18 May 2018

David Robinson
Project Manager - Works Approvals Development Assessments
EPA Victoria
200 Victoria Street
Carlton VIC 3053

Our ref: 3135300-74784
Your ref: SO1003002

Dear David

Morwell Power Station Asbestos Landfill
Section 22 Notice - 8 May 2018

A Works Approval Application (WAA) has been prepared by GHD Pty Ltd (GHD) on behalf of Energy Brix Australia Corporation Pty Ltd (In Liquidation) (EBAC), requesting approval for the establishment of an asbestos landfill at the former Morwell Power Station and Briquette Manufacturing Plant located at 412 Commercial Road, Morwell (the site).

In assessing the WAA, EPA Victoria (EPA) has requested further information from EBAC in the form of a Section 22(1) Notice dated 8 May 2018 (the Notice). The Notice requires the following further information:

1. ***Provide justification for the use of strip filter drains in the landfill cells***
   - *The use of filter strip drainage is not normally recommended in landfill cells as it does not support ongoing maintenance such as inspection and cleaning and is a higher risk of premature failure due to clogging*
2. ***Provide further justification for the substitution of the drainage layer with a soil protection layer***
   - *Please outline the OH&S risks associated with the use of the BPEM compliant aggregate layer*
   - *Outline how the build-up of leachate head will be prevented. The build-up of a leachate could comprise the integrity of the cell liner leading to failure*
   - *It is understood that over many decades that leachate collection systems could fail. Explain how the design requirement for the cell to still be able to remove liquid from the CCL surface through natural drainage alone will be met, in the event of failure of the drains*
3. ***Please provide supporting evidence that demonstrates how the deviations from the best practice design that you have proposed in your application will still achieve the objectives of the BPEM and do not increase the environmental risk***

1 Leachate generation modelling

To assist in responding to the Notice and provide further evidence of the suitability of the alterative leachate collection system design, GHD has undertaken Hydrological Evaluation of Landfill Performance (HELP) modelling to estimate leachate generation following final capping of the landfill reporting to the leachate collection system. The modelling considers rainfall, evapotranspiration and stormwater run-off. Given the base of the landfill is located a considerable distance above the groundwater table and the asbestos waste will have negligible moisture content, rainfall infiltration is considered to be the only significant source of water contributing to leachate generation. Only rain falling directly on the cap has been considered as stormwater run on will not occur due to the shape (ie. doming) of the final cap.

The following modelling methodology has been undertaken:

- Gather climate data for the site
- Undertake HELP modelling to estimate infiltration of rainfall through the final cap
- Estimate landfill leachate generation reporting to the leachate collection system

1.1 Climate data

GHD has gathered a comprehensive set of daily climate data to represent the site. Patched point data was collated by SILO, an enhanced climate data bank hosted by The Science Delivery Division of the Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA). Patched point data uses real historical data, where available, and patches missing or suspect data with interpolated data.

Data from the Morwell (Latrobe Valley Airport) BOM weather station (number 85280), latitude -38.21 longitude 146.47) was utilised for the years 1984 to 2017. This weather station is closest to the site, at approximately 7 km north-east of the BOM weather station.

An assessment of the SILO daily rainfall data was undertaken to identify years which approximately represent median rainfall and two consecutive wet rainfall years 90th percentile rainfall years) in accordance with the suggested measure of the BPEM to model leachate treatment facilities to ensure that they have sufficient capacity to store and treat all leachate generated over two consecutive wet years.

Table 1 below summarises the rainfall and evaporation information for the median and consecutive 90th percentile rainfall years. These years (2010, 2011 and 2012) have been utilised in the modelling of leachate generation.

Table 1 Summary of rainfall and evaporation data for median and 90th percentile rainfall years

Year	Statistic	Total rainfall (mm)	Evaporation (mm)
2010	Median	771	1206
2011	Consecutive 90th percentile	954	1118
2012	Consecutive 90th percentile	900	1241

1.2 Final cap profile

The HELP model is based on the final cap profile shown in Table 2 (from top to bottom). The cap profile is in accordance with the WAA. The total area of the final cap was rounded-up to 4.5 hectares.

Table 2 Final cap profile

Layer	HELP default soil type*	Thickness (m)	Hydraulic conductivity (m/sec)
Topsoil	Silty loam	0.1	1.9×10^{-6}
Subsoil	Silty clay loam	0.5	4.2×10^{-6}
Compacted clay	Clay	0.5	1.0×10^{-9}
Daily cover material	Silty clay loam	0.3	4.2×10^{-6}
Note: *As per USDA soil texture triangle			

1.3 Results of HELP modelling

The annual volume of rainfall infiltrating the final cap for the median rainfall year and two consecutive 90th percentile rainfall years is shown in Table 3. To account for seepage through the base of the landfill and therefore not reporting to the leachate collection system, 1000 L/ha/day has been deducted from the rainfall infiltration rate estimated by HELP. This is the BPEM required outcome maximum seepage rate through a Type 3 cell liner. The annual volume of accumulated leachate reporting to the leachate collection system (i.e. rainfall infiltration less seepage) is also presented in Table 3.

Table 3 Leachate generation modelling results

Year	Volume of rainfall infiltrating the final cap (m^3)	Accumulated leachate (m^3)	Percentage of rainfall infiltration (%)
2010 (median rainfall)	211	48	1.45
2011 (consecutive 90th percentile)	256	92	2.67
2012 (consecutive 90th percentile)	256	92	3.13

The HELP modelling results indicate that minimal volumes of leachate will accumulate in the cell overtime, minimising the potential for leachate head to build-up on the liner.

A summary of the HELP input and outputs is presented in Attachment 1 and summary of the interpreted results is presented in Attachment 2.

2 Item 1 – Leachate strip filter drains

The decision was made to use prefabricated strip filter drains for two main reasons:

- Strip filter drains will be more cost effective and easy to install then HDPE pipes due to the small size of the landfill. HDPE pipes are purchased in rolls and due to the small size of the landfill a surplus of pipes would remain at the end of construction. Therefore the prefabricated strip filter drains will minimise material wastage during construction as the drains will be prefabricated to meet the cell design.
- Strip filter drains provide better drainage than HDPE pipe as the open area for water collection is 65-80% compared to 3-5% in perforated HDPE pipe. Consequently they collect a higher volume of water and provide more efficient drainage.

