Appendix E Water Balance and Leachate Management

Appendix E1 Water Balance

GOLDER
MEMBER OF WSP

REPORT

Water Balance Model, Leachate and Stormwater Management Strategies

Shoal Bay Landfill, Darwin

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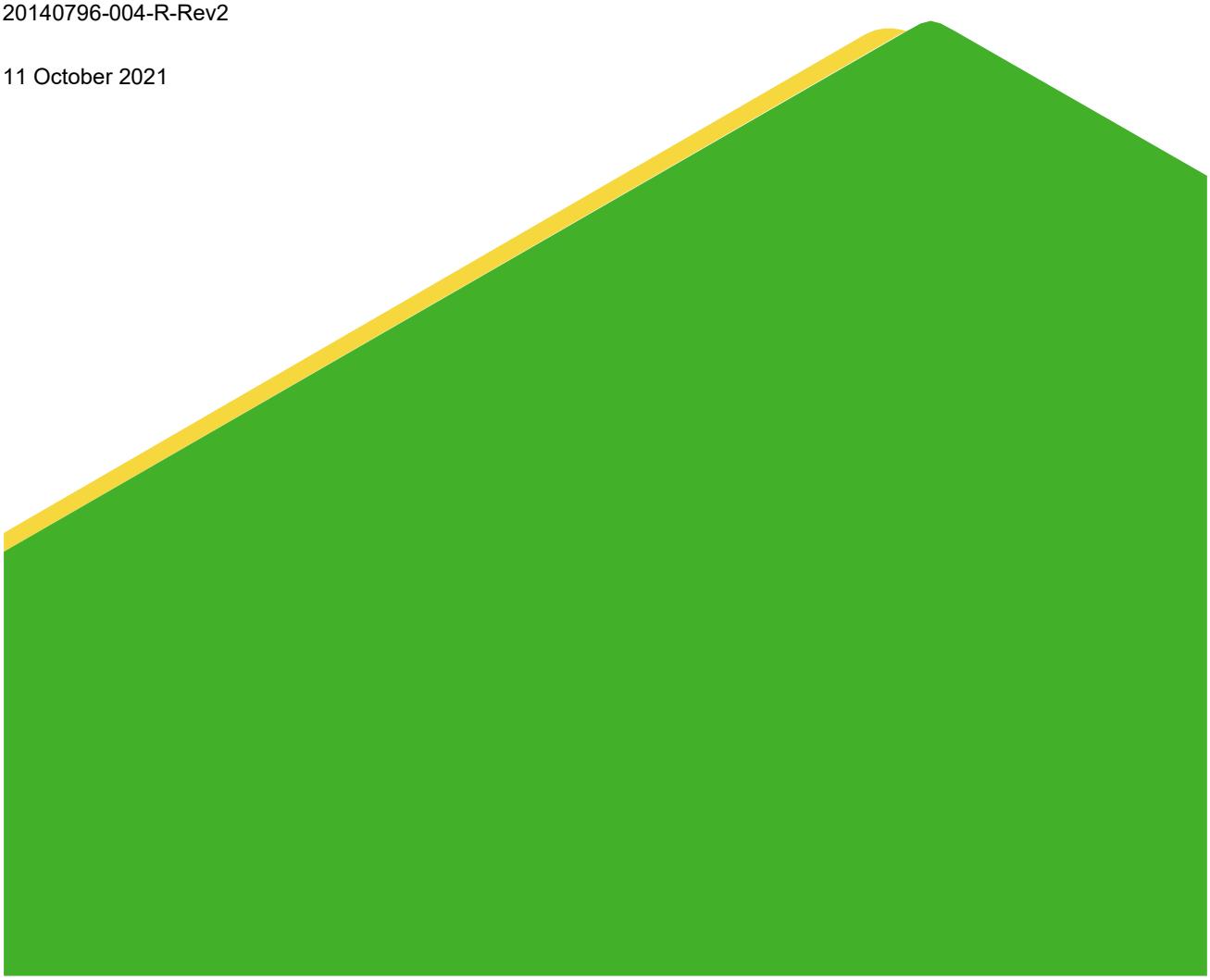

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Table of Contents

TABLES

FIGURES

APPENDICES

APPENDIX A
Key Stage 3 to Stage 6 Design Documentation

APPENDIX B
Key Stage 2 Inert Waste Landfill Development Plans

APPENDIX C
Key General Waste Landfill Development Plans

APPENDIX D
Key Stage 3/4 Final Capping Design Drawings

APPENDIX E
Stormwater Treatment Train Typical Infrastructure Examples

APPENDIX F
Important Information

1.0 INTRODUCTION

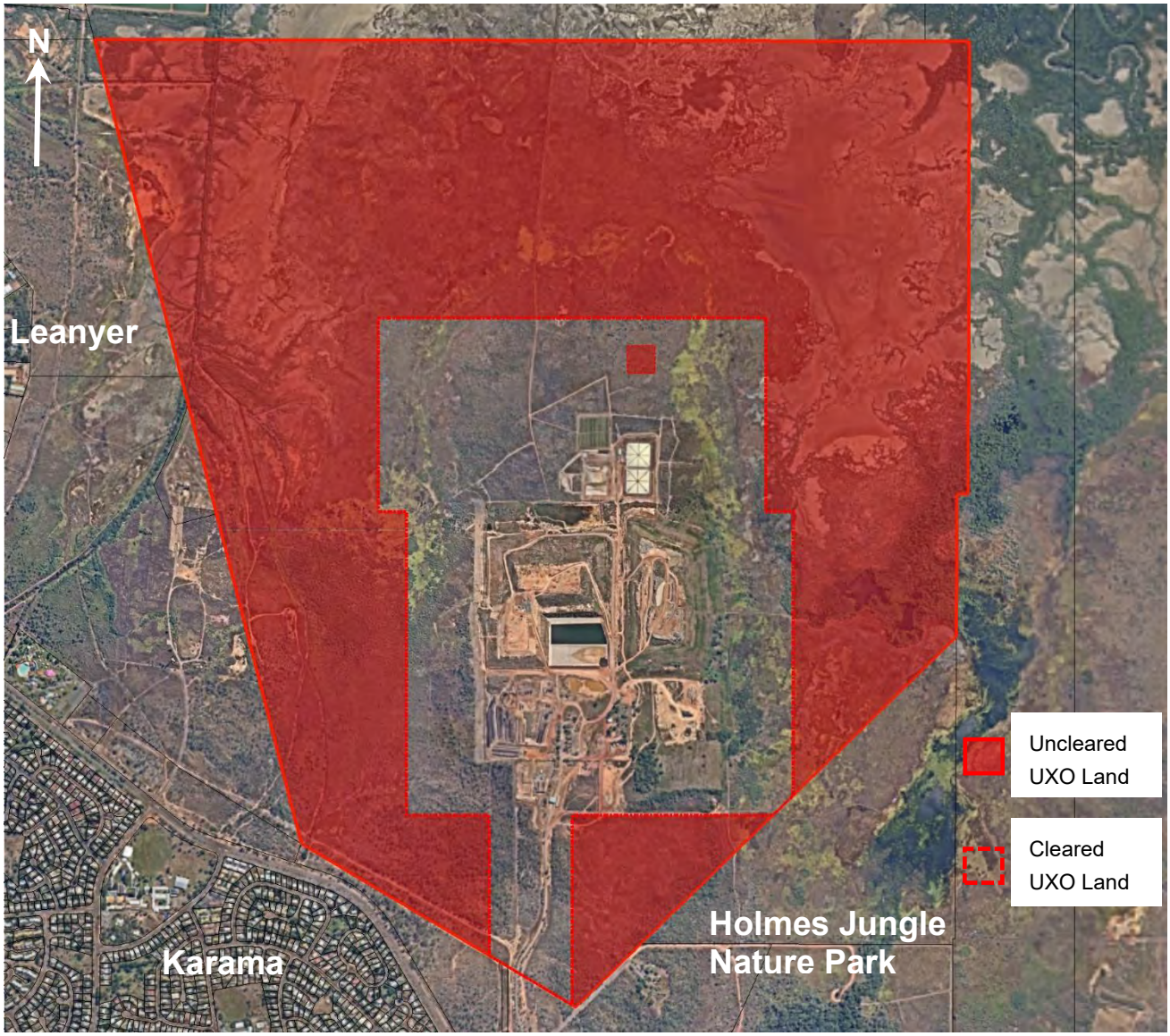
The City of Darwin (Council) is responsible for the operation of Shoal Bay Landfill and the site's environmental performance, including compliance with the conditions of Northern Territory Environmental Protection Authority (NT EPA) Environmental Protection Licence (EPL) 188, dated 2 July 2021.

The Shoal Bay Landfill site is leased from the Department of Defence and comprises a total land area of 823.6 ha, comprising three key areas listed in Table 1 and shown in Figure 1.

Table 1: Shoal Bay Landfill Key Areas

Land Status	Current Land Use	Land Condition	Area
Cleared Unexploded Ordinance (UXO) Area	■ Waste management	■ Cleared/grass vegetation	97.3 ha
	■ Vacant/Unused	■ Modified native habitat	171.3 ha
Uncleared UXO Area	■ Vacant/Unused	■ Modified native habitat	555.0 ha

Figure 1: Site Boundary and Layout Plan



Sources: Nearmap Image, June 2021, Council/Defence Lease Plan (Golder reference 20140796-002-TM-Rev0, 25 June 2020)

Council commissioned Golder Associates Pty Ltd (Golder) to review and update existing water balance modelling and associated leachate and stormwater management strategies for current and indicative future landfill operational precincts listed in Table 2 and identified in Figure 2.

Table 2: Scope of Report Precincts

Landfill Precinct	Sub-Precincts	Current Land Use	Future Land Use	Area
Stage 1 Former general waste landfill	N/A	■ Earthworks stockpiles ■ Leachate irrigation	■ Greenwaste Hardstands	12.2 ha
Stage 2 Former general waste landfill	N/A	■ Inert waste landfill	■ Inert waste landfill	18.1 ha
Existing General Waste Landfill	■ Stage 3/Stage 4 ■ Stage 5 ■ Stage 6	■ Interim capping/ leachate irrigation ■ General waste landfill cells	■ Final capping/ treated leachate irrigation ■ General waste landfill cells	20.2 ha
Future General Waste Landfill	■ Stage 7 ■ Stage 8 ■ Stage 9 ■ Stage 10	■ Greenwaste hardstands ■ Transfer station ■ Weighbridge	■ General waste landfill cells	14.1 ha
Future Resource Recovery/Disaster Waste Hardstands	N/A	■ Generally none	■ Resource recovery hardstands ■ Disaster waste management	31.1 ha

Other than the existing greenwaste hardstand area, the scope of this report generally excludes current and future non-waste disposal operational precincts such as the buyback shop, Operations Contractor compound, landfill gas contractor operations, leachate treatment/management infrastructure, disaster waste management and short-term construction-related works.

2.0 BACKGROUND INFORMATION

2.1 Existing Reports

Information contained in the following reports previously prepared for the Shoal Bay Landfill site form the basis for assessments presented in this report:

- Report 1: '*Leachate Management Strategy, Shoal Bay Landfill Darwin, Northern Territory*', Golder Reference: 147635014-008-R-Rev0, dated June 2014.
- Report 2: '*Landfill Development Plan, Stage 2 Inert Landfill, Shoal Bay Waste Management Facility*', Golder Reference: 1653988-006-R-Rev1, dated March 2017.
- Report 3: '*Landfill Development Plan, Stage 5 to Stage 10 General Waste Cells, Shoal Bay Waste Facility, Darwin*', Golder Reference: 1526230-020-R-Rev1, dated June 2017.

Figure 2: Current and Indicative Future Landfill Operations Precincts

Sources: Nearmap Image, June 2021, Council/Defence Lease Plan (Golder reference 20140796-002-TM-Rev0, 25 June 2020)

- Report 4: '*Preliminary Review of Master Plan Precincts, Shoal Bay Landfill*', Golder Reference: 21040796-002-TM-Rev0, dated June 2020.
- Report 5: '*Water Balance, Leachate and Stormwater Management Strategies, Shoal Bay Landfill*', Golder Reference: 21040796-004-R-Rev1, dated August 2020.

2.2 Regulatory Requirements

2.2.1 Environmental Protection Licence EPL 188

Conditions of EPL188 considered relevant to water balance modelling and the preparation of leachate and stormwater management strategies for Shoal Bay Landfill are summarised in Table 3.

Table 3: EPL 188 Key Relevant Conditions

Condition	Description
General	Environment Protection Objectives (Part 4 of the WMPC Act), and Water Quality Standards (section 73 of the Water Act): ■ An Environment Protection Objective (EPO) is a statutory instrument to establish principles on which: a) environmental quality is to be maintained, enhanced, managed or protected; b) pollution, or environmental harm resulting from pollution, is to be assessed, prevented, reduced, controlled, rectified or cleaned up; and c) effective waste management is to be implemented or evaluated. ■ In accordance with section 18 of the WMPC Act a beneficial use, quality standard, criteria or objective declared under section 73 of the Water Act and in force is an environment protection objective for the purposes of the WMPC Act. ■ The following EPOs and Beneficial Use Declarations (BUDs) are relevant to this licence: ▪ Declared Beneficial Use for the Darwin Harbour Area: Water Quality Objectives, NTG Gazette 29 June 2010.
General	Environmental Interests: ■ This section highlights sensitivity of the surrounding land use and environment associated with the location of the approved activity: ■ Sites of Conservation Significance ▪ SOC 6 - Darwin Harbour ▪ SOC 8 – Shoal Bay
16	The licensee must implement, maintain and follow an Emergency Response Plan that addresses procedures for responding to emergencies associated with the activity that may cause environmental harm.
20	The licensee must ensure that wastewater generated from washing plant and equipment associated with the activity does not cause pollution.
30	The licensee must ensure that neither leachate nor water pond on the surface of the premises.
31	The licensee must only store leachate: 31.1 in covered ponds identified as 'leachate storage ponds' in Attachment 2; or 31.2 in enclosed storage tanks with bunded areas constructed, sized, operated and maintained to contain 110% capacity of the largest container within the bund.
43	The licensee must ensure there is no migration or overflow of a contaminant or waste, which causes or may cause environmental harm, beyond the boundary of the land on which the premises are located. (For the avoidance of doubt, this condition is not intended to authorise the discharge of a contaminant or waste to any land or water which discharge has not been specifically authorised by another condition of this licence.)

Condition	Description
44	The licensee must not allow a contaminant or waste, which causes or may cause environmental harm, to enter water.
45	The licensee must ensure that quality of surface water leaving site does not exceed the limits specified in Attachment 3 of this licence.
66	The licensee must at all times maintain an up-to-date environmental monitoring database which records: 66.1 leachate pumping volumes; and 66.2 monitoring results for any monitoring required under this licence from January 2010 to present
81	The licensee must not directly cause or pump any leachate (including treated or concentrated leachate) into any landfill waste cell or landfill, without NT EPA approval.
84	The licensee must ensure that the level of leachate within any lined landfill waste cell (Stage 6) does not exceed 300mm at any time.
88	The licensee must develop an Integrated Leachate Monitoring, Inspection and Maintenance program for the site, reviewed by an independent environmental auditor. The program is to include, but not limited to; 88.1 leachate collection systems and all leachate sources received by the system. 88.2 method of conveyance of leachate from all source points to the leachate management system. 88.3 leachate leakage detection system. 88.4 the subgrade drainage testing and their locations. 88.5 the type of leachate pump and operation of pumping systems. 88.6 data collection infrastructure and recording methodology. 88.7 a program for the inspection of drainage, pumps, blockages, flows and equipment
89	The licensee must submit the integrated Leachate Monitoring, Inspection and Maintenance program reviewed by an independent environmental auditor to the NT EPA by 30 October 2021.
92	The licensee must develop a revised Environmental Management Plan (EMP) for the premises that incorporates: 92.1 a holistic integrated environmental management plan for the premises. 92.2 approved changes to plant, equipment and construction works since the last EMP revision. 92.3 measured performance criteria. 92.4 staged progressive rehabilitation plan. 92.5 staged capping and closure planning.
93	The licensee must submit the revised Environmental Management Plan to the NT EPA by no later than 13 December 2021.
94	The licensee must develop of a revised Site Water Balance plan that includes: 94.1 leachate volumes within all landfill stages validated by onsite monitoring data. 94.2 predicted volumes from all potential sources.
95	The licensee must submit the revised Site Water Balance plan to the NT EPA by 30 October 2021.

2.2.2 NT EPA Guidelines

Elements of the NT EPA *Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory* considered relevant to water balance modelling and the preparation of leachate and stormwater management strategies for Shoal Bay Landfill are summarised in Table 4

Table 4: NT EPA Guidelines Key Elements

Description
Water Management – General
Water management relies upon the management of three water streams with the intention of minimising the volumes to be managed and avoiding mixing the streams. The three components to be kept separate are: Stormwater; leachate; groundwater. When considering means of managing water on the site, reusing water onsite is always preferred to discharging the water to the environment.
Leachate Generation and Management
Sound landfill design requires calculation of expected leachate production in addition to composition as the amount of leachate generated will affect operating costs. The amount of leachate generated will also affect the cost of post-closure care. Predicting leachate generation quantities requires water balance calculations that consider precipitation, surface runoff, evapotranspiration, leachate production and storage.
There are several factors that can influence the production of leachate at landfills, which need to be considered as part of the design process, these include: Climate; Topography; Landfill Cover; Vegetation.
Leachate should only be recirculated in landfills that are designed and equipped with a liner and leachate collection system capable of containing a 300 mm depth of leachate over the liner. Recirculation rates need to be carefully monitored and controlled to ensure that areas of refuse do not become saturated, as this could result in surface outbreaks, and could potentially jeopardise the slope stability of the landfill. Rates and areas of recirculation should be carefully chosen and will invariably require seasonal adjustment to maintain optimum landfill performance.
Management options for leachate are: evaporation; discharge to sewer, with or without pre-treatment; treatment; surface irrigation of treated leachate outside the waste disposal area and subject to salinity management; or dust suppression in the landfill. In deciding upon any of the above management options, a water balance should be modelled over at least two consecutive wet years to ensure that the proposed system has sufficient capacity to deal with all leachate generated over the operational life of the landfill.
Surface Water and Storm Water Management
Surface water management is required to ensure that: ■ contaminated surface run-off from the active fill area does not enter water courses; ■ rainfall run-off from surrounding areas does not drain into the landfill; ■ surface water and stormwater does not generate excessive quantities of leachate; and ■ ponding and erosion on filled and capped landfill surfaces is minimised.
The following control measures are mechanisms for achieving surface water management objectives. ■ Interception drains surrounding the active fill area to prevent overland flow from entering the active fill area should be provided. ■ Rainfall falling on the active fill area should be collected and managed as leachate via the leachate collection, treatment and disposal system. ■ Rainfall run-off from slopes outside and above the landfill should be intercepted and diverted to watercourses.

Description
Diversion drains and channels must be designed in order to prevent scouring and leakage into the landfill. ■ Drainage channels or drains constructed on the completed landfill surface should be designed and constructed to accommodate settlement, minimise or eliminate erosion, and cope with localised storms. ■ Completed fill areas and areas of intermediate cover should be contoured to direct stormwater into drains leading away from the active filling area and working face. ■ Permanent or temporary access roads should be designed to prevent them acting as stormwater channels that may direct water into the landfill.
Water discharged from any of the above sources to surface or ground water courses must be disposed of in accordance with license conditions, which may stipulate both quality and quantity limits. Any stormwater that has been diverted from the filling site is likely to carry a high silt load and should be held in sedimentation ponds prior to discharge. Sedimentation ponds should be developed prior to discharge of surface waters to natural stream or river flows. The ponds and traps should be designed to ensure easy maintenance and cleaning.

2.3 Existing Infrastructure

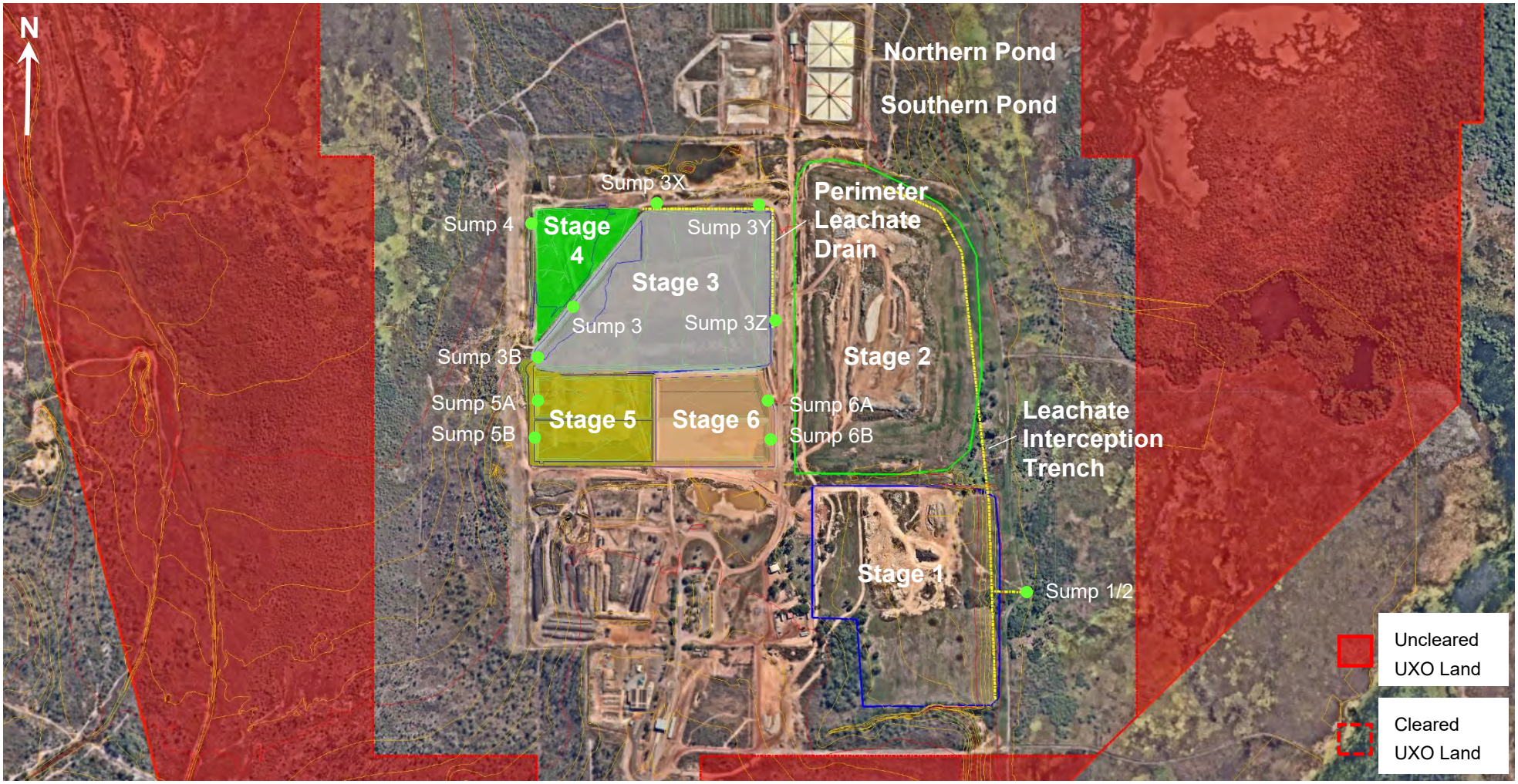
2.3.1 Landfill Stages and Leachate Collection Systems

Waste disposal landfill stages and installed leachate collection systems are summarised in Table 5 and shown on Figure 3.

Table 5: Landfill Stages and Leachate Collection Systems

Stage	Waste Cell	Area	Leachate Collection System	Condition	Collection Sump	Status
Stage 1	N/A	12.2 ha	Toe Pipe and Trench	Operational	Sump 1/2	Operational
Stage 2	General Waste	17.6 ha	Toe Pipe and Trench	Operational	Sump 1/2	Operational
	Inert Waste	7.0 ha	General Waste	Unknown	Sump 1/2	Operational
Stage 3	Cell Floor	10.5 ha	Pipes and gravel strips @ 50 m spacing	Non-Functional	Sump 3	Not Used
	Southern Area	N/A	Pipe and gravel blanket	Operational	Sump 3B	Operational
	Northern Toe	N/A	Toe pipe/aggregate	Operational	Sump 3C/3D	Operational
	Eastern Toe	N/A	Toe pipe/aggregate	Operational	Sump 3E	Operational
Stage 4	Cell Floor	2.5 ha	Gravel blanket & pipes	Operational	Sump 4	Operational
Stage 5	Stage 5A	1.9 ha	Gravel blanket & pipes	Operational	Sump 5A	Operational
	Stage 5B	1.75 ha	Gravel blanket & pipes	Operational	Sump 5B	Operational
Stage 6	Stage 6A	1.8 ha	Gravel blanket & pipes	Operational	Sump 6A	Operational
	Stage 6B	1.65 ha	Gravel blanket & pipes	Constructed	Sump 6B	Constructed

Figure 3: Constructed Landfill Waste Cells and Leachate Collection Systems



Sources: Nearmap Image, June 2021, Council LIDAR Survey Data, Council/Defence Lease Plan, Council Stage 4/Stage 5 As-Constructed Survey, 2012 & 2016, Golder Design, 2019

The Stage 1 and Stage 2 general waste landfills were constructed without engineered leachate collection systems; however, a leachate interception trench was subsequently constructed along the eastern toe of each stage that drains to a single collection sump (Sump 1/2). Council was not able to provide as-constructed details for the toe drainage system. The current Stage 2 inert waste landfill is located above the closed Stage 2 general waste landfill mound.

The Stage 3 general waste landfill cells were constructed with a geomembrane liner in three stages. Leachate collection systems were limited to gravel mound covered drainage pipes located at 50 m spacings. Monitoring of leachate pump volumes collected from Sump 3 between 2015 and 2016 indicated that the Stage 3 leachate collection system was no longer functional. An elevated leachate mound in known to be present within the current waste landform. Council has commenced installation of final capping for approximately 60% of the combined Stage 3/ Stage 4 landfill cells that is due to be completed in 2022. The capping works includes installation of a new perimeter leachate drain along the northern and eastern toe line of Stage 3 that drain to three new leachate collection sumps (Sump 3X to Sump 3Z)

Stage 4, Stage 5 and Stage 6 general waste cells have been designed and constructed with composite liner and gravel blanket leachate collection systems consistent with current good practice design.

Key waste cell liner and leachate collection system design documentation for Stage 3 to Stage 6 is presented in Appendix A.

2.3.2 Leachate Management

Leachate extracted from the operational leachate sumps is managed as follows:

- Stage 1/Stage 2:
  - Leachate is pumped to a surface irrigation system operated within the plateau area of Stage 1
- Stage 3 to Stage 6:
  - Leachate from each identified sump is pumped through a rising main to two 15 ML covered leachate storage ponds (Northern Pond & Southern Pond) as shown on Figure 3.
  - Currently leachate disposal methods comprise:
    - Surface irrigation within a section of the combined plateau areas of Stage 3/Stage 4.
    - An enhanced evaporation system fuelled using either diesel or landfill gas.

Council has commenced construction of a permanent leachate treatment/disposal system to service Shoal Bay Landfill, with the objective of completing installation in 2021 and commissioning and initial operation in 2022. Until the permanent system is fully operational it is understood that Council and its landfill Operations Contractor will continue disposing of leachate using a combination of the existing surface irrigation and enhanced evaporation.

2.3.3 Surface Water Catchments and Stormwater Management

Figure 4 identifies stormwater catchment areas, flow pathways and primary stormwater control structures that were delineated based site walkover inspections carried out in May 2020, Council-supplied LIDAR survey data collected in March 2020, 2021 aerial photography and the Stage 3/4 capping design. Stormwater control infrastructure and catchment areas are summarised in Table 6. Please note:

- Most landforms are shedding as sheet flow across vegetated batters with some concentrated flow paths along access ramps or in engineered drains.
- Existing ponds may provide some primary sediment capture but are not considered to operate as engineered sediment basins.

Figure 4: Surface Water Catchment Areas and Stormwater Drainage Features Plan

Sources: Nearmap Image, May 2021, Council LIDAR Survey Data, Veolia LIDAR Survey Data (2020). GHD Storm Surge Mapping (2014)

Legend

- Storm Surge Mapping (GHD 2014)
  - Highest Astronomical Tide
  - 1 in 100 Year ARI
- Catchment Areas
  - Boundaries (White)
  - C-3/4 – S Labels
- Stormwater Infrastructure
  - Flow Pathways
  - Drains
  - Chutes
  - Pipelines
  - Pipeline Labels (White)

Table 6: Surface Water Catchments and Primary Stormwater Infrastructure Summary

Precincts	Catchment	Infrastructure	Disturbed Area
Stage 1	■ C-Stage 1	■ None	■ 12 ha
Stage 2	■ C-2 ■ C-2 – W ■ C-2 – N ■ C-2 – E ■ C-2 – S	■ None ■ Stage 2W Toe Drain/Stage 2 NW Chute ■ Stage 2NW Toe Drain/Stage 2 NW Chute ■ None ■ Stage 1/2 Drain	■ Total 7.2 ha
Stage 3/Stage 4	■ C-3/4 Capping ■ C-3/4 – E ■ C-3/4 – S	■ Stage 3/4 Chute/Stage 4 Toe Drain/ Stage 3/4 Diversion Bund ■ Stage 6 Drain ■ Stage 3S Bund/Stage 3S Pipeline	■ 7 ha ■ 1 ha ■ 3 ha
Stage 5	■ C-5	■ Stage 5 Chute	■ 4 ha
Stage 6	■ C-6	■ Stage 6 Drain	■ 4 ha
Future General Waste Cells	■ C-Greenwaste ■ C-Transfer Station	■ Greenwaste Pond ■ Stage 8 Pond	■ 6 ha

- Disturbed native vegetation located around the perimeter of operational precincts does appear to be subject to significant stress from long term run-off from waste disposal and greenwaste processing areas.
- Highest astronomical tide (HAT) levels and 1 in 100-year ARI storm surge levels are located within close proximity to the eastern and western extents of current operational precincts.

2.4 Future Landfill Development and Final Capping

Key figures outlining existing landfill development plans for Shoal Bay Landfill are presented as follows:

- Appendix B: Stage 2 Inert Waste Landfill (sourced from Report 2).
- Appendix C: Stage 3 to Stage 10 General Waste Landfill (sourced from Report 3).
- Appendix D: Stage 3/Stage 4 Capping Design Drawings

Current Council projects considered relevant to the development and final capping of the inert waste and general waste landfills comprise:

- Expansion of remaining airspace capacity of the Stage 2 Inert Waste Landfill. This report is based upon the current landfill development plan for Stage 2 presented in Appendix B and may require review and updating based upon the findings of a separate Stage 2 expansion project.
- Construction of the final capping of an 8.5 ha area of the existing Stage 3/Stage 4 waste mound is currently due to be completed by 2022.

3.0 WATER BALANCE ASSESSMENT

3.1 Climate Conditions

Darwin is located within Australia's monsoon zone, dominated by a prolonged 'cooler', low rainfall 'dry' season period typically from April/ May to October/November and a 'hotter', high rainfall 'wet' season period typically from November/December to March/April.

The main weather station servicing Darwin [Bureau of Meteorology (BOM) Station 14015] is located at the Darwin Airport, approximately 5 km from the Shoal Bay Landfill. Key annual rainfall and pan evaporation conditions recorded at Darwin Airport are summarised in Table 7.

Table 7: Darwin Airport (BOM STN 14015) Annual Rainfall and Pan Evaporation

	Mean	Minimum	10th Percentile	90th Percentile	Maximum
Rainfall (1941 to 2020)	1,722.8 mm	1,024.7 mm	1,222.4 mm	2,209.0 mm	2,776.6 mm
Pan Evaporation (1957 to 2020)	2,450.4 mm	2,094.8 mm	2,307.6 mm	2,796.9 mm	2,880.8 mm

A summary of mean and extreme monthly climate records for Darwin Airport is shown on Figure 5. Key information to note from the monthly weather data includes:

- Average annual pan evaporation is well above average annual rainfall.
- Average monthly pan evaporation is typically well above rainfall except during the four highest rainfall months between December and March. Minimal rainfall typically occurs in the six-month period between May and October.
- Maximum monthly rainfall totals are typically 2 to 3 times average monthly rainfall conditions.
- Maximum daily rainfall totals are typically equivalent to, or greater, than average monthly rainfall conditions.

Given the importance of wet season and dry season periods in tropical climate regions, Golder has adapted available rainfall and pan evaporation data to match a twelve-month period from November to October, comprising:

- Wet Season: Six-month period from November to April.
- Dry Season: Six-month period from May to October.

To assist with the water balance modelling Golder has also generated an extended rainfall data set encompassing a 153-year period from November 1869 to August 2021, combining the Darwin Airport BOM data (1941 to present) with the Darwin Port Office BOM data (1869 to 1940) that is presented as percentiles in Figure 6, noting the following:

- Typically, over 90% of total annual rainfall occurs during the six-month wet season period between November and April, with wet season pan evaporation approximately 46% of annual pan evaporation.
- Annual pan evaporation > annual rainfall within the range from 1st up to 97th percentile conditions.
- Wet season pan evaporation < wet season rainfall from 15th percentile conditions and above.
- Dry season pan evaporation > dry season rainfall under all conditions.

Figure 5: Darwin Airport (BOM STN 14015) Monthly Climate Conditions

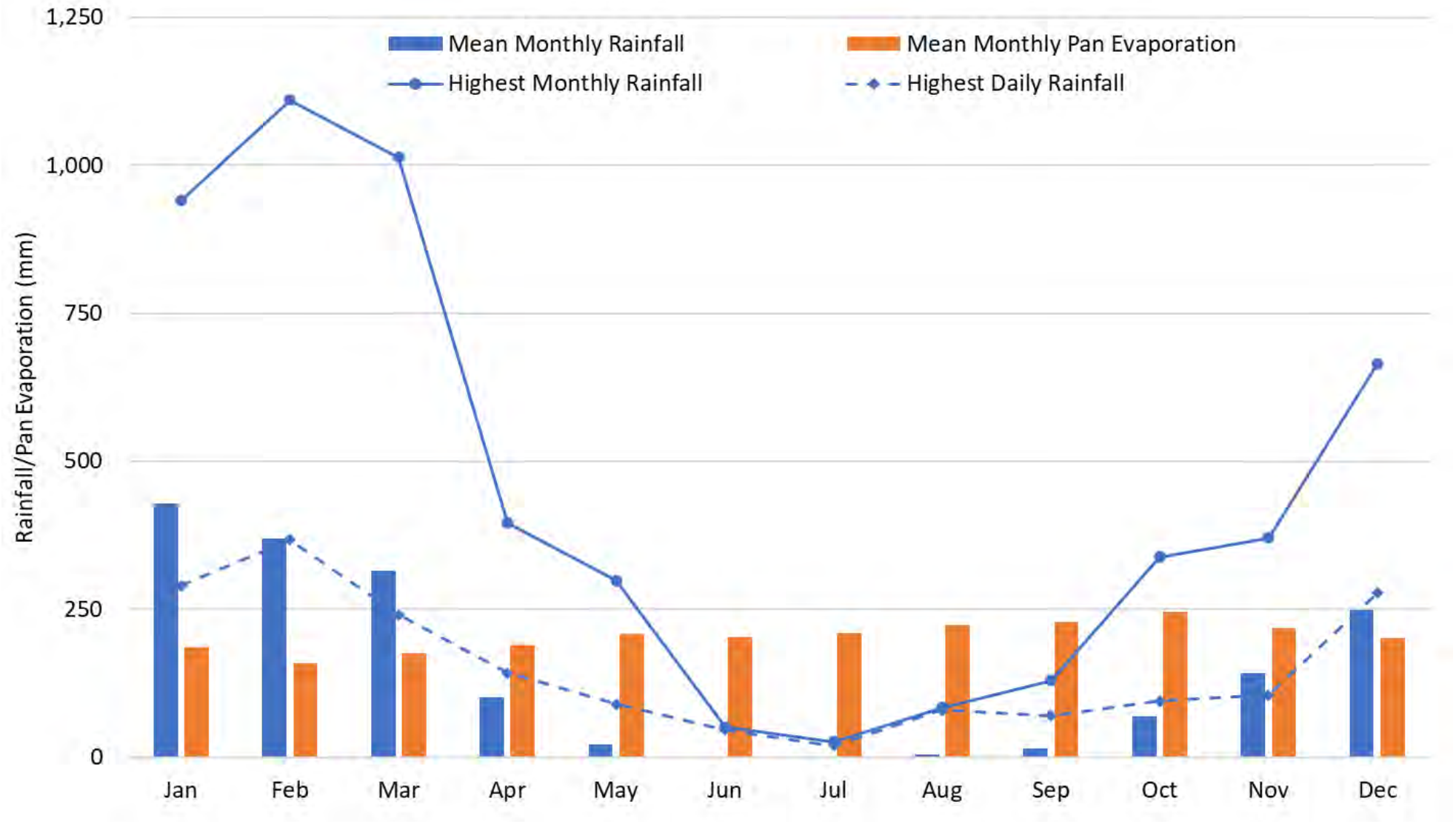
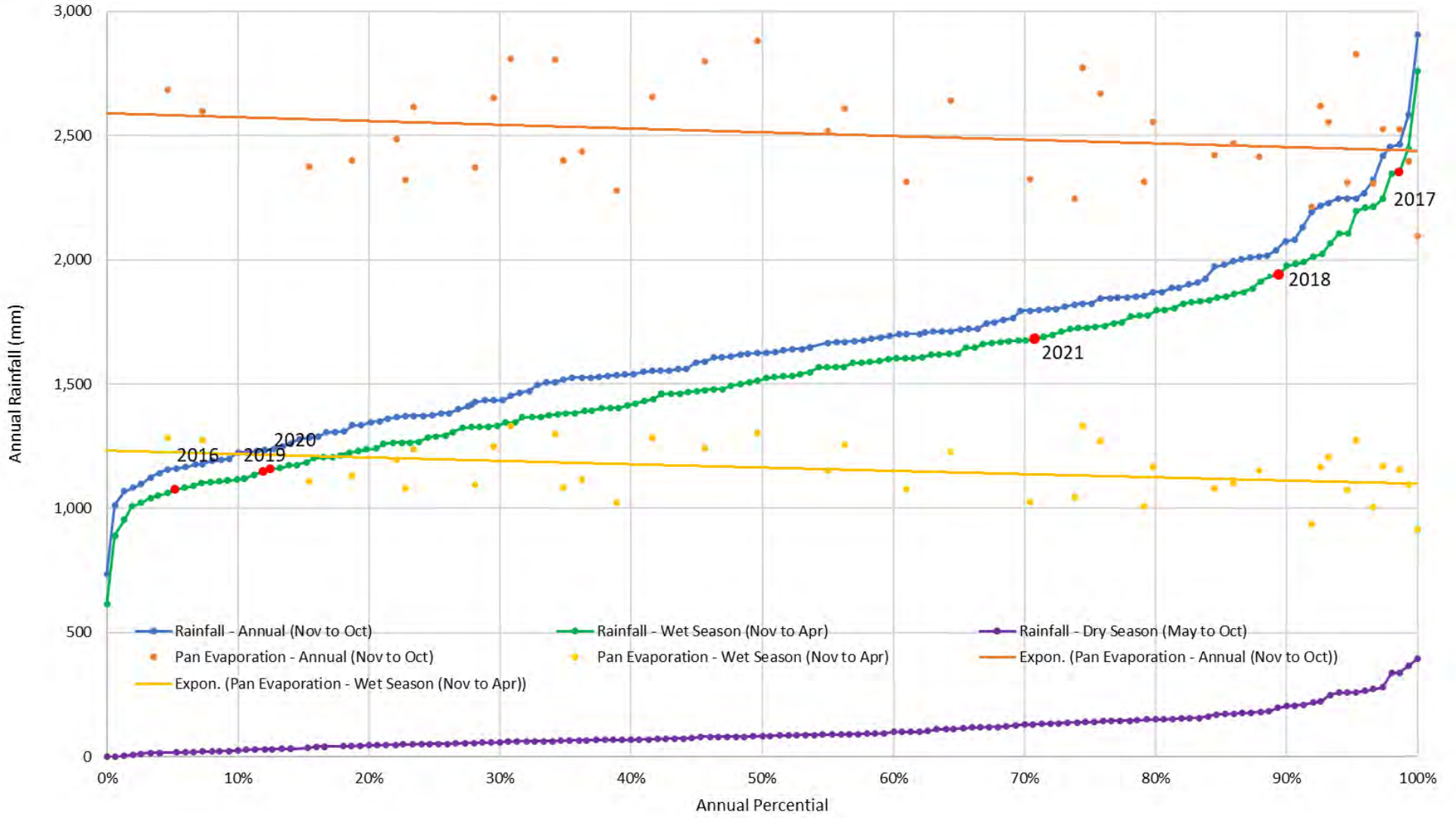


Figure 6: Rainfall and Pan Evaporation Percentile Conditions (1870 to 2021)



3.2 Landfill Water Types and Management Objectives

The NT EPA Landfill Guidelines (refer to Table 4) identify three types of water that require management: stormwater, leachate and groundwater. For landfill sites located within high rainfall tropical climates, such as Shoal Bay, Golder typically identifies five types of water require the effective separation and management as summarised in Table 8.

Table 8: High Rainfall Climate Landfill Water Types

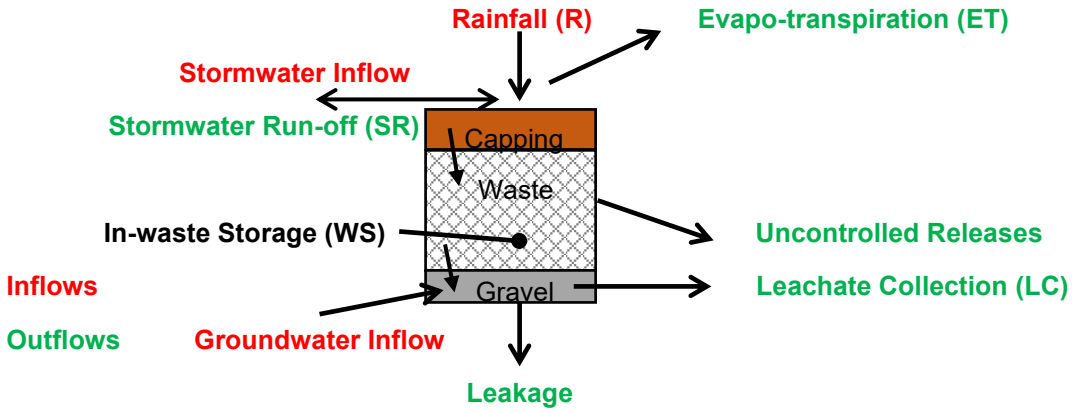
Water Types	Description	Management Objectives
Clean Water	Stormwater run-off that is not impacted by landfilling operations. This may include: ■ Catchments upstream/outside of the landfill operations. ■ Undisturbed catchments within the landfill operations area. ■ Rehabilitated landfill areas.	■ Diversion around or away from operation areas and other water types. ■ Suitable quality for direct release to the environment without active management.
Sediment Water	Suspended soil impacted stormwater runoff from erosion of exposed earthen materials within operational areas such as: ■ Unvegetated waste cell bunds. ■ Daily and interim landfill cover soils. ■ Temporary soil stockpiles. ■ Unsealed vehicle access tracks and vacant hardstand areas.	■ Minimise the size of disturbed areas. ■ Progressive rehabilitation of waste cells. ■ Capture of sediment prior to release of water into the environment.
First Flush	Potentially impacted stormwater run-off from lower risk stockpiled resource recovery materials such as: ■ Greenwaste (tannins and nutrients). ■ Steel (metals and hydrocarbons). ■ Concrete (sediment).	■ Minimise the size of resource recovery hardstand areas. ■ Capture initial rainfall event run-off containing contaminants for management through water quality testing and/or treatment prior to release to the environment.
Leachate	Water that has been in direct contact with putrescible waste. This can occur through: ■ Release of stored water from buried waste material. ■ Surface water infiltration through cover materials into underlying buried waste. ■ Stormwater run-off contacting uncovered waste.	■ Minimising leachate generation through maximising stormwater run-off away from buried waste through small active disposal faces, placement of daily cover material and well-shaped landforms. ■ Progressive rehabilitation of waste cells. ■ Active collection and management of leachate generated within buried waste materials.
Groundwater	Water flowing through subsurface soils and rock. Groundwater is generally recharged by stormwater within higher elevation catchment areas and discharges into stormwater and waterways within lower elevation catchments areas.	■ Containment of buried wastes and leachate and separation from underlying groundwater.

3.3 Leachate Collection Assessment

3.3.1 Waste cell Water Balance Model Elements

The main elements of a water balance model for most solid waste landfill waste cells are shown in Figure 7.

Figure 7: Waste Cell Water Balance Model Elements



For the purposes of estimating leachate collection rates at Shoal Bay Landfill, Golder assumed the following general conditions for the water balance model:

- All waste mounds are shaped to be free draining with no external run-off entering the cell area.
- No direct stormwater run-off or groundwater inflow into the waste material.
- No uncontrolled releases or leakage occurs from lined cells. Please note that some leakage would be anticipated, however, it is more conservative to assume this is not the case for modelling purposes.

Based upon these assumptions the volume of leachate collected from a waste cell comprises the following water balance components:

$$LC = R - (SR + ET + WS)$$

3.3.2 Landfill Operation Stages

Landfills sites operated over multiple decades and stages of development represent a highly dynamic environment for modelling most elements of the water balance conditions. Based upon published information, practical experience and the results of previous water balance modelling for landfill sites located within Northern Australia, Golder has identified five key landfill operation stages that influence leachate volumes and waste moisture content through the landfills lifecycle as shown on Figure 8 and summarised in Table 9.

Figure 8: Key Landfill Operation Stages

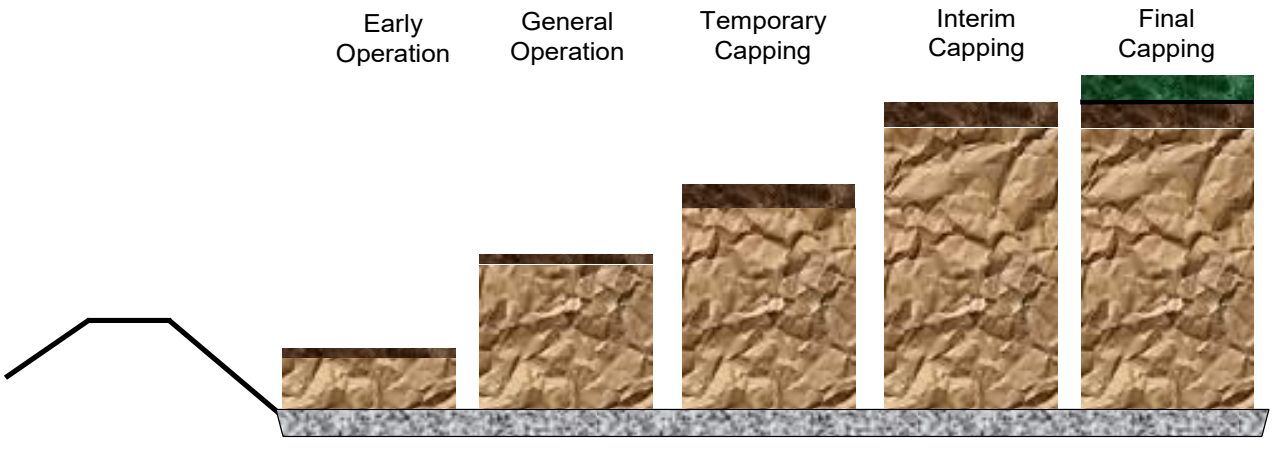
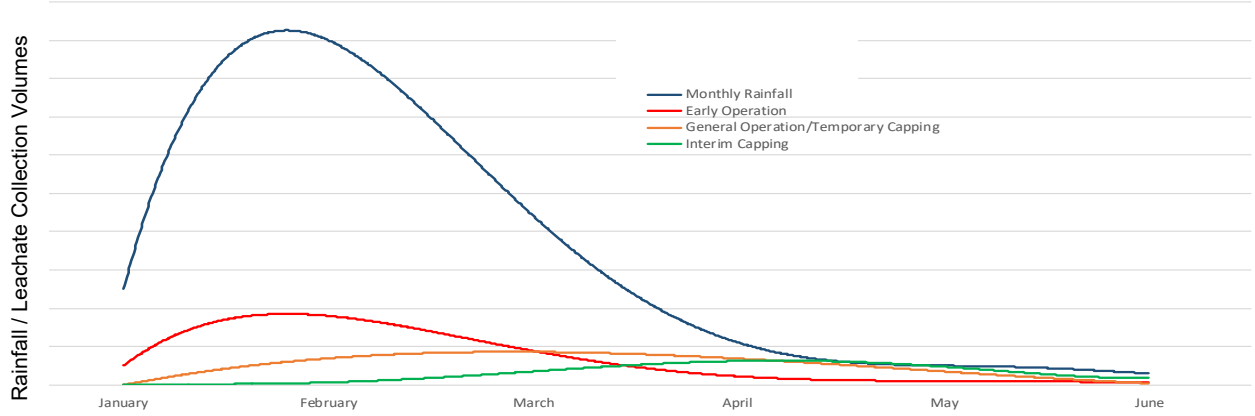


Table 9: Typical Landfill Operation Stages

Operation Stage	Description	Waste Thickness	Stormwater Drainage	Leachate Generation	Leachate Collection
Early Operation	Initial placement of waste within a new cell. Waste material readily saturated by large rainfall events.	Typically <5 m	Poor or not free draining	High Volumes	■ Almost immediate ■ Moderate (moist waste) ■ High (saturated waste)
General Operation	Main operational period. Moist waste material retains capacity to absorb large rainfall events.	Typically >5 m	Good, mostly free draining	Moderate Volumes	■ Delayed response (typically 2 to 6 weeks) ■ Low (moist waste) ■ Moderate (saturated waste)
Temporary Capping	Section temporarily outside operations area > 6 months with interim cover material layer.	Typically >10m	Good, generally free draining	Low Volumes	■ Delayed response (typically 2 to 6 weeks) ■ Low (moist waste) ■ Moderate (saturated waste)
Interim Capping	Waste mound at final elevation with interim cover material layer.	Typically >15 m	Good, generally free draining	Low Volumes	■ Delayed response (typically 4 to 12 weeks) ■ Low (moist waste) ■ Moderate (saturated waste)
Final Capping	Final waste height with engineered final capping and stormwater management systems.	Typically >15 m	Excellent	Very Low Volumes	■ Low ■ Limited influence by rainfall events

Indicative trends that indicate how the collection of leachate may be off-set from rainfall for each landfill operational stage for a typical landfill during wet season conditions are shown on Figure 9.

Figure 9: Typical Landfill Indicative Off-set Trends for Wet Season Leachate Collection



3.3.3 Previous Modelling and Assessments

Past water balance modelling and leachate collection volume estimates for Shoal Bay Landfill prepared by GHD (2013) and Golder (2014 and 2020) are documented in Report 3 and Report 5.

Published landfill water balance models, such as the Hydraulic Evaluation of Landfill Performance (HELP) program (United States Environmental Protection Agency) that formed the basis for Report 3, are primarily structured for modern landfill designs comprising waste cells constructed with low permeability liners and cell floor blanket leachate collection systems. Experience with HELP has typically identified that it is suitable for temperate climate conditions, however, it is less reliable for tropical climate conditions subject to high rainfall 'wet season' conditions such as experienced at Darwin. For coastal landfill sites in tropical climate regions of northern Australia it is generally necessary to calibrate and adjust the model outputs based on actual site leachate collection data. In the absence of a reliable site-based data set, calibration of water balance modelling for Report 3 was primarily based upon:

- Results of field trials undertaken at Stuart Landfill in Townsville in support of the Australian Alternative Cover Assessment Project (A-ACAP) between 2007 and 2011. In summary, the A-ACAP trials indicated rainfall infiltration rates in the order of 10% through 1.1 m to 1.5 m thick soil cover layers.
- Queensland Urban Drainage Manual (2008) that documents a range of stormwater run-off catchment coefficients that should be adopted for design purposes based upon rainfall intensity and surface conditions. Table 10 summarises the adopted stormwater run-off catchment coefficients considered to be representative of the identified landfill operation stages.

Table 10: Summary of Stormwater Run-off Catchment Coefficients

Development Stage	Cover Soil Permeability	Typical Rainfall (50th Percentile)	Extreme Rainfall (>90th percentile)
Early Operation	High	20%	30%
General Operation	High	30%	60%
Interim Capped	Medium	50%	70%
Final Capped	Low	50%	70%

Calibrated leachate collection rates for Shoal Bay Landfill presented as a percentage of rainfall adopted as the basis for the water balance modelling documented in Report 5 are summarised in Table 11, noting:

- Moisture condition of the waste material has a strong influence on the adsorption of rainfall infiltration.
- Waste would be effectively saturated prior to placement of interim capping.

Table 11: Report 5 Calibrated Leachate Collection Rates as % of Rainfall

Description	Annual Rainfall	Early Operation	General Operation	Interim Capped	Final Capped (geosynthetic)
Typical Rainfall	50th Percentile	15%	8%	10%	<1%
Extreme Rainfall	90th Percentile	12.5%	7%	10%	<1%

3.3.4 Review and Update of Water Balance Model Calibration

Approach

No new water balance modelling using published packages such as HELP has been carried out for this assessment. The objective of this assessment was to review actual rainfall conditions and leachate collection volumes recorded over the period from November 2015 to August 2021 to assist with further calibration and updating key assumptions that form the basis of the sites water balance model.

Rainfall Conditions

Season rainfall totals between 2015 and 2021 and associated wet season recurrence percentiles against historical conditions are summarised in Table 12 and shown on Figure 6.

Table 12: Rainfall Data Summary

Annual Rainfall Period	Wet Season (Nov to Apr)			Dry Season (May to Oct)	
	Rainfall (Site)	Rainfall (BOM)	Percentile	Rainfall (Site)	Rainfall (BOM)
Nov 15 – Oct 16	1,408.2 mm	1,076.0 mm	5th (v low)	N/A	257.6 mm
Nov 16 – Oct 17	2,699.5 mm	2,353.6 mm	99th (v high)	75.0 mm	100.6 mm
Nov 17 – Oct 18	1,803.6 mm	1,938.0 mm	89th (v high)	88.4 mm	62.8 mm
Nov 18 – Oct 19	N/A	1,147.8 mm	12th (v low)	N/A	51.6 mm
Nov 19 – Oct 20	N/A	1,159.8 mm	13th (v low)	N/A	258.2 mm
Nov 20 – Aug 21	N/A	1,682.6 mm	71st (high)	N/A	N/A

We note that Wet season conditions for Darwin over the past 6 years have generally been at the extreme ends (< 13th percentile or > 71st percentile) of the composite BOM data set.

Leachate Collection and Management Data Set – Geomembrane Lined Waste Cells

Leachate management data sets supplied by Council and/or its Operations Contractor and our assessment of their data reliability are summarised in Table 13. The data provided and comparison as a percentage of rainfall is summarised as follows:

- Table 14: Raw Leachate Sump Pumping Volumes – Geomembrane-Lined Waste Cells
- Table 15: Leachate Pond Storage Volume Changes, Surface Irrigation Volumes and Updated Leachate Collection Volumes – Geomembrane-Lined Waste Cells

General Data Review Observations – Geomembrane Lined Waste Cells

Based upon our review of the available leachate pumping and management data sets, we make the following key observations:

- Leachate collection volumes during dry season periods as a percentage of rainfall are typically much higher than wet season periods. Such conditions may be caused by:
  - Presence of the raised leachate mound in Stage 3 that continuously discharges large volumes of leachate into the Stage 3 toe interception system and adjacent floor leachate collection systems for Stage 4 and Stage 5A during dry season periods.

Table 13: Leachate Management Data Sets – Geomembrane-Lined Waste Cells

Data Set	Collection Method	Collection Period	Frequency	Reliability
Leachate Sump Pumping Volumes	Pneumatic pump cycles (multiplied by pump capacity)	Nov 15 to Mar 16 Nov 16 to Mar 20 Nov 20 to Aug 21	Daily	Low. Data sets corrupted by undocumented pump changes and apparent cycling of pumps below nominated capacity. High. Direct reading of flow volume.
Leachate Pond Storage Volumes	Survey of Floating Cover (modelling of water volume)	Mar 16 to Jul 21 (missing periods)	Monthly	High. Modelling carried out using survey of floating cover level and as-constructed floor surface of each pond.
Leachate Irrigation Volumes	In-pipe flow meter	Nov 16 to Mar 20 Aug 2021	Daily	High. Direct reading of flow volume. Low. No recorded data.

Table 14: Raw Leachate Pumping Volume Data – Geomembrane-Lined Waste Cells

Data Period	Stage 3 Toe Sumps	Stage 3 Sump 3B	Stage 4 Sump 4	Stage 5A Sump 5A	Stage 5B Sump 5B	Total Leachate Volume	Rainfall Volume	Leachate as % of Rainfall
16 Wet Season	4,779 kL	2,123 kL	2,238 kL	N/A	N/A	9,139 kL	131,792 kL	7%
16 Dry Season	N/A	N/A	N/A	N/A	N/A	N/A	32,974 kL	N/A
17 Wet Season	10,879 kL	8,656 kL	4,322 kL	N/A	N/A	23,856 kL	301,268 kL	8%
17 Dry Season	5,733 kL	6,006 kL	3,412 kL	N/A	N/A	15,152 kL	14,826 kL	102%
18 Wet Season	9,903 kL	17,565 kL	4,270 kL	9,918 kL	N/A	41,657 kL	286,366 kL	15%
18 Dry Season	2,438 kL	3,895 kL	3,375 kL	680 kL	3,437 kL	13,824 kL	10,346 kL	134%
19 Wet Season	9,028 kL	3,649 kL	3,886 kL	1,168 kL	17,982 kL	35,712 kL	189,092 kL	19%
19 Dry Season	3,994 kL	4,452 kL	4,796 kL	12,148 kL	2,077 kL	27,467 kL	8,501 kL	323%
20 Wet Season	5,391 kL	6,781 kL	6,877 kL	22,253 kL	20,749 kL	62,051 kL	170,410 kL	36%
20 Dry Season	No Available Data							
21 Wet Season	20,550 kL (Pond Inflow Data)						277,197 kL	7%

Table 15: Leachate Pond Storage Volume Changes, Surface Irrigation Volumes and Revised Updated Leachate Collection Volumes – Geomembrane Lined Waste Cells

Data Period	Leachate Pond Storage Ponds				Leachate Irrigation/ Reinjection	Benevap System	Reconciled Leachate Collection[(1)]	Leachate as % of Rainfall	Cumulative Leachate Volume	Cumulative Leachate % of Rainfall
	Volume	% Capacity	Inflows	Outflows						
16 Wet Season	12,495 kL	44%	11,525 kL	0 kL	Unknown	None	11,525 kL	8.4%	11,525 kL	8.4%
16 Dry Season	16,021 kL	56%	3,526 kL	0 kL	Unknown	None	3,526 kL	10.7%	15,051 kL	8.8%
17 Wet Season	26,792 kL	94%	13,620 kL	0 kL	13,085 kL	None	23,856 kL	7.9%	38,908 kL	8.2%
17 Dry Season	25,896 kL	91%	0 kL	896 kL	6,681 kL	None	5,785 kL	39.0%	44,693 kL	9.2%
18 Wet Season	33,184 kL	117%	9,036 kL	1,748 kL	28,336 kL	None	35,623 kL	12.4%	80,316 kL	10.4%
18 Dry Season	20,992 kL	74%	0 kL	12,192 kL	17,937 kL	None	5,745 kL	55.5%	86,061 kL	11.0%
19 Wet Season	23,970 kL	84%	5,224 kL	2,246 kL	5,277 kL	None	8,255 kL	4.4%	94,316 kL	9.7%
19 Dry Season	13,870 kL	49%	0 kL	10,100 kL	17,790 kL	None	7,690 kL	90.5%	102,006 kL	10.4%
20 Wet Season	25,340 kL	89%	11,470 kL	0 kL	189 kL	None	11,659 kL	6.8%	113,665 kL	9.9%
20 Dry Season	24,485 kL	86%	3,763 kL	4,618 kL	4,618 kL	None	3,763 kL	8.8%	117,428 kL	9.9%
21 Wet Season	34,048 kL	120%	20,550 kL	10,987 kL	6,907 kL	4,080 kL	20,550 kL	7.4%	137,978 kL	9.4%

Note: (1) Reconciled Leachate Collection = Pond Inflows, less Pond Outflow, plus Leachate Irrigation, plus Inferred Injection

  - Previously high volumes of leachate irrigated over the Stage 3/Stage 4 waste mound during both wet season (up to 5 ML) and dry season periods (18 ML). Surface run-off from leachate irrigation areas is evident in available aerial photography, indicating that irrigation application rates may have exceeded evaporation conditions for prolonged periods.

- Wet season leachate collection volumes increase and decrease in direct correlation with rainfall conditions, with leachate collection as a percentage of rainfall varying between a low of 4.4 % up to 12.4%. The highest wet season leachate collection volume of 35.6 ML and associated highest percentage of rainfall (12.4%) occurred during a combination of a very high rainfall wet season period (89th percentile) and the early operations stage placement of waste in Stage 5A. Lower leachate volumes as a percentage of rainfall generally correlated to lower rainfall wet season periods and general operation conditions such as the 2020/21 wet season.
- Cumulative leachate collection as a percentage of rainfall at the end of the available data set period of 9.4% could be used at the basis for estimation of short to medium term leachate rates for general operation conditions. A higher average leachate collection rate of 12.4% is considered suitable a suitable allowance for early waste placement within new waste cells during extreme rainfall conditions (90th percentile).
- Leachate collection, both in terms of total volumes and as a percentage of rainfall are within the range of estimates from the previous water balance modelling (Report 5) and are consistent with typical conditions at other similar regional landfill sites in Northern Australia that are subject to high rainfall tropical climate conditions.

Based upon the available water balance model calibration data, estimated leachate collection rates for Shoal Bay Landfill, as percentages of rainfall, remain unchanged as summarised in Table 11.

Leachate Collection and Management Data Set – Unlined Landfill Stages

Leachate collected at Sump 1/2 sourced from the interception trench installed along the toe of Stage 1 and Stage 2 is pumped to a surface irrigation system operated within a section of Stage 1. Council and its landfill Operations Contractor provided intermittent daily leachate pumping volumes for the period between 1 November 2016 to 22 February 2021 as summarised in Table 16.

Table 16: Leachate Collection Volumes - Unlined Landfill Stages

Data Set	2017 Seasons		2018 Seasons		2019 Seasons		2020 Seasons		2021
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Rainfall	701 ML	30 ML	577 ML	19 ML	342 ML	15 ML	346 ML	N/A	501 ML
Leachate	3.1 ML	1.9 ML	1.1 ML	1.6 ML	N/A	2.5 ML	1.4 ML	N/A	1.3 ML
% Rainfall	0.4%	6.2%	0.2%	8.6%	N/A	16.5%	0.4%	N/A	0.3%

Council was not able to provide construction details for the final capping installed over the general waste landfill areas within Stage 1 and Stage 2, however, it is assumed to be consistent with a soil cover thickness of 1 m to 1.5 m, equivalent to interim capped conditions.

Based upon our review of the available leachate pumping and management data sets, we make the following key observations:

- Collected leachate volumes as a percentage of rainfall over the combined surface areas of Stage 1 and Stage 2 comprised the following:

  - Wet season conditions: 0.2% to 0.4%
  - Dry season conditions: 6.2% to 16.5%
  - Overall average: 0.6 %
- There is no district variation in actual leachate collection volumes between wet season and dry season conditions, indicating that the rate of leachate collection along the Stage 1/Stage 2 toe collection drain is not primarily influenced by rainfall conditions. This may be indicative of:
  - The presence of the raised leachate mounds in Stage 1 and Stage 2 that continuously discharge leachate into the toe interception system during dry season periods.
  - Potential groundwater discharge into the base of the waste mounds in Stage 1 and Stage 2 and/or the toe drain collection system.
- The overall average leachate collection rates for Stage 1 and Stage 2 of 0.6% is considerably lower than the adopted interim capping rate of 10% (refer to Table 11). This may be indicative of:
  - Higher than anticipated performance of the final capping for Stage 1 and Stage 2.
  - Loss of leachate into the environment resulting from the absence of engineered liner and containment systems for Stage 1 and Stage 2.
- Leachate collection rates of less than 1% of rainfall have been observed from similar toe collection drain systems installed at other non-engineered waste cells located within high rainfall tropical climate areas of northern Australia.
- For the purposes of managing leachate collected from the toe drain along Stage 1 and Stage 2, the following rates have been adopted:
  - Wet season conditions: 0.4% of rainfall
  - Dry season conditions: 10% of rainfall

3.3.5 Future Leachate Collection Volume Estimates

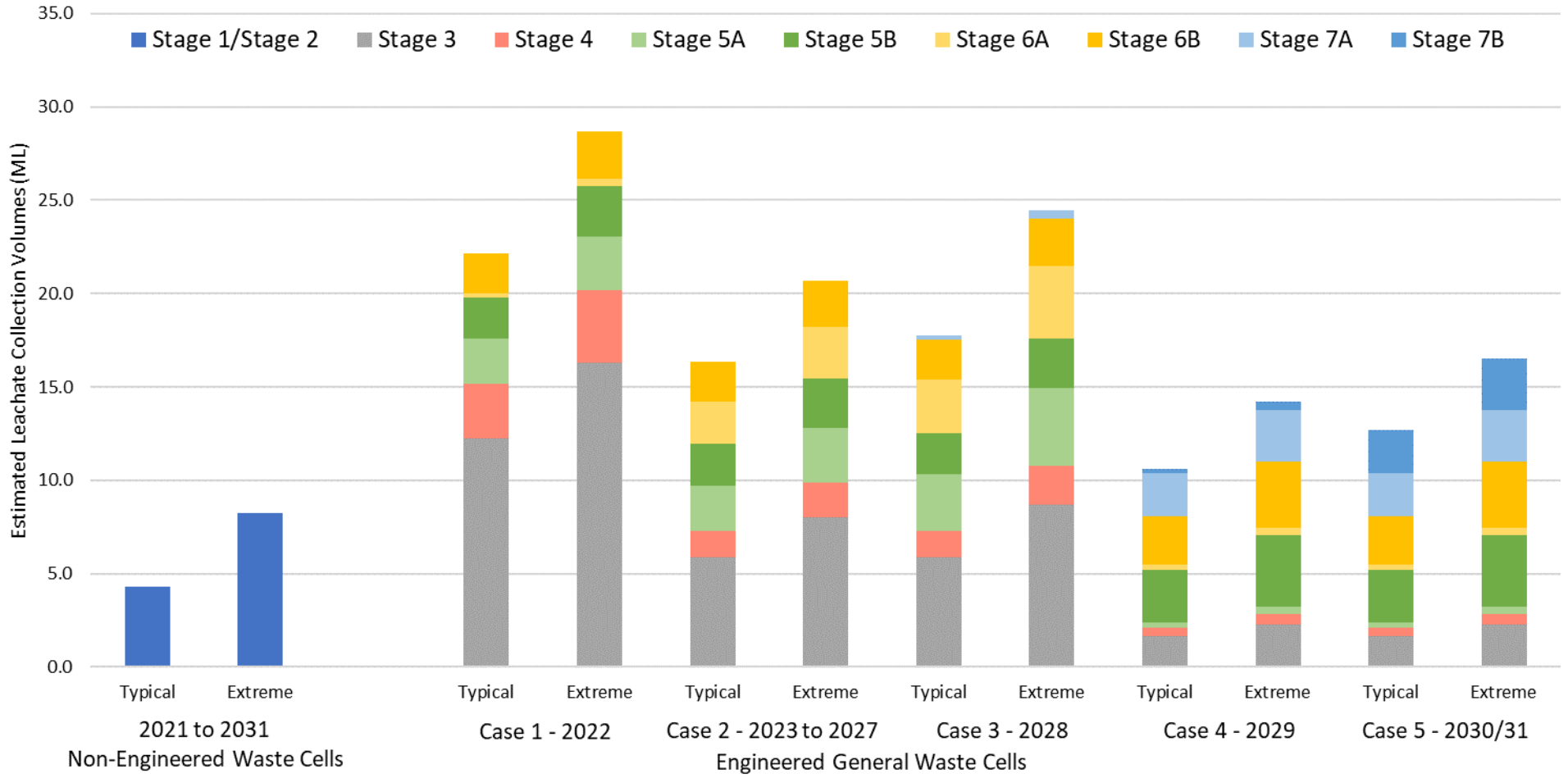
The basis for estimating of future leachate collection volumes at Shoal Bay Landfill for the 10-year period commencing from the 2021/2022 wet season, comprise the following range of conditions summarised in Table 17, with estimated volumes presented in Figure 10. Please note that these volume estimates do not include the planned future drawdown of the existing leachate mound present within Stage 3.

