OPAL VALE SALT VALLEY ROAD CLASS II LANDFILL

LOT 11 CHITTY ROAD, TOODYAY

WORKS APPROVAL APPLICATION SUPPORTING DOCUMENTATION

View of Existing Clay Pit

Prepared for

OPAL VALE PTY LTD

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1. Introduction

Opal Vale Pty Ltd (Proponent) proposed to development of a Class II landfill site within an existing clay pit at Lot 11 Chitty Road, Toodyay.

To achieve this, it is necessary that a Works Approval application be submitted to the Department of Environment Regulation (DER).

This document provides the supporting information for the Works Approval application.

2. The Proponent

The Proponent for this proposed development is Opal Vale Pty Ltd.

The Proponent is a well-regarded company operating in the resource recovery industry.

The Proponent currently operates the Class I Landfill on Lot 1 Salt Valley Road and has a demonstrated track record in the waste management field.

The Proponent's postal address is:

- Opal Vale Pty Ltd
- PO Box 419
- MORLEY BC
- WA 6943.

3.Premises Location and Details

Property Location:

Lot 11 Chitty Road
TOODYAY

The site is the Williamson's Clay Pit which is situated on the south eastern portion of Lot 11, approximately 1.25 km to the east of Chitty Road.

The clay pit is currently operated by Austral Bricks. Agreements are in place between Austral Bricks, the landholder and the Proponent for the utilisation of the existing and future clay pits for the development of a Class II landfill.

Site Area:

Overall Lot 11 area is 619 ha.

Proposed area to be used for landfill and associated operational activities is approximately 30 ha.

Land Use

The land use is an "A" use within the Rural Zone. An "A" use means that the use is not permitted unless the local government has exercised its discretion by granting planning approval.

Appendix No. 1 – Location – Land Uses and Buffers provides detail of the site location.

4. Project History

The development of a landfill within the existing clay pit has been considered for many years. In mid-2009, the Proponent submitted a Works Approval Application to the DER (then DEC) and a Development Application to the Shire of Toodyay for a Class II landfill within an existing clay pit on site. These applications were assessed and progressed to varying degrees. Ultimately, there was a requirement for additional technical landfill design information before the application could be progressed further.

In mid-2011, a new, amended application was lodged with both the DER and the Shire. The amended documentation contained significantly more technical information relating to the proposed development.

Subsequently, the Shire refused the application and the Proponent took the matter to the State Administrative Tribunal (SAT). Due to the Shire refusal, the DER ceased assessing the Works Approval Application until the Shire Planning matters were resolved through SAT.

In early 2013, the SAT process unfolded with the outcome being in June 2013, the proposed development was given conditional Planning Approval. Some of the SAT conditions related to technical landfill development matters, which required additional environmental investigations and consequently amendments to the originally proposed landfill base design.

As a result of the drawn out process of obtaining (conditional) Planning Approval, the number of related Works Approval Application documents and revisions as well as the subsequent SAT conditions, it was agreed between the DER and the Proponent that the most efficient way forward was for the Proponent to withdraw the previous Works Approval Application and commence with a new application consisting of the latest, most up-to-date documentation for assessment by the DER.

Consequently, all previous documentation issued prior to this document is no longer relevant to the Works Approval application.

5. Local Government Authority

The proposed development is within the Shire of Toodyay.

The proposed land use is an "A" use within the Rural Zone. An "A" use is not a permitted use unless the Local Government has exercised its discretion by granting Planning Approval.

Planning Issues – In mid-2009, the Proponent submitted a Planning Application for the development of a Class II landfill in the Williamson's Pit. At its Council Meeting of 19 August 2010, the Shire resolved accordingly:

"*That Council defer consideration of the planning application until such time as the Environmental Protection Authority and/or Department of Environment and Conservation has issued works approval and a licence for the facility and they have agreed to receive and manage a financial assurance from the Applicant in accordance with the provisions of the Environmental Protection Act 1986*."

As can be seen from the above resolution, there was a procedural conflict as a licence could not be issued by the DER without the facility being constructed and the facility could not be constructed without Planning Approval being received by the Proponent.

Following the August 2010 Council resolution, the Proponent progressed with the technical design of the proposed landfill facility, which culminated in the submission of a further Planning Approval application in March 2012.

At its Council Meeting of 17 July 2012, the Shire resolved accordingly:

"*That the planning application for a Class II landfill be refused for the following reasons:*

1. *There is insufficient information contained in the hydrology report (Council would require an independent hydrology report commissioned by the Shire of Toodyay at the proponents cost).*

2. *There is insufficient information to demonstrate that the facility is adequately designed to meet the seismic conditions of the area, to determine whether the integrity of the landfill could be maintained during or following a seismic event.*
3. *There is no agreement from the Department of Environment and Conservation to receive and manage a financial assurance from the applicant.*
4. *The Development application report refers to the application as being for a Class III landfill.*
5. *The Development application report is insufficient in relation to rehabilitation outcomes.*
6. *The application does not address the measures that would be implemented to address the mosquito management issues raised by the Department of Health.*
7. *The proposal would establish an undesirable precedent for the use of other extractive industry sites in the area as landfill sites for waste disposal:*
8. *The proposal is inconsistent with the content and intent of the Shire of Toodyay's Local Planning Scheme No 4.*
9. *The proposed use is inconsistent with the content and intent of the Shire of Toodyay's Local Planning Strategy.*
10. *The proposed use is inconsistent with the approved rehabilitation plan for the extractive industry licence granted for the site.*
11. *The proposal fails to meet specific objectives of the Avon Arc Sub-Regional Strategy.*
12. *The proposal fails to meet the objects and principles of the Environmental Protection Act 1986.*
13. *The proposal would have an adverse impact on the amenity of the area.*
14. *The proposal would have an adverse impact on the tourism industry within the district.*
15. *The proposal does not address the concerns raised by Main Roads WA in relation to truck movements associated with the operation of the landfill."*

Following the refusal of the Development Application by the Shire, the Proponent took the Shire to the State Administrative Tribunal (SAT).

On 13 June 2013, SAT issued its Reasons, Decisions and Orders and determined that "*the application for review is allowed, with effect from 27 February 2013*". The SAT decision contained 28 orders, of which 15 are impacted by the Works Approval process.

Consequently, there is currently conditional Planning Approval for the proposed development. The majority of the SAT conditions (Orders) will be complied with when a Works Approval has been issued by the DER. There are a number of orders that are unrelated to the Works Approval process and will be complied with by the Proponent independently of the Works Approval process.

6. State Administrative Tribunal

Following the refusal of the Development Application by the Shire of Toodyay, the Proponent took the Shire to the State Administrative Tribunal (SAT).

On 13 June 2013, SAT issued its Reasons, Decisions and Orders. The SAT decision contained 28 orders as well as extensive Reasons and Decisions associated with the orders. Order number 4 has 7 sub-orders; hence, there are effectively 34 orders and sub-orders that need to be complied with. 15 orders and sub-orders have a consequence to the Works Approval process.

The full SAT judgement can be sourced from the SAT website at "*http://decisions.justice.wa.gov.au/SAT/SATdcsn.nsf/PDFJudgments-WebVw/2013WASAT0088/$FILE/2013WASAT0088.pdf*"

The SAT orders (in *italics)* and Works Approval related impacts are as follows (numbering is as per the SAT order numbering):

1. *The application for review is allowed, with effect from 27 February 2013.*

   This order has no consequence to the Works Approval process.
2. *The refusal of the Shire of Toodyay is set aside and planning approval personal to the applicant is granted under the Shire of Toodyay Local Planning Scheme No 4 for the proposed landfill development as generally described in the document 'Management and Rehabilitation Program of Clay Pit, Class II Landfill, Lot 11 Chitty Road, Toodyay' by Landform Research dated January 2012 (Application Document) and shown in Attachments 1 to 4 of the document 'Opal Vale Clay Pit - Landfill Design and Closure' by IW Projects dated January 2012 which is Appendix 2 to the Application Document (facility), subject to the conditions set out in paragraphs 3 to 28 of these orders.*

This order has no consequence to the Works Approval process. It is noted that this Works Approval Supporting document supersedes the referenced documents in this order; however, is effectively the updated version of the referenced documentation covering the aspects ordered by SAT.

Deferred commencement

3. *This approval, while otherwise current and effective as a planning approval from the date of these orders, commences and can only be acted upon from the date that the Department of Environment and Conservation issues a works approval under the Environmental Protection Act 1986 (WA) in respect of Stage 1 of the facility (works approval).*

   This order has no consequence to the Works Approval process; however, the issue of a Works Approval is required to enable the Planning Approval to be acted upon.

4. *The applicant is to:*

   a. *install an additional five bores located around the perimeter of the landfill area, drilled to the water bearing horizon, in approximately the locations shown on the plan attached to the orders of 27 February 2013 as Annexure A (perimeter bores);*

      This order has a consequence to the Works Approval process. The bores referred to in this order have been installed in accordance with the agreed locations.

   b. *install five bores within the landfill area for each stage of the facility, the approximate locations of which for Stage 1 are shown on Annexure A, drilled to a depth of 5 metres below the proposed design base level of the landfill area at the location of each bore as shown on the Landfill Earthworks Layout Plan Drg No OV-WA-02 prepared by IW Projects dated May 2012 (pit bores);*

      This order has a consequence to the Works Approval process. The bores referred to in this order have been installed in accordance with the agreed locations.

c. *arrange for a suitably qualified independent person to measure the water levels at a minimum of once per month from 1 June (and as far as is practicable with respect to June 2013) to December 2013 in the perimeter bores and the pit bores to better define the winter static water levels;*

   This order has a consequence to the Works Approval process. Following the installation of the required additional bores, they have been monitored since March 2013 on a monthly basis by Stass Environmental. This monitoring will continue until the maximum winter groundwater level is known.

d. *further investigate the material in the existing pit and walls and undertake further calculation of seismic risk by reference to both AS4678-2002 and AS1170.4-2007;*

   This order has a consequence to the Works Approval process. These further calculations have been undertaken by CMW Geosciences.

e. *utilise the information referred to in 4(c) and 4(d) above to confirm or inform the final engineering design of the facility, including the batter slopes, shape and base level of each landfill stage, for the purposes of seeking the works approval;*

   This order has a consequence to the Works Approval process. The landfill base design has been amended to cater for the possible presence of groundwater below the landfill by a combination of raising the base of the liner, installing an additional leachate sump and the inclusion of an underdrainage blanket below the lower portions of the landfill. The proposed amended design is provisional on the estimated highest static groundwater level that is likely to be measured at the end of winter in order 4(c). If the highest groundwater level is marginally different to the estimated (conservative) level, the landfill base design will be further amended, most likely by adjusting the coverage of the underdrainage blanket to the required surface area to adequately protect the landfill liner as required by the DER

landfill design guidelines (maintaining the groundwater a minimum of 2 m below the level of the landfill liner).

f. *provide the information referred to in 4(c) and 4(d) above to the Department of Environment and Conservation at the time of seeking the works approval; and*

This order has a consequence to the Works Approval process. The most up-to-date information is provided in this supporting documentation. With regards to order 4(c), this is an ongoing monthly activity until there is a decline in the monitored groundwater levels; hence, indicating the highest winter groundwater level. This monthly information will be provided to the DER on a monthly basis during the monitoring period, with a final hydrogeological report being presented at the end of the monitoring period.

g. *provide a copy of the information referred to in 4(c) and 4(d) above, together with a copy of the application for the works approval, to the Shire of Toodyay at the time of seeking the works approval.*

This order has no consequence to the Works Approval process. This information will be provided to the Shire as required.

5. *If the works approval has not been issued by the Department of Environmental and Conservation within two years from the date of this approval, then this approval shall lapse and be of no further effect.*

This order has no consequence to the Works Approval process; however, if the Works Approval is not issued with the allowable two years, then this will have an impact on the Planning Approval.

Substantial commencement

6. *If development of the facility is not substantially commenced within a period of one year from date of issue of the works approval, then this approval shall lapse and be of no further effect.*

This order has no consequence to the Works Approval process.

General development and construction

7. *The final engineering design of the facility, including the batter slopes and shape and base level of each landfill stage, shall be implemented in accordance with the works approval issued by the Department of Environment and Conservation.*

   This order has no consequence to the Works Approval process.

