TUMBLONG QUARRY

Surface Water Assessment

Prepared for:

MH Earthmoving Pty Ltd
150 Sheridan Street
Gundagai NSW 2722

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with MH Earthmoving Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.19102-R01-v0.4	4 November 2019	Stephane Peignelin	Paul Delaney	Paul Delaney
610.19102-R01-v0.3	4 November 2019	Stephane Peignelin	Paul Delaney	Paul Delaney
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DOCUMENT REFERENCES

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1 Objectives

This report presents the results and details of a surface water assessment carried out at a quarry site that is proposed to change the land use to a waste management facility (landfill).

The report identifies potential soil and surface water environmental impacts of the proposal, describes proposed mitigation measures that can satisfactorily mitigate those impacts, and outlines environmental management requirements. The report responds to the following relevant issues identified in the Secretary's Environmental Assessment Requirements (SEARS):

- details of water usage for the proposal including existing and proposed water licencing requirements in accordance with the Water Act 1912 and/or the Water Management Act 2000;
- an assessment of potential impacts on floodplain and stormwater management and any impact to flooding in the catchment;
- details of sediment and erosion controls;
- a detailed site water balance, including identification of water requirements for the life of the proposal, measures that would be implemented to ensure an adequate and secure water supply is available for the proposal and a detailed description of the measures to minimise water use at the site;
- an assessment of potential impacts on the quality and quantity of surface resources;
- details of the proposed stormwater management system, water monitoring program and other measures to mitigate surface impacts; and
- characterisation of the nature and extent of any contamination on the site and surrounding area.

2 Summary of key findings

Key findings from this report are as follows:

- During operation of the landfill, the total catchment area draining to the overland flow path under Tumblong Reserve Road may be reduced by up to 5ha. This will have only a minor impact on catchment yield and environmental flows. Runoff collected in the Sediment Basin will be released downstream if there is sufficient volume collected for water to enter the Settlement Zone.
- The site is not subject to flooding from watercourses. Minor sheet flows running onto the site will be diverted around the site with a Clean Water Diversion Drain. There will be a decrease in runoff rate to downstream property during light rainfall, and a very minor increase during heavy rainfall that causes the Sediment Basin to overtop.
- Leachate from the landfill operations will be managed by a leachate management system which includes a leachate storage pond, sized using a water balance approach in accordance with EPA guidelines.
- Potential impacts to surface water quality can be adequately managed by sequencing construction, progressive revegetation of disturbed areas, and implementation of erosion and sediment control measures as described in this report. The primary control measures will be:

- A Sediment Basin to collect stormwater runoff from disturbed areas within both Stages 1 and 2. The Sediment Basin will contain runoff from a 5 day, 90th percentile design storm. During Stage 1 water will be pumped from a temporary sump located on Cell 2 footprint to the proposed Sediment Basin; and
- Progressive revegetation of disturbed surfaces.

- The water quality of stormwater discharges will be monitored and comply with limits as stated in the Environment Protection Licence issued by the NSW Environment Protection Authority.
- A Construction Environmental Management Plan (CEMP) will be prepared to manage potential environmental impacts during the construction phase. The CEMP will include a detailed Erosion and Sediment Control Plan (ESCP) that meets minimum requirements outlined in this report.
- Potential environmental impacts during the operational phase will be managed in accordance with a Landfill Environment Management Plan that will comply with requirements outlined in this report.

3 Existing Site Description

3.1 Site Identification

Site identification details are shown in Table 1.

Table 1 Site Identification

Identifier	Details
Address	Lot 7004 and Lot 7300, Tumblong Reserve Road, Tumblong NSW 2729
Real property description	Lot 7004 DP 1028797 Lot 7300 DP 1149008
Centre co-ordinate	589059E 6113435N MGA GDA z55
Property size	Approximately 4.4ha
Owner	Cootamundra- Gundagai Regional Council (Lot7004 DP 1028797) Crown Land (Lot 7300 DP 1149008)
Local Government Area	Cootamundra- Gundagai Regional Council
Present use	Quarry
Present zoning	RU1 – Primary Production (Gundagai LEP, 2012)

A small proportion of the adjacent DP702858 also forms part of the development, albeit for the temporary storage of excavated quarry resource used for ongoing Council commitments and for rehabilitation soils post closure.

3.2 Site Topography and Existing Surface Water Regime

The site is located on a broad ridgeline with slopes of seven degrees falling westwards towards Tumblong Reserve Road. There are no existing watercourses on the site and runoff from a small catchment upslope of the proposal site runs across the northern site boundary as sheet flow. There is a low point in the road with a stormwater culvert underneath, which corresponds to a natural overland flow path and currently catches the runoff from the existing quarry. Downstream of the road, this overland flow path runs into an existing farm dam.

There is limited run-on water to the subject site from neighbouring lands owing to the spur that the site is located on creating a drainage divide, **Figure 1**. There are no watercourses lines within the proposed landfill site.

Downstream of the farm dam there is an unnamed first order watercourse, which commences approximately 100m from the site. This watercourse flows into a second order watercourse approximately 900m west of the site, and then un-named third order watercourse which discharge in a generally north-westerly direction to the Murrumbidgee River.

The subject site is part of the Murrumbidgee Central (Burrinjuck to Gogeldrie) Water Source under the Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012.

