Golder Associates

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ALLAWUNA FARM WORKS APPROVAL APPLICATION: W5830/2015/1
FURTHER INFORMATION

Dear Rebecca

The Department of Environment Regulation (DER) submitted a letter to SITA Australia Pty Ltd (SITA) dated 20 July 2015 requesting further information in regards to the Works Approval Application for the Allawuna Farm landfill. Golder Associates Pty Ltd (Golder) is pleased to provide the following response on behalf of SITA.

The queries have been addressed in the same order as your enquiry.

1.0 CELL CONSTRUCTION

Landfill Construction Management Plan, as discussed in section 5.3 of the Works Approval Application Supporting Document – Allawuna Landfill

A landfill construction management plan is typically produced by the Contractor responsible for the construction of the facility. At this time, the Works have not been tendered and hence a Contractor has not been appointed. A guidance document will be provided to the Contractor to assist him in preparing the landfill construction management plan. A copy of this guidance document is attached in Attachment A.

Explanation on how cell bases will be constructed and configured in areas where hard ground/rock excavation may be required. Please also provide details on the proposed method for hard ground/rock excavation, and details about how emissions and discharges will be managed, and

The landfill cell base has intentionally been designed to limit or prevent excavation of hard ground or rock. However, in the event that hard ground/rock is encountered, the cell base will be reconfigured to allow drainage around the obstruction such that removal of the rock will either not be required or minimised.

Should hard ground/rock removal still be required to facilitate drainage, a rock breaker will be utilised to break the rock, followed by removal with an excavator. SITA does not intend blasting any materials as it is expected that if rock removal should be required, it will be limited to a small area. It is the intent to avoid rock removal as far as possible.

Interpretation of Figures D207-D212 in Appendix B with regards to the base of the landfill cells (factoring in the liner and drainage system), the depth that waste is proposed for placement and the anticipated separation between the base of the cells in reference to the highest predicted groundwater levels across the cell footprints.

Written descriptions of Figures D207 to D212 are provided below based on Figure number. We are also happy to meet with the DER to discuss any specific questions that you may have in regards the figure descriptions provided below.

Table 1: Figure Descriptions

Figure Number	Description
D207 and D208	***Cell 1A and 1B Sections and Cell 2A and 2B Sections***
	Figures D207 and D208 provide cross sections of Cell 1 (D207) and Cell 2 (D208) showing the location of the estimated maximum groundwater surface and soil excavation surface relative to the invert of the cells. The extent of **Unit 3 – Engineered Clayey Material** and **Unit 4 – General Fill** is shown as well. Typically, **Unit 4 – General Fill** will be used in the construction of the embankments, whereas **Unit 3 – Engineered Clayey** material will be used within the cell basin to replace excavated materials or as fill material below the liner. Figure D208 indicates excavation below the estimated soil excavation surface. Test pits in this area were terminated at reach of excavator and not because hard material or rock was encountered. Based on the depth of some surrounding test pits that were excavated deeper and the general geology, we anticipate that we will be able to lower the invert of the cell prior to encountering rock or hard material and the design has therefore been optimised to remove as much soil as possible. The proposed maximum depth of waste in Cell 1 and Cell 2 will be 31 m and 29.5 m respectively. The minimum separation distance between the base of the cells and the highest predicted groundwater level is 2.7 m (Section C, Chainage 209.99 m).
D209	***Typical Details Sheet 1 of 3***
	Figure D209 depicts typical perimeter and division embankment details as well as anchor trench and liner details. *Detail 3 – Typical Perimeter Embankment Detail* Detail 3 depicts the final outer embankments along the perimeter of the landfill. The crest of the embankment is 5 m wide to allow single vehicle access. The downstream or outer face of the embankment will be covered with topsoil and vegetated to reduce erosion and manage sediment. The internal face will be lined with the typical liner configuration shown in Detail 9. *Detail 4 – Typical Division Embankment Detail* Detail 4 depicts a typical division embankment between adjacent cells (i.e. Cell 1 and Cell 2). The liner from the first cell will terminate in an anchor trench, while the liner from the following cell will be connected to the first liner as shown in Detail 9. *Detail 5 – Typical Perimeter Excavation Detail* Detail 5 depicts the scenario where the perimeter bund is in an area of excavation. In instances like this, a 5 m wide crest will be formed at the crest level of the cell, while the upstream face will be excavated at a slope of 1V:3H. A stormwater diversion bund will be included along the upstream face with a nominal bund height of 0.5 m. *Detail 6 – Typical Stormwater Management Bund on Cell Floor* A stormwater management bund will be constructed on the cell floor to divide the cell into two sub-cells (i.e. Cell 1A and 1B). The purpose of the bund is to reduce the generation of leachate. Water collected on the upstream side of the bund will be treated as clean stormwater (after testing to confirm water quality is suitable). Once Cell 1A has been filled, filling will move over to Cell 1B. At that time the geomembrane flap that covers the aggregate bund will be cut just above the connection weld and removed to allow free flow of leachate. *Detail 7 – Typical Anchor Trench Detail on Perimeter Embankment* Detail 7 depicts the anchor trench configuration on an external perimeter embankment, where all three materials (GCL, HDPE and Cushion geotextile) will be anchored in a trench with dimensions, 0.7 mm deep by 0.6 m wide, placed 1.0 m in from the embankment crest. *Detail 8 – Typical Anchor Trench Detail on Division Embankment* Detail 8 depicts the anchor trench configuration on an internal division embankment, where all three materials (GCL, HDPE and Cushion geotextile) will be anchored in a trench with dimensions, 0.7 mm deep by 0.6 m wide, placed 2.0 m in from the division embankment crest. This is to allow sufficient working space to construct the liner jointing detail shown.

Figure Number	Description
	The jointing of the two liners will take place as follows: ■ Cut cushion geotextile and geomembrane at anchor trench crest ■ Fold back cushion geotextile and geomembrane to expose GCL ■ Overlap new GCL with existing GCL using a bentonite paste between the two layers of GCL ■ Fold back the geomembrane and overlap with new geomembrane. Join with a wedge weld. ■ Fold back cushion geotextile and overlap with new cushion geotextile and stitch or heat tack together. *Detail 9 – Typical Liner Detail* Detail 9 depicts the typical liner detail for the cells which consists of (from bottom up): ■ 0.5 m compacted clayey material ■ Geosynthetic clay liner (GCL) ■ 2.0 mm HDPE liner ■ Cushion geotextile ■ 0.3 m leachate drainage aggregate (including leachate drainage pipes as shown on Figure D210) ■ Separation geotextile *Typical Liner Detail for Sandy Areas* This detail depicts the approach that will be followed in areas where thick layers of sandy material is encountered directly below the completed subgrade level. In this instance the sandy material will be removed up to a depth of 1.5 m below finished subgrade level and replaced with compacted clay up to a level of -0.5 m of completed subgrade level, after which the liner system as shown in Detail 9 will be constructed.
D210	***Typical Details Sheet 2 of 3***
	Figure D 210 depicts typical details for a variety of aspects as well as the typical construction sequence for the construction of the cells. *Typical Sequence of Construction Section* The purpose of this section is to demonstrate the typical construction sequence to the contractor, which will consist of the following steps (also described in the Construction Specification Doc No. 147645033-016-R-Rev0): ■ Remove vegetation ■ Strip topsoil ■ Remove 0.8 m of unsuitable material (sandier material) ■ Excavate or fill to – 0.5 m below finished subgrade level ■ Inspect subgrade and remove any sandy material (unsuitable material) to a an additional depth of 1.0 m (total depth remove is -1.5 m below finished subgrade level ■ Backfill with compacted engineered clayey material up to subgrade level ■ Install remainder of lining system *Typical Stormwater Management Bund* The typical stormwater management bund will be constructed from General Fill to a nominal height of 0.5 m, with a crest width of 1.0 m and overall nominal width of 3.0 m. The typical stormwater management bund will be constructed wherever stormwater diversion is required. *Typical Base and Side Liner Detail* The typical base and side liner detail shows the placement of leachate collection pipes on the base and the extent of leachate drainage aggregate on the side slope. The aggregate is placed up the side slope to a vertical height of 2.0 m, after which a soil protection layer is placed for the remainder of the slope up to crest height. The purpose of the soil protection layer is to protect the liner from

Figure Number	Description
	damage but also limit ingress of oxygen into the landfill, thereby limiting the likelihood of landfill fires and improving the quality of the extracted landfill gas. *Typical Batter Toe Pipe Detail* The typical batter toe detail shows the placement location of leachate collection pipes located at the toe of the batter. The leachate collection pipes should be covered with a mound of leachate drainage aggregate of at least 0.3 m thick.
D211	***Typical Details Sheet 3 of 3***
	Figure D211 depicts typical pipe penetration details. *Pipe Penetration through Stormwater Management Bund on Cell Floor* The leachate collection system will extend over the whole base of the cell and hence pipe penetrations will be required through the temporary stormwater management bund. This detail depicts the pipe penetration detail and the boot required around the leachate collection pipe. During the period when the two sub-cells will be in operation a blank flange will be attached to the pipe to prevent stormwater from entering Cell 1A or 2A. Prior to commissioning Cell 1B or 2B the blank flanges will be removed and the pipe system connected. *Pipe Penetration through Cell Division Bund* The major collection pipes will continue through the future cells. Cells 4 and 6 will be connected to Cell 1 and Cells 3 and 5 will be connected to Cell 2. For this reason penetrations will be required through the cell division bunds. This detail depicts the pipe penetration and temporary exit point. When the future cell is constructed the leachate header pipe will be exposed and connected at the stainless steel flange to the next cell's leachate header pipe. As each of the future cells will also have their own dedicated leachate sump, the connection of all the leachate header pipes allows for additional redundancy in the system.
D212	***Subsurface Drainage Details***
	Figure D212 provides details around the subsurface drainage system. *Typical Subsurface Drain Detail* The subsurface drain will consist of a pipe covered by aggregate and then sand to form a filter drain. Based on the typical grading of the site materials and the salinity of the water, it was expected that a typical geotextile and rock filter would clog and hence a graded filtration system was selected for the subsurface drains. *Typical Subsurface Drain Daylight Detail* For the purposes of cleaning the subsurface drain, a detail has been provided showing how the pipe should daylight to allow access to the pipe. The pipe extending above ground level will be capped to prevent infiltration of water and or sand into the pipe. *Typical Subsurface Sump Detail* The subsurface drainage pipe will drain into a sump, which will be fitted with a pump and level switch. The drainage water collected in the pump will be pumped to the retention dam, where it will be tested and depending on the result be transferred to the leachate dam or be released as clean water into 13 Mile Brook, similar to seepage water currently reporting to 13 Mile Brook. The seepage water is collected and tested as a contingency measure and is not expected to be impacted water generated from the landfill.

2.0 SUBSURFACE DRAINAGE

Explanation for the inclusion of the subsurface drainage system given that a proposed 2.5 m separation distance will be maintained between base of the landfill and the highest groundwater level, and

The subsurface drainage system is a short term management structure that has been included to:

- facilitate construction of the embankment in the groundwater seepage zone and
- Reduce the likelihood of "piping" due to long term groundwater seepage ("piping" is a geotechnical term that refers to the regressive erosion of soil particles starting at the downstream face, working upstream until a continuous "pipe" is formed. It is typically seen in areas of constant seepage), and
- maintain interim term stability of the embankment; as groundwater seepage is expected to reduce over the long term due to the construction of the landfill resulting in a reduction in upstream surface water infiltration.

The subsurface seepage system is not intended as a leachate detection layer; however, in the unlikely event that the liner system is breached, potential leachate seepage water (in the vicinity of the drain) can be intercepted by the subsurface drainage system and transferred to the retention dam until it has been tested and an appropriate disposal system determined.

Contingencies if the subsurface drainage system fails.

The subsurface drainage system consists of a pipe, surrounded by drainage media, with both these elements being capable of accepting flows. These results in redundancy in the system which will still allow flow towards the sump should a section of the pipe become blocked.

In addition, should it be required, the pipe can be cleaned using jet-rodding to clear obstructions and improve or restore flow.

It is noted again that the subsurface seepage system is not intended as a leachate detection layer.

3.0 LEACHATE MANAGEMENT

Details and/or clarification on the leachate pond water balance, including, but not limited to:

Anticipated total volumes (kl and m3) of leachate being generated from the total area of each cell

During the first seven years of landfill operation the total estimated leachate volume that can potentially be generated in each cell is presented in Table 2.

Table 2: Leachate generation estimate during the first seven years of landfill operations

Year	Cell 1A	Cell 1B	Cell 2A	Cell 2B	Total
	kL (m^3)				
1	687	N/A	N/A	N/A	687
2	855	N/A	N/A	N/A	855
3	0	369	N/A	N/A	369
4	180	0	603	N/A	783
5	0	97	751	N/A	847
6	0	0	0	318	318
7	0	0	158	396	555

The estimate presented in the table above are based on the Hydrologic Evaluation of Landfill Performance (HELP) model developed for the Allawuna landfill and presented in Golder report reference number 147645033-015-R-Rev0, dated March 2015 (Appendix E2 of the Works Approval Application).

Based on the data presented in Table 2, a maximum yearly leachate rate of approximately 850 m^3 could be generated during the first seven years of landfill operations. The total estimated volume of leachate generated by Cell 1 is 2188 m^3 over a five year period and for Cell 2 it is 2226 m^3 over a four year period. The maximum volume for two consecutive wet years would be over year 4 to 5, with a total estimated volume of leachate of approximately 1630 m^3. These two years have therefore been used to calculate the maximum capacity required in the leachate pond.

Measures to reduce leachate generation (included in the assessment) comprise adopting a phase-by-phase waste filling plan (i.e. constructing and operating one active cell at a time) and progressive capping (i.e. once a cell is active, the inactive cell will be capped to reduce potential runoff infiltration and leachate generation).

The estimate is based on the conservative assumption that two consecutive wet years will occur at any time during the operation of the landfill (in line with the Victoria BPEM[1]).

Clarification on the dimensions of the leachate pond and whether these dimensions include, in addition to catering for predicted leachate volumes and incident rainfall, the:

- *requirement to maintain a freeboard of 500 mm at all times*

The sizing of the Allawuna leachate pond has been undertaken using GoldSim; a simulation software with the capacity to develop probabilistic simulations and reduce uncertainties by introduction of probability functions to represent inputs such as rainfall. The model developed for the Allawuna landfill incorporates the leachate estimate generated by the HELP model as well as the climate data of the site (i.e. rainfall and evaporation).

The model has been developed assuming that:

- The leachate pond at the start of year 4 has an initial amount of stored leachate of 1000 m^3 (refer to Table 2).
- A freeboard of 500 mm is maintained.
- No leachate is recirculated into the landfill.

Based on the modelling, the estimated maximum storage volume require in the pond was approximately 2500 m^3 (occurred during the year seven wet season). Under the scenario modelled, a pond with a capacity of 3500 m^3 was indicated in order to maintain a freeboard of 0.5 m. The model incorporates incident rainfall into the leachate pond (assuming the occurrence of two consecutive wet years). The leachate pond was therefore designed with a total capacity of approximately 3600 m^3 (approximately 2700 m^3 at freeboard level).

- *capacity to cater for a 1 in 20 year storm event (20 year ARI) of 72 hours duration*

Based on the climate data statistics presented in 147645033-015-R-Rev0, the 1 in 20 ARI 72 hours duration rainfall event is approximately 245 mm. Based on the designed area of the leachate pond (i.e. 2800 m^2) and assuming a coefficient of runoff of 1, the volume of runoff correspondent to this rainfall event would be approximately 700 m^3. Therefore, based on the expected maximum yearly generation of leachate (approximately maximum 850 m^3 per year) and the 1 in 20 ARI 72 hours duration rainfall event, the total maximum storage volume required at any time during the first seven years of operations would be approximately 1550 m^3, which is within the design capacity of the leachate pond.

- *capacity to cater for contaminated stormwater in the event that it is required to be pumped to the leachate pond, and*

Potential contaminated stormwater is incorporated in the leachate volumes estimated in the HELP model. The model has been developed assuming that any rainfall in contact with waste is leachate. Therefore, the estimated volumes of leachate comprise infiltrated runoff captured by the leachate collection system as well as contaminated runoff.

- *capacity to cater for inflow of condensate from landfill gas collection wells*

[1] Victorian EPA, 2014. Publication 788.2 titled *'Best Practice Environmental Management Siting, Design, Operation and Rehabilitation of Landfills'*, October 2014

The formation of condensate from landfill gas occurs when the gas (typically warm and saturated with water vapour) cools down as it passes through gas collection wells. The models used for estimating liquid volumes (i.e. HELP model) do not explicitly take account of this process but it is considered in the model logic. Leachate is formed when the moisture content in the waste mass is greater than its field capacity. The landfill gas reduces the moisture content of the waste to below its field capacity while the infiltrated runoff increases the moisture back to its field capacity before it becomes leachate. It is therefore reasonable to assume that this volume is implicitly included in the leachate volume estimated in the HELP model.

Condensate management normally consists of draining the landfill gas condensate back into the waste or collecting it into a tank or manhole and recirculating it back into the leachate collection system. It will therefore intrinsically be part of the leachate collection management system of the landfill. Nevertheless, this volume of liquid it is not expected to be a significant amount.

Details on the separation distance between the base of the leachate pond to highest predicted groundwater levels depicted. Please also include a diagram which depicts this information

The minimum separation distance between the base of the leachate pond and the highest predicted groundwater level is 9.55 m. This information has been included on Figure D226 Rev D (Refer Attachment B).

Details on when leachate is anticipated to break through the liner for different containment infrastructure (landfill cells and leachate pond) including details of the time taken to reach nearest receptors, and

The landfill and leachate pond liner system has been designed and specified to contain the leachate for a period of up to 100 years; hence, we do not expect a breach of the liner over that period due to material failure. In addition, protection measures have been included in the liner systems and operational measures across the site to limit mechanical damage to the liner systems of both facilities (i.e. fencing, cushion geotextile, operational controls etc.). Both the landfill and leachate pond liner designs consists compacted engineered clayey fill, geosynthetic clay liner (GCL) and high density polyethylene (HDPE) liner.

For the purposes of this assessment we have disregarded the influence of the GCL and HDPE geomembrane components of the liner system and have assumed that these would be breached at some point in time in the future. In the instance of the landfill the presence of the final cover will significantly reduce the volume of leachate that would be released from the site and the advanced biodegradation of the waste would reduce the environmental impact. The leachate pond is no longer expected to be in operation at 100 years from the start of landfill operation.

The closest receptor to the landfill would be 13-Mile Brook. Based on the hydrogeological and geotechnical information of the site we have estimated that it would require between 25 and 690 years, with an average of approximately 350 years, to reach 13-Mile Brook (depending on the *in situ* saturated clay permeability). The following inputs have been used to estimate the time of seepage:

- Distance of the source (location of leak) to the groundwater assumed to be 2.5 m, with the top 0.5 m layer consisting of compacted clayey soil
- Distance of the source to the receptor (13-Mile Brook) assumed to be 400 m
- Permeability of the compacted clayey soil when saturated with a leachate solution (50 000 ppm NaCl solution) of 10^{-8} m/s
- Permeability of the *in situ* clay between 0.02 – 0.6 m/day[2] (2.3×10^{-7} – 6.9×10^{-6} m/s)
- Effective porosity of the compacted clay material and *in situ* clay of 0.25.

The estimate is based on Darcy's law constitutive equation, which assumes that the material is completely saturated. This assumption simplifies the real mechanism of seepage transport as the compacted clayey and *in situ* soils will likely be unsaturated. Under unsaturated conditions, the permeability is significant lower than assumed in the estimate. Additionally, the transport of any contaminants will be likely be retarded by the sorption and absorption processes taking place in the surrounding clayey minerals.

[2] Refer Golder Report 147645033-009-R-Rev0, Table 4 – Included as Appendix E in the Works Approval Application

Operational leachate management plan, which shall include, but not be limited to:

The leachate management plan for Allawuna Farm landfill is included in Attachment C.

Details on how the leachate is pumped from the extraction sumps to the leachate pond. Please provide details, including diagrams if necessary, on the equipment and infrastructure required to achieve this

The leachate is pumped from the leachate collection sumps in Cell 1 and Cell 2 with submersible pumps fitted with a high and low level switch which will activate or stop pumping as required. A flow meter will also be attached to the pump to measure the pump rate. The data collected from the flow meter can be used to estimate the volume of leachate extracted from a sump and correlate it with the leachate modelling results. Please refer to Attachment D for further details and diagrams.

Details on how the leachate pond will be kept aerobic

Aerators will be installed in the leachate pond to aerate the water. These aerators will be anchored on the embankment crest to limit their movement.

Details on how residue salts in the leachate pond will be managed

Residue salts will be removed once a year prior to commencement of the rain season. After removal of the salts the pond will also be cleaned and inspected for potential damage.

Summary of water balance calculations and management measures to ensure:

- *no overflow occurs, and*
- *levels are maintained to prevent contents drying out in order to prevent potential residue dust emissions and maintain the integrity of the liner*

A Monte Carlo simulation has been undertaken using the GoldSim model developed for the Allawuna landfill, to investigate if during the 100-year period for which rainfall data is available for the site the leachate pond would overflow. Based on the simulation, overflow of the leachate pond is shown to be unlikely; only one of 100 Monte Carlo realisations showed a maximum level in the leachate pond slightly higher than the freeboard level. The results of the Monte Carlo simulation are shown in Figure 1 and Figure 2 below.

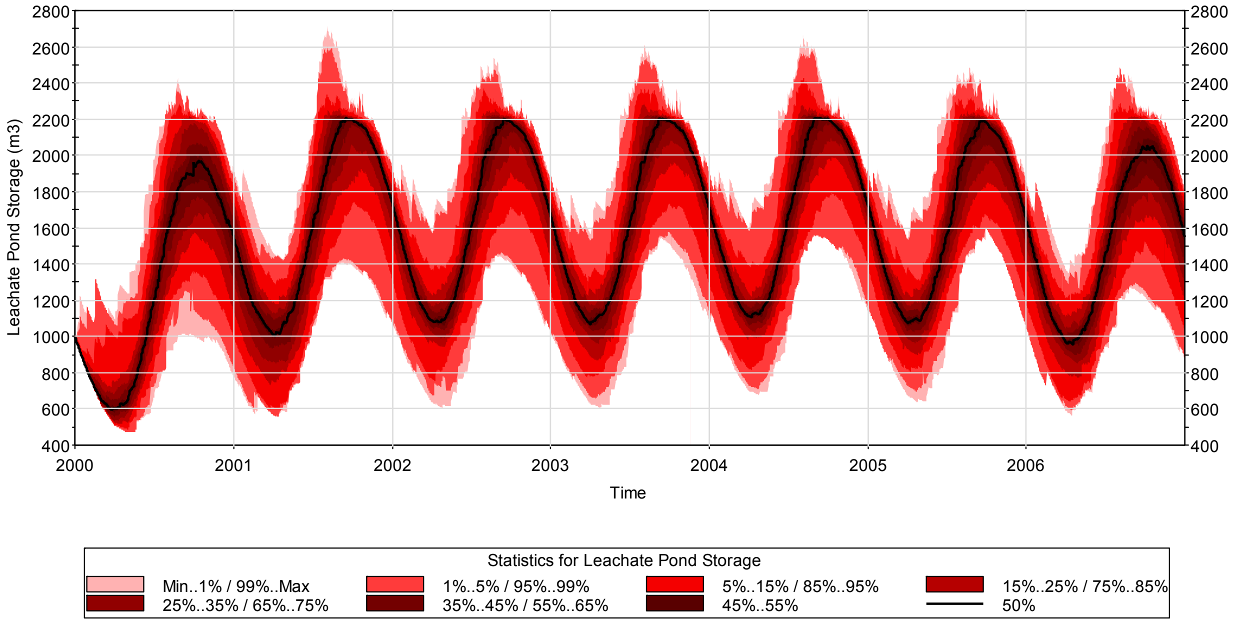

Figure 1: Leachate pond storage – Monte Carlo simulation using 100 years of rainfall data (maximum storage capacity at freeboard level is approximately 2700 m³).

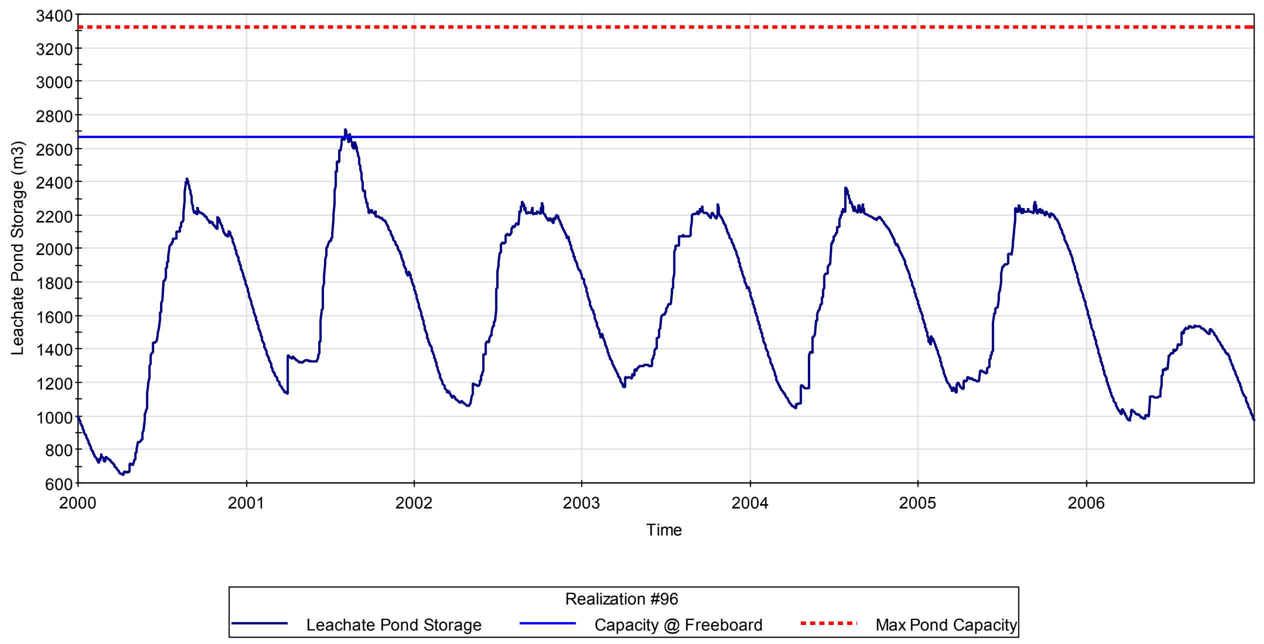

Figure 2: Leachate pond storage – Realisation that generated the greatest storage volume in the leachate pond.

Based on the simulation undertaken using GoldSim, it is unlikely that the leachate pond will completely dry out. However, as a contingency measure, in the event of a drought, the minimum pond level could be maintained by pumping water from production bores in the vicinity of the landfill site (location of production bores yet to be identified).

Contingency measures in the case of emergency events for both the leachate pond and the retention pond. Please include clarification on what constitutes an emergency for the purpose of leachate re-circulation or redirection to the retention pond, and

A risk assessment has been carried out to assess the emergency events that may occur on site and the associated contingency measures required as well as the resulting risk level.

