South Cell at Woy Woy Waste Management Facility

Technical Report 2 – Leachate Infiltration Modelling and Water Balance

Central Coast Council

06 December 2023

→ The Power of Commitment

Project name		Detailed Design and Documentation for South Landfill Cell at Woy Woy					
Document title		South Cell at Woy Woy Waste Management Facility | Technical Report 2 – Leachate Infiltration Modelling and Water Balance					
Project number		12595244					
File name		12595244-REP_Leachate Infiltration Modelling and Water Balance.docx					
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S4	0	S. Kentwell	C. Nivison-Smith A. Dixon		D. Gamble		6/12/23

GHD Pty Ltd | ABN 39 008 488 373

133 Castlereagh Street, Level 15

Sydney, New South Wales 2000, Australia

T +61 2 9239 7100 | **F** +61 2 9239 7199 | **E** sydmail@ghd.com | **ghd.com**

© GHD 2023

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Contents

Table index

Figure index

Appendices

1. Introduction

1.1 Overview

Central Coast Council (Council) owns and operates the existing Woy Woy Waste Management Facility (WMF) located on Nagari Road, Woy Woy. The WMF is the primary waste disposal facility for the southern Central Coast community and has operated since 1974. The WMF operates in accordance with Environment Protection Licence (EPL) No. 6053. The EPL permits resource recovery, waste disposal (application to land) and waste storage and authorises landfilling of up to 100,000 tonnes per year of putrescible and non-putrescible general solid waste, tyres and asbestos.

Key components of the existing WMF include:

– Weighbridge and office/education centre
– Current active landfill cell and tipping area
– Transfer station
– Garden organics (GO) facility
– Excavation and stockpiling area
– Stormwater and leachate management infrastructure

In 2020 Council commissioned the 'Woy Woy Waste Management Facility – Development Strategy' (SMEC, 2020) (the 'Development Strategy') to guide the future use and development of the facility. The Development Strategy identified the existing excavation and stockpile area at the southern end of the WMF as the location for the next waste cell (known as the new 'South Cell').

Council is now proposing to develop the new South Cell to optimise the remaining landfill air space at the WMF and ensure that the WMF remains open for as long as possible to accept putrescible waste from the Local Government Area (LGA).

The construction of the proposed new South Cell is required to be completed and able to receive waste when the current tipping area reaches capacity in mid to late 2024. Construction would commence following receipt of planning approval and be completed in two stages. Each stage is expected to take four to six months.

The project is deemed regionally significant development (RSD) and is subject to approval by the Hunter and Central Coast Regional Planning Panel under the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).

This report has been prepared by GHD Pty Ltd (GHD) as part of the environmental impact statement (EIS) for the project. The EIS has been prepared to support the application for approval of the project and address the environmental assessment requirements of the Secretary of the NSW Department of Planning and Environment (the SEARs) dated 24 August 2023.

1.2 The project

1.2.1 Location

The project would be located within the existing Woy Woy WMF. The WMF is about 10 kilometres south of Gosford across Brisbane Water, within the Central Coast LGA (refer Figure 1.1).

The WMF site consists of:

– Lot 110 DP 755251
– Lot 1 DP 126813
– Lot 1 DP 654885

The South Cell (the project site) is about five hectares in area and located on the southern portion of the WMF. It comprises part of Lot 110 DP 755251.

1.2.2 Key features

Key features of the project include:

– Cell construction including excavation and earthworks to form the base of the cell and lining installation
– Development of associated access, stormwater, and leachate management infrastructure
– Continuation of current landfilling operations in the new cell location
– Capping, closure, and rehabilitation

The project is expected to provide up to approximately an additional 920,000 cubic metres of airspace or 7.7 years of filling capacity (based on current filling rates). It is also expected to generate additional cell construction and cover materials for the ongoing landfilling operations.

No change is proposed to the existing approved annual disposal capacity or waste types as per EPL 6053.

The other existing operations (weighbridge and office/education centre, transfer station, GO facility etc) at the WMF would continue to be operated in conjunction with the project.

Further information on the project is provided in the EIS.

The project site layout is shown in **Error! Reference source not found.**.

1.2.3 Construction overview

Construction of the project would be subject to the methods proposed by the construction contractor, but is expected to involve the following:

– Site establishment: establishment of site environmental controls including sediment and erosion controls
– Earthworks: excavation and grading along the base of the landfill cell in accordance with the requirements of the *Environmental Guidelines: Solid waste landfills* (NSW EPA, 2016)
– Lining and gravel placement: installation of basal, batter and sidewall liners systems
– Development of ancillary infrastructure including access roads, leachate, gas and water management infrastructure

Construction is expected to take about three months to complete.

The construction activities would be carried out during the following hours, consistent with the recommended standard hours of the *Interim Construction Noise Guideline* (NSW DECC, 2009):

– 7 am to 6 pm Monday to Friday
– 8 am to 1 pm Saturdays
– No work on Sundays or Public Holidays

The construction workforce is expected to range between five and ten workers per day.

Further information on the construction of the project is provided in the EIS.

1.3 Secretary's Environmental Assessment Requirements

The specific SEARs addressed in this report are summarised in Table 1.1.

Table 1.1 SEARs relevant to this assessment

Requirement	Where addressed in this report
Details of proposed leachate and gas management and monitoring	Section 7

1.4 Purpose of this report

This purpose of this report is to outline the methodology, assumptions and results of the infiltration modelling and a leachate water balance for existing and future stages of the WMF landfill operations, including the South Cell.

1.5 Scope of this report

Specifically, this report includes:

– Review of existing leachate management system.
– Description of infiltration modelling, including methodology and results.
– Description of leachate water balance modelling, including methodology and results.
– Overview of proposed leachate management measures for the South Cell.

The infiltration modelling and leachate water balance modelling described in this report were completed in accordance with NSW EPA's *Environmental Guidelines: Solid Waste Landfills* (2016).

1.6 Limitations

This report: has been prepared by GHD for Central Coast Council and may only be used and relied on by Central Coast Council for the purpose agreed between GHD and Central Coast Council as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Central Coast Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

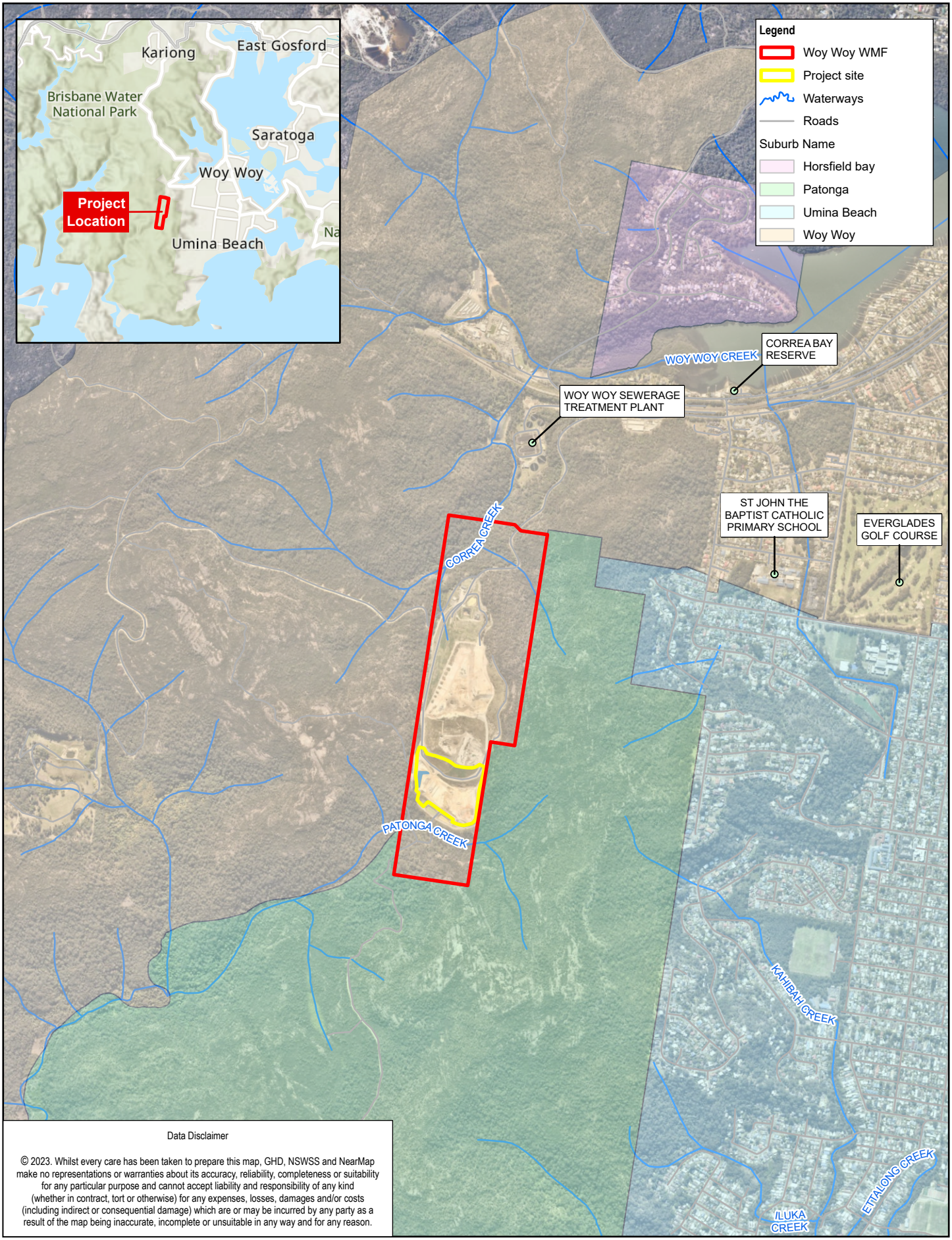
The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. WMF conditions at other parts of the WMF may be different from the WMF conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

GHD has prepared this report on the basis of information provided by Central Coast Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.



Data Disclaimer

© 2023. Whilst every care has been taken to prepare this map, GHD, NSWSS and NearMap make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Paper Size ISO A4

0 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Central Coast Council
South Cell at Woy Woy WMF
Leachate Infiltration Modelling and Water Balance

Site location

Project No. **12595244**
Revision No. **0**
Date **10/10/2023**

FIGURE 1.1

\\ghdnet\ghd\AU\Newcastle\Projects\22\12595244\GIS\Maps\Deliverables\12595244_EIS.aprx
Print date: 10 Oct 2023 - 19:19

Data source: GHD: Site Boundary (2023), Survey Data (2023). World Topographic Map: Esri, HERE, Garmin, Foursquare, METI/NASA, USGS
World Hillshade: Esri, Geoscience Australia, NASA, NGA, USGS
Nearmap WMS Server: . Created by: dbbanatin

2. What is leachate?

Leachate is liquid/water which has been in contact with the landfilled waste at the WMF, resulting in “leaching” of substances from the waste into this water. Due to its composition, leachate must be managed in a specific way, from collection to eventual disposal.

Leachate is managed separate to other surface water flows at a landfill, including:

– Clean water diverted around any waste and/or disturbed areas.
– Sediment laden water that has been entrained only by sediment from disturbed areas (and no other contaminants).

For this delineation, where virgin excavated natural material (VENM) is used as daily, intermediate and final cover, any water runoff can be managed as one of the surface water flows above and does not need to be managed as leachate (unless leachate were to enter it via seepages from a batter or similar).

In addition, the area located on the platform of the WMF is used for the temporary storage of garden organics (GO), referred to as the GO facility. While there is no composting or processing undertaken here, Condition O7.1 of the EPL 6053 identifies this area as the ‘organics processing area’ and references its design plans titled ‘Central Coast Council Woy Woy WMF – Organics Processing Area – Revision A – Drawing Numbers 22-20113-C001 to C004, Drawing 22-20113-C011 to C018, Drawing 22-20113-C021 and 22-20113-C080’. It is noted that Council intends to remove this clause from their EPL.

This area, along with the transfer station, currently discharges to the sediment-laden management system where it is collected for re-use or treated/discharged accordingly. As a result of the low residence time of materials and the absence of higher risk materials and processes (e.g., food waste or composting), runoff from this area may be characterised as stormwater and could potentially continue to be discharged to the stormwater system. Monitoring and testing is currently being undertaken by Council to confirm this outcome.

A Trigger Action Response Plan (TARP) has been developed and is included in the Soil and Water Impact Assessment (separate to this report) with appropriate actions based on results of future water quality monitoring. In extreme circumstances, this TARP may require diversion of the runoff from the GO facility and transfer station to the leachate management system. Specific to this leachate water balance, potential diversion of these flows to the leachate management system has been considered in terms of estimated leachate quantities, to confirm the system is adequate for this scenario.

3. Regulatory guidance

3.1 NSW Landfill Guidelines

The NSW EPA's *Environmental Guidelines: Solid Waste Landfills* (2016) – henceforth referred to as the NSW Landfill Guidelines – provide guidance for the environmental management of landfills in NSW by specifying a series of 'Minimum Standards'. They involve design and construction techniques, effective site operations, monitoring and reporting protocols, and post-closure management. These guidelines have been considered with reference to the leachate water balance assessment and development of leachate management measures for the South Cell.

3.2 Development consent

In 1994 a legal review of the development consent for the Woy Woy WMF (Dawson, 1994) found that a consent was obtained of the then Health Commission to use the WMF as a solid waste disposal depot.

A new development consent would be sought for the project. The project is deemed to be regionally significant development (RSD) in accordance with Clause 7(1)(c) and Clause 3 in Schedule 6 of *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP) and it is a development for the purposes of a waste management facility or works that meets the requirements for designated development under the Environmental Planning and Assessment Regulation 2021, Schedule 3, section 45 as well as being Council related development with a capital investment value over $5 million. The project therefore requires assessment and approval in accordance with Part 4, Division 4.3 of *the Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) for determination by the Hunter and Central Coast Regional Planning Panel. An environmental impact statement (EIS) is required to be submitted as part of the application for development consent.

3.3 Environment protection licence

Table 3.1 lists the relevant conditions of EPL 6053 that were considered as part of the concept design. As the project is outside the approved landfill footprint, it is expected that the design would need to comply with the NSW Landfill Guidelines which would supersede certain conditions below, such as lining and capping requirements.

Table 3.1 Relevant EPL conditions

Condition Requirements	
O5	*Processes and Management*
O5.1	The sedimentation and leachate dams must be maintained to ensure that their design capacity is available for the storage of stormwater/leachate.
O5.4	A leachate barrier system must be installed on each surface within the premises to be used for the storage of leachate.
O6	*Waste Management*
O6.1	The sedimentation and leachate dams must be maintained to ensure that their design capacity is available for the storage of stormwater/leachate.
O6.2	A leachate barrier system and leachate collection system as detailed in Section 7.2 of the LEMP must be installed on each surface within the premises to be used for the disposal of waste. This condition does not apply to any surface used for the emplacement of waste before 1 July 1998 as described by Section 7.2 of the LEMP.
O6.3	The liner and sub-grade must be installed above the groundwater table.
O6.4	A leachate barrier system must be installed on each surface within the premises to be used for the storage of leachate.
O6.8	The licensee must manage the disposal of waste at the premises in accordance with the progressive filling plan Section 6.3 of the LEMP.

Condition Requirements	
O6.9	The licensee must ensure that the landfill cells are capped progressively and specifically at times when the level of waste reaches final heights as detailed in Section 10 of the LEMP.
O6.10	Final capping at the premises must comprise of two layers in the order of installation - a sealing layer and a revegetation layer. Final capping must be in accordance with the capping profile and the five year capping survey prepared by Chase, Burke and Harvey Surveying (June 2013).
O6.11	The cap must comprise a firm stable smooth foundation layer overlaid by a clay sealing layer which has a permeability of no more than 10^{-8}metres per second, and a minimum thickness of 900mm overlaid by a topsoil revegetation layer with a minimum thickness of 150mm.
O6.13	Cover material must be: (a) Daily Cover Cover material must be applied to a minimum depth of 15 centimetres over all exposed landfilled waste prior to ceasing operations at the end of each day and must be either (i) virgin excavated natural material; or (ii) an approved synthetic cover. (b) Intermediate Cover Cover material must be virgin excavated natural material and must be to a depth of 30 centimetres over surfaces of the landfilled waste at the premises which are to be exposed for more than 90 days (c) Cover material Stockpile At least two weeks of cover material must be available at the premises under all weather conditions. The material may be won on site, or alternatively a cover stockpile must be maintained adjacent to the tip face.

3.4 Landfill management plan

The WMF operates in accordance with a Landfill Management Plan (LMP) prepared by URS (2012). As described above, a number of the EPL conditions reference the LMP. This includes the current approved final landform, as shown in Figure 3.1.

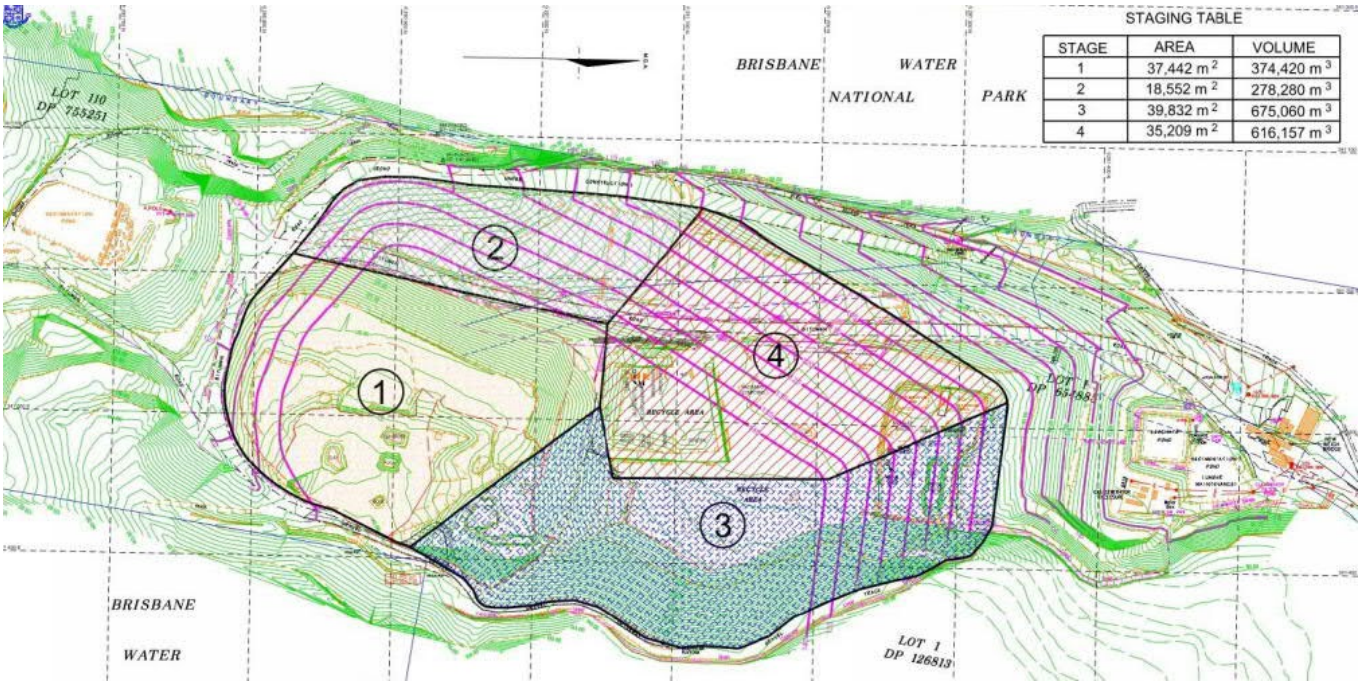


Figure 3.1 Filling plan from LEMP (URS, 2012)

4. Existing leachate management system

4.1 Minimisation

Daily and intermediate cover material is used to limit infiltration of rainfall into the landfilled waste, as per Condition O13.1 of the WMF's EPL. Excavated material from the South Cell is currently being used as a cover material source.

Council has indicated that final capping has been installed across finished portions of the existing landfill, in line with the requirements of conditions O6.9, O6.10 and O6.11.

4.2 Containment

URS (2012) outlines that historical cells A1 to A5 are unlined and do not have a leachate barrier system. However, they are constructed within medium to high strength sandstone within a network of perimeter clay bunds and internal clay cell walls (SMEC, 2020).

