental Assessment Requirements
SEPP SRD	*State Environmental Planning Policy (State and Regional Development) 2011*
SSD	State Significant Development
SWMP	Surface Water Management Plan
WM Act	*Water Management Act 2000*
WOAOW	Water and Other Ancillary Works

1. Introduction

Jacobs Australia Pty Limited (Jacobs) were commissioned by AGL Macquarie Pty Limited (AGLM) to prepare a Soil and Water Management Plan (SWMP) for the Stage 3 Bayswater Ancillary Works (hereafter referred to as "BAW" or "the Project") to be undertaken at Bayswater Power Station (Bayswater) as part of the Liddell Battery and Bayswater Ancillary Works Project (LBBAWP). These works will allow Bayswater to maintain supply to the National Energy Market (NEM) until its planned closure in 2035, and ultimately improve the environmental performance of the plant with no change to coal consumption - with electricity, emissions, and ash generation remaining consistent.

The LBBAWP is classified as a State Significant Development (SSD) under the State Environmental Planning Policy (State and Regional Development) 2011 (SEPP SRD) and it is subject to Part 4, Division 4.7 of the Environmental Planning and Assessment Act 1979 (EP&A Act) which requires an Environmental Impact Statement (EIS) to be prepared in accordance with the NSW Department of Planning and Environment (DPE) Secretary's Environmental Assessment Requirements (SEARs).

AGL submitted the LBBAWP EIS in March 2021. The Development Consent (SSD 8889679) was issued by the DPE on the 8th of March 2022. The LBBAWP is being undertaken in the staged approach shown in Table 1-1, approved by DPE on the 18th of October 2022.

Table 1-1. LBBAWP Stages

Stage
Stage 1 – Liddell decoupling works
Stage 2 – Liddell battery energy storage system and associated works
Stage 3 – Bayswater Ancillary Works

1.1 Context

This Soil and Water Management Plan (SWMP) has been developed to address the SDD 8889679 development consent condition C1(e)(i) issued for the LBBAWP by the Planning Secretary for the NSW DPE. This condition requires a subplan to manage the environmental impacts of construction and decommissioning noise.

Relevant conditions are outlined in Table .

Table 1-2. Soil and water - Consent requirements for SDD 8889679

Consent requirement	Section/reference
C1. Prior to commencing construction, the Applicant must prepare an Environmental Management Strategy for the development to the satisfaction of the Secretary. This strategy must: (e) include: (i) the following subplans: • **soil, stormwater, water quality, flood and spoil management;** • construction and decommissioning noise, including an out-of-hours works protocol; • air quality management; • contamination, including an unexpected finds protocol;	This SWMP

Consent requirement	Section/reference
• waste management; and • traffic.	
B.24 The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of the development to match its available water supply. *Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.*	Section 4.3.2
B.25 The Applicant must ensure that all surface discharges from the development comply with all relevant provisions of the POEO Act, including any discharge limits (both volume and quality) set for the development in any EPL.	Section 6
B.26 The Applicant must: (a) ensure the development is designed, constructed and maintained to minimise impacts on surface water, flooding and groundwater at the site; (b) minimise any soil erosion associated with the construction, upgrading or decommissioning of the development in accordance with the relevant requirements in the *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004) manual, or its latest version; (c) ensure the battery energy storage system and ancillary infrastructure are designed, constructed and maintained to avoid causing any erosion on site; and **(d)** ensure all works are undertaken in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (NRAR, 2018), or its latest version unless DPE Water agrees otherwise.	Section 6

1.2 Purpose and scope

The purpose of this SWMP is to:

- Outline the potential impacts on soil, surface water and groundwater environment
- Detail the management strategies, actions and controls to manage these impacts and inform the Construction Environmental Management Plan (CEMP) for the project.
- Maintain compliance with the conditions of SSD 8889679, Environmental Protection Licence (EPL) 779, and legislation relating to soil and water.

The LBBAWP is staged and this SWMP specifically addresses the Stage 3 BAW as identified in Section 1.3.1 and described in the EMS (hereafter referred to as "the Project"). The SWMP and the accompanying EMS for Stage 1 and Stage 2 works are available on the AGLM Website for public reference following DPE approval.

Works undertaken by the Principal Contractor and any appointed sub-contractors must comply with the environmental management measures outlined in Section 6 of this SWMP.

1.3 Project overview

AGL Macquarie Pty Limited (AGLM) own and operate the Bayswater power station (Bayswater) which is approved to generate up to 2,740 megawatts (MW), the now retired (April 2023) 2,000 MW Liddell power station (Liddell), the 50 MW Hunter Valley Gas Turbines and associated ancillary infrastructure systems.

AGL has publicly announced its intention to transition towards a low-carbon future and respond to the requirements from the NEM and customers. Bayswater is expected to operate through to 2035 and then is intended to be retired. AGL has committed to closing all coal fired generation assets in its portfolio by 2050.

AGLM is undertaking works that will facilitate the efficient, safe, and reliable continuation of electricity generating works from the Bayswater and Liddell sites through the LBBAWP, of which this Project is a sub-stage. The overarching LBBAWP involves the following:

- **Decoupling Works:** Alternative network connection arrangements for the Liddell 33 Kilovolt (kV) Switching Station that provides electricity to infrastructure required for the ongoing operation of Bayswater and associated ancillary infrastructure and third-party industrial energy users.
- **Liddell Battery (the Battery):** The installation of a grid connected Battery Energy Storage System with capacity of up to 500 MW and 2 GWh.
- **Bayswater Ancillary Works:** Works associated with the ongoing operation of Bayswater which includes (but is not limited to) upgrades to ancillary infrastructure such as pumps, pipelines, conveyor systems, roads and assets to enable maintenance, repairs, replacement, expansion or demolition.
- **Consolidated consents:** A modern consolidated consent for the continued operation of Bayswater through the voluntary surrender and consolidation into this application of various existing development approvals required for the ongoing operation of AGLM assets.

The Project includes Stage 3 BAW works as listed in Section 1.3.1.

1.3.1 Project elements

The purpose of the Stage 3 BAW Project is to respond to the ongoing operational and maintenance requirements of Bayswater, as well align with modern office and site requirements. The proposed works and expected construction staging include:

1. **Shortening of the MA1B Conveyor** as the conveyor is no longer required to transport coal from the Mt Arthur Coal Mine. Works are anticipated to be completed over a 3-month period and involve approximately 25 construction personnel.

   Proposed works would include:

   (a) Construction of a new concrete foundation adjacent to the existing Antiene Check Weigh Bin

   (b) Modification to ancillary power, water and communications infrastructure

   (c) Establishment of spillage control and capture and water management infrastructure

   (d) Removal of redundant conveyor belts and associated conveyor stringer, purlins, idler rollers footing piers, electrical cabling, pull wires and roof sheeting

   (e) Rehabilitation of areas no longer required for operational purposes.

2. **Refurbishment of River Road** including complete surface removal, repairs will be made to the underlying layers (subgrade) and levelling and reconstruction of approximately 3 kilometres (km) of the dual lane River Road from its junction with the Bayswater Access Road to the Bayswater tank farm. Anticipated to be completed over a 2-month period and involve approximately 50 contract personnel. No change expected to scope or footprint of the current roadway. Staging is expected to occur within the construction footprint, with traffic diverted to a single lane when works are to occur (no additional disturbance area).

Proposed works include:

(a) Current road surface removal

(b) Repairs to the underlying layers and levelling

(c) Construction of the new road surface.

3. **Formalisation of Waste Storage Area** for hydrocarbons, oils, and greases generated onsite, with a total storage capacity of approximately 20 Kilolitres (kL). This includes environmental controls such as bunding, runoff management and roofing. A fully containerised / self-bunded solution - proposed to be established in a pre-bunded concrete hard stand area (already existing).

4. **Construction of a small diameter brine concentrator return water pipeline** (approximately 3 km long) to return brine from the brine concentrator decant basin to the brine concentrator. Minimal earth works are expected to be required. Installation of additional HDPE pipe approximately 50 mm diameter. To be laid on earth surface adjacent to existing pipeline (within 1 m of existing pipeline). No additional works outside of pipeline installation are expected. Anticipated to be completed over a 1-month period and to involve approximately 20 contract personnel.

5. **Replacement of the existing emergency power system** with a new system. The new system would include three 415 V diesel generators with two located outside the existing diesel generator building that would connect to the existing 6.6 kV network via 415 V / 6.6 kV step up transformers. The third diesel generator would remain connected to the 1/2 end 415 V diesel generator switchboard via a change-over switch such that power can be supplied from the third diesel generator or via the 6.6 kV network. The existing diesel generator building would have all redundant equipment removed allowing the building to be repurposed. Anticipated to be completed over a 2-month period and to involve approximately 5 contractor personnel.

6. **Formalisation of the contractor area** involving upgrades to the current informal contractor area established between Bayswater turbine hall and coal handling yards including electrical works, earthworks, road grading, sealing, drainage improvements and establishment of carparks and offices for use during maintenance shutdowns.

7. **Installation of auxiliary infrastructure** such as maintenance storage areas, laydown, car parks, security gatehouse upgrades, washdown facilities, car wash, equipment wash, and a drive through hard stand area. These are to be equipped with appropriate civil design, drainage, coal settlement bund, oil water separator and water transfer to contaminated water bund to the east of proposed area. Works associated with security gatehouse, laydown and storage are currently seen as maintenance and upkeep of existing infrastructure.

8. **Establishment of a cultural heritage storage area** for heritage items salvaged during earthworks. This will be a temporary containerised solution available for use as required. It is expected that the containers would be trucked in to site and placed on to a disturbed area on the inner footprint at Bayswater. The storage containers would be removed from site once the cultural heritage items are relocated. This would occur after construction is completed and be carried out in agreement with the RAPs.

9. **Refurbishment of the Administration Building** including redesign and upgrade of workspaces, kitchens and amenities.

The proposed works include:

(a) removal of internal walls to create more open plan office space and lunchrooms, effectively repurposing some areas within the existing building

(b) conversion of an existing toilet into a disabled compliant toilet

(c) installation of a cabin lift in the existing to improve accessibility, noting that the only means of accessing the first floor currently is via stairs

(d) replacement of two existing doors with an automatic opening door

(e) installation of small internal roof electronic beacons to enable assisted office navigation for seeing or hearing-impaired persons

(f) modification of kitchen spaces to increase accessibility, by lowering fittings and improving cabinetry and

(g) widening of concrete paths and installation of handrails to enable wheelchair access.

The Social club will be pursued under a stand-alone Development Application at a later stage on a separate parcel of land.

1.4 Site location

The Project is located within the 10,000 hectares (ha) AGLM landholding, which encompasses Bayswater, Liddell, the Ravensworth rehabilitation area, Lake Liddell and surrounding buffer lands. The AGLM landholding is located approximately 15 kilometres (km) south-east of Muswellbrook, 25 km north-west of Singleton, and approximately 165 km west northwest of Sydney in NSW. The location of the AGLM landholding is shown in Figure 1-1.

The Project is located within an area that has a Australian Land use and Management Classification (ALUM) of 5 – Intensive Uses (ABARES 2016). As such it is dominated by mining and power generation (Class 5.8.1 and 5.6.1) and associated infrastructure with some areas of grazing (Class 4.2).

The Project footprint is located within and surrounding Bayswater, as shown in Figure 1-2. Bayswater is accessible from the New England Highway via an interchange with an unnamed east-west access road. The access road is a single carriageway road with one lane in each direction.

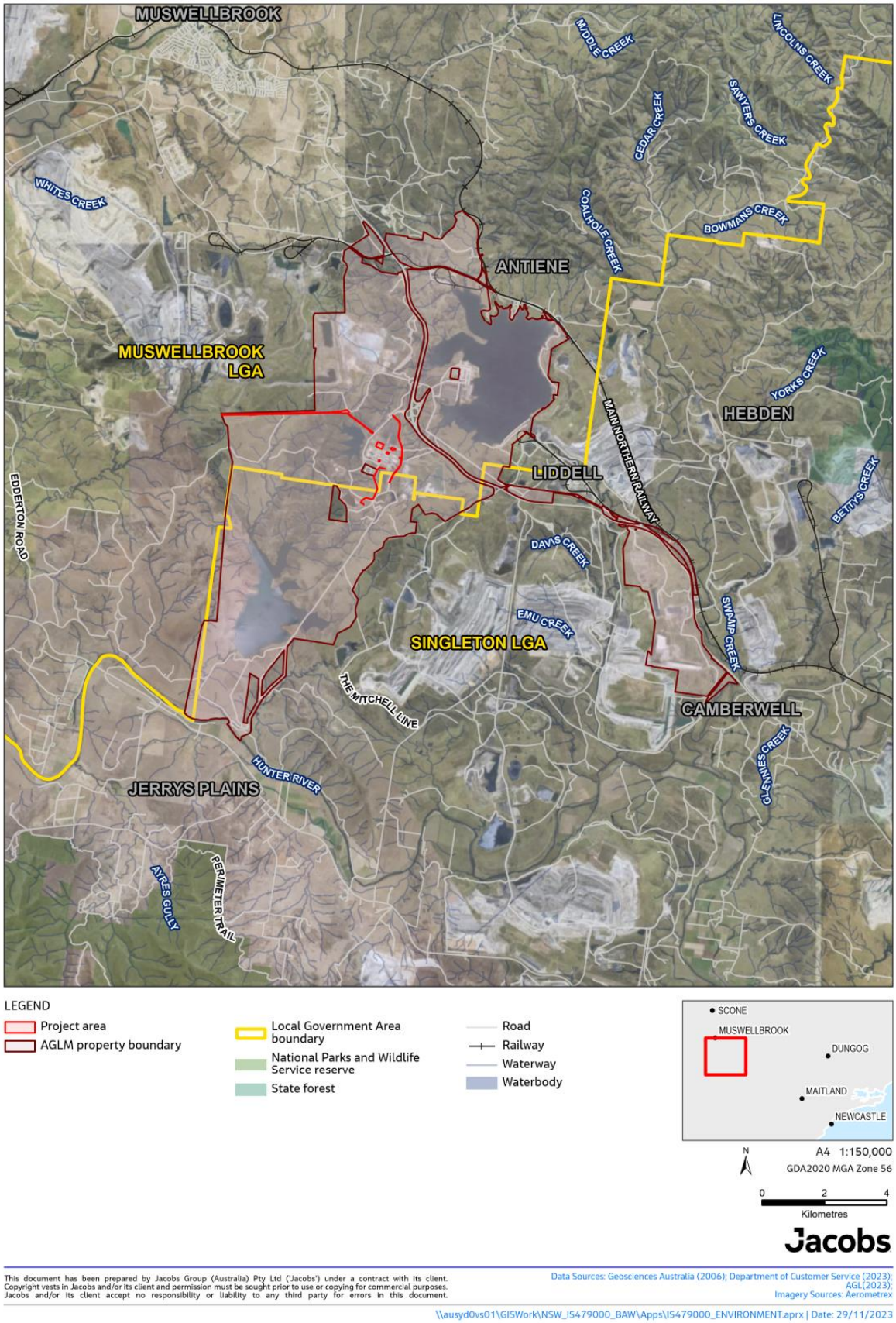

Figure 1-1. Project location

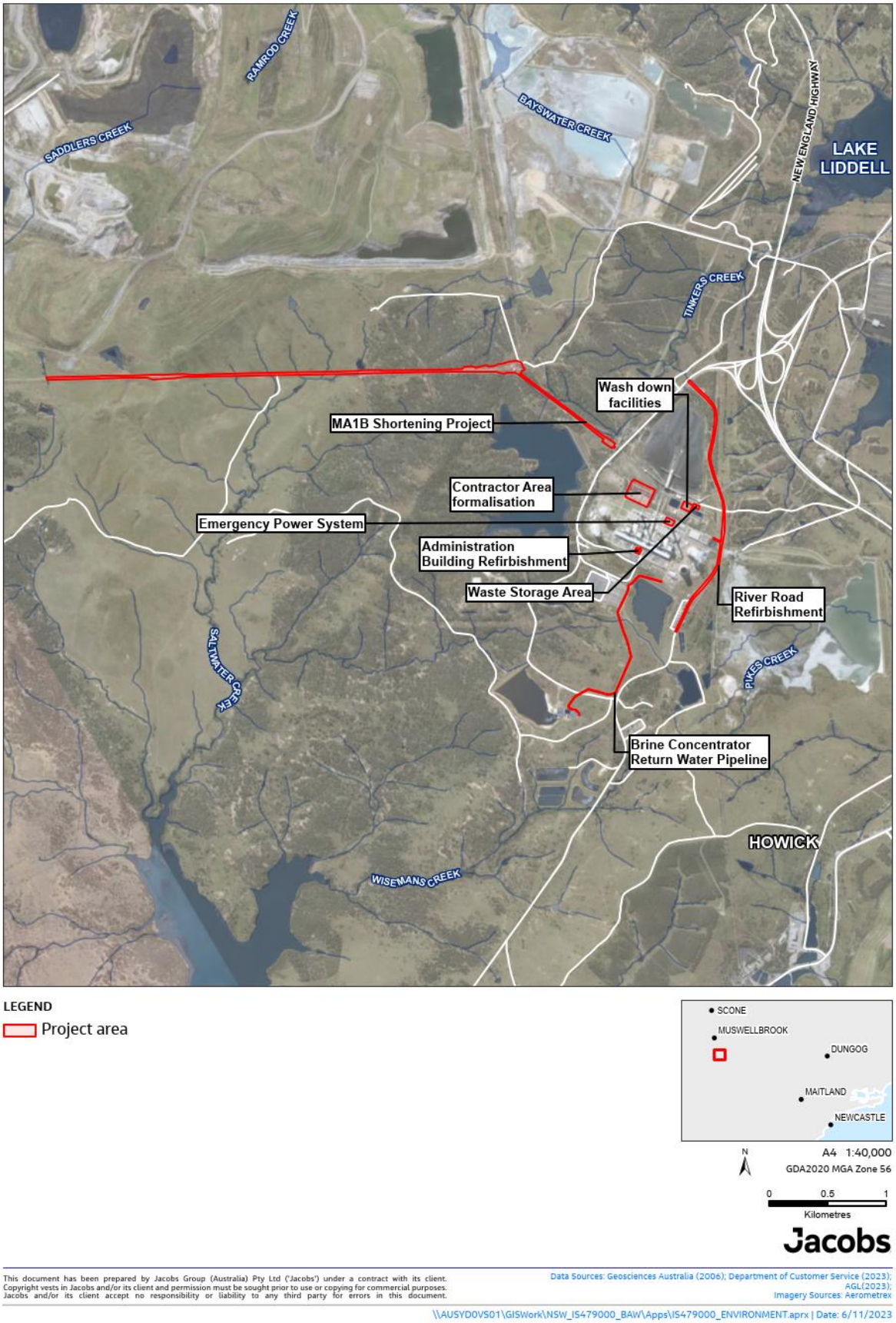

Figure 1-2. Project area

1.5 Related reports and plans

There are environmental assessments, management plans and monitoring programs for existing and proposed operations within the AGLM landholdings. The following documents are considered related and shall be read in conjunction with this SWMP:

- Land Management Plan (AGLM-HSE-PLN-009.01) (AGLM, 2021)
- Water Management Plan (AGLM-HSE-PLN-009.02) (AGLM, 2022)
- Liddell Battery and Bayswater Ancillary Works Project EIS (Jacobs, 2021)
- Liddell Battery and Bayswater Ancillary Works Project EIS: Appendix D - Contamination Impact Assessment (Jacobs, 2021)
- Pollution Incident Response Management Plan (PIRMP) (AGLM, 2023)
- Bayswater WOAOW Environmental Management Strategy (Jacobs, 2022).