Table 3: Risk assessment for leachate and retention ponds

Emergency Event	Possible Causes	Proposed Management and Mitigating Actions	Likelihood	Consequence	Proposed Residual Risk Level
Capacity of leachate pond exceeded	Extreme weather (i.e. high rainfall events in short succession); overfilling; limited availability of tanker trucks (e.g. road closure); higher volume of leachate than estimated	1) Cease pumping leachate into the leachate pond; temporarily retaining leachate in the landfill. 2) Re-circulate leachate into the landfill, limiting recirculation to the active working face and uncapped areas. 3) Temporarily transfer excess leachate from the leachate pond to the retention pond, if required (maximum retention time of 14 days). 4) Temporarily store excess leachate in tanker trucks and/or transport to a wastewater treatment plant. 5) Construct an additional pond if the pond were to spill on a regular basis (e.g. once or twice every rainy season).	Rare	Significant	High

Emergency Event	Possible Causes	Proposed Management and Mitigating Actions	Likelihood	Consequence	Proposed Residual Risk Level
Leachate pond damaged (remediation work on liner or earthworks are required)	Animals, vandals, etc.	1) Fencing around leachate pond to limit access. 2) Cease pumping leachate into the leachate pond; temporarily retaining leachate in the landfill. 3) Reduce the level of the leachate pond to below level of damage, if required, by re-circulating leachate into the landfill, limiting recirculation to the active working face and uncapped areas. 4) Temporarily transfer excess leachate from the leachate pond to the retention pond, if required (maximum retention time of 14 days). 5) Repair damage.	Unlikely	Medium	Moderate
Leachate pond is temporarily de-commissioned	Accidental strike by operational vehicle or equipment, etc.	1) Fencing around leachate pond and physical barriers (bollards) between pond and truck movement zone. 2) Cease pumping leachate into the leachate pond; temporarily retaining leachate in the landfill. 3) Empty the leachate pond, by re-circulating leachate into the landfill, limiting recirculation to the active working face and uncapped areas. 4) Temporarily transfer excess leachate from the leachate pond to the retention pond, if required (maximum retention time of 14 days). 5) Temporarily store excess leachate in tanker trucks and/or transport to a wastewater treatment plant. 6) Repair damage	Rare	Medium	Moderate
Capacity of retention pond exceeded	Extreme weather (i.e. high rainfall events in short succession); maximum retention time of 14 days is not sufficient; high seepage rates from subsoil system during the wet season.	1) Cease pumping seepage water from the subsoil system into the retention pond. 2) Test the quality of the seepage water to assess if this water can be safely discharged to the environment. 3) If water quality is not acceptable: a) temporarily pump seepage water into the leachate pond. b) re-circulate seepage water into the landfill, limiting recirculation to the active working face and uncapped areas. c) temporarily store seepage water in tanker trucks and/or transport to a wastewater treatment plant. 4) Construct an additional pond if risk of spills occur on a regular basis (e.g. once or twice every rainy season).	Unlikely	Medium	Moderate

Emergency Event	Possible Causes	Proposed Management and Mitigating Actions	Likelihood	Consequence	Proposed Residual Risk Level
Retention Pond is damaged (remediation work on liner or earthworks are required)	Animals, vandals, etc.	1) Fencing around leachate pond to limit access. 2) Cease pumping seepage water from the subsoil system into the retention pond; temporarily retaining seepage water in the sump. 3) Test the quality of the seepage water to assess if this water can be safely discharged to the environment. 4) If water quality is not acceptable: a) temporarily pump seepage water into the leachate pond. b) re-circulate seepage water into the landfill, limiting recirculation to the active working face and uncapped areas. c) temporarily store seepage water in tanker trucks and/or transport to a wastewater treatment plant. 5) Repair the damage.	Unlikely	Minor	Low
Retention pond is temporarily de-commissioned	Accidental strike by operational vehicle or equipment, etc.	1) Fencing around leachate pond and physical barriers (bollards) between pond and truck movement zone. 2) Cease pumping seepage water from the subsoil system into the retention pond; temporarily retaining seepage water in the sump. 3) Test the quality of the seepage water to assess if this water can be safely discharged to the environment. 4) If water quality is not acceptable: a) water into the leachate pond. b) re-circulate seepage water into the landfill, limiting recirculation to the active working face and uncapped areas. c) temporarily store seepage water in tanker trucks and/or transport to a wastewater treatment plant. 5) Repair the damage.	Rare	Minor	Low
Other events	Combination of the above; Unforseen causes	Combination of the above mitigation measures as is applicable.	-		

Details on how long leachate will remain in the retention pond following an emergency. Please also provide details on how this material will be managed, including any testing requirements to determine reuse or disposal options.

There is no industry standard, guidelines or recommendations on the time leachate could be temporarily stored in the retention pond following an emergency situation. However, we would propose a maximum leachate storage period of 14 days. We are of the opinion that this period will provide sufficient time to manage the leachate in accordance with the actions discussed in our response to the previous bullet point and in response to the queries regarding the retention pond (Refer section 4.0).

4.0 RETENTION POND

Section 5.2 in the Allawuna Farm Landfill Surface Water, Groundwater and Leachate Management Plan in Appendix E indicates a total pond capacity of 2000 m^3 However, Figure D230 in Appendix B indicates a total capacity of 3900 m^3, based on the maximum height of the pond. Clarification on the dimensions of the retention pond is required

The proposed storage capacity up to the freeboard level has been proposed at 2000 m^3 (as per Section 5.2 in Golder report reference number 147645033-015-R-Rev0, dated March 2015 – Appendix E2 of the Works Approval Application).

The design storage capacity (taking into account site topography, etc.) is 2690 m^3 at freeboard level (RL 308.8 m). The actual pond capacity is therefore slightly in excess of the proposed required capacity. The total storage capacity of the pond up to crest level (RL 309.3 m) is 3900 m^3, including the capacity within the freeboard zone of 0.5 m. The depth of the pond varies between approximately 1.2 m and 1.5 m.

Details on the separation distance between the base of the retention pond to highest predicted groundwater levels depicted. Please also include a diagram which depicts this information, and

The minimum separation distance between the base of the retention pond and the highest predicted groundwater level is 2.58 m. This information has been included on Figure D230 Rev D (Refer Attachment B).

Justification for not including a geosynthetic clay liner on the retention pond considering that this pond has been identified as potential containment infrastructure for leachate in emergencies.

We have based the design on a risk assessment that concluded the risk for environmental breach is negligible based on the following:

- The pond liner consists of compacted clayey material and HDPE geomembrane that will form the containment system for the pond. Liner installation and subsurface earthworks will be quality controlled during construction.
- Operational inspections will occur on a regular basis to assess integrity of the pond.
- Prior to transferring leachate, the pond will be inspected to assess whether the pond is suitable for leachate containment and whether there are signs of damage to the liner system.
- Retention time in pond will be limited to 14 days after which the leachate will either be transferred back to the leachate pond or be tanked off site for disposal. We expect that a period of 14 days would result in low risk to the environment, should a breach occur during this time period. Notwithstanding the above, the risk of a breach is expected to negligible based on the physical and management measures that will be in place.

The risk assessment has been included in the response to leachate management (Refer section 3.0).

5.0 SURFACE WATER

Details of the Options Study to determine water demand requirements and water availability during construction and operational phases, including an assessment for emergency water supplies

Construction water

The purpose of the Options Study was to:

- Assess whether there would be sufficient water available during the construction phase of the landfill site, specifically for Cell 1A and 1B in the first instance, including all the ancillary works such as access roads etc.

- Assess whether the water available on the farm would be suitable for construction purposes
- Assess the volume of construction water required for construction activities such as moisture conditioning, dust suppression and maintenance of compacted areas
- Assess the quality of water required such that the performance of the individual construction components (i.e. compacted clayey material layerworks, geosynthetic clay liner, roadworks, etc.) is not adversely affected. The main constituent of concern was identified as salinity
- Provide recommendations on options available for supplementing the available water, should it fall short of the identified requirements

The outcomes of the Options Study were:

- That during an average rainfall year sufficient run-off will be generated and stored in the dams available on the farm to provide the volume of water required for initial construction works (Cell 1A and 1B and ancillary works)
- The quality of the water in the dams will generally meet the water quality requirements for the type of construction works that will take place
- Existing bores are available on the landfill to supplement run-off water, however the yield of these bores should be established during the next phase of study

Based on the results of the Options Study the following steps were recommended:

- Monitor rainfall values on the farm and water levels in the dams to assess whether the dams are being replenished at the required rate
- Assess the yield of existing boreholes on the farm to determine potential yield
- Assess the opportunity to drill additional boreholes on the farm to supplement the existing boreholes, should the yield from these bores not be sufficient. (The criteria for sufficient yield is, amongst other factors, based on the time required to fill a water tanker and number of water tankers that require filling in a day.)

Operational water

A water management assessment was provided in the Works Approval Application (Refer Appendix E2, Report number 147645033-015-R-Rev0). As part of this assessment the operational water requirements for the site was estimated. The sizing of the stormwater dam is based on a combination of the construction water requirements and the operational water requirements and hence has a storage capacity of approximately 36 000 m^3 (36 ML). Based on the 25 year simulation carried out the stormwater dam will only fail to provide sufficient water during 1 year. Based on the outcome of the further studies recommended in the Options Study, the volume of water in the stormwater dam could be supplemented either through existing bores on the farm or by drilling additional bores or by pumping water from the other dams located on the farm.

Emergency water

The water balance model presented in Report number 147645033-015-R-Rev0 (Appendix E2 of the Works Approval Application) indicates that in general a volume of approximately 5000 m^3 could be available in the Stormwater dam for use as emergency water. Should this water need to be supplemented, the other dams on the farm or boreholes could be utilised.

Dimensions of the proposed stormwater diversion drain as depicted in Figure D202 in Appendix B, and

The dimensions of the stormwater drain are shown on Figure D240 (Attachment B). The drain will have a nominal depth of 0.5 m and a nominal width of 3.0 m based on 1V:3H side slopes. The bund along the downstream edge of the drain will be constructed with the material excavated from the drain and have a nominal height of 0.5 m.

Surface Water Management Plan, as discussed in section 4.1 and 4.5 of the Allawuna Farm Landfill Surface Water, Groundwater and Leachate Management Plan provided in Appendix E, including contingencies if erosion is identified at the premises

The surface water management plan for the operational as well as construction phases of the landfill site is attached. The management plan includes guidance for dealing with issues such as erosion and breach or failure of the stormwater management structures, which includes pumping to alternative dams or installing temporary sediment control structures such as sand bags.

6.0 SEDIMENT CONTROL

Contingencies if the Sediment Management Structure fails or in times of heavy rainfall or localised flooding

In the event that the sediment structure fails, temporary sediment management systems will be installed downstream of the sediment structure. These systems will include sand bags or silt fences, which can be installed in a short period of time to contain and manage sediment. These details will be included in an updated *Environment Quality and Safety Management System Manual* and *Emergency Procedure Guide and Contingency Plan* for the Allawuna Landfill site.

Details on how sediment is removed from the Sediment Management Structure and storage zone

Sediment will be removed from behind the sediment management structure and storage zone utilising an excavator, backhoe or mini-digger, transported to the landfill via truck, spread out and allowed to dry before utilising the material as cover material.

Explanation of proposed controls in consideration of the Rivercare project for sediment and water quality of Thirteen Mile Brook, including rehabilitation and revegetation of waterways adjacent to the proposed landfill

SITA commit to meet with personnel from the Rivercare project to establish and implement a rehabilitation and revegetation plan. This meeting will take place should the Works Approval be granted to SITA.

7.0 LANDFILL GAS

Consideration of site specific data in landfill gas modelling including the inclusion of liner and cap details

As detailed within Section 3.4 of our Landfill Gas Assessment Report (Reference 147645033-010-L-Rev0 in Appendix G2 of the Works Approval Application), the input of cap and liner details has no material impact on the modelled quantity of LFG generated. The purpose is to determine portioning between the surface gas emissions and lateral migration. Lateral migration is considered to be a very low risk to the surrounding environment due to the presence of the composite liner system below the landfill which will limit vertical and lateral gas movement. We therefore expect that any LFG generated would be emitted through the landfill surface.

Consider the performance of landfill gas collection infrastructure under high leachate loads due to abnormal operating conditions such as failure of barrier layers

As the landfill is being constructed above the maximum ground water level failure of the basal liner will not result in a high leachate load being applied to gas collection infrastructure. Similarly intermediate capped or final capped areas will be inspected regularly and any defects remediated, again mitigating the risk of high leachate levels impacting the performance of the gas collection system. We would also like to note that occurrence of a high leachate load is not necessarily the result of a failure of the barrier layers (basal liner or capping).

It is common practice to pump leachate from landfill gas extraction wells to prevent the wells becoming blocked from condensate or leachate and to improve the efficiency and life of the gas extraction wells. Management systems will therefore already be in place, or can be easily retrofitted using pumping systems like Airwell pumps (or similar) to remove high leachate loads.

Management actions under emergency conditions such as damaged pipes, system blockages and landfill fire, and

General site management would require all gas infrastructure to be monitored and repaired as and when required. In the case of an emergency condition, the gas extraction system or sections within the affected zone will be switched off until damage to pipes or blockages can be rectified. Depending on the nature of the damage, site personnel may be able to repair the infrastructure or specialist contractors may be required. Each incident will however be assessed and the necessary actions taken as required.

A plan is presented in the document Landfill Gas Management Plan, Allawuna Farm landfill, March 2015 depicting vertical wells with fields of influence, however the wording in the management plan suggest horizontal pipework may be installed. Please provide a detailed management plan discussing progressive filling and construction of pipework.

SITA has indicated that it is their intent to utilise vertical wells in preference to horizontal wells as far as is practicable, as horizontal wells are more difficult and costly to maintain. It may be necessary in some instances to install horizontal wells in limited locations to optimise gas extraction. This will however not be general practice and will be avoided wherever possible.

The landfill gas management plan has been included as Appendix G2 of the Works Approval Application. An updated management plan, in which the progressive filling and construction of the gas extraction wells will be further detailed, will be provided prior to the installation of the gas extraction infrastructure, but no later than 6 months after commencement with waste placement. Based on the filling rate of the landfill it is expected that installation of vertical gas extraction wells will commence during the second year of operation in areas where waste is a minimum of 15 m deep. These initial wells will be installed to a depth of between 10 m and 11.5 m, with following wells extending deeper as the thickness of the waste increases. Installation will commence on the outer side slopes and will progressively continue as the landfill height increases. The gas extraction wells at the top of the site will be installed when the landfill reaches its final height.

It should be noted that the landfill was designed to facilitate progressive filling, capping of completed cells or sub-cells and installation of gas extraction infrastructure to minimise environmental impact and optimise airspace consumption.

8.0 GEOLOGY

Figure 1 to Figure 6 (Attachment E) graphically illustrating the geological features across the landfill footprint and in the vicinity of the landfill

Cross-sections across the area of low magnetic intensity across the proposed landfill footprint (using relevant CPT, soil bore logs and/or test pits)

Figure 1 shows the location of the cross sections in relation to the landfill site and the extents of the magnetic anomaly.

Figure 3, Section B shows an interpretive cross section across the area of low magnetic intensity, the landfill (Cells 3, 2 and 1) and the area where sandy material was encountered at depth (test pit TP94 and borehole GMB6).

Figure 4, Section C was taken at the northern extent of the surveyed area and shows a cross section across the area of low magnetic intensity, where shallow sand (≤ 1.5 m depth) was encountered before the CPTs terminated on stiff to very stiff clay.

Lateral delineation of the above geological feature; if possible, determine extent and include an explanation of any geological end-points or barriers

The sections have been selected to demonstrate the extent of the deep sandier material encountered in TP94 and GMB6 relative to the landfill footprint and the magnetic anomaly and to demonstrate the geological end-points.

Figure 3, Section A shows an interpretive cross section along the lateral extents of the magnetic anomaly. CPT tests were carried across the northern most extent of the surveyed anomaly, in the vicinity of GMB6 and TP94 and towards the southern extent of the anomaly in the vicinity of the downstream toe of the landfill. The depth of the CPTs at the northern extent of Section A varied between 0.4 m and 3.4 m prior to encountering refusal on stiff to very stiff clay.

GMB6 was drilled to a depth of 21.8 m into granite with sand encountered up to a depth of 14 m, and again from 19.5 to 21.5 m. CPTU6 refused at a depth of 14.5 m, while CPTU6.2 refused at 1.0 m. Other CPTs in that area extended up to a depth of 3.7 m (maximum) prior to encountering refusal on stiff or very stiff clay.

Towards the southern extents of Section A the test pits and CPTs were terminated upon refusal at relatively shallow depths varying between 0.7 m and 2.8 m.

Figure 3, Section A and the observations as described above identify that the geological end points towards the north of the sandier zone is formed by stiff to very stiff clayey materials, while to the south it is formed by bedrock. The sandy material encountered in TP94 and its vicinity is expected to be localised *in situ* weathered granite or valley fill (mass wasting) materials that have not travelled very far from their source, surrounded by stiff to very stiff clayey materials.

Particular explanation or illustration to map out the extent of the sand deposits within the above feature

Figure 1 shows a plan layout of the expected extent of the sandy materials. The sandy materials have been denoted “shallow” and “deep”. Shallow sand is sandy material up to a maximum depth of 1.5 m measured from the current ground surface. Deep sand is sand in excess of 1.0 m and is limited to an area either side of the division wall between Cell 2 and Cell 3. Shallow sand will be removed during the construction of the cells, whilst deep sand will be removed up to a maximum depth of 1.5 m below the finished subgrade level and replaced with compacted clayey material.

Consideration of whether any additional bores/test pits/cone penetrometer tests/geophysical tests etc. need to be undertaken to provide justification for any above findings, and

In total 114 test pits were excavated, of which 69 were in the landfill footprint or in proximity to it. In addition one groundwater exploration bore (GMB6) and 33 CPTu tests were undertaken in the same area, specifically to investigate the occurrence of sandier materials. In Golder’s professional opinion the extent of test pits, drilling and testing carried out is sufficient to provide reasonable confidence in the extent of the sandier materials and no additional bores/test pits/cone penetrometer tests/geophysical tests etc. need to be undertaken to provide justification for any of the above findings. The information obtained from the investigation has also assisted in amending the design of the landfill to suit the site conditions and address concerns around areas of higher permeability. This will include supervision by a qualified geotechnical engineer during the excavation phase to further delineate the sandier material and provide direction as to the extent of materials removed and replaced with compacted clayey material.

Concluding summary and discussion with regards to the feature and any potential pathways to the water catchments and other sensitive receptors i.e. Thirteen Mile Creek.

Additional drilling, CPT and test pit investigations and a regional remote sensing data review have been carried out to examine the extent and nature of the magnetic anomaly identified within the landfill footprint.

Regional Total Magnetic Intensity and Geology Data

Figure 5 shows regional scale Total Magnetic Intensity (TMI) data. A pronounced north – south oriented magnetic “low” (blue) is indicated approximately 2.5 km east of the landfill footprint. This “low” correlates with porphyritic granite (“Agp” on the geological map, Figure 6). The similar magnetic anomaly that crosses the site is not seen on Figure 5 because the regional magnetic survey has lower resolution than the local ground magnetics survey that Golder commissioned. The implication of this is that the magnetic low is most likely due to the underlying rocktype (Agp), rather than a reduced magnetic response due to a thickness of palaeovalley sediment overlying the rocktype.

Drilling

Golder drilled GMB6 within the outline of the anomaly, down to bedrock (granite) for the purpose of identifying whether the materials intersected could be interpreted to be associated with palaeochannel sediment. The angularity of the quartz sands and gravels recovered in GMB6, in combination with the presence of angular felspathic grains, are indicative of material that has not travelled far from its source, and probably not within higher energy fluvial settings of a typical palaeochannel that would reduce the angularity of individual grains. The presence of intervals with greatly reduced clay matrix material may indicate a reduced proportion of weatherable feldspar minerals in the parent rock, or flushing of the clays during mass wasting/transport processes, or groundwater movement.

Golder interpreted the quartz sand and gravel material intersected in GMB6 to represent some combination of:

- an extremely weathered zone derived from granitic parent rock,
- a zone of enhanced weathering because of faulting, or denser fracture or joint spacing,
- materials that have not travelled far from their granitic source.

GMB6 was drilled into massive fresh granite at 21.5 m depth (core recovered), without encountering sediments indicative of high energy fluvial processes (i.e. palaeochannel sands.

CPT Program

CPT test work to establish whether the anomalous feature extended laterally, showed the sandy materials did not extend beyond the site to the west. In addition the CPT test encountered intervals of clayey material interspersed with more sandy material, similar to what was encountered in the test pits and the bores.

Remote Sensing

A review of public domain remote sensing data and imagery was undertaken to see whether there was any evidence that the anomalous feature extended beyond the site. No evidence was found to indicate the anomaly extended off site.

In summary, the balance of evidence indicates that the landfill site is located over variably weathered material developed over granitic rocks and not transported far from their source. The magnetic anomaly that transects the landfill footprint is not a palaeochannel feature, but rather reflects the magnetic properties of the underlying porphyritic granite in a zone of deeper *in situ* weathering.

The geotechnical and hydrogeological information obtained from the investigation demonstrates that:

- The area of deep sand is expected to be discontinuous within the landfill footprint
- The areas of deep and shallow sand are contained by low permeability granite and clayey material and is not a palaeochannel. There are no expected potential pathways to sensitive receptors (including Thirteen Mile Creek or any other water catchments)

9.0 FIRE MANAGEMENT

Endorsement of Fire Management Plan by Department of Fire and Emergency Services and/or local fire brigade.

The Allawuna Landfill Fire Management Plan (FMP) provided with the Works Approval Application has been consulted on with the Department of Fire and Emergency Services (DFES) as follows:

- Bowman & Associates prepared a draft of the FMP in early May 2014 and discussed with the Shire of York's Community Emergency Services Manager.
- The draft was sent to the Shire on 9 May 2014, but the Shire would not consider it given the JDAP refusal.
- The draft was sent to DFES.
- Bowman & Associates and DFES met and discussed the draft FMP in early June 2014. DFES advised of amendments DFES required.
- Bowman & Associates amended the FMP and sent it to DFES in June 2014.
- DFES provided further comment in September 2014.
- Bowman & Associates amended the FMP and sent it to DFES on 24 November 2014.
- Bowman & Associates have since sought to confirm acceptance with DFES, but have not received any further comment or confirmation from DFES.

- Bowman & Associates updated the FMP in early 2015 to reflect the changes to the proposal, as included in the Works Approval Application.

Bowman & Associates understand the updated FMP addresses DFES' concerns.

Tanks and truck fittings with be compatible with Local Fire Brigade and DFES fittings. The Local Fire Brigade and DFES will be issued a master key to access the gates on the farm.

SITA expects DFES is reluctant to endorse the FMP while the planning approval remains pending. SITA will obtain endorsement of the FMP following the receipt of planning approval, which is anticipated to be a condition of the planning approval.

10.0 REHABILITATION

Management plan to address site rehabilitation

A Rehabilitation Management Plan (RMP) will be prepared for the site that will include, but may not be limited to the following aspects:

- ***General background information.*** This section will include a description of the site, site conditions, geology, hydrogeology and climatic conditions.
- ***Purpose.*** This section will include a description of the purpose of the document.
- ***Regulatory requirements.*** The section will include the regulatory requirements relevant to the site at time of closure and rehabilitation. At this time the relevant regulatory guideline is the Victorian BPEM[3].
- ***Rehabilitation and closure objectives.*** This section will list the relevant rehabilitation and closure objectives such as water quality requirements, compliance points, end use requirements etc.
- ***Future land use.*** This section will provide a description of the intended future land use for the site after closure, which in this instance consists of grazing for the landfill and grazing/cropping for the borrow areas.
- ***Landfill staging and rehabilitation sequencing.*** This section will include the proposed staging of rehabilitation and capping activities. The sequence will be closely related to the rate of filling, but will take place in a staged manner. For cells 1 and 2 we propose that the first capping activities will commence after the completion of each cell up to final height at an interval of approximately 3 years for each cell. A similar principle will be applied to future cells.
- ***Capping design and stormwater management measures.*** This section will include details on the cap design and the associated stormwater management measures required to manage stormwater and maintain the integrity of the cap suitable to achieve the end use objectives. (Refer Figure D107 in Appendix A of the Works Approval Application.)
- ***Rehabilitation activities.*** This section will include details on interim rehabilitation activities that will take place as the landfill develops and prior to final capping, as well as final capping activities. Interim rehabilitation activities will include aspects such as placement of interim capping on the side slope, potential for interim vegetation or other means of sediment control.
- ***Landfill gas management.*** This section will include details on landfill gas management requirements for areas that have been capped, including monitoring and maintenance requirements.
- ***Leachate management.*** This section will include details on long term leachate management, if required, which may include forced evaporation for a period or continued removal off site via tankers.
- ***Monitoring.*** This section will include monitoring requirements such as frequency, location etc.

The RMP will be prepared once the site is operational, but before the first cell reaches completion, which is expected to be approximately 3 years after commencement of waste disposal.

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[3] Victorian EPA, 2014. Publication 788.2 titled *'Best Practice Environmental Management Siting, Design, Operation and Rehabilitation of Landfills',* October 2014

11.0 CLOSING

We trust the information presented addresses the queries raised. Should you have any questions please do not hesitate to contact John Jones (SITA) or the undersigned.

GOLDER ASSOCIATES PTY LTD

Liza du Preez
Associate

LDP/PJC,MM,JB,SH,DT,JW/hsl

CC: John Jones – SITA Australia Pty Ltd
Nial Stock – SITA Australia Pty Ltd

Attachments: A – Landfill Construction Guideline
B – Figures, General
C – Leachate Management Plan
D – Electrical connection diagrams
E – Figures, Hydrogeology

https://aupws.golder.com/sites/147645033alluwunafarmpeerreview/correspondence out/147645033-027 der queries and responses 20 july 2015/147645033-027-l-rev0.docx

ATTACHMENT A

Landfill Construction Guideline

LANDFILL CONSTRUCTION MANAGEMENT PLAN GUIDELINES - ALLAWUNA FARM LANDFILL

This document outlines the requirements of the Landfill Construction Management Plan for the Allawuna Farm Landfill, to be prepared by the Civil Contractor(s) for the Works.

Prepared by Bowman & Associates Pty Ltd

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TABLE OF CONTENTS

1 INTRODUCTION

The proposed Allawuna Farm Landfill will be a Class II putrescible landfill and will be owned and operated by SITA Australia Pty Limited (SITA). The site is located on the southern side of Great Southern Highway approximately 80 km by road from Perth and 20 km by road from York.

As outlined in Section 5.3 of the *Works Approval Application Supporting Document – Allawuna Landfill*, this Landfill Construction Management Plan (LCMP) will be submitted to the relevant stakeholders prior to the commencement of construction works.

This brief guideline outlines the aspects that should be considered by the Contractor when preparing a Construction Management Plan. The objective of the LCMP is to assess and apply appropriate management practices to minimise disturbance to the surrounding area during construction of the Allawuna Farm Landfill.

1.1 BACKGROUND INFORMATION

SITA Australia Pty Limited (ABN 70 002 902 650) is a leading multinational waste, recycling and resource recovery service provider. SITA has 100 operations across Australia including composting facilities, resource recovery facilities, materials recycling facilities, depots, transfer stations and nine landfills. Since opening the very first engineered landfill in Australia at Lyndhurst in Victoria in 1991 SITA has continued as a leader in landfill and waste management technology.

SITA landfills 2.5 million tonnes of waste per year across Australia and has successfully operated the Shale Road Landfill in South Cardup in Western Australia since 1999. SITA has a significant presence in Western Australia and currently provides collection and disposal services for a variety of clients including local governments, service industries and commercial enterprises.

SITA proposes to establish Allawuna Farm Landfill in the Shire of York. The site will be a Prescribed Premises licensed by the Department of Environment Regulation as a Category 64 premises, receiving up to 250,000 tonnes per annum of Class II putrescible waste from the Perth metropolitan area. The Allawuna Farm Landfill is proposed as a replacement to SITA's Shale Road Landfill at South Cardup which is nearing capacity.

2 GUIDELINES FOR CONSTRUCTION MANAGEMENT PLAN

The following sections outline the documentation requirements and management measures that should be included in the Landfill Construction Management Plan (LCMP). This plan shall be prepared by the Civil Contractor(s) engaged by SITA for construction of the Allawuna landfill infrastructure.

The following sections outline suggested issues that should be addressed in the LCMP by the Contractor(s) for the Allawuna Landfill works. The plan shall consider all relevant aspects of the works including worker safety, amenity and site security, operating hours, noise and dust control, stormwater and sediment control, waste and material re-use, construction procedures[1] and traffic management.

2.1 REFERENCE DOCUMENTS

The LCMP must comply with the following reference documents:

[1] *Technical Specification – Infrastructure – Allawuna Farm Landfill*, June 2015, Bowman & Associates Pty Ltd.

[2] *Technical Specification – Construction of Cell 1 and Ancillary Works – Allawuna Farm Landfill*, June 2015, Golder Associates Pty Ltd.

[3] *A Guideline for the Prevention of Dust and Smoke Pollution from Land Development Sites in Western Australia (November 1996)*, Department of Environment.

[4] *Allawuna Farm Landfill – Dust Management Plan*, Bowman & Associates Pty Ltd.

[5] *Environmental Protection (Noise) Regulations 1997.*

[6] *Allawuna Farm Landfill – Noise Management Plan,* Bowman & Associates Pty Ltd.

[7] *Allawuna Farm Landfill Surface Water and Sediment Management Plan,* Golder Associates Pty Ltd, August 2015.