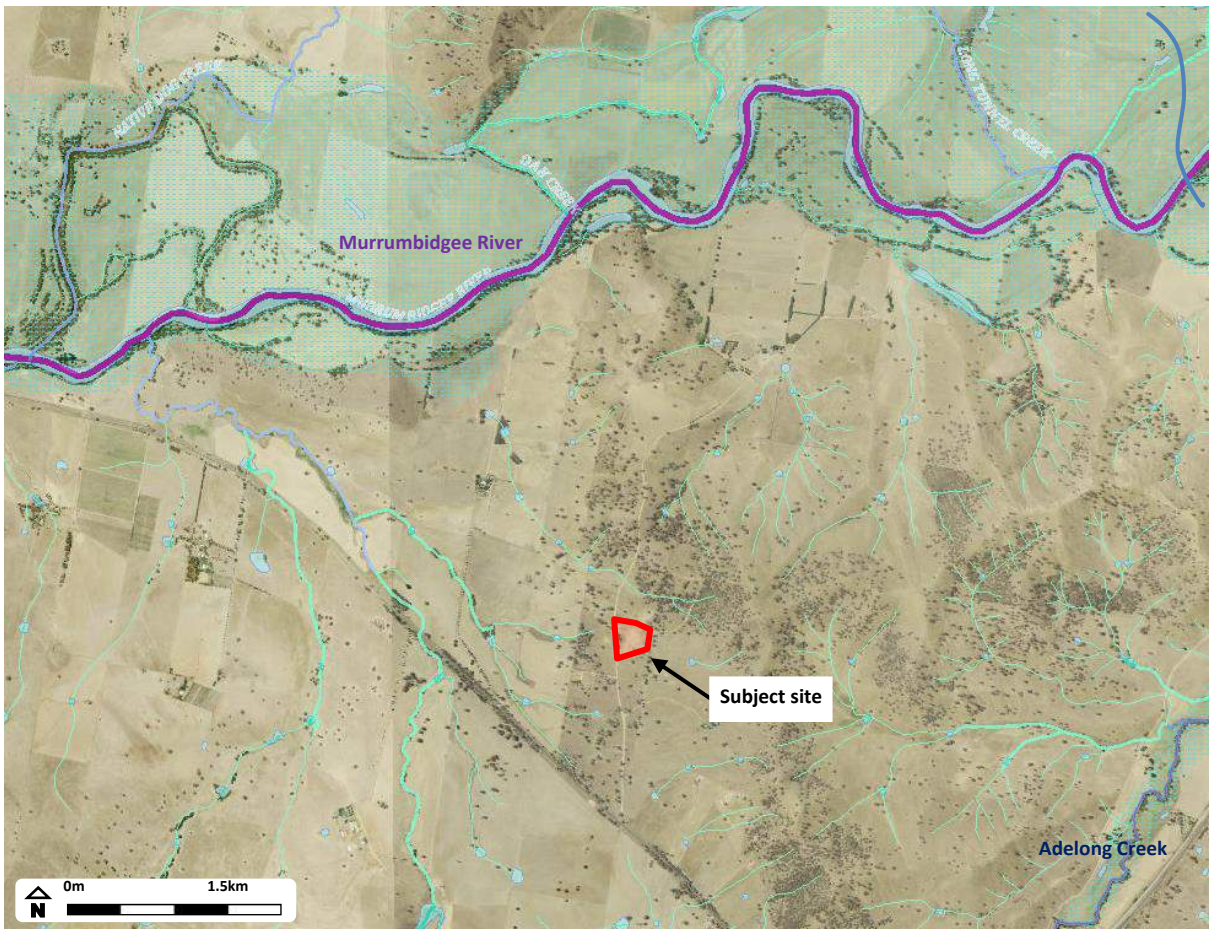


Figure 1 Hydrology Map

3.3 Description Site Soils

The site is in Silurian aged weathered and fractured rocks of the eastern Lachlan Fold Belt, **Figure 1**. The regional geological map (Wagga Wagga 1:250,000) describes the geology in the region of the site as conglomerate, sandstone, siltstone and minor volcanics. The Tumut 1:100,000 geological map which covers the area to the west of the site and contains the continuation of the geological unit (Su) at the site identifies it as quartz rich shale/slate siltstone and fine sandstone of the Bumbolee Creek Formation. The fine-grained siltstone and sandstone are defined as fined grained and predominantly quartz arenites.

The NSW SEED database indicates that a soil landscape of Kurosol soils, which are characterised by high acidity, low chemical fertility, and low water holding capacity. There are no known occurrence of acid sulphate soil risks in proximity to the site. Residual site soils are sandy clays with dispersive characteristics.

4 Project description

The proposal seeks to utilise the final excavated quarry void as a waste disposal facility (landfill) receiving up to 60,000 tpa of general solid (non-putrescible) waste materials.

The construction of the waste disposal facility at the site will require bulk excavation of the quarry to the required subgrade levels, formation of the waste cells to incorporate a composite lined leachate barrier system, a full leachate collection and extraction system, lining and construction of leachate control facilities and construction of stormwater management infrastructure. The landfill design and associ, and often sodicted infrastructure shall be in full accordance with the NSW EPA Environmental Guidelines: Solid Waste Landfills Second Edition, 2016.

The proposal is designed to include two waste cells which are formed around the current quarry void footprint (the gravel pit). Additional excavation of the pit would be required to form both waste cells (Cell 1 & Cell 2) and this is activity is proposed to be performed in two stages.

Excavated materials would be used to construct the perimeter bunds, Cell 1/Cell 2 intercell bund and minimum 200mm thick basal sub-base layer consistent with NSW EPA Guidelines, with the remainder stored in Cell 2 and temporarily within the adjacent Lot owned by the proponent.

A 1 metre high engineered bund will be constructed on the northern and western boundary of the landfill, utilising compacted clay fill, these bunds, side slopes and floor will be subsequently covered with geosynthetic clay liner (GCL), high density polyethylene (HDPE) geomembrane and protection geotextile. A sump area for leachate collection and extraction will be constructed within Cell 1 and Cell 2. A series of slotted HDPE pipes laid within a minimum 300mm aggregate leachate drainage blanket will also be installed on the base of the landfill to collect and direct leachate into the two separate sump areas. Leachate will be pumped from the two landfill sumps via 400mm ID HDPE side riser where it will be carried via surface laid pipework to the clay, GCL and HDPE lined leachate storage dam. The leachate storage dam has been designed to meet the requirements of the NSW EPA Environmental Guidelines: Solid Waste Landfills 2016.

Excavated aggregate and fill temporarily stored in the adjacent lot will be progressively removed by Council requiring the material for its ongoing construction needs with the remainder being used for rehabilitation involving the installation of a minimum of 1m upon an engineered capping layer.

A small office and associated infrastructure will be constructed on site for administration purposes.

5 Sensitivity of Receiving Environment and Surface Water Characterisation

5.1 Baseline water quality data

There is no baseline surface water quality monitoring data available at the site.

5.2 Water Quality Objectives and Trigger Values

The NSW Water Quality Objectives are the agreed environmental values and long-term goals for NSW's surface waters. The objectives are consistent with the agreed national framework for assessing water quality set out in the ANZECC 2000/ANZG2018 Guidelines. These guidelines provide an agreed framework to assess water quality in terms of whether the water is suitable for a range of environmental values (including human uses). The Water Quality Objectives provide environmental values for NSW waters and the ANZECC 2000/ANZ2018 Guidelines provide the technical guidance to assess the water quality needed to protect those values.

Water Quality Objectives (WQO's) for catchments in NSW are published on the Department of Environment Climate Change and Water website (http://www.environment.nsw.gov.au/ieo/).

The guidelines specify three levels of protection, corresponding to whether the condition of the particular ecosystem is:

- Of high conservation value,
- Slightly to moderately disturbed, or
- Highly disturbed.

For this site the downstream land-use is agricultural and has been extensively cleared. The waterway should be considered as 'moderately disturbed'.