2. Regulatory requirements

2.1 Relevant legislation and conditions

Legislation relevant to managing soil and water impacts:

- *Environmental Planning and Assessment Act 1979* (EP&A Act) and *Environmental Planning and Assessment Regulation 2000*
  - This Act and regulation establishes a system of environmental planning and assessment of development proposals for the State and this project has been assessed under Division 4.7 of the Act. The approval conditions and obligations are incorporated into this SWMP.
- *Protection of the Environment Operations Act 1997* (POEO Act)
  - The POEO Act is the primary piece of legislation for the regulation of potential pollution impacts associated with scheduled activities in NSW. Scheduled Activities are those defined in Schedule 1 of the Act and EPL799 for which Bayswater is operated under.
- *Water Management Act 2000* (WM Act) and *Water Management (General) Regulation 2018*
  - This Act and regulation for the protection, conservation and ecologically sustainable development of water sources of the State and in particularly to protect, enhance and restore water sources and their associated ecosystems.

The Minister's Conditions of Approval for the LBBAWP, relevant to this SWMP, are listed in Table 1-2.

2.1.1 Environmental Protection Licence

Bayswater is operated under EPL 779; as such, the construction contractor must ensure that all works are conducted in accordance with the conditions of this licence.

The EPL includes a range of conditions regarding surface and groundwater management and stipulates water quality limits for any water discharged from site (EPL 779 Section 3). It is assumed that these conditions would also apply to the Project.

2.1.2 Additional requirements

Additional environmental requirements established in the EIS are in Table . These requirements have been set for the overarching LBBAWP and are applicable to Stage 3 BAW works where relevant risks are present. Management requirement L04 (addressing Geotechnical Stability Risks) is not considered relevant to the Project due to the nature of the works being undertaken. Where works are in close proximity to waterways, management requirement W2 will be followed where appropriate, so far as reasonably practicable.

Water collected from worksites will be treated as required to meet EPL discharge criteria and discharged in accordance with management requirement W4. However, if visual or olfactory evidence of chemical contamination is present (e.g. hydrocarbon sheen) it will be captured and assessed for disposal as liquid waste.

Table 2-1. LBBAWP EIS – Soil and water management requirements

Reference	Management measure	Timing
L1	The internal bunding and environmental controls for hazardous substances management suitable for the Battery and transformers will be in accordance with applicable guidelines.	Detailed design

L2	Potential contamination-related impacts associated with the Project will be managed by the implementation of a CEMP that includes (but not limited to): ▪ An unexpected finds protocol for the appropriate assessment and management of encountered contamination to mitigate impacts to the development ▪ Procedures to ensure that all material excavated during the construction of the development is appropriately assessed and classified before being disposed of in accordance with environmental laws ▪ Specific control measures to mitigate impacts to soil, water, air, noise, traffic, structures and clear protocols for measurement of affected media and validation of results during construction of the development.	Construction
L4	Detailed design of each Project component would consider and address geotechnical stability risks in accordance with applicable design standards.	Detailed design
W1	The specific requirements for water quality controls will be confirmed as the detailed design develops and prior to commencement of construction of each Project component, to ensure the objectives of the Project are achieved.	Pre-construction
W2	The following measures will be undertaken to manage activities in proximity to waterways: ▪ The design and implementation of works within waterfront land would be undertaken in accordance with *Guidelines for Controlled Activities on Waterfront Land* (NRAR, 2018) ▪ Implementing practices to minimise disturbance of banks and undertake bank stabilization ▪ Where appropriate, drainage features will be incorporated into the design of the Project components by a suitably qualified and experienced professional. All Project components will be designed and constructed in accordance with relevant guidelines.	Pre-construction and construction
W3	Stockpiles would be managed to minimise the potential for mobilisation and transport of dust, sediment and leachate in runoff. This would include: ▪ Minimising the number of stockpiles, area used for stockpiles, and time that they are left exposed ▪ Locating stockpiles away from drainage lines, waterways and areas where they may be susceptible to wind erosion ▪ Stabilising stockpiles, establishing appropriate sediment controls and suppressing dust as required.	Construction
W4	Erosion and sediment control measures will be implemented and maintained at all work sites in accordance with the principles and requirements in *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and Volume 2D commonly referred to as the "Blue Book" where appropriate. Additionally, any water collected from worksites will be treated and discharged (where able) to avoid any potential contamination or local	Construction

	storm water impacts. Measures will be designed in accordance with the relevant guideline where appropriate.	
W5	Water use during construction will be minimised where possible and measures to reduce water use will be applied.	Construction
W6	The Bayswater site operational water quality monitoring program will be updated and implemented as required.	Pre-operation and operation
B1	Erosion and sediment controls will remain in place until all rehabilitation has been completed. Drainage lines will be protected from runoff and stockpiling of spoil.	Construction

2.2 Standards and guidelines

Guidelines and standards relating to the management of surface and groundwater that are applicable to the project include:

- *Managing Urban Stormwater: Soils and Construction (Volume 1), 2004* (Landcom)
  - These guidelines form part of what is commonly known as the 'Blue Book'. They provide support for councils and industry to reduce the impacts of land disturbance activities on waterways by better management of soil erosion and sediment control during service installation.
- *Guidelines for Controlled Activity Approvals, 2022* (DPE)
  - These guidelines provide essential information on how to safeguard the state's water resources and stay compliant when carrying out activities that require a controlled activity approval. Guidelines are included for in-stream works, laying pipes and cables in watercourses, outlet structures, riparian corridors, vegetation management plans, and watercourse crossings.
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018* (Australian Government Initiative), referred to herein as the ANZG (2018) Water Quality Guidelines
  - These guidelines provide authoritative guidance that water managers can use for water quality planning, approvals, licensing and compliance, monitoring and assessment.
- *Australian Guidelines for Water Quality Monitoring and Reporting, 2000* (ANZECC & ARMCANZ)
  - These water quality guidelines provide governments and communities with a set of tools for assessing and managing ambient water quality in natural and semi-natural water resources.
- *Approved Methods for Sampling and Analysis of Water Pollutants in NSW, 2022* (NSW EPA)
  - These approved methods list the sampling and analysis methods to be used to test for the presence or concentration of matter in water and the volume, depth and flow of water or wastewater, when complying with statutory requirements.
- *NSW Water Quality and River Flow Objectives, 2006* (DECCW)
  - These objectives are the agreed environmental values and long-term goals for NSW's surface waters. They set out community values and uses for rivers, creeks, estuaries and lakes, and a range of water quality indicators.
- *Pollution Incident Response Management Plans Guidelines, 2020* (NSW EPA)
  - These guidelines assist holders of an environment protection licence to comply with their pollution incident response management plan (PIRMP) obligations.
- *Acid Sulfate Soil Manual, 1998* (ASSMAC)

- This manual outlines best practice in assessing and managing the impacts of proposed works in areas likely to contain acid sulfate soils (ASS) and provides guidance for on-site management.

3. Performance criteria

High-level targets for the soil and water environment are set for the Project, described in Table . These are based on legislative requirements (SSD 8889679 and EPL 779) and AGLM's commitment to the continuous improvement of their environmental performance.

Table 3-1. Soil and water quality criteria

Aspect	Target	Indicator	Timeframe
General	All control measures listed in this SWMP are to be implemented, as required.	Number of non-conformances with this SWMP.	Ongoing
Water Quality	All water discharged from site to comply with water quality limits stipulated in EPL 779.	Number of incidents.	Ongoing
Contamination	No contamination incidents to occur during the Project (e.g. unmanaged chemical leaks/spills/overflows).	Number of incidents.	Ongoing
Training & Awareness	All personnel working on behalf of AGLM to complete the Site Induction, which will include environmental awareness components.	Percentage of workforce personnel that have completed the Site Induction prior to beginning work on the Project.	Ongoing
	All relevant personnel working on the Project on behalf of AGLM to attend a CEMP briefing held by the Principal Contractor, and be trained and competent in CEMP requirements.	Percentage of relevant workforce personnel that are trained and competent to enact the CEMP.	Ongoing

4. Existing environment

4.1 Climate

The Project areas have a Mediterranean climate with hot summers and cool to mild winters. The long-term average annual rainfall for the AGLM Bayswater rain gauge is 699 mm, with highest rainfall occurring in late spring/summer from November to February. High monthly rainfall also occurs in June. According to the Bureau of Meteorology, average class A evaporation pan is 1,514 mm/year (1920–2020).

Rainfall surplus, defined as rainfall minus evapotranspiration, is a measure of the available water for recharge to groundwater. A positive rainfall surplus indicates a water surplus, which may manifest itself in increased potential for groundwater recharge. Conversely, a negative rainfall surplus indicates a water deficit and therefore is associated with reduced potential for groundwater recharge. Based on the Doyles Creek daily rainfall and the areal actual evapotranspiration monthly averages reported by the Bureau, there is a rainfall surplus in February and from April to September. The remaining months have a rainfall deficit.

4.2 Soils

4.2.1 Soil Landscape

The BAW works area as shown in Figure 1-2 is predominately situated across the Liddell soil landscape which comprise earthy and siliceous sands on the mid to lower slopes with clayey subsoils or sandy loan between depths of 20–40 cm. These types of soils experience minor to severe sheet erosion and moderate gully erosion (AGL 2021). The southern extent of the project area is located across Bayswater soils landscapes which comprise of yellow solodic soils up to a depth of around 20 cm on slopes with alluvial soils. Drainage lines comprise of brown and yellow earths and prairie soils. The subsoils of this landscape are sandy clay loams or light to medium clay. This landscape experiences moderate sheet and gully erosion on slopes. Salt scalds and associated erosion are common in some areas (AGL 2021).

4.2.2 Acid Sulphate Soil

Mapping of the land within the project site shows that acid sulphate soils are unlikely to be present a ‘low probability of occurrence’ of acid sulphate soils with a ‘very low’ level of confidence (CSIRO 2019). According to the Australian Soil Resources Information System, acid sulphate soils are not anticipated due to the project area elevation ranging from approximately 90 to 250 m above sea level.

4.2.3 Soil salinity

The eSPADE profile data available for the Project area indicate soil salinity classes ranging between ‘non saline’ to ‘highly saline’ soils (DPE, 2023).

4.3 Water

4.3.1 Water quality and hydrology

There are several natural and artificial waterways within the proposal area. Natural waterways include Tinkers Creek, Bayswater Creek, Pikes Creek, Saltwater Creek, Chilcotts Creek, and Wisemans Creek. Artificial waterbodies include Bayswater Ash Dam, Plashett Reservoir, Lake Liddell, and Freshwater Dam. All waterways are highly disturbed and not classified as sensitive receiving environments. The waterways and artificial water bodies adjacent to or that intersect with the BAW are:

- Saltwater Creek. Saltwater Creek fourth order waterway that flows in a southerly direction towards Plashett Reservoir. A major unnamed tributary running east to west flows into Saltwater Creek approximately 1 km upstream of the confluence of Saltwater Creek and Plashett Reservoir. Saltwater Creek also receives flows from a number of smaller tributaries located along the length of the waterway towards its southern extent. Saltwater Creek then drains into Plashett Reservoir; a constructed water storage for Bayswater and Liddell which also receives water pumped from the Hunter River in addition to catchment runoff. There is currently no available water quality data for Saltwater Creek.
- Freshwater Dam. This dam is located to the west of Bayswater and is used to store water from the Lime Softening Plan and also supplies water to Jerrys Plains for potable water supply after treatment through the Bayswater Water Treatment Plant.
- Tinkers Creek. This creek is a degraded first order stream that drains from the Freshwater Dam west of Bayswater into Lake Liddell. Tinkers Creek receives flows from a modified drainage line that links the Freshwater Dam to Tinkers Creek and from Bayswater via two licenced discharge points (EPA01 and EPA07) that drain to Tinkers Creek. Water quality monitoring of Tinkers Creek from 2015 to 2019 was reported in the EIS for the Water and other Associated Operational Works (WOAOW) Project (AGL Macquarie 2020). During this time, the median pH (8.1) was within the recommended limits of 6.5-9 as per the Environment Protection Licence (EPL) and the ANZG (2018) criteria of 6.5–8.5 for protection of slightly to moderately disturbed lowland river aquatic ecosystems. The median electrical conductivity (3050 µS/cm) was within the limits specified in EPL770 but fell outside the ANZG (2018) default trigger value range for lowland rivers (125–2,250 µS/cm) (AGL Macquarie 2020). The limited toxicant data available for sites along Tinkers Creek reported in 2017 showed that concentrations of most trace metals and ions were below either detection limits or the ANZG (2018) aquatic ecosystem toxicant guidelines of 80% species protection and the primary industry guidelines. The metals that exceeded guideline values on at least one sampling occasion were boron, chloride, chromium, copper, fluoride, lead, sodium, and zinc.

4.3.1.1 Aquifer characterisation

Groundwater is likely to be hosted in two primary formations: the porous sediment of the alluvium associated with the creeks in the Project area, and the fractured rock aquifer of the Permian sections. Groundwater in the alluvium is likely to be unconfined. Groundwater flows are generally parallel to the water flow direction in the creek and depend on stream size and whether the flow is ephemeral or perennial. The depth to groundwater in the alluvium is generally low with depths to water between 0 metres to approximately 10 metres below ground level (mBGL). Groundwater aquifers in fractured rock systems are the coarse and weathered units and the coal seams. The fractured rock groundwater systems can be confined or unconfined, and the shallow aquifer flow directions follow the general surface topography. In the fractured rock aquifers, depth to water ranges from a few metres to tens of metres below ground level.

4.3.1.2 Registered groundwater bores

4.3.1.3 The LBBAWP EIS identified 35 registered groundwater bores within the surrounding lands with standing water levels ranging between 3 to 43 mBGL (16m and 182m (both at Australian Height Datum)). On the Project Site, average groundwater depths are relatively shallow ranging from 0.4 m to 11.5 m (both below ground level) due to the bores being located in relatively low-lying land. Further information on groundwater depths is detailed in Appendix C. Groundwater quality

The groundwater of the bores within the AGLM site contains:

- Elevated concentrations of aluminium, boron, copper, cadmium, manganese, nickel, and zinc that frequently exceed the ANZG (2018) guidelines for 95% species protection limit.
- Concentrations for filterable reactive phosphorus and total nitrogen that, at times, exceeded the ANZG (2018) default guidelines for protection of lowland river aquatic ecosystems.
- pH levels at some bores were above the ANZG (2018) default guidelines for lowland river aquatic ecosystems.
- Total recoverable hydrocarbons, benzene, toluene, ethyl benzene and xylenes (BTEX), polyaromatic hydrocarbons (PAH) and polychlorinated biphenyl (PCB) were not detected.

4.3.2 Water supply

Bayswater and Liddell have an integrated water management system to ensure adequate supply of water for cooling and other processes across the sites. The primary water source for the site is the Hunter River, and the major water storages on site include Lake Liddell, Bayswater Ash Dam, Liddell Ash Dam, Plashett Dam and Freshwater Dam.

During construction, water would be required for activities such as dust suppression, drilling, concrete works, and revegetation. Water would be sourced from existing onsite sources in accordance with existing water allocations. No new potable water connections would be required, and no surface water would be abstracted during construction associated with the BAW.