8. *The facility is to be confined to that part of Lot 11 Chitty Road, Toodyay that has been used for an extractive industry and such adjacent land as is required for its operations, as identified in the application document.*

   This order has no consequence to the Works Approval process as the development is totally within the allowable Lot 11 and hence compliant with this order.

9. *No existing vegetation is to be removed for the operation of the facility (not including vegetation required to be removed for the initial or staged construction of the facility as set out in the application document).*

   This order has a consequence to the Works Approval process as the supporting documentation covers the issue of native vegetation clearing. There is however no clearing of native vegetation beyond that required to be removed for the initial or staged construction of the facility as allowable within the order.

10. *Approval for any effluent disposal systems to be located at the facility shall be sought from the Shire of Toodyay through the lodgment of an 'Application to Construct or Install an Apparatus for the Treatment of Sewage'.*

    This order has no consequence to the Works Approval process. There is no current proposal to construct or install an apparatus for the treatment of sewage. If in future a sewage treatment facility is required, the approval thereof will be sought from the Shire through the lodgement of the necessary application.

11. *All groundwater/stormwater management and watercourse protection measures detailed in the Water Management Plan (contained in the application document) shall be implemented prior to the commencement of operations at the facility.*

    This order has a consequence to the Works Approval process. groundwater and stormwater management is addressed within this supporting documentation.

Fire Management Plan

12. *Prior to the commencement of operation of the facility, the applicant must prepare and implement a Fire Management Plan, such plan being submitted to the Shire of Toodyay for approval.*

    This order has no direct consequence to the Works Approval process. A Fire Management Plan will be presented to the Shire and once approved, implemented prior to the commencement of operations on site.

    The supporting documentation does however cover the management of fires on the landfill. Hence, some aspects of on-site fire management will be assessed as part of the Works Approval process.

13. *Prior to the commencement of operation of the facility, the applicant must prepare and implement a Mosquito Management Plan, such plan being submitted to the Shire of Toodyay for approval.*

    This order has no consequence to the Works Approval process. A Mosquito Management Plan will be presented to the Shire and once approved, implemented prior to the commencement of operations on site.

Confirmation that clay resource no longer a viable basic raw material

14. *Prior to the commencement of construction of each landfill cell at the facility, the applicant must provide the Shire of Toodyay with confirmation from the clay extraction operator that the clay resource is no longer considered to be a viable basic raw material.*

    This order has no consequence to the Works Approval process.

Gates and fencing

15. *Lockable gates are to be installed at all entries to the facility and are to be locked at all times when the facility is not manned.*

    This order has a consequence to the Works Approval process as site access and fencing is addressed in this supporting documentation.

16. *All boundary fencing around Lot 11 Chitty Road, Toodyay shall be a sufficient rural fence, as defined by the respondent's local law relating to fencing, and must be installed prior to the commencement of operations.*

    This order has no consequence to the Works Approval process as this covers fencing on the perimeter of the greater Lot 11. Due to the size of the Lot and the fact that there is stock grazing within the Lot (but not within the landfill operational area), this supporting documentation covers the appropriate fencing of the landfill operational area and not the overall Lot perimeter.

17. *Prior to the commencement of operation of each landfill cell at the facility, a 2 metre high temporary mesh fence must be erected as shown on the site layout plan detailed in the application document, or otherwise located so as to act as a litter trap for waste items being disposed of in the landfill cell in question. All such fencing must be removed at the completion of the landfill.*

    This order has a consequence to the Works Approval process as site fencing of the operational landfill area is addressed in this supporting documentation.

Operation on the facility

18. *Only waste in conformity with the requirements of Class II, Category 64 Landfill, as defined under the Department of Environment and Conservation's Landfill Waste Classification and Waste Definitions 1996 (as amended), shall be disposed at the facility.*

    This order has a consequence to the Works Approval process as waste acceptance criteria are addressed in this supporting documentation.

19. *The hours of operation for entry to the facility for the purposes of disposing waste or any other activity related to the waste disposal operation shall be Monday to Saturday (excluding public holidays) 7 am to 6 pm.*

    This order has a consequence to the Works Approval process as facility operating hours is addressed in this supporting documentation.

20. *Measures shall be taken to minimise the amount of dust pollution associated with the waste disposal site and trucks transporting materials to the facility, as detailed in the Off Site Impacts Management Plan (contained in the application document). This includes the covering of all truck loads entering or leaving the Shire of Toodyay.*

    This order has a consequence to the Works Approval process as dust emissions are addressed in this supporting documentation.

21. *The facility must be maintained in a tidy condition at all times and any landfill and waste disposal items must be contained within the 2 metre temporary mesh fence referred to in condition 17. If any materials leave the approved landfill area, they must be collected and disposed of by the applicant.*

    This order has a consequence to the Works Approval process as litter management is addressed in this supporting documentation.

22. *All trucks entering the Shire of Toodyay in connection with the facility shall comply with the respondent's Policy A.8 - Oversize Vehicles.*

    This order has no consequence to the Works Approval process.

23. *At no time can Chitty Road be used by trucks accessing the facility.*

    This order has no consequence to the Works Approval process.

24. *The facility is not to be used by the general public for the disposal of domestic waste.*

    This order has no consequence to the Works Approval process.

Information to be provided to the Shire of Toodyay

25. *The applicant is required to provide the Shire of Toodyay with a copy of the information and report required to be submitted quarterly by the applicant to the Department of Environment and Conservation, or such other information as may reasonably be required to identify the quantity of waste that has been disposed of to landfill in the facility.*

    This order has no consequence to the Works Approval process.

26. *The facility must be rehabilitated in accordance with the Rehabilitation Management Plan detailed in the application document, or any alternative rehabilitation plan approved by the Department of Environment and Conservation and the Shire of Toodyay. The rehabilitation works must be completed within the first winter months following the re-establishment of the final contour ground levels and maintained for a period of three years thereafter.*

    This order has a consequence to the Works Approval process as landfill closure and rehabilitation is addressed in this supporting documentation.

Cash bond

27. *Prior to the commencement of operation of the facility, the applicant shall provide a cash bond of $120,000 to the Shire of Toodyay as a performance guarantee against the satisfactory completion of the rehabilitation of the site, such funds to be held in an interest bearing account, with the interest forming part of the bond. The performance guarantee will be refunded at a rate of 50% following completion of the final stage of rehabilitation works and 50% at the conclusion of the three year monitoring period. Any such bond is to be accompanied by a bonding agreement and written authorisation from the owner of the land that the respondent may enter the site to complete or rectify any outstanding work. The respondent will recover the bond, or part thereof as appropriate, for any costs to the respondent in completing and/or rectifying the outstanding works.*

    This order has no consequence to the Works Approval process.

Road maintenance

28. The applicant shall be responsible for the cost of maintaining and repairing damage to the roads controlled by the Shire of Toodyay which are used by heavy haulage traffic to deliver Class II waste for disposal at the facility, to the extent that such traffic contributes to the need for such maintenance and repair. Prior to the commencement of operation of the facility, a Road Maintenance Plan based on this principle and including:

a. an audit of the condition of relevant roads prior the commencement of operation of the facility;

b. appropriate maintenance standards and associated requirements and responsibilities;

c. the estimated average annual cost of road maintenance and repairs for the duration of operation of the facility; and

d. the amount of the contribution to such cost to be paid by the applicant,

shall be lodged with the Shire of Toodyay for approval and the Road Maintenance Plan shall then be implemented throughout the duration of operation of the facility.

This order has no consequence to the Works Approval process.

7. Ministerial Requirements

Environmental Protection Act Part IV - The proposal has not been assessed by the Environmental Protection Authority (EPA) and has no associated Ministerial Conditions.

However, on 15 July 2013, the EPA wrote to the Proponent indicating that the proposed development had been referred to the EPA and requested that the Proponent provide sufficient information on the proposed development to enable the EPA to make a decision on whether or not to assess the proposal.

The EPA will be provided with a copy of this Works Approval supporting documentation in order to determine whether the proposal requires formal assessment.

8. Existing Site

The proposed landfill site will be developed on the south eastern portion of Lot 11 Chitty Road, within an existing clay extraction pit.

Lot 11 has an area of 619 ha and forms a part of a larger farming property known as "Longford Grazing". The property has large areas of existing remnant vegetation with some areas of cleared grazing land. Also located on the property are two existing clay extraction areas; one is operated by BGC and the other by Austral Bricks. The proposed landfill activities will consume approximately 30 ha, which is less than 5% of the overall site area.

The clay pit (Williamson's Pit) is currently operated by Austral Bricks. Agreements are in place between Austral Bricks, the landholder and the Proponent for the utilisation of the existing and future clay pits for the development of a Class II landfill.

Williamson's Pit has ideal geological, topographical and hydrogeological features for the development of a Class II landfill site.

To date approximately 1,000,000 m^3 of clay and soil have been excavated from the pit. The proposed landfill design incorporates some additional excavation and limited filling on the floor of the existing clay pit to achieve a landfill base design that complies with the DER landfill design guidelines as well as expansion into areas of future clay extraction.

9.Site Selection

The Proponent has over many years considered numerous sites surrounding the Perth metropolitan area as potential landfill development sites. As part of this consideration, the Salt Valley site has been determined as being the preferred development site.

The proposed landfill is to be located in an existing clay extraction pit. The clay pit is located at the top of a small valley with only minimal catchment upstream of the proposed landfill location. Based on the requirements of the DER landfill development guidelines (*Siting, Design, Operation and Rehabilitation of Landfills, September 2010 – EPA Victoria*), the preferred landfill location is in an existing extractive industries site. This proposal complies with this preferred position.

The site development preference is based on the following:

- Located with a reasonable travel distance from the Perth Metropolitan area (economically viable);
- No surrounding, lined Class II landfills (provides an improved local landfill solution);
- Adequate transport access to the site (economically viable);
- Adequate buffer distances surrounding the proposed facility (manageable landfill impacts on surrounding community);
- Agreeable landowner and clay extraction contractor (land availability);
- Appropriate environmental conditions (minimal environmental impact);
- Within an existing extractive industries excavation (DER preferred landfill siting and pre-existing void);
- Preferred geological conditions (significant depth of natural clay);
- Stable geological conditions (long-term sustainable solution);
- No need to clear native vegetation (minimal environmental impact);
- No significant upstream surface water considerations (long-term sustainable solution); and,

- Rehabilitation of an existing clay pit (landscape rehabilitation).

10. Physical Environment

10.1. Geology and Geomorphology

The site is located on the dissected Darling Plateau.

The locality consists of an elongated narrow plateau remnant that runs north west along the ridge line in the west, at an elevation of 295 m AHD ranging down to about 240 m in the north west.

The general area is located in a drainage basin of the Avon River system and geologically, is part of the Pre-Cambrian meta sedimentary complex which is known as the Jimperding Metamorphic Belt.

The Jimperding Metamorphic Belt Series extends as a 120 km long belt in a north westerly direction from York to Clackline and from there to Jimperding and then Chittering, where it becomes the higher grade metamorphic Chittering Metamorphic Belt.

Williamson's Pit is located on the crest of a hill, at a maximum elevation of about 295 m. To the west of the pit the land is gently undulating before sloping relatively uniformly to the river flat a few kilometres away. To the immediate north of the existing pit the land slopes gently down to a small drainage line (draining from south to north) at about 280 m and from there the land slopes gently upwards to about 330 m.

The Jimperding Series consists of inter-bedded schists, quartzites and minor metamorphosed volcanics. They are steeply dipping and trend northerly and then north westerly.

The geology is further described in the Stass Environmental Ground Water Assessment Report.

Appendix No. 2 - Ground Water Assessment, 11 Chitty Road January 2012 VR 1.3 provides additional detail of the surrounding geology.

10.2. Soils

The soils which overlay the clay belong to the Yalanbee and Leaver soil landscape units. In the vicinity of Williamson's Pit the soil is a yellow gravelly loamy sand and loam, which overlies sandy clay at a depth of about 0.5 m.