The WQO for the uncontrolled streams in the Murrumbidgee River and Lake George catchment are (DEC 2006):

- Aquatic ecosystems;
- Visual amenity;
- Primary and secondary contact recreation;
- Livestock, irrigation, and homestead water supply;
- Drinking water at point of supply; and
- Aquatic foods.

Drinking water supply and aquatic foods are not relevant at this location.

The ANZECC 2000 was superseded in 2018 by the Australian and New Zealand Guidelines (ANZG (2018)). The ANZG (2018) will eventually provide updated default water quality values across Australia. However, these have not yet been published for the Murrumbidgee River and Lake George catchment, and this assessment therefore refers to the ANZECC 2000 values as shown in **Table 2** below.

Table 2 ANZECC Trigger Values – Environment

Parameter	Default Trigger Value for NSW upland rivers for slightly disturbed ecosystems
Total Phosphorous TP (mg/L)	0.02
Total Nitrogen TN (mg/L)	0.25
pH	6.5 – 8.5
Salinity (µS/cm)	30 – 350
Turbidity (NTU)	2-25 Values in the higher part of the range will be found in rivers and streams in high flows and lower in the catchment
Total Suspended Solids	50mg/L (Professional judgement / not ANZECC)
Total Dissolved Solids	1000 mg/L
Chemical contaminants and toxicants	See ANZECC 2000 Guidelines Table 3.4.1

The ANZECC 2000 guidelines for recreational water quality and aesthetics, for secondary contact such as boating and fishing, and visual recreational use, provide the following water quality triggers as shown in **Table 3**.

Table 3 ANZECC Trigger Values – Recreational

Parameter	Range of trigger values for NSW east flowing lowland rivers
Microbiological: • Faecal coliform • Enterococci	 1000 organisms / 100mL 230 organisms / 100mL
Physical and chemical: • Visual clarity • Toxic chemicals • Surface films	 • <20% reduction • Toxic substances should not exceed the values in ANZECC 2000 Table 5.2.3 for general chemical, and Table 5.2.4 for pesticides. • Oils and petrochemicals should not be visible as a surface film, nor detectable by odour

The trigger values provided in the ANZECC Guidelines are intended to be an indicator of potential environmental problems measured in the ambient waters that receive stormwater. The ANZECC guidelines are not originally intended for direct application to the water quality of stormwater from individual sites or systems, although in the absence of better information they are commonly used in this manner.

5.3 Groundwater

Groundwater is addressed in a separate groundwater assessment report.

6 Potential Impacts and Mitigation Strategies

This chapter of the report identifies potential soil and surface water environmental impacts and provides details of how they will be mitigated during the construction and operational phases. Additional detail on the proposed water management system is provided in the next chapter.

6.1 Potential Impacts during Construction and Operational Phases

Potential environmental risks associated with construction of the landfill cells include:

- Runoff water quality;
- Storage and use of hydrocarbon fuels and other chemicals on site; and
- Potential for flood events to inundate the construction site.

Additional risk and potential impacts during the operational phase include:

- Water quality impacts from sediment loads in stormwater system;
- Water quality impacts from potential migration or overflow of leachate;
- Change in catchment yield and environmental flows, and change in creek flows during major rainfall events;
- Potential for flood events to come into contact with waste; and
- Changes to catchment yield, environmental flows, hydrology, and flooding behaviour.

6.2 Assessment Methodology

The potential environmental impacts from construction and operations have many similarities and to avoid repetition are discussed together in the analysis below. For each risk the following sections identify the risk/cause, potential impact, and the requirements for mitigation.

6.3 Runoff Water Quality – Stormwater

This section addresses the risks of erosion on site and associated transport of sediment loads and turbidity to the receiving environment. This risk applies during initial construction activities and continues through the operational period of the landfill.

Aspect	Details
Risk/Cause:	Soil disturbance during the construction and final capping of the cells has potential to cause erosion and the transport of turbidity, nutrients and sediments in stormwater runoff, to the downstream environment.
Potential Impact	Turbid water can reduce light penetration in downstream water bodies, impacting aquatic ecology. Increased nutrient loads can contribute to eutrophication, and an accumulation of coarse sediment can smother creek beds.

Aspect	Details
Requirements for Mitigation	• **Sequencing of construction** – the landfill will be developed in two stages. During the first stage, most surface water runoff will report to a temporary sump located in Cell 2 footprint area. This temporary sump will be pumped out to the proposed sediment basin located in the north-west corner of the site. • **Sump in void** – When the excavation of Cell 2 commences, a sump located on the floor of the excavation will receive and contain stormwater runoff from areas inside the batter of the external bund. This water will be pumped out to the proposed sediment basin in the north-west corner of the site; • **Progressive revegetation of disturbed areas** – following formation, the outside batters of the external bund will be revegetated to limit the potential for ongoing erosion. A temporary vegetative cover may be established prior to placement of the final cap. • **Diversion of clean water** – a clean water diversion drain will be constructed to convey upslope run-on around the edge of the disturbance area. This drain will need to be lined. Conceptual dimensions for this drain are shown on Drawing 1 & 2. Selection of lining materials will be subject to detailed design; and • **Proposed Sediment basin** - A sediment basin in the north-west corner of the site will collect runoff from the external batters of the landfill and flows pumped out from a sump during Stage 1. When landfilling is completed the sediment basin will collect runoff from the final landform, including the external batters and domed capping over the top of the landfill. The sediment dam will contain runoff from a 5 day, 90th percentile design storm. Additional detail on the proposed water management system is provided in Section 7.

6.4 Hydrocarbon Spills

This section addresses the risk of hydrocarbon spills and leaks during the construction and operational phases.

The proposed development does not include on site storage of fuel in tanks. Fuel for construction and operational plant will be brought in daily by vehicle.

The proposal does not include any storage of hazardous materials.

Aspect	Details
Risk/Cause:	• Leaking fuel storage tanks or accidental spillages from plant/machinery.
Potential Impact	• Hydrocarbon spills may have significant environmental impact on the receiving environment.
Requirements for Mitigation	• **Spillage** – spill kits will be kept on site, and staff trained in their use. • **Pollution Incident Response Management Plan (PIRMP)**– during construction and operations, the site will have a PIRMP which details the emergency response and reporting requirements in the event of a spill.

6.5 Water Quality - Leachate

This section addresses risks associated with leachate (water which has come into contact with waste) finding its way into the receiving surface water environment.