Based on URS (2012), Cells 1 and 2 were constructed with a clay and geosynthetic clay liner (GCL), comprising:

– Cell base liner (top to bottom):
  - 600 mm thick clay protection layer
  - GCL sealing layer
  - 100 mm thick clay subgrade improvement layer
– Cell batter liner
  - 900 mm thick clay sealing layer

The Western Cell was constructed with a clay and GCL (top to bottom), comprising:

– 300 mm thick soil protection layer
– GCL sealing layer
– 300 mm thick clay subgrade improvement layer

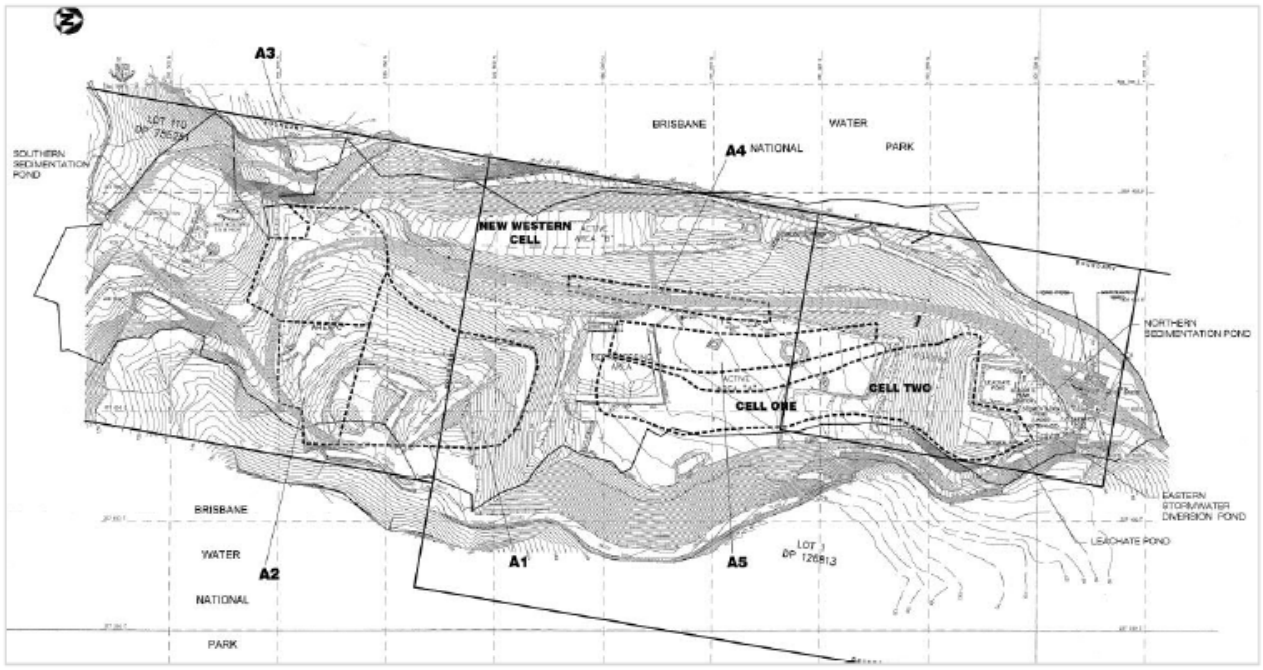


Figure 4.1 Existing cell locations (URS, 2012)

4.3 Collection and transfer

As documented in SMEC (2020), a leachate collection system has been constructed within the historical landfill cells, located on the down slope side of the landfilled areas along the extremities of the WMF. The leachate collected in the south and northwest is directed to sumps where it is pumped to the leachate dam in the north of the WMF, shown in Figure 4.2.

Leachate collected in Cells 1 and 2 drains to the leachate dam via gravity. The cells are graded at a minimum of 1(V):80(H) on the cell base, and 1(V):20(H) along the main leachate drainage lines to the leachate dam. Cells 1 and 2 are lower than the historical cells, allowing leachate to be collected by the new leachate collection systems.

Leachate collected in the newer Western Cell also gravity drains to the leachate dam in the north. The leachate collection system for the Western Cell comprises a herringbone structure of slotted pipes within the fill area at a spacing of 20 m. The collection pipes feed to a solid leachate drainage pipe, running directly to the leachate dam.

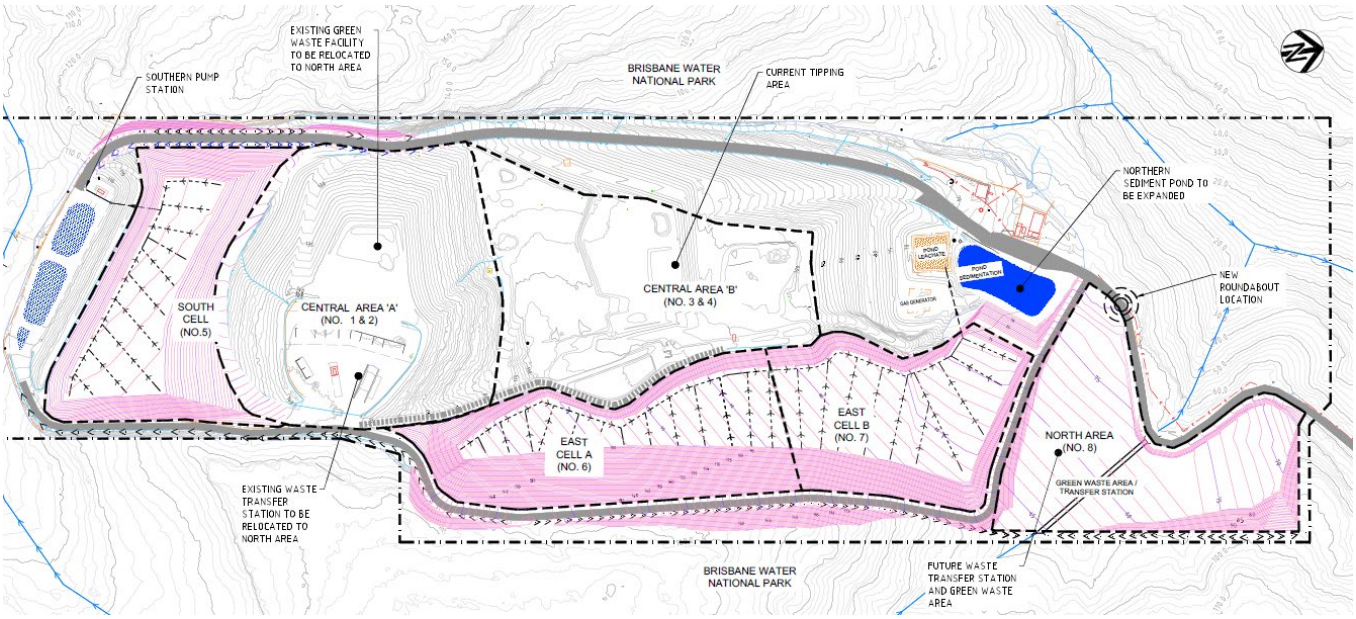


Figure 4.2 WMF layout development plan (SMEC, 2020)

4.4 Storage and disposal

The leachate dam was constructed in February 1999 and is lined with HDPE, with an approximate capacity of 1,000 kL. Stored leachate is discharged from the dam directly to the Woy Woy Sewerage Treatment Plant (STP) located to the north of the WMF when the leachate in the dam reaches a specified level. A recent survey of the leachate pond is provided in Figure 4.3 below (designated 'L1', noting 'N1' is a sediment pond). Alongside the South Cell development, Council is upgrading the sewer disposal pipework from the dam to the Woy Woy STP.

It is understood that there are no current restrictions on the leachate volumes or quality accepted by the treatment plant (SMEC, 2020). No other leachate disposal mechanisms exist at the WMF other than evaporation from the leachate dam and discharge to sewer.

Further to the above, it is understood that Council has historically utilised the sewer disposal for sediment laden water disposal during significant wet weather events. However, Council is seeking to move away from this practice as part of the development of the South Cell.

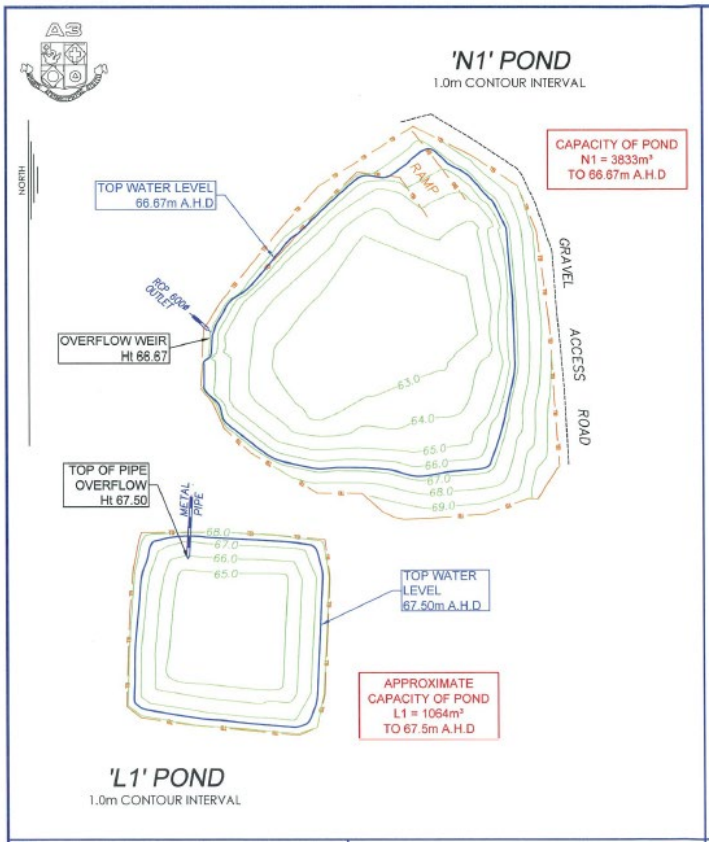


Figure 4.3 Leachate pond survey (Barry Hunt Associates, 2020)

4.5 Monitoring

Relevant to leachate management, condition M2 of the WMF's EPL requires quarterly and annual monitoring of:

– Five groundwater monitoring bores.
– The leachate storage pond.

Further information has been sought from Council to estimate groundwater levels at the WMF and potential interaction with historical unlined cells, to be considered in future updates to this report.

Based on Council feedback, the existing leachate flow meters onsite do not operate correctly, as such no leachate volumetric data is available at the time of this report. Council is seeking to install a leachate flow meter on a secondary line and pump to support this assessment. Where possible, the data from this flow meter would be considered as part of this leachate water balance and its calibration in future updates to this report. Further information is also being sought on the leachate volumes being received and recorded at the treatment plant, to be considered in future updates to this report.

5. Infiltration modelling

5.1 Methodology

The United States Environmental Protection Agency's Hydrologic Evaluation of Landfill Performance (HELP) model was used to provide a comparative evaluation of infiltration through the various cover and cap profiles across the WMF for all stages of development proposed. The model considers rainfall, evapotranspiration and stormwater run-off. The use of this software is endorsed as a suitable method within the NSW Landfill Guidelines.

The data was analysed for the 50% Average Exceedance Probability (AEP) rainfall (median) year (2008 – 1190.5 mm) and 10% AEP rainfall (wet) year (1952 – 1701.4 mm)[1] to estimate annual leachate generation rates.

5.2 Input data

5.2.1 General

Two key inputs were required for the infiltration modelling:

1. Climate data (specifically rainfall, temperature and evaporation data)
2. Cover and capping profiles (including material type and depth)

5.2.2 Climate data

The model requires a comprehensive set of daily climate data to represent the WMF. Rainfall, evaporation and temperature data was obtained from SILO, hosted by The Science Delivery Division of the Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA). SILO is a database of Australian climate data from 1889 to the present which provides daily meteorological datasets for a range of climate variables, constructed from observational data obtained from the Bureau of Meteorology (BOM) and other suppliers (e.g., private landholders, natural resource management groups, commercial organisations and Government agencies).

Patched point data uses real historical data, where available, and patches missing or suspect data with interpolated daily observations data. SILO data was extracted on 7 February 2023 from the data drill point of coordinates (-33.50, 151.30). The identified period (1923-2022) was selected as it provides a representation of 100 years of storm events so that a wide range of potential rainfall events can be considered to select the applied rainfall events..

Data from the Mangrove Mountain Automated Weather Station (AWS) Bureau of Meteorology (BOM) weather station (No. 061375) located approximately 10 km northwest of the WMF was used for relative humidity and windspeed. The years of data for the relevant climatic parameters used are contained in Table 5.1.

Table 5.1 HELP modelling climatic parameters and years of data used

Parameter	Data source	Years
Rainfall	SILO data drill point	1923 to 2022
Evaporation	SILO data drill point	1923 to 2022
Solar radiation	SILO data drill point	1923 to 2022
Temperature	SILO data drill point	1923 to 2022
Relative humidity	Mangrove Mountain AWS	1944 to 2010
Wind speed	Mangrove Mountain AWS	1944 to 2010

[1] Based on the 10% AEP rainfall using SILO grid point data for years between 1923 to 2022

5.3 Cover and capping profiles

5.3.1 General

Table 5.2 below identifies the modelling parameters associated with each of the cover and capping profiles proposed for the project. Unless otherwise specified, the standard HELP values for porosity, field capacity, wilting point and hydraulic conductivity have been utilised for the selected material types.

The slope grades and lengths have been extracted from a recent survey of the existing areas (December 2022, as supplied by Council) and the concept design for the project, which is being completed in parallel to this study. These would be updated progressively based on the ongoing design updates completed by GHD as part of the overall project to align with the final design documentation. Where relevant, the cover and capping profiles were split up into platform and batter areas to model these differing surfaces.

5.3.2 Cover profiles

Cover profiles are based on the requirements of the WMF's EPL, which align with the recommendations of the NSW Landfill Guidelines (hence is applicable to current operations and future operations in the project). A silty clay was modelled which is a similar material type to what has historically been utilised at the WMF (including crushed sandstone from WMF borrow pits).

5.3.3 Capping profiles

The WMF's EPL outlines a capping profile of clay (900 mm thick) overlain by topsoil (150 mm thick), as specified in capping profile and the five-year capping survey prepared by Chase, Burke and Harvey Surveying (June 2013). This has been included as Option 1 and is applicable to existing landfilled areas within the EPL footprint. Council feedback suggests this option was used across all capped areas in the existing WMF.

However, as the South Cell is a new development area and would be subject to a new consent, it is expected that the EPA would require capping to be line with the current version of NSW Landfill Guidelines. Hence a second option has been modelled in line with these guidelines and the concept design for the South Cell:

– Option 1: Final cap in accordance with the Capping Profile and the Five Year Capping Survey prepared by Chase, Burke and Harvey Surveying (2013), as per the WMF's EPL. Given the limited thickness of the revegetation layer for this option, calibration activities in future updates to this report would consider a higher permeability range for the clay material as part of a sensitivity analysis.
– Option 2: Final cap in accordance with the current NSW Landfill Guidelines, with GCL instead of clay as per the South Cell concept design.

In addition to the above, another profile was modelled specific to the GO facility given its alternative hardstand profile as identified by Council, which was akin to the Option 1 capping with hardstand materials overtopping instead of revegetation material.

The transfer station area was covered separate from the HELP modelling, as described in Section 6.4.

Table 5.2 Cover and capping arrangements

Cover	Assumptions	Profile (top to bottom)
Daily cover	– 0% runoff allowance – No vegetation – 0.1 m evaporative zone depth – Slope grade 5% – Slope length 50 m	– 0.15 m thick daily cover – Silty clay (HELP soil profile #14) – Underlying waste material
Intermediate cover – platform (unvegetated)	– 50% runoff allowance – No vegetation – 0.2 m evaporative zone depth – Slope grade 5% – Slope length 225 m	– 0.3 m thick intermediate cover – Silty clay (HELP soil profile #14) – Underlying waste material
Intermediate cover – batter (unvegetated)	– 50% runoff allowance – No vegetation – 0.2 m evaporative zone depth – Slope grade 15% – Slope length 90 m	
Intermediate cover – batter (vegetated)	– 50% runoff allowance – Poor stand of grass – 0.2 m evaporative zone depth – Slope grade 15% – Slope length 90 m	
Final Cap Option 1 – platform	– 75% runoff allowance – Poor stand of grass – 0.15 m evaporative zone depth – Slope grade 5% – Slope length 225 m	– 0.15 m thick topsoil layer – Loam (HELP soil profile #8) – 0.9 m thick sealing layer – Compacted clay (HELP soil profile #16, hydraulic conductivity K ≤ 10^{-8} m/s) – 0.3 m thick intermediate cover – Silty clay (HELP soil profile #14) – Underlying waste material
Final Cap Option 1 – batter	– 90% runoff allowance – Poor stand of grass – 0.15 m evaporative zone depth – Slope grade 15% – Slope length 90 m	
Final Cap Option 2 – platform	– 75% runoff allowance – Fair stand of grass – 0.3 m evaporative zone depth – Slope grade 5% – Slope length 225 m	– 0.2 m thick topsoil layer – Loam (HELP soil profile #8) – 0.8 m thick subsoil layer – Sandy loam (HELP soil profile #10) – LLDPE geomembrane (HELP profile #36) – Geosynthetic clay liner (HELP soil profile #17) – 0.3 m thick intermediate cover – Silty clay (HELP soil profile #14) – Underlying waste material
Final Cap Option 2 - batter	– 90% runoff allowance – Fair stand of grass – 0.3 m evaporative zone depth – Slope grade 15% – Slope length 90 m	
Central area – GO facility	– 75% runoff allowance – No vegetation – 0.15 m evaporative zone depth – Slope grade 1% – Slope length 80 m	– 0.3 m thick hardstand cover – Sandstone (HELP soil profile #10) – 0.9 m thick sealing layer – Compacted clay (HELP soil profile #16, hydraulic conductivity K ≤ 10^{-8} m/s) – Underlying waste material

5.4 Results

The results of the HELP modelling are contained in Appendix A and as a summary, as a percentage of rainfall infiltrating through the cover/capping profile, is included in Table 5.3.

The results for the daily and interim cover profiles are within expected levels, and result in higher infiltration compared to the capping profiles. The existing capping profile in the WMF's EPL produces significantly more infiltration compared to the proposed final capping for the project. This is expected given the proposed final capping utilises a composite geosynthetic material profile that includes materials with significantly improved sealing capabilities compared to the clay material currently being used.

Table 5.3 HELP model results (percentage infiltration)

Cover / capping scenario	Rainfall scenario	Percentage infiltration (%)
Daily cover	50% AEP (2008) – median year	65%
	10% AEP (1952) – wet year	77%
Interim cover (platform)	50% AEP (2008) – median year	27%
	10% AEP (1952) – wet year	37%
Interim cover (batter, unvegetated)	50% AEP (2008) – median year	27%
	10% AEP (1952) – wet year	37%
Interim cover (batter, vegetated)	50% AEP (2008) – median year	28%
	10% AEP (1952) – wet year	36%
Final capping – Option 1 (platform)	50% AEP (2008) – median year	12%
	10% AEP (1952) – wet year	9%
Final capping – Option 1 (batter)	50% AEP (2008) – median year	12%
	10% AEP (1952) – wet year	9%
Final capping – Option 2 (platform)	50% AEP (2008) – median year	<1%
	10% AEP (1952) – wet year	<1%
Final capping – Option 2 (batter)	50% AEP (2008) – median year	<1%
	10% AEP (1952) – wet year	<1%
Central area – GO facility	50% AEP (2008) – median year	3%
	10% AEP (1952) – wet year	2%

6. Leachate water balance

6.1 General

Leachate water balance modelling was undertaken utilising the results of the infiltration modelling presented in Section 5 and the assumptions described below. The water balance was used to estimate leachate generation across the existing and future stages of the WMF (including the South Cell) and inform the proposed leachate management measures for the South Cell. It does not consider leachate volumes should it be mounded in the landfill. This is addressed separately is section 7.7 for consideration if needed when later calibrating the water balance.

6.2 Surface water run-on and run-off

Cut off drains are located on the east and west ridges, to convey external catchment flows and discharge to a tributary of Woy Woy Creek in the northwest of the WMF.

Sediment laden flows from operational areas are directed to the sediment ponds at the northern and southern ends of the WMF, where it is reused for WMF operations or disposed of via evaporation. In heavy rainfall events, surface water in the northern pond discharges to a creek located to the west of the WMF and surface water in the southern ponds discharge towards Patonga Creek.

A number of additional improvements are being proposed as part of *Technical Report 1 - Soil and Water Impact Assessment*, being completed alongside the leachate water balance and concept design of the South Cell. Based on the above these proposed improvements, it is assumed that no additional leachate is generated via run-off or run-on of surface water flows.

In line with Section 4.4, it is assumed that the sewer disposal is not utilised for other disposal measures such as for sediment laden water.

6.3 Groundwater inflow

Insufficient information is available on the base levels of the historical landfill cells to determine if groundwater inflow is likely and needs to be incorporated in the leachate water balance. As such, this has been excluded from the volumetric estimates, however the potential impacts are discussed as part of the results section below.

The South Cell is proposed to be located above the groundwater table (discussed further in *Technical Report 1 - Soil and Water Impact Assessment*) and include a groundwater drainage system, hence no groundwater inflow into this cell has been considered in the leachate water balance.

6.4 Unlined areas

As there are unlined areas with limited collection measures, it is likely that the leachate collection efficiency from these areas is low (i.e. the proportion of leachate generated that is subsequently collected). However, as this cannot be verified using onsite data at present, a 100% leachate collection efficiency was conservatively assumed from the existing landfilled areas.

6.5 Transfer station area

The existing transfer station at the WMF overlies existing waste, hence rainfall infiltrating the surface in this area would contribute to leachate generation. However, the concrete surface in this area is not able to be modelling using the infiltration modelling approach outlined in Section 5. As an alternative, an infiltration percentage of 3% was assumed for this area based on previous experience, and this was varied as part of the sensitivity analysis of the results.

6.6 Landfill staging

Based on feedback from Council, the existing landfill areas has been delineated into different areas based on the cover and capping status (refer Figure 6). The areas associated with this figure are summarised in Table 6.1 and are captured in each stage of the modelling, given they will remain consistent across the development of the South Cell.The proposed staging plans for the development of the South Cell are outlined in Figure 7 and 8, and summarised in Table 6.2, based on the design works being completed in parallel to this modelling. Leachate generation was modelled for each of these stages. The different scenarios were then reviewed to estimate the peak leachate generation volumes (based on the modelled parameters) across the life of the WMF and their impact on leachate management requirements.

