



TUMBLONG NON-PUTRESCIBLE WASTE DISPOSAL FACILITY

LEACHATE MANAGEMENT PLAN

Prepared for MH Earthmoving Pty Ltd
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- Appendix A Compliance Summary with NSW EPA Environmental Guidelines: Solid Waste Landfills (2016) and EPL 21440.
- Appendix B Emergency Response Plan (ERP).
- Appendix C Site Leachate HELP Modelling Report
- Appendix D Temporary Leachate Dam and Floating Cover As-Constructed Drawings.
- Appendix E Cell 1 & 2 Leachate Side Riser Solar Pump Specification

ABBREVIATIONS

AS	Australian Standard	HDPE	High Density Polyethylene (Geomembrane)
AHD	Australian Height Datum	HELP	Hydrologic Evaluation Landfill Performance
BOM	Bureau of Meteorology	kN	Kilonewton
CGRC	Cootamundra-Gundagai Regional Council	LCES	Leachate Collection and Extraction System
CQA	Construction Quality Assurance	LLDPE	Linear Low Density Polyethylene (geomembrane)
DA	Development Approval (Cootamundra-Gundagai Regional Council)	LMP	Leachate Management Plan
DST	Double-Sided Textured (Geomembrane)	m	Metres
EIS	Environmental Impact Statement	MHE	MH Earthmoving Pty Ltd
EMP	Environmental Management Plan	mm	Millimetres
ENM	Excavated Natural Material, defined in the NSW EPA excavated natural material exemption 2014	N	Newton
EPA	Environment Protection Authority	NATA	National Association of Testing Authorities
EPL	Environment Protection Licence	NSW	New South Wales
ERP	Emergency Response Plan	RL	Reduced Level
ESCP	Erosion and Sediment Control Plan	SST	Single-Sided Textured (Geomembrane)
GCL	Geosynthetic Clay Liner	TSS	Total Suspended Solids
GRI	Geosynthetic Research Institute	WH&S	Work Health & Safety

DEFINITIONS

Geosynthetics	Synthetic material (man-made plastic and fabric) used in geotechnical and construction applications.
Leachate	Liquid generated when water interacts with decomposing waste.
Emergency Response Plan	A structured plan detailing actions in case of leachate emergencies.
Principal	MH Earthmoving Pty Ltd (MHE)
Protection Geotextile	A non-woven, needle punched geotextile deigned to protect the underlying leachate barrier from damage during installation and subsequent landfilling.
Site	Tumblong Non-Putrescible Waste Disposal Facility
Leachate Management Plan	This document.
Works	The whole of the work to be executed in accordance with the Contract, including variations provided for by the Contract, which by the Contract is to be handed over to the Principal.
Works Area	As defined by the Contract Drawings.

1 INTRODUCTION

Tumblong Non-Putrescible Waste Disposal Facility (Tumblong Landfill), located at Tumblong Reserve Road, Tumblong, NSW (the site), is operated by MH Earthmoving Pty Ltd (MHE) under Environmental Protection Licence (EPL) 21440, issued by the NSW Environmental Protection Authority (EPA). The landfill accepts general solid waste (non-putrescible) and has been developed in accordance with relevant planning approvals, design documentation, and environmental management requirements.

This Leachate Management Plan (LMP) outlines the strategy for managing leachate during both the operational and post-closure phases of the landfill. MHE is committed to effective leachate management to ensure compliance with statutory obligations under EPL 21440 and the NSW EPA Environmental Guidelines: Solid Waste Landfills (2016), herein referred to as the 'Landfill Guidelines'.

The aims of this LMP are to minimise the risk of leachate escaping the containment system, to protect surrounding environmental receptors (including surface water and groundwater) and to ensure appropriate handling, storage, treatment and disposal of leachate throughout the life of the landfill. This LMP also supports ongoing environmental monitoring and continuous improvement initiatives implemented by MHE to uphold best practice landfill management.

1.1 Objectives and Purpose of this Plan

The purpose of this LMP is to provide a clear and comprehensive framework for the effective management of leachate generated at Tumblong Landfill and to satisfy condition U1 of EPL 21440. Leachate has the potential to mobilise contaminants, posing a risk to surrounding environmental receptors if not properly managed. This LMP outlines the strategies and procedures for the collection, containment, transfer and disposal of leachate in strict accordance with the conditions of EPL 21440 and the Landfill Guidelines.

This LMP encompasses all aspects of leachate management at the site, including the design and construction of the leachate storage dams, collection and transfer systems, approved disposal methods and restrictions on the use of leachate. It applies to all personnel involved in landfill operations, ensuring each team member understands their role in maintaining environmental compliance and protecting the surrounding environment.

2 REGULATORY REQUIREMENTS

This section details the relevant regulatory requirements in respect to leachate management at the site.

2.1 NSW EPA Environment Protection Licence 21440

Leachate management at Tumblong Landfill is supported by the regulatory framework established by EPL 21440, which sets specific conditions related to leachate management that must be strictly adhered to. Additionally, MHE align their operations with the Landfill Guidelines, which provide best practice techniques for the containment and responsible management of waste and leachate at modern landfills.

This LMP serves as a proactive response to these regulatory requirements. It details MHE's commitment to not only meet, but exceed the stipulated conditions, ensuring Tumblong Landfill operates in an environmentally responsible and sustainable manner.

It is MHE's responsibility to implement the measures outlined in this LMP and through ongoing monitoring, reporting and training continually improve leachate management practices. By doing so, MHE contribute to the preservation and protection of the natural surroundings in Tumblong and uphold the commitment to the local environment and community.

A copy of current EPL 21440 is provided in the following link.

<https://app.epa.nsw.gov.au/prpoeoapp/SearchResult.aspx?SearchTag=licence&searchrange=licence&range=licence>

2.1.1 Key EPL Conditions Relevant to Leachate Management

EPL 21440 contains the following conditions that are relevant to leachate management and the preparation of this LMP:

O7.4 Management of Water Contacting Waste

EPL condition O7.4 states that any *'water which contacts waste, other than virgin excavated natural material, must be managed as leachate'*. This condition recognises the potential for water to become contaminated when it comes into contact with waste materials, necessitating its proper collection and treatment as leachate.

O7.5 Leachate Disposal

EPL condition O7.5 provides clear directives regarding the permissible methods for leachate disposal. Condition O7.5 states *'Leachate must only be disposed of by:*

- a) Evaporation;*
- b) Irrigation within the active cell of the landfill; or*
- c) Disposal at a facility licensed to accept such waste'.*

While EPL 21440 does not explicitly specify where evaporation may occur, it is undertaken within the permanent leachate dam, above the floating geomembrane cover of the temporary leachate dam, and within the active landfill cell/s.

Irrigation within the active cell involves the controlled application of leachate onto waste surfaces to promote evaporation. This practice occurs within fully contained, EPA-approved landfill cells and leachate dams equipped with composite leachate barrier systems. Spraying leachate onto waste during dry conditions is considered best practice, as it enhances evaporation beyond what would occur from the storage dam/s alone.

O7.6 Irrigation of Leachate

EPL condition O7.6 states *'Irrigation of leachate within an active cell must only be undertaken:*

- a) During dry weather; and*
- b) Such that ponding or run off within the active cell does not occur and if the active tipping face is enclosed by a 300mm high earthen bund'.*

O7.7 Use of Leachate as Dust Suppressant

EPL condition O7.7 states *'Use of leachate as a dust suppressant outside of the active landfill cell is prohibited'.*

This restriction ensures leachate is managed responsibly and prevents potential environmental risks and pollution associated with its application beyond contained landfill areas.

O7.8 Leachate Level Above the Base Liner

EPL condition O7.8 states *'Leachate in all waste cells must be kept at a level no greater than 300 millimetres above the upper surface of the base liner'.*

The condition limits the build-up of leachate within the base of the landfill, meaning automated measures are required to ensure pumping maintains the maximum leachate head stated (within the operating capacity of the side riser pumps).

U1 Leachate Management Plan

Condition U1 requires MHE to submit a LMP to address a number of operational and environmental measures which are covered in detail in Section 6 of this LMP.

2.2 Cootamundra – Gundagai Regional Council Development Consent

Tumblong Landfill operates under Development Consent DA2019/143, issued by the Cootamundra – Gundagai Regional Council (CGRC) on 29 June 2020. Specific leachate management requirements from both EPL 21440 and DA2019/143 are detailed in this LMP.

Development Consent DA2019/143 is largely silent on specific requirements for leachate management. Instead, the consent defers to the regulatory oversight of the NSW EPA by adopting the General Terms of Approval (GTAs) issued under the Protection of the Environment Operations Act 1997 (POEO Act).

The GTAs, as outlined in Attachment 1 of the Development Consent, include provisions under Section O.8 – Leachate Management, which broadly reflect the current EPL 21440 conditions. Notably, the GTAs explicitly permit irrigation of leachate within the active cell of the landfill, subject to strict operational controls to prevent ponding, runoff, or environmental harm.

This alignment between the DA and EPL ensures a consistent and enforceable framework for the management, treatment, and disposal of leachate generated on site, in accordance with best practice principles and environmental protection objectives.

2.3 NSW EPA Landfill Guidelines

The Landfill Guidelines provides guidance and outlines the minimum standards for the environmental management, which includes leachate management, of landfills in NSW. These include a mix of design and construction techniques, effective site operations, post-closure management and monitoring & reporting protocols.

Section 2 of The Landfill Guidelines specify the following required outcomes in relation to leachate storage and disposal:

- Collected leachate must be stored in appropriately sized dams or tanks and disposed of so as not to cause environmental harm.
- There must be sufficient leachate disposal capacity to prevent the build-up of leachate and an increase in the risks of water pollution and offensive odours.
- Untreated leachate must not be disposed of to off-site water or land, used for dust suppression, or used to supply the water needs of any process conducted at the landfill, such as composting.

3 SITE SETTING AND OVERVIEW

3.1 Site Location and Access

The site is identified as Lot 7004 of Deposited Plan 1028797, Lot 7300 of Deposited Plan 1149008 and Lot 10 DP1210362 and Part Crown Road was designated as a quarry (Reserve 89508). The Site is located within the Tumblong region within the CGRC area. The Site is located off the surfaced Tumblong Reserve Road, approximately 1.2 kilometres from its intersection with the Old Hume Highway (see Figure 1). In turn, the sealed Old Hume Highway intersection with the current Hume Highway lies a further 2.3 kilometres away. The site occupies approximately 4.5 hectares of land.

The site is located approximately 3.5 kilometres from the Tumblong community and 18 kilometres from the Gundagai township. Site access is via Tumblong Reserve Road.

3.2 Ownership and Zoning

The site was previously administered by the NSW Department of Industry (Crown Lands) but has subsequently been transferred to CGRC who used the previous quarry site since being licensed in 1975. MHE has management rights over the site until the landfill is fully rehabilitated. The adjacent Lot 1 DP702858 is owned by MHE. MHE operates the landfill facility under a commercial lease agreement with CGRC.

The site is zoned RU1 – Primary Production in the Land Zoning Map and is designated as “AB2” in the Lot Size Map.

3.3 Site Overview

The site contains two engineered landfill cells, two leachate storage dams (one permanent and one temporary), a sediment dam, sealed access roads and perimeter fencing. Ancillary structures are contained at the site, including a site office and staff amenities.

Only paper machine rejects, dregs, grits, boiler sand/fly ash and recrystallisation plant residue that has come from the Visy Pulp and Paper Mill, located at Tumut NSW and meets the definition of General Solid (non-putrescible) Waste can be accepted at the premises.

Waste void space capacity is limited to 485,000 m³ and the total quantity of waste disposed of at the premises must not exceed 60,000 tonnes per annum. Waste disposal at the premises must cease 10 years from the date the first load of waste received at the premises, unless otherwise approved in writing by the EPA. After this period, the site must be closed, capped and rehabilitated.

3.4 Environmental Characteristics

3.4.1 Regional Geology

A review of the 1:250,000 regional geological map for Wagga Wagga, Metallogenic Series Sheet SI/55-15, first edition 1977 shows the site within a geological unit labelled B3L6. From the geological map, the site geology comprises rocks of the Bowning Tectonic Stage of mid-late Silurian age. The rocks form part of the Cowra Trough which formed by volcanic rift initially which developed into marginal sea with oceanic crust. The B3L6 unit is described as ‘*chloritic phyllite, greywacke, andesite, andesitic tuff, porphyritic dacite, rhyodacitic and rhyolitic lava and tuff, ignimbrite, jasper, cert, minor limestone; includes small serpentinite lenses*’.

3.4.2 Surface Water

A Surface Water Assessment was undertaken by SLR Consulting Pty Ltd (SLR), (November 2019) and concluded the following:

- 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.
- 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.
 - Progressive revegetation of disturbed surfaces.

3.4.3 Hydrogeology

DM McMahon Pty Ltd (McMahon) *Groundwater Impact Assessment, Ref.5985*, dated November 2019, presented the hydrogeological findings of an investigation that included the installation of a series of boreholes drilled at the site. The main findings from this study, with respect to groundwater at the site, were:

- The hydrogeology at the site and the surrounding region is a low yielding fractured rock aquifer system within the Silurian quartz rich shale/slate siltstone and fine sandstone of the Bumbole Creek Formation.
- The site assessment identified a water bearing zone at the contact between the weathered and unweathered shale at a depth of approximately 58 metres below the ground surface.
- Falling head slug tests found that shallow and deep monitoring bores have hydraulic conductivities between 4.4×10^{-6} m/sec and 8.2×10^{-8} m/sec, which is considered to compare favourably to a minimum hydraulic conductivity of a compacted clay liner of 1×10^{-9} m/sec.
- Concentrations of nickel in samples of groundwater collected from the monitoring bores precludes the aquifer from being used as a source of drinking water.
- Elevated concentrations of manganese in samples of groundwater collected from the monitoring bores suggest the aquifer is anoxic and hydraulically disconnected from the overlying surface water system.

3.4.4 Local Climate

The typical climate and rainfall statistics of the area are provided in Table 1.

Table 1 Typical Climate and Rainfall for the Gundagai Region

Average Temperatures and Rainfall for Gundagai region	
Climate Element	Annual Average
Mean Maximum Temperature (°C)	22.7
Mean Minimum Temperature (°C)	9.1
Mean Rainfall (mm)	624.1

Source: Bureau of Meteorology (BOM) – Summary Statistics Gundagai
http://www.bom.gov.au/climate/averages/tables/cw_073141.shtml

4 LEACHATE MANAGEMENT INFRASTRUCTURE

The leachate management infrastructure includes principally a fully contained operational Cell 1 & 2 which includes leachate drainage aggregate, perforated basal pipework and extraction side risers, and a fully contained permanent and temporary leachate storage dam. Both the landfill cells and the leachate dams are operational, having been constructed under independent construction quality assurance (CQA) supervision, and a CQA validation report being submitted and subsequently approved by the NSW EPA. Figure 1 presents a general site layout with locations of the landfill cells and leachate management infrastructure.

4.1 Landfill Cells 1 & 2

Both Cell 1 and Cell 2 at Tumblong Landfill are active operational landfills and play a central role in containing and storing leachate. They were constructed in accordance with EPL 21440 condition E1, CGRC Development Consent and the Landfill Guidelines. The Cells were constructed in accordance with the approved Technical specification and CQA plan, which incorporated the following design elements, from bottom up:

- >200mm thick compacted sub-base;
- geosynthetic clay liner (GCL);
- 2mm thick high-density polyethylene geomembrane liner;
- protection geotextile;
- leachate collection layer comprising >300mm of drainage aggregate;
- leachate collection pipework and extraction side risers;
- separation/filter geotextile.

The leachate management component for Cells 1 & 2 incorporate the following;

- An engineered fall on the cell floor that has a minimum 1% fall to the sump and a 3% transverse fall to the leachate collection pipework and sump (localised low point).
- A minimum 300mm granular leachate drainage aggregate placed upon the geosynthetic layers.
- A leachate collection pipework system, comprising of perforated HDPE pipes, that assists in conveying leachate to the sump.
- Separator geotextile placed over the leachate drainage aggregate to minimise contamination of the aggregate from fine particles within the percolating leachate and overlying waste.
- Leachate side-slope HDPE riser pipe to allow for the extraction of collected leachate within the basal sump.

The design ensured the safe containment of leachate and minimises the risk of environmental contamination. A Construction Quality Assurance (CQA) Validation Report was produced for both Cells 1 and 2, post construction and submitted to the NSW EPA, in response to Section 9 – Special Conditions (E1) of EPL 21440.

The design configuration including leachate pipework layout is presented within Figure 2.

4.2 Permanent Leachate Storage Dam

The leachate storage dam at Tumblong Landfill plays a central role in containing and storing leachate. It was constructed in accordance with Landfill Guidelines Section 2.1, which requires *'the dam liner must be designed and constructed to a standard similar to that of the landfill cell liner'*. The design ensured the safe containment of leachate and minimizes the risk of environmental contamination.

The 2020 CGRC DA approval for Tumblong Landfill included provision for a single permanent leachate storage dam on the western boundary of the site, designed to service both Cell 1 and Cell 2. The required storage volume was determined in accordance with the findings of the SLR Consulting Pty Ltd (SLR) *Leachate Generation Assessment Report*, dated 17th August 2020, see Appendix C. The SLR report provided modelled leachate generation volumes derived using the Hydrologic Evaluation of Landfill Performance (HELP) model in accordance with the Landfill Guidelines.

The permanent leachate dam was constructed concurrently with the development of Cell 1 and was constructed under independent CQA supervision, with validation reporting completed in accordance with the project's CQA Plan. The CQA Validation Report was submitted to and approved by the NSW EPA, confirming compliance with all design and environmental requirements.

This dam forms a critical component of the site's leachate management system and was intended to provide sufficient capacity under normal operating conditions. However, due to exceptional rainfall events in recent years, a supplementary temporary leachate dam was consented by CGRC and subsequently constructed to manage additional leachate volume from Cells 1 & 2 and to maintain operational flexibility.

4.2.1 Design and Construction – Leachate Dam Lining Requirements

In accordance with Landfill Guidelines section 2.1, the leachate storage dam at Tumblong Landfill was designed and constructed to meet the following requirements:

- **Geosynthetic Liner:** The dam is lined with a geosynthetic clay liner (GCL) and a 2mm HDPE geomembrane, which provides a composite leachate barrier which prevents leachate from escaping. This composite leachate barrier system meets and exceeds the specifications outlined in the Environmental Guidelines.
- **Compacted Low Permeability Clay:** In addition to the composite leachate barrier system, the dam is lined with > 200mm of compacted low permeability clay-rich material. This clay-rich sub-base serves as an additional third layer of groundwater protection.

The design and construction of the leachate storage dam adheres to industry best practices and engineering standards ensuring its ability to contain leachate effectively.

4.3 Temporary Leachate Storage Dam

As a result of unprecedented rainfall events across the region in recent years, characterised by prolonged wet weather, limited evaporation, and episodic flooding, the volume of leachate accumulating within the operational Cell 1 and the non-operational Cell 2 at Tumblong Landfill reached approximately 25 megalitres (ML). Cell 2, while fully lined, had not yet been commissioned and therefore did not have active leachate extraction infrastructure in place at the time of the prolonged rainfall events.

Despite the HELP modelling and suitable design capacity proposed by SLR, the permanent leachate dam did not have sufficient capacity to manage the accumulation of leachate on site. To enable the completion of construction works within Cell 2 and to prevent environmental impacts from uncontrolled leachate storage, a temporary leachate storage dam was proposed, consented and subsequently constructed.

This temporary dam was fully engineered in accordance with the technical requirements of the Landfill Guidelines, including the installation of a GCL and HDPE geomembrane liner system and a fully sealed floating linear low density polyethylene (LLDPE) cover. The floating cover serves a dual function, excluding rainfall, thereby preventing further volume accumulation, and containing odours. To further mitigate potential odour impacts, and in accordance with recommendations from The Odour Unit Pty Ltd (TOU), the dam cover is fitted with air displacement outlets that connect to a series of activated carbon filter units. These filters treat vented air displaced during leachate transfer operations and ongoing storage fluctuations.

The proposed temporary leachate dam has been constructed at the Tumblong Landfill facility within the neighbouring Lot by MH Earthmoving (MHE) and a specialist lining contractor. The neighbouring Lot is situated to the east of the landfill site, owned by MHE (see Figure 1). The approximate dimensions (between anchor trenches) of the temporary leachate dam is approximately 130m in length (east - west) x 60m wide (north - south) and 3m deep from ground level, recessed within insitu subgrade.

In accordance with the CGRC consent, *'the temporary leachate pond on Lot 3 DP 702858 is to be decommissioned five (5) years from the date of the transfer of leachate from Cell 2 to the temporary leachate pond'*. The decommissioning of the temporary leachate dam will therefore be 12 December 2028. Leachate within the temporary leachate dam will need to be removed in a manner prescribed within the Consent. Leachate management at the site will revert back to the permanent leachate dam located close to the western boundary of the site. Decommissioning shall be undertaken in accordance with InSitu Advisory *Tumblong Landfill, Temporary Leachate Dam – Decommissioning & Rehabilitation Plan*, ref: ISA-521-24-25, dated December 2024.

4.3.1 Temporary Leachate Dam Floating Cover

The floating cover system installed within the temporary leachate pond at Tumblong Landfill is a purpose-engineered geomembrane cover designed to control rainfall ingress (limiting additional leachate volume generation from direct rainfall) into the dam and assist in the passive control of odours and emissions from the stored leachate. The limiting factor of the floating cover is no evaporation from the leachate surface can occur in suitable drying conditions.

The general arrangement drawings (see Appendix D) demonstrates the floating cover comprised of a prefabricated geomembrane panel system, shaped to conform to the dam's planform and being securely restrained at its perimeter via an anchor trench installed along the internal batter crest. The membrane floats directly on the leachate surface beneath, supported by encapsulated closed-cell polyethylene foam floats that are evenly distributed beneath the cover and strategically reinforced in areas subject to foot traffic.

To facilitate surface water management, the cover is constructed with an intentional gradient to encourage stormwater migration towards designated low points. At these locations, a purpose-fabricated sump detail is integrated into the membrane. Some liquid above the floating cover assists with minimising wind uplift of the cover and affords a degree of UV resistance to the LLDPE geomembrane floating cover materials.

Collectively, the design presents a robust and operationally considered floating cover system. All major components, geomembrane, floats, ballasts, anchorage, sump and gas extraction points are detailed in accordance with best practice construction standards for floating covers used in waste containment infrastructure. The system offers a balance of durability, functionality, and maintainability, addressing both hydraulic and environmental requirements of the leachate storage facility at Tumblong Landfill.