10.3. Geotechnical Attributes

Clays, which are suitable for brick making are being excavated to an average depth of about 12 m. The clays continue to a depth of at least a further 15 m to 20 m below the base of the existing pit. Whilst these clays may not be ideal for brick making (due to elevated salt content), their low permeability renders them highly suitable as a natural landfill liner.

The weathered material has a relatively high salt content, increasing to depth from 200 ppm at depths of up to 6 metres, rising to 1,500 ppm and in some cases up to 4,000 ppm at depths of 15 metres below natural ground level.

As the schists (clay material) have low permeability, it is generally only the surface of the exposed schist or stockpiles from which salt is dissolved. The clays are removed by Austral Bricks and the overburden retained on site. These overburden materials, which are inherently low in salt, are proposed to be used as final landfill capping material.

Prior to any excavation, as part of the initial site investigation, the site was extensively drilled by Austral Bricks and found to have a pH of slightly over 7 in some holes ranging down to pH 4 across much of the clay resource. The average is in the range pH 4 – 7. Some clay has a lower pH, down to 3 and below, but this is limited.

Martinick McNulty conducted a drilling program on 24 March 1998 when ten holes were drilled by Wallis Drilling with a Mantis drilling rig mounted on a Toyota Landcruiser to assess the local geology and groundwater.

Further drill holes have recently been sunk by Stass Environmental to confirm the geology and provide data on the hydrogeology. The Stass Environmental Ground Water Assessment Report contains the hydrogeology and the geotechnical investigations of the site.

Appendix No. 2 - Ground Water Assessment, 11 Chitty Road January 2012 VR 1.3 provides additional detail of the surrounding geology.

Six samples of weathered schist (clay) were collected from the base of the pit by Landform Research in December 2010. These were tested for:

- Emerson Class;
- Liquid Limit;
- Plastic Limit;
- Plasticity Index;
- Linear Shrinkage;
- Dry Moisture Content; and,
- Permeability.

The Emerson Class was 6. The linear shrinkage on drying ranged from 2.0% to 5.5%.

The additional permeability results are discussed below.

10.4. Earthquake Stability

Earthquake Risk is dependent on the proximity to the active earthquake areas in the Wheatbelt, the soil types and the types of construction.

The risk has been defined by Geoscience Australia and is based on AS 1170:2007.

The ridge soils provide good foundation and subsoil stability and are no different to other soils in the general locality.

There are no low winter and seasonally wet soils that may have an increased earthquake risk because of the potential for moist or deeper less consolidated sediments. The slightly increased potential for earthquake risk can be managed through the use of slightly stronger footings that should be used on such soils.

Jones et al, 2000, show the area as having a low earthquake risk, with a risk of 0.3 – 0.4 cm/sec2 response spectral acceleration and a return likelihood of 475 years. This is similar risk to that of the Toodyay townsite and lower risk than parts of the western Wheatbelt, including York, Brookton and Dowerin.

With a natural regolith and schist basement to the void, and constructed liners, the risk of liner or basal failure or leakage is low.

In addition to the low earthquake risk, the landfill base design has been battered back to a gentle slope of 1 (vertical) by 3 (horizontal). This significantly reduces the side slope on comparison to the existing clay pit batters.

Following the submission of the Planning Application, there was concern raised by the Shire about the earthquake stability of the site. Consequently, the Proponent commissioned CMW Geoscience to undertake a stability assessment of the site and proposed landfill development. This culminated in a report being presented on 16 August 2012.

This report concluded that "*in the short term, the existing 70 degree slope during static conditions has an adequate factor of safety. However, the lowest factors of safety were obtained in the long term for the existing steep slopes when the phreatic surface is highly elevated. Unfortunately we are unable to determine what time period long term could be. Once the slopes are recontoured to 18 degrees, then they are stable even under seismic loading with the parameters used.*"

Appendix No. 3 - Earthquake Stability Assessment Report 16 August 2012 provides detail of the earthquake assessment.

Earthquake stability was one of the issues that was discussed in detail during the SAT process. Consequently, it was agreed (and ordered by SAT) that both AS4678-2002 and AS1170.4-2007 would be considered during the earthquake stability assessment. This was subsequently carried out and CMW Geoscience presented a further report.

This report concluded that "*based on our site inspection, defects and schistosity was identified at two exposures and further analysis was therefore completed to assess the effect of these discontinuities have on slope instability. It was concluded that it is kinematically possible for toppling type failures at Exposure 1 and for wedge type failures at Exposure 2.*

However, once the slopes are re-contoured to 18 degrees then we maintain they should be stable against general slip failures through the insitu material, (even under seismic loading with the parameters used) and against rock slope type failures along existing discontinuities.

As mentioned in our previous report, site specific geotechnical investigations should be undertaken to confirm our findings with consideration given to relevant laboratory testing. As discussed previously, there are a number of variables that influence shear strength parameters and our research into these correlations must be validated."

CMW Geoscience is currently reviewing what additional site specific geotechnical investigations should be undertaken. Once this additional investigation has been carried out, the report will be provided to the DER.

Appendix No. 4 - Earthquake Stability Assessment Report 11 February 2013 provides details of the earthquake assessment.

10.5. Climate

The climate of the area is Mediterranean with warm to hot dry summers and cool wet winters.

The closest recording weather station is Toodyay, which only records rainfall. Other data is recorded at Northam.

The highest temperatures are from December to February with between 31° and 33° C maxima, and the lowest temperatures in July with maxima of just over 16° C and minima near 8° C.

Annual rainfall for the area averages 427 mm of which the majority falls in the months April to October inclusive.

The prevailing winds are from the southwest, particularly in the afternoon. In summer the easterly in the mornings and the sea breeze in the afternoon can be relatively strong.

Winter winds are more variable and on average lighter, but have an easterly predominance in the morning and slight south westerly dominance in the afternoons.

Wind roses and additional climate data are provided in the environmental report prepared by Stass Environmental.

Appendix No. 2 - Ground Water Assessment, 11 Chitty Road January 2012 VR 1.3 provides detail of the local climate.

10.6. Geotechnical Investigations

The local hydrogeology has been characterised from an interpretation of the exploration drilling undertaken by Austral Bricks and hydrogeological studies completed by Martinick McNulty in 1998.

On 24 March 1998 ten holes were drilled by Wallis Drilling with a Mantis drilling rig, which was mounted on a Toyota Landcruiser, to assess the local geology and groundwater conditions.

Water was generally not encountered during drilling, with the exception of some holes, which are located approximately 1 kilometre to the northwest of the existing clay pit. In these holes granite was intersected and water was found to be present in weathered basement.

Hydraulic testing of all of the monitoring bores (WF 1 to WF 11) was undertaken by Martinick McNaulty to determine the in-situ hydraulic properties of the schistose clay.

Testing comprised injection of a known volume of water into the bore and subsequently monitoring the rate at which the water level declined. Analysis of the response was completed using the Bower and Rice method.

From the results of the hydraulic testing it was concluded by Martinick McNulty, that the schistose clay present in the pit and its vicinity has a low to very low permeability and that the groundwater regime in that area is classified as an aquiclude. That is to say, although groundwater is present there is no defined aquifer system. The sandy clays are partially saturated and the local groundwater levels vary with changes in topography.

Appendix No. 5 – Martinick McNaulty Geotechnical Report June 1998 provides additional detail of the site investigations undertaken.

Strass Environmental recently conducted additional drilling and the installation of monitoring bores, the results thereof are covered in the Stass Environmental report.

Appendix No. 2 - Ground Water Assessment, 11 Chitty Road January 2012 VR 1.3 provides additional detail of the site investigations undertaken.

10.7. Permeability

In early 1998, six piezometers were installed by Martinick/McNulty around the perimeter and another four within the clay pit. Whilst the clay pit has been enlarged in the past decade, the results provide a good indication of the geotechnical properties of the weathered schist.

In each piezometer a PVC standpipe of 50 millimetre diameter was installed immediately after the hole was drilled. The casing was slotted for the entire depth of the hole and all of the piezometers were surveyed. A summary of monitoring bore details is provided in the Stass Environmental Report.

The piezometers are now difficult to find so Strass Environmental installed four monitoring bores in June 2011 and, as an outcome of the SAT process, an additional five deep monitoring bores around the proposed landfill site and five shallow bores within the clay pit.

Descriptions of the bores, the bore logs and other data is contained in the Stass Environmental Report. It is note that the Stass Environmental report only covers the detail of the first four bores that were installed. As part of the outcome of the SAT process, the groundwater bores are still being monitored to determine the highest winter groundwater level. Once this monitoring has been completed (estimated to be in November of December 2013), the Stass Environmental report will be updated to include detail of the more recent bores that have been installed.

Appendix No. 6 – Site Bore Locations provides information on the location of the known bores on site.

Two clay samples were collected by Martinick/McNaulty from the floor of Williamson's Pit adjacent to bores WF2 and WF4. These samples were analysed for particle size distribution, optimal moisture content for compaction and permeability of the compacted clay.

The distribution of particle sizes demonstrated that the material in Williamson's Pit consists of a clayey, silty sand with minor gravel. The clay content varies from 4 to 8%, the silt content varies from 26% to 33% silt, and the sand content varies from 53 to 56%.

The falling head permeability tests for samples compacted to 90% standard compaction at optimal moisture content, gave coefficients of permeability of 3.12 x 10-9 m/s and 1.49 x 10-8 m/s respectively for WF2 and WF4.

The compaction tests indicate that maximum dry densities of 1.87 and 1.74 t/m3 at optimum moisture contents of 13% and 17% respectively could be achieved for the material obtained from WF2 and WF4.

In December 2010, additional permeability testing was conducted by SGS from samples collected by Landform Research from six samples collected from across the floor of the existing clay excavation.

Table 10.7.1 Permeability Testing provides the results of the testing undertaken.

Table 10.7.1 Permeability Testing

Sample No.	Permeability (m/s)
1	7.2×10^{-9}
2	3.9×10^{-9}
3	5.8×10^{-9}
4	6.8×10^{-8}
5	2.2×10^{-8}
6	9.1×10^{-9}

Appendix No. 7 - SGS Permeability Results provides additional detail of the testing results.

Stass Environmental found from recent drilling that there was an aquiclude under the clay resource within the area of the proposed landfill, with clays and weathered schist of 20 m to the aquifer.

Even though Stass Environmental concluded that the site is underlain by an aquiclude, the proposed landfill base design incorporates the use of a low permeability 2mm HDPE synthetic liner to provide additional environmental protection.

Appendix No. 2 - Ground Water Assessment, 11 Chitty Road January 2012 VR 1.3 provides additional detail of the site investigations undertaken.

10.8. Surface Hydrology

Drainage lines run northwest from either side of the ridge on which the clay pit is located. These drain to Jimperding Brook which drains approximately from south to north and ultimately ends up in the Avon River.

This brook is fed by several drainage lines from the surrounding hills. Fresh water typically flows in Jimperding Brook during the early winter months following the opening rainfall events of the autumn and winter seasons. The first rains typically result in a run-off of fresh water, but the water in Jimperding Brook becomes progressively brackish during the spring months when subsoil drainage contributes to the flow in the brook.

Williamson's Pit is located on the crest of a hill. Consequently, it does not intersect any drainage lines and receives no upstream run-off water. Just to the north east of the current pit is the beginning of a small drainage line which in that area drains approximately from south to north. This is located downstream of a small disused farm dam.

The Department of Water notes that the site is located within the Avon Catchment.

All water from the pit, stockpiles and pit surrounds is internally draining to the base of the pit. This water forms a permanent dam in the base of the pit and demonstrates that the permeability of the clay is sufficiently low to retain surface water.

The landfill will have up slope diverter banks to enable surface water to bypass the landfill footprint. Excess surface water from within the clay excavation is to be retained on site either within the clay pit or the surface water dam for use within the landfill and clay extraction operations. Excess water will be evaporated or discharged to the northern drainage line. There will be no dewatering to the natural land surface of overly saline (< 5,000 ppm) or contaminated surface water.

10.9. Groundwater Hydrology

Based on previous site investigations, neither the regional groundwater nor perched watertable were encountered in the drill holes for the clay excavation area. No watertable has been encountered during clay excavation.

A deep regional watertable exists within the geological basement, mostly located within fractures and quartz and quartzite based aquifers. The watertable is at depth, near or below the elevation of the local creeks, and below the base of the void.