EPA has suggested that strip filter drains do not support ongoing maintenance such as inspection and cleaning and is a higher risk of premature failure due to clogging.

In regards to clogging, the strip filter drains are wrapped in a strong non-woven, high flow geotextile sock that allows water to pass into the core while preventing soil particles blocking the core and reducing the flow. EPA has suggested that the geotextile socks may become clogged over time. GHD notes that in BPEM designed leachate collection systems a required outcome is for a drainage geotextile to be placed over the aggregate drainage layer, which would also be subject to clogging over time. We contend that should the strip filter drain become clogged due to geotextile sock, then leachate can continue to be effectively collected and recovered via the 150 mm layer of aggregate piled over the drain. However, if the geotextile over the aggregate drainage layer was to be blocked then leachate would build up above the layer and not report (or more likely not effectively report) to the leachate recovery sump. The Technical Specifications for the landfill propose that the Contractor prepare a WMS for the placement of aggregate to prevent any damage to the drains. Additionally, the landfill will only be accepting asbestos and other inert material such as bricks and steel adhered to asbestos gaskets and therefore leachate generated in the landfill will be low in suspended solids, further minimising the risk of the drains clogging.

GHD notes that the filter drains cannot be jetted with water as per HDPE pipes to remove a build-up of material that could potentially occur overtime. However, GHD considers that the most important period for the drains to operate at maximum capacity is during the operational period of the landfill. The maximum operating life of the landfill is estimated to be two years. As mentioned above, the filter strip drains will provide better drainage than HDPE pipe during this period due to a significantly greater open area for water collection. At the end of the operational life, the last cell will be capped and the entire cap will then be vegetated. Following final capping the leachate generation in the landfill is estimated to be minimal as discussed in Section 1.

Filter strip drains are commonly used for a wide range of civil engineering projects requiring long term seepage collection. We therefore contend that for the proposed asbestos landfill the strip filter drain provides superior long term performance in terms of leachate collection efficiency than the Landfill BPEM design.

3 Item 2 – Alternative leachate collection system

3.1 OH&S risks

EPA has requested further information on the OH&S risks associated with installing a BPEM compliant aggregate layer. During GHD's Safety in Design review process operational safety risks were identified associated with placement of asbestos waste in the cells.

As discussed in the WAA, placement of asbestos will occur through using a 4WD forklift to unload pallets (holding the asbestos) from a flat-bed truck and then placed in the cell. Stacking of pallets will be undertaken to fill the cell to the required fill height. Placement of gravel aggregate across the entire cell floor will present an operational safety risk as this will result in the forklift driving on top of the coarse, unstable aggregate. The consequence of this risk may result in spillage of asbestos material from the pallets being carried by the forklift potentially leading to liberation of asbestos fibres if the plastic wrapping is punctured. Another consequence, albeit less likely, could be that the forklift tips over on the unstable surface potentially leading to injury to the operator. For a municipal waste landfill, this risk is less likely to result in an incident as waste is commonly spread and compacted across the aggregate drainage layer in a fan arrangement across the landfill cell in order to avoid heavy plant trafficking directly on the layer. Clearly, trafficking of asbestos waste is not permitted due to the risk of asbestos fibre liberation.

Eliminating exposure to hazards is universally recognised as the highest or most preferred control in the hierarchy of hazard control. Eliminating the hazard of asbestos fibres being liberated or a forklift tipping over by providing a stable platform on which to operate therefore represents a higher control than putting in place administrative/management controls to reduce the likelihood of these incidents occurring and hence hazard.

While we appreciate that OH&S risk does not fall within EPA's jurisdiction, it is a key legislative responsibility for landfill designers. It is this responsibility which drives the alternative design proposed.

3.2 Leachate collection system failure

EPA has requested further information on how the build-up of leachate head will be prevented to avoid comprising the integrity of the cell liner leading to failure as it is understood that over many decades that leachate collection systems could fail. EPA has requested that an explanation is provided on how the design requirement for the cell to still be able to remove liquid from the CCL surface through natural drainage alone will be met, in the event of failure of the drains.

The WAA outlines the leachate collection, storage and disposal procedures to maintain a maximum leachate head of 300 mm in the cells during the operation and post-closure stages of the landfill. If the leachate collection system were to fail over a long period of time the cell floor is sloped at 3% in east to west direction and 1% in south to north direction towards the leachate sumps. Therefore leachate will drain via gravity to the sumps. As mentioned in section 2, the aggregate piled over the strip drains will continue to effectively act as a conduit to enable leachate to drain to the leachate sumps. Additionally, the spacing of the strip drains will be 10 m, which is less than the Landfill BPEM recommended leachate pipework spacing of 25 m. Therefore, two strip drains will be installed in each sub-cell, which will reduce the risk of the failure of the entire leachate drainage system.

HELP modelling of leachate generation following capping is provided in Section 1, which indicates following final capping the leachate generation in the landfill will be minimal, between 1.5 to 3.0% of incident rainfall. Considering the small volumes of leachate that will accumulate in the landfill cell and that leachate will continue to be extracted from the leachate sumps in the aftercare period it is expected that leachate head will be maintained at very low levels and less than 300 mm.

4 Item 3 – Environmental risk assessment

EPA has requested supporting evidence that demonstrates how the deviation from the best practice design that is proposed in the application will still achieve the objectives of the BPEM and do not increase the environmental risk.

The BPEM specifically outlines the following in relation to alternative designs achieving the objectives and required outcomes:

These guidelines are intended to be used as a default position for landfill siting, design, operation and rehabilitation. Landfill operators must meet the objectives and required outcomes by implementing the relevant best-practice measures, described as suggested measures, contained herein.

Where a landfill operator believes that, for a particular section of the guidelines, alternative means can achieve the objectives and required outcomes, a risk-based assessment will be required to support the proposed alternative measure. Alternatively, if EPA believes that additional requirements are needed to protect the environment, then this will also be supported by a risk based assessment.

The alternative leachate collection system design proposed in the WAA does not meet the following required outcomes of the BPEM:

- Drainage layer to be at least 0.3 metres thick with a hydraulic conductivity of not less than 1×10^{-3} m/s.
- Drainage layer extending over the entire base of the landfill.