[8] *Topsoil Handling and Sedimentation Management,* March 2015, Golder Associates Pty Ltd.

[9] *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007*.

[10] *AS 1940-2004, The Storage and Handling of Flammable and Combustible Liquids,* Standards Australia.

[11] *Allawuna Landfill Emergency Procedures Guide and Contingency Plan*, SITA Australia Pty Ltd.

[12] *Construction Waste Management Plan Guidelines*, Western Australian Waste Authority.

[13] *Environment, Quality & Safety Management System (MAN 018),* SITA Australia Pty Ltd.

[14] *Occupational Safety and Health Regulations 1996.*

[15] *Media Policy*, SITA Australia Pty Ltd.

[1] For excavations, soil conditioning, removal of unsuitable material and management of general fill.

2.2 CONSTRUCTION PROGRAM

The Contractor shall submit a detailed program of works (in MS Project format or similar) based on the outlined scope of works and Hold Points in accordance with the Technical Specifications (**[1]** & **[2]**) prior to the works commencing. The program of works shall include a list of Subcontractors, resource allocation and requirements (including construction water), line of communication chart and time frames for each task and Hold Points.

The Contractor shall schedule the construction program such that the infrastructure required for the retention and/or management of stormwater and sediment is to be completed before commencing vegetation removal, topsoil stripping, earthworks or other works that may result in sediment release from the site. Construction shall not take place outside the hours of 07:00 and 19:00, or on Sundays and public holidays.

This plan shall also include the project team and their respective responsibilities for the Works, as well as emergency procedures and contacts.

2.3 DUST MANAGEMENT PLAN

The Contractor shall implement all reasonable and practical measures to prevent or minimise the generation of windborne particles during all tasks at all times of the Works. The Contractor shall be bound to the Department of Environment's publication, *A Guideline for the Prevention of Dust and Smoke Pollution from Land Development Sites in Western Australia (November 1996*) **[3]**, as well as the site specific Dust Management Plan **[4]** as part of the supporting documentation for the Works Approval.

The Contractor shall provide a site specific Dust Management Plan for the Works prior to commencing the Works. This plan must be approved by the Superintendent before construction begins, with regular inspections and audits of the construction site by the Superintendent taking place to ensure that the Contractor is complying with the plan.

2.4 NOISE MANAGEMENT PLAN

The Contractor shall comply with the Environmental Protection Authority, *Environmental Protection (Noise) Regulations 1997* (EPNR) **[5]**. The Contractor shall include a Noise Management Plan in the LCMP which complies with the site-specific Noise Management Plan **[6]**. This will be subject to review and approval by the Superintendent prior to the start of the Works, and the Superintendent will conduct regular site inspections to ensure that the Contractor is complying with the plan.

2.5 STORMWATER AND SEDIMENT MANAGEMENT

The Contractor shall prepare a site specific stormwater and sediment management plan as part of the LCMP. The plan must be applied in conjunction with the *Allawuna Farm Surface Water and Sediment Management Plan* **[7]** and detail the measures that will be put in place to:

- prevent sediment discharge into 13 Mile Brook, and
- contain contaminated stormwater in a temporary, lined containment dam for appropriate disposal within 14 days.

2.6 TOPSOIL, SOIL AND STOCKPILE MANAGEMENT

The Contractor shall prepare a site specific soil and stockpile management plan, including the location of the proposed soil stockpiles, as part of the LCMP. Erosion and subsequent off-site sediment transport originating from material stockpiles must be prevented, and details on how the Contractor will achieve this are to be included in the LCMP. The LCMP must adhere to the management measures outlined in the Works Approval Application supporting documentation (**[7]**, **[8]**).

2.7 PLANT AND MATERIAL LAYDOWN MANAGEMENT

The Contractor shall prepare a site specific management plan, including the location of the proposed machinery storage area and material laydown area as part of the LCMP.

2.8 FUEL AND CHEMICAL MANAGEMENT

The Contractor shall prepare a site specific management plan for the storage and handling of fuel and chemicals, including the location of the proposed chemical/fuel storage area, appropriate bunding and spill kits, as part of the LCMP.

The Contractor must stipulate the proposed storage requirements for fuel, chemicals and lubricants needed to complete the Works, as well as the relevant management measures that will be put in place to prevent their discharge into the surrounding environment.

These measures will be consistent with the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007* **[9]** and *Australian Standard 1940-2004, The Storage and Handling of Flammable and Combustible Liquids* **[10]**. The management measures will include emergency response and spill/contingency plans that complement the SITA Australia *Emergency Procedures Guide & Contingency Plan* for Allawuna Landfill **[11]**.

2.9 GROUNDWATER MANAGEMENT

The Contractor shall prepare a site specific ground water management plan to prevent groundwater contamination during the execution of the Works. The Contractor shall comply with the groundwater management requirements as specified in the Works Approval.

2.10 REFUSE DISPOSAL

The Contractor shall stipulate the management strategy for on-site refuse (including foodstuffs) in accordance with the *Construction Waste Management Plan Guidelines* as published by the Waste Authority **[12]**.

2.11 OCCUPATIONAL HEALTH AND SAFETY PLAN

The contractor shall provide a site specific health and safety management plan for all the Works. The Contractor shall determine appropriate safe working procedures and methodologies to construct the Works as specified, as part of the LCMP. The plan shall be applied in conjunction with the health and safety systems that SITA already has in place (**[13]**) and be in line with the *Occupational Safety & Health Regulations 1996* (**[14]**).

2.12 TRAFFIC MANAGEMENT PLAN

The Contractor shall prepare a site specific traffic management plan as part of the LCMP. This shall include contingency measures in the event of protests by members of the public at the site access point on Great Southern Highway.

2.13 SERVICES AND AMENITIES

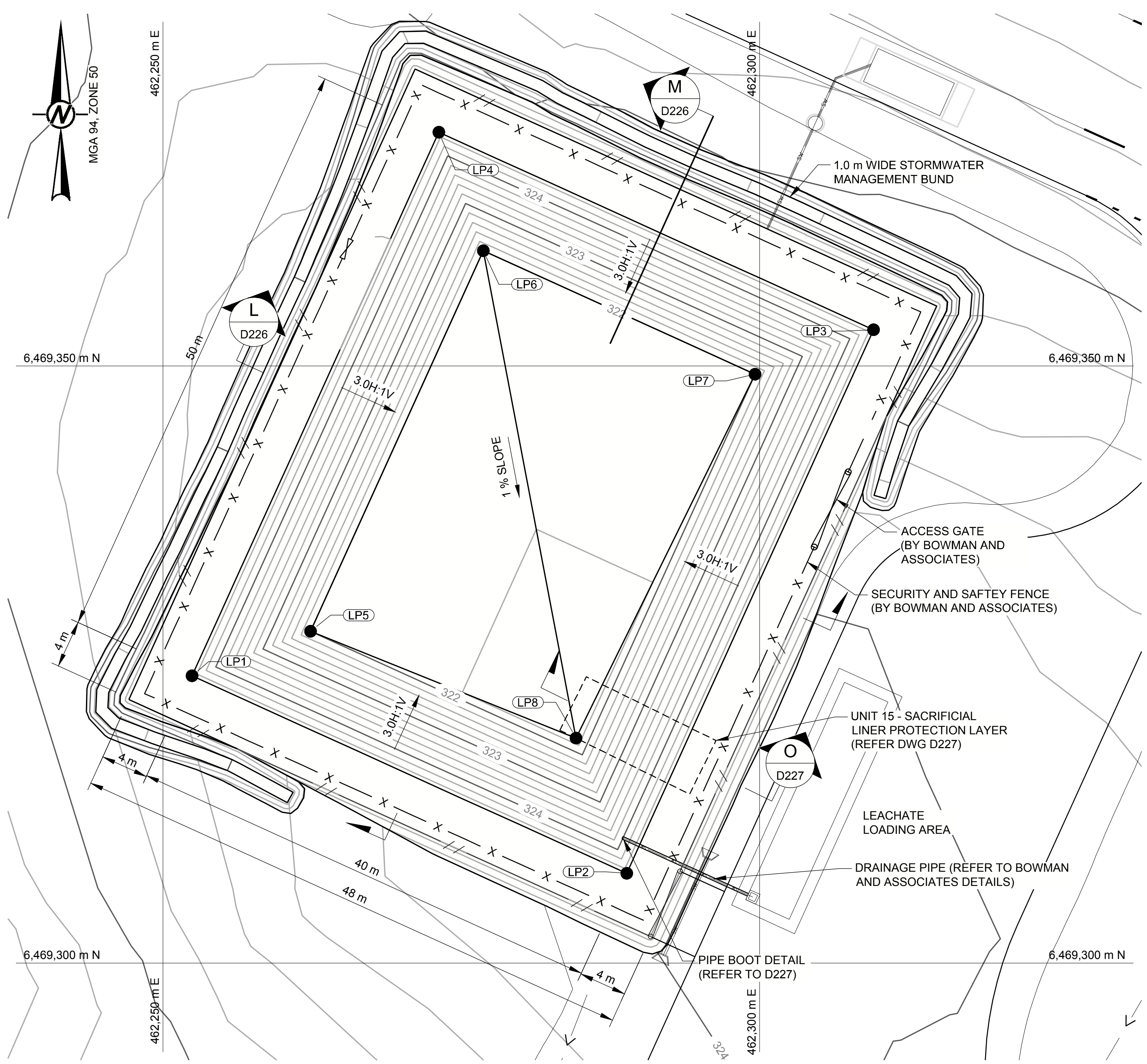
The Contractor shall list the appropriate services and amenities required for the completion of the Works, and outline the management thereof as part of the LCMP. This will include, as a minimum, management of construction water, power, ablution facilities, underground services and plant lay-down area.

2.14 PHYSICAL SECURITY

The LCMP will detail the procedure for employees to follow in the event that unauthorised members of the public attempt to gain access to the site or disrupt the construction process. Under no circumstances should the Contractor (or any staff or subcontractors) interact with the media or any members of the public that act in an adversarial or obstructive manner. The Contractor (or any staff or subcontractors) will abide by SITA's *Media Policy* **[15]**.

ATTACHMENT B

Figures, General



LEACHATE POND LAYOUT PLAN

SCALE 1:500

LEACHATE POND SETOUT			
POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
LP1	462252.43	6469324.06	324.50
LP2	462288.85	6469307.51	324.50
LP3	462309.53	6469353.04	324.50
LP4	462273.11	6469369.58	324.50
LP5	462262.36	6469327.78	322.00
LP6	462276.84	6469359.65	322.00
LP7	462299.60	6469349.31	322.00
LP8	462284.60	6469318.84	321.65

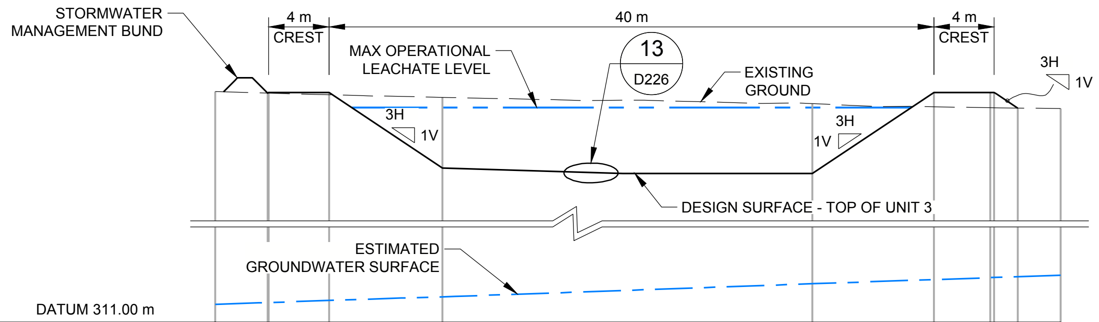
LEACHATE POND STORAGE		
HEIGHT (m RL)	STORAGE (m³)	DESCRIPTION
324.50	3602.00	MAX HEIGHT OF POND
324.00	2668.00	0.5 m FREEBOARD
323.50	1186.00	
323.00	1169.00	
322.50	586.00	
322.00	102.00	
321.65	0	LOWEST POINT IN POND

REFERENCE:

BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.

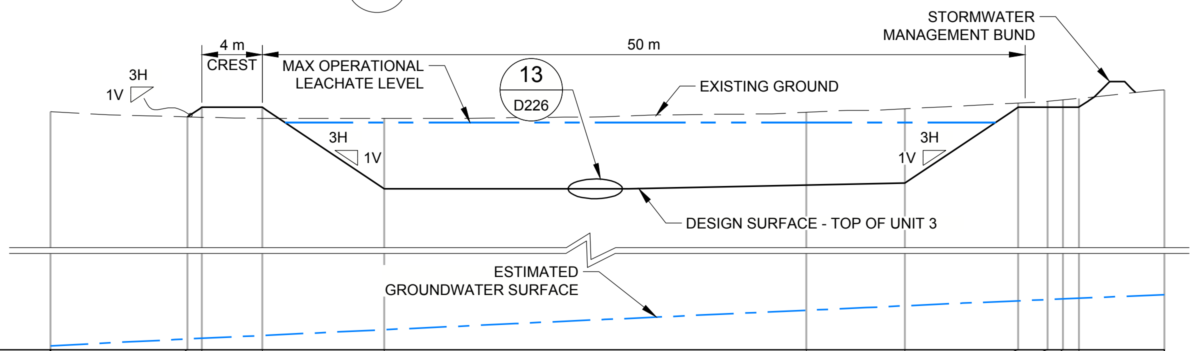
NOTE

1. REFER TO D001 FOR GENERAL NOTES.
2. INFRASTRUCTURE DETAILS BY BOWMAN AND ASSOCIATES.
3. FENCING DETAILS BY BOWMAN AND ASSOCIATES.
4. ADDITIONAL SET-OUT INFORMATION SHALL BE OBTAINED FROM THE 3D MODEL SUPPLIED.



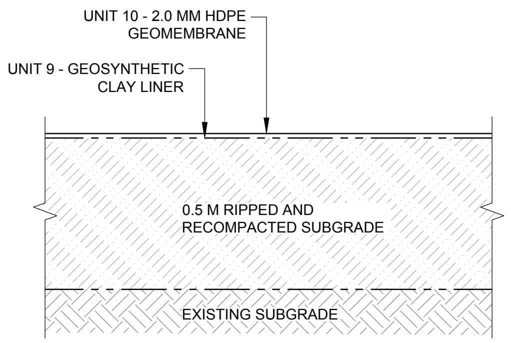
DESIGN SURFACE		324.48	324.50	324.50	322.00	321.83	324.50	324.50	324.50	323.98	
EXISTING GROUND	324.53	324.48	324.48	324.42	324.33	324.13	324.02	323.99	323.99	323.98	323.97
CUT AND FILL DEPTH (m)		0.00	0.02	0.08	-2.33	-2.30	0.48	0.51	0.51	0.00	
ESTIMATED GROUND-WATER SURFACE	311.59		311.65	311.72	311.84	312.27	312.41	312.48	312.48	312.51	312.56
CHAINAGE	0.00	2.20	2.27	6.27	13.77	38.24	46.27	50.00	50.27	51.82	55.91

HOR. SCALE 1:500 VERT. SCALE 1:250 L D226 LEACHATE POND SECTION

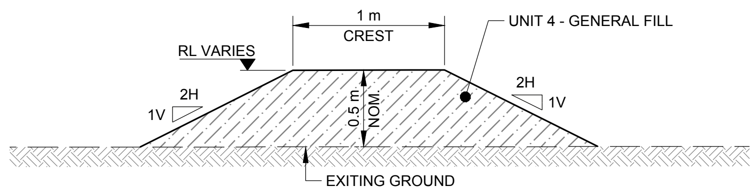


DESIGN SURFACE		324.19	324.50	324.50	321.81	321.93	322.00	324.50	324.50	324.50	324.50	
EXISTING GROUND	324.36	324.19	324.17	324.14	324.14	324.34	324.45	324.64	324.70	324.74	324.79	325.08
CUT AND FILL DEPTH (m)		0.00	0.33	0.36	-2.33	-2.41	-2.45	-0.14	-0.20	-0.24	-0.29	
ESTIMATED GROUND-WATER SURFACE	311.13	311.36	311.38	311.47	311.66	312.30	312.45	312.62	312.66	312.68	312.70	312.82
CHAINAGE	0.00	9.08	10.02	14.02	22.08	50.00	56.52	64.02	65.97	66.97	68.03	73.67

HOR. SCALE 1:500 VERT. SCALE 1:250 M D226 LEACHATE POND SECTION



SCALE 1:25 13 D226 LEACHATE DAM LINER DETAIL



TYPICAL STORMWATER MANAGEMENT BUND

SCALE 1:50

WORKS APPROVAL

0 0.5 1 1:25 METRES

0 1 2 1:50 METRES

0 5 10 1:250 METRES

0 10 20 1:500 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
D	2015-07-23	AMENDED FOR WORKS APPROVAL	L.DuPREEZ	E.KING	L.DuPREEZ	
C	2015-06-05	ISSUE FOR TENDER	L.DuPREEZ	E.KING	L.DuPREEZ	
B	2015-03-30	ISSUE FOR WORKS APPROVAL	L.DuPREEZ	E.KING	L.DuPREEZ	-
A	2015-02-1	ISSUE FOR COMMENT	L.DuPREEZ	E.KING	L.DuPREEZ	-

CLIENT
SITA AUSTRALIA

PROJECT
ALLAWUNA FARM LANDFILL

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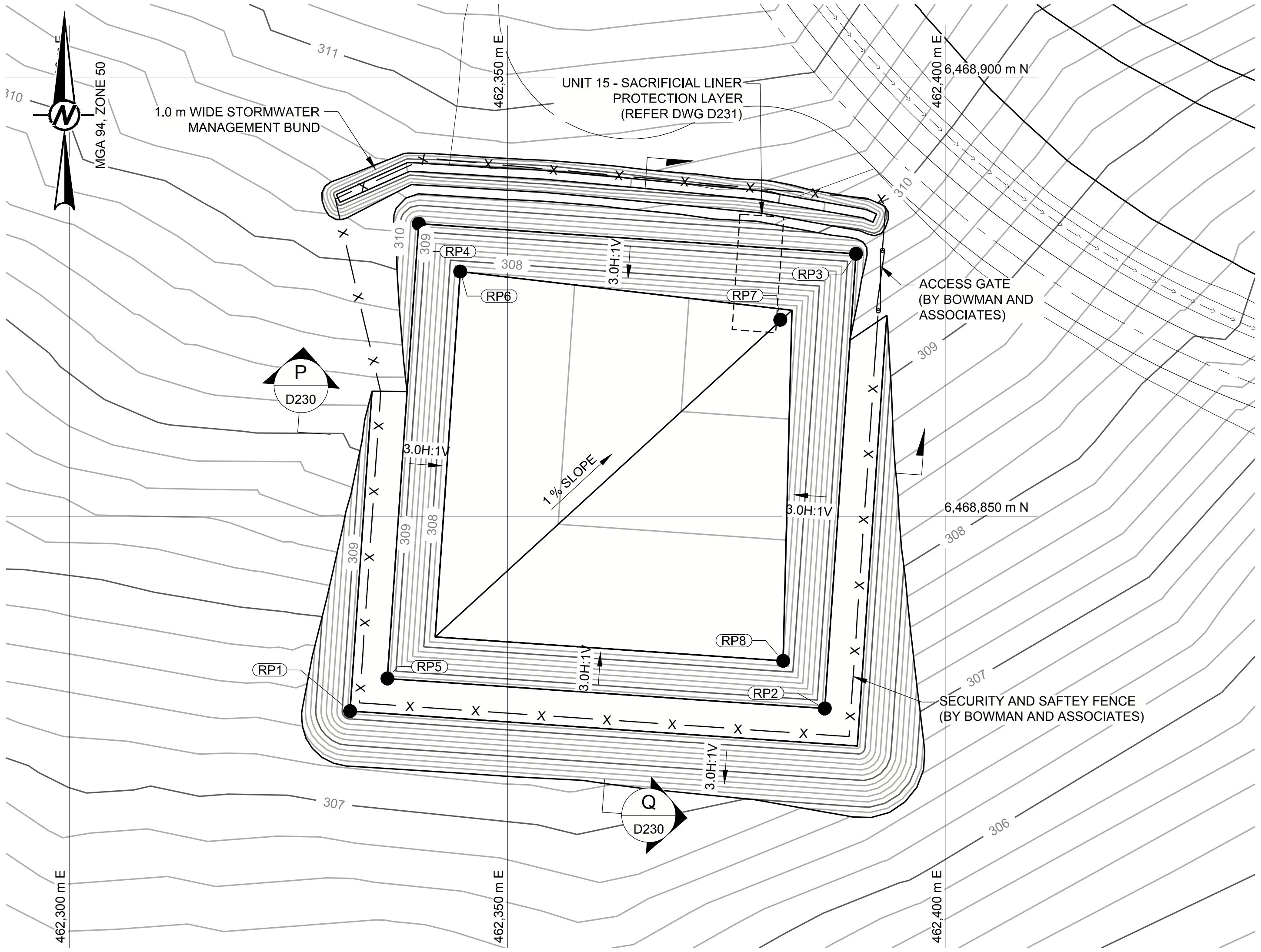
TITLE
LEACHATE POND PLAN AND SECTIONS

PROJECT NO.	DOCUMENT NO.	REV.		FIGURE
147645033	016-R	D	20 of 27	D226



RETENTION POND LAYOUT PLAN
SCALE 1:750

RETENTION POND SETOUT

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
RP1	462332.02	6468827.77	309.30
RP2	462386.17	6468828.05	309.30
RP3	462389.73	6468879.93	309.30
RP4	462339.85	6468883.36	309.30
RP5	462336.28	6468831.48	309.30
RP6	462344.59	6468877.91	307.60
RP7	462381.10	6468872.41	306.60
RP8	462381.43	6468833.49	307.60

RETENTION POND STORAGE

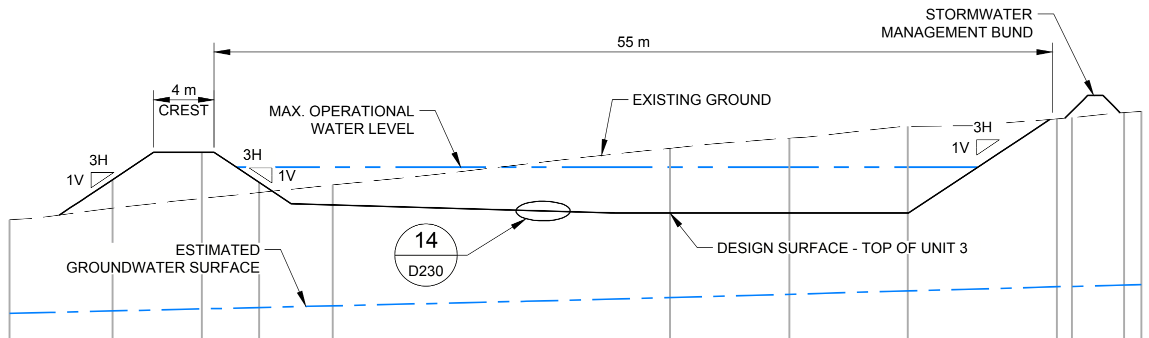
HEIGHT (m RL)	STORAGE (m³)	DESCRIPTION
309.30	3900	MAX HEIGHT OF POND
308.80	2690	0.5 m FREEBOARD
308.50	2025	
308.00	1030	
307.50	183	
307.20	0	LOWEST POINT IN POND

REFERENCE:

BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.

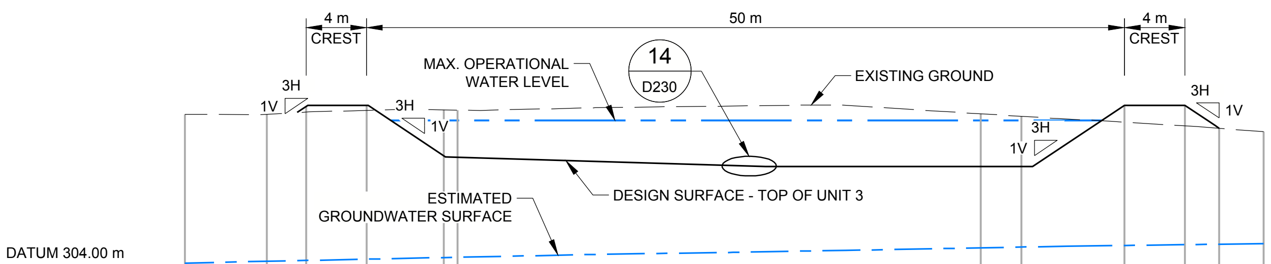
NOTE

1. REFER TO D001 FOR GENERAL NOTES.
2. INFRASTRUCTURE DETAILS BY BOWMAN AND ASSOCIATES.
3. FENCING DETAILS BY BOWMAN AND ASSOCIATES.
4. ADDITIONAL SET-OUT INFORMATION SHALL BE OBTAINED FROM THE 3D MODEL SUPPLIED.