From earlier, shallow drilling (up to approximately 20 m from the natural ground surface), Martinick McNaulty and Austral Bricks found that there are small volumes of groundwater present in the sandy clays which surround and underlie Williamson's Pit, but site specific hydrogeological investigations had confirmed that there is no defined aquifer system below or immediately adjacent to Williamson's Pit. This was primarily because the previous drilling exercises had not drilled sufficiently deep to intersect the underlying groundwater aquifer, as this was not necessary for the clay extraction activities.

With the proposed development of a landfill within the clay pit, the DER was insistent that the Proponent determine more definitively at what level the local groundwater was at. This was to ensure that the landfill liner was at least 2 m above the local groundwater level. Consequently, the Proponent commissioned Stass Environmental to undertake a detailed investigation of the hydrogeology below the site. This investigation entailed drilling down into the groundwater table.

The drilling undertaken by Stass Environmental, combined with an up to date survey of the elevations of the drill holes showed that the base of the pit is sitting on an aquiclude. The clay pit perimeter drills cut through 20 – 40 metres of weathered schists and clay before breaking through into an underlying aquifer. Once broken through, the aquifer was under upward pressure that was able to lift the water by 20 - 40 metres to its standing water level.

That is the groundwater movement is under pressure and would flow upwards if it was not constrained. The groundwater hydraulics was presented in a report by Stass Environmental.

Appendix No. 2 - Ground Water Assessment, 11 Chitty Road January 2012 VR 1.3 provides details of the groundwater hydraulics below the site.

This aspect of the proposed development was one of the major concerns raised by the Shire of Toodyay and subsequently was extensively dealt with through the SAT process.

As part of the SAT process, the site hydrogeology was extensively reviewed and discussed by the Proponent's and Shire's specialist consultants as well as involving the DER hydrogeological specialist. As an outcome of this extensive review and discussion, it was agreed and subsequently ordered by SAT that an additional five deep groundwater monitoring bores be installed around the landfill site perimeter and an additional five shallow bores be installed within the clay pit for each stage of landfill development.

All available monitoring bores were agreed to be monitored on a monthly bases until there was a downturn in the groundwater level indicating that the highest groundwater level had been reached. This highest groundwater level would then be used to finalise the landfill base design to ensure that the landfill liner was at least 2 m above the groundwater table.

The additional groundwater monitoring bores where installed and monitoring commenced in March 2013 and will continue throughout winter until the highest groundwater level has been ascertained.

Appendix No. 8 - SAT Agreed Bore Locations provides the locations of the additional monitoring bores as agreed during the SAT process. **Appendix No. 6 - Site Bore Locations** provides the locations of all bores drilled on site (including the additional SAT bores) and **Appendix No. 9 - Groundwater Monitoring Bore Levels** provides the most recent groundwater depth monitoring data of these bores and will continue to be updated and provided to the DER as and when the data becomes available.

Once the highest groundwater level has been determined, Stass Environment will update its hydrogeological report to reflect the changes made as a result of the SAT determination and the subsequent groundwater depth monitoring results.

The updated hydrogeological report will be used to confirm that the proposed landfill base design as contained within this document has a liner that is at least 2 m above the possible groundwater level. Should there be any minor design changes required, these will be undertaken and forwarded to the DER for final assessment before the Works Approval can be issued.

In summary, the current hydrogeological report has determined the following:

- The water quality of the groundwater was brackish for monitoring bores SE1 – SE3 along the western side of the pit or down water flow, with total dissolved solids of 2,800 – 5,700 mg/L.
- SE4 up flow and to the south east was fresh at 280 mg/L.

- The proportion of ions in the water was generally low although heavy metals were recorded. It was noted that the groundwater quality of the three western bores as "poor". A water sample from SE3 contained copper and zinc, suggesting the presence of a small amount of nearby sulphide.
- The pH ranged from 4.3 to 4.9 in SE 1 – SE3 rising to pH 6.4 in SE4 the freshest and best quality water sample.
- The proportion of nitrogen was also low as could be expected. However the water from SE3 contained elevated nitrogen levels of 7.1 mg/L. The source of this nitrogen is not known but is usually associated with biological sources.

For further details of the outcomes of the hydrogeological investigation refer to **Appendix No. 2 - Ground Water Assessment, 11 Chitty Road January 2012 VR 1.3**. It is noted that this report will be updated once monitoring of the groundwater bores has been completed and the highest winter groundwater level is know.

10.10. Surface Water

There are no naturally occurring surface water bodies located within the vicinity of the proposed landfill site. The proposed site is at the top of a small valley with minimal surface water catchment above the landfill. The minimal quantity of surface water that is generated upstream of the landfill will be diverted around the landfill via dedicated stormwater diversion drains.

There is an existing drainage line running down the valley in a northerly direction. This is an ephemeral stream that only flows after heavy rainfall events. The existing clay excavation catches and stores the vast majority of surface run-off from the upper portions of the valley.

There are no natural surface water bodies present within 500 m downhill of the proposed landfill site. There is a disused, dry farm dam immediately to the north of the existing clay excavation pit. This dam has however been included in the overall footprint of the landfill and will be removed as part of the progressive landfill development.

As part of the development, it is proposed to construct a water storage dam approximately 400 m downstream from the landfill. This water storage dam has a dual purpose that being the storage of operational water supplies as well as providing a surface water monitoring location.

The Shire of Toodyay in its letter of 30 November 2011, requested that additional considerations and comments be provided detailing how the application addresses the Department of Water's Water Quality Protection Note – Landfills for Disposal of Putrescible Materials, as the plans show that the application would not comply with the recommended setback of 100m to a water course.

The Water Quality Protection Note (WQPN 111), in the section Purpose, states that "Regulatory agencies should not use this note's recommendations without a site-specific assessment of any project's environmental risks. Any conditions set should consider the values of the surrounding environment, the safeguards in place, and take a precautionary approach. The note shall not be used as this department's policy position on a specific matter, unless confirmed in writing."

Although the WQPN specifically recommends that there be a 100 m setback from a landfill to a watercourse, it does allow for discretion based upon individual site circumstances. On this particular site the landfill is located at the top of the valley with no water catchment above the proposed landfill sites. The watercourse being referred to, in the vicinity of the proposed landfill site, is a minor watercourse and has been significantly impacted by the existing clay quarrying operations. Consequently, there is minimal if any flow in the ephemeral watercourse in the immediate area of the existing quarry. With the development of the proposed landfill this situation will continue. The development of the landfill site will not negatively impact on the quantity of water entering the watercourse.

In its June 2012 comments on the proposed development, the Department of Water (DoW) concluded, "*the DoW's database has this waterway mapped as a minor, non-perennial waterway. The DoW does not consider the proposal to have the potential for significant impact on this waterway and the issue of water quality management can be addressed through the licensing and works approvals requirements of the Department of Environment and Conservation. The DoW is confident that some form of setback can be achieved to the closest waterway and it appears that the 100m setback can be achieved for all other waterways on site.*"

There are a number of site-specific features/safeguards that are available to minimise the potential for any contamination of the watercourse. These include the following:

- Lined landfill to contain leachate.
- Naturally occurring clayey soil to further improve the leachate containment.
- Large portion of the landfill is below ground; hence, improved control of surface water runoff.
- Groundwater movement away from the watercourse.
- Active leachate collection system on top of the landfill liner.
- Leachate evaporation ponds to receive and evaporate excess leachate.
- 500 mm freeboard to all leachate evaporation ponds.
- Water storage dam immediately downstream of the landfill to collect any contaminated surface water runoff and allow an opportunity to sample the surface water.
- In excess of 2.5 km of watercourse downstream of the landfill before the watercourse exits the site (significant opportunity to remediate any surface water contamination if it should occur).

Based on the above, the development of the landfill within 100 m of the minor watercourse is not seen as an environmental concern, as ratified by the DoW.

10.11. Water Management

10.11.1. Surface Water

The lined landfill is set into and based on clays, which in the event of a liner leakage, provide very low permeabilities and a high absorptive capacity for metal ions. The basal and containing clays will assist in stabilising any metallic ions, because clay aggressively adsorbs metallic ions. (*Tiller K G, 1993, Micronutrients, IN Soils and Australian Viewpoint, CSIRO and Hirschberg 1993*).

The surface water control system has been designed as a series of cut off drains to shed surface water around and away from the active landfill area. This will prevent the contamination of the surface water and hence enable it to be discharged to the environment (natural water course) without having to be treated as leachate.

The active landfill cells and associated leachate collection systems will be separated from surface water runoff to prevent leachate and contaminated stormwater interacting with the local stormwater.

Storage ponds and other drainage measures have been designed to contain and control rainfall runoff for a 1 in 20 year storm event.

There will be no discharge of overly saline (< 5,000 ppm) or contaminated surface water into the natural water course.

The final elevation of the landfill will be designed to shed surface water and keep it separate from water that could potentially contain leachate.

10.12. Groundwater

The site has been extensively drilled by Austral Brick as part of the investigations of the clay resource. It has also been drilled by Martinick McNaulty who conducted permeability testing. Further testing of the base of the pit was conducted in December 2010 by Landform Research.

Stass Environmental also drilled the site in June 2011 and provided an assessment of the hydrology. Within the vicinity and within the existing clay pit no watertable will be intersected because the clay under the pit void is regarded by Stass Environmental as an aquitard of 20 metres thick.

The natural clay base combined with a 2 mm HDPE synthetic liner will provide an adequate protection to the local groundwater.

10.13. Leachate

Leachate management is discussed in detail further in this document. From a water management point of view, all leachate will be separated from surface water and not allowed to enter the natural drainage course.

11. Biological Environment

11.1. Vegetation and Flora

The site has previously been cleared for agriculture and subsequently extractive industry purposes.

The original native forests on these areas were cleared progressively from the 1960's onwards for pasture and cropping purposes. The uncleared part of the property supports a forest of predominantly Jarrah *(Eucalyptus marginata),* Marri *(Eucalyptus calophylla),* Wandoo *(Eucalyptus wandoo)* and Powderbark Wandoo *(Eucalyptus accedens)* trees with an understorey of a range of native shrubs, herbs and grasses.

These forests are well represented throughout the Shires of Toodyay and Northam, including Clackline Reserve (Moore, *et al* 1985) and will not be impacted on by the proposed development.

Williamson's Pit is located on the crest of a rise, which supports pasture and cropping land with very occasional Marri trees. No clearing of native vegetation is required for the construction of the landfill or access roads, as these will be constructed within the existing clay pit or on previously cleared land.

The leachate evaporation ponds will be constructed on previously cleared land; however will require the removal of three isolated trees. The construction of the surface water storage dam in the creek line downstream from the landfill will require the clearing of approximately 0.1 ha (estimated 15 trees) of native vegetation.

Prior to any native vegetation clearing, the appropriate Clearing Permit will be obtained from the Department of Parks and Wildlife (previously DEC).

11.2. Fauna

A definitive fauna report has not been conducted because the proposed development is contained within previously cleared lands and within an existing clay pit. The minimal native vegetation (approximately 18 trees) that is likely to be impacted is either isolated single trees or an isolated clump of trees within the overall cleared pasture. There is no significant fauna habitat that will be negatively impacted by the proposed development.

The landfill will be developed in a currently active clay pit and on being filled will be rehabilitated back to native bush land and pasture, which will in time improve the fauna habitat on site.

12. Proposal Description and Throughput

12.1. Proposal Description

It is proposed to develop a lined Class II landfill in the existing clay extractive industries site within Lot 11 Chitty Road, Toodyay.

The site offers a highly suitable environment for the proposed landfill development and in addition, the extractive industry's activities have created and will continue to create available void space for the proposed landfill development.

As the landfill develops, it will be progressively closed, capped and rehabilitated to return the site back to a similar landform as existed prior to the extractive industries activities.

12.2. Service Provision

The proposed facility is anticipated to provide a convenient waste disposal location for the Perth metropolitan commercial waste collection companies as well as neighbouring Shires.

12.3. Facility Operating Hours

The facility will operate during the following hours:

- Monday to Saturday – 7.00 am to 6.00 pm.
- Sunday and Public Holidays – Closed.