4.3.3 Flooding

BAW works will not be occurring on land that is mapped under the Singleton Local Environment Plan (LEP) as being susceptible to flooding. No mapping of flood prone land is available under the Muswellbrook LEP.

5. Soil and water impacts

5.1 Soils

5.1.1 Soils, geology and geotechnical stability

The BAW works would not significantly modify the existing landform nor create new landforms.

During construction of the BAW components, earthworks and vegetation clearing will be required and, as such, there is potential for soil erosion to occur. To minimise this risk, soil stabilisation and revegetation would be implemented. The project is unlikely to cause large-scale soil disturbance at depth and is unlikely to interface with groundwater.

The Project is not expected to further reduce the soil capability.

5.1.2 Contamination

Localised concentrations of hydrocarbons, copper, and zinc have been detected above the screening criteria in the Project area; however, widespread gross contamination is not expected. The disturbance of known or unknown areas of contamination can result in human health impacts, or the unintentional spreading of contamination (e.g. generation of contamination dust, or contamination of surface run-off).

If elevated levels of contaminants are present in areas where the Project is being carried out, it is likely that the activity would be limited in extent and unlikely to require significant remediation. Sensitive receptors are unlikely to be repeatedly exposed to soil contaminants over a prolonged period with the implementation of AGLMs occupational hygiene controls to mitigate exposure.

No per- and polyfluoroalkyl substances (PFAS) contamination was identified. However, the application of potentially PFAS contaminated fire-fighting water during training, testing and emergency events may be a source of contamination in the Project area (particularly within and adjacent the fire training area AEC). Additional investigation undertaken by Aecom in 2019 (PFAS Investigation Report) found that PFAS concentrations are generally less than the laboratory limit of reporting and / or investigation levels.

The BAW works do not propose a change in land use and works have a low potential to result in contamination (AGLM, 2021).

5.2 Water

5.2.1 Water quality and hydrology

Water would be required for various activities associated with construction of the BAW components including dust suppression, drilling, concrete works, and revegetation. Water would be sourced from existing sources onsite in accordance with existing water allocation. No new potable water connections would be required and no extraction of surface water would occur during construction of the Project.

Potential detrimental impacts to water quality and hydrology without appropriate erosion and sediment controls could occur from:

- Vegetation removal, general earthworks including striping of topsoil and excavation which could result in the mobilisation of exposed soils and increased erosion and sedimentation. Should sediment be transported offsite via wind or runoff to downstream waterways, water quality could be reduced from elevated turbidity and nutrient concentrations and lower dissolved oxygen.

- Stockpiling of topsoil and vegetation leading to the discharge of sediment-laden water to downstream waterway which could cause the discharge of dark coloured water and reduced water quality from altered instream pH, reduced visibility, higher biochemical oxygen demand and lower dissolved oxygen.
- Transportation of cut and/or fill materials and the movement of heavy vehicles across exposed earth.
- Concreting works resulting in concrete dust, concrete slurries or washout water entering downstream waterways which can increase the alkalinity and pH of downstream waterways which can be harmful to aquatic life.
- Potential for spills and leaks of chemicals, petroleum, oils and other toxicants from construction machinery, plant equipment, refuelling and vehicles travelling to and from construction sites which could result in discharges to the environment.

The construction activities outlined in Table 5-1. Summary of Bayswater Ancillary Works construction activities and potential impacts to surface and groundwater provide detail on specific actions during construction that may result in impacts to surface water.

Table 5-1. Summary of Bayswater Ancillary Works construction activities and potential impacts to surface and groundwater

Construction work	Description	Potential impacts	Potential receivers
MA1B Conveyor shortening	▪ Construction of new concrete foundation adjacent to the existing Antiene Check Weigh Bin ▪ Modification to ancillary power, water and communications infrastructure ▪ Establishment of spillage control and capture and water management infrastructure ▪ Removal of redundant conveyor belts and associated conveyor stringer, purlins, idler rollers, footing piers, electrical cabling, pull wires and sheeting ▪ Rehabilitation of areas no longer required for operational purposes.	▪ Sediment-laden runoff entering downstream receiving waterway ▪ Accidental spills and leaks from vehicle and machinery required for earthworks ▪ Contaminated runoff from concrete wastewater entering downstream receiving waterway.	▪ Saltwater Creek ▪ Unnamed tributary of Saltwater Creek ▪ Freshwater Dam ▪ Tinkers Creek.
River Road refurbishment	Reconstruct approximately 3 km of dual lane River Road from its junction with the Bayswater Access Road to the Bayswater tank farm. Works would include: ▪ Current road surface removal ▪ Repairs to the underlying layers and levelling ▪ Construction of the new road surface.	▪ Sediment-laden runoff entering downstream receiving waterway ▪ Accidental spills and leaks from vehicle and machinery required for earthworks ▪ Contaminated runoff from concrete wastewater entering downstream receiving waterway.	▪ Tinkers Creek ▪ Unnamed drainage line.
Environmental improvement projects	Creation of formalised waste storage area for hydrocarbons, oils, and greases generation online with a total storage capacity of 20 kilolitres (kL) and inclusion of environmental controls such as bunding, runoff management and roofing.	▪ Sediment-laden runoff entering downstream receiving waterway ▪ Accidental spills and leaks from vehicle and machinery required for earthworks.	
Brine concentrator return water pipe	Construct and operate a new small diameter approximately 3 km pipeline to return brine from the brine concentrator decant basin to the brine concentrator.	▪ Sediment-laden runoff entering downstream receiving waterway ▪ Accidental spills and leaks from vehicle and machinery required for earthworks.	▪ Unnamed drainage line and storage pond.

Construction work	Description	Potential impacts	Potential receivers
Emergency Power System Redevelopment	Replacement of the existing emergency power system with a new system. The new system would include three 415 V diesel generators with two located outside the existing diesel generator building that would connect to the existing 6.6 kV network via 415 V / 6.6 kV step up transformers. The third diesel generator would remain connected to the 1/2 end 415 V diesel generator switchboard via a change-over switch such that power can be supplied from the third diesel generator or via the 6.6 kV network. The existing diesel generator building would also be gutted of all redundant equipment allowing the building to be re-purposed.	▪ Accidental spills and leaks from vehicles and machinery required for earthworks.	▪ No named waterways within close proximity.
Various works within the Bayswater operations area	▪ Formalisation of contractor involving upgrades to the current informal contractor area established between Bayswater turbine hall and coal handling yards including electrical works, earthworks, drainage improvements and establishment of carparks and offices for use during maintenance shutdowns ▪ Creation of a formalised waste storage area for hydrocarbons, oils, greases for approximately 20 kL and inclusion of environmental controls such as bunding, runoff management and roofing ▪ Installation of auxiliary infrastructure such maintenance storage areas, laydown, car parks, security gatehouse upgrades, washdown facilities, car wash, equipment wash ▪ Establishment of a cultural heritage storage area for heritage items salvaged associated with future earthworks at Bayswater ▪ Bayswater administration building refurbishment and/or upgrade works including redesign and upgrade of workspaces, kitchens and amenities.	▪ Sediment-laden runoff entering downstream receiving waterway ▪ Accidental spills and leaks from vehicle and machinery required for earthworks ▪ Contaminated runoff from concrete wastewater entering downstream receiving waterway.	▪ No named waterways within close proximity ▪ Storage ponds.

5.2.2 Groundwater

Extraction of groundwater for construction use is not proposed. The Project would source potable water from onsite utilities. The Project is therefore not expected to impact on any adjacent licensed water users or existing groundwater infrastructure.

Indirect impacts to the groundwater environment during construction may occur as a result of spills or leaks of hazardous materials occurring during construction and migrating to the water table. Potential spills or leaks may include oils, lubricants, and fuels used by construction plant.

Most construction activities would be limited to surface works and, as such, there would be limited possibilities for direct interaction with groundwater.

5.2.3 Water supply

The construction of each Project element may require water for ground improvement, dust suppression and wash down purposes that would be drawn from within the existing AGLM water allocations and would be negligible compared to existing uses.

6. Soil and water control measures

6.1 Mitigation and management measures

As outlined in Section 5, construction activities have potential to cause impacts to surface and groundwater if not properly managed. Mitigation and management measures to prevent these impacts will be undertaken during the pre-construction, construction, and demobilisation phases. The key aspects of the soils and water management strategy include:

- Erosion and sediment controls
- Water quality control measures

6.1.1 Concept erosion and sediment control plan

A concept erosion and sediment control plan (ESPC) is provided in Appendix B and further detailed with various erosion and sediment control strategies in Section 7. The ESCP will be used as a guide by the Principal Contractor in developing and implementing the site-specific ESCP. The site-specific ESCP will be developed by the Principal Contractor in accordance with Section 2 of the Blue Book and included for implementation with the CEMP.

6.1.2 Water quality controls

In addition to erosion and sedimentation, water contaminated by construction activities must be managed through specific water quality controls (WQC) including those outlined in Table . All control measures will be managed by the Principal Contractor.

Table 6-1. Water quality control measures implemented during the construction phase

Reference	Aspect	Management measure	Timing	Responsibility
WQC1	Accidental spills and leaks	▪ An emergency spill response will be employed in the event of an accidental spill. Refer to the CEMP for details. ▪ Spill kits will be available on site.	Construction	Principal Contractor
WQC2	Vehicle machinery and maintenance	▪ Maintenance areas will be established for vehicles, equipment, and machinery, including for refuelling and repair areas, and wash down bays. ▪ Where possible, maintenance areas will be fully bunded and runoff will be directed via on-site diversion drains to the sediment basin. ▪ Undertake regular maintenance and inspections to ensure that plant and equipment is leak free and in good working condition. Repair oil/fuel leaks immediately	Construction	Principal Contractor

Reference	Aspect	Management measure	Timing	Responsibility
		or remove from site and replace with a leak-free item.		
WQC3	Storage of fuels, chemicals, and liquids	▪ All fuels, chemicals and liquids would be stored on level ground at least 50 m away from waterways (including existing stormwater drainage systems) and where possible would be stored in a sealed bunded area within the Project Site.	Construction	Principal Contractor
WQC4	Concrete	▪ Concrete washout will be confined to designated concrete washout bays that will securely capture and store concrete wastewater and solids in an impervious bunded area. ▪ Dust suppression techniques will be implemented to minimise mobilisation of concrete dust	Construction	Principal Contractor
WQC5	Contamination	▪ Ensure any unexpected finds of potential contamination are mitigated in accordance with the unexpected finds protocol in the Contamination Management Plan.	Construction	Principal Contractor
WQC6	Equipment	▪ Conduct equipment washdown within a designated washdown area.	Construction	Principal Contractor

6.2 Training

Construction workers who attend the Project site may be required to undergo training and awareness programs regarding soil, surface water and groundwater management issues and management. Compulsory training will be determined by AGLM and will be developed and delivered by the Principal Contractor. Training delivered by the Principal Contractor will be subject to approval and auditing by AGLM to ensure it aligns with AGL induction requirements and fulfils the conditions of SSD 8889679.

Delivery of training may include:

- Work Inductions
- Toolbox Talks
- Meetings lead by the Environment Team
- Posters and educational items.

Training should detail:

- The contents of this SWMP
- Legislation and legislative requirements

- Water protection requirements
- Stockpile locations, laydown areas and management measures.

Further to this, targeted training will be delivered to personnel with key roles in water management. Examples of training topics could include:

- Erosion and sediment control procedures
- Sediment basin discharge procedures
- Water quality control procedures.

Training will be undertaken in accordance with Section 7.4 of the Stage 3 Bayswater Ancillary Works EMS.

7. Erosion and sediment controls strategy

The Erosion and Sediment Controls strategy is described in this section and the Concept Erosion and the Sediment Controls Plans/Figures for the site areas that will be disturbed are shown in Appendix B. These figures are to be read in conjunction with the supporting information in this section. The CESCPs are indicative only to provide guidance to the contractors who may need to prepare and submit comprehensive Principle ESCPs for approval before any works on site, to be followed by Progressive ESCPs that may be frequently updated based on the construction activities, staging and changes on site during the construction phase.

7.1 Design approach

Erosion and sediment controls need to be designed for the construction phase of the various AGL sites that are being disturbed including the access roads, to controls construction runoff before discharging into the receiving waterways.

Water quality would be managed within the area bounded by the proposal site, including, but not limited to:

- Access tracks
- Earthworks stockpile
- Vegetation stockpile areas
- Compound areas, such as the Contractor's and the Principals facilities (if any)
- Wash-down facilities.
- Temporary sediment basins (if any).

During construction, temporary sediment basins or sediment sumps may be provided as the primary mechanism to capture and treat runoff from all disturbed areas within construction footprint before discharging into the receiving waterways. Where construction does not result in a high potential for erosion, such as small areas, only local sediment controls, for example sediment fences or filter logs, would be required.

This report needs to be read in conjunction with the Erosion and Sediment Control Plans that have been prepared which have been included in Section 7.

7.2 Erosion and sediment control (ESC) strategy

The overall erosion and sediment control design strategy for the proposal is to prevent or reduce erosion and sediment impacts during construction. Where erosion occurs, the aim is to capture it as close to this source as practicable.

The proposed detailed ESC measures to be implemented during each construction stage of the project should consider five principles:

1. Controlling the occurrence of erosion.
2. Controlling the movement of sediment.
3. Diverting offsite "clean" water away from construction areas.
4. Diverting onsite "dirty" water towards a sediment basin.
5. Capturing sediments that are transported through diversion drains in basins.

To achieve these principles, water quality during construction will be managed using the following measures, where relevant:

:

- Procedural controls
- Site-managed erosion control measures
- Physical sediment control measures.
- Treatment with sediment basins
- Monitoring and maintenance.

7.3 Site-managed erosion control measures

Construction activities would be sequenced and managed by the construction contractor to minimise potential water quality degradation due to erosion. Management will include:

- Minimising the extent and duration of exposed topsoil by retaining topsoil cover, grassed drainage lines and shrub cover on the soil surface for as long as possible.
- Minimising the lengths of slopes through limiting the extent of excavations and the use of diversion drains to reduce water velocity over disturbed areas.
- Designation of 'no go' zones for construction plant and equipment.
- Shaping of land to minimise slope lengths and gradients and improve drainage (for example, benching).
- Employment of appropriate measures to prevent wind-blown dust entering waterways.
- Creation of diversion banks at the upstream boundary of construction activities to ensure diversion of upstream runoff around exposed areas.
- Creation of catch drains at the downstream boundary of construction activities, where practicable, to ensure containment of sediment-laden runoff and diversion toward treatment areas to prevent flow of runoff to downstream undisturbed areas.
- Specification of construction procedures that minimise water flow velocities and avoid excess velocities such as implementation/construction of level spreaders, check dams, bank and channel linings.
- Where possible, constructing working platforms from rock fill so that bare earth is not exposed.
- Installing stabilised vehicle exit points to remove sediments from vehicles leaving site areas.

In addition to these general erosion control measures, specific management measures are required for site compounds, stockpiles, works near waterways and spills.

7.3.1 Site compound management (if any)

In general, mitigation would be similar to general construction site mitigation, with additional factors, such as:

- Restricting vehicle movements to designated pathways where feasible.
- Paving areas that would be exposed for extended periods where feasible.
- Diverting offsite runoff around stockpiles sites where required.
- Designation of areas for plant and construction material storage within the site compound.
- If the above local controls are not implemented, and where required, treating onsite runoff with a construction or compound-specific sediment basin. Monitoring the sediment basin for parameters such

as dissolved oxygen levels and organics would be required to determine suitable discharge to the environment. Such basins will be considered once compound locations have been finalised.

7.3.2 Stockpile management

The maintenance of established stockpile sites during construction prevents erosion of the stockpile flowing into downstream waterways. Stockpile management recommendations include:

- Diverting runoff around stockpiles sites where required.
- Minimising the number and size of stockpiles.
- Lining the base of stockpiles if they are located over shallow water tables. Information on groundwater is available in the following document: *Water and other Associated Operational Works (WOAOW) Project - Surface water, Groundwater and Flooding Technical Paper (Prepared by Jacobs for AGL Macquarie, 2020)*.
- Treating stockpiles at the source by covering with plastic sheets.
- Establishing effective sediment control works to contain any runoff including cut-off drains, vegetation and silt fences to minimise risk of sediments entering waterways.
- If the above local controls are not implemented, and where required, treating onsite runoff with a construction or compound-specific sediment basin. Monitoring the sediment basin for parameters such as dissolved oxygen levels and organics would be required to determine suitable discharge to the environment. Such basins will be considered once compound locations have been finalised.

Any material found to be unsuitable for reuse would be disposed of in accordance with the Waste Classification Guidelines (DECCW 2008).

7.3.3 Managing spills

Sediment basins (if any) must be designed to include provision for spill containment. Spill management procedures during construction, including an Emergency Spill Plan, would be developed and aligned with the PIRMP and incorporated into the CEMP prior to construction. This would include measures to avoid spillages of fuels, chemicals, and fluids into waterways. The storage, handling and use of the materials would be undertaken in accordance with the Occupational Health and Safety Act 2000 and Workcover's Storage and Handling of Dangerous Goods Code of Practice (Workcover, 2005). Procedures would include:

- All fuels, chemicals, and liquids would be stored at least 50 m away from any waterways or drainage lines and would be stored in an impervious bunded area within the compound site.
- Bunded areas for refuelling and wash-down.
- Spill kits.
- Training of staff.