4.3.2 Temporary Leachate Dam - Odour Management Infrastructure

The odour management component of the floating cover includes two dedicated odour take-off ports located on two sides of the cover. These ports were constructed by welding HDPE flanges to the cover membrane at 300 mm penetrations over the installed Megaflow drainage pipe. Each port comprises a sandwich flange system with a removable cap, allowing connection of gas extraction pipework to the odour control units. The Megaflow drain itself is installed over the underlying geomembrane liner and is positioned around the perimeter of the pond to manage subsurface odour or liquid accumulation beneath the floating cover.

4.4 Landfill Capping

Landfill capping plays a vital part of leachate management strategy at any landfill facility, the following section presents the current situation at Tumblong Landfill, and what commitments are to be made by MHE.

4.4.1 Interim Capping

Cell 1 has largely ceased being operational (with the exception of Cell 2 waste placed against the Cell 1 waste as the landfill continues to be filled to achieve the required landform). The northern, western and southern flanks of Cell 1 have been covered with an intermediate cap, in accordance with Landfill Guidelines, Section 8.2, comprising clay-rich materials derived from on-site stockpiles. Intermediate cover thickness exceeds the Landfill Guidelines requirements in respect to minimum thickness of 300mm, MHE states the cover soils upon Cell 1 are in excess of 500mm. The intermediate cap restricts rainwater infiltration into the waste, diverting stormwater to perimeter catchment ditches.

4.4.2 Proposed Final Capping and Revegetation

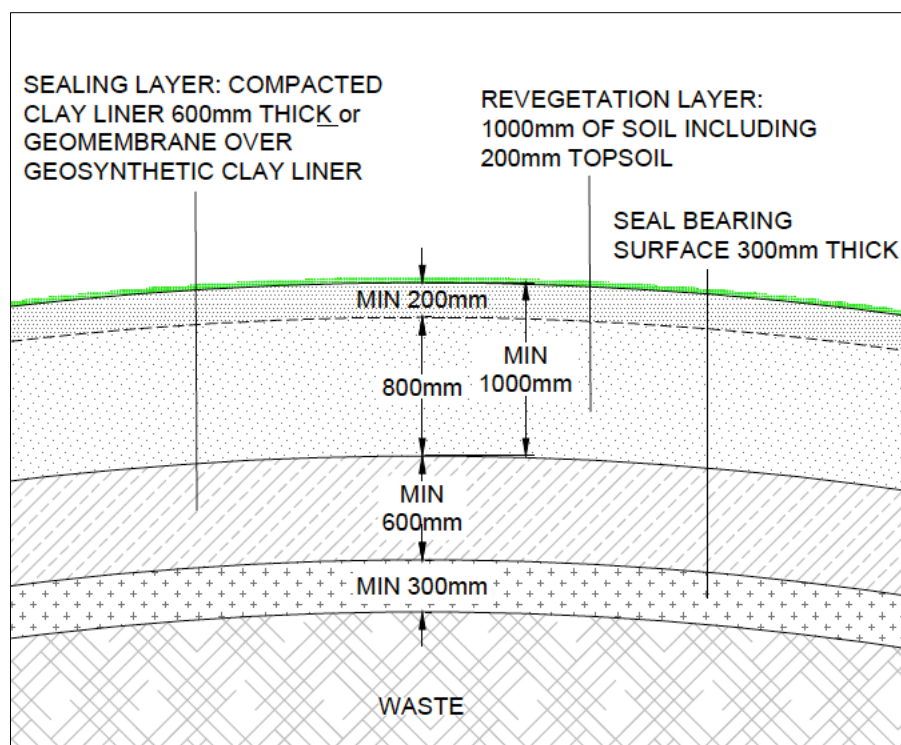
Final capping and revegetation of completed waste cells at Tumblong Landfill shall be undertaken in accordance with Landfill Guidelines, Section 9. Section 9 provides minimum standards to be achieved for final capping and revegetation which are as follows, from bottom to top:

- a seal-bearing surface consisting of a properly designed and engineered layer of material at least 300 millimetres thick to support the sealing layer;
- a sealing layer, comprising a compacted clay layer at least 600 millimetres thick, with an in situ saturated hydraulic conductivity of less than 1×10^{-9} metres/second.
- a revegetation layer at least 1000 millimetres thick and comprising clean soils and vegetation with root systems that will not penetrate into lower layers; the upper 200 millimetres should be a topsoil layer, which can include compost to help with vegetation establishment and growth.

The Landfill Guidelines allow a geosynthetic clay liner to be used as an alternative to compacted clay, provided it is used in composite with a geomembrane. To allow flexibility and to avoid stressing of the geomembrane, a linear low density polyethylene geomembrane (LLDPE) may be used as an alternative to a high-density polyethylene (HDPE) that is typically used in a basal landfill containment leachate barrier.

Typical final landfill capping profile is shown in **Figure A** below.

Figure A – Typical Permanent Landfill Capping Profile



MHE is looking to engage a consultant to undertake the final capping and revegetation design for the completed areas of Cell 1. A detailed capping design shall be undertaken and submitted to the NSW EPA for consideration, prior to commencement of works. The detailed design shall propose which capping option is preferred (compacted clay or geosynthetic), and present edge tie in details to ensure the permanent capping is connected to the side wall engineered leachate barrier for full containment. The design shall also provide details of the rehabilitation soils details and final landfill profile, post restoration.

The capping design will acknowledge Landfill Guidelines, Section 9.1 that states “*to facilitate runoff and minimise ponding of water, the cap should have a gradient of greater than 5% to defined drainage points. However, to reduce the risk of erosion, steep caps (greater than 20%) should be avoided*”. Furthermore, “*the final capping should not permit water pooling and should not contain constructed water features such as ornamental lakes or ponds on areas over the waste mass. These features may leak and infiltrate the cap if the pond lining is compromised by differential settlement of the waste and/or desiccation if the pond becomes dry*”.

Permanent capping works shall be undertaken in accordance with Landfill Guidelines, Section 11 – Quality Assurance. An independent construction quality assurance engineer shall be on site during the critical stages of the works to ensure the works are completed in accordance with an approved Technical Specification, CQA Plan and the Landfill Guidelines.

Stormwater measures shall be incorporated into the final capping design to divert water from the capped surface to perimeter ditches. Allowing stormwater to drain freely from the cap minimises infiltration and water ponding, thereby reducing further leachate generation.

5 OPERATIONAL LEACHATE MANAGEMENT

Leachate is generated when rainfall or other liquids infiltrate the landfill, coming into contact with waste materials. Its composition varies with waste type and may contain organic matter, heavy metals, suspended solids, and other contaminants. Effective collection, containment and disposal of leachate are essential to prevent environmental harm and ensure compliance with the requirements of EPL 21440 and the POEO Act 1997.

Effective leachate management is a fundamental aspect of the commitment to responsible landfill operations at Tumblong Landfill.

5.1 Significance of Leachate Management

Leachate management is vital for several reasons:

1. **Environmental Protection:** Leachate may contain pollutants that, if not managed properly, may harm local ecosystems, soil, and water quality. By effectively managing leachate, MHE can mitigate potential environmental damage;
2. **Regulatory Compliance:** Compliance with EPL 21440 and CGRC development consent is a legal obligation. Failure to manage leachate in accordance with these requirements can result in regulatory violations, penalties and harm to the community's well-being; and
3. **Community Responsibility:** As responsible stewards of the environment, it is MHE's ethical duty to ensure that landfill operations do not adversely affect the surrounding area. Effective leachate management is an essential part of fulfilling this responsibility.

5.2 Key Aspects of Leachate Management

MHE has implemented robust collection and containment systems, including:

- Leachate collection pipes and drainage layers, which intercept and convey leachate from within the waste mass;
- Basal sumps and sidewall risers for leachate extraction;
- Temporary and permanent lined leachate storage dams for interim containment; and
- Automated pump control systems, including float switches, to manage leachate levels at EPL thresholds.

5.3 Minimisation

The following measures are implemented to minimise leachate generation at the site:

- Landfilled waste is compacted following placement and covered with daily cover materials from on-site stockpiles;
- Intermediate cover material is placed on areas of waste that will be exposed for an extended period of time (> 90 days, but not yet final capped) with on-site stockpiled clay-rich materials;
- Where possible, clean stormwater is diverted away from landfilled areas which have not yet reached their final levels and grades; and
- Daily and intermediate covered areas are generally sloped to encourage stormwater runoff.

5.4 Cell 1 and Cell 2 Leachate Collection & Extraction

Leachate generated within the active cells percolates through the waste profile and passes through a separator/filter geotextile into a minimum 300 mm thick basal drainage aggregate layer. Embedded within this aggregate layer are perforated HDPE collection pipes, installed at grades to direct leachate to a basal sump.

From the sump, leachate is extracted via an HDPE sidewall riser pipe, which has been designed to extend from each cell base to at least 1 m above the landfill surface, allowing for safe and controlled pump access.

5.5 Leachate Transfer & Treatment

Leachate generated within the current landfill cells on site needs to be transferred to the leachate storage dams to ensure environmental compliance. Both Cells 1 and 2 have an HDPE side wall riser pipe where a pump is installed that pumps leachate from the base of the landfill. Each cell has a solar/direct current (DC) powered pump fitted with a float switch that either pumps continuously or initiates pumping to maintain a leachate level in compliance with the EPL. The pumps are powered by a DC generator set initially until sufficient power is provided by the attached solar power. With the combination of solar and DC power, the pumps can operate unattended continuously for 24 hours per day. Technical details of the pumps are presented within Appendix E.

At the time of drafting this LMP, both leachate side risers pump leachate to the permanent leachate dam on the western site boundary. Leachate within the permanent leachate dam is oxygenated by the following methods:

- Mechanical oxygenation – two floating aeration pumps operate within the permanent dam by re-circulating leachate from deeper in the water column and spraying over the surface of the leachate by multi-directional nozzles.
- Chemical oxygenation – hydrogen peroxide H_2O_2 is an oxidant which is introduced to the leachate to compliment the mechanical oxidation. H_2O_2 can oxidize odour-causing compounds such as hydrogen sulphide.

Mechanically and chemically treated leachate within the permanent leachate dam is subsequently pumped by a skid mounted Pioneer pump through a series of surface laid pipes and manifolds up to the temporary leachate dam where it is either discharged under the floating cover for temporary storage or above the cover for ongoing disposal via evaporation. Pumping of treated leachate occurs from the upper water column in the permanent dam, to ensure suspended solids and sediment at the base of the dam are not pumped to the temporary dam but stay in the permanent dam where they can be periodically removed.

Leachate stored within the temporary leachate dam, under the floating cover is pumped to the permanent dam, when capacity allows, for mechanical and chemical treatment prior to disposal by the following means.

5.6 Responsible Leachate Disposal

Leachate disposal is conducted strictly in accordance with EPL 21440. It may occur through evaporation, irrigation or transport to a licensed facility for disposal. These methods ensure that leachate is managed responsibly, minimising environmental impact. Leachate is managed, stored and disposed of with strict adherence to EPL condition O7.5 and O7.6.

The following leachate disposal methods are consented within EPL 21440:

5.6.1 Evaporation

Natural evaporation is utilised under favourable climatic conditions, particularly during warmer months (November to March), to reduce stored volumes with minimal environmental impact. Evaporation occurs within the permanent leachate dam, above the floating cover within the temporary dam and within the operational waste areas.

5.6.2 Irrigation

Spray irrigation within the active Cell 2, usually undertaken by water cart spraying over the exposed waste surfaces.

5.6.3 Disposal at Off-Site Licensed Facility

When circumstances require and as per EPL condition O7.5(c) leachate may be transported and disposed of at a facility that holds the appropriate licence to accept such waste.

5.7 Leachate as Dust Suppression

Leachate may be considered for use as a dust suppressant only within active lined cells, subject to EPL Conditions O7.5 and O7.6. This limited use requires careful application to prevent leachate migration beyond the lined containment zone and over-saturation of the waste.

5.7.1 Prohibited Use Outside Active Cell

As per EPL condition O7.7, the use of leachate as a dust suppressant outside of the active lined cells is strictly prohibited. This condition reflects a commitment to responsible leachate management and environmental protection. The prohibition on using leachate as a dust suppressant outside the active lined cells is based on several key considerations:

- Potential environmental impact - leachate may contain contaminants and pollutants derived from unclean waste materials. Using leachate for dust suppression outside the active lined cells increases the risk of introducing these contaminants into the environment, potentially causing harm to ecosystems, soil, and water quality.
- Regulatory compliance - EPL condition O7.5 aligns with the regulatory framework established by the NSW EPA. Compliance with this condition is a legal requirement.
- Alternative dust control methods - Where dust control is required outside the active lined areas, MHE utilises non-leachate dust suppressants (such as clean water from the stormwater collection pond), selected based on its environmental compatibility, effectiveness and regulatory acceptability.

5.8 Odour Management and Mitigation

Odour associated with the storage of leachate within both the leachate dams and within the active landfill is discussed in Northstar Air Quality report *Landfill Gas Management Plan*, reference 25.1120.FR2V1, dated July 2025.

6 POLLUTION REDUCTION MEASURES

This section addresses EPL 21440 Section 8 Pollution Studies and Reduction Programs, clause U1 Leachate Management Plan.

Clause U1 requires a number of management measures, that are addressed in the following sub-sections:

6.1 Control of landfill subsurface water table (EPL U1.1.1)

Groundwater occurs at a depth of 58 metres below existing ground surface at an elevation of 209.47 m AHD, as detailed in the McMahon Earth Science *Groundwater Impact Assessment* dated November 2019. This substantial hydraulic separation and the depth of natural geological barrier significantly reduces the risk of leachate impacting groundwater quality. Groundwater inflow into the landfill cells is expected to be minimal as they are lined in accordance with the NSW Landfill Guidelines.

6.2 Actions to be taken to minimise water ingress (EPL U1.1.2)

i. Restriction and/or limitation, or allowance of specified activities to be performed during wet weather;

Minimising water ingress into the landfill is essential to reduce leachate generation and maintain the effectiveness of containment systems. Site measures to minimise water ingress into the landfill are as follows:

- Installation and management of stormwater diversion bunds around the perimeter of the landfill cells to divert clean rainwater to settlement ponds on site;
- Minimising the operational tipping area, keeping the landfill area as small as possible, with the remaining area being daily or intermediate covered;
- Application of daily cover in accordance with Landfill Guidelines, Section 8.1 to limit rainfall infiltration into the waste (and therefore the amount of leachate generated) and the emission of landfill gas;
- Application of intermediate cover in accordance with Landfill Guidelines, Section 8.2 over any waste-filled areas that have not been landfilled for more than 90 days should have an intermediate soil cover to restrict the rainfall infiltration rate into the waste to 20% of the total rainfall;
- MHE plan to permanently cap Cell 1 in accordance with the Landfill Guidelines, Section 9 as part of the staged development of the landfill. Once completed, the final cap will substantially reduce rainfall infiltration into the waste mass by introducing a separating low-permeability barrier above the waste and directing surface water away from the waste body into stormwater collection infrastructure detailed in the SLR *Surface Water Assessment* report, dated 4 November 2019, submitted as part of the EIS; and
- Spray irrigation of leachate within Cell 2 to be undertaken on suitable drying days only, not during wet weather periods where additional leachate loads into the active cell will occur.

6.3 Leachate extraction and level-control within the active cells (EPL U1.1.3)

Leachate extraction and level control within the active cells at Tumblong Landfill are critical components of the site's broader leachate management strategy, supporting compliance with EPL 21440.

Leachate extraction and level control measures are detailed in Section 5.5 of this LMP. Leachate is extracted from the basal drainage infrastructure through HDPE side riser pipes by fully automated pumps, ensuring leachate heads within the cells remain compliant with EPL 21440. Leachate depths are verified through regular monitoring of leachate sump levels and the ongoing performance of extraction equipment.

Should high rainfall or pump malfunction occur, contingency measures will be in place, including using available capacity within the lined leachate storage dam/s and operational protocols to replace defective pumps etc.

Routine inspections and scheduled maintenance of the pumping infrastructure form part of MHE's operational approach to ensure the system performs as intended and remains compliant with environmental requirements.

6.4 Leachate Storage Options (EPL U1.1.4)

Leachate generated at Tumblong Landfill is currently stored and managed using two dedicated leachate storage dams and within the base of the landfill cells, within the leachate drainage layer.

i. Contingency measures for when on-site leachate storage is at capacity or exhausted

A number of contingency measures are in place in the event that both dams approach or exceed their operational freeboard limits:

- Additional temporary storage: MHE, through discussion with the EPA could utilise above-ground tanks as prescribed in the Landfill Guidelines, Section 2.1. The tanks and associated connection points must be surrounded by a bund with a capacity of at least 110% of the tanks. Suitable double-skinned tanks can offer the same level of protection.
- Off-site disposal: Leachate may be transported to an appropriately licensed liquid waste treatment facility in accordance with EPL 21440.
- Temporary utilisation of on-site engineered containment infrastructure; Subject to approval from the EPA, MHE, as an emergency measure, may place additional leachate in temporary storage within the fully contained, engineered operational waste cell, until such a time that weather conditions improved to allow evaporation and leachate heads to revert to compliant levels.
- Subject to approval from the EPA, MHE, as an emergency measure, may transport leachate to the fully contained and engineered lined leachate dams at the MHE operated Burra Road Landfill (EPL 20297), and/or Tumut Waste operated Bellettes Landfill, Gilmore (EPL 20596), until such a time that weather conditions improved to allow evaporation and leachate heads to revert to compliant levels at Tumblong.

ii. Measures to prevent off-site odour impacts

Leachate may, under certain conditions become odorous. MHE are committed to minimise odour emissions as a result of leachate on site. EPL 21440 does not require odour monitoring at the leachate monitoring location. Should odour become an issue as a result of leachate, MHE will initiate preventative measures, working closely with the NSW EPA.

Odour preventative measures currently include the following:

- Mechanical oxygenation – two floating oxygenation pumps operate within the permanent dam by re-circulating leachate from deeper in the water column and spraying over the surface of the leachate by multi-directional nozzles;
- Chemical oxygenation – hydrogen peroxide H_2O_2 is introduced to the leachate to compliment the mechanical oxidation. H_2O_2 is an effective oxidation agent, minimising the emission of reduced sulphur compounds including hydrogen sulphide (H_2S) and carbon disulphide (CS_2);
- MHE have installed a floating cover system over the temporary leachate dam that includes an integrated odour management system. The cover acts as a physical barrier to limit the release of odorous vapours and is fitted with carbon filter units that capture and treat any odour pulled from beneath the membrane by the suction spinners within the units;
- Application of daily cover in accordance with Landfill Guidelines, Section 8.1 to limit the emission of landfill gas / odour; and

- Minimising the operational tipping area, keeping the landfill area as small as possible, with the remaining area being daily or intermediate covered.

Routine inspections and maintenance ensure the offsite odour mitigation measures are maintained to ensure that the leachate storage infrastructure does not contribute to off-site odour impacts and remains compliant with environmental and community expectations.

Northstar Air Quality report *Landfill Gas Management Plan*, reference 25.1120.FR2V1, dated July 2025 for additional air quality and odour mitigation recommendations.

6.5 Leachate Treatment And Disposal Options (EPL U1.1.5)

i. Details specifying appropriate on-site locations to treat and/or dispose of leachate and the manner in which to do so at each location

Treatment of leachate on site is treated within the permanent leachate dam on site, as detailed in Section 5.5 of this LMP.

Leachate within the permanent leachate dam is treated by oxygenation by the following methods:

- Mechanical oxygenation – two floating oxygenation pumps operate within the permanent dam by re-circulating leachate from deeper in the water column and spraying over the surface of the leachate by multi-directional nozzles.
- Chemical oxygenation – hydrogen peroxide H_2O_2 is an oxidant which is introduced to the leachate to compliment the mechanical oxidation. H_2O_2 can oxidize odour-causing compounds such as hydrogen sulphide.

Disposal of leachate on site is undertaken by the following methods:

- Evaporation within the permanent leachate dam, assisted by the mechanical oxygenation pumps;
- Evaporation above the temporary leachate dam floating cover, allowing suitable freeboard to meet the requirements of the Landfill Guidelines, Section 2.1; and
- Irrigation within the active cell, applied by water cart spraying over the exposed waste, or by water cannon.

ii. Contingency measures for in the event that on-site leachate treatment and disposal capacity options are exhausted

Should both on-site leachate dams reach critical capacity, MHE will implement the following contingency measures:

- Disposal at a facility licensed to accept the leachate waste;
- As detailed in Section 6.4i of this LMP, MHE, through discussion with the EPA could utilise above-ground tanks as prescribed in the Landfill Guidelines, Section 2.1. The tanks and associated connection points must be surrounded by a bund with a capacity of at least 110% of the tanks. Suitable double-skinned tanks can offer the same level of protection;
- Again, as detailed in Section 6.4i of this LMP, subject to approval from the EPA, MHE, as an emergency measure, may place additional leachate in temporary storage within the fully contained, engineered operational waste cell, until such a time that weather conditions improved to allow evaporation and leachate heads to revert to compliant levels; and
- Again, as detailed in Section 6.4i of this LMP, subject to approval from the EPA, MHE, as an emergency measure, may transport leachate to the fully contained and engineered lined leachate dams at the MHE operated Burra Road Landfill (EPL 20297), and/or Tumut Waste operated Bellettes Landfill, Gilmore (EPL 20596), until such a time that weather conditions improved to allow evaporation and leachate heads to revert to compliant levels at Tumblong.

iii. Measures to ensure that leachate storage options utilised at the Premises do not result in adverse off-site odour impacts

Odour control measures are currently undertaken on site at the leachate storage locations, as follows:

- Odour control units installed at the temporary leachate dam, to filter odour released from leachate stored beneath the floating cover;
- Mechanical and chemical oxygenation – two floating oxygenation pumps operate within the permanent dam by re-circulating leachate from deeper in the water column and spraying over the surface of the leachate by multi-directional nozzles. Mechanical oxygenation is complimented by chemical oxygenation with the introduction of H₂O₂ into the leachate. H₂O₂ can oxidize odour-causing compounds such as hydrogen sulphide;
- Leachate placed on top of the temporary leachate dam floating cover (for evaporative disposal) should only be pumped from post treated leachate within the permanent leachate dam, not directly from Cell 1, 2 or from beneath the floating cover;
- Application of daily cover in accordance with Landfill Guidelines, Section 8.1 to limit the emission of landfill gas / odour; and
- Routine desludging of the permanent leachate dam to ensure that long-term leachate quality is maintained, and odour generating particulates are minimised.

iv. Leachate monitoring, including: Odour monitoring

Leachate quality monitoring is currently undertaken at Point 23, as stated in EPL 21440. Additional leachate quality monitoring could be undertaken at the temporary leachate dam, above the floating cover to compare to the leachate results within the permanent dam.