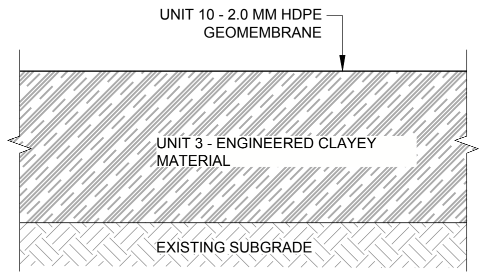
DESIGN SURFACE		308.40	309.30	308.30	307.56	307.29	307.29	307.29		310.66		
EXISTING GROUND	307.06	307.45	307.77	307.97	308.22	309.43	309.77	310.16	310.41	310.45	310.62	310.66
CUT AND FILL DEPTH (m)		0.95	1.53	0.34	-0.66	-2.15	-2.48	-2.87		0.21		
ESTIMATED GROUND-WATER SURFACE	303.97	304.05	304.12	304.16	304.22	304.49	304.60	304.71	304.85	304.86	304.91	304.92
CHAINAGE	0.00	3.34	9.54	13.54	18.64	42.09	50.00	58.63	68.99	70.05	73.66	74.86

SCALE 1:500 Q D230 RETENTION POND SECTION

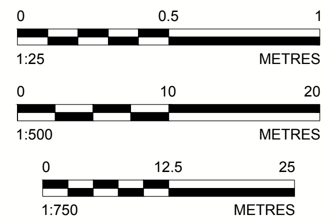


DESIGN SURFACE			309.26	309.30	307.64	307.59	307.28	307.28	309.30	309.30	308.54	
EXISTING GROUND	309.01	309.00	309.08	309.13	309.15	309.15	309.02	308.94	308.75	308.63	308.54	308.43
CUT AND FILL DEPTH (m)			0.18	0.17	-1.51	-1.56	-1.75	-1.66	0.55	0.67	0.00	
ESTIMATED GROUND-WATER SURFACE	304.09	304.15	304.17	304.22	304.27	304.28	304.59	304.62	304.67	304.70	304.71	304.73
CHAINAGE	0.00	5.42	8.01	12.01	17.11	65.41	100.00	102.69	109.51	113.51	115.78	71.34

HOR. SCALE 1:500
VERT. SCALE 1:250 P D230 RETENTION POND SECTION



SCALE 1:25 14 D230 LINER DETAIL



WORKS APPROVAL

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
D	2015-07-23	AMENDED FOR WORKS APPROVAL	L.DuPREEZ	E.KING	L.DuPREEZ	
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CLIENT
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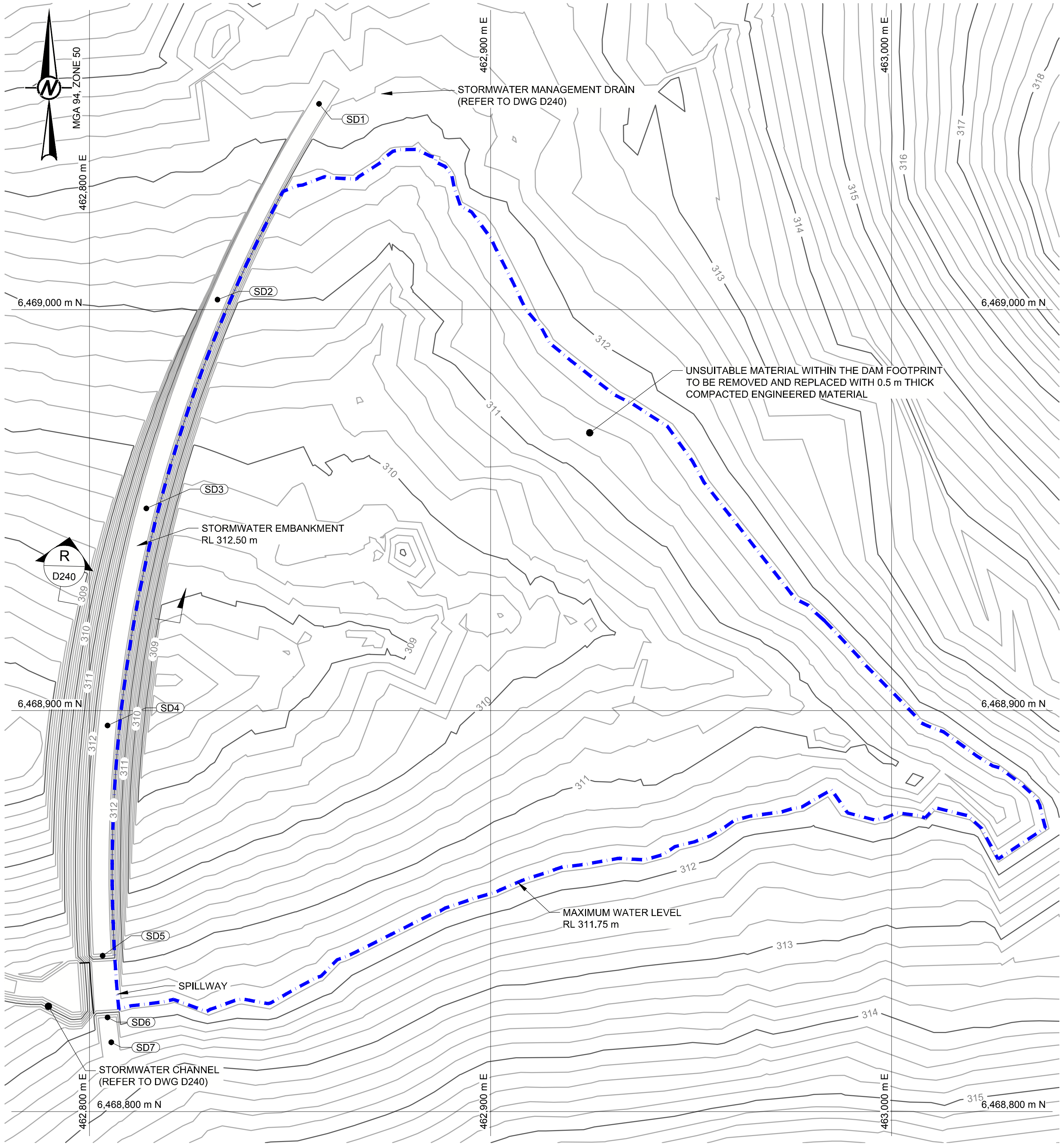
TITLE
RETENTION POND PLAN AND SECTIONS

PROJECT NO.	DOCUMENT NO.	REV.	22 of 27	FIGURE
147645033	016-R	D		D230



STORMWATER DAM
SCALE 1:1,250

LEACHATE POND SETOUT			
POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)
LP1	462857.22	6469051.28	312.25
LP2	462831.91	6469002.46	312.25
LP3	462814.15	6468950.40	312.25
LP4	462804.48	6468896.26	312.25
LP5	462803.25	6468838.87	312.25
LP6	462804.48	6468823.48	312.25
LP7	462805.41	6468817.28	312.25

STORMWATER DAM STORAGE		
HEIGHT (m RL)	STORAGE (m³)	DESCRIPTION
312.25	47630	MAX HEIGHT OF POND
311.75	33150	0.5 m FREEBOARD
311.00	16995	
310.00	4740	
309.00	400	
308.00	0	LOWEST POINT IN POND

LEGEND:

STORMWATER DAM EXTENTS (MAXIMUM WATER LEVEL)

EXISTING CONTOURS (1 m INTERVALS)

NOTE

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2. INFRASTURCTURE DETAILS BY BOWMAN AND ASSOCIATES.
3. FENCING DETAILS BY BOWMAN AND ASSOCIATES.
4. ADDITIONAL SET-OUT INFORMATION SHALL BE OBTAINED FROM THE 3D MODEL SUPPLIED.

REFERENCE:

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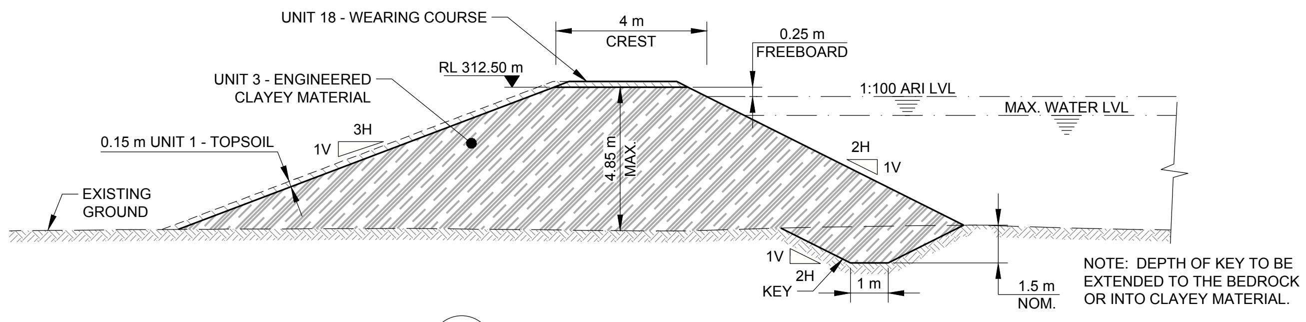
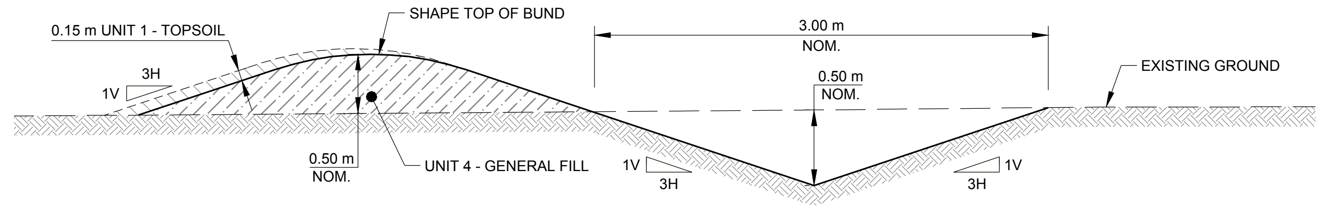


SCALE 1:200 R D240 STORMWATER DAM EMBANKMENT SECTION



TYPICAL STORMWATER MANAGEMENT DRAIN
SCALE 1:50

0 5 10
1:200 METRES

0 25 50
1:1,250 METRES

WORKS APPROVAL

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
D	2015-07-23	AMENDED FOR WORKS APPROVAL	L.DuPREEZ	E.KING	L.DuPREEZ	
C	2015-06-05	ISSUE FOR TENDER	L.DuPREEZ	E.KING	L.DuPREEZ	
B	2015-03-30	ISSUE FOR WORKS APPROVAL	L.DuPREEZ	E.KING	L.DuPREEZ	-
A	2015-02-1	ISSUE FOR COMMENT	L.DuPREEZ	E.KING	L.DuPREEZ	-

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PROJECT
ALLAWUNA FARM LANDFILL

TITLE
STORMWATER DAM PLAN AND SECTIONS

PROJECT NO.	DOCUMENT NO.	REV.		FIGURE
147645033	016-R	D	24 of 27	D240

ATTACHMENT C

Leachate Management Plan

LEACHATE MANAGEMENT PLAN – ALLAWUNA FARM LANDFILL

This document outlines the measures to be implemented to manage leachate at the proposed Allawuna Farm Landfill.

blank page

TABLE OF CONTENTS

APPENDICES

TABLES

FIGURES

1 SUMMARY

The proposed Allawuna Farm Landfill will be a Class II putrescible landfill and will be owned and operated by SITA Australia Pty Limited (SITA). The site is located on the southern side of Great Southern Highway approximately 80 km by road from Perth and 20 km by road from York.

The objective of the Leachate Management Plan is to effectively manage leachate generated and:

- Minimise risk to the environment,
- Segregate leachate from stormwater and groundwater,
- Prevent offensive odours impacting offsite,
- Minimise risk to personnel,

This Leachate Management Plan sets out the measures that will be put in place to effectively manage leachate at the proposed Allawuna Farm Landfill.

1.1 BACKGROUND INFORMATION

SITA Australia Pty Limited (ABN 70 002 902 650) is a leading multinational waste, recycling and resource recovery service provider. SITA has 100 operations across Australia including composting facilities, resource recovery facilities, materials recycling facilities, depots, transfer stations and nine landfills. Since opening the very first engineered landfill in Australia at Lyndhurst in Victoria in 1991 SITA has continued as a leader in landfill and waste management technology.

SITA landfills 2.5 million tonnes of waste per year across Australia and has successfully operated the Shale Road Landfill in South Cardup in Western Australia since 1999. SITA has a significant presence in Western Australia and currently provides collection and disposal services for a variety of clients including local governments, service industries and commercial enterprises.

SITA proposes to establish Allawuna Farm Landfill in the Shire of York. The site will be a Prescribed Premises licensed by the Department of Environment Regulation as a Category 64 premises, receiving up to 250,000 tonnes per annum of Class II putrescible waste from the Perth metropolitan area. The Allawuna Farm Landfill is proposed as a replacement to SITA's Shale Road Landfill at South Cardup which is nearing capacity.

2 LEACHATE MANAGEMENT SYSTEM

The landfill liner system is designed to protect the groundwater from the impacts of leachate. The design and construction of the landfill liner system is detailed in the Works Approval documentation and construction reports authored by Golder Associates Pty Ltd and submitted to the Department of Environment Regulation (DER) for approval prior to the deposition of any waste. All leachate management procedures will be completed in accordance with the proposed DER licence. The lining system consists of the following:

- 500 mm engineered, compacted clayey fill,
- Geosynthetic clay liner (GCL),
- 2 mm HDPE Liner,
- Non-woven cushion geotextile layer,
- 300 mm drainage layer, and
- Non-woven cushion geotextile layer.

The leachate drainage and collection layer consists of 300 mm of aggregate and perforated HDPE pipes within the aggregate to collect and drain leachate to the sump. This layer is designed to achieve the following objectives:

- Drain leachate to the sump area to enable removal from the landfill cell, minimising leachate head above the liner,
- Provide a preferential flow-path for leachate to the collection sump,
- Sized to collect the estimated volume of leachate produced,
- Resistant to physical, chemical and biological clogging, and
- Withstand the mass of waste above.

The landfill liner is sloped at 3% to promote drainage towards the leachate sump. An additional network of collection pipes located at 20 m intervals across the landfill floor will also aid in directing leachate towards the collection sumps.

The leachate will be pumped from the landfill cells to the leachate pond from where it will be evaporated. A freeboard of at least 900 mm will be maintained at all times to minimise the chances of leachate overtopping the pond. Where excess leachate generation occurs above the design capacity of the leachate management system, collected leachate will generally be transferred offsite for treatment at a licenced treatment facility. Leachate may also be re-circulated into the landfill as an emergency management measure.

Aerators will be installed in the leachate pond to maintain the water in aerobic conditions. These aerators will be anchored on the embankment crest to limit their movement.

2.1 LEACHATE COLLECTION SYSTEM

The leachate header pipes direct leachate towards the leachate collection sumps at a grade of 1%. Leachate will be removed from the sumps, in cells 1 and 2, by progressively pumping via a leachate riser pipe to an on-site leachate storage pond.

2.2 MANAGING LEACHATE HEAD OVER LINER

The hydraulic head of leachate over the landfill liner will be managed during the landfill operation in accordance with the proposed DER licence requirements. Leachate levels in the landfill will be maintained to a maximum level of 300 mm above the landfill base liner. A fully automated leachate management system will be in place, with a pressure transducer continuously monitoring leachate levels, automatic leachate pumping and continuous depth monitoring in the leachate sump. A Supervisory Control and Data Acquisition (SCADA) system will be utilised to ensure these devices can be accessed from a central system and monitored remotely.

3 LEACHATE PRODUCTION

Leachate is produced during the natural degradation of waste and is collected in the sump (low point) of the lined cells where waste is deposited. Rainfall falling within the lined areas increases the volume of leachate produced.

To minimise the amount of leachate produced, the landfill will be operated by keeping the exposed area of waste to a minimum with rehabilitation following shortly after completion of filling each cell. In order to minimise leachate generation, the following controls will be implemented:

- Divert stormwater away from working and active operating areas,
- Plan cell construction to minimise leachate generation over the winter period. For example, if possible, delay the filling of a new cell until spring,
- Place intermediate cover on intermediate batters as soon as waste placement is finished in the area,
- Progressively cap filled landfill areas with low permeability compacted material as soon as practicable,
- Maintain caps and site drainage to prevent standing water on the landfill and stormwater runoff from entering the active landfill areas,
- Divert stormwater away from active lined areas,
- Maintain empty leachate pond (May to August) in order to minimise the amount of stormwater being in direct contact with leachate.

To minimise leachate generation each landfill cell is fitted with a temporary bund dividing each cell into two catchments. The upslope catchment will trap clean stormwater for discharge to the surrounding environment and the lower catchment will be utilised for initial waste placement. As landfilling in the cell progresses the temporary bund will be removed allowing the leachate collection system to cover the entire base of the cell.

4 LEACAHTE POND AND PUMP DETAILS

Table 1 below outlines the specifications of the leachate pumps at the Allawuna Landfill. Each pump will have its own TESLA CSCR Series Control Box with a control panel.

Table 1: Leachate Pump Specifications

Cell 1 Sump	Cell 2 Sump	Drainage Sump
Pump rating (KW): 4KW;	Pump rating (KW): 4KW;	Pump rating (KW): 1.3KW Pump
Discharge pipe to leachate pond: Size: 160 mm Type: PE100 PN8 HDPE pipe	Discharge pipe to leachate pond: Size: 160 mm Type: PE100 PN8 HDPE pipe	Discharge pipe to retention pond (230 m run): Size : 110mm Type: PE100 PN8 HDPE pipe
Pipe length: 630 m	Pipe length: 430 m	Pipe length: 230 m
Total head elevation: 15.5 m With friction loss @ 12 Lps : 17.23 m total	Total head elevation: 8 m With friction loss @ 18Lps: 11 m total	Total head elevation: 5.3 m With friction loss @ 6 Lps: 6.5 m total

The finalised sump and pipework details are outlined in in **Appendix B.**

5 STORAGE OF LEACHATE

It is intended that leachate will be directed via pumping to a leachate pond located to the north of the landfill, as indicated in **Appendix A**. The leachate pond will be constructed prior to the initial operation of cell 1a. The sizing of the leachate pond considers a scenario of the maximum storage required for the number of closed, interim capped and operational cells, based on the estimated leachate generation rates defined in **Table 2** below.

Additionally the water balance assessment for the leachate pond sizing includes the water volumes resulting from incident rainfall on the leachate storage pond as well as direct evaporation losses. The 90^{th} percentile rainfall year (1995) is applied as the rainfall input and the estimated open water evaporation profile has been adopted to account for evaporation losses from the pond. The leachate pond will be externally bunded to prevent runoff entering the pond from surrounding upslope areas.

Based on the estimated leachate generation rates and cell development schedule, the maximum 2 year leachate production periods of the presented scenarios are:

- **Year 4-5:** Total leachate generation volume of approx. 1,750 m^3, and
- **Year 1-2:** Total leachate generation volume of approx. 1,500 m^3.

Applying these leachate generation rates to the leachate pond water balance via the GoldSim modelling platform results in an operational storage requirement of around 2,500m^3. This includes the assumption that the leachate pond starts with 1,000m^3 of leachate at the start of the year 4-5 scenario. Therefore, the leachate pond would have approximate dimensions of 40 m x 40 m with a capacity of around 2,500 m^3 at 2.0 m depth and approximately 3,500 m^3 at 2.5 m depth including a recommended 900 mm freeboard.

Ongoing monitoring of leachate generation rates will be carried out as the site develops in order to ensure that sufficient leachate storage capacity is available and that the leachate management strategy remains robust and effective over the life of the landfill.

Table 2: Estimated annual leachate generation rates

Year	Cell 1a (m^3/ha)	Cell 1b (m^3/ha)	Cell 2a (m^3/ha)	Cell 2b (m^3/ha)	Total (m^3/ha)
1	167.5	N/A	N/A	N/A	167.5
2	208.5	N/A	N/A	N/A	208.5
3	0	167.5	N/A	N/A	167.5
4	44	0	167.5	N/A	211.5
5	0	44	208.5	N/A	252.5
6	0	0	0	167.5	167.5
7	0	0	44	208.5	252.5

A simulation for the Allawuna landfill has been undertaken using the GoldSim model; this was to investigate if during any of the 100-years of rainfall data for the site the leachate pond would overflow. Based on the simulation, overflowing of the leachate pond is shown to be unlikely; only one of 100 realisations showed a maximum level in the leachate pond slightly higher than the freeboard level. The simulation shown in **Figure 1** is based on the period with the highest rainfall data.

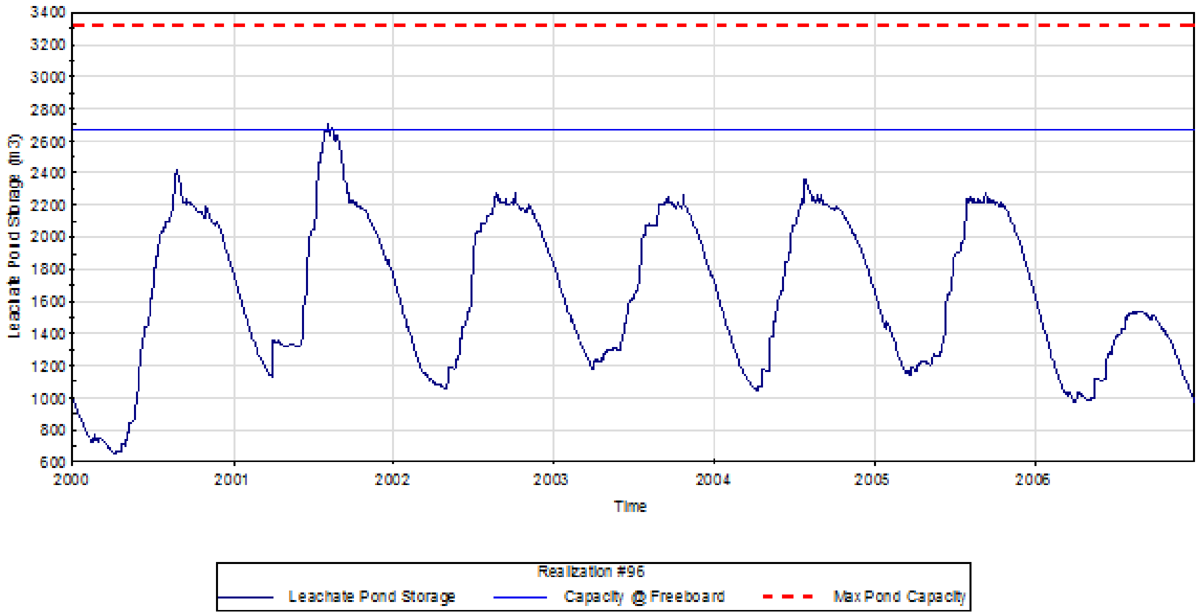


Figure 1: Leachate Pump Specifications

6 LEACHATE DISPOSAL

The Allawuna Farm Landfill will employ the following management options for leachate reduction:

- Evaporation,
- Surface irrigation of leachate within the active cell,
- Recirculation into the landfill, and
- Off-site disposal at licensed facilities as required.

6.1 EVAPORATION

The leachate pond has been designed to maximise the evaporation of leachate over the summer months. Keeping the leachate levels to a minimum during the winter months allows for any accumulated rainwater to be disposed directly to the surrounding environment as stormwater. This can only occur after the pond is thoroughly cleaned once emptied and a first flush has occurred. Upon the completion of the first flush (which is still classified as leachate), testing of the water must be undertaken to validate the stormwater pumped from the pond is not contaminated. Validation testing shall be undertaken for the same range of contaminants leachate is tested for in accordance with the Allawuna Farm Landfill Sampling and Analysis Plan. Test results must be within the Aquatic Standard prior to the releasing of accumulated stormwater from within the leachate pond to the environment.

6.2 IRRIGATION

Irrigation systems such as trickle irrigation and sprays can be used on uncapped areas (daily cover only) of the landfill and to enhance evaporation. These areas must be separate to the current tipping area and access restricted to essential personnel only. Leachate must not leave the lined area and control measures such as clay bunding can be used to prevent this.

6.3 OFFSITE DISPOSAL OF LEACHATE

Offsite disposal is required when the volume of leachate being stored exceeds the volume able to be handled by recirculation, evaporation and trickle irrigation. Offsite disposal will be used to maintain the leachate pond levels at or below the 900 mm freeboard.

Should offsite disposal be required, it must be ensured that the disposal facility is correctly licensed to accept leachate, that a licensed transporter is used and that all loads are tracked as per DER requirements (Controlled Waste Tracking System).

7 CONTROL OF SYSTEM

7.1 INSPECTION PROCEDURE

Inspection of the leachate management system minimises the risk of environmental harm from a breach in the system.

Inspection will occur prior to the transfer of any leachate, immediately after a pump is turned on and periodically during the transfer of leachate. Items inspected shall include:

- Leachate transfer pipes,
- Pipe joiners,
- Valves and flow meters,
- Pumps, and
- Destinations (i.e. leachate pond levels, sprinkler system).

The leachate transfer pipework from the landfill to the leachate pond will be air pressure tested and signed off by an engineer as part of the commissioning process. This will ensure the pipework is constructed correctly, ensuring no leaks.

7.2 MAINTENANCE

In the event of a leachate pump requiring maintenance/repair, a spare leachate pump will be stored on site for use whilst the original sump pump is offsite undergoing repairs.

Non-return valves and flow-meters shall be inspected and/or serviced as required. The shut-off timers and flow switches on the leachate pumps shall be tested for correct operation on a quarterly basis.

Shut-off timers shall be tested to ensure that pumps turn off automatically at 4:30 pm. The shut-off timers in operation are analogue and therefore there may be some margin of error (e.g. the timers may turn off at 4:35pm). The system must be recalibrated by the on-site electrician if the calibration is out by more than 15 minutes.

Flow Switches shall be checked to ensure that the pumps turn off when no flow is detected within leachate transfer pipe. When a pump is initially turned on, the flow switch will not activate for the first two minutes to allow for the pump to commence pumping leachate into the transfer pipe.

To test the operation of the Flow Switch, disconnect the suction hose from the leachate transfer pipe, and redirect back down the leachate sump. Turn the pump on and allow to run ensuring that the suction hose is securely directed back down the leachate sump. After 2 minutes the pump should turn off as no flow is detected within the Transfer Line. The Flow Switch must also be tested to ensure the flow switch allows the pump to continue to operate when flow is present within the pipe.

7.3 LEACHATE POND ANNUAL INSPECTION

Residue salts will be removed once a year prior to commencement of winter. At this time the pond will also be cleaned.

After annual cleaning of the leachate pond, the HPDE liner will be inspected to ensure no damage has occurred during the cleaning process. If any damage to the liner system has occurred, appropriately qualified and experienced contractors shall be engaged to undertake the required repair works prior to the pond being filled with leachate.

7.4 MINIMISING LEACHATE POPOUTS

Leachate popouts from the external slopes of the landfill can occur when leachate flow from generation or recirculation is unable to find an unobstructed downward flow to the sump. Road materials or excessive/impermeable cover which is not removed prior to a new lift can obstruct the downward flow of leachate.

In the unlikely event of a leachate popout the impacts will be minimised by:

- Permeable protection layer placed over the side slope liner which allows the leachate to be redirected into the leachate collection drainage layer at any point along the side liner.
- The temporary bund around the external edges of the landfill liner during construction of a cell which separates the landfill from the surface water system.
- Extracting leachate during landfill life ensuring a well-drained fill mass with no build-up of leachate level, thus reducing the potential for leachate seepage gradients to develop

7.5 REPAIRING LEACHATE POPOUTS

Should a leachate popout occur the cap at the location of the leachate popout will be removed from the popout down to the landfill bund and landfill liner anchor trench. Waste will be removed and replaced with drainage aggregate to create a flow path for leachate to travel to the base of the landfill. The landfill cap will then be replaced to reseal the landfill.

7.6 LEACHATE SPILLS

The Allawuna Farm Landfill 'Emergency Procedures Guide and Contingency Plan' outlines the response procedures required to be followed in the event of a leachate spill. These are summarised below.

7.6.1 LEACHATE SPILL OR LEAK

Definition:

A leachate spill or leak is the unintentional discharge of leachate (waste water) from the landfill to the environment.

Policy:

All site procedures must be followed to prevent spills/leaks of leachate from site. In the event of a spill or leak this contingency plan will be followed to minimise the environmental impact of a leachate spill or leak.

Procedure:

Leachate spillages could conceivably originate from:

- Surface breakout of leachate (popout).
- Leachate spills while loading.
- Leachate transfer pipes.
- A vehicle accident.
- Pond overflow.

In the event of any leachate spillage the following steps will be undertaken:

- Protection of surface water.
- Containment of spill.
- Collection and disposal.
- Remediation actions.
- Contact DER immediately.
- Complete Environmental Protection Act 1986 Section 72 – Waste Discharge Notification Report and submit to the DER.

7.6.2 SURFACE BREAKOUT LEACHATE (POPOUT)

Risk is minimised by:

- Ensuring cover is removed from each layer to ensure that leachate has an unobstructed downwards flow.
- Sump area is sized to collect the estimated volume of leachate produced.
- The liner is designed to be resistant to chemical attack, physical and biological clogging.
- Ensure leachate is drained regularly to stop any build up of leachate.

In the event of a leachate popout the following contingency measures are undertaken:

- Undertake measures to protect surface water (e.g. Block surface water inlets).
- Isolate the area and collect and remove any leachate.
- Excavate the popout area, clearing any obstructions to the downward flow of leachate (e.g. Road materials or excess cover).
- Fill excavated area with drainage materials and re-compact waste layer to assist with downward flow of leachate.
- Apply intermediate cover or capping.
- Further monitoring of the area.

7.6.3 LEACHATE SPILLS WHILE LOADING

There is a risk of leachate spillage when pumping into a tanker truck due to a valve or connection leakage, or a burst hose.

This risk is minimised by:

- Each leachate riser pipe having a concrete spill pad at the head of the riser pipe.
- Any tanker connection points having a concrete spill pad.
- In the event of a leachate spill while loading the following contingency measures are undertaken:
- Any leachate collected in the containment areas are recirculated in the landfill or leachate management system.
- Any water contaminated by leachate is recirculated in the landfill or leachate management system.
- Any contaminated soil is removed and sent to the landfill for disposal.
- Clean the containment area.
- Undertake soil sampling to ensure all contaminated soil is removed.

7.6.4 SPILLS DUE TO VEHICLE ACCIDENTS

Spills of leachate could potentially occur as a result of an incident involving a truck/trailer unit loaded with leachate.

The risk is minimised by:

- SITA Australia uses approved and licensed Controlled Waste carriers for the transport of leachate. The waste carriers contain their own spill kits, drain mats and emergency response plans in the event of a leachate spill.
- SITA Australia provides technical assistance or may attend any emergency situation.

7.6.5 LEACHATE POND OVERFLOW

There is potential for the leachate pond to overflow if too much leachate is pumped into the pond. An overflow may also occur if a large storm event causes a mass influx of stormwater into the leachate pond.

This risk is minimised by:

- Having a Leachate Management Manual which details operational procedures to ensure that a leachate pumping operation is adequately monitored.
- Engineering controls on leachate pumps (auto shutoff switches/telemetry) on all leachate pumps to ensure that pumps cannot run after hours.

- Engineering controls on the leachate pond to ensure that pumping ceases if the filling of the pond reaches the 900 mm freeboard capacity (telemetry).
- Maintaining 900 mm freeboard in ponds at all times to ensure that adequate capacity is available in the case of a significant rain event.
- The amount of leachate stored on site should be kept to a minimum in the cells and pond.
- Leachate pond levels will be continuously monitored by a SCADA system. The SCADA system will automatically switch off the pumps if the freeboard (900mm) is breached. If the freeboard is exceeded a text message or alarm will immediately notify the site manager.
- Pressure censors will be installed on leachate transfer points with auto shut off switches to prevent leakage of leachate due to pip failure.