- Adoption of the leachate collection rates for geomembrane-lined waste cells presented in Table 11 and the rates for Stage 1/Stage 2 identified above.
- Rainfall conditions assessed comprised:
  - Typical Rainfall: 50th Percentile
  - Extreme Rainfall: 90th Percentile

Table 17: Basis for Future Leachate Volume Estimates Summary

Landfill Stage	Waste Cell Areas	Case 1	Case 3	Case 3	Case 4	Case 5
Period		2022	2023 to 2027	2028	2029	2030/2031
Non-Engineered Landfill Stages						
Stage 1	12.2 ha	Interim Capped	Interim Capped	Interim Capped	Interim Capped	Interim Capped
Stage 2	17.6 ha	Interim Capped	Interim Capped	Interim Capped	Interim Capped	Interim Capped
Totals	**29.8 ha**	**29.8 ha**	**29.8 ha**	**29.8 ha**	**29.8 ha**	**29.8 ha**
Geomembrane-Lined Landfill Stages						
Stage 3	10.5 ha	35% Final Cap	65% Final Cap	65% Final Cap	65% Final Cap	100% Final Cap
Stage 4	2.5 ha					
Stage 5A	1.9 ha	General Operation	General Operation	Interim Capping	100% Final Cap	100% Final Cap
Stage 5B	1.75 ha			General Operation	Interim Capping	Interim Capping
Stage 6A	1.8 ha	Not in Use/Early Op.		Interim Capping	100% Final Cap	100% Final Cap
Stage 6B	1.65 ha	General Operation		General Operation	Interim Capping	Interim Capping
Stage 7A	1.8 ha	Not Constructed	Not Constructed	Early Operation	General Operation	General Operation
Stage 7B	1.8 ha			Not in Use	Early Operation	
Totals	**23.7 ha**	**20.1 ha**	**20.1 ha**	**21.9 ha**	**23.7 ha**	**23.7 ha**

Figure 10: Estimated Leachate Collection Volumes Estimates



- Early operations waste disposal with the general waste landfill will be limited to the following periods:
  - Stage 6A: 2022 Dry Season
  - Stage 6B: 2021 Dry Season
  - Stage 7A: 2028 Dry Season
  - Stage 7B: 2029 Dry Season
- Final capping of general waste cells will be undertaken as follows:
  - Phase 1A: 4 ha area of Stage 3: 2021
  - Phase 1B: 4.5 ha area of Stage 3/Stage 4: 2022
  - Phase 2: 7 ha area of Stage 3/Stage 4/Stage 5/ Stage 6: 2028
- Dewatering the leachate mound present within Stage 3 will occur over a 5-year period, commencing in 2022 and being completed in 2027. As noted above, dewatering of Stage 3 has not been accounted for in the estimated leachate collection volumes presented in Figure 10.

In summary, the range of estimated annual leachate collection volumes that would require management by Council over the next ten years comprise:

- Stage 1/Stage 2 Non-Engineered Landfills: 4 ML to 8 ML.
- Engineered General Waste Cells:
  - Operation of Stage 5/Stage 6 – Prior to completion of Phase 1 Capping: 22.5 ML to 29 ML.
  - Operation of Stage 5/Stage 6 – Post Phase 1 Capping: 16 ML to 21 ML.
  - Operation of Stage 7 – Post Phase 2 Capping: 11 ML to 16 ML.

3.4 Stormwater Run-off Hydrological Assessment

3.4.1 Design Rainfall and Peak Flows

Rainfall Intensity Frequency Duration (IFD) data sourced from BOM is presented in Table 18.

Table 18: BoM Intensity Frequency Duration Data: Rainfall Depths (BOM, Lat.-12.39, Lon. 130.94)

Duration	Exceedances per Year (E/Y)		Annual Exceedance Probability (AEP)		
	4E/Y	2E/Y	63.2%#	10%	1%
10 min	14.1 mm	17.4 mm	19.9 mm	29.8 mm	39 mm
15 min	18 mm	22.4 mm	26 mm	38.8 mm	50.8 mm
20 min	20.9 mm	26.4 mm	30.9 mm	46.1 mm	60 mm
30 min	25.3 mm	32.5 mm	38.5 mm	57.4 mm	74.1 mm
45 min	29.7 mm	38.7 mm	46.4 mm	69.8 mm	89.6 mm
1 hour	32.6 mm	42.9 mm	52.2 mm	79 mm	101 mm
3 hour	41.6 mm	57.3 mm	72.5 mm	118 mm	159 mm

Duration	Exceedances per Year (E/Y)		Annual Exceedance Probability (AEP)		
	4E/Y	2E/Y	63.2%[#]	10%	1%
6 hour	46.4 mm	65.4 mm	84.6 mm	146 mm	214 mm
12 hour	52.7 mm	75.4 mm	99.1 mm	184 mm	292 mm
24 hour	63.6 mm	91.3 mm	121 mm	236 mm	400 mm

[#] 63.2% AEP corresponds to slightly greater than 1 exceedance per year or 1-in-1 year ARI.

Estimated peak flows (10%AEP) for key existing drains assessed using the Rational Method (QUDM, 2013) are presented in Table 19.

Table 19: Key Existing Drain Peak Flows

Site Drain/Catchment	Catchment Area	Time of concentration	Peak Flow (10% AEP)
Stage 2 NW Toe Drain	3.3 ha	8 min.	1.2 m^3/s
Stage 2W Toe Drain	6.2 ha	10 min.	2.3 m^3/s
Stage 1/2 Drain	15.5 ha	14.2 min.	4.9 m^3/s
C-Greenwaste	6 ha	10 min.	2.2 m^3/s
Stage 5 Chute	1.2 ha	9 min.	0.4 m^3/s
Stage 3S Pipeline	3.3 ha	11 min.	1.1 m^3/s

We note that the 10% AEP peak flow for the Stage 1/2 Drain would generate high velocities (up to 2.4 m/s) that represents a high risk of scour.

3.4.2 Key Catchment Area Stormwater Contaminant Sources

Table 20 nominates potential stormwater contaminants for selected catchment areas based upon our understanding of current landfill operations and water types identified in Table 6.

Table 20: Catchment Area Stormwater Contaminants

Precincts	Catchment	Operations	Water Types	Key Contaminants
Stage 2	■ C-2 – W ■ C-2 – N ■ C-2 – E ■ C-2 – S	■ Inert Waste Disposal	■ Sediment Water	■ Sediment
Stage 3/ Stage 4	■ C-3/4 – E ■ C-3/4 – S ■ C-3/4 – Cap.	■ General Waste Disposal ■ Final Capping (2021/2022)	■ Sediment Water ■ Clean Water	■ Sediment ■ None

Precincts	Catchment	Operations	Water Types	Key Contaminants
Stage 5	■ C-5	■ General Waste Disposal	■ Sediment Water	■ Sediment
Stage 6	■ C-6	■ Not in use ■ General Waste Disposal (2021)	■ Clean Water ■ Sediment Water	■ None ■ Sediment
Future General Waste Cells	■ C-Greenwaste	■ Greenwaste stockpiling/ processing	■ First Flush Water	■ Sediment ■ Nutrients

4.0 LEACHATE MANAGEMENT STRATEGY

4.1 Opportunities for Minimising Leachate Volumes

4.1.1 General

Whilst rainfall conditions play an important role in leachate generation, there are other equally important aspects that influence both the rate and total volume of leachate that will be collected and require management. Leachate generation and collection volumes within each waste cell will vary considerably over its lifecycle dependent upon key variables including:

- Staging and sizing of new waste cells and placement of final capping.
- Disposal practices, stormwater run-off controls and thickness of waste lifts.
- Effectiveness of daily and interim cover materials.
- Reinjection of leachate within the waste material.

Moisture content of waste is the primary control of how stormwater infiltration migrates downwards through buried wastes into cell floor leachate collection systems. At the time of placement, most waste material has a relatively low moisture content ("*moist waste*", 10% to 20% by weight), particularly when placed during low rainfall 'dry season' periods. This waste material then has the capacity to adsorb or store additional moisture up to its field capacity ("*saturated waste*", 30% to 40% by weight).

Limiting immediate additional moisture into waste following initial placement ('moist waste') can assist with reducing or delaying leachate collection rates from rainfall events during subsequent wet season periods. However, once the waste material reaches field capacity ('saturated waste'), leachate collection rates will trend towards rainfall infiltration (leachate generation) rates, with a reduced time delay for migration of new leachate through the waste material following periods of heavy rainfall.

The priority of any leachate management strategy should, therefore, focus on landfill design and operational practices that reduce the volume of rainfall infiltration and leachate reinjection into buried waste material.

1.1.1 Cell Sizing and Waste Filling Plans

There are multiple examples at landfill sites across Northern Australia, including Shoal Bay Landfill, where the introduction of new waste cells has resulted in significant increases in leachate collection volumes that have directly impacted upon landfill operations, overwhelmed existing leachate management infrastructure and in some cases uncontrolled contaminant releases to the environment.

As adopted for Stage 5 and Stage 6, new landfill cells and associated waste filling plans should be specifically planned and designed to minimise the generation of leachate. A key methodology to achieve this has been sizing new waste cells to enable the early operations stages to be completed within a single dry season period, with waste placed to a self-draining landform and minimum thickness of 5 m consistent with general operations conditions. Use of sub-cells that divide cell floor areas into smaller sub-cells to be filled over multiple years should be implemented as shown on Figure 11.

4.1.2 Daily Cover Material

The use and type of daily cover materials placed over waste materials at the end of each day has a material impact on surface water seepage into the landfill mass and leachate collection rates. Council should continue monitoring its Operations Contractor to ensure exposed waste is progressively covered each day and that no waste material is left uncovered overnight, particularly during the wet season.

Figure 11: Recommended Oversized Cell Filling Strategy

Daily cover material typically comprises a clay rich soil material that can provide an effective short-term seal with limited earthworks requirements. It is important, however, to ensure that most of the daily cover soil is excavated and removed prior to the placement of the next layer of waste material to reduce the risk of barriers limiting the movement of leachate within waste into the collection system that can result in lateral leachate breakouts around the external batters of the landfill.

There are commercially available alternative daily cover systems in use at landfill sites across Northern Australia. These include use of canvas covers that are placed and removed each day. Although each site will have its own unique characteristics that would need to be considered on a case by case basis, experience indicates that use of alternative daily cover systems is unlikely to make a measurable improvement to surface water infiltration rates into underlying waste material compared to the use of soil material. This is primarily due to the limited area that alternate daily cover can be applied.

Typically use of soil material for daily cover needs to be maintained on the upper horizontal surfaces, with alternative daily cover systems restricted to the angled working faces that normally comprises less than 50% of daily operational areas. One of the primary benefits of alternative daily cover systems is reducing the volume of airspace lost from use of soil daily cover materials.

4.1.3 Working Face Area

Key influences on typical areas adopted for the active working face include:

- The number and type of waste disposal vehicles requiring concurrent access during each day.
- The resources available to continuously move and compact waste within the working face.

- Maintaining minimum safety buffers between waste disposal vehicles and landfill operations plant.
- The materials and resources available to ensure that daily cover material is placed over the entire working face at the end of each day.

The size of the daily working face area stripped of daily cover until the end of each day's operations will impact on the volume of surface water infiltration, particularly during wet season periods.

It is important to note, however, that implementing small-scale reductions to the working face is only likely to result in small incremental reductions in stormwater infiltration, the benefits of which may not be measurable compared to the overall infiltration rates across the whole landfill area.

4.1.4 Stormwater Management

Management of stormwater run-off within operational landfill cells represents an important element of minimising infiltration into underlying waste material. Key influences comprise:

- Stormwater run-off directly entering waste material within the working face area.
- Sheet flow of stormwater across landfill areas protected only by daily cover material.
- Ponding of stormwater over daily cover material and other interim capped areas across the landfill.

Council should ensure that its Operations Contractor implements good practice stormwater management through:

- Maintaining a free draining landform at all times.
- Ensuring that daily cover material is placed as a uniform surface with no ponding.
- Use of temporary bunds and other controls to direct stormwater run-off around the active working face area that are actively managed as the working face area changes over time.

4.1.5 Leachate Reinjection

Reinjection of leachate within landfill cells has regularly been adopted as the primary leachate management strategy for regional landfills located within tropical climate areas of Northern Australia. This management strategy has, however, been associated with uncontrolled leachate conditions at multiple landfill sites, including Shoal Bay Landfill, resulting from:

- Collection and reinjection of leachate contaminated stormwater into the waste mass.
- Older waste material reaching field capacity ('saturated waste') and losing further moisture adsorption capacity. As an indicative guide, issues have arisen at multiple landfill sites that have been reliant on reinjection within the same waste cells for periods in the order of 5 to 10 years.

Poorly managed leachate reinjection also has the potential to impact the stability of the waste mass and increase the temperature of the waste mass and leachate above that allowed for in the cell liner design.

A key benefit of not relying on reinjection as part of the primary leachate management strategy is that new waste material will retain its original moisture adsorption capacity that can be taken advantage of as part of a broader leachate management strategy, for example:

- Natural buffering of leachate collection volumes during periods of heavy rainfall.
- Use as a contingency/emergency control measure during:
  - Introduction of new cells.

- Prolonged periods of above average rainfall.
- Unexpected conditions or events.

Given the ongoing presence of elevated leachate levels within Stage 3, no further reinjection should be undertaken in this area and reinjection within Stage 4 should only be considered as a contingency/emergency control measure.

4.1.6 High Rainfall Contingency Planning

Periods of higher rainfall that can result in increased stormwater infiltration are generally able to be forecast several days in advance (i.e. tropical/monsoon lows, cyclones, etc.). When such conditions are forecast, Council should inspect current site conditions and implement short term improvements as required to the active waste face, areas with interim capping, temporary stormwater controls and daily/interim waste cover.

4.1.7 Progressive Interim and Final Capping

Implementation of progressive placement of interim and final capping will directly impact upon the rate of stormwater infiltration into the waste mass. The nominal suggested approach shown in Figure 11 should continue to be implemented and optimised by Council and its Operations Contractor. A practical example is the construction of Phase 1 final capping of Stage 3/Stage 4 planned to be undertaken in 2021.

4.2 Leachate Collection, Storage and Disposal Infrastructure Capacity

4.2.1 Approach

The long-term performance of landfill leachate collections systems is highly dependent upon design, construction, leachate chemistry and biological processes and site operational practices. Maximising long-term performance and lifespan of any leachate collection system, regardless of construction, is generally achieved through implementation of continuous drainage through installed infrastructure through full time pumping. Continuous pumping maintains flow pathways within waste materials and leachate drainage aggregate that may become degraded and clogged by biological and chemical processes during prolonged periods of saturation without flows.

4.2.2 Geomembrane-Lined Landfill Stages

Council upgraded its leachate collection system for the general waste landfill stages to automatically operated pneumatic pumps in 2015. Subject to implementation of good practice monitoring and maintenance, the pneumatic pump system has generally been robust and reliable. Council should ensure that the pumping system continues to be maintained and operated to high standards.

The two 14 ML covered leachate storage ponds have generally provided Council with capacity to manage collected leachate volumes since their installation in 2015. It is noted, however, that Council and its Operations Contractor has struggled to dispose of collected leachate and empty the ponds prior to the commencement of each wet season. As identified in Section 3.3.5, future annual leachate collection volumes are estimated to be in the range of 16 ML to 29 ML, potentially exceeding the available on-site storage capacity.

4.2.3 Non-Engineered Landfill Stages

Recent inspection of Sump 1/2 servicing the Stage 1/Stage 2 toe interception trenches indicated some leakages and potential pump reliability issues. It is understood that Council is currently assessing the existing infrastructure with the objective of identifying upgrades to improve reliability and performance. As noted, in Section 4.2.1, upgrades of the pumping system for Sump 1/2 should ensure that it supports continuous automatic pumping.

Leachate collected from the Stage 1/Stage 2 toe trenches is currently surface irrigated within Stage 1. It is understood that all leachate collection from Sump 1/2 will be redirected to Council's permanent leachate treatment and disposal system following its commissioning, allowing the existing Stage 1 irrigation system to be decommissioned.

4.2.4 Leachate Treatment and Disposal

Council is currently undertaking construction and commissioning of a permanent leachate treatment and disposal system for Shoal Bay Landfill, supported by additional interim disposal capacity using a combination of surface irrigation and enhanced evaporation system (Benevap) until the permanent system is operational as summarised in Table 21.

Table 21: Current and Proposed Leachate Disposal/Treatment Infrastructure

Disposal/Treatment System	Operational Period	Nominal Capacity
Surface Irrigation	Temporary to Mid 2022	■ 60 kL per day
Enhanced Evaporation (Benevap)	Temporary to April 2022	■ 40 kL per day
Permanent Treatment System	Commissioned in 2022	■ 140 kL per day (40 ML/Year)

The combined operation of surface irrigation and the enhanced evaporation systems should support the disposal of 10 ML to 15 ML of leachate during the 2021/2022 wet season period. Based upon the forecast leachate collection volumes for this period in Figure 10, at least one of the 14 ML covered leachate storage ponds may need to be emptied prior to the commencement of the wet season to provide contingency capacity in the event of extreme rainfall conditions.

4.3 Proposed Strategy

Our proposed leachate management strategy for Shoal Bay Landfill presented in Table 22 was based upon the review of existing landfill operations and proposed future development and final capping plans.

Table 22: Proposed Shoal Bay Landfill Leachate Management Strategy

	Current Operations	Medium Term Operations (Existing Waste Cells)	Longer Term Operations (Future Waste Cells)
Cell Sizing / Design Final Capping	■ Construction of Stage 6 waste cells completed.	■ Construction of Stage 3/Stage 4 Final Capping underway.	■ Future waste design sized to support: ▪ Construction within a single dry season period. ▪ Completion of Early Operations within single dry season. ▪ Progressive capping of completed waste cells.
Landfill Operations	■ Council and its Operations Contractor to delay waste disposal in Stage 6A until 2022 dry season. ■ Continue to implement good practice landfill management, i.e.: ▪ Relatively small disposal faces. ▪ Placement of daily and interim cover. ▪ Diversion of stormwater away from active face area. ▪ Rectify any leachate breakouts as they occur. ▪ Exclude stormwater run-off from entering leachate systems. ▪ Prepare/update wet season management plans each year.	■ Target incremental improvements, including: ▪ Continue to assess and optimise performance of daily and interim cover materials. ▪ During periods of high rainfall target waste disposal within areas of greatest waste thickness. ■ Fill lower landfill areas during dry season periods.	■ Prioritise leachate minimisation controls, such as: ▪ Planning Early Operation periods for new waste cells be completed within single dry season. ▪ Progressive improvements to daily and interim cover material placement practices and review of opportunities for use of more efficient alternative cover solutions.
Leachate Management	■ Continue pumping from all leachate sumps, as required. ■ Optimise surface irrigation and enhanced evaporation of leachate to maximise available storage capacity within the covered leachate ponds prior to 2021/2022 wet season. ■ Empty at least one covered leachate storage pond prior to the 2021/2022 wet season, if possible, to provide contingency storage capacity for extreme rainfall conditions. ■ Review and update leachate management plans for the 2021/2022 wet season.	■ Commission permanent leachate treatment and disposal infrastructure at earliest opportunity. ■ Commence dewatering of Stage 3 leachate mound.	■ Monitor and review leachate collection volumes annually to assess performance against rainfall conditions and the suitability of installed leachate storage and treatment infrastructure.
Leachate Treatment/ Disposal Infrastructure ■ Non-engineered landfill stages	■ Continued interim irrigation within Stage 1 plateau.	■ Transition to permanent leachate treatment/disposal system	■ Permanent leachate treatment/disposal system. ■ Undertake assessment of leachate quality, risks to the environment and continued need for interception, treatment and disposal.
Leachate Treatment/ Disposal Infrastructure ■ Geomembrane-lined landfill stages	■ Continued interim irrigation within Stage 3/Stage 4 plateau. ■ Continued operation of enhanced evaporation (Benevap) over the 2021/2022 wet season. ■ Identify options for contingency capacity that could be implemented during 2021/2022 wet season period.	■ Transition to permanent leachate treatment/disposal system.	■ Permanent leachate treatment/disposal system.
Data Collection	■ Implement robust data collection systems to accurately record current leachate collection volumes from each landfill stage.	■ Review and upgrade data collection systems to align with and support Council's preferred leachate management systems.	■ Review and upgrade data collection systems to support the introduction of new landfill stages.

5.0 STORMWATER MANAGEMENT STRATEGY

5.1 Key Principles

5.1.1 General

As identified in Table 21, water types to be managed by this Stormwater Management Strategy comprise:

- Clean Water – Diversion away from waste management operations areas. For the purposes of this Stormwater Management Strategy this includes all run-off from landfill areas containing rehabilitated areas of Final Capping.
- Sediment Water – Containment, collection and treatment of sediment-impacted water from disturbed areas within waste management operations areas (i.e. landfills and greenwaste hardstands).
- First Flush Water – Containment, collection and management of the initial first flush run-off from non-landfill operational areas (i.e. greenwaste hardstands).

It is important to note that the Stormwater Management Strategy is based on the assumption that leachate generated within waste disposal cells is managed appropriately to prevent release to stormwater run-off. In high rainfall tropical climate regions such as Darwin it is generally not practical to manage stormwater that has been impacted by leachate.

5.1.2 Sediment Water

The effective and efficient management of erosion and sediment is planned to be achieved by following the basic principles of stormwater management as outlined by IECA (2008).

- Erosion protection and sediment control measures should be installed and maintained for all stages of the activity to minimise erosion and the release of sediments.
- All areas of soil disturbed and exposed should be managed to minimise the loss of sediment through revegetation and/or use of other stabilisation techniques.
- All concentrated stormwater flows (including ‘clean’ stormwater and ‘dirty’ stormwater) should have concentrated flow paths, such as drainage lines, diversion drains, channels which have been designed, constructed, effectively armoured and maintained to convey the runoff from events up to and including the 10% AEP storm event without causing water contamination, sheet, rill or gully erosion, sedimentation, or damage to structures or property.
- Stormwater runoff from external or undisturbed catchments should be diverted around or away from disturbed areas as much as possible.
- Sediment basin(s) or equivalent sediment containment controls should be installed and maintained to collect and treat stormwater runoff from all disturbed areas of the site(s).

5.1.3 First Flush

Management of First Flush water is typically achieved by containment, collection and management of the initial 20 mm of higher risk run-off from waste stockpiling and processing hardstand areas. Lower risk run-off above the initial 20 mm is typically diverted form management as Sediment Water. At present the greenwaste stockpile and processing hardstands are located within the Future General Waste Landfill Precinct. Commencing with the planned construction of the Stage 7 general waste landfill cells, greenwaste management and processing will transition to a more permanent location.

Council’s objectives for the existing greenwaste hardstand area is to implement short-term incremental improvements to manage First Flush run-off until a permanent hardstand and associated stormwater management infrastructure is established.

5.1.4 Treatment Train Approach

For the management of Sediment Water and interim management of First Flush, it is proposed to adopt a "treatment train" approach to manage sediment and nutrient impacted runoff generated by existing waste management operations at Shoal Bay Landfill, targeting capture or attenuation of approximately 80% of the contaminant load in run-off from disturbed or active operational areas up to an including the 2 exceedances per year (2E/Y) events.

This targeted approach is:

- Consistent with good practice urban stormwater management that aims to improve water quality in run-off discharge based on managing the annual pollutant load (Healthy Waterways, 2014); and
- Reduces the scale of stormwater management infrastructure required and associated disturbance and clearing of native vegetation regrowth surrounding current waste management operational areas.

The proposed treatment train approach uses a combination of the following stormwater controls:

- Grass-lined Contour Banks: used to control and direct flows on slopes to the toe drains or to rock-lined chutes. Contour banks can also be used to separate clean and impacted runoff and can be built on the landfill batters. Contour banks can be modified to cross access ramps using a low, wider profile and rock lining.
- Rock-lined Chutes: Used to convey impacted runoff from the active elevated areas of the landform to Toe Drains directly down the 3H:1V batters. Designed with rock armour, geotextile lining and a rock apron at the base to eliminate scour.
- Grass-lined Drains: used to convey runoff to eastern treatment areas or to surrounding environment. Sized to convey the 10% AEP runoff event and with a longitudinal grade of 0.5% to 2% to minimise velocities and maximise sediment filtration. Potentially incorporating Check dams constructed with rock in deeper channels and fibre rolls (Coir logs) in shallow or temporary channels. Earth (or geotextile) lined drains may be used where flows are less or where drains will be in place for less than 12 months, such as the top of the active landform.
- Catch Dams: Strategically placed rock dams or fibre logs in catch drains used to slow flow velocities and facilitate sediment capture.
- Causeway/Culvert: Convey flows across roads/access tracks and maintain trafficability. Causeways are preferable for flows west of the general waste landfill stages. Culverts are to be used where the maintenance of regular operational vehicle traffic is required such as the primary landfill access roads.
- Coarse Sediment Trap/Inlet Zone: Used to settle-out and capture coarse sediment from most flows. Provides external access for regular sediment clean-out with an excavator. Designed with an overflow weir that spread flows.
- High-flow Bypass Drain: Grassed trapezoidal drain adjacent to Coarse Sediment Trap used to convey flows greater than the design event (2EY or 6-month event). This is to minimise potential damage or inundation of downstream treatment options. The operation of the high flow bypass is estimated to be for periods of approximately 30 minutes to 1 hour of the peak runoff intensity during typical 2 E/Y conditions based on estimated runoff hydrographs.

- Level Spreader: Grassed and bunded structure to spread and direct flow from the Coarse sediment trap / Inlet zone to a well vegetated area. Uses a bunded and grassed approach drain and a completely level 25 m long concrete sill to discharge partially treated runoff as sheet flow to a well-vegetated and minimally sloped area for further filtration.
- Stiff Grass Barrier: Vetiver strips (or other suitable vegetation) placed downstream of level spreader discharge or in grassed drains. Grasses shall be densely planted along the contour to act as flow velocity control and as a sediment trap. May be planted in spaced, consecutive rows as needed.
- Vegetated Extended Detention Area: Localised bunding in surrounding vegetation to promote increased settling of sediment and uptake of nutrients from greenwaste processing area by strategically planted grasses and sedges. Implementation based on water quality modelling and the performance of other treatment train-elements in terms of downstream water quality as this option will require significant disturbance of remnant vegetation. To be implemented downslope of first flush primary treatment areas.
- Sediment basin: Optional large scale engineered structure to capture, treat and store sediment-impacted runoff. Typically sized as per Type C Sediment Basin (IECA, 2008) incorporating spillway for overflows of treated runoff.

Specific examples and typical sections of the stormwater treatment train elements are presented in Appendix E.

5.1.5 Stormwater Treatment Precincts

The Shoal Bay Landfill site encompasses large areas of unused land surrounding the existing waste management operational precincts; however, as shown on Figure 1 to Figure 3, much of these areas are subject to the following constraints:

- Uncleared UXO.
- Low-lying land at risk of inundation during highest astronomical tides storm surge events.
- Remanent/regrowth native habitat.

To account for these constraints, the following hierarchy for the placement of stormwater management infrastructure was adopted by Council in the development of this Stormwater Management Strategy:

- Exclusion of land subject to highest astronomical tides and 1 in 100-year ARI storm surge events.
- Avoidance of Uncleared UXO areas where possible.
- Targeting existing disturbed/cleared land and areas containing limited or lower value native habitat.

Suitable areas identified for the implementation of stormwater management infrastructure were limited to:

- The borrow pit area located immediately north of the Stage 3/Stage 4 general waste landfill cells.
- Vacant land located west of the Stage 5 general waste landfill cells and the existing greenwaste hardstands.

Please note; however, although low-lying vacant land located east of the Stage 1 and Stage 1 landfill was considered unsuitable for implementation of stormwater management controls and treatment infrastructure, the existing native habitat provides a large buffer to waterways located outside the Shoal Bay Landfill boundary and will provide some natural attenuation for sediment and nutrients released in stormwater run-off from waste management operational areas.

5.2 Stage 2 Inert Landfill

5.2.1 Stormwater Management Concept Design

A concept layout plan for the management of Sediment Water discharged from the Stage 2 Inert Landfill is shown on Figure 12, comprising:

- Two contour banks surrounding the active waste area at the top of the landform that will convey impacted runoff to a chute in the north-west corner.
- Runoff from the chute will be conveyed via culverts under the leachate pond access road towards a grassed drain that bypasses a proposed soil stockpile hardstand area.
- Sediment impacted water will be discharged into an expanded sediment basin located within the existing disturbed borrow pits area north of the Stage 3/Stage 4 general waste landfill cells.

Concept design details present below are required to be updated during detailed design to be based upon the future landfill area to be identified in Council's Stage 2 inert waste landfill expansion study.

5.2.2 Catchment Area and Peak Flows

The indicative catchment areas and peak flows for the Stage 2 Inert Waste Landfill identified in Figure 12 are presented in Table 23 for the 10% AEP and 2EY design rainfall events.

Table 23: Stage 2 Inert Waste Landfill Catchment Area and Peak Flows

Waste Disposal Stage	Impacted Catchment Area	Stormwater Catchment	Peak flow 10%AEP	Peak flow 2EY
Stage 2	7.2 ha	7.2 ha	2.0 m^3/s	0.8 m^3/s

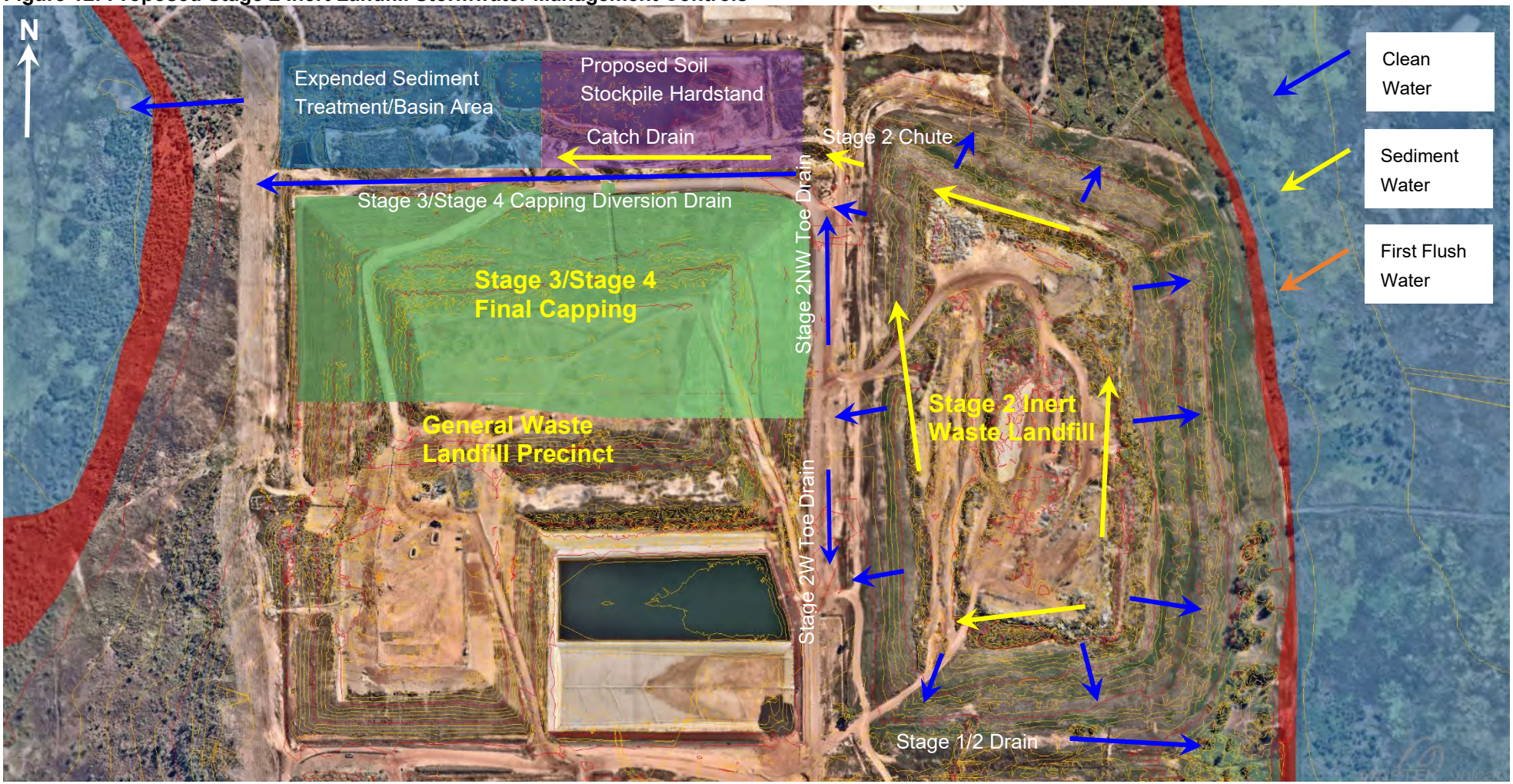
5.2.3 Contour Bank Details

Concept level design requirements for the contour banks proposed for Stage 2 are summarised below, with typical sizing and flow velocities are presented in Table 24:

- Contour banks are to be built using 2H:1V side-slopes on the earth bank, with a minimum 3H:1V slope towards the active area. The bank shall have a minimum top width of 0.5 m and be compacted during construction and keyed-in to the existing ground at the base. The whole bank shall be grassed post-construction.
- Triangular drains are not recommended due to potential scour at the base.
- Longitudinal slopes are to be optimised between 0.5% and 1% to prevent ponding and maintain the contour bank at the top of the landform. Towards the north-west corner of the landform the bank will be located on the batter.
- To maintain trafficability at ramps and road access the bank is to be flattened with the drain widened and rock-lined. The proposed dimensions will be determined in detailed design.

The drain section of the contour bank shall be geotextile or rock-lined on the active area and grassed on the slopes.

Figure 12: Proposed Stage 2 Inert Landfill Stormwater Management Controls



Sources: Nearmap Image.

- Storm Surge Mapping (GHD 2014)
  - Highest Astronomical Tide
  - 1 in 100 Year ARI
- Stormwater Infrastructure
  - Drains
  - Chutes

Table 24: Concept Design Contour Bank Dimensions and Flow Velocities

Sizing	Peak Flow (10% AEP)	Base width	Bank height	Maximum velocity
Minimum Size (start of drain)	0.2 m^3/s	0.6 m	0.3 m	1.0 m/s
Maximum Size (end of drain)	1.1 m^3/s	0.6 m	0.6 m	1.5 m/s

5.2.4 Rock Chute Details

Rock chutes convey runoff from upper levels of waste landforms to base level toe drains. The two contour banks shall discharge to a rock chute located at the north west corner of the Stage 2 waste landform. The contour banks should merge into the chute at 45° and incorporate rock armour for 3 m prior to the junction.

Concept level design requirements for Rock Chutes are summarised below, with typical sizing and flow velocities are presented in Table 25:

- The chutes shall be at the maximum slope of the landform batter (3H:1V (33%)) and employ 2H:1V side-slopes. Geotextile lining shall be placed under the chutes and anchored appropriately.
- Chutes can be designed to sit raised on the batter reducing the excavation into the landform by using bunds on each side and merging the junction of the inflow drains.
- The base of the chutes shall include a rock apron / dissipation basin of a minimum 3 m long and 0.7 m deep with the same rock armour as the chute. This will be incorporated into the toe/catch drain at the base of the landform.

Table 25: Concept Design Rock Chute Dimensions and Flow Velocities

Design Criteria	Minimum Size	Maximum Size
Peak flow (10% AEP)	0.6 m^3/s	1.9 m^3/s
Base width	2 m	4 m
Water depth	0.15 m	0.22 m
Water velocity	2.1 m/s	3.0 m/s
Total depth*	0.3 m	0.45 m
Rock armour d_{50}	0.2 m	0.3 m
Rock depth	0.35 m	0.55 m

The proposed Stage 2 rock chute is anticipated to require the maximum size design criteria with an estimated 10% AEP flow of 1.9 m^3/s for run-off from a 7.2 ha area of disturbance.

5.2.5 Culvert

The rock chute will discharge to a 5 m long rock apron/dissipation basin prior to being channelled through tow box culverts under the main access road. Concept design sizing of the culverts indicates two 600 mm deep and 1200 mm wide RCP culverts with trapezoidal concrete headwalls with a 2% longitudinal grade to provide capacity to convey a 10% AEP rain event. The culvert will discharge to a catch drain with rock protection at the junction.

5.2.6 Catch Drain

Run-off discharge from the culverts under the main access road will be conveyed in a 2 m wide grassed catch drain towards the sediment treatment/basin area. The drain shall be a minimum 0.5% longitudinal grade, 0.5 m deep and shall incorporate check dams or stiff grass barriers.

5.2.7 Concept Sediment Basin Design

An engineered sediment basin is proposed to treat Sediment Water discharged from the Stage 2 Inert Waste Landfill. Concept level design requirements upon an IECA Type C sediment basin are summarised below, with proposed dimensions presented in Table 26:

- Dimensions are based on a 3:1 Length:Width ratio. Where this may not feasible internal baffles can be utilised.
- The sediment basin will require rock armour at the inlet and a rock lined spillway. The spillway shall be a minimum 8 m wide and 0.5 m deep with 2H:1V side slopes (4H:1V if required to be trafficable) and rock armour of d_{50} 250 mm.
- Deepening the sediment basin will not increase the sediment treatment performance but will reduce the required frequency for removal of collected sediment.
- A grassed outlet drain shall be place at the base of the spillway to convey outflows to the surrounding vegetation with rock armour to prevent scour at the transition.

Table 26: Concept Design Sediment Basin Dimensions

Design criteria	Values
Design inflow 63.2% AEP	0.6 m^3/s
Required surface area	922 m^2
Minimum width	21 m
Minimum length	59 m
Minimum depth	1.2 m
Minimum volume	907 m^3

5.3 General Waste Landfill

5.3.1 Staged Stormwater Management Concept Design

Concept plans for the staged implementation of stormwater controls for the management of Sediment Water discharged from the General Waste Landfill are presented as follows:

- Figure 13: Future Introduction of Stage 6 and Partial Final Capping of Stage 3/Stage 4
- Figure 14: Future Introduction of Stage 7
- Figure 15: Future Introduction of Stage 8 and Remainder of Stage 3/Stage 4 Final Capping
- Figure 16: Future Introduction of Stage 9 and Final Capping of Stage 5/Stage 6
- Figure 17: Future Introduction of Stage 10

Figure 13: Future Introduction of Stage 6 and Partial Final Capping of Stage 3/Stage 4

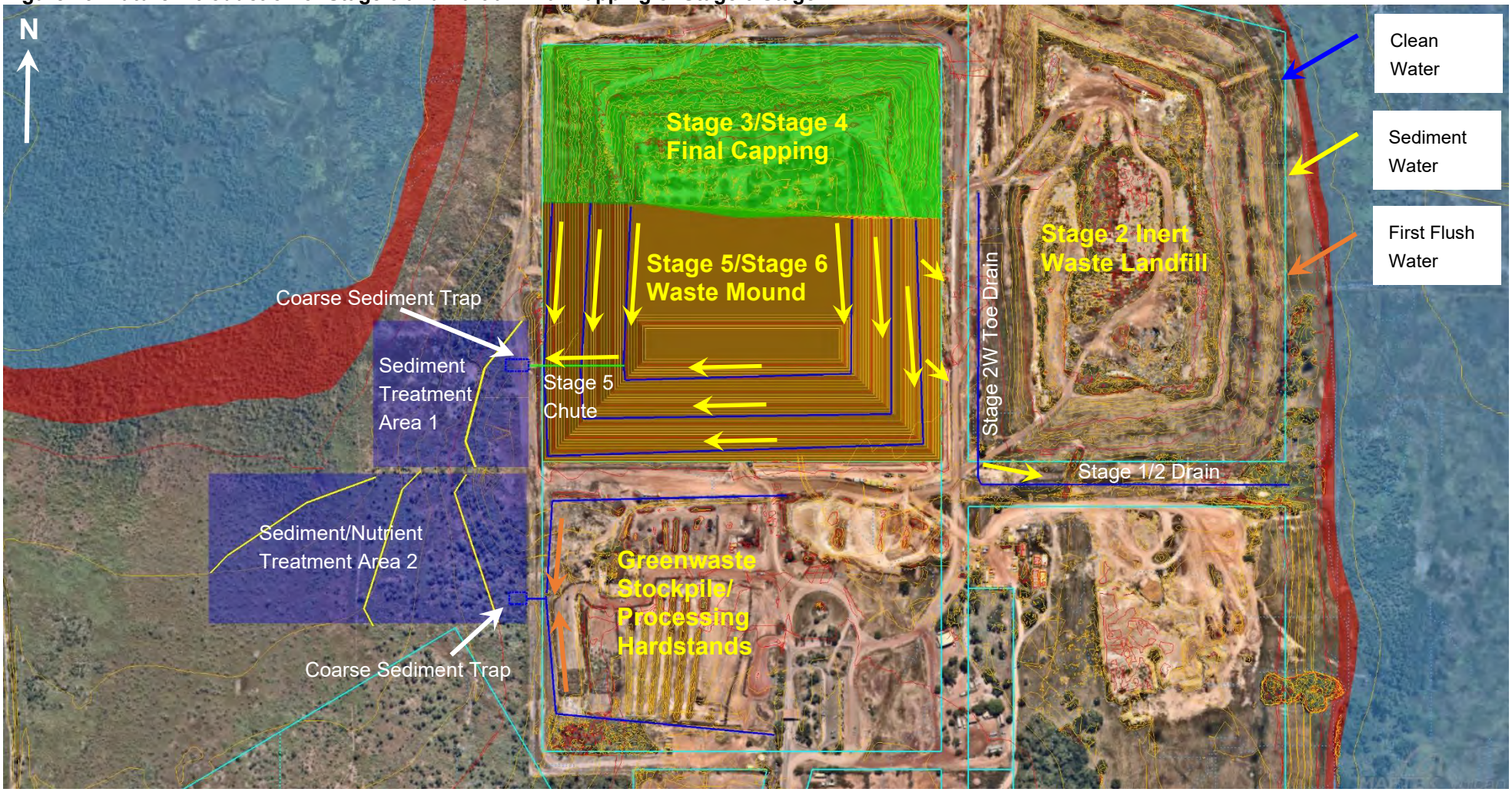


Figure 14: Future Introduction of Stage 7

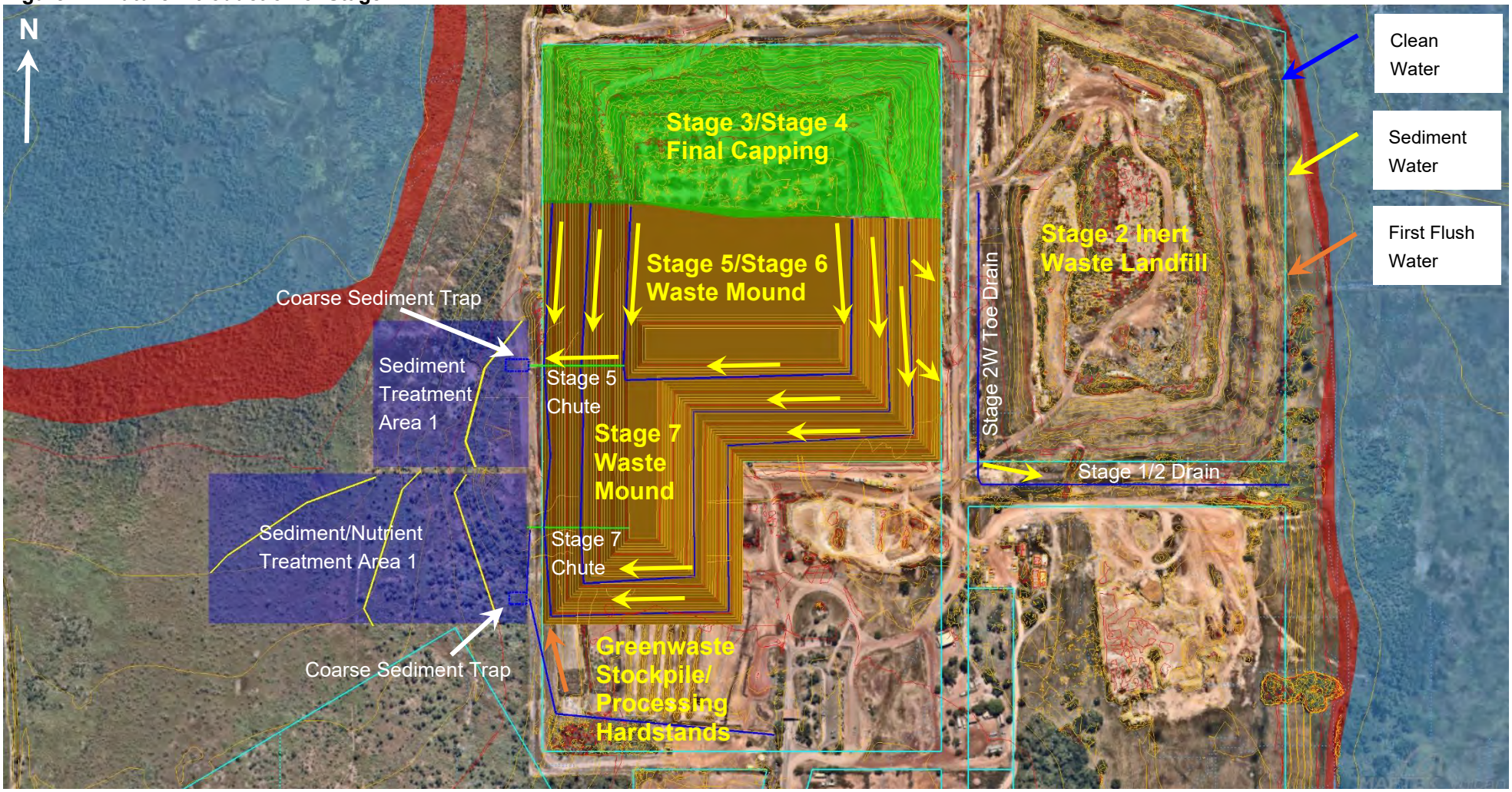


Figure 15: Future Introduction of Stage 8 and Remainder of Stage 3/Stage 4 Final Capping

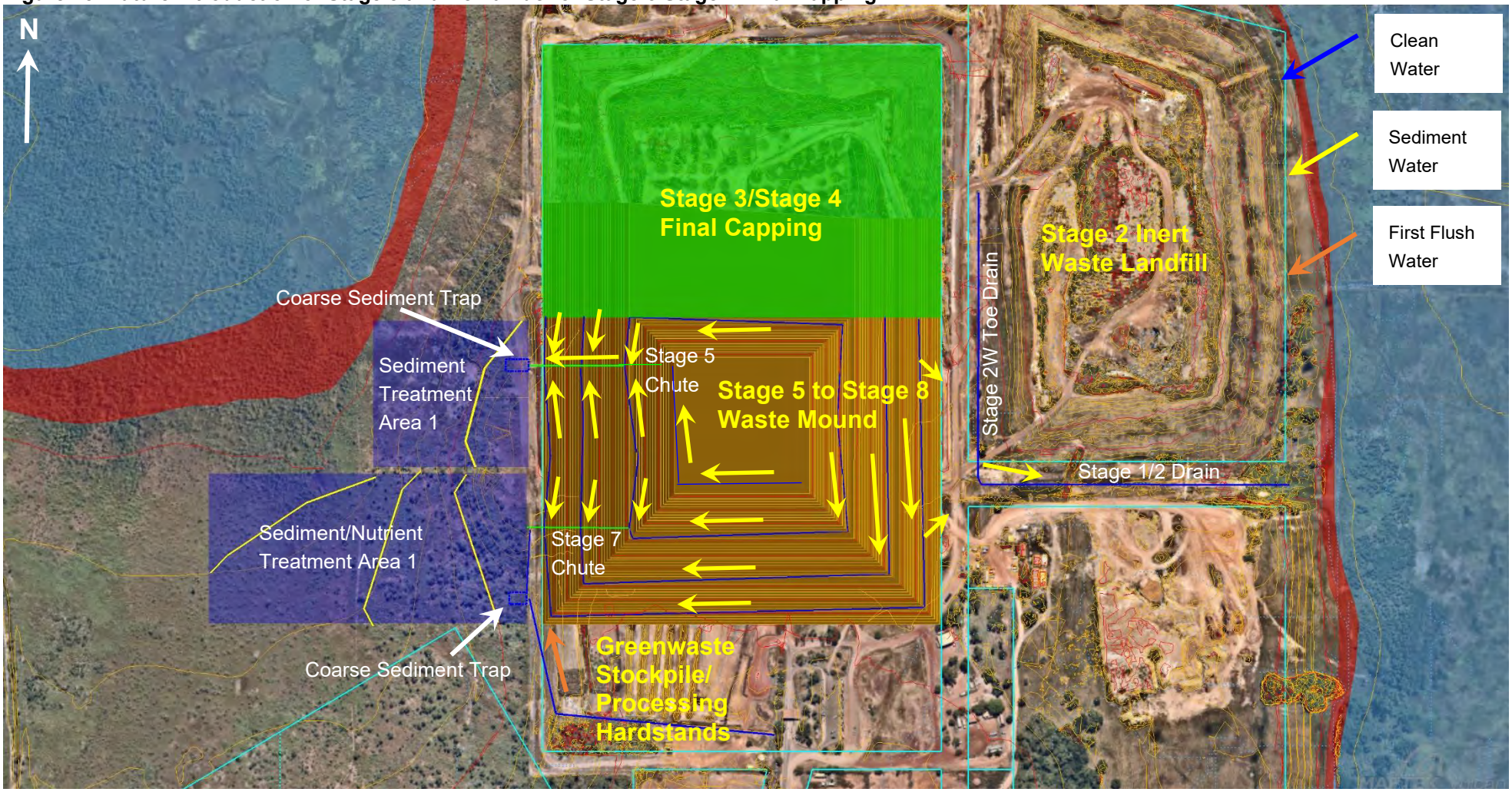


Figure 16: Future Introduction of Stage 9 and Final Capping of Stage 5/Stage 6

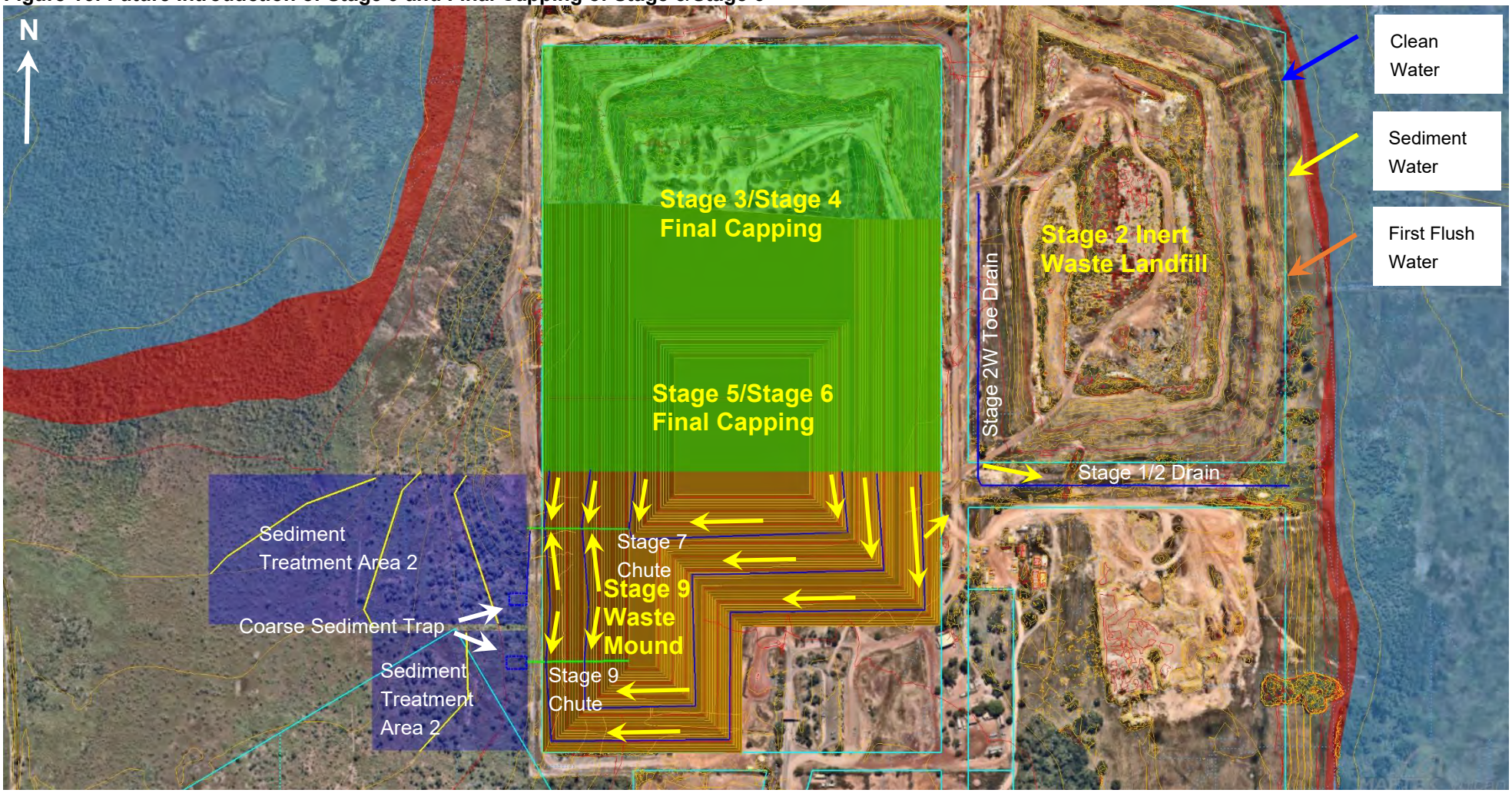
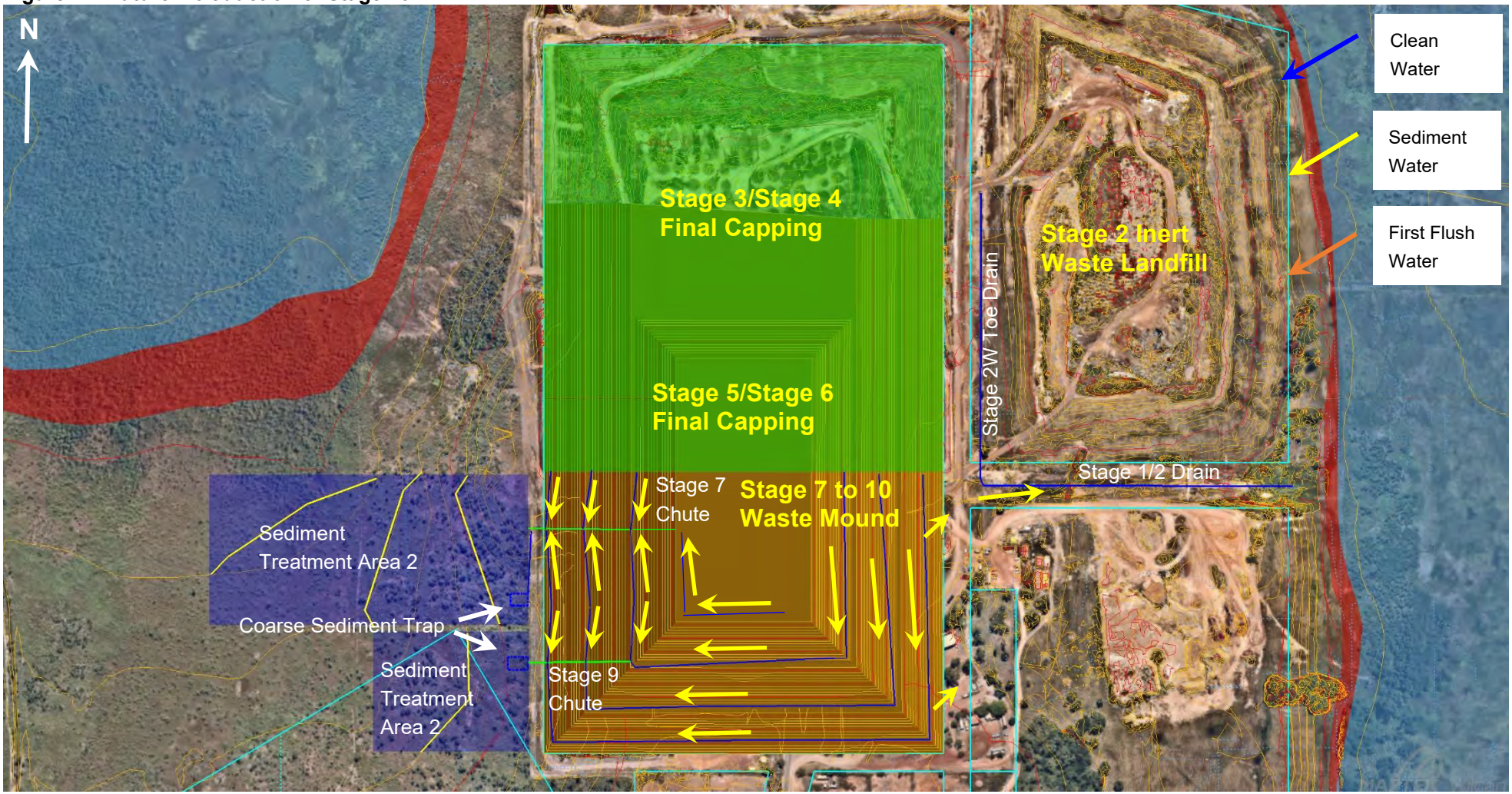


Figure 17: Future Introduction of Stage 10



Given the larger catchment areas, high rainfall conditions and available land areas, for the general waste landfill cells it is proposed to utilise a combination of sediment containment infrastructure as an alternative to large scale sediment basins.

Treatment systems have been conceptually designed assuming that each treatment area receives 100% of impacted runoff from the landfill, however, treatment efficiency will be maximised with spreading runoff of across multiple separate treatment areas comprising:

- Sediment Treatment Area 1: Primarily servicing Stage 5/Stage 6.
- Sediment Treatment Area 2: Primarily servicing the existing greenwaste hardstand and Stage 7/Stage 8.
- Sediment Treatment Area 3: Primarily servicing Stage 9/Stage 10.

5.3.2 Catchment Area and Peak Flows

The indicative catchment areas and peak flows for general waste landfill stage identified in Figure 13 to Figure 17 are presented in Table 27 for the 10% AEP and 2EY design rainfall events.

Table 27: Stage 2 Inert Waste Landfill Catchment Area and Peak Flows

Waste Disposal Stage	Impacted Catchment Area	Stormwater Catchment(1)	Peak flow 10%AEP	Peak flow 2EY
Stage 5	8.2 ha	6.2	2.0 m^3/s	0.9 m^3/s
Stage 6	11 ha	8.3	2.6 m^3/s	1.1 m^3/s
Stage 7	10 ha	7.5	2.3 m^3/s	1 m^3/s
Stage 8	7.8 ha	5.9	1.8 m^3/s	0.8 m^3/s
Stage 9	11.6 ha	8.7	2.7 m^3/s	1.1 m^3/s
Stage 10	11 ha	8.3	2.6 m^3/s	1.1 m^3/s

Note (1): The nominated stormwater catchment areas are representative of 75% of the total catchment based on the assumption that no all run-off will be able to be directed westwards to proposed stormwater treatment areas. As shown on Figure 13 to Figure 17, a portion of stormwater run-off from the general waste landfill cells is anticipated to flow eastwards between Stage 1 and Stage 2 and discharge into the large native vegetation habitat area.

5.3.3 Contour Bank Details

Concept level design requirements for the contour banks to be used to control run-off from general waste landfill cells are consistent with the Stage 2 Inert Landfill concept design presented in Section 5.2.3.

5.3.4 Rock Chute Details

Concept level design requirements for the three identified rock chutes (Stage 5, Stage 7, Stage 9) to be used to convey runoff from upper levels of the general waste landforms to base level toe drains are consistent with the Stage 2 Inert Landfill concept design presented in Section 5.2.4.

5.3.5 Causeway Details

Shallow causeways are to be employed to convey runoff across the western perimeter access track. The causeways shall be a maximum of 300 mm deep with 6H:1V slopes and compacted rock or concrete lined. Base width shall be a minimum of 4 m. Causeways shall discharge to a rock or concreted lined inlet with 2H:1V batters prior to discharge into primary coarse sediment traps.

High-flow bypasses will be integrated to the inlet zone.

5.3.6 Coarse Sediment Trap/Inlet Zone Details

To slow concentrated flows and to settle coarse suspended sediment, an inlet zone or sediment trap shall be employed. Concept level design requirements for Rock Chutes are summarised below, with proposed minimum dimensions for coarse sediment traps are presented in Table 28:

- Minimum width of the coarse sediment trap dependent on the maximum flow across the outlet weir. This has been assessed based on a peak inflow of 1.1 m^3/s (refer Table 28), resulting in a maximum depth of 0.25 m across the weir.
- Design will need to incorporate a high-flow bypass to convey flows greater than 1.1 m^3/s. The weir has been checked to have capacity to convey 10% AEP event of the total impacted runoff in case of a blockage in the high flow bypass.
- Structure is to be rock or concrete lined with at least 2 m surrounding hardstand and 2 sides to support regular sediment clean-out by a long-reach excavator.

Table 28: Concept Design Coarse Sediment Trap Dimensions

Dimension	Width	Length	Water depth	Total depth	Weir depth	Freeboard
Value	6 m	6 m	1 m	2 m	0.5 m	0.25 m

High-flow Bypass drains are to be built alongside the sediment trap to convey peak flows greater than the 2EY event. Designs to be finalised but are likely to include a minimum 2 m base width, 2H;1V side-slopes and grass-lining. The bypass drain will widen with rock armour placed at the outlet to the surrounding environment to dissipate energy and prevent scour. May also incorporate Stiff Grass Barriers (Vetiver strips) downstream of outlet.

5.3.7 Level Spreader Details

Design flows from the coarse sediment trap will be conveyed along a bunded, grassed approach drain to a level spreader. The level spreader will act to release the concentrated inflow as sheet flow to a stable vegetated area downslope. Concept level design requirements for the level spreader are summarised below, with proposed dimensions provided in Table 29:

- The level spreaders shall be designed as an L-shape from the sediment trap weir.
- Level spreaders shall be lined with turf reinforced matting and well grassed.
- The approach drain shall be sloped at approximately 2% toward the sill.
- Sill is to be concrete of 100 mm wide and minimum 300 mm deep and to be completely level.
- Downslope sheet flow area to be stable, undisturbed and well-vegetated.
- Flow diversion banks to be well compacted and grassed with turf reinforced matting placed on inner slope.

Table 29: Concept Design Level Spreader Dimensions

Design Dimension	Approach drain width (m)	Approach drain bund height (m)	Minimum sill length (m)	Maximum sill length (m)
Value	4	0.30	10	25

5.3.8 Stiff Grass Barrier Details

Strategic planting of strips of vetiver or other suitable grasses or sedges should be placed downslope of the level spreader and across the contour. The grass strips will form an extra sediment trap by slowing and filtering sheet flow runoff, noting:

- Plantings should be dense (6 to 7 plants per meter) to maximise filtration.
- Successive rows can be used with a vertical spacing of approximately 0.5 m (20 m to 25 m horizontal in this area).
- Care should be taken to ensure selected species are suitable for the site and non-invasive. If locally present species are not suitable a sterile form of Vetiver grass (e.g. Vetiveria zizanoides) should be considered.
- Vetiver should be cut back to 500 mm height annually after each wet season.

5.4 Interim Greenwaste Hardstands

Effective bunding of the greenwaste processing area should be assessed to minimise ingress of Clean Water from other waste management operational areas. The existing Greenwaste Pond should be maintained as a coarse sediment trap, with overflow managed in general accordance with the treatment train approach adopted for the general waste landfill cells.

It is acknowledged that vegetation filter systems used to remove sediment may not effectively attenuate nutrients contained in run-off from the greenwaste hardstands. Given this limitation and that the greenwaste hardstands will be moved to a separate permanent location, the following interim management strategy approach is proposed:

- Detailed design for Sediment/Nutrient Treatment Area 2 to consider use of a larger area, with additional level spreaders.
- Surface water monitoring programs to be used to assess the performance of the interim treatment controls.
- Where nitrogen and phosphorous concentrations are considered elevated and a potential risk to water quality, an extended detention area or bioretention system will be constructed downstream of the lower level spreader. It is noted that:
  - This option may require significant disturbance of the existing vegetation and earthworks to create a treatment area with sufficient capacity for the required flow events.
  - Such a system will require the importation of a specific sandy biofiltration media (with high hydraulic conductivity) and the placement of an underdrainage network and outlet.
  - The area will require mass plantings of specific vegetation with nutrient treatment performance characteristics and the ability to withstand extended inundation of 200 mm water depth from long duration storm events (native reeds and sedges including Carex appressa and Ficina nodosa).
  - A bioretention system will require a high flow bypass to avoid peak flows from rainfall events greater the 2EY.
  - If this option is required the expected pollutant treatment performance will need to be modelled in specific water quality software (MUSIC) to refine the design.

5.5 Inspection and Maintenance

Routine inspection and maintenance of all stormwater management infrastructure is required to maintain performance. In summary:

- Contour Banks/Catch Drains

  Maintenance of the bunds and drains are required to ensure that they continue to provide the necessary design capacity. Catch drains will be inspected for erosion damage, sediment / debris blockage, changes in design slopes.

  Catch drains are to have debris removed, be reprofiled, and vegetated drains are to be mowed to maintain grass length ~ 100 mm, with any non-grass species to be removed.