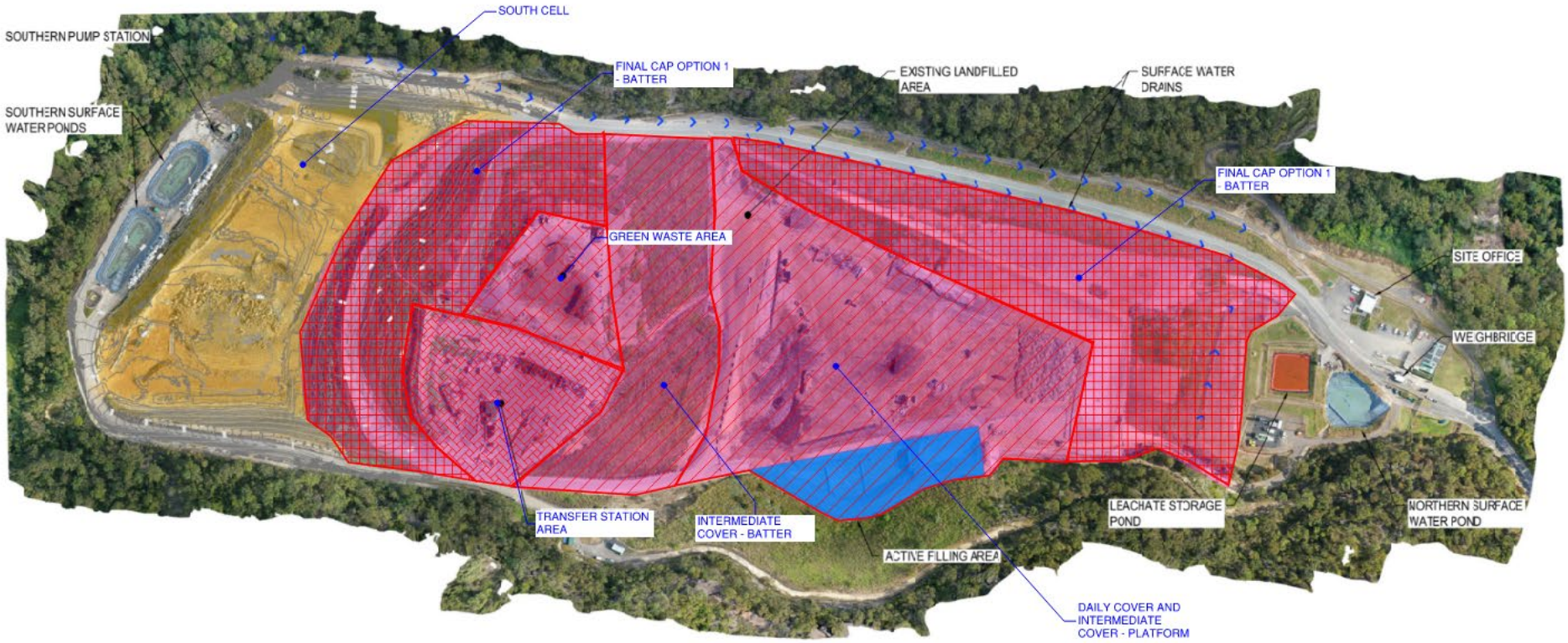


Figure 6.1 *Overview of existing cover and capping areas*

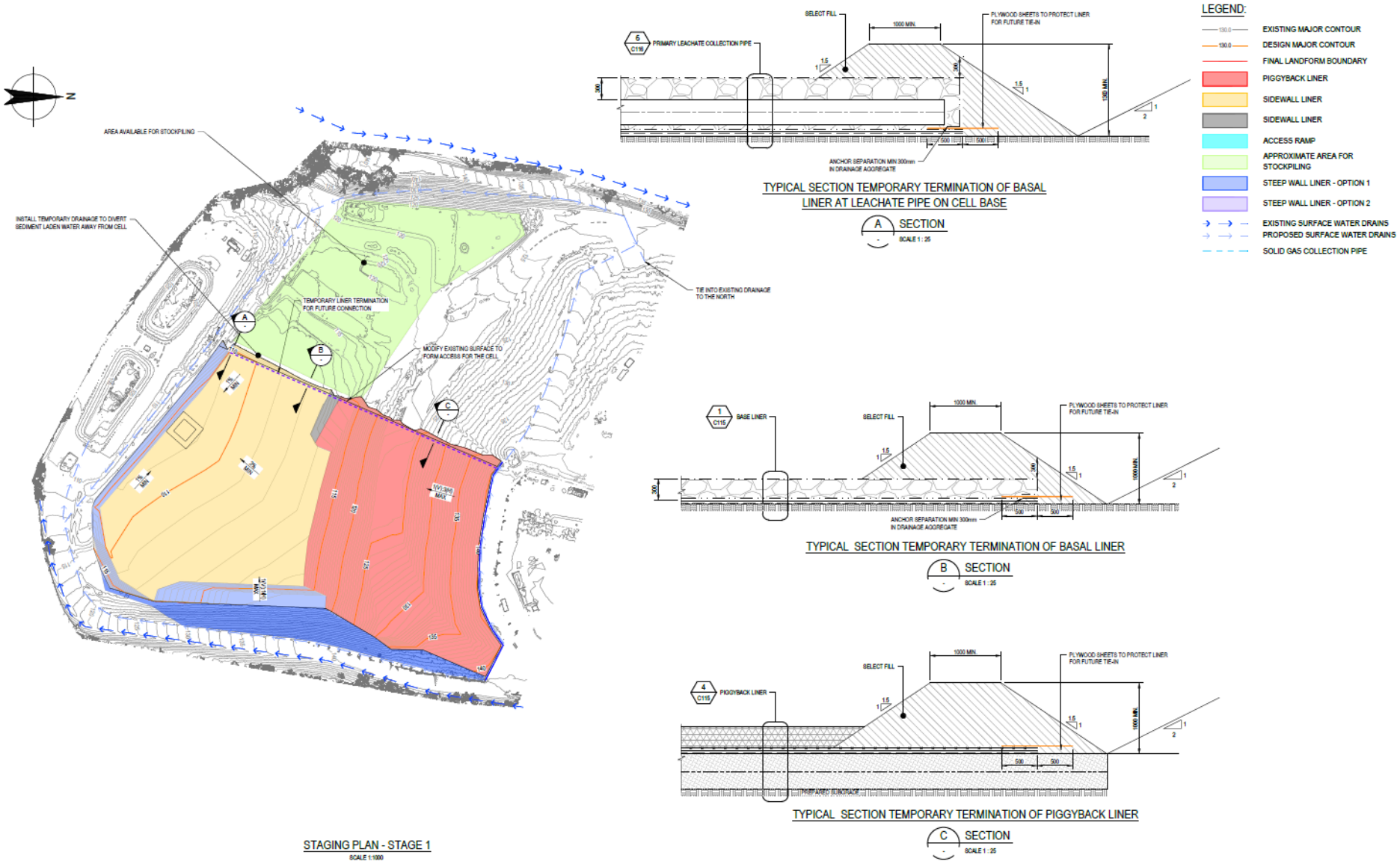


Figure 6.2 South Cell Stage 1

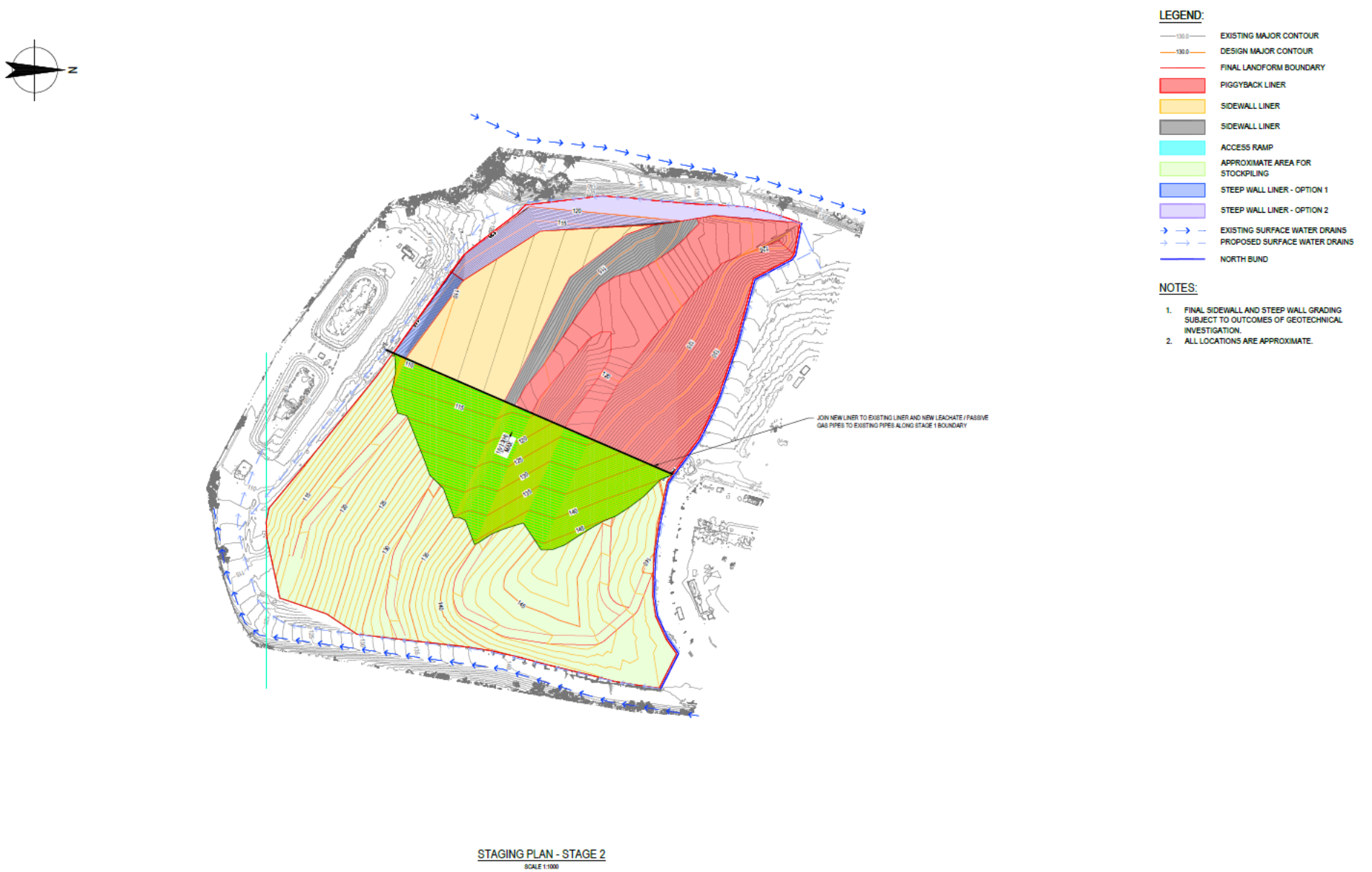


Figure 6.3 *South Cell Stage 2*

Table 6.1 Landfill staging – existing landfilled areas

Stage	Description	Areas
Scenario 0 (existing layout	– Existing northern and central areas	– Existing northern area (platform) = Intermediate cover area (platform) = 46,000 m^2 – Existing northern area (batter) = Final capping Option 1 (batter) = 30,400 m^2 – Existing central area (northern batter) = Intermediate cover area (batter) = 20,700 m^2 – Existing central area (southern batter) = Final capping Option 1 (batter) = 20,300 m^2 – Existing central area (GO facility) = 6,300 m^2 – Existing central area (transfer station) = 11,800 m^2

Table 6.2 Landfill staging – South Cell

Stage	Description	Areas
Scenario 1	– Western half of South Cell open	– Open cell = 17,200 m^2
Scenario 2	– Eastern half of South Cell open – Western half of South Cell largely final capped with some remaining daily/interim cover	– Open cell = 21,300 m^2 – Daily cover area = 600 m^2 – Interim cover area (platform) = 7,000 m^2 – Final capping Option 2 (batter) = 10,200 m^2
Scenario 3 (Final)	– South Cell final capped	– Final capping Option 2 (platform) = 15,900 m^2 – Final capping Option 2 (batter) = 22,600 m^2

6.7 Storage and disposal capabilities

In line with current practices, it is proposed that stored leachate is discharged directly from the South Cell to the leachate storage dam and then onto the Woy Woy STP. As per Section 4.4, it is understood that there are no current restrictions on the leachate volumes or quality accepted by the treatment plant (SMEC, 2020).

The sewer disposal pipework would be upgraded alongside the South Cell development, with the final outcomes of this leachate water balance used to confirm the pipe size requirements.

In addition, the South Cell would be utilised for temporary emergency leachate level fluctuation where needed and this would be considered in subsequent design phases with regards to the instrumentation and controls for the pumping system. This would allow additional buffer prior to sewer disposal and reduce the potential risk for pond overflows.

6.8 Trigger action response

As outlined in Section 2, in extreme circumstances, the TARP within *Technical Report 1 - Soil and Water Impact Assessment* may require diversion of runoff from the GO facility and transfer station to the leachate management system. Specific to this leachate water balance, potential diversion of these flows to the leachate management system has been considered in terms of estimated leachate quantities, to confirm the system is adequate for this scenario. Quantitative estimates for these flows were developed as part of the sediment laden water estimates in the Soil and Water Impact Assessment, and utilised for the water balance results below.

6.9 Calibration with leachate flow data

As per Section 4.5, no onsite flow data was available at the time of preparing this report.

6.10 Results

6.10.1 Leachate generation estimates

The results of the leachate generation modelling can be found in Appendix B and are summarised in Table 6.3 (South Cell), Table 6.4 (whole of WMF) and Table 6.5 (whole of WMF plus GO facility and transfer station runoff) below.

Table 6.3 Leachate generation modelling results (South Cell only)

	Estimated leachate generation for 50% AEP rainfall year			Estimated leachate generation for 10% AEP rainfall year		
	Average monthly (kL/month)	Peak month (kL/month)	Total for year (kL)	Average monthly (kL/month)	Peak month (kL/month)	Total for year (kL)
Stage 1	1,730	4,590	20,760	2,500	6,670	29,970
Stage 2	2,350	6,070	28,140	3,480	9,330	41,740
Final	40	200	510	70	280	840

Table 6.4 Leachate generation modelling results (whole of WMF)

	Estimated leachate generation for 50% AEP rainfall year			Estimated leachate generation for 10% AEP rainfall year		
	Average monthly (kL/month)	Peak month (kL/month)	Total for year (kL)	Average monthly (kL/month)	Peak month (kL/month)	Total for year (kL)
Stage 1	4,040	9,300	48,510	6,560	17,430	78,770
Stage 2	4,510	10,530	54,130	7,390	19,760	88,670
Final	2,190	4,620	26,250	3,970	10,710	47,650

Table 6.5 Leachate generation modelling results (whole of WMF plus GO facility and transfer station runoff)

	Estimated leachate generation for 50% AEP rainfall year			Estimated leachate generation for 10% AEP rainfall year		
	Average monthly (kL/month)	Peak month (kL/month)	Total for year (kL)	Average monthly (kL/month)	Peak month (kL/month)	Total for year (kL)
Stage 1	5,150	10,410	67,150	10,310	21,170	105,330
Stage 2	5,620	11,640	72,780	11,130	23,510	115,220
Final	3,300	5,730	44,890	7,710	14,460	74,200

6.10.2 Leachate disposal requirements

Given the limited storage capacity/buffer provided by the existing pond, leachate disposal requirements are estimated to be generally equivalent to the leachate generation estimates provided above. This could be reduced/buffered via use of the emergency in-cell storage during significant wet weather events, and this is discussed further below.

6.11 Discussion

The results provide estimates for leachate generation and subsequent disposal to sewer. As there is no specific limit for sewer disposal to the Woy Woy STP, no constraints have been identified in disposing of this leachate. In addition, as shown by the modelling the progressive capping and closure of the site will reduce leachate

generation and disposal requirements over time. The leachate collection and transfer infrastructure would be sized based on these estimates to provide adequate flow capacity within the leachate management system.

Based on the geometry of the South Cell, there is potential for temporary emergency storage of up to approximately 10 ML of leachate (7 ML in Stage 1 and 3 ML in Stage 2), should this be required during operations.

The following has been considered to address the limitations of the modelling:

– Calibration: As identified in Section 6.9, no leachate flow data was available to calibrate the model. As such, it is recommended that additional flow monitoring infrastructure (for both the South Cell and existing leachate pipework) be installed where possible as part of the South Cell construction. The collected data should then be used to calibrate, verify and/or update the leachate water balance within 1-2 years of the South Cell being commissioned, and every three years thereafter. In calibrating the model consideration should be given to developing and implementing a program to measure leachate levels in the existing filled areas and assess if any additional leachate volumes should be considered in the calibration exercise. This may also consider leachate seeps from the existing landfilled batters as an indicator of this issue.
– Groundwater inflow: As identified in Section 6.3, there is a potential for groundwater inflow to increase leachate generation within the unlined areas at the WMF, however this cannot be quantified with the available data. Qualitatively, WMF observations have suggested that the leachate management system for the existing landfilled areas was able to adequately manage leachate flows from these areas in recent years, including in 2022 during which significant rainfall and when there was a rise in the groundwater level. As discussed in the Soil and Water Impact Assessment, the monitoring data also suggests no leachate migration concerns at the groundwater monitoring locations. Hence, whilst not quantified, it is expected that the existing system can adequately address any additional leachate generated by groundwater inflow, and this can be quantified in future via the calibration works proposed above.

6.12 Model limitations

The HELP model is widely used (particularly in the USA) and is an industry accepted hydraulic modelling tool. It was developed for the United States Environmental Protection Agency to predict the hydraulic performance of differing landfill designs using site specific data.

The results of the HELP model tend to overestimate infiltration due to the use of daily instead of hourly data, which has the effect of reducing storm intensities and associated runoff quantities. There have been some concerns about using the HELP model in Australia, particularly in semi-arid to arid conditions, due to an under-estimation of evaporation rates in these climates. This under-estimation of evaporation rates tends to result in an overestimate of infiltration rates but for the purpose of design, some conservatism in the computed infiltration flows is appropriate.

7. Proposed leachate management measures

7.1 General

The following outlines the proposed leachate management measures at the WMF.

7.2 Minimisation

In line with current operations, leachate generation would be minimised through sound operating procedures including daily covering of wastes, the implementation of interim and final capping, effective surface water drainage and the use of landfill staging as parts of the cells are filled.

Filling of the South Cell is proposed to be separated into two stages, with the western half of the cell opened and filled first, followed by the eastern half of the cell, as outlined above in Table 6.2. These stages would limit the amount of “open cell” during operations, which would limit leachate generation during these phases.

Surface water drainage channels and diversions exist onsite to prevent the inflow of surface water into existing open cells. Surface water cut off drains and flow redirections are further outlined in Section 6.2.

7.3 Containment

The project would be fully lined across the cell footprint. The proposed liner profile options for the basal liner, sidewall liner, piggyback liner and steep wall liner for the project are described in the EIS. Each of the proposed liner profiles are designed in line with the NSW Landfill Guidelines and meet the design objectives.

7.4 Collection and transfer

The existing landfilled areas would continue to collect and transfer leachate in line with current operations. For the project, the proposed leachate collection and transfer system comprises (as described in the EIS):

– Perforated pipework to be laid at the base level of the project would be used to collect the generated leachate, which would be drained out by gravity.
– The collected drained leachate in a proposed sump within the extent of project would be extracted/transferred via a rising main to the upgraded sewer disposal network.

In addition, a contingency rising main would be installed alongside the rising main described above, to facilitate transfer of runoff from the GO facility and transfer station area if required based on the TARP implementation.

All of the proposed pipework would be sized based on the results of the leachate water balance described in this report.

7.5 Storage and disposal

For existing landfilled areas and the project, the existing leachate pond would be utilised for leachate storage prior disposal via sewer connection to the nearby Woy Woy STP. In addition, the project would be utilised for temporary emergency storage of leachate where needed and this would be considered in subsequent design phases with regards to the instrumentation and controls for the pumping system. This would allow additional buffer prior to sewer disposal and reduce the potential risk for pond overflows.

The sewer disposal pipework would be upgraded alongside the South Cell development, with the final outcomes of the leachate water balance used to confirm the pipe size requirements.

7.6 Monitoring

Alongside current compliance monitoring at the WMF, it is proposed that the following is implemented for the project:

– Leachate sump level monitoring via continuous monitoring measures (e.g. level switches) designed as part of the leachate collection and transfer system for the project.
– Yearly leachate quality monitoring in the sump in line with recommendations in the NSW Landfill Guidelines.
– Ongoing monitoring of the surrounding network of groundwater monitoring bores as outlined in *Technical Report 1 - Soil and Water Impact Assessment*.
– Ongoing monitoring of key surface water monitoring locations outlined in *Technical Report 1 - Soil and Water Impact Assessment* to identify any potential leachate migration from the South Cell into the surface water at the site.

The design of the leachate management system would also include instrumentation and controls to determine when pumps are turned on and off based on leachate levels, and measure leachate flow transfer from the project to the Woy Woy STP. This flow measurement would be expanded to capture the leachate transfer pipework for the existing landfilled areas where possible.