7.3.4 Maintenance of erosion and sediment control

Regular maintenance of all erosion and sediment controls on site is required after each storm event (more than 2 mm of rainfall) to remove trapped sediments and repair eroded areas. Accumulated sediments in the basins need to be checked every 2 months and removed when the sediment depth reaches 300 mm.

7.4 Physical sediment control measures

Whilst the installation of appropriate erosion control measures would greatly reduce the quantity of soil eroded from a construction site, some erosion will inevitably occur, and measures are therefore required to

ensure that eroded material is trapped and retained. Such measures include catch and diversion drains, check dams, level spreaders, sediment fences, constructed drainage and sediment basins.

7.4.1 Catch and diversion drains

Either individually or in combination, these structures are used to intercept and direct runoff water to a desired location. By doing so, sheet flow is converted to concentrated flow, and the time of concentration for runoff is decreased. There are two types of drains for clean and dirty runoff used during the construction phase, and they are often used in conjunction with level spreaders and check dams:

- Upslope runoff diversion drain (catch drain)
  - This diversion drain is an earth channel with lining designed to intercept and direct clean runoff from the undisturbed upstream catchment and divert it to an existing waterway, so that it does not enter the construction site. Drains would be lined with biodegradable organic fibre mesh hydro seeding and anionic bitumen emulsion spray at a rate of 3 L/m^2. Other suitable linings can also be used.
- Onsite runoff diversion drains
  - A temporary earth bank installed at the downstream end of disturbed areas to convey contaminated runoff to sediment basins.

All temporary drains would be constructed to avoid trees and other permanent structures, where feasible.

7.4.2 Check dams

A check dam is a small, temporary dam built across a swale or diversion drain. Its primary function is to reduce the velocity of flow in the channel and thus reduce erosion of the channel bed. The entrapment of sediment behind these structures is a secondary function. Check dams can be used:

- To protect a grass lined channel during initial establishment of vegetation.
- As a substitute for channel lining in a temporary channel.

Check dams can be constructed by using any materials on the site that can withstand the flow of water. Rock, logs and sandbag check dams can be the strongest if these materials are correctly placed in position. Wire netting, woven brush and straw bales can also be used.

Although check dams are not primarily intended as sediment trapping devices, larger-sized particles would inevitably accumulate behind them. This sediment should be removed before it accumulates to one-half of the original height of the dam and placed where it would not be washed back into the drainage system.

7.4.3 Level spreaders

A level spreader is an excavated outlet constructed with zero grade. It converts an erosive, concentrated flow of runoff into sheet flow, and discharges it at a non-erosive velocity onto an undisturbed area stabilised by vegetation.

Level spreaders may be used as outlets for diversion or perimeter banks or channels, where storm runoff has been intercepted and diverted to stable areas. They should be used only where the spreader can be constructed on undisturbed soil. The area directly below the spreader sill should be uniform in slope and well vegetated, allowing water to spread out as sheet flow.

The cross-sectional area and length of the level spreader would be designed by the contractor to be sufficient to discharge the design flow from the selected frequency rainfall event.

7.4.4 Sediment fencing and filters

Sediment fences/filters act as sediment mitigation measures for small, disturbed areas where it is impracticable to direct the runoff to sediment basins by diversion drains. Sediment fences/filters function by intercepting and filtering small volumes of runoff, which mainly occur as sheet flow.

Sediment fences would be selected that use woven polypropylene and cotton/geotextile thread with a flow rate greater than 110 L/m^2/s to Australian standards AS3706.9.

If straw bales are used in conjunction and in addition to sediment fencing, the straw bales should be weed free to ensure that weeds are managed appropriately and do not spread.

7.4.5 Airborne dust and sediments

During construction, air quality issues may arise from temporary increases in local dust (including total deposited dust, total suspended solids, and fine particulate matter) emissions associated with vegetation clearing, excavation and demolition works and the handling, storage and disturbance of soils and materials; and other emissions such as exhaust fumes associated with the operation of construction machinery. This might cause direct impacts on the residential and commercial properties adjacent to the project.

Although all phases of construction have the potential to adversely impact upon local ambient air quality, the following activities present the greatest risk:

- Excavation activities.
- Materials handling and storage operations.
- Demolition works.
- Compound, laydown, and storage area operations.

The primary issues which need to be managed associated with these phases of construction are identified below:

- Site preparation and clearing: increased risk of windborne erosion arising from disturbed and exposed surfaces.
- Earthwork and excavations: temporary increases in local dust and exhaust emissions associated with:
  - Windborne dust emanating from disturbed/exposed surfaces.
  - Dust and debris arising from haulage of materials.
- Revegetation work: increased risk of windborne erosion arising from non-vegetated surfaces.

7.5 Sediment basins (if any)

If the site area to be disturbed is not sufficiently large, it may not warrant the need to provide a sediment basin for the construction phase. This critical catchment area varies from one location to another as it also depends on the soil and climatic factors that are described in the Blue Book.

The Blue Book (Landcom 2004 and DECC 2008) criteria of a "minimum 150 m^3 of annual sediment loss" has been investigated. This criterion indicates that if the estimated annual soil losses from a disturbed catchment is less than 150 m^3 then a sediment basin may not be required, subject to other erosion and sediment controls being implemented. It is critically important that the contractor adequately implements local erosion and sediment controls if a sediment basin is not used. Relevant extracts from the Blue Book include:

- *".....the average annual soil loss from the total area of land disturbance can be estimated (Appendix A). Where this is less than 150m^3 per year, the building of a sediment retention basin can be considered*

unnecessary. In such circumstances, alternate measures may be employed to protect the receiving waters." (Blue Book Section 6.3.2, Clause (d))

- *"Sediment basin(s) must be constructed where the calculated total annual soil loss from the disturbed lands is more than 150m³. Where the calculated basin size is less than 150m³, other erosion and sediment control devices can be installed instead."* (Blue Book, Appendix M, Clause (54)).

Estimations of the measured areas to be disturbed on the various sites which have separate outlets points have shown that catchment soil losses are less than 150 m³. Therefore, sediment basins are not required for this site as the areas are relatively small, however local sediment control methods are required.

The critical area of site disturbance before a sediment basin is needed for this site is 0.75 ha, which corresponds to an annual soil loss of 35 m^3 and a sediment basin total volume of 140 m^3, which are both less than 150 m^3.

The design criteria and design parameters for sizing a sediment basin have been include in this section even though they are not required. This has been done in case there are changes to the catchment area that may require sediment basins to be included.

7.5.1 Design criteria for sediment basin sizing

The design criteria for the temporary water quality treatment controls implemented during the construction phase are aimed at achieving the water quality objectives and meeting the performance objectives described in Section 4.2.

In general, sediment basins have been located where they will collect a high proportion of sediment-laden runoff from disturbed areas of the construction site, and where they are accessible for maintenance. The ideal location of the sediment basins is on the downstream side of the proposed construction area and immediately upstream of the proposed culvert crossings. However, in determining locations, consideration has also been given to minimising impact upon existing or proposed utilities, property owners, and environmental exclusion zones or existing trees and vegetation.

The sediment basins have been designed as Type D basins, as per the Blue Book (Landcom 2004; DECC 2008) classifications and the site-specific soil test results. The basin design provides a volume for settling and storage. The settling zone volume has been estimated using the appropriate design rainfall depth and catchment areas. The storage zone has been estimated using the Revised Universal Soil Loss Equation. The parameters that have been used to size the sediment basins are outlined in Table .

Table 7-1. Design criteria for sizing sediment basins (Sources: Landcom 2004; DECC 2008)

Parameter	Value	Comments
Rainfall Parameters		
Rainfall depth duration (days)	5	5 day adopted as standard duration
Rainfall percentile	85th	85th adopted for sensitive receiving creek
Rainfall Depth (mm) – 5 Day	85th = 27.7 mm	For Scone (closest available site in Blue Book) 80th = 22.6 mm
Volumetric Runoff Coefficient, C_v	0.56	0.56 adopted for rainfall depth in the range of 21 to 30 mm and Hydrologic group D. Table F2 of Blue Book.
Rainfall intensity for 2-year ARI, 6 h duration	7.7 mm/h	Refer to Rainfall Erosivity below

Revised Universal Soil Loss Equation and soil Parameters		
Soil/sediment Type	C, D or F	Varies, mainly type F, type D, and small localised pockets of type C. Type D has been adopted
Erodibility, k	0.03 to 0.04	K=0.04 has been adopted
Rainfall Erosivity, R	1,446	Based on Blue Book map and rainfall intensity above
Hydrologic Soil Group	D	For high runoff potential, Ref: Appendix F of Blue Book
Soil Cover, C	1	Corresponding to expected type of activities on site
Soil Conservation Practices, P	1.3	Corresponding to expected type of activities on site
Length Slope Factors, LS	Variable	Determined separately for main car park area and some localised steeper embankment areas (cut or fill) assumed to be less than 5%.
Sediment Yield Time Period (months)	12 months for maximum area test and 2 months for any basins	

7.5.2 Methodology for sediment basin sizing

The design methodology and the relevant equations used in the sizing of sediment basins are described in the following sections of the Blue Book:

1. Revised Universal Soil Loss Equation which estimates annual soil loss amount: pages A1–A11 of Appendix A of the Blue Book.
2. Settling zone volumetric requirements: pages 6–22 to 6—25 of Chapter 6.
3. Rainfall erosivity estimation: Appendix B.
4. Volumetric runoff coefficient (Type D): pages F1–F4 of Appendix D.

The required volume of each sediment basin was determined according to the maximum catchment area that would drain to the basin during the various stages of construction assuming that all external catchment areas would divert away from the basins and the parameters listed in Table . The required basin volume includes the volume of both the settling zone and the sediment storage zone.

8. Summary of mitigation measures

A summary of the erosion and sediment project specific risks and mitigation measures to be adopted to manage soil and erosion risks during construction of the project are detailed in Table .

Table 8-1. Summary of project specific risks and mitigation measures

Identified risk	Location on project	Comments on identified risk	Proposed control measures
Existing drainage	Project wide	Mixing of clean and dirty runoff.	Use temporary piping, drainage diversions and culverts during construction stages to divert clean water.
Ecology	Project wide	Road widening activities impacting the environmentally sensitive areas. Sediment controls affecting natural habitats, vegetation, protected coastal wetlands and national park estate.	Undertake careful consideration of where controls are required and appropriately size and locate them to minimise impacts to vegetation. Use turbidity barrier.
Existing services	Project wide (where sediment controls may clash)	Sediment controls clashing with existing services and structures.	Coordinate with existing and proposed design interfaces to avoid clashes between sediment controls and existing services/structures.
Land availability	Project wide	Land availability for controls and stockpiles.	Leasing land/temporary construction boundaries. Use temporary drainage networks.
Soils	Variable areas dependent on soil conditions	Dispersible soils, acid sulphate rock, shallow groundwater table.	Provide flocculation during construction stage (super fine gypsum). Provide limestone lining treatment in drains leading to basins and at base of sediment basins.
Climate	Project wide	Air quality issues from temporary increases in dust. Severe weather events.	During high wind days, it is especially important to monitor the generation of dust and control them via usage of temporary covers and water trucks. During dry seasons, keep track of revegetation efforts with watering of plants or planting hardier, adaptable, drought tolerant plants.

9. Soil and water monitoring

A recommended monitoring and inspection plan is provided in Table . Monitoring requirements for the Project are listed in Section 10 of the Stage 3 Bayswater Ancillary Works EMS.

Table 9-1. Water management monitoring plan

Monitoring	Frequency	Responsibility	Records
Control implementation inspection: Water Quality and Erosion controls have been installed effectively prior to construction.	Once	Project Contractor	▪ Inspection Checklist
Control effectiveness inspection: General observations of water quality and erosion controls to ensure they remain installed effectively.	Daily	Project Contractor	▪ Inspection Checklist
Environmental site inspection: ▪ Inspection of control measures – clean, adjust and replace as required ▪ Inspection of disturbed areas and stockpiles – ensure dust and sediment control measures are active ▪ Inspection of sealed roads – identify any sediment/soil which has been transferred offsite ▪ Inspection of local water quality (i.e. turbidity, hydrocarbon spills/slicks) – identify any potential spills or deficient erosion and sediment controls.	Weekly	Project Contractor	▪ Inspection Checklist
Adverse weather event inspection: ▪ Inspection of control measures ▪ Inspection of disturbed areas and stockpiles ▪ Inspection of sealed roads ▪ Inspection of local water quality.	As required	Project Contractor	▪ Inspection Checklist
Rainfall and weather forecasts.	Daily	Project Contractor	▪ Daily Site Diary
Surface water quality testing.	As required	Project Contractor	▪ Water Quality Report
Controlled discharge monitoring.	As required	Project Contractor	▪ Water Quality Report

The following sections provide guidance for all surface water and groundwater sampling conducted by personnel during the project.

9.1 In situ/field testing

In situ water quality testing is to be carried out where sufficient water is present. In-situ water quality parameters to be measured include:

- pH
- Temperature (°C)
- Electrical conductivity (µS/cm)
- Salinity (ppm)
- Turbidity (NTU)
- Dissolved oxygen (% saturation and mg/L)
- Redox potential (mV).

Measurements will be collected at the edge of the waterway (to avoid streambed disturbance) between 15 cm and 30 cm below the surface of the water. Sampling depth is to be recorded in the field.

For each parameter measured in situ, three replicate measurements will be recorded about 10 metres apart. Each parameter will then be recorded as the average (arithmetic mean) of the three measures.

9.2 Sample collection

All surface water samples will be collected according to methods outlined in the Australian Guidelines for water quality monitoring and reporting (ANZECC & ARMCANZ 2000b) and with reference to procedures outlined in the Approved Methods or Sampling and Analysis of Water Pollutants in NSW (DEC 2004).

Grab samples will be collected manually from the sampling locations identified by the Principal Contractor. The volume of sample collected will be of sufficient volume for the required analyses, including any repeat analyses and will be collected into sampling bottles and jars provided by the NATA accredited testing laboratory.

9.3 Sample labelling and preservation

All samples will be clearly labelled with unique sampling identification nomenclature consisting of the sample date, location, and sampler initials.

All samples will be kept cool by being placed in an insulated cool box (or equivalent) with ice to be kept ≤6°C for preservation prior to dispatch to the NATA accredited testing laboratory under chain of custody procedures.

9.4 Decontamination and calibration

Sampling equipment will be cleaned and decontaminated between sampling sites as well as on return to the laboratory at the end of each sampling trip.

In addition, the water quality probe must be calibrated prior to each sampling event and must be maintained by a regular service regime using an accredited repairer. A log for the water quality probe that details service history, repairs, calibration and other relevant information will be maintained.

9.5 Quality control samples

Duplicate water quality samples will be taken every 10 water samples to verify laboratory quality assurance (QA) and quality control (QC). Further to this, internal laboratory QA/QC is conducted on a batch basis, as per standard laboratory practice, and therefore may not be specific to samples. In the event that laboratory QA/QC is conducted on Project samples, this information will be compared.

9.6 Training

Construction workers who attend the Project site may be required to undergo training and awareness programs regarding water sampling activities and procedures. Compulsory training will be determined by AGLM and will be developed and delivered by the Principal Contractor. Training delivered by the Principal Contractor will be subject to approval and auditing by AGLM to ensure it aligns with AGL induction requirements and fulfils the conditions of SSD 8889679.

Delivery of training may include:

- Toolbox Talks
- Work Inductions
- Meetings lead by the Environment Team
- Posters and educational items.

Training should detail:

- The contents of this SWMP
- Legislation and legislative requirements
- Water protection requirements
- Soil and water monitoring procedures

Training will be undertaken in accordance with Section 7.4 of the Stage 3 Bayswater Ancillary Works EMS.

10. Compliance

10.1 Roles and responsibilities

Roles and responsibilities are outlined in Section 7.3 of the Stage 3 Bayswater Ancillary Works EMS.

10.2 Inspections

Inspections of the Project site will occur as outlined in Section 7.6 of the Stage 3 Bayswater Ancillary Works EMS.

10.3 Incidents and complaints

Incident management will be managed in accordance with the process outlined in Section 7.5 of the Stage 3 Bayswater Ancillary Works EMS.

Environmental incidents relating to water quality may include but not be limited to:

- Uncontrolled discharges from the sediment basin due to overflows
- Discharging water from the sediment basin which does not meet the discharge criteria
- Uncontrolled release of contaminants from spills and leaks.

Complaints and enquiries will be managed in accordance with the process outlined in Section 6.3 of the Stage 3 Bayswater Ancillary Works EMS.

10.4 Document review and update

All strategies, management plans, and programs that are produced to meet the SSD 8889679 development consent requirements will be regularly reviewed as part of a continual improvement process to ensure they remain current and relevant to the Project.

It is a requirement of the EMS that the associated plans, studies and strategies are reviewed and updated within three months of the following events, including:

- The submission of an environmental incident report
- The submission of an audit report
- The approval of any modification to the conditions of the development consent
- A direction of the DPE Planning Secretary.

Document and records management for the Project is described in Section 7 of the Stage 3 Bayswater Ancillary Works EMS.