Aspect	Details
Risk/Cause:	Without adequate engineering controls and ongoing landfill management practices, there is a risk that pollutants present in landfill leachate enter the downstream dams and watercourses, via: • Landfill leaks; • Leachate pond overtops; or • Run-off from operational areas containing waste entering the stormwater system.
Potential Impact	Pollutants present in the landfill leachate (water which has been in contact with the landfill waste) may cause significant and widespread contamination of the receiving environment. High nutrient levels may contribute to eutrophication of downstream water bodies, and adversely impact on the ecology of local streams.
Requirements for Mitigation	• **Landfill design** – information relating to the landfill design in the EIS document is available from report *'610.19102-Leachate Generation Asessment-v1.3.docx'* dated 1 November 2019. • **Leachate Pond –** information relating to the leachate pond is available from report *'610.19102-Leachate Generation Asessment-v1.3.docx'* dated 1 November 2019. • **Separation of leachate and stormwater** – operational procedures will contain clear procedures for drainage from operational areas with exposed waste to be drained to the leachate system. • **Water quality monitoring** at the sediment dam should include testing for the presence of ammonia, which is an indicator of the presence of leachate. Water quality monitoring will be performed in accordance with any requirements stipulated in a future Environmental Protection Licence.

6.6 Flooding Events

The site is not located near any rivers or creeks and is not situated within a floodplain. There is therefore no risk of the site being inundated by flood events.

Minor overland flow from a small catchment situated immediately upslope of the site will be diverted around the edge of the site by a Clean Water Drain.

6.7 Catchment Hydrology

The final landform will have surface slopes greater than those present in the natural landform, and this will cause some very localised increases in runoff. However, these increases will be attenuated by the retention of runoff within the proposed site sediment basin.

6.8 Catchment Yield and Environmental Flows

This section examines how the completed proposal may affect environmental flows to the downstream environment and land-uses.

Construction of the proposed landfill will involve capturing potentially sediment laden runoff from within the site footprint in a Sediment Basin. This water will be released downstream in all but very light rainfall events.

Site runoff from light rainfall will be captured on site in the proposed sediment basin and may not be released to the downstream environment if there is insufficient volume for the water level to enter the settlement zone.

Rainfall with sufficient depth for water to enter the settlement zone, (and up to the 5 day 90th percentile rainfall depth of 31.2mm), will be treated for compliance with water quality criteria, and then released downstream. It is proposed to include a 'low flow' discharge pipe through the sediment basin embankment to facilitate the release of treated water from site, which would flow to the existing downstream farm dam. Flow through the 'low flow' pipe will be regulated by a stop valve. The stop valve will remain closed until it is verified that water quality in the proposed sediment basin complied with requirements for discharge off-site.

Heavy rainfall with a depth of greater than the 5 day 90th percentile rainfall depth may cause the sediment basin to overtop and discharge downstream. In these circumstances, water will discharge from the sediment basin via a spillway which reports to the existing culvert underneath Tumblong Reserve Road.

Aspect	Details
Risk/Cause:	The capture of surface runoff and containment on site can affect the environmental water regime in the downstream environment, and/or for agricultural use.
Potential Impact	A reduction in the quantity of water available downstream, and reduced frequency of low flow events along watercourses. Reduced catchment runoff to downstream farm. This is presently captured in a small farm dam downstream of Tumblong Reserve Road.
Requirements for Mitigation	All runoff water which generates sufficient runoff for the water level to enter the 'Settlement Zone' of the Sediment Basin, as marked by a level indicator, will be treated as required to comply with water quality criteria, and released downstream.

7 Description of Proposed Site Water Management

7.1 Relevant Design Standards

The management of surface water on site should be consistent with the following guidelines:

- Environmental guidelines: Solid Waste Landfills, second edition 2016 – Section 3, Stormwater Management required outcomes (NSW Environment Protection Authority (EPA), 2016).
- Managing Urban Stormwater – Soils and Construction (4th Edition), (DECC 2008).
- Managing Urban Stormwater – Soils and Construction, Volume 2B, Waste Landfills, (DECC 2008).
- Managing Urban Stormwater – Soils and Construction, Volume 2D, Unsealed Roads, (DECC 2008).

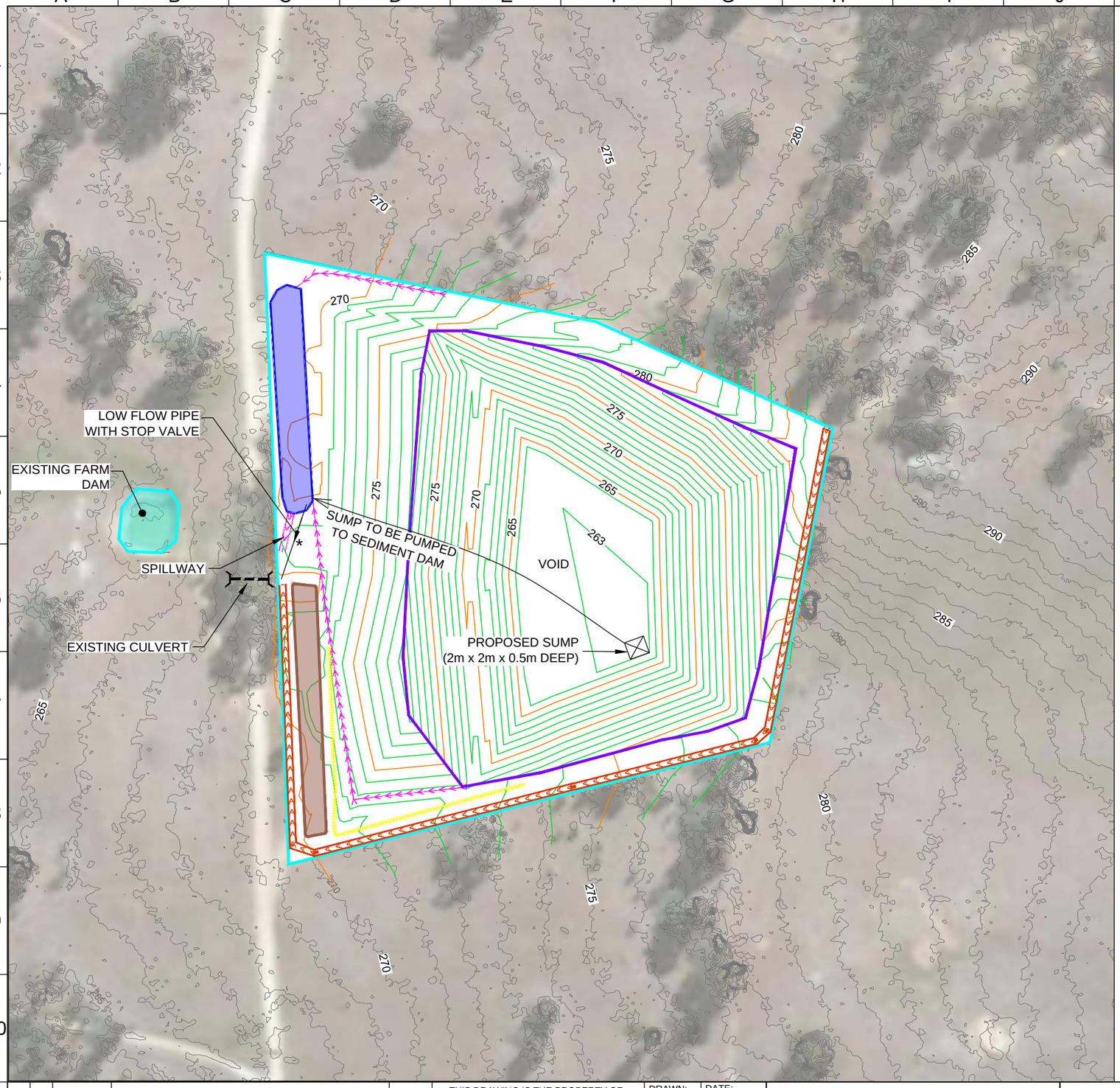
7.2 Proposed Surface Water Management Regime