7.7 Model calibration

The collected leachate flow data from the monitoring described in Section 7.6 should be used to calibrate, verify and/or update the leachate water balance within 1-2 years of the South Cell being commissioned, and every three years thereafter.

The calibration works will delineate the older existing areas from the South Cell to better assess their leachate generation with respect to impacts of items such as, capping deficiencies, groundwater inflow and leachate build-up.

8. Conclusions and recommendations

The report presents recommendations for the proposed leachate management measures for the South Cell, based on conclusions from the infiltration and leachate water balance modelling. These primarily consist of:

– Leachate minimisation via efficient staging of the South Cell operations, including progressive covering and capping and surface water diversion.
– Leachate containment via a suitably designed leachate barrier system for the South Cell.
– Leachate collection and transfer from the South Cell via an in-cell leachate collection system with leachate transferred to the upgraded sewer disposal network.
– Temporary leachate storage within the South Cell if needed, followed by disposal to the nearby Woy Woy STP.
– Ongoing monitoring of both leachate and water quality as well as quantity of leachate collected and transferred.
– Calibration of the leachate water balance presented in this report over time to determine if any changes to the leachate management system are warranted over time.

These recommendations should be incorporated into the detailed design of the South Cell and ongoing management during operation, closure and post-closure.

9. References

Bureau of Meteorology, 7 February 2023. Climate data for Mangrove Mountain AWS (BOM station number 061375)

Chase, Burke and Harvey Surveying, 2013. Capping Profile and the Five Year Capping Survey.

Environment Protection Licence No. 6053, version dated 24 October 2019

GHD, 2023. South Cell at Woy Woy Waste Management Facility – Preliminary Design Report

NSW EPA, 2016. Environmental Guidelines: Solid Waste Landfills, Second edition, 2016

SILO, 7 February 2023. Weather data (**http://www.longpaddock.qld.gov.au/silo**) from SILO grid point of coordinates (-33.50, 151.30)

SMEC, 2020. Woy Woy Waste Management Facility – Development Strategy Report

Tetra Tech Coffey, 2022. Annual Environmental Monitoring Report, Woy Woy Waste Management Facility

US EPA, 1994. The Hydrologic Evaluation of Landfill Performance (HELP) Model

URS, 2006. Woy Woy Waste Management Facility Preliminary Closure Plan

URS, 2012. Landfill Management Plan (incorporating Pollution Incident Response Management Plan) – Woy Woy Waste Depot

Appendices

Appendix A

HELP modelling outputs

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************



PRECIPITATION DATA FILE:    \WOY.D4
TEMPERATURE DATA FILE:      \WOY.D7
SOLAR RADIATION DATA FILE:  \WOY.D13
EVAPOTRANSPIRATION DATA:    \WOY10.D11
SOIL AND DESIGN DATA FILE:  \DAILY.D10
OUTPUT DATA FILE:           \DAILY.OUT


TIME:  16: 1     DATE:   3/22/2023



**********************************************************************

     TITLE:  Daily Cover

**********************************************************************



     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  14
          THICKNESS                    =     15.00   CM
          POROSITY                     =      0.4790 VOL/VOL
          FIELD CAPACITY               =      0.3710 VOL/VOL
          WILTING POINT                =      0.2510 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.3058 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.249999994000E-04 CM/SEC

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	= 500.00	CM
POROSITY	= 0.6710	VOL/VOL
FIELD CAPACITY	= 0.2920	VOL/VOL
WILTING POINT	= 0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	= 0.2943	VOL/VOL
EFFECTIVE SAT. HYD. COND.	= 0.100000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #14 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 50. METERS.

SCS RUNOFF CURVE NUMBER	= 96.50	
FRACTION OF AREA ALLOWING RUNOFF	= 0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	= 1.0000	HECTARES
EVAPORATIVE ZONE DEPTH	= 10.0	CM
INITIAL WATER IN EVAPORATIVE ZONE	= 2.661	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	= 4.790	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	= 2.510	CM
INITIAL SNOW WATER	= 0.000	CM
INITIAL WATER IN LAYER MATERIALS	= 151.756	CM
TOTAL INITIAL WATER	= 151.756	CM
TOTAL SUBSURFACE INFLOW	= 0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Woy Woy NSW

STATION LATITUDE	= -33.51	DEGREES
MAXIMUM LEAF AREA INDEX	= 0.00	
START OF GROWING SEASON (JULIAN DATE)	= 275	
END OF GROWING SEASON (JULIAN DATE)	= 91	

EVAPORATIVE ZONE DEPTH = 10.0 CM
AVERAGE ANNUAL WIND SPEED = 12.70 KPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 66.70 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 60.80 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 72.30 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 67.20 %

NOTE: PRECIPITATION DATA FOR

WAS ENTERED BY THE USER.

NOTE: TEMPERATURE DATA FOR

WAS ENTERED BY THE USER.

NOTE: SOLAR RADIATION DATA FOR

WAS ENTERED BY THE USER.

****

MONTHLY TOTALS (MM) FOR YEAR 1952

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	46.4	28.0	228.0	320.7	45.6	111.4
	317.4	371.3	24.4	115.1	43.1	50.1
RUNOFF	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
EVAPOTRANSPIRATION	20.00	8.28	44.38	77.50	40.98	18.31
	19.54	56.66	9.91	63.29	30.61	30.24

PERCOLATION/LEAKAGE THROUGH	58.118	4.156	25.979	147.214	173.143
97.160					
LAYER 2	94.892	364.055	174.925	83.710	67.621
10.905					

****

****

ANNUAL TOTALS FOR YEAR 1952

	MM	CU. METERS	PERCENT
PRECIPITATION	1701.50	17014.996	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	419.693	4196.929	24.67
PERC./LEAKAGE THROUGH LAYER 2	1301.877080	13018.771	76.51
CHANGE IN WATER STORAGE	-20.070	-200.700	-1.18
SOIL WATER AT START OF YEAR	1535.362	15353.617	
SOIL WATER AT END OF YEAR	1515.292	15152.917	
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 2008

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	106.7	257.2	46.3	166.1	13.5	164.3
	55.0	47.0	99.9	69.6	76.1	88.8
RUNOFF	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
EVAPOTRANSPIRATION	37.19	68.39	38.87	56.22	10.08	52.19
	18.40	31.59	39.63	46.12	29.00	48.76
PERCOLATION/LEAKAGE THROUGH	81.598	100.253	104.554	60.328	105.198	63.022
LAYER 2	60.009	29.419	56.429	46.368	15.351	51.341

****

****

ANNUAL TOTALS FOR YEAR 2008

	MM	CU. METERS	PERCENT
PRECIPITATION	1190.50	11904.997	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	476.452	4764.515	40.02
PERC./LEAKAGE THROUGH LAYER 2	773.870605	7738.707	65.00
CHANGE IN WATER STORAGE	-59.822	-598.221	-5.02
SOIL WATER AT START OF YEAR	1584.238	15842.376	
SOIL WATER AT END OF YEAR	1524.415	15244.154	
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	-0.0003	-0.003	0.00

****

****

AVERAGE MONTHLY VALUES (MM) FOR YEARS 1923 THROUGH 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	108.32	125.65	140.77	121.45	100.17	120.21
	70.25	70.88	62.27	75.55	86.71	91.16
STD. DEVIATIONS	74.48	85.28	94.50	101.89	75.37	96.67
	65.33	74.25	50.54	56.69	62.89	65.51
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	48.096	47.936	52.254	44.928	36.001	35.796
	26.789	27.412	29.274	37.696	43.342	43.831
STD. DEVIATIONS	21.313	24.259	24.029	22.217	16.023	14.990
	12.984	16.433	16.823	18.777	22.983	24.861
PERCOLATION/LEAKAGE THROUGH LAYER 2						

TOTALS	42.8462	52.7584	75.4286	81.2284	78.8577	70.9595
	77.9302	52.8244	41.7436	39.1942	40.5054	45.8560
STD. DEVIATIONS	31.3442	35.9754	47.0601	48.4904	55.8188	44.4526
	52.6035	53.2454	41.4941	31.5600	31.2264	33.8870

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1923 THROUGH 2022

	MM	CU. METERS	PERCENT
PRECIPITATION	1173.39 (283.704)	11733.9	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	473.354 (89.2795)	4733.54	40.341
PERCOLATION/LEAKAGE THROUGH LAYER 2	700.13257 (232.32204)	7001.326	59.66773
CHANGE IN WATER STORAGE	-0.101 (2.3479)	-1.01	-0.009

****

****

PEAK DAILY VALUES FOR YEARS 1923 THROUGH 2022

	(MM)	(CU. METERS)
PRECIPITATION	150.40	1504.000
RUNOFF	0.000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 2	24.715059	247.15059
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4790

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.2510

****

****

FINAL WATER STORAGE AT END OF YEAR 2022

LAYER	(CM)	(VOL/VOL)
1	4.7480	0.3165
2	146.0000	0.2920
SNOW WATER	0.000	

****
****

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************


PRECIPITATION DATA FILE:    \WOY.D4
TEMPERATURE DATA FILE:      \WOY.D7
SOLAR RADIATION DATA FILE:  \WOY.D13
EVAPOTRANSPIRATION DATA:    \WOY20.D11
SOIL AND DESIGN DATA FILE:  \INTPLAT.D10
OUTPUT DATA FILE:           \INTPLAT.OUT


TIME:  16: 6     DATE:   3/22/2023


**********************************************************************

     TITLE:  Intermediate Cover - PLATFORM

**********************************************************************


     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  14
          THICKNESS                    =     30.00   CM
          POROSITY                     =      0.4790 VOL/VOL
          FIELD CAPACITY               =      0.3710 VOL/VOL
          WILTING POINT                =      0.2510 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.3462 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.249999994000E-04 CM/SEC

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	= 500.00	CM
POROSITY	= 0.6710	VOL/VOL
FIELD CAPACITY	= 0.2920	VOL/VOL
WILTING POINT	= 0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	= 0.2920	VOL/VOL
EFFECTIVE SAT. HYD. COND.	= 0.100000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #14 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 225. METERS.

SCS RUNOFF CURVE NUMBER	= 96.30	
FRACTION OF AREA ALLOWING RUNOFF	= 50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	= 1.0000	HECTARES
EVAPORATIVE ZONE DEPTH	= 20.0	CM
INITIAL WATER IN EVAPORATIVE ZONE	= 6.348	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	= 9.580	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	= 5.020	CM
INITIAL SNOW WATER	= 0.000	CM
INITIAL WATER IN LAYER MATERIALS	= 156.382	CM
TOTAL INITIAL WATER	= 156.382	CM
TOTAL SUBSURFACE INFLOW	= 0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Woy Woy NSW

STATION LATITUDE	= -33.51	DEGREES
MAXIMUM LEAF AREA INDEX	= 0.00	
START OF GROWING SEASON (JULIAN DATE)	= 275	
END OF GROWING SEASON (JULIAN DATE)	= 91	

EVAPORATIVE ZONE DEPTH = 20.0 CM
AVERAGE ANNUAL WIND SPEED = 12.70 KPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 66.70 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 60.80 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 72.30 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 67.20 %

NOTE: PRECIPITATION DATA FOR

WAS ENTERED BY THE USER.

NOTE: TEMPERATURE DATA FOR

WAS ENTERED BY THE USER.

NOTE: SOLAR RADIATION DATA FOR

WAS ENTERED BY THE USER.

****

MONTHLY TOTALS (MM) FOR YEAR 1952

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	46.4	28.0	228.0	320.7	45.6	111.4
	317.4	371.3	24.4	115.1	43.1	50.1
RUNOFF	9.09	1.25	79.29	88.24	2.59	35.00
	131.02	132.73	0.56	19.40	1.68	1.77
EVAPOTRANSPIRATION	34.81	7.54	62.10	89.65	65.22	32.58
	18.72	73.70	9.10	83.25	34.11	38.06

PERCOLATION/LEAKAGE THROUGH	3.019	0.000	18.489	67.669	103.775
50.065					
LAYER 2	32.069	144.187	140.892	65.679	3.416
0.000					

****

****

ANNUAL TOTALS FOR YEAR 1952

	MM	CU. METERS	PERCENT
PRECIPITATION	1701.50	17014.996	100.00
RUNOFF	502.611	5026.106	29.54
EVAPOTRANSPIRATION	548.866	5488.658	32.26
PERC./LEAKAGE THROUGH LAYER 2	629.260498	6292.605	36.98
CHANGE IN WATER STORAGE	20.763	207.634	1.22
SOIL WATER AT START OF YEAR	1547.804	15478.035	
SOIL WATER AT END OF YEAR	1568.567	15685.669	
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	-0.0006	-0.006	0.00

****

****

MONTHLY TOTALS (MM) FOR YEAR 2008

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	106.7	257.2	46.3	166.1	13.5	164.3
	55.0	47.0	99.9	69.6	76.1	88.8
RUNOFF	21.10	65.90	4.74	38.74	0.11	39.94
	6.63	3.70	28.74	5.33	10.84	18.51
EVAPOTRANSPIRATION	50.67	87.04	61.51	74.15	20.21	63.82
	21.52	47.23	49.62	55.00	47.01	71.21
PERCOLATION/LEAKAGE THROUGH	36.661	57.084	48.406	13.504	33.313	40.822
LAYER 2	24.256	4.415	38.286	4.881	6.987	13.627

****

****

ANNUAL TOTALS FOR YEAR 2008

	MM	CU. METERS	PERCENT
PRECIPITATION	1190.50	11904.997	100.00
RUNOFF	244.280	2442.800	20.52
EVAPOTRANSPIRATION	648.982	6489.815	54.51
PERC./LEAKAGE THROUGH LAYER 2	322.244476	3222.445	27.07
CHANGE IN WATER STORAGE	-25.006	-250.061	-2.10
SOIL WATER AT START OF YEAR	1575.933	15759.326	
SOIL WATER AT END OF YEAR	1550.927	15509.266	
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	-0.0002	-0.002	0.00

****

****

AVERAGE MONTHLY VALUES (MM) FOR YEARS 1923 THROUGH 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	108.32	125.65	140.77	121.45	100.17	120.21
	70.25	70.88	62.27	75.55	86.71	91.16
STD. DEVIATIONS	74.48	85.28	94.50	101.89	75.37	96.67
	65.33	74.25	50.54	56.69	62.89	65.51
RUNOFF						
TOTALS	22.188	28.572	32.459	28.221	22.069	28.308
	14.370	14.737	10.559	13.103	15.394	16.865
STD. DEVIATIONS	24.942	26.988	31.337	34.740	24.563	32.528
	22.439	25.375	14.429	17.068	19.838	20.367
EVAPOTRANSPIRATION						
TOTALS	62.491	62.324	66.097	58.604	46.569	45.685
	36.001	36.495	37.771	49.112	53.549	55.816
STD. DEVIATIONS	27.143	30.676	28.595	26.507	19.197	17.700
	15.758	21.217	22.203	24.703	29.914	32.323
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	16.3613	24.0738	36.3222	36.3352	35.7836	33.9265
	39.3497	24.5090	17.9842	17.2494	16.0761	18.1064
STD. DEVIATIONS	18.2482	22.1719	27.8716	32.4591	35.0043	27.6348
	34.3125	31.3496	28.0634	20.1686	19.0507	20.7887

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1923 THROUGH 2022

	MM		CU. METERS	PERCENT
PRECIPITATION	1173.39	(283.704)	11733.9	100.00
RUNOFF	246.845	(88.7719)	2468.45	21.037
EVAPOTRANSPIRATION	610.513	(109.0491)	6105.13	52.030
PERCOLATION/LEAKAGE THROUGH LAYER 2	316.07736	(123.38899)	3160.774	26.93721
CHANGE IN WATER STORAGE	-0.050	(1.1163)	-0.50	-0.004

****

****

PEAK DAILY VALUES FOR YEARS 1923 THROUGH 2022

	(MM)	(CU. METERS)
PRECIPITATION	150.40	1504.000
RUNOFF	70.107	701.0656
PERCOLATION/LEAKAGE THROUGH LAYER 2	9.531699	95.31699
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4520
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.2510

****

****

FINAL WATER STORAGE AT END OF YEAR 2022

LAYER	(CM)	(VOL/VOL)
1	10.0084	0.3336
2	145.8777	0.2918
SNOW WATER	0.000	

****
****

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************



PRECIPITATION DATA FILE:    \WOY.D4
TEMPERATURE DATA FILE:      \WOY.D7
SOLAR RADIATION DATA FILE:  \WOY.D13
EVAPOTRANSPIRATION DATA:    \WOY20.D11
SOIL AND DESIGN DATA FILE:  \INTBAT.D10
OUTPUT DATA FILE:           \INTBAT.OUT


TIME:  16:15     DATE:   3/22/2023



**********************************************************************

     TITLE:  Intermediate Cover - BATTER

**********************************************************************



     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  14
               THICKNESS                    =     30.00   CM
               POROSITY                     =      0.4790 VOL/VOL
               FIELD CAPACITY               =      0.3710 VOL/VOL
               WILTING POINT                =      0.2510 VOL/VOL
               INITIAL SOIL WATER CONTENT   =      0.3518 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.249999994000E-04 CM/SEC

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	500.00	CM
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2919	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #14 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 15.% AND A SLOPE LENGTH OF 90. METERS.

SCS RUNOFF CURVE NUMBER	=	96.50	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.0000	HECTARES
EVAPORATIVE ZONE DEPTH	=	20.0	CM
INITIAL WATER IN EVAPORATIVE ZONE	=	6.649	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	=	9.580	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	=	5.020	CM
INITIAL SNOW WATER	=	0.000	CM
INITIAL WATER IN LAYER MATERIALS	=	156.510	CM
TOTAL INITIAL WATER	=	156.510	CM
TOTAL SUBSURFACE INFLOW	=	0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Woy Woy NSW

STATION LATITUDE	=	-33.51 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	275
END OF GROWING SEASON (JULIAN DATE)	=	91

EVAPORATIVE ZONE DEPTH = 20.0 CM
AVERAGE ANNUAL WIND SPEED = 12.70 KPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 66.70 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 60.80 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 72.30 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 67.20 %

NOTE: PRECIPITATION DATA FOR

WAS ENTERED BY THE USER.

NOTE: TEMPERATURE DATA FOR

WAS ENTERED BY THE USER.

NOTE: SOLAR RADIATION DATA FOR

WAS ENTERED BY THE USER.