In the event of a leachate spill caused from an overtopping leachate pond the following contingency measures are to be undertaken:

- The pump causing the overflow must be turned off immediately to stop the overflow of the pond/tank.
- Pump out leachate (via tankers or recirculation into the landfill) to regain 900 mm freeboard.
- Contain the leachate at the closest accessible point to prevent the further migration of the leachate. This may be done via constructing an earthen bund or excavating a cut off trench.
- Any leachate collected in the containment areas is to be recirculated in the landfill or leachate management system.
- Any water contaminated by leachate is recirculated in the landfill or leachate management system.
- Any contaminated soil is removed and sent to the landfill for disposal.
- Clean the containment area.
- Undertake Sampling and Analysis Plan as agreed with the DER.

8 COLLECTION AND ANALYSIS OF DATA

The collection, recording and analysis of data is important in determining any trends in leachate production, planning of future leachate management, including offsite disposal.

Type of Monitoring	Frequency	Recorded	Responsibility
Infrastructure design documents	As occurs	Construction file	Landfill Manager
Inspection checks	On commencement of leachate transfer During leachate transfer	Pump operation	Landfill Supervisor
Leachate transfer records	As occurs (daily)	Pump operation Leachate data spreadsheet	Landfill Supervisor
Leachate level measurements	Continuous. After leachate transfer	Sump /pond depth (SCADA) Leachate data spreadsheet & weekly monitoring checklist	Landfill Supervisor
Leachate offsite disposal records	As occurs	Offsite disposal folder	Landfill Manager
Maintenance records	Quarterly	Record – Maintenance record	Landfill Supervisor
Rainfall	As occurs	Monthly monitoring checklist & rainfall file	Landfill Supervisor
Leachate quality data	Quarterly	Quarterly surface & groundwater monitoring reports prepared by consultants	Landfill Manager

9 EMERGENCY DETAILS

Refer to Emergency Procedure Guide & Contingency Plan for details on emergency procedures relating to a leachate incident.

10 REFERENCE DOCUMENTS

DER -Best Practice Environmental Management Draft Siting, Design, Operation and Rehabilitation of Landfills, November 2005.

Environmental Protection Act 1986 – Licence L7390/1999/8

EPG & Contingency Plan

BoM website www.bom.gov.au

Allawuna Farm Landfill Geotechnical Investigations for Landfill Development Report, March 2015. Golder Associates Pty Ltd.

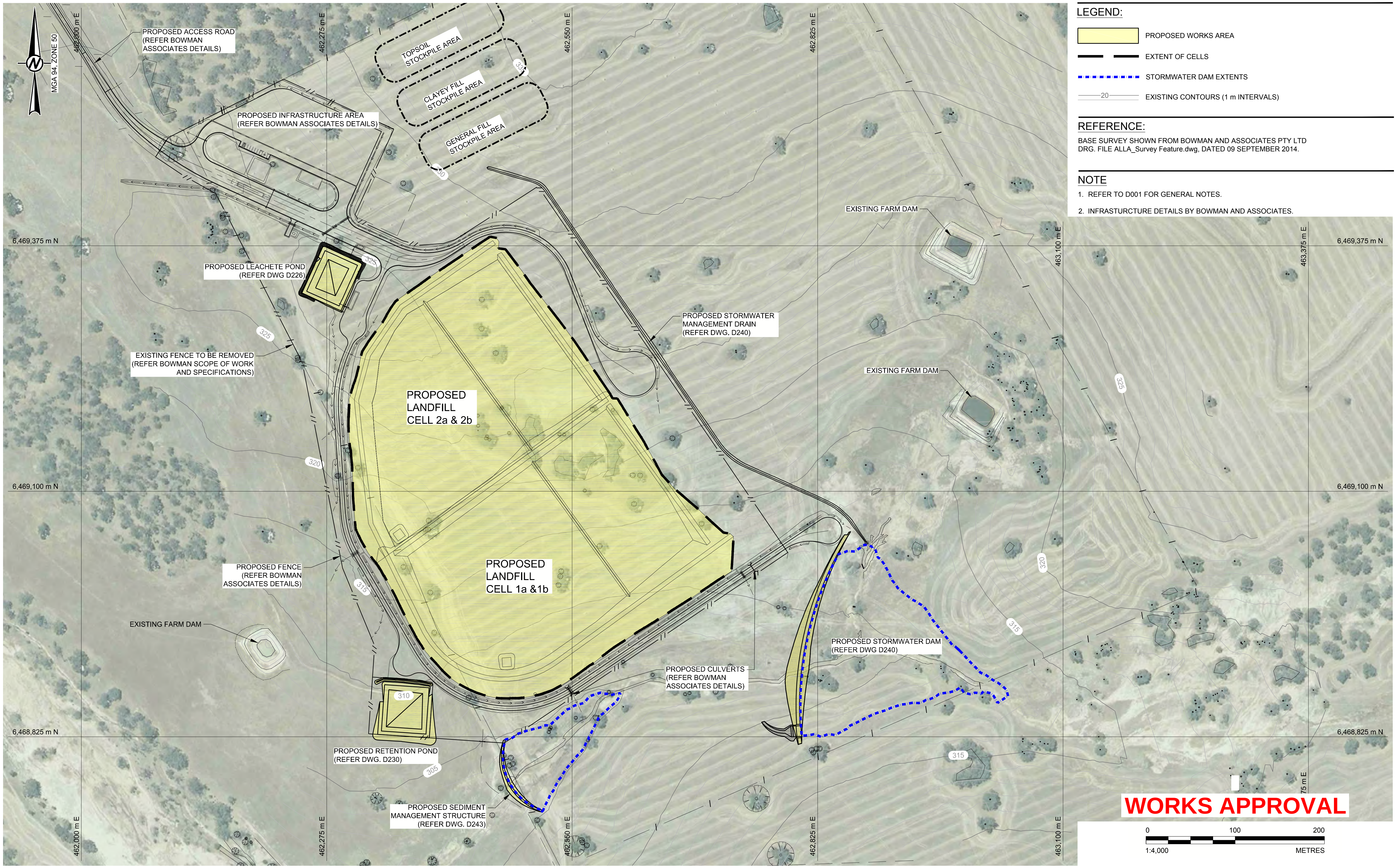
Allawuna Farm Landfill Surface Water, Groundwater and Leachate Management Plan, March 2015. Golder Associates Pty Ltd.

Allawuna Farm Landfill Hydrogeological Site Characterisation Studies Report, March 2015. Golder Associates Pty Ltd.

Works Approval Submission: Construction and Operation of Allawuna Farm Landfill, January 2014. Bowman and Associates Pty Ltd.

11 APPENDICIES

Appendix A: Allawuna Landfill Site Layout



Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
B	2015-03-30	ISSUE FOR WORKS APPROVAL	E.KING	L.DuPREEZ	L.DuPREEZ	-
A	2015-02-1	ISSUE FOR COMMENT	E.KING	L.DuPREEZ	L.DuPREEZ	-

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PROJECT
ALLAWUNA FARM LANDFILL

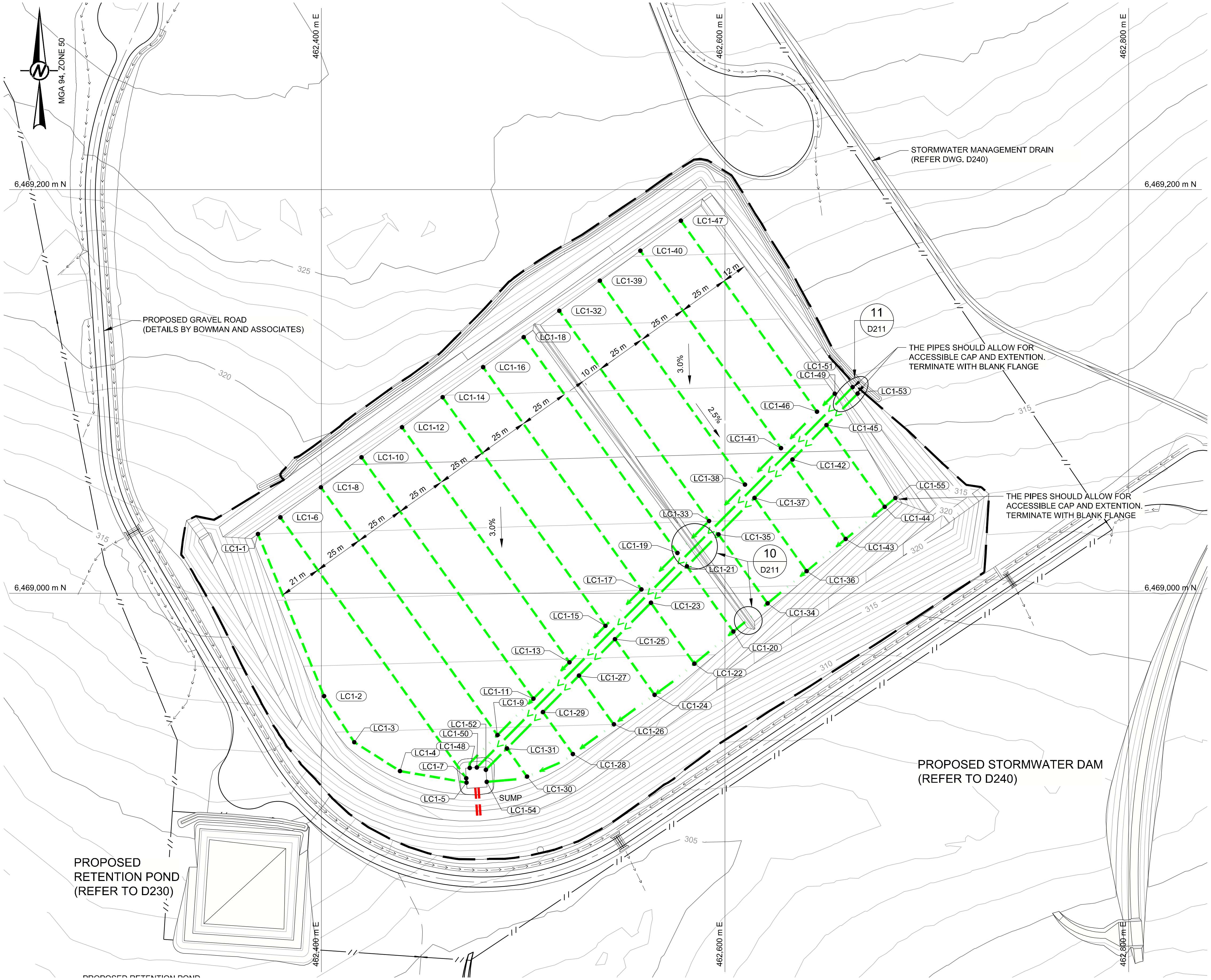
TITLE
GENERAL ARRANGEMENT

PROJECT No.	DOCUMENT NO.	Rev.	3 of 27	FIGURE
147645033	016-R	B		D202

Path: \\pth1-s-file02\JOBS-MINING\Jobs414\Design\147645033 - SITA Allawuna Farm Peer Review York\Technical\Doc\CAD\DRAWINGS\Works Approval\ | File Name: 147645033-001-R-D003.dwg

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

Appendix B: Sump and Pipework Details



LEGEND:

- EXTENT OF CELL WORKS
- CONTOURS (1 m INTERVALS)
- UNIT 13.1 - Ø0.25 M PERFORATED LEACHATE HEADER PIPES
- UNIT 13.2 - Ø0.15 M PERFORATED LEACHATE COLLECTION PIPES
- UNIT 13.3 - Ø0.25 M SOLID LEACHATE HEADER PIPE
- UNIT 14.2 - LEACHATE SUMP OUTLET SLEEVES

NOTE

1. REFER TO D001 FOR GENERAL NOTES.
2. INFRASTRUCTURE DETAILS BY BOWMAN AND ASSOCIATES.
3. SUBSURFACE DRAINAGE NOT SHOWN.
4. LEACHATE COLLECTION PIP CONFIGURATION DICTATED BY DRAINAGE CONFIGURATION OF FUTURE CELL 1 & 6.

REFERENCE:

BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD
DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.

LECHATE COLLECTION PIPES

POINT No.	EASTING (m)	NORTHING (m)
LC1-1	462368.58	6469029.33
LC1-2	462401.34	6468948.97
LC1-3	462416.30	6468926.17
LC1-4	462438.95	6468911.85
LC1-5	462471.92	6468906.13
LC1-6	462379.71	6469037.60
LC1-7	462471.78	6468908.27
LC1-8	462399.79	6469052.48
LC1-9	462487.25	6468929.67
LC1-10	462419.89	6469067.37
LC1-11	462505.08	6468947.72
LC1-12	462439.98	6469082.25
LC1-13	462522.92	6468965.78
LC1-14	462460.07	6469097.14
LC1-15	462540.75	6468983.83
LC1-16	462480.16	6469112.02
LC1-17	462558.58	6469001.88
LC1-18	462500.25	6469126.91
LC1-19	462576.42	6469019.94
LC1-20	462604.15	6468980.99
LC1-21	462581.13	6469013.32
LC1-22	462584.81	6468965.05
LC1-23	462563.30	6468995.27
LC1-24	462565.11	6468949.63
LC1-25	462545.46	6468977.21
LC1-26	462544.96	6468935.02
LC1-27	462527.63	6468959.16
LC1-28	462524.62	6468920.27

LECHATE COLLECTION PIPES

POINT No.	EASTING (m)	NORTHING (m)
LC1-29	462509.79	6468941.11
LC1-30	462501.90	6468909.09
LC1-31	462491.96	6468923.05
LC1-32	462517.88	6469139.96
LC1-33	462592.06	6469035.77
LC1-34	462621.11	6468994.98
LC1-35	462596.77	6469029.16
LC1-36	462640.44	6469010.92
LC1-37	462614.61	6469047.21
LC1-38	462609.90	6469053.83
LC1-39	462537.97	6469154.85
LC1-40	462558.06	6469169.73
LC1-41	462627.73	6469071.88
LC1-42	462633.42	6469066.26
LC1-43	462659.78	6469026.87
LC1-44	462679.12	6469042.82
LC1-45	462650.27	6469083.32
LC1-46	462645.56	6469089.94
LC1-47	462578.15	6469184.62
LC1-48	462473.52	6468913.40
LC1-49	462654.38	6469098.86
LC1-50	462477.04	6468913.64
LC1-51	462663.24	6469102.13
LC1-52	462481.52	6468912.48
LC1-53	462665.70	6469098.93
LC1-54	462481.92	6468906.50
LC1-55	462684.41	6469047.18

WORKS APPROVAL

0 50 100
1:2,000 METRES

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
B	2015-03-30	ISSUE FOR WORKS APPROVAL	E.KING	L.DuPREEZ	L.DuPREEZ	-
A	2015-02-1	ISSUE FOR COMMENT	E.KING	L.DuPREEZ	L.DuPREEZ	-

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PROJECT
ALLAWUNA FARM LANDFILL

TITLE
CELL 1 LEACHATE COLLECTIONS PIPES AND SETOUT PLAN

PROJECT No.	DOCUMENT NO.	Rev.	14 of 27	FIGURE
147645033	016-R	B		D220

LEGEND:

- EXTENT OF CELL WORKS
- CONTOURS (1 m INTERVALS)
- UNIT 13.1 - Ø0.25 M PERFORATED LEACHATE HEADER PIPES
- UNIT 13.2 - Ø0.15 M PERFORATED LEACHATE COLLECTION PIPES
- UNIT 13.3 - Ø0.25 M SOLID LEACHATE HEADER PIPE
- UNIT 14.2 - LEACHATE SUMP OUTLET SLEEVES

NOTE

1. REFER TO D001 FOR GENERAL NOTES.
2. INFRASTURCTURE DETAILS BY BOWMAN AND ASSOCIATES.

REFERENCE:

BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD
DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.

LECHATE COLLECTION PIPES

POINT No.	EASTING (m)	NORTHING (m)
LC2-1	462348.31	6469055.33
LC2-2	462341.27	6469067.22
LC2-3	462330.15	6469200.00
LC2-4	462338.78	6469247.29
LC2-5	462365.14	6469294.49
LC2-6	462363.98	6469060.62
LC2-7	462338.87	6469095.90
LC2-8	462380.13	6469072.43
LC2-9	462335.46	6469135.16
LC2-10	462396.27	6469084.24
LC2-11	462332.11	6469174.34
LC2-12	462412.41	6469096.05
LC2-13	462331.83	6469209.22
LC2-14	462428.55	6469107.86
LC2-15	462336.84	6469236.67
LC2-16	462444.70	6469119.67
LC2-17	462345.39	6469259.14
LC2-18	462460.84	6469131.48

LECHATE COLLECTION PIPES

POINT No.	EASTING (m)	NORTHING (m)
LC2-19	462356.18	6469278.46
LC2-20	462476.98	6469143.29
LC2-21	462366.27	6469299.52
LC2-22	462509.34	6469166.97
LC2-23	462400.57	6469319.72
LC2-24	462525.48	6469178.78
LC2-25	462417.74	6469330.09
LC2-26	462541.63	6469190.59
LC2-27	462434.92	6469340.45
LC2-28	462557.77	6469202.40
LC2-29	462452.09	6469350.81
LC2-30	462358.94	6469056.84
LC2-31	462572.25	6469213.00
LC2-32	462582.30	6469216.51
LC2-33	462360.69	6469054.41
LC2-34	462362.32	6469051.94
LC2-35	462584.73	6469213.36

WORKS APPROVAL

0 50 100
1:2,000 METRES

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B	2015-03-30	ISSUE FOR WORKS APPROVAL	E.KING	L.DuPREEZ	L.DuPREEZ	-
A	2015-02-1	ISSUE FOR COMMENT	E.KING	L.DuPREEZ	L.DuPREEZ	-

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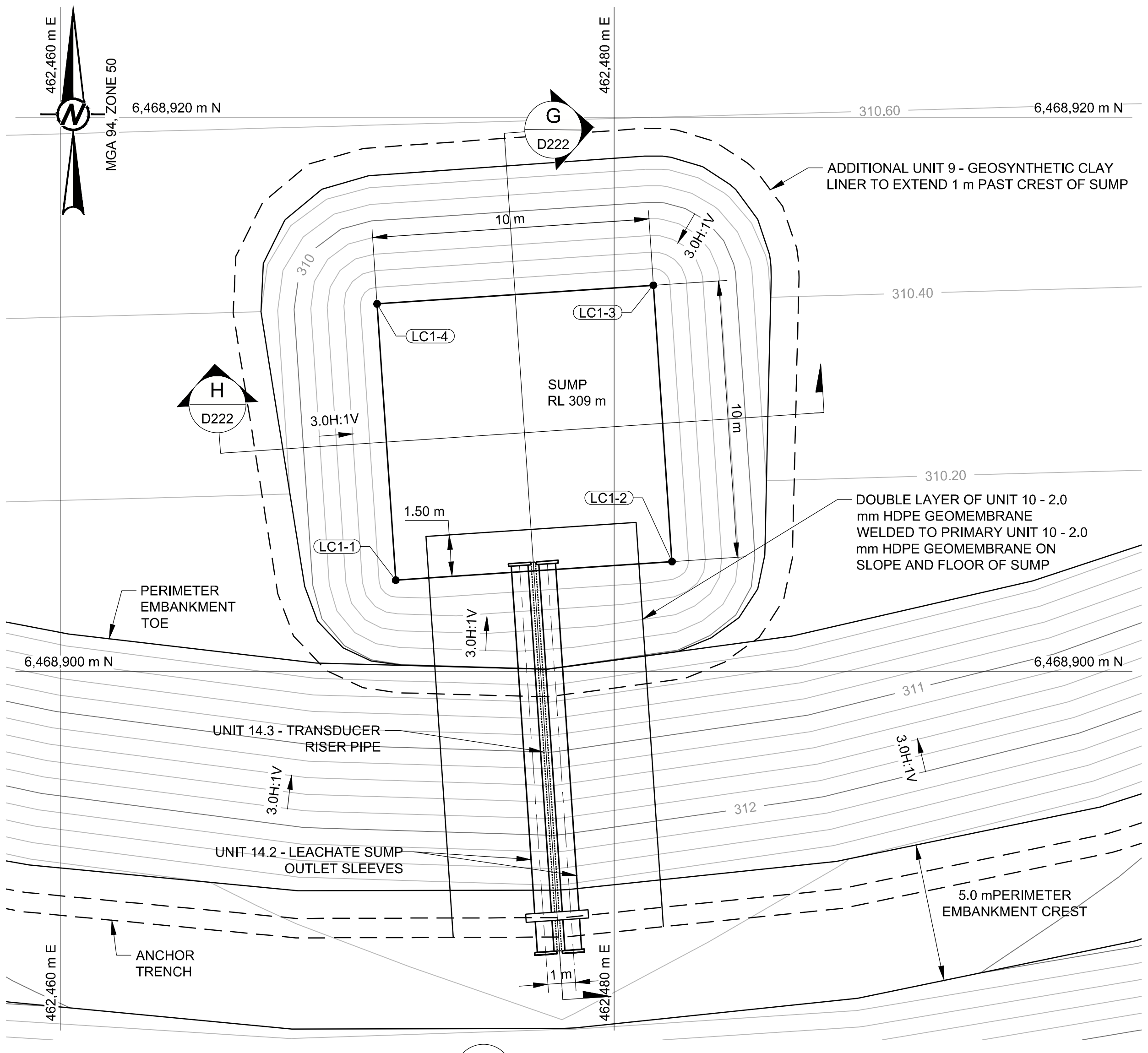
PROJECT
ALLAWUNA FARM LANDFILL

TITLE
CELL 2 LEACHATE COLLECTIONS PIPES AND SETOUT PLAN

PROJECT No.	DOCUMENT NO.	Rev.		FIGURE
147645033	016-R	B	15 of 27	D221



SCALE 1:250 1 D222 CELL 1 SUMP DETAIL

SUMP SETOUT			
POINT No.	EASTING (m)	NORTHING (m)	RL (m)
S1-1	462472.11	6468903.28	309.0
S1-2	462482.09	6468903.96	309.0
S1-3	462481.42	6468913.93	309.0
S1-4	462471.44	6468913.26	309.0

LEGEND:

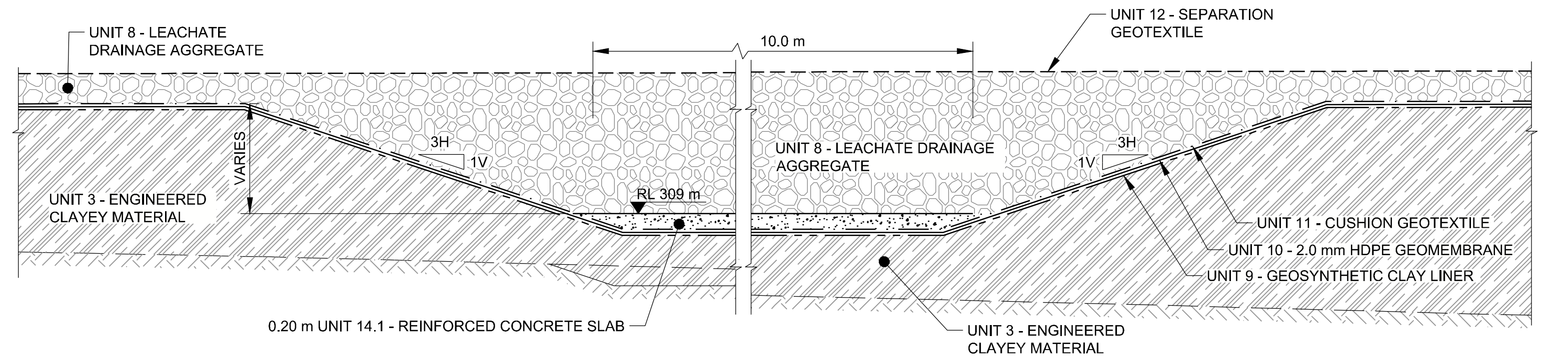
20 CONTOURS (1 m INTERVALS)

NOTE

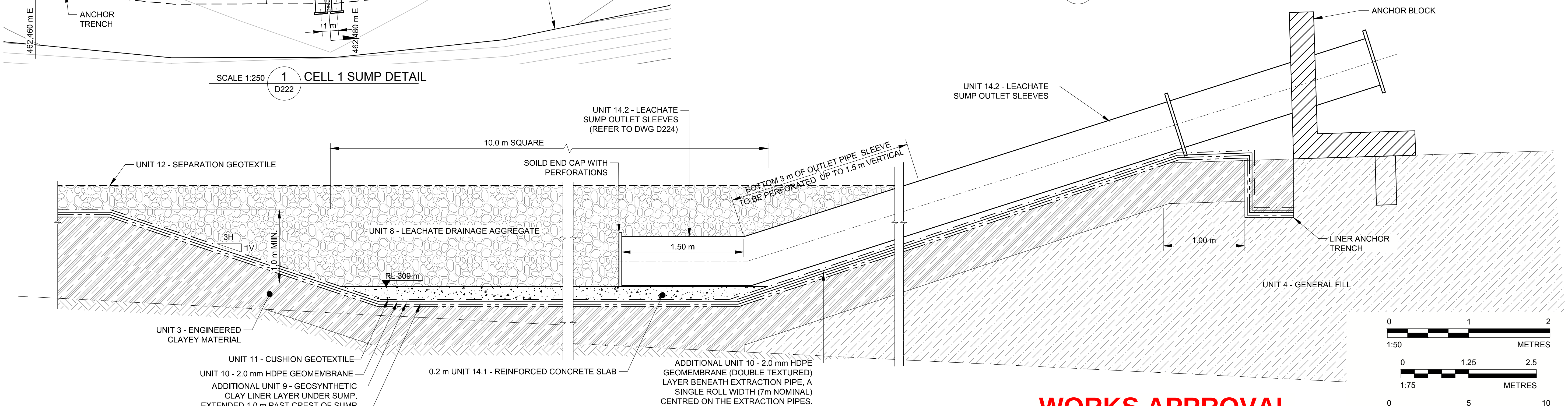
1. REFER TO D001 FOR GENERAL NOTES.
2. INFRASTRUCTURE DETAILS BY BOWMAN AND ASSOCIATES.

REFERENCE:

BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.