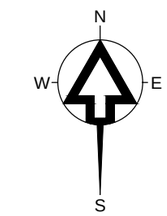
7.2.1 Classes of water and how they will be managed

Three classes of water will be present on site, and these will be managed as shown on Drawing 1 & 2 and described in **Table 4** below.

Table 4 Types of runoff

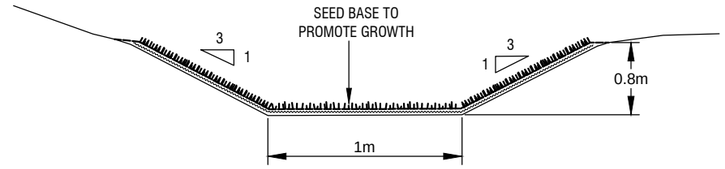
Type of Water	Project Features to manage / mitigate
Clean water from upslope catchment	Clean water will be diverted around operational landfill site with **Clean Water Drains**. Clean water will be kept separate from stormwater and leachate and discharged to the receiving environment via the culvert under Tumblong Reserve Road.
Stormwater which is potentially sediment laden (but not in contact with wastes)	The stormwater system will comprise three key elements: • **Contour Drain** – limit the potential for erosion on external landfill batters, and discharge to the Toe Drain; • **Toe Drain** – located around the base of the landfill final landform, and collecting potentially sediment laden water and conveying it to the proposed sediment basin; and • **Sediment Basin –** stores stormwater (not exposed to waste) runoff from the operational landfill external batters and cap, allowing it to be either re-used or treated and discharged from site. During construction the sediment basin will be used to reduce sediment loads from disturbed areas.
Leachate – Any rainfall that comes into contact with waste within the landfill footprint is considered to be leachate.	A leachate containment and collection system will be provided in accordance with NSW EPA requirements. Design elements will include a low permeability cap, basal lining system, leachate collection system and leachate pond. The leachate pond will be sized in accordance with leachate water balance calculations and incorporate freeboard that can accept rainfall directly on the dam from a 24-hour rainfall event with a 1-in-25-year average recurrence interval (ARI). Details on the leachate system may be found in report '610.19102-Leachate Generation Asessment-v1.3.docx' dated 1 November 2019.



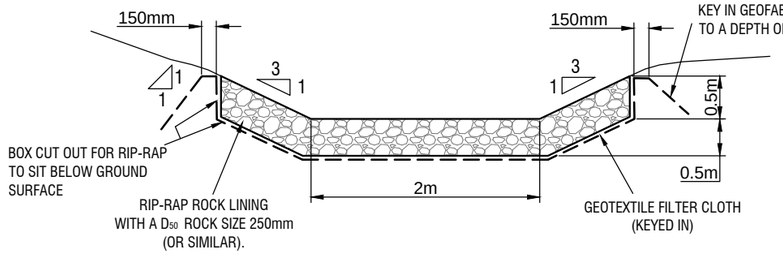


LEGEND

- EXISTING CONTOURS (1.0m INTERVALS)
- DESIGN CONTOURS (1.0m INTERVALS)
- PROPOSED SEDIMENT DAM
- PROPOSED LEACHATE DAM
- DIRTY CATCHMENT BOUNDARY
- PROPOSED SUMP DIRTY CATCHMENT BOUNDARY
- PROPOSED CONTOUR BANK
- PROPOSED CLEAN WATER DIVERSION
- PROPOSED TOE DRAIN
- PROPOSED SEDIMENT FENCE



TYPICAL CONTOUR BANK / TOE DRAIN SECTION



CLEAN WATER DIVERSION

SEDIMENT DAM SIZING TABLE				
Catchment Area (ha)	Design Storm	Settling Zone Capacity (ML)	Sediment Zone Capacity (ML)	Total Required Capacity (ML)
4.95	5 day, 90th Percentile	1.00	0.50	1.50

NOTE:
* FOR DEWATERING USE. SUBJECTED TO WATER QUALITY REQUIREMENTS.

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TUMBLONG QUARRY

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STAGE 1
SURFACE WATER REGIME