12.4. Proposal Throughput

The landfill is to be a Class II facility, with the incoming waste type being determined in accordance with the DER *Landfill Waste Classification and Waste Definitions 1996 (as amended)*. It is anticipated that the landfill will be able to receive up to approximately 150,000 tonnes of waste per year (based on the anticipated economic climate). It is however anticipated that it will take a number of years for the waste quantity to build up to this level. The majority of the incoming waste will come from the Resource Recovery Solutions recycling and transfer station located in Bayswater. The vast majority of this waste will be residual waste left over from the facilities recycling process.

It is also anticipated that the surrounding local governments may utilise the facility for the disposal of municipal waste as well as local commercial waste generators and collectors. It may be that commercial waste companies from the Perth metropolitan area will also utilise the facility.

13. Facility Categories

Based on the intended activities on-site, the following facility Category is relevant:

Associated with the proposed Works Approval:

- Category 64 – Class II Putrescible Landfill.

14. Material Type and Quantity

14.1. Material Type

Material types will consist of Class I and Class II material including the following:

- C&I waste;
- C&D waste; and,
- Municipal waste.

Typically the material will be originating from a wide range of construction, commercial, industrial and residential activities from within the Perth metropolitan area and potentially the surrounding Shires; these include building & construction waste, light manufacturing, transport and freight services, mechanical workshops, offices, showrooms, shops, agriculture and residential properties.

The majority of the material being delivered to the landfill site will be coming from the Resource Recovery Solutions waste sorting and transfer station in Bayswater. This facility is partly owned by the Director of Opal Vale Pty Ltd. The Bayswater facility sorts and recycles a significant percentage of the waste it receives, the Class II residue from this facility will be sent to the landfill.

The remainder of the incoming waste will be delivered by a range of other commercial waste collection companies or directly by the waste generators and will generally arrive at the landfill in a mixed form. Occasionally there will be dedicated loads of a single material type.

The following waste types will not be acceptable on site:

- Liquid waste;
- Hazardous, intractable and problematic waste;
- High hazard flammable; and,
- Class III and IV waste.

There will also be a quality control process at the weighbridge and on the tipping floors to identify any unacceptable waste types that may inadvertently be delivered to site. If unacceptable materials have been identified, it will be immediately loaded back into the customers' bin or vehicle and removed off site. If the source is unknown, the Proponent will separate the particular non-compliant waste material and appropriately store it in preparation for immediate off-site removal.

Only waste that complies with the DER *Landfill Waste Classification and Waste Definitions 1996 (as amended)* as applicable to Class II landfill site will be accepted on site.

14.2. Material Quantity

The quantity of material being disposed of to landfill will not be restricted by the landfill design capacity, but will be limited by the quantity of waste material being delivered. The commercial environment will effectively determine the quantity of material being landfilled.

It is anticipated that initially the facility will receive approximately 50,000 tonnes per year, increasing to approximately 150,000 tonnes per year; however, this will be dependent on the commercial environment.

The facility design capacity will be limited by available airspace within the active landfill area. So long as future landfill cells are developed well ahead of when the landfill airspace is required, the facility would easily be able to receive up to 400,000 tonnes of waste per year. As mentioned above, the commercial reality is that this level of utilisation is most unlikely to occur.

15. Landfill Design

15.1. Site Layout

The shape of the landfill is largely determined by the shape of the existing and future proposed clay excavation. The clay pit shape will be modified slightly to accommodate the new landfill development.

These modifications will include:

- Battering back of the excavation walls to facilitate liner installation;
- Shaping the excavation base to remove the existing water storage dams and provide the necessary slope to accommodate leachate flow into predetermined extraction sumps. The overall design concept is to minimise the depth of fill in the base of the clay pit so as not to have future problems with settlement of the base of the landfill and hence a negative impact on the leachate drainage on top of the landfill liner;
- Removal of a small, disused farm dam to achieve a more uniform landfill perimeter shape; hence, resulting in a more uniform and sustainable landfill cap profile (removal of the narrow middle portion of the landfill footprint); and,
- Footprint modification to accommodate surface water run-off and ensure that all stormwater can be diverted around the landfill and into the downstream creek line.

The development will also include the following landfill related infrastructure:

- Site access roads;
- Weighbridge located at the entrance to the landfill;
- Site office and staff amenities will be co-located within the weighbridge;
- Leachate ponds;
- Groundwater monitoring bores;
- Stormwater control;

- Construction of a surface water storage dam in the downstream creek line;
- Site fencing and gates; and,
- Provision for future landfill gas power generation facility.

Appendix No. 10 – DWG 001 - Opal Vale Site Layout provides conceptual details of the proposed site layout and **Appendix No. 11 - OV-WA-01B Landfill Overall Site Plan** provides specific design details.

15.2. Site Infrastructure

The local infrastructure is able to sustain the operation of the landfill. Currently the site is used for clay extraction. This incorporates the movement of heavy road vehicles to and from the site. These vehicles currently have adequate access to site in order to remove clay. The waste delivery vehicles would use the same traffic routes as these existing clay removal vehicles.

In order to ensure all-round accessibility to the waste delivery vehicles there would be minor modifications to the road network in the immediate vicinity of the landfill. The location of the access roads directly into the landfill will be determined based on where the landfill tipping face is located. The internal access roads will be located and constructed to ensure easy access and egress from the landfill tipping area. Due to the clayey nature of the natural ground it is likely that during winter there will be a need to sheet the roads with crushed rock of similar material to improve the vehicle traction on the surface to prevent the vehicles from getting bogged down in the roads.

15.3. Site Fencing

There is currently stock fencing around the clay pit. During the construction of the landfill development, the site fencing will be improved to establish a sound perimeter fence around the landfill operational area that will prevent stock wandering into the site and uncontrolled vehicle access. The site entrance gate will be securely locked when the site is unmanned.

Immediately surrounding the active landfill area there will be a 2 m chain link mesh fence to act as a litter collector. Depending on the prevailing wind direction and location of landfilling there may be a temporary litter fence erected immediately adjacent to the landfill tipping area to improve litter management.

15.4. Landfill Available Airspace

The total anticipated available landfill airspace is approximately 2.8 million m³, of this; there is approximately 1.4 million m³ currently available (Stage 1 landfill development). Continuing clay excavation will progressively increase the size of the void to ultimately allow the total anticipated airspace to be achieved.

Available landfill airspace is a combination of the clay void and above ground airspace; consequently, there is more available landfill airspace than there is clay extraction void.

15.5. Landfill Life Expectancy

At an annual landfill incoming waste tonnage of approximately 150,000 tonnes, with an anticipated landfill waste density of 0.85 tonnes per cubic metre, the waste will consume approximately 200,000 m³ of airspace annually. Based on a total available landfill airspace of 2.8 million m³ the landfill is anticipated to have a life expectancy of approximately 14 years. With the anticipated gradual increase in annual waste quantities up to the maximum anticipated 150,000 tonnes per year, it is likely that the landfill will have a life expectancy of approximately 20 years. The final landfill duration will be dependent on the annual waste tonnage received and the actual waste density achieved.

Over the life of the landfill it is anticipated that there will be a fluctuation in the quantity of waste delivered to site. This will be impacted by the availability of other Class II landfill site within the Perth metropolitan and surrounding areas as well as the rate of future recycling in the waste industry.

15.6. Clay Extraction and Landfill Interaction

To date, clay extraction has created a void of approximately 1 million m^3, with a further 0.4 million m^3 of landfill airspace being created aboveground. The clay extraction has commenced at the top of the valley and is progressing in a north westerly direction down the valley. There is currently sufficient airspace available to allow a landfill to be developed without adversely impacting the clay extraction operation.

In a typical year, there will be approximately 25,000 m^3 of clay removed, with an additional 40% airspace being created aboveground. Hence, in a typical year, there is about 35,000 m^3 of landfill airspace created on site. Initially there is anticipated to be approximately 70,000 m^3 of landfill airspace being consumed annually. This could eventually increase to 200,000 m^3 within approximately five to seven years (based on an annual waste intake of 150,000 tonnes). With approximately 1,400,000 m^3 of airspace currently available, within 12 years, the landfill activities will have consumed all available airspace and have caught up with the clay extraction activity.

The Proponent has an agreement with Austral Bricks (clay extraction company) that the Proponent will excavate the clay in advance of the waste placement to ensure that the landfill operation is not negatively impacted. The Proponent with stockpiled the excavated clay in dedicated areas for future removal by Austral Bricks. Hence, it is likely that the landfill will reach maximum capacity and be closed in advance of the completion of clay removal from site.

As part of the clay extraction activity, all the substandard clay material (from a brick making point of view) will be used for site screening, landfill daily cover and selected materials used as final landfill capping.

15.7. Cell Development and Staging

The landfill will be developed in a series of cells, with each cell being sized to accommodate approximately one to three years' airspace requirements.

Due to the existing shape of the clay pit and the fact that the future clay extraction will be occurring downhill of the landfill (in the direction in which the leachate will flow), the landfill will be developed in two stages. Stage one will be developed in the existing void, with stage two being developed in the future void.

Stage one and stage two will have separate leachate collection and extraction systems, each being at the low point of the stage. Stage one has been designed with two leachate sumps (to accommodate of flatter landfill base profile. It is possible that stage two may also have numerous leachate sumps.

Appendix No. 10 – DWG 001 - Opal Vale Site Layout provides conceptual details of the proposed landfill staging, **Appendix No. 11 - OV-WA-01B Landfill Overall Site Plan** provides specific details on stage one landfill and **Appendix No. 12 - OV-WA-02B Landfill Earthworks Layout Plan** indicates the proposed progressive landfill cell development.

15.8. Landfill Design Standard

The landfill design has been developed to comply with the DER landfill development guidelines (*Siting, Design, Operation and Rehabilitation of Landfills September 2010 – EPA Victoria*). Accordingly, this design typically includes the following aspects:

- Landfill base greater than 2 m above the groundwater level, including a partial underdrainage layer;
- Landfill lining system to achieve a leakage rate of less than 1,000 L per hectare per day;
- Baseliner slope of greater than or equal to 3% and leachate drains a slope of greater than or equal to 1%;
- Leachate drainage layer;
- Active leachate extraction system;

- Leachate recirculation and evaporation system; and,
- Facilitation for future landfill gas extraction and potential power generation.

The following drawings provide additional information on the proposed landfill design:

- **Appendix No. 11 - OV-WA-01B Landfill Overall Site Plan**;
- **Appendix No. 12 - OV-WA-02B Landfill Earthworks Layout Plan**;
- **Appendix No. 13 - OV-WA-03B Liner Details - Sheet 1 of 2**;
- **Appendix No. 14 - OV-WA-04B Liner Details - Sheet 2 of 2**;
- **Appendix No. 15 - OV-WA-05B Leachate Extraction Layout Plan**;
- **Appendix No. 16 - OV-WA-06B Leachate Extraction Details - Sheet 1 of 2**;
- **Appendix No. 17 - OV-WA-07B Leachate Extraction Details - Sheet 2 of 2**;
- **Appendix No. 18 - OV-WA-08B Landfill Underdrainage Blanket**; and,
- **Appendix No. 19 - OV-WA-09B Landfill Underdrainage Details**.

15.9. Separation to Groundwater

The DER landfill design guidelines (*Siting, Design, Operation and Rehabilitation of Landfill September 2010, EPA Victoria)* stipulates a minimum separation distance between the groundwater and the landfill liner of 2 m.

At the time of submitting this documentation, the highest static groundwater level below site was still being monitored; hence, the maximum groundwater level was not known when designing the level of the landfill base.

A conservative estimation of the anticipated highest groundwater level has been made based on the previous year's site monitoring and the landfill base designed accordingly to ensure that the liner remains a minimum 2 m above the groundwater. This is achieved by a combination of raising the landfill base floor level above the anticipated groundwater level and also the installation of an underdrainage layer to artificially maintain the groundwater at a maximum level.

There is significant speculation (as was discussed through the SAT process) that, due to the presence of an aquiclude, it is highly unlikely that there will be any groundwater within the clay pit at the level of the static groundwater level as determined in the perimeter monitoring bores. If there is any groundwater, due to the (partial) aquiclude and the relatively low permeability of the naturally occurring clays (schists), the flow from the underdrainage blanket will be minimal.