- Check Dams

  Check dams will be inspected for any damage such as displacement of check dams, soil scour around ends of check dams and evidence of overtopping.

  Any sediment accumulated within the check dams to be removed. If soil scour around ends of check dams is occurring, the width of the dam may be extended. If significant erosion occurs between check dams, intermediate check dams may be placed to reduce the dam spacing or a suitable channel liner may be installed. Sediment removed from the basins must be disposed of in a manner that does not create an erosion or pollution hazard.

- Rock Chutes

  Rock chutes to be inspected for any damage such as displacement of rock, soil scour on base or bunds and degradation of geotextile.

  Any displaced rock will be replaced in position and consideration given to using larger rock in local sections. Evidence of scour or piping on base or bunds should be inspected and reinstated with the next larger grade of rock placed locally and geotextile repaired. Inspections shall also include inlet junctions and the apron/dissipation basin.

- Coase Sediment Ponds/Sediment Basins

  Whilst sediment basins are in general low maintenance structures, inspection and maintenance is required to ensure sufficient sediment storage capacity is maintained and inflow and outflows are not actively eroding. Sediment pond embankments, inflow chutes, spillways and downstream channel banks are to be inspected for erosion damage or sediment / debris blockage. Accumulated sediment is to be removed when it exceeds approximately 30% of the storage volume. Sediment removed from the basins must be disposed of in a manner that does not create an erosion or pollution hazard.

- Level Spreaders

  The flow diversion banks especially at the entrance to the inflow channel and at the end of the sill shall be inspected for signs of scour or overtopping. Turf Reinforcement Mat pins should be regularly checked and replaced if necessary. The grass shall be maintained at ~100 mm and the area directly below the concrete sill shall be inspected for signs of scour or concentrated flow. Areas of concentrated flows downslope of the level spreader shall be filled with rock armour and revegetated to promote sheet flow conditions.

Regular inspections of stormwater infrastructure shall be conducted at 3-monthly or intervals or after significant rainfall events. Typical requirements for routine maintenance of surface water management infrastructure is presented in Table 30.

Table 30: Typical Stormwater Maintenance Requirements

Measure	Trigger Criteria	Maintenance Action
Catch Drains, Toe Drains, Contour Banks	Evidence of erosion or slumping	Repair/reinstate. Investigate need for additional controls or replace with more effective controls (Geotextile /TRM/Rock armour)
	Evidence of slumping of contour bank	Backfill with competent material and compact and reprofile. Consider soil nails or duck bill anchors
	Sediment, debris or vegetation blockage	Remove accumulated sediment and debris
	Changes in drain design slope	Reprofile drain
Rock Chutes	Displacement of rock or scour	Move rock to original location and consider local placement of larger rock.
	Exposed base and/or geotextile	Ensure integrity of base/ geotextile (not exposed and no-undermining). Reinstate locally
	Erosion on bunds	Repair/reinstate
Check Dams	Damage to dam structure	Reinstate check dam
	Sediment accumulation	Remove any accumulated sediment
	Signs of overtopping of the drain	Reduce height of dam by removing or embedding rock
	Significant erosion between dams	Install additional intermediate check dams or install channel liner
Vegetated Drains	Vegetation is longer than ~250 mm	Grass lined-drains to be to be mown to ~100 mm
	Poor vegetation growth	Water if applicable. Consider secured turf or plant tubestock of native grasses/sedges/vetiver
	Evidence of erosion	Repair/reinstate. Consider TRM or localised rock armour
	Evidence of erosion or damage	Repair/reinstate

Measure	Trigger Criteria	Maintenance Action
Road Contour Banks / Causeways	Evidence of overtopping	Place more rock protection or increase depth of contour bank
Culverts	Evidence of erosion or damage to headwalls, inlet and outlet channels	Repair/reinstate Install extra scour protection
	Blockage, Sediment build-up	Unblock and/or desilt immediately
Sediment Basins / Inlet Ponds	Evidence of erosion or damage to banks, inflow chute, spillway or outlet channels	Repair/reinstate Place more rock protection
	Sediment build-up of 30%	Remove sediment build-up of dispose appropriately
Level Spreaders	Evidence of erosion or damage to flow diversion banks, inflow channel or concrete sill	Repair/reinstate
	Evidence of erosion in vegetation directly below sill	Consider placing geotextile and rock armour for first 0.5 m after concrete sill or lower inflow level to high flow bypass drain

5.6 Proposed Strategy

Our proposed stormwater management strategy for Shoal Bay Landfill presented in Table 31 was based upon the review of existing waste management operations and proposed future landfill development and final capping plans.

Table 31: Proposed Shoal Bay Landfill Stormwater Management Strategy

Current Operations	Medium Term Operations (Existing Waste Cells/Greenwaste Hardstands)	Longer Term Operations (Future Waste Cells)
■ Improve grass-lining in existing drains. ■ Integrate stormwater infrastructure into Stage 3/ Stage 4 final capping to divert Clean Water from mixing with impacted water from adjacent areas. ■ Maximise use of check dams and plant Vetiver strips at discharge points. ■ Maximise diversion of clean runoff from mixing with impacted runoff including adding a bund or diversion drain to divert runoff from the south flowing through the greenwaste processing area. ■ Maximise progressive rehabilitation of inactive areas by seeding or mulching. ■ Consider the use of spray polymers for bare areas that will be utilised within six months. ■ Integrate stormwater infrastructure into capping plans, master plan and daily operations including allowing for contour banks, catch drains and rock chutes. ■ Commence detailed design of Stage 2 Treatment Train including Sediment basin location. ■ Commence detailed design of Treatment Train stormwater infrastructure for general waste landfill stages and the greenwaste hardstand. ■ Trial plantings of Vetiver strips to determine required density, establishment time and performance.	■ Identify opportunities to divert existing general waste landfill run-off flowing to the Stage 1/2 drain using contour banks. ■ Establish Vetiver strips or other supplemental plantings as early as possible at preferred locations. ■ Construct Sediment Treatment Area 1 treatment train (sediment trap/level spreader) to manage runoff from Stage 5/Stage 6. ■ Construct Sediment/Nutrient Treatment Area 2 treatment train (sediment trap/multiple level spreaders) to manage runoff from the greenwaste hardstands. ■ Monitor water quality improvement performance of treatment trains by comparing runoff at source (active area) and downstream (post sheet flow treatment area) during the same runoff event. ■ Incorporate contour drains and rock chutes to landfill filling plan to maximise diversion of impacted runoff to treatment train. ■ Select new greenwaste processing location and water collection and reuse system.	■ Construct Sediment Treatment Area 3 as required to maximise diversion of impacted runoff from future landfill stages and improve treatment efficiency of systems by dividing flows. ■ Integrate learnings from construction and maintenance activities of previously implemented stormwater infrastructure to improve design/operation of new infrastructure. ■ Design and construct bioretention basis within Sediment/Nutrient Treatment Area 2 if additional interim nutrient removal performance is required. ■ Plan for decommissioning of first treatment train as landfill development progresses. This may involve removal of concrete pond and backfill while leaving level spreader and drains operational. ■

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Leachate Management

Key conclusions drawn from the assessments undertaken to support the preparation of the Leachate Management Strategy for Shoal Bay Landfill comprise:

- Leachate containment and management at Shoal Bay Landfill by Council and its Operations Contractor has improved considerably between 2014 and 2021.
- Council and its Operations Contractor have generally collected leachate pumping volumes on a daily basis and pond storage levels on a monthly basis between 2016 and 2021, however, data collection infrastructure and recording methodology is not considered to be robust and reliable, limiting its suitability for assisting with calibration of water balance models and estimation of future leachate collection volumes.
- The leachate collection system constructed in Stage 3 is non-functional, with elevated leachate levels within Stage 3 waste mound present to depths of 10 m to 15 m above the geomembrane liner. Leachate with Stage 3 currently flows outwards into adjacent waste cells (Stage 4/Stage 5) or into toe collection trenches installed on the northern and eastern perimeter of Stage 3.
- Based upon reconciliation of available leachate pumping and storage volumes from the geomembrane-lined landfill stages, leachate collection rates as a percentage of rainfall between 2016 and 2021 are generally considered consistent with previous water balance modelling estimates, varying between 4.4% and 12.4 % during wet season periods. High dry season leachate pumping volumes are considered to mostly comprise continuous flows from elevated leachate levels within the Stage 3 waste mound.
- Leachate collection volumes from the non-engineered landfill stages are considered to be much less than rainfall infiltration, indicating the loss of uncontained leachate into the environment.
- Council and its Operations Contractor have transitioned leachate management from almost full reliance on reinjection into Stage 3 in 2014 to interim surface irrigation over the past 5 years.
- Rainfall over the 2018/2019 and 2019/2020 wet season periods was low (< 13th percentile conditions).
- Existing leachate storage (2 x 14 ML covered ponds) and interim surface irrigation disposal infrastructure has generally considered to be at full capacity in most years between 2016 and 2021 and may be exceeded during future periods of above average rainfall conditions.

Key recommendations proposed by Golder to be considered by Council to minimise leachate generation and provide incremental improvements to existing robust leachate management comprise:

- Upgrade its existing leachate management data collection systems to systematically provide reliable and robust information to support future planning and infrastructure upgrades.
- Continue to implement progressive improvements to landfill operations, particularly with respect to daily and interim cover management and in-cell stormwater management.
- Continue to avoid use of leachate reinjection unless required due to exceptional circumstances/ emergency conditions.
- Leachate management should be considered the highest priority for landfill operations until the permanent treatment system is commissioned.

6.2 Stormwater Management

Key conclusions drawn from the assessments undertaken to support the preparation of the Stormwater Management Strategy for Shoal Bay Landfill comprise:

- There are minimal existing controls in place at Shoal Bay Landfill to control, manage and treat stormwater run-off.
- Key potential contaminants of concern present in existing stormwater run-off are sediments from all disturbed waste management operation areas and nutrients from the greenwaste storage and processing hardstands.
- Leachate from waste disposal operations must be kept separate from stormwater and has not been considered in the selection of proposed run-off treatment systems.
- Shoal bay Landfill is subject to high rainfall tropical climate conditions. Consistent with good practice urban stormwater management, it is proposed to target capture and attenuation of approximately 80% of potential contaminant loads in high risk stormwater run-off.
- The Shoal Bay Landfill site is subject to a number of constraints for the implementation of stormwater management and treatment infrastructure. Given the proximity of low-lying, inundation prone land east of the Stage 1/Stage 2 landfill areas, it is planned to locate stormwater treatment infrastructure to existing more disturbed and lower risk land located directly to the north and west of the existing and future general waste landfill stages.
- Council is planning on moving the existing greenwaste hardstands as progressive development of future general waste landfill stages occurs. It is proposed to adopt interim control measures for the management of First Flush Water from the existing greenwaste hardstands, with permanent controls and treatment systems to be implemented for the future location.

Key recommendations proposed by Golder to be considered by Council to provide incremental improvements to stormwater management comprise:

- Capturing and directing stormwater run-off from the Stage 2 inert waste landfill operations to the existing borrow pit area located north of the Stage 3/Stage 4 generate waste stages. Subject to detailed assessment and design it is anticipated that the primary treatment system for Sediment Water from Stage 2 would comprise an engineered sediment basin.
- Capture and control of at least 75% of Sediment Water Run-off from operational general waste cells using contour banks to direct run-off to multiple new Sediment Water treatment areas located to the west within adjacent lower value disturbed vegetated areas. It is proposed to use a treatment train system comprising multiple containment measures to capture sediment prior to release of stormwater run-off into waterways located outside the site boundary.
- Capture and control of First Flush Water from the existing greenwaste hardstands into an interim treatment train system comprising multiple containment measures to capture sediment and attenuate nutrients prior to release of stormwater run-off into waterways located outside the site boundary. Depending on water quality monitoring results, it may be necessary to also construct a bioretention basin to further improve nutrient attenuation.

7.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled - “Important Information Relating to this Report”, which is included in Appendix F of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

Signature Page

Golder Associates Pty Ltd

James Begg
Principal Engineer, Waste Management

JSB/NR/NU/ol

A.B.N. 64 006 107 857

https://golderassociates.sharepoint.com/sites/124524/shared documents/deliverables/20140796-004-r-rev2 - shoal bay landfill water balance & management strategy.docx

APPENDIX A

Key Stage 3 to Stage 6 Design Documentation

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29th November 2001
Ref: sm:1719/094

Director Technical Services
Darwin City Council
GPO Box 84
Darwin NT 0801

ATTENTION: Mr. Chris Horsey

Dear Sir,

RE: SHOAL BAY WASTE DISPOSAL SITE
CONTRACT NO: 27/00-2007

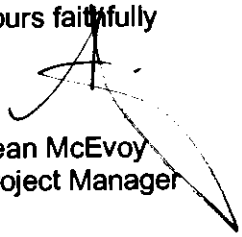
Please find attached updated and additional design information for Stage 3 Shoal Bay Waste Disposal Site.

The following attached drawings supersede conceptual information provided within Part B, Site Development Plan Section 3 and is provided for your information and approval.

1. Drawing no. 36206-CD-01, Drawing Index.
2. Drawing no. 36206-CD-02, Stage 3.1 Excavation Plan.
3. Drawing no. 36206-CD-03, Stage 3.1 Set-out Plan.
4. Drawing no. 36206-CD-04, Stage 3.1 Cross Sections.
5. Drawing no. 36206-CD-05, Stage 3.1 Sub-cell 1 Filling.
6. Drawing no. 36206-CD-06, Stage 3.1 Sub-cell 2 Filling and 3.2 Excavation Contours.
7. Drawing no. 36206-CD-07, Final Excavation Plan.
8. Drawing no. 36206-CD-08, Stage 3.2 Set-out Plan.
9. Drawing no. 36206-CD-09, Stage 3.2 Cross Sections.
10. Drawing no. 36206-CD-10, Stage 3.2 Cross Sections.
11. Drawing no. 36206-CD-11, Stage 3.2 Cross Sections.
12. Drawing no. 36206-CD-12, Stage 3.2 Cross Sections.
13. Drawing no. 36206-CD-13, Ultimate Cover Contours.
14. Drawing no. 36206-CD-15, Emergency Leachate Overflow Pond, Leachate Well and Temp Bund Details.
15. Drawing no. 36206-CD-16, Leachate Collection Layout.

If you have any queries or require further information please contact the undersigned.

Yours faithfully



Sean McEvoy
Project Manager

SHOAL BAY LANDFILL

DRAWING INDEX

DRAWING NO.	TITLE
36206-CD-01	DRAWING INDEX
36206-CD-02	STAGE 3.1 EXCAVATION PLAN
36206-CD-03	STAGE 3.1 SETOUT PLAN
36206-CD-04	STAGE 3.1 CROSS SECTIONS
36206-CD-05	STAGE 3.1 SUBCELL I FILLING
36206-CD-06	STAGE 3.1 SUBCELL II FILLING AND 3.2 EXCAVATION CONTOURS
36206-CD-07	FINAL EXCAVATION PLAN
36206-CD-08	STAGE 3.2 SETOUT PLAN
36206-CD-09	STAGE 3.2 CROSS SECTIONS - SHEET 1 OF
36206-CD-10	STAGE 3.2 CROSS SECTIONS - SHEET 2 OF
36206-CD-11	STAGE 3.2 CROSS SECTIONS - SHEET 3 OF
36206-CD-12	STAGE 3.2 CROSS SECTIONS - SHEET 4 OF
36206-CD-13	ULTIMATE COVER CONTOURS
36206-CD-14	EMERGENCY LEACHATE POND OVERFLOW EXCAVATION PLAN
36206-CD-15	EMERGENCY LEACHATE OVERFLOW POND, LEACHATE WELL AND TEMP. BUND DETAILS
36206-CD-16	LEACHATE COLLECTION LAYOUT

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CODE	DATE	AMMENDMENT / ISSUE DESCRIPTION	APPRN
2	27.11.01	ADDITIONAL DRAWINGS	D.C.

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PROJECT TITLE
SHOAL BAY LANDFILL
DRAWING INDEX

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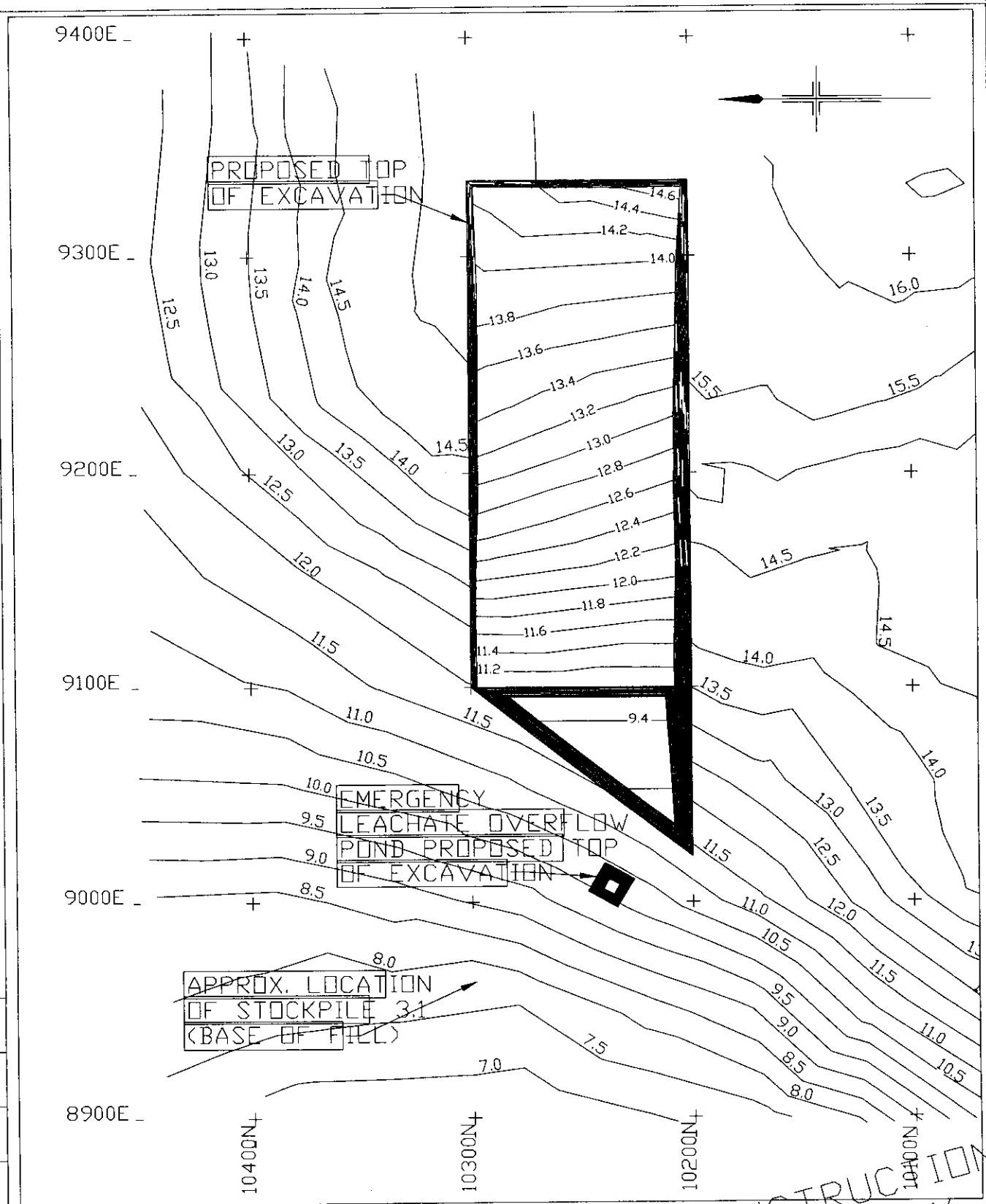

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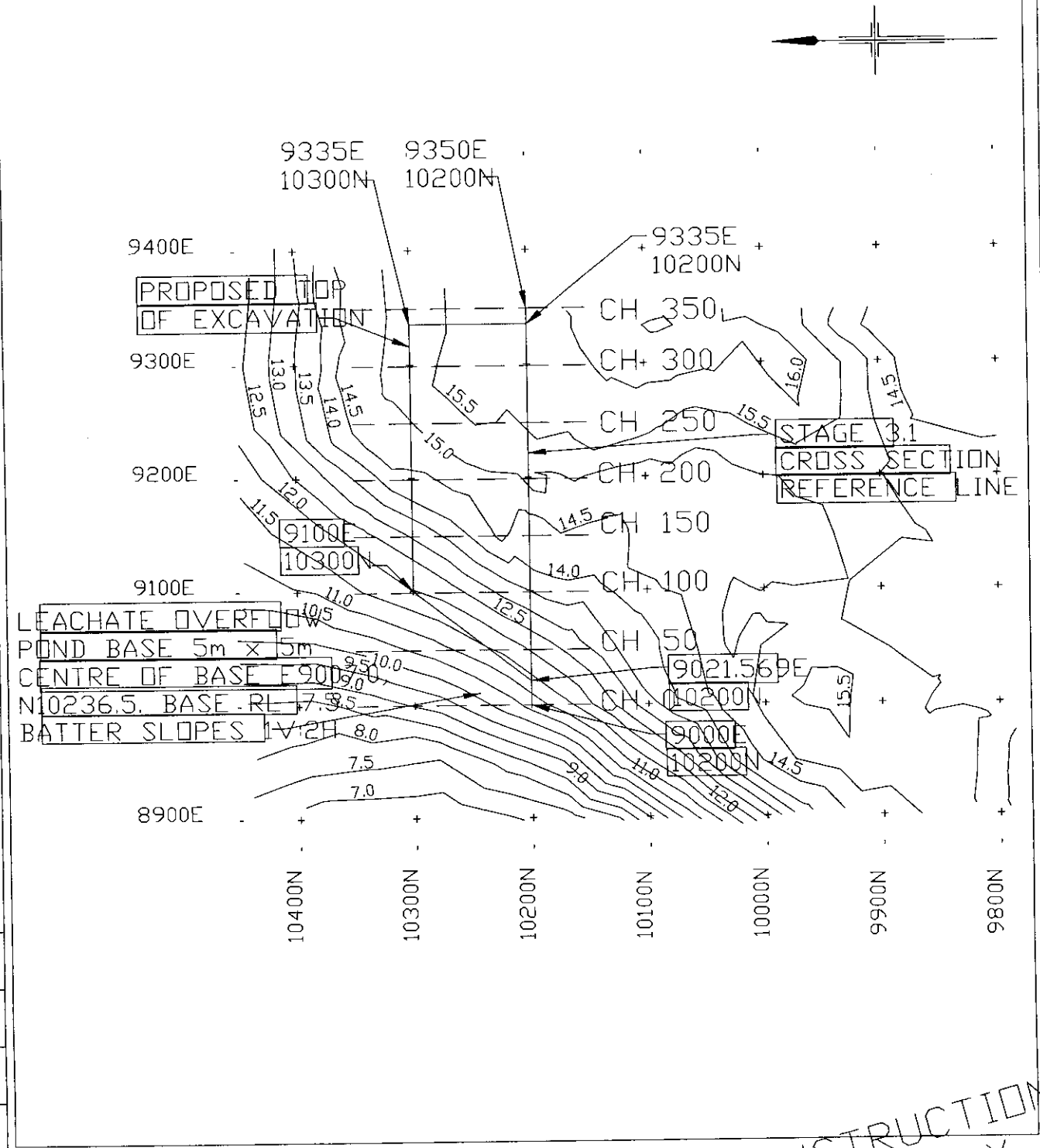

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PROJECT TITLE
SHOAL BAY LANDFILL
STAGE 3.1 SETOUT PLAN

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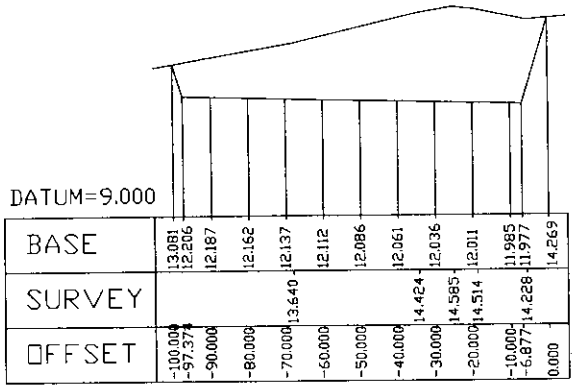

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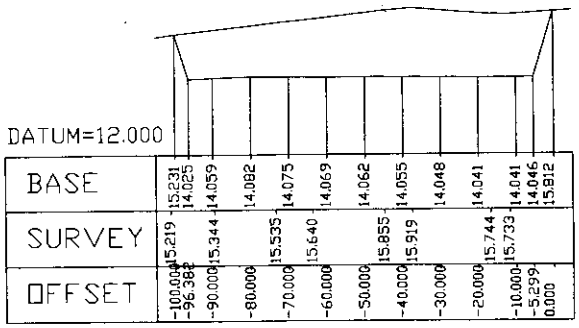

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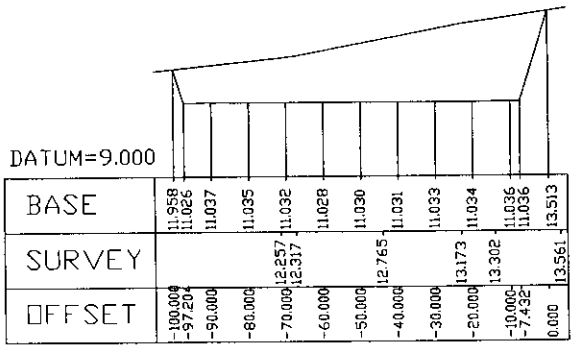

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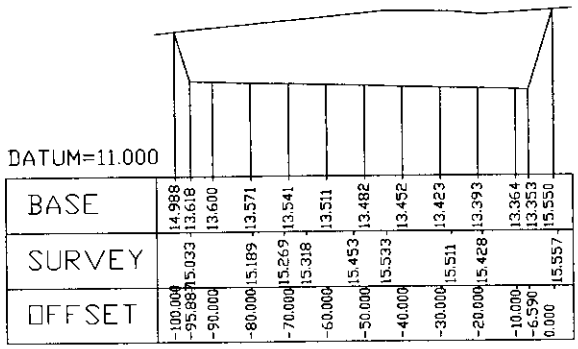

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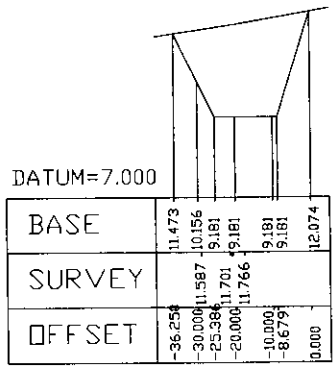

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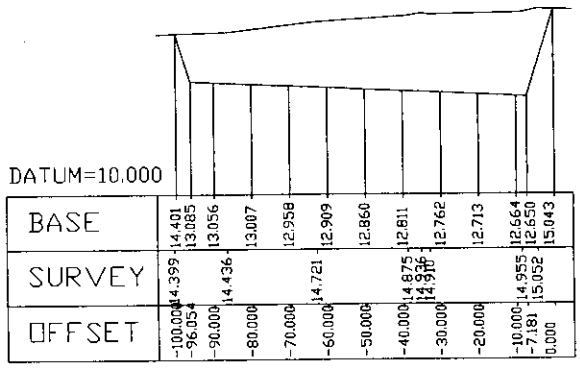

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SCALE 1: 2000

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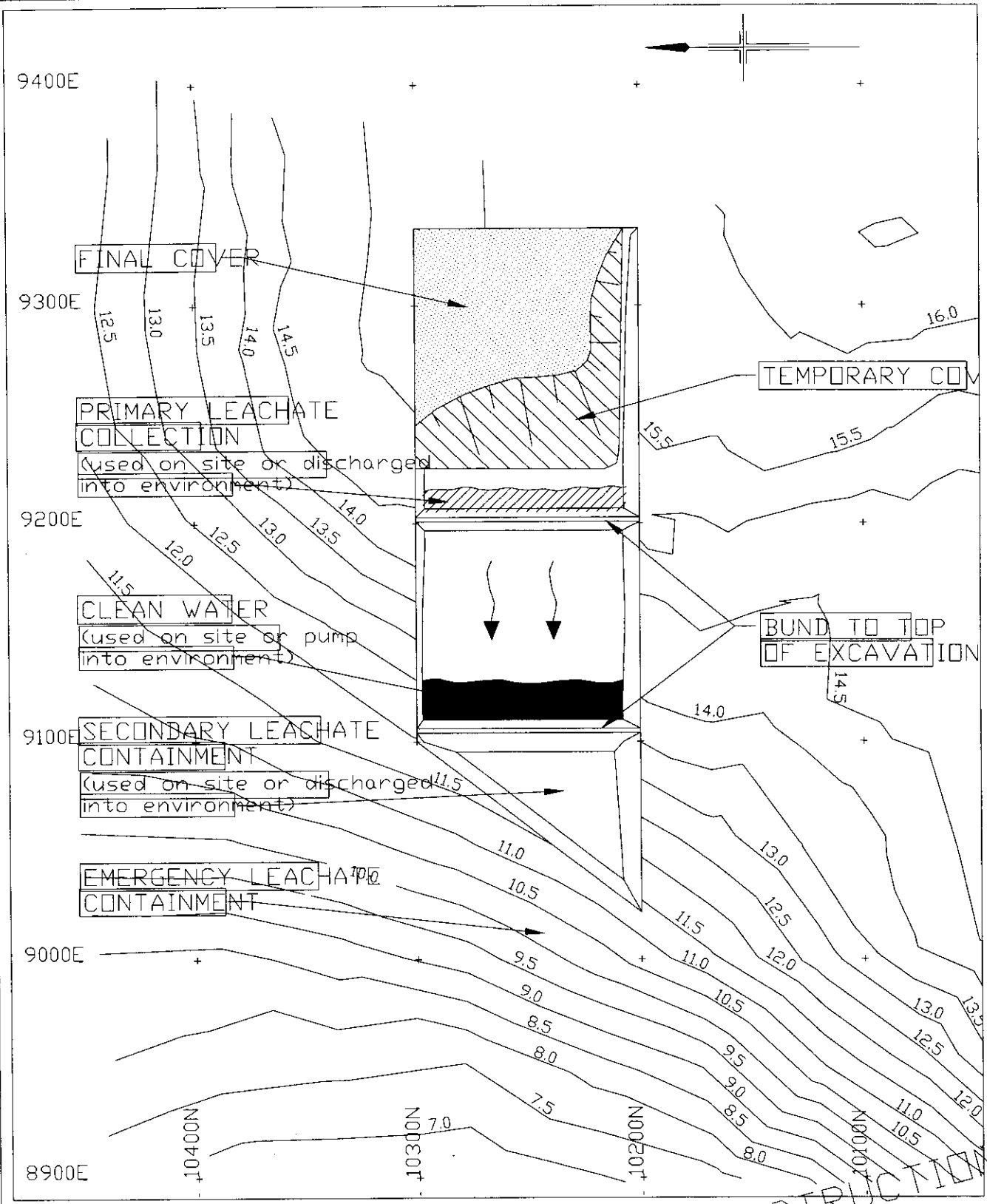

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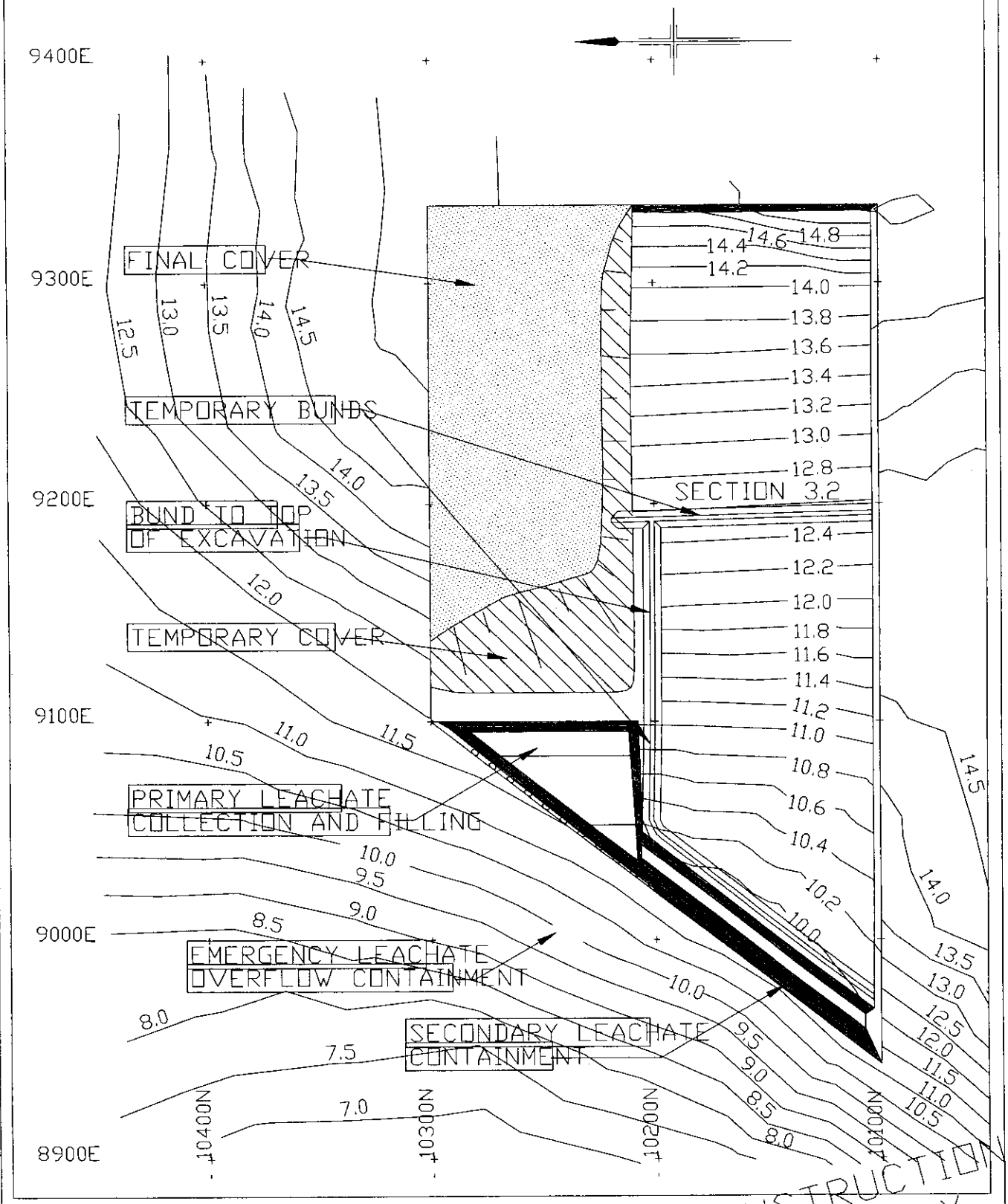
PROJECT TITLE
SHOAL BAY LANDFILL
STAGE 3.1 SUBCELL I FILLING

SCALE	APPROVED	PROJECT / DRAWING No.	ISSUE
1:2500		36206-CD-05	2



CODE	DATE	AMMENDMENT / ISSUE DESCRIPTION	APPRN
2	27.11.01	POND & STOCKPILE RELOCATED	

NOT FOR CONSTRUCTION
FOR REVIEW ONLY

0 50 100 150 200m

SCALE 1: 2500 (on A1 Sheet)

100 mm ON ORIGINAL

HWE Henry Walker Eltin

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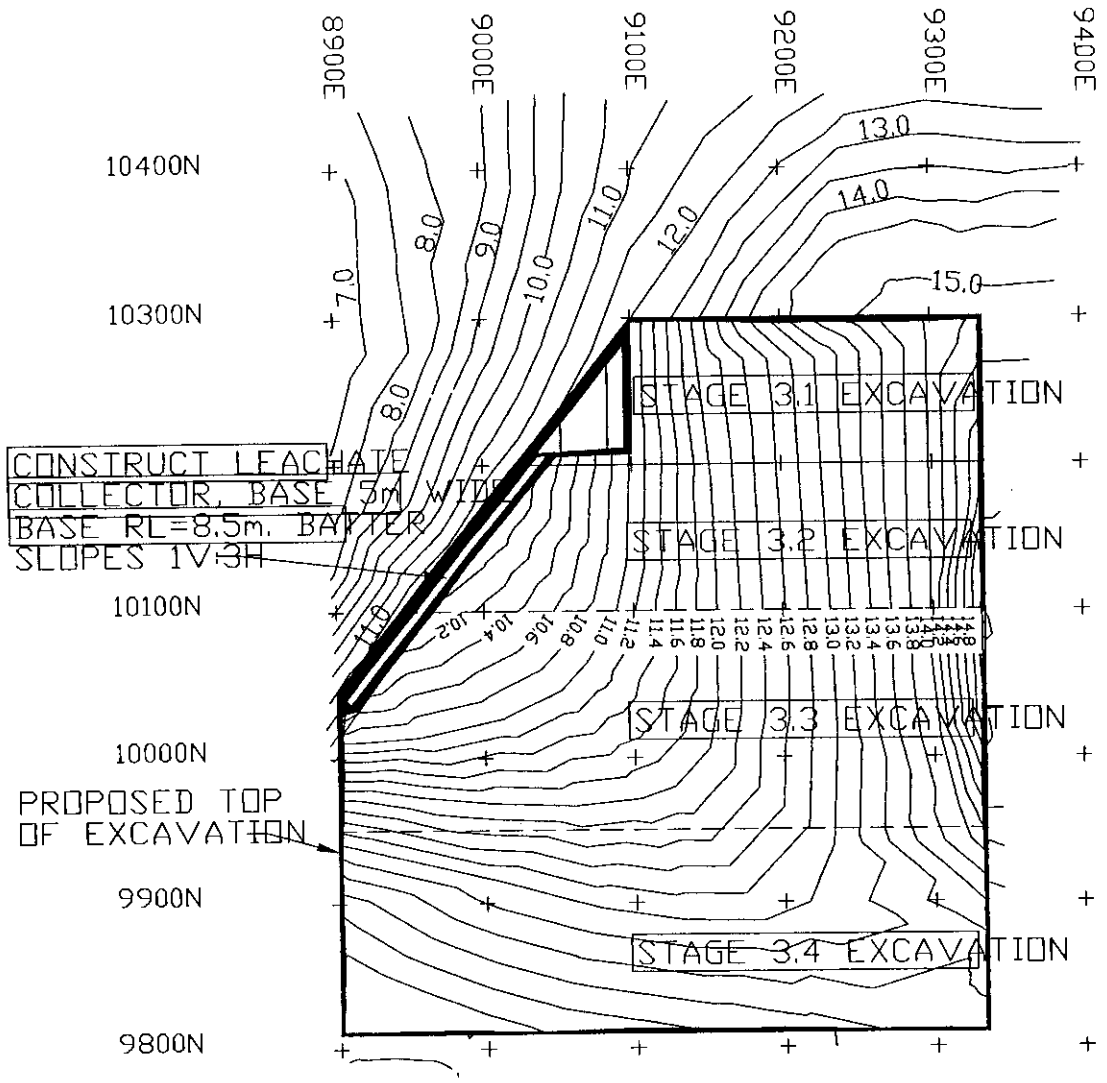
PROJECT TITLE
SHOAL BAY LANDFILL
STAGE 3.1 SUBCELL II FILLING AN
3.2 EXCAVATION CONTOURS

SCALE	APPROVED	PROJECT / DRAWING No.	ISSUE
1:2500		36206-CD-06	



CODE	DATE	AMMENDMENT / ISSUE DESCRIPTION	APPRN
2	27.11.01	POND & STOCKPILE RELOCATED	

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0 100 200 300 400m

100 mm ON ORIGINAL

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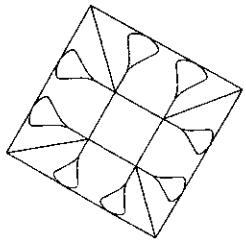
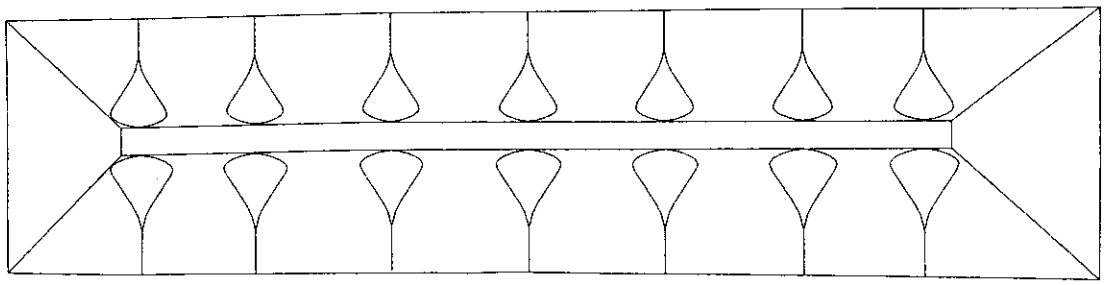
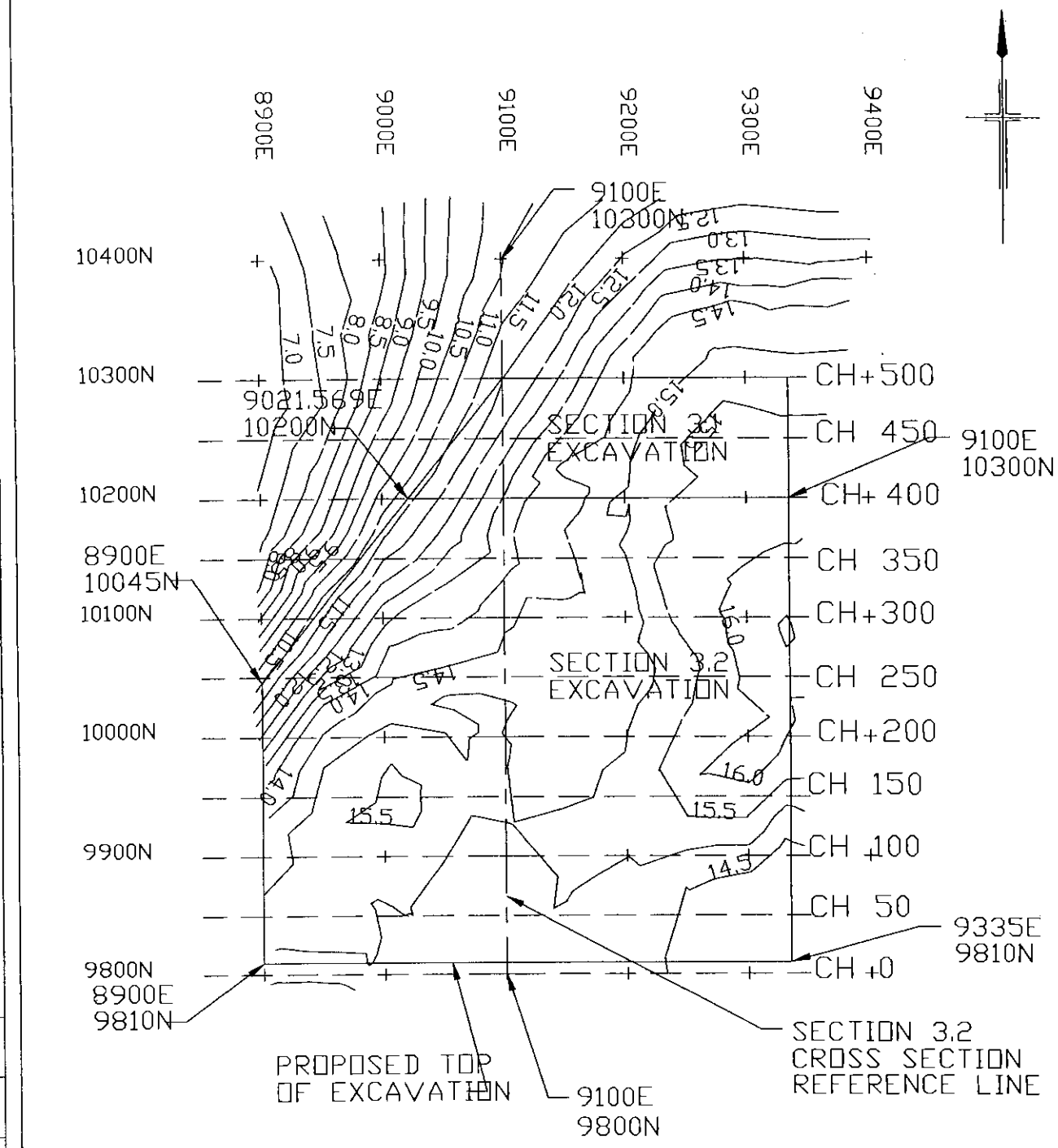
PROJECT TITLE
SHOAL BAY LANDFILL FINAL EXCAVATION PLAN

SCALE	APPROVED	PROJECT / DRAWING No.	ISSUE
1:5000		36206-CD-07	2







CODE	DATE	AMMENDMENT / ISSUE DESCRIPTION	APPROVED

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0 100 200 300 400m

100 mm ON ORIGINAL

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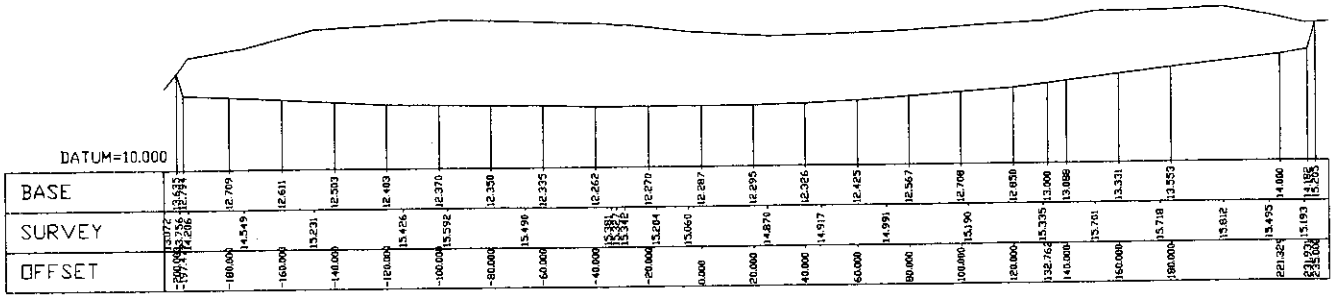
PROJECT TITLE
SHOAL BAY LANDFILL
STAGE 3.2 SETOUT PLAN

SCALE	APPROVED	PROJECT / DRAWING No	ISSUE
1:5000		36206-CD-08	



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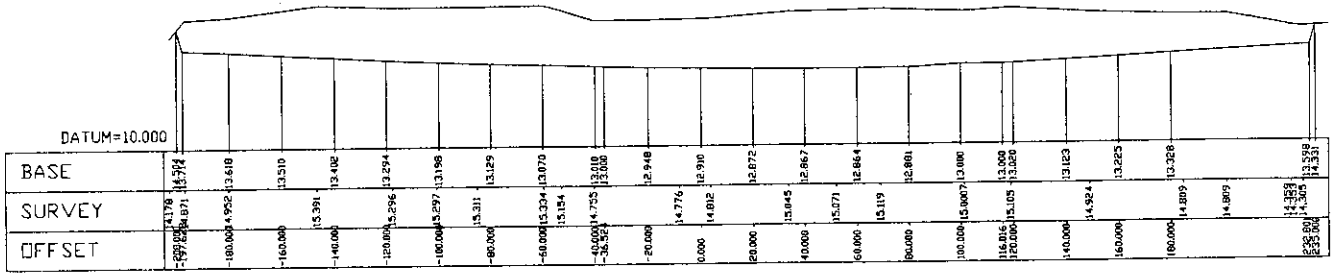

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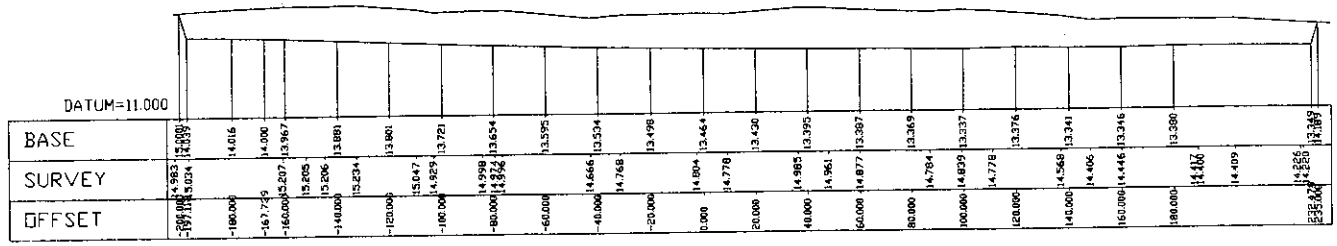

CHAINAGE 50.000

VERT. 0 5 10 15m
SCALE 1: 200

HORIZ. 0 50 100 150m
SCALE 1: 2000

NOT FOR CONSTRUCTION
FOR REVIEW ONLY

100 mm ON ORIGINAL

CODE	DATE	AMENDMENT / ISSUE DESCRIPTION	APPROVAL	TITLE	INITIAL	SIGNATURE	DATE
				DRAFTSMAN			
				DESIGNER			
				PROJ. MANAGER			
				PROJ.DIRECTOR			

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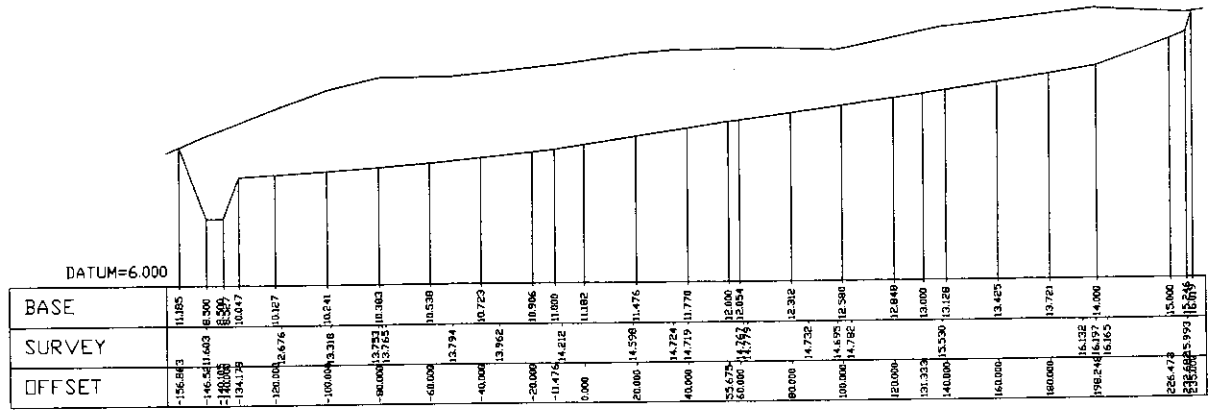
PROJECT TITLE
SHOAL BAY LANDFILL

STAGE 3.2 CROSS SECTIONS
SHEET 1 OF 4

SCALE	DRAWING STATUS	PROJECT / DRAWING No.	ISSUE
AS SHOWN		36206-CD-09	1



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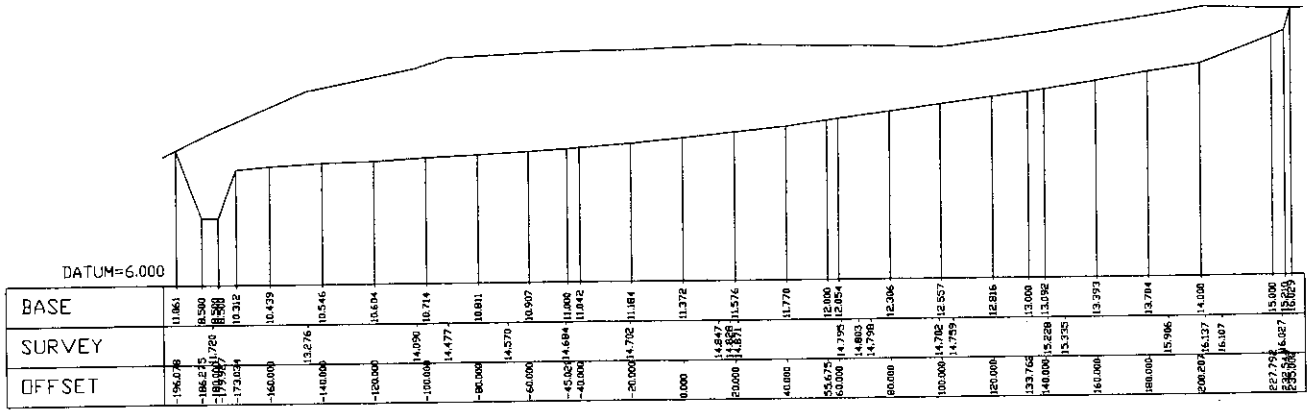

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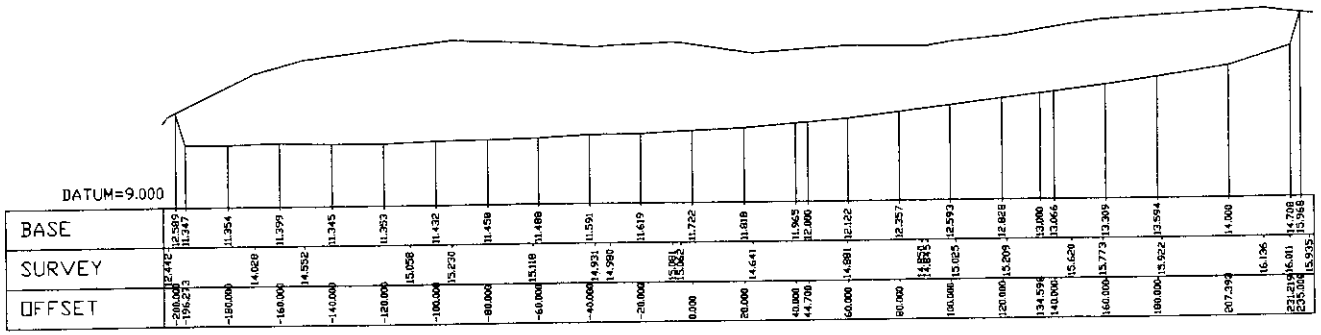

CHAINAGE 200.000

VERT. SCALE 1: 200

HORIZ. SCALE 1: 2000

NOT FOR CONSTRUCTION FOR REVIEW ONLY

100 mm ON ORIGINAL

CODE	DATE	AMENDMENT / ISSUE DESCRIPTION	APPROVAL	TITLE	INITIAL	SIGNATURE	DATE
				DRAFTSMAN			
				DESIGNER			
				PROJ. MANAGER			
				PROJ.DIRECTOR			

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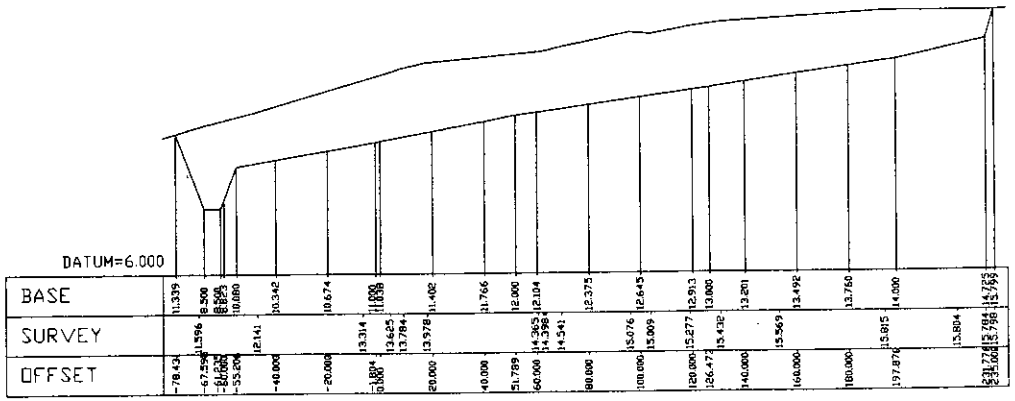
PROJECT TITLE
SHOAL BAY LANDFILL

STAGE 3.2 CROSS SECTIONS
SHEET 2 OF 4

SCALE	DRAWING STATUS	PROJECT / DRAWING No.	ISSUE
AS SHOWN		36206-CD-10	1



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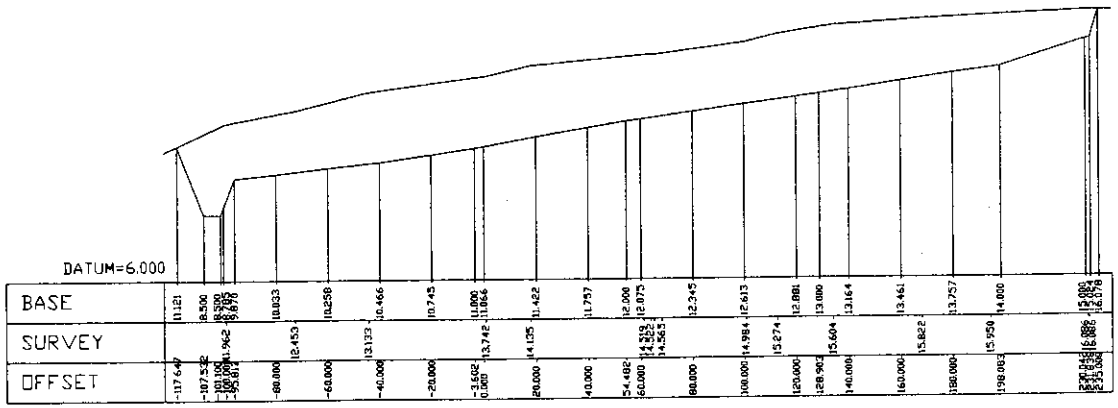

CHAINAGE 350.000

VERT. 0 5 10 15m
SCALE 1: 200

HORIZ. 0 50 100 150m
SCALE 1: 2000

NOT FOR CONSTRUCTION
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100 mm ON ORIGINAL

CODE	DATE	AMENDMENT / ISSUE DESCRIPTION	APPROVAL

TITLE	INITIAL	SIGNATURE	DATE
DRAFTSMAN			
DESIGNER			
PROJ. MANAGER			
PROJ.DIRECTOR			

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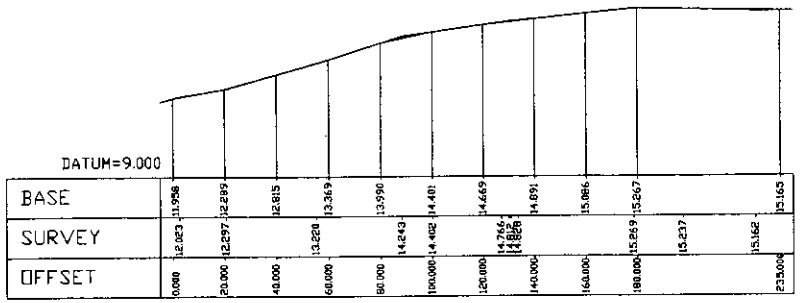
PROJECT TITLE
SHOAL BAY LANDFILL

STAGE 3.2 CROSS SECTIONS
SHEET 3 OF 4

SCALE	DRAWING STATUS	PROJECT / DRAWING No.	ISSUE
AS SHOWN		36206-CD-11	1



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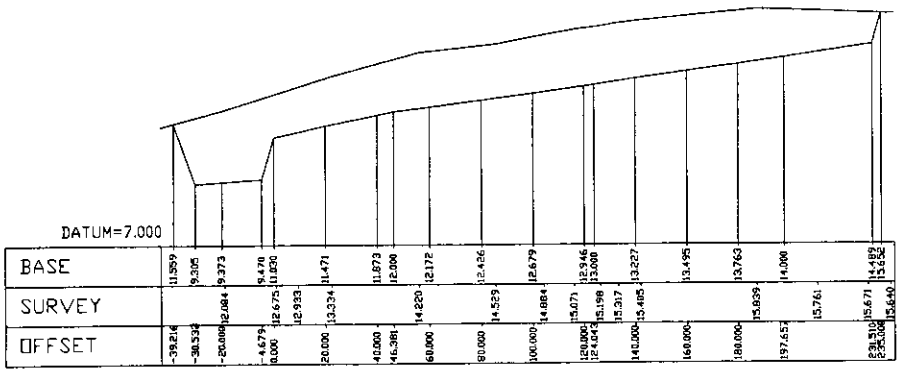

CHAINAGE 450.000

VERT. SCALE 1: 100

HORIZ. SCALE 1: 2000

NOT FOR CONSTRUCTION
FOR REVIEW ONLY

100 mm ON ORIGINAL

CODE	DATE	AMENDMENT / ISSUE DESCRIPTION	APPROVAL

TITLE	INITIAL	SIGNATURE	DATE
DRAFTSMAN			
DESIGNER			
PROJ. MANAGER			
PROJ.DIRECTOR			

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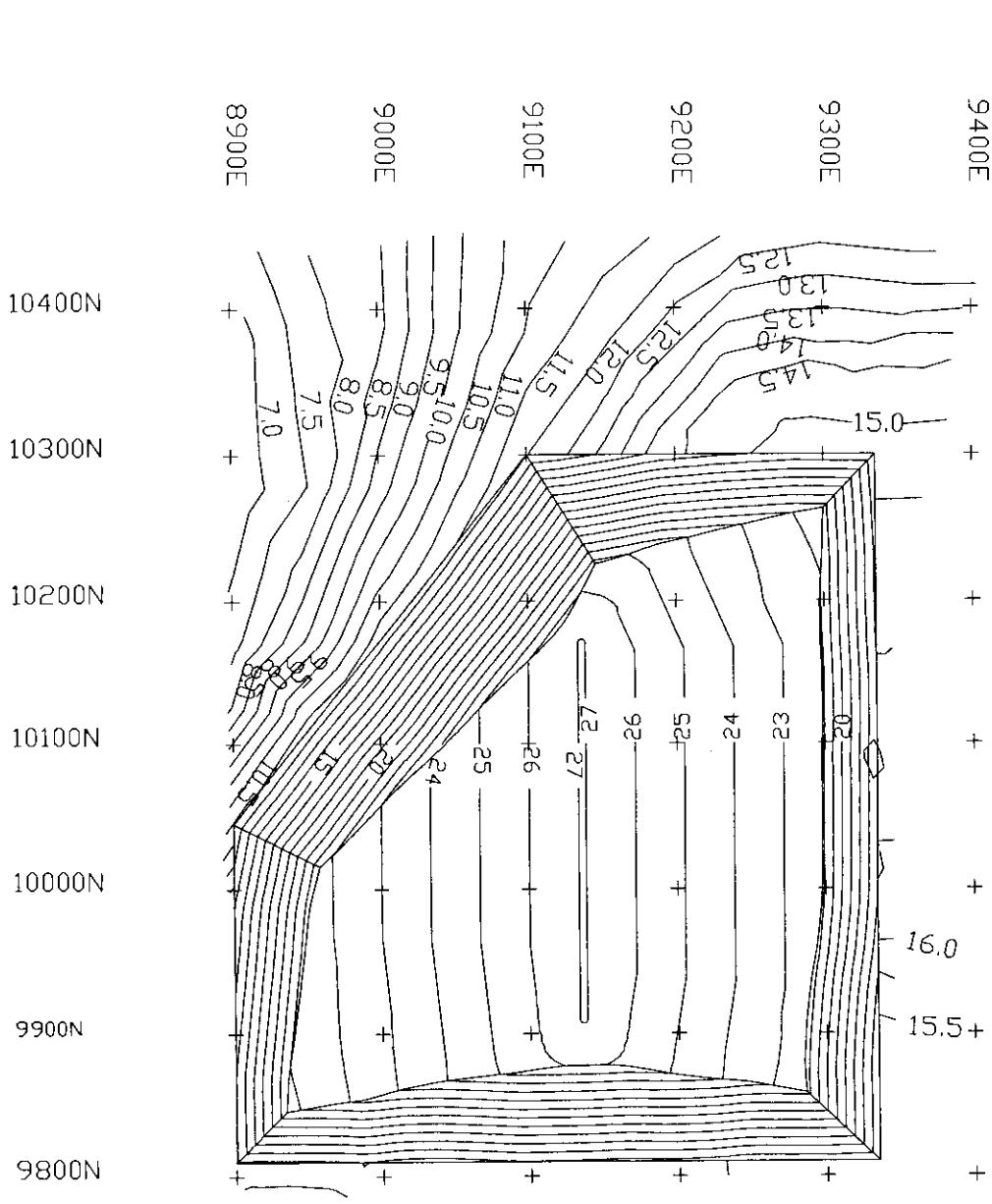
PROJECT TITLE
SHOAL BAY LANDFILL

STAGE 3.2 CROSS SECTIONS
SHEET 4 OF 4

SCALE	DRAWING STATUS	PROJECT / DRAWING No.	ISSUE
AS SHOWN		36206-CD-12	1



CODE	DATE	AMMENDMENT / ISSUE DESCRIPTION	APPRN

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FOR REVIEW ONLY

0 100 200 300 400m

100 mm ON ORIGINAL

0 10 20 30 40 50 60 70 80 90 100

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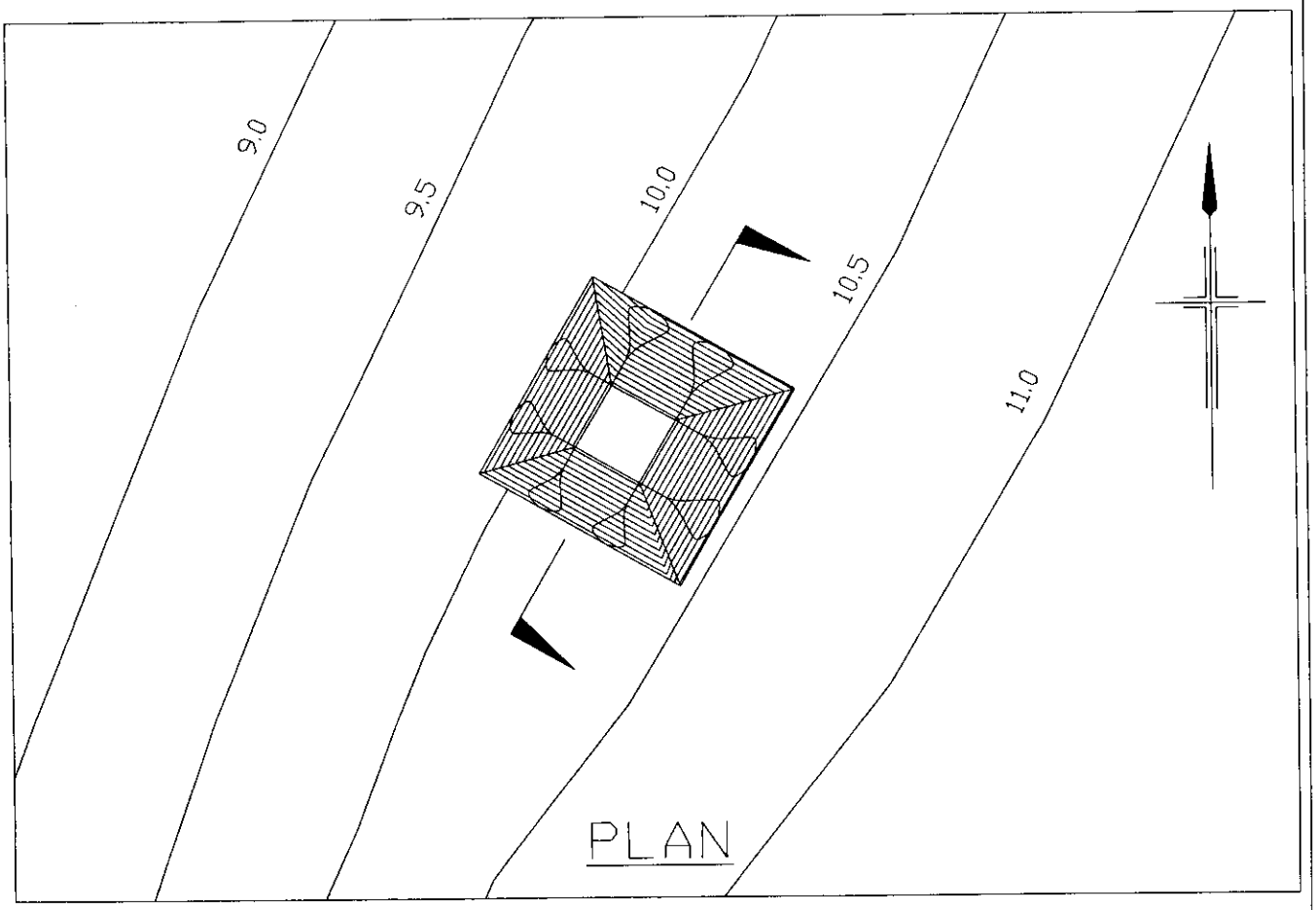
PROJECT TITLE
SHOAL BAY LANDFILL
ULTIMATE COVER CONTOURS