DRAWING NUMBER: 610.19102 - DRAWING 01

ISSUE: C

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CONSULTANT PROJECT

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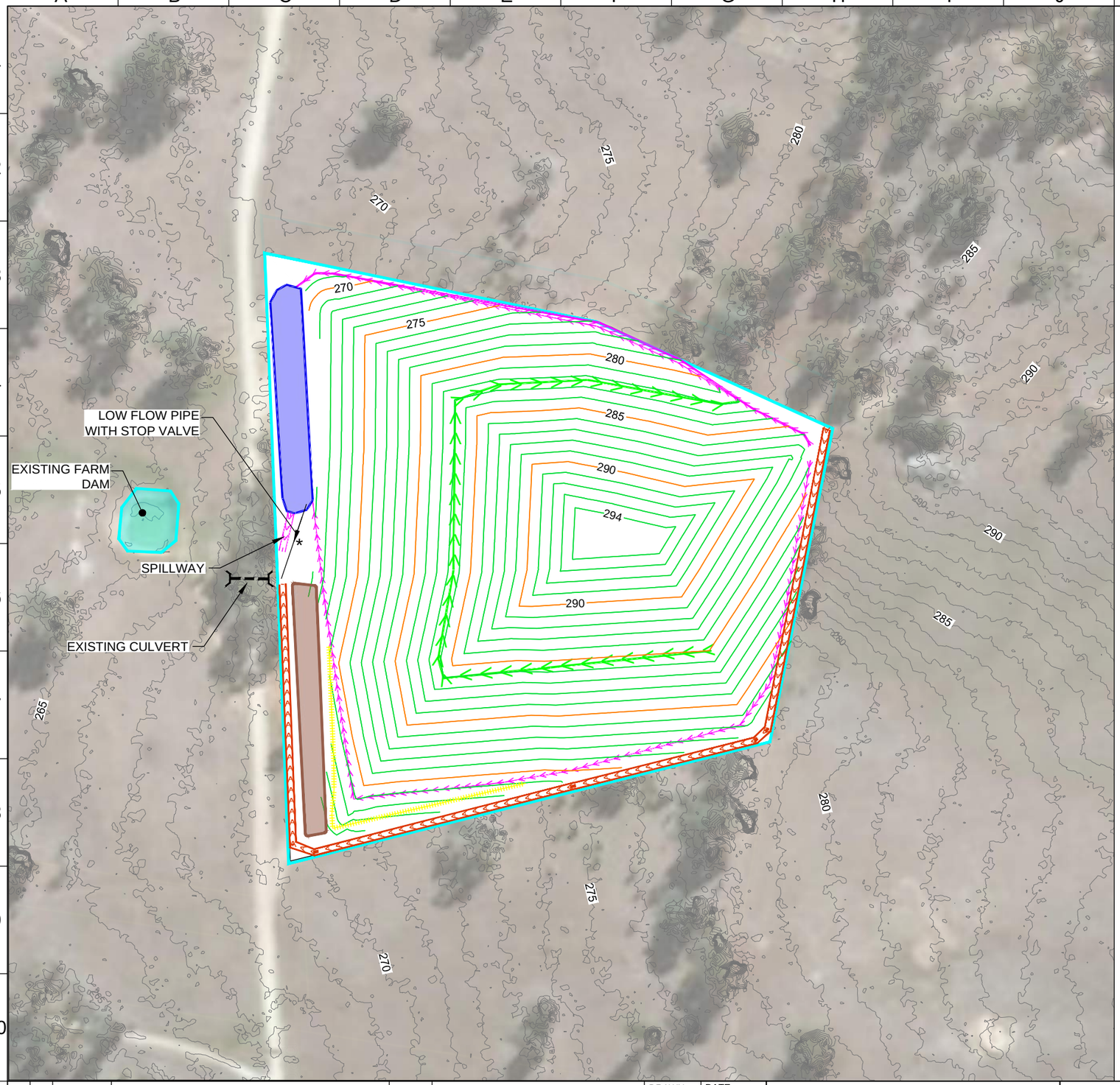

LEGEND

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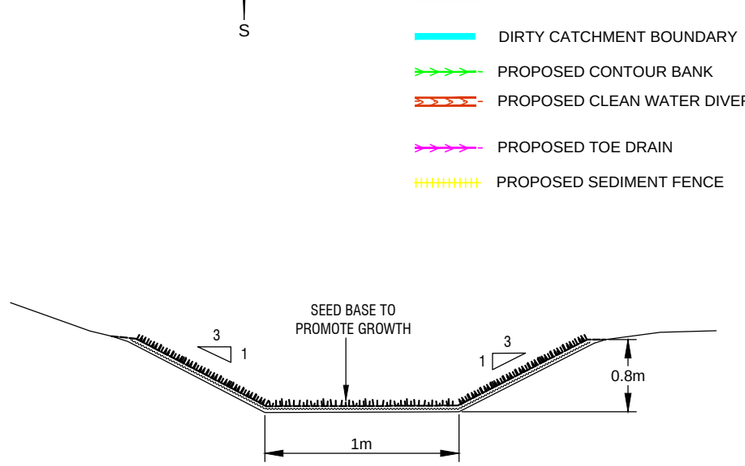
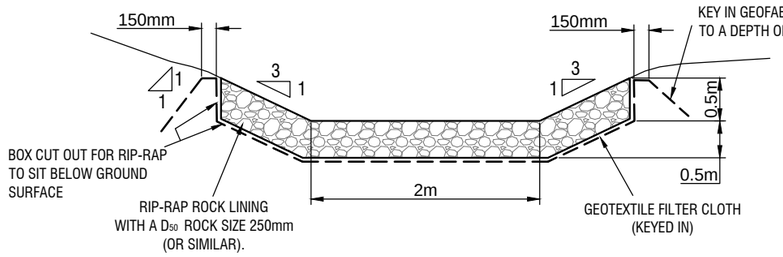


TYPICAL CONTOUR BANK / TOE DRAIN SECTION



CLEAN WATER DIVERSION

SEDIMENT DAM SIZING TABLE				
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4.95	5 day, 90th Percentile	1.00	0.50	1.50

NOTE:
* FOR DEWATERING USE. SUBJECTED TO WATER QUALITY REQUIREMENTS.

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DIAL 1100 BEFORE YOU DIG

0.0 40 80 120 160 METRES

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CLIENT: INSITU ADVISORY PTY. LTD.

TUMBLONG QUARRY

DRAWING TITLE:

STAGE 2
SURFACE WATER REGIME

DRAWING NUMBER: 610.19102 - DRAWING 02

ISSUE: B

CONSULTANT PROJECT

FULL SIZE ON ORIGINAL A3

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7.2.2 Staged Implementation of works

The landfill cells will be developed in two stages. Requirements for the staged implementation of surface water controls are listed below:

Stage 1 – Cell 1 formed, filled and temporary capping:

Prior to commencement of construction works for Cell 1:

- Establish a Clean Water Diversion Drain to divert upslope run-on around edge of site to culvert under road;
- Construct the Sediment Basin;
- Construct Toe Drains at edge of Cell 1 external batter as shown on Drawing 1; and
- Install Sediment Fencing for any disturbed areas not draining into the Sediment Basin.

During construction of Cell 1:

- Construct temporary Sump in Cell 2 footprint for pumping to the newly constructed Sediment Basin.

During filling of Cell 1:

- Progressively revegetate external batters (including temporary ground cover for surfaces not at finished landform level).

Stage 2 – Cell 2 filled, and final capping to Cells 1 and 2:

Prior to commencement of construction works for Cell 2:

- Extend the Toe Trains at the edge of the Cell 2 external batter as shown on Drawing 2; and
- Install Sediment Fencing for any small disturbed areas not draining into the Sediment Basin. These areas should also be mulched.

During construction of Cell 2:

- Prior to commencement of placing waste, pump out 'dirty water' accumulated in void to Sediment Basin; and
- Progressively revegetate external batters (including temporary ground cover for surfaces not at finished landform level).