Therefore a risk assessment has been conducted following the general method in Appendix 2 of EPA Publication 1323.3. Risks have been assessed for both a Type 3 BPEM compliant leachate collection system and the alternative design proposed in the WAA. The methodology of the risk assessment is outlined below and results of the risk assessment are presented in Table 7.

4.1 Likelihood descriptors

Table 4 lists the likelihood categories devised for assessing risks to the environment for the landfill. The descriptors adopted for this risk assessment are similar to the descriptors set out in EPA Publication 1321.2, with the revisions having the intention of providing greater clarity with regard to this assessment and reducing the potential for overlap.

The likelihood rankings are limited to “highly unlikely”; where it is considered implausible that an adverse effect would occur the situation is not considered further.

Table 4 Qualitative measure of likelihood

Rating	Descriptor	Description
A	Certain	The event is occurring or will occur
B	Likely	It is likely but not certain that the event will occur
C	Possible	It is possible that the event may occur, although it is also possible that it will not occur
D	Unlikely	It is unlikely that the event will occur, although it is possible it may occur
E	Highly Unlikely	It is highly unlikely that the event will occur; it would only occur in exceptional or unforeseen circumstances

4.2 Consequence descriptors

The consequence descriptors in EPA Publication 1321.2 are generic and applicable to all EPA licensed sites, including activities or operations other than landfills. For the purposes of assessing risk for the project site and the surrounding area, the descriptors have been revised to better consider the range of impacts that can occur from the landfill, with reference to the various most relevant segments of the environment and pathways for impact, and the various regulatory requirements, policies and guidance documents. The latter include:

- AS/NZS ISO 31000:2009 – Risk Management: Principles and Guidelines
- EPA Publication 1321.2 – Licence Assessment Guidelines
- Victorian State Environment Protection Policy for Ambient Air Quality (SEPP AAQ), 1999
- EPA Publication 788.3: Best Practice Environmental Management Siting, Design, Operation and Rehabilitation of Landfills, 2015

The revised descriptors adopted for this risk assessment are listed in Table 5.

Table 5 Qualitative measure of consequence / impact

Level	Descriptor	Event Description
1	Catastrophic	Significant impact to the wider community / serious side effects to persons, or long-term environmental damage / serious effects on beneficial uses with environmental impact within and beyond site-boundary; site shutdown and/or immense financial loss
2	Significant	Significant impact on local community / evacuation of local populace / medical treatment required, or medium to long-term environmental damage or serious effects on beneficial uses with environmental impact within and beyond site boundary; extensive clean-up with external assistance required and major financial loss
3	Moderate	Some impact upon staff or short term environmental damage on site or minor short term environmental damage off site; external complaints (greater than 3 per year); minimal clean-up required and large financial loss

Level	Descriptor	Event Description
4	Minor	Minor effect on a small number of staff; minor environmental damage; no distinguishable off-site effects; occasional external complaints (less than 3 per year); minimal financial costs
5	Negligible	No impact expected, or minor impact contained within site and requires no action; no off-site effects

4.3 Risk matrix and risk ratings

Table 6 presents the risk matrix adopted for this assessment. The matrix has been based on the EPA risk matrix presented in Publication 1321.2, and has been revised to result in risk rankings that reflect the level of risk expected to result from the various combinations of likelihood and consequence relevant to the landfill.

In reviewing and adjusting the EPA matrix, the following considerations applied:

- Where the likelihood of an event (consequence) occurring is considered to not be plausible, this will not be considered
- Where consequences are considered to be "negligible", the risk is ranked as "low" regardless of the likelihood
- Where consequences are considered to be "catastrophic", the risk is ranked as "very high" if this is judged to be "certain" or "likely"; "high" if this is judged to be "possible" or "unlikely" and "medium" if it is judged to be "highly unlikely" (but plausible)

Table 6 Risk Matrix

Consequence		Likelihood				
		A	B	C	D	E
		Certain	Likely	Possible	Unlikely	Highly Unlikely
1	Catastrophic	V	V	H	H	M
2	Significant	V	H	H	M	M
3	Moderate	H	H	M	M	L
4	Minor	M	M	M	L	L
5	Negligible	L	L	L	L	L

The following definitions of risk ratings are applied:

- V – Very high risk, immediate action required involving evacuation (if residential properties are established) and invoking state emergency response
- H – High risk, immediate action required by site management
- M – Medium risk, management action required

- L – Low risk, manage with standard operational procedures

4.4 Results

Risks are assessed in Table 7 for a Type 3 BPEM liner and leachate collection system and the alternative design proposed in the WAA.

Table 7 Risk assessment of non-compliance with BPEM required outcomes for liner and leachate collection system compliance

No.	Relevant BPEM required outcome	Potential pathway and impact to receptors (if required outcome is not achieved)	Control measures	C	L	BPEM design risk	C	L	WAA design risk	Alternative design comment
1	Design and construction of the best liner and leachate collection system practicable to prevent contamination of groundwater	Liner and leachate system not fit for purpose leads to excessive leachate seepage through cell liner impacting groundwater beneficial uses	The landfill will only be licensed to accept asbestos (Class I and Class II) To minimise the risk of non-scheduled wastes being disposed in the landfill, an inspection protocol will be implemented to ensure only scheduled wastes are disposed of at the landfill PIW other than asbestos or putrescible waste will not be disposed in the landfill Asbestos gaskets that contain residual hydrocarbons will be cleaned in a bunded area prior to disposal in the landfill The landfill will have a compacted clay liner and leachate drainage system minimising the potential for seepage of leachate to the groundwater beneath the landfill Leachate will be managed in accordance with the Landfill BPEM, as described in Section 4.8.5 of the WAA Groundwater and leachate monitoring will be undertaken as described in Section 4.14 of the WAA	5	D	L	5	D	L	WAA concept design is compliant with the BPEM required outcome. **Risk is equivalent.**
2	Type 3 liner uses best available technology to control seepage to an amount not exceeding 1000 L/ha/day	Seepage greater than 1000 L/ha/day leads to impact to groundwater beneficial uses		5	D	L	5	D	L	WAA concept design is compliant with the BPEM required outcome. The Type 3 liner will meet the seepage requirement to not exceed 1000 L/ha/day. **Risk is equivalent.**
3	Implementation of the best practicable measures to meet all groundwater quality objectives contained in SEPP (Groundwaters of Victoria) below the landfill liner	Best practicable design measures for cell liner and leachate collection systems are not implemented, which leads to impacts to groundwater beneficial uses		5	D	L	5	D	L	WAA concept design is compliant with the BPEM required outcome. **Risk is equivalent.**
4	Design and construction of the most robust liner and leachate collection system to ensure that the system will continue to achieve the objective in the event of several components of the system failing	Failure of components of the liner and leachate collection system or failure of the entire system over several decades leads to a build-up of leachate head on the cell liner or in extreme cases liner failure resulting in increased leachate seepage and impact to groundwater beneficial uses		5	D	L	5	D	L	The most important period for the leachate collection system to operate at maximum capacity is during the operational period of the landfill. The maximum operating life of the landfill is estimated to be two years. As mentioned previously the filter strip drains will provide better drainage than HDPE pipes during the landfill operational period as the open area for water collection is 65-80% compared to 3-5% in perforated HDPE pipe. At the end of the operational life, the last cell will be capped and the entire cap will then be vegetated. Following final capping the leachate generation in the landfill will be minimal as discussed in Section 1. Additionally, the spacing of the strip drains (200 mm x 40 mm) have been included within the design of each sub-cell at 10 m spacing, which is less than the