15.10. Landfill Liner

The naturally occurring soils on site are silty clays with permeability in the range of 6.8 x 10^{-8} m/s to 3.9 x 10^{-9} m/s (*Landform Research January 2011* ***Appendix No. 7 - SGS Permeability Results***). This is marginally higher than the ideal 1 x 10^{-9} m/s and hence the naturally occurring soils do not have the necessary impermeability to be classified as an adequate landfill liner.

The Stass Environmental report (***Appendix No. 2 - Ground Water Assessment, 11 Chitty Road January 2012 VR 1.3*** - *Figure 7*) indicates that there is approximately 25 m of clay below the existing clay pit excavations. This provides a substantial natural buffer to the groundwater.

The proposed landfill liner incorporates a 2 mm HDPE geomembrane placed directly on the naturally occurring silty clays. This composite liner provides the necessary environmental protection for a Class II landfill. The landfill liner will extend over the complete base and up the side walls of the landfill.

It is likely that with the appropriate search, there could be suitable low permeability clay located on site and this material used to construct the landfill liner. This option has however not been considered, as the preference is to provide adequate environmental protection with the 2 mm HDPE geomembrane supported by the low permeability clay substrate. The 2 mm HDPE geomembrane is deemed a far more uniform and predictable liner material than the naturally occurring clay.

Appendix No. 13 - OV-WA-03B Liner Details - Sheet 1 of 2 and **Appendix No. 14 - OV-WA-04B Liner Details - Sheet 2 of 2** provide additional information on the proposed liner configuration.

With regards to potential leakage rates through the proposed liner, the US EPA and subsequently the Victoria BPEM 2010 use the theoretical scenario of two construction defects per hectare of liner, each defect being a circular hole of 2 mm diameter. The leakage rate is then calculated as a function of the particular liner design. The leakage rate through the virgin material is deemed as inconsequential in comparison to the leakage rate through the defects; hence this is ignored in the calculations.

In the Chitty Road Class II landfill design, the composite liner consists of a primary 2 mm HDPE liner and a secondary layer of natural clay a minimum of 10 m deep. The natural clay has been tested to have a permeability range of between $3.9x10^{-9}$ m/s to $6.8x10^{-8}$ m/s (*Landform Research January 2011* **Appendix No. 7 - SGS Permeability Results**).

Based on the theoretical defect assumption above, using the Giroud equation for Liquid Migration Through Composite Liners Due To Circular Defects the Action Leakage Rate (ALR) can be calculated.

The ALR is impacted by the following site variables:

- Degree of construction quality control; and,
- Range of permeability of the underlying clay.

The ALR is calculated utilising the following input data:

- Quality Control coefficient = 0.21 (good control) to 1.15 (poor control).
- Diameter of circular defect = 2 mm.

- Number of defects per hectare = two.
- Leachate Head on liner = 300 mm.
- Clay base permeability = $3.9x10^{-9}$ m/s to $6.8x10^{-8}$ m/s.

Table 15.9.1 – Action Leakage Rate provides the range of leakage rates under different scenarios.

Table 15.9.1 – Action Leakage Rate

Scenario	**Liner Leakage Rate**	
Permeability Range	$3.9x10^{-9}$ m/s	$6.8x10^{-8}$ m/s
Good Quality Control	2.07 l/ha/day	17.17 l/ha/day
Poor Quality Control	11.34 l/ha/day	94.05 l/ha/day

The DER (and Victorian) landfill design guidelines for a Class II landfill require a leakage rate of not exceeding 1,000 L/ha/day (*Table 4, page 19*). From the above calculations, it is clearly indicated that the theoretical ALR for the proposed composite liner is significantly less that the allowable leakage rate; hence the proposed lining system complies with the necessary design guidelines.

The above calculations contain a sensitivity analysis between good construction quality control and poor construction quality control. The conclusion being that there is theoretically 5.5 times more leakage from a liner with poor quality control than for a liner with good quality control. However, it is pointed out that in the worse case scenario of poor quality control in an area of highest permeability (worst case scenario), the leakage rate through the liner is still 10 times less that is allowable in the landfill design guidelines.

The lifetime of HDPE liner material has been estimated to be between 200 and 700 years. Municipal solid waste (MSW) leachate is typically quite benign and does not damage geomembrane liners; hence the degradation effect of MSW on HDPE can practically be ignored (*Ian D. Peggs I-Corp International, Inc.*).

HDPE liner failure is typically as a result of the following:

- Inadequate construction welding;
- Imposed stresses during construction;
- Mechanical damage during construction;
- Stress cracking at stress points; or,
- Service stresses that separate welds.

The following actions have and will be utilised to ensure the integrity of the installed liner:

- Gradual slopes and transitions within the liner design profile;
- Steel smooth drum rolling of the clay substrate;
- Installation of a geotextile cushion protection layer directly on top of the HDPE liner.
- Minimum 300 mm aggregate drainage layer or surface protection over the cushion geofabric.
- Utilisation of reputable liner manufacturers;
- Use of specialist liner installation contractor;
- Good construction quality control; and,
- Specific waste placement techniques for the first layer of waste placed on the exposed liner.

15.11. Leachate Collection

The base of the landfill will be sloped at a minimum 3% across the lined surface to the leachate collection pipes, with the pipes being at a minimum of 1% slope to the leachate sump. This configuration of gradient will ensure adequate flow of leachate from the lined surface into the leachate sump.

The landfill lining system will also incorporate a 300 mm leachate drainage layer and leachate collection pipes across the complete landfill base. Leachate collecting in this drainage layer will be directed, under gravity to a dedicated leachate sump. Each sump will have leachate extraction points to allow the leachate to be removed from the base of the landfill.

The critical aspect of the leachate collection system is the high permeability drainage layer to allow the leachate to flow unimpeded across the liner and into the sumps. To ensure that the drainage layer retains its high permeability a separation geofabric will be placed on top of the coarse aggregate drainage layer to prevent fine material passing into the drainage layer.

Appendix No. 15 - OV-WA-05B Leachate Extraction Layout Plan, **Appendix No. 16 - OV-WA-06B Leachate Extraction Details - Sheet 1 of 2** and **Appendix No. 17 - OV-WA-07B Leachate Extraction Details - Sheet 2 of 2** provide details of the leachate collection and management system.

15.12. Leachate Ponds

A series of three leachate ponds have been proposed, each of approximately 2,500 m² in area (2,500 m³ at 1 m deep). Initially only two leachate ponds will be constructed, with the other leachate pond being constructed as and when leachate volumes determine.

The leachate ponds have been designed with an operating depth of 1 m and an additional 500 mm freeboard, resulting in a total maximum depth of 1.5 m.

The DER landfill design guidelines require a 500 mm freeboard and the Department of Water requirements for freeboard (*Water Quality Protection Note WQPN 27 – Liners for Contaminating Pollutants, using Engineering Soils*) is to cater for a 1 in 20 year storm event, without specifying a specific minimum freeboard.

With the leachate pond only being 1 m deep and of relatively small surface area (50 m x 50 m), it is not deemed likely to generate wave action that requires more than a 500 mm freeboard to retain the contained leachate.

The Bureau of Meteorology (BOM) rainfall intensity calculator (*coordinates 31.675S 116.475E*) provides a 1 in 100 year, 72 hour rainfall event (worst case scenario) as measuring 144 mm of rain. This is well below the 500 mm of freeboard allowed for in the design and still provides in excess of 350 mm freeboard for wave action.

Appendix No. 20 – BoM IFD Data System – Opal Vale provides additional information on the anticipated rainfall intensity on site.

Based on rainfall data from Northam (nearest weather station) and evaporation data from the Perth Airport (nearest evaporation data), there should be approximately 1 m of net evaporation per year in the evaporation ponds. With each leachate evaporation pond having a surface area or 2,500 m^2, each pond should evaporate approximately 2,500 m^3 of leachate. That is a total for three ponds of 7,500 m^2.

Appendix No. 21 – Opal Vale Evaporation Calculations provides additional information on the evaporation potential on site.

Based on the surface area of Cell 1 of 22,500 m^2 and an annual rainfall of 430 mm the first evaporation pond can manage approximately 110 mm of rain landing in Cell 1. This is approximately 25% of the total annual rainfall. If the first two evaporation ponds were constructed, 50% of the rainfall landing in Cell 1 could be managed via evaporation. This excludes any additional evaporation from within the landfill cell. Normal landfill operations would result in a significant quantity of the rainfall being absorbed and suspended in the waste; hence, not generating leachate. If the site was managed efficiently and the lined cell was completely covered with waste, the vast majority of the rainfall could be absorbed in the waste and also evaporated off the waste surface, resulting in a further decrease in leachate generation.

Once the second landfill cell was operational, there would be a significant area of waste on which to evaporate the leachate and hence there would be less reliance on the evaporation ponds.

The design incorporates the location of three evaporation ponds to the east of the landfill, of which the first two would be constructed immediately. The third pond would only be constructed if and when required. In future, if there were a need for additional leachate evaporation ponds, adequate space is available on site to construct more ponds.

The leachate ponds are primarily evaporation ponds and have been designed to be filled to a maximum depth of 1 m. At this depth, the ponds should dry out by the end of each summer, the ponds could then be cleaned out with high-pressure hoses to remove any residual leachate evaporites prior to the onset of winter rains so that all rainwater collected in the ponds during winter would be uncontaminated and hence able to be pumped out to the natural water course in preparation for filling with leachate at the start of the next summer season. Prior to the collected rainwater being discharged to the environment, it would be analysed to confirm that it is not contaminated. If testing does indicate contamination, the collected water will be treated as leachate and not discharged to the environment.

Attachment No. 22 – Drawing 040 Opal Vale Landfill Leachate Pond Concept Detail provides details of the proposed leachate pond design.

With regards to the anticipated leachate generation quantities and how the leachate ponds were designed to cater for the anticipated leachate quantity, as mentioned above, leachate quantities are not easy to accurately predict, especially during the first few years of a landfills life when the waste mass is initially being accumulated. The logic used in the design of the evaporation ponds is that there will be sufficient storage and evaporation capacity constructed (ponds 1 & 2) to handle 50% of the total volume of rainfall that will fall within the first landfill cell. This is seen as a conservative approach as the vast majority of the rainfall will be absorbed by the waste and a significant quantity of leachate re-circulated back into the waste before any is pumped into the two evaporation ponds.

In addition, the evaporation calculations are based on 70% efficiency against theoretical evaporation rates (refer **Appendix No. 21 - Opal Vale Evaporation Calculations**). The DER landfill design guidelines use 80% efficiency; hence the anticipated evaporation rate is conservative and if the DER guidelines were strictly applied, the pond evaporation surface could be reduced by 20%.

In the event that there be more leachate generated than is able to be adequately managed with the initial two leachate ponds, the site layout makes space provision for the construction of a third pond. This is again a conservative approach that allows for some contingency planning against unforeseen weather patterns. It is not seen as an "*ad hoc*" approach, but possibly over conservative when considering all of the contingencies included in the design of the leachate evaporation system. It is confirmed that the ponds are appropriately sized for the intended leachate generation quantity and that the proposal to only build the first two ponds is adequate to accommodate reasonable rainfall contingencies.

Due to the degree of uncertainty surrounding the accuracy of determining leachate generation volumes in the first few years of operation, it is felt that the conservative approach adopted is appropriate for the proposed development.

As a means of comparison, it is pointed out that some lined metropolitan landfills have operated for many years without any leachate evaporation ponds and have quite adequately been able to manage leachate volumes via re-circulation on site. Hence, again pointing out the conservative nature of the proposed design.

15.13. Landfill Gas

As a large putrescible landfill, the waste mass will generate significant quantities of landfill gas. After the landfill has been operating for a number of years and the quantity of landfilled waste is sufficient to generate a commercial quantity of landfill gas, a landfill gas extraction and management system will be developed on site (this will be a separate Works Approval application process).

In anticipation of the need for landfill gas extraction systems and associated infrastructure, an area on site has been allocated for this activity. The area has been selected as being higher ground to allow landfill gas condensate to drain back to the landfill (a critical aspect of landfill gas extraction management).