Odour monitoring is performed both within the operational areas and at the site boundary during routine inspections, particularly downwind and during warm or still conditions. Any reports or complaints received are formally investigated, with records kept in accordance with the site's Environmental Management System.

Odour monitoring and odour mitigation measures recommendations made by Northstar shall be adopted by MHE in an aim to prevent odour release from the leachate storage areas.

6.6 Best Practices Measures for Odour Control (EPL U1.1.6)

Odour control measures identified for the site, are as follows:

- Irrigation of leachate onto the active landfill cells shall be undertaken in accordance with the recommendations outlined in The Odour Unit Pty Ltd (TOU), *Odour Mitigation and Management Advice*, dated 10 November 2022. TOU state '*this activity should be performed during daylight hours and in a manner that does not promote aerosol formation. It should also be conducted during daylight hours and under favourable wind conditions (e.g., blowing away from nearby sensitive receptors). No leachate should be surface applied to Cell 1 during wet weather events*';
- Landfill cover soil layers and permanent capping of completed landfill cells, as detailed within this LMP;
- Restriction of the active 'tip face' to 600 m², in accordance with the Northstar *Tumblong Landfill - Air Quality Impact Assessment, 2025*;
- Undertaking an audit of any potential/actual odour sources to understand the odour source and implement mitigation measures;
- Use of vapour odour control measures such as atmospheric discharge and dilution\masking agents and counteraction chemicals/chemical wet scrubbing; activated carbon adsorption; biofiltration; thermal incineration; or aeration system treatment etc; and
- Use of liquid odour control methods such as chemical additions to leachate storage areas.

- Implementation of odour management strategies, including:
 - a) identification of all major sources of odour that may be emitted from the leachate system;
 - b) pro-active management and response mechanisms for odour emissions, with specific reference to measures to be implemented and actions to be taken to minimise and (where practicable) prevent potential odour impacts on surrounding land uses as a consequence of meteorological conditions, operational failures within the leachate system, or the mode of operation of the plant;
 - c) review of odour monitoring data, with comparison of monitoring data with that assumed and predicted;
 - d) regular maintenance of process equipment to minimise the potential for odour emissions; and
 - e) a contingency plan should an accident or process failures lead to elevated odour impacts, whether above normal operating conditions or environmental performance goals / limits.
- Acquiring adversely affected properties to provide adequate separation distance improvements.

7 MONITORING AND REPORTING

A comprehensive monitoring and reporting program is an integral component of MHE's commitment to responsible leachate management at Tumblong Landfill. Monitoring serves to track leachate quality and the effectiveness of management practices, ensuring compliance with EPL 21440 and the Landfill Guidelines.

Monitoring also facilitates early detection of potential issues, enabling timely responses to prevent environmental harm and ensure continued regulatory compliance.

7.1.1 Leachate Quality

Leachate quality monitoring is conducted as per the requirements stipulated in EPL 21440, specifically under Monitoring Section M2. Leachate sampling is undertaken at the location identified in the EPL as EPA Identification Number 23.

Monitoring at this location includes the sampling and analysis of leachate collected from the permanent leachate storage dam or other nominated collection infrastructure. The range of analytes and sampling frequency are prescribed within EPL 21440, and include:

Table 2 Leachate Sampling & Testing Requirements (Point 23)

Pollutants	Units of measure	Frequency	Sampling Method
Alkalinity (as calcium carbonate)	Milligrams per litre	Every 6 months	Grab sample
Calcium	Milligrams per litre	Every 6 months	Grab sample
Chloride	Milligrams per litre	Every 6 months	Grab sample
Conductivity	Milli-siemens per centimetre	Every 6 months	Grab sample
Fluoride	Milligrams per litre	Yearly	Grab sample
Lead	Milligrams per litre	Yearly	Grab sample
Magnesium	Milligrams per litre	Every 6 months	Grab sample
Manganese	Milligrams per litre	Yearly	Grab sample
Nitrate + Nitrite (oxidised nitrogen)	Milligrams per litre	Every 6 months	Grab sample
Nitrogen (ammonia)	Milligrams per litre	Every 6 months	Grab sample
pH	pH	Every 6 months	Grab sample
Potassium	Milligrams per litre	Every 6 months	Grab sample
Sodium	Milligrams per litre	Every 6 months	Grab sample
Sulfate	Milligrams per litre	Every 6 months	Grab sample
Total dissolved solids	Milligrams per litre	Every 6 months	Grab sample
Total organic carbon	Milligrams per litre	Every 6 months	Grab sample
Total phenolics	Milligrams per litre	Every 6 months	Grab sample

Sampling and analysis should be undertaken by suitably qualified personnel in accordance with the NSW EPA's Approved Methods for the Sampling and Analysis of Water Pollutants in NSW, ensuring data reliability and regulatory compliance.

All analytical results are retained as part of the site's environmental record-keeping system and reported in accordance with the EPL conditions. Should results indicate exceedances of applicable criteria or trigger values, further investigation and appropriate management responses are implemented in consultation with regulatory authorities.

7.1.2 Leachate Odour

Leachate has the potential to generate odour under certain environmental or chemical conditions. Landfill leachate odours are primarily caused by reduced sulphur compounds and volatile organic compounds (VOCs) produced during the decomposition of organic waste. MHE are committed to proactively minimising odour emissions associated with leachate to prevent nuisance impacts on surrounding land uses and uphold environmental responsibilities.

While EPL 21440 does not stipulate specific odour monitoring requirements at designated leachate monitoring points (e.g. EPA ID Point 23), MHE acknowledge the importance of odour control as part of good landfill practice. Should leachate-related odour become evident or be the subject of complaint, MHE will promptly implement corrective actions and engage with the NSW EPA to address the issue transparently and cooperatively.

7.1.3 Leachate Level Monitoring

Leachate levels within Cell 1 and Cell 2 are managed by submersible pumps and float switches installed within the HDPE side risers that maintain leachate heads below that stated in EPL 21440. Operation of these pumps and pipework are checked routinely. Regular inspection and maintenance of the leachate pumping systems are undertaken to ensure functionality, reduce downtime, and prevent overfilling. Any issues identified during monitoring will be promptly addressed to maintain system performance and regulatory compliance.

MHE state that leachate levels within Cell 1 and Cell 2 are also monitored on a periodic basis using manual dip measurements to confirm compliance with the requirements of EPL 21440 and to check the functionality of the submersible pumps.

The submersible pumps with float switches and manual dip measure readings ensure that leachate levels remain below the regulatory threshold of no greater than 300 mm above the basal liner consistent with EPL 21440 and the Landfill Guidelines.

7.2 Frequency of Monitoring

Routine sampling and analysis of leachate are undertaken in accordance with the requirements of EPL 21440 to assess the effectiveness of on-site leachate management practices and ensure compliance with environmental performance criteria.

Monitoring results are documented and reported as required under Section M2 of EPL 21440 and submitted to the NSW EPA within the specified reporting periods. These reports include details of analytical results, exceedances (if any), corrective actions taken, and commentary on leachate trends or anomalies.

Table 2 identifies the specific pollutants that must be monitored at the designated leachate monitoring location (EPA Identification Point 23) and outlines the required sampling methods, units of measurement, and sampling frequencies to which the licensee must adhere.

7.3 Reporting

Compliance with regulatory obligations and the promotion of transparency in environmental management are key priorities at Tumblong Landfill. Accordingly, a structured reporting framework has been implemented to ensure all monitoring outcomes and associated management actions are communicated effectively to both external regulators and internal stakeholders.

7.3.1 Regulatory Reporting

Reporting to the NSW EPA is conducted in accordance with the conditions specified in EPL 21440. Submitted reports include the results of routine and event-based leachate monitoring, detailing data on leachate quality, quantity, levels and any exceedances or deviations from compliance parameters. Reports also include commentary on potential causes of variation and corrective or preventative actions undertaken.

7.3.2 Internal Reporting

In parallel with regulatory submissions, MHE maintains internal reporting systems that document monitoring results and operational responses. These reports are used to inform landfill management decisions, ensure the effectiveness of environmental controls, and support continual improvement across leachate management practices.

7.4 Exceedances and Corrective Actions

Should monitoring results indicate any exceedance of regulatory criteria or deviation from established leachate management protocols, MHE will implement corrective measures without delay. Corrective actions may include, but are not limited to:

- Modification of operational procedures for leachate handling and containment;
- Inspection, maintenance, or repair of leachate infrastructure (e.g. risers, pumps);
- Deployment of additional controls to mitigate environmental risk; and
- Increased monitoring frequency to verify the effectiveness of remedial actions.

All non-compliances or environmental incidents are subject to formal investigation. Where necessary, incident reports are generated, and corrective/preventative actions are allocated to prevent recurrence.

For the purposes of this LMP, an incident includes any activity or event that:

- Results in non-compliance with this LMP or other site-specific environmental management plans;
- Constitutes actual or potential Material or Serious Environmental Harm, as defined under the POEO Act 1997; or
- Results in or may result in Pollution of Waters, pursuant to Section 120 of the POEO Act.

All such incidents are documented and, where required, reported to the NSW EPA in accordance with statutory obligations.

7.5 Employee Competency

All personnel engaged in leachate monitoring and reporting activities must have suitable experience to ensure consistent, accurate and reliable data collection, analysis and documentation. Ongoing competency assessment includes familiarisation with EPL 21440 monitoring requirements, sampling procedures, equipment use, and data handling protocols. MHE staff undergo annual pollution incident management plan training.

Ongoing development ensures that staff are equipped to uphold compliance, maintain transparency and contribute meaningfully to MHE's environmental management objectives.

7.6 Conclusion

Monitoring and reporting are fundamental components of the leachate management strategy at Tumblong Landfill. By systematically measuring and documenting leachate quality and behaviour across the site, MHE strives to maintain compliance with EPL 21440 and the Landfill Guidelines.

This proactive approach enables early detection of potential issues, facilitates continuous improvement, and demonstrates MHE's ongoing commitment to protecting the environment through transparent and responsible landfill operations.

8 EMERGENCY RESPONSE

Emergency response procedures form a critical component of MHE's commitment to responsible leachate management at Tumblong Landfill. These procedures are designed to address unplanned incidents or abnormal events that may pose a risk to the environment, public health, or operational continuity.

Potential emergency scenarios may include, but are not limited to:

- Structural failure or over filling of the leachate dam;
- Pump malfunction leading to uncontrolled leachate levels;
- Significant odour emissions or leachate spills;
- Storm events exceeding design rainfall capacity.

MHE has developed and implemented an Emergency Response Plan (ERP) specific to the landfill's operational risks. The ERP outlines responsibilities, escalation protocols, communication procedures, and immediate response actions. Key personnel are trained in emergency response measures and drills are conducted periodically to verify preparedness.

The ERP aims to:

- Ensure the safety of on-site personnel and the public;
- Prevent or minimise environmental harm;
- Contain and control leachate-related incidents promptly;
- Notify relevant authorities in accordance with EPL 21440 and statutory requirements.

A copy of the site-specific Emergency Response Plan is provided in **Appendix B** of this LMP

8.1 Emergency Scenarios

8.1.1 Leachate Containment Breach

A breach of the containment system in Cell 1, Cell 2 or the leachate storage dam/s represent a primary emergency scenario for leachate management. Such a breach may result from extreme weather events (e.g. flooding, high winds), accidental liner puncture, foundation movement, or other unforeseen events that compromise the integrity of the containment system.

In the event of a containment breach, the following response actions will be initiated:

- Immediate isolation of the affected area to prevent further release of leachate;
- Suspension of any ongoing leachate transfers or inputs to the compromised system;
- Deployment of temporary bunding or containment to restrict the spread of leachate;
- Notification to site management, the NSW EPA, and other relevant authorities as required;
- Engagement of a qualified geosynthetics contractor to inspect and repair the containment system;
- Collection of environmental samples (soil, surface water, groundwater if applicable) to assess the extent of impact;

- Documentation of the incident, including cause analysis, corrective actions taken, and prevention strategies.

All actions will be conducted in accordance with the ERP and regulatory reporting requirements under EPL 21440 and the POEO Act 1997.

8.1.2 Spills or Leaks

Leachate spills or leaks occurring within the landfill footprint or during transfer to a licensed off-site disposal facility are considered potential environmental emergencies and require immediate response.

Spills may arise due to:

- Equipment failure (e.g. ruptured hoses, leaking couplings, or pump malfunction);
- Overflows from tanks, sumps, or pipelines;
- Accidents involving leachate transport vehicles.

In the event of a spill or leak, the following actions will be undertaken:

- Cease all leachate transfer activities in the affected area immediately;
- Contain the spill using temporary bunding, absorbent materials, or mobile containment units;
- Prevent any leachate from entering stormwater drains, natural waterways, or unlined ground;
- Notify site supervisors and implement the ERP (Appendix B);
- Recover spilled leachate using appropriate pumping or vacuum recovery methods;
- Dispose of recovered leachate at a licensed facility or return to the leachate storage system;
- Undertake site remediation and environmental sampling where contamination has occurred;
- Record and report the incident to the NSW EPA in accordance with EPL 21440 and relevant statutory requirements.

Staff involved in leachate transfer and handling are trained to respond swiftly and effectively to such events, minimising potential environmental harm and ensuring regulatory compliance.

8.2 Emergency Response Plan

An ERP has been developed for Tumblong Landfill to address potential leachate-related incidents. The ERP outlines procedures for containment, notification and remediation in the event of a spill, leak or containment breach. It ensures a coordinated and timely response to minimise environmental harm and meet regulatory obligations.

8.2.1 Identification of Emergency Contacts

The ERP designates key personnel responsible for managing leachate-related emergencies. These individuals are trained to promptly assess incidents, coordinate response activities, and liaise with regulatory authorities and stakeholders to ensure an effective and compliant emergency response.

8.2.2 Emergency Response Procedures

The ERP includes clear procedures for managing emergencies such as containment breaches, spills, or leaks. These steps are designed to swiftly mitigate the incident, reduce environmental harm and safeguard public health.

8.2.3 Notification and Communication

The ERP establishes a protocol for prompt notification of regulatory authorities, emergency services and other stakeholders. Timely and accurate communication is critical to enable a coordinated and effective emergency response.

8.2.4 Resources and Equipment

The ERP identifies and maintains all necessary resources, equipment and materials for emergency response. This includes containment and clean-up supplies, personal protective equipment (PPE) and specialised tools tailored to address specific leachate-related incidents.

8.2.5 Pollution Incident Training

MHE staff undergo annual pollution incident management plan training. This training simulates potential scenarios to test and maintain the preparedness and effectiveness of the response teams.

8.3 Reporting and Documentation

Following an emergency, a detailed incident report is prepared, documenting the event, response actions, and outcomes. This report is submitted to regulatory authorities as required and used to guide post-incident reviews and improvements to the Emergency Response Plan.

8.4 Conclusion

Emergency response procedures form a critical part of MHE's environmental commitment to safety at Tumblong Landfill. Through effective implementation and ongoing improvement, they ensure readiness to protect the environment from potential leachate-related emergencies.

9 MAINTENANCE AND TRAINING

9.1.1 Regular Inspections

Leachate management infrastructure, including the active landfill cells, leachate storage dam, transfer and connecting pipes etc. are subject to regular inspections. These inspections, carried out by trained personnel, assess the condition and integrity of the systems, identifying any damage or deterioration. Inspection schedules align with regulatory requirements and industry best practice.

9.1.2 Preventative Maintenance

Preventative maintenance is implemented to ensure ongoing reliability and effectiveness of the leachate management infrastructure. This includes timely repairs of any identified damage, managing erosion control, maintaining spare parts for pipework and valves and upkeeping perimeter embankments to preserve structural integrity.

9.2 Emergency Response

Should any issues arise, such as a containment breach or potential leak, the established ERP guides immediate actions to mitigate the situation, contain leachate, and prevent environmental harm. In the event of damage to the leachate storage dam, the plan typically involves pumping the remaining leachate into Cell 1 and Cell 2, subject to prior approval from the NSW EPA. Conversely, if damage occurs within either landfill cell, leachate would be transferred to the storage dam, provided there is sufficient capacity, and the necessary freeboard is maintained for rainfall events.

9.3 Employee Training

All personnel involved in leachate collection, handling and disposal receive instruction on proper procedures, safety protocols and environmental responsibilities. This ensures the MHE team is fully equipped to perform their duties in compliance with regulatory requirements and industry best practices.

10 CONTINUOUS IMPROVEMENT

Leachate management is an ongoing commitment for MHE. Practices are continually monitored, with necessary improvements implemented to ensure adaptability to evolving regulations and industry best practices. Regular reviews, reporting and employee training form integral components of the leachate management strategy.

By adhering to the principles outlined in this LMP, MHE aim to protect the environment, safeguard public health and meet all regulatory obligations.

Leachate collection and disposal at Tumblong Landfill are conducted with a clear commitment to environmental stewardship and regulatory compliance. The strategies and procedures are designed to minimise environmental impact, protect public health and fulfil the requirements under EPL 21440 and the Landfill Guidelines.

Through diligent adherence to these principles and continuous enhancement of leachate management practices, MHE contribute to the preservation and protection of the natural surroundings and the well-being of the local community.

Data gathered from on-site leachate testing, combined with rainfall monitoring, will be used to assess the capacity and performance of the current leachate management infrastructure during operations. The LMP will be reviewed and updated regularly, as required, to reflect any operational or regulatory changes.

11 STATEMENT OF COMPLIANCE

This document has been prepared by InSitu Advisory Pty Ltd with all reasonable skill, care, and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of MH Earthmoving Pty Ltd and the NSW EPA. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from InSitu Advisory Pty Ltd.

InSitu Advisory Pty Ltd is a Member of the APIV Limitation of Liability Scheme approved under Professional Standards Legislation.

InSitu Advisory Pty Ltd disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

12 REFERENCES

DM McMahon Pty Ltd; *Groundwater Impact Assessment, Ref.5985*, dated November 2019.

InSitu Advisory *Tumblong Landfill, Cell 2 Landfill Construction – CQA Validation Report, Ref: ISA-285-22-23*, dated 30 January 2024.

InSitu Advisory *Tumblong Landfill, Temporary Leachate Dam – Decommissioning & Rehabilitation Plan, Ref: ISA-521-24-25*, dated December 2024.

Northstar Air Quality Pty Ltd; *Air Quality Impact Assessment, Ref 25.1105.DR1V1*, dated May 2025.

Northstar Air Quality Pty Ltd; *Landfill Gas Risk Assessment, Ref 25.1120.FR2V1*, dated July 2025.

NSW EPA: Environmental Guidelines; Solid Waste Landfills, Second Edition, NSW EPA, dated April 2016.

NSW EPA: Environment Protection Licence 21440, NSW Environment Protection Authority, version date 2 May 2025.

NSW EPA: Protection of the Environment Operations Act 1997 (POEO Act).

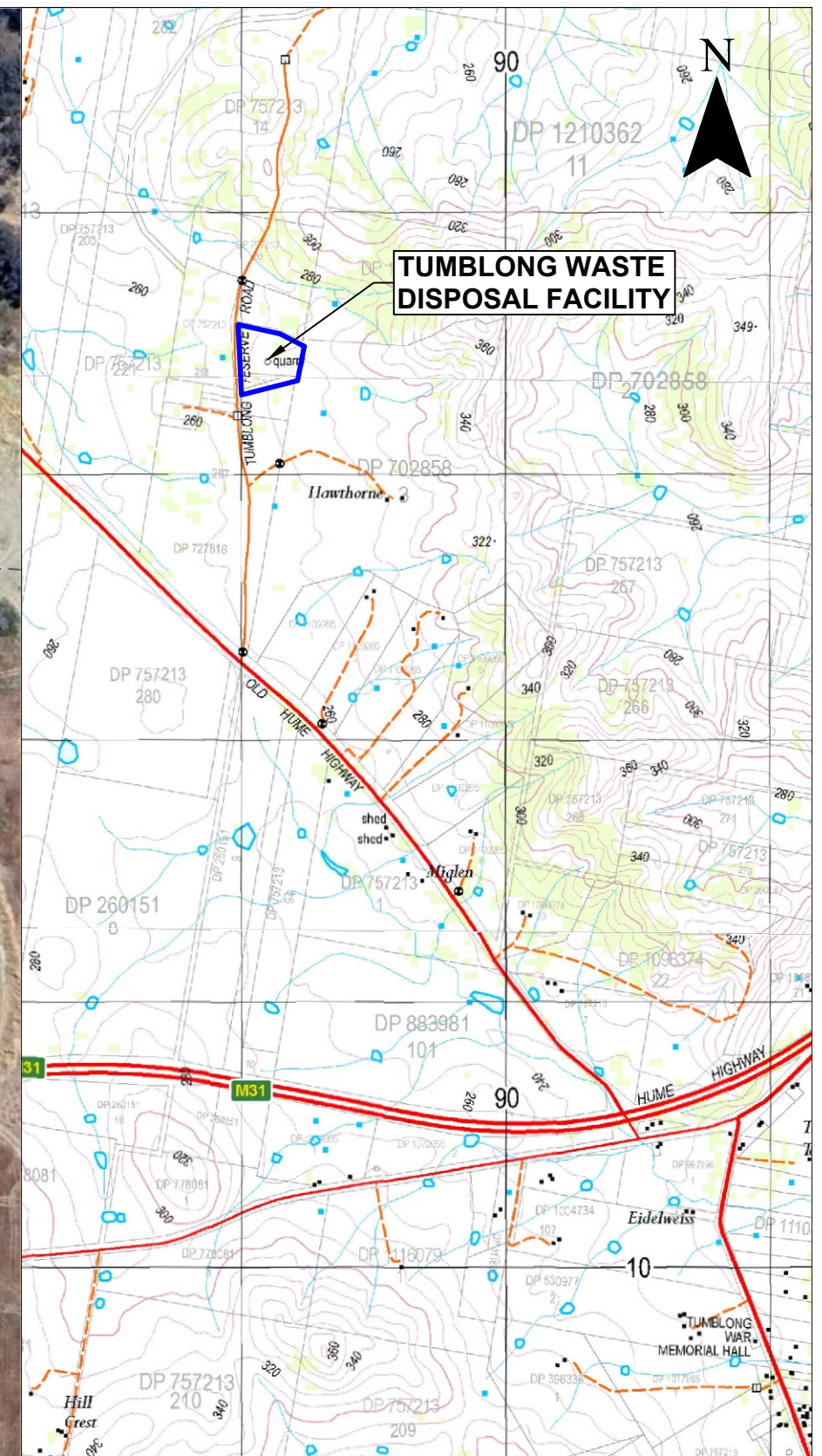
SLR Consulting Pty Ltd; *Tumblong Landfill - Surface Water Assessment v0.4, Ref: 610.19102.R01*, dated November 2019.

The Odour Unit Pty Ltd, *Odour Mitigation and Management Advice*, dated 10 November 2022.