No.	Relevant BPEM required outcome	Potential pathway and impact to receptors (if required outcome is not achieved)	Control measures	C	L	BPEM design risk	C	L	WAA design risk	Alternative design comment
			A separation distance of 11 m exists between the base of the landfill and the groundwater table. Asbestos and the other solid inert material to deposited have a very low leachability.							Landfill BPEM recommended leachate pipework spacing of 25 m. Therefore, installation of two strip drains in each of the sub-cells which will reduce the environmental risk in the event of several components of the system failing. To prevent clogging and to prevent trafficking directly over the strip drains, the drains will be covered by a 150 mm layer of aggregate. Additionally, the landfill will only be accepting asbestos and other inert material such as bricks and steel adhered to asbestos gaskets and therefore leachate generated in the landfill will be low in suspended solids further minimising the risk of the drains clogging. **Risk is equivalent.**
5	The maximum leachate head on the liner surface not to exceed 0.3 m	Failure of leachate collection system in the sub-cells leads to a build-up of leachate in portions of the sub-cells exceeding 0.3 m Leachate is not extracted from the sump resulting in a build-up of leachate in the sumps and sub-cells exceeding 0.3 m		5	D	L	5	D	L	The WAA outlines the leachate collection, storage and disposal procedures to maintain a leachate head of 0.3 m in the cells during the operation and post-closure stages of the landfill. The leachate collection strip drains have been designed and spaced to ensure there is adequate capacity to accept the leachate flow. **Risk is equivalent.**
6	Drainage layer to be at least 0.3 metres thick with a hydraulic conductivity of not less than 1 x 10-3 m/s Drainage layer extending over the entire base of the landfill	Failure of the leachate collection system leads to a build-up of leachate head on the cell liner or in extreme cases liner failure resulting in increased leachate seepage and impact to groundwater beneficial uses.		5	D	L	5	D	L	No drainage layer is to be placed over the entire cell base. Instead, leachate collection strip drains (overlain by protection aggregate) will be placed at 10 m intervals. Two strip drains of 200 mm x 40 mm have been included within the design of each sub-cell. The following landfill design features and operation measures will be implemented to minimise leachate generation: • Construction of an earthen bund around the perimeter of the asbestos landfill to prevent stormwater runoff from adjoining land entering the cells • The primary landfill (Cell A) to comprise four cells with a very small footprint • Each cell will be separated by an internal bund. All rain falling in a non-active cell (i.e. a cell which

No.	Relevant BPEM required outcome	Potential pathway and impact to receptors (if required outcome is not achieved)	Control measures	C	L	BPEM design risk	C	L	WAA design risk	Alternative design comment
										has not been landfilled) is considered uncontaminated and will be managed accordingly • Each cell will be filled to final height and capped before landfilling of the next cell commences • The final cap will be sloped to achieve the minimum slope recommended by the Landfill BPEM • Following final capping the leachate generation in the landfill will be minimal between 1.5 to 3.0% of rainfall • The final cap will be fully vegetated **Risk is equivalent.**
		Placement of gravel aggregate across the entire cell floor results in the forklift driving on top of the coarse, unstable aggregate potentially leading to spillage of asbestos material from the pallets being carried by the forklift and liberation of asbestos fibres if the plastic wrapping is punctured. Another consequence, albeit less likely, could be that the forklift tips over on the unstable surface potentially leading to injury to the operator.	EBAC will be employing an occupational hygienist to oversee the removal of asbestos from the Power Station and disposal of asbestos in the landfill Implementing the asbestos wrapping and landfilling procedures described in Section 4.12.2 of WAA Implementing the asbestos fibre monitoring program, which entails conducting random background fibre counts will be conducted by an independent hygiene auditor when filling of the landfill is being undertaken	3	D	M	3	E	L	A variation to placing drainage aggregate over the entire cell base is sought as it is considered the proposed design will provide a safer and more practicable solution for operation of the landfill compared to BPEM. The forklift driving on the soil protection layer and compacted layer base underneath will provide a more stable base then driving on a soil protection layer with 0.3 m of drainage aggregate underneath. **Alternative design provides a reduced risk.**

Notes:

C – Consequence, L – Likelihood

5 Conclusions

In assessing the WAA, EPA has requested further information from EBAC in the form of a Section 22(1) Notice dated 8 May 2018 relating to the alternative design proposed for the leachate collection system. GHD has performed calculations, assessments and provided further information to document why we believe the alternative design can achieve the relevant objectives and required outcomes of the Landfill BPEM and in some aspects is superior to the BPEM compliant design.