Annexure No. 10 - DWG 001 Opal Vale Landfill Layout Rev 1 identifies the proposed location of the future landfill gas infrastructure.

15.14. Landfill Closure and Rehabilitation

The concept for landfill closure has been developed. This incorporates a final landfill cap with a post settlement slope ranging between 1 in 17 (6%) through to 1 in 7 (14%). This provides a slope that achieves a stable, easily manageable slope for capping, rehabilitation and future maintenance.

The landfill will be progressively closed. As individual landfill cells or portions of the landfill reached the ultimate design profile these areas will be capped, rehabilitated and closed off.

The landfill capping layer will consist primarily of overburdened clay from the existing and future clay excavation. There may be a requirement to import selected cover material from off-site sources if there is insufficient suitable capping material on site. The capping layer will be a minimum of 1 m thick, ideally 1.5 m thick, with nodes of thicker capping material of up to 4 m thick to enable clusters of deeper rooted species to thrive on the capped surface.

Appendix No. 23 - DWG 020 Opal Vale Landfill Cap Contours Rev 1 provides additional details on the proposed landfill cap profile and **Appendix No. 24 - DWG 030 Opal Vale Landfill Typical Section** provides a conceptual section through the landfill.

Landfill closure and rehabilitation will be carried out is accordance with the Rehabilitation Management Plan.

Appendix No. 25 - Rehabilitation Management Plan provides details of the proposed landfill rehabilitation.

15.15. Post Closure Use

Following the closure and final rehabilitation of the landfill site, the affected land area will be returned back to native bush and pasture. The native bush component will comprise of the areas of previous waste placement (landfill capped area), with other areas of the site either returned to native bush or pasture.

The important aspect is to prevent stock from accessing the landfill capped area to enable it to completely rehabilitate over many years back to a native bush environment.

16. Construction

16.1. Property Modifications

There will be a need to modify the shape of the existing clay pit to accommodate the landfill base design. This will entail the removal and control of the existing surface water as well as filling and/or excavation to achieve the desired ground profile for the landfill underdrainage and landfill liner sub base.

The remaining activities such as the storage dam, evaporation ponds, weighbridge and amenities will be external to the existing clay pit.

16.2. Construction Activities

The proposed landfill development consists of the following construction components:

- Water storage dam;
- Removal and control of existing surface water;
- Earthworks to form underdrainage system;
- Earthworks to form the landfill cell base;
- Cell perimeter bunds;
- Leachate extraction sump;
- Lining of the landfill floor. Walls and perimeter bunds;
- Protection/cushion geofabric;
- Leachate collection pipework;
- Leachate drainage layer;
- Separation geofabric;
- Leachate extraction/transfer infrastructure;
- Leachate ponds;
- Weighbridge and amenities; and,
- Perimeter fencing.

The following drawings provide additional information on the proposed landfill design:

Appendix No. 11 - OV-WA-01B Landfill Overall Site Plan;

Appendix No. 12 - OV-WA-02B Landfill Earthworks Layout Plan;

Appendix No. 13 - OV-WA-03B Liner Details - Sheet 1 of 2;

Appendix No. 14 - OV-WA-04B Liner Details - Sheet 2 of 2;

Appendix No. 15 - OV-WA-05B Leachate Extraction Layout Plan;

Appendix No. 16 - OV-WA-06B Leachate Extraction Details - Sheet 1 of 2;

Appendix No. 17 - OV-WA-07B Leachate Extraction Details - Sheet 2 of 2;

Appendix No. 18 - OV-WA-08B Landfill Underdrainage Blanket; and,

Appendix No. 19 - OV-WA-09B Landfill Underdrainage Details.

16.3. Construction Quality Assurance Plan

A Construction Quality Assurance (CQA) plan will be implemented as part of construction phase. The Plan will provide a means of demonstrating to the public and regulating authorities that the landfill is being constructed meets its design requirements.

The main purpose of this Plan will be to demonstrate that the construction is appropriate and complies with the Works Approval.

The CQA Plan will be based on the design contained within this proposal. It will contain the material/construction specifications, testing methods, testing frequency, corrective action and provide for appropriate documentation procedures in addition to the responsible parties and timeframes.

Appendix No. 26 – CQA Plan provides detail of the Construction Quality Assurance Plan.

17. Operating Methodology

17.1. Waste Acceptance

The acceptance of waste to site will be governed by the DER *Landfill Waste Classification and Waste Definitions 1996 (As Amended)*. No waste will be landfilled that does not comply with the necessary waste acceptance criteria. The applicable waste acceptance criteria will be strictly adhered to by the Proponent.

On arrival at the site, the following activities will be undertaken in dealing with each waste load:

- On arrival at the weighbridge, customers will be required to provide information on the source and type of waste material being delivered. Due to vehicles either being covered (transfer trailers and bins vehicles) or sealed (compactor vehicles), it is not practical/possible to visually inspect the waste material at the weighbridge.
- The incoming load will be weighed over the weighbridge and as a minimum, the following information recorded:
    - Customer name;
    - Waste type;
    - Waste load weight (either by deducting the vehicle's stored tare weight from the gross weight or reweigh of empty vehicle on exiting the facility);
    - Date and time of entry; and,
    - Vehicle registration.
- If there is likelihood that the incoming load may contain non-acceptable waste, the load will be inspected as best possible prior to discharge at the active tipping face. If this is not possible, the load will be tipped under supervision on the side of the active landfill area to enable the load to be adequately inspected while being unloaded. If the load is then deemed unacceptable, it will be placed back into the delivery vehicle and removed from site. If the load is deemed acceptable, it will be pushed up into the landfill and compacted.

- When a waste load is discharged at the active landfill tipping area, each load will be inspected by landfill operations personnel for conformance with the site waste acceptance criteria. Waste deemed acceptable will be incorporated into the landfill and waste deemed unacceptable will rejected, reloaded into the customer's vehicle and removed from site.

Due the active tipping area be permanently manned, all loads will be inspected on arrival and hence there is a reasonable likelihood that if unacceptable waste is identified, that the customer will still be on site and able to remove the non-conforming waste. If the customer has departed the site and is subsequently unidentifiable, the Proponent will separate the waste and quarantine it to one side while making the necessary arrangements to remove the waste from site to the appropriate disposal location.

17.2. Asbestos Management

The landfill site will accept asbestos containing material.

The control of materials containing asbestos products is a critical management aspect within the facility.

It is deemed advantageous to the greater community to allow asbestos materials to be accepted on site. This ensures the appropriate handling and disposal of asbestos material.

Asbestos material will only be accepted on site if it is appropriately wrapped and sealed in plastic. The delivered material will be immediately taken to landfill where the asbestos will be appropriately buried within the landfill.

Prior to the commencement of operations the Proponent will develop an appropriate asbestos handling procedure. The procedure will cover the following aspects:

<u>Prevention/Inspection</u>

- All customers will be advised that asbestos will only be accepted if it is handled in accordance with the asbestos handling procedure.
- Inspection of incoming loads by facility operations personnel.

Material Handling

- Wearing of appropriate PPE when handling asbestos.
- Separation of asbestos material from general loads.
- Wrapping asbestos in a manner to prevent asbestos fibres entering the atmosphere.
- Applicable labelling of wrapped materials.
- Methodology for unloading wrapped materials at the tipping face.
- Methodology for landfilling asbestos material.
- Maintenance of an asbestos disposal register.

17.3. Waste Management

On arrival at the active tipping area, the waste will be discharged from the deliver vehicles on a prepared hardstand area, which will be located as close to the final waste disposal location as is reasonable possible.

The deposited waste will be pushed into place by a dozer or waste compactor. Once in the area of final disposal, the waste will be broken up and compacted by the waste compactor. This is typically achieved by a minimum of four passed of the compaction vehicle. Subsequent loads of waste will be placed on top of this waste and similarly broken up and compacted.

This process is continued until the area of waste placement has reached it is desired height or waste deliveries have ceased for the day. Thereafter, the compacted waste will be covered with adequate daily cover material to cover all waste.

17.4. Leachate Management

Leachate percolating through the waste mass will collect in the dedicated leachate sumps from where it will be pumped to either be recirculated into the landfill or into the evaporation ponds.

The waste profile will be shaped to ensure that all exposed waste areas slope into the landfill to prevent any contaminated surface water runoff from flowing off the lined landfill area.

17.4.1. Leachate Quantity

There are numerous theoretical models available for the calculation of leachate quantities anticipated to be generated within landfills (eg. HELP model). Typically these theoretical models provide anticipated leachate quantities for a closed and capped landfill. This information is of no value to landfill operators during the life of the landfill (prior to closure and capping). The quantity of leachate to be generated during the operating life of the landfill is highly dependent on a range of factors including:

- Timing of when new landfill cells are commissioned (summer or winter);
- Size of the landfill;
- Area of exposed landfill liner;
- Quantity of landfill waste within the landfill;
- Shape of the waste mass (slope angle);
- Operation of the landfill;
- Type of waste; and,
- Type of cover material.

All of the above variables can have a significant influence on the quantity of leachate being generated on-site. Consequently it is not possible to accurately determine the quantities of leachate that are likely to be generated during the first few years of operation.

The most appropriate method is to ensure that the landfill is not commissioned in late summer (just prior to the onset of winter rains) and to provide an initial leachate evaporation pond(s) with adequate space available on site to develop further leachate evaporation ponds if required.

Once the landfill has been commissioned it is essential that the landfill site operations personnel be adequately trained and educated on the importance of continuous leachate management, especially during the summer months in which to reduce the quantity of leachate on-site in preparation for the winter rainfall.

17.4.2. Leachate Depth Monitoring

The depth of the leachate in the leachate sumps will be monitored to ensure that the depth of the leachate does not exceed 300 mm on the landfill liner (maximum allowable pressure head). This leachate depth measuring will determine when and how much leachate will need to be pumped out of the landfill to maintain the leachate level below the maximum allowable level.

The landfill design includes a minimum of two leachate assess points at each leachate sump, one as the duty assess point down which the leachate extraction pump will be placed and the other being a standby assess point that can be used in future if there is a problem with the duty access point. The standby access point will be used as the leachate level monitoring access point.

17.4.3. Leachate Recirculation

The primary means of leachate management on site will be the recirculation of leachate back into the landfill waste mass. The benefit of this is to "consume" leachate while wetting the waste to increase biodegradation and hence more rapid landfill stabilisation.

Initially, it may not be possible to recirculate all leachate back into the landfill as there will potentially be too smaller waste mass to cater for the leachate volume. This will however be dependent on the season of the year that the landfill commences operation. If the landfill commences operation in late summer, there will be insufficient time for sufficient waste to be placed before the onset of winter rains and hence the generation of leachate. In this scenario, the leachate will need to be pumped directly to the leachate ponds.

18. Rights to Water Irrigation Act 1914

The proposed development will be relying on surface water for its operational requirements. There will be no groundwater consumption associated with the proposed activities; hence, there is no requirement for groundwater usage and no consequential impact of the *Rights to Water Irrigation Act 1914*.

Groundwater Licence Number – Not applicable.

Groundwater Allocation and Aquifer - Not applicable.

Groundwater Use - Not applicable.

In future, if there is a need to utilise groundwater, the appropriate application will be lodged with the Department of Water.

19. Social Environment

19.1. Surrounding Land Uses

The surrounding land uses are rural, broad acre cropping and grazing. Some larger rural living lots are present to the east.

19.2. Site Lines to Neighbouring Properties

The Lot 11 farm manager's dwelling lies 400 m to the south west of the proposed landfill, behind a ridge and existing trees.

A bund will be constructed along the top of the ridge as recommended by Herring Storer in their consideration of potential noise impacts from the proposed development (refer to the Section on Noise Emissions). This bund combined with additional tree planting should prevent any view of the landfill from the dwelling. Although there have been sight line and noise considerations associated with this dwelling, it is within Lot 11 and owned and controlled by the property owner that has consented to the proposed landfill development; hence, this dwelling is not seen as a "neighbouring property"; however, has been considered in an attempt to minimise the impact on the dwelling.