11. References

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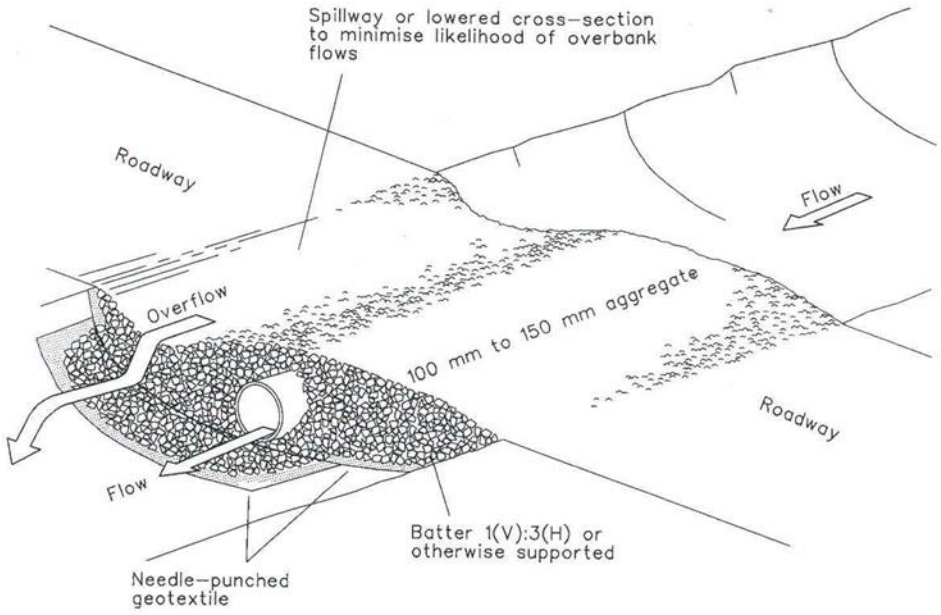
Appendix A. Blue Book Standard Drawings

Several Standard Drawings from Landcom (2004) are referred to in this document, either directly or indirectly. These are appended here:

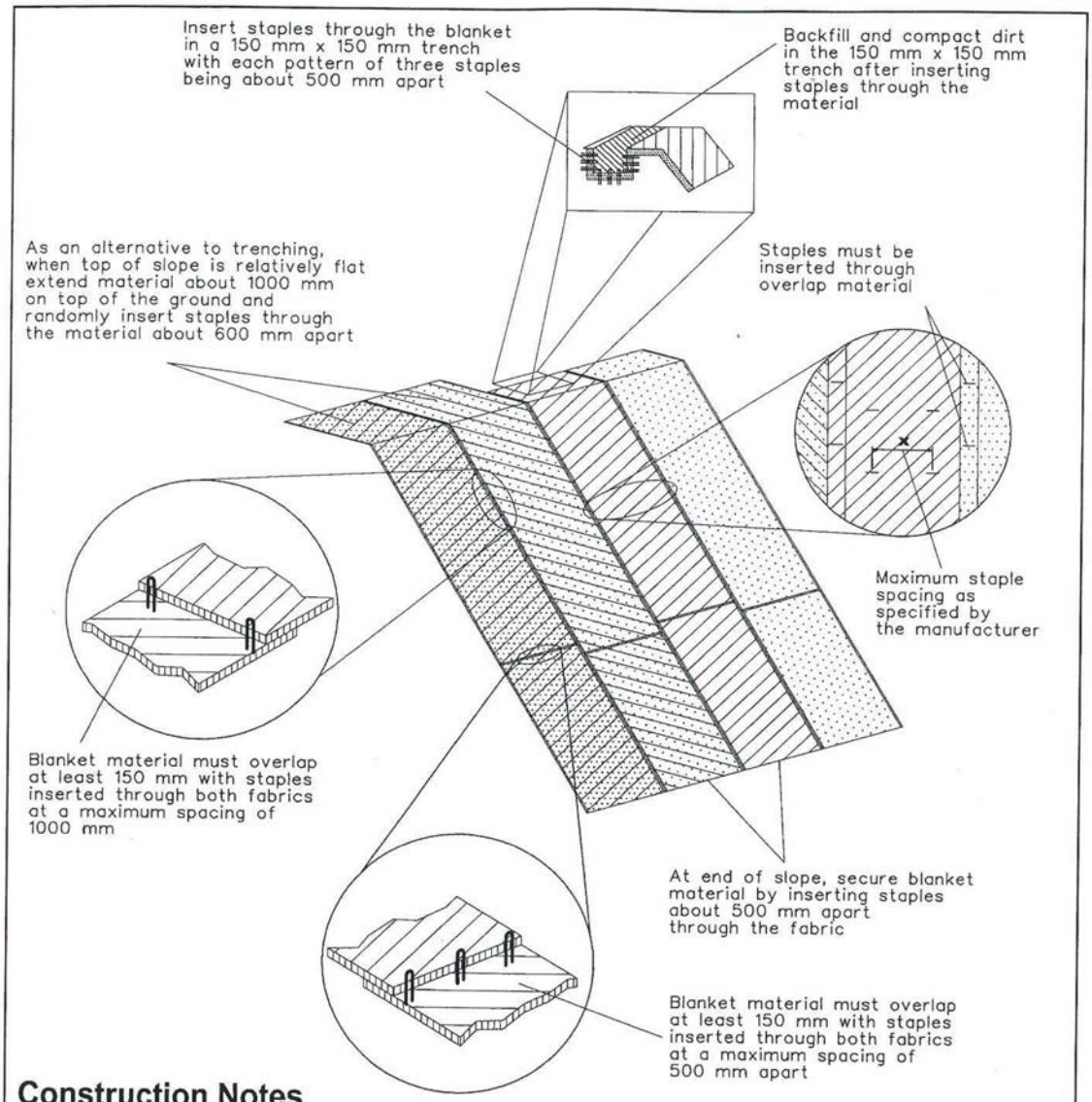
- Standard Drawing SD 5-1 (Temporary Waterway Crossing)
- Standard Drawing SD 5-2 (Sheet Flow)
- Standard Drawing SD 5-3 (Cellular Confinement Systems)
- Standard Drawing SD 5-4 (Rock Check Dam)
- Standard Drawing SD 5-5 (Earth Bank (Low Flow))
- Standard Drawing SD 5-6 (Earth Bank (High Flow))
- Standard Drawing SD 5-7 (RECP: Concentrated Flow)
- Standard Drawing SD 5-8 (Energy Dissipater)
- Standard Drawing SD 6-3 (Earth Basin - Dry)
- Standard Drawing SD 6-4 (Earth Basin - Wet)
- Standard Drawing SD 6-7 (Straw Bale Filter)
- Standard Drawing SD 6-8 (Sediment Fence)
- Standard Drawing SD 6-9 (Alternative Sediment Fence)
- Standard Drawing SD 6-10 (Turbidity Barrier)
- Standard Drawing SD 6-11 (Mesh and Gravel Inlet Filter)
- Standard Drawing SD 6-12 (Geotextile Inlet Filter)
- Standard Drawing SD 6-13 (Kerbside Turf Strip)
- Standard Drawing SD 6-14 (Stabilised Site Access)
- Standard Drawing SD 6-15 (Control of Wind Erosion)
- Standard Drawing SD 7-1 (Seedbed Preparation)



Construction Notes

1. Prohibit all traffic until the access way is constructed.
2. Strip any topsoil and place a needle-punched textile over the base of the crossing.
3. Place clean, rigid, non polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm.
4. Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3(H): 1 (V) slope on side batters.
5. Install a lower section to act as an emergency spillway in greater than design storm events.
6. Ensure that culvert outlets extend beyond the toe of fill embankments.

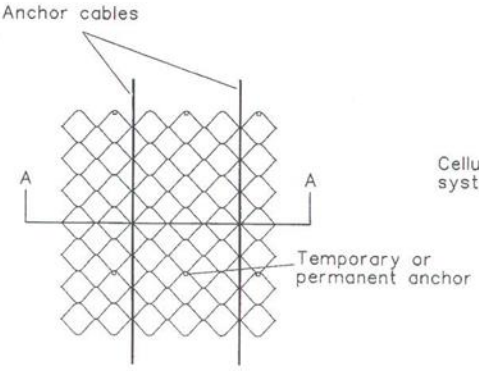
TEMPORARY WATERWAY CROSSING **SD 5-1**

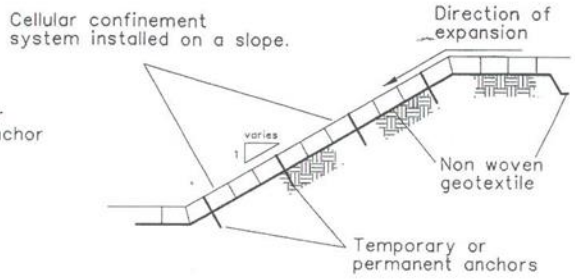


Construction Notes

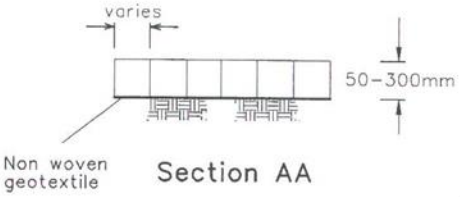
1. Remove any rocks, clods, sticks or grass from the ground surface before laying the matting.
2. Spread topsoil to at least 75 mm depth.
3. Where appropriate, complete fertilising and seeding on a properly prepared seedbed (Standard Drawing 7-1) before laying the matting.
4. Ensure the fabric can be continuously in contact with the soil by grading the surface carefully first.
5. Lay the matting in "shingle-fashion" with the ends of each upstream roll overlapping the next roll downslope.
6. Ensure sufficient staples are used to maintain a good contact between the soil and the matting.

RECP : SHEET FLOW **SD 5-2**

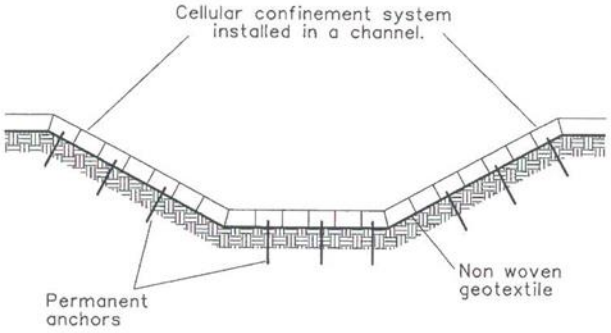




Slope Protection System



Section AA

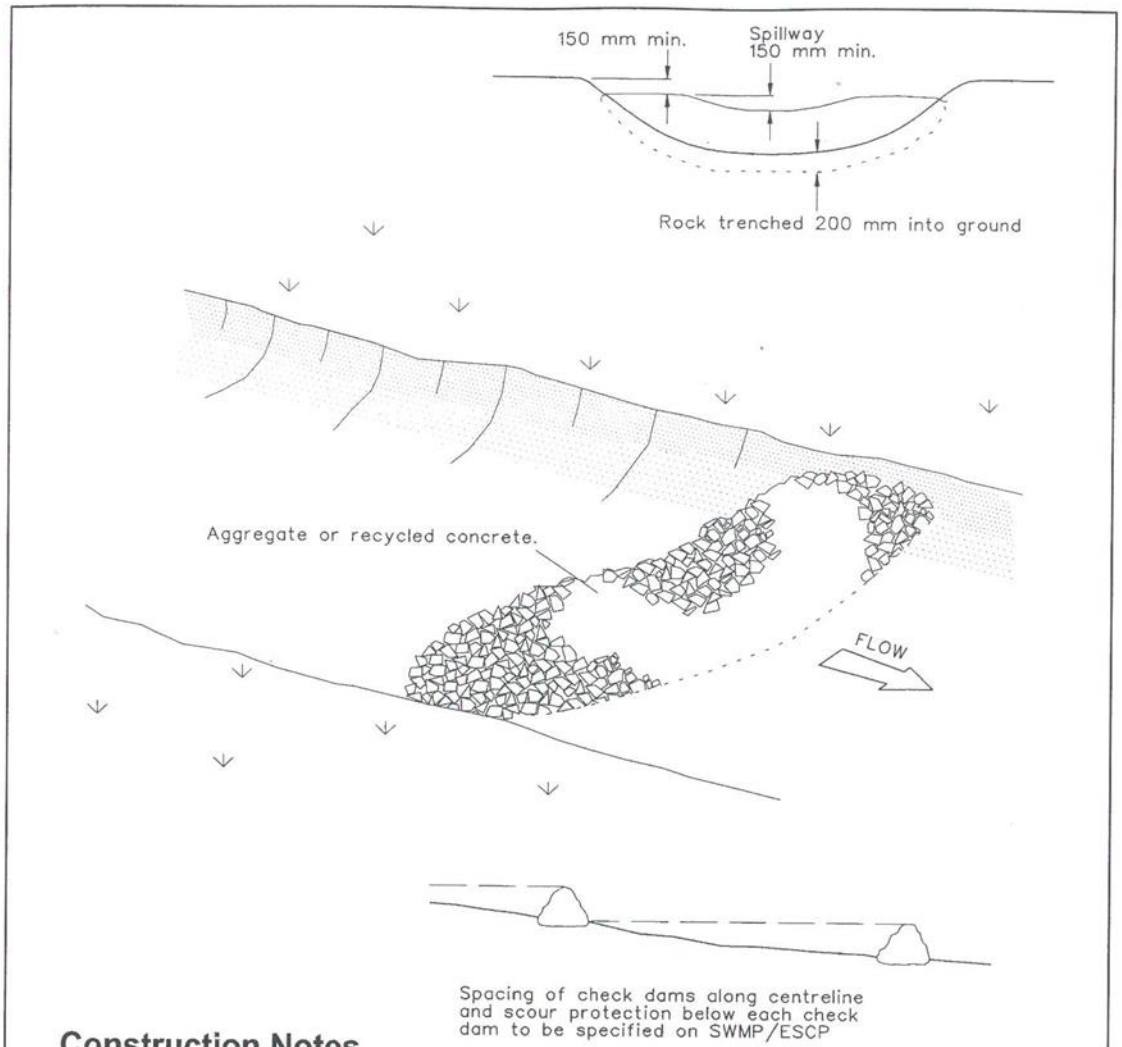


Channel Protection System

Construction Notes

1. Undertake design only with the help of a suitably qualified geotechnical engineer.
2. Anchor systems on steep slopes to prevent sliding or movement under gravitational forces. This might include the use of high tensile, low creep cables made of polyester (not polypropylene), rope or steel wire.
3. Place thick, non woven geotextiles under the cellular confinement system to allow for lateral drainage.
4. Fill the cells with soil, rock or concrete depending on the application.

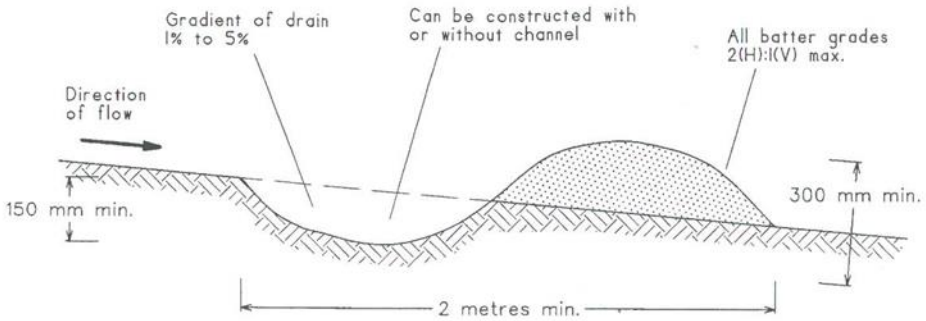
CELLULAR CONFINEMENT SYSTEMS **SD 5-3**



Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.
3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.
4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM **SD 5-4**