SCALE	APPROVED	PROJECT / DRAWING No.	ISSUE
1:5000		36206-CD-13	



DATUM=5.000

POND_BASE	9.922	7.500	7.500	10.460
SURVEY	9.830			
OFFSET	-7.343	-2.500	2.500	8.421

TYPICAL SECTION

CODE	DATE	AMMENDMENT / ISSUE DESCRIPTION	APP'D

0 10 20 30 40m

SCALE 1: 500

0 20 40 60 80m

SCALE 1: 1000

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100 mm ON ORIGINAL

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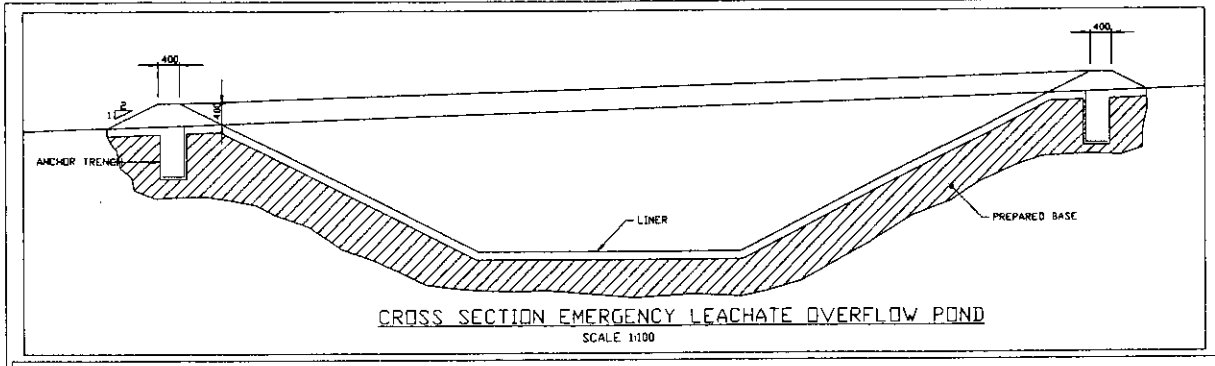
PH 08 9221-5900 FAX 08 9221-5901

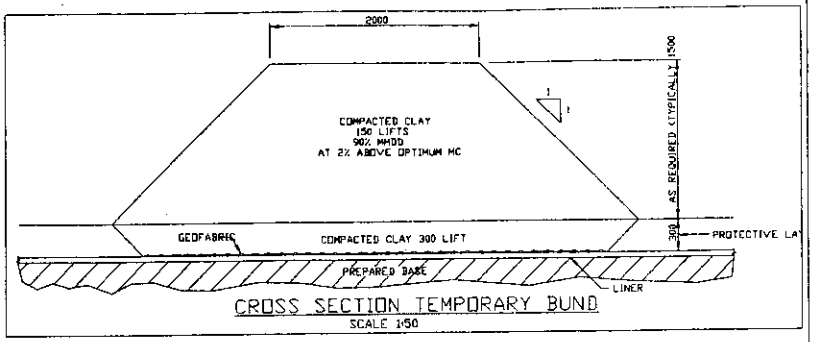
PROJECT TITLE
SHOAL BAY LANDFILL
EMERGENCY LEACHATE POND OVERFL
EXCAVATION PLAN

SCALE	APPROVED	PROJECT / DRAWING No.	ISSUE
PLAN 1:500 SECT 1:1000		36206-CD-14	



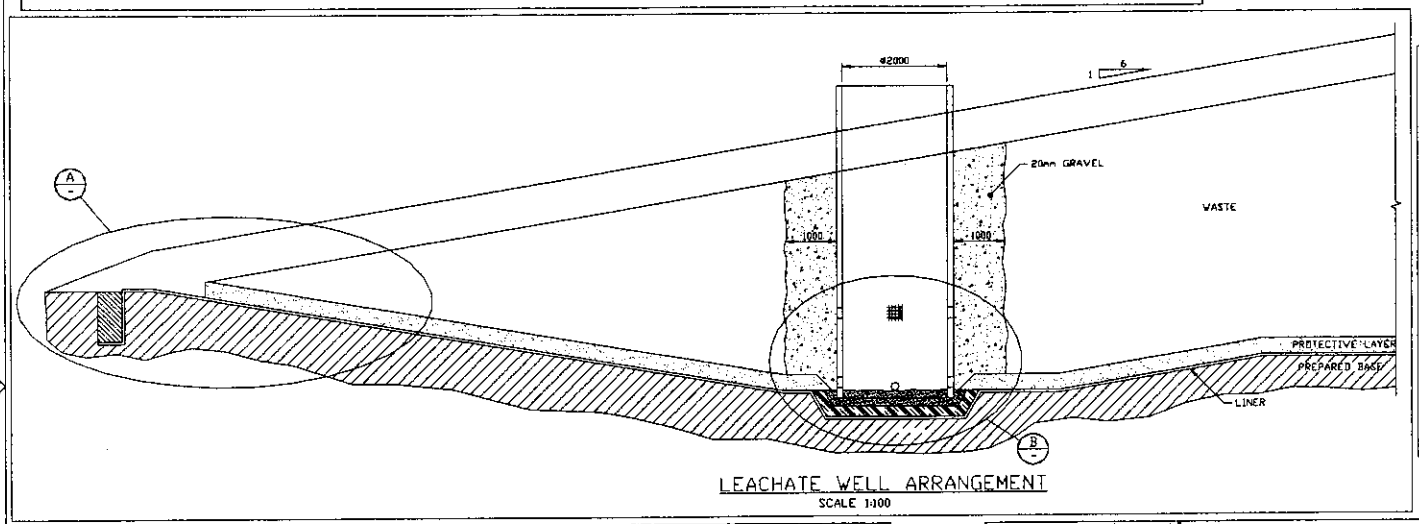
CROSS SECTION EMERGENCY LEACHATE OVERFLOW POND

SCALE 1:100



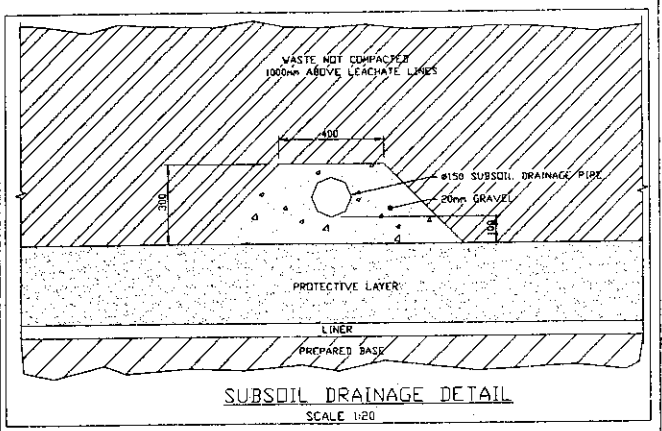
CROSS SECTION TEMPORARY BUND

SCALE 1:50



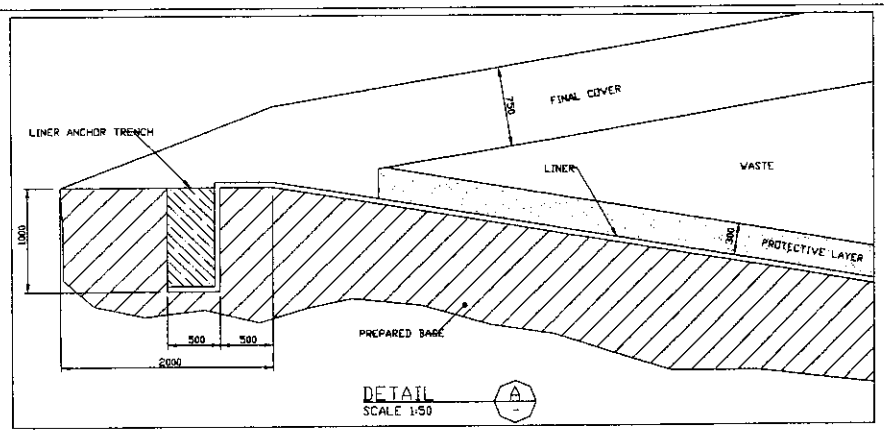
LEACHATE WELL ARRANGEMENT

SCALE 1:100



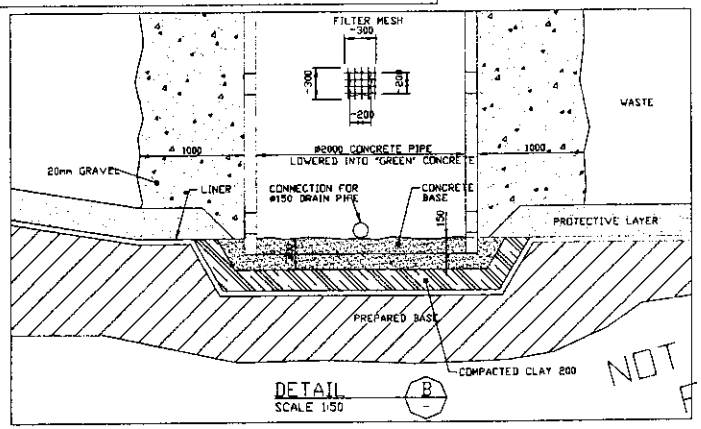
SUBSOIL DRAINAGE DETAIL

SCALE 1:20



DETAIL A

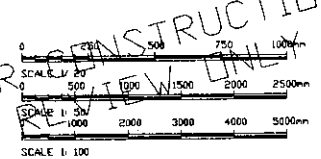
SCALE 1:50



DETAIL B

SCALE 1:50

NOTE:
FIRST 1000mm OF WASTE ABOVE THE LINER PROTECTION LAYER SHALL NOT CONTAIN OBJECTS THAT CAN PENETRATE THE PROTECTIVE LAYER AND LINER.



CODE	DATE	AMENDMENT / ISSUE DESCRIPTION	APPROV	TITLE	INITIAL	SIGNATURE	DATE
				DRAFTSMAN			
				DESIGNER			
				PROJ. MANAGER			
				PROJ.DIRECTOR			

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Henry Walker Eltin

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PROJECT TITLE
SHOAL BAY LANDFILL

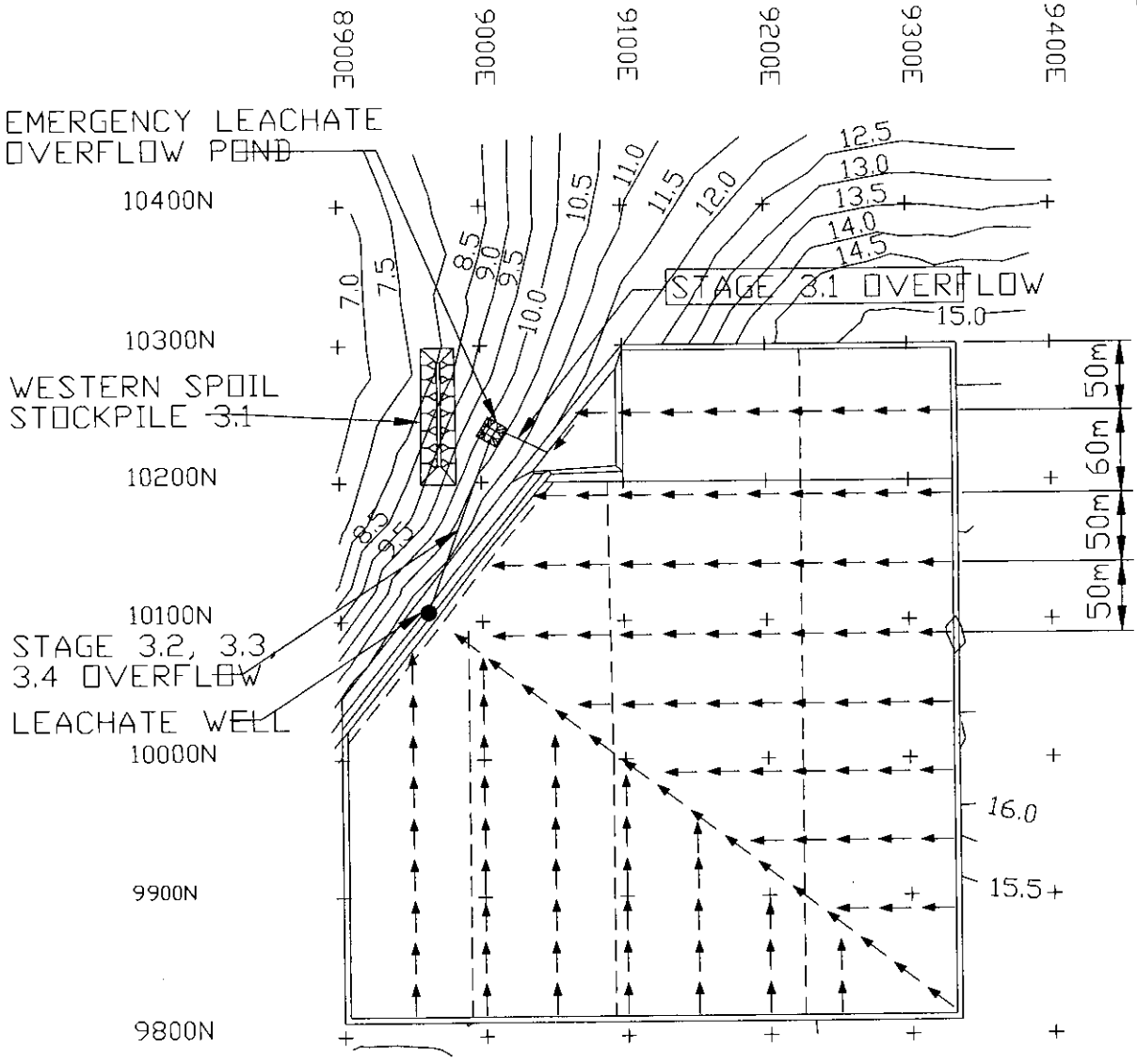
EMERGENCY LEACHATE OVERFLOW POND LEACHATE WELL AND TEMP. BUND DETA

SCALE	DRAWING STATUS	PROJECT / DRAWING No.	ISSUE
AS SHOWN		36206-CD-15	1

LEGEND:

200mm DRAINAGE PIPE

TEMPORARY BUNDS



CODE	DATE	AMMENDMENT / ISSUE DESCRIPTION	APPD

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0 100 200 300 400m

100 mm ON ORIGINAL

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PERTH WA. 6000
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PROJECT TITLE
SHOAL BAY LANDFILL
LEACHATE COLLECTION LAYOUT

SCALE	APPROVED	PROJECT / DRAWING No.	ISSUE
1:5000		36206-CD-16	

DARWIN CITY COUNCIL
SHOAL BAY WASTE DISPOSAL FACILITY
LANDFILL EXTENSION 1-A
41-23955-04

SHOAL BAY WASTE DISPOSAL FACILITY

(IMAGE EXTRACTEDFROM GOOGLE EARTH PRO - 19/01/12)

LOCALITY PLAN

N.T.S.

DRAWING LIST

DRG No.	DRAWING TITLE
41-23955-04-C101	LOCALITY PLAN
41-23955-04-C102	EXISTING SITE CONDITIONS & PROPOSED WORKS
41-23955-04-C103	TOP OF SUBGRADE
41-23955-04-C104	LEACHATE COLLECTION SYSTEM LAYOUT
41-23955-04-C105	TYPICAL SECTIONS - SHEET 1 OF 2
41-23955-04-C106	TYPICAL SECTIONS - SHEET 2 OF 2
41-23955-04-C107	TYPICAL DETAILS - SHEET 1 OF 2
41-23955-04-C108	TYPICAL DETAILS - SHEET 2 OF 2
41-23955-04-G001	GENERAL NOTES - CIVIL

FOR TENDER

No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
0	ISSUED FOR TENDER	AL	DB*	SD*	10.08.12

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GPO Box 668 Brisbane QLD 4001
T 61 7 3316 3000 **F** 61 7 3316 3333
E bnemail@ghd.com **W** www.ghd.com

DO NOT SCALE

Drawn	A.LIN	Designer	D.BARRETT
Drafting Check	M.HAMMOND*	Design Check	S.DEVER*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DARWIN CITY COUNCIL
Project: SHOAL BAY WASTE DISPOSAL FACILITY
Title: LANDFILL EXTENSION 1-A
LOCALITY PLAN

Original Size: A1
Drawing No: 41-23955-04-C101
Rev: 0

Plot Date: 10 August 2012 - 2:03 PM Plotted by: Aeran Lin Cad File No: G:\41\23955\CADD\Drawings\Work package 4\CELL EST 1 REVD\41-23955-04-C101.dwg

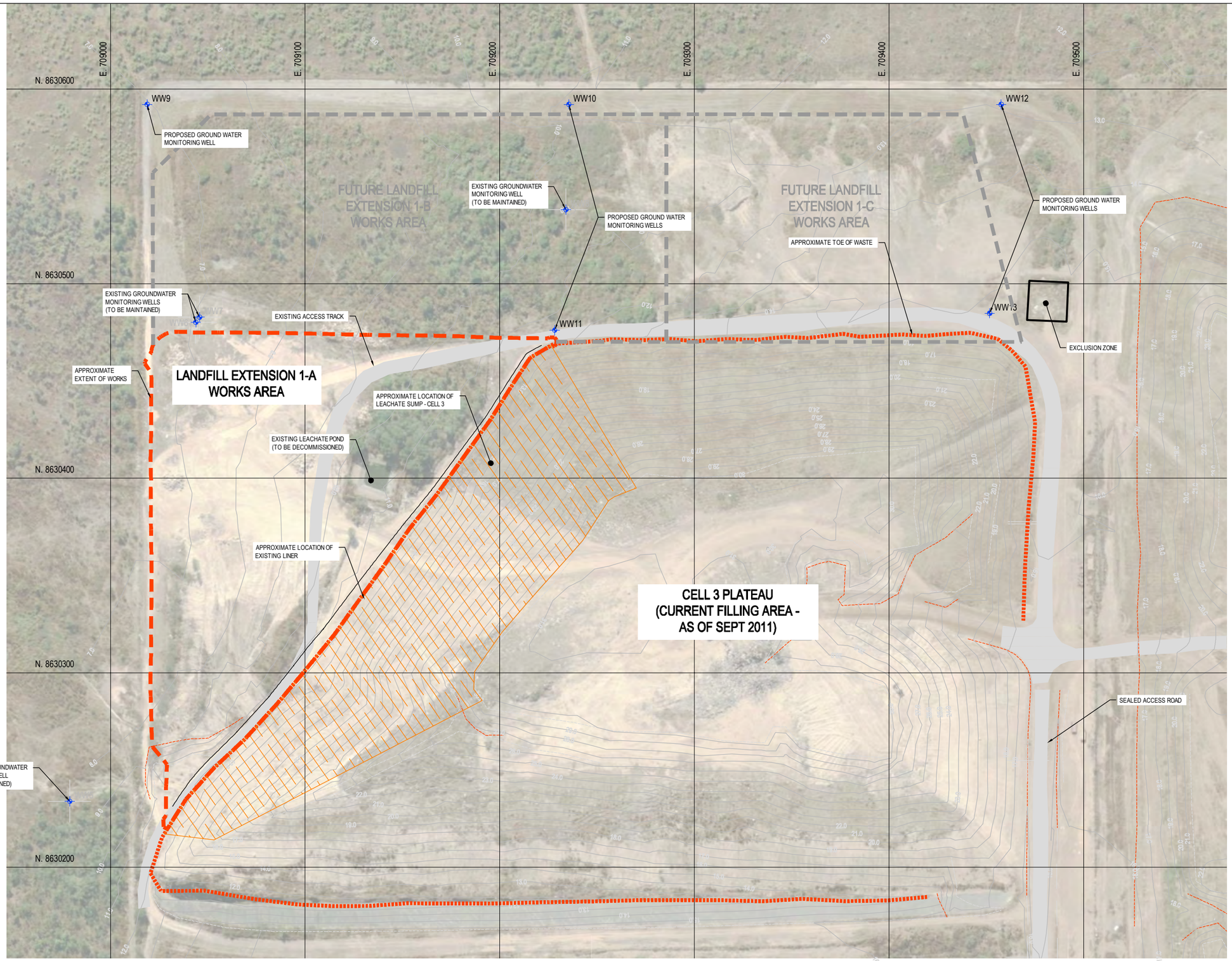
N

LEGEND

- EXTENT OF WORKS
- APPROX. TOE OF WASTE
- EXISTING CONTOURS
- CELL 3 AS BUILT LINER CONTOURS
- FENCE
- UNSEALED ACCESS TRACK
- EXISTING BOREHOLE LOCATION (WW8)
- PROPOSED BOREHOLE LOCATION (REFER NOTE 4) (WW9)

NOTES:

1. SEE DWG 41-23955-04-G001 FOR GENERAL NOTES.
2. LOCATIONS OF PROPOSED BOREHOLES TO BE AGREED WITH SUPERINTENDENT ONSITE.



FOR TENDER

No	Revision	Drawn	Job Manager	Project Director	Date
0	ISSUED FOR TENDER	AL	DB*	SD*	10.08.12

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 10 20 30 40 50m

SCALE 1:1000 AT ORIGINAL SIZE

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DO NOT SCALE

Drawn	A.LIN	Designer	D.BARRETT
Drafting Check	M.HAMMOND*	Design Check	S.DEVER*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DARWIN CITY COUNCIL

Project: SHOAL BAY WASTE DISPOSAL FACILITY

Title: LANDFILL EXTENSION 1-A
EXISTING SITE CONDITIONS & PROPOSED WORKS

Original Size: A1

Drawing No: 41-23955-04-C102

Rev: 0

Plot Date: 10 August 2012 - 2:02 PM Plotted by: Aeran Lin Cad File No: G:\41\23955\CADD\Drawings\Work package 4\CELL EST 1 REVD\41-23955-04-C102.dwg

EXISTING CONTOURS

DESIGN CONTOURS

FENCE

WASTE BATTER TO BE REPROFILED (IF REQUIRED)

CELL 3 LINER LOCATION

EXISTING BOREHOLE LOCATION WW8

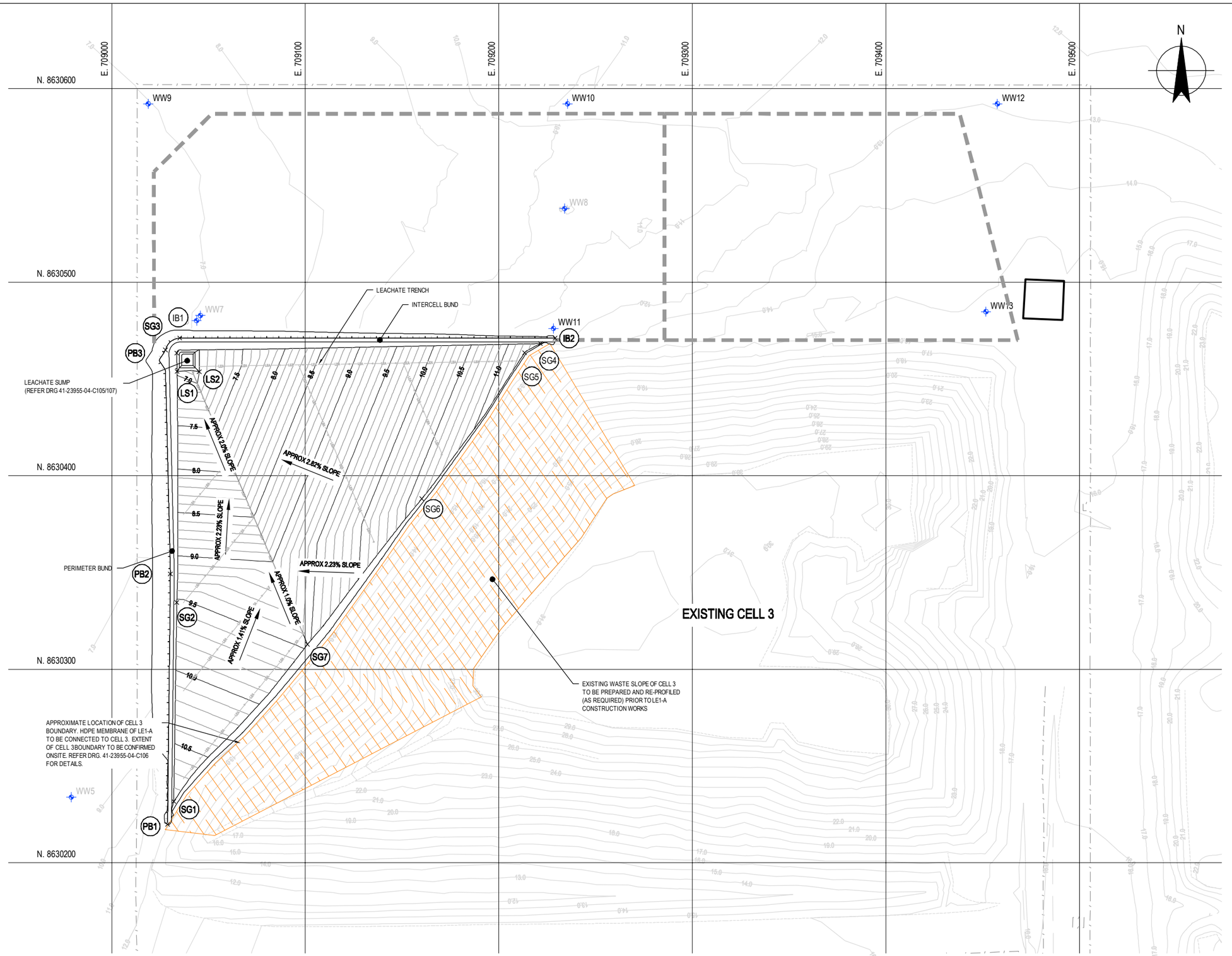
PROPOSED BOREHOLE LOCATION WW9

1. SEE DWG 41-23955-04-G001 FOR GENERAL NOTES.

BUND SETOUT POINT TABLE			
POINT	EASTING	NORTHING	RL
PB1	709028.857	8630219.862	12.229
PB2	709030.235	8630352.230	10.082
PB3	709027.749	8630464.935	8.864
IB1	709035.096	8630471.102	8.883
IB2	709229.088	8630471.081	11.781

LEACHATE SUMP SETOUT POINT TABLE			
POINT	EASTING	NORTHING	RL
LS1	709033.829	8630447.586	6.976
LS2	709044.173	8630447.587	7.000

SUBGRADE SETOUT POINT TABLE			
POINT	EASTING	NORTHING	RL
SG1	709032.005	8630231.740	10.863
SG2	709033.595	8630334.543	9.100
SG3	709033.552	8630463.359	6.850
SG4	709221.440	8630468.293	11.426
SG5	709213.250	8630463.416	11.263
SG6	709160.194	8630386.074	10.686
SG7	709101.129	8630312.685	9.469



FOR TENDER

No	Revision	Drawn	Job Manager	Project Director	Date
0	ISSUED FOR TENDER	AL	DB*	SD*	10.08.12

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 10 20 30 40 50m

SCALE 1:1000 AT ORIGINAL SIZE

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Drawn	A.LIN	Designer	D.BARRETT
Drafting Check	M.HAMMOND*	Design Check	S.DEVER*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client DARWIN CITY COUNCIL
Project SHOAL BAY WASTE DISPOSAL FACILITY
Title LANDFILL EXTENSION 1-A
TOP OF SUBGRADE

Original Size A1 Drawing No: 41-23955-04-C103 Rev: 0

Plot Date: 10 August 2012 - 2:19 PM Plotted by: Aeran Lin Cad File No: G:\41\23955\CADD\Drawings\Work package 4\CELL EST 1 REVD\41-23955-04-C103.dwg

LEGEND

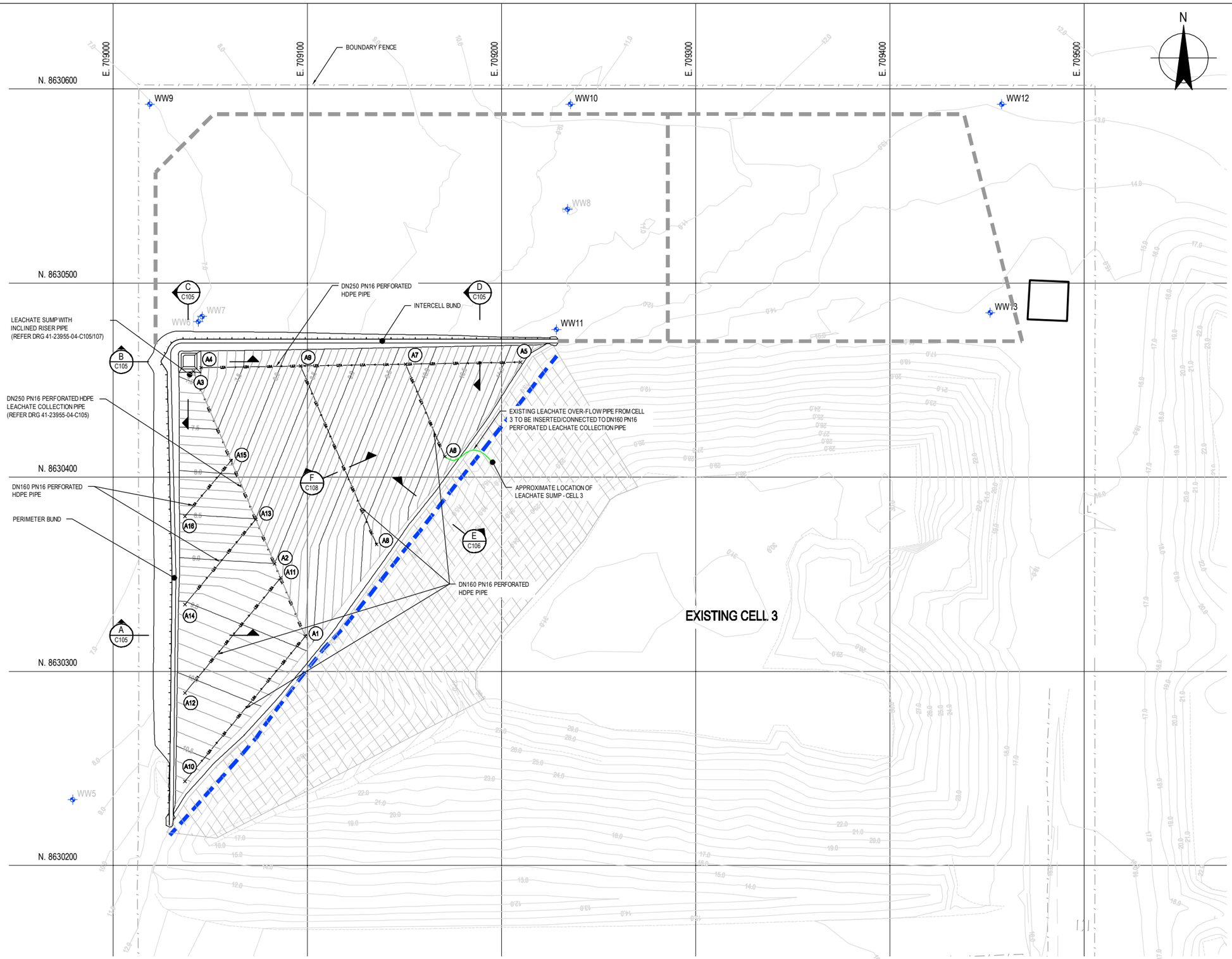
- APPROX. PROPOSED CELL 3 LINER CONNECTION
- EXISTING CONTOURS
- DESIGN CONTOURS
- FENCE
- LEACHATE COLLECTION PIPE
- EXISTING BOREHOLE LOCATION — WW8
- PROPOSED BOREHOLE LOCATION — WW9

NOTES:

1. SEE DWG 41-23955-04-G001 FOR GENERAL NOTES.

LEACHATE SETOUT POINT TABLE

POINT	EASTING	NORTHING	COMMENTS
A1	709098.943	8630318.056	LANDFILL EXT 1-A
A2	709083.117	8630355.483	LANDFILL EXT 1-A
A3	709041.270	8630454.453	LANDFILL EXT 1-A
A4	709045.189	8630456.405	LANDFILL EXT 1-A
A5	709209.711	8630459.219	LANDFILL EXT 1-A
A6	709170.789	8630410.663	LANDFILL EXT 1-A
A7	709150.591	8630458.214	LANDFILL EXT 1-A
A8	709135.684	8630365.418	LANDFILL EXT 1-A
A9	709096.474	8630457.294	LANDFILL EXT 1-A
A10	709036.939	8630243.379	LANDFILL EXT 1-A
A11	709086.198	8630348.198	LANDFILL EXT 1-A
A12	709036.939	8630288.871	LANDFILL EXT 1-A
A13	709073.453	8630378.340	LANDFILL EXT 1-A
A14	709036.939	8630334.364	LANDFILL EXT 1-A
A15	709060.707	8630408.482	LANDFILL EXT 1-A
A16	709036.939	8630379.856	LANDFILL EXT 1-A



FOR TENDER

No	Revision	Drawn	DB* Job Manager	SD* Project Director	Date
0	ISSUED FOR TENDER	AL	DB*	SD*	10.08.12

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

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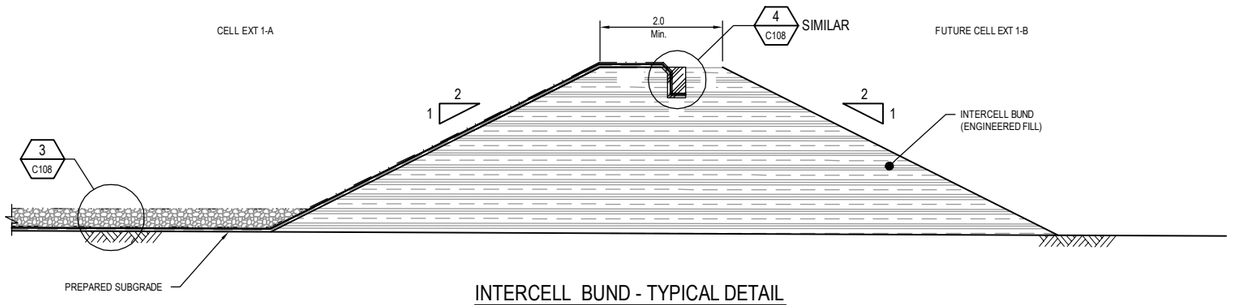
Drafting Check	M.HAMMOND*	Design Check	S.DEVER*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DARWIN CITY COUNCIL
Project: SHOAL BAY WASTE DISPOSAL FACILITY
Title: LANDFILL EXTENSION 1-A
LEACHATE COLLECTION SYSTEM LAYOUT

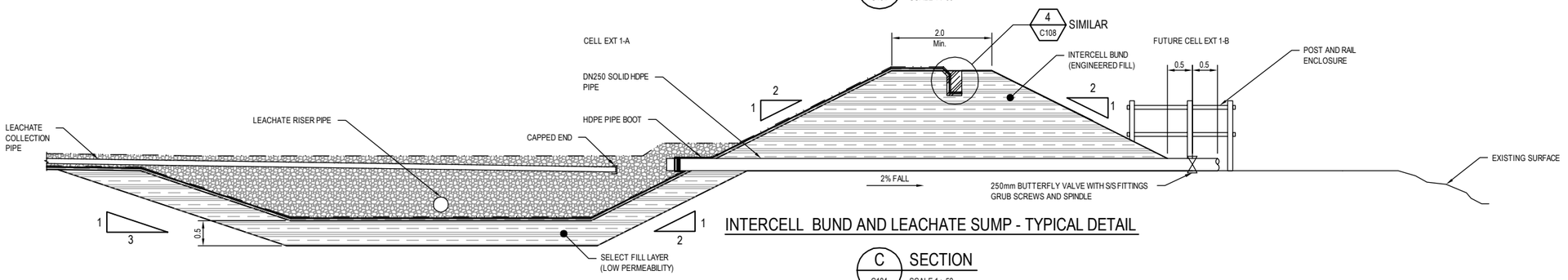
Original Size A1 | Drawing No: 41-23955-04-C104 | Rev: 0

Plot Date: 10 August 2012 - 2:00 PM | Plotted by: Aeran Lin | Cad File No: G:\41\23955\CADD\Drawings\Work package 4\CELL EST 1 REVD\41-23955-04-C104.dwg



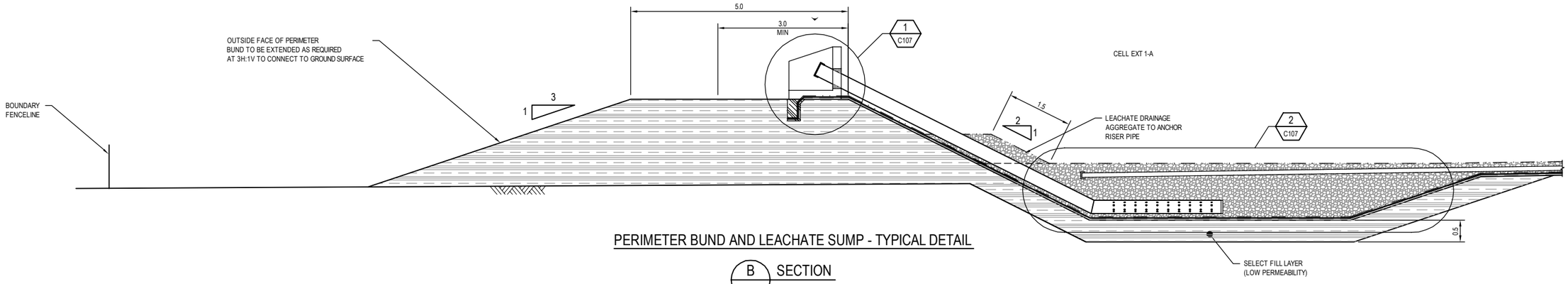
INTERCELL BUND - TYPICAL DETAIL

D SECTION
C104 SCALE 1 : 50



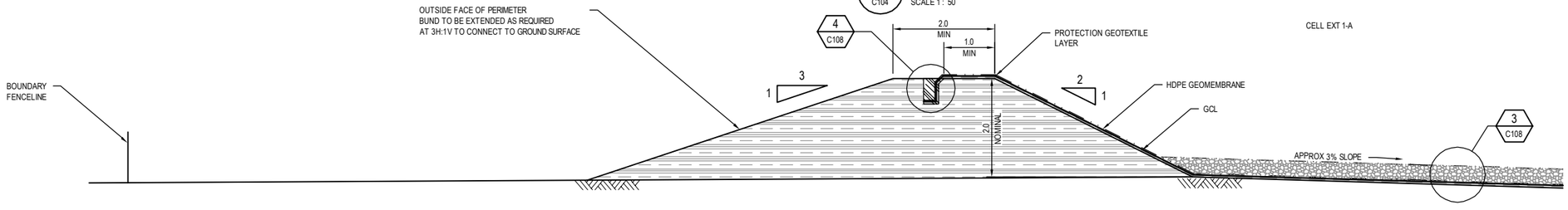
INTERCELL BUND AND LEACHATE SUMP - TYPICAL DETAIL

C SECTION
C104 SCALE 1 : 50



PERIMETER BUND AND LEACHATE SUMP - TYPICAL DETAIL

B SECTION
C104 SCALE 1 : 50



PERIMETER BUND - TYPICAL DETAIL

A SECTION
C104 SCALE 1 : 50

NOTES:
1. REFER TO DRAWING 41-23955-04-G001 FOR GENERAL NOTES.

FOR TENDER

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
0	ISSUED FOR TENDER		AL	DB*	SD*	10.08.12

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

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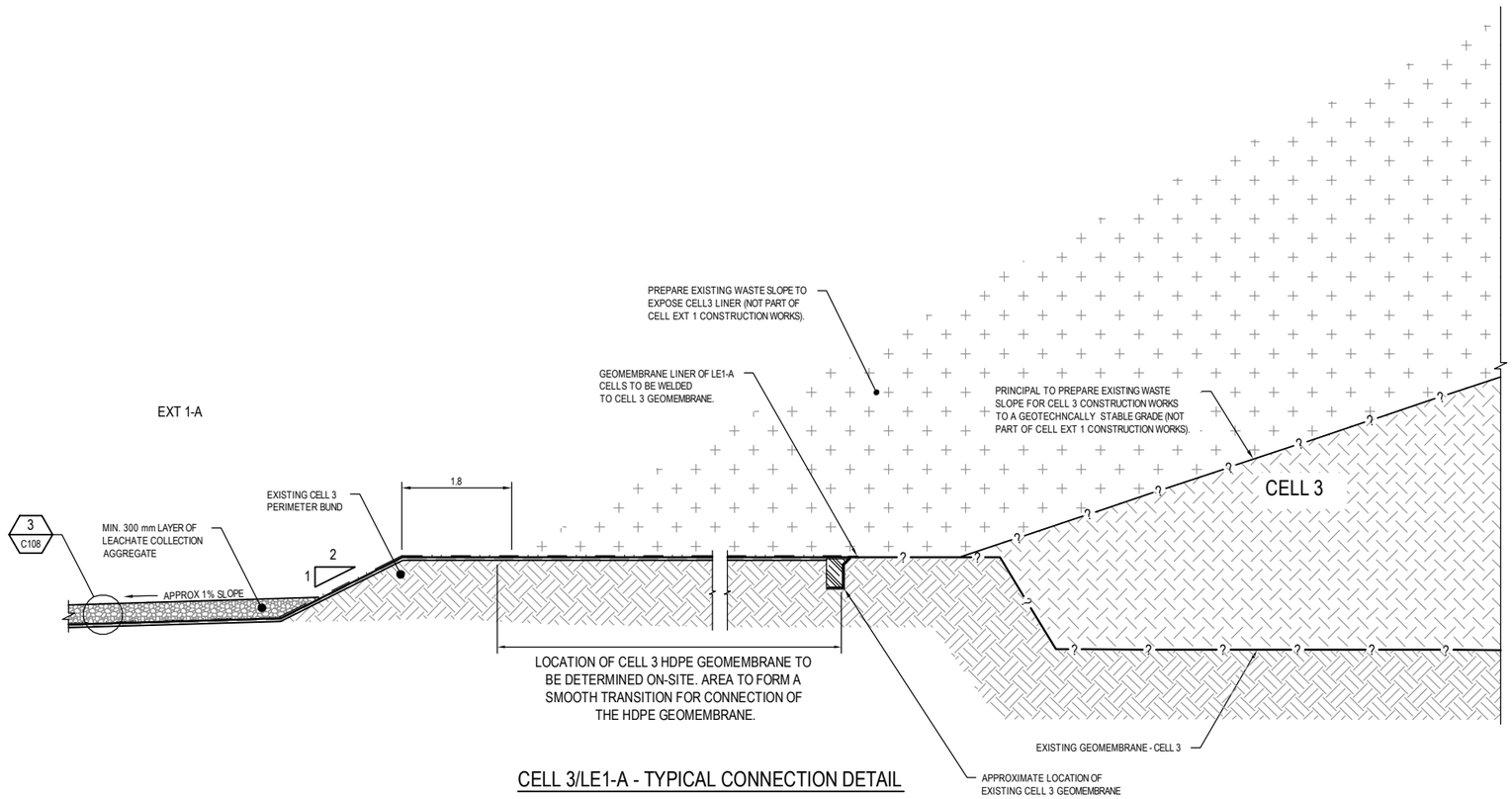
Drafting Check	M.HAMMOND*	Design Check	S.DEVER*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client DARWIN CITY COUNCIL
Project SHOAL BAY WASTE DISPOSAL FACILITY
Title LANDFILL EXTENSION 1-A
TYPICAL SECTIONS - SHEET 1 OF 2

Original Size A1
Drawing No: 41-23955-04-C105
Rev: 0

Plot Date: 10 August 2012 - 2:05 PM Plotted by: Aeran Lin
Cad File No: G:\41\23955\CADD\Drawings\Work package 4\CELL EST 1 REVD\41-23955-04-C105 to 108-REV-B.dwg

EXT 1-A



CELL 3/LE1-A - TYPICAL CONNECTION DETAIL

E / 104 SECTION
SCALE 1 : 50

NOTES:
1. REFER TO DRAWING 41-23955-04-G001 FOR GENERAL NOTES.

FOR TENDER

No	Revision	Drawn	Job Manager	Project Director	Date
0	ISSUED FOR TENDER	AL	DB*	SD*	10.08.12

Note: * indicates signatures on original issue of drawing or last revision of drawing

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

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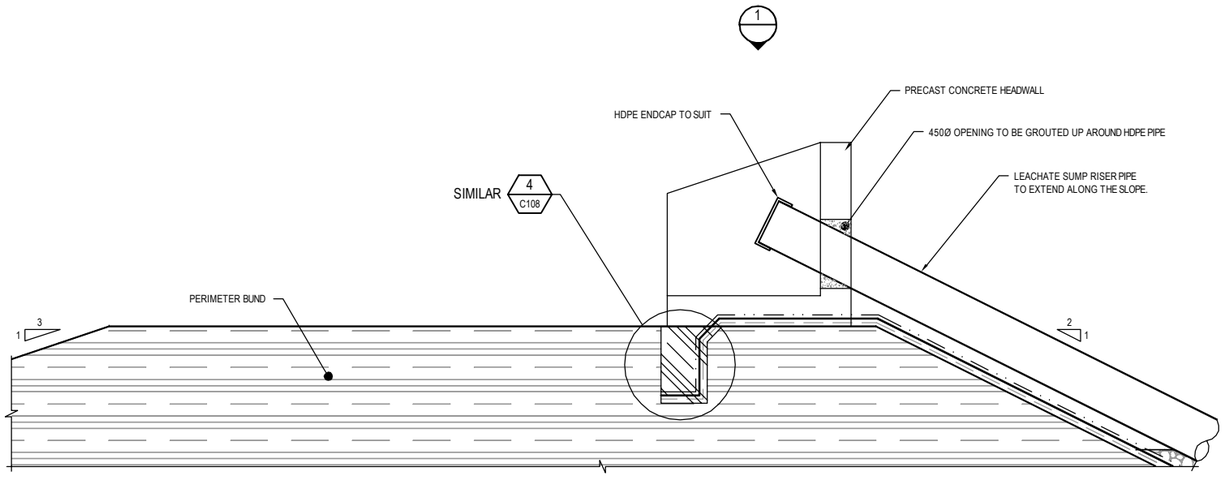
Drafting Check	M.HAMMOND*	Design Check	S.DEVER*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

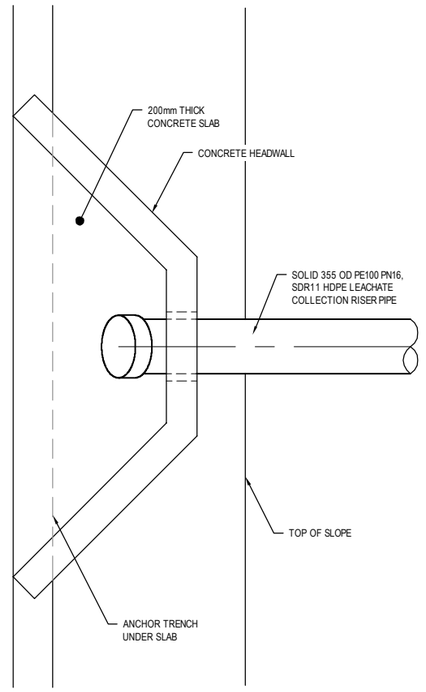
Client: DARWIN CITY COUNCIL
Project: SHOAL BAY WASTE DISPOSAL FACILITY
Title: LANDFILL EXTENSION 1-A
TYPICAL SECTIONS - SHEET 2 OF 2

Original Size A1 | Drawing No: 41-23955-04-C106 | Rev: 0

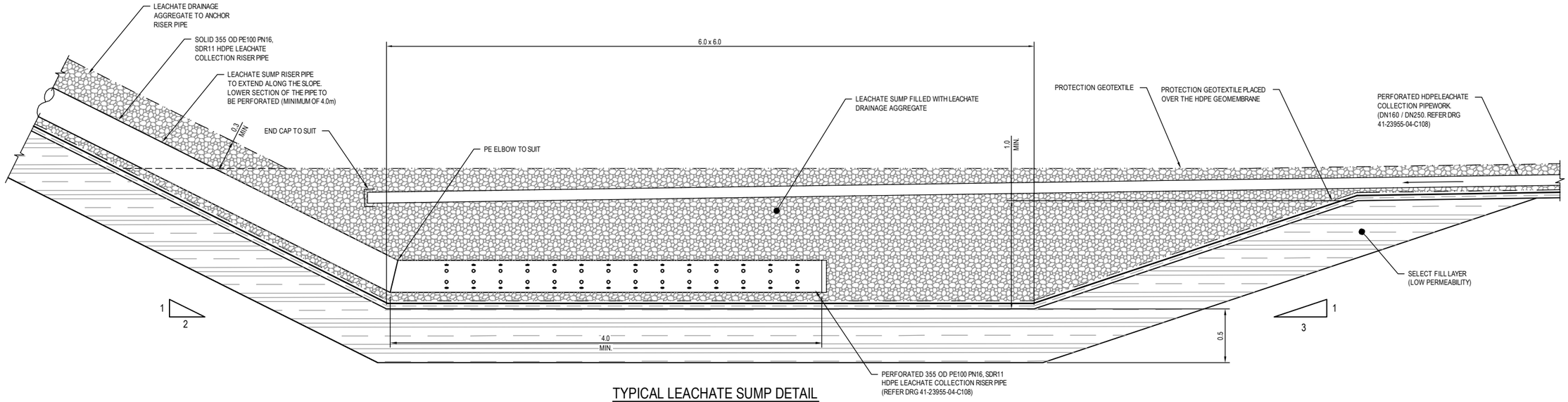
Plot Date: 10 August 2012 - 2:07 PM | Plotted by: Aeran Lin | Cad File No: G:\41\23955\CADD\Drawings\Work package 4\CELL EST 1 REVD\41-23955-04-C105 to 108-REV-B.dwg



1 DETAIL
C105 SCALE 1 : 20



1 ELEVATION
- SCALE 1 : 20



TYPICAL LEACHATE SUMP DETAIL

2 DETAIL
C105 SCALE 1 : 20

NOTES:
1. REFER TO DRAWING 41-23955-04-G001 FOR GENERAL NOTES.

FOR TENDER

No	Revision	Drawn	Job Manager	Project Director	Date
0	ISSUED FOR TENDER	AL	DB*	SD*	10.08.12

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0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

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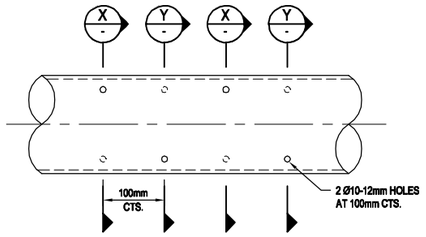
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client **DARWIN CITY COUNCIL**
Project **SHOAL BAY WASTE DISPOSAL FACILITY**
Title **LANDFILL EXTENSION 1-A**
TYPICAL DETAILS - SHEET 1 OF 2

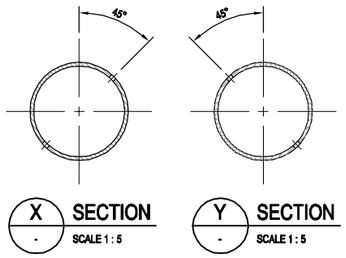
Original Size **A1**
Drawing No: 41-23955-04-C107 **Rev: 0**

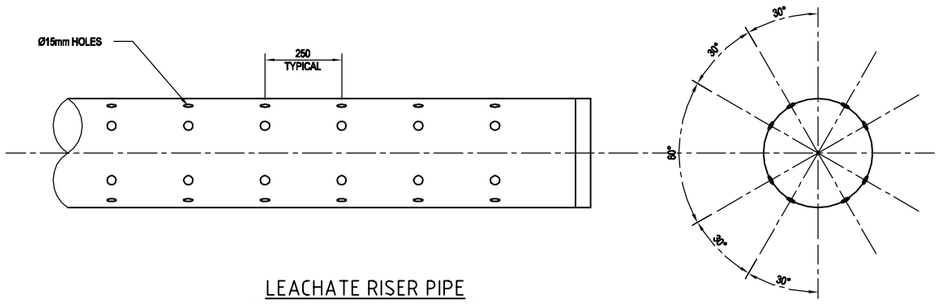
Plot Date: 10 August 2012 - 2:07 PM Plotted by: Aeran Lin Cad File No: G:\41\23955\CADD\Drawings\Work package 4\CELL EST 1 REVD\41-23955-04-C105 to 108-REV-B.dwg



PERFORATED LEACHATE COLLECTION PIPE DRILLING DETAIL

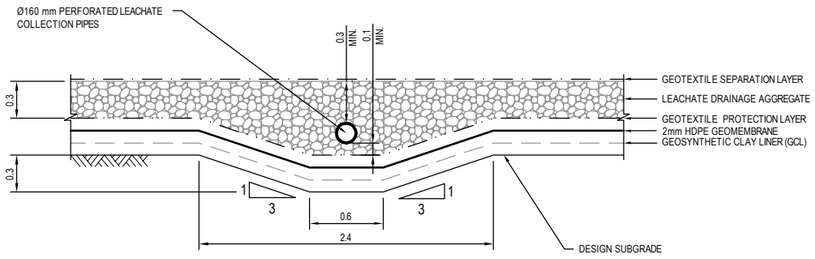
SCALE 1:5





LEACHATE RISER PIPE DRILLING DETAIL - 355 OD

SCALE 1:10

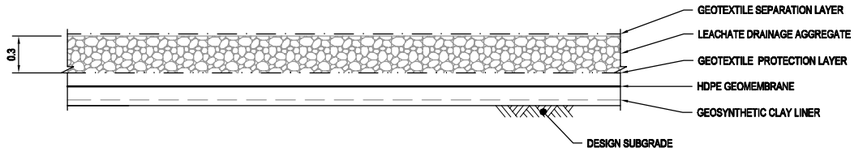


TYPICAL LEACHATE COLLECTION PIPE AND TRENCH DETAIL

F — C104 — SECTION

SCALE 1 : 25

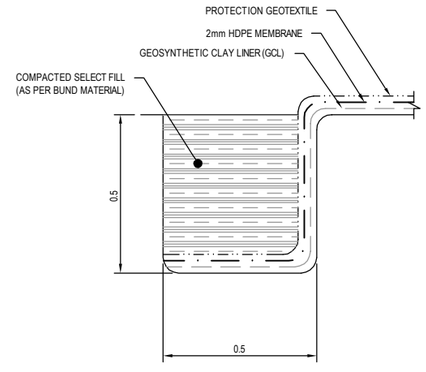
(SECTION THROUGH DN250 LEACHATE COLLECTION PIPE AND TRENCH SIMILAR)



BASAL LINER DETAIL

3 — C105 — DETAIL

SCALE 1 : 25



TYPICAL ANCHOR TRENCH DETAIL

4 — C105 — DETAIL

SCALE 1 : 10

NOTES:
1. REFER TO DRAWING 41-23955-04-G001 FOR GENERAL NOTES.

FOR TENDER

No	Revision	Drawn	Job Manager	Project Director	Date
0	ISSUED FOR TENDER	AL	DB*	SD*	10.08.12

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 0.05 0.1 0.15 0.2 0.25m
SCALE 1:5 AT ORIGINAL SIZE

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

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Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DARWIN CITY COUNCIL
Project: SHOAL BAY WASTE DISPOSAL FACILITY
Title: LANDFILL EXTENSION 1-A
TYPICAL DETAILS - SHEET 2 OF 2

Original Size A1 — Drawing No: 41-23955-04-C108 — Rev: 0

Plot Date: 10 August 2012 - 2:07 PM Plotted by: Aeran Lin Cad File No: G:\41\23955\CADD\Drawings\Work package 4\CELL EST 1 REVD\41-23955-04-C105 to 108-REV-B.dwg

GENERAL

G1. READ THESE DRAWINGS IN CONJUNCTION WITH ENGINEERING DRAWINGS, SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED. THE CONSTRUCTION NOTES SHALL APPLY UNLESS OTHERWISE VARIED BY THE DRAWINGS OR SPECIFICATIONS.

G2. NOMINATION OF PROPRIETARY ITEMS DOES NOT INDICATE EXCLUSIVE PREFERENCE BUT INDICATES THE REQUIRED PROPERTIES OF THE ITEM. SIMILAR ALTERNATIVES HAVING THE REQUIRED PROPERTIES MAY BE OFFERED FOR APPROVAL.

G3. REFER ANY DISCREPANCY TO THE DESIGNER BEFORE PROCEEDING WITH THE WORK.

G4. DO NOT OBTAIN DIMENSIONS BY SCALING FROM THE DRAWINGS. ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES, UNO.

G5. VERIFY SETTING OUT DIMENSIONS SHOWN ON THE DRAWINGS BEFORE CONSTRUCTION AND FABRICATION IS COMMENCED.

G6. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE SAA CODES, SPECIFICATIONS AND THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITY.

G7. THE CONTRACTOR SHALL MAINTAIN ACCURATE RECORDS OF LEVELS AND LOCATIONS OF SERVICES TO FULLY COMPLY WITH LOCAL AUTHORITY 'AS CONSTRUCTED' INFORMATION REQUIREMENTS.

G8. UNO - UNLESS NOTED OTHERWISE.

G9. NO SLOPE OR LINER STABILITY ASSESSMENT WAS INCLUDED AS PART OF THE APPROVED SCOPE OF WORKS. GHD RECOMMENDS THAT PRIOR TO CONSTRUCTION A SLOPE STABILITY ASSESSMENT BE UNDERTAKEN.

EARTHWORKS

E1. EXISTING WASTE BATTERS ARE TO BE MADE SAFE PRIOR TO UNDERTAKING ANY WORKS.

E2. WORK METHOD STATEMENTS SHOULD BE GENERATED FOR ALL WORKS UNDERTAKEN NEAR OR ADJACENT TO THE TOES OF THE EXISTING WASTE BATTERS.

E3. LEACHATE POND TO BE DECOMMISSIONED PRIOR TO WORKS BY PUMPING OUT REMAINING LEACHATE, CUTTING THE BASAL LINER AND FILLING IN THE VOID WITH FILL MATERIAL. FILLING CARRIED OUT AS PER TECHNICAL SPECIFICATION.

DRAINAGE

D1. ALL WATER DISCHARGED TO THE SITES STORMWATER SYSTEM SHOULD BE SAMPLED AND MONITORED TO CONFIRM COMPLIANCE WITH SITE LICENCE QUALITY LIMITS.

SURVEY

V1. SURVEY PROVIDED TO GHD FROM EJA DATED 23 FEBRUARY 2012. (BASED ON NTG SUPPLIED COORDS FOR CRM S94167102)

V2. EXISTING CELL 3 LINER BOUNDARY ESTIMATED FROM CELL 3 AS BUILT SURVEY FOR SUBGRADE SURFACE PROVIDED BY EJA ON 9 FEBRUARY 2012

V2. AERIAL IMAGE EXTRACTED FROM GOOGLE EARTH PRO, DATED JANUARY 19, 2012.

V3. HORIZONTAL DATUM TO MGA 94 ZONE 52.
VERTICAL DATUM TO SITE DATUM ORIGIN: 5209-500 - RL 16.570, 5209-501- RL 16.332
(RELATIONSHIP TO AHD IS UNCONFIRMED)

FOR TENDER

No	Revision	Drawn	Job Manager	Project Director	Date
0	ISSUED FOR TENDER	AL	DB*	SD*	10.08.12

Note: * indicates signatures on original issue of drawing or last revision of drawing

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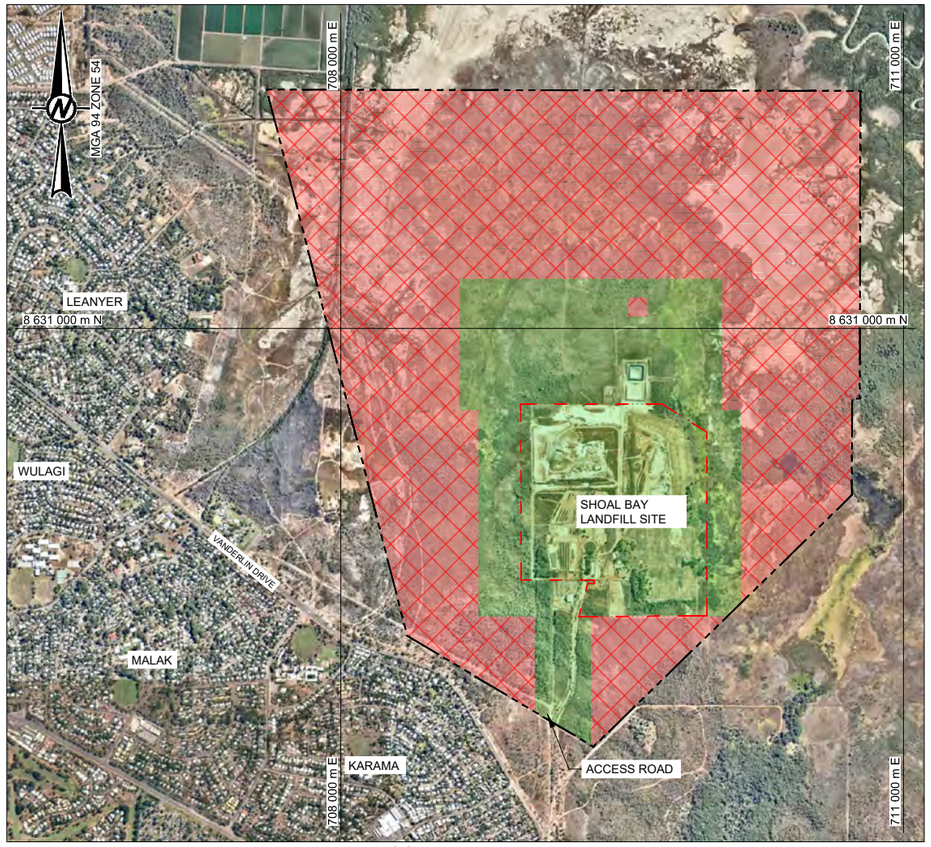
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client DARWIN CITY COUNCIL
Project SHOAL BAY WASTE DISPOSAL FACILITY
Title LANDFILL EXTENSION 1-A
GENERAL NOTES - CIVIL

Original Size A1
Drawing No: 41-23955-04-G001
Rev: 0

Plot Date: 10 August 2012 - 1:57 PM Plotted by: Aeran Lin
Cad File No: G:\41\23955\CADD\Drawings\Work package 4\CELL EST 1 REVD\41-23955-04-G001.dwg

CITY OF DARWIN
SHOAL BAY LANDFILL - STAGE 5



LOCALITY PLAN
NOT TO SCALE

LOCALITY PLAN LEGEND

- UNCLEARED UNEXPLODED ORDINANCE AREA
- CLEARED UNEXPLODED ORDINANCE AREA
- LEASE BOUNDARY
- OPERATIONS AREA BOUNDARY

REFERENCE

IMAGE DATED 21.07.2015
SOURCED WITH PERMISSION FROM
NEARMAP ON 27.08.2014
IMAGE GEOREFERENCED BY
GOLDER AND INTENDED FOR
INDICATIVE PURPOSES ONLY
www.nearmap.com.au

1. LEASE AREA BOUNDARY IS BASED ON CADASTRAL BOUNDARIES PROVIDED BY CITY OF DARWIN ON 23 SEPTEMBER 2014 AS CADD FILE "CADASTRE_SHOALBAYREGION.DXF".
2. UNEXPLODED ORDINANCE CLEARANCE AREA IS BASED ON BOUNDARIES PROVIDED BY CITY OF DARWIN ON 23 SEPTEMBER 2014 AS DRAWING TITLE "RAAF BOMBING RANGE LEASE AREA FOR DARWIN CITY COUNCIL LOT 3952", DRAWING DATED 25 AUGUST 1999, DRAWING NUMBER DA00350_1, FILE NAME "20100043_20140908_145851_01948_3536.PDF", MAPINFO FILES "EXCLUSION" AND COUNCIL LEASE.