****

MONTHLY TOTALS (MM) FOR YEAR 1952

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	46.4	28.0	228.0	320.7	45.6	111.4
	317.4	371.3	24.4	115.1	43.1	50.1
RUNOFF	9.50	1.40	80.35	90.69	2.82	35.67
	131.86	134.73	0.65	20.43	1.88	1.79
EVAPOTRANSPIRATION	34.56	7.54	62.12	89.15	64.56	32.54
	18.72	73.43	9.12	82.96	26.93	41.71

```
 PERCOLATION/LEAKAGE THROUGH       2.163   0.000  18.012  67.704 102.974
49.302
   LAYER  2                      30.897 142.247 140.310  63.460   2.165
5.181
```

****

****

ANNUAL TOTALS FOR YEAR 1952

	MM	CU. METERS	PERCENT
PRECIPITATION	1701.50	17014.996	100.00
RUNOFF	511.765	5117.648	30.08
EVAPOTRANSPIRATION	543.354	5433.542	31.93
PERC./LEAKAGE THROUGH LAYER 2	624.414551	6244.146	36.70
CHANGE IN WATER STORAGE	21.967	219.666	1.29
SOIL WATER AT START OF YEAR	1546.972	15469.717	
SOIL WATER AT END OF YEAR	1568.938	15689.382	
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	-0.0006	-0.006	0.00

****

****

MONTHLY TOTALS (MM) FOR YEAR 2008

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	106.7	257.2	46.3	166.1	13.5	164.3
	55.0	47.0	99.9	69.6	76.1	88.8
RUNOFF	21.97	66.09	5.11	39.81	0.14	41.10
	6.96	4.01	29.42	5.74	11.56	19.00
EVAPOTRANSPIRATION	50.63	84.11	60.96	71.32	20.40	63.39
	21.82	46.22	50.44	53.62	47.83	69.84
PERCOLATION/LEAKAGE THROUGH	27.822	56.560	53.201	14.253	33.459	42.172
LAYER 2	21.770	4.427	37.204	6.428	5.179	14.217

****

****

ANNUAL TOTALS FOR YEAR 2008

	MM	CU. METERS	PERCENT
PRECIPITATION	1190.50	11904.997	100.00
RUNOFF	250.925	2509.248	21.08
EVAPOTRANSPIRATION	640.575	6405.747	53.81
PERC./LEAKAGE THROUGH LAYER 2	316.692047	3166.920	26.60
CHANGE IN WATER STORAGE	-17.692	-176.917	-1.49
SOIL WATER AT START OF YEAR	1568.599	15685.985	
SOIL WATER AT END OF YEAR	1550.907	15509.067	
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	-0.0001	-0.001	0.00

****

****

AVERAGE MONTHLY VALUES (MM) FOR YEARS 1923 THROUGH 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	108.32	125.65	140.77	121.45	100.17	120.21
	70.25	70.88	62.27	75.55	86.71	91.16
STD. DEVIATIONS	74.48	85.28	94.50	101.89	75.37	96.67
	65.33	74.25	50.54	56.69	62.89	65.51
RUNOFF						
TOTALS	22.965	29.434	33.419	29.021	22.719	29.109
	14.850	15.168	10.966	13.615	15.943	17.479
STD. DEVIATIONS	25.434	27.513	31.939	35.357	25.026	33.079
	22.774	25.806	14.778	17.419	20.135	20.858
EVAPOTRANSPIRATION						
TOTALS	62.341	61.625	66.235	58.259	46.510	45.569
	35.931	36.465	37.532	48.721	53.576	55.727
STD. DEVIATIONS	27.095	30.797	28.416	26.445	19.099	17.798
	15.814	21.319	22.139	24.605	30.184	32.578
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	15.9369	23.8075	35.6081	35.5866	35.2203	33.4624

	38.6760	23.7714	17.6965	17.0045	15.8720	17.6193
STD. DEVIATIONS	18.2635	21.9734	27.5198	31.9323	34.5039	27.4761
	34.0729	30.8883	27.5991	19.8508	18.7634	20.5620

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1923 THROUGH 2022

	MM		CU. METERS	PERCENT
PRECIPITATION	1173.39	(283.704)	11733.9	100.00
RUNOFF	254.688	(90.4030)	2546.88	21.705
EVAPOTRANSPIRATION	608.491	(108.6803)	6084.91	51.858
PERCOLATION/LEAKAGE THROUGH LAYER 2	310.26135	(121.85497)	3102.614	26.44155
CHANGE IN WATER STORAGE	-0.054	(1.1207)	-0.54	-0.005

****

****

PEAK DAILY VALUES FOR YEARS 1923 THROUGH 2022

	(MM)	(CU. METERS)
PRECIPITATION	150.40	1504.000
RUNOFF	70.329	703.2940
PERCOLATION/LEAKAGE THROUGH LAYER 2	9.418694	94.18694
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4526
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.2510

****

****

FINAL WATER STORAGE AT END OF YEAR 2022

LAYER	(CM)	(VOL/VOL)
1	10.0051	0.3335
2	145.9629	0.2919
SNOW WATER	0.000	

****
****

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************



PRECIPITATION DATA FILE:    \WOY.D4
TEMPERATURE DATA FILE:      \WOY.D7
SOLAR RADIATION DATA FILE:  \WOY.D13
EVAPOTRANSPIRATION DATA:    \WOY15.D11
SOIL AND DESIGN DATA FILE:  \FIN1PLAT.D10
OUTPUT DATA FILE:           \FIN1PLAT.OUT


TIME:  16:22     DATE:   3/22/2023



**********************************************************************

     TITLE:  Final Cap Option 1 - PLATFORM

**********************************************************************



     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   8
          THICKNESS                    =     15.00   CM
          POROSITY                     =      0.4630 VOL/VOL
          FIELD CAPACITY               =      0.2320 VOL/VOL
          WILTING POINT                =      0.1160 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.1348 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.369999994000E-03 CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	90.00 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. COND.	=	0.999999997000E-06 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 14

THICKNESS	=	30.00 CM
POROSITY	=	0.4790 VOL/VOL
FIELD CAPACITY	=	0.3710 VOL/VOL
WILTING POINT	=	0.2510 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3710 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.249999994000E-04 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	500.00 CM
POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2919 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 8 WITH A POOR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 225. METERS.

SCS RUNOFF CURVE NUMBER	=	85.50	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.0000	HECTARES
EVAPORATIVE ZONE DEPTH	=	15.0	CM
INITIAL WATER IN EVAPORATIVE ZONE	=	2.023	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.945	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.740	CM
INITIAL SNOW WATER	=	0.000	CM
INITIAL WATER IN LAYER MATERIALS	=	197.542	CM
TOTAL INITIAL WATER	=	197.542	CM
TOTAL SUBSURFACE INFLOW	=	0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM Woy Woy NSW

STATION LATITUDE	=	-33.51	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00	
START OF GROWING SEASON (JULIAN DATE)	=	275	
END OF GROWING SEASON (JULIAN DATE)	=	91	
EVAPORATIVE ZONE DEPTH	=	15.0	CM
AVERAGE ANNUAL WIND SPEED	=	12.70	KPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.70	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	60.80	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.30	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	67.20	%

NOTE: PRECIPITATION DATA FOR

WAS ENTERED BY THE USER.

NOTE: TEMPERATURE DATA FOR

WAS ENTERED BY THE USER.

NOTE: SOLAR RADIATION DATA FOR

WAS ENTERED BY THE USER.

****

MONTHLY TOTALS (MM) FOR YEAR 1952

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	46.4	28.0	228.0	320.7	45.6	111.4
	317.4	371.3	24.4	115.1	43.1	50.1
RUNOFF	0.57	0.00	116.76	188.12	0.00	46.60
	244.02	305.63	0.00	2.65	0.00	0.00
EVAPOTRANSPIRATION	40.99	27.82	82.53	77.51	55.72	35.30
	34.23	69.20	23.15	99.15	50.91	41.82
PERCOLATION/LEAKAGE THROUGH	4.839	0.000	7.985	29.488	28.818	16.587
LAYER 2	12.882	30.243	2.234	15.130	0.879	0.000
PERCOLATION/LEAKAGE THROUGH	8.055	0.000	0.000	24.534	29.582	16.502
LAYER 4	18.019	24.911	15.030	7.299	8.173	0.000

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	0.691	0.000	2.880	12.390	6.837	5.164
TOP OF LAYER 2	3.369	11.623	0.156	3.664	0.052	0.000
STD. DEVIATION OF DAILY	1.619	0.000	5.161	3.300	2.810	5.488

HEAD ON TOP OF LAYER 2	5.384	3.520	0.545	4.365	0.280	0.000

****

****

ANNUAL TOTALS FOR YEAR 1952

	MM	CU. METERS	PERCENT
PRECIPITATION	1701.50	17014.996	100.00
RUNOFF	904.351	9043.513	53.15
EVAPOTRANSPIRATION	638.341	6383.414	37.52
PERC./LEAKAGE THROUGH LAYER 2	149.084061	1490.841	8.76
AVG. HEAD ON TOP OF LAYER 2	39.0223		
PERC./LEAKAGE THROUGH LAYER 4	152.103912	1521.039	8.94
CHANGE IN WATER STORAGE	6.703	67.035	0.39
SOIL WATER AT START OF YEAR	1975.953	19759.529	
SOIL WATER AT END OF YEAR	1982.656	19826.564	
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	-0.0005	-0.005	0.00

****

****

MONTHLY TOTALS (MM) FOR YEAR 2008

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	106.7	257.2	46.3	166.1	13.5	164.3
	55.0	47.0	99.9	69.6	76.1	88.8
RUNOFF	23.01	100.85	0.00	55.99	0.00	68.75
	0.40	0.00	37.13	0.00	0.00	3.41
EVAPOTRANSPIRATION	72.81	107.38	72.64	54.96	34.80	52.58
	30.48	47.71	66.48	69.58	54.48	95.83
PERCOLATION/LEAKAGE THROUGH	10.881	18.836	3.791	20.700	9.564	26.150
LAYER 2	13.020	11.383	13.652	2.036	0.628	8.811
PERCOLATION/LEAKAGE THROUGH	7.735	21.235	10.760	7.472	20.906	15.627
LAYER 4	18.067	15.487	12.440	6.255	0.604	6.276

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	3.181	7.143	0.403	7.375	1.653	9.801
TOP OF LAYER 2	1.654	1.234	3.905	0.009	0.001	1.144
STD. DEVIATION OF DAILY	4.990	6.104	1.013	5.438	2.795	4.386
HEAD ON TOP OF LAYER 2	2.107	1.862	5.145	0.030	0.005	2.532

****

****

ANNUAL TOTALS FOR YEAR 2008

	MM	CU. METERS	PERCENT
PRECIPITATION	1190.50	11904.997	100.00
RUNOFF	289.549	2895.491	24.32
EVAPOTRANSPIRATION	759.741	7597.415	63.82
PERC./LEAKAGE THROUGH LAYER 2	139.451508	1394.515	11.71
AVG. HEAD ON TOP OF LAYER 2	31.2533		
PERC./LEAKAGE THROUGH LAYER 4	142.864883	1428.649	12.00
CHANGE IN WATER STORAGE	-1.655	-16.549	-0.14
SOIL WATER AT START OF YEAR	1978.371	19783.711	
SOIL WATER AT END OF YEAR	1976.716	19767.162	
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	-0.0008	-0.008	0.00

****

****

AVERAGE MONTHLY VALUES (MM) FOR YEARS 1923 THROUGH 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	108.32	125.65	140.77	121.45	100.17	120.21
	70.25	70.88	62.27	75.55	86.71	91.16
STD. DEVIATIONS	74.48	85.28	94.50	101.89	75.37	96.67
	65.33	74.25	50.54	56.69	62.89	65.51

RUNOFF

TOTALS	20.291	33.925	44.198	46.268	36.351	55.123
	24.132	21.981	11.021	13.038	13.256	12.985
STD. DEVIATIONS	42.639	48.216	66.857	76.800	53.629	79.138
	46.841	54.676	27.433	28.988	34.583	30.198

EVAPOTRANSPIRATION

TOTALS	76.581	78.379	82.269	51.335	43.633	40.195
	36.777	39.093	42.627	60.263	67.524	71.231
STD. DEVIATIONS	32.632	32.902	31.660	19.175	13.545	11.384
	11.196	20.176	24.734	26.410	33.604	38.726

PERCOLATION/LEAKAGE THROUGH LAYER 2

TOTALS	7.2708	9.9451	12.9160	17.7969	19.1055	20.8287
	19.4139	12.5287	9.2291	8.9690	6.9101	6.0115
STD. DEVIATIONS	6.2651	8.0311	8.7819	9.9423	9.7781	9.8274
	9.4630	10.4572	8.2783	6.8831	6.7659	6.7523

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	5.7761	8.2589	12.2195	15.3874	18.8044	20.2395
	21.3463	14.8749	10.5675	9.1109	7.6024	6.7365
STD. DEVIATIONS	5.6777	6.6276	8.7143	9.3660	9.3888	9.3296
	9.1327	10.1026	9.3094	6.9165	6.8030	6.2751

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (CM)

DAILY AVERAGE HEAD ON TOP OF LAYER 2

AVERAGES	1.7781	3.0073	3.6390	5.1249	5.4014	6.7689
	4.9623	3.1395	2.1090	1.9380	1.5595	1.2545
STD. DEVIATIONS	1.8827	2.8869	3.1101	3.9049	3.7975	4.1413
	3.6958	3.3906	2.4734	2.1916	1.9448	1.8748

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1923 THROUGH 2022

	MM	CU. METERS	PERCENT
PRECIPITATION	1173.39 (283.704)	11733.9	100.00
RUNOFF	332.568 (191.6273)	3325.68	28.343
EVAPOTRANSPIRATION	689.908 (108.2144)	6899.08	58.796
PERCOLATION/LEAKAGE THROUGH LAYER 2	150.92529 (34.15227)	1509.253	12.86238
AVERAGE HEAD ON TOP OF LAYER 2	33.902 (10.376)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	150.92433 (34.71054)	1509.243	12.86230
CHANGE IN WATER STORAGE	-0.014 (0.8893)	-0.14	-0.001

****

****

PEAK DAILY VALUES FOR YEARS 1923 THROUGH 2022

	(MM)	(CU. METERS)
PRECIPITATION	150.40	1504.000
RUNOFF	143.792	1437.9207
PERCOLATION/LEAKAGE THROUGH LAYER 2	1.007985	10.07985
AVERAGE HEAD ON TOP OF LAYER 2	150.000	
PERCOLATION/LEAKAGE THROUGH LAYER 4	1.512899	15.12899
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4630
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1160

****

****

FINAL WATER STORAGE AT END OF YEAR 2022

LAYER	(CM)	(VOL/VOL)
1	1.8741	0.1249
2	38.4300	0.4270
3	11.1292	0.3710
4	145.9694	0.2919
SNOW WATER	0.000	

****
****

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************



PRECIPITATION DATA FILE:    \WOY.D4
TEMPERATURE DATA FILE:      \WOY.D7
SOLAR RADIATION DATA FILE:  \WOY.D13
EVAPOTRANSPIRATION DATA:    \WOY15.D11
SOIL AND DESIGN DATA FILE:  \FIN1BAT.D10
OUTPUT DATA FILE:           \FIN1BAT.OUT


TIME:  17:34     DATE:   3/22/2023



**********************************************************************

     TITLE:  Final Cap Option 1 - BATTER

**********************************************************************



     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   8
          THICKNESS                    =     15.00   CM
          POROSITY                     =      0.4630 VOL/VOL
          FIELD CAPACITY               =      0.2320 VOL/VOL
          WILTING POINT                =      0.1160 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.1348 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.369999994000E-03 CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	90.00 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. COND.	=	0.999999997000E-06 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 14

THICKNESS	=	30.00 CM
POROSITY	=	0.4790 VOL/VOL
FIELD CAPACITY	=	0.3710 VOL/VOL
WILTING POINT	=	0.2510 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3710 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.249999994000E-04 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	500.00 CM
POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2919 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 8 WITH A POOR STAND OF GRASS, A SURFACE SLOPE OF 15.% AND A SLOPE LENGTH OF 90. METERS.

SCS RUNOFF CURVE NUMBER	=	86.50	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.0000	HECTARES
EVAPORATIVE ZONE DEPTH	=	15.0	CM
INITIAL WATER IN EVAPORATIVE ZONE	=	2.022	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.945	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.740	CM
INITIAL SNOW WATER	=	0.000	CM
INITIAL WATER IN LAYER MATERIALS	=	197.544	CM
TOTAL INITIAL WATER	=	197.544	CM
TOTAL SUBSURFACE INFLOW	=	0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM Woy Woy NSW

STATION LATITUDE	=	-33.51	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00	
START OF GROWING SEASON (JULIAN DATE)	=	275	
END OF GROWING SEASON (JULIAN DATE)	=	91	
EVAPORATIVE ZONE DEPTH	=	15.0	CM
AVERAGE ANNUAL WIND SPEED	=	12.70	KPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.70	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	60.80	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.30	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	67.20	%

NOTE: PRECIPITATION DATA FOR

WAS ENTERED BY THE USER.

NOTE: TEMPERATURE DATA FOR

WAS ENTERED BY THE USER.

NOTE: SOLAR RADIATION DATA FOR

WAS ENTERED BY THE USER.

****

MONTHLY TOTALS (MM) FOR YEAR 1952

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	46.4	28.0	228.0	320.7	45.6	111.4
	317.4	371.3	24.4	115.1	43.1	50.1
RUNOFF	1.06	0.00	120.48	188.52	0.00	48.51
	246.41	305.51	0.00	4.07	0.00	0.00
EVAPOTRANSPIRATION	40.56	27.82	82.72	73.36	55.40	34.63
	33.26	68.68	22.13	98.25	50.63	41.82
PERCOLATION/LEAKAGE THROUGH	4.787	0.000	7.904	29.387	28.833	16.578
LAYER 2	12.566	30.153	1.980	14.887	0.878	0.000
PERCOLATION/LEAKAGE THROUGH	8.049	0.000	0.000	24.156	29.791	16.288
LAYER 4	17.116	25.571	14.789	6.723	8.614	0.000

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	0.662	0.000	2.607	12.041	6.887	5.063
TOP OF LAYER 2	3.218	11.321	0.125	3.575	0.047	0.000
STD. DEVIATION OF DAILY	1.535	0.000	4.738	3.674	2.795	5.365

HEAD ON TOP OF LAYER 2	5.226	3.609	0.473	4.272	0.260	0.000

****

****

ANNUAL TOTALS FOR YEAR 1952

	MM	CU. METERS	PERCENT
PRECIPITATION	1701.50	17014.996	100.00
RUNOFF	914.561	9145.612	53.75
EVAPOTRANSPIRATION	629.264	6292.644	36.98
PERC./LEAKAGE THROUGH LAYER 2	147.952194	1479.522	8.70
AVG. HEAD ON TOP OF LAYER 2	37.9559		
PERC./LEAKAGE THROUGH LAYER 4	151.097153	1510.972	8.88
CHANGE IN WATER STORAGE	6.578	65.775	0.39
SOIL WATER AT START OF YEAR	1975.755	19757.551	
SOIL WATER AT END OF YEAR	1982.333	19823.326	
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	-0.0007	-0.007	0.00

****

****

MONTHLY TOTALS (MM) FOR YEAR 2008

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	106.7	257.2	46.3	166.1	13.5	164.3
	55.0	47.0	99.9	69.6	76.1	88.8
RUNOFF	25.53	102.47	0.00	58.81	0.00	70.27
	0.74	0.00	38.91	0.01	0.05	5.07
EVAPOTRANSPIRATION	70.73	106.51	72.11	54.83	33.25	51.94
	30.23	46.78	64.05	69.76	54.52	94.45
PERCOLATION/LEAKAGE THROUGH	10.440	18.531	3.786	20.593	8.639	26.069
LAYER 2	12.558	11.878	14.040	2.123	0.560	8.516
PERCOLATION/LEAKAGE THROUGH	8.120	20.347	10.800	7.075	20.235	14.763
LAYER 4	17.848	15.617	12.859	6.795	0.610	5.975

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	2.946	6.822	0.387	7.005	1.424	9.518
TOP OF LAYER 2	1.541	1.150	3.751	0.009	0.001	1.036
STD. DEVIATION OF DAILY	4.769	5.919	0.974	5.204	2.538	4.304
HEAD ON TOP OF LAYER 2	2.000	1.740	4.980	0.028	0.007	2.336

ANNUAL TOTALS FOR YEAR 2008

	MM	CU. METERS	PERCENT

PRECIPITATION	1190.50	11904.997	100.00
RUNOFF	301.859	3018.588	25.36
EVAPOTRANSPIRATION	749.148	7491.476	62.93
PERC./LEAKAGE THROUGH LAYER 2	137.731537	1377.315	11.57
AVG. HEAD ON TOP OF LAYER 2	29.6577		
PERC./LEAKAGE THROUGH LAYER 4	141.043152	1410.432	11.85
CHANGE IN WATER STORAGE	-1.550	-15.495	-0.13
SOIL WATER AT START OF YEAR	1978.367	19783.670	
SOIL WATER AT END OF YEAR	1976.818	19768.176	
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

****

****

AVERAGE MONTHLY VALUES (MM) FOR YEARS 1923 THROUGH 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	108.32	125.65	140.77	121.45	100.17	120.21
	70.25	70.88	62.27	75.55	86.71	91.16
STD. DEVIATIONS	74.48	85.28	94.50	101.89	75.37	96.67
	65.33	74.25	50.54	56.69	62.89	65.51
RUNOFF						

TOTALS	21.345	34.838	45.176	47.585	37.270	56.228
	24.562	22.357	11.419	13.485	14.074	13.799
STD. DEVIATIONS	43.401	48.707	67.283	78.382	54.477	80.112
	47.292	54.885	27.854	29.469	35.506	31.053

EVAPOTRANSPIRATION

TOTALS	76.078	77.608	81.578	50.166	42.796	39.336
	36.366	38.681	42.434	59.910	66.958	70.539
STD. DEVIATIONS	32.197	32.828	31.550	18.470	13.110	11.062
	11.150	19.929	24.342	26.253	33.355	38.221

PERCOLATION/LEAKAGE THROUGH LAYER 2

TOTALS	7.1469	9.7060	12.6490	17.5508	18.9471	20.7307
	19.1682	12.3694	9.1277	8.8665	6.7535	5.7971
STD. DEVIATIONS	6.0404	7.9037	8.6151	9.9178	9.7663	9.8104
	9.4769	10.3433	8.1928	6.8479	6.6132	6.5331

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	5.6599	8.0598	11.9425	15.1715	18.6141	20.0294
	21.0506	14.7999	10.6083	8.9371	7.3913	6.5456
STD. DEVIATIONS	5.4245	6.3244	8.5983	9.4021	9.2588	9.3223
	9.2767	9.9192	9.2685	6.7751	6.6500	6.1274

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (CM)

DAILY AVERAGE HEAD ON TOP OF LAYER 2

AVERAGES	1.6713	2.8531	3.4576	4.9429	5.2588	6.6095
	4.8123	3.0294	2.0457	1.8680	1.4669	1.1663
STD. DEVIATIONS	1.7747	2.7704	2.9837	3.8013	3.7332	4.0635
	3.6252	3.2933	2.4174	2.1082	1.8322	1.7650

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1923 THROUGH 2022

	MM		CU. METERS	PERCENT
PRECIPITATION	1173.39	(283.704)	11733.9	100.00
RUNOFF	342.138	(193.1760)	3421.38	29.158
EVAPOTRANSPIRATION	682.450	(107.1736)	6824.50	58.161
PERCOLATION/LEAKAGE THROUGH LAYER 2	148.81273	(33.77270)	1488.127	12.68234
AVERAGE HEAD ON TOP OF LAYER 2	32.652	(10.118)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	148.80998	(34.26350)	1488.100	12.68210
CHANGE IN WATER STORAGE	-0.013	(0.8493)	-0.13	-0.001

****

****

PEAK DAILY VALUES FOR YEARS 1923 THROUGH 2022

	(MM)	(CU. METERS)
PRECIPITATION	150.40	1504.000
RUNOFF	147.803	1478.0273
PERCOLATION/LEAKAGE THROUGH LAYER 2	1.007985	10.07985
AVERAGE HEAD ON TOP OF LAYER 2	150.000	
PERCOLATION/LEAKAGE THROUGH LAYER 4	1.514090	15.14090
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4630
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1160

****

****

FINAL WATER STORAGE AT END OF YEAR 2022

LAYER	(CM)	(VOL/VOL)
1	1.8690	0.1246
2	38.4300	0.4270
3	11.1296	0.3710
4	145.9896	0.2920
SNOW WATER	0.000	

****
****

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************



PRECIPITATION DATA FILE:    \WOY.D4
TEMPERATURE DATA FILE:      \WOY.D7
SOLAR RADIATION DATA FILE:  \WOY.D13
EVAPOTRANSPIRATION DATA:    \WOY30.D11
SOIL AND DESIGN DATA FILE:  \FIN2BPLT.D10
OUTPUT DATA FILE:           \FIN2BPLT.OUT


TIME:  17:55     DATE:   3/22/2023



**********************************************************************

     TITLE:  Final Cap Option 2B - PLATFORM

**********************************************************************



     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   8
          THICKNESS                    =     20.00   CM
          POROSITY                     =      0.4630 VOL/VOL
          FIELD CAPACITY               =      0.2320 VOL/VOL
          WILTING POINT                =      0.1160 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.1479 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.369999994000E-03 CM/SEC
NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 3.00
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	= 80.00	CM
POROSITY	= 0.3980	VOL/VOL
FIELD CAPACITY	= 0.2440	VOL/VOL
WILTING POINT	= 0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	= 0.3626	VOL/VOL
EFFECTIVE SAT. HYD. COND.	= 0.119999997000E-03	CM/SEC
SLOPE	= 5.00	PERCENT
DRAINAGE LENGTH	= 225.0	METERS

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	= 0.20	CM
POROSITY	= 0.0000	VOL/VOL
FIELD CAPACITY	= 0.0000	VOL/VOL
WILTING POINT	= 0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	= 0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	= 0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	= 0.00	HOLES/HECTARE
FML INSTALLATION DEFECTS	= 0.00	HOLES/HECTARE
FML PLACEMENT QUALITY	= 4 - POOR	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	= 0.60	CM
POROSITY	= 0.7500	VOL/VOL
FIELD CAPACITY	= 0.7470	VOL/VOL
WILTING POINT	= 0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	= 0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	= 0.300000003000E-08	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 14

THICKNESS	=	30.00	CM
POROSITY	=	0.4790	VOL/VOL
FIELD CAPACITY	=	0.3710	VOL/VOL
WILTING POINT	=	0.2510	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3710	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.249999994000E-04	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	500.00	CM
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2919	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 8 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 225. METERS.