FIGURES



- LEGEND
-  SITE BOUNDARY
 -  LOT BOUNDARY



SITE LOCATION



NOTES

1. MGA ZONE 55, GDA94.
2. AERIAL IMAGERY PROVIDED BY GOOGLE EARTH PRO, CAPTURE DATE : 28.10.2023.



CLIENT:

MH EARTHMOVING

SITE:

TUMBLONG WASTE DISPOSAL FACILITY - LEACHATE MANAGEMENT PLAN

TITLE:

SITE LOCATION PLAN & GENERAL SITE LAYOUT

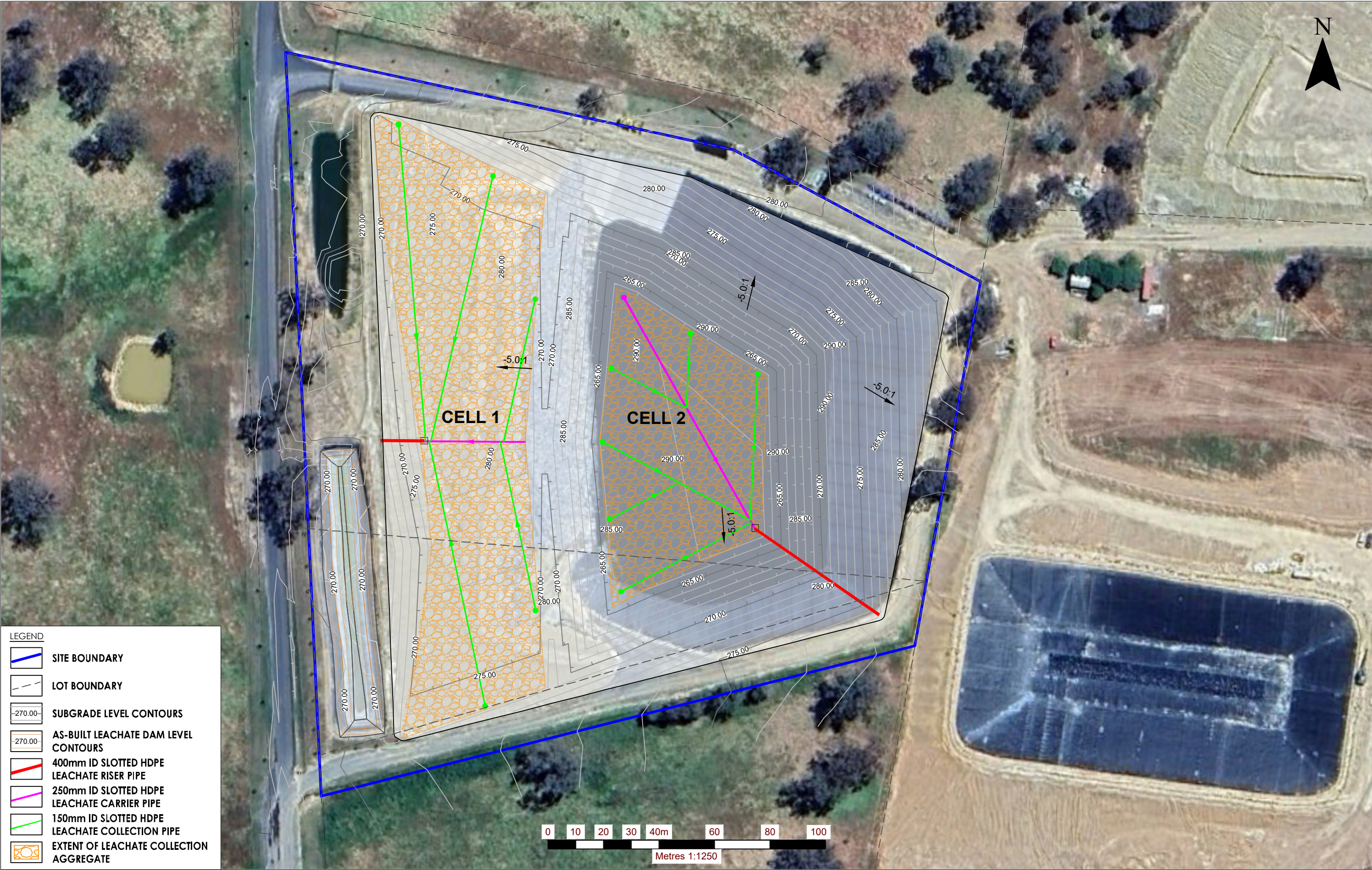
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SCALE: **1:2500**

PAPERSIZE: **A3**

DWG: **FIGURE 01**

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NOTES

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NOTES

1. MGA ZONE 55, GDA94.
2. AERIAL IMAGERY PROVIDED BY GOOGLE EARTH PRO, CAPTURE DATE : 28.10.2023.

CLIENT:

MH EARTHMOVING

SITE:

TUMBLONG WASTE DISPOSAL FACILITY - LEACHATE MANAGEMENT PLAN

TITLE:

GENERAL LEACHATE PUMPING ARRANGEMENT

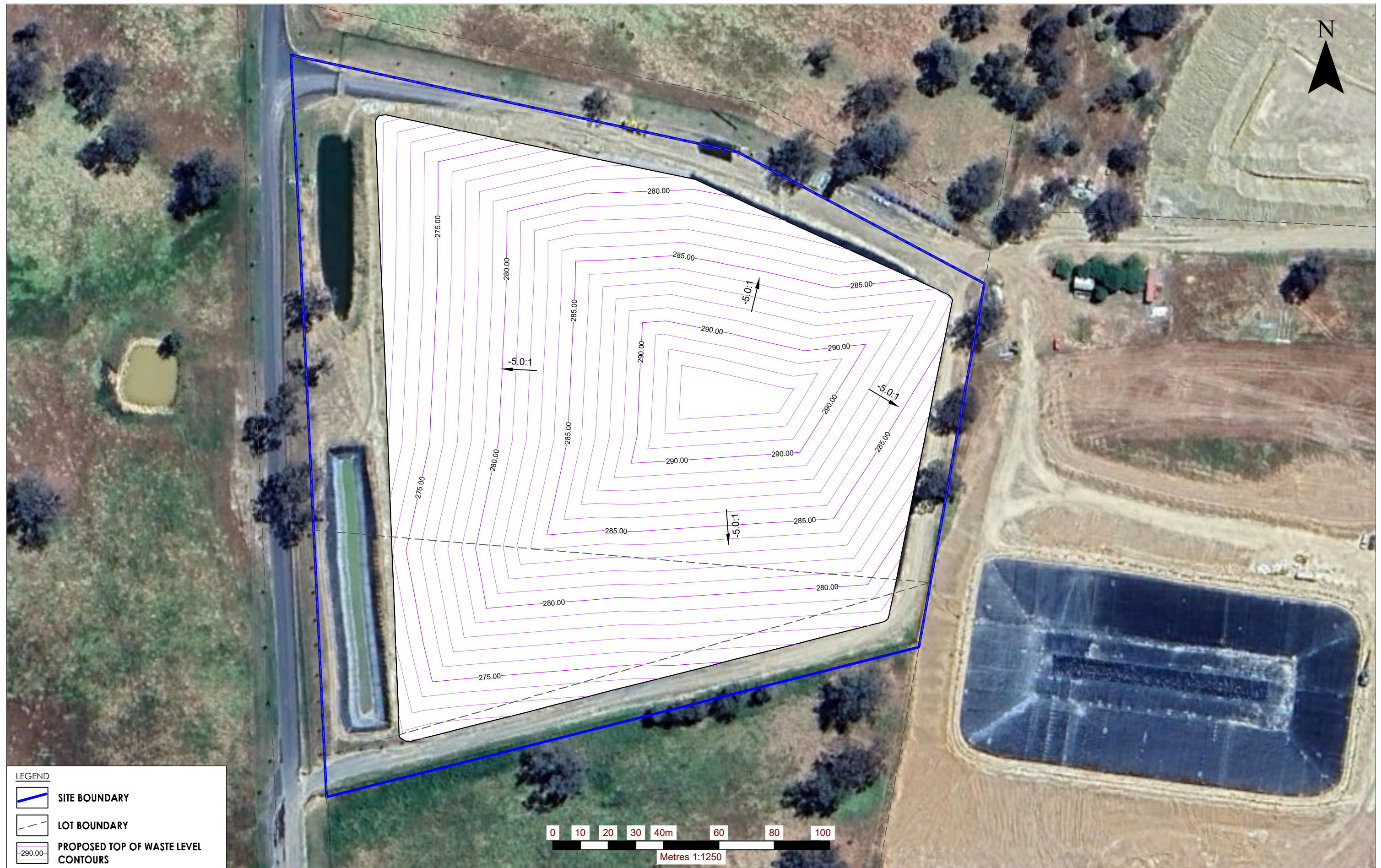
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PAPERSIZE: **A3**

DWG: **FIGURE 03**

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LEGEND

- SITE BOUNDARY
- LOT BOUNDARY
- PROPOSED TOP OF WASTE LEVEL CONTOURS

- NOTES**
- MGA ZONE 55, GDA94.
 - AERIAL IMAGERY PROVIDED BY GOOGLE EARTH PRO, CAPTURE DATE : 28.10.2023.



CLIENT: **MH EARTHMOVING**

SITE: **TUMBLONG WASTE DISPOSAL FACILITY - LEACHATE MANAGEMENT PLAN**

TITLE: **APPROVED TOP OF WASTE SURFACE**

DATE: **26.06.2025** SCALE: **1:1250** PAPERSIZE: **A3** DWG: **FIGURE 04**

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APPENDIX A

COMPLIANCE SUMMARY WITH NSW EPA ENVIRONMENTAL GUIDELINES: SOLID WASTE LANDFILLS (2016) AND EPL 21440

Appendix A Compliance Summary with NSW EPA Environmental Guidelines: Solid Waste Landfills (2016) and EPL 21440

Section	Environmental Guidelines: Solid Waste Landfills, 2016 Requirement	Requirement Met	Where
1. Leachate Barrier System	The landfill must have a leachate barrier system to contain leachate and prevent the contamination of surface water and groundwater over the life of the landfill.	Met in landfill Cell 1, Cell 2, Permanent Leachate Dam & Temporary Leachate Dam, verified in CQA Validation Reports	Section 3 of CQA Validation reports.
	If pollutants that can harm groundwater quality move beyond the premises boundary or beyond a 150-metre radius from the landfill footprint, additional measures may be needed to stop further pollution and potentially remediate the existing contamination.	Has not occurred.	N/A
1.1 Design Of Leachate Barrier System	The base and walls of all solid waste landfill cells should be lined with a durable material of very low permeability to form a barrier between the waste and the groundwater, soil and substrata.	Met in landfill Cell 1, Cell 2, Leachate Dam & Temporary Leachate Dam, verified in CQA Validation Reports	Section 3 of CQA report Validation report.
	a compacted sub-base 200 millimetres thick to provide a firm, stable, smooth surface of high bearing strength on which to install the liner	Met in landfill Cell 1, Cell 2, Leachate Dam & Temporary Leachate Dam, verified in CQA Validation Reports.	Section 1.6 & 2.2 of CQA Validation reports.
	Minimum 1000mm thick compacted clay liner with an in situ hydraulic conductivity of less than 1×10^{-9} metres/second is required; for landfills receiving more than 20,000 tonnes of waste per year, the liner should include a geomembrane over the compacted clay; the base liner should have gradients of greater than 1% longitudinally and 3% in transverse directions. (the clay should have high plasticity and a suitable particle-size distribution, with no particles greater than 50 millimetres in any dimension) As an alternative to compacted clay, a geosynthetic clay liner may be used.	Met in landfill Cell 1, Cell 2, Leachate Dam & Temporary Leachate Dam, verified in CQA Validation Reports. Clay seal bearing layer, GCL and HDPE liner has been used.	Section 1.5 & 3.1 of CQA Validation reports.
	The leachate collection layer comprises a 300mm thick gravel drainage layer with collection pipes, featuring a minimum internal diameter of 150mm, spaced no more than 25m apart lengthwise in the cell, and installed with at least a 1% slope toward the sump and 3% transverse slope for effective leachate removal.	Met in Tumblong landfill Cell 1, Cell 2, Leachate Dam & Temporary Leachate Dam, verified in CQA Validation Reports.	Section 1.5, 1.8 & 4.1 of CQA Validation reports.
	A protection or cushion geotextile	Met in landfill Cell 1 & Cell 2 verified in CQA Validation Reports.	Section 3.3 of CQA Validation reports.
	A separation geotextile should be placed above the drainage layer	Met in landfill Cell 1 & Cell 2, verified in CQA Validation Reports.	Section 4.4 of CQA Validation reports.
	A geonet drainage geocomposite may be used as an alternative to the gravel drainage layer for wall drainage and leak detection layers.	Drainage aggregate has been used in Cell 1 and Cell 2.	N/A
	Ensure a minimum 15-metre separation between the landfill cell's outer perimeter and the property boundary at all elevations to accommodate monitoring well installation and potential pollution control actions in case of off-site pollutant escape.	Met in landfill Cell 1, Cell 2, Leachate Dam & Temporary Leachate Dam, verified in CQA Validation Reports.	Drawings/Figures Figure 2 of CQA Validation reports.

Appendix A Compliance Summary with NSW EPA Environmental Guidelines: Solid Waste Landfills (2016) and EPL 21440

Section	Environmental Guidelines: Solid Waste Landfills, 2016 Requirement	Requirement Met	Where
1.9 Leachate Extraction And Level-Control System	Install a collection sump and stable leachate riser(s) capable of withstanding waste load and settling stresses, meeting Australian Standards for pipe materials like AS 4058:2007.	Met in landfill Cell 1 and Cell 2 verified in CQA Validation Reports.	Section 4 of CQA Validation reports.
	be installed in all cells, be able to control leachate levels within each cell, and be able to convey collected leachate out of the cell to surface storage or other infrastructure	Met in landfill Cell 1 and Cell 2 verified in CQA Validation Reports.	Section 4 of CQA Validation reports.
	Maintain leachate levels within 300 millimetres above the upper base liner surface, or another justified level, considering design, site conditions, and leachate management, as excessive levels can disrupt landfill gas controls and liner permeability.	Leachate pumps with float switches installed within Cell 1 and Cell 2.	To be demonstrated through monitoring to ensure compliance, see Section 6 & 7 of LMP
2. Leachate Storage And Disposal	Collected leachate must be stored in appropriately sized dams or tanks and disposed of so as not to cause environmental harm.	Leachate dam capacity determined by HELP model recommendations and constructed to meet requirements of the Environmental Guidelines.	Section 4 and 5 of the LMP
	There must be sufficient leachate disposal capacity to prevent the build-up of leachate and an increase in the risks of water pollution and offensive odours.	Leachate dam capacity determined by HELP model recommendations, additional capacity constructed at the temporary leachate dam.	Section 5 and 6 of the LMP
	Untreated leachate must not be disposed of to off-site water or land, used for dust suppression, or used to supply the water needs of any process conducted at the landfill, such as composting.	Management of leachate following EPL 21440, and NSW EPA guidelines is occurring.	Section 5 of the LMP
2.1 Leachate Storage	The dam must have sufficient leachate storage volume, as determined by using a water balance methodology.	Leachate dam capacity determined by HELP model recommendations.	Appendix C of the LMP
	The dam must have a freeboard that can accept rainfall directly on the dam from a 24-hour rainfall event with a 1-in-25-year average recurrence interval without overflowing. The dam must have a visible marker to indicate the bottom depth of the required freeboard. If the freeboard is exceeded, the occupier must re-establish and maintain the required freeboard. If the dam is in danger of overflowing, an option may be to inject some leachate back into the cells and to stop leachate extraction from the cells.	HELP modelling utilised to calculate pond capacity including freeboard. Leachate dam constructed to incorporate required freeboard, verified in CQA Validation Report.	Appendix C of the LMP
	The dam liner must be designed and constructed to a standard similar to that of the landfill cell liner.	The dam liner includes a geosynthetic clay liner (GCL) and a 2mm HDPE geomembrane similar to the landfill cells. verified in CQA Validation Reports.	Section 2 & 3 of CQA Validation reports
	Leachate storage dams should not be constructed over previously landfilled areas, except in exceptional circumstances.	Leachate dams are not constructed over a previously landfilled area.	N/A

Appendix A Compliance Summary with NSW EPA Environmental Guidelines: Solid Waste Landfills (2016) and EPL 21440

Section	Environmental Guidelines: Solid Waste Landfills, 2016 Requirement	Requirement Met	Where
2.2 Leachate Treatment And Disposal	Stored leachate should be dealt with by one or more of the following strategies: discharging to sewer under a discharge agreement with the local water authority, tankering off-site to a licensed treatment facility, evaporation, irrigation, or reinjection back into the waste.	Leachate is managed and disposed of with strict adherence to the EPL 21440.	Section 5 of the LMP
	On-site treatment of leachate broadens the range of management options: Sewer discharge, Off-site transport, Evaporation, Irrigation, Reinjection, Bioreactors	Leachate is managed and disposed of with strict adherence to the EPL 21440.	Section 5 & 6 of the LMP
2.3 Conducting A Water Balance	Leachate management proposals should be supported by water balance calculations that provide estimates of the required leachate storage capacity. A water balance should be conducted when a new landfill or cell is proposed, or when there is a proposal for a major change to leachate storage and disposal at the landfill.	Leachate dam capacity determined by HELP model recommendations.	Appendix C of the LMP

APPENDIX B

EMERGENCY RESPONSE PLAN

APPENDIX B – EMERGENCY RESPONSE PLAN

Tumblong Non-Putrescible Waste Disposal Facility – Leachate Management Plan

Site Location

Tumblong Non-Putrescible Waste Disposal Facility is located at:

Tumblong Reserve Road, Tumblong NSW 2729

LOT 7004 DP 1028797, LOT 7300 DP 1149008, LOT 10 DP 1210362

Emergency Contacts

Emergency Response Co-ordinator

Name: Mr Martin Hay

EPL Holder Details: MH Earthmoving Pty Ltd (MHE)

Mobile: 0417 246 381

Email: martin@mhem.com.au

NSW EPA Emergency Pollution Line

Phone: 131 555

Weblink: <https://www.epa.nsw.gov.au/Reporting-and-incidents/Report-pollution>

Email: info@epa.nsw.gov.au

Emergency Services

Phone (Fire, Police, Ambulance): 000

Flood Emergency Services

SES Contact: 132 500

Flood Reporting Line: 13 77 88

Purpose and Scope

This Emergency Response Plan (ERP) has been developed in accordance with the requirements of Environmental Protection Licence (EPL) 21440 and the NSW EPA Environmental Guidelines: Solid Waste Landfills (2016). It supports the Leachate Management Plan (LMP) by providing structured procedures for responding to emergencies involving leachate management, including spills, containment breaches, bushfire and flood. The plan ensures environmental risks are promptly addressed to minimise potential impacts.

General Emergency Response Strategy

MHE has implemented trained personnel, documented procedures, and appropriate equipment to support a rapid, controlled, and compliant response to leachate-related incidents. In all emergencies:

- Immediate containment and risk mitigation measures are undertaken.
- Regulatory authorities are notified in accordance with EPL and legislative requirements.
- Actions are documented, reviewed, and used to inform continual improvement.

Incident Types and Responses

Leachate Containment Breach

In the event of a liner or bund failure:

- Assessment – Evaluate the nature and extent of the breach.
- Containment – Deploy berms or pumps to contain released leachate.
- Notification – Inform NSW EPA, emergency services, and the site manager.
- Safety & Isolation – Isolate the affected area and restrict access.
- Remediation – Undertake environmental protection and remediation works.
- Documentation – Log all activities, communications, and corrective actions.
- Leachate Collection Contractor: 1800 677 560

Leachate Spills or Leaks

From tanks, pipelines or vehicle transfer:

- Immediate Containment – Use spill kits and bunding to control the flow.
- Clean-Up – Collect and dispose of spilled leachate as per LMP procedures.
- Regulatory Notification – Notify EPA where applicable.
- Report and Investigate – Log incident and conduct root cause analysis.
- Leachate Collection Contractor: 1800 677 560

Bushfire Emergency

- Monitoring – Monitor NSW RFS alerts and fire danger ratings.
- Evacuation – Evacuate personnel to the designated assembly point.
- Notify Authorities – Contact 000 and provide site risk details.
- Critical Asset Protection – Secure or isolate hazardous materials if safe.
- Post-Emergency – Assess damage, document actions, and provide support.
- Evacuation Assembly Point: As designated by the Site Manager.

Flooding Emergency

- Early Detection – Monitor BOM weather and water levels.
- Evacuation – Move personnel to higher ground.
- Notification – Alert SES and stakeholders.
- Protection Measures – Elevate or isolate critical assets.
- Clean-Up and Assessment – Post-flood evaluation and recovery.

Notification of Environmental Harm

In accordance with Condition R2 of EPL 21440 and Part 5.7 of the Protection of the Environment Operations Act 1997:

- Notify the EPA via 131 555 immediately upon awareness of an incident.
- Submit written details to the EPA within 7 days including:
 - Volume and duration of discharge.
 - Date and time of overflow.
 - Weather and rainfall data (day of and preceding week).
 - Most recent leachate quality analysis.
 - Root cause and discharge location(s).
 - Preventative actions.
 - Confirmation whether discharge was permitted under EPL.

Documentation and Review

All emergency responses must be documented in the Site Environmental Management System. The ERP will be reviewed annually or following a significant incident to incorporate learnings and improve response capacity.

APPENDIX C

SITE LEACHATE HELP MODELLING REPORT

To:	Alan Dyer	At:	InSitu Advisory Pty Ltd
From:	Sam Butler	At:	SLR Consulting Australia Pty Ltd
Date:	17 th August 2020	Ref:	610.19102-Leachate Generation Assessment-v1.6.docx
Subject:	Tumblong Quarry Leachate Generation Assessment		

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1 Introduction

SLR has been engaged to undertake water balance modelling to determine storage requirements for leachate generated at the Bangus Quarry landfill. Bangus Quarry is located in Tumblong, NSW, identified as Lot 7004 of Deposited Plan 1028797 and Lot 7300 of Deposited Plan 1149008.

The conceptual design for the landfill has been undertaken by InSitu Advisory and the key components of this design impacting the leachate generation have been discussed and agreed with InSitu Advisory prior to commencement of modelling (refer Tumblong Quarry HELP Model Assumptions Memorandum, SLR 2019).

The scope of works included:

- HELP modelling to determine leachate generation rates from the two most critical landfilling scenarios
- Sizing of a leachate storage pond and irrigation system (location to be determined by others); and
- Reporting (this memo).

HELP modelling involves input of:

- Climate data (including rainfall and evapotranspiration);
- Anticipated depth and type of waste;
- Information on materials likely to be used in the final capping (e.g. soil type, permeability, porosity, run-off); and
- Consideration of leachate disposal method (e.g. irrigation, leachate evaporative ponds etc.).