SCALE 1:75 H D222 CELL 1 SUMP SECTION



SCALE 1:50 G D222 CELL 1 SUMP SECTION

0 1 2
1:50 METRES

0 1.25 2.5
1:75 METRES

0 5 10
1:250 METRES

WORKS APPROVAL

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
B	2015-03-30	ISSUE FOR WORKS APPROVAL	E.KING	L.DuPREEZ	L.DuPREEZ	-
A	2015-02-1	ISSUE FOR COMMENT	E.KING	L.DuPREEZ	L.DuPREEZ	-

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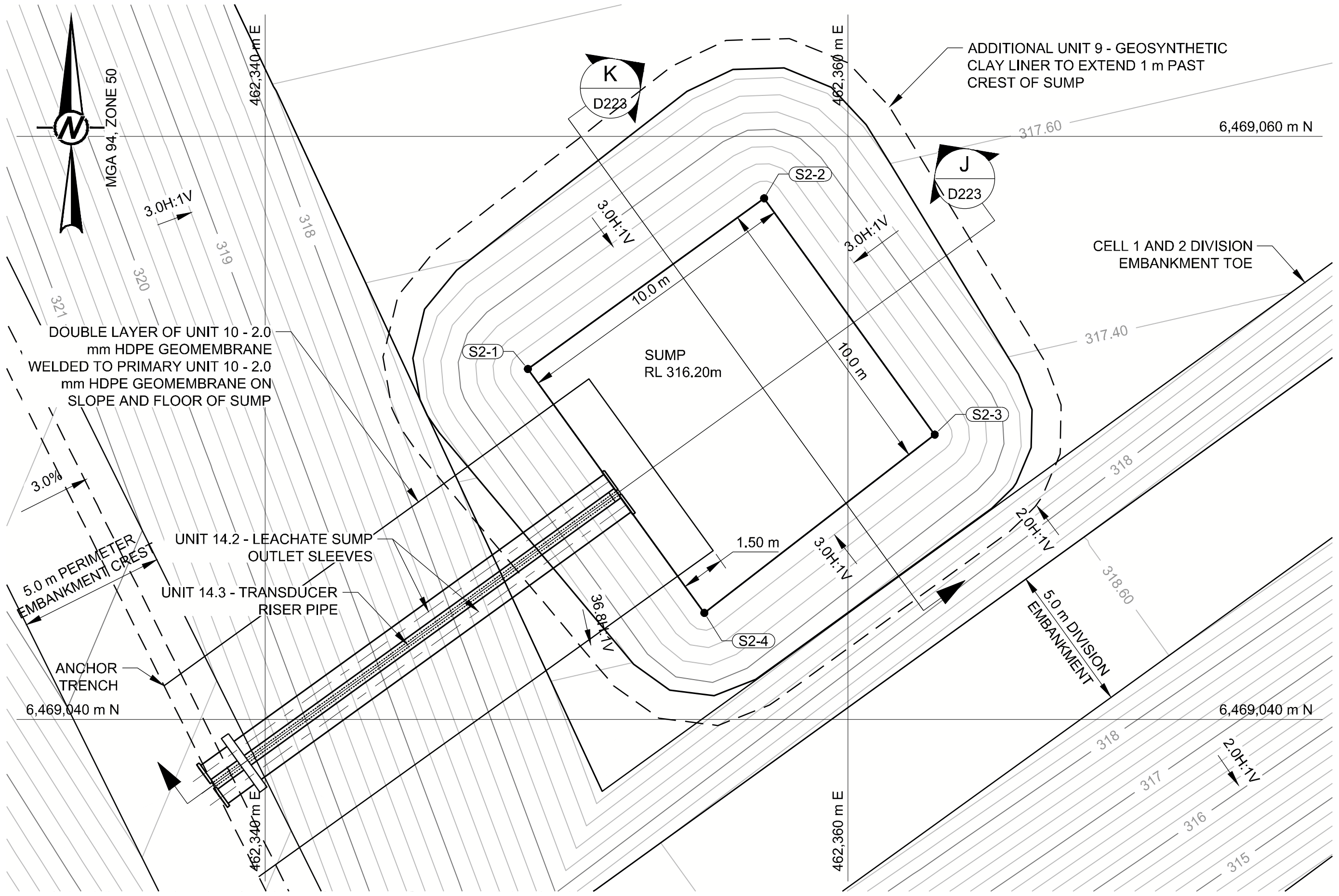
PROJECT
ALLAWUNA FARM LANDFILL

TITLE
CELL 1 SUMP LAYOUT PLAN AND SETOUT

PROJECT No.	DOCUMENT NO.	Rev.	16 of 27	FIGURE
147645033	016-R	B		D222



SCALE 1:250 — 2 (D223) CELL 2 SUMP DETAIL

CELL 2 SUMP SETOUT			
POINT No.	EASTING (m)	NORTHING (m)	RL (m)
S2-1	462349.02	6469052.03	316.2
S2-2	462357.13	6469057.88	316.2
S2-3	462362.98	6469049.77	316.2
S2-4	462355.07	6469043.66	316.2

LEGEND:

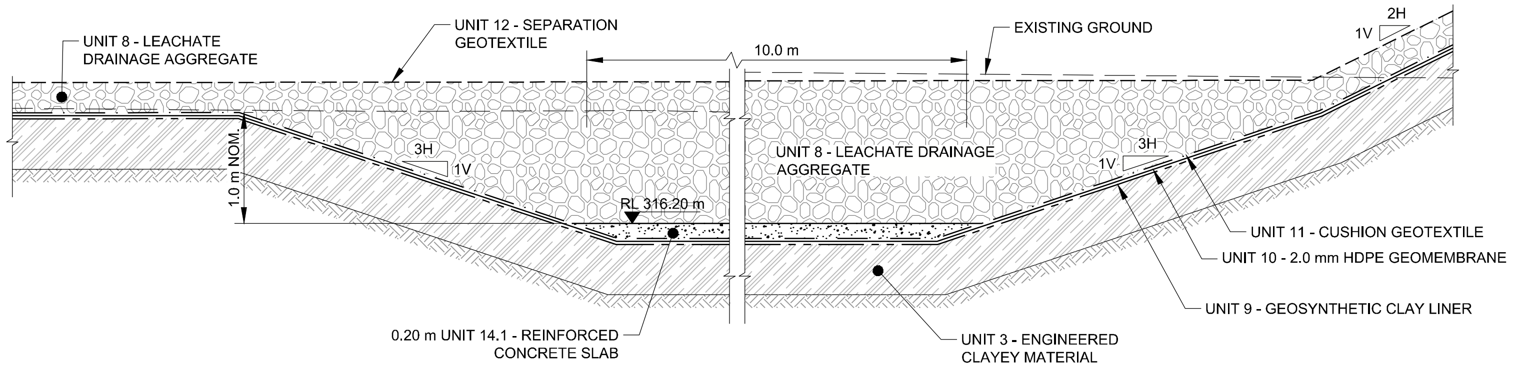
—20— CONTOURS (1 m INTERVALS)

NOTE

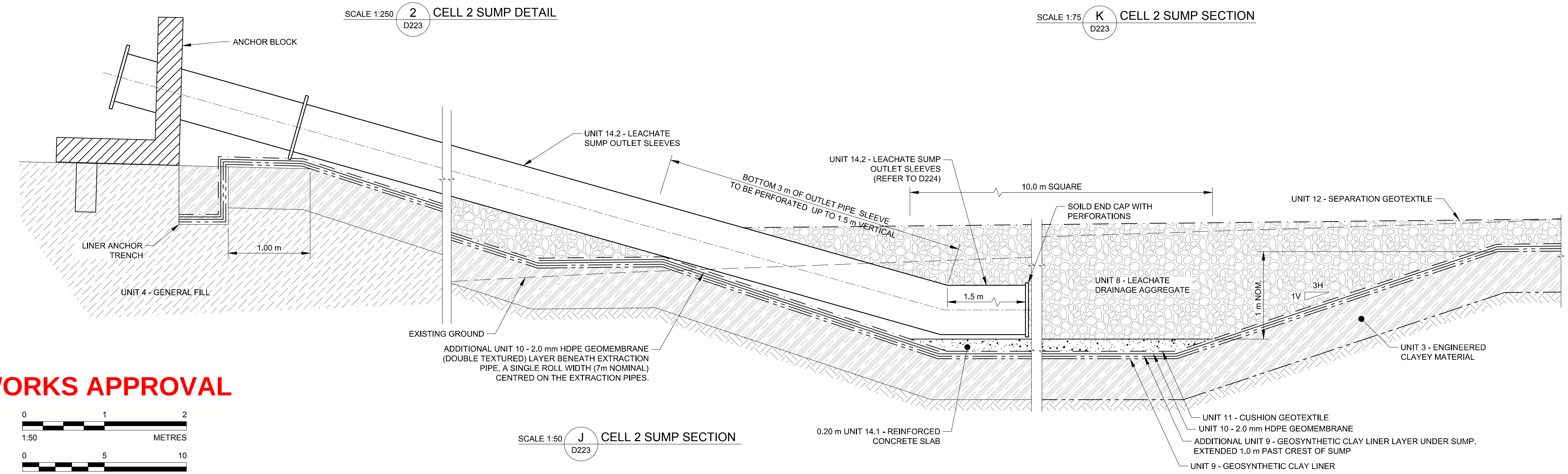
1. REFER TO D001 FOR GENERAL NOTES.
2. INFRASTRUCTURE DETAILS BY BOWMAN AND ASSOCIATES.

REFERENCE:

BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.



SCALE 1:75 — K (D223) CELL 2 SUMP SECTION



SCALE 1:50 — J (D223) CELL 2 SUMP SECTION

WORKS APPROVAL

0 1 2 — 1:50 METRES

0 5 10 — 1:250 METRES

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
B	2015-03-30	ISSUE FOR WORKS APPROVAL	E.KING	L.DuPREEZ	L.DuPREEZ	-
A	2015-02-1	ISSUE FOR COMMENT	E.KING	L.DuPREEZ	L.DuPREEZ	-

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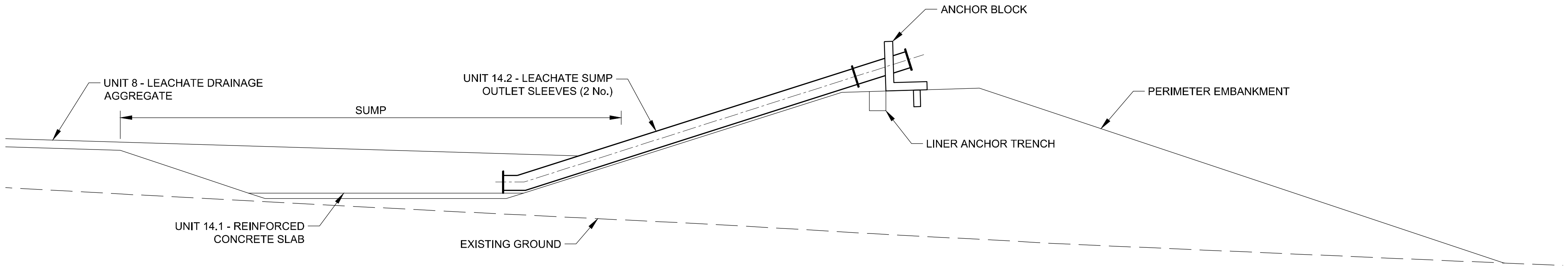
PROJECT
ALLAWUNA FARM LANDFILL

TITLE
CELL 2 SUMP LAYOUT PLAN AND SETOUT

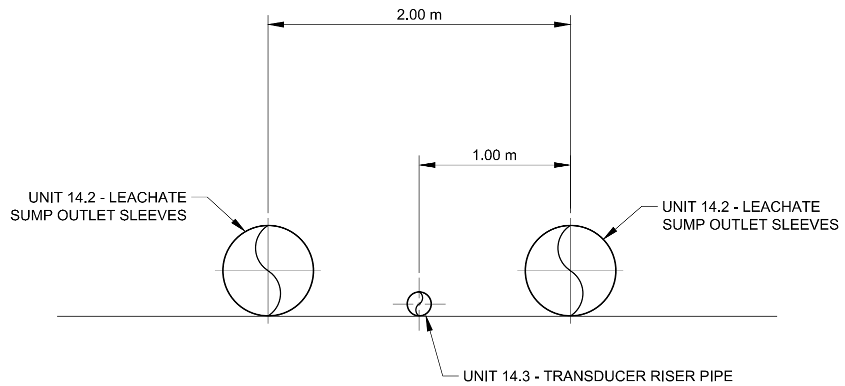
PROJECT No. 147645033 | DOCUMENT NO. 016-R | Rev. B | 17 of 27 | FIGURE D223

Path: \\pth1-s-file02\JOBS-MINING\Jobs414\Design\147645033 - SITA Allawuna Farm Peer Review York\Technical\Doc\CAD\DRAWINGS\Works Approval\ | File Name: 147645033-001-R-D223.dwg

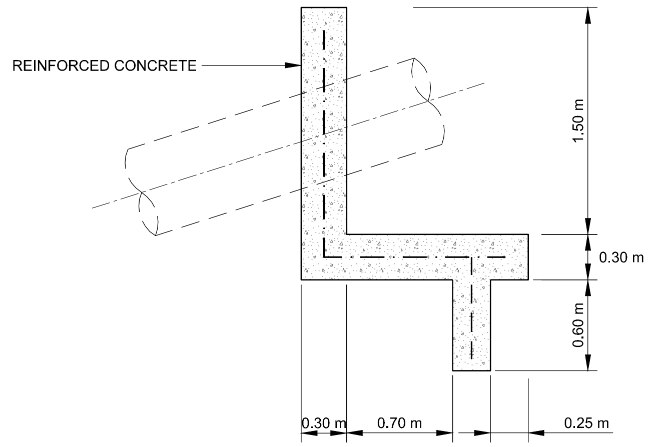
25 mm | IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3



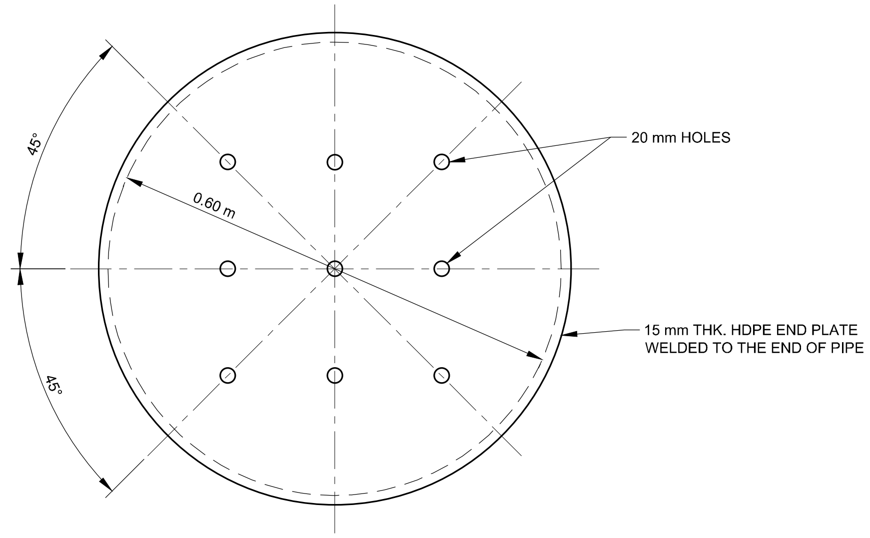
TYPICAL SUMP OUTLET SLEEVE DETAIL
SCALE 1:200



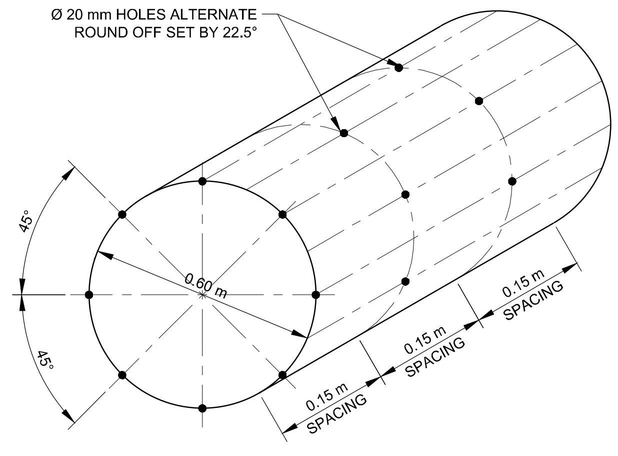
TYPICAL SUMP OUTLET PIPE SECTION
SCALE 1:50



TYPICAL ANCHOR BLOCK DETAIL
SCALE 1:50

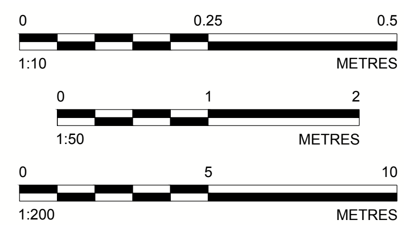


TYPICAL END PLATE DETAIL
SCALE 1:10



TYPICAL SUMP OUTLET SLEEVE PERFORATION DETAIL
N.T.S

WORKS APPROVAL



Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
B	2015-03-30	ISSUE FOR WORKS APPROVAL	E.KING	L.DuPREEZ	L.DuPREEZ	-
A	2015-02-1	ISSUE FOR COMMENT	E.KING	L.DuPREEZ	L.DuPREEZ	-

CLIENT
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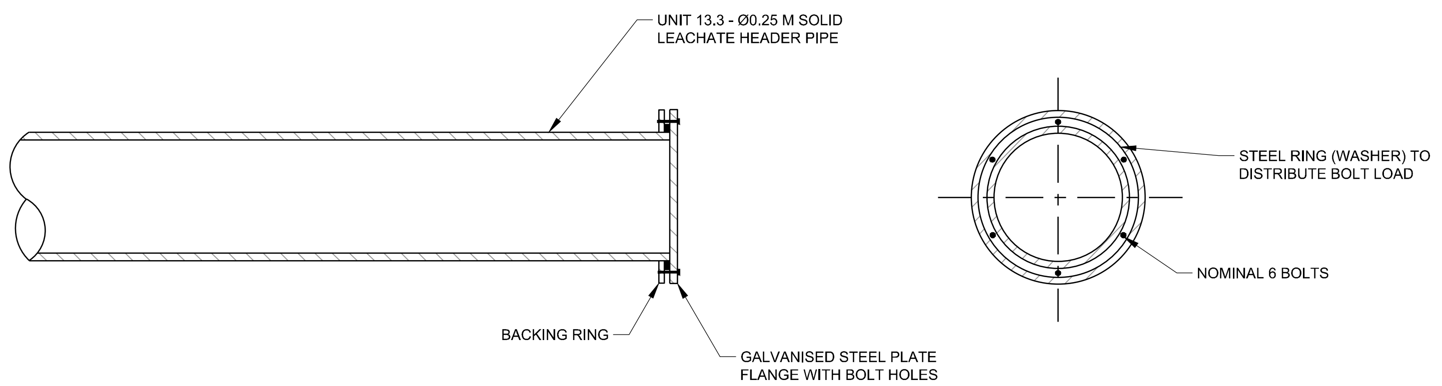
PROJECT
ALLAWUNA FARM LANDFILL

TITLE
SUMP OUTLET PIPES

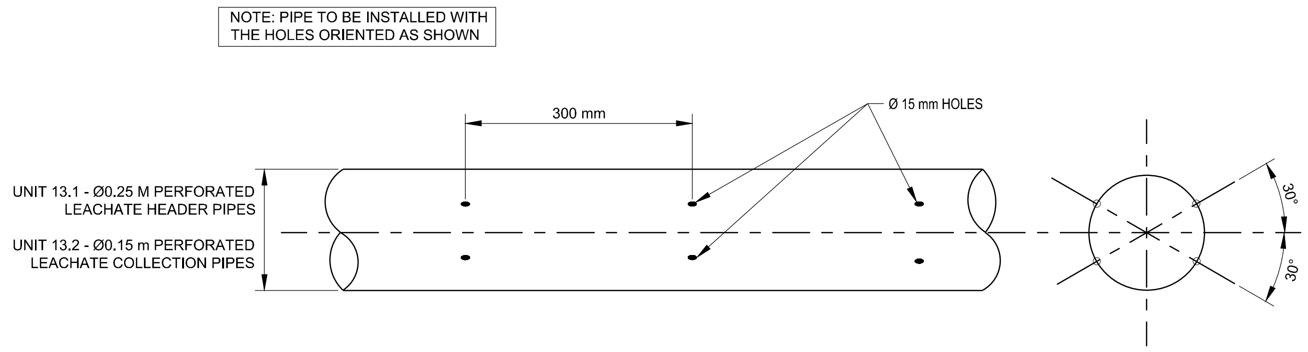
PROJECT No.	DOCUMENT NO.	Rev.	18 of 27	FIGURE
147645033	016-R	B		D224

Path: \\pth1-s-file02\JOBS-MINING\Jobs414\Design\147645033 - SITA Allawuna Farm Peer Review York\Technical\Doc\CAD\DRAWINGS\Works Approval\ | File Name: 147645033-001-R-D024.dwg

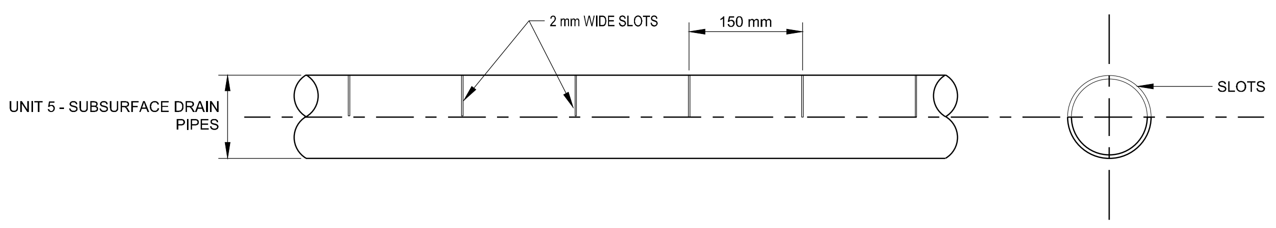
25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3



TYPICAL LEACHATE COLLECTION PIPE END
SCALE 1:10



TYPICAL PERFORATED LEACHATE COLLECTION PIPE - DRILLED
SCALE 1:10



TYPICAL SUBSURFACE DRAIN PERFORATED PIPE - SLOTTED
SCALE 1:10

WORKS APPROVAL

0 0.25 0.5
1:10 METRES

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
B	2015-03-30	ISSUE FOR WORKS APPROVAL	E.KING	L.DuPREEZ	L.DuPREEZ	-
A	2015-02-1	ISSUE FOR COMMENT	E.KING	L.DuPREEZ	L.DuPREEZ	-

CLIENT
SITA AUSTRALIA

PROJECT
ALLAWUNA FARM LANDFILL

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AUSTRALIA
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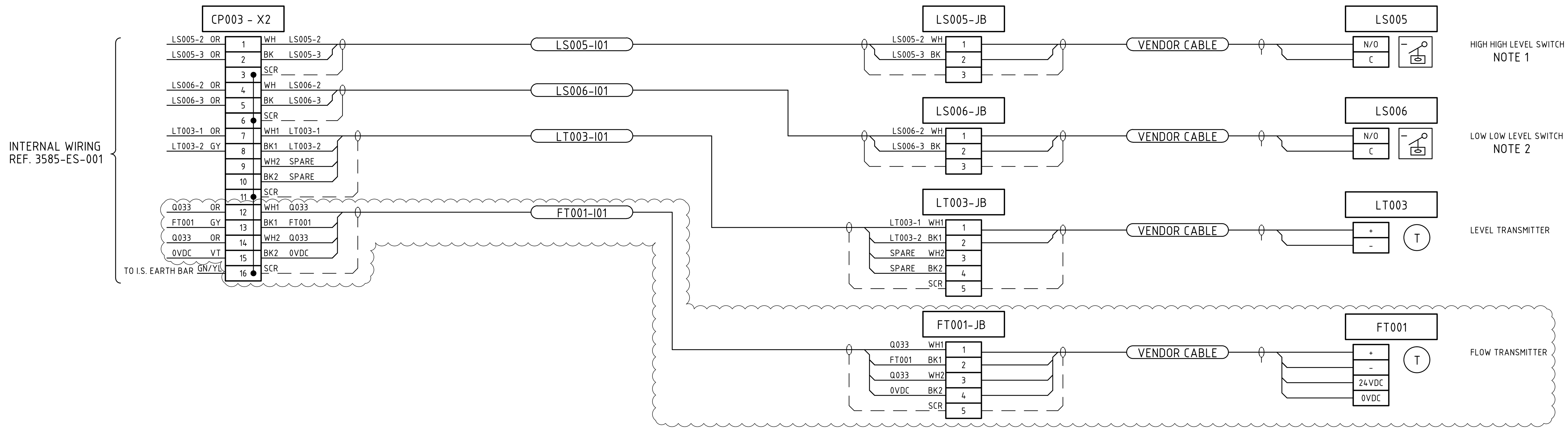
TITLE
LEACHATE COLLECTION PIPE DETAILS

PROJECT No.	DOCUMENT NO.	Rev.		FIGURE
147645033	016-R	B	19 of 27	D225

ATTACHMENT D

Electrical Connection Diagrams



NOTES

1. N/O CONTACT OPENS AT HIGH LEVEL.
2. N/O CONTACT CLOSES ON NORMAL LEVEL, OPENS WHEN LEVEL DROPS TO LOW.

REV	BY	DATE	DESCRIPTION	CHK'D	APP'D
1	NS	07/05/15	RE-ISSUED FOR CONSTRUCTION	MG	MG
0	NS	01/04/15	ISSUED FOR CONSTRUCTION	MG	MG

No	REF. DRG. No.	TITLE

CLIENT
Bowman and Associates Pty Ltd
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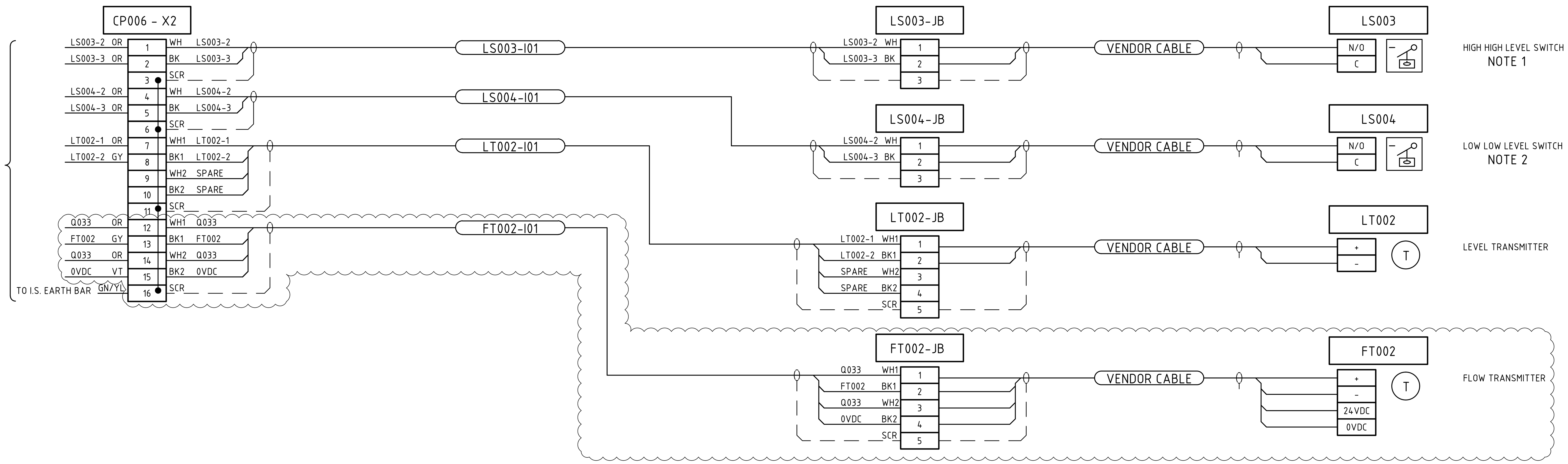
	BY	DATE
DRAWN	ABM	18.03.15
CHECKED	MG	27.03.15
DESIGNED	AS	18.03.15
CHECKED		
APPROVED	MG	01.04.15

VENDOR/DESIGNER DRG No. ALLA-090 REV. 1

TITLE
ALLAWUNA FARM LANDFILL
CELL 1 SUMP PUMP - CP003
CONNECTION DIAGRAM

SCALE | SHEET SIZE A1 | DRG. No. 3585- CD-001 | REV. 1



NOTES

1. N/O CONTACT OPENS AT HIGH LEVEL.
2. N/O CONTACT CLOSES ON NORMAL LEVEL, OPENS WHEN LEVEL DROPS TO LOW.

REV	BY	DATE	DESCRIPTION	CHK'D	APP'D
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0	NS	01/04/15	ISSUED FOR CONSTRUCTION	MG	MG