In conclusion:

- To assist in responding to the Notice HELP modelling of leachate generation following final capping is provided in Section 1. The results indicate that following final capping the leachate generation in the landfill will be minimal, between 1.5 to 3.0% of incident rainfall
- EPA has requested further justification for the use of strip filter drains in the landfill cells:
  - The basis of design for using strip drains has been provided in Section 2
  - GHD considers that in the case of the proposed asbestos landfill, strip filter drains will provide superior long term performance in terms of leachate collection efficiency than the Landfill BPEM design
- EPA has requested further information on the OH&S risks associated with installing a BPEM compliant aggregate layer:
  - Discussion of the OH&S risks is provided in Section 3
  - Placement of gravel aggregate across the entire cell floor will present an operational safety risk as this will result in the forklift driving on top of the coarse, unstable aggregate potentially leading to spillage of asbestos material from the pallets and/or liberation of asbestos fibres if the plastic wrapping is punctured
  - GHD considers that eliminating the hazard of asbestos fibres being liberated or a forklift tipping over by providing a stable platform on which to operate therefore represents a higher control than putting in place administrative/management controls to reduce the likelihood of these incidents occurring
- EPA has requested that an explanation is provided on how the design requirement for the cell to still be able to remove liquid from the CCL surface through natural drainage alone will be met, in the event of failure of the drains:
  - Discussions of the suitability and robustness of the leachate collection system is provided in Section 3
  - If the leachate collection system were to fail over a long period of time the cell floor is sloped at 3% in east to west direction and 1% in south to north direction towards the leachate sumps
  - The spacing of the strip drains will be 10 m, which is less than the Landfill BPEM recommended leachate pipework spacing of 25 m, reducing the risk of the failure of the entire leachate drainage system
  - The aggregate piled over the strip drains will continue to effectively act as a conduit to enable leachate to drain to the leachate sumps

– Considering the small volumes of leachate that will accumulate in the landfill following final capping and that leachate will continue to be extracted from the leachate sumps in the aftercare period it is expected that leachate head will be maintained at very low levels and less than 300 mm.

- EPA has requested supporting evidence that demonstrates how the deviation from the best practice design that is proposed in the application will still achieve the objectives of the BPEM and do not increase the environmental risk:
  - A risk assessment has been conducted following the general method in Appendix 2 of EPA Publication 1323.3. Risks have been assessed for both a Type 3 BPEM compliant liner and leachate collection system and the alternative design proposed in the WAA
  - The results of the risk assessment indicate for the proposed asbestos landfill an equivalent level of risk exists for a Type 3 BPEM liner and leachate collection system and the proposed alternative leachate collection system
  - Low risks were identified for proposed asbestos landfill liner and leachate collection system
  - A single medium risk was identified for the BPEM liner and leachate collection system in regards to placement of drainage across the entire cell floor leading to spillage of asbestos material from the pallets and/or liberation of asbestos fibres if the plastic wrapping is punctured. While this is OH&S related risk, we believe it is relevant to this risk assessment because landfill designers have a regulatory responsibility to consider such risks as part of the Safety in Design process.

Sincerely
GHD

Senior Environmental Engineer
+61 3 8687 8627

Attachment 1: HELP model inputs and output results

Attachment 2: Accumulated leachate generation estimates

Attachment 1

HELP model inputs and output results

****
****
** **
** **
** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE **
** **
** HELP Version 3.95 D (10 August 2012) **
** developed at **
** Institute of Soil Science, University of Hamburg, Germany **
** based on **
** US HELP MODEL VERSION 3.07 (1 NOVEMBER 1997) **
** DEVELOPED BY ENVIRONMENTAL LABORATORY **
** USAE WATERWAYS EXPERIMENT STATION **
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY **
** **
** **
****
****

TIME: 15.17 DATE: 15.05.2018

PRECIPITATION DATA FILE: G:\31\35300\Tech\Design\HELP modelling\001 Input data\HELP weat
TEMPERATURE DATA FILE: G:\31\35300\Tech\Design\HELP modelling\001 Input data\HELP wea
SOLAR RADIATION DATA FILE: G:\31\35300\Tech\Design\HELP modelling\001 Input data\HELP we
EVAPOTRANSPIRATION DATA F. 1: G:\31\35300\Tech\Design\HELP modelling\001 Input data\HELP
SOIL AND DESIGN DATA FILE 1: G:\31\35300\Tech\Design\HELP modelling\001 Input data\Cap desi
OUTPUT DATA FILE: G:\31\35300\Tech\Design\HELP modelling\002 Output data\01_Output.
DAILY OUTPUT DATA FILE: G:\31\35300\Tech\Design\HELP modelling\002 Output data\01_Outp
MONTHLY OUTPUT DATA FILE: G:\31\35300\Tech\Design\HELP modelling\002 Output data\01_O
YEARLY OUTPUT DATA FILE: G:\31\35300\Tech\Design\HELP modelling\002 Output data\01_Out

COLUMNS OF DAILY OUTPUT DATA FILE:

1 DATE (yyyymmdd)
2 AIR TEMPERATURE (* INDICATES FREEZING TEMPERATURES)
3 FROZEN SOIL STATE (* INDICATES FROZEN SOIL)
4 PRECIPITATION (MM)
5 RUNOFF (MM)
6 POTENTIAL EVAPOTRANSPIRATION (MM)
7 ACTUAL EVAPOTRANSPIRATION (MM)
8 WATER CONTENT OF THE EVAPORATIVE ZONE (MM)
9 HEAD #1: AVERAGE HEAD ON TOP OF LAYER 3 (CM)
10 LEAK #1: PERCOLATION/LEAKAGE THROUGH LAYER 3 (MM)
11 LEAK #2: PERCOLATION/LEAKAGE THROUGH LAYER 4 (MM)

COLUMNS OF MONTHLY OUTPUT DATA FILE:

1 DATE OF ULTIMO (yyyymmdd)
2 PRECIPITATION (MM)
3 RUNOFF (MM)
4 POTENTIAL EVAPOTRANSPIRATION (MM)
5 ACTUAL EVAPOTRANSPIRATION (MM)
6 HEAD #1: AVERAGE HEAD ON TOP OF LAYER 3 (CM)
7 LEAK #1: PERCOLATION/LEAKAGE THROUGH LAYER 3 (MM)
8 LEAK #2: PERCOLATION/LEAKAGE THROUGH LAYER 4 (MM)

COLUMNS OF YEARLY OUTPUT DATA FILE:

1 DATE OF ULTIMO (yyyy1231)
2 PRECIPITATION (MM)
3 RUNOFF (MM)
4 POTENTIAL EVAPOTRANSPIRATION (MM)
5 ACTUAL EVAPOTRANSPIRATION (MM)
6 LEAK #1: PERCOLATION/LEAKAGE THROUGH LAYER 3 (MM)
7 LEAK #2: PERCOLATION/LEAKAGE THROUGH LAYER 4 (MM)
8 CHANGE IN TOTAL WATER STORAGE (MM)
9 CHANGE IN SOIL WATER STORAGE (MM)
10 CHANGE IN INTERCEPTION WATER STORAGE (MM)
11 CHANGE IN SNOW WATER STORAGE (MM)
12 ANNUAL WATER BUDGET BALANCE (MM)

****

TITLE: Asbestos Landfill Rehabilitated Leachate Generation

****

WEATHER DATA SOURCES

NOTE: PRECIPITATION DATA FOR Morwell Victoria
WAS ENTERED FROM A TEXT FILE.