This memo details the assumptions adopted for the water balance modelling and provides recommendations for leachate storage.

2 Assumptions

2.1 Modelling Assumptions

Assumptions agreed by SLR and InSitu Advisory for the development of the water balance modelling are detailed in **Table 1**.

Table 1 Water Balance Modelling Assumptions

Item	Detail
HELP Model	Hydrologic Evaluation of Landfill Performance, version 3.95D
Climate Data Origin	SILO data from 35 09'S 148 00'E Climate data for the model will be obtained from SILO (Scientific Information for Land Owners) which contains a database of historical climate records for Australia, hosted by the Science Delivery Division of the Department of Science, Information Technology and Innovation. SILO datasets are constructed from observational records provided by the Bureau of Meteorology. SILO was utilized to process the raw data, which may contain missing values, to derive a dataset for the Site which is both spatially and temporally complete. SILO data will be obtained for maximum and minimum temperature, pan evaporation, vapour pressure, and relative humidity at the times of maximum and minimum temperature.
Time Step	Daily (1950-2018)
Data Period	69 years
Rainfall Input Data	In accordance with the dataset, A 90 th percentile wet year is estimated to be 949.5 millimetres. For the purposes of this assessment, the closest modelled rainfall year is 1970 (949.8 millimetres).
Proposed Leachate Management Infrastructure	Leachate storage pond and irrigation system

2.2 Climatic Parameters

2.2.1 Evaporative zone depth

The evaporative zone depth is the maximum depth from which water may be removed by evapotranspiration. The value specified influences the storage of water near the surface and therefore directly affects the computations for evapotranspiration and runoff. Where surface vegetation is present, the evaporative depth should at least equal the expected average depth of root penetration. The depth specified should be characteristic of the maximum depth to which the moisture changes near the surface due to drying over the course of a year, typically occurring during peak evaporative demand or when peak quantity of vegetation is present. It is assumed that the evaporative zone depth for the purpose of this assessment is 10 cm.

2.2.2 Maximum leaf area index

Leaf area index (LAI) is defined as the dimensionless ratio of the leaf area of actively transpiring vegetation to the nominal surface area of the land on which the vegetation is growing. The LAI for this assessment is 1.0 (poor stand of grass).

2.2.3 Growing Season

The start of the growing season is based on mean daily temperature and plant species. Typically, the start of the growing season for grasses is the Julian date (day of the year) when the normal mean daily temperature rises above 10 to 13 degrees Celsius. For the purpose of this assessment, the growing season is considered to be year-round. The mean minimum and mean maximum temperature for the area is included in **Figure 1**.

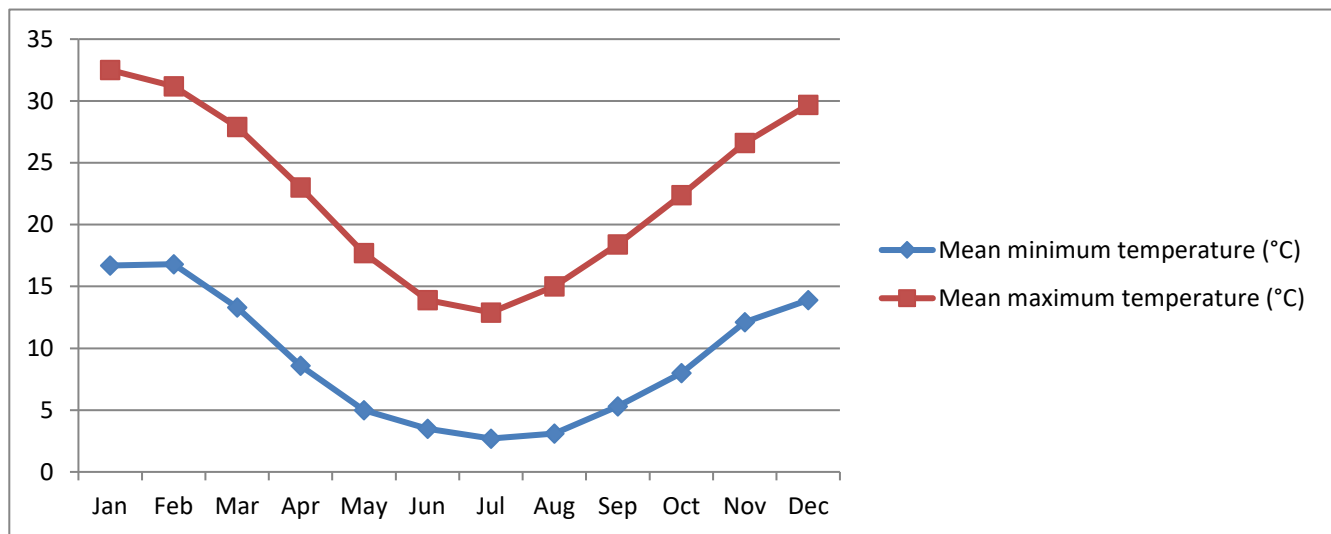


Figure 1 Growing Season

2.2.4 Other Climate Data Inputs

The yearly average wind speed is 3.3 km/hr (at 2m above ground level) and the average relative humidity for the area (BOM, 2018) is described within **Table 2**.

Table 2 Average relative humidity

Quarter	Average Relative Humidity (%)
First Quarter	47.2
Second Quarter	68.0
Third Quarter	71.8
Fourth Quarter	50.0

2.3 Runoff curve number

Surface water runoff and infiltration will be dependent on the surface slope, slope length, soil texture of the top layer and vegetation. The HELP model computed runoff curve numbers utilized for this model are given in **Table 3**. The slope length of the final cover is assumed to be reduced due to the installation of regularly spaced batter slope drains.

Table 3 HELP Computed Runoff curve number

Scenario	Slope (%)	Slope Length (m)	US Soil Texture	Vegetation	Runoff Curve Number
Daily Cover	25	50	10 – Sandy Clay Loam	Bare Soil	94.39
Intermediate Cover	25	50	24 – Sandy Clay Loam	Bare Soil	96.97
Final cover	25	50	4 – Loamy Sand	Bare Soil	82.93

2.4 Material Properties

The HELP model requires material properties relating to hydraulic behaviour. These are summarised in **Table 4**.

Table 4 HELP Model Material Parameters

Layer	Layer Type	Soil Texture Number	Depth (m)	Pore Volume	Field Capacity	Wilting Point	Hydraulic Conductivity (m/s)
Temporary Cover Systems							
Daily Cover	Vertical percolation layer	10 – Sandy clay loam	0.15	0.39	0.244	0.136	1.2×10^{-6}
Interim Cover	Barrier Soil layer	24 – Sandy clay loam	0.30	0.365	0.305	0.202	2.7×10^{-8}
Final Cover System							
Topsoil	Vertical percolation layer	4 – Loamy Sand	0.2	0.437	0.105	0.047	1.7×10^{-5}
Soil sub-base	Vertical percolation layer	13 – Sandy Clay	0.8	0.43	0.321	0.221	1×10^{-7}
LLDPE	Geomembrane	36 – Linear Low Density Poly Ethylene	0.002	-	-	-	4.0×10^{-11}
Geosynthetic Clay Liner	Barrier layer	17 – Bentonite Mat	0.006	0.75	0.747	0.40	1.9×10^{-11}

Layer	Layer Type	Soil Texture Number	Depth (m)	Pore Volume	Field Capacity	Wilting Point	Hydraulic Conductivity (m/s)
Seal bearing layer	Vertical Percolation layer	13 – Sandy Clay	0.3	0.43	0.321	0.221	3.3×10^{-7}
Waste							
Waste	Vertical percolation layer	18 – Municipal Waste	11.7m (Cell1) 30.7m (Cell 2)	0.671	0.292	0.077	1.0×10^{-5}
Basal Lining System							
Leachate Drainage Layer	Lateral Drainage Layer	21 – Gravel	0.3	0.39	0.032	0.13	1.0×10^{-3}
Geosynthetic Clay Liner	Barrier layer	17 – Bentonite Mat	0.006	0.75	0.747	0.4	1.9×10^{-11}
HDPE Geomembrane	Barrier layer	35 – High Density Poly Ethylene	0.002	-	-	-	2.0×10^{-13}

3 Results

The 90th percentile annual total of the leachate generation for Cell 1 (final cover) and Cell 2 (daily and interim cover) is detailed in **Table 5**.

Table 5 HELP Modelling Results

Month	Precipitation (mm)	Runoff (mm)	Evaporation (Actual) (mm)	Leakage Through Layer 4 (mm)	Leachate Generation (m ³)
January	101.4	0	51.9	15.1	413.9
February	37.6	0	24	21.5	587.9
March	48.8	0	28.7	2.9	78.2
April	121.5	0	33.8	14.0	382.2
May	57.7	0	38.8	13.7	373.9
June	45.7	0	27.5	50.9	1,393.1
July	34.7	0	29.1	48.8	1,336.8
August	126.1	0	35.2	14.7	402.1
September	154.1	0	55.7	17.5	477.9
October	36.9	0	36.2	28.5	780.6

Month	Precipitation (mm)	Runoff (mm)	Evaporation (Actual) (mm)	Leakage Through Layer 4 (mm)	Leachate Generation (m ³)
November	134.5	0	58.4	54.6	1,496.3
December	50.8	0	31	53.7	1,471.2
Total:	949.8	0.0	450.3	335.8	9,194.1

4 Leachate Storage Pond and Irrigation System Sizing

4.1 General

The leachate pond will store leachate generated by landfilling activities at the site. The conceptual leachate pond is sized based upon the leachate generation (HELP) modelling, evaporation data, irrigation model sizing and assumptions detailed within the memorandum 'Tumblong Quarry HELP Model Assumptions' (SLR, 2019).

4.2 Leachate Management

For the purposes of leachate generation assessment, two worst-case leachate management scenarios have been prepared for the site, as detailed in **Table 6**.

Table 6 Leachate management scenarios

Scenario	Cell	Capping Arrangement	Estimated Landfilled Area (ha)	Leachate Management Strategy
1	1 (0.79 ha)	Cell 1 completed to final height (daily cover installed)	0.79	Leachate pond only
2	1 (0.79 ha) and 2 (2.74 ha)	Cell 1 completed to final height (final capping installed) Cell 2 two-thirds filled (combination of interim and daily cover area installed). Assumption that the entire Cell 2 area will contribute to leachate generation.	3.53	Leachate pond and irrigation system

4.3 Water Balance Input Data

The water balance model accounts for all predicted leachate inputs and outputs from the leachate management system. The required leachate dam(s) storage volume is the rainfall infiltration into the waste that becomes leachate (rainfall depth x surface area), plus rainfall onto the leachate dam, less evaporation from the leachate dam. The model is run by using monthly time intervals, and it estimates the changes in the cumulative volume with each month. Leachate generation (inputs) and source reduction (outputs) considered within this assessment include the following:

Leachate Generation

- Leachate generation produced from Cell 1 and Cell 2; and
- Direct leachate pond rainfall.

Source reduction

- Pond evaporation;
- Dust suppression; and
- Irrigation (Scenario 2 only).

4.3.1 Water Balance Calculation Summary

The water balance calculation is determined by the following parameters:

- Surface area of the proposed leachate pond. The surface area of the liquid contained within the leachate pond for each month is calculated in conjunction with the associated leachate pond volume via the pyramidal frustum formula.
- Calculation of the total (cumulative) leachate pond volume (m³). The volume of liquid contained within the leachate pond for each month is calculated via the pyramidal frustum formula.
- Monthly evaporation rate is determined in accordance with the leachate pond surface area (based on the leachate level for the associated month). Details of evaporation rates (in m³ and mm/month) are included in **Table 7** and **Table 8**.
- Pan evaporation data is obtained from the Silo Data Drill. A pan co-efficient (a ratio of evaporation from a large body of water to that measured in an evaporation pan) of 0.7 (NSW EPA, 2016) is included within this assessment.

In accordance with Section 2.3 of the NSW EPA landfill guideline the evaporation from the leachate dam is estimated as:

$$0.7 \times \text{Monthly Evaporation Rate} \times \text{Surface area of the leachate pond}$$

A summary of the evaporation volume calculations for each leachate management scenario is included within **Table 7** and **Table 8**.

Table 7 Scenario 1 – Evaporation Calculation Summary

Element	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Monthly evaporation (mm/month)	234.8	238.2	177.2	110.4	59.8	40.6	60.2	76.8	91.6	148.8	187.2	247.2	1,672
Pan Co-efficient x Monthly evaporation Rate (mm/month)	164.3	166	124	77.2	41.8	28.4	42.1	53.7	64.1	104.1	131.0	173.0	1,170
Leachate Pond Surface Area (m ²)	390	490	429	512	645	790	867	920	1029	1144	1263	1325	-
Mean leachate pond evaporation (m ³)	64	221	164	102	55	38	56	71	85	138	174	229	1,398

Table 8 Scenario 2 – Evaporation Calculation Summary

Element	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Monthly evaporation (mm)	234.8	238.2	177.2	110.4	59.8	40.6	60.2	76.8	91.6	148.8	187.2	247.2	1,672
Pan Co-efficient x Monthly evaporation Rate (mm)	164.36	166	124	77.2	41.8	28.4	42.1	53.7	64.1	104.1	131.0	173.0	1,170
Leachate Pond Surface Area (m ²)	819	819	566	566	786	1273	1660	1823	1992	2122	2345	2436	-
Mean leachate pond evaporation (m ³)	135	137	70	44	33	36	70	98	128	221	307	422	1,700

4.3.2 Conceptual Irrigation System

In accordance with *Environmental Guidelines: Solid Waste Landfills, Second Edition 2016*, irrigation should be managed in accordance with *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004b). Preference by the NSW EPA is to irrigate over rehabilitated landfill areas.

NSW EPA requirements for the irrigation system are as follows:

- The irrigation application rate must not exceed the capacity of the land to absorb the nutrient, salt, organic and hydraulic loadings supplied by the leachate.
- It must not compromise any future use of the land or productivity of the soil.
- The application rate must minimise runoff.
- All runoff from the irrigation area should be collected and managed as leachate. Irrigation rates should be based on water balance modelling that demonstrates that a water deficit will be maintained and percolation and/or runoff will be minimised.
- Irrigation system to be located in an area of restricted public access and low levels of human contact.
- It should not cause spray drift of leachate.
- Signs should be prominently displayed to inform the public that leachate irrigation is taking place.

An irrigation water balance has been prepared to determine the maximum volume that can be sustainably irrigated each year. The elements to be considered in an irrigation system water balance are:

- Precipitation;
- Irrigation volume applied;
- Evapotranspiration;
- Percolation; and
- Runoff.

In accordance with *Environmental Guidelines: Use of Effluent by Irrigation*, the water balance equation is determined as follows:

$$\text{Precipitation} + \text{Irrigation volume applied} = \text{Evapotranspiration} + \text{Percolation} + \text{Runoff}$$

The surface area required of the irrigation system was determined via an iterative process, by adjusting the monthly irrigation volume applied. The irrigation volume was adjusted so that it did not exceed monthly evapotranspiration and percolation totals to ensure no runoff from the irrigation area would occur.

Assumptions for the design of the irrigation system are detailed in **Table 9**.

Table 9 Irrigation design assumptions

Element	Design Assumption
Location and size of irrigation area	Constructed over an existing landfilled area with a minimum 300mm intermediate or final cover as defined on <i>Figure 12 – Typical Capping Construction Details (InSitu Advisory, 2019)</i> . Irrigation area to be located in an area of restricted public access and low levels of human contact. The irrigation area is assumed to be 7,890m ² in size.
Rainfall scenario	90 th percentile wet year is assumed.
Irrigation Discharge Volume Applied	Monthly irrigation discharge volume was iteratively adjusted in the model in accordance with seasonal variations in evapotranspiration, leachate generation and rainfall. No discount for losses from spray irrigation was conservatively assumed.
Evapotranspiration	Evapotranspiration varies throughout the year depending on temperature, humidity, solar radiation, wind, crop type and crop growth. It is estimated by multiplying monthly evaporation values by an appropriate crop factor for the particular species of plant. Crop factors are expressed as the ratio of crop evapotranspiration to pan evaporation. For the purposes of this assessment, a 'pasture' crop factor is applied as defined in Table 4.1 of <i>Environmental Guidelines: Use of Effluent by Irrigation (NSW DEC, 2004b)</i> .
Dust Suppression	Disposal of leachate via dust suppression over previously landfilled areas was estimated to be 30% under Scenario 2 conditions.
Percolation	The fraction of percolation water passing through the capping layer after any rainfall event that exceeds the soil moisture deficit, is determined in accordance with the guidelines. For the purposes of this assessment, the assumed permeability of the cover soil was 1 x 10 ⁻⁷ m/s resulting in a maximum percolation rate of 8.64 mm/day over the irrigation area.
Runoff	Runoff as a result of irrigation with effluent is conservatively set to zero in the monthly water balance. This provides a safety factor to ensure that runoff is not used as a means to dispose of the effluent to the environment and ensure runoff does not occur.
Irrigation Method	Assumed irrigation method is via fixed spray nozzle sprinklers delivering uniform distribution of leachate to the irrigation area. Irrigation discharge method is assumed to be capable of evenly distributing up to 50m ³ per day over the irrigation area whilst minimising the risk of aerosol drift.

4.4 Water Balance

Water balance inputs and outputs for the leachate pond and irrigation system are calculated and included within **Table 10** and **Table 11**.

Table 10: Summary of water balance inputs and outputs – Scenario 1

Element	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Inputs													
90 th Percentile rainfall over leachate pond area (m ³)	132	49	63	158	75	59	45	164	200	48	175	66	1,235
Monthly leachate production (90 th percentile) (m ³)	245	201	53	194	333	465	213	29	302	369	421	437	3,264
Outputs													
Mean leachate pond evaporation (m ³)	64	221	164	102	55	38	56	71	85	138	174	229	1,398

Table 11: Summary of water balance inputs and outputs – Scenario 2

Element	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Monthly Inputs													
90 th Percentile rainfall over leachate pond area (m ³)	247	92	119	296	141	111	85	307	375	90	328	124	2,314
90 th Percentile rainfall over Irrigation Area (m ³)	800	297	385	959	455	361	274	995	1,216	291	1,061	401	7,494
Monthly leachate production (90 th percentile) (m ³)	413	587	78.2	382	373	1393	1336	402	477	780	1496	1471	9,194
Irrigation Volume Applied (m ³)	556	640	167	300	300	400	400	100	200	1,200	800	1,500	6,563
Leachate Pond Surface Area	483	527	284	483	549	923	1211	1242	1368	1400	1400	1400	-
Monthly Outputs													
Mean leachate pond evaporation (m ³)	84	93	37	39	24	28	54	71	93	154	194	256	1,127
Dust Suppression	307	179	41	368	330	628	559	498	551	371	628	432	4,893
Irrigation Area Crop Factor	0.95	0.9	0.85	0.8	0.7	0.55	0.55	0.65	0.75	0.85	0.95	1	-
Irrigation Area Evapotranspiration (m ³)	1760	1691	1188	697	330	176	261	394	542	998	1403	1950	11,392
Irrigation Area Percolation (m ³)	0	0	0	561	425	584	412	701	873	493	458	0	4,510
Irrigation Area Runoff (m ³)	0	0	0	0	0	0	0	0	0	0	0	0	0

4.5 Leachate Pond Sizing

As detailed within **Figure 2** and **Figure 3**, the model is developed using monthly time intervals, and estimates the changes in the cumulative volume with each month. The size of each leachate storage dam is based on a maximum cumulative monthly volume over a period of one wet year (90th percentile). In addition, the leachate pond design allows for the direct rainfall on the dam from a 1-in-25-year average recurrence interval 24-hour rainfall event for the location without overflowing.

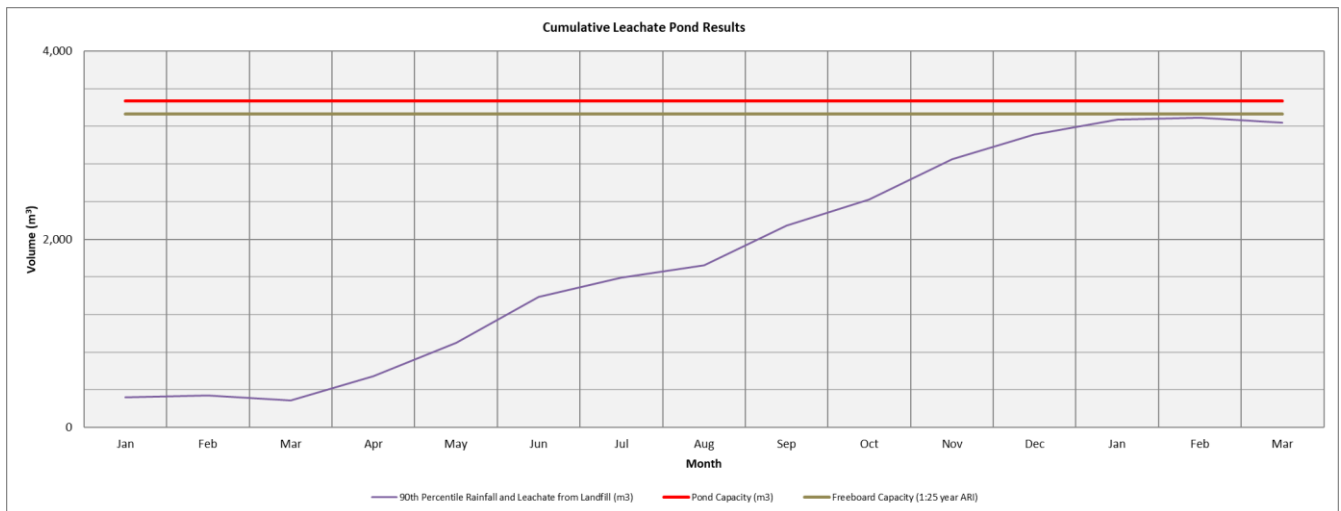


Figure 2 Leachate pond sizing assessment – Scenario 1

For Scenario 2, it is assumed that the pond is empty at the start of the model period due to all generated leachate within the pond being applied to the irrigation application area. The net result is no leachate accumulation within the pond during this initial period.