All stockpiled material should be managed to reduce the risk of sediment export. Localised controls should include diversion of upslope run-on, and sediment fences downstream of stockpiles. Temporary vegetative cover should be established for stockpiles that will store soils for longer than 3 months.

Capping of Final Landform:

- Progressively revegetate final landform batters as sections of the landfill are completed.

7.2.3 Sediment Dam Sizing

The required storage capacity of the Sediment Dam was calculated in accordance with the requirements of the *'Blue Book'* with the following design criteria and assumptions:

- The Sediment Dam was sized for a 5 day, 90th percentile design storm (rainfall depth of 31.2 mm as documented for Queanbeyan/Wagga) for expected disturbance durations greater than 3 years in accordance with Table 6.3(a) of the Blue Book;
- Sediment dam was type F or type D based on the typical soil types within the area;

- A 'Disturbed' runoff coefficient of 0.64 was utilised in accordance with Table F2 of the Blue Book for the design rainfall depth;
- 'Clean' water runoff coefficient of 0.25 was utilised from undisturbed and rehabilitated areas; and
- The Sediment Storage Zone was calculated using fifty percent of the Settling Storage Zone in accordance with the *'Blue Book'*.

The Sediment Dam has been be sized for the 'worst case' and for this site this has been assumed to be for the establishment of the final landform for Stage 2, but prior to successful establishment of stabilising vegetation.

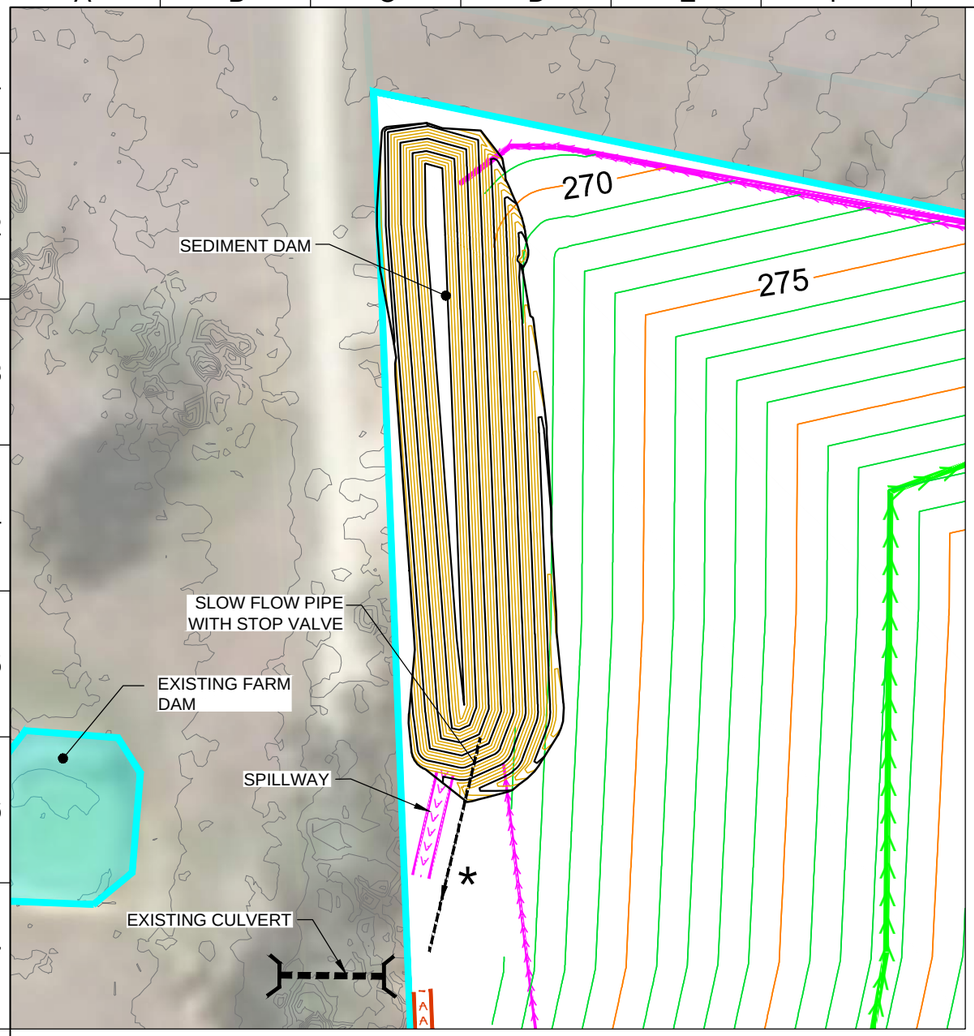
During the construction works for Stage 1 most of the landform will drain inwards to the temporary Sump constructed in Cell 2 footprint. Prior to the lining of Cell 2, there is potential for stormwater to accumulate in the base. This water will also be collected in a small Sump, and pumped out to the site Sediment Basin, which will be established at the commencement of construction in Stage 1.

The results of the dam capacity calculations are shown in **Table 5**.

Table 5 Proposed Sediment Dam Capacity Details

Catchment Area (ha)	Settling Zone Storage Volume (ML)	Sediment Zone Storage Volume (ML)	Total Volume Required (ML)
4.95ha	1.00	0.50	1.50

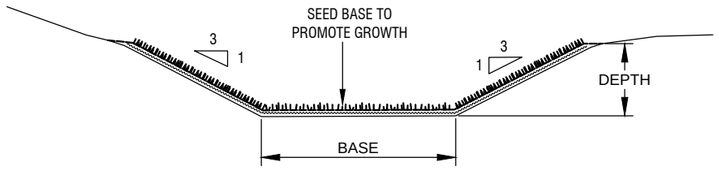
Table 5 identifies that the minimum capacity required in the sediment basin for compliance with the Blue Book is 1.5ML. For more information regarding the Sediment Basin refer to Drawing 3 below.