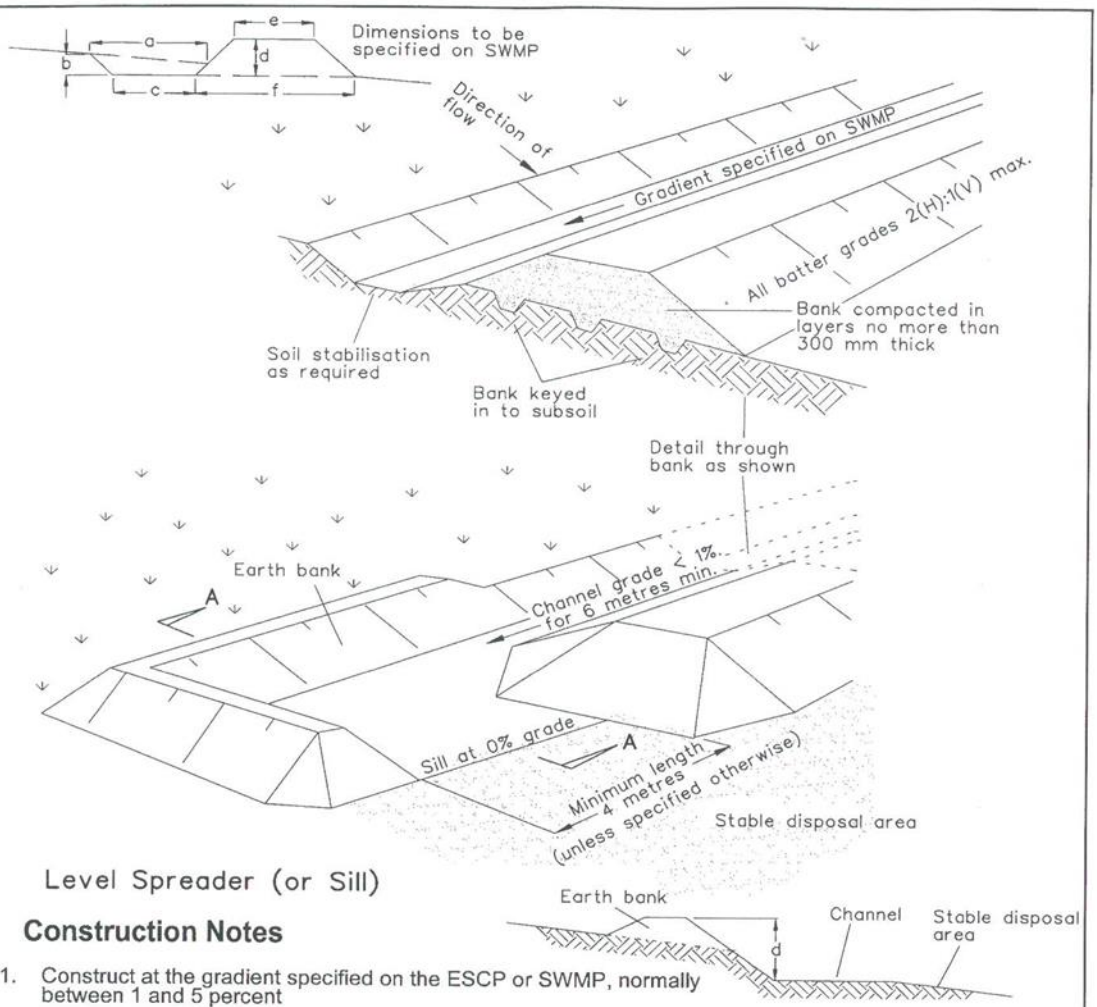


NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

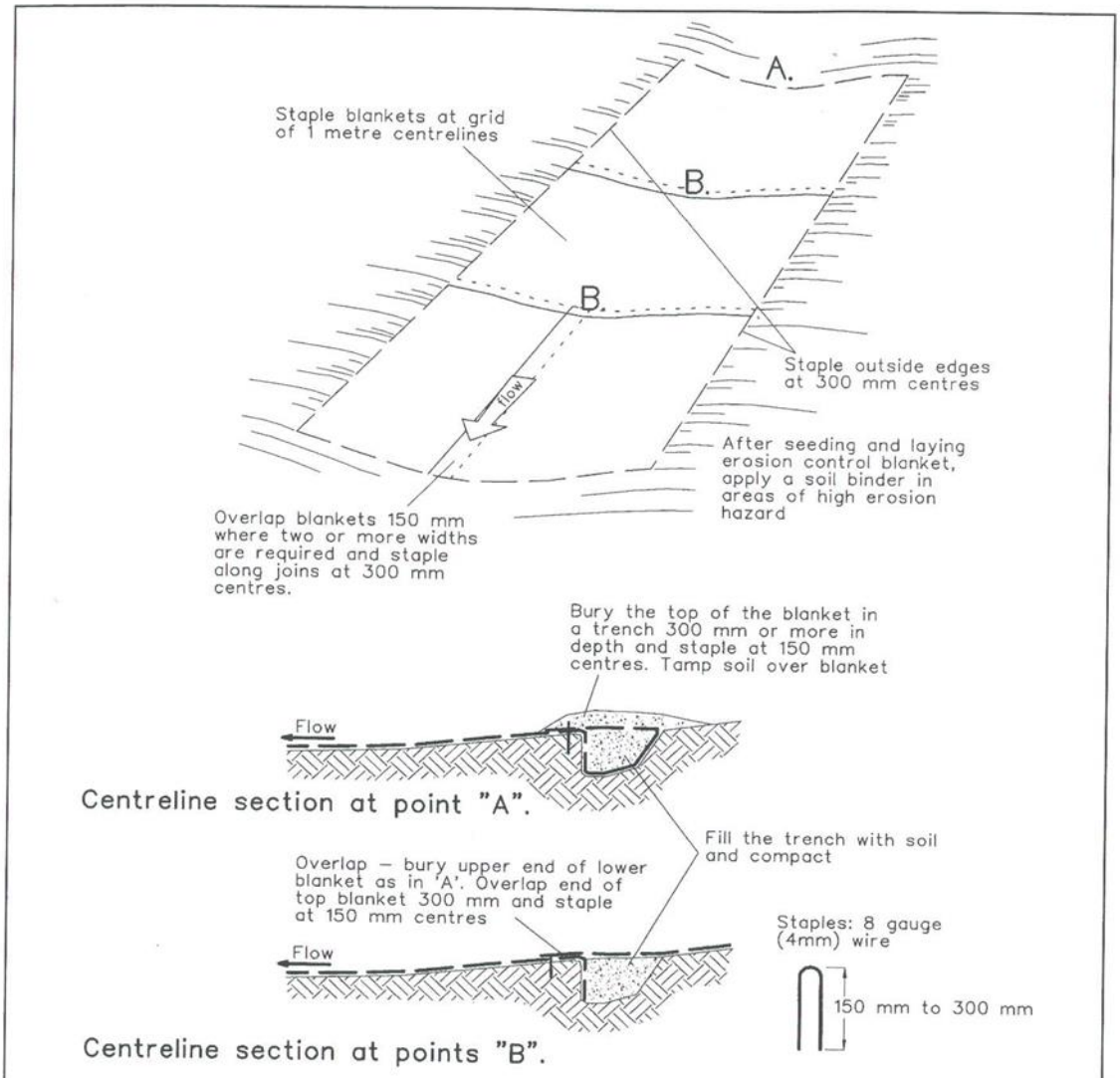
EARTH BANK (LOW FLOW) **SD 5-5**



Construction Notes

1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

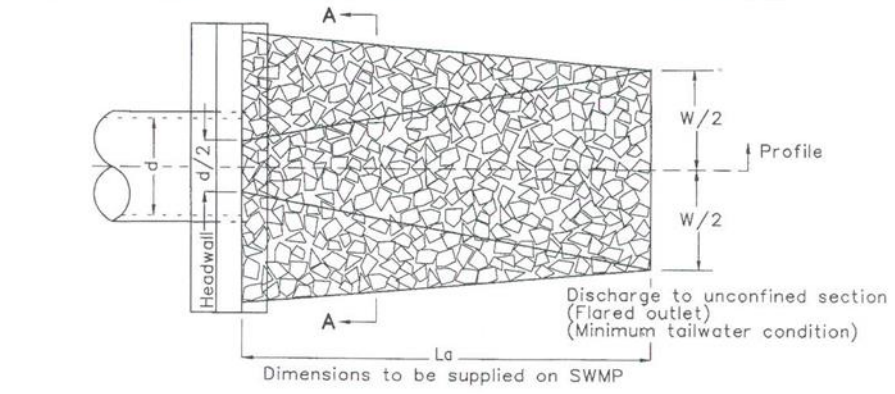
EARTH BANK (HIGH FLOWS) **SD 5-6**



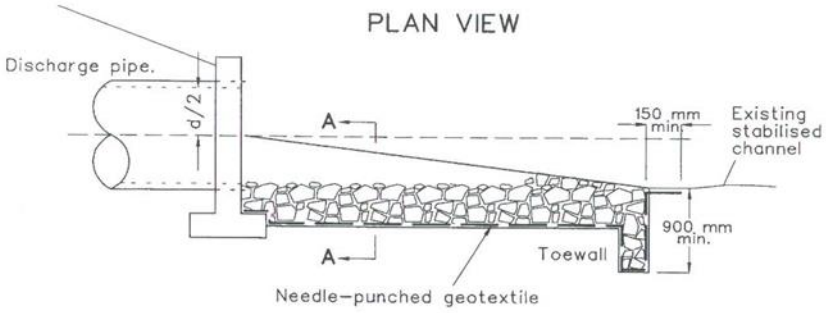
Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

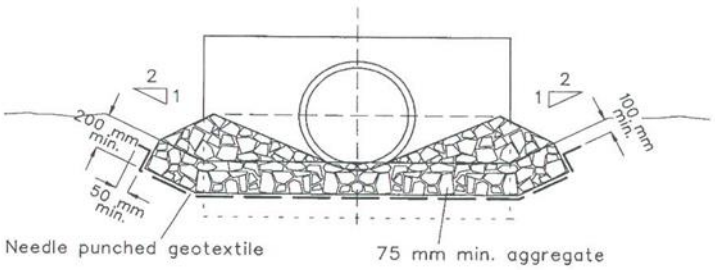
RECP : CONCENTRATED FLOW **SD 5-7**



PLAN VIEW



PLAN VIEW

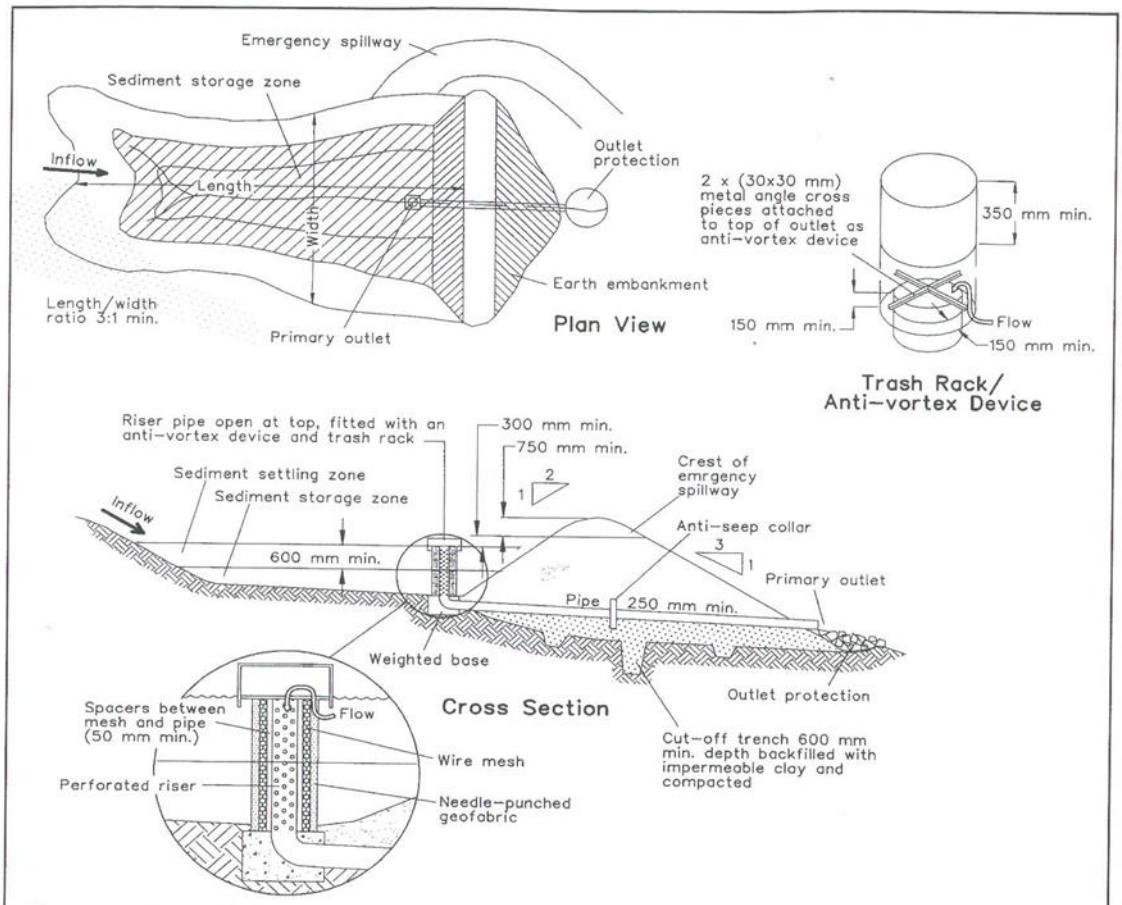


CROSS SECTION AA

Construction Notes

1. Compact the subgrade fill to the density of the surrounding undisturbed material.
2. Prepare a smooth, even foundation for the structure that will ensure that the needle-punched geotextile does not sustain serious damage when covered with rock.
3. Should any minor damage to the geotextile occur, repair it before spreading any aggregate. For repairs, patch one piece of fabric over the damage, making sure that all joints and patches overlap more than 300 mm.
4. Lay rock following the drawing, according to Table 5.2 of Landcom (2004) and with a minimum diameter of 75 mm.
5. Ensure that any concrete or riprap used for the energy dissipater or the outlet protection conforms to the grading limits specified on the SWMP.

ENERGY DISSIPATER **SD 5-8**

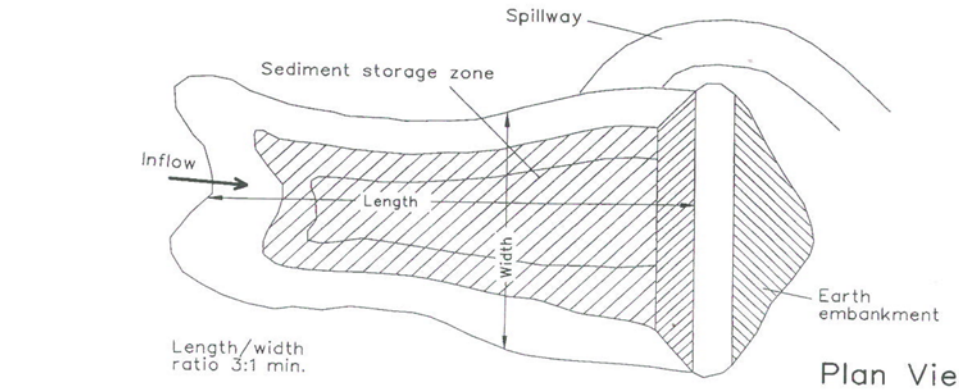


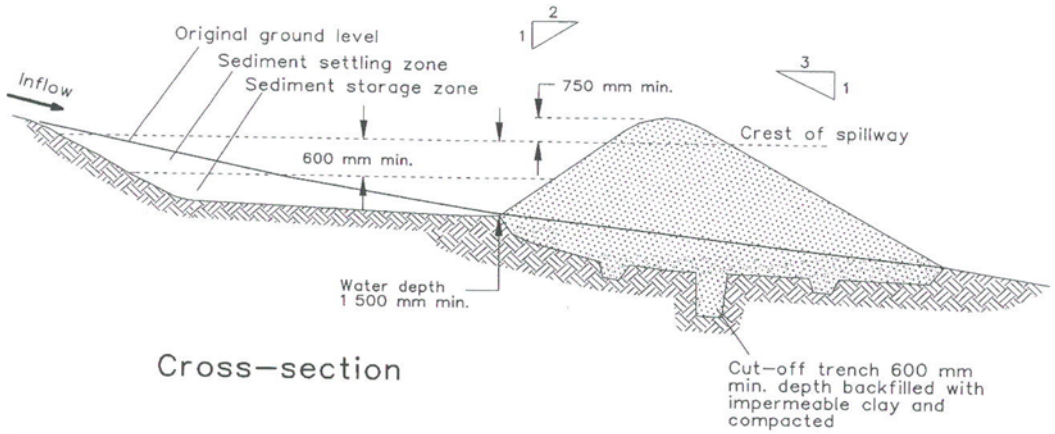
Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Form a cut off trench under the centreline of the embankment 600 mm deep and 1,200 mm wide, extending to a point on the watercourse wall above the riser sill level.
3. Maintain the trench free of water and recompact the materials with equipment as specified In the SWMP to 95 per cent Standard Proctor Density.
4. Select fill according to the SWMP that is free from roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond the compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Install the pipe outlet with seepage collars as specified in the SWMP and Standard Drawing 6-3b.
8. Form batter grades at 2(H):1(V) upstream and 3(H):1(V) downstream or as specified in the SWMP

EARTH BASIN - DRY
(APPLIES TO 'TYPE C' SOILS ONLY)

SD 6-3



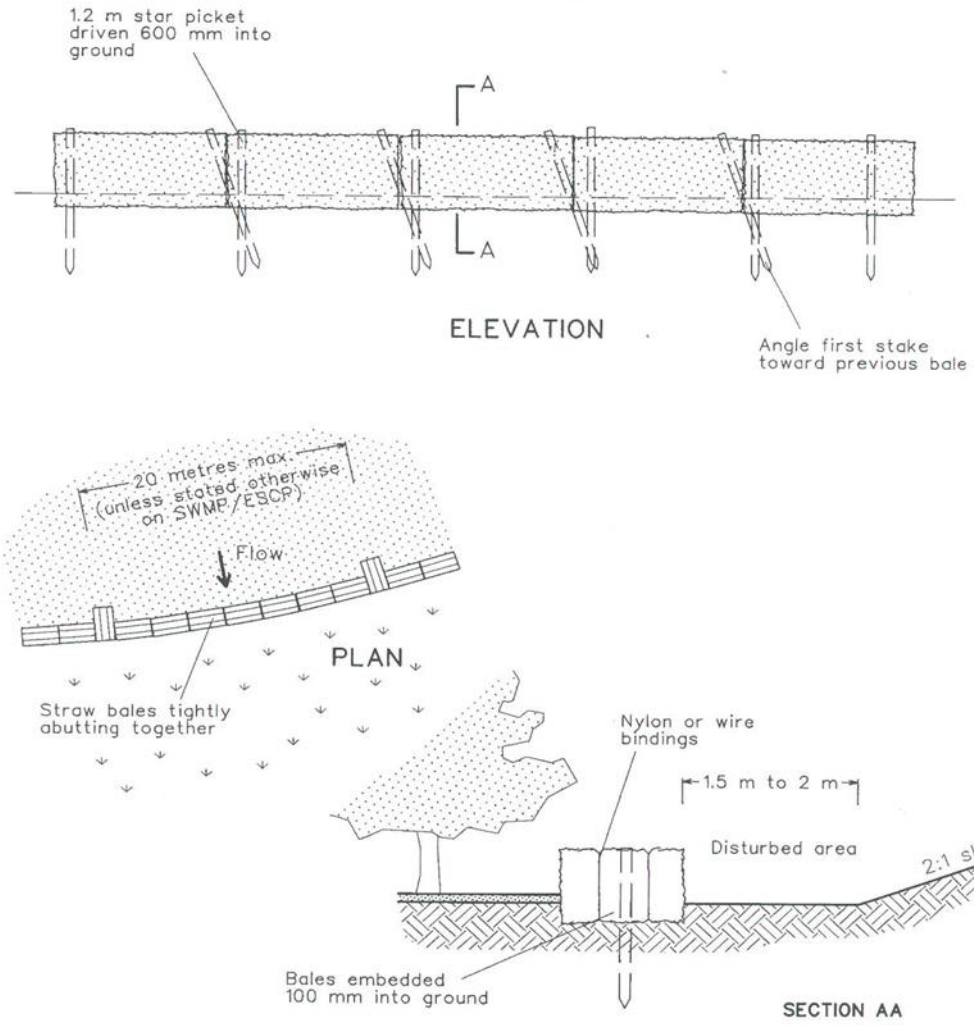


Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET
(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