DRAWING No.	REV	DATE	DESCRIPTION
D001	C	2016-03-07	COVER SHEET
D002	C	2016-03-07	SHOAL BAY WASTE MANAGEMENT FACILITY LAYOUT PLAN
D003	C	2016-03-07	EXISTING SITE CONDITIONS
D004	C	2016-03-07	SUB SURFACE DRAINAGE SETOUT PLAN
D005	C	2016-03-07	TOP OF DESIGN SUBGRADE SETOUT PLAN
D006	C	2016-03-07	TOP OF SELECT FILL DESIGN SURFACE SETOUT PLAN
D007	C	2016-03-07	GEOSYNTHETIC AND LEACHATE COLLECTION PIPES LAYOUT PLAN
D008	C	2016-03-07	SUBGRADE AND SELECT FILL SUMP PLANVIEW AND SETOUT POINTS
D009	C	2016-03-07	LEACHATE PIPE PROTRUSION THROUGH EMBANKMENT
D010	C	2016-03-07	SOUTHERN SPILLWAY
D011	C	2016-03-07	SUB SURFACE DRAINAGE PIPE LONGSECTION
D012	C	2016-03-07	TYPICAL SECTIONS SHEET 1 OF 4
D013	C	2016-03-07	TYPICAL SECTIONS SHEET 2 OF 4
D014	C	2016-03-07	TYPICAL SECTIONS SHEET 3 OF 4
D015	C	2016-03-07	TYPICAL SECTIONS SHEET 4 OF 4
D016	C	2016-03-07	DETAILS 1 OF 2
D017	C	2016-03-07	DETAILS 2 OF 2
D018	C	2016-03-07	SETOUT POINTS TABLE (NOT ISSUED FOR TENDER)

MATERIAL LIST

- TOP OF SUBGRADE
- UNIT 1 - ENGINEERED FILL
- UNIT 2 - SELECT FILL
- UNIT 3 - PIPE BEDDING SAND
- UNIT 4 - SUBGRADE DRAINAGE AGGREGATE
- UNIT 5 - LEACHATE DRAINAGE AGGREGATE
- UNIT 6 - SURFACE GRAVEL
- UNIT 10 - REINFORCED GCL
- UNIT 11D - DOUBLE - SIDED TEXTURED GEOMEMBRANE
- UNIT 11S - SINGLE - SIDED TEXTURED GEOMEMBRANE
- UNIT 12 - CUSHION GEOTEXTILE
- UNIT 13 - SEPARATION GEOTEXTILE
- UNIT 14 - GEOGRID
- UNIT 20P - PERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE
- UNIT 20U - UNPERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE
- UNIT 21P - PERFORATED 280 DIA. PRIMARY LEACHATE PIPE
- UNIT 21U - UNPERFORATED 280 DIA. PRIMARY LEACHATE PIPE
- UNIT 22P - PERFORATED 160 DIA. SECONDARY LEACHATE PIPE
- UNIT 22U - UNPERFORATED 160 DIA. SECONDARY LEACHATE PIPE
- UNIT 23 - RISER PIPE
- UNIT 30 - CONCRETE
- UNIT 31 - MARINE PLYWOOD 2700 WIDE 12 mm THICK
- UNIT 32 - BENTONITE
- UNIT 33 - EROSION PROTECTION
- UNIT 34 - 1.8 m PERIMETER FENCE LINE

NOTES

1. THESE NOTES APPLY TO ALL PROJECT DRAWINGS IN THE SET UNLESS NOTED OTHERWISE AND SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION.
2. ALL LEVELS ARE IN METRES TO AHD DATUM.
3. ALL CO-ORDINATES ARE IN METRES TO MAP GRID AUSTRALIA (MGA 94, ZONE 52).
4. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE
5. LOCATION AND DEPTH OF ALL SERVICES TO BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.
6. DIMENSIONS SHALL NOT BE SCALED OFF DRAWINGS.
7. DRAWINGS MUST BE PRINTED IN COLOUR TO CORRECTLY IDENTIFY ALL DESIGN ELEMENTS
8. EXISTING SURVEY DATA SUPPLIED BY DARWIN CITY COUNCIL, SURVEYED BY AUSURV SURVEYORS P/L CONSULTANTS, SURVEY DATE 01/08/2015, DRAWING - DETAIL SURVEY SHOAL BAY WASTE MANAGEMENT FACILITY, REF 15-0099 SHOAL BAY LANDFILL.
9. THE CITY OF DARWIN IS CURRENTLY UNDERTAKING EXCAVATIONS IN THE STAGE 5 WORKS AREA, SITE CONDITIONS MAY VARY FROM THE SURVEY INFORMATION SHOWN.

NOT FOR CONSTRUCTION ISSUED FOR
TENDER

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-03-21	NOT FOR CONSTRUCTION ISSUED FOR TENDER	SRM	MMC	DJR	JSB

CLIENT
CITY OF DARWIN

CONSULTANT
Golder Associates

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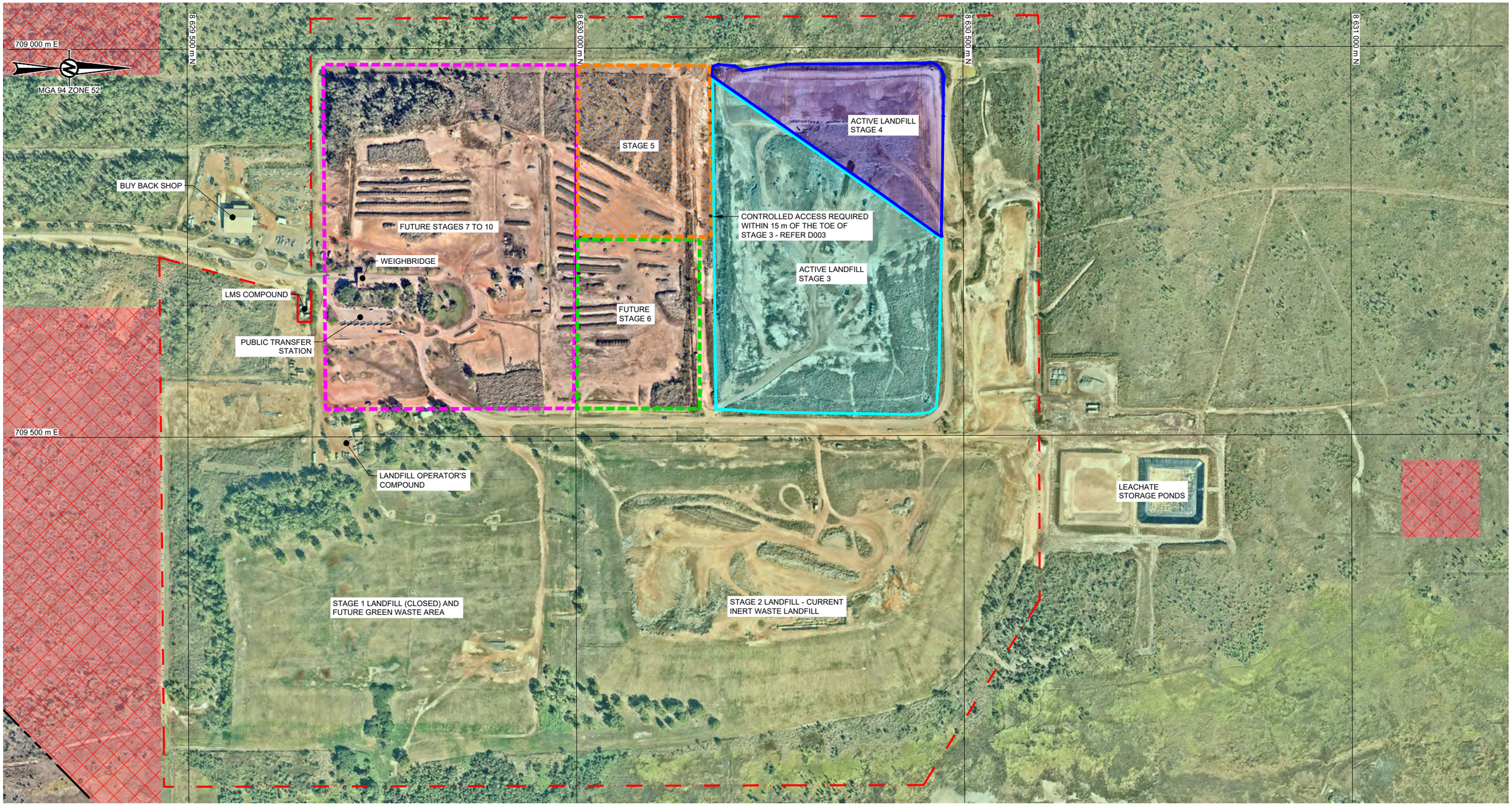
PROJECT
SHOAL BAY LANDFILL - STAGE 5

TITLE
COVER SHEET

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	1 of 18	D001



REFERENCE

nearmap

IMAGE DATED 21.07.2015
SOURCED WITH PERMISSION FROM NEARMAP ON 27.08.2014
IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY
www.nearmap.com.au

1. LEASE AREA BOUNDARY IS BASED ON CADASTRAL BOUNDARIES PROVIDED BY CITY OF DARWIN ON 23 SEPTEMBER 2014 AS CADD FILE "CADASTRE_SHOALBAYREGION.DXF".
2. UNEXPLODED ORDINANCE CLEARANCE AREA IS BASED ON BOUNDARIES PROVIDED BY CITY OF DARWIN ON 23 SEPTEMBER 2014 AS DRAWING TITLE "RAAF BOMBING RANGE LEASE AREA FOR DARWIN CITY COUNCIL LOT 3952", DRAWING DATED 25 AUGUST 1999, DRAWING NUMBER DA00350_1, FILE NAME "20100043_20140908_145851_01948_3536.PDF", MAPINFO FILES "EXCLUSION" AND COUNCIL LEASE.

LEGEND

- UNCLEARED UNEXPLODED ORDINANCE AREA
- CLEARED UNEXPLODED ORDINANCE AREA
- APPROXIMATE EXTENT OF FUTURE STAGES 7 TO 10
- APPROXIMATE EXTENT OF FUTURE STAGE 6
- APPROXIMATE EXTENT OF STAGE 5
- ACTIVE LANDFILL STAGE 3
- ACTIVE LANDFILL STAGE 4
- OPERATIONS AREA BOUNDARY
- LEASE BOUNDARY

NOT FOR CONSTRUCTION ISSUED FOR

TENDER

0 100 200
1:5,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-03-21	NOT FOR CONSTRUCTION ISSUED FOR TENDER	SRM	MMC	DJR	JSB

CLIENT
CITY OF DARWIN

CONSULTANT
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PROJECT
SHOAL BAY LANDFILL - STAGE 5

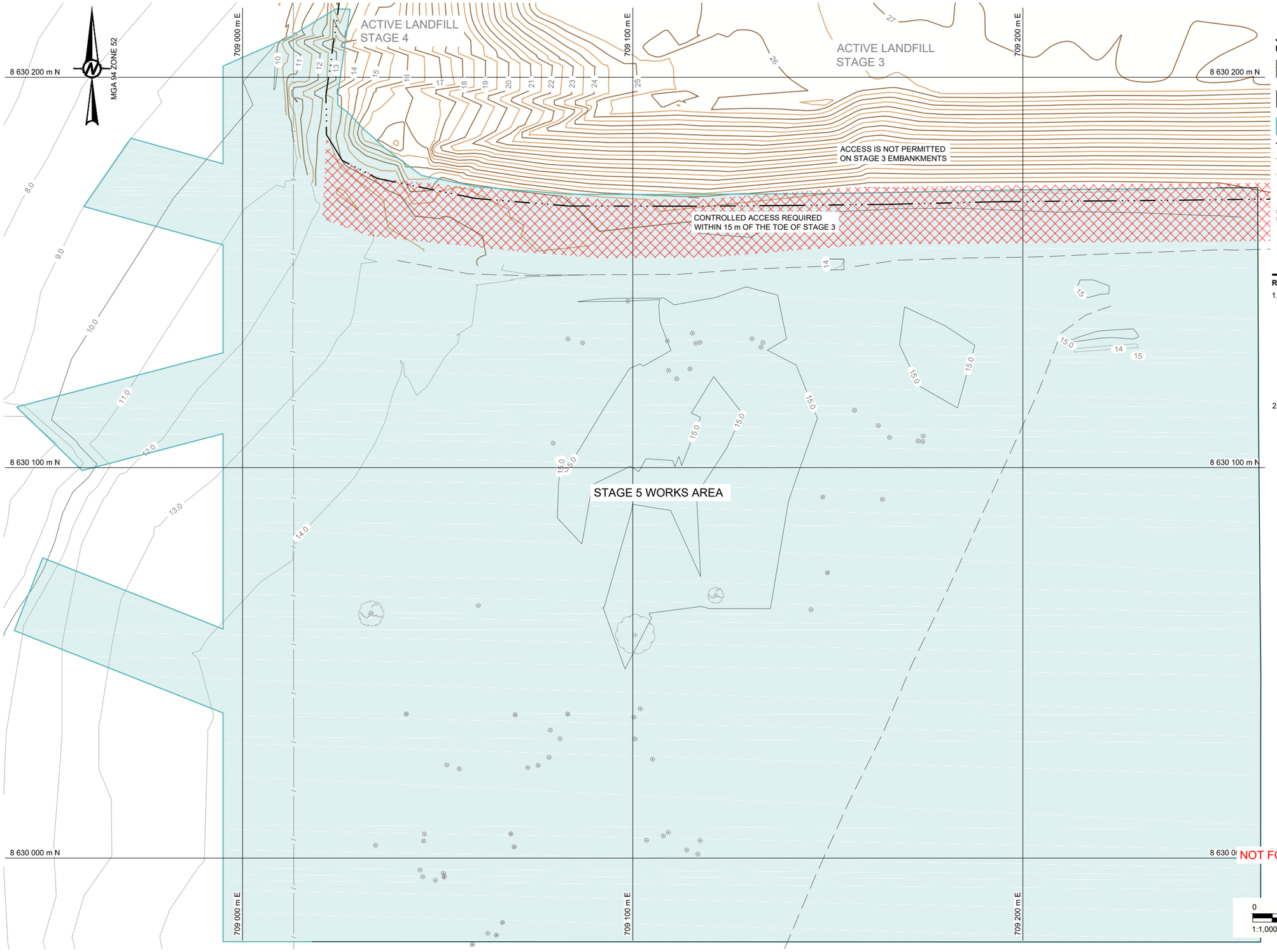
TITLE
SHOAL BAY WASTE MANAGEMENT FACILITY LAYOUT PLAN

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	2 of 18	D002

Path: \\golder.gds\gap\Adelaide\Geomatics\SHOAL_BAY_LANDFILL-Darwin\09_PROJECTS\1539233 - CELL 5 AND 6\02_PRODUCTION\DWG\GDOC 008-S\ | File Name: DRAWING 2.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25 mm



LEGEND

- STAGE 3 & 4 EXISTING SURFACE CONTOURS AT 0.5 m INTERVALS DECEMBER SURVEY 2015
- EXISTING GROUND SURFACE CONTOURS AT 0.5 m INTERVALS AUGUST SURVEY 2015
- STAGE 5 WORKS AREA
- AS-CONSTRUCTED EDGE OF STAGE 3 LINER - REFER TO REFERENCES.
- EXISTING OPEN DRAIN
- EXISTING SITE PERIMETER FENCE LINE
- EXISTING VEGETATION
- AREA FOR CONTROLLED ACCESS WITHIN 15 m OF THE TOE OF STAGE 3

REFERENCE(S)

1. EXISTING GROUND SURFACE COMPRISES THE FOLLOWING:
   - DEC 2015 SURVEY WITHIN THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY UNKNOWN ON DECEMBER 2015, DRAWING TITLE "5209-131(3DINFO).DWG", PROVIDED TO GOLDER BY CLIENT DATE UNKNOWN.
   - AUGUST 2015 SURVEY IN AREAS OUTSIDE THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY AUSURV SURVEYORS P/L COMPLETED ON 1 AUGUST 2015, DRAWING TITLE "DETAIL SURVEY SHOAL BAY WASTE MANAGEMENT FACILITY", DRAWING NUMBER 15-0099-1, CAD FILE NAME "15-0099 SHOAL BAY LANDFILL", PROVIDED TO GOLDER BY CITY OF DARWIN ON 14 AUGUST 2015.
2. AS-CONSTRUCTED EDGE OF STAGE 3 LINER IS BASED ON THE FOLLOWING:
   - STAGE 3 LINER SURVEY. SURVEY BY EARL JAMES & ASSOCIATES ON 10 FEBRUARY 2012, CAD FILE NAME "5209 151013 CELL BASE 3 ON MGA AND AHD.DWG",PROVIDED TO GOLDER BY TERRITORIA CIVIL ON 13 OCT 2015 (SACAGIO/BEGG).
   - STAGE 4 LINER SURVEY. SURVEY BY FYFE EARTH PARTNERS ON 10 JAN 2013, PLAN TITLE "SHOAL BAY LANDFILL ASCON 18/10/2012 WITH RAINFLAP DESIGN COMPARISON", PLAN NO 29814 / 10 REV 0, CAD FILE NAME "29810 (RAINFLAP SURVEY) (3).DWG", PROVIDED TO GOLDER BY COUNCIL ON18 JUNE 2014.

NOT FOR CONSTRUCTION ISSUED FOR

TENDER

0 25 50
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-03-21	NOT FOR CONSTRUCTION ISSUED FOR TENDER	SRM	MMC	DJR	JSB

CLIENT
CITY OF DARWIN

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PROJECT
SHOAL BAY LANDFILL - STAGE 5

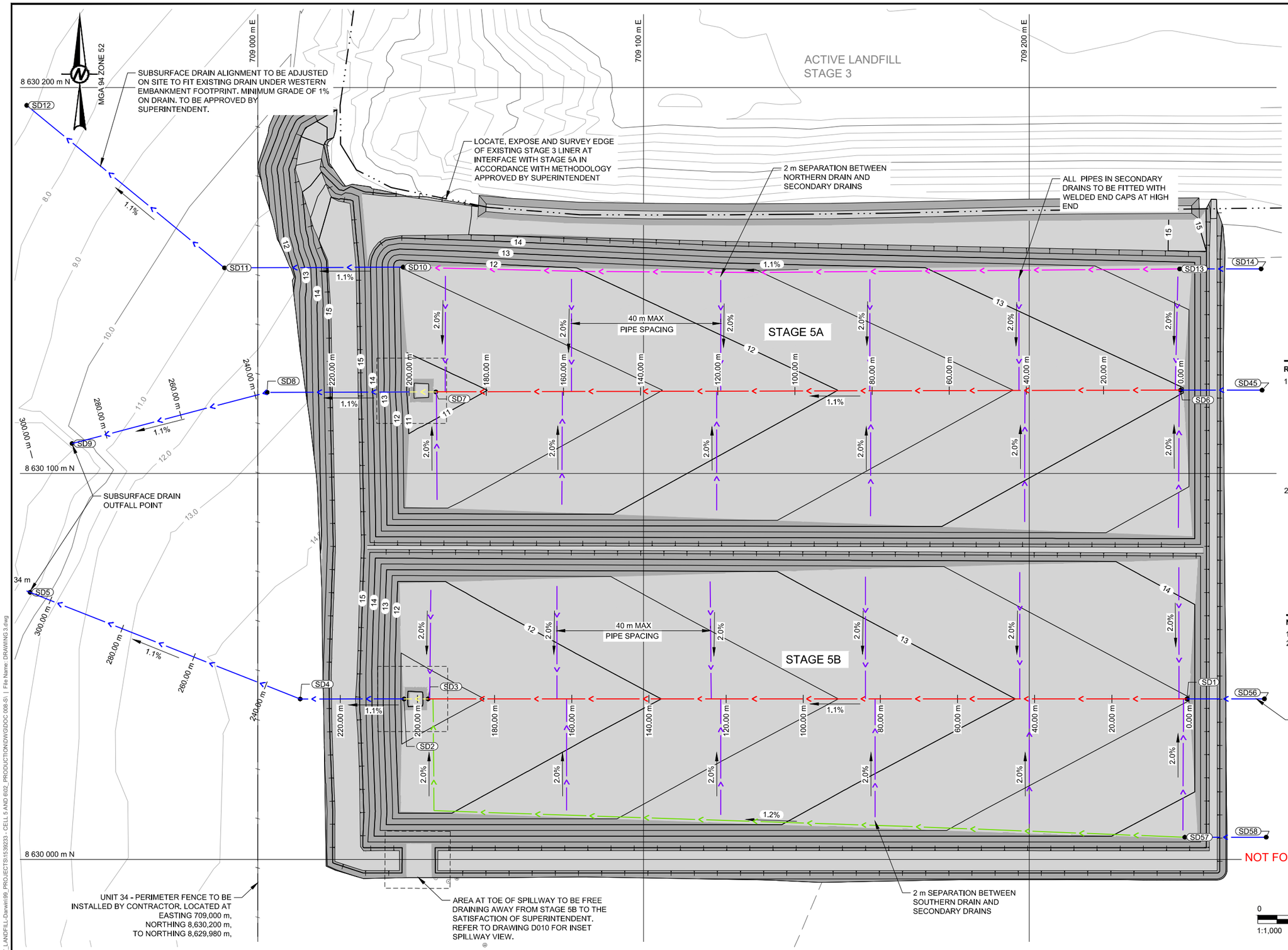
TITLE
EXISTING SITE CONDITIONS

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	3 of 18	D003

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

0 25mm

Path: \\golder.gds\gap\Adelaide\Geomatics\SHOAL_BAY_LANDFILL-Darwin\99_PROJECTS\1539233 - CELL 5 AND 6\02_PRODUCTION\DWG\DOC 008-S\ | File Name: DRAWING 3.dwg



REFERENCE(S)

1. EXISTING GROUND SURFACE COMPRISES THE FOLLOWING:
   - DEC 2015 SURVEY WITHIN THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY UNKNOWN ON DECEMBER 2015, DRAWING TITLE "5209-131(3DINFO).DWG", PROVIDED TO GOLDER BY CLIENT DATE UNKNOWN.
   - AUGUST 2015 SURVEY IN AREAS OUTSIDE THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY AUSURV SURVEYORS P/L COMPLETED ON 1 AUGUST 2015, DRAWING TITLE "DETAIL SURVEY SHOAL BAY WASTE MANAGEMENT FACILITY", DRAWING NUMBER 15-0099-1, CAD FILE NAME "15-0099 SHOAL BAY LANDFILL", PROVIDED TO GOLDER BY CITY OF DARWIN ON 14 AUGUST 2015.
2. AS-CONSTRUCTED EDGE OF STAGE 3 LINER IS BASED ON THE FOLLOWING:
   - STAGE 3 LINER SURVEY. SURVEY BY EARL JAMES & ASSOCIATES ON 10 FEBRUARY 2012, CAD FILE NAME "5209 151013 CELL BASE 3 ON MGA AND AHD.DWG",PROVIDED TO GOLDER BY TERRITORIA CIVIL ON 13 OCT 2015 (SACAGIO/BEGG).
   - STAGE 4 LINER SURVEY. SURVEY BY FYFE EARTH PARTNERS ON 10 JAN 2013, PLAN TITLE "SHOAL BAY LANDFILL ASCON 18/10/2012 WITH RAINFLAP DESIGN COMPARISON", PLAN NO 29814 / 10 REV 0, CAD FILE NAME "29810 (RAINFLAP SURVEY) (3).DWG", PROVIDED TO GOLDER BY COUNCIL ON18 JUNE 2014.

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. SUBSURFACE DRAIN 5A AND 5B LONGSECTION REFER TO DRAWING D011.

NOT FOR CONSTRUCTION ISSUED FOR

TENDER

0 25 50
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-03-21	NOT FOR CONSTRUCTION ISSUED FOR TENDER	SRM	MMC	DJR	JSB

CLIENT
CITY OF DARWIN

PROJECT
SHOAL BAY LANDFILL - STAGE 5

CONSULTANT
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TITLE
SUB SURFACE DRAINAGE SETOUT PLAN

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	4 of 18	D004

Path: \\golder.gds\gan\Adelaide\Geomatics\SHOAL BAY_LANDFILL-Darwin\99_PROJECTS\1539233 - CELL 5 AND 6\02_PRODUCTION\DWG\DOC 008-S\ | File Name: DRAWING 3.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25 mm
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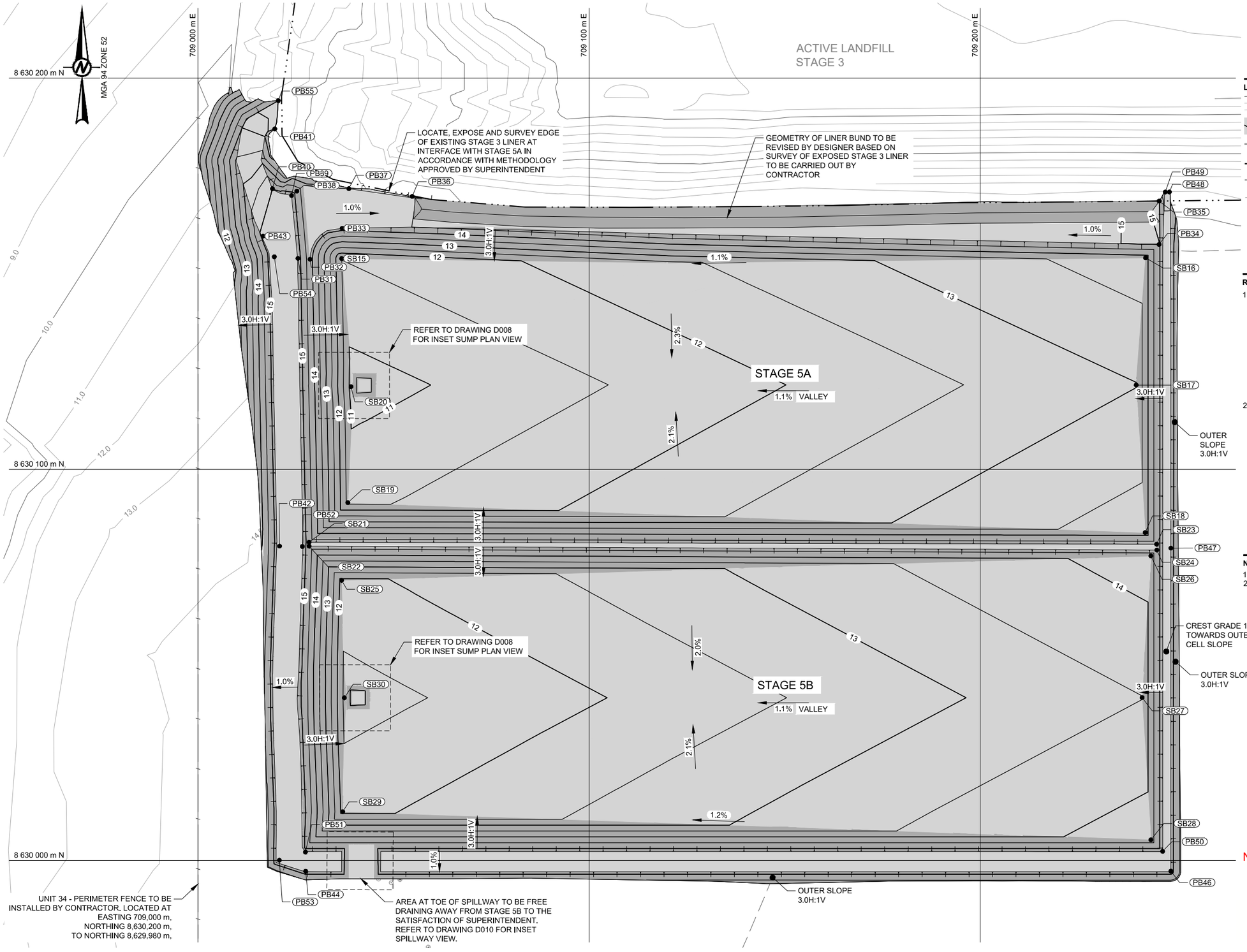

LEGEND

- EXISTING CONTOURS AT 0.5 m INTERVALS
- TOP OF DESIGN SUBGRADE AT 0.5 m INTERVALS
- DESIGN STAGE 5 CREST
- AS-CONSTRUCTED EDGE OF STAGE 3 LINER - REFER TO REFERENCES.
- UNIT 34 - 1.8 m PERIMETER FENCE LINE
- EXISTING OPEN DRAIN
- EXISTING VEGETATION
- 3.0H:1V / 1.1% GRADIENT ON TOP OF DESIGN SUBGRADE SURFACE

REFERENCE(S)

1. EXISTING GROUND SURFACE COMPRISES THE FOLLOWING:
   - DEC 2015 SURVEY WITHIN THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY UNKNOWN ON DECEMBER 2015, DRAWING TITLE "5209-131(3DINFO).DWG", PROVIDED TO GOLDER BY CLIENT DATE UNKNOWN.
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   - STAGE 4 LINER SURVEY. SURVEY BY FYFE EARTH PARTNERS ON 10 JAN 2013, PLAN TITLE "SHOAL BAY LANDFILL ASCON 18/10/2012 WITH RAINFLAP DESIGN COMPARISON", PLAN NO 29814 / 10 REV 0, CAD FILE NAME "29810 (RAINFLAP SURVEY) (3).DWG", PROVIDED TO GOLDER BY COUNCIL ON18 JUNE 2014.

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. SETOUT POINT TABLE FOR CELL 6A AND 6B SUBGRADE AND PERIMETER BUND ARE LOCATED ON DRAWING D018

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TENDER

0 25 50
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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PROJECT
SHOAL BAY LANDFILL - STAGE 5

TITLE
TOP OF DESIGN SUBGRADE SETOUT PLAN

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	5 of 18	D005

Path: \\golder.gds\gap\Adelaide\Geomatics\SHOAL_BAY_LANDFILL-Darwin\99_PROJECTS\1539233 - CELL 5 AND 6\02_PRODUCTION\DWG\DOC 008-S\ | File Name: DRAWING 3.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

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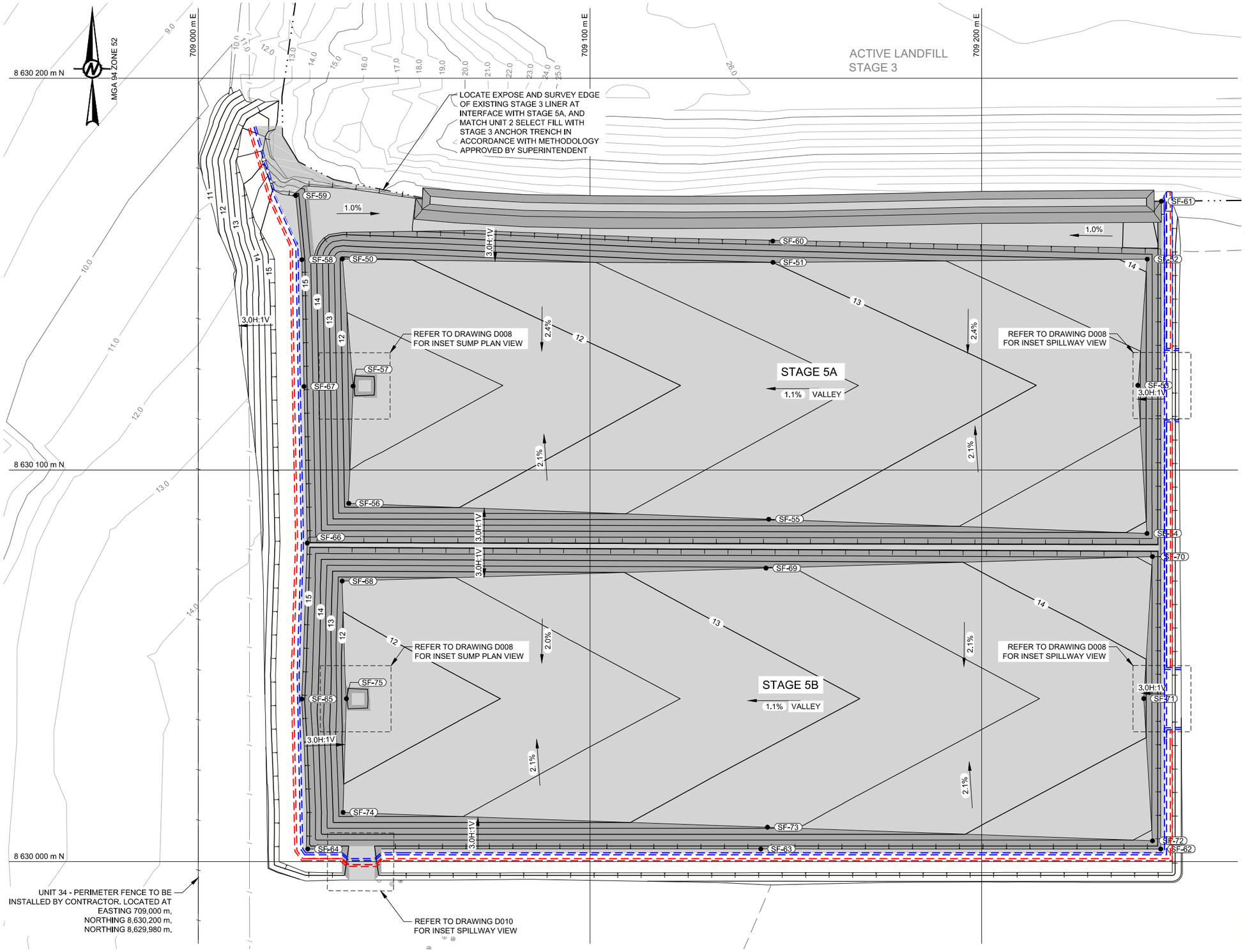

LEGEND

- EXISTING CONTOURS AT 0.5 m INTERVALS
- DESIGN TOP OF UNIT 2 - SELECT FILL ON CELL FLOORS, WALLS AND PERIMETER BUNDS AT 0.5 m INTERVALS
- EXISTING VEGETATION
- AS-CONSTRUCTED EDGE OF STAGE LINER - REFER TO REFERENCES.
- LINER ANCHOR TRENCH
- GEOGRID ANCHOR TRENCH
- DESIGN STAGE 5 CREST
- UNIT 34 - 1.8 m PERIMETER FENCE LINE
- EXISTING OPEN DRAIN

REFERENCE(S)

1. EXISTING GROUND SURFACE COMPRISES THE FOLLOWING:
   - DEC 2015 SURVEY WITHIN THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY UNKNOWN ON DECEMBER 2015, DRAWING TITLE "5209-131(3DINFO).DWG", PROVIDED TO GOLDER BY CLIENT DATE UNKNOWN.
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NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. SETOUT POINT TABLE FOR DESIGN TOP OF UNIT 2 - SELECT FILL SHOWN ON D018.

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TENDER

0 25 50
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-03-21	NOT FOR CONSTRUCTION ISSUED FOR TENDER	SRM	MMC	DJR	JSB

CLIENT
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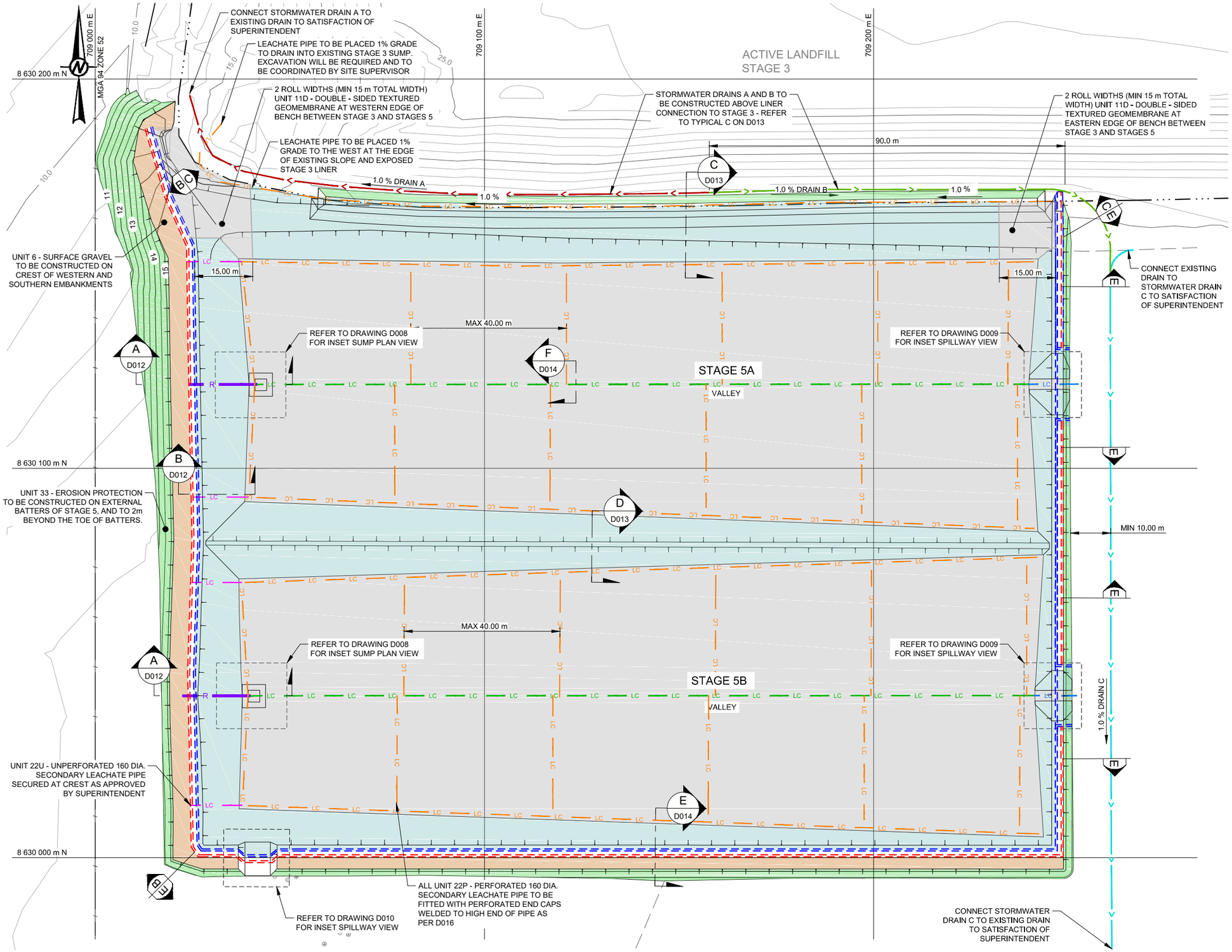
PROJECT
SHOAL BAY LANDFILL - STAGE 5

TITLE
TOP OF SELECT FILL DESIGN SURFACE SETOUT PLAN

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	6 of 18	D006



REFERENCE(S)

1. EXISTING GROUND SURFACE COMPRISES THE FOLLOWING:
   - DEC 2015 SURVEY WITHIN THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY UNKNOWN ON DECEMBER 2015, DRAWING TITLE "5209-131(3DINFO).DWG", PROVIDED TO GOLDER BY CLIENT DATE UNKNOWN.
   - AUGUST 2015 SURVEY IN AREAS OUTSIDE THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY AUSURV SURVEYORS P/L COMPLETED ON 1 AUGUST 2015, DRAWING TITLE "DETAIL SURVEY SHOAL BAY WASTE MANAGEMENT FACILITY", DRAWING NUMBER 15-0099-1, CAD FILE NAME "15-0099 SHOAL BAY LANDFILL", PROVIDED TO GOLDER BY CITY OF DARWIN ON 14 AUGUST 2015.
2. AS-CONSTRUCTED EDGE OF STAGE 3 LINER IS BASED ON THE FOLLOWING:
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   - STAGE 4 LINER SURVEY. SURVEY BY FYFE EARTH PARTNERS ON 10 JAN 2013, PLAN TITLE "SHOAL BAY LANDFILL ASCON 18/10/2012 WITH RAINFLAP DESIGN COMPARISON", PLAN NO 29814 / 10 REV 0, CAD FILE NAME "29810 (RAINFLAP SURVEY) (3).DWG", PROVIDED TO GOLDER BY COUNCIL ON18 JUNE 2014

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. UNIT 11S - SINGLE - SIDED TEXTURED GEOMEMBRANE TO EXTEND ONTO FLOOR BY MINIMUM 1 m.

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TENDER

0 25 50
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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CLIENT
CITY OF DARWIN

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PROJECT
SHOAL BAY LANDFILL - STAGE 5

TITLE
GEOSYNTHETIC AND LEACHATE COLLECTION PIPES LAYOUT PLAN

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	7 of 18	D007

Path: ---- | File Name: DRAWING 7.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

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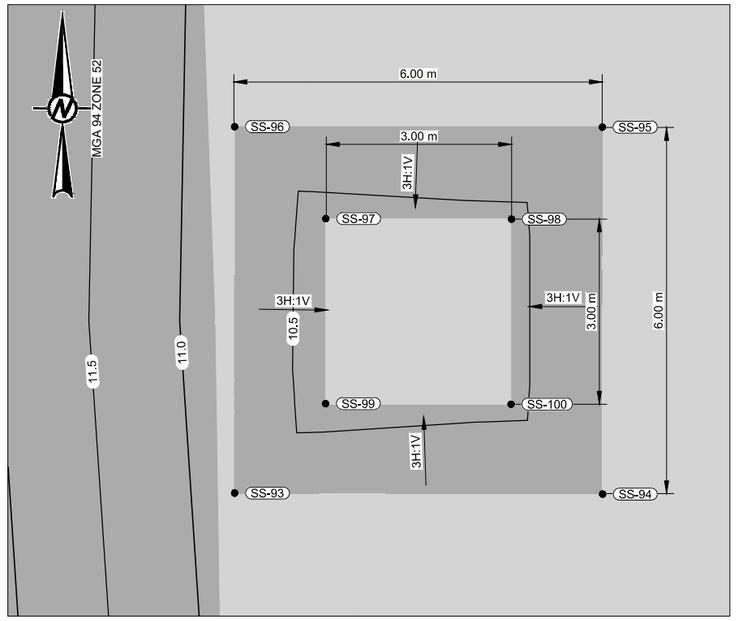
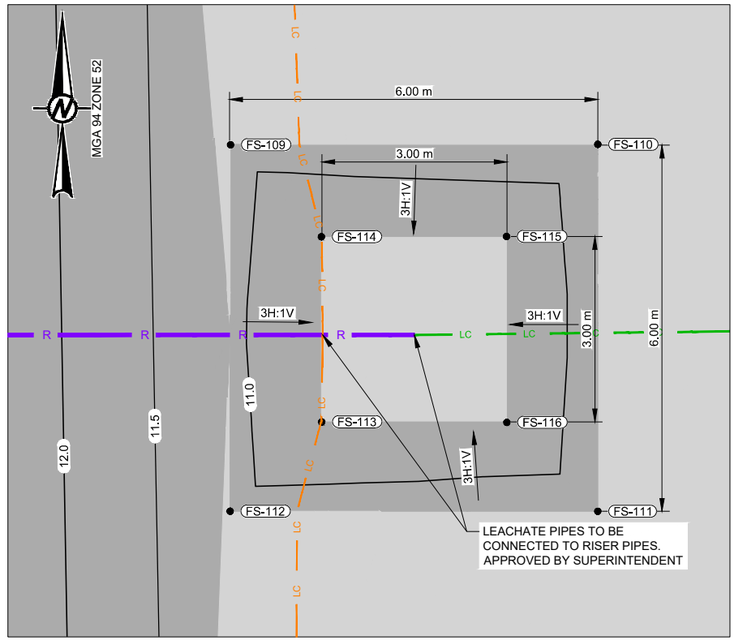


SUMP PLAN VIEW CELL 5A TOP OF SUBGRADE
SCALE 1:100 m



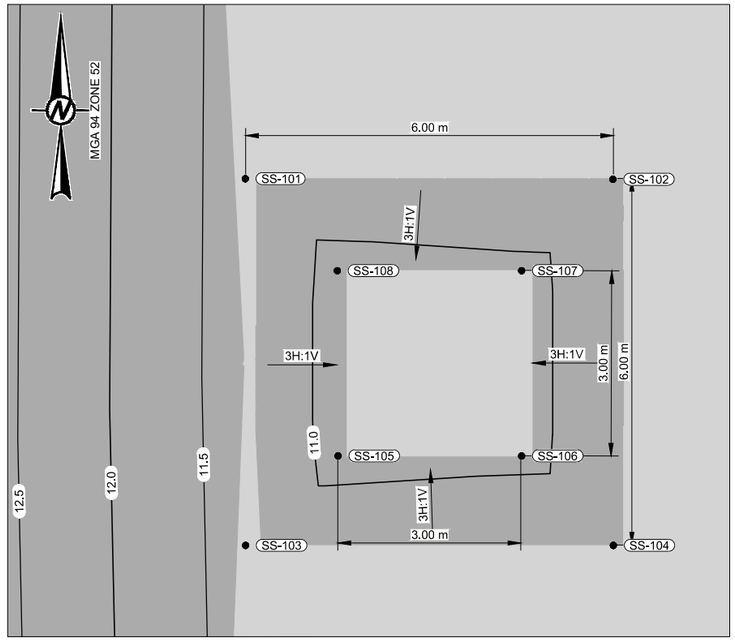
SUMP PLAN VIEW CELL 5A TOP OF SELECT FILL
SCALE 1:100 m

LEGEND

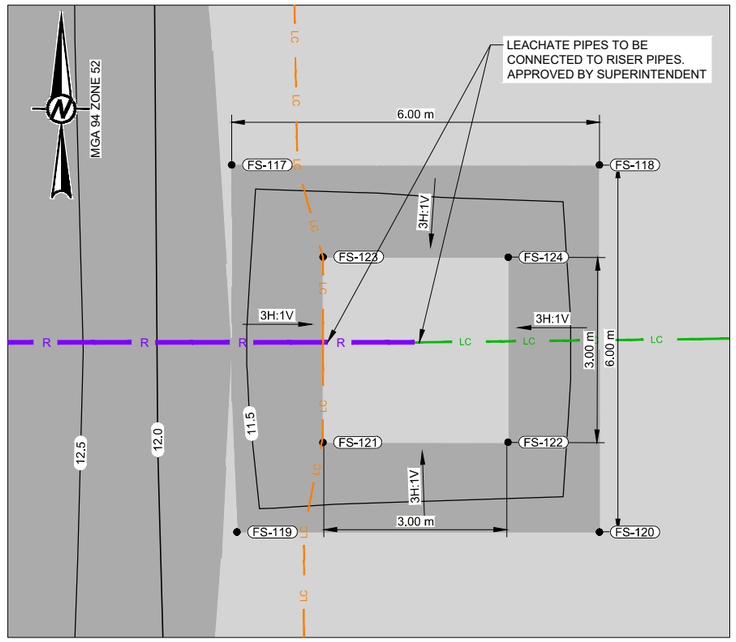
- DESIGN SURFACE CONTOURS AT 0.5 m INTERVALS
- LC — UNIT 21P - PERFORATED 280 DIA. PRIMARY LEACHATE PIPE
- LC — UNIT 22P - PERFORATED 160 DIA. SECONDARY LEACHATE PIPE
- R — UNIT 23 - RISER PIPE

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. SETOUT POINT TABLE FOR TOP SUBGRADE SUMP AND TOP OF SELECT FILL SUMP, REFER TO DRAWING D018.
3. REFER TO DRAWING D006 FOR PLAN VIEW STAGE 5A AND 5B LANDFILL CELL.



SUMP PLAN VIEW CELL 5B TOP OF SUBGRADE
SCALE 1:100 m



SUMP PLAN VIEW CELL 5B TOP OF SELECT FILL
SCALE 1:100 m

NOT FOR CONSTRUCTION ISSUED FOR

TENDER

0 2.5 5
1:100 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-03-21	NOT FOR CONSTRUCTION ISSUED FOR TENDER	SRM	MMC	DJR	JSB

CLIENT
CITY OF DARWIN

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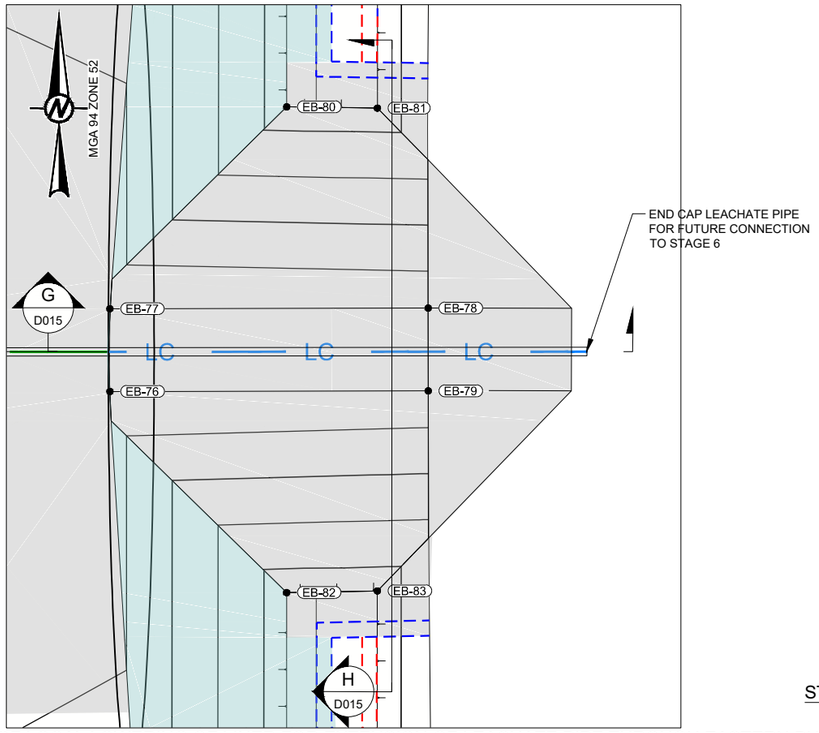
PROJECT
SHOAL BAY LANDFILL - STAGE 5

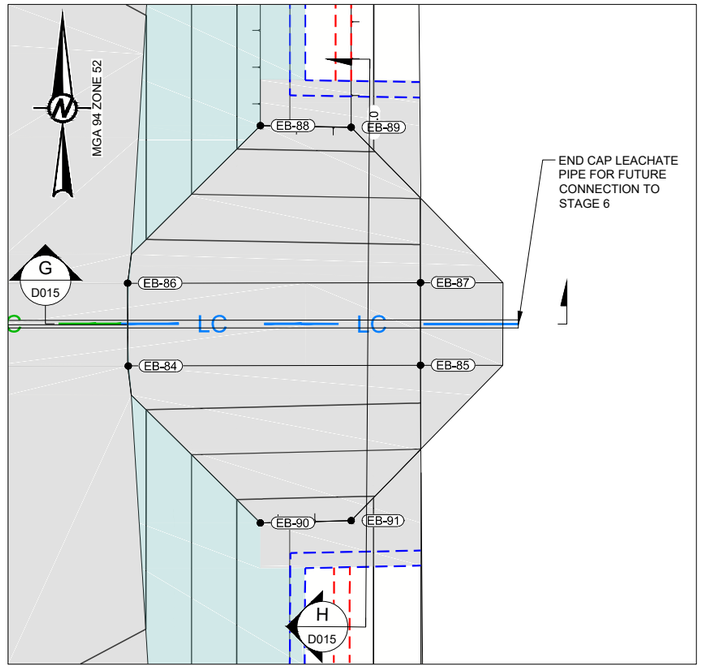
TITLE
SUBGRADE AND SELECT FILL SUMP PLANVIEW AND SETOUT POINTS

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	8 of 18	D008



STAGE 5A PLANVIEW OF LOCAL LOWERING OF LINER FOR EXTENSION OF LEACHATE PIPE THROUGH EASTERN BUND

SCALE 1:200 m

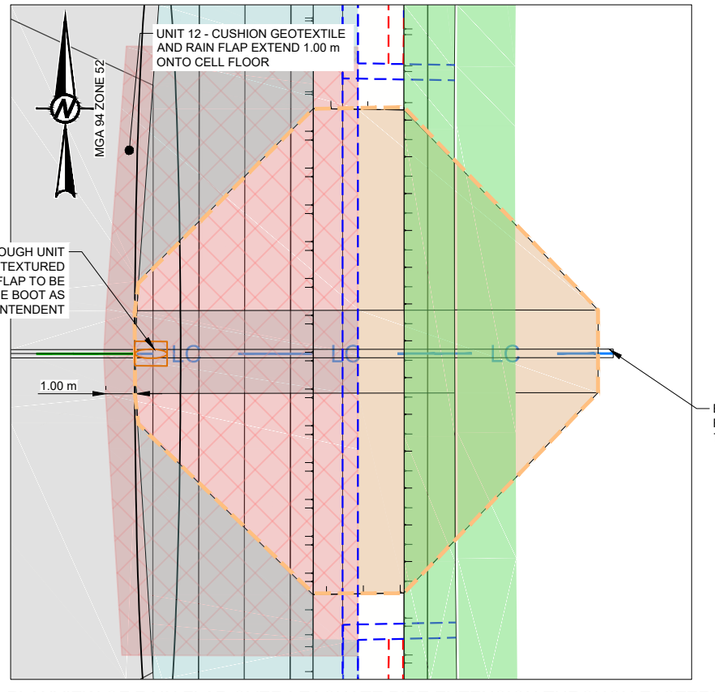


STAGE 5B PLANVIEW OF LOCAL LOWERING OF LINER FOR EXTENSION OF LEACHATE PIPE THROUGH EASTERN BUND

SCALE 1:200 m

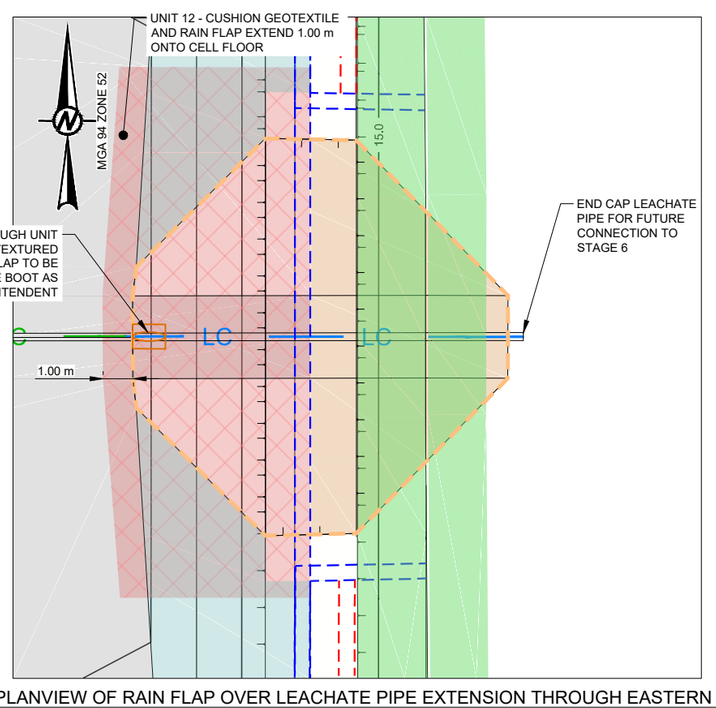
LEGEND

- UNIT 11S - SINGLE - SIDED TEXTURED GEOMEMBRANE
- UNIT 11D - DOUBLE - SIDED TEXTURED GEOMEMBRANE
- UNIT 1 - ENGINEERED FILL & UNIT 2 - SELECT FILL EMBANKMENT BACKFILL
- UNIT 11D - DOUBLE - SIDED TEXTURED GEOMEMBRANE AND RAIN FLAP OVER LEACHATE PIPE EXTENSION THROUGH EASTERN BUND
- UNIT 33 - EROSION PROTECTION
- UNIT 21P - PERFORATED 280 DIA. PRIMARY LEACHATE PIPE
- UNIT 21U - UNPERFORATED 280 DIA. PRIMARY LEACHATE PIPE
- DESIGN STAGE 5 CREST
- LINER ANCHOR TRENCH
- GEOSYNTHETIC REINFORCING LAYER ANCHOR TRENCH



STAGE 5A PLANVIEW OF RAIN FLAP OVER LEACHATE PIPE EXTENSION THROUGH EASTERN BUND

SCALE 1:200 m



STAGE 5B PLANVIEW OF RAIN FLAP OVER LEACHATE PIPE EXTENSION THROUGH EASTERN BUND

SCALE 1:200 m

REFERENCE(S)

1. EXISTING GROUND SURFACE COMPRISES THE FOLLOWING:
   - AUGUST 2015 SURVEY IN AREAS OUTSIDE THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY AUSURV SURVEYORS P/L COMPLETED ON 1 AUGUST 2015, DRAWING TITLE "DETAIL SURVEY SHOAL BAY WASTE MANAGEMENT FACILITY", DRAWING NUMBER 15-0099-1, CAD FILE NAME "15-0099 SHOAL BAY LANDFILL", PROVIDED TO GOLDER BY CITY OF DARWIN ON 14 AUGUST 2015.

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. SETOUT POINT TABLE FOR DESIGN TOP OF UNIT 2 - SELECT FILL EMBANKMENT BREAK AND BACKFILL SHOWN ON D018.

NOT FOR CONSTRUCTION ISSUED FOR

TENDER

0 5 10

1:200 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-03-21	NOT FOR CONSTRUCTION ISSUED FOR TENDER	SRM	MMC	DJR	JSB

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CONSULTANT

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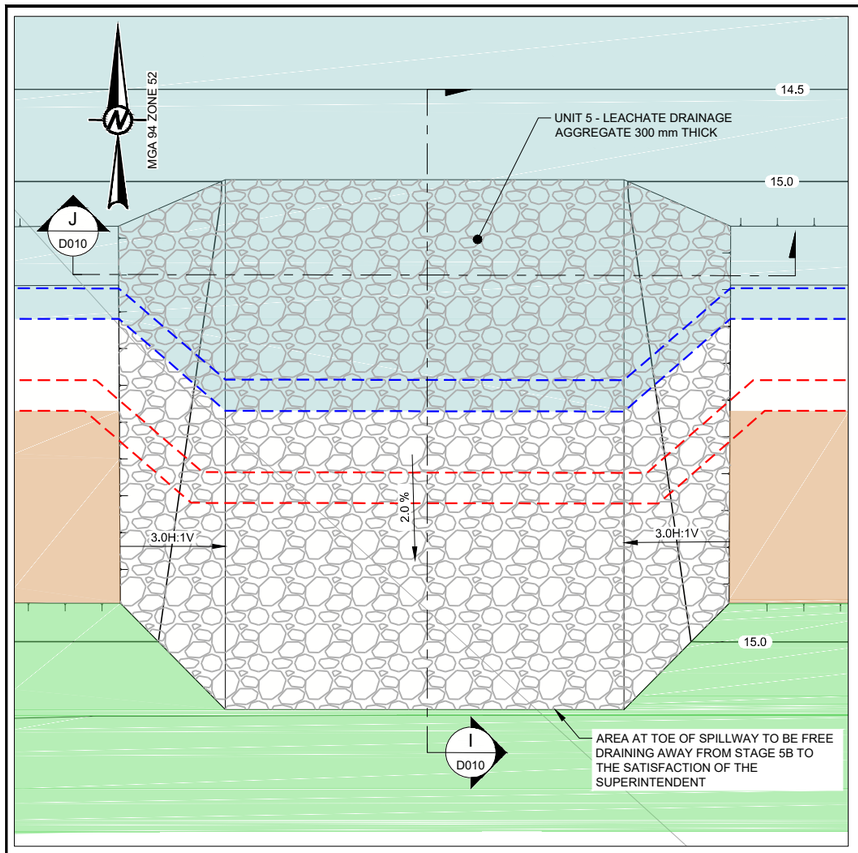
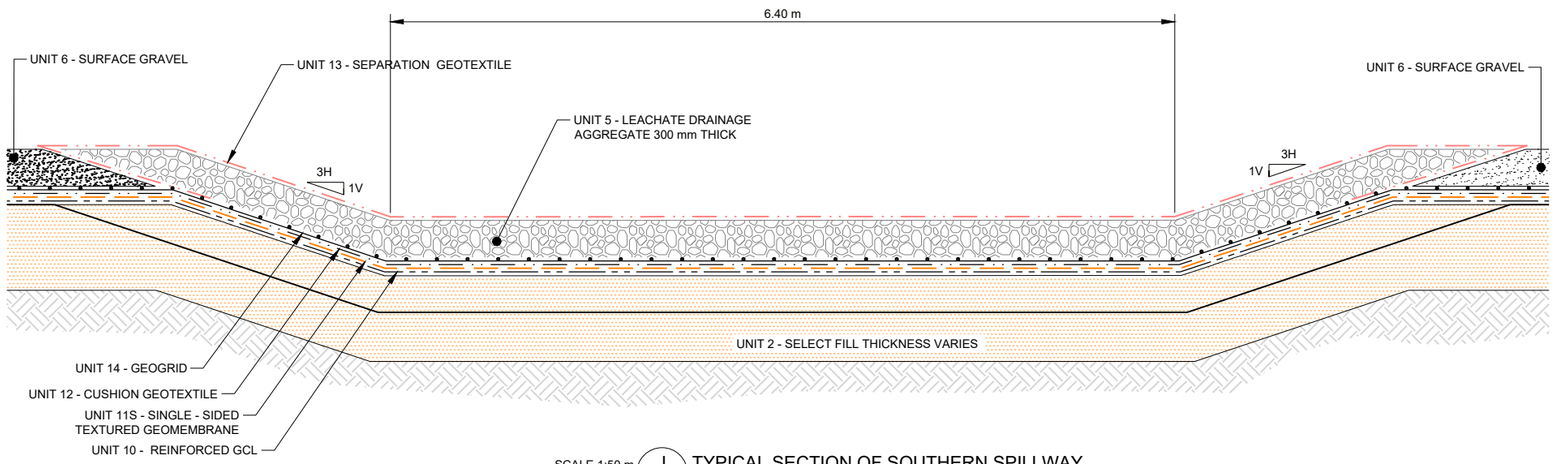
PROJECT
SHOAL BAY LANDFILL - STAGE 5

TITLE
LEACHATE PIPE PROTRUSION THROUGH EMBANKMENT

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	9 of 18	D009



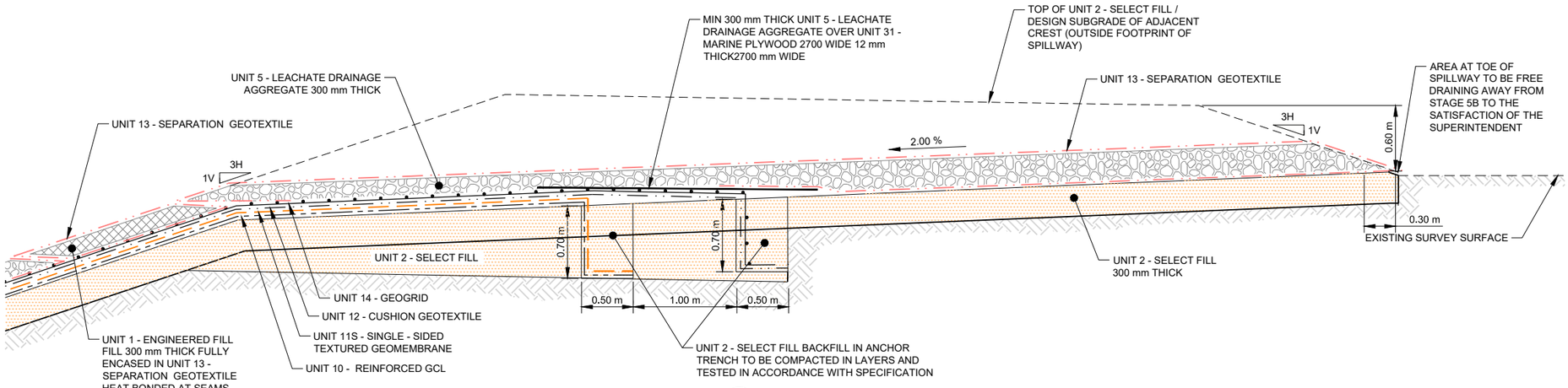
STAGE 5B PLANVIEW OF SOUTHERN EMBANKMENT SPILLWAY
SCALE 1:100 m



SCALE 1:50 m J D007 TYPICAL SECTION OF SOUTHERN SPILLWAY

LEGEND

- UNIT 11S - SINGLE - SIDED TEXTURED GEOMEMBRANE
- UNIT 6 - SURFACE GRAVEL
- UNIT 33 - EROSION PROTECTION
- DESIGN STAGE 5 CREST
- LINER ANCHOR TRENCH
- GEOSYNTHETIC REINFORCING LAYER ANCHOR TRENCH



SCALE 1:50 m I D007 TYPICAL SECTION OF SOUTHERN SPILLWAY

REFERENCE(S)

1. EXISTING GROUND SURFACE COMPRISES THE FOLLOWING:
   - DEC 2015 SURVEY WITHIN THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY UNKNOWN ON DECEMBER 2015, DRAWING TITLE "5209-131(3DINFO).DWG", PROVIDED TO GOLDER BY CLIENT DATE UNKNOWN.
   - AUGUST 2015 SURVEY IN AREAS OUTSIDE THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY AUSURV SURVEYORS P/L COMPLETED ON 1 AUGUST 2015, DRAWING TITLE "DETAIL SURVEY SHOAL BAY WASTE MANAGEMENT FACILITY", DRAWING NUMBER 15-0099-1, CAD FILE NAME "15-0099 SHOAL BAY LANDFILL", PROVIDED TO GOLDER BY CITY OF DARWIN ON 14 AUGUST 2015.
2. AS-CONSTRUCTED EDGE OF STAGE 3 LINER IS BASED ON THE FOLLOWING:
   - STAGE 3 LINER SURVEY. SURVEY BY EARL JAMES & ASSOCIATES ON 10 FEBRUARY 2012, CAD FILE NAME "5209 151013 CELL BASE 3 ON MGA AND AHD.DWG",PROVIDED TO GOLDER BY TERRITORIA CIVIL ON 13 OCT 2015 (SACAGIO/BEGG).
   - STAGE 4 LINER SURVEY. SURVEY BY FYFE EARTH PARTNERS ON 10 JAN 2013, PLAN TITLE "SHOAL BAY LANDFILL ASCON 18/10/2012 WITH RAINFLAP DESIGN COMPARISON", PLAN NO 29814 / 10 REV 0, CAD FILE NAME "29810 (RAINFLAP SURVEY) (3).DWG", PROVIDED TO GOLDER BY COUNCIL ON18 JUNE 2014

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. SETOUT POINT TABLE FOR DESIGN TOP OF SPILLWAY SHOWN ON D018.

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0 1 2
1:50 METRES

0 2.5 5
1:100 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-03-21	NOT FOR CONSTRUCTION ISSUED FOR TENDER	SRM	MMC	DJR	JSB

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PROJECT
SHOAL BAY LANDFILL - STAGE 5

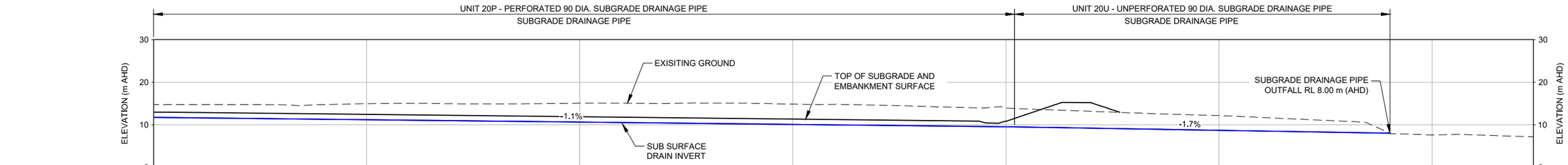
TITLE
SOUTHERN SPILLWAY

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	10 of 18	D010

Path: ---- | File Name: DRAWING 9.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

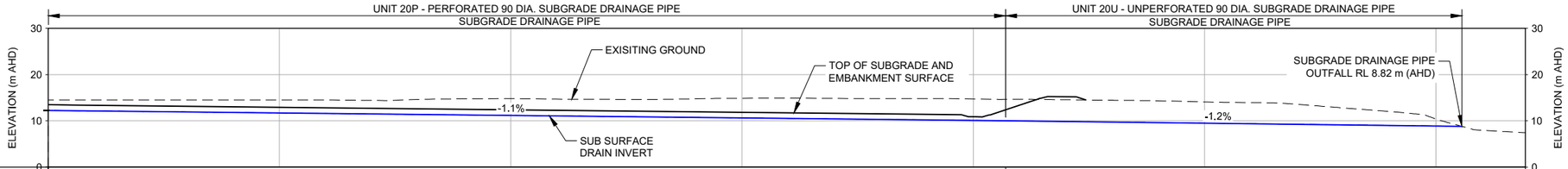
0 25 mm



GRADE		-1.1%				-1.7%		
EXISTING GROUND	14.74	14.94	15.06	14.84	13.97	12.14	7.60	7.17
DESIGN SURFACE TOP OF SUBGRADE & EMBANKMENTS	12.98	12.43	11.88	11.33	10.80			
BASE OF SUBGRADE DRAINAGE PIPE IN TRENCH	11.72	11.18	10.63	10.09	9.53	8.69		
BASE OF TRENCH	11.67	11.13	10.58	10.04	9.48	8.64		
CHAINAGE	0.00	50.00	100.00	150.00	200.00	250.00	300.00	323.78

STAGE 5A LONGSECTION SUBSURFACE DRAIN

SCALE 1:1000



GRADE		-1.1%				-1.2%		
EXISTING GROUND	14.52	14.53	14.80	14.87	14.72	14.10	10.39	7.43
DESIGN SURFACE TOP OF SUBGRADE & EMBANKMENTS	13.50	12.95	12.40	11.86	10.88			
BASE OF SUBGRADE DRAINAGE PIPE IN TRENCH	12.25	11.71	11.17	10.63	10.09	9.50	8.89	
BASE OF TRENCH	12.20	11.66	11.12	10.58	10.04	9.45		
CHAINAGE	0.00	50.00	100.00	150.00	200.00	250.00	300.00	319.34

STAGE 5B LONGSECTION SUBSURFACE DRAIN

SCALE 1:1000

REFERENCE(S)

1. EXISTING GROUND SURFACE COMPRISES THE FOLLOWING:
   - DEC 2015 SURVEY WITHIN THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY UNKOWN ON DECEMBER 2015, DRAWING TITLE "5209-131(3DINFO).DWG", PROVIDED TO GOLDER BY CLIENT DATE UNKNOWN.
   - AUGUST 2015 SURVEY IN AREAS OUTSIDE THE FOOTPRINT OF STAGES 3 AND 4. SURVEYED BY AUSURV SURVEYORS P/L COMPLETED ON 1 AUGUST 2015, DRAWING TITLE "DETAIL SURVEY SHOAL BAY WASTE MANAGEMENT FACILITY", DRAWING NUMBER 15-0099-1, CAD FILE NAME "15-0099 SHOAL BAY LANDFILL", PROVIDED TO GOLDER BY CITY OF DARWIN ON 14 AUGUST 2015.