SCS RUNOFF CURVE NUMBER	=	78.70	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.0000	HECTARES
EVAPORATIVE ZONE DEPTH	=	30.0	CM
INITIAL WATER IN EVAPORATIVE ZONE	=	4.322	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	=	13.240	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	=	3.680	CM
INITIAL SNOW WATER	=	0.000	CM
INITIAL WATER IN LAYER MATERIALS	=	189.492	CM
TOTAL INITIAL WATER	=	189.492	CM
TOTAL SUBSURFACE INFLOW	=	0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Woy Woy NSW

STATION LATITUDE	=	-33.51 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	275
END OF GROWING SEASON (JULIAN DATE)	=	91
EVAPORATIVE ZONE DEPTH	=	30.0 CM
AVERAGE ANNUAL WIND SPEED	=	12.70 KPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.70 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	60.80 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.30 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	67.20 %

NOTE: PRECIPITATION DATA FOR

WAS ENTERED BY THE USER.

NOTE: TEMPERATURE DATA FOR

WAS ENTERED BY THE USER.

NOTE: SOLAR RADIATION DATA FOR

WAS ENTERED BY THE USER.

****

MONTHLY TOTALS (MM) FOR YEAR 1952

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	46.4	28.0	228.0	320.7	45.6	111.4
	317.4	371.3	24.4	115.1	43.1	50.1
RUNOFF	0.00	0.00	73.00	222.01	9.28	65.08
	257.37	322.14	0.00	3.50	0.00	0.00
EVAPOTRANSPIRATION	46.40	27.80	81.55	71.71	48.16	43.09
	43.80	67.49	35.69	115.16	93.84	42.27
LATERAL DRAINAGE COLLECTED	0.976	0.905	1.398	2.979	2.816	2.485
FROM LAYER 2	2.269	3.036	1.479	1.900	1.015	0.986
PERCOLATION/LEAKAGE THROUGH	0.004	0.003	0.004	0.005	0.005	0.005
LAYER 4	0.005	0.005	0.004	0.005	0.004	0.004
PERCOLATION/LEAKAGE THROUGH	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 6	0.000	0.000	0.000	0.000	0.000	0.000

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	68.478	67.867	74.129	98.056	96.061	94.174
TOP OF LAYER 3	91.907	97.731	86.175	88.847	72.488	69.232
STD. DEVIATION OF DAILY	0.184	0.168	12.235	2.991	1.981	3.582
HEAD ON TOP OF LAYER 3	4.179	2.478	2.053	5.125	4.998	0.187

****

****

ANNUAL TOTALS FOR YEAR 1952

	MM	CU. METERS	PERCENT
PRECIPITATION	1701.50	17014.996	100.00
RUNOFF	952.365	9523.651	55.97
EVAPOTRANSPIRATION	716.953	7169.527	42.14
DRAINAGE COLLECTED FROM LAYER 2	22.2423	222.423	1.31
PERC./LEAKAGE THROUGH LAYER 4	0.053003	0.530	0.00
AVG. HEAD ON TOP OF LAYER 3	837.6210		
PERC./LEAKAGE THROUGH LAYER 6	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	9.940	99.399	0.58
SOIL WATER AT START OF YEAR	1889.080	18890.801	
SOIL WATER AT END OF YEAR	1899.020	18990.199	
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 2008

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	106.7	257.2	46.3	166.1	13.5	164.3

	55.0	47.0	99.9	69.6	76.1	88.8
RUNOFF	0.00	77.72	0.00	38.73	0.00	120.13
	14.21	0.00	67.08	0.00	0.00	0.29
EVAPOTRANSPIRATION	93.25	131.94	114.18	34.38	20.70	33.97
	32.56	48.53	65.69	105.17	71.16	107.77
LATERAL DRAINAGE COLLECTED	1.185	2.152	1.110	1.681	2.715	3.102
FROM LAYER 2	2.717	2.609	2.323	1.357	0.967	1.004
PERCOLATION/LEAKAGE THROUGH	0.004	0.005	0.004	0.004	0.005	0.005
LAYER 4	0.005	0.005	0.005	0.004	0.004	0.004
PERCOLATION/LEAKAGE THROUGH	0.000	0.000	0.000	0.000	0.000	0.000
LAYER 6	0.000	0.000	0.000	0.000	0.000	0.000

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	75.536	91.037	75.223	81.033	95.297	99.017
TOP OF LAYER 3	95.314	94.490	92.903	83.961	70.106	70.476
STD. DEVIATION OF DAILY	7.696	8.261	6.254	12.984	1.155	1.399
HEAD ON TOP OF LAYER 3	2.569	2.379	4.486	2.548	1.256	1.804

****

****

ANNUAL TOTALS FOR YEAR 2008

	MM	CU. METERS	PERCENT
PRECIPITATION	1190.50	11904.997	100.00
RUNOFF	318.155	3181.549	26.72

EVAPOTRANSPIRATION	859.298	8592.978	72.18
DRAINAGE COLLECTED FROM LAYER 2	22.9212	229.212	1.93
PERC./LEAKAGE THROUGH LAYER 4	0.053968	0.540	0.00
AVG. HEAD ON TOP OF LAYER 3	853.6609		
PERC./LEAKAGE THROUGH LAYER 6	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-9.874	-98.736	-0.83
SOIL WATER AT START OF YEAR	1901.890	19018.896	
SOIL WATER AT END OF YEAR	1892.016	18920.160	
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	-0.0005	-0.005	0.00

****

****

AVERAGE MONTHLY VALUES (MM) FOR YEARS 1923 THROUGH 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	108.32	125.65	140.77	121.45	100.17	120.21
	70.25	70.88	62.27	75.55	86.71	91.16
STD. DEVIATIONS	74.48	85.28	94.50	101.89	75.37	96.67
	65.33	74.25	50.54	56.69	62.89	65.51
RUNOFF						
TOTALS	10.784	21.206	34.933	47.617	47.149	76.116

	36.921	30.502	14.902	14.092	8.038	6.461
STD. DEVIATIONS	33.232	39.984	64.318	83.238	59.790	88.958
	55.871	61.805	33.163	30.209	28.252	20.694

EVAPOTRANSPIRATION

TOTALS	88.171	91.770	98.636	45.718	37.779	35.530
	37.294	48.387	50.495	96.811	88.220	84.309
STD. DEVIATIONS	41.512	37.461	35.371	13.510	9.221	8.109
	5.124	12.458	22.404	19.699	43.202	45.983

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	1.1573	1.2427	1.5465	1.9153	2.4455	2.6680
	2.6586	2.2294	1.7757	1.5903	1.1707	1.1372
STD. DEVIATIONS	0.2993	0.4517	0.5783	0.7891	0.7116	0.5464
	0.4478	0.5413	0.4646	0.3900	0.3467	0.2975

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0039	0.0037	0.0043	0.0044	0.0049	0.0049
	0.0051	0.0049	0.0046	0.0045	0.0039	0.0039
STD. DEVIATIONS	0.0003	0.0004	0.0005	0.0006	0.0005	0.0003
	0.0002	0.0003	0.0002	0.0002	0.0003	0.0003

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0122	0.0060	0.0062
	0.0000	0.0000	0.0000	0.0122	0.0122	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0856	0.0600	0.0608
	0.0000	0.0000	0.0000	0.0856	0.0856	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (CM)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	72.9832	76.5038	79.6441	85.1422	91.4712	95.0115
	94.5953	91.3784	88.2080	84.4645	74.4921	72.8184
STD. DEVIATIONS	5.5559	8.1215	8.7293	10.9462	8.4248	6.1281
	4.2663	4.7054	4.2784	4.5852	6.4924	5.9228

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1923 THROUGH 2022

	MM	CU. METERS	PERCENT
PRECIPITATION	1173.39 (283.704)	11733.9	100.00
RUNOFF	348.723 (221.4369)	3487.23	29.719
EVAPOTRANSPIRATION	803.120 (117.0217)	8031.20	68.445
LATERAL DRAINAGE COLLECTED FROM LAYER 2	21.53731 (2.68768)	215.373	1.83548
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.05297 (0.00194)	0.530	0.00451
AVERAGE HEAD ON TOP OF LAYER 3	838.927 (30.844)		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.04866 (0.16584)	0.487	0.00415
CHANGE IN WATER STORAGE	-0.043 (1.3499)	-0.43	-0.004

****

****

PEAK DAILY VALUES FOR YEARS 1923 THROUGH 2022

	(MM)	(CU. METERS)
PRECIPITATION	150.40	1504.000
RUNOFF	143.412	1434.1163
DRAINAGE COLLECTED FROM LAYER 2	0.10755	1.07555
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000173	0.00173
AVERAGE HEAD ON TOP OF LAYER 3	999.995	

MAXIMUM HEAD ON TOP OF LAYER 3	1551.996		
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	50.0 METERS		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.608241	6.08241	
SNOW WATER	0.00	0.0000	

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4413
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1227

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 2022

LAYER	(CM)	(VOL/VOL)
1	2.4461	0.1223
2	29.0519	0.3631
3	0.0000	0.0000
4	0.4500	0.7500
5	11.1297	0.3710
6	145.9863	0.2920
SNOW WATER	0.000	

****
****

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************



PRECIPITATION DATA FILE:    \WOY.D4
TEMPERATURE DATA FILE:      \WOY.D7
SOLAR RADIATION DATA FILE:  \WOY.D13
EVAPOTRANSPIRATION DATA:    \WOY30.D11
SOIL AND DESIGN DATA FILE:  \FIN2BBAT.D10
OUTPUT DATA FILE:           \FIN2BBAT.OUT