No	REF. DRG. No.	TITLE

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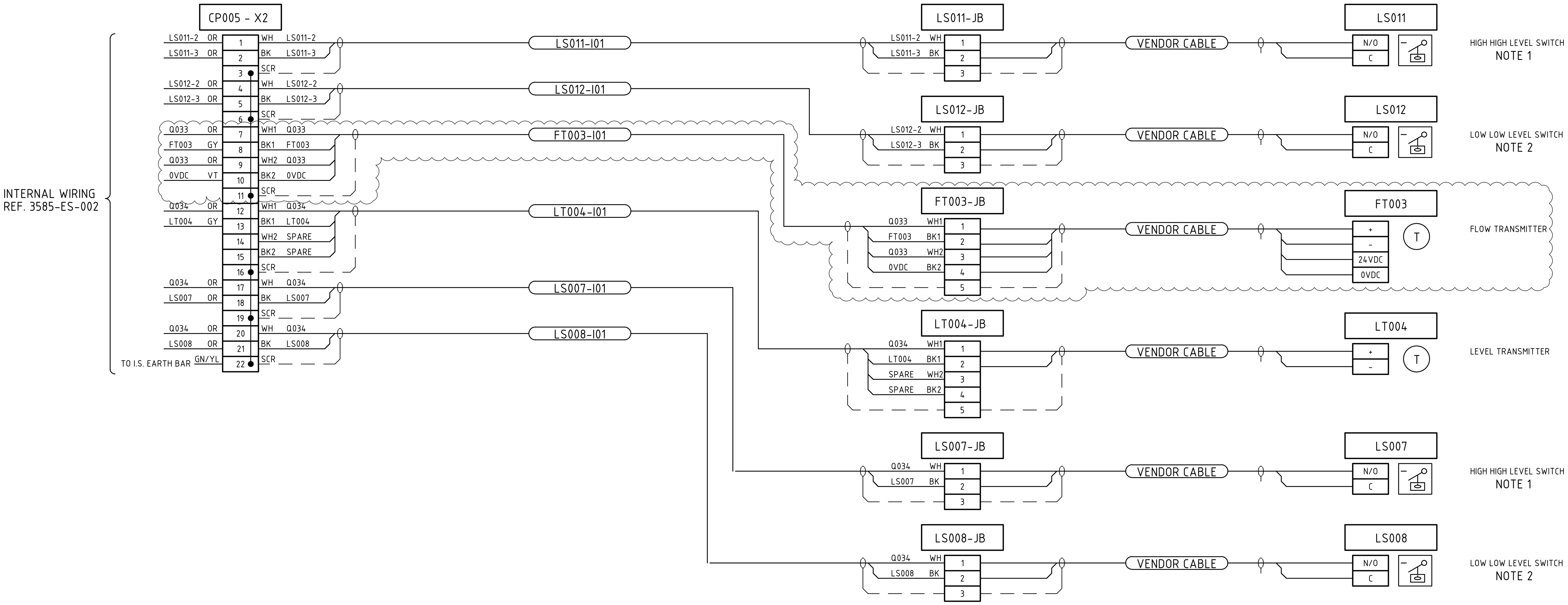
	BY	DATE
DRAWN	ABM	18.03.15
CHECKED	MG	27.03.15
DESIGNED	AS	18.03.15
CHECKED		
APPROVED	MG	01.04.15

VENDOR/DESIGNER DRG No. ALLA-091 REV. 1

TITLE
ALLAWUNA FARM LANDFILL
CELL 2 SUMP PUMP - CP006
CONNECTION DIAGRAM

SCALE | SHEET SIZE A1 | DRG. No. 3585- CD-002 | REV. 1

PLOT TIMESTAMP: 07.05.2015 3:11 PM



NOTES

1. N/O CONTACT OPENS AT HIGH LEVEL.
2. N/O CONTACT CLOSES ON NORMAL LEVEL, OPENS WHEN LEVEL DROPS TO LOW.

REV	BY	DATE	DESCRIPTION	CHK'D	APP'D
1	NS	07/05/15	RE-ISSUED FOR CONSTRUCTION	MG	MG
0	NS	01/04/15	ISSUED FOR CONSTRUCTION	MG	MG

No	REF. DRG. No.	TITLE

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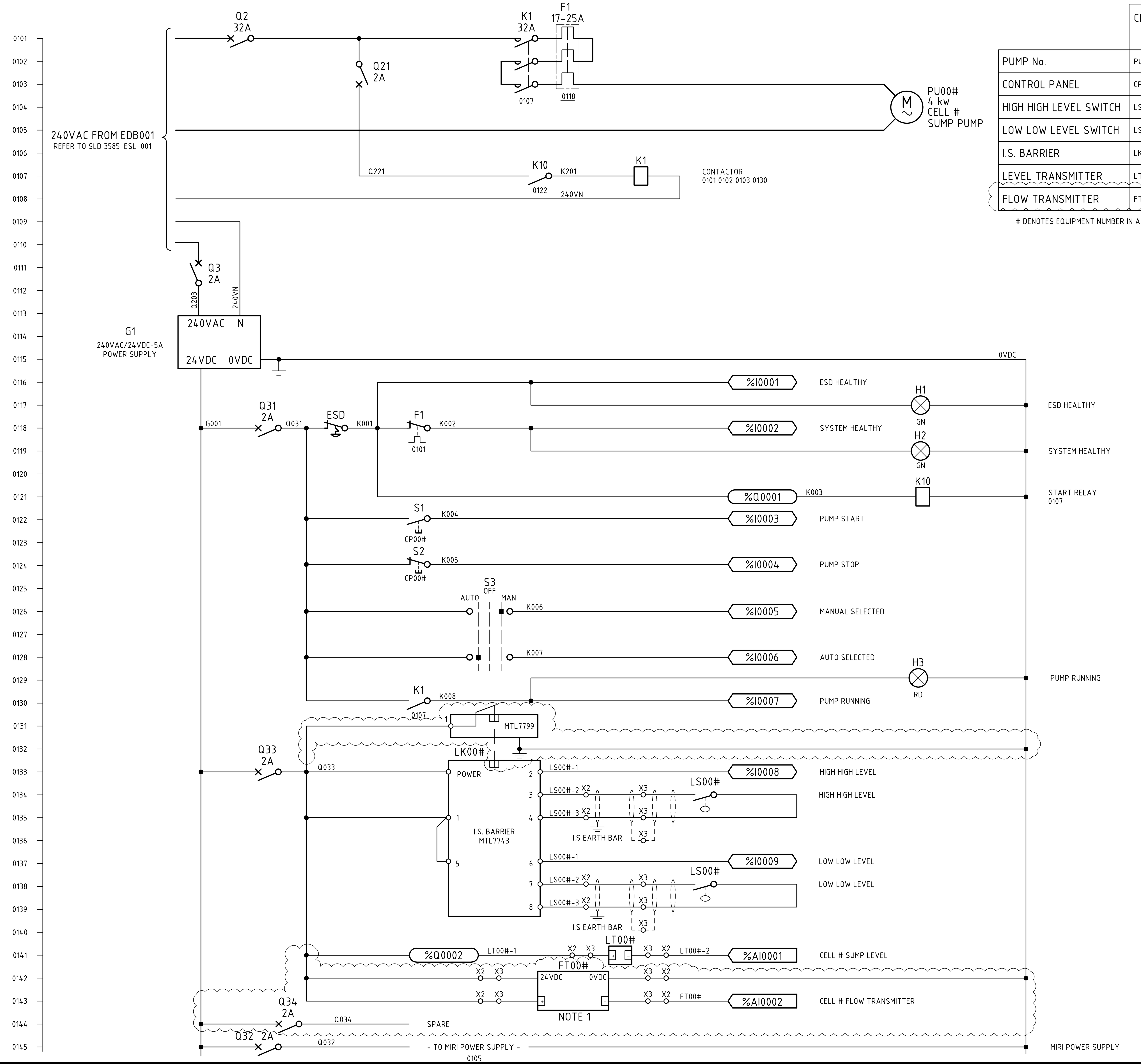
	BY	DATE
DRAWN	ABM	18.03.15
CHECKED	MG	27.03.15
DESIGNED	AS	18.03.15
CHECKED		
APPROVED	MG	01.04.15

VENDOR/DESIGNER DRG No. ALLA-092 REV. 1

TITLE
ALLAWUNA FARM LANDFILL
DRAINAGE SUMP PUMP/RETENTION POND - CP005
CONNECTION DIAGRAM

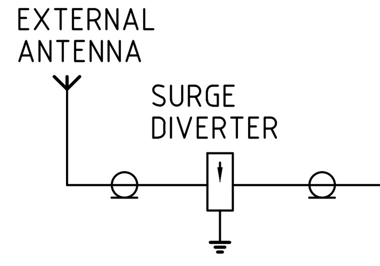
SCALE | SHEET SIZE A1 | DRG. No. 3585- CD-003 | REV. 1

PLOT TIMESTAMP: 07.05.2015 3:12 PM



	CELL 1 SUMP PUMP	CELL 2 SUMP PUMP
PUMP No.	PU001	PU002
CONTROL PANEL	CP003	CP006
HIGH HIGH LEVEL SWITCH	LS005	LS003
LOW LOW LEVEL SWITCH	LS006	LS004
I.S. BARRIER	LK005/6	LK003/4
LEVEL TRANSMITTER	LT003	LT002
FLOW TRANSMITTER	FT001	FT002

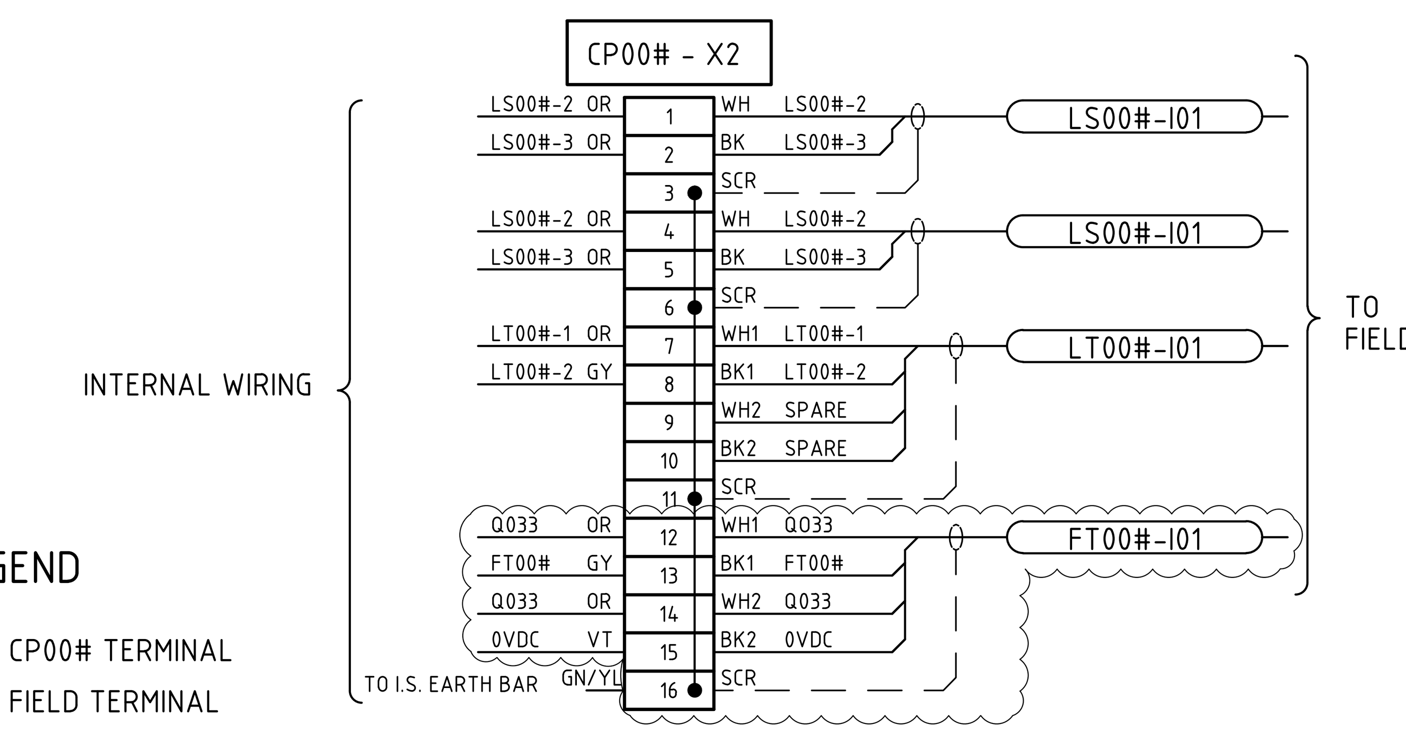
# DENOTES EQUIPMENT NUMBER IN ALL INSTANCES.



CP00# - MIRI

INTERNAL WIRING

Wiring	TERM. No.	I/O. No.	DESCRIPTION	JUMPERS SETTINGS
	ANTENNA PORT		EXTERNAL ANTENNA	J18 J49 J7 J50 J10 J33J34 / J8 J1 J3 J9 J11
Q032 OR	+		POWER SUPPLY - 24VDC	MODULE CONFIG. AS PER FACTORY DEFAULT - 2400 BAUD RATE.
0VDC VT	-		POWER SUPPLY - 0VDC	
	DOT			
K001 OR	1	1	DIGITAL OUTPUT 1 (N/O)	J12 J14 / J13 J15
K003 OR	1A			
Q033 OR	2	2	DIGITAL OUTPUT 2 (N/O)	
LT00#-1 OR	2A			
	3	3	DIGITAL OUTPUT 3 - COM	ALL OUTPUTS SET TO ISOLATED RELAYS, 2 SPST AND 2 SPDT (FACTORY DEFAULT)
	3A		DIGITAL OUTPUT 3 - N/O	
	3B		DIGITAL OUTPUT 3 - N/C	
	4	4	DIGITAL OUTPUT 4 - COM	
	4A		DIGITAL OUTPUT 4 - N/O	
	4B		DIGITAL OUTPUT 4 - N/C	
	DIN			
K001 OR	1	1	DIGITAL INPUT 1	J28 J30 / J27 J29
K002 OR	2	2	DIGITAL INPUT 2	ALL INPUTS DINs (FACTORY DEFAULT)
K004 OR	3	3	DIGITAL INPUT 3	
K005 OR	4	4	DIGITAL INPUT 4	
K006 OR	5	5	DIGITAL INPUT 5	
K007 OR	6	6	DIGITAL INPUT 6	
K008 OR	7	7	DIGITAL INPUT 7	
LS00#-1 OR	8	8	DIGITAL INPUT 8	
LS00#-1 OR	9	9	DIGITAL INPUT 9	
	10	10	DIGITAL INPUT 10	
	11	11	DIGITAL INPUT 11	
	12	12	DIGITAL INPUT 12	
	13	13	DIGITAL INPUT 13	
	14	14	DIGITAL INPUT 14	
	15	15	DIGITAL INPUT 15	
	16	16	DIGITAL INPUT 16	
0VDC VT	C1		COMMON 1	
0VDC VT	C2		COMMON 2	
	ALG			
LT00#-2 GY	1	1	ANALOG INPUT 1	J26 J25
	2	2	ANALOG INPUT 2	ALL CHANNELS SET TO 4-20mA INPUTS (FACTORY DEFAULT)
	3	3	ANALOG INPUT 3	
	4	4	ANALOG INPUT 4	
	5	5	ANALOG INPUT 5	
	6	6	ANALOG INPUT 6	
	7	7	ANALOG INPUT 7	
	8	8	ANALOG INPUT 8	
0VDC VT	G			
0VDC VT	G			



LEGEND

X2 CP00# TERMINAL
X3 FIELD TERMINAL

NOTES

1. GROUNDING REQUIREMENT AS PER MANUFACTURER REQUIREMENTS.

REV	BY	DATE	DESCRIPTION	CHK'D	APP'D
2	NS	07/05/15	RE-ISSUED FOR CONSTRUCTION	MG	MG
1	NS	09/04/15	RE-ISSUED FOR CONSTRUCTION	AS	AS
0	NS	31/03/15	ISSUED FOR CONSTRUCTION	AS	MG

No | REF. DRG. No. | TITLE

CLIENT
Bowman and Associates Pty Ltd
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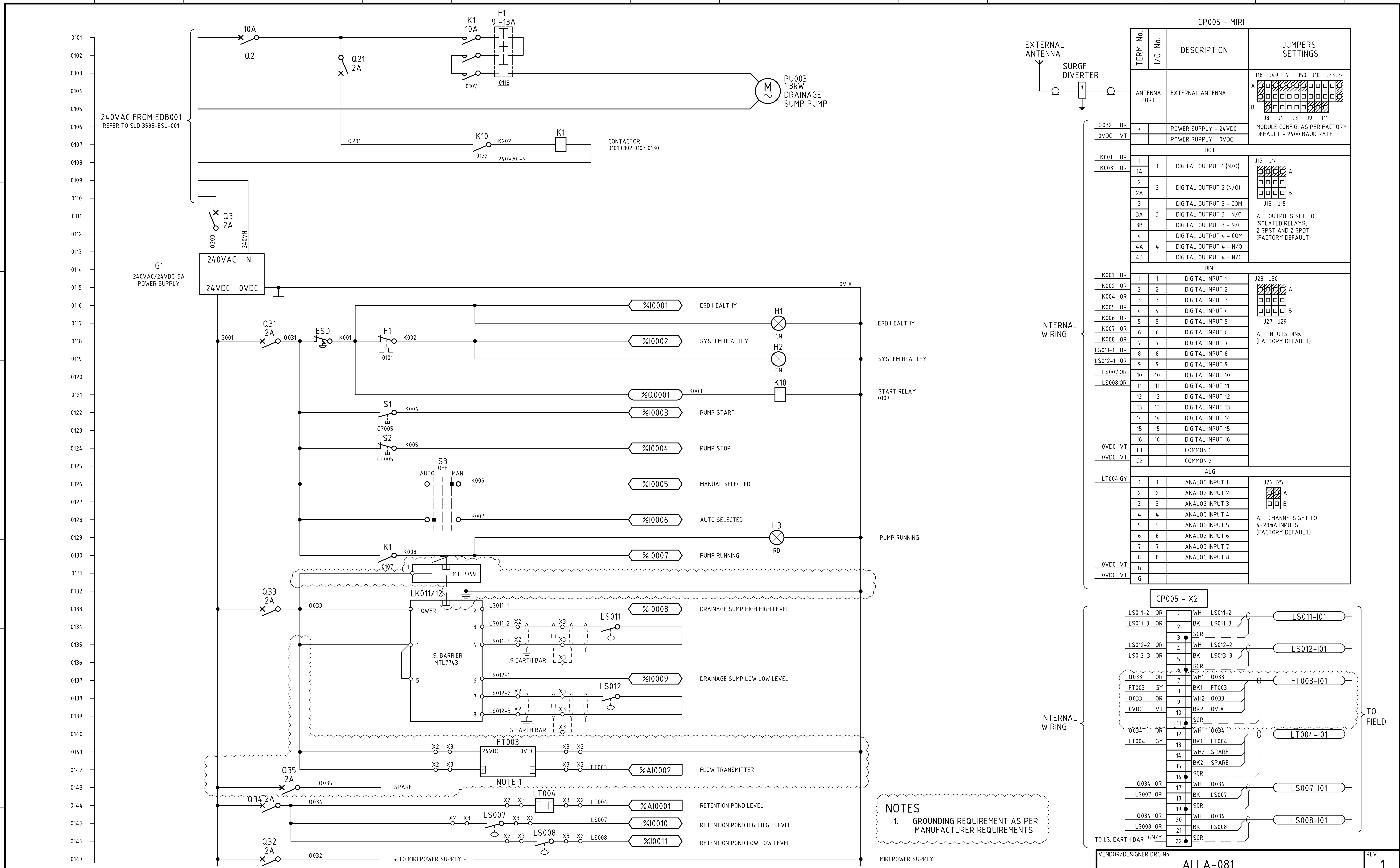
	BY	DATE
DRAWN	ABM	18.03.15
CHECKED	MG	25.03.15
DESIGNED	AS	18.03.15
CHECKED		
APPROVED	MG	31.03.15

VENDOR/DESIGNER DRG No. ALLA-080 REV. 2

TITLE
ALLAWUNA FARM LANDFILL
CELL 1 & 2 SUMP PUMP - CP003/CP006
SCHEMATIC DIAGRAM

SCALE | SHEET SIZE A1 | DRG. No. 3585- ES-001 | REV. 2

PLOT TIMESTAMP: 07.05.2015 3:13 PM



NOTES

1. GROUNDING REQUIREMENT AS PER MANUFACTURER REQUIREMENTS.

REV	BY	DATE	DESCRIPTION	CHK'D	APP'D
1	NS	07/05/15	RE-ISSUED FOR CONSTRUCTION	MG	MG
0	ABM	31/3/15	ISSUED FOR CONSTRUCTION	AS	MG

No	REF. DRG. No.	TITLE

CLIENT

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	BY	DATE
DRAWN	ABM	18.03.15
CHECKED	MG	25.03.15
DESIGNED	AS	18.03.15
CHECKED		
APPROVED	MG	31.03.15

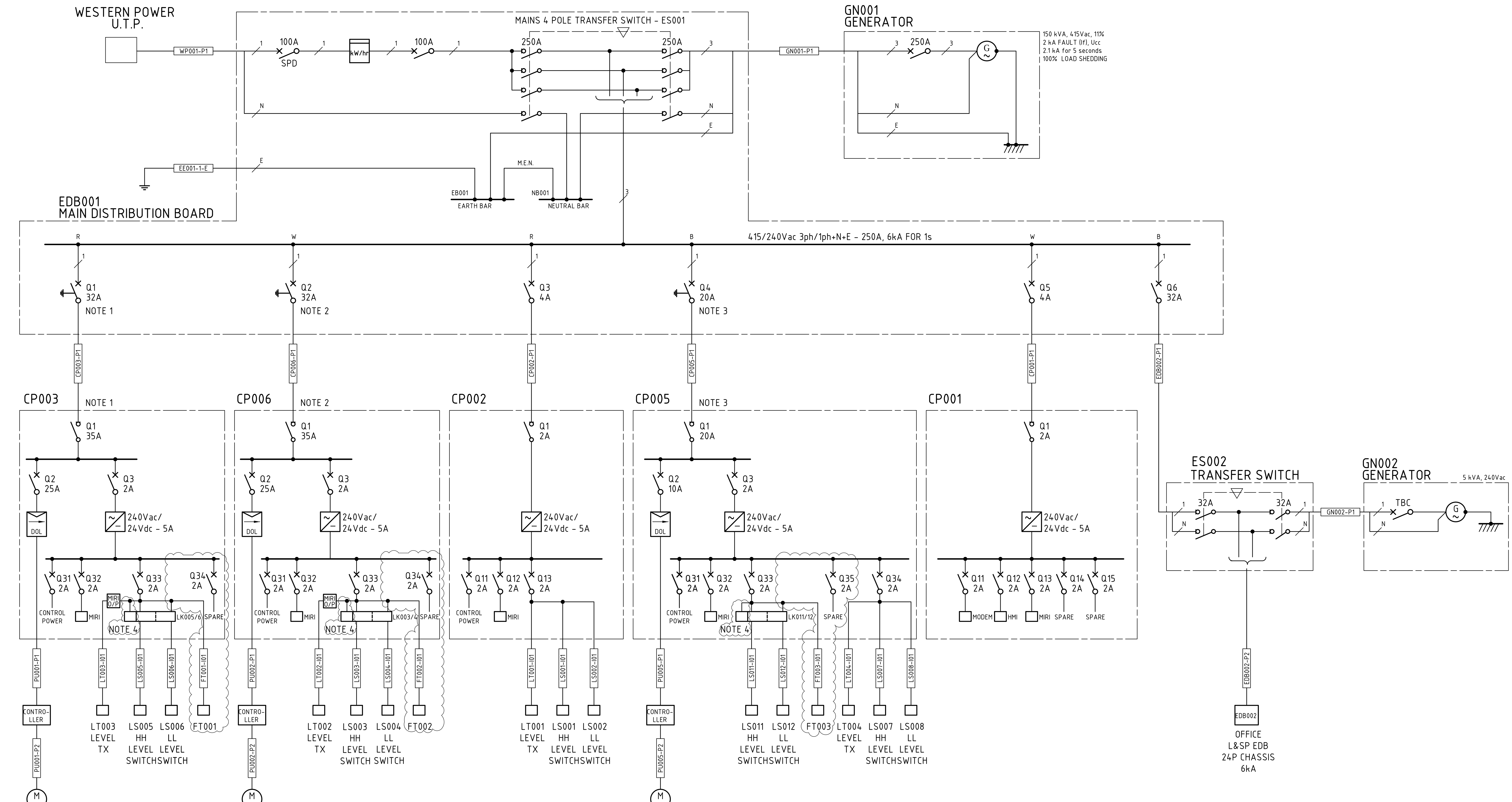
VENDOR/DESIGNER DRG No. ALLA-081 REV. 1

TITLE

ALLAWUNA FARM LANDFILL
DRAINAGE SUMP PUMP/RETENTION POND - CP005
SCHEMATIC DIAGRAM

SCALE | SHEET SIZE A1 | DRG. No. 3585- ES-002 | REV. 1

PLOT TIMESTAMP: 07.05.2015 3:13 PM



NOTES

1. INCOMER CABLE IS 70mm², INSTALL CABLE REDUCERS IF NECESSARY.
2. INCOMER CABLE IS 50mm², INSTALL CABLE REDUCERS IF NECESSARY.
3. INCOMER CABLE IS 35mm², INSTALL CABLE REDUCERS IF NECESSARY.
4. MTL7799 FOR POWERING LK005/6, LK003/4, LK011/12.

No	REF. DRG. No.	TITLE

REV	BY	DATE	DESCRIPTION	CHK'D	APP'D
2	NS	07/05/15	RE-ISSUED FOR CONSTRUCTION	MG	MG
1	NS	09/04/15	RE-ISSUED FOR CONSTRUCTION	AS	AS
0	NS	31/03/15	ISSUED FOR CONSTRUCTION	MG	AS

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	BY	DATE
DRAWN	ABM	13.03.15
CHECKED	IDP	13.03.15
DESIGNED	AS	13.03.15
CHECKED		
APPROVED	AS	31.03.15

VENDOR/DESIGNER DRG No. ALLA-070 REV. 2

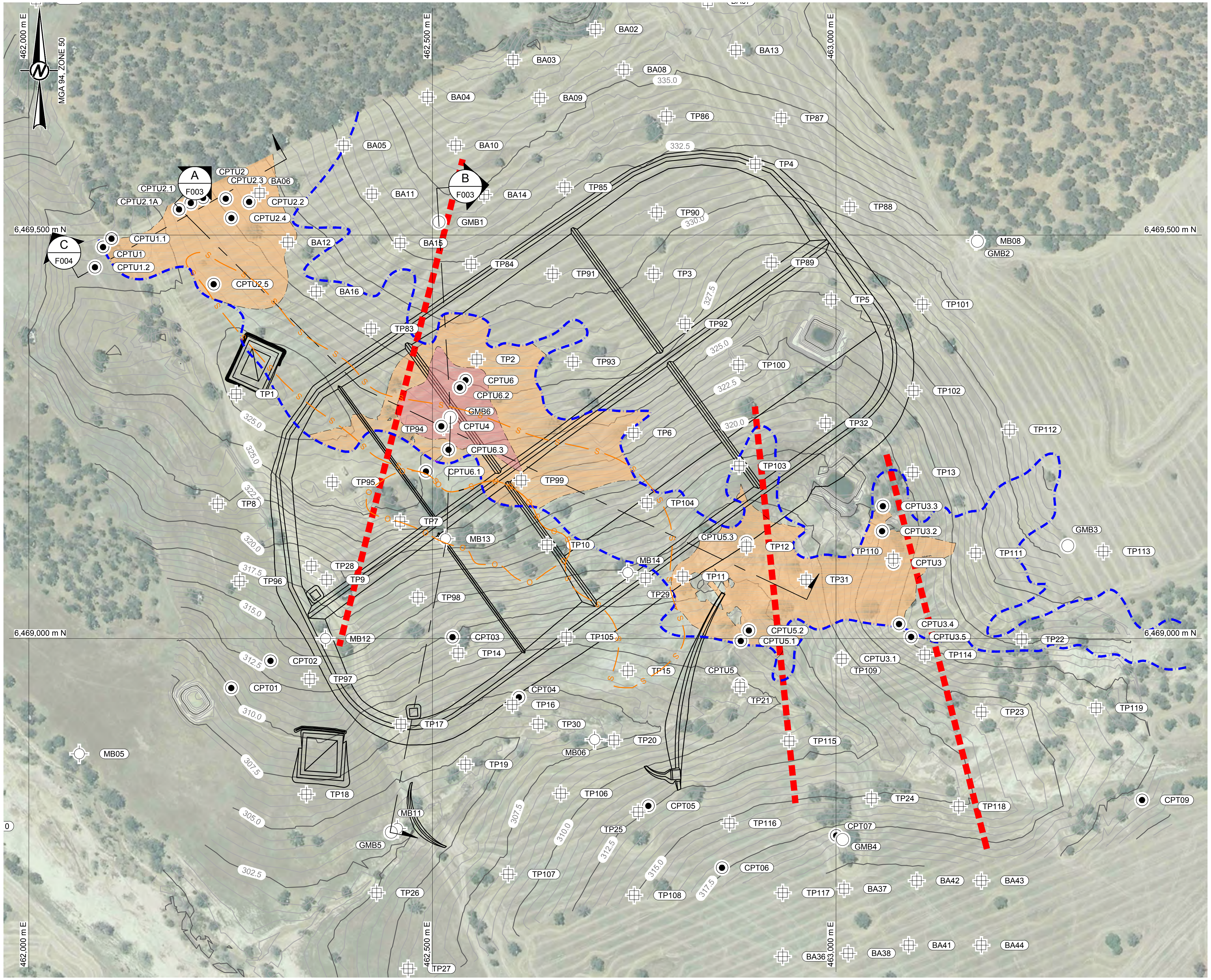
TITLE
ALLAWUNA FARM LANDFILL
SINGLE LINE DIAGRAM

SCALE	SHEET SIZE	DRG. No.	REV.
	A1	3585- ESL-001	2

PLOT TIMESTAMP: 07.05.2015 3:14 PM

ATTACHMENT E

Figures, Hydrogeology



LEGEND:

- MAGNETIC ANOMALY EXTENTS
- DYKE
- OUTCROP
- VISUALLY INTERPRETED EXTENT OF SANDIER SOIL (GOOGLE MAPS - 24/10/2013)
- SHALLOW SAND (TO BE REMOVED DURING CONSTRUCTION) (0 m > 1.5 m DEPTH)
- DEEPER SAND (PARTIALLY REMOVED DURING CONSTRUCTION) (1.5 m > DEPTH)
- EXISTING CONTOURS (1 m INTERVALS)
- TEST PIT LOCATIONS (AUG - SEPT 2014, NOV 2014, FEB 2015)
- CONE PENETRATION TEST LOCATIONS
- BOREHOLE LOCATIONS
- MONITOR WELL LOCATIONS

REFERENCE:

BASE SURVEY SHOWN FROM BOWMAN AND ASSOCIATES PTY LTD DRG. FILE ALLA_Survey Feature.dwg, DATED 09 SEPTEMBER 2014.