NOTE: TEMPERATURE DATA FOR Morwell Victoria
WAS ENTERED FROM A TEXT FILE.

NOTE: SOLAR RADIATION DATA FOR Morwell Victoria
WAS ENTERED FROM A TEXT FILE.

****

LAYER DATA 1

VALID FOR 3 YEARS

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 9
THICKNESS = 10.00 CM
POROSITY = 0.5010 VOL/VOL
FIELD CAPACITY = 0.2840 VOL/VOL
WILTING POINT = 0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1352 VOL/VOL
EFFECTIVE SAT. HYD. CONDUCT.= 0.1900E-03 CM/SEC
NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10
THICKNESS = 50.00 CM
POROSITY = 0.3980 VOL/VOL
FIELD CAPACITY = 0.2440 VOL/VOL
WILTING POINT = 0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2646 VOL/VOL
EFFECTIVE SAT. HYD. CONDUCT.= 0.1200E-03 CM/SEC

LAYER 3

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16
THICKNESS = 50.00 CM
POROSITY = 0.4270 VOL/VOL
FIELD CAPACITY = 0.4180 VOL/VOL
WILTING POINT = 0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4270 VOL/VOL
EFFECTIVE SAT. HYD. CONDUCT.= 0.1000E-06 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10
THICKNESS = 30.00 CM
POROSITY = 0.3980 VOL/VOL
FIELD CAPACITY = 0.2440 VOL/VOL
WILTING POINT = 0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2533 VOL/VOL
EFFECTIVE SAT. HYD. CONDUCT.= 0.1200E-03 CM/SEC

****

GENERAL DESIGN AND EVAPORATIVE ZONE DATA 1

VALID FOR 3 YEARS

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
SOIL DATA BASE USING SOIL TEXTURE #10 WITH A
POOR STAND OF GRASS, A SURFACE SLOPE OF 5.%
AND A SLOPE LENGTH OF 46. METERS.

SCS RUNOFF CURVE NUMBER = 90.55
FRACTION OF AREA ALLOWING RUNOFF = 100.0 PERCENT
AREA PROJECTED ON HORIZONTAL PLANE = 1.0000 HECTARES
EVAPORATIVE ZONE DEPTH = 45.0 CM
INITIAL WATER IN EVAPORATIVE ZONE = 8.612 CM
UPPER LIMIT OF EVAPORATIVE STORAGE = 18.940 CM
FIELD CAPACITY OF EVAPORATIVE ZONE = 11.380 CM
LOWER LIMIT OF EVAPORATIVE STORAGE = 6.110 CM
SOIL EVAPORATION ZONE DEPTH = 45.0 CM
INITIAL SNOW WATER = 0.000 CM
INITIAL INTERCEPTION WATER = 0.000 CM
INITIAL WATER IN LAYER MATERIALS = 43.530 CM
TOTAL INITIAL WATER = 43.530 CM
TOTAL SUBSURFACE INFLOW = 0.00 MM/YR

****

EVAPOTRANSPIRATION DATA 1

VALID FOR 3 YEARS

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Morwell Victoria
STATION LATITUDE = -38.21 DEGREES
MAXIMUM LEAF AREA INDEX = 1.00
START OF GROWING SEASON (JULIAN DATE) = 274
END OF GROWING SEASON (JULIAN DATE) = 154
EVAPORATIVE ZONE DEPTH = 45.0 CM
AVERAGE ANNUAL WIND SPEED = 11.15 KPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.0 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 75.0 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 74.0 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 64.0 %

****

****

MONTHLY TOTALS (MM) FOR YEAR 2010

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	26.0	69.6	86.6	63.6	60.4	59.8
	30.6	66.8	52.8	92.6	86.8	75.6
RUNOFF	0.28	4.37	19.04	0.24	0.12	0.40
	0.11	3.39	0.02	10.75	19.37	4.55
POTENTIAL EVAPOTRANSPIRATION	177.49	141.80	124.57	68.78	44.79	32.39
	38.14	52.59	71.38	118.29	134.57	157.41
ACTUAL EVAPOTRANSPIRATION	49.74	60.93	58.89	40.04	31.21	25.25
	30.43	45.65	53.99	60.82	54.44	116.60
PERCOLATION/LEAKAGE THROUGH	3.523	3.018	3.233	3.023	3.019	3.245
LAYER 3	4.452	4.773	4.730	4.933	4.916	4.887
PERCOLATION/LEAKAGE THROUGH	4.098	3.285	3.431	3.190	3.184	2.776
LAYER 4	3.282	4.321	4.579	4.745	4.830	5.191

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	15.762	12.385	10.354	8.323	6.360	12.601
TOP OF LAYER 3	33.103	39.099	41.245	42.084	44.833	41.226
STD. DEVIATION OF DAILY	2.914	0.576	0.616	0.576	0.575	6.563
HEAD ON TOP OF LAYER 3	2.504	1.909	2.363	6.594	3.152	4.962