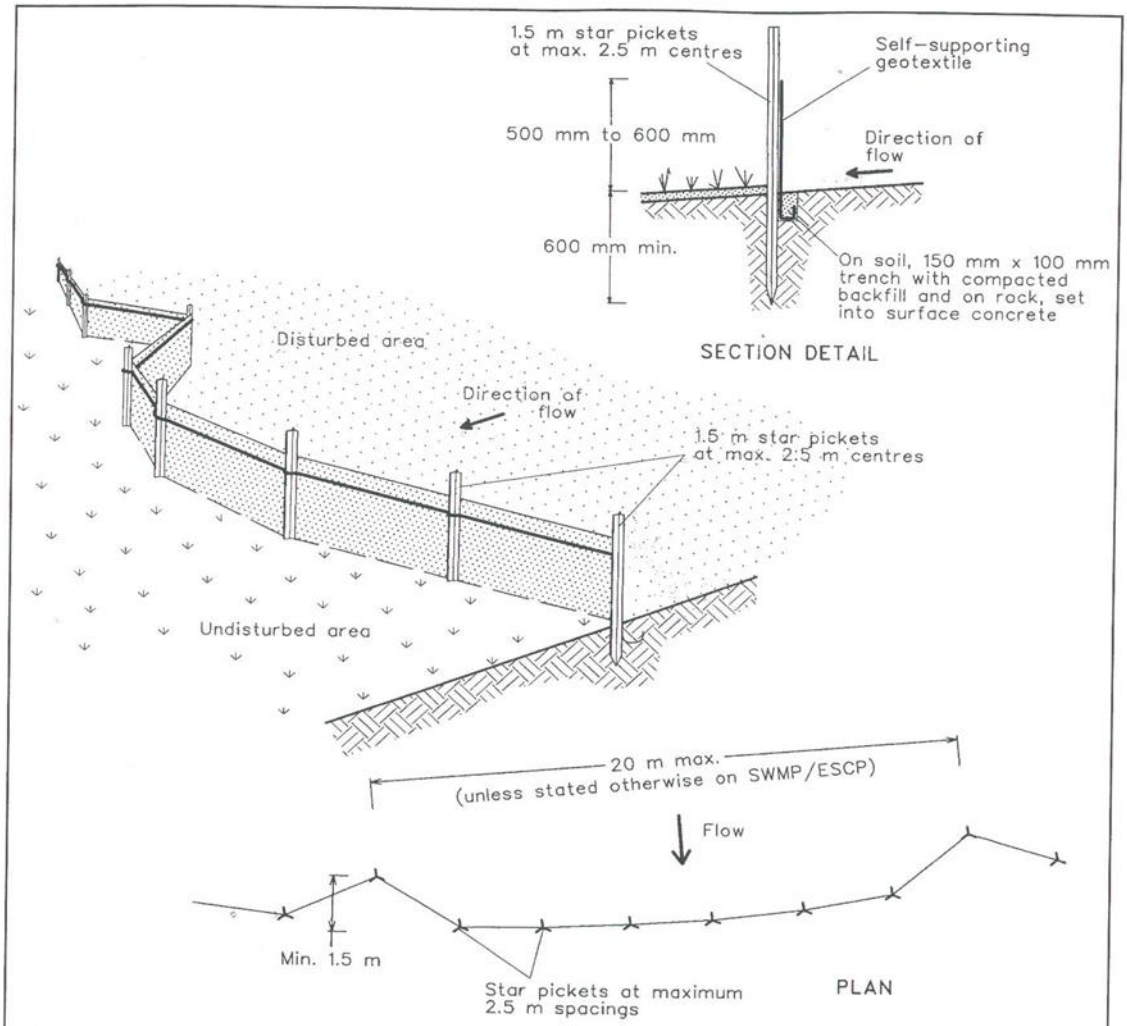
SD 6-4



Construction Notes

1. Construct the straw bale filter as close as possible to being parallel to the contours of the site.
2. Place bales lengthwise in a row with ends tightly abutting. Use straw to fill any gaps between bales. Straws are to be placed parallel to ground.
3. Ensure that the maximum height of the filter is one bale.
4. Embed each bale in the ground 75 mm to 100 mm and anchor with two 1.2 metre star pickets or stakes. Angle the first star picket or stake in each bale towards the previously laid bale. Drive them 600 mm into the ground and, if possible, flush with the top of the bales. Where star pickets are used and they protrude above the bales, ensure they are fitted with safety caps.
5. Where a straw bale filter is constructed downslope from a disturbed batter, ensure the bales are placed 1 to 2 metres downslope from the toe.
6. Establish a maintenance program that ensures the integrity of the bales is retained - they could require replacement each two to four months.

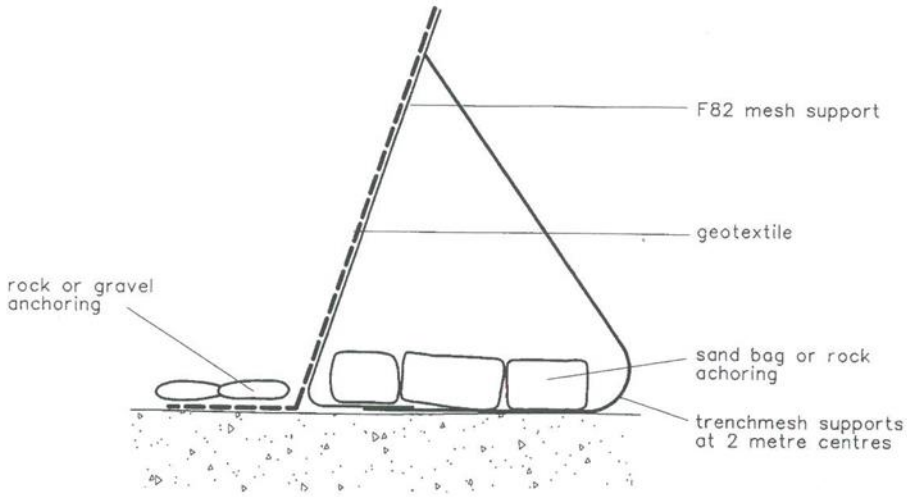
STRAW BALE FILTER **SD 6-7**



Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

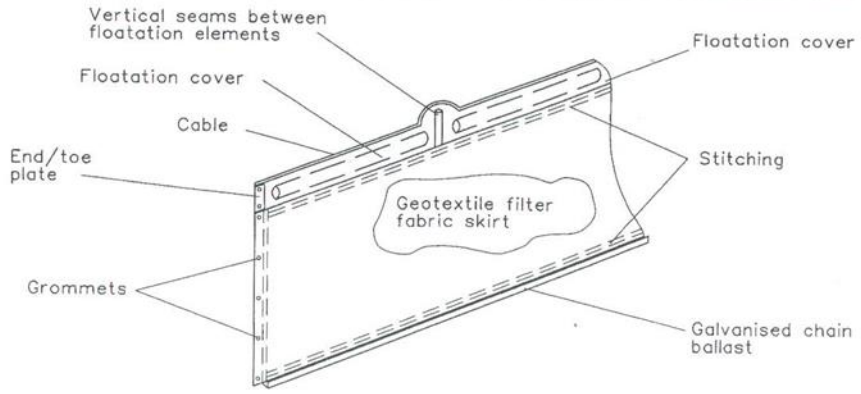
SEDIMENT FENCE **SD 6-8**

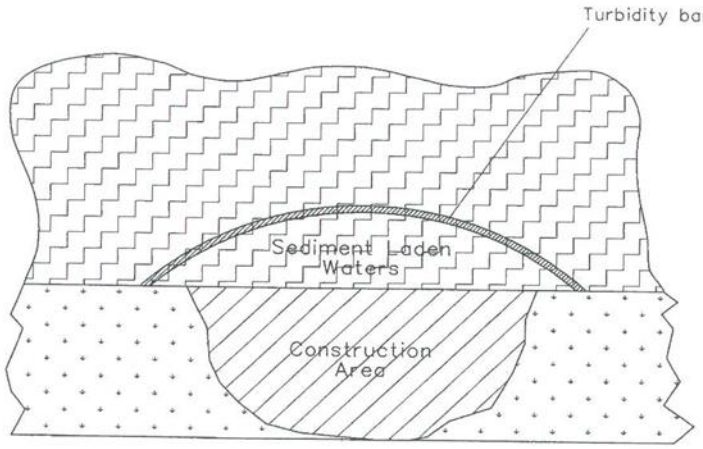


Construction Notes

1. Install this type of sediment fence when use of support posts is not desirable or not possible. Such conditions might apply, for example, where approval is granted from the appropriate authorities to place these fences in highly sensitive estuarine areas.
2. Use bent trench mesh to support the F82 welded mesh facing as shown on the drawing above. Attach the geotextile to the welded mesh facing using UV resistant cable ties.
3. Stabilise the whole structure with sandbag or rock anchoring over the trench mesh and the leading edge of the geotextile. The anchoring should be sufficiently large to ensure stability of the structure in the design storm event, usually the 10 year event.

ALTERNATIVE SEDIMENT FENCE **SD 6-9**

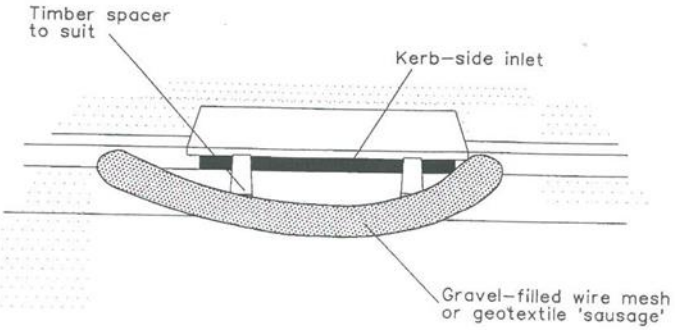


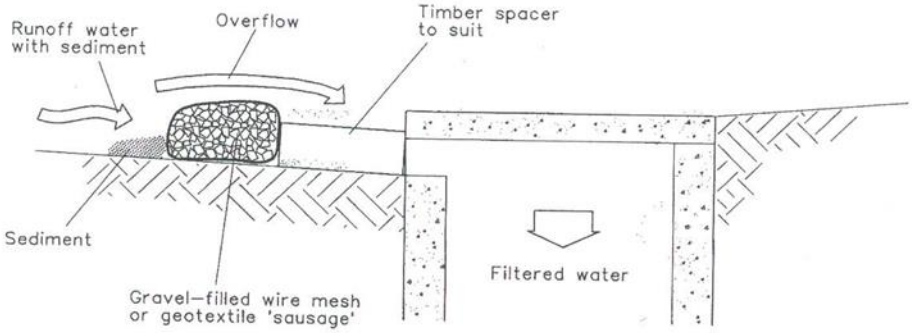


Construction Notes

1. Use turbidity barriers only where high flows are unlikely to remove accumulated sediment and/or move the curtain significantly.
2. Where the barrier is to remain in place for more than one month, ensure the floatation cover is a UV-resistant, durable material.
3. Use only closed cell foam or foam-filled PVC piping as floatation elements. Do not use unfilled pipes.
4. Use only woven or heat-set non woven geotextiles. Needle-punched, non woven geotextiles can become fouled with debris that fray and delaminate them as they move with the waves or currents.
5. Remove captured sediment before the barrier is decommissioned.
6. In tidal areas, ensure the barrier can rise and fall without being moved from its position.

TURBIDITY BARRIER **SD 6-10**



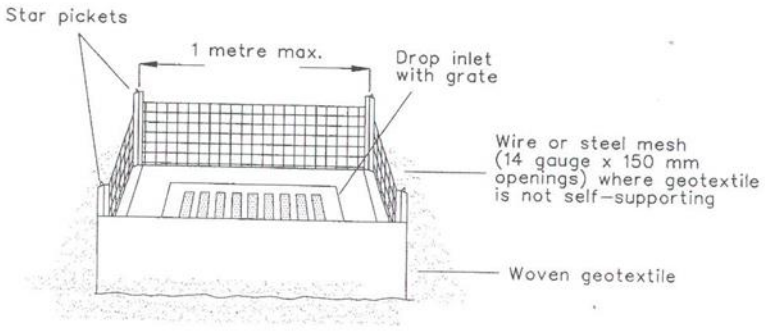


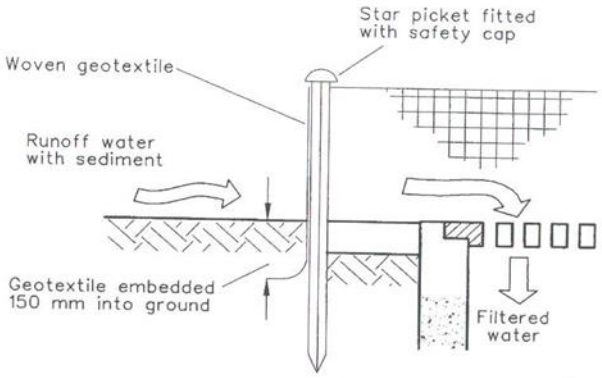
NOTE: This practice only to be used where specified in an approved SWMP/ESCP.

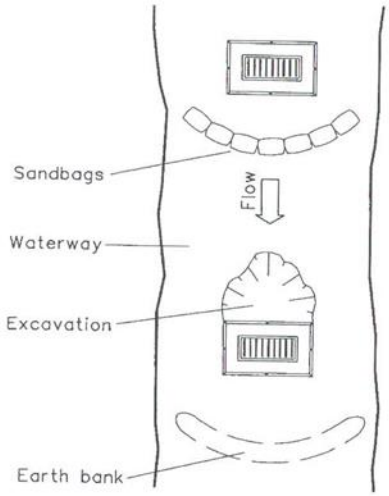
Construction Notes

1. Install filters to kerb inlets only at sag points.
2. Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 25 mm to 50 mm gravel.
3. Form an elliptical cross-section about 150 mm high x 400 mm wide.
4. Place the filter at the opening leaving at least a 100-mm space between it and the kerb inlet. Maintain the opening with spacer blocks.
5. Form a seal with the kerb to prevent sediment bypassing the filter.
6. Sandbags filled with gravel can substitute for the mesh or geotextile providing they are placed so that they firmly abut each other and sediment-laden waters cannot pass between.

MESH AND GRAVEL INLET FILTER **SD 6-11**





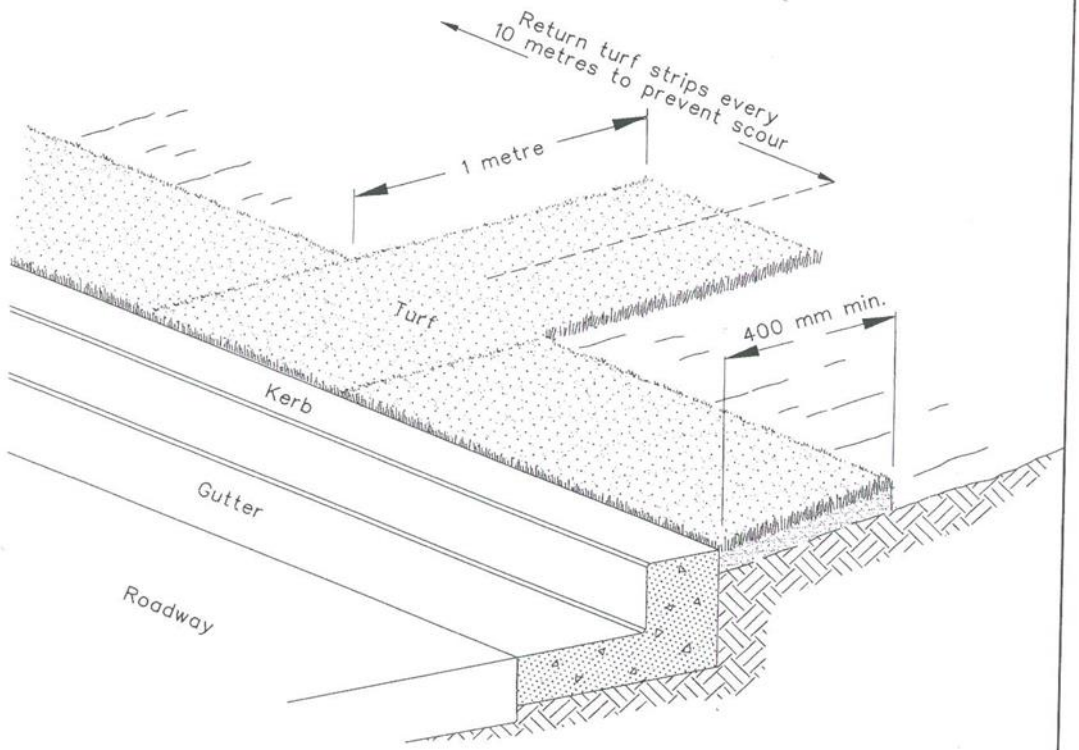


For drop inlets at non-sag points, sandbags, earth bank or excavation used to create artificial sag point

Construction Notes

1. Fabricate a sediment barrier made from geotextile or straw bales.
2. Follow Standard Drawing 6-7 and Standard Drawing 6-8 for installation procedures for the straw bales or geofabric. Reduce the picket spacing to 1 metre centres.
3. In waterways, artificial sag points can be created with sandbags or earth banks as shown in the drawing.
4. Do not cover the inlet with geotextile unless the design is adequate to allow for all waters to bypass it.