SEDIMENT DAM LOCATION

LEGEND

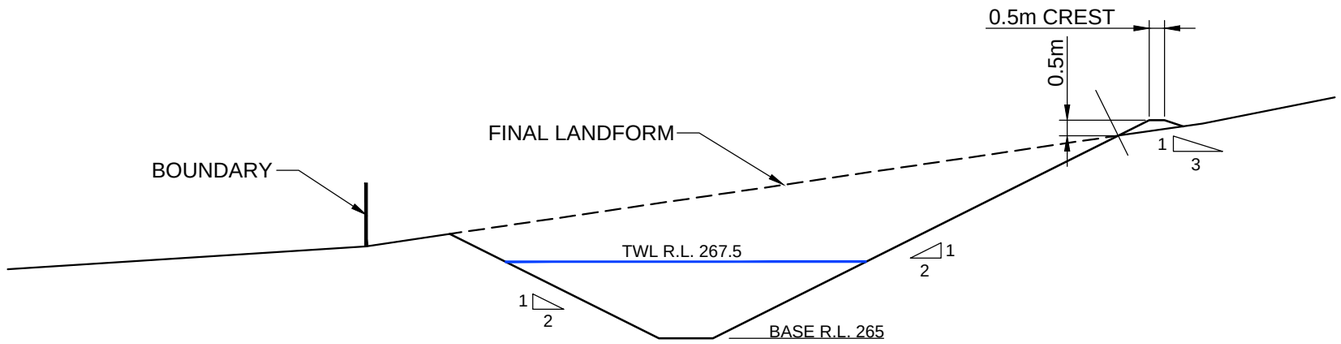
- EXISTING CONTOURS (1.0m INTERVALS)
- DESIGN CONTOURS (1.0m INTERVALS)
- PROPOSED SEDIMENT DAM
- PROPOSED LEACHATE DAM
- DIRTY CATCHMENT BOUNDARY
- PROPOSED CONTOUR BANK
- PROPOSED CLEAN WATER DIVERSION
- PROPOSED TOE DRAIN
- PROPOSED SEDIMENT FENCE



TYPICAL SPILLWAY SECTION

SEDIMENT DAM SIZING TABLE				
Catchment Area (ha)	Design Storm	Settling Zone Capacity (ML)	Sediment Zone Capacity (ML)	Total Required Capacity (ML)
4.95	5 day, 90th Percentile	1.00	0.50	1.50

NOTE:
* FOR DEWATERING USE. SUBJECTED TO WATER QUALITY REQUIREMENTS.



SEDIMENT DAM TYPICAL SECTION

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DRAWN:	MS	DATE: 31.10.2019
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CLIENT: INSITU ADVISORY PTY. LTD.

TUMBLONG QUARRY

DRAWING TITLE:
SEDIMENT DAM
PLAN AND SECTIONS

DRAWING NUMBER: 610.19102 - DRAWING 03

ISSUE: A

CONSULTANT PROJECT

FULL SIZE ON ORIGINAL 0 5 10 20 30 40 50 A3

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7.2.4 Operation of Sediment Basin

Water collected in the Sediment Basin must be treated to comply with water quality objectives prior to discharge downstream.

The storage capacity of the Sediment Basin, which is made up of the 'settling zone' and the 'sediment storage zone', will be actively managed in order to comply with the Blue Book requirements. The following operations and maintenance actions will be carried out to ensure compliance with these requirements:

- The Sediment Basin must be dewatered, within 5 days following rainfall, to ensure the available storage capacity is equal to the 'settling zone' volume; and
- The Sediment Basin must be desilted when the volume of accumulated sediments exceeds the 'sediment storage zone' volume.

It is recommended that the following actions be undertaken to assist in the operation and maintenance of the Sediment Basin:

- Install depth markers at the top of the Sediment Zone indicating when the basin required desilting. The same level will also indicate the start of the Settlement Zone, indicating the level the Sediment Basin needs to be drawn down to when water is released; and
- Inspections of the Sediment Basin will be carried out following heavy rainfalls.

8 Water Demands and Supply

8.1 Leachate

Information relating to leachate generation at the site can be found in report *'610.19102-Leachate Generation Asessment-v1.3.docx'* dated 1 November 2019.

8.2 Potable Water and sewerage

The proposal does not include the installation of any offices or permanent amenities at site. A portable toilet with washbasin will be provided for use by staff during construction and operational phases.

Potable water will be transported to site in bottles for drinking and handwash.

Toilets will be serviced by a pump-out arrangement or be a composting toilet. Arrangements for sewerage will be in accordance with Council regulations and requirements.

8.3 Non-potable water use

Non-potable water will be required for dust suppression.

Stormwater collected in the Sediment Basin will generally be released downstream, and not available for dust suppression activities at site. Water for dust suppression will be sourced as follows:

- For site areas with active waste activities (generating leachate) water will be drawn from the leachate pond; and
- For non-waste areas that drain to the stormwater system, water will be trucked in with water tankers.

Estimated dust suppression demands are as follows:

- During construction: the daily application of 3mm of dust suppression water to disturbed areas of up to 4.95Ha during construction may result in up to 5KL of water demand per month. During dry weather and when water is not available from the Sediment Basin, water will be pumped into the Sediment Basin by the proponent by road tanker.
- During operation of Cell 2: Following construction, and when vegetative cover is established on most of the external batters, then water demand for dust suppression will be significantly reduced. At this stage, dust suppression will be managed in accordance with the requirements of the EPL.

9 Environmental Management

9.1 Environmental Licence

The site is not presently licensed. Stormwater discharges will need to comply with water quality and monitoring requirements imposed by any Environment Protection License issued by the NSW Environment Protection Authority in accordance with the NSW Protection of Environment Operations Act.

9.2 Landfill Environmental Management Plan.

Requirements for environmental management of the landfill will be documented in a Landfill Environmental Management Plan (LEMP). This plan will identify requirements for surface water monitoring and reporting.

9.3 Monitoring Regime for Surface Water

Surface water should be monitored in the sediment dam in accordance with requirements stipulated in the Environment Protection Licence, and procedures outlines in the LEMP. Typical requirements would include:

- Quarterly routine monitoring of water quality;
- Monitoring of water quality after rainfall and prior to any 'planned discharge' to verify compliance with the requirements of the EPL. If the water quality is unlikely to comply with water quality requirements, then the dam should be flocculated to improve water quality prior to discharge; and
- Monitoring of water quality during heavy rainfall resulting in 'unplanned discharges' via the spillway, to the extent that is practical and safe to do so.

Typical analytes for testing and reporting include:

- Total nitrogen;
- Potassium;
- pH;
- Total Suspended Solids (TSS);
- Total Organic Compounds;
- Total Dissolved Solids;
- Visibility of oils and petrochemical films; and
- Presence of ammonia.

10 References

The Australian and New Zealand guidelines for fresh and marine water quality, 2000, published by the Australian and New Zealand Environment and Conservation Council (ANZECC 2000)

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

Managing Urban Stormwater – Soils and Construction (4th Edition), (DECC 2008).

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NSW EPA (2016) Environmental Guidelines Solid Waste Landfills 2nd ed. Sydney

NSW Water Quality and River Flow Objectives (DEC 2006)
https://www.environment.nsw.gov.au/ieo/Murrumbidgee/report-02.htm#P393_43912

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