TIME:  18: 1     DATE:   3/22/2023



**********************************************************************

     TITLE:  Final Cap Option 2B - BATTER

**********************************************************************



     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   8
          THICKNESS                    =     20.00   CM
          POROSITY                     =      0.4630 VOL/VOL
          FIELD CAPACITY               =      0.2320 VOL/VOL
          WILTING POINT                =      0.1160 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.1510 VOL/VOL
```

EFFECTIVE SAT. HYD. COND. = 0.369999994000E-03 CM/SEC
NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 3.00
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	80.00	CM
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3458	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC
SLOPE	=	15.00	PERCENT
DRAINAGE LENGTH	=	90.0	METERS

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.20	CM
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/HECTARE
FML INSTALLATION DEFECTS	=	0.00	HOLES/HECTARE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.60	CM
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 14

THICKNESS	=	30.00	CM
POROSITY	=	0.4790	VOL/VOL
FIELD CAPACITY	=	0.3710	VOL/VOL
WILTING POINT	=	0.2510	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3710	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.249999994000E-04	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 18

THICKNESS	=	500.00	CM
POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2919	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 8 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 15.% AND A SLOPE LENGTH OF 90. METERS.

SCS RUNOFF CURVE NUMBER	=	80.30	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.0000	HECTARES
EVAPORATIVE ZONE DEPTH	=	30.0	CM
INITIAL WATER IN EVAPORATIVE ZONE	=	4.384	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	=	13.240	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	=	3.680	CM
INITIAL SNOW WATER	=	0.000	CM
INITIAL WATER IN LAYER MATERIALS	=	188.210	CM
TOTAL INITIAL WATER	=	188.210	CM
TOTAL SUBSURFACE INFLOW	=	0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Woy Woy NSW

STATION LATITUDE	=	-33.51 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	275
END OF GROWING SEASON (JULIAN DATE)	=	91
EVAPORATIVE ZONE DEPTH	=	30.0 CM
AVERAGE ANNUAL WIND SPEED	=	12.70 KPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.70 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	60.80 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.30 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	67.20 %

NOTE: PRECIPITATION DATA FOR

WAS ENTERED BY THE USER.

NOTE: TEMPERATURE DATA FOR

WAS ENTERED BY THE USER.

NOTE: SOLAR RADIATION DATA FOR

WAS ENTERED BY THE USER.

****

MONTHLY TOTALS (MM) FOR YEAR 1952

JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC

PRECIPITATION	46.4	28.0	228.0	320.7	45.6	111.4
	317.4	371.3	24.4	115.1	43.1	50.1
RUNOFF	0.00	0.00	58.37	195.80	0.18	51.28
	243.57	310.41	0.00	0.92	0.00	0.00
EVAPOTRANSPIRATION	46.40	27.69	81.54	67.26	48.65	43.04
	41.35	66.55	35.75	114.77	71.08	42.30
LATERAL DRAINAGE COLLECTED	6.140	5.377	7.957	21.001	18.852	
15.581						
FROM LAYER 2	13.771	21.298	9.109	10.099	7.011	
6.706						
PERCOLATION/LEAKAGE THROUGH	0.003	0.003	0.003	0.005	0.005	
0.005						
LAYER 4	0.005	0.005	0.004	0.004	0.004	
0.003						
PERCOLATION/LEAKAGE THROUGH	0.000	0.000	0.000	0.000	0.000	
0.000						
LAYER 6	0.000	0.000	0.000	0.000	0.000	
0.000						

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	58.600	54.862	60.658	97.089	94.147	91.287
TOP OF LAYER 3	88.639	96.674	82.394	81.666	69.148	64.002
STD. DEVIATION OF DAILY	1.171	1.025	17.286	4.156	2.822	4.858
HEAD ON TOP OF LAYER 3	5.445	3.324	2.780	5.659	2.837	1.278

****

****

ANNUAL TOTALS FOR YEAR 1952

	MM	CU. METERS	PERCENT

PRECIPITATION	1701.50	17014.996	100.00
RUNOFF	860.523	8605.234	50.57
EVAPOTRANSPIRATION	686.378	6863.777	40.34
DRAINAGE COLLECTED FROM LAYER 2	142.9020	1429.020	8.40
PERC./LEAKAGE THROUGH LAYER 4	0.049533	0.495	0.00
AVG. HEAD ON TOP OF LAYER 3	782.6395		
PERC./LEAKAGE THROUGH LAYER 6	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	11.697	116.970	0.69
SOIL WATER AT START OF YEAR	1876.352	18763.518	
SOIL WATER AT END OF YEAR	1888.049	18880.486	
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	-0.0005	-0.005	0.00

****

****

MONTHLY TOTALS (MM) FOR YEAR 2008

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	106.7	257.2	46.3	166.1	13.5	164.3
	55.0	47.0	99.9	69.6	76.1	88.8
RUNOFF	0.03	67.09	0.00	29.34	0.00	94.64
	0.11	0.00	48.22	0.00	0.00	0.73

EVAPOTRANSPIRATION	86.39	131.87	102.42	33.62	21.64	30.59
	32.23	49.55	62.57	103.14	57.81	100.91
LATERAL DRAINAGE COLLECTED	8.165	14.574	7.635	11.693	15.678	
21.247						
FROM LAYER 2	15.836	14.838	14.192	8.535	6.859	
6.906						
PERCOLATION/LEAKAGE THROUGH	0.004	0.004	0.004	0.004	0.005	
0.005						
LAYER 4	0.005	0.005	0.005	0.004	0.004	
0.004						
PERCOLATION/LEAKAGE THROUGH	0.000	0.000	0.000	0.000	0.000	
0.000						
LAYER 6	0.000	0.000	0.000	0.608	0.000	
0.000						

MONTHLY SUMMARIES FOR DAILY HEADS (CM)

AVERAGE DAILY HEAD ON	73.856	89.057	72.510	77.759	90.869	97.353
TOP OF LAYER 3	91.032	90.000	89.701	79.494	67.650	65.917
STD. DEVIATION OF DAILY	7.406	8.766	4.963	14.396	2.698	3.400
HEAD ON TOP OF LAYER 3	3.047	3.204	4.931	3.322	1.308	1.352

****

****

ANNUAL TOTALS FOR YEAR 2008

	MM	CU. METERS	PERCENT
PRECIPITATION	1190.50	11904.997	100.00
RUNOFF	240.161	2401.615	20.17
EVAPOTRANSPIRATION	812.741	8127.409	68.27
DRAINAGE COLLECTED FROM LAYER 2	146.1598	1461.598	12.28

PERC./LEAKAGE THROUGH LAYER 4	0.051893	0.519	0.00
AVG. HEAD ON TOP OF LAYER 3	820.9964		
PERC./LEAKAGE THROUGH LAYER 6	0.608223	6.082	0.05
CHANGE IN WATER STORAGE	-9.170	-91.702	-0.77
SOIL WATER AT START OF YEAR	1895.263	18952.625	
SOIL WATER AT END OF YEAR	1886.092	18860.924	
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	-0.0005	-0.005	0.00

****

****

AVERAGE MONTHLY VALUES (MM) FOR YEARS 1923 THROUGH 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	108.32	125.65	140.77	121.45	100.17	120.21
	70.25	70.88	62.27	75.55	86.71	91.16
STD. DEVIATIONS	74.48	85.28	94.50	101.89	75.37	96.67
	65.33	74.25	50.54	56.69	62.89	65.51
RUNOFF						
TOTALS	9.646	17.431	28.942	40.842	36.078	61.514
	27.420	23.472	10.511	9.473	6.660	5.595
STD. DEVIATIONS	30.329	33.997	58.412	78.858	54.374	84.544
	50.620	56.531	28.333	22.325	26.490	17.858

EVAPOTRANSPIRATION

TOTALS	84.556	88.003	94.128	44.822	37.235	34.486
	36.960	47.807	49.769	83.606	80.318	81.215
STD. DEVIATIONS	38.716	36.851	35.155	12.903	9.155	7.589
	5.313	12.660	22.314	26.858	42.368	44.591

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	7.5225	7.9825	10.0449	12.2253	14.8827	16.4795
	15.7363	12.9162	10.2361	9.4127	7.8965	7.5352
STD. DEVIATIONS	2.0056	3.0585	3.8761	5.4456	5.2415	4.7534
	4.2016	4.3003	3.3129	2.7078	2.1489	1.8151

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0036	0.0034	0.0040	0.0041	0.0046	0.0047
	0.0048	0.0046	0.0042	0.0041	0.0037	0.0036
STD. DEVIATIONS	0.0004	0.0005	0.0006	0.0007	0.0006	0.0005
	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0061	0.0000	0.0000	0.0061	0.0061
	0.0122	0.0000	0.0000	0.0061	0.0000	0.0122
STD. DEVIATIONS	0.0000	0.0608	0.0000	0.0000	0.0608	0.0608
	0.0856	0.0000	0.0000	0.0608	0.0000	0.0856

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (CM)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	66.3632	70.0554	74.4490	79.7412	85.8644	90.3134
	89.7337	85.8534	80.9613	76.9465	70.5300	67.6519
STD. DEVIATIONS	7.6618	10.8146	10.8947	13.8571	11.6919	9.4594
	7.1170	7.3656	7.8557	7.3882	7.1799	7.0530

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1923 THROUGH 2022

	MM	CU. METERS	PERCENT
PRECIPITATION	1173.39 (283.704)	11733.9	100.00
RUNOFF	277.584 (204.9355)	2775.84	23.657
EVAPOTRANSPIRATION	762.906 (116.8757)	7629.06	65.017
LATERAL DRAINAGE COLLECTED FROM LAYER 2	132.87039 (20.77154)	1328.704	11.32368
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.04938 (0.00295)	0.494	0.00421
AVERAGE HEAD ON TOP OF LAYER 3	782.053 (46.851)		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.04866 (0.16584)	0.487	0.00415
CHANGE IN WATER STORAGE	-0.022 (1.3347)	-0.22	-0.002

****

****

PEAK DAILY VALUES FOR YEARS 1923 THROUGH 2022

	(MM)	(CU. METERS)
PRECIPITATION	150.40	1504.000
RUNOFF	147.975	1479.7485
DRAINAGE COLLECTED FROM LAYER 2	0.79088	7.90884
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000173	0.00173
AVERAGE HEAD ON TOP OF LAYER 3	999.995	
MAXIMUM HEAD ON TOP OF LAYER 3	1594.380	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	16.6 METERS	

PERCOLATION/LEAKAGE THROUGH LAYER 6	0.608227	6.08227
SNOW WATER	0.00	0.0000

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4413

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1227

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 2022

LAYER	(CM)	(VOL/VOL)
1	2.4519	0.1226
2	28.0036	0.3500
3	0.0000	0.0000
4	0.4500	0.7500
5	11.1290	0.3710
6	145.9510	0.2919
SNOW WATER	0.000	

****
****

Appendix B

Water balance modelling results

50th percentile AEP year - Stage 1

50th percentile year (2008)

LANDFILL GENERATION		
Daily cover	-	m2
Interim cover (flat)	46,000	m2
Interim cover (sloped)	20,700	m2
Final cap - Option 1 (flat)	-	m2
Final cap - Option 1 (sloped)	40,513	m2
Final cap - Option 2 (flat)	-	m2
Final cap - Option 2 (sloped)	-	m2
Centre area - Green waste	6,300	m2
OTHER GENERATION		
Open cell	17,220	m2
Centre area - Transfer station	11,800	m2
Transfer station infiltration rate	3.0%	
STORAGE		
Pond storage capacity	1,021	m3
Freeboard storage capacity	-	m3
Pond storage surface area	900	m2
Pond storage basal area	186	m2
Pond storage catchment area	900	m2
Initial pond volume	0.5	vol/vol
Pan evaporation percentage - winter	70%	
Pan evaporation percentage - autumn	75%	
Pan evaporation percentage - spring	70%	
Pan evaporation percentage - summer	70%	
DISPOSAL		
Pond operating volume	0.2	

Parameter		January	February	March	April	May	June	July	August	September	October	November	December	Annual Total mm	Annual Total m3	Percent
		31	28	31	30	31	30	31	31	30	31	30	31			
Precipitation (mm)																
Rainfall (2008)	(mm)	106.7	257.2	46.3	166.1	13.5	164.3	55.0	47.0	99.9	69.6	76.1	88.8	1191		100%
Pan Evaporation																
Evaporation (from SILO)	(mm)	146.6	110.1	127.8	82.9	58.0	50.0	62.2	78.5	115.9	141.4	142.1	178.1	1294		109%
Pan evaporation	(mm)	102.6	77.1	95.9	62.2	43.5	35.0	43.5	55.0	86.9	106.1	106.6	124.7	939		79%
Runoff - Calculated using HELP (mm)																
Daily cover		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Interim cover (flat)		22.0	66.1	5.1	39.8	0.1	41.1	7.0	4.0	29.4	5.7	11.6	19.0	251	11542	21%
Interim cover (sloped)		21.1	65.9	4.7	38.7	0.1	39.9	6.6	3.7	28.7	5.3	10.8	18.5	244	0	21%
Final cap - Option 1 (flat)		23.0	100.9	0.0	56.0	0.0	68.8	0.4	0.0	37.1	0.0	0.0	3.4	290	11730	24%
Final cap - Option 1 (sloped)		25.5	102.5	0.0	58.8	0.0	70.3	0.7	0.0	38.9	0.0	0.1	5.1	302	12229	25%
Final cap - Option 2 (flat)		0.0	119.2	1.1	26.6	111.3	91.1	6.2	0.0	0.0	0.0	0.0	0.0	356	0	30%
Final cap - Option 2 (sloped)		0.0	67.1	0.0	29.3	0.0	94.6	0.1	0.0	48.2	0.0	0.0	0.7	240	0	20%
Centre area - Green waste		35.1	119.9	0.1	77.5	0.0	86.2	2.0	0.2	51.4	0.4	1.0	8.5	382	2408	32%
Total Runoff	(m3/month)	**2,703**	**9,311**	**334**	**5,504**	**9**	**6,107**	**500**	**262**	**3,848**	**377**	**765**	**1,516**		**37,909**	
Evapotranspiration - Calculated using HELP (mm)																
Daily cover		37.2	68.4	38.9	56.2	10.1	52.2	18.4	31.6	39.6	46.1	29.0	48.8	476	0	40%
Interim cover (flat)		50.7	87.0	61.5	74.2	20.2	63.8	21.5	47.2	49.6	55.0	47.0	71.2	649	29854	55%
Interim cover (sloped)		50.6	84.1	61.0	71.3	20.4	63.4	21.8	46.2	50.4	53.6	47.8	69.8	641	13260	54%
Final cap - Option 1 (flat)		72.8	107.4	72.6	55.0	34.8	52.6	30.5	47.7	66.5	69.6	54.5	95.8	760	0	64%
Final cap - Option 1 (sloped)		70.7	106.5	72.1	54.8	33.3	51.9	30.2	46.8	64.1	69.8	54.5	94.5	749	30351	63%
Final cap - Option 2 (flat)		77.3	82.7	139.9	45.7	42.5	37.3	38.9	41.6	15.2	101.3	70.6	56.7	750	0	63%
Final cap - Option 2 (sloped)		86.4	131.9	102.4	33.6	21.6	30.6	32.2	49.6	62.6	103.1	57.8	100.9	813	0	68%
Centre area - Green waste		67.8	106.9	72.4	55.8	37.5	53.3	38.6	56.9	64.7	67.5	52.6	94.9	769	4844	65%
Total Evapotranspiration	(m3/month)	**6,671**	**10,733**	**7,469**	**7,460**	**2,935**	**6,688**	**2,909**	**5,383**	**6,329**	**6,891**	**5,693**	**9,146**		**78,308**	
Leachate - Calculated using HELP (mm)																
Daily cover		81.6	100.3	104.6	60.3	105.2	63.0	60.0	29.4	56.4	46.4	15.4	51.3	774	0	65%
Interim cover (flat)		36.7	57.1	48.4	13.5	33.3	40.8	24.3	4.4	38.3	4.9	7.0	13.6	322	14823	27%
Interim cover (sloped)		27.8	56.6	53.2	14.3	33.5	42.2	21.8	4.4	37.2	6.4	5.2	14.2	317	6556	27%
Final cap - Option 1 (flat)		7.7	21.2	10.8	7.5	20.9	15.6	18.1	15.5	12.4	6.2	0.6	6.3	143	0	12%
Final cap - Option 1 (sloped)		8.1	20.3	10.8	7.1	20.2	14.8	17.8	15.6	12.9	6.8	0.6	6.0	141	5714	12%
Final cap - Option 2 (flat)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Final cap - Option 2 (sloped)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Centre area - Green waste		2.5	0.0	3.6	3.7	4.2	2.0	2.1	1.6	2.0	3.2	6.4	5.2	36	230	3%
Total Leachate Collected	(m3/month)	**2,607**	**4,621**	**3,788**	**1,226**	**3,071**	**3,361**	**2,303**	**937**	**3,065**	**653**	**494**	**1,196**		**27,322**	
Other Leachate Sources	(m3/month)															
Open cell		1,837	4,429	797	2,860	232	2,829	947	809	1,720	1,199	1,310	1,529		20,500	
Centre area - Transfer station		38	91	16	59	5	58	19	17	35	25	27	31		421	
Leachate Storage Pond																
Rainfall into pond	(m3)	96	231	42	149	12	148	50	42	90	63	68	80		1,071	
Evaporation from pond	(m3)	56	69	86	56	39	32	39	49	78	95	96	112		808	
Net Leachate Generation	(m3)	**4,522**	**9,303**	**4,557**	**4,238**	**3,281**	**6,365**	**3,279**	**1,756**	**4,832**	**1,844**	**1,804**	**2,724**		**48,507**	

10th percentile AEP year - Stage 1

10th percentile year (1952)

LANDFILL GENERATION		
Daily cover	-	m2
Interim cover (flat)	46,000	m2
Interim cover (sloped)	20,700	m2
Final cap - Option 1 (flat)	-	m2
Final cap - Option 1 (sloped)	40,513	m2
Final cap - Option 2 (flat)	-	m2
Final cap - Option 2 (sloped)	-	m2
Centre area - Green waste	6,300	m2
OTHER GENERATION		
Open cell	17,220	m2
Centre area - Transfer station	11,800	m2
Transfer station infiltration rate	3.0%	
STORAGE		
Pond storage capacity	1,021	m3
Freeboard storage capacity	-	m3
Pond storage surface area	900	m2
Pond storage basal area	186	m2
Pond storage catchment area	900	m2
Initial pond volume	0.5	vol/vol
Pan evaporation percentage - winter	70%	
Pan evaporation percentage - autumn	75%	
Pan evaporation percentage - spring	70%	
Pan evaporation percentage - summer	70%	
DISPOSAL		
Pond operating volume	0.2	

Parameter		January	February	March	April	May	June	July	August	September	October	November	December	Annual Total mm	Annual Total m3	Percent
		31	28	31	30	31	30	31	31	30	31	30	31			
Precipitation (mm)																
Rainfall (1952)	(mm)	46.4	28.0	228.0	320.7	45.6	111.4	317.4	371.3	24.4	115.1	43.1	50.1	1702		100%
Pan Evaporation																
Evaporation (from SILO)	(mm)	170.9	139.6	120.8	91.2	66.9	55.3	63.6	89.2	115.9	143.4	157.6	181.5	1396		82%
Pan evaporation	(mm)	119.6	97.7	90.6	68.4	50.2	38.7	44.5	62.4	86.9	107.6	118.2	127.1	1012		59%
Runoff - Calculated using HELP (mm)																
Daily cover		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Interim cover (flat)		9.1	1.3	79.3	88.2	2.6	35.0	131.0	132.7	0.6	19.4	1.7	1.8	503	23121	30%
Interim cover (sloped)		9.5	1.4	80.4	90.7	2.8	35.7	131.9	134.7	0.7	20.4	1.9	1.8	512	10594	30%
Final cap - Option 1 (flat)		0.6	0.0	116.8	188.1	0.0	46.6	244.0	305.6	0.0	2.7	0.0	0.0	904	0	53%
Final cap - Option 1 (sloped)		1.1	0.0	120.5	188.5	0.0	48.5	246.4	305.5	0.0	4.1	0.0	0.0	915	37052	54%
Final cap - Option 2 (flat)		0.0	0.0	73.0	222.0	9.3	65.1	257.4	322.1	0.0	3.5	0.0	0.0	952	0	56%
Final cap - Option 2 (sloped)		0.0	0.0	58.4	195.8	0.2	51.3	243.6	310.4	0.0	0.9	0.0	0.0	861	0	51%
Centre area - Green waste		3.1	0.0	125.1	216.0	4.5	60.2	257.4	320.9	0.0	14.4	0.0	0.0	1002	6310	59%
Total Runoff	(m3/month)	**677**	**86**	**10,979**	**14,934**	**206**	**4,693**	**20,361**	**23,294**	**39**	**1,571**	**116**	**118**		**77,075**	
Evapotranspiration - Calculated using HELP (mm)																
Daily cover		20.0	8.3	44.4	77.5	41.0	18.3	19.5	56.7	9.9	63.3	30.6	30.2	420	0	25%
Interim cover (flat)		34.8	7.5	62.1	89.7	65.2	32.6	18.7	73.7	9.1	83.3	34.1	38.1	549	25247	32%
Interim cover (sloped)		34.6	7.5	62.1	89.2	64.6	32.5	18.7	73.4	9.1	83.0	26.9	41.7	543	11247	32%
Final cap - Option 1 (flat)		41.0	27.8	82.5	77.5	55.7	35.3	34.2	69.2	23.2	99.2	50.9	41.8	638	0	38%
Final cap - Option 1 (sloped)		40.6	27.8	82.7	73.4	55.4	34.6	33.3	68.7	22.1	98.3	50.6	41.8	629	25493	37%
Final cap - Option 2 (flat)		46.4	27.8	81.6	71.7	48.2	43.1	43.8	67.5	35.7	115.2	93.8	42.3	717	0	42%
Final cap - Option 2 (sloped)		46.4	27.7	81.5	67.3	48.7	43.0	41.4	66.6	35.8	114.8	71.1	42.3	686	0	40%
Centre area - Green waste		41.5	27.6	82.6	78.8	57.3	45.2	39.5	70.1	22.1	98.3	53.7	42.2	659	4151	39%
Total Evapotranspiration	(m3/month)	**4,221**	**1,804**	**8,014**	**9,438**	**6,942**	**3,860**	**2,845**	**8,134**	**1,643**	**10,146**	**4,516**	**4,574**		**66,138**	
Leachate - Calculated using HELP (mm)																
Daily cover		58.1	4.2	26.0	147.2	173.1	97.2	94.9	364.1	174.9	83.7	67.6	10.9	1302	0	77%
Interim cover (flat)		3.0	0.0	18.5	67.7	103.8	50.1	32.1	144.2	140.9	65.7	3.4	0.0	629	28946	37%
Interim cover (sloped)		2.2	0.0	18.0	67.7	103.0	49.3	30.9	142.2	140.3	63.5	2.2	5.2	624	12925	37%
Final cap - Option 1 (flat)		8.1	0.0	0.0	24.5	29.6	16.5	18.0	24.9	15.0	7.3	8.2	0.0	152	0	9%
Final cap - Option 1 (sloped)		8.0	0.0	0.0	24.2	29.8	16.3	17.1	25.6	14.8	6.7	8.6	0.0	151	6121	9%
Final cap - Option 2 (flat)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Final cap - Option 2 (sloped)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Centre area - Green waste		3.5	1.9	3.5	2.4	0.5	4.0	0.0	1.4	1.6	6.3	4.1	5.1	34	216	2%
Total Leachate Collected	(m3/month)	**532**	**12**	**1,245**	**5,508**	**8,115**	**4,008**	**2,808**	**10,622**	**9,994**	**4,647**	**577**	**140**		**48,209**	
Other Leachate Sources	(m3/month)															
Open cell		799	482	3,926	5,522	785	1,918	5,466	6,394	420	1,982	742	863		29,300	
Centre area - Transfer station		16	10	81	114	16	39	112	131	9	41	15	18		602	
Leachate Storage Pond																
Rainfall into pond	(m3)	42	25	205	289	41	100	286	334	22	104	39	45		1,531	
Evaporation from pond	(m3)	65	88	82	62	45	35	40	56	78	97	106	114		868	
Net Leachate Generation	(m3)	**1,324**	**441**	**5,376**	**11,371**	**8,913**	**6,032**	**8,632**	**17,425**	**10,367**	**6,677**	**1,267**	**951**		**78,774**	

50th percentile AEP year - Stage 2

50th percentile year (2008)

LANDFILL GENERATION		
Daily cover	600	m2
Interim cover (flat)	46,000	m2
Interim cover (sloped)	27,133	m2
Final cap - Option 1 (flat)	-	m2
Final cap - Option 1 (sloped)	28,062	m2
Final cap - Option 2 (flat)	-	m2