****

****

ANNUAL TOTALS FOR YEAR 2010

	MM	CU. METERS	PERCENT
	----------	----------	-------
PRECIPITATION	771.20	7712.009	100.00
RUNOFF	62.632	626.322	8.12
POTENTIAL EVAPOTRANSPIRATION	1162.194	11621.938	
ACTUAL EVAPOTRANSPIRATION	627.987	6279.869	81.43
PERC./LEAKAGE THROUGH LAYER 3	47.751633	477.516	6.19
AVG. HEAD ON TOP OF LAYER 3	256.1466		
PERC./LEAKAGE THROUGH LAYER 4	46.911137	469.111	6.08
CHANGE IN WATER STORAGE	33.670	336.696	4.37
SOIL WATER AT START OF YEAR	435.297	4352.968	
SOIL WATER AT END OF YEAR	468.966	4689.664	
INTERCEPTION WATER AT START OF YEAR	0.000	0.000	
INTERCEPTION WATER AT END OF YEAR	0.000	0.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0010	0.010	0.00

****

****

MONTHLY TOTALS (MM) FOR YEAR 2011

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
	-------	-------	-------	-------	-------	-------
PRECIPITATION	44.0	145.0	109.2	101.0	57.0	48.0
	76.8	49.0	70.0	72.3	126.4	55.4
RUNOFF	0.05	24.36	10.65	34.11	1.67	7.37
	41.93	18.09	10.45	19.33	20.62	5.65
POTENTIAL EVAPOTRANSPIRATION	162.71	126.40	114.14	67.37	41.45	33.22
	39.05	55.78	79.86	117.97	141.26	164.30
ACTUAL EVAPOTRANSPIRATION	92.15	89.38	73.66	35.11	25.78	20.48
	30.11	40.22	38.68	51.61	102.34	72.40
PERCOLATION/LEAKAGE THROUGH	3.964	3.093	3.318	4.112	5.002	5.408
LAYER 3	5.817	5.665	5.084	5.428	5.227	5.110
PERCOLATION/LEAKAGE THROUGH	4.848	3.670	3.587	3.021	4.150	4.855
LAYER 4	5.639	5.810	5.365	5.381	5.208	5.436

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	23.992	13.926	11.935	29.318	43.387	54.331
TOP OF LAYER 3	58.589	55.747	48.078	51.322	50.825	45.393
STD. DEVIATION OF DAILY	5.077	0.590	0.582	10.962	6.383	3.472
HEAD ON TOP OF LAYER 3	0.960	2.503	2.152	3.712	2.347	4.069

****

****

ANNUAL TOTALS FOR YEAR 2011

	MM	CU. METERS	PERCENT
PRECIPITATION	954.10	9541.003	100.00
RUNOFF	194.268	1942.676	20.36
POTENTIAL EVAPOTRANSPIRATION	1143.523	11435.230	
ACTUAL EVAPOTRANSPIRATION	671.920	6719.202	70.42
PERC./LEAKAGE THROUGH LAYER 3	57.226673	572.267	6.00
AVG. HEAD ON TOP OF LAYER 3	405.7029		
PERC./LEAKAGE THROUGH LAYER 4	56.968266	569.683	5.97
CHANGE IN WATER STORAGE	30.944	309.439	3.24
SOIL WATER AT START OF YEAR	468.966	4689.664	
SOIL WATER AT END OF YEAR	499.910	4999.103	
INTERCEPTION WATER AT START OF YEAR	0.000	0.000	
INTERCEPTION WATER AT END OF YEAR	0.000	0.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0004	0.004	0.00

****

****

MONTHLY TOTALS (MM) FOR YEAR 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
	-------	-------	-------	-------	-------	-------
PRECIPITATION	46.2	97.2	120.2	57.8	96.9	109.2
	26.6	97.2	86.4	54.4	33.8	74.2
RUNOFF	0.28	3.56	12.03	1.35	17.99	57.05
	2.86	30.83	24.03	2.44	0.05	2.53
POTENTIAL EVAPOTRANSPIRATION	172.40	137.53	111.89	68.82	43.10	31.29
	39.56	54.84	77.57	122.49	144.77	167.95
ACTUAL EVAPOTRANSPIRATION	90.16	95.23	86.00	45.00	30.32	26.22
	30.94	46.83	60.56	72.00	41.51	105.92
PERCOLATION/LEAKAGE THROUGH	4.531	3.450	3.729	3.567	4.044	5.541
LAYER 3	5.666	5.668	5.459	5.386	4.786	4.680
PERCOLATION/LEAKAGE THROUGH	5.085	4.297	3.763	3.677	3.446	4.121
LAYER 4	5.637	5.583	5.550	5.613	5.173	4.994

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	34.579	18.838	19.614	18.803	25.496	56.895
TOP OF LAYER 3	55.772	55.804	55.314	50.552	42.333	37.368
STD. DEVIATION OF DAILY	3.846	3.581	2.834	0.875	11.297	3.541
HEAD ON TOP OF LAYER 3	2.477	2.487	3.005	3.454	2.834	4.261

****

****

ANNUAL TOTALS FOR YEAR 2012

	MM	CU. METERS	PERCENT
	----------	----------	-------
PRECIPITATION	900.10	9001.005	100.00
RUNOFF	155.007	1550.068	17.22
POTENTIAL EVAPOTRANSPIRATION	1172.220	11722.203	
ACTUAL EVAPOTRANSPIRATION	730.679	7306.791	81.18
PERC./LEAKAGE THROUGH LAYER 3	56.507069	565.071	6.28
AVG. HEAD ON TOP OF LAYER 3	392.8059		
PERC./LEAKAGE THROUGH LAYER 4	56.938229	569.382	6.33
CHANGE IN WATER STORAGE	-42.524	-425.240	-4.72
SOIL WATER AT START OF YEAR	499.910	4999.103	
SOIL WATER AT END OF YEAR	457.386	4573.863	
INTERCEPTION WATER AT START OF YEAR	0.000	0.000	
INTERCEPTION WATER AT END OF YEAR	0.000	0.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0004	0.004	0.00

****

****

FINAL WATER STORAGE AT END OF YEAR 2012

LAYER	(CM)	(VOL/VOL)
1	1.3517	0.1352
2	15.3719	0.3074
3	21.3500	0.4270
4	7.6651	0.2555

TOTAL WATER IN LAYERS	45.739
SNOW WATER	0.000
INTERCEPTION WATER	0.000
TOTAL FINAL WATER	45.739

****

****

PEAK DAILY VALUES FOR YEARS 2010 THROUGH 2012

	(MM)	(CU. METERS)
PRECIPITATION	70.00	700.000
RUNOFF	33.828	338.2809
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.189914	1.89914
AVERAGE HEAD ON TOP OF LAYER 3	599.058	
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.190726	1.90726
SNOW WATER	0.00	0.0000
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4209	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1358	