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. SUBSURFACE DRAIN 5A AND 5B PLAN VIEW REFER TO DRAWING D004.

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0 25 50

1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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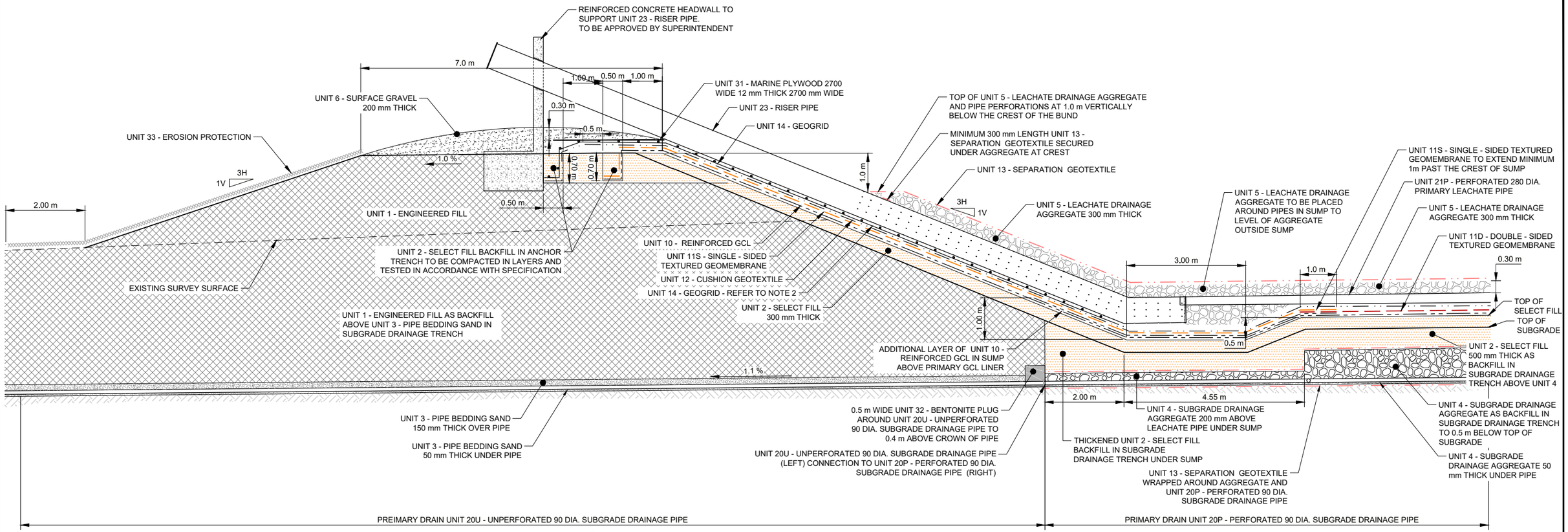
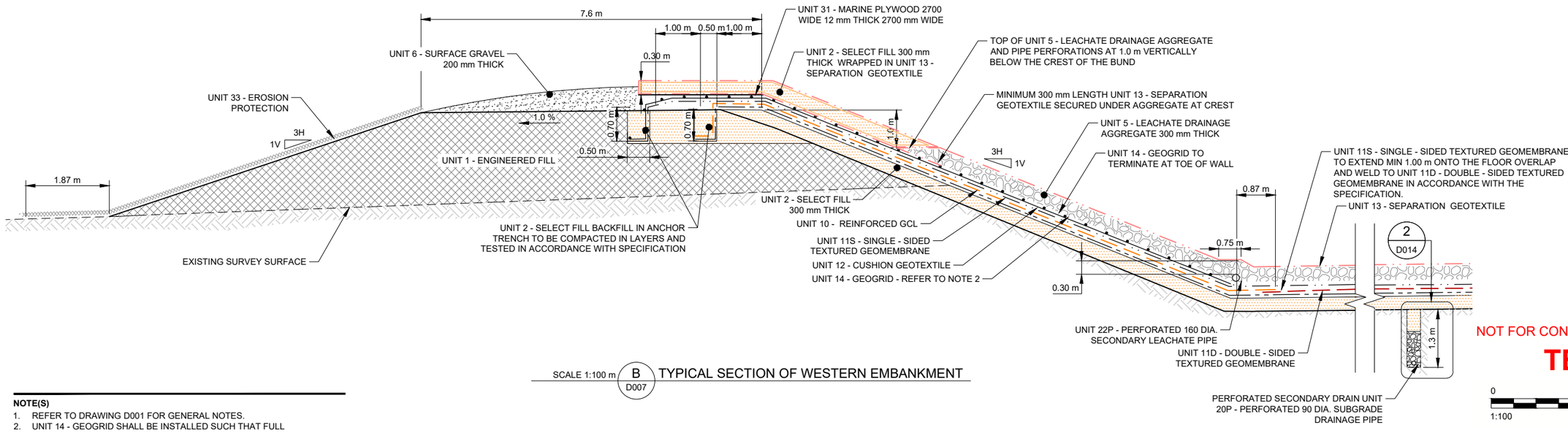
PROJECT
SHOAL BAY LANDFILL - STAGE 5

TITLE
SUB SURFACE DRAINAGE PIPE LONGSECTION

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	10 of 18	D011



SCALE 1:100 m A D007 TYPICAL SECTION OF RISER PIPE ON WESTERN EMBANKMENT RISER PIPE



SCALE 1:100 m B D007 TYPICAL SECTION OF WESTERN EMBANKMENT

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. UNIT 14 - GEOGRID SHALL BE INSTALLED SUCH THAT FULL LENGTH OF SLOPE IS COVERED WITH A SINGLE PANEL, WITHOUT HORIZONTAL JOINS.

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0 2.5 5

1:100 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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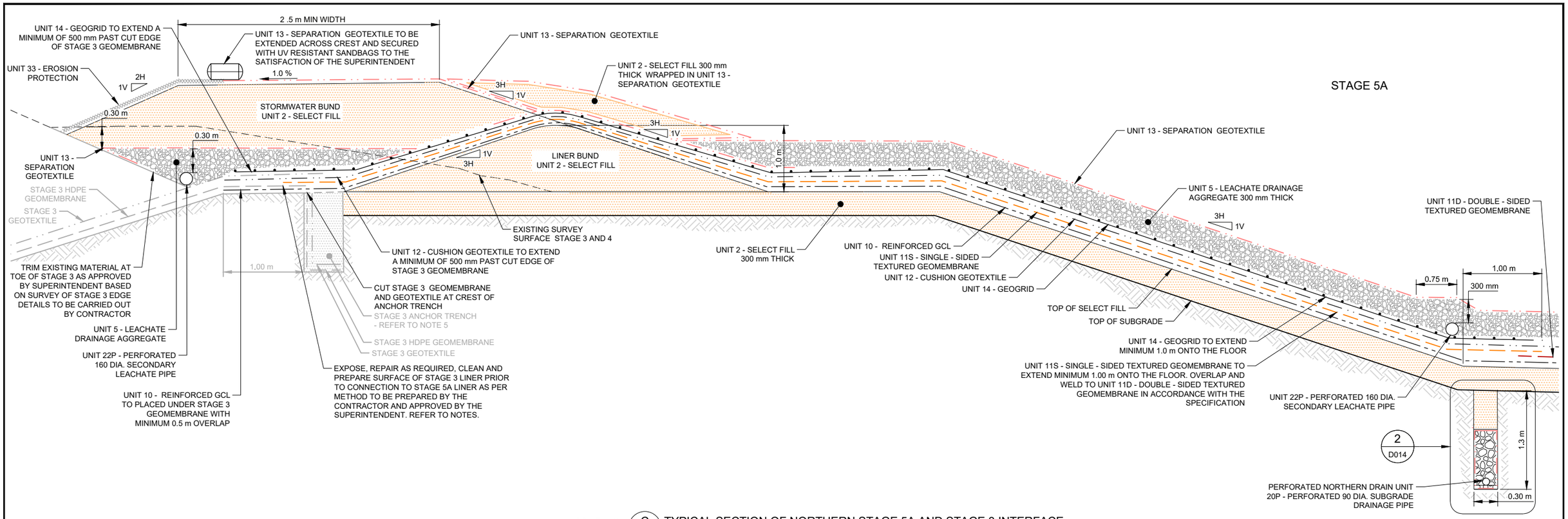
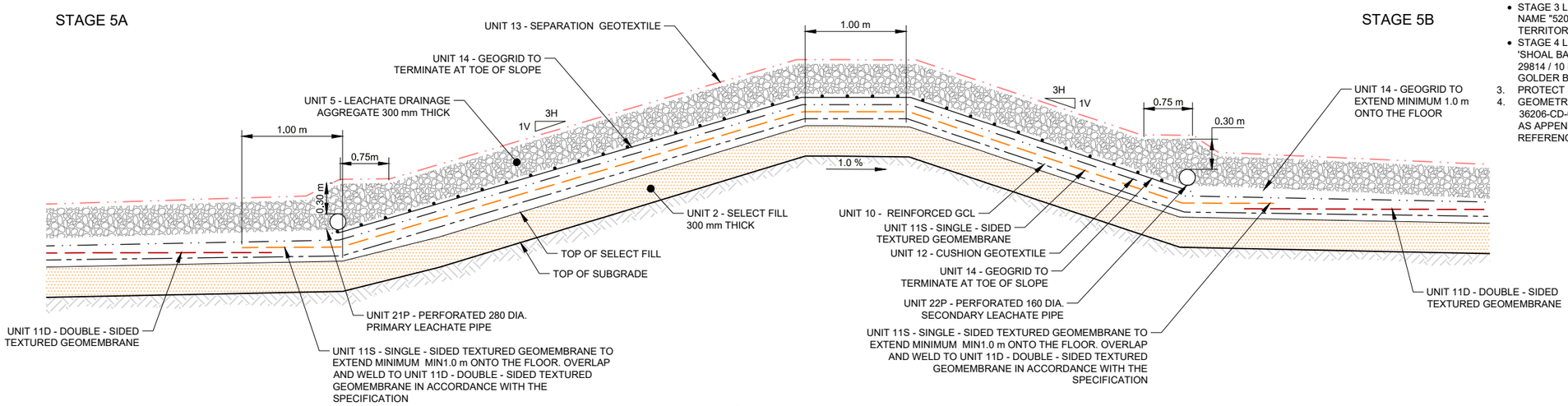
PROJECT
SHOAL BAY LANDFILL - STAGE 5

TITLE
SECTIONS SHEET 1 OF 3

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	11 of 18	D012



SCALE 1:50 m C D007 TYPICAL SECTION OF NORTHERN STAGE 5A AND STAGE 3 INTERFACE



SCALE 1:50 m D D007 TYPICAL SECTION OF STAGE 5A AND STAGE 5B INTERFACE BUND

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. LOCATION OF STAGE 3 LINER TO BE CONFIRMED ON SITE LOCATION RELATIVE TO DESIGN STAGE 5A LINER VARIES HORIZONTALLY AND VERTICALLY. LOCATION INDICATED ON DRAWINGS IS BASED ON THE FOLLOWING:
   - STAGE 3 LINER SURVEY. SURVEY BY EARL JAMES & ASSOCIATES ON 10 FEB 2012,CAD FILE NAME "5209 151013 CELL BASE 3 ON MGA AND AHD.DWG", PROVIDED TO GOLDER BY TERRITORIA CIVIL ON 13 OCT 2015 (SACAGIO / BEGG).
   - STAGE 4 LINER SURVEY. SURVEY BY FYFE EARTH PARTNERS ON 10 JAN 2013, PLAN TITLE 'SHOAL BAY LANDFILL ASCON 18/10/2012 WITH RAINFLAP DESIGN COMPARISON", PLAN NO 29814 / 10 REV 0, CAD FILE NAME "29810 (RAINFLAP SURVEY) (3).DWG", PROVIDED TO GOLDER BY COUNCIL ON 18 JUNE 2014
3. PROTECT INTEGRITY OF STAGE 3 LINER DURING WORKS.
4. GEOMETRY OF STAGE 3 ANCHOR TRENCH BASED ON STAGE 3 DESIGN DRAWINGS 36206-CD-01 TO 36206-CD-18, PREPARED BY SMEC, ISSUED TO COUNCIL 18 DECEMBER 2001 AS APPENDIX D OF "SHOAL BAY LANDFILL STAGE 3 DETAILED DESIGN REPORT" (SMEC REFERENCE 36206.009/001). AS-BUILT GEOMETRY MAY VARY FROM THAT INDICATED.

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0 2.5 5

1:100 METRES

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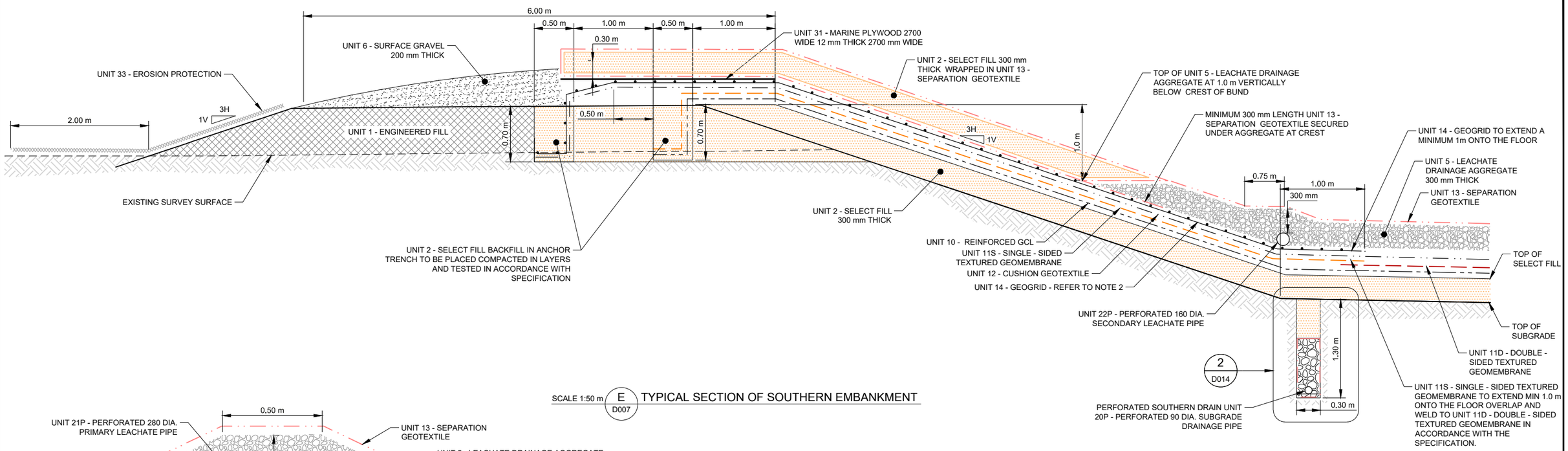
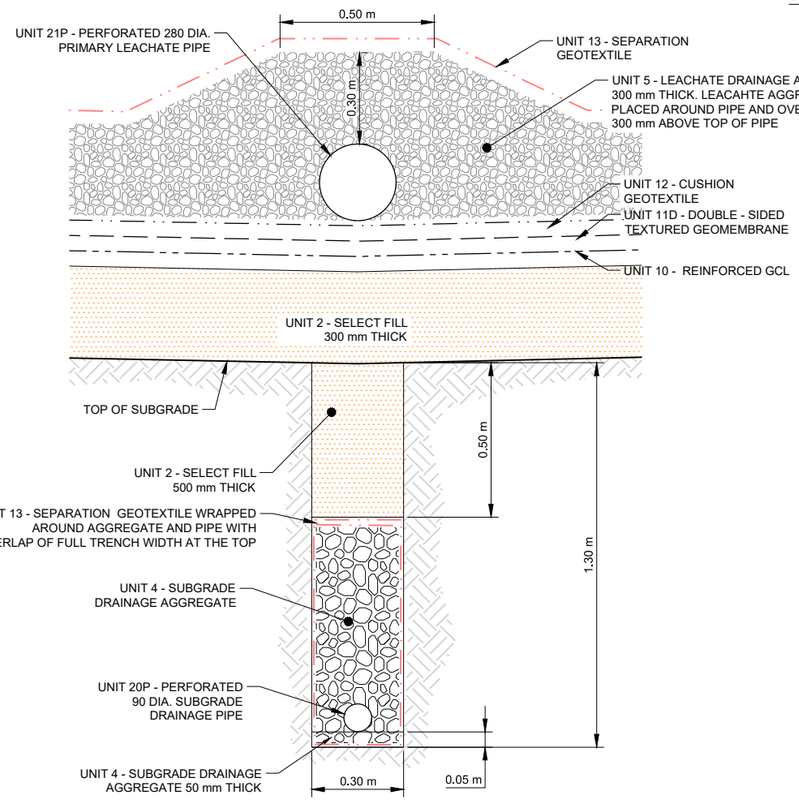
PROJECT
SHOAL BAY LANDFILL - STAGE 5

TITLE
SECTIONS SHEET 2 OF 3

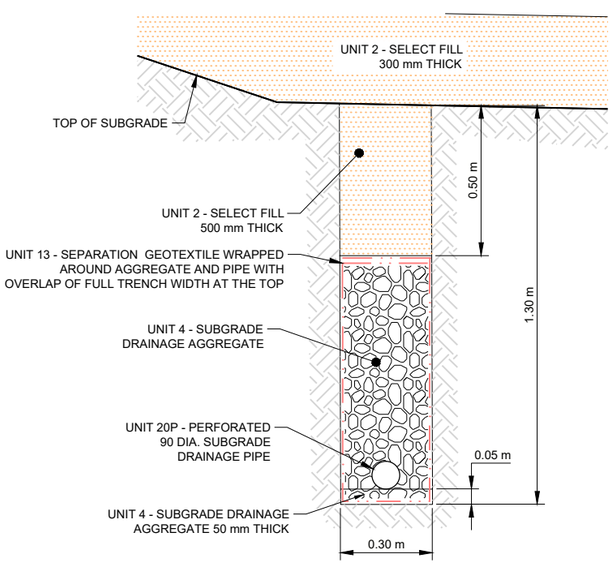
PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	12 of 18	D013



SCALE 1:50 m (E D007) TYPICAL SECTION OF SOUTHERN EMBANKMENT



SCALE 1 :20 m (F D007) TYPICAL SECTION OF LEACHATE PIPE AND SUBGRADE DRAINAGE TRENCH



SCALE 1:20 m (2 D012 D013 D014 D015) TYPICAL DETAIL NORTHERN SOUTHERN AND SECONDARY DRAIN

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. UNIT 14 - GEOGRID SHALL BE INSTALLED SUCH THAT FULL LENGTH OF SLOPE IS COVERED WITH A SINGLE PANEL, WITHOUT HORIZONTAL JOINS.

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0 0.5 1
1:20 METRES

0 1 2
1:50 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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CLIENT
CITY OF DARWIN

PROJECT
SHOAL BAY LANDFILL - STAGE 5

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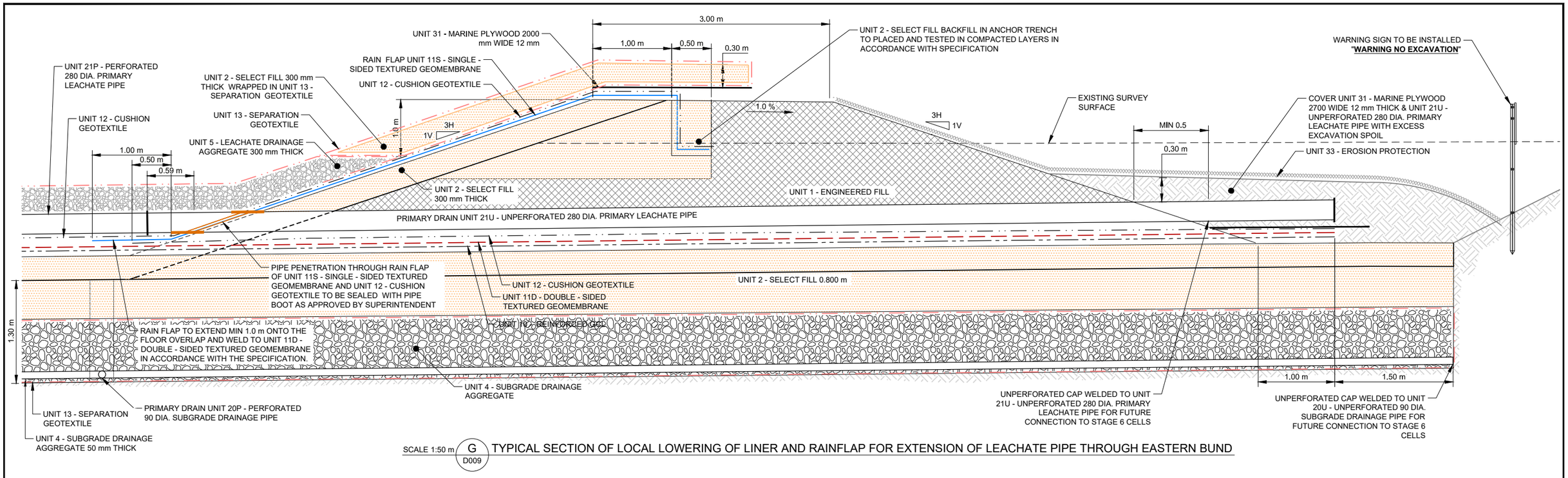
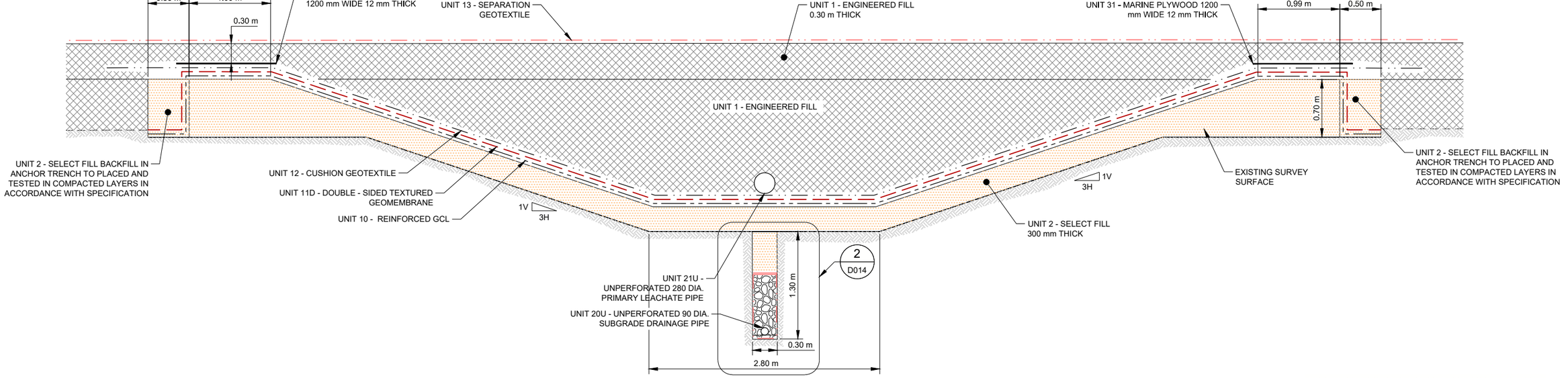
TITLE
SECTIONS SHEET 3 OF 4

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	13 of 18	D014



SCALE 1:50 m — G / D009 — TYPICAL SECTION OF LOCAL LOWERING OF LINER AND RAINFLAP FOR EXTENSION OF LEACHATE PIPE THROUGH EASTERN BUND



SCALE 1:50 m — H / D009 — TYPICAL SECTION OF LOCAL LOWERING OF LINER AND RAINFLAP FOR EXTENSION OF LEACHATE PIPE THROUGH EASTERN BUND

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. UNIT 14 - GEOGRID SHALL BE INSTALLED SUCH THAT FULL LENGTH OF SLOPE IS COVERED WITH A SINGLE PANEL, WITHOUT HORIZONTAL JOINS.

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TENDER

0 1 2
1:50 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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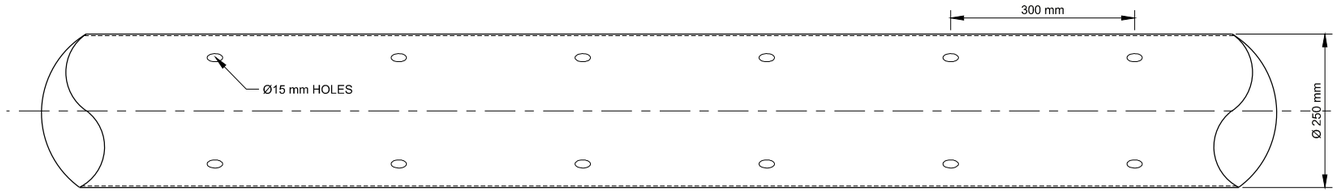
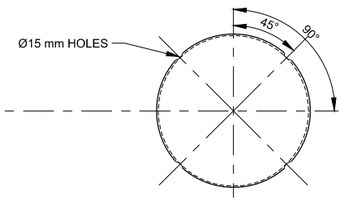
PROJECT
SHOAL BAY LANDFILL - STAGE 5

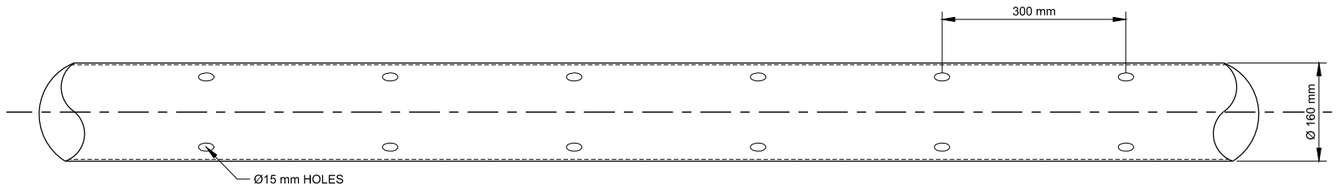
TITLE
SECTIONS SHEET 4 OF 4

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	14 of 18	D015

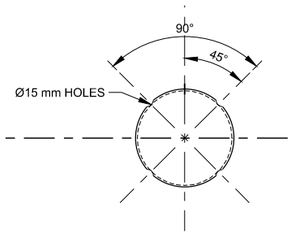


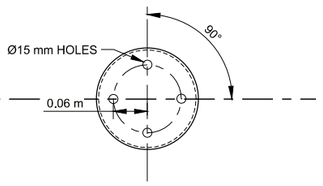
TYPICAL UNIT 21P - PERFORATED 280 DIA. PRIMARY LEACHATE PIPE - DRILL DETAIL
SCALE 1:10 m



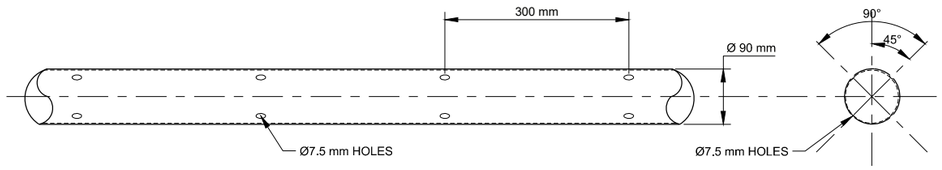


TYPICAL UNIT 22P - PERFORATED 160 DIA. SECONDARY LEACHATE PIPE - DRILL DETAIL
SCALE 1:10 m





UNIT 22 P END CAP TYPICAL DRILL DETAIL
SCALE 1:10 m



TYPICAL UNIT 20P - PERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE - DRILL DETAIL
SCALE 1:10 m

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0 0.25 0.5
1:10 METRES

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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CITY OF DARWIN

PROJECT
SHOAL BAY LANDFILL - STAGE 5

CONSULTANT

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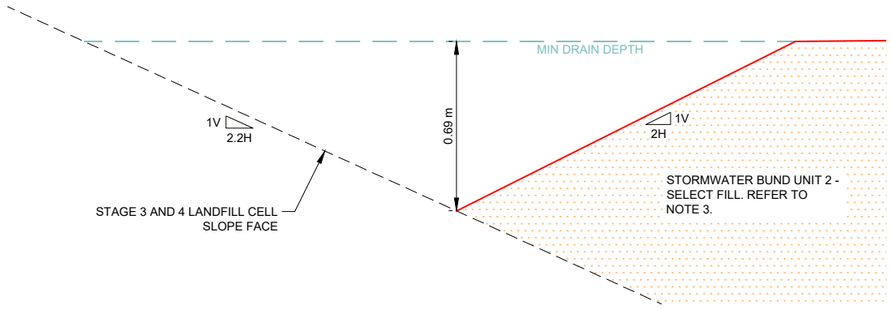
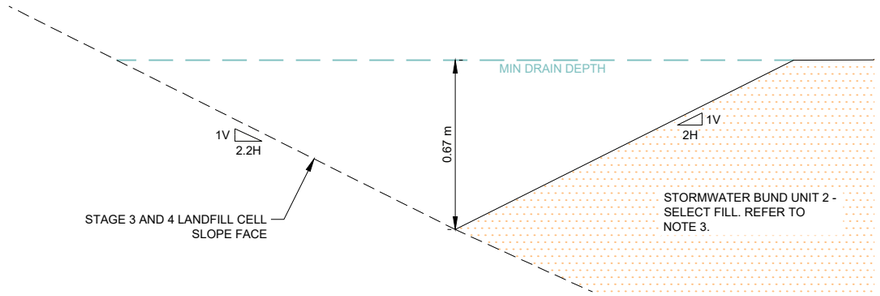
TITLE
DETAILS 1 OF 2

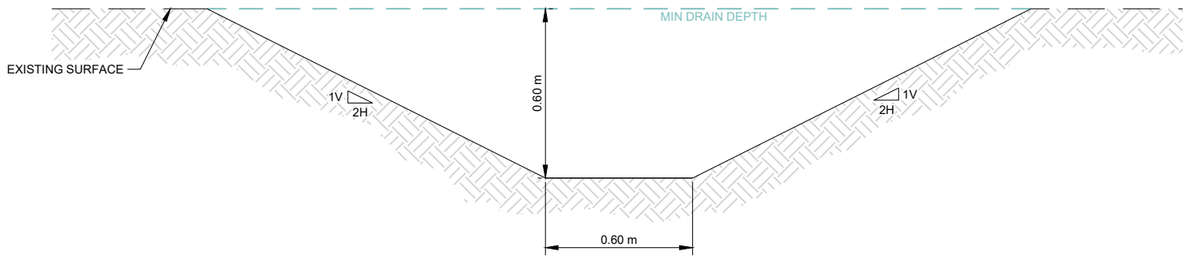
PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	15 of 18	D016



TYPICAL STORMWATER DRAIN A PROFILE DETAIL
SCALE 1:25 m



TYPICAL STORMWATER DRAIN B PROFILE DETAIL
SCALE 1:25 m



TYPICAL STORMWATER DRAIN C PROFILE DETAIL
SCALE 1:25 m

NOTE(S)

1. REFER TO DRAWING D001 FOR GENERAL NOTES.
2. REFER TO DRAWING D007 FOR DRAIN A, B AND C ALIGNMENT PLAN VIEW LAYOUT.
3. STORMWATER DRAINS A AND B TO BE CONSTRUCTED OVER LINER CONNECTION TO STAGE 3 - REFER TO TYPICAL SECTION C, D012.

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0 0.5 1
1:25 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2016-03-21	NOT FOR CONSTRUCTION ISSUED FOR TENDER	SRM	MMC	DJR	JSB

CLIENT
CITY OF DARWIN

PROJECT
SHOAL BAY LANDFILL - STAGE 5

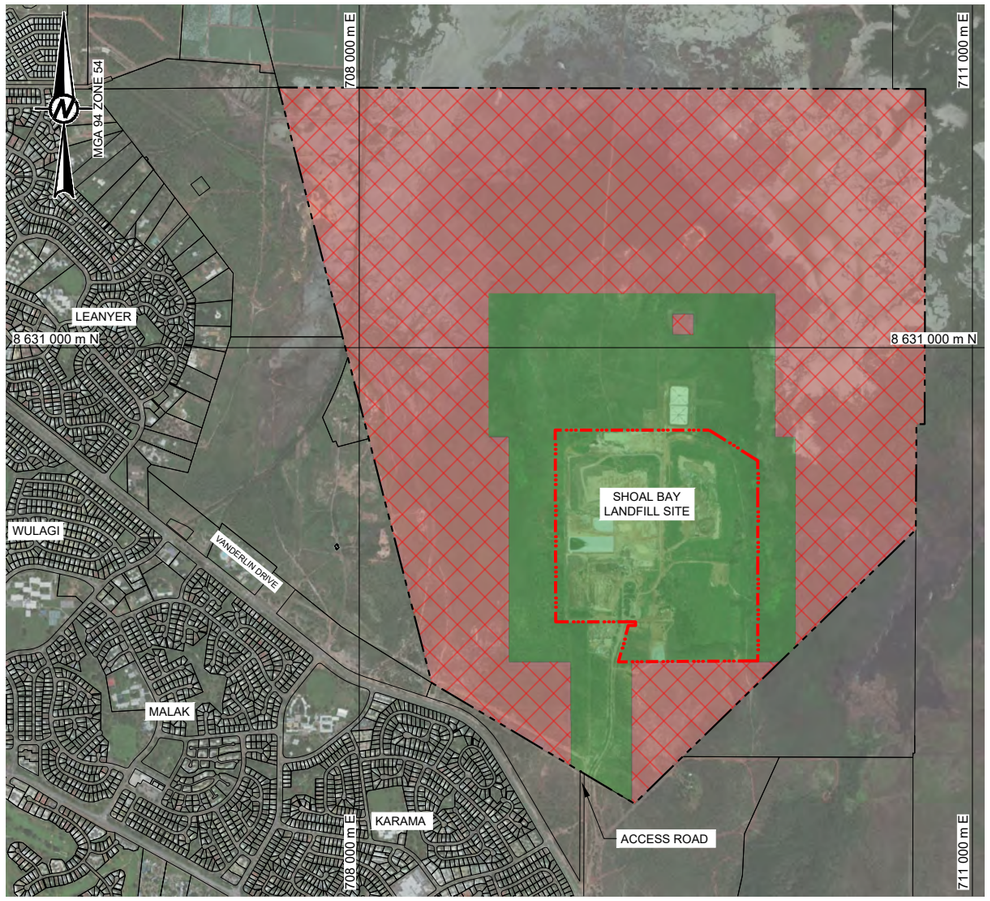
CONSULTANT

GOLDER ASSOCIATES - ADELAIDE OFFICE
118 FRANKLIN STREET
ADELAIDE SA 5000
AUSTRALIA
[+61] (8) 8213 2100
www.golder.com

TITLE
DETAILS 2 OF 2

PROJECT NO.	DOC	REV.		DRAWING
1526230	008-S	0	17 of 18	D017

CITY OF DARWIN
SHOAL BAY LANDFILL - STAGE 6



LOCALITY PLAN
NOT TO SCALE

LEGEND

- UNCLEARED UNEXPLODED ORDINANCE AREA
- CLEARED UNEXPLODED ORDINANCE AREA
- LEASE BOUNDARY
- OPERATIONS AREA BOUNDARY

MATERIAL LIST

DRG NO.	REV.	DATE	DRAWING DESCRIPTION
001	3	2019-10-08	COVER SHEET
002	2	2019-07-22	PLAN - SITE LAYOUT
003	2	2019-07-22	PLAN - EXISTING SITE CONDITIONS
004	2	2019-07-22	PLAN - TOP OF DESIGN SUBGRADE AND SUBGRADE DRAINAGE SETOUT
005	2	2019-07-22	PLAN - TOP OF SELECT FILL DESIGN SURFACE SETOUT PLAN
006	3	2019-10-08	PLAN - GEOSYNTHETIC AND LEACHATE PIPES LAYOUT
007	2	2019-07-22	LONGSECTION - SUBGRADE DRAINAGE PIPES
008	2	2019-07-22	PLAN AND TYPICAL SECTIONS - SUMP ARRANGEMENT AND SETOUT
009	2	2019-07-22	TYPICAL SECTIONS AND DETAILS - SUMP
010	2	2019-07-22	PLAN AND TYPICAL SECTIONS - SPILLWAY ARRANGEMENT AND SETOUT
011	2	2019-07-22	TYPICAL SECTIONS - CELL - SHEET 1 OF 2
012	2	2019-07-22	TYPICAL SECTIONS - CELL - SHEET 2 OF 2
013	3	2019-10-08	TYPICAL SECTIONS - STAGES 3 AND 5 TIE-IN
014	2	2019-07-22	TYPICAL SECTIONS - STAGES 5 LOWERED AREA
015	3	2019-10-08	PLAN AND LONGSECTION - NORTHERN LEACHATE DRAIN
016	2	2019-07-22	PLAN AND LONGSECTION - NORTHERN STORMWATER DRAIN
017	2	2019-07-22	PLAN AND TYPICAL SECTIONS - STORMWATER DRAINS
018	2	2019-07-22	PLAN AND LONGSECTION - GROUND WATER PIPELINE
019	2	2019-07-22	TYPICAL SECTION AND DETAIL - GROUND WATER PIPELINE
020	2	2019-07-22	TABLE - SETOUT POINTS

NOTES

1. THESE NOTES APPLY TO ALL PROJECT DRAWINGS IN THE SET UNLESS NOTED OTHERWISE AND SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION.
2. ALL LEVELS ARE IN METRES TO AHD DATUM.
3. ALL CO-ORDINATES ARE IN METRES TO MAP GRID AUSTRALIA (MGA 94, ZONE 52).
4. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE
5. LOCATION AND DEPTH OF ALL SERVICES TO BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.
6. DIMENSIONS SHALL NOT BE SCALED OFF DRAWINGS.
7. DRAWINGS MUST BE PRINTED IN COLOUR TO CORRECTLY IDENTIFY ALL DESIGN ELEMENTS
8. THE CITY OF DARWIN IS CURRENTLY UNDERTAKING EXCAVATIONS IN THE STAGE 6 WORKS AREA, SITE CONDITIONS MAY VARY FROM THE SURVEY INFORMATION SHOWN.

REFERENCES

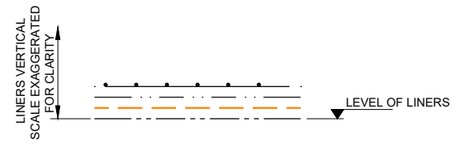
1. LEASE AREA BOUNDARY:
   - BASED ON CADASTRAL BOUNDARIES IN CADD FILE "CADASTRE_SHOALBAYREGION.DXF".
2. UNEXPLODED ORDINANCE CLEARANCE AREA:
   - BASED ON BOUNDARIES IN DRAWING TITLE "RAAF BOMBING RANGE LEASE AREA FOR DARWIN CITY COUNCIL LOT 3952", DRAWING DATED 25 AUGUST 1999, DRAWING NUMBER DA00350_1, FILE NAME "20100043_20140908_145851_01948_3536.PDF", MAPINFO FILES "EXCLUSION" AND COUNCIL LEASE.
3. EXISTING GROUND SURFACE BASED ON THE FOLLOWING:
   - APR 2018 FACILITY WIDE SURVEY TAKEN 2018-04-03, EXTRACTED FROM FILE"Shoal_Bay_Waste_Management_Facility _Whole_site_03_APR_2018_DXF___240_482_faces (1).zip"
   - EXISTING SURVEY DATA SUPPLIED BY DARWIN CITY COUNCIL, SURVEYED BY AUSURV SURVEYORS P/L CONSULTANTS, SURVEY DATE 01/08/2015, DRAWING - DETAIL SURVEY SHOAL BAY WASTE MANAGEMENT FACILITY, REF 15-0099 SHOAL BAY LANDFILL
4. AS-CONSTRUCTED EDGE OF STAGE 3 CREST:
5. DRAWING TITLED "5209 151013 Cell Base 3 on MGA and AHD.dwg", DATED 2015/12/03 PROVIDED BY CLIENT.
6. AS-CONSTRUCTED EDGE OF STAGE 5 LINER EXTRACTED FROM THE FOLLOWING:
   - DRAWING BY FIFE, TITLED "72011-51 (As-constructed survey Anchor Trenches Cell 5A (23-11-16)"
   - DRAWING BY TERRITORIA CIVIL, TITLED "72011-67 (As-constructed survey - Anchor Trench) FULL SHEET.DWG"

MATERIAL LIST

- BASE OF SUBGRADE
- UNIT 1 - ENGINEERED FILL
- UNIT 2 - SELECT FILL
- UNIT 3 - PIPE BEDDING SAND
- UNIT 4 - SUBGRADE DRAINAGE AGGREGATE
- UNIT 5 - LEACHATE DRAINAGE AGGREGATE
- UNIT 6 - SURFACE GRAVEL
- UNIT 10 - REINFORCED GCL
- UNIT 11D - DOUBLE-SIDED HDPE
- UNIT 11S - SINGLE-SIDED HDPE
- UNIT 12 - CUSHION GEOTEXTILE
- UNIT 13 - SEPARATION GEOTEXTILE
- UNIT 14 - GEOGRID
- UNIT 20P - PERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE
- UNIT 20U - UNPERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE
- LC UNIT 21P - PERFORATED 280 DIA. LEACHATE COLLECTION PIPE
- LC UNIT 21U - UNPERFORATED 280 DIA. LEACHATE COLLECTION PIPE
- LC UNIT 22P - PERFORATED 160 DIA. LEACHATE COLLECTION PIPE
- LC UNIT 22U - UNPERFORATED 160 DIA. LEACHATE COLLECTION PIPE
- R UNIT 23 - 630 DIA. RISER PIPE
- UNIT 24U - UNPERFORATED 160 DIA. DISCHARGE PIPE
- UNIT 25 - GROUND WATER VERTICAL RISER
- UNIT 30 - CONCRETE
- UNIT 31 - MARINE PLYWOOD 2400 MM WIDE 12 MM THICK
- UNIT 32 - BENTONITE
- UNIT 33 - EROSION PROTECTION
- UNIT 35 - SANDBAGS

LINER VERTICAL EXAGERATION DETAILS

1. LINER MATERIALS HAVE BEEN EXAGGERATED ON ALL PLANS AS DETAIL BELOW



2. LINER MAY COVER PIPES AND MATERIALS ON DETAILS

ISSUED FOR
CONTRUCTION

0 500 1,000
1:30,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
3	2019-10-08	UNIT 22P - PERFORATED 160 DIA. LEACHATE COLLECTION PIPE LOCATION CORRECTED, UPDATED SHEET LIST	IO	BK	JB	JB	05873
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER - UPDATE INDEX - MINOR EDITS	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

CLIENT
CITY OF DARWIN

CONSULTANT
GOLDER

BRISBANE OFFICE
147 CORONATION DRIVE
MILTON, QLD 4064
AUSTRALIA
[+61] (7) 3721 5400
www.golder.com

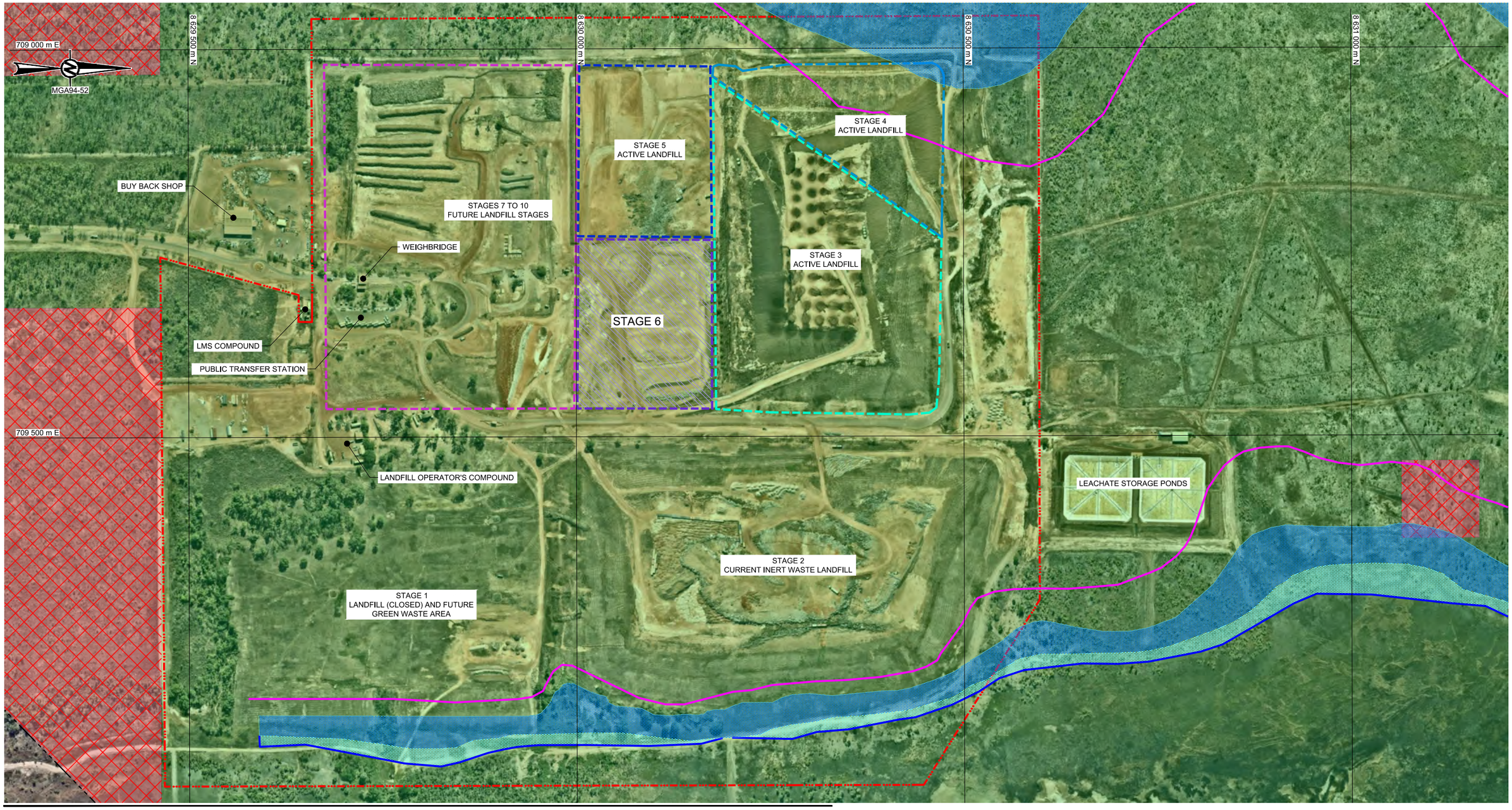
PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
COVER SHEET

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	3	1 of 20	001

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
25 mm
0

Path: \\golder.gtsi.pri\au\Brisbane\Geomatics\city_of_darwin\shoal_bay_landfill\99_projects\18106426-stage 6 construction\017-ef5_ifc\02_PRODUCTION\DWG\ | File Name: 18106426-017-CW-001.dwg



LEGEND

- UNCLEARED UNEXPLODED ORDINANCE AREA
- CLEARED UNEXPLODED ORDINANCE AREA
- APPROXIMATE EXTENT OF FUTURE STAGES 7 TO 10
- APPROXIMATE EXTENT OF STAGE 6
- ACTIVE LANDFILL STAGE 5
- ACTIVE LANDFILL STAGE 4
- ACTIVE LANDFILL STAGE 3
- LEASE BOUNDARY
- OPERATIONS AREA BOUNDARY
- ESTIMATED HAT (HIGHEST ASTRONOMICAL TIDE LINE)
- PRIMARY STORM SURGE ZONE (100 YEAR ARI)
- SECONDARY STORM SURGE ZONE (1 000 YEAR ARI)
- EXTREME STORM SURGE EXTENT (10 000 YEAR ARI)

ISSUED FOR

CONTRUCTION

0 100 200

1:5,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

CLIENT

CITY OF DARWIN

CONSULTANT

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[+61] (7) 3721 5400
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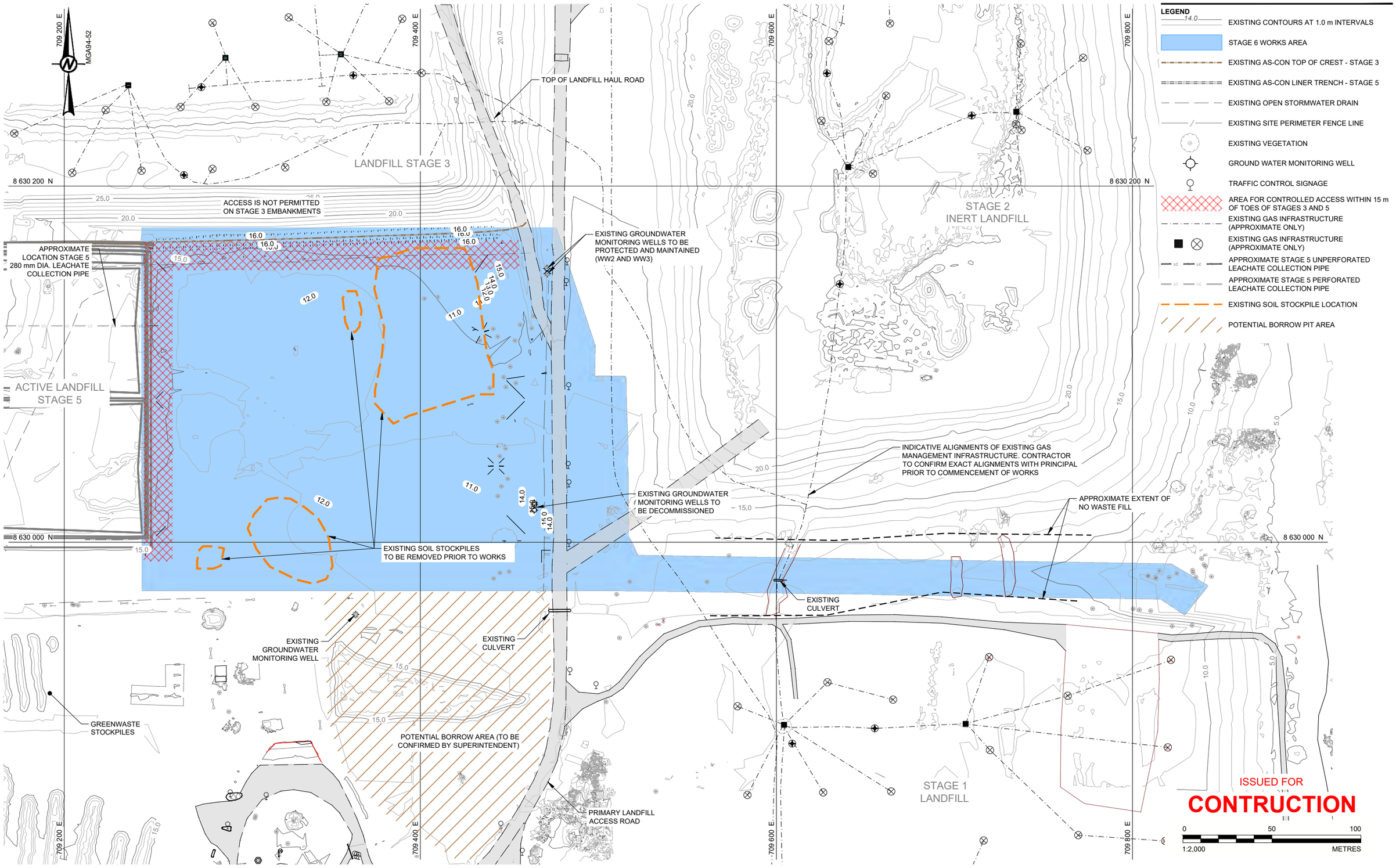
PROJECT

SHOAL BAY LANDFILL
STAGE 6

TITLE

PLAN - SITE LAYOUT

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	2 of 20	002



REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

CLIENT
CITY OF DARWIN

CONSULTANT
GOLDER

BRISBANE OFFICE
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AUSTRALIA
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www.golder.com

PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
PLAN - EXISTING SITE CONDITIONS

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	3 of 20	003

709 200 E | 709 300 E | 709 400 E | 709 500 E

MGA94-52

8 630 200 N | 8 630 100 N | 8 630 000 N

LANDFILL STAGE 3

ACTIVE LANDFILL STAGE 5

CELL 6A

CELL 6B

25.0 | 20.0 | 15.0

16.0 | 15.0 | 14.0 | 13.0 | 12.0 | 11.0

3.0H:1V

2.2%

1.0%

VARIES%

20.00 m | 40.00 m | 60.00 m | 80.00 m | 100.00 m | 120.00 m | 140.00 m | 160.00 m | 180.00 m | 200.00 m | 206.63 m

FORMATION FOR LEACHATE INTERCEPTION DRAIN

CONTRACTOR TO EXPOSE EXISTING STAGE 3 LINER FROM (709459.50 m E,8630179.63 m N) TO ALLOW CONNECTION TO STAGE 6 LINER.

LOCATE, EXPOSE AND SURVEY EDGE OF LINER FOR EXISTING STAGES 3 AND 5 AS PER TECHNICAL SPECIFICATIONS

APPROXIMATE LOCATION OF STAGE 5 208mm DIA. LEACHATGE COLLECTION PIPE

SUMP A REFER DRG 008 FOR DETAIL

SUMP B REFER DRG 008 FOR DETAIL

SPILLWAY REFER DRG 010 FOR DETAIL

LANDFILL ACCESS RAMP

PAVED ACCESS RAMP

UNIT 32 - 0.5 m WIDE PLUG AROUND PIPE TO 0.4 m ABOVE CROWN ON TRANSITION FROM UNIT 20P TO UNIT 20U

GROUNDWATER VERTICAL RISER B - REFER TO DRG 018 FOR DETAIL

SUBSURFACE DRAIN ALIGNMENTS TO BE ADJUSTED ON SITE TO FIT UNDER EASTERN EMBANKMENT FOOTPRINT. MINIMUM GRADE OF 0.8% ON DRAIN.

UNIT 32 - 0.5 m WIDE PLUG AROUND PIPE TO 0.4 m ABOVE CROWN ON TRANSITION FROM UNIT 20P TO UNIT 20U

GROUND WATER WELLS TO BE DECOMMISSIONED

MAIN LANDFILL ACCESS TRACK TO BE MAINTAINED AND ACCESS NOT IMPEDED DURING WORKS

LEGEND

- EXISTING CONTOURS AT 1.0 m INTERVALS
- DESIGN CONTOURS - BASE OF SUBGRADE AT 1.0 m INTERVALS
- EXISTING AS-CON TOP OF CREST - STAGE 3
- EXISTING AS-CON LINER TRENCH - STAGE 5
- EXISTING OPEN STORMWATER DRAIN
- EXISTING SITE FENCE LINE
- EXISTING VEGETATION
- GROUND WATER MONITORING WELL
- UNIT 20P - PERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE - PRIMARY ALIGNMENT
- UNIT 20U - UNPERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE
- UNIT 24U - UNPERFORATED 160 DIA. DISCHARGE PIPE
- UNIT 25 - GROUND WATER VERTICAL RISER
- EXISTING GAS INFRASTRUCTURE (APPROXIMATE ONLY)
- EXISTING GAS INFRASTRUCTURE (APPROXIMATE ONLY)
- SETOUT POINT REFER DRG 020 FOR COORDINATES

NOTE(S)

1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. SUBSURFACE DRAIN A AND B LONGSECTION REFER TO DRAWING 007.

ISSUED FOR

CONTRUCTION

0 | 50 | 100

1:2,000 METRES

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25 mm | 0

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

CLIENT

CITY OF DARWIN

CONSULTANT

GOLDER

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147 CORONATION DRIVE
MILTON, QLD 4064
AUSTRALIA
[+61] (7) 3721 5400
www.golder.com

PROJECT

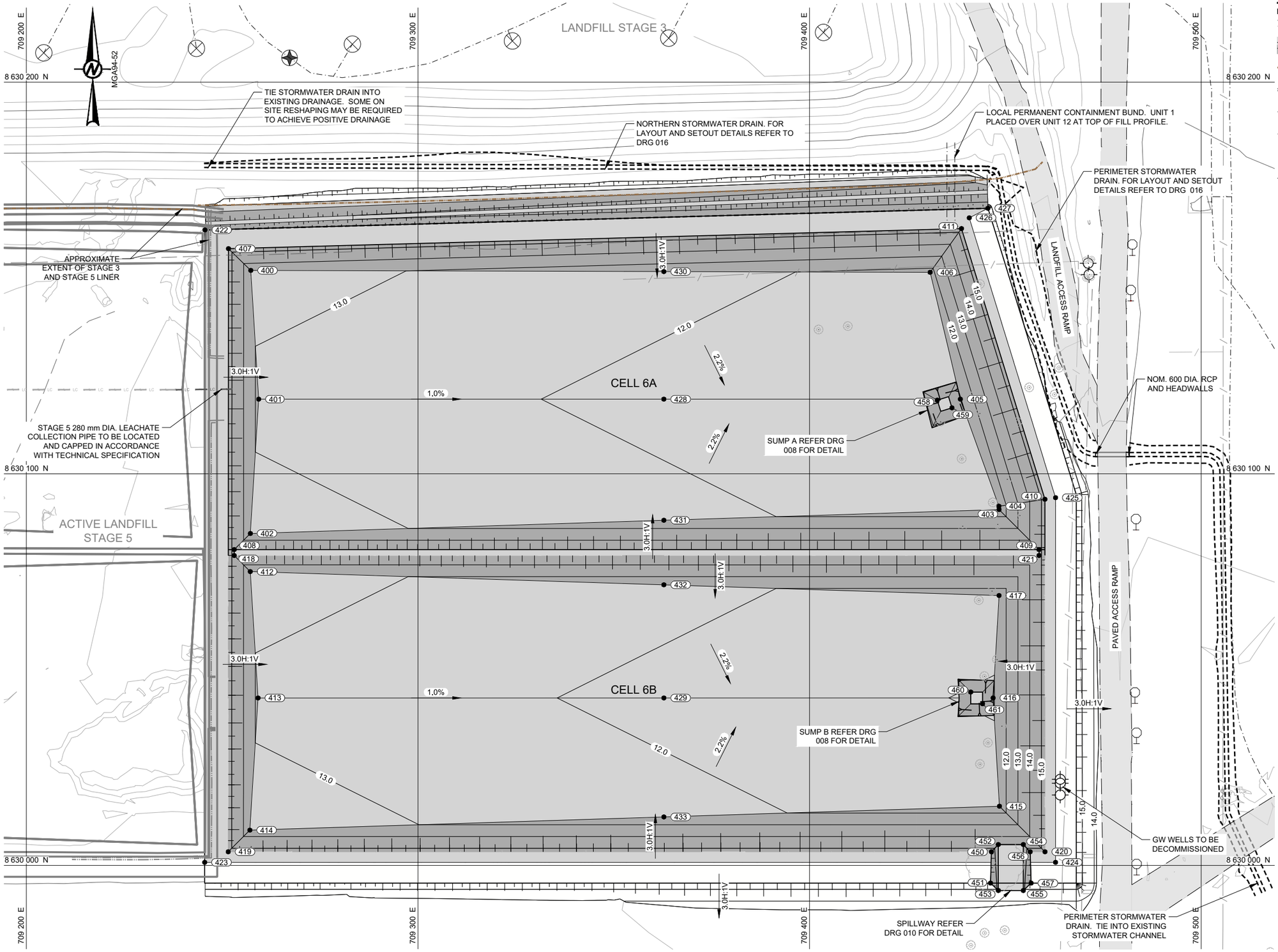
SHOAL BAY LANDFILL
STAGE 6

TITLE

PLAN - TOP OF DESIGN SUBGRADE AND SUBGRADE DRAINAGE SETOUT

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	4 of 20	004

Path: \\golder.gds\gan\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\99_PROJECTS\18106426-Stage 6 Construction\017-STR_IFC\02_PRODUCTION\DWGS\ | File Name: 18106426-017-CIW-003-004.dwg



LEGEND

- 14.0 — EXISTING CONTOURS AT 1.0 m INTERVALS
- 14.0 — DESIGN CONTOURS - TOP OF FILL AT 1.0 m INTERVALS
- EXISTING AS-CON TOP OF CREST - STAGE 3
- EXISTING AS-CON LINER TRENCH - STAGE 5
- EXISTING OPEN STORMWATER DRAIN
- EXISTING SITE PERIMETER FENCE LINE
- EXISTING VEGETATION
- EXISTING GAS INFRASTRUCTURE (APPROXIMATE ONLY)
- EXISTING GAS INFRASTRUCTURE (APPROXIMATE ONLY)
- 411 — SETOUT POINT - REFER DRG 020 FOR COORDINATES

NOTE(S)

1. CONTRACTOR MUST ENSURE ALL PAVEMENT IS PROTECTED DURING WORKS.

ISSUED FOR

CONTRUCTION

0 25 50

1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

CLIENT: CITY OF DARWIN

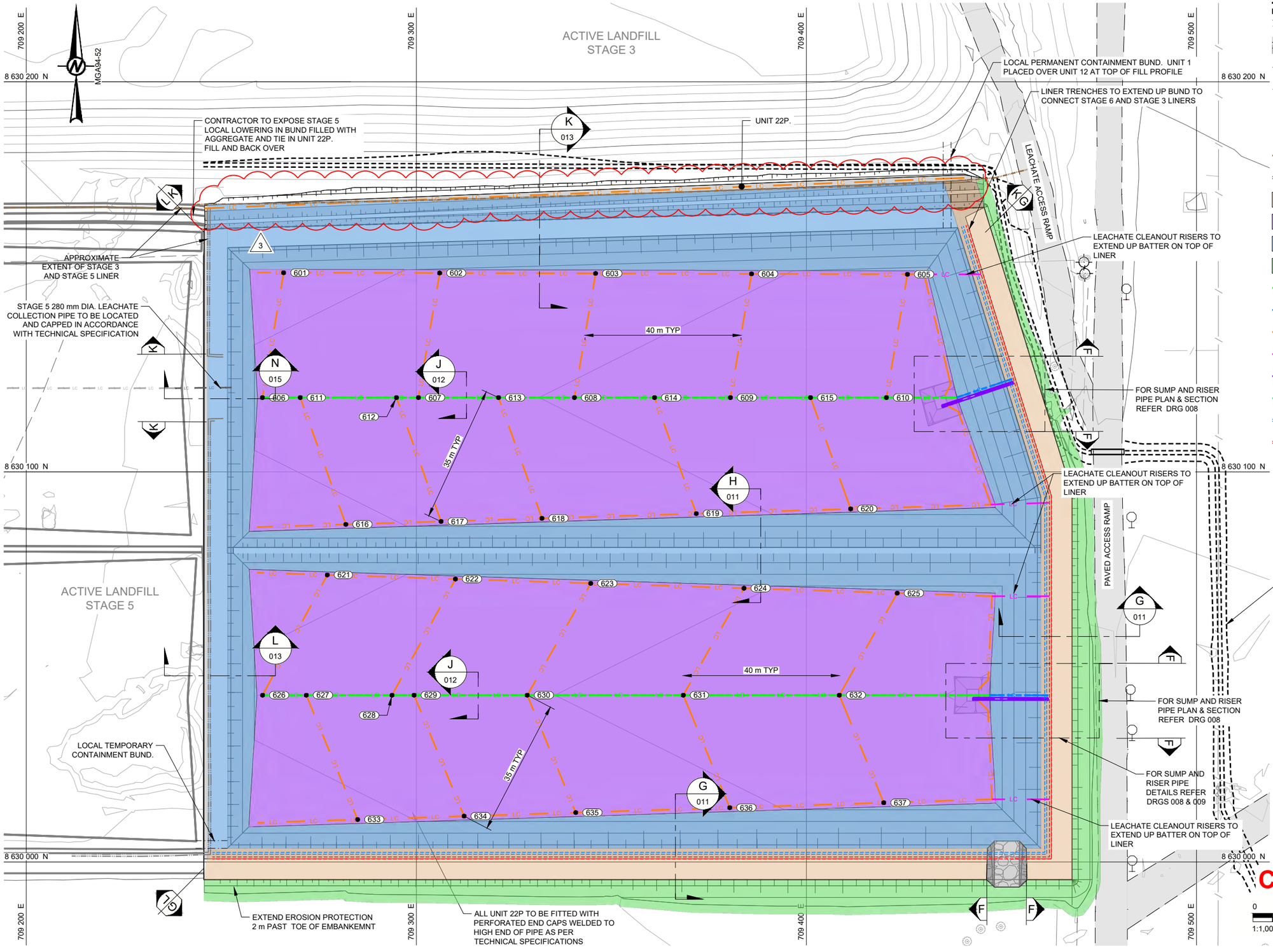
CONSULTANT: GOLDER

BRISBANE OFFICE
147 CORONATION DRIVE
MILTON, QLD 4064
AUSTRALIA
[+61] (7) 3721 5400
www.golder.com

PROJECT: SHOAL BAY LANDFILL STAGE 6

TITLE: **PLAN - TOP OF SELECT FILL DESIGN SURFACE SETOUT PLAN**

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	5 of 20	005



LEGEND

- EXISTING CONTOURS AT 1.0 m INTERVALS
- DESIGN CONTOURS - TOP OF FILL AT 1.0 m INTERVALS
- EXISTING OPEN STORMWATER DRAIN
- EXISTING SITE PERIMETER FENCE LINE
- EXISTING VEGETATION
- EXISTING AS-CON TOP OF CREST - STAGE 3
- EXISTING AS-CON LINER TRENCH - STAGE 5
- UNIT 6 - SURFACE GRAVEL
- UNIT 11D - DOUBLE-SIDED HDPE
- UNIT 11S - SINGLE-SIDED HDPE
- UNIT 33 - EROSION PROTECTION
- LC — UNIT 21P - PERFORATED 280 DIA. LEACHATE COLLECTION PIPE
- LC — UNIT 21U - UNPERFORATED 280 DIA. LEACHATE COLLECTION PIPE
- LC — UNIT 22P - PERFORATED 160 DIA. LEACHATE COLLECTION PIPE
- LC — UNIT 22U - UNPERFORATED 160 DIA. LEACHATE COLLECTION PIPE
- R — UNIT 23 - 630 DIA. RISER PIPE
- UNIT 24U - UNPERFORATED 160 DIA. DISCHARGE PIPE
- LINER ANCHOR TRENCH ALIGNMENT
- GEOGRID ANCHOR TRENCH ALIGNMENT

NOTE(S)

1. CONTRACTOR MUST ENSURE ALL PAVEMENT IS PROTECTED DURING WORKS.

ISSUED FOR
CONTRUCTION

0 25 50
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
3	2019-10-08	UNIT 22P - PERFORATED 160 DIA. LEACHATE COLLECTION PIPE LOCATION CORRECTED	IO	BK	JB	JB	05873
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER - ADDED NOTE FOR LEACHATE CLEANOUT RISERS - CORRECTED LEGEND	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

CLIENT
CITY OF DARWIN

CONSULTANT
GOLDER

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AUSTRALIA
[+61] (7) 3721 5400
www.golder.com

PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
PLAN - GEOSYNTHETIC AND LEACHATE PIPES LAYOUT

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	3	6 of 20	006

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25 mm
0

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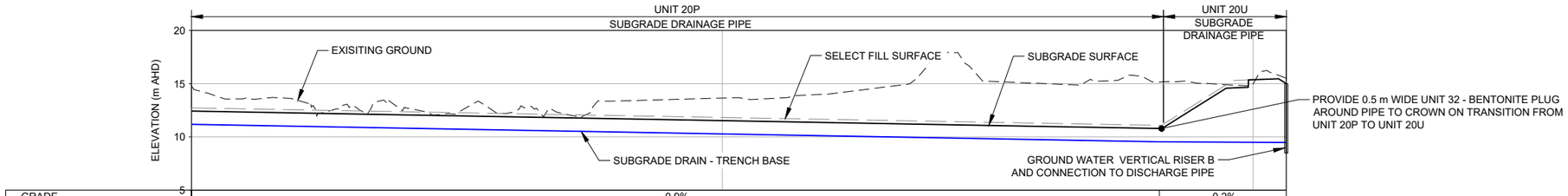
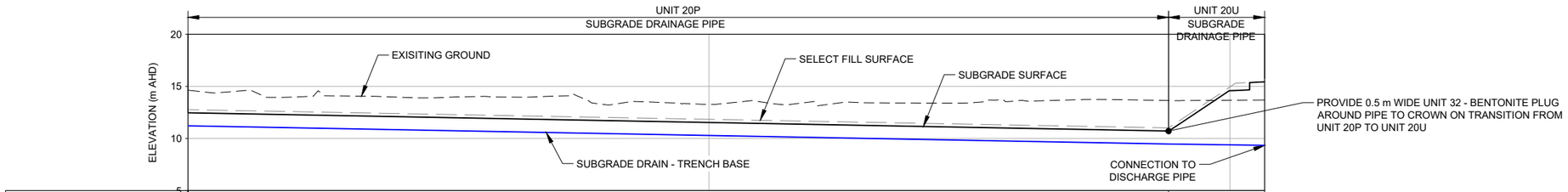


GRADE		-0.9%									-0.2%	
EXISTING GROUND	14.78	13.43	12.73	12.27	13.37	13.65	14.02	17.68	15.02	15.43	14.97	15.51
SUBGRADE DRAIN SUBGRADE LEVEL	12.42	12.24	12.06	11.88	11.70	11.52	11.34	11.17	10.99	10.81	15.37	15.01
SUBGRADE DRAIN BASE OF TRENCH	11.17	10.99	10.81	10.63	10.45	10.27	10.09	9.91	9.73	9.55	9.49	9.48
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	206.23

LONGSECTION SUBGRADE DRAIN CELL 6A

SCALE 1:500 VERT. 1:1000 HORIZ.