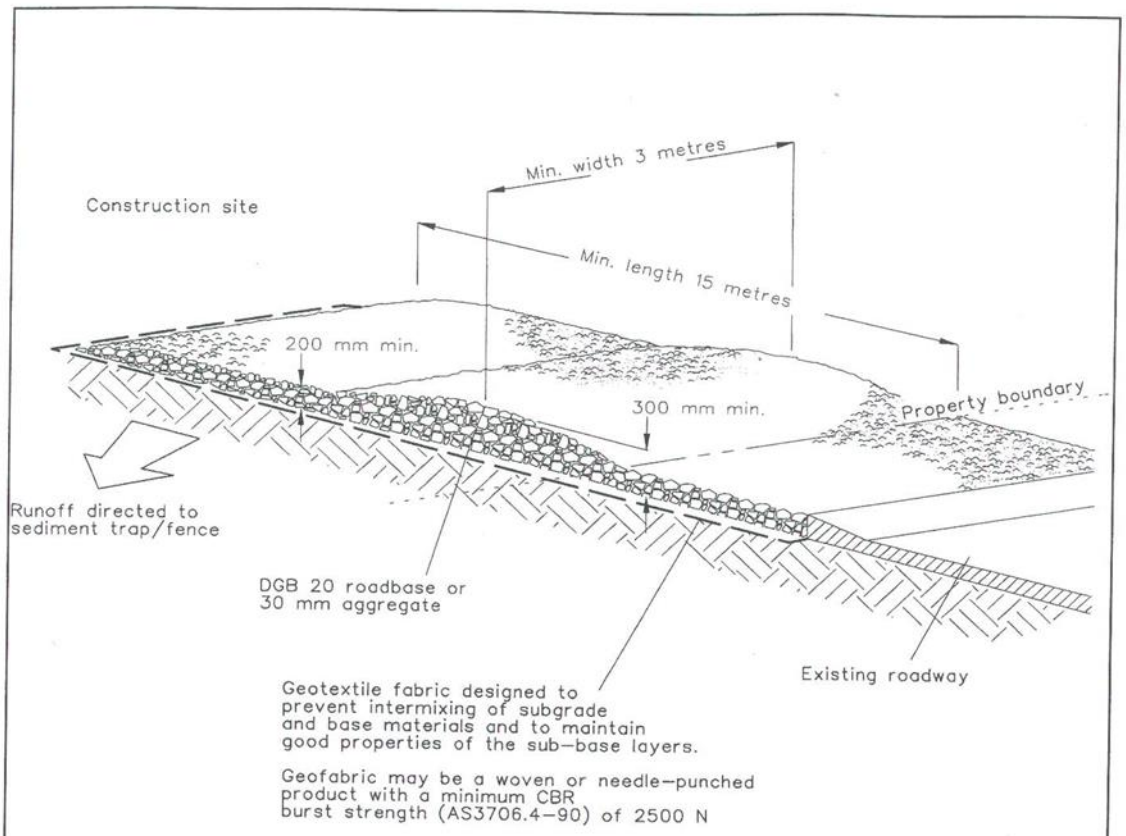
GEOTEXTILE INLET FILTER **SD 6-12**



Construction Notes

1. Install a 400-mm minimum wide roll of turf on the footpath next to the kerb and at the same level as the top of the kerb.
2. Lay 1.4 metre long turf strips normal to the kerb every 10 metres.
3. Rehabilitate disturbed soil behind the

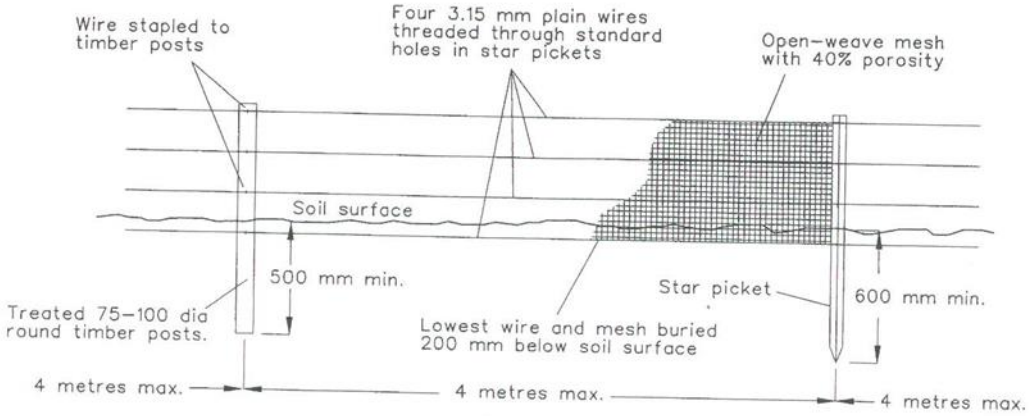
KERBSIDE TURF STRIP **SD 6-13**

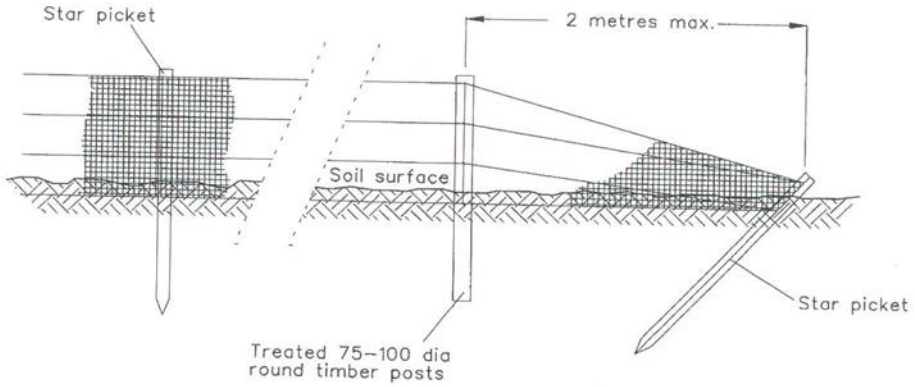


Construction Notes

1. Strip the topsoil, level the site and compact the subgrade.
2. Cover the area with needle-punched geotextile.
3. Construct a 200-mm thick pad over the geotextile using road base or 30-mm aggregate.
4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide.
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence

STABILISED SITE ACCESS **SD 6-14**

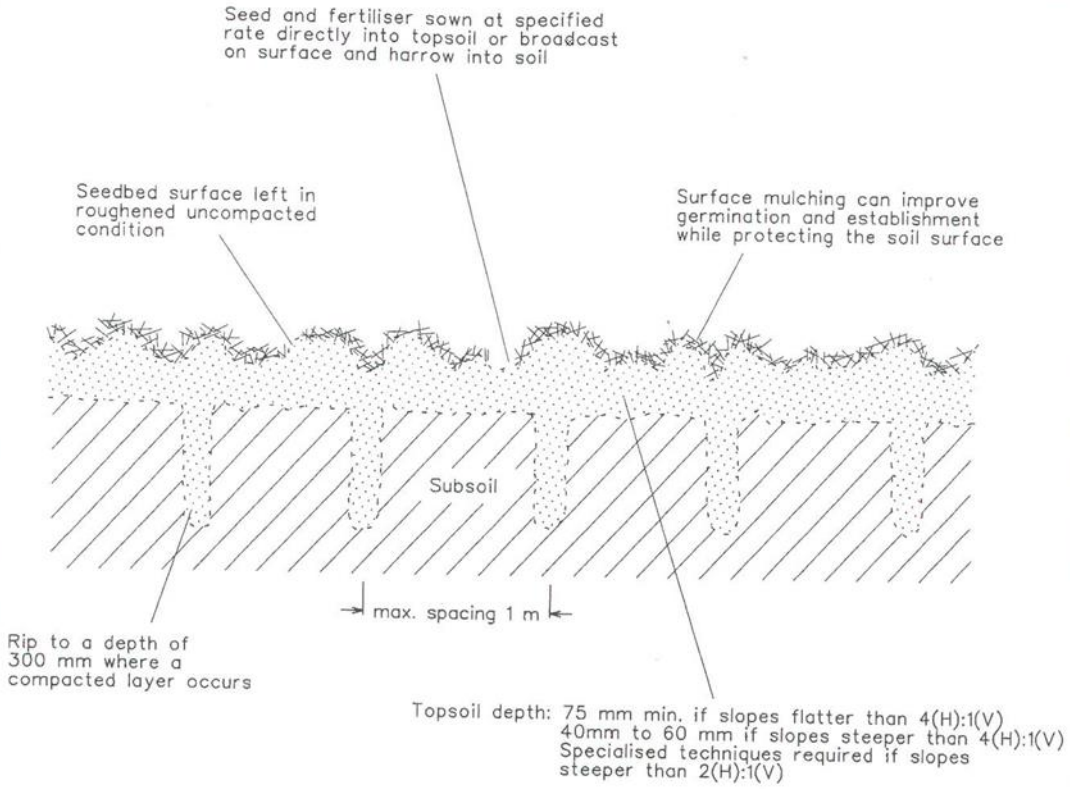




Construction Notes

1. Install the fence to the height specified in the ESCP/SWMP.
2. Cut a channel 200 mm deep along the fence line.
3. Place wire and light resistant, open-weave polymer mesh with 40 percent porosity on the prevailing wind side of fence.
4. Fasten the mesh to all wires using ring fasteners at 100 mm to 150 mm intervals on top wire and 300 mm intervals on other wires.
5. Use one 75-mm to100-mm diameter treated round timber post every 20 metres.
6. Where star pickets are used, ensure they are fitted with safety caps.

CONTROL OF WIND EROSION **SD 6-15**



Construction Notes

1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
2. Work the ground only as much as necessary to achieve the desired tilth and prepare a good seedbed.
3. Avoid cultivation in very wet or very dry conditions.
4. Cultivate on or close to the contour where possible, not up and down the slope.

SEEDBED PREPARATION **SD 7-1**

7-7

Appendix B. Erosion and Sediment Controls Plans/Figures

Appendix C. Groundwater Bore Information

The Monitored groundwater depths and levels are provided in Table 11-1 below. The registered groundwater bores referred to in Section 4.3.1.2 are shown in Figure 11-1.

Table 11-1 Monitored groundwater depths and levels for existing groundwater monitoring bores in the surrounding area (AGL, 2020)

Bore ID	Easting (m)	Northing (m)	Elevation (mAHD)	Drilled depth (mBGL)	Standing Water Level (mBGL)
GW024022	308245	6416589	139.66	3	NULL
GW053862	305106	6417425	196.15	99	NULL
GW060263	301855	6415205	260.38	61	NULL
GW080212	313389	6415560	119.05	0	NULL
GW080213	315687	6414594	110.88	0	NULL
GW080725	313424	6411091	89.9	130	43
GW200743	305476	6416977	194.16	114	NULL
GW200744	305476	6416977	194.16	196	14
GW200745	305476	6416977	194.16	119	9
GW200746	305371	6416853	203.5	133	28
GW200956	307024	6407896	142.75	97	NULL
GW200957	308715	6411207	191.6	60	NULL
GW201061	311490	6413430	111.79	15	NULL
GW201062	311451	6413551	109.76	17	NULL
GW201110	313676	6412975	92.67	48	NULL
GW201265	309624	6406493	117.04	74	NULL
GW201266	308715	6411207	160.47	60	NULL
GW201267	310326	6406955	113.58	43	NULL
GW201845	315528	6417638	0	22	3.1
GW201846	315281	6417210	0	23	NULL
GW201847	315703	6417043	0	21	4.8
GW201848	314994	6416402	0	22	4.56
GW201957	314700	6407480	0	78	NULL
GW201958	315140	6407325	0	71	NULL
GW201959	315440	6407265	0	69	NULL
GW202777	305476	6408573	0	854	NULL
GW203052	312568	6409432	0	202	NULL
GW203053	312157	6409431	0	200	NULL

Bore ID	Easting (m)	Northing (m)	Elevation (mAHD)	Drilled depth (mBGL)	Standing Water Level (mBGL)
GW203054	311561	6409524	0	200	NULL
GW203055	311490	6409008	0	200	NULL
GW203056	314380	6409215	0	262	NULL
GW203057	312820	6409605	0	248	NULL
GW203058	313476	6409215	0	251	NULL
GW203059	313768	6408418	0	248	NULL
GW203063	314548	6408282	0	300	NULL

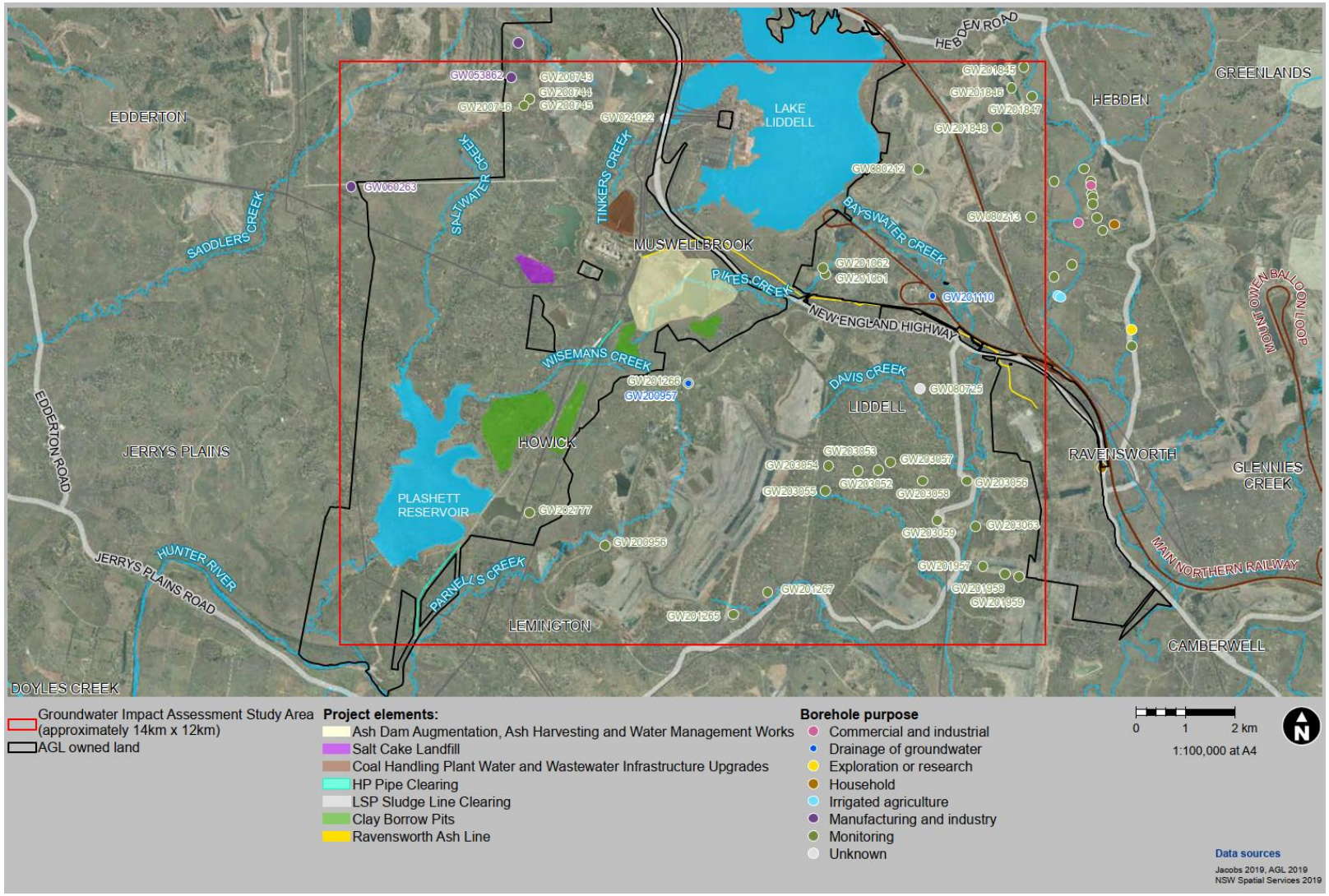


Figure 11-1 Groundwater Monitoring Bores (AGL, 2020)