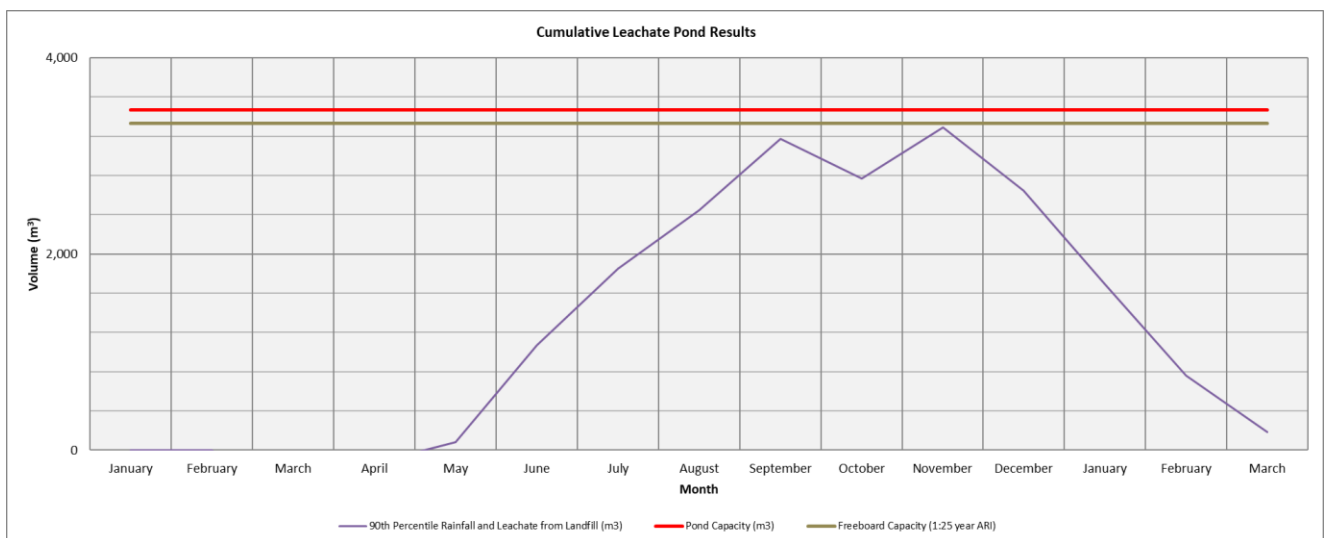


Figure 3 Leachate pond sizing assessment – Scenario 2

The proposed leachate pond sizing details to accommodate both scenarios is summarised within **Table 12**.

Table 12: Leachate Pond Properties

Proposed Pond Dimensions	
Leachate Pond Base Width (m)	5
Leachate Pond Width at Top (m)	25
Leachate Pond Base Length (m)	36
Leachate Pond Length at Top (m)	56
Leachate Pond Depth (m)	5
Leachate Pond Surface Area (m ²)	1,250
Leachate Pond Volume (ML)	3.47

5 Conclusion

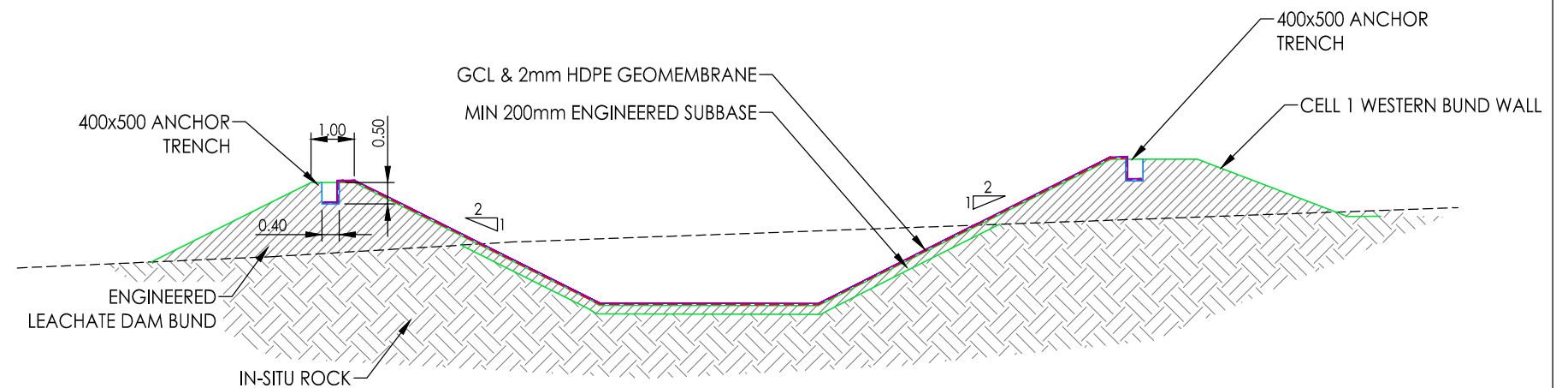
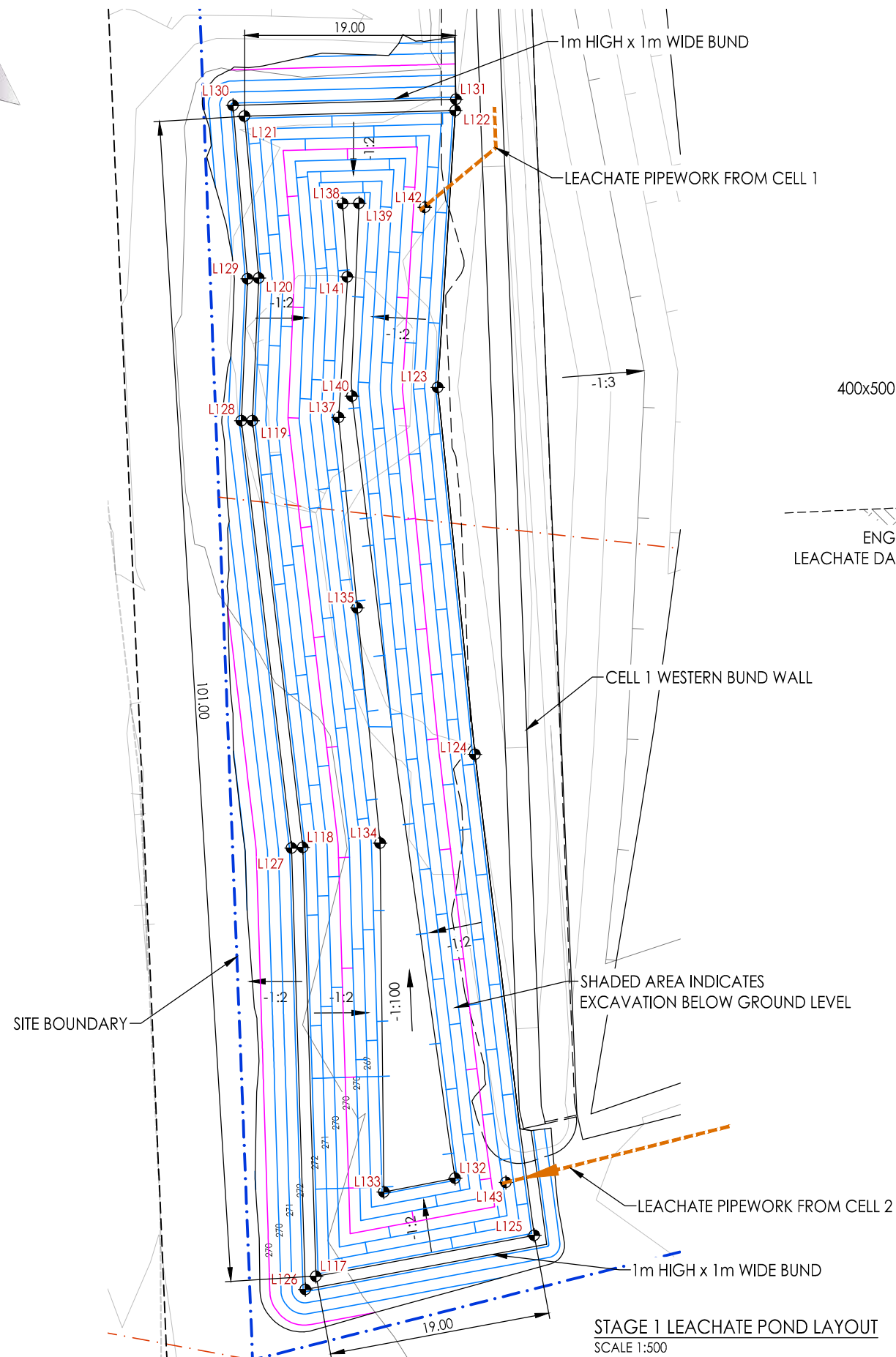
In summary, the model has been prepared in accordance with the *Environmental Guidelines: Solid Waste Landfills, Second edition* (NSW EPA, 2016) and *Environmental Guidelines: Use of Effluent by Irrigation* (NSW DEC, 2004b). The water balance models prepared account for all predicted leachate inputs and outputs from the leachate management system. The leachate pond volume allows for leachate generated from rainfall infiltration into the waste (rainfall depth x surface area), rainfall onto the leachate dam, less evaporation from the leachate dam. The model incorporates rainfall volumes from a historically wet year (90th percentile wet year) in the locality. The model was run using monthly time intervals and estimates the changes in the cumulative volume with each month over a period of one year.

Based upon this assessment, the results indicate the minimum volume (including freeboard allowance) of the leachate storage pond should be 3.47 ML with a surface area of 1,250 m². Should parameters change, such as a larger or smaller pond surface area be adopted, the pond sizing may change due to an increase or decrease in evaporation.

Checked/
Authorised by: DOT

APPENDIX D

PERMANENT AND TEMPORARY LEACHATE DAM AND FLOATING COVER CONSTRUCTION DRAWINGS



TYPICAL SECTION THROUGH LEACHATE POND
SCALE 1:150

Leachate pond setting out			
SOP REF	EASTING	NORTHING	ELEVATION
L117	589,001.14	6,113,313.93	271.60
L118	588,999.94	6,113,352.67	271.60
L119	588,995.40	6,113,391.22	271.60
L120	588,995.97	6,113,404.09	271.60
L121	588,994.68	6,113,418.73	271.60
L122	589,013.71	6,113,419.24	271.60
L123	589,012.14	6,113,394.21	271.60
L124	589,015.49	6,113,361.07	271.60
L125	589,020.85	6,113,317.63	271.60
L126	589,000.17	6,113,312.73	271.60
L127	588,998.94	6,113,352.62	271.60
L128	588,994.40	6,113,391.22	271.60
L129	588,994.96	6,113,404.03	271.60
L130	588,993.65	6,113,419.71	271.60

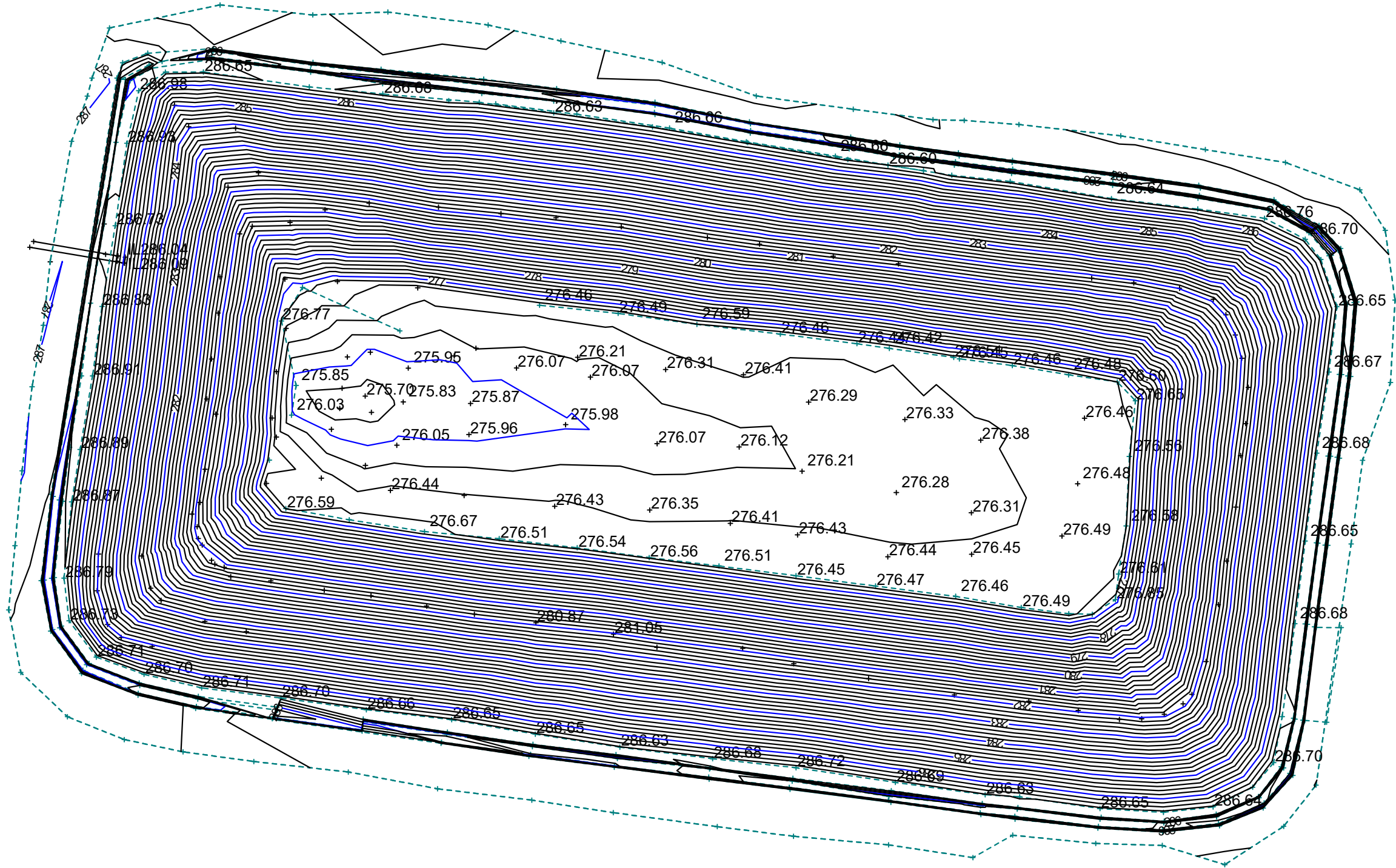
Leachate pond setting out			
SOP REF	EASTING	NORTHING	ELEVATION
L131	589,013.78	6,113,420.24	271.60
L132	589,013.71	6,113,322.79	268.41
L133	589,007.26	6,113,321.55	268.42
L134	589,006.92	6,113,353.06	268.11
L135	589,004.86	6,113,374.31	267.89
L137	589,003.18	6,113,391.50	267.72
L138	589,003.55	6,113,410.82	267.53
L139	589,005.03	6,113,410.86	267.53
L140	589,004.39	6,113,393.43	267.70
L141	589,003.97	6,113,404.21	267.60
L142	589,010.96	6,113,410.49	270.50
L143	589,018.29	6,113,322.42	270.65

LEGEND:

- SITE BOUNDARY
- - - LOT BOUNDARIES

FOR CONSTRUCTION





SCALE 1:500 A3						SRD LAND CONSULTING GOULBURN: 4823 5100 YOUNG: 6382 1501 YOUR LAND CONSULTANT SPECIALISTS WWW.SRDLAND.XYZ	CLIENT: MHE	Sheet 1 of 1			
ORIGIN OF LEVELS CORSNET APPROX.							PROJECT: LECHATE DAM CLAYLINER WORKS AS EXECUTED	Rev	1	Size	A3
CONTOUR INTERVAL ... 0.2m MINOR 1m MAJOR	2	WORKS AS EXECUTED ON LECHATE DAM UPDATED	JMc	JMc	24/10/23		LOCATION: TUMBLONG LANDFILL TUMBLONG, NSW	DATE: 29/9/2023			
DATUM: GDA 2020 55	1	WORKS AS EXECUTED ON LECHATE DAM	JMc	JMc	26/9/23			PLAN No. 21044.dwg			
	No.	REVISIONS & AMENDMENTS			Drawn	Approved	Date				

TUMBLONG LANDFILL
LEACHATE POND FLOATING COVER
PROJECT No.2310-135
CLIENT: MH EARTHMOVING PTY LTD
150 SHERIDAN STREET, PO BOX 227, GUNDAGAI NSW 2722

GENERAL NOTES:

- 1. ALL DIMENSIONS ARE IN MILLIMETERS(mm) (UNLESS NOTED OTHERWISE).
- 2. ALL CHAINAGES ARE IN METERS (UNLESS NOTED OTHERWISE).
- 3. ALL LEVELS ARE IN METERS (m) AND TO AUSTRALIAN HEIGHT DATUM (AHD).
- 4. ALL TBM AND SETOUT COORDINATES ARE TO GDA94/MGA 55.
- 5. GEOMEMBRANE MATERIAL: AS PER DRAWINGS
- 6. WHERE DISSIMILAR MATERIALS ARE USED INSULATION WASHER ARE TO BE FITTED TO ELIMINATE DIRECT CONTACT.
- 7. ALL COVER ANCILLARY FOAM WORK TO BE COMPLETELY ENCAPSULATED IN COVER MATERIAL.

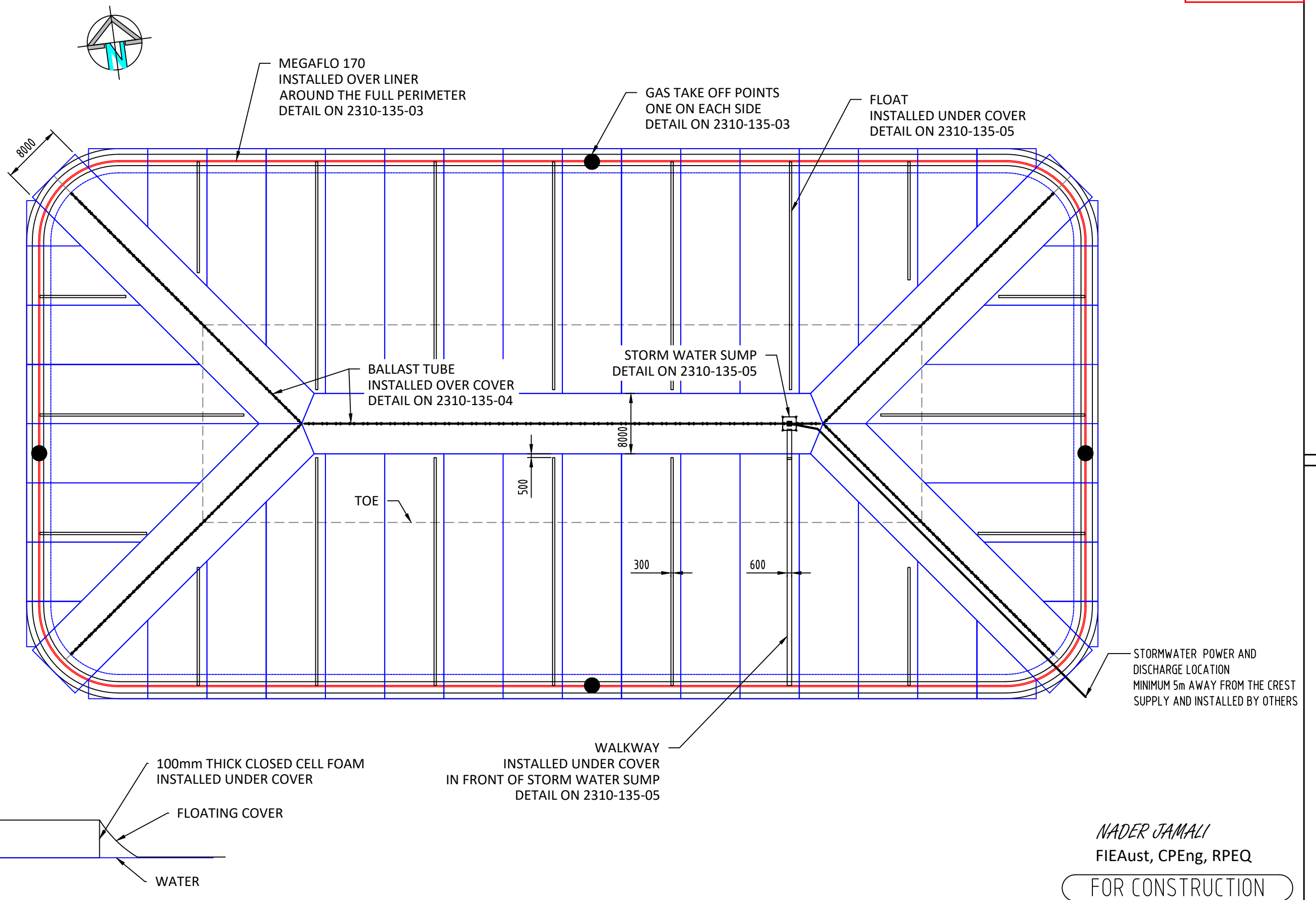
DRAWING LIST:

DRAWING NUMBER	DESCRIPTION
2310-135-01	MASTER DRAWING - SPECIFICATION INDEX
2310-135-02	COVER - GENERAL ARRANGEMENT
2310-135-03	COVER - GAS COLLECTION AND EXTRACTION DETAILS
2310-135-04	COVER - BALLAST LINE DETAIL
2310-135-05	COVER - FLOAT, WALKWAY AND STORM WATER SUMP
2310-135-06	COVER - ANCHOR TRENCH DETAIL

NADER JAMALI
FIEAust, CPEng, RPEQ

FOR CONSTRUCTION

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NADER JAMALI
FIEAust, CPEng, RPEQ

FOR CONSTRUCTION

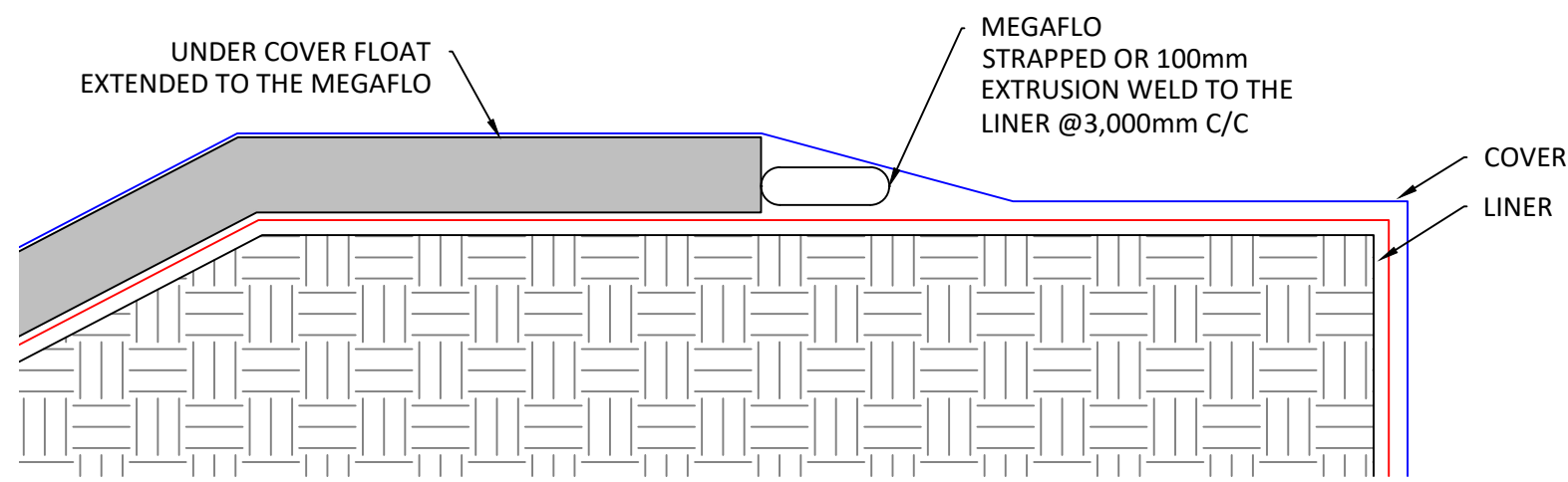
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A	26.10.23	PRELIMINARY ISSUE	NJ	NJ	SD	AH