GRADE		-0.9%									-0.7%	
EXISTING GROUND	14.63	13.97	13.97	13.97	13.25	13.28	13.54	13.40	13.65	13.71	13.67	13.69
SUBGRADE DRAIN SUBGRADE LEVEL	12.46	12.28	12.09	11.91	11.72	11.53	11.35	11.16	10.98	10.79	14.58	15.43
SUBGRADE DRAIN BASE OF TRENCH	11.21	11.03	10.84	10.66	10.47	10.28	10.10	9.91	9.73	9.54	9.38	9.34
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	206.63

LONGSECTION SUBGRADE DRAIN CELL 6B

SCALE 1:500 VERT. 1:1000 HORIZ.

NOTE(S)

1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. REFER TO DRAWING 004 FOR PLANVIEW OF SUBSURFACE DRAINS A AND B.

ISSUED FOR

CONTRUCTION

0 10 20
1:500 METRES

0 25 50
1:1,000 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

CLIENT
CITY OF DARWIN

CONSULTANT
GOLDER

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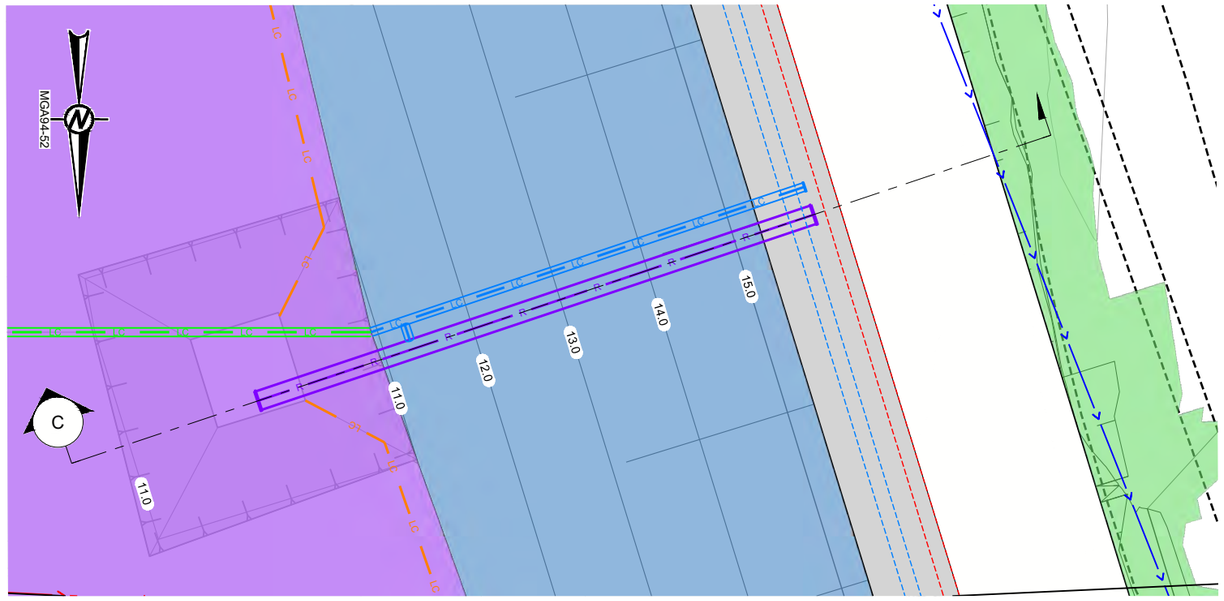
www.golder.com

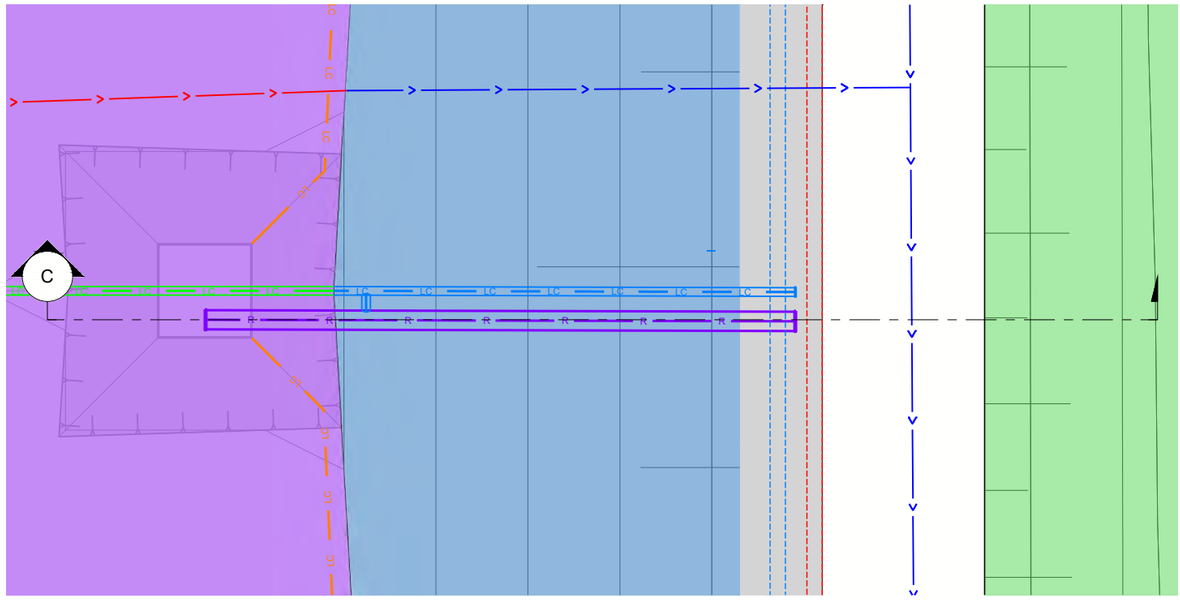
PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
LONGSECTION - SUBGRADE DRAINAGE PIPES

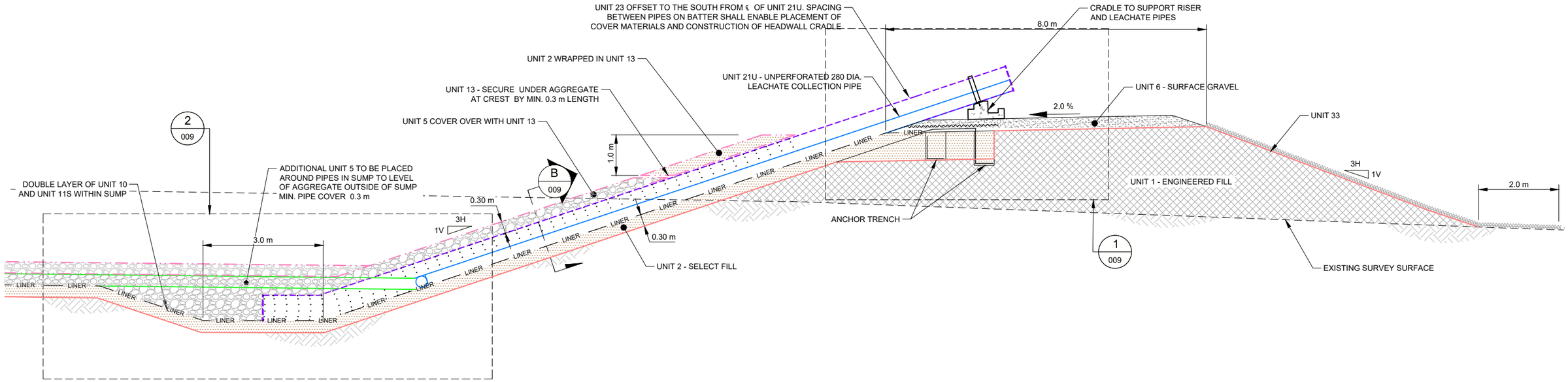
PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	7 of 20	007



PLAN VIEW - SUMP CELL 6A
SCALE 1:200 m



PLAN VIEW - SUMP CELL 6B
SCALE 1:200 m



SCALE 1:100 m C SECTION - RISER PIPE RUNOUT

LEGEND

- BASE OF SUBGRADE
- UNIT 1 - ENGINEERED FILL
- UNIT 2 - SELECT FILL
- UNIT 5 - LEACHATE DRAINAGE AGGREGATE
- UNIT 6 - SURFACE GRAVEL
- LINER — LINER ARRANGEMENT - REFER DRG 009 FOR DETAILS
- UNIT 20P - PERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE
- UNIT 20U - UNPERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE
- UNIT 21P - PERFORATED 280 DIA. LEACHATE COLLECTION PIPE
- UNIT 21U - UNPERFORATED 280 DIA. LEACHATE COLLECTION PIPE
- UNIT 31 - MARINE PLYWOOD 2400 MM WIDE 12 MM THICK
- UNIT 33 - EROSION PROTECTION
- UNIT 23 - 630 DIA. RISER PIPE

NOTE(S)

1. REFER TO DRG 001 FOR GENERAL NOTES.
2. SETOUT POINT TABLE FOR TOP SUBGRADE SUMP AND TOP OF SELECT FILL SUMP, REFER TO DRG 004.
3. LINER LAYERING OMITTED FOR CLARITY, REFER DRG 009 FOR DETAIL

ISSUED FOR
CONTRUCTION

0 2.5 5
1:100 METRES

0 5 10
1:200 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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CONSULTANT
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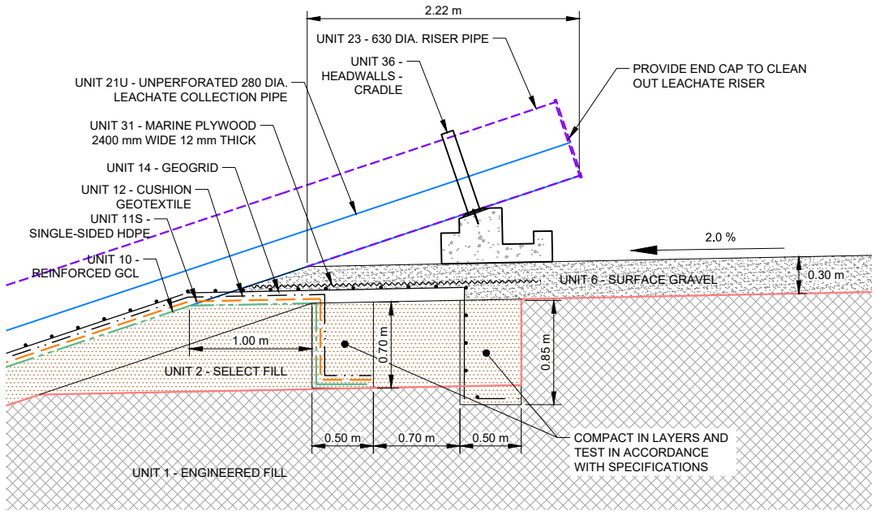
www.golder.com

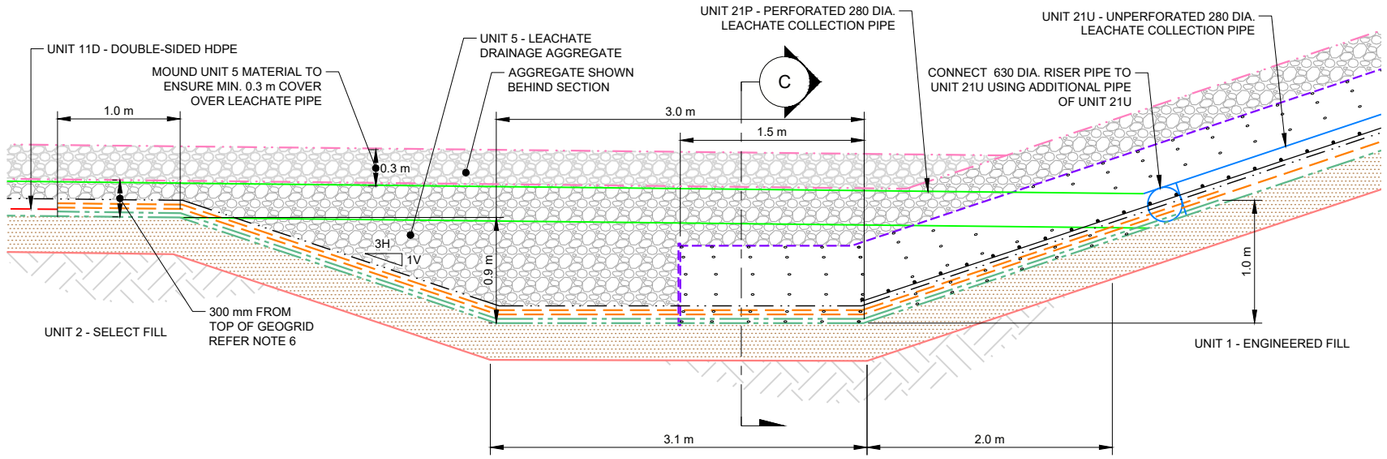
PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
PLAN AND TYPICAL SECTIONS - SUMP ARRANGEMENT AND SETOUT

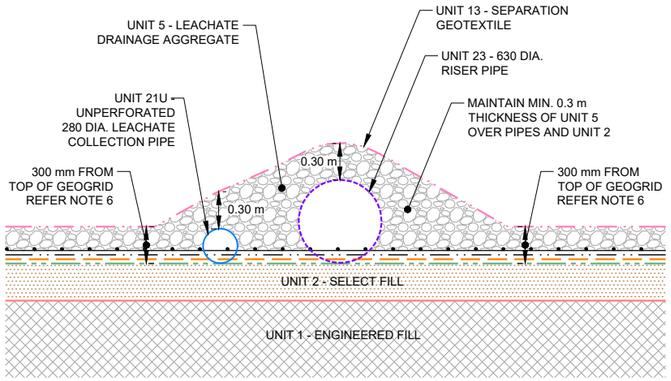
PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	8 of 20	008



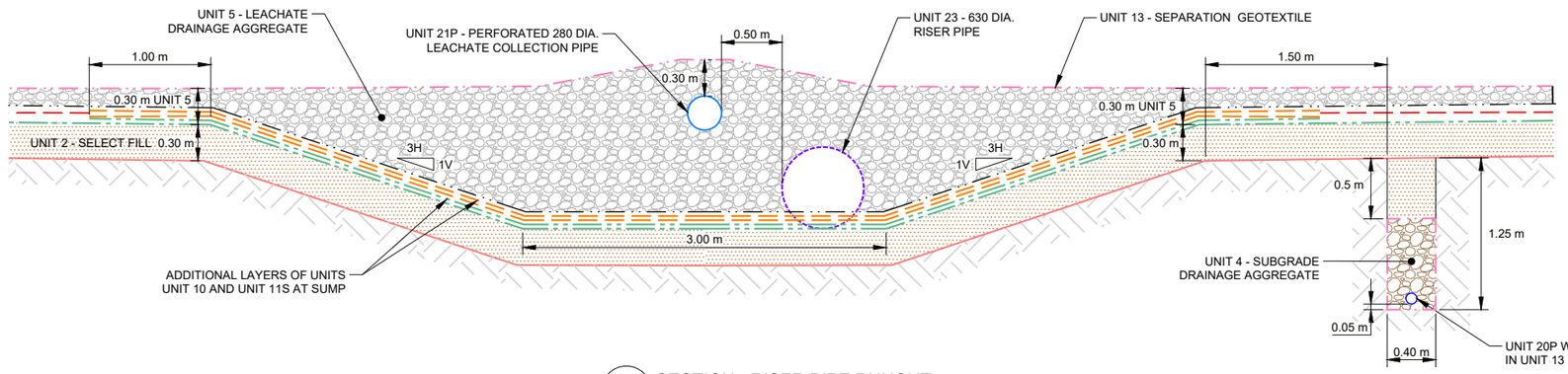
SCALE 1:50 m — 1 / 008 — DETAIL - ANCHOR TRENCH AT RISER PIPE



SCALE 1:50 m — 2 / 008 — DETAIL - SUMP AND RISER RUNOUT



SCALE 1:50 m — B / 008 — SECTION - LINER AND PIPE ARRANGEMENT AT SUMP LOCATIONS



SCALE 1:50 m — C — SECTION - RISER PIPE RUNOUT

LEGEND

- BASE OF SUBGRADE
- UNIT 1 - ENGINEERED FILL
- UNIT 2 - SELECT FILL
- UNIT 3 - PIPE BEDDING SAND
- UNIT 4 - SUBGRADE DRAINAGE AGGREGATE
- UNIT 5 - LEACHATE DRAINAGE AGGREGATE
- UNIT 6 - SURFACE GRAVEL
- UNIT 10 - REINFORCED GCL
- UNIT 11S - SINGLE-SIDED HDPE
- UNIT 11D - DOUBLE-SIDED HDPE
- UNIT 12 - CUSHION GEOTEXTILE
- UNIT 13 - SEPARATION GEOTEXTILE
- UNIT 14 - GEOGRID
- UNIT 20P - PERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE
- UNIT 20U - UNPERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE
- UNIT 21P - PERFORATED 280 DIA. LEACHATE COLLECTION PIPE
- UNIT 21U - UNPERFORATED 280 DIA. LEACHATE COLLECTION PIPE
- UNIT 31 - MARINE PLYWOOD 2400 MM WIDE 12 MM THICK
- UNIT 33 - EROSION PROTECTION
- UNIT 23 - 630 DIA. RISER PIPE

NOTE(S)

1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. SETOUT POINT TABLE FOR TOP SUBGRADE SUMP AND TOP OF SELECT FILL SUMP, REFER TO DRAWING 020.
3. REFER TO DRAWING 004 FOR SUMP LOCATIONS LAYOUT.
4. REFER TO DRAWING 005 FOR SUMP LOCATIONS LAYOUT.
5. SOME UNIT MATERIALS HAVE BEEN PROJECTED FOR FURTHER ARRANGEMENT CLARITY
6. LINER LAYERING SCALE EXAGGERATED FOR CLARITY

ISSUED FOR

CONTRUCTION

0 1 2

1:50 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

CLIENT: CITY OF DARWIN

CONSULTANT: GOLDER

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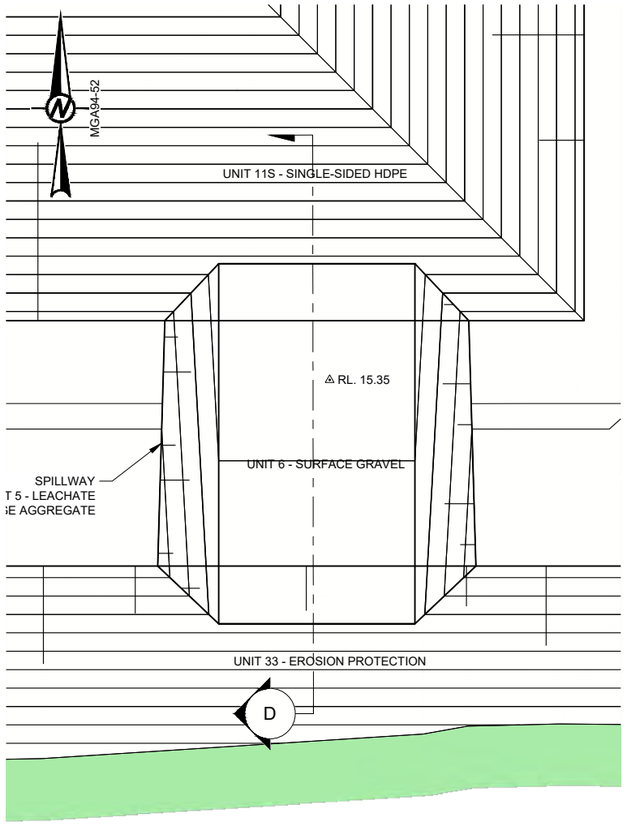
PROJECT: SHOAL BAY LANDFILL STAGE 6

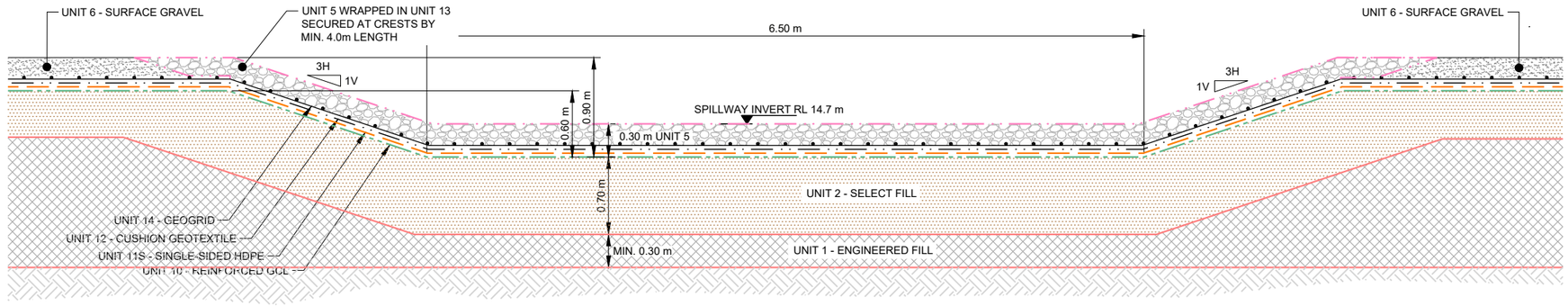
TITLE: **TYPICAL SECTIONS AND DETAILS - SUMP**

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	9 of 20	009

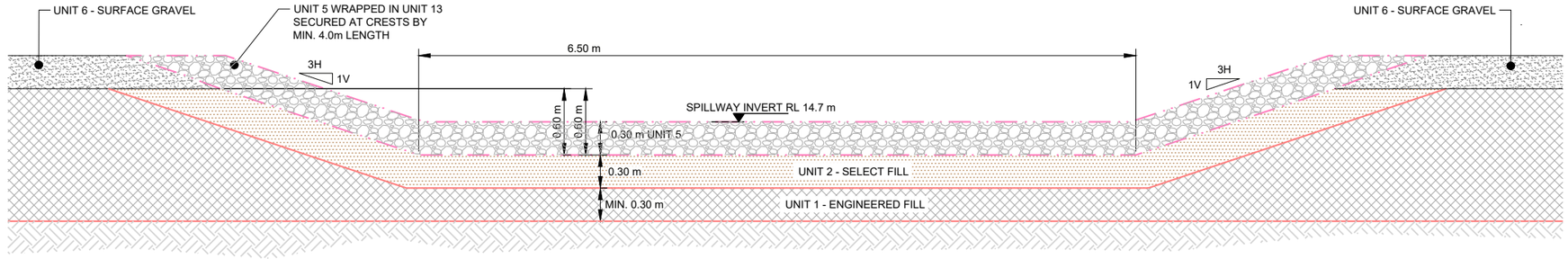


PLANVIEW OF SOUTHERN EMBANKMENT SPILLWAY

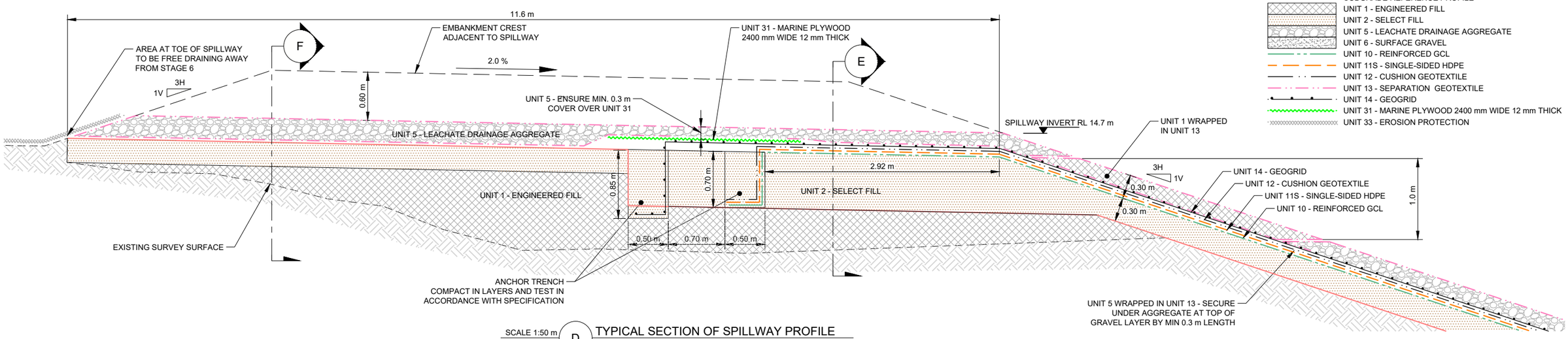
SCALE 1:200 m



SCALE 1:50 m E TYPICAL SECTION THROUGH SPILLWAY FACE



SCALE 1:50 m F TYPICAL SECTION THROUGH SPILLWAY



SCALE 1:50 m D TYPICAL SECTION OF SPILLWAY PROFILE

LEGEND

- 12.4 — DESIGN CONTOURS - TOP OF FILL AT 0.2 m INTERVALS
- SINGLE-SIDED HDPE (PLAN)
- SURFACE GRAVEL (PLAN)
- EROSION PROTECTION (PLAN)
- LINER ANCHOR TRENCH (PLAN)
- GEOGRID ANCHOR TRENCH (PLAN)
- SUBGRADE REFERENCE PROFILE
- UNIT 1 - ENGINEERED FILL
- UNIT 2 - SELECT FILL
- UNIT 5 - LEACHATE DRAINAGE AGGREGATE
- UNIT 6 - SURFACE GRAVEL
- UNIT 10 - REINFORCED GCL
- UNIT 11S - SINGLE-SIDED HDPE
- UNIT 12 - CUSHION GEOTEXTILE
- UNIT 13 - SEPARATION GEOTEXTILE
- UNIT 14 - GEOGRID
- UNIT 31 - MARINE PLYWOOD 2400 mm WIDE 12 mm THICK
- UNIT 33 - EROSION PROTECTION

NOTE(S)

1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. SETOUT POINT TABLE FOR DESIGN TOP OF SPILLWAY SHOWN ON DRG 020.
3. LINER LAYERING EXAGGERATED FOR CLARITY.

ISSUED FOR

CONTRUCTION

1:50 0 1 2 METRES

1:200 0 5 10 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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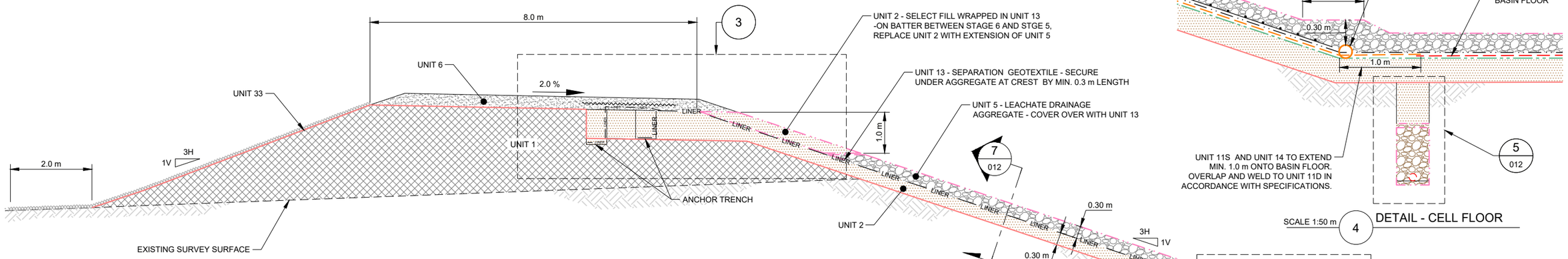
PROJECT

SHOAL BAY LANDFILL
STAGE 6

TITLE

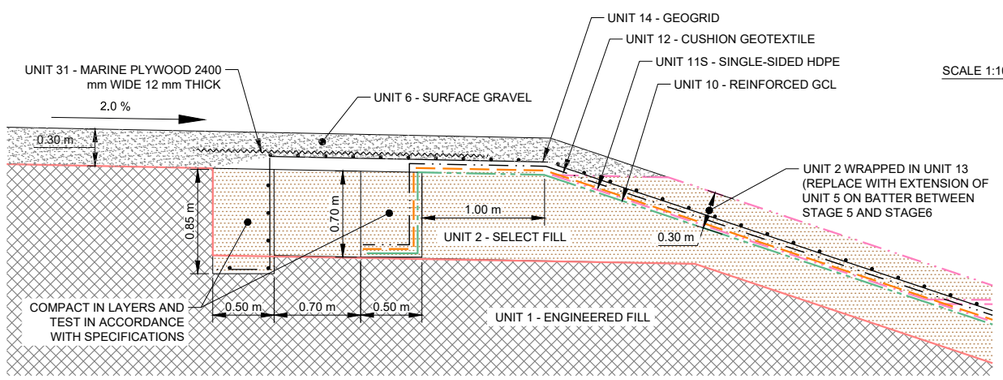
PLAN AND TYPICAL SECTIONS - SPILLWAY ARRANGEMENT AND SETOUT

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	10 of 20	010

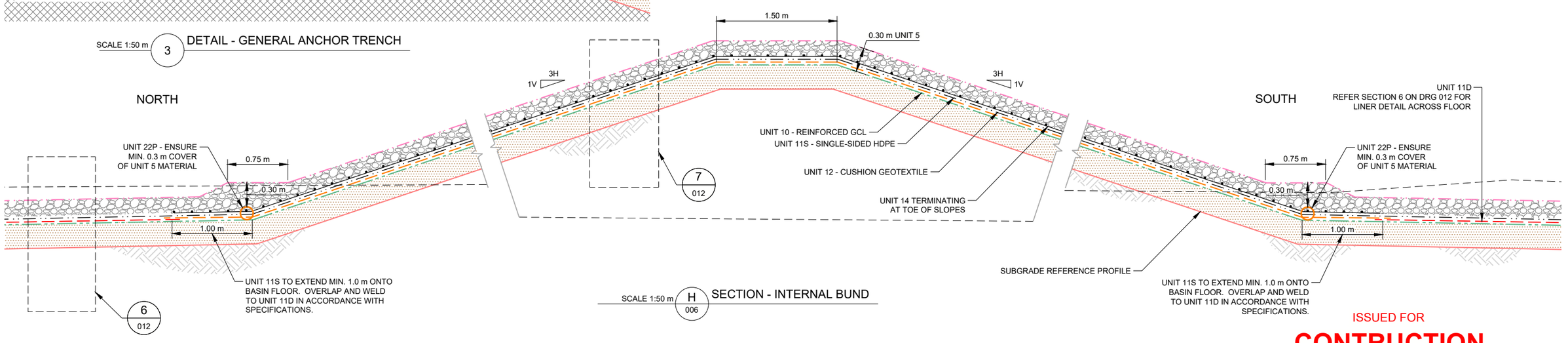


SCALE 1:50 m 4 DETAIL - CELL FLOOR

SCALE 1:100 m G 006 SECTION - GENERAL EMBANKMENT PROFILE



SCALE 1:50 m 3 DETAIL - GENERAL ANCHOR TRENCH



SCALE 1:50 m H 006 SECTION - INTERNAL BUND

NOTE(S)

1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. UNIT 14 - GEOGRID SHALL BE INSTALLED SUCH THAT FULL LENGTH OF SLOPE IS COVERED WITH A SINGLE PANEL, WITHOUT HORIZONTAL JOINS.
3. EXISTING GEOSYNTHETICS TO BE EXPOSED, CUT AT THE ANCHOR TRENCH AND FOLDED BACK.
4. MINIMUM OF 500 mm OVERLAP OF GCL TO BE JOINED WITH BENTONITE PASTE. REFER TO TECHNICAL SPECIFICATION.
5. GEOMEMBRANE TO BE FUSION WELDED. REFER TECHNICAL SPECIFICATION.
6. PROTECTION GEOTEXTILE TO BE JOINED BY MACHINE SEWING.
7. UNIT 11S - SINGLE-SIDED HDPE GEOMEMBRANE INSTALLED ON BATTERS AND EXTENDING MIN. 1.0 m ONTO CELL FLOOR SHALL BE INSTALLED TEXTURED SIDE AGAINST GCL (ie. SMOOTH UP)

ISSUED FOR

CONTRUCTION

0 2.5 5
1:100 METRES

0 1 2
1:50 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
TYPICAL SECTIONS - CELL - SHEET 1 OF 2

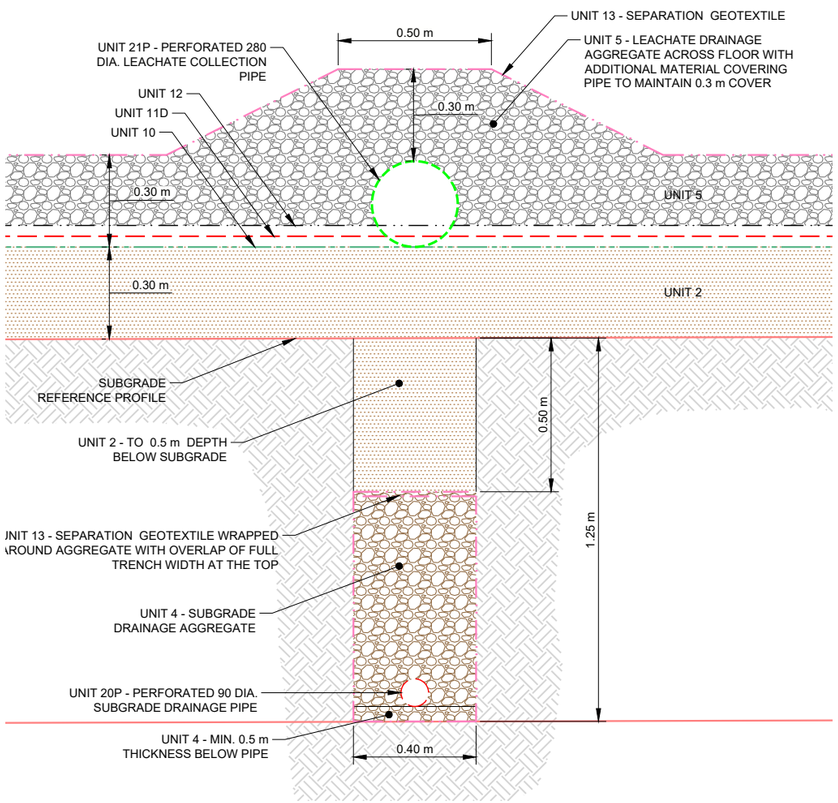
PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	11 of 20	011

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

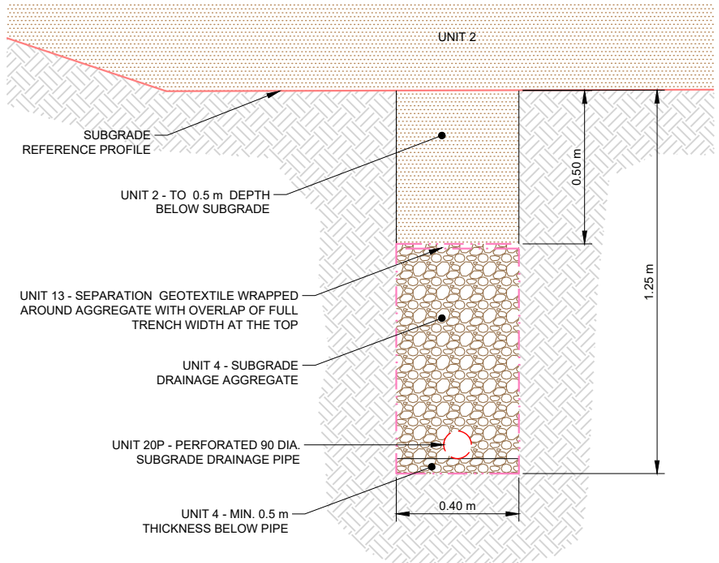
25 mm

0

Path: \\golder.gds\gal\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\99_PROJECTS\18106426_Stage 6 Construction\017-STB_IFC\02_PRODUCTION\DWG\ | File Name: 18106426-017-CW-011-013.dwg

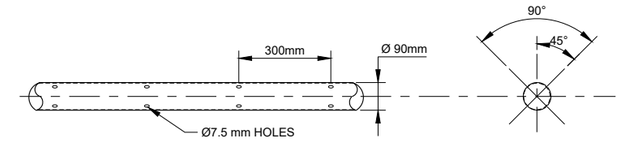


SCALE 1 :20 m J 006 008 SECTION - SUBSURFACE DRAIN TRENCH - CENTRAL

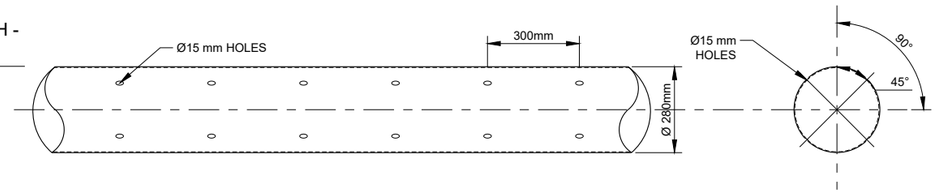


SCALE 1:20 m 5 011 TO 012 DETAIL - SUBSURFACE DRAIN TRENCH - NORTHERN & SOUTHERN LINES

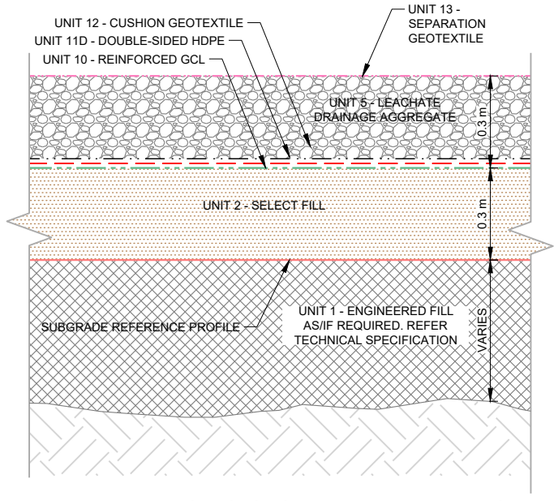
NOTE(S)
1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. PROTECTION GEOTEXTILE TO BE JOINED BY MACHINE SEWING.
3. UNIT 11S - SINGLE-SIDED HDPE GEOMEMBRANE INSTALLED ON BATTERS AND EXTENDING MIN. 1.0 m ONTO CELL FLOOR SHALL BE INSTALLED TEXTURED SIDE AGAINST GCL (ie. SMOOTH UP)



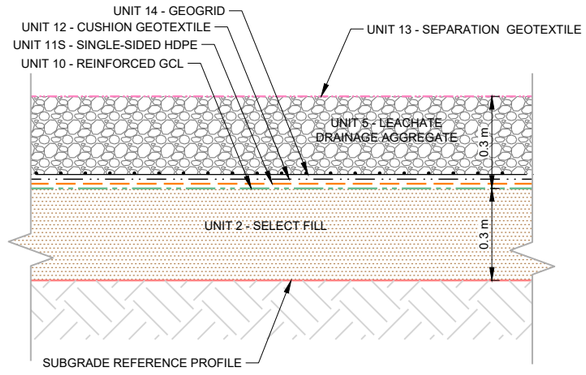
TYPICAL UNIT 20P - PERFORATED 90 DIA. SUBGRADE DRAINAGE PIPE - DRILL DETAIL
SCALE 1:20 m



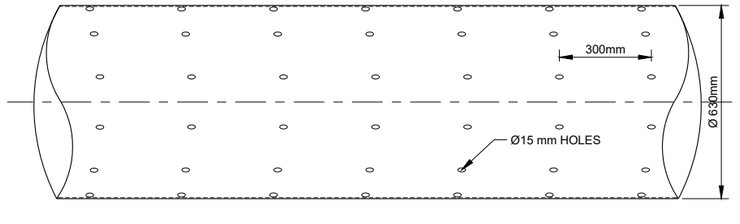
TYPICAL UNIT 21P - PERFORATED 280 DIA. LEACHATE COLLECTION PIPE - DRILL DETAIL
SCALE 1:20 m



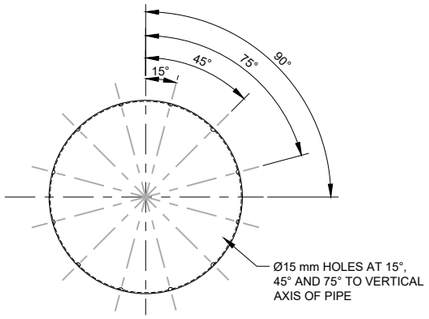
SCALE 1 :20 m 6 011 TYPICAL SECTION - LANDFILL LINER PROFILE (FLOOR)

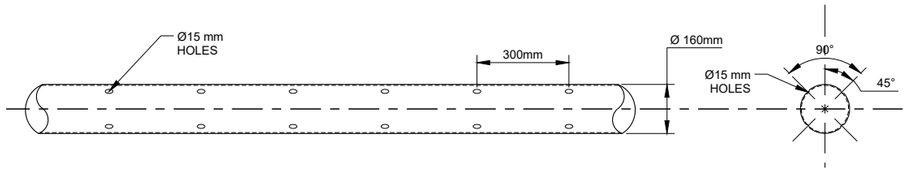


SCALE 1:20 m 7 011 TYPICAL SECITON - LANDFILL LINER PROFILE (BATTERS)

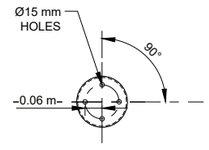


TYPICAL UNIT 23 - 630 DIA. RISER PIPE - DRILL DETAIL
SCALE 1:20 m





TYPICAL UNIT 22P - PERFORATED 160 DIA. LEACHATE COLLECTION PIPE - DRILL DETAIL
SCALE 1:20 m



UNIT 22P END CAP TYPICAL DRILL DETAIL
SCALE 1:20 m

0 0.5 1
1:20 METRES

0 0.5 1
1:20 METRES

ISSUED FOR
CONTRUCTION

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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BRISBANE OFFICE
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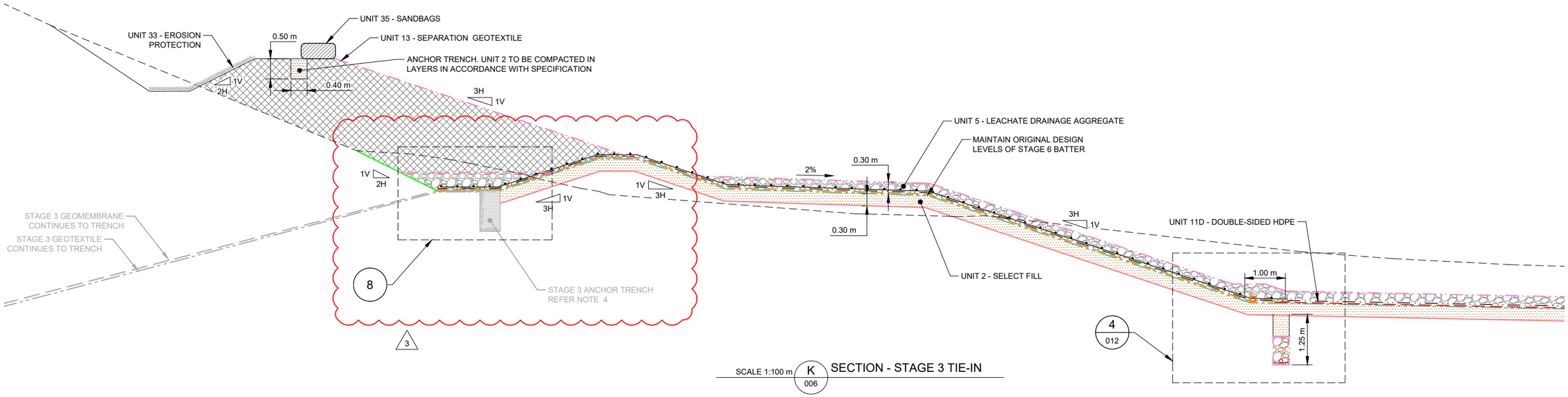
PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
TYPICAL SECTIONS - CELL - SHEET 2 OF 2

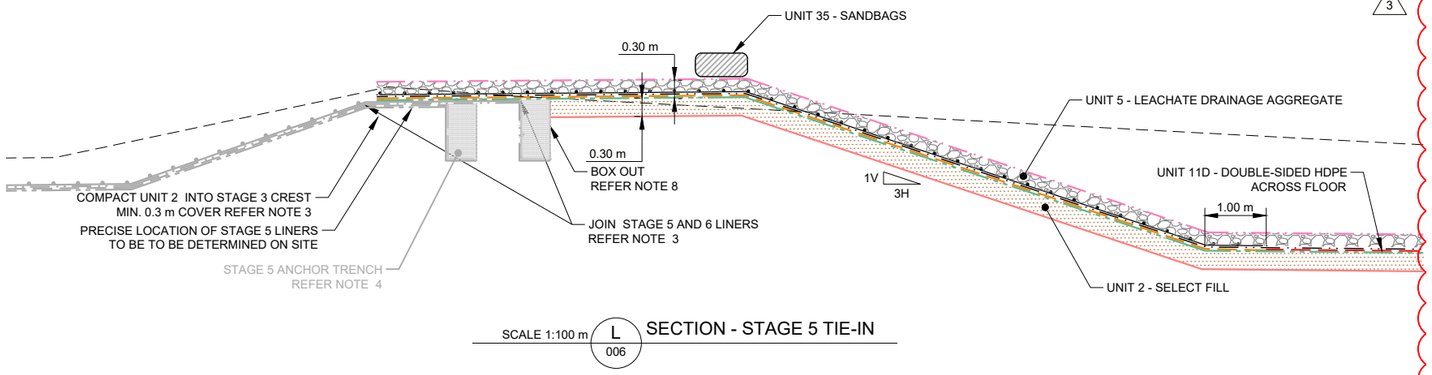
PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	12 of 20	012

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
25 mm
0

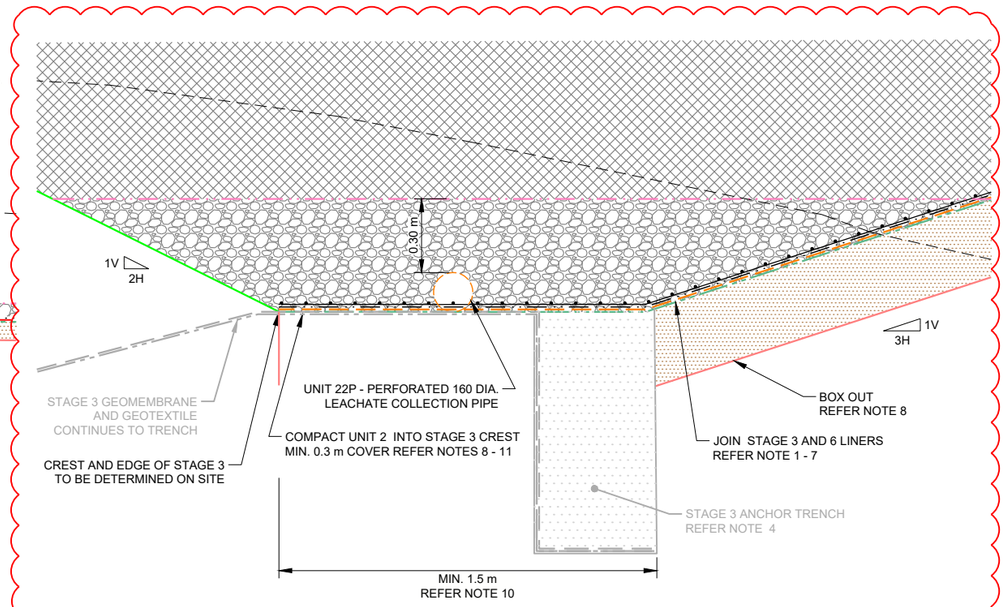
Path: \\golder.gds\gan\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\99_PROJECTS\18106426-Stage 6 Construction\017-STR_IFC\02_PRODUCTION\DWG\ | File Name: 18106426-017-CW-011-013.dwg



SCALE 1:100 m K 006 SECTION - STAGE 3 TIE-IN



SCALE 1:100 m L 006 SECTION - STAGE 5 TIE-IN



SCALE 1:25 m 8 DETAIL - STAGE 3 TIE-IN AND PIPE BEDDING

NOTE(S)

1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. UNIT 14 - GEOGRID SHALL BE INSTALLED SUCH THAT FULL LENGTH OF SLOPE IS COVERED WITH A SINGLE PANEL, WITHOUT HORIZONTAL JOINS.
3. EXISTING GEOSYNTHETICS TO BE EXPOSED, CUT AT THE ANCHOR TRENCH AND FOLDED BACK.
4. MINIMUM OF 500 mm OVERLAP OF GCL TO BE JOINED WITH BENTONITE PASTE. REFER TO TECHNICAL SPECIFICATION.
5. GEOMEMBRANE TO BE FUSION WELDED. REFER TECHNICAL SPECIFICATION.
6. PROTECTION GEOTEXTILE TO BE JOINED BY MACHINE SEWING.
7. UNIT 11S - SINGLE-SIDED HDPE GEOMEMBRANE INSTALLED ON BATTERS AND EXTENDING MIN. 1.0 m ONTO CELL FLOOR SHALL BE INSTALLED TEXTURED SIDE AGAINST GCL (ie. SMOOTH UP)
8. BOX OUT TO MAINTAIN MIN. 0.3 m THICKNESS OF UNIT 2 - SELECT FILL OVER SUBGRADE. NOMINAL BOX-OUT WIDTH FROM STAGE STAGE 3 LINER CREST TO BE CONFIRMED BY SUPERINTENDENT ON SITE.
9. CAREFULLY EXPOSE EXISTING STAGE 3 LINER TAIL IN TRENCH AND LIFT UP TO BOX OUT UNDERNEATH. DO NOT TRIM OR CUT-OFF. EXPOSED STAGE 3 LINER TAIL WILL BE CLEANED AND RE-USED FOR JOINING STAGE 6 LINER WHERE POSSIBLE AND APPROVED BY SUPERINTENDENT.
10. KEY UNIT 2 - SELECT FILL INTO EXISTING STAGE 3 COMPACTED CLAY CREST TO CREATE MIN. 1.5 m WIDE, 0.3 m THICK HORIZONTAL SURFACE EXTENDING FROM CREST OF STAGE 3 LINER.
11. GEOMETRY OF STAGE 3 ANCHOR TRENCH BASED ON FILE 5209 151013 Cell Base 3 on MGA and AHD.dwg PROVIDED BY EARL JAMES AND ASSOCIATES, OCTOBER 13, 2015.

ISSUED FOR

CONTRUCTION

1:25 0 0.5 1 METRES

1:100 0 2.5 5 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
3	2019-10-08	UNIT 22P - PERFORATED 160 DIA. LEACHATE COLLECTION PIPE LOCATION CORRECTED, ADDED ADDITONAL DETAIL	IO	BK	JB	JB	05873
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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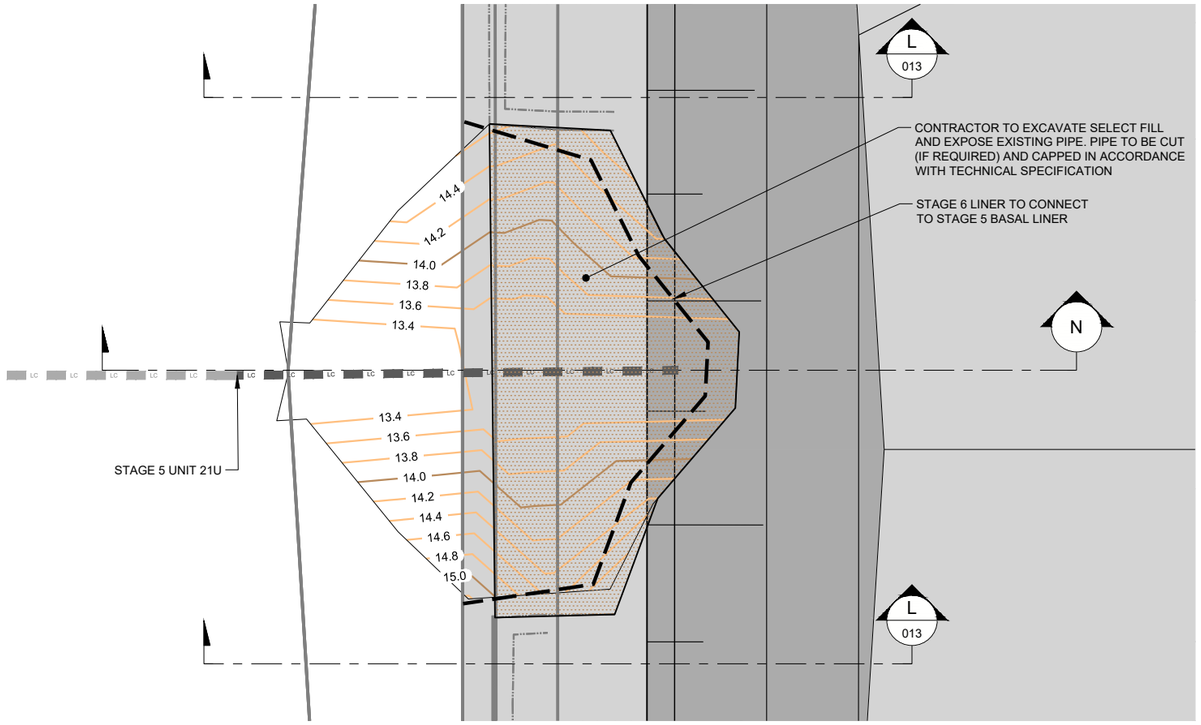
PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
TYPICAL SECTIONS - STAGES 3 AND 5 TIE-IN

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	3	13 of 20	013

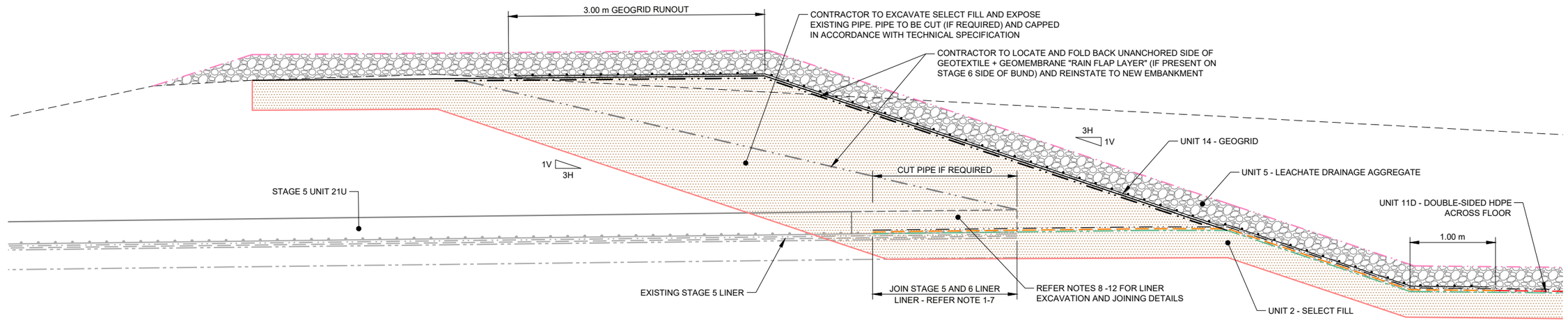


PLAN VIEW - LOWERED AREA

SCALE 1:200 m

NOTE(S)

1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. UNIT 14 - GEOGRID SHALL BE INSTALLED SUCH THAT FULL LENGTH OF SLOPE IS COVERED WITH A SINGLE PANEL, WITHOUT HORIZONTAL JOINS.
3. EXISTING GEOSYNTHETICS TO BE EXPOSED, CUT AT THE ANCHOR TRENCH AND FOLDED BACK.
4. MINIMUM OF 500 mm OVERLAP OF GCL TO BE JOINED WITH BENTONITE PASTE. REFER TO TECHNICAL SPECIFICATION.
5. GEOMEMBRANE TO BE FUSION WELDED. REFER TECHNICAL SPECIFICATION.
6. PROTECTION GEOTEXTILE TO BE JOINED BY MACHINE SEWING.
7. UNIT 11S - SINGLE-SIDED HDPE GEOMEMBRANE INSTALLED ON BATTERS AND EXTENDING MIN. 1.0 m ONTO CELL FLOOR SHALL BE INSTALLED TEXTURED SIDE AGAINST GCL (ie. SMOOTH UP)
8. THE GEOTEXTILE AND HDPE "RAINFLAP" SHALL BE IDENTIFIED AND CAREFULLY FOLDED BACK ON THE BATTER.
9. AT LOWERED AREA, THE EXISTING BURIED LEACHATGE COLLECTION PIPE SHALL BE UNCOVERED WITH MINIMAL EXCAVATION. THE PIPE SHALL BE CUT BACK AND CAPPED TO ALLOW THE JOINING OF THE LINERS.
10. THE CELL 6A UNIT 10 - REINFORCED GCL AND UNIT 11S - SINGLE-SIDED HDPE SHALL BE LAPPED AND JOINED IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION.
11. EXCAVATED FILL SHALL BE REPLACED WITH UNIT 2 - SELECT FILL IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION.
12. THE GEOTEXTILE AND GEOMEMBRANE "RAINFLAP" SHALL BE FOLDED BACK TO PROTECT SELECT FILL.
13. BOX OUT TO MAINTAIN MIN. 0.3 m THICKNESS OF UNIT 2 - SELECT FILL OVER SUBGRADE. NOMINAL BOX-OUT WIDTH FROM STAGE STAGE 3 LINER CREST TO BE CONFIRMED BY SUPERINTENDENT ON SITE.
14. CAREFULLY EXPOSE EXISTING STAGE 3 LINER TAIL IN TRENCH AND LIFT UP TO BOX OUT UNDERNEATH. DO NOT TRIM OR CUT-OFF. EXPOSED STAGE 3 LINER TAIL WILL BE CLEANED AND RE-USED FOR JOINING STAGE 6 LINER WHERE POSSIBLE AND APPROVED BY SUPERINTENDENT.
15. KEY UNIT 2 - SELECT FILL INTO EXISTING STAGE 3 COMPACTED CLAY CREST TO CREATE MIN. 1.5 m WIDE, 0.3 m THICK HORIZONTAL SURFACE EXTENDING FROM CREST OF STAGE 3 LINER.
16. GEOMETRY OF STAGE 3 ANCHOR TRENCH BASED ON FILE 5209 151013 Cell Base 3 on MGA and AHD.dwg PROVIDED BY EARL JAMES AND ASSOCIATES, OCTOBER 13, 2015.