AERIAL PHOTOGRAPHY SOURCED FORM NEARMAP WEB SITE http://maps.au.nearmap.com, ACCESSED 27.01.2015.

NOTE

1. EXTENT OF THE MAGNETIC ANOMALY, DYKE, SHALLOW SAND AND DEEP SAND ARE APPROXIMATE BASED ON INTERPRETATION OF THE GEOTECHNICAL INFORMATION. THE EXTENT OF ANY OF THESE FEATURES MAY VARY ON SITE.
2. THESE NOTES APPLY TO ALL PROJECT DRAWINGS IN THE SET UNLESS NOTED OTHERWISE AND SHALL BE READ IN CONJUNCTION WITH THE LETTER.
3. ALL LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM (AHD).
4. ALL CO-ORDINATES ARE IN METRES TO MAP GRID AUSTRALIA (MGA 94, ZONE 55).
5. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
6. DIMENSIONS SHALL NOT BE SCALED OFF DRAWINGS.

WORKS APPROVAL

0 100 200
1:5,000 METRES

CLIENT
SITA AUSTRALIA

PROJECT
ALLAWUNA FARM LANDFILL

CONSULTANT

Golder Associates

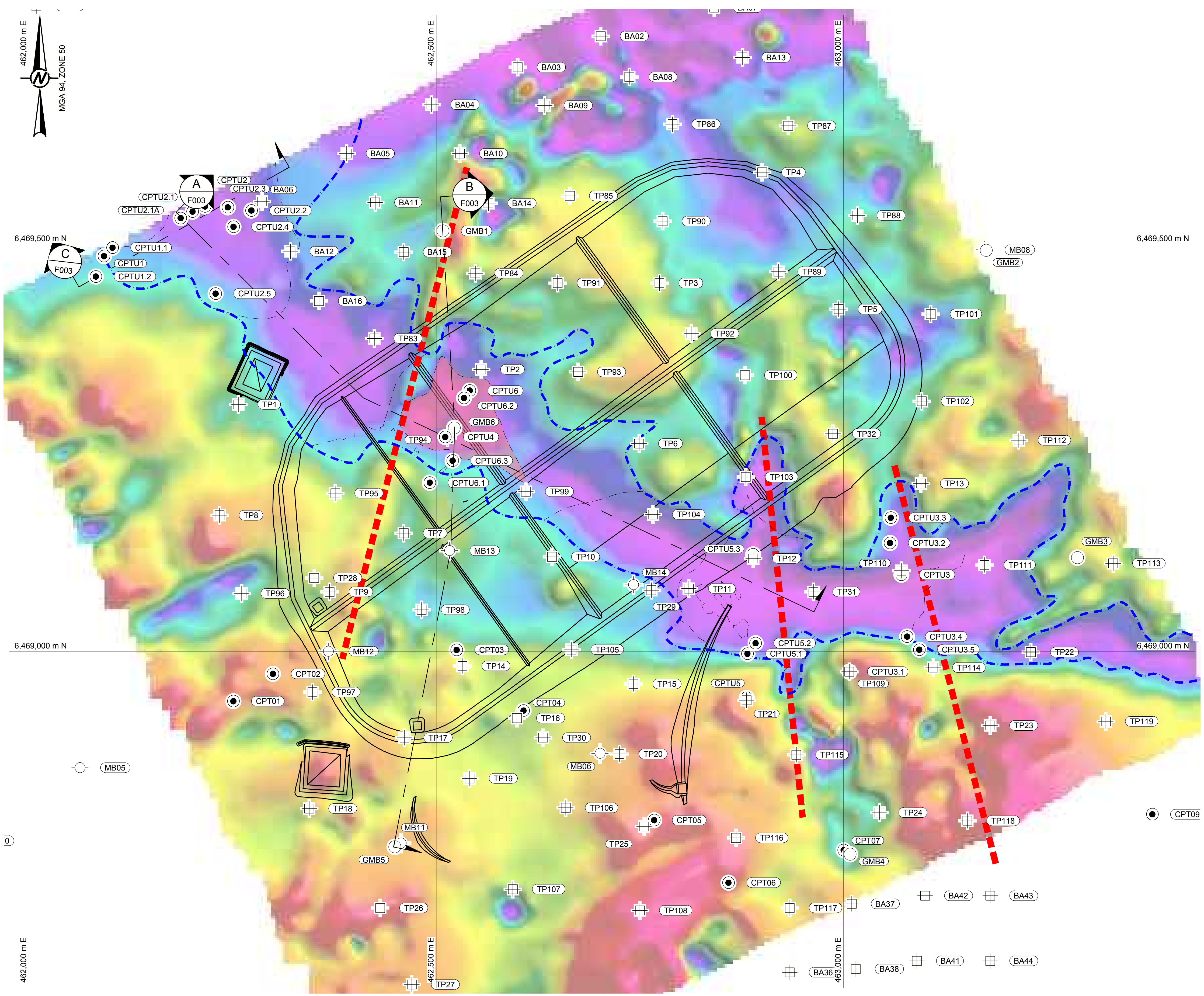
YYYY-MM-DD	2014-08-22
DESIGNED	L.DuPREEZ
PREPARED	E.KING
REVIEWED	L.DuPREEZ
APPROVED	L.DuPREEZ

TITLE
INFEERED INSITU SAND EXTENTS

PROJECT NO.	DOCUMENT NO.	REV.	FIGURE
147645033	027-L	0	F001

Path: \\GOLDER.GDS\GAP\PERTH\JOBS-MINING\Jobs414\Design\147645033 - SITA Allawuna Farm Peer Review York\CAD\FIGURES\026-L\ | File Name: 147645033-026-L-F001.dwg

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



LEGEND:

- MAGNETIC ANOMALY EXTENTS
- DYKE
- TEST PIT LOCATIONS (AUG - SEPT 2014, NOV 2014, FEB 2015)
- CONE PENETRATION TEST LOCATIONS
- BOREHOLE LOCATIONS
- MONITOR WELL LOCATIONS

NOTE

1. EXTENT OF THE MAGNETIC ANOMALY, DYKE, SHALLOW SAND AND DEEP SAND ARE APPROXIMATE BASED ON INTERPRETATION OF THE GEOTECHNICAL INFORMATION. THE EXTENT OF ANY OF THESE FEATURES MAY VARY ON SITE.
2. THESE NOTES APPLY TO ALL PROJECT DRAWINGS IN THE SET UNLESS NOTED OTHERWISE AND SHALL BE READ IN CONJUNCTION WITH THE LETTER.
3. ALL LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM (AHD).
4. ALL CO-ORDINATES ARE IN METRES TO MAP GRID AUSTRALIA (MGA 94, ZONE 55).
5. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
6. DIMENSIONS SHALL NOT BE SCALED OFF DRAWINGS.

WORKS APPROVAL

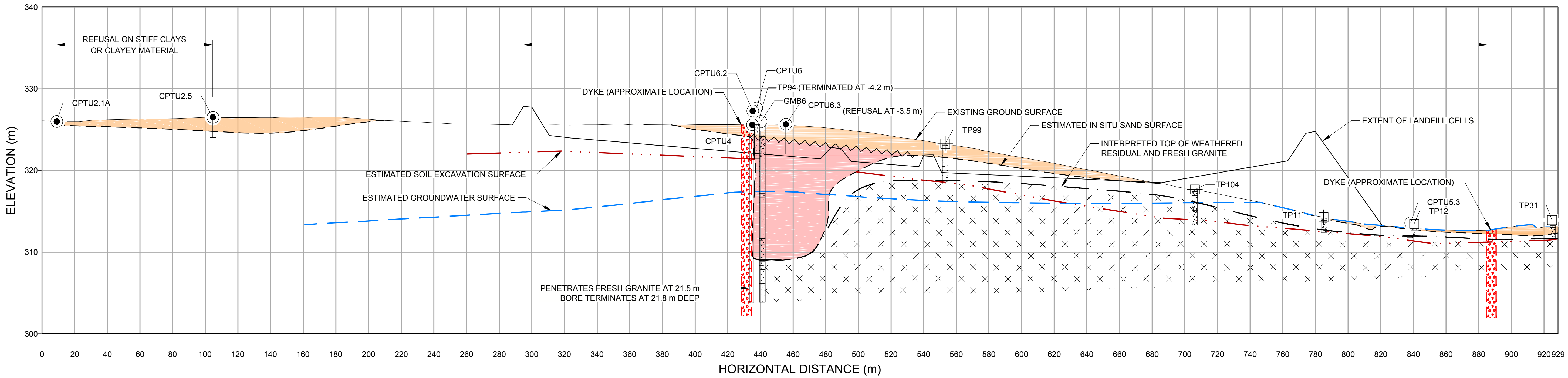
0 100 200
1:5,000 METRES

CLIENT SITA AUSTRALIA		PROJECT ALLAWUNA FARM LANDFILL	
CONSULTANT Golder Associates	YYYY-MM-DD: 2014-08-22 DESIGNED: L.DuPREEZ PREPARED: E.KING REVIEWED: L.DuPREEZ APPROVED: L.DuPREEZ	TITLE **MAGNETIC INTENSITY SURVEY**	
		PROJECT NO.: 147645033 DOCUMENT NO.: 027-L	REV.: 0 FIGURE: F002

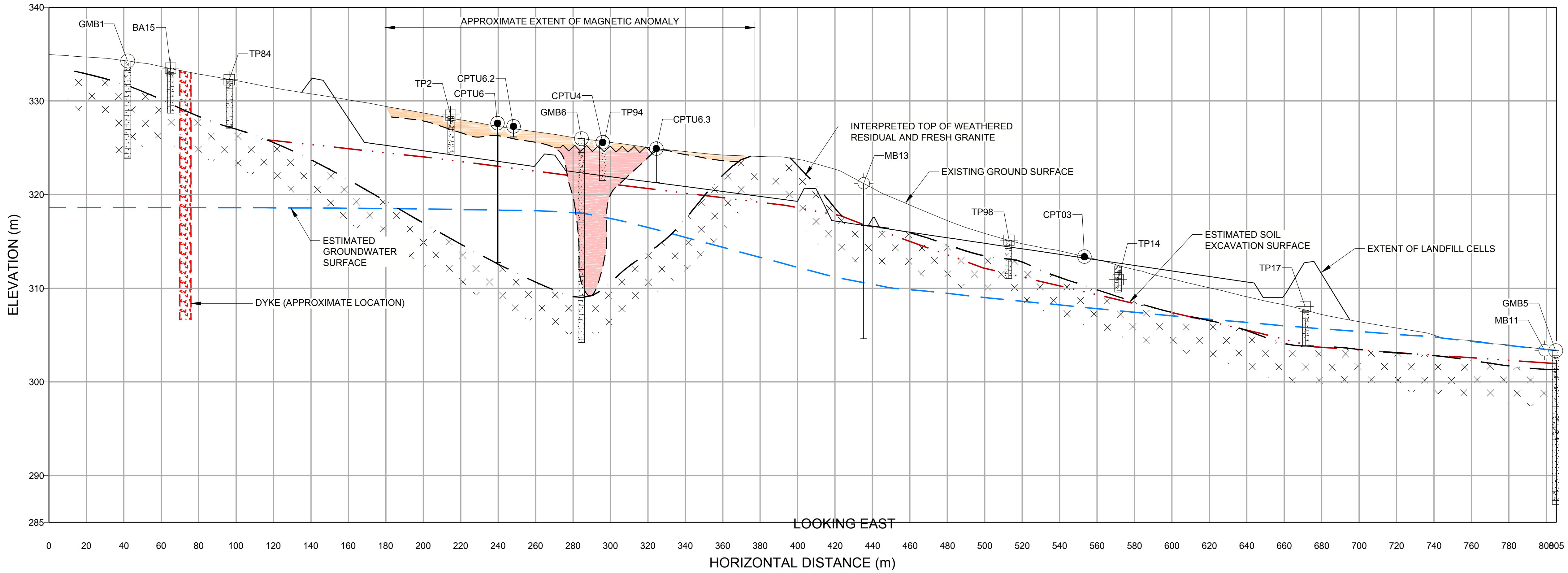
Path: \\GOLDER.GDS\GAP\PERTH\JOBS-MINING\Jobs414\Design\147645033 - SITA Alluvuna Farm Peer Review York\CAD\FIGURES\026-L\ | File Name: 147645033-026-L-F002.dwg

25 mm

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



HOR. SCALE 1:2,500
VERT. SCALE 1:500
A
F001
TYPICAL SECTION
LOOKING NORTH



HOR. SCALE 1:2,500
VERT. SCALE 1:500
B
F001
TYPICAL SECTION

0 10 20
1:500 METRES

0 50 100
1:2,500 METRES

LEGEND:

- SHALLOW SAND (TO BE REMOVED COMPLETELY DURING CONSTRUCTION) (0 m > 1.5 m DEPTH)
- DEEPER SAND (PARTIALLY REMOVED DURING CONSTRUCTION) (1.5 m > DEPTH)
- WEATHERED RESIDUAL OR FRESH GRANITE
- TEST PIT LOCATIONS (AUG - SEPT 2014, NOV 2014, FEB 2015)
- CONE PENETRATION TEST LOCATIONS
- BOREHOLE LOCATIONS
- MONITOR WELL LOCATIONS

WORKS APPROVAL

NOTE

1. EXTENT OF THE MAGNETIC ANOMALY, DYKE, SHALLOW SAND AND DEEP SAND ARE APPROXIMATE BASED ON INTERPRETATION OF THE GEOTECHNICAL INFORMATION. THE EXTENT OF ANY OF THESE FEATURES MAY VARY ON SITE.

CLIENT
SITA AUSTRALIA

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-08-22
DESIGNED	L.DuPREEZ
PREPARED	E.KING
REVIEWED	L.DuPREEZ
APPROVED	L.DuPREEZ

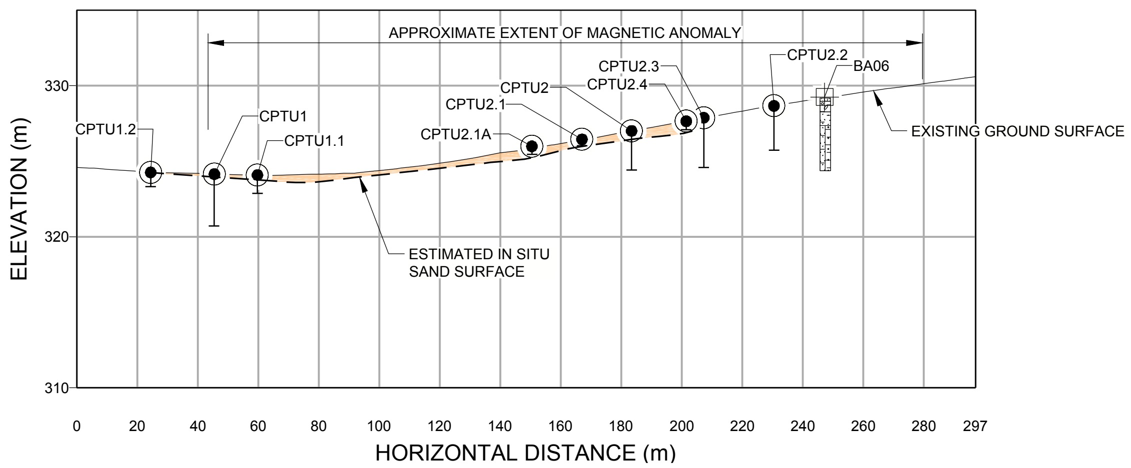
PROJECT
ALLAWUNA FARM LANDFILL

TITLE
TYPICAL INTERPRETIVE SECTIONS SHEET 1 OF 2

PROJECT NO.	DOCUMENT NO.	REV.	FIGURE
147645033	027-L	0	F003

Path: \\GOLDER.GDS\GAP\PERTH\JOBS-MINING\Jobs414\Design\147645033 - SITA Allawuna Farm Peer Review York\CAD\FIGURES\026-L\ | File Name: 147645033-026-L-F001.dwg

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



HOR.SCALE 1:2,500 | VERT. SCALE 1:500 — C / F001 — TYPICAL SECTION LOOKING NORTH WEST

LEGEND:

- SHALLOW SAND (TO BE REMOVED COMPLETELY DURING CONSTRUCTION) (0 m > 1.5 m DEPTH)
- DEEPER SAND (PARTIALLY REMOVED DURING CONSTRUCTION) (1.5 m > DEPTH)
- GRANITE
- TEST PIT LOCATIONS (AUG - SEPT 2014, NOV 2014, FEB 2015)
- CONE PENETRATION TEST LOCATIONS

NOTE

1. EXTENT OF THE MAGNETIC ANOMALY, DYKE, SHALLOW SAND AND DEEP SAND ARE APPROXIMATE BASED ON INTERPRETATION OF THE GEOTECHNICAL INFORMATION. THE EXTENT OF ANY OF THESE FEATURES MAY VARY ON SITE.

WORKS APPROVAL

0 10 20 — 1:500 METRES
0 50 100 — 1:2,500 METRES

CLIENT
SITA AUSTRALIA

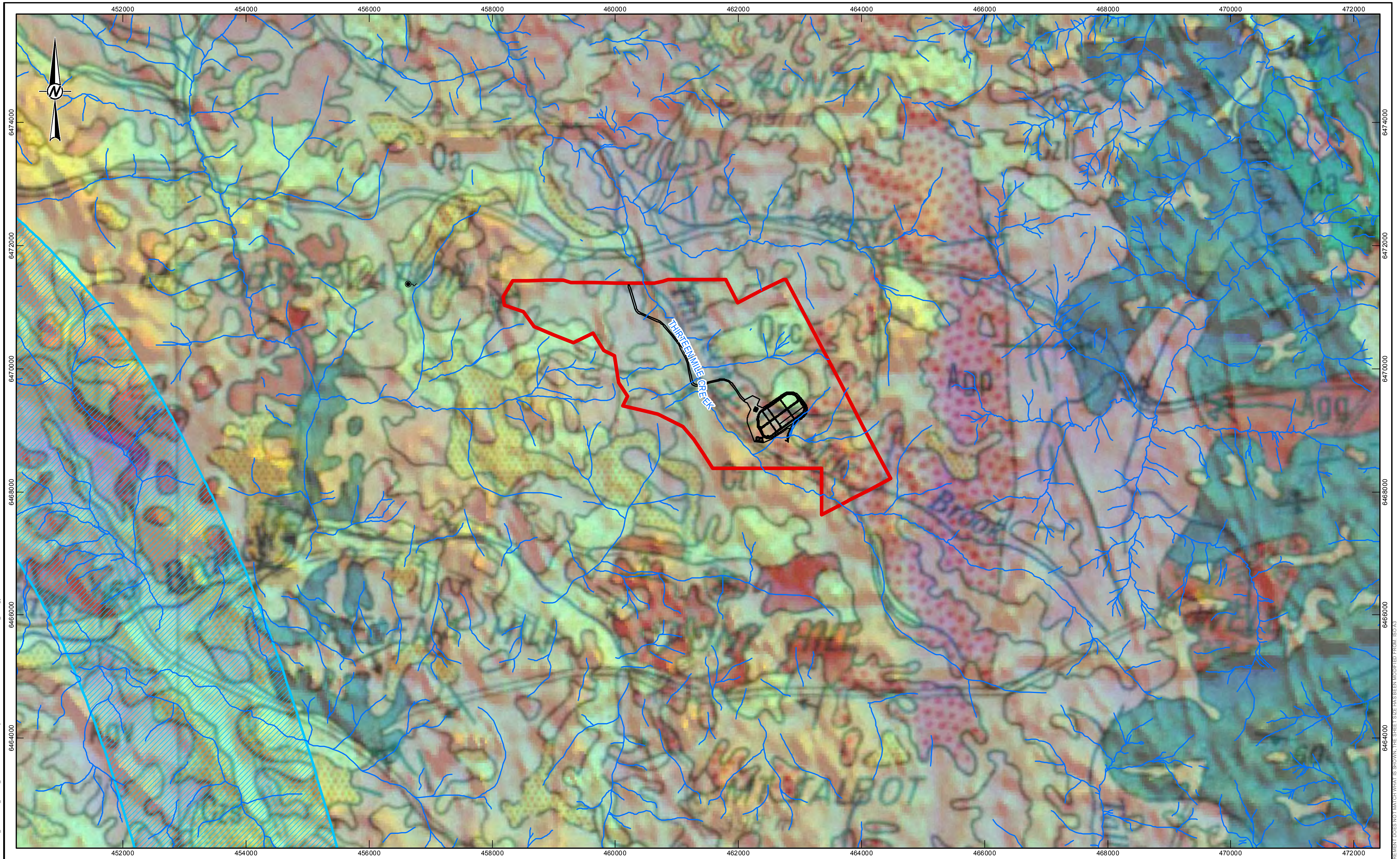
PROJECT
ALLAWUNA FARM LANDFILL

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-08-22
DESIGNED	L.DuPREEZ
PREPARED	E.KING
REVIEWED	L.DuPREEZ
APPROVED	L.DuPREEZ

TITLE
TYPICAL INTERPRETIVE SECTIONS
SHEET 2 OF 2

PROJECT NO.	DOCUMENT NO.	REV.	FIGURE
147645033	027-L	0	F004



LEGEND

- MANYUERING SPRING
- LANDFILL DESIGN
- WATERCOURSE
- SITE LOCATION
- AVON PALAEOVALLEY

NOTES

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

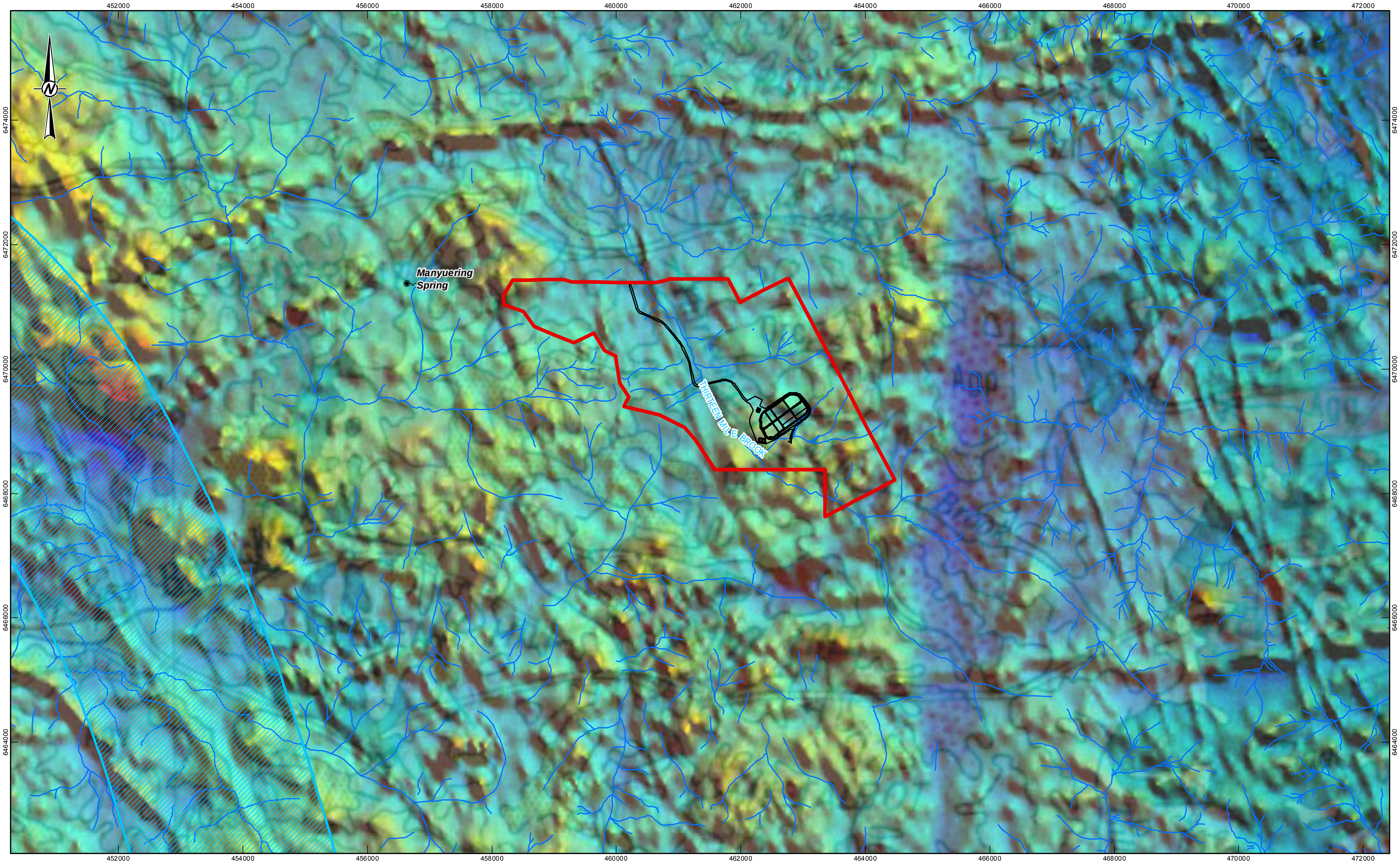
REFERENCE

GEOLOGY MAP, PERTH SHEET SH 5014 AND PART OF SH 5013 © DEPARTMENT OF MINES AND PETROLEUM.
PALAEOCHANNEL SOURCED FROM GEOSCIENCE AUSTRALIA - WASANTPALAEOVALLEYS2012.

0 570 1,140 1,710 2,280 2,850 m

1:57,079

CLIENT		PROJECT
SITA AUSTRALIA PTY LTD		ALLUWUNA FARM, YORK
CONSULTANT	YYYY-MM-DD 2015.08.10	TITLE
Golder Associates	PREPARED SAR	REGIONAL GEOLOGY
	DESIGN	
	REVIEW DMT	PROJECT No. 147645033 · CONTROL 027 L · Rev. A · FIGURE 6
	APPROVED DMT	



LEGEND

- MANYUERING SPRING
- LANDFILL DESIGN
- STREAM
- AVON PALAEOVALLEY

NOTES

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50

REFERENCE

GEOLOGY MAP, PERTH SHEET SH 5014 AND PART OF SH 5013 © DEPARTMENT OF MINES AND PETROLEUM.
PALAEOCHANNEL SOURCED FROM GEOSCIENCE AUSTRALIA - WASANTPALAEOVALLEYS2012.

0 570 1,140 1,710 2,280 2,850 m

1:57,079

CLIENT	SITA AUSTRALIA PTY LTD
PROJECT	ALLUWUNA FARM, YORK
CONSULTANT	Golder Associates
YYYY-MM-DD	2015.08.10
PREPARED	SAR
DESIGN	
REVIEW	DMT
APPROVED	DMT
TITLE	TOTAL MAGNETIC INTENSITY
PROJECT No.	147645033
CONTROL	027 L
Rev.	A
FIGURE	5

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

25mm

0