REVISIONS AND ISSUES

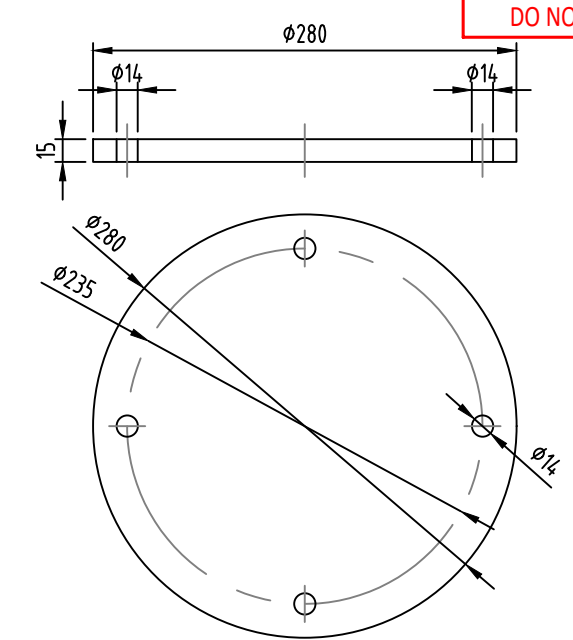


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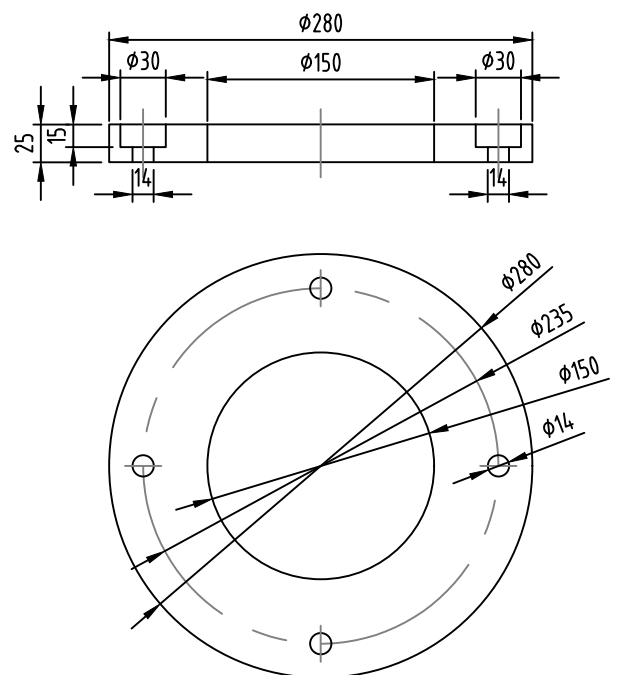
TITLE TUMBLONG LANDFIL - FLOATING COVER GENERAL ARRANGEMENT			
CLIENT ECO LINE SOLUTIONS PTY LTD / MH EARTHMOVING PTY LTD	SHEET SIZE A3	DWG NO. 2310-135-02	REV. 0



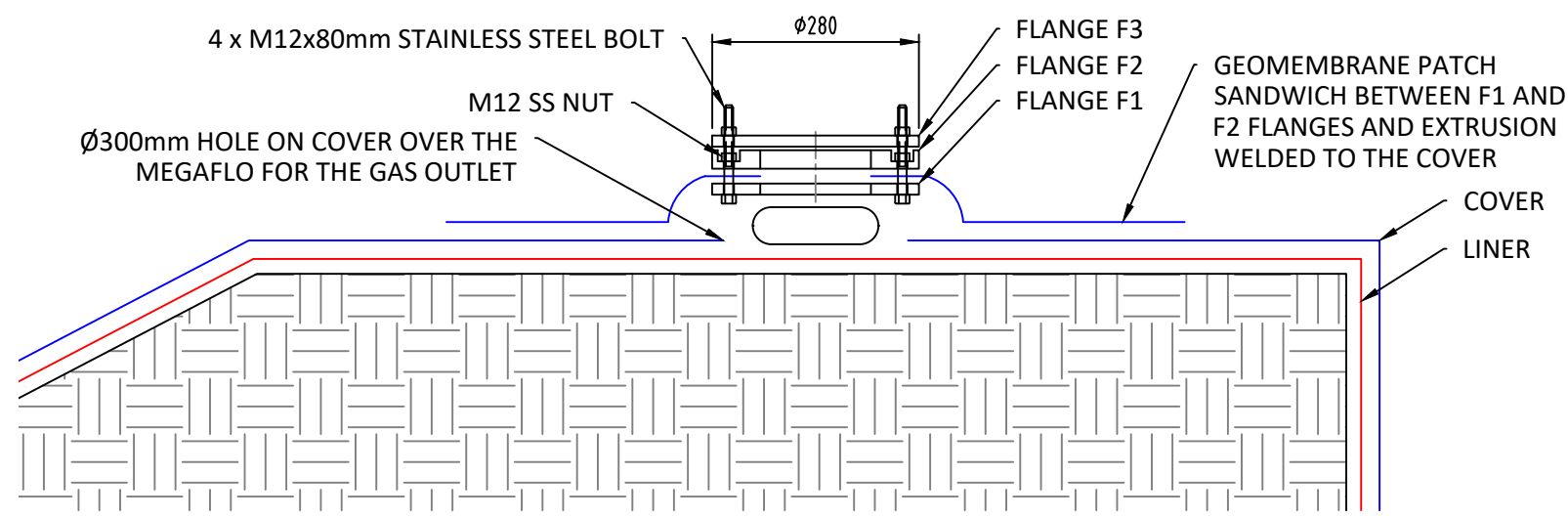
GAS COLLECTION DETAIL
1:20



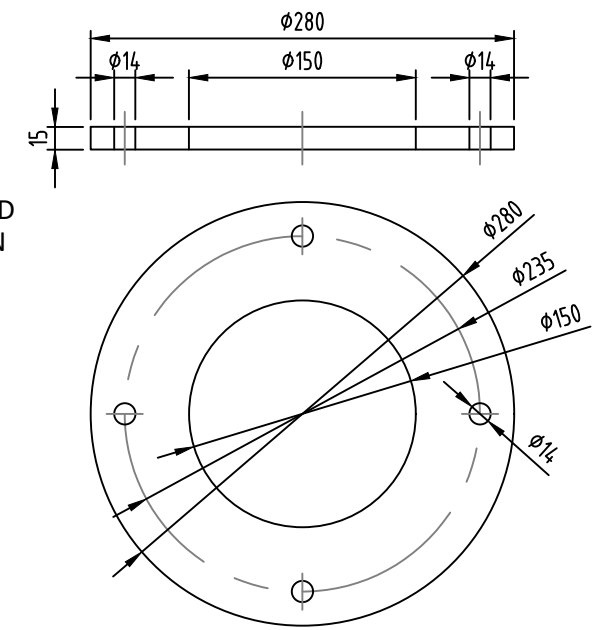
F3 HDPE CAP FLANGE QTY=4
1:20



F2 HDPE FLANGE QTY=4
1:20



GAS EXTRACTION PORT DETAIL
1:20



F1 HDPE FLANGE QTY=4
1:20

- NOTE:
- SUPPLY AND INSTALLATION OF GAS TAKE OFF PIPE BY OTHERS.
 - REMOVE F3 HDPE CAP FLANGE TO INSTALL THE GAS TAKE OFF PIPE.
 - ALL DIMENSIONS ON THE FLANGES ARE BASED ON USING VINIDEX CAT 16A METAL BACKING RING CODE 83550 FOR GAS TAKE OFF PIPE CONNECTION TO F2 HDPE FLANGE.

NADER JAMALI
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FOR CONSTRUCTION

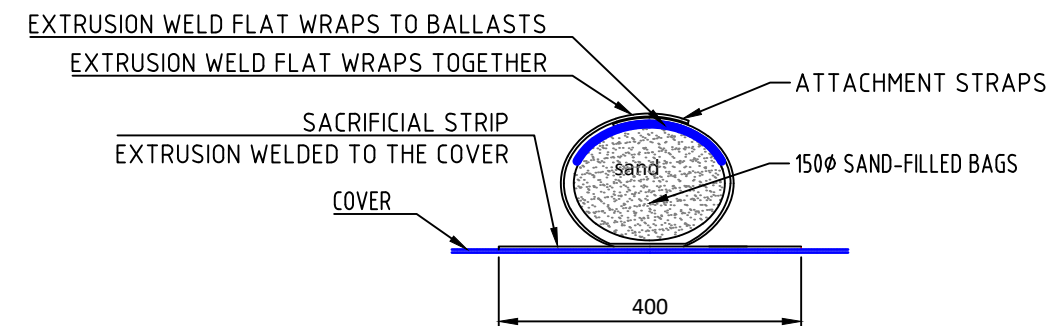
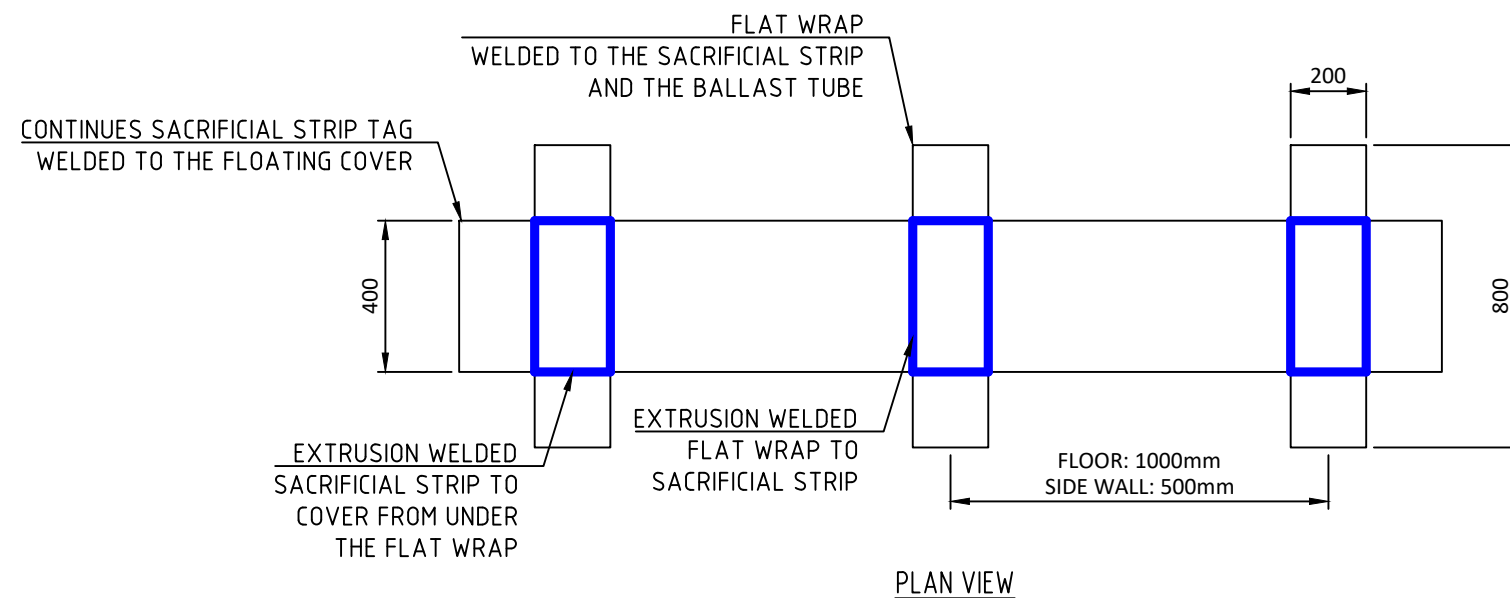
REV	DATE	DESCRIPTION	DESIGN	DRWN	REWD	APRVD
0	27.10.23	ISSUED FOR CONSTRUCTION	NJ	NJ	SD	AH
A	26.10.23	PRELIMINARY ISSUE	NJ	NJ	SD	AH

REVISIONS AND ISSUES

EPC TECH
ENGINEERING • PROCUREMENT • CONSTRUCTION

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TITLE: TUMBLONG LANDFILL - FLOATING COVER COVER - GAS COLLECTION AND EXTRACTION DETAILS			
CLIENT: ECO LINE SOLUTIONS PTY LTD / MH EARTHMOVING PTY LTD	SHEET SIZE: A3	DWG NO: 2310-135-03	REV: 0



ON WALL USE 10mm UV RESISTANCE PE ROPE WARPED AROUND TUBE @1500
SECURE THE END OF THE ROPE INTO THE TOP ANCHOR TRENCH
MAKE NOMINAL 5mm DIAMETER HOLES ON THE BALLAST TUBES AT APPROXIMATELY
1m CENTERS TO LET RAIN WATER FILL THE AIR TRAPPED IN THE BALLASTS

NADER JAMALI
FIEAust, CPEng, RPEQ

FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DESIGN	DRWN	REWD	APRVD
0	27.10.23	ISSUED FOR CONSTRUCTION	NJ	NJ	SD	AH
A	26.10.23	PRELIMINARY ISSUE	NJ	NJ	SD	AH



1029 South Rd, Edwardstown, SA 5039
0428 149 537
nader@epctec.com.au

TITLE

TUMBLONG LANDFIL - FLOATING COVER
COVER - BALLAST LINE DETAIL

CLIENT

ECO LINE SOLUTIONS PTY LTD / MH EARTHMOVING PTY LTD

SHEET SIZE

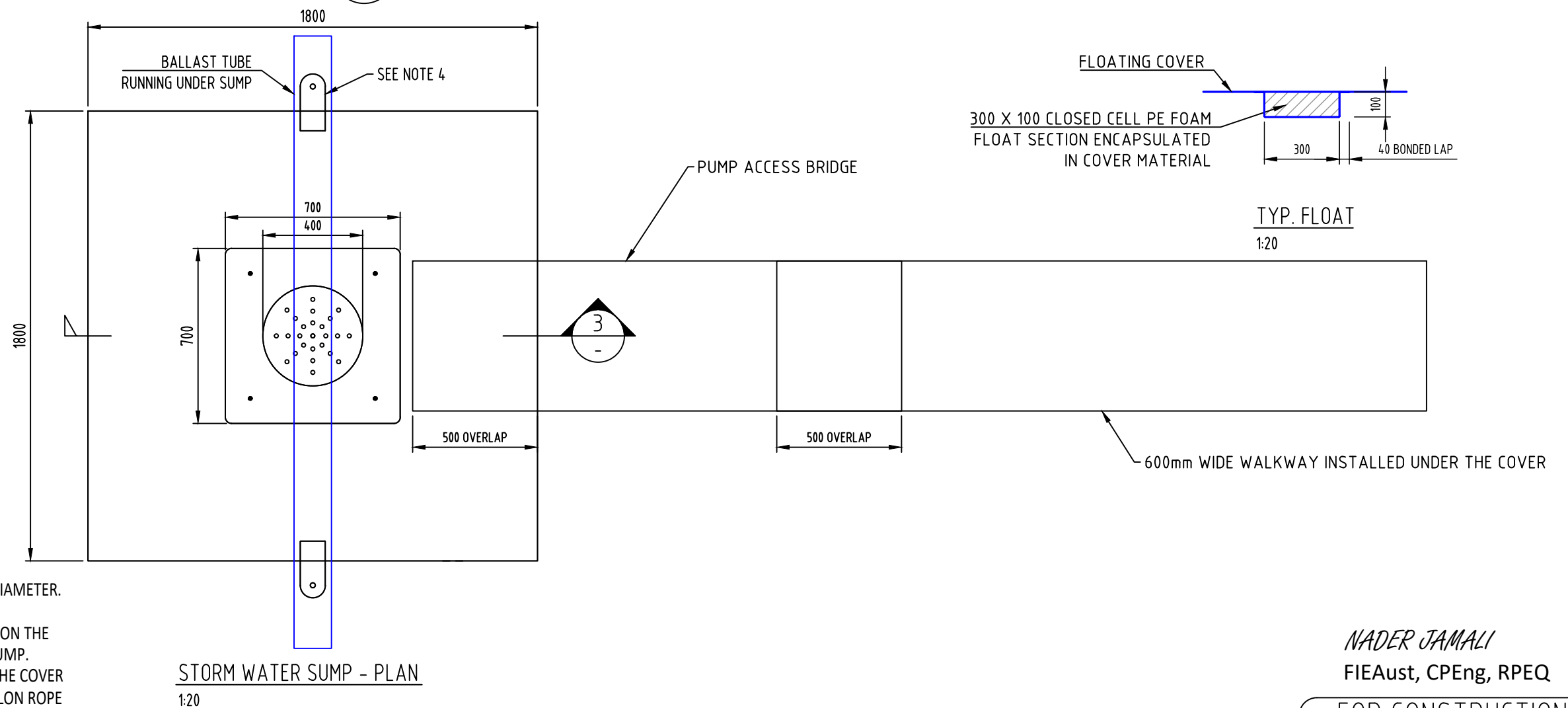
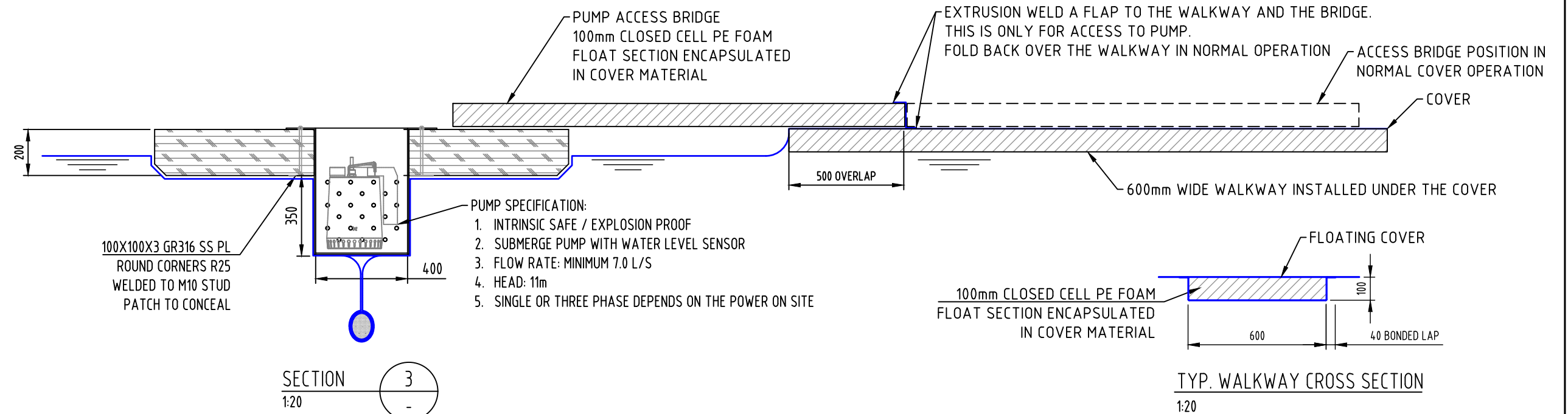
A3

DWG NO.

2310-135-04

REV.

0



NOTES:

- SUMP MADE OF HDPE PIPE NOMINAL 400mm DIAMETER.
- 10mm THICK TOP AND BOTTOM PLATES.
- SERIES OF Ø16 HOLES AROUND THE SUMP AND ON THE BOTTOM PLATE FOR WATER FLOW IN TO THE SUMP.
- 100mm WIDTH TETHER POINTS ATTACHED TO THE COVER BY Ø10mm POLYPROPYLENE POLYESTER OR NYLON ROPE BY USING ANOTHER 100mm WIDTH TETHER POINTS

NADER JAMALI
FIEAust, CPEng, RPEQ

FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DESIGN	DRWN	REVWD	APRVD
0	27.10.23	ISSUED FOR CONSTRUCTION	NJ	NJ	SD	AH
A	26.10.23	PRELIMINARY ISSUE	NJ	NJ	SD	AH

REVISIONS AND ISSUES



1029 South Rd, Edwardstown, SA 5039
0428 149 537
nader@epctec.com.au

TITLE:

TUMBLONG LANDFILL - FLOATING COVER
COVER - BALLAST LINE DETAIL

CLIENT:

ECO LINE SOLUTIONS PTY LTD / MH EARTHMOVING PTY LTD

SHEET SIZE

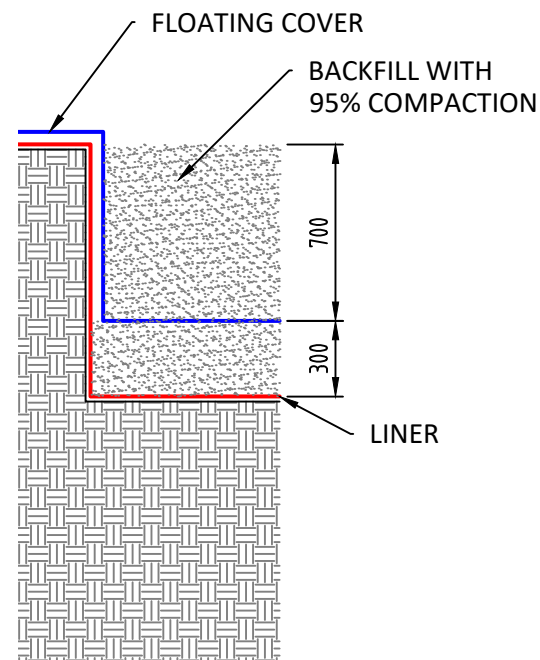
A3

DWG NO:

2310-135-05

REV.