SCALE 1:50 m

N 005

TYPICAL SECTION - LOWERED AREA LINER CONNECTION

ISSUED FOR

CONTRUCTION

0 5 10
1:200 METRES

0 1 2
1:50 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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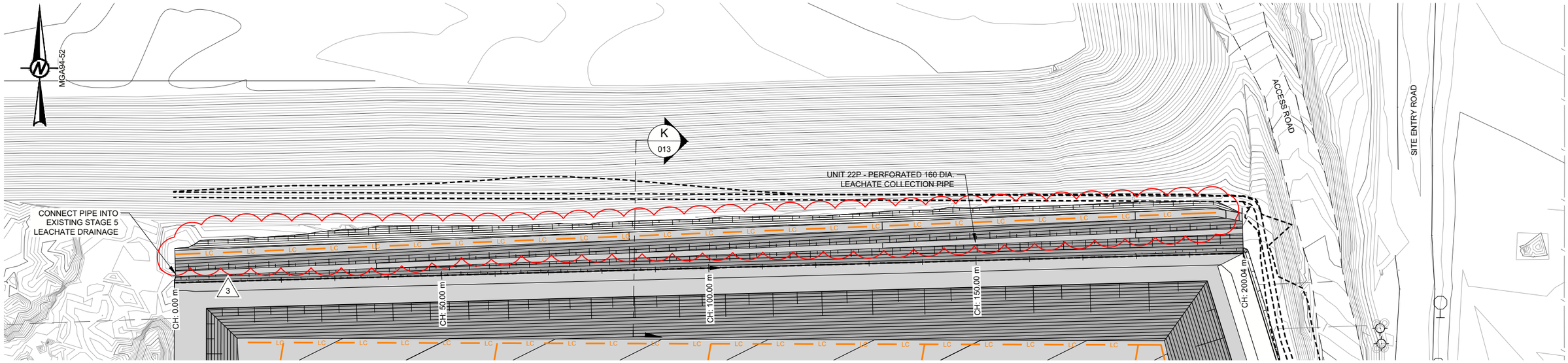
PROJECT
SHOAL BAY LANDFILL
STAGE 6

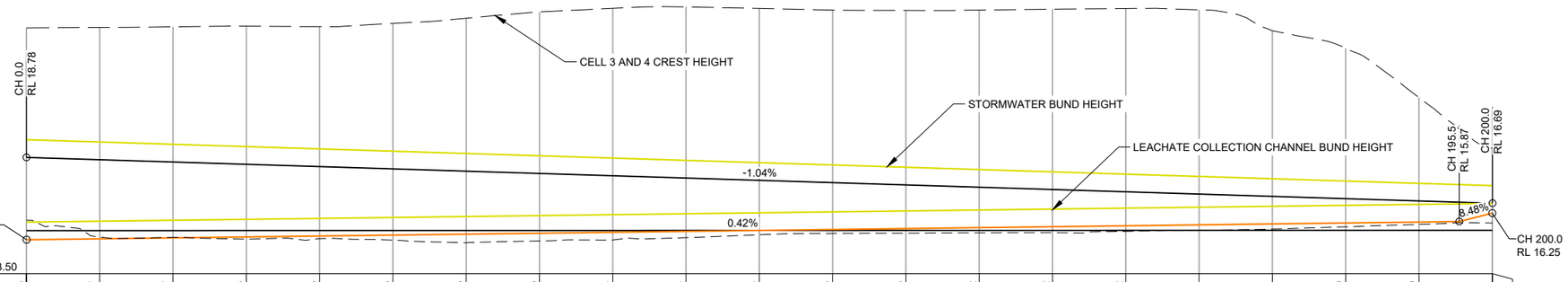
TITLE
TYPICAL SECTIONS - STAGES 5 LOWERED AREA

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	14 of 20	014



STAGE 3 NORTHERN EMBANKMENT PLAN VIEW

SCALE 1:750 m



STORMWATER DRAIN LEVEL	18.78	18.67	18.57	18.46	18.36	18.26	18.15	18.05	17.94	17.84	17.74	17.63	17.53	17.42	17.32	17.22	17.11	17.01	16.90	16.80	16.69	16.69
LEACHATE COLLECTION CHANNEL LEVEL		15.08	15.12	15.17	15.21	15.25	15.29	15.34	15.38	15.42	15.46	15.50	15.55	15.59	15.63	15.67	15.72	15.76	15.80	15.84	16.25	16.25
STAGE 6 CELL CREST LEVEL	15.45	15.45	15.46	15.46	15.46	15.46	15.46	15.46	15.46	15.46	15.46	15.46	15.46	15.46	15.47	15.47	15.47	15.47	15.47	15.47	**15.47**	15.47
EXISTING GROUND	15.92	15.17	15.15	15.07	15.09	15.02	14.91	14.99	15.03	15.13	15.27	15.33	15.33	15.36	15.37	15.42	15.47	15.53	15.63	15.74	15.80	15.80
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	

STAGE 3 NORTHERN EMBANKMENT LONGSECTION

HORIZ. SCALE 1:750 m
VERT. SCALE 1:250 m

ISSUED FOR

CONTRUCTION

0 5 10
1:250 VERTICAL METRES

0 12.5 25
1:750 HORIZONTAL METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
3	2019-10-08	UNIT 22P - PERFORATED 160 DIA. LEACHATE COLLECTION PIPE LOCATION CORRECTED	IO	BK	JB	JB	05873
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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PROJECT
SHOAL BAY LANDFILL
STAGE 6

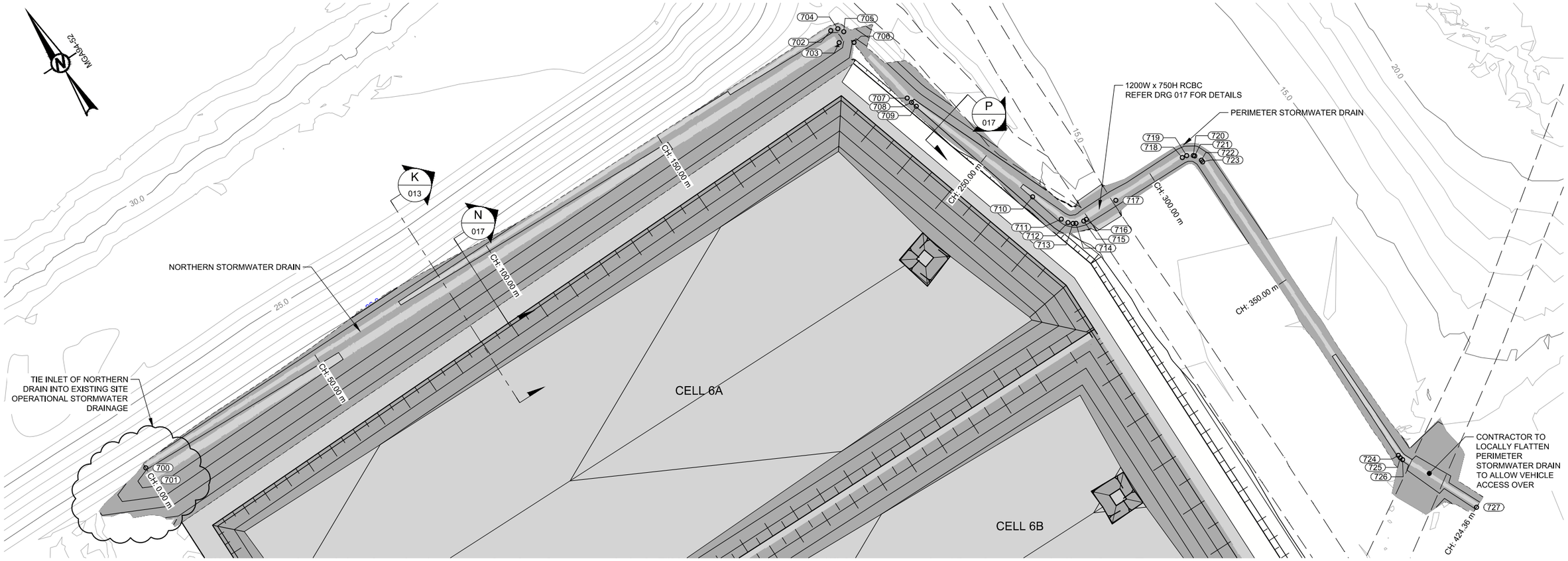
TITLE
PLAN AND LONGSECTION - NORTHERN LEACHATE DRAIN

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	3	15 of 20	015

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

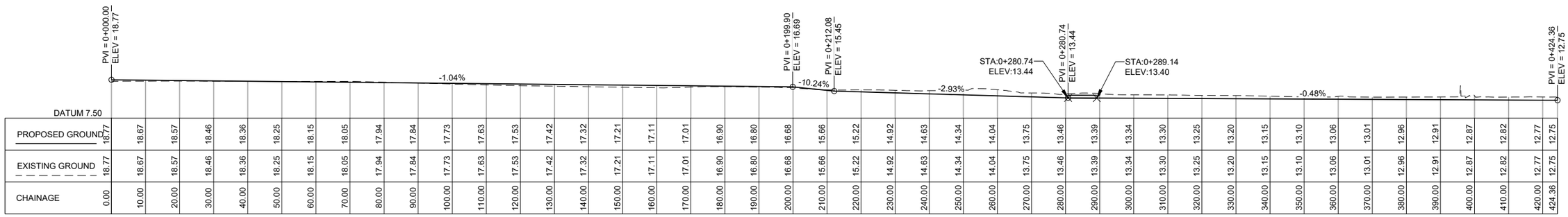
25 mm

0



STORMWATER DRAIN PLAN

SCALE 1:1,000 m



CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	250.00	260.00	270.00	280.00	290.00	300.00	310.00	320.00	330.00	340.00	350.00	360.00	370.00	380.00	390.00	400.00	410.00	420.00	424.36
EXISTING GROUND	18.77	18.67	18.57	18.46	18.36	18.25	18.15	18.05	17.94	17.84	17.73	17.63	17.53	17.42	17.32	17.21	17.11	17.01	16.90	16.80	16.68	15.66	15.22	14.92	14.63	14.34	14.04	13.75	13.46	13.39	13.34	13.30	13.25	13.20	13.15	13.10	13.06	13.01	12.96	12.91	12.87	12.82	12.77	12.75
PROPOSED GROUND	18.77	18.67	18.57	18.46	18.36	18.25	18.15	18.05	17.94	17.84	17.73	17.63	17.53	17.42	17.32	17.21	17.11	17.01	16.90	16.80	16.68	15.66	15.22	14.92	14.63	14.34	14.04	13.75	13.46	13.39	13.34	13.30	13.25	13.20	13.15	13.10	13.06	13.01	12.96	12.91	12.87	12.82	12.77	12.75

STORMWATER DRAIN LONGSECTION

SCALE 1:1,000 m

ISSUED FOR

CONTRUCTION

0 1 2

1:50 METRES

0 25 50

1:1,000 METRES

NOTE(S)

1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. REFER TO DRAWING 006 FOR DRAIN A, B AND C ALIGNMENT PLAN VIEW LAYOUT.
3. REFER TO DRAWING 020 FOR SETOUT POINT COORDINATES.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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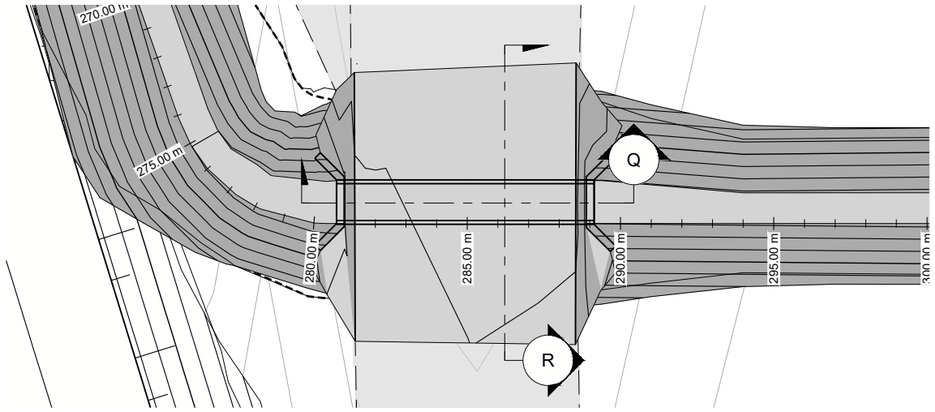
PROJECT

SHOAL BAY LANDFILL
STAGE 6

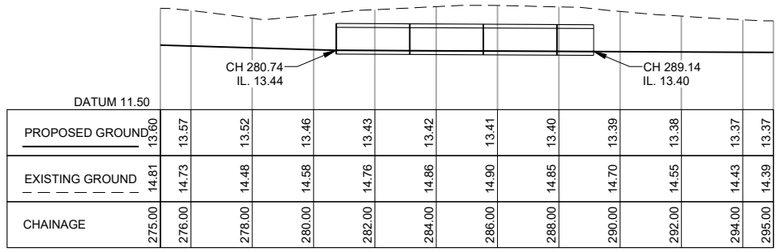
TITLE

PLAN AND LONGSECTION - NORTHERN STORMWATER DRAIN

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	16 of 20	016

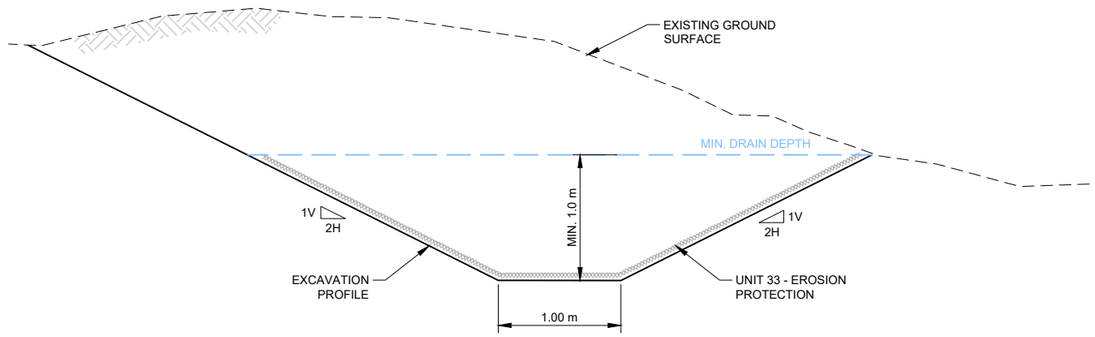


PLAN - CULVERT ROAD CROSSING
SCALE 1:200 m

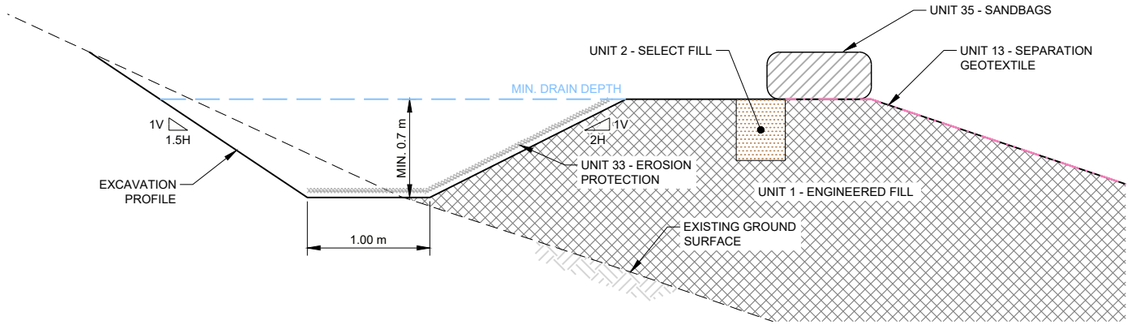


PROPOSED GROUND	13.60	13.57	13.52	13.46	13.43	13.42	13.41	13.40	13.39	13.38	13.37	13.37
EXISTING GROUND	14.81	14.73	14.48	14.58	14.76	14.86	14.90	14.85	14.70	14.55	14.43	14.39
CHAINAGE	275.00	276.00	278.00	280.00	282.00	284.00	286.00	288.00	290.00	292.00	294.00	295.00

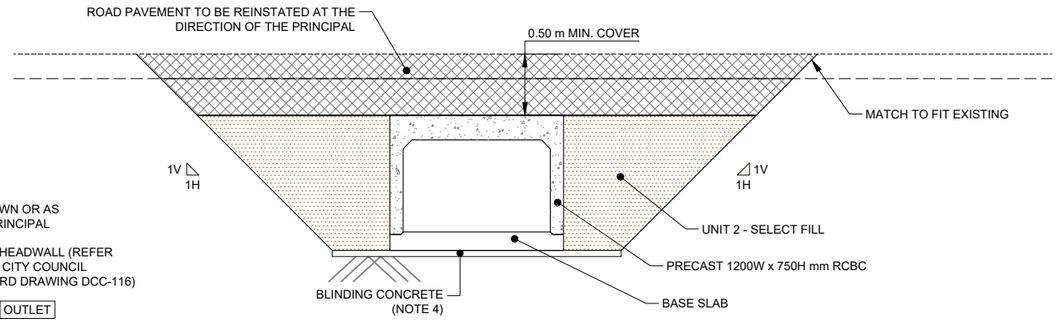
LONGSECTION - CULVERT ROAD CROSSING
SCALE 1:200 m



SCALE 1:50 m P 016 TYPICAL SECTION - PERIMETER STORMWATER DRAIN



SCALE 1:50 m N 016 TYPICAL SECTION - NORTHERN STORMWATER DRAIN

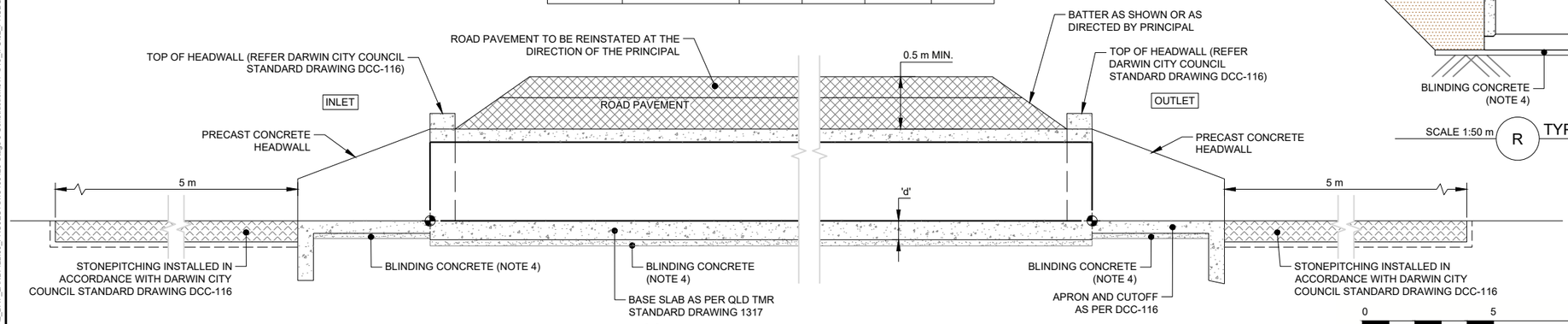


SCALE 1:50 m R TYPICAL SECTION - ROAD CROSSING

NOTE(S)

1. REFER TO DRAWING 001 FOR GENERAL NOTES.
2. REFER TO DRAWING 006 FOR DRAINS ALIGNMENT PLAN VIEW LAYOUT.
3. STORMWATER DRAINS TO BE CONSTRUCTED OVER LINER CONNECTION TO STAGE 3 - REFER TO TYPICAL SECTION K, 013
4. BLINDING CONCRETE AS PER QLD TMR STANDARD DRAWING 1317 OR 1318

CULVERT SCHEDULE					
PIPE NAME	ROWS / SIZE	LENGTH (m)	SLOPE (%)	NO. LENGTHS	'd' (mm)
CULVERT 1	1 X 1200 W X 750 H	8.400	0.5	3 X 2.4m 1 X 1.2m	180



SCALE 1:50 m Q TYPICAL SECTION - CULVERT INET AND OUTLET TREATMENT

ISSUED FOR
CONTRUCTION

0 5 10
1:200 METRES

0 1 2
1:50 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER - VARIOUS NOTE CHANGES TO CULVERT DETAILS	RS	GG	JB	JB	05873

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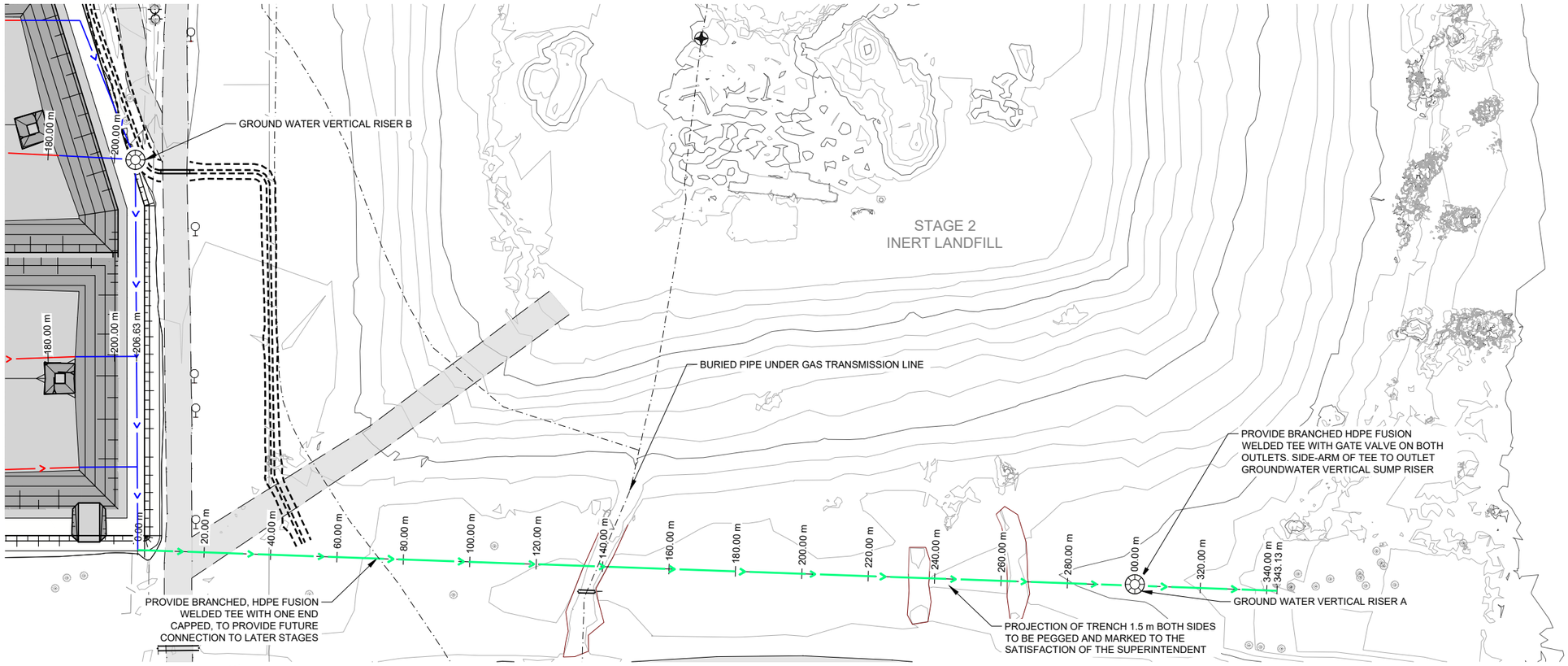
PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
PLAN AND TYPICAL SECTIONS - STORMWATER DRAINS

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	17 of 20	017



NOTE(S)

1. THE INFERRED AREA SHOWN AS NON-WASTE IS BASED ON LIMITED TEST PITTING CARRIED OUT BY GOLDER IN OCTOBER 2018. DOCUMENT XXX. PRIOR TO COMMENCING WORKS , THE CONTRACTOR SHALL SATISFY THEMSELVES THAT CONSTRUCTION OF THE TRENCH IS NOT IN WASTE.

ISSUED FOR

CONTRUCTION

0 12.5 25
1:750 METRES

0 25 50
1:1,500 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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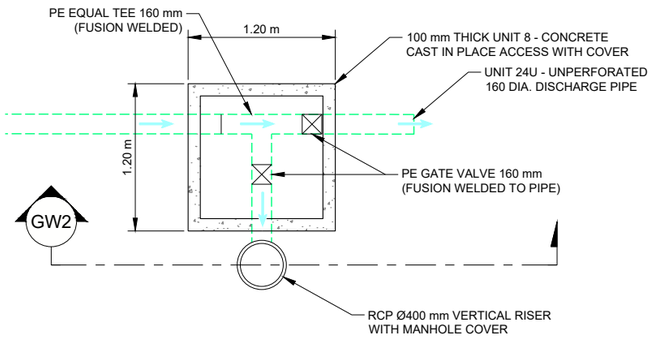
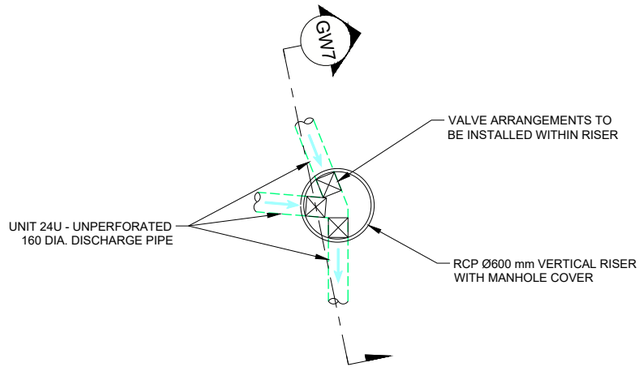
PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
PLAN AND LONGSECTION - GROUND WATER PIPELINE

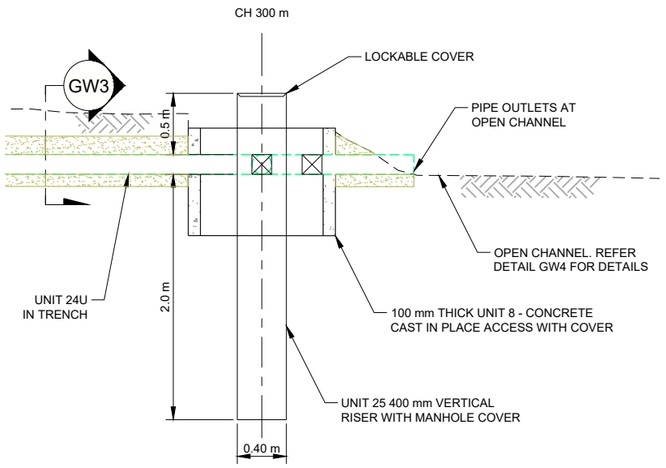
PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	18 of 20	018



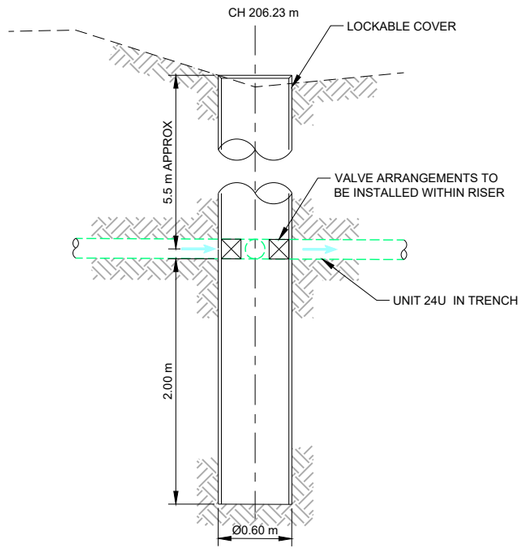
SCALE 1:50 m GW1 018 DETAIL - GW VERTICAL RISER A



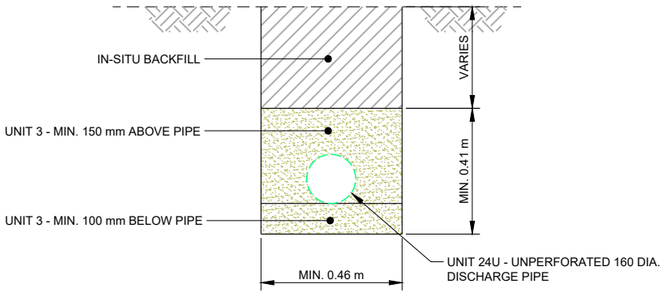
SCALE 1:50 m GW6 018 DETAIL - GW VERTICAL RISER B



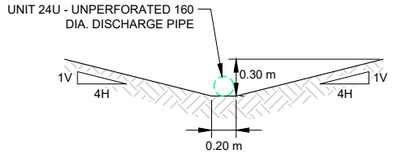
SCALE 1:50 m GW2 SECTION - GW VERTICAL RISER A



SCALE 1:50 GW7 SECTION - GW VERTICAL RISER B



SCALE 1:20 m GW3 SECTION - GW PIPELINE TRENCH



SCALE 1:20 m GW4 GW OPEN CHANNEL

ISSUED FOR
CONTRUCTION

0 0.5 1
1:20 METRES

0 1 2
1:50 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER	RS	GG	JB	JB	05873

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PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
TYPICAL SECTION AND DETAIL - GROUND WATER PIPELINE

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	19 of 20	019

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
25 mm
0

Path: \\golder.gds\gan\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\99_PROJECTS\18106426-Stage 6_Construction\017-STR_IFC\02_PRODUCTION\DWGS\ | File Name: 18106426-017-CW-018_019.dwg

SUBGRADE SURFACE SETOUT TABLE GENERAL

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
100	709245.60	8630162.25	14.90
101	709245.57	8630078.87	15.00
102	709245.66	8629995.49	15.53
103	709356.88	8629995.49	15.53
104	709468.10	8629995.49	15.53
105	709468.10	8630045.09	15.49
106	709468.10	8630094.70	15.46
107	709445.56	8630167.79	15.17
108	709437.70	8630161.07	14.48
109	709437.98	8630162.62	15.00
110	709251.55	8630157.52	15.00
111	709251.54	8630003.49	14.60
112	709252.78	8630004.72	14.58
113	709245.54	8630000.79	14.90
114	709458.88	8630004.72	14.58
115	709458.88	8630093.31	14.58
116	709458.60	8630079.14	14.48
117	709458.60	8630080.64	14.48
118	709253.07	8630080.64	14.48
119	709253.07	8630079.14	14.48
120	709257.13	8630075.08	13.13
121	709259.12	8630042.76	12.46
122	709257.01	8630008.96	13.16
123	709362.79	8630012.34	12.04
124	709448.52	8630015.07	11.12
125	709446.91	8630042.77	10.59
126	709448.43	8630068.97	11.10
127	709362.79	8630071.71	12.01
128	709257.25	8630151.97	13.10
129	709259.27	8630119.05	12.42
130	709257.13	8630084.70	13.13
131	709362.79	8630088.07	12.01
132	709448.43	8630090.81	11.10
133	709448.38	8630091.73	11.08
134	709438.55	8630119.07	10.63
135	709430.83	8630151.49	11.36
136	709362.79	8630151.68	12.04

REFER DRG 004 FOR GENERAL SUBGRADE SURFACE SETOUT LOCATIONS

SUBGRADE SURFACE SETOUT TABLE SUMPS

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
200	709437.49	8630123.50	10.73
201	709428.89	8630120.96	10.76
202	709431.24	8630111.68	10.85
203	709440.05	8630114.88	10.70
204	709435.52	8630119.75	9.73
205	709432.55	8630118.84	9.73
206	709433.46	8630115.88	9.73
207	709436.43	8630116.79	9.73
208	709447.17	8630047.28	10.67
209	709437.85	8630047.58	10.77
210	709437.85	8630037.96	10.77
211	709447.17	8630038.26	10.67
212	709444.22	8630044.32	9.69
213	709441.11	8630044.32	9.69
214	709441.11	8630041.22	9.69
215	709444.22	8630041.22	9.69

REFER DRG 004 FOR SUBGRADE SURFACE SUMP SETOUT LOCATIONS

SUBGRADE SURFACE SETOUT TABLE SPILLWAY

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
300	709448.18	8630006.63	13.94
301	709446.38	8630004.72	14.57
302	709445.41	8630000.79	15.00
303	709446.36	8630000.79	14.66
304	709445.28	8629995.49	15.53
305	709448.18	8629992.75	14.61
306	709454.58	8629992.75	14.61
307	709457.48	8629995.49	15.53
308	709456.41	8630000.79	14.66
309	709457.35	8630000.79	15.00
310	709456.38	8630004.72	14.57
311	709454.58	8630006.63	13.94

REFER DRG 004 FOR SUBGRADE SURFACE SPILLWAY SETOUT LOCATIONS

SUBGRADE DRAIN SETOUT TABLE BOTTOM OF TRENCH

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
150	709257.38	8630150.92	11.83
151	709430.79	8630150.44	10.08
152	709448.67	8630150.39	9.91
153	709259.32	8630119.05	11.17
154	709442.44	8630109.76	9.53
155	709465.31	8630108.46	9.48
156	709259.16	8630042.76	11.21
157	709447.29	8630049.30	9.46
158	709465.68	8630049.40	9.34
159	709257.08	8630009.96	11.89
160	709448.49	8630016.07	9.85
161	709465.88	8630016.18	9.27
162	709466.04	8629991.19	9.20

REFER DRG 004 FOR SUBGRADE SURFACE SUBGRADE DRAINS SETOUT LOCATIONS

SUBGRADE SURFACE SETOUT TABLE LEACHATE DRAIN

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
500	709245.81	8630163.42	15.54
501	709360.85	8630168.03	16.03
502	709445.46	8630171.43	16.38
503	709245.72	8630166.81	14.74
504	709360.76	8630171.43	15.23
505	709440.49	8630174.63	15.56
506	709445.36	8630173.73	15.95

REFER DRG 004 FOR SUBGRADE SURFACE LEACHATE DRAIN SETOUT LOCATIONS

SETOUT TABLE LEACHATE COLLECTION DRAINS

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
601	709266.00	8630151.06	13.29
602	709305.98	8630150.97	12.89
603	709345.95	8630150.87	12.49
604	709385.92	8630150.76	12.09
605	709425.90	8630150.65	11.69
606	709260.54	8630119.05	12.71
607	709300.54	8630119.05	12.31
608	709340.53	8630119.05	11.91
609	709380.52	8630119.05	11.51
610	709420.51	8630119.05	11.11
611	709270.23	8630119.05	12.61
612	709294.91	8630119.05	12.37
613	709321.06	8630119.05	12.10
614	709361.06	8630119.05	11.70
615	709401.06	8630119.05	11.30
616	709281.92	8630086.55	13.15
617	709306.34	8630087.30	12.89
618	709332.20	8630088.09	12.61
619	709371.77	8630089.31	12.19
620	709411.33	8630090.52	11.77
621	709277.16	8630073.58	13.20
622	709310.04	8630072.54	12.85
623	709344.71	8630071.43	12.48
624	709384.00	8630070.17	12.06
625	709423.29	8630068.92	11.65
626	709260.57	8630042.76	12.75
627	709271.79	8630042.76	12.64
628	709293.76	8630042.76	12.42
629	709299.43	8630042.76	12.36
630	709328.44	8630042.77	12.07
631	709368.44	8630042.77	11.67
632	709408.44	8630042.77	11.27
633	709284.95	8630010.90	13.14
634	709312.23	8630011.76	12.85
635	709340.87	8630012.67	12.55
636	709380.35	8630013.93	12.13
637	709419.83	8630015.19	11.71

REFER DRG 006 FOR LEACHATE COLLECTION DRAIN SETOUT LOCATIONS

TOP OF SELECT FILL SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
400	709257.30	8630151.92	13.40
401	709259.32	8630119.05	12.72
402	709257.19	8630084.76	13.43
403	709448.39	8630090.86	11.39
404	709448.34	8630091.72	11.38
405	709438.50	8630119.05	10.93
406	709430.79	8630151.44	11.65
407	709251.60	8630157.47	15.30
408	709253.07	8630080.64	14.80
409	709458.60	8630080.64	14.80
410	709460.10	8630093.49	15.30
411	709438.79	8630162.60	15.30
412	709257.18	8630075.03	13.43
413	709259.17	8630042.76	12.76
414	709257.07	8630009.01	13.46
415	709448.47	8630015.12	11.42
416	709446.86	8630042.77	10.89
417	709448.38	8630068.92	11.39
418	709253.07	8630079.14	14.80
419	709251.54	8630003.49	15.30
420	709460.10	8630003.49	15.30
421	709458.60	8630079.14	14.80
422	709245.60	8630162.25	15.45
423	709245.54	8630000.79	15.34
424	709462.80	8630000.79	15.42
425	709462.80	8630093.90	15.36
426	709440.77	8630165.35	15.39
427	709445.54	8630167.79	15.47
428	709362.79	8630119.05	11.69
429	709362.79	8630042.77	11.73
430	709362.79	8630151.63	12.34
431	709362.79	8630088.13	12.31
432	709362.79	8630071.65	12.31
433	709362.79	8630012.39	12.34
450	709446.43	8630003.49	15.30
451	709446.19	8629995.49	15.53
452	709448.18	8630005.34	14.68
453	709448.18	8629993.61	14.90
454	709454.59	8630005.34	14.68
455	709454.58	8629993.61	14.90
456	709456.34	8630003.49	15.30
457	709456.57	8629995.49	15.53
458	709432.61	8630118.81	10.99
459	709436.36	8630116.83	11.00
460	709441.16	8630044.27	10.97
461	709444.16	8630041.27	10.94

REFER DRG 005 FOR SELECT FILL SURFACE SETOUT LOCATIONS

SETOUT TABLE NORTHERN & SOUTH WESTERN DRAINS

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
700	709245.40	8630178.21	18.77
701	709245.50	8630174.61	19.57
702	709445.26	8630177.45	16.69
703	709445.40	8630173.86	17.49
704	709446.96	8630176.91	16.51
705	709447.80	8630175.50	16.34
706	709448.49	8630171.93	15.97
707	709452.10	8630153.35	15.04
708	709452.44	8630151.88	15.00
709	709452.89	8630150.43	14.95
710	709464.92	8630116.25	13.89
711	709467.89	8630107.82	13.63
712	709468.82	8630106.21	13.57
713	709469.75	8630105.36	13.54
714	709470.38	8630104.98	13.52
715	709472.29	8630104.44	13.46
716	709473.03	8630104.42	13.44
717	709481.67	8630104.42	13.39
718	709501.12	8630104.42	13.30
719	709502.27	8630104.23	13.30
720	709503.67	8630103.37	13.29
721	709503.90	8630103.12	13.29
722	709504.72	8630101.33	13.28
723	709504.76	8630100.84	13.27
724	709506.20	8630014.11	12.86
725	709506.29	8630013.35	12.86
726	709506.52	8630012.66	12.85
727	709515.49	8629992.98	12.75

REFER DRG 016 FOR NORTHERN DRAIN AND SOUTH WESTERN OUTLET DRAIN SETOUT LOCATIONS

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	RPEQ
2	2019-07-22	ISSUED FOR CONSTRUCTION	RS	BK	JB	JB	05873
1	2019-02-05	ISSUED FOR TENDER	RS	BK	JB	JB	05873
0	2019-01-17	ISSUED FOR TENDER - ADDED MISSING 500 SERIES POINTS	RS	GG	JB	JB	05873

CLIENT
CITY OF DARWIN

CONSULTANT
GOLDER
BRISBANE OFFICE
147 CORONATION DRIVE
MILTON, QLD 4064
AUSTRALIA
[+61] (7) 3721 5400
www.golder.com

PROJECT
SHOAL BAY LANDFILL
STAGE 6

TITLE
TABLE - SETOUT POINTS

PROJECT NO.	DOC	REV.		DRAWING
18106426	017	2	20 of 20	020

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
25 mm
0

APPENDIX B

Key Stage 2 Inert Waste Landfill Development Plans

GREEN WASTE

STAGE 3

STAGE 1

STAGE 2

MGA94 ZONE52

8 630 000 m N

8 630 200 m N

8 630 400 m N

8 630 600 m N

709 600 m E

709 800 m E

A F003

B F003

C F003

9.37%

9.01%

9.48%

8.06%

9.46%

9.59%

5.0H:1V

20

25

30

35

10

5

LECHATE POND

SEDIMENT BASIN D

SEDIMENT BASIN B

LEGEND

- STAGE 2 LANDFILL AREA
- ACTIVE INERT WASTE DISPOSAL AREA
- ROCK LINED SHOOT
- PERIMETER DRAIN (IMPACTED RUNOFF)
- SWALE (IMPACTED RUNOFF)
- RL 36 m WASTE LIFT 5
- RL 33 m WASTE LIFT 4
- RL 30 m WASTE LIFT 3
- RL 27 m WASTE LIFT 2
- RL 24 m WASTE LIFT 1

NOT FOR CONSTRUCTION

CONCEPT

0 50 100

1:2,000 METRES

CLIENT
CITY OF DARWIN

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-03-23
DESIGNED	MMC
PREPARED	MMC
REVIEWED	JSB
APPROVED	JSB

PROJECT
SHOAL BAY WASTE MANAGMENT FACILITY
STAGE 2 LANDFILL

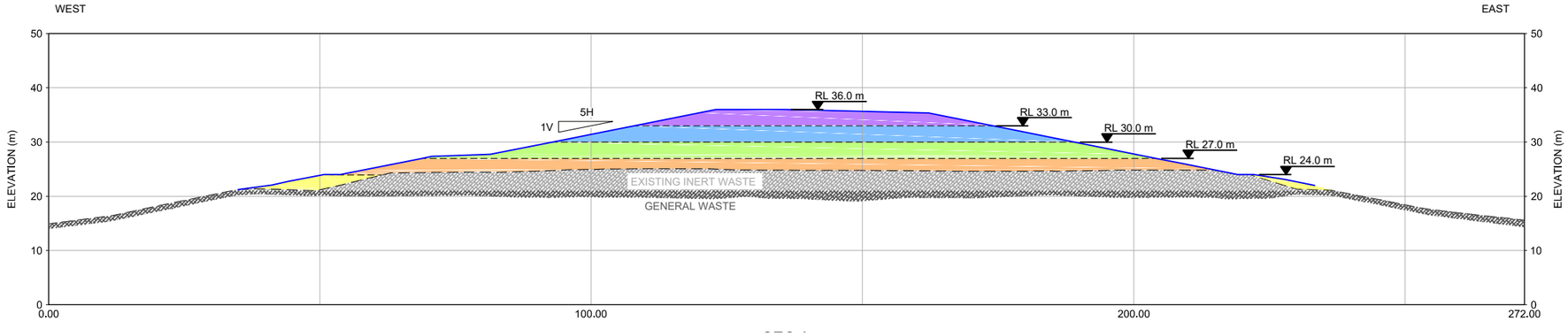
TITLE
STAGE 2 FINAL LANDFORM

PROJECT NO.	DOC	REV.	FIGURE
1659388	006	1	F003

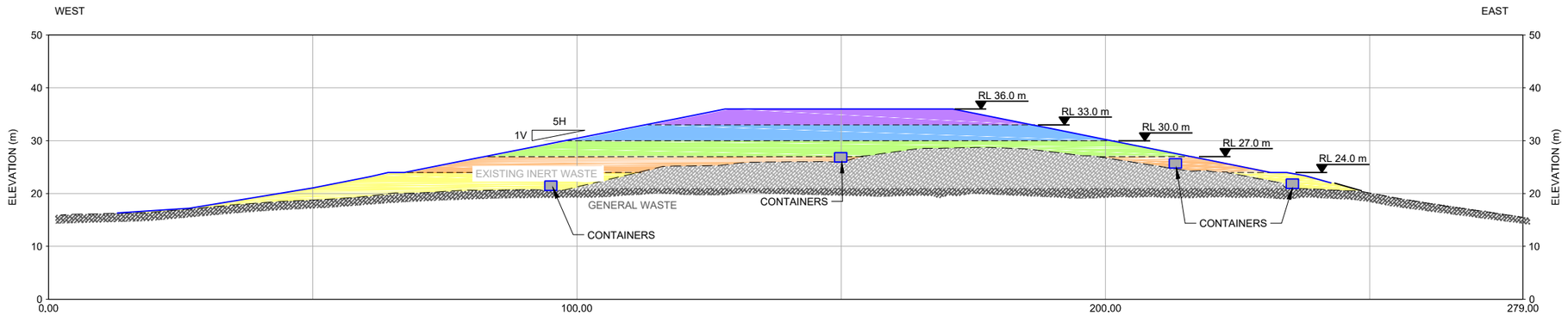
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

0 25 mm

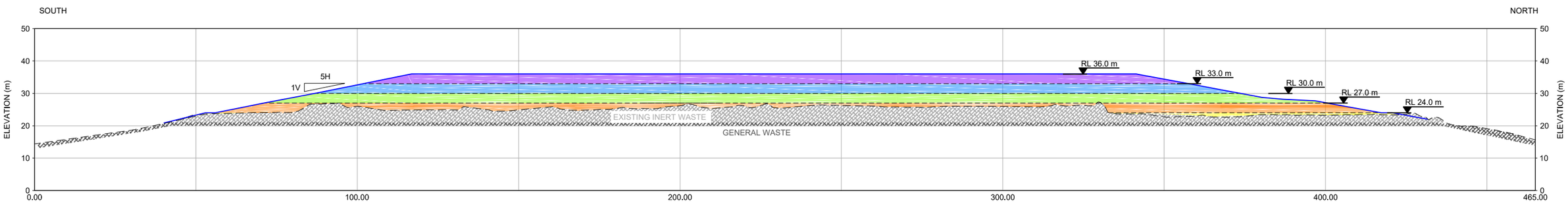
Path: \\golder.gds\gap\Adelaide\Geomatics\city_of_darwin\shoal_bay_landfill\99_projects\1659388 - stage 2 - inert landfill_development plan\02_PRODUCTION\DWG\DOC 001\ | File Name: 1659388_001_A_FIG 002 - 005.dwg



SCALE 1:1,000 — A F002 — WEST TO EAST CROSS SECTION 1



SCALE 1:1,000 — B F002 — WEST TO EAST CROSS SECTION 1



SCALE 1:1,250 m — C F002 — SOUTH TO NORTH CROSS SECTION

LEGEND

- GENERAL WASTE
- EXISTING INERT WASTE
- RL 24 m WASTE LIFT 1
- RL 27 m WASTE LIFT 2
- RL 30 m WASTE LIFT 3
- RL 33 m WASTE LIFT 4
- RL 36 m WASTE LIFT 5

0 25 50
1:1,000 METRES

0 25 50
1:1,250 METRES

CLIENT
CITY OF DARWIN

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-03-23
DESIGNED	MMC
PREPARED	MMC
REVIEWED	JSB
APPROVED	JSB

PROJECT
SHOAL BAY WASTE MANAGMENT FACILITY
STAGE 2 LANDFILL

TITLE
TYPICAL SECTIONS

PROJECT NO.	DOC	REV.	FIGURE
1659388	006	1	F004

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

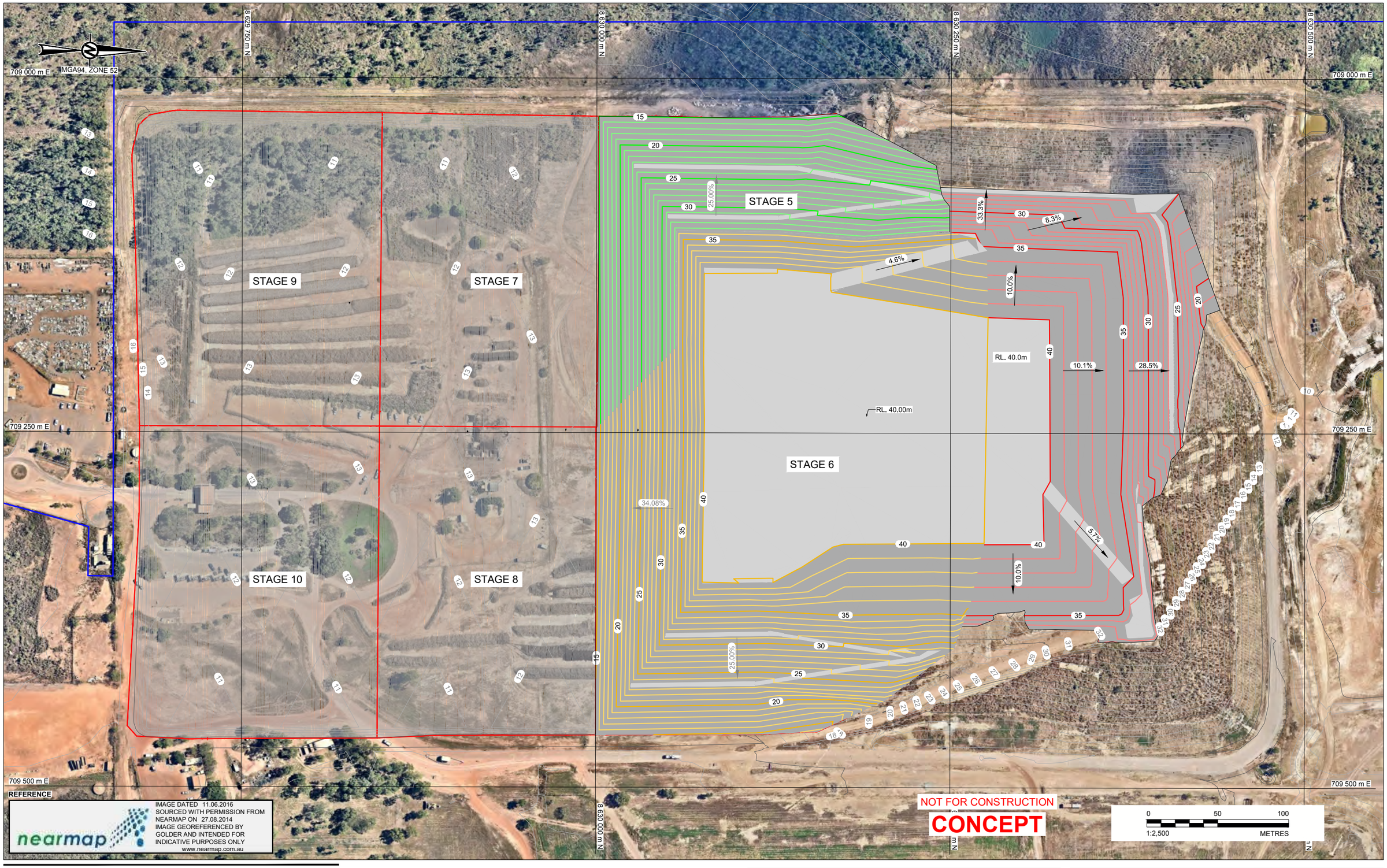
25 mm

0

Path: \\golder.gds\gan\Adelaide\Geomatics\city_of_darwin\shoal_bay_landfill\99_projects\1659388 - stage 2 - inert landfill_development plan\02_PRODUCTION\DWG\DOC 0011 | File Name: 1659388_001_A_FIG 002 - 005.dwg

APPENDIX C

Key General Waste Landfill Development Plans



REFERENCE

nearmap

IMAGE DATED 11.06.2016
SOURCED WITH PERMISSION FROM NEARMAP ON 27.08.2014
IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY
www.nearmap.com.au

NOT FOR CONSTRUCTION

CONCEPT

0 50 100
1:2,500 METRES

LEGEND

- STAGE 3 AND 4 INTERIM AND FINAL WASTE LANFORM, 1m CONTOURS
- STAGE 5 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 6 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- FUTURE LANDFILL STAGES
- LANDFILL OPERATIONS BOUNDARY

CLIENT
CITY OF DARWIN

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-08-15
DESIGNED	SRM
PREPARED	MMC
REVIEWED	JSB
APPROVED	JSB

PROJECT
SHOAL BAY WASTE MANAGEMENT FACILITY
GENERAL WASTE LANDFILL DEVELOPMENT PLAN

TITLE
STAGE 6 DEVELOPMENT AND INTERIM LANDFORM PLAN

PROJECT NO.	DOC	REV.	FIGURE
1526230	020	0	F009

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25 mm

Path: \\golder.gds\gap\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\09_PROJECTS\1526230 - COD - Shoal Bay Landfill Design\DOC 020 CAPPING ASSESMENT staging\ | File Name: FIGURE F009.dwg

MGA94, ZONE 52

8 629 750 m N
8 630 000 m N
8 630 250 m N
8 630 500 m N
709 000 m E
709 250 m E
709 500 m E

STAGE 9
STAGE 10
STAGE 8
STAGE 7
STAGE 5
STAGE 6

RL. 33.50m
RL. 40.00m
RL. 40.0m

33.35%
33.34%
34.08%
25.00%
25.00%
33.3%
8.3%
4.6%
10.0%
10.1%
28.5%
5.7%
10.0%

REFERENCE

nearmap

IMAGE DATED 11.06.2016
SOURCED WITH PERMISSION FROM NEARMAP ON 27.08.2014
IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY
www.nearmap.com.au

NOT FOR CONSTRUCTION

CONCEPT

0 50 100
1:2,500 METRES

LEGEND

- STAGE 3 AND 4 INTERIM AND FINAL WASTE LANFORM, 1m CONTOURS
- STAGE 5 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 6 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 7 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- FUTURE LANDFILL STAGES
- LANDFILL OPERATIONS BOUNDARY

CLIENT
CITY OF DARWIN

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-08-15
DESIGNED	SRM
PREPARED	MMC
REVIEWED	JSB
APPROVED	JSB

PROJECT
SHOAL BAY WASTE MANAGEMENT FACILITY
GENERAL WASTE LANDFILL DEVELOPMENT PLAN

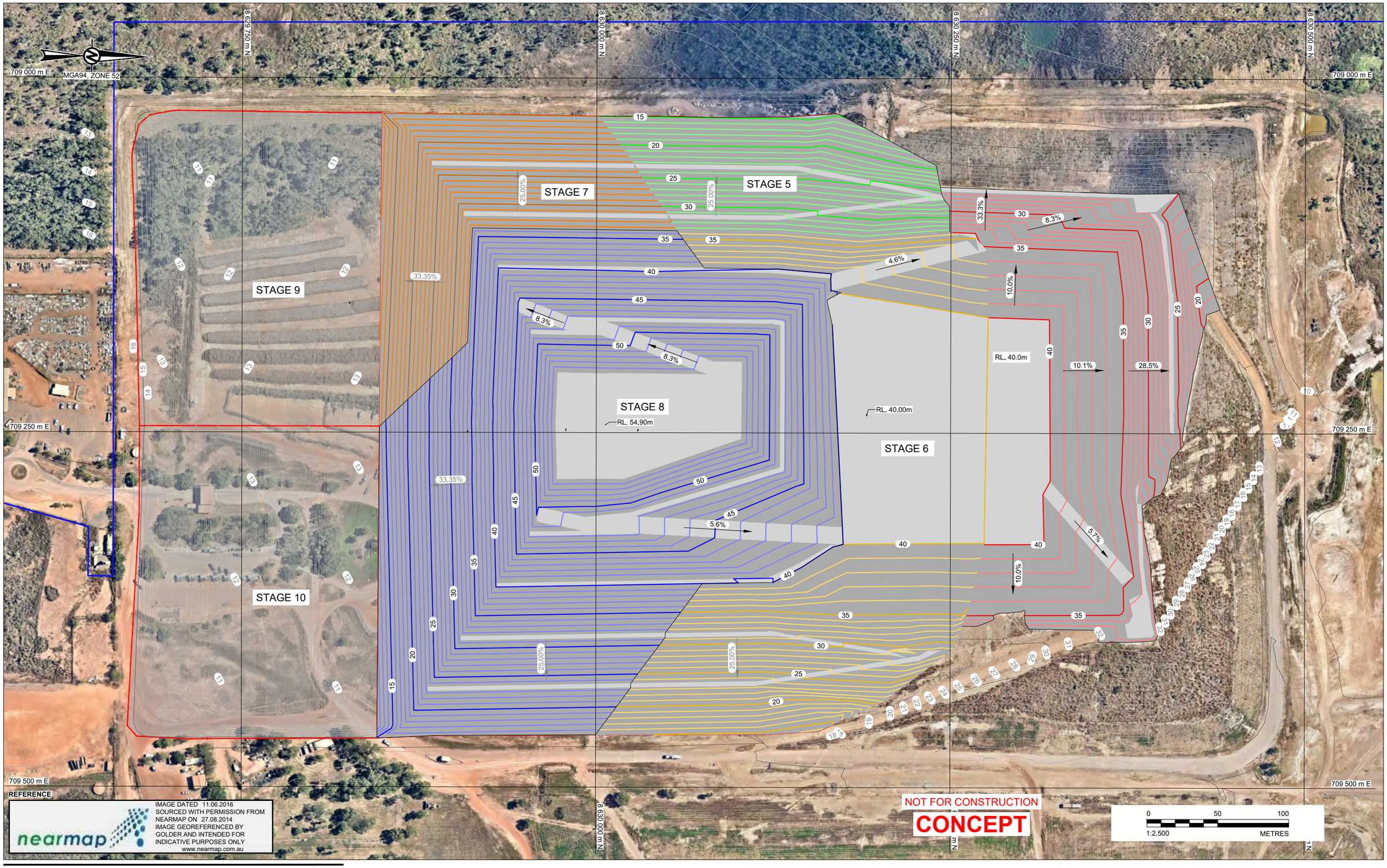
TITLE
STAGE 7 DEVELOPMENT AND INTERIM LANDFORM PLAN

PROJECT NO.	DOC	REV.	FIGURE
1526230	020	0	F010

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

0 25 mm

Path: \\golder.gds\gal\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\99_PROJECTS\1526230 - COD - Shoal Bay Landfill Design\DOC 020 CAPPING ASSESMENT staging\ | File Name: FIGURE F009.dwg



REFERENCE

IMAGE DATED 11.06.2016
SOURCED WITH PERMISSION FROM NEARMAP ON 27.08.2014
IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY
www.nearmap.com.au

LEGEND

- STAGE 3 AND 4 INTERIM AND FINAL WASTE LANFORM, 1m CONTOURS
- STAGE 5 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 6 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 7 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 8 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- FUTURE LANDFILL STAGES
- LANDFILL OPERATIONS BOUNDARY

CLIENT
CITY OF DARWIN

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-08-15
DESIGNED	SRM
PREPARED	MMC
REVIEWED	JSB
APPROVED	JSB

PROJECT
SHOAL BAY WASTE MANAGEMENT FACILITY
GENERAL WASTE LANDFILL DEVELOPMENT PLAN

TITLE
STAGE 8 DEVELOPMENT AND INTERIM LANDFORM PLAN

PROJECT NO.	DOC	REV.	FIGURE
1526230	020	0	F011

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

0 25 mm

Path: \\golder.gds\gap\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\89_PROJECTS\1526230 - COD - Shoal Bay Landfill Design\DOC 020 CAPPING ASSESMENT staging\ | File Name: FIGURE F009.dwg

709 000 m E
MGA94, ZONE 52
709 250 m E
709 500 m E
8 629 750 m N
8 630 000 m N
8 630 250 m N
8 630 500 m N

STAGE 5
STAGE 6
STAGE 7
STAGE 8
STAGE 9
STAGE 10

RL. 33.50m
RL. 54.90m
RL. 40.00m
RL. 40.0m

25.00%
33.39%
33.35%
33.3%
5.2%
8.3%
4.6%
10.0%
10.1%
28.5%
5.6%
5.7%

REFERENCE
AIM 2016/MGE

IMAGE DATED 11.06.2016
SOURCED WITH PERMISSION FROM
NEARMAP ON 27.08.2014
IMAGE GEOREFERENCED BY
GOLDER AND INTENDED FOR
INDICATIVE PURPOSES ONLY
www.nearmap.com.au

NOT FOR CONSTRUCTION

CONCEPT

0 50 100
1:2,500 METRES

LEGEND

- STAGE 3 AND 4 INTERIM AND FINAL WASTE LANFORM, 1m CONTOURS
- STAGE 5 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 6 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 7 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 8 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 9 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- FUTURE LANDFILL STAGES
- LANDFILL OPERATIONS BOUNDARY

CLIENT
CITY OF DARWIN

CONSULTANT
Golder Associates

PROJECT
SHOAL BAY WASTE MANAGEMENT FACILITY
GENERAL WASTE LANDFILL DEVELOPMENT PLAN

TITLE
STAGE 9 DEVELOPMENT AND INTERIM LANDFORM PLAN

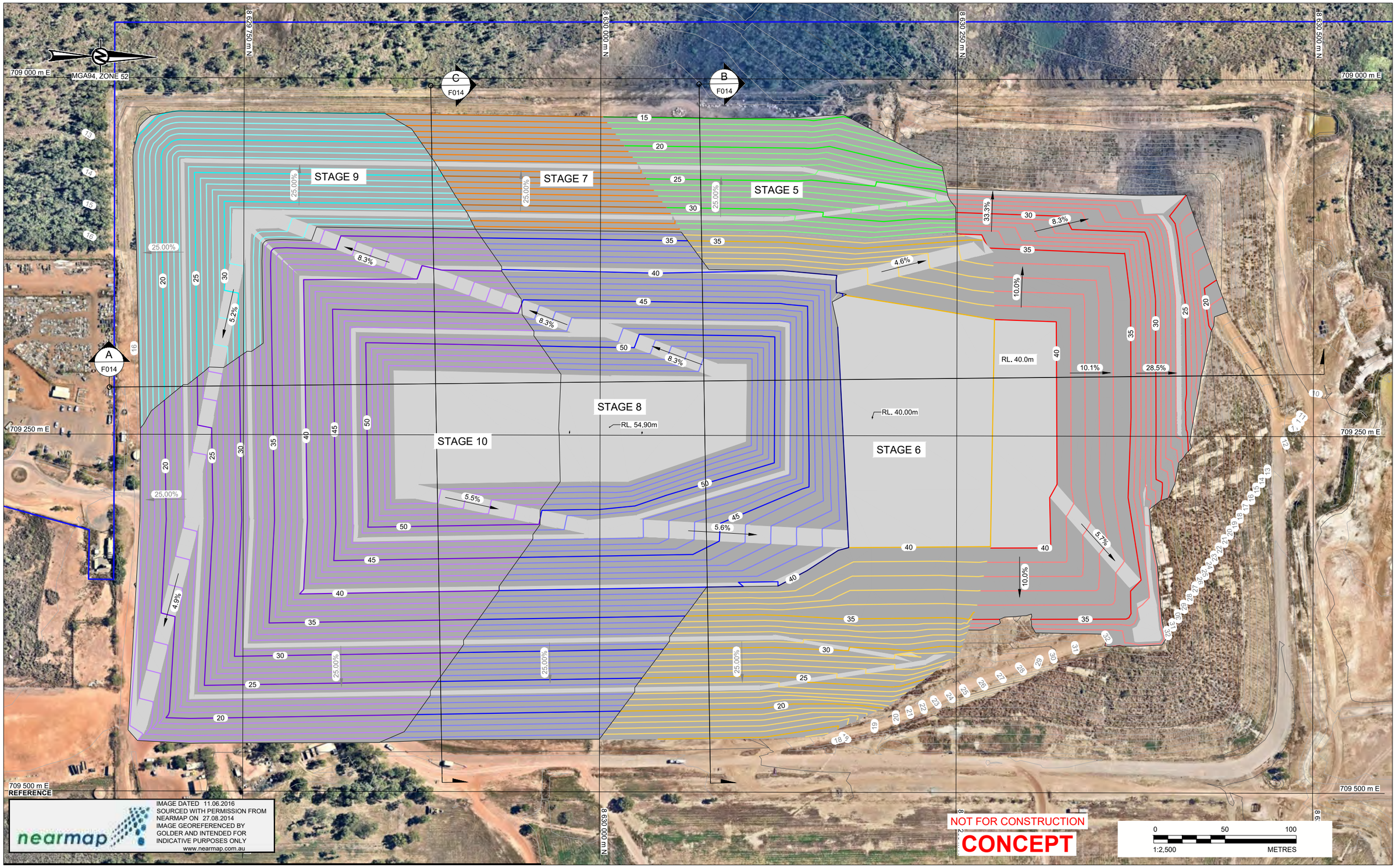
YYYY-MM-DD	2016-08-15
DESIGNED	SRM
PREPARED	MMC
REVIEWED	JSB
APPROVED	JSB

PROJECT NO.	DOC	REV.	FIGURE
1526230	020	0	F012

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

0 25 mm

Path: \\golder.gds\gap\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\89_PROJECTS\1526230 - COD - Shoal Bay Landfill Design\DOC 020 CAPPING ASSESMENT staging\ | File Name: FIGURE F009.dwg



LEGEND

- STAGE 3 AND 4 INTERIM AND FINAL WASTE LANFORM, 1m CONTOURS
- STAGE 5 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 6 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 7 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 8 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 9 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 10 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- LANDFILL OPERATIONS BOUNDARY

CLIENT
CITY OF DARWIN

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-08-15
DESIGNED	SRM
PREPARED	MMC
REVIEWED	JSB
APPROVED	JSB

PROJECT
SHOAL BAY WASTE MANAGEMENT FACILITY
GENERAL WASTE LANDFILL DEVELOPMENT PLAN

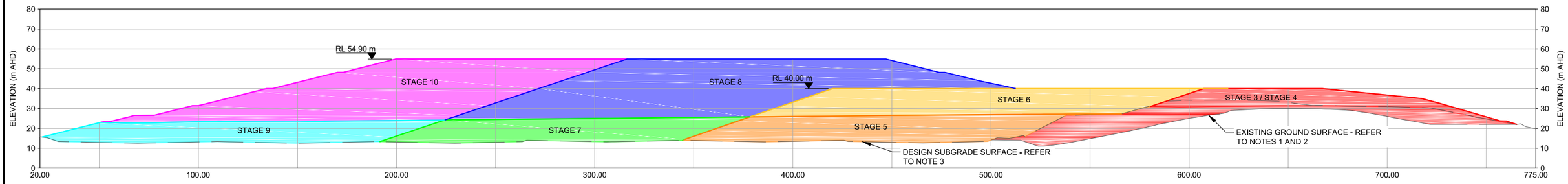
TITLE
STAGE 10 DEVELOPMENT AND INTERIM LANDFORM PLAN

PROJECT NO.	DOC	REV.	FIGURE
1526230	020	0	F013

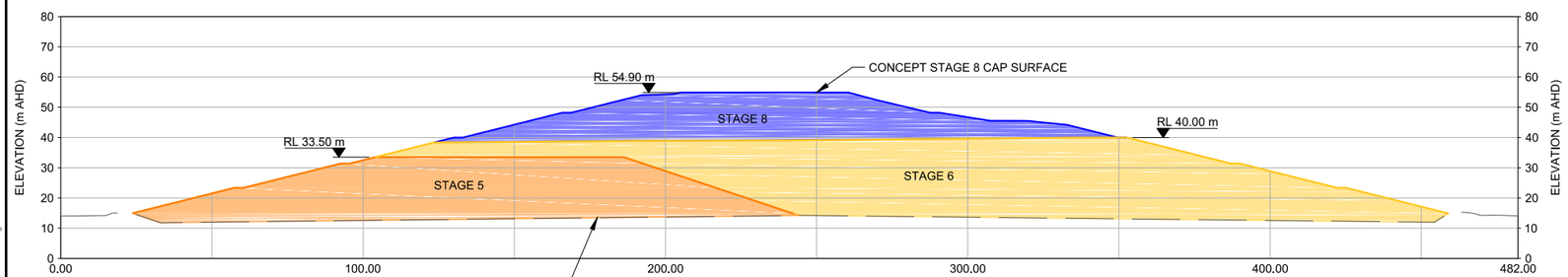
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

0 25 mm

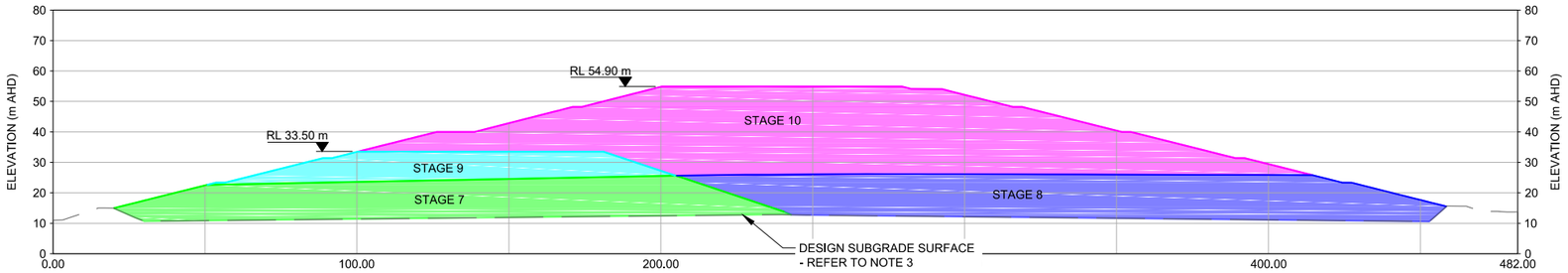
Path: \\golder.gds\gal\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\99_PROJECTS\1526230 - COD - Shoal Bay Landfill Design\DOC 020 CAPPING ASSESMENT staging\ | File Name: FIGURE F009.dwg



SCALE 1:2,000 m A F013 SECTION A



SCALE 1:2,000 m B F013 SECTION B



SCALE 1:2,000 m C F013 SECTION C

NOTES:

1. EXISTING GROUND SURFACE COMPRISES THE FOLLOWING:
   - SEPTEMBER 2015 SURVEY WITHIN THE FOOTPRINT OF STAGE 3 / STAGE 4. SURVEY BY EARL JAMES & ASSOCIATES ON 29 SEPTEMBER 2015, DRAWING TITLE "VOLUMES - END OF MONTH - SEPTEMBER 29 2015", DRAWING NUMBER 15/5209/126, CAD FILE NAME "5209-126 (3D INFO)".
   - AUGUST 2015 SURVEY IN AREAS OUTSIDE THE FOOTPRINT OF STAGE 3/STAGE 4. SURVEY BY AUSURV SURVEYORS P/L COMPLETED ON 1 AUGUST 2015, DRAWING TITLE "DETAIL SURVEY SHOAL BAY WASTE MANAGEMENT FACILITY", DRAWING NUMBER 15-0099-1, CAD FILE NAME "15-0099 SHOAL BAY LANDFILL".
2. EXISTING TOP OF STAGE 3 / STAGE 4 SURFACE IS BASED ON 28 JUNE 2016 SURVEY.
3. DESIGN SUBGRADE SURFACES IS THE DESIGN SUBGRADE SURFACE OPTION A DRAINING DOWN TOWARDS EAST AND WEST PRESENTED IN GOLDER DOCUMENT 152630-006-L-REV1.

LEGEND

- STAGE 3 / STAGE 4 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 5 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 6 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 7 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 8 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 9 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS
- STAGE 10 CONCEPT INTERIM AND FINAL WASTE LANDFORM, 1m CONTOURS

0 50 100
1:2,000 METRES

CLIENT
CITY OF DARWIN

CONSULTANT
Golder Associates

PROJECT
SHOAL BAY WASTE MANAGEMENT FACILITY
GENERAL WASTE LANDFILL DEVELOPMENT PLAN

YYYY-MM-DD	2016-08-15
DESIGNED	SRM
PREPARED	MMC
REVIEWED	JSB
APPROVED	JSB

TITLE
TYPICAL GENERAL WASTE INTERIM STAGE LANDFORMS AND FINAL LANDFORM SECTIONS

PROJECT NO.	DOC	REV.	FIGURE
1526230	020	0	F014

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0 25 mm

Path: \\golder.gds\gap\Brisbane\Geomatics\CITY_OF_DARWIN\SHOAL_BAY_LANDFILL\09_PROJECTS\1526230 - COD - Shoal Bay Landfill Design\DOC 020 CAPPING ASSESSMENT staging\ | File Name: FIGURE F009.dwg