****

****

AVERAGE MONTHLY VALUES (MM) FOR YEARS 2010 THROUGH 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	38.73	103.93	105.33	74.13	71.43	72.33
	44.67	71.00	69.73	73.10	82.33	68.40
STD. DEVIATIONS	11.08	38.15	17.13	23.45	22.12	32.47
	27.90	24.37	16.80	19.11	46.46	11.28
RUNOFF						
TOTALS	0.203	10.760	13.906	11.903	6.593	21.605
	14.966	17.436	11.499	10.841	13.347	4.242
STD. DEVIATIONS	0.135	11.781	4.497	19.243	9.897	30.891
	23.390	13.735	12.039	8.446	11.532	1.581
POTENTIAL EVAPOTRANSPIRATION						
TOTALS	170.868	135.243	116.867	68.323	43.115	32.300
	38.918	54.406	76.270	119.584	140.203	163.217
STD. DEVIATIONS	7.504	7.948	6.768	0.825	1.672	0.969
	0.721	1.640	4.388	2.525	5.182	5.351
ACTUAL EVAPOTRANSPIRATION						
TOTALS	77.350	81.843	72.849	40.048	29.106	23.983
	30.492	44.236	51.078	61.475	66.097	98.307
STD. DEVIATIONS	23.933	18.347	13.575	4.945	2.913	3.068
	0.418	3.524	11.229	10.211	32.047	23.060
PERCOLATION/LEAKAGE THROUGH LAYER 3						
TOTALS	4.0056	3.1870	3.4266	3.5673	4.0219	4.7317
	5.3114	5.3683	5.0912	5.2488	4.9764	4.8922
STD. DEVIATIONS	0.5053	0.2305	0.2653	0.5442	0.9919	1.2890
	0.7484	0.5157	0.3647	0.2746	0.2262	0.2150
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	4.6769	3.7502	3.5936	3.2957	3.5936	3.9173
	4.8530	5.2378	5.1647	5.2461	5.0701	5.2069
STD. DEVIATIONS	0.5153	0.5107	0.1666	0.3405	0.4993	1.0541
	1.3602	0.8021	0.5158	0.4493	0.2090	0.2219

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (CM)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	24.7777	15.0497	13.9676	18.8145	25.0811	41.2760
	49.1546	50.2165	48.2123	47.9863	45.9967	41.3293
STD. DEVIATIONS	9.4328	3.3703	4.9536	10.4975	18.5168	24.8661
	13.9721	9.6281	7.0351	5.1256	4.3642	4.0137

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2010 THROUGH 2012

	MM		CU. METERS	PERCENT
PRECIPITATION	875.13	(93.970)	8751.3	100.00
RUNOFF	137.302	(67.5800)	1373.02	15.689
POTENTIAL EVAPOTRANSPIRATION	1159.312	(14.5659)	11593.12	
ACTUAL EVAPOTRANSPIRATION	676.862	(51.5258)	6768.62	77.344
PERCOLATION/LEAKAGE THROUGH LAYER 3	53.82845	(5.27498)	538.285	6.15088
AVERAGE HEAD ON TOP OF LAYER 3	351.552	(82.875)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	53.60588	(5.79783)	536.059	6.12545
CHANGE IN WATER STORAGE	7.363	(1.7018)	73.63	0.841

****
****

Attachment 2

Accumulated leachate generation estimates

Client Energy Brix Australia
Job Asbestos Landfill WAA
Subject Leachate generation estimates
Job Number 31-35300
Date May-18

Cell Area

Cell No.	HELP model No.	Area (m2)	Area (Ha)
Cell A	1	4,500	0.45

1 YEAR MEDIAN+2 YEARS 90th PERCENTILE

Leachate generation Output 1

			Year 1 (Months)												Year 2 (Months)											
Model No.	Cells	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**Infiltration Cells 1 -4**	mm	4.10	3.29	3.43	3.19	3.18	2.78	3.28	4.32	4.58	4.75	4.83	5.19	4.85	3.67	3.59	3.02	4.15	4.86	5.64	5.81	5.37	5.38	5.21	5.44
	Infiltration Cells 1 -4	m3	18.44	14.78	15.44	14.36	14.33	12.49	14.77	19.44	20.61	21.35	21.74	23.36	21.82	16.52	16.14	13.59	18.68	21.85	25.38	26.15	24.14	24.21	23.44	24.46
	Seepage through base	m3/ha/month	13.95	12.60	13.95	13.50	13.95	13.50	13.95	13.95	13.50	13.95	13.50	13.95	13.95	12.60	13.95	13.50	13.95	13.50	13.95	13.95	13.50	13.95	13.50	13.95
		Total (m^3)	**4.49**	**2.18**	**1.49**	**0.86**	**0.38**	**-**	**0.82**	**5.49**	**7.11**	**7.40**	**8.24**	**9.41**	**7.87**	**3.92**	**2.19**	**0.09**	**4.73**	**8.35**	**11.43**	**12.20**	**10.64**	**10.26**	**9.94**	**10.51**

Client	Energy Brix Australia
Job	Asbestos Landfill WAA
Subject	Leachate generation estimates
Job Number	31-35300
Date	May-18

Cell Area

Cell No.	HELP model No.	Area (m2)
Cell A	1	4,500

1 YEAR MEDIAN+2 YEARS 90th PERCENTILE

Leachate generation Output 1

			Year 3 (Months)												TOTAL
Model No.	Cells	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1	**Infiltration Cells 1 -4**	mm	5.09	4.30	3.76	3.68	3.45	4.12	5.64	5.58	5.55	5.61	5.17	4.99	
	Infiltration Cells 1 -4	m3	22.88	19.34	16.93	16.55	15.51	18.54	25.37	25.12	24.98	25	23	22	
	Seepage through base	m3/ha/month	13.95	12.60	13.95	13.50	13.95	13.50	13.95	13.95	13.50	13.95	13.50	13.95	
		Total (m^3)	**8.93**	**6.74**	**2.98**	**3.05**	**1.56**	**5.04**	**11.42**	**11.17**	**11.48**	**11.31**	**9.78**	**8.52**	**232**