Final cap - Option 2 (sloped)	10,187	m2
Centre area - Green waste	6,300	m2
OTHER GENERATION		
Open cell	21,319	m2
Centre area - Transfer station	11,800	m2
Transfer station infiltration rate	3.0%	
STORAGE		
Pond storage capacity	1,021	m3
Freeboard storage capacity	-	m3
Pond storage surface area	900	m2
Pond storage basal area	186	m2
Pond storage catchment area	900	m2
Initial pond volume	0.5	vol/vol
Pan evaporation percentage - winter	70%	
Pan evaporation percentage - autumn	75%	
Pan evaporation percentage - spring	70%	
Pan evaporation percentage - summer	70%	
DISPOSAL		
Pond operating volume	0.2	

Parameter		January	February	March	April	May	June	July	August	September	October	November	December	Annual Total mm	Annual Total m3	Percent
		31	28	31	30	31	30	31	31	30	31	30	31			
Precipitation (mm)																
Rainfall (2008)	(mm)	106.7	257.2	46.3	166.1	13.5	164.3	55.0	47.0	99.9	69.6	76.1	88.8	1191		100%
Pan Evaporation																
Evaporation (from SILO)	(mm)	146.6	110.1	127.8	82.9	58.0	50.0	62.2	78.5	115.9	141.4	142.1	178.1	1294		109%
Pan evaporation	(mm)	102.6	77.1	95.9	62.2	43.5	35.0	43.5	55.0	86.9	106.1	106.6	124.7	939		79%
Runoff - Calculated using HELP (mm)																
Daily cover		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Interim cover (flat)		22.0	66.1	5.1	39.8	0.1	41.1	7.0	4.0	29.4	5.7	11.6	19.0	251	11542	21%
Interim cover (sloped)		21.1	65.9	4.7	38.7	0.1	39.9	6.6	3.7	28.7	5.3	10.8	18.5	244	0	21%
Final cap - Option 1 (flat)		23.0	100.9	0.0	56.0	0.0	68.8	0.4	0.0	37.1	0.0	0.0	3.4	290	8125	24%
Final cap - Option 1 (sloped)		25.5	102.5	0.0	58.8	0.0	70.3	0.7	0.0	38.9	0.0	0.1	5.1	302	8471	25%
Final cap - Option 2 (flat)		0.0	119.2	1.1	26.6	111.3	91.1	6.2	0.0	0.0	0.0	0.0	0.0	356	0	30%
Final cap - Option 2 (sloped)		0.0	67.1	0.0	29.3	0.0	94.6	0.1	0.0	48.2	0.0	0.0	0.7	240	2447	20%
Centre area - Green waste		35.1	119.9	0.1	77.5	0.0	86.2	2.0	0.2	51.4	0.4	1.0	8.5	382	2408	32%
Total Runoff	(m3/month)	**2,521**	**9,143**	**364**	**5,320**	**9**	**6,453**	**535**	**286**	**4,040**	**411**	**834**	**1,580**		**32,992**	
Evapotranspiration - Calculated using HELP (mm)																
Daily cover		37.2	68.4	38.9	56.2	10.1	52.2	18.4	31.6	39.6	46.1	29.0	48.8	476	286	40%
Interim cover (flat)		50.7	87.0	61.5	74.2	20.2	63.8	21.5	47.2	49.6	55.0	47.0	71.2	649	29854	55%
Interim cover (sloped)		50.6	84.1	61.0	71.3	20.4	63.4	21.8	46.2	50.4	53.6	47.8	69.8	641	17381	54%
Final cap - Option 1 (flat)		72.8	107.4	72.6	55.0	34.8	52.6	30.5	47.7	66.5	69.6	54.5	95.8	760	0	64%
Final cap - Option 1 (sloped)		70.7	106.5	72.1	54.8	33.3	51.9	30.2	46.8	64.1	69.8	54.5	94.5	749	21023	63%
Final cap - Option 2 (flat)		77.3	82.7	139.9	45.7	42.5	37.3	38.9	41.6	15.2	101.3	70.6	56.7	750	0	63%
Final cap - Option 2 (sloped)		86.4	131.9	102.4	33.6	21.6	30.6	32.2	49.6	62.6	103.1	57.8	100.9	813	8279	68%
Centre area - Green waste		67.8	106.9	72.4	55.8	37.5	53.3	38.6	56.9	64.7	67.5	52.6	94.9	769	4844	65%
Total Evapotranspiration	(m3/month)	**7,019**	**11,333**	**8,030**	**7,612**	**2,879**	**6,792**	**3,013**	**5,621**	**6,517**	**7,446**	**5,928**	**9,476**		**81,666**	
Leachate - Calculated using HELP (mm)																
Daily cover		81.6	100.3	104.6	60.3	105.2	63.0	60.0	29.4	56.4	46.4	15.4	51.3	774	464	65%
Interim cover (flat)		36.7	57.1	48.4	13.5	33.3	40.8	24.3	4.4	38.3	4.9	7.0	13.6	322	14823	27%
Interim cover (sloped)		27.8	56.6	53.2	14.3	33.5	42.2	21.8	4.4	37.2	6.4	5.2	14.2	317	8593	27%
Final cap - Option 1 (flat)		7.7	21.2	10.8	7.5	20.9	15.6	18.1	15.5	12.4	6.2	0.6	6.3	143	0	12%
Final cap - Option 1 (sloped)		8.1	20.3	10.8	7.1	20.2	14.8	17.8	15.6	12.9	6.8	0.6	6.0	141	3958	12%
Final cap - Option 2 (flat)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Final cap - Option 2 (sloped)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Centre area - Green waste		2.5	0.0	3.6	3.7	4.2	2.0	2.1	1.6	2.0	3.2	6.4	5.2	36	230	3%
Total Leachate Collected	(m3/month)	**2,734**	**4,792**	**4,059**	**1,266**	**3,097**	**3,486**	**2,256**	**789**	**3,178**	**638**	**529**	**1,244**		**28,068**	
Other Leachate Sources	(m3/month)															
Open cell		2,275	5,483	987	3,541	288	3,503	1,173	1,002	2,130	1,484	1,622	1,893		25,380	
Centre area - Transfer station		38	91	16	59	5	58	19	17	35	25	27	31		421	
Leachate Storage Pond																
Rainfall into pond	(m3)	96	231	42	149	12	148	50	42	90	63	68	80		1,071	
Evaporation from pond	(m3)	56	69	86	56	39	32	39	49	78	95	96	112		808	
Net Leachate Generation	(m3)	**5,087**	**10,528**	**5,018**	**4,959**	**3,363**	**7,164**	**3,459**	**1,801**	**5,355**	**2,113**	**2,150**	**3,136**		**54,133**	

10th percentile AEP year - Stage 2

10th percentile year (1952)

LANDFILL GENERATION		
Daily cover	600	m2
Interim cover (flat)	46,000	m2
Interim cover (sloped)	27,133	m2
Final cap - Option 1 (flat)	-	m2
Final cap - Option 1 (sloped)	28,062	m2
Final cap - Option 2 (flat)	-	m2
Final cap - Option 2 (sloped)	10,187	m2
Centre area - Green waste	6,300	m2
OTHER GENERATION		
Open cell	21,319	m2
Centre area - Transfer station	11,800	m2
Transfer station infiltration rate	3.0%	
STORAGE		
Pond storage capacity	1,021	m3
Freeboard storage capacity	-	m3
Pond storage surface area	900	m2
Pond storage basal area	186	m2
Pond storage catchment area	900	m2
Initial pond volume	0.5	vol/vol
Pan evaporation percentage - winter	70%	
Pan evaporation percentage - autumn	75%	
Pan evaporation percentage - spring	70%	
Pan evaporation percentage - summer	70%	
DISPOSAL		
Pond operating volume	0.2	

Parameter		January	February	March	April	May	June	July	August	September	October	November	December	Annual Total mm	Annual Total m3	Percent
		31	28	31	30	31	30	31	31	30	31	30	31			
Precipitation (mm)																
Rainfall (1952)	(mm)	46.4	28.0	228.0	320.7	45.6	111.4	317.4	371.3	24.4	115.1	43.1	50.1	1702		100%
Pan Evaporation																
Evaporation (from SILO)	(mm)	170.9	139.6	120.8	91.2	66.9	55.3	63.6	89.2	115.9	143.4	157.6	181.5	1396		82%
Pan evaporation	(mm)	119.6	97.7	90.6	68.4	50.2	38.7	44.5	62.4	86.9	107.6	118.2	127.1	1012		59%
Runoff - Calculated using HELP (mm)																
Daily cover		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Interim cover (flat)		9.1	1.3	79.3	88.2	2.6	35.0	131.0	132.7	0.6	19.4	1.7	1.8	503	23121	30%
Interim cover (sloped)		9.5	1.4	80.4	90.7	2.8	35.7	131.9	134.7	0.7	20.4	1.9	1.8	512	13886	30%
Final cap - Option 1 (flat)		0.6	0.0	116.8	188.1	0.0	46.6	244.0	305.6	0.0	2.7	0.0	0.0	904	0	53%
Final cap - Option 1 (sloped)		1.1	0.0	120.5	188.5	0.0	48.5	246.4	305.5	0.0	4.1	0.0	0.0	915	25664	54%
Final cap - Option 2 (flat)		0.0	0.0	73.0	222.0	9.3	65.1	257.4	322.1	0.0	3.5	0.0	0.0	952	0	56%
Final cap - Option 2 (sloped)		0.0	0.0	58.4	195.8	0.2	51.3	243.6	310.4	0.0	0.9	0.0	0.0	861	8766	51%
Centre area - Green waste		3.1	0.0	125.1	216.0	4.5	60.2	257.4	320.9	0.0	14.4	0.0	0.0	1002	6310	59%
Total Runoff	(m3/month)	**725**	**95**	**10,591**	**15,165**	**226**	**4,841**	**20,622**	**23,518**	**43**	**1,661**	**128**	**130**		**77,747**	
Evapotranspiration - Calculated using HELP (mm)																
Daily cover		20.0	8.3	44.4	77.5	41.0	18.3	19.5	56.7	9.9	63.3	30.6	30.2	420	252	25%
Interim cover (flat)		34.8	7.5	62.1	89.7	65.2	32.6	18.7	73.7	9.1	83.3	34.1	38.1	549	25247	32%
Interim cover (sloped)		34.6	7.5	62.1	89.2	64.6	32.5	18.7	73.4	9.1	83.0	26.9	41.7	543	14742	32%
Final cap - Option 1 (flat)		41.0	27.8	82.5	77.5	55.7	35.3	34.2	69.2	23.2	99.2	50.9	41.8	638	0	38%
Final cap - Option 1 (sloped)		40.6	27.8	82.7	73.4	55.4	34.6	33.3	68.7	22.1	98.3	50.6	41.8	629	17658	37%
Final cap - Option 2 (flat)		46.4	27.8	81.6	71.7	48.2	43.1	43.8	67.5	35.7	115.2	93.8	42.3	717	0	42%
Final cap - Option 2 (sloped)		46.4	27.7	81.5	67.3	48.7	43.0	41.4	66.6	35.8	114.8	71.1	42.3	686	6992	40%
Centre area - Green waste		41.5	27.6	82.6	78.8	57.3	45.2	39.5	70.1	22.1	98.3	53.7	42.2	659	4151	39%
Total Evapotranspiration	(m3/month)	**4,423**	**1,793**	**8,241**	**9,830**	**7,187**	**4,088**	**2,984**	**8,464**	**1,796**	**10,664**	**4,801**	**4,771**		**69,042**	
Leachate - Calculated using HELP (mm)																
Daily cover		58.1	4.2	26.0	147.2	173.1	97.2	94.9	364.1	174.9	83.7	67.6	10.9	1302	781	77%
Interim cover (flat)		3.0	0.0	18.5	67.7	103.8	50.1	32.1	144.2	140.9	65.7	3.4	0.0	629	28946	37%
Interim cover (sloped)		2.2	0.0	18.0	67.7	103.0	49.3	30.9	142.2	140.3	63.5	2.2	5.2	624	16942	37%
Final cap - Option 1 (flat)		8.1	0.0	0.0	24.5	29.6	16.5	18.0	24.9	15.0	7.3	8.2	0.0	152	0	9%
Final cap - Option 1 (sloped)		8.0	0.0	0.0	24.2	29.8	16.3	17.1	25.6	14.8	6.7	8.6	0.0	151	4240	9%
Final cap - Option 2 (flat)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Final cap - Option 2 (sloped)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Centre area - Green waste		3.5	1.9	3.5	2.4	0.5	4.0	0.0	1.4	1.6	6.3	4.1	5.1	34	216	2%
Total Leachate Collected	(m3/month)	**480**	**15**	**1,377**	**5,731**	**8,511**	**4,181**	**2,851**	**11,437**	**10,818**	**5,022**	**524**	**179**		**51,125**	
Other Leachate Sources	(m3/month)															
Open cell		989	597	4,861	6,837	972	2,375	6,767	7,916	520	2,454	919	1,068		36,274	
Centre area - Transfer station		16	10	81	114	16	39	112	131	9	41	15	18		602	
Leachate Storage Pond																
Rainfall into pond	(m3)	42	25	205	289	41	100	286	334	22	104	39	45		1,531	
Evaporation from pond	(m3)	65	88	82	62	45	35	40	56	78	97	106	114		868	
Net Leachate Generation	(m3)	**1,463**	**559**	**6,442**	**12,908**	**9,495**	**6,661**	**9,975**	**19,762**	**11,290**	**7,523**	**1,391**	**1,196**		**88,665**	

50th percentile AEP year - Stage 3

50th percentile year (2008)

LANDFILL GENERATION		
Daily cover	-	m2
Interim cover (flat)	46,000	m2
Interim cover (sloped)	20,700	m2
Final cap - Option 1 (flat)	-	m2
Final cap - Option 1 (sloped)	28,062	m2
Final cap - Option 2 (flat)	15,901	m2
Final cap - Option 2 (sloped)	22,638	m2
Centre area - Green waste	6,300	m2
OTHER GENERATION		
Open cell	-	m2
Centre area - Transfer station	11,800	m2
Transfer station infiltration rate	3.0%	
STORAGE		
Pond storage capacity	1,021	m3
Freeboard storage capacity	-	m3
Pond storage surface area	900	m2
Pond storage basal area	186	m2
Pond storage catchment area	900	m2
Initial pond volume	0.5	vol/vol
Pan evaporation percentage - winter	70%	
Pan evaporation percentage - autumn	75%	
Pan evaporation percentage - spring	70%	
Pan evaporation percentage - summer	70%	
DISPOSAL		
Pond operating volume	0.2	

Parameter		January	February	March	April	May	June	July	August	September	October	November	December	Annual Total mm	Annual Total m3	Percent
		31	28	31	30	31	30	31	31	30	31	30	31			
Precipitation (mm)																
Rainfall (2008)	(mm)	106.7	257.2	46.3	166.1	13.5	164.3	55.0	47.0	99.9	69.6	76.1	88.8	1191		100%
Pan Evaporation																
Evaporation (from SILO)	(mm)	146.6	110.1	127.8	82.9	58.0	50.0	62.2	78.5	115.9	141.4	142.1	178.1	1294		109%
Pan evaporation	(mm)	102.6	77.1	95.9	62.2	43.5	35.0	43.5	55.0	86.9	106.1	106.6	124.7	939		79%
Runoff - Calculated using HELP (mm)																
Daily cover		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Interim cover (flat)		22.0	66.1	5.1	39.8	0.1	41.1	7.0	4.0	29.4	5.7	11.6	19.0	251	11542	21%
Interim cover (sloped)		21.1	65.9	4.7	38.7	0.1	39.9	6.6	3.7	28.7	5.3	10.8	18.5	244	0	21%
Final cap - Option 1 (flat)		23.0	100.9	0.0	56.0	0.0	68.8	0.4	0.0	37.1	0.0	0.0	3.4	290	8125	24%
Final cap - Option 1 (sloped)		25.5	102.5	0.0	58.8	0.0	70.3	0.7	0.0	38.9	0.0	0.1	5.1	302	8471	25%
Final cap - Option 2 (flat)		0.0	119.2	1.1	26.6	111.3	91.1	6.2	0.0	0.0	0.0	0.0	0.0	356	5653	30%
Final cap - Option 2 (sloped)		0.0	67.1	0.0	29.3	0.0	94.6	0.1	0.0	48.2	0.0	0.0	0.7	240	5437	20%
Centre area - Green waste		35.1	119.9	0.1	77.5	0.0	86.2	2.0	0.2	51.4	0.4	1.0	8.5	382	2408	32%
Total Runoff	(m3/month)	**2,386**	**11,449**	**351**	**5,859**	**1,779**	**8,823**	**592**	**262**	**4,455**	**378**	**764**	**1,470**		**41,635**	
Evapotranspiration - Calculated using HELP (mm)																
Daily cover		37.2	68.4	38.9	56.2	10.1	52.2	18.4	31.6	39.6	46.1	29.0	48.8	476	0	40%
Interim cover (flat)		50.7	87.0	61.5	74.2	20.2	63.8	21.5	47.2	49.6	55.0	47.0	71.2	649	29854	55%
Interim cover (sloped)		50.6	84.1	61.0	71.3	20.4	63.4	21.8	46.2	50.4	53.6	47.8	69.8	641	13260	54%
Final cap - Option 1 (flat)		72.8	107.4	72.6	55.0	34.8	52.6	30.5	47.7	66.5	69.6	54.5	95.8	760	0	64%
Final cap - Option 1 (sloped)		70.7	106.5	72.1	54.8	33.3	51.9	30.2	46.8	64.1	69.8	54.5	94.5	749	21023	63%
Final cap - Option 2 (flat)		77.3	82.7	139.9	45.7	42.5	37.3	38.9	41.6	15.2	101.3	70.6	56.7	750	11918	63%
Final cap - Option 2 (sloped)		86.4	131.9	102.4	33.6	21.6	30.6	32.2	49.6	62.6	103.1	57.8	100.9	813	18399	68%
Centre area - Green waste		67.8	106.9	72.4	55.8	37.5	53.3	38.6	56.9	64.7	67.5	52.6	94.9	769	4844	65%
Total Evapotranspiration	(m3/month)	**8,975**	**13,707**	**11,115**	**8,265**	**3,687**	**7,326**	**3,880**	**6,583**	**7,190**	**9,968**	**7,445**	**11,156**		**99,297**	
Leachate - Calculated using HELP (mm)																
Daily cover		81.6	100.3	104.6	60.3	105.2	63.0	60.0	29.4	56.4	46.4	15.4	51.3	774	0	65%
Interim cover (flat)		36.7	57.1	48.4	13.5	33.3	40.8	24.3	4.4	38.3	4.9	7.0	13.6	322	14823	27%
Interim cover (sloped)		27.8	56.6	53.2	14.3	33.5	42.2	21.8	4.4	37.2	6.4	5.2	14.2	317	6556	27%
Final cap - Option 1 (flat)		7.7	21.2	10.8	7.5	20.9	15.6	18.1	15.5	12.4	6.2	0.6	6.3	143	0	12%
Final cap - Option 1 (sloped)		8.1	20.3	10.8	7.1	20.2	14.8	17.8	15.6	12.9	6.8	0.6	6.0	141	3958	12%
Final cap - Option 2 (flat)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Final cap - Option 2 (sloped)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Centre area - Green waste		2.5	0.0	3.6	3.7	4.2	2.0	2.1	1.6	2.0	3.2	6.4	5.2	36	230	3%
Total Leachate Collected	(m3/month)	**2,506**	**4,368**	**3,654**	**1,138**	**2,819**	**3,177**	**2,080**	**743**	**2,905**	**569**	**486**	**1,122**		**25,566**	
Other Leachate Sources	(m3/month)															
Open cell		0	0	0	0	0	0	0	0	0	0	0	0		0	
Centre area - Transfer station		38	91	16	59	5	58	19	17	35	25	27	31		421	
Leachate Storage Pond																
Rainfall into pond	(m3)	96	231	42	149	12	148	50	42	90	63	68	80		1,071	
Evaporation from pond	(m3)	56	69	86	56	39	32	39	49	78	95	96	112		808	
Net Leachate Generation	(m3)	**2,584**	**4,621**	**3,626**	**1,290**	**2,797**	**3,352**	**2,110**	**753**	**2,952**	**560**	**485**	**1,121**		**26,251**	

10th percentile AEP year - Stage 3

10th percentile year (1952)

LANDFILL GENERATION		
Daily cover	-	m2
Interim cover (flat)	46,000	m2
Interim cover (sloped)	20,700	m2
Final cap - Option 1 (flat)	-	m2
Final cap - Option 1 (sloped)	28,062	m2
Final cap - Option 2 (flat)	15,901	m2
Final cap - Option 2 (sloped)	22,638	m2
Centre area - Green waste	6,300	m2
OTHER GENERATION		
Open cell	-	m2
Centre area - Transfer station	11,800	m2
Transfer station infiltration rate	3.0%	
STORAGE		
Pond storage capacity	1,021	m3
Freeboard storage capacity	-	m3
Pond storage surface area	900	m2
Pond storage basal area	186	m2
Pond storage catchment area	900	m2
Initial pond volume	0.5	vol/vol
Pan evaporation percentage - winter	70%	
Pan evaporation percentage - autumn	75%	
Pan evaporation percentage - spring	70%	
Pan evaporation percentage - summer	70%	
DISPOSAL		
Pond operating volume	0.2	

Parameter		January	February	March	April	May	June	July	August	September	October	November	December	Annual Total mm	Annual Total m3	Percent
		31	28	31	30	31	30	31	31	30	31	30	31			
Precipitation (mm)																
Rainfall (1952)	(mm)	46.4	28.0	228.0	320.7	45.6	111.4	317.4	371.3	24.4	115.1	43.1	50.1	1702		100%
Pan Evaporation																
Evaporation (from SILO)	(mm)	170.9	139.6	120.8	91.2	66.9	55.3	63.6	89.2	115.9	143.4	157.6	181.5	1396		82%
Pan evaporation	(mm)	119.6	97.7	90.6	68.4	50.2	38.7	44.5	62.4	86.9	107.6	118.2	127.1	1012		59%
Runoff - Calculated using HELP (mm)																
Daily cover		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Interim cover (flat)		9.1	1.3	79.3	88.2	2.6	35.0	131.0	132.7	0.6	19.4	1.7	1.8	503	23121	30%
Interim cover (sloped)		9.5	1.4	80.4	90.7	2.8	35.7	131.9	134.7	0.7	20.4	1.9	1.8	512	10594	30%
Final cap - Option 1 (flat)		0.6	0.0	116.8	188.1	0.0	46.6	244.0	305.6	0.0	2.7	0.0	0.0	904	0	53%
Final cap - Option 1 (sloped)		1.1	0.0	120.5	188.5	0.0	48.5	246.4	305.5	0.0	4.1	0.0	0.0	915	25664	54%
Final cap - Option 2 (flat)		0.0	0.0	73.0	222.0	9.3	65.1	257.4	322.1	0.0	3.5	0.0	0.0	952	15144	56%
Final cap - Option 2 (sloped)		0.0	0.0	58.4	195.8	0.2	51.3	243.6	310.4	0.0	0.9	0.0	0.0	861	19481	51%
Centre area - Green waste		3.1	0.0	125.1	216.0	4.5	60.2	257.4	320.9	0.0	14.4	0.0	0.0	1002	6310	59%
Total Runoff	(m3/month)	**664**	**86**	**11,962**	**20,550**	**358**	**6,285**	**26,899**	**31,639**	**39**	**1,596**	**116**	**118**		**100,313**	
Evapotranspiration - Calculated using HELP (mm)																
Daily cover		20.0	8.3	44.4	77.5	41.0	18.3	19.5	56.7	9.9	63.3	30.6	30.2	420	0	25%
Interim cover (flat)		34.8	7.5	62.1	89.7	65.2	32.6	18.7	73.7	9.1	83.3	34.1	38.1	549	25247	32%
Interim cover (sloped)		34.6	7.5	62.1	89.2	64.6	32.5	18.7	73.4	9.1	83.0	26.9	41.7	543	11247	32%
Final cap - Option 1 (flat)		41.0	27.8	82.5	77.5	55.7	35.3	34.2	69.2	23.2	99.2	50.9	41.8	638	0	38%
Final cap - Option 1 (sloped)		40.6	27.8	82.7	73.4	55.4	34.6	33.3	68.7	22.1	98.3	50.6	41.8	629	17658	37%
Final cap - Option 2 (flat)		46.4	27.8	81.6	71.7	48.2	43.1	43.8	67.5	35.7	115.2	93.8	42.3	717	11400	42%
Final cap - Option 2 (sloped)		46.4	27.7	81.5	67.3	48.7	43.0	41.4	66.6	35.8	114.8	71.1	42.3	686	15538	40%
Centre area - Green waste		41.5	27.6	82.6	78.8	57.3	45.2	39.5	70.1	22.1	98.3	53.7	42.2	659	4151	39%
Total Evapotranspiration	(m3/month)	**5,504**	**2,527**	**10,127**	**11,187**	**8,119**	**5,089**	**4,063**	**9,859**	**2,744**	**13,352**	**6,987**	**5,683**		**85,242**	
Leachate - Calculated using HELP (mm)																
Daily cover		58.1	4.2	26.0	147.2	173.1	97.2	94.9	364.1	174.9	83.7	67.6	10.9	1302	0	77%
Interim cover (flat)		3.0	0.0	18.5	67.7	103.8	50.1	32.1	144.2	140.9	65.7	3.4	0.0	629	28946	37%
Interim cover (sloped)		2.2	0.0	18.0	67.7	103.0	49.3	30.9	142.2	140.3	63.5	2.2	5.2	624	12925	37%
Final cap - Option 1 (flat)		8.1	0.0	0.0	24.5	29.6	16.5	18.0	24.9	15.0	7.3	8.2	0.0	152	0	9%
Final cap - Option 1 (sloped)		8.0	0.0	0.0	24.2	29.8	16.3	17.1	25.6	14.8	6.7	8.6	0.0	151	4240	9%
Final cap - Option 2 (flat)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Final cap - Option 2 (sloped)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0%
Centre area - Green waste		3.5	1.9	3.5	2.4	0.5	4.0	0.0	1.4	1.6	6.3	4.1	5.1	34	216	2%
Total Leachate Collected	(m3/month)	**431**	**12**	**1,245**	**5,207**	**7,744**	**3,806**	**2,595**	**10,304**	**9,810**	**4,563**	**470**	**140**		**46,327**	
Other Leachate Sources	(m3/month)															
Open cell		0	0	0	0	0	0	0	0	0	0	0	0		0	
Centre area - Transfer station		16	10	81	114	16	39	112	131	9	41	15	18		602	
Leachate Storage Pond																
Rainfall into pond	(m3)	42	25	205	289	41	100	286	334	22	104	39	45		1,531	
Evaporation from pond	(m3)	65	61	56	62	45	35	40	56	78	97	106	114		816	
Net Leachate Generation	(m3)	**425**	**-14**	**1,475**	**5,548**	**7,756**	**3,910**	**2,953**	**10,713**	**9,763**	**4,611**	**417**	**88**		**47,645**	

ghd.com

→ The Power of Commitment