0



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FIEAust, CPEng, RPEQ

FOR CONSTRUCTION

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A	26.10.23	PRELIMINARY ISSUE					
REV	DATE	DESCRIPTION	DESIGN	DRWN	REWD	APRVD	
REVISIONS AND ISSUES							



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0428 149 537
nader@epctec.com.au

TITLE:

TUMBLONG LANDFIL - FLOATING COVER
COVER - ANCHOR TRENCH DETAIL

CLIENT:

ECO LINE SOLUTIONS PTY LTD / MH EARTHMOVING PTY LTD

SHEET SIZE

A3

DWG NO:

2310-135-06

REV.

0

APPENDIX E

CELL 1 & 2 LEACHATE SIDE RISER SOLAR PUMP SPECIFICATION

Thursday, September 26, 2024

Tumut Waste

Solar pumping project

Parameter

Location:	Australia, Tumut (36° South; 148° East)	Water temperature:	25 °C		
Required daily output:	50 m³; Sizing for average month	Dirt loss:	5.0 %	Motor cable:	50 m
Pipe type:	-	Total dynamic head:	30 m	Pipe length:	-

Products

Quantity	Details
PS2-1800 HRE-32-3	1 pc. System layout for PS-1800 EV controller: Submersible pump system including controller with DataModule, motor and pump end
Jinko 440w	4 pc. 1,760 Wp; 4 x 1 modules; 36 ° tilted
Motor cable	50 m 4 mm² 3-phase cable for power and 1-phase cable for ground
Accessories	1 set Water Level Measurement Solution, PP2000S PowerPack

Sun Sensor setting in PumpScanner

min. 100 W/m²

Daily output in average month

47 m³

Daily values

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
Output [m³]	53	53	51	45	41	36	38	42	46	51	52	53	47
Energy [kWh]	10.0	9.9	9.6	8.2	6.9	5.6	6.0	7.1	8.4	9.5	9.8	9.8	8.4
Irradiation [kWh/m²]	6.5	6.5	6.1	5.1	4.1	3.3	3.5	4.2	5.1	6.0	6.3	6.4	5.3
Rainfall [mm]	2.3	1.7	2.0	2.3	2.8	2.9	3.5	3.4	3.1	3.2	2.6	2.3	2.7
Ambient temp. [°C]	21	20	17	14	10	7	5	6	9	13	16	19	13

Hourly values

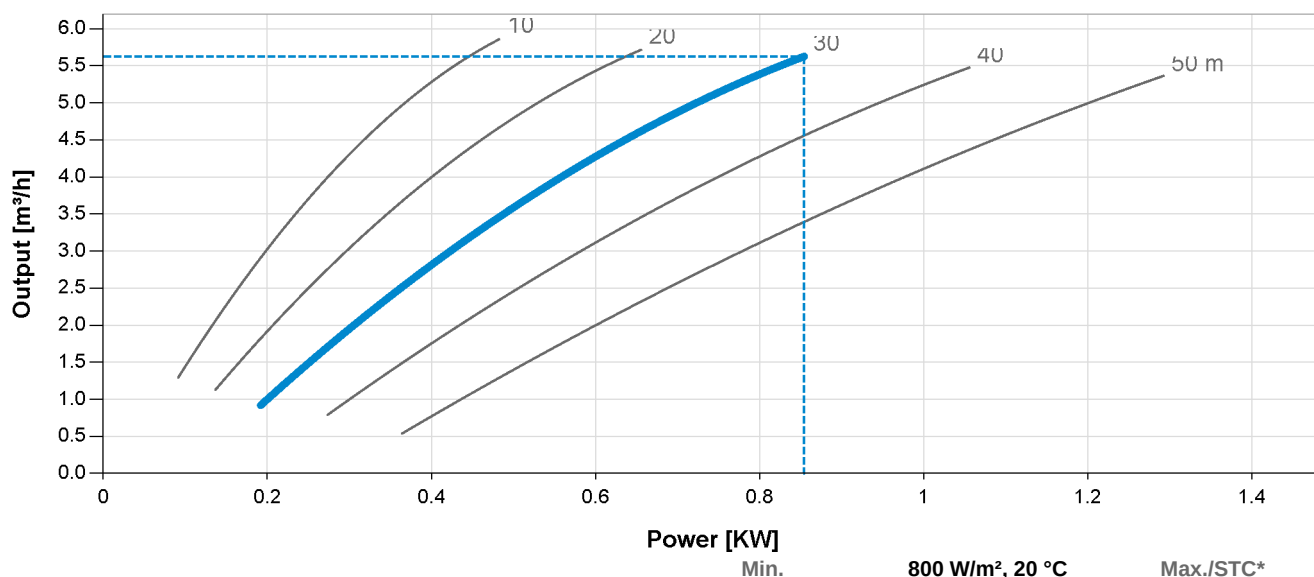
	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
Output [m³/h]	0	1.2	3.4	5	5.5	5.6	5.6	5.6	5.5	4.9	3.3	1	0
Energy [kWh]	0.043	0.22	0.51	0.78	1.00	1.1	1.2	1.1	0.97	0.75	0.49	0.21	0.041
Irradiation [kWh/m²]	0.025	0.13	0.30	0.48	0.62	0.71	0.75	0.71	0.62	0.48	0.30	0.13	0.025
Ambient temp. [°C]	8	8	9	11	13	15	17	18	18	18	18	17	17

Thursday, September 26, 2024

Tumut Waste

Solar pumping project

System characteristic



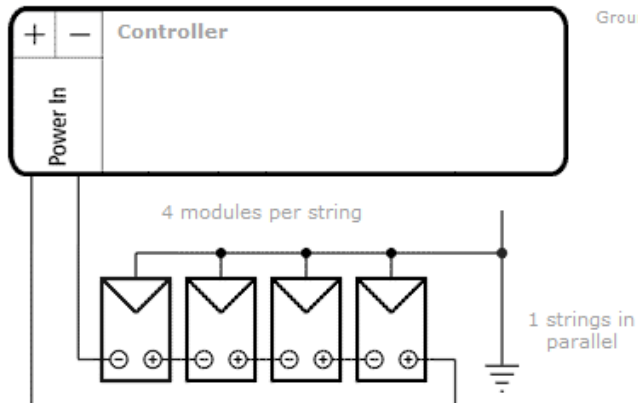
			Min.	800 W/m², 20 °C	Max./STC*
PV generator	Cell temperature	[°C]		46	25
	Temperature loss	[%]		11	-
	Dirt loss	[%]		5.0	-
	Pmax	[Wp]		1,195	1,760
	Vmp	[V]		121	135
	Imp	[A]		9.9	13
	Voc	[V]		151	164
	Isc	[A]		11	14
	Pout	[W]		888	-
	Vout	[V]		139	-
	Iout	[A]		6.2	-
Motor cable	Power loss	[%]	2.8	2.8	7.3
Pump systems	Motor power	[W]	192	854	854
	Motor voltage	[V EC]	33	116	116
	Motor current	[A]	5.8	7.4	7.4
	Motor speed	[rpm]	903	3,295	3,295
	Flow rate	[m³/h]	0.92	5.6	5.6
	Efficiency	[%]	37	52	57

*STC: Standard test conditions for photovoltaic modules, 1000 W/m² solar irradiance, 25 °C cell temperature

Thursday, September 26, 2024

Tumut Waste

Solar pumping project

Wiring diagram

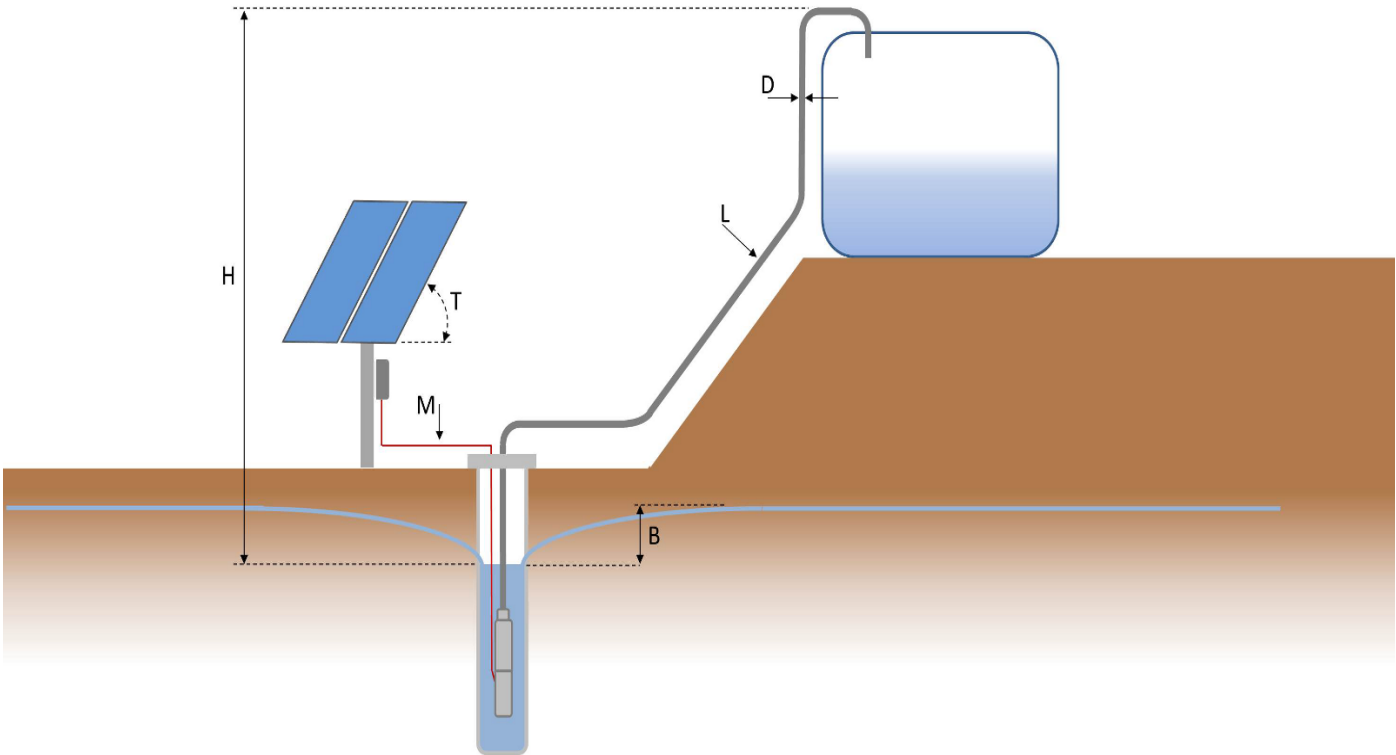
Grounding should be done according to the instructions of the module manufacturer.

Thursday, September 26, 2024

Tumut Waste

Solar pumping project

Sizing Layout



H (Static head):	Vertical height from the dynamic water level to the highest point of delivery.
B (Drawdown):	Lowering of water level depending on flow rate and recovery rate of the well.
D (Pipeline inner diameter)	
L (Pipe length):	Entire pipeline from the pump outlet to the point of delivery. Ellbows and armatures must be added as an equivalent length of pipeline.
M (Motor cable):	The cable between controller and pump unit.
T (Tilt angle):	Angle of the PV generator surface from the horizontal plane.

PS2-1800 HRE-32

Solar Submersible Pump System for 4" wells

System Overview

Head	max. 50 m
Flow rate	max. 5.9 m³/h

Technical Data

Controller PS2-1800

- Controlling and monitoring
- Control inputs for dry running protection, remote control etc.
- Protected against reverse polarity, overload and overtemperature
- Integrated MPPT (Maximum Power Point Tracking)
- Battery operation: Integrated low voltage disconnect
- Integrated Sun Sensor

Power	max. 1.8 kW
Input voltage	max. 200 V
Optimum Vmp**	> 102 V
Motor current	max. 14 A
Efficiency	max. 98 %
Ambient temp.	-40...50 °C
Enclosure class	IP68

Motor ECDRIVE 1800-HRE

- Maintenance-free brushless DC motor
- Water filled
- Premium materials, stainless steel: AISI 304/316
- No electronics in the motor

Rated power	1.7 kW
Efficiency	max. 92 %
Motor speed	900...3,300 rpm
Insulation class	F
Enclosure class	IP68
Submersion	max. 150 m

Pump End PE HRE-32***

- Non-return valve
- Premium materials, stainless steel: AISI 304/316
- Helical rotor pump

Efficiency	max. 65 %
------------	-----------



Pump Unit PU1800 HRE-32 (Motor, Pump End)

Borehole diameter	min. 4,0 in
Water temperature	max. 50 °C

Standards



2006/42/EC, 2004/108/EC, 2006/95/EC

IEC/EN 61702:1995, IEC/EN 62253 Ed.1

The logos shown reflect the approvals that have been granted for this product family. Products are ordered and supplied with the approvals specific to the market requirements.

**Vmp: MPP-voltage under Standard Test Conditions (STC): 1000 W/m² solar irradiance, 25 °C cell temperature

***Specify temperature range on order

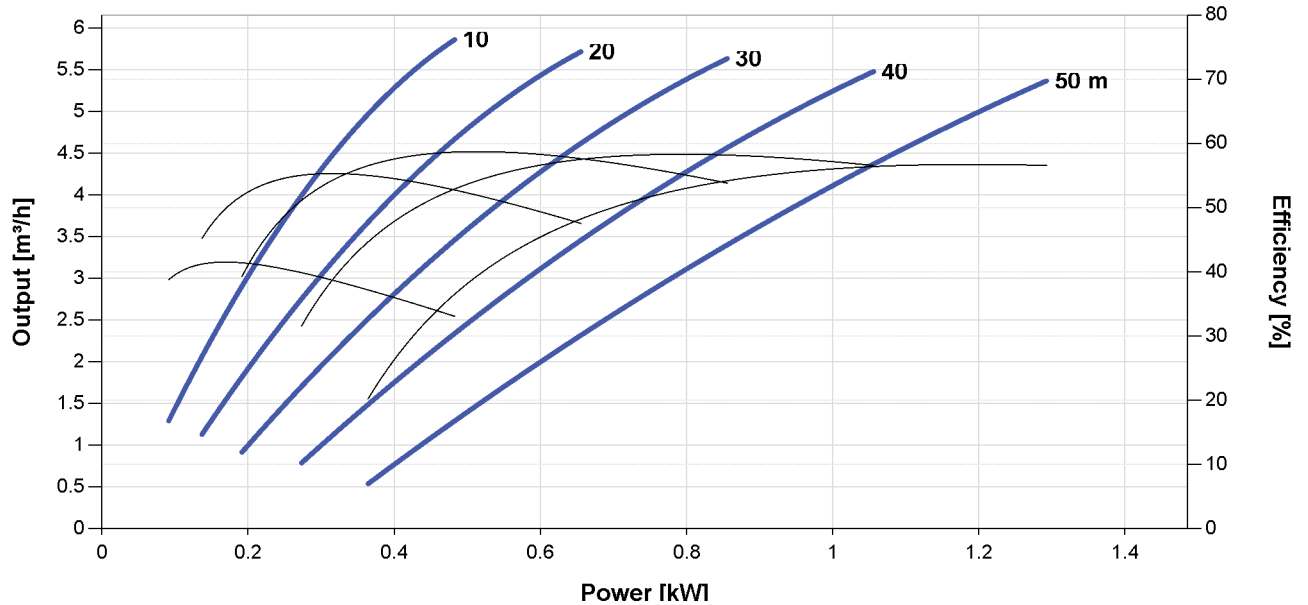


PS2-1800 HRE-32

Solar Submersible Pump System for 4" wells

Pump Chart

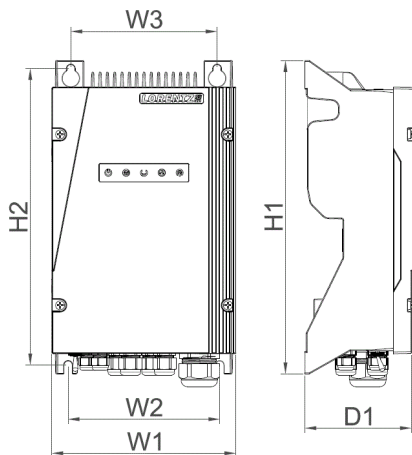
V_{mp}* > 102 V



Dimensions and Weights

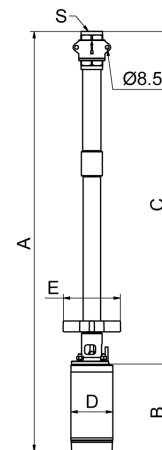
Controller

H1 = 352 mm
H2 = 333 mm
W1 = 207 mm
W2 = 170 mm
W3 = 164 mm
D1 = 124 mm



Pump Unit

A = 1,030 mm
B = 205 mm
C = 825 mm
D = 96 mm
E = 147 mm
S = 1.5 in



	Net weight
Controller	6.0 kg
Pump Unit	12 kg
Motor	6.8 kg
Pump End	5.5 kg

*V_{mp}: MPP-voltage under Standard Test Conditions (STC): 1000 W/m² solar irradiance, 25 °C cell temperature



Water Level Measurement Solution

The LORENTZ Water Level Measurement Solution (WLMS) accurately measures water levels in boreholes and tanks. WLMS is a combination of pressure sensor and plug in barometer to provide water level measurement for PS2 and PSk3 systems. Used in conjunction with inbuilt software WLMS allows you to record and monitor water levels in your tank and control your system based on these levels.

The sealed sensor comes with a plug-in barometer placed in the controller and measures the pressure based on the difference between the submersed sensor and the barometer.

This solution allows control of the pump based on the water level in the source or tank. It delivers not only information about the current water level but also about trends related to water usage. Predicting and planning for low water levels is possible with this solution.

The WLMS can also provide dry run protection for the pump and is a very good alternative to a well probe in any water source that is prone to calcium scaling, snails, algae or other contaminants that can effect operation of mechanical float switches.

Features

- Measures water levels in tank, well or other water source
- Provides pump run dry run protection
- Absolute pressure sensor - complete with plug in barometer
- Control of pump based on sensor data
- Very simple configuration and high customer value
- Real time and historic level data is viewed locally via LORENTZ CONNECTED apps (PumpScanner or Assistant or remotely via LORENTZ Global

Technical Data

Sensor type	absolute pressure sensor
Enclosure class	IP68
Sensor housing	high tech polymer
Measuring range	25 m / 82 ft water level
Accuracy	+/- 0.35 m / 1.15 ft
Diaphragm material	stainless steel AISI316L
O-ring material	FKM
Overpressure	max 75m / 246 ft water column
Min shut off level	0.5 m / 1.6 ft
Output signal	4-20mA
Power supply	12-28V DC
Cable jacket	PVC
Cable length	35 m / 114.8 ft
Application temperature	-10 to 80° C / 14 to 176° F
Meets the requirements for CE	

Compatibility

- for use with LORENTZ PS2 controllers and LORENTZ PSk3 controllers



WLMS Ordering Information

Order information

Item number	Description
19-005347	Water Level Measurement Solution, measurement range 25 m / 82 ft cable length 35 m / 115 ft

Dimensions

Packing Dimensions	Weight
225 x 205 x 70 mm / 8.9 x 8 x 2.8 in	1.5 kg / 3.3 lbs

Shipping Items

Sensor with 35m (115 ft) cable on a cable drum

Plug-in barometer

Balancing valve

Splice kit



PowerPack 2000S

DC power supply for PS2-1800 and PS2-600 pump systems

Description

The PowerPack 2000S is an outdoor rated power supply unit which allows LORENTZ PS2-1800 and PS2-600 systems to be powered from an AC (mains voltage) power source. The PowerPack 2000S can be used as a continuous power supply, in conjunction with PV modules or as a temporary or seasonal power supply.

Features

- DC power supply to power LORENTZ solar pump systems from the grid or a generator
- Single phase powered device
- Robust weatherproof housing
- Wall or panel mount possible
- Efficiency up to 93%
- External on / off switch plus LED indicator
- Forced air cooling by built-in fans
- Protections against short circuit, overload, over voltage, over temperature, fan failure



photo may differ from actual product

Technical data / Specifications

	PowerPack 2000S
Pump systems	PS2-1800 / PS2-600
AC input voltage	Single phase 200-240 V AC $\pm$ (10%)
AC current	20 A / 180 V AC 16 A / 230 V AC
Frequency	47-63 Hz
PV input PS2-1800	Max. 200 V DC (solar)
PV input PS2-600	Max. 150 V DC (solar)
DC output PS2-1800	up to 200 V DC (solar) 160 V DC (PowerPack) 12-14 A
DC output PS2-600	up to 150 V DC (solar) 135 V DC (PowerPack) 12-14 A
Working ambient temp.	-20~ + 45°C (-4°F to 113°F)
IP class	IP33
Remote control	On-Off control function
Housing material	Steel box

Additional certifications concerning the inbuilt power supply:



BERNT LORENTZ GmbH

Siebenstuecken 24, 24558 Henstedt-Ulzburg, Germany
Tel. +49 (0) 4193 8806 - 700, www.lorentz.de

Sun. Water. Life.

All specifications and information are given with good intent, errors are possible and products may be subject to change without notice. Pictures may differ from actual products depending on local market requirements and regulations.

Order information

Item number	Description
19-001057	PowerPack 2000S

Figure 1 key

A	280 mm / 11 in
B	350 mm / 13.8 in
C	140 mm / 5.5 in
D	334 mm / 13.1 in
E	384 mm / 15.1 in
F	180 mm / 7.1 in

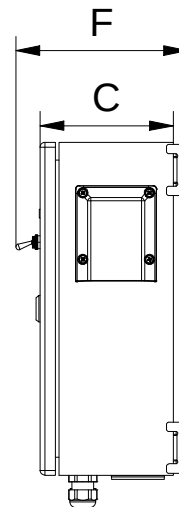
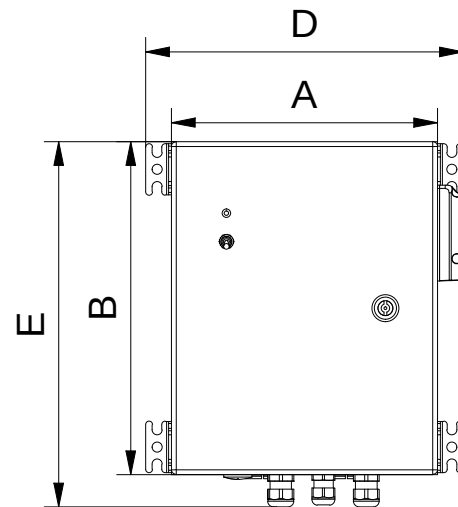
Mounting

- Fixing pattern for holes: 310 x 292 mm / 12.2 x 11.5 in

Dimensions and weight

Package height	450 mm (17.7 in)
Package width	350 mm (13.8 in)
Package depth	230 mm (9 in)
Packed volume	0.036 m³ (1.27 ft³)
Gross weight	9.5 kg (20.9 lbs)
Net weight	8.5 kg (18.7 lbs)

Figure 1: Product dimensions



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