There are two neighbouring dwellings on the ridge to the north east of the proposed landfill site at a distance of 1,350 m. From a consideration of the contours and section lines, it is possible that the landfill will be visible at least in part from those dwellings. There is substantial intervening natural vegetation, but even so, the elevation of the vegetation and gaps between trees may allow glimpses of the landfill development. The amount of visual exposure will depend on the elevation and density of trees between the landfill and the dwellings, and their maintenance or additional planting over time. Additional tree planting at the neighbouring dwellings or just down-slope would provide additional screening of the proposed landfill.

Appendix No. 27 - Contour Plan and **Appendix No. 28 - Section Lines** provides sectional sight lines from the farm manager's residence and neighbouring properties to the proposed development.

Most of the visual risk will occur in the later stages of the landfill development as it reaches maximum elevation. The landfill will be developed from south to north with continuous closure and rehabilitation of the completed portions of the landfill. Consequently, only the active cell would be able to be viewed if the landfill is exposed to the dwellings.

The location of the boundary of Lot 11 and the proposed landfill in relation to the contours make it impossible for perimeter tree planting on Lot 11 to screen the landfill from all land to the north east.

19.3. Buffer Zones

The issue of appropriate buffers is a matter of the distance and protection measures to prevent impact on adjoining land users. This applies mainly to landfill gas migration, safety and amenity impacts.

The DER landfill development guidelines (*Siting, Design, Operation and Rehabilitation of Landfills September 2010 – EPA Victoria*) recommends a buffer distance of 500 m to a building or structure for a putrescible landfill (Class II).

Appendix No. 1 - Location - Land Uses and Buffers provides the location of the 500 m generic buffer zone.

The mapping shows that the two dwellings to the north east lie at over double the distance of the generic buffer and therefore can be deemed as unaffected. The Lot 11 farm manager's cottage, at a distance of 400 m from the edge of the landfill is just within the recommended buffer zone, but is not considered as a neighbouring property as it is within the same Lot and owned by the same property owner; consequently, the property owner has accepted the potential amenity issues associated with the proposed landfill development. The safety issues associated with the migration of landfill gas are deemed negligible as the landfill will be lined to contain landfill gas and with the natural soils on site having a low permeability, any fugitive landfill gas escaping through the liner, is most unlikely to impact on the dwelling as 400 m away.

Clay excavation has operated on this site for many years without buffer issues and there is no reason why the landfill will not similarly operate.

There are no dwellings within 500 metres apart from the dwelling on the property belonging to the landholder.

20. Stakeholder and Community Consultation

As part of the Shire of Toodyay Development Approval assessment in 2009/10 the Shire undertook an extensive stakeholder and community consultation process.

The 2009 proposal documentation was circulated to Government Departments and Authorities through the Shire's normal application processes.

During the community consultation the Shire of Toodyay placed an advertisement in the Avon Advocate (16 September 2009) and in the October edition of the Toodyay Herald.

The proposal was listed on the Shire of Toodyay website.

A sign was placed on site and all local residents and adjoining landowners within 500 m were advised of the proposal.

The proposal was also referred to Austral Bricks, BGC, the Department of Environment and Conservation and the Department of Water.

A total of 13 submissions were received by the Shire as a result of the advertising.

Appendix No. 29 – Stakeholder and Community Submissions July 2010 provides a copy of the comments received.

As part of the Shire of Toodyay Development Approval assessment in 2012/13 the Shire undertook an extensive stakeholder and community consultation process of the more recent Development Approval application.

In accordance with Council's Policy M.2 – Public Consultation Formal Matters, consultation on the proposed development was undertaken in accordance with Level 'E'.

An advertisement was placed in the April and May 2012 edition of the Toodyay Herald. A notice was also placed on Council's website, a sign was located on the site and all adjoining landowners located within 500 m of the site were advised of the proposal and were provided with an opportunity to make comment.

The application was also referred to relevant government authorities including the adjoining Shire of Northam.

Advertising was undertaken in excess of the required public consultation period of 28 days (38 days in total) and concluded on 11 May 2012.

In total, 12 submissions were received, six from government agencies, five from adjoining landowners or owners within proximity of the site and one from an environmental advocacy group.

Prior to the application being advertised for public comment, Council undertook a site inspection with the Proponent and its technical consultant. This inspection provided an opportunity for Councillors to view the proposed landfill site and raise questions in regards to the application.

Appendix No. 30 – Stakeholder and Community Submissions June 2012 provides a copy of the comments received.

There is some similarity between the comments received in the two consultation exercises. The majority being either non-environmental concerns or unrelated to the particular application.

The relevant issues raised by the stakeholders and community have been commented on by the Shire (refer relevant **Appendix**) and where appropriate the development documentation amended to cover particular issues.

In addition to the above consultation, as part of the SAT Mediation process, on 3 October 2012, the Proponent, its consultants and legal advisors again met with Councillors, Council Officers and Council legal representatives on site to again run through the proposed development.

21. Heritage

21.1. Aboriginal Heritage

A search of the Department of Indigenous Affairs database for the local area did not reveal any local Aboriginal Heritage sites.

21.2. European Heritage

There are no known European Heritage sites on or adjoining Lot 11 Chitty Road.

22. Emissions

22.1. Air Emissions

The only air emissions will be landfill gas emitting from the decomposing waste mass.

Composition and Quantity – The composition of landfill gas is typically 50% methane and 50% carbon dioxide. Over time (many years), the composition of methane decreases, with a corresponding increase in carbon dioxide. Ultimately, once the waste mass has stabilised and all organic material has decomposed, the methane content will decrease to zero.

The quantity of landfill gas being emitted will be dependent on numerous factors including:

- Waste type/composition;
- Waste quantity;
- Waste compaction;
- Moisture content;
- Landfill capping system; and,
- Landfill gas extraction system.

Within a few years (likely three to four years) an active landfill gas extraction system will be installed on site (the subject of a future Works Approval). The timing of when the facility will be installed will be a function of the quantity of landfill gas being generated. Once the system is installed, it is reasonable to anticipate that up to 85% of the generated gas will be collected, with the remaining gas being fugitive emission.

At this stage it is not possible to accurately assess the likely quantity of gas emissions as the waste type and quantity is yet unknown.

Based on theoretical assumptions, there will be no gas in the first six months, with the quantity generated gradually increasing annually until the gas management system is installed. At this time there will be a dramatic drop in emissions and then the emissions will gradually increase as the quantity of waste on site increases.

As a demonstration of a rough calculation of the quantity of gas likely to be emitted, based on 1 t of CO_{2e} per 1 t of waste, gas emitted over 30 year (straight line graph) a gas management system of 85% efficiency installed in year 4, 10 % methane oxidation and waste tonnage staring at 50,000 t/yr increasing to 150,000 t/yr in year 5, there would be approximately 1,500 tonnes of CO_{2e} in year two, increasing to 3,000 tonnes of CO_{2e} by year six. It is noted that this is an extremely rough calculation and is for indicative purposes only.

Variability of Emissions – The variability is indicated in the above example of potential gas emissions. The emissions will not vary dramatically from day to day, these will effectively be constant, but over time, the emissions will gradually increase with the increase in waste mass volume on site. There will be dramatic fluctuation when the gas management system is installed of upgraded.

Treatment Methodology – This will be via active gas extraction and flaring and in time possible power generation.

Monitoring – Landfill gas emissions will be assessed in year three to determine the viability of an active gas management system and annually thereafter until an extraction system is installed. Once the system is installed, gas extraction efficiency will be monitored weekly by the gas management contractor.

Contingency Plans – If in time a power generation system is installed, the flare will be maintained on site to enable flaring of the gas when the power generation system is off line.

Environmental Receptors – The major receptor is the atmosphere (ozone layer) as the methane in the landfill gas is a greenhouse gas. Minor receptors may be near by residents experiencing odour from the landfill gas emissions. The extensive buffer zones should adequately manage this occurrence.

Fugitive Emissions – As discussed above.

Cumulative Impact – Nil.

Targets and Limits – The landfill gas emissions targets are as follows:

Landfill surface (final cover) – 100 ppm.

Landfill surface (intermediate cover) – 0.1 mg/m^2/second.

Landfill gas flares – 98% destruction efficiency.

Environmental Risk – Nil.

22.2. Dust Emissions

Potential sources of dust emissions include:

- Construction – minor consideration;
- Dusty loads delivered to site - minor consideration;
- The mobile equipment and delivery vehicles moving around on site - minor consideration;
- Landfill active tipping area activities – minor consideration
- Vehicle wheels spreading dirt around the site - minor consideration.

There are no dust emissions that are anticipated to require major considerations. All identified sources are deemed relatively minor and easily manageable within the confines of the large Lot 11.

Variability of Emissions – There is the potential for variable emissions, which will depend of the following:

- Material type;
- Vehicle numbers;
- Ambient weather conditions; and,
- Dust management activities undertaken on site.

Treatment Methodology – The following are the suite of preventative measures available:

- Wetting down of access roads and active tipping area;
- Restricted activities during certain weather conditions (strong winds); and,
- Application of dust suppressant chemicals (eg. Dustex).

Monitoring – Dust emissions will be visually monitored on a continuous basis by site operations staff. The facility will also maintain a comprehensive complaints register, which will be used as a gauge of success with regards to dust emissions management. In the event that there be a dust emissions issue identified, formal dust monitoring will be undertaken by an independent third party to determine the extent of the problem and to propose appropriate improved dust management solutions.

Contingency Plans - If unacceptable dust emissions are identified offsite, the following contingency plans are available to improve dust management on site:

- Slow vehicles down by traffic calming methods (speed humps);
- Restrict dust generating activities to the appropriate time of day to reduce dust generation (weather dependent);
- Reject or restrict excessively dusty loads; and,
- Utilisation of chemical dust suppressants (last resort).

Environmental Receptors - Environmental receptors include the site operations staff, customers depositing waste at the facility and neighbouring properties.

Cumulative Impact – The potentially dust generating activities that have been identified above are typically individual activities. If there were two or more of these occurring simultaneously, there is the potential for a cumulative impact being generated. The consequence of this will be highly dependent on the type of activity and the quantity of dust being generated. As there are preventative measures that can be applied (primarily, temporally ceasing the particular operation), the impact on receptors can be controlled.

Targets and Limits – No dust emissions beyond the property boundary and nil community complaints.

Environmental Risk – Extremely low.

22.3. Odour Emissions

Potential sources of odour emissions include:

- Putrescible waste being delivered and unloaded at the active tipping area; and,
- Fugitive landfill gas emissions.

Composition and Quantity – The composition will be a mix of odours emanating from the general waste as it putrefies. The quantity of odour will be a function of the quantity of waste in the landfill and the degree to which the putrescible waste has putrefied (odour intensity). Based on these variables, it is not possible to determine the precise composition or quantity of odour likely to be omitted. The installation of an active gas collection system will dramatically reduce the quantity of landfill gas being emitted from the waste mass and hence reduce the odour impact.

Variability of Emissions – The emissions will be highly dependent on the waste quantity, degree of purification, extent of landfill gas management and ambient weather conditions.

Treatment Methodology – The following are the suite of preventative measures available:

- Rejection of excessively odourous waste streams;
- Application of cover material over incoming waste; and,
- Improved landfill gas management.

Monitoring – Odour emissions will be monitored on a continuous basis by site operations staff. It is acknowledged that site staff do become desensitised to odour after being exposed to the same odour for an extended period. The facility will also maintain a comprehensive complaints register, which will be used as a gauge of success with regards to odour emissions management. In the event that there are odour emissions issues identified, formal odour (olfactory) monitoring will be undertaken by an independent third party to determine the extent of the problem and to propose appropriate improved odour management solutions.

Contingency Plans – If significant odour is identified by the onsite attendant or complaints are received from neighbouring properties, the Proponent will increase odour management activities to ensure appropriate levels of odour management are maintained.

If the odour is emanating from a particular waste stream (eg. crayfish heads), the waste stream will either be rejected from site or received under certain conditions (eg. at a certain time of the day or if it has not yet started putrefying).

Environmental Receptors – Environmental receptors include the site operations staff, customers depositing waste at the site and neighbouring properties.

Fugitive Emissions – Nil.

Cumulative Impact – Nil.

Targets and Limits – The method for assessing the extent of the emissions will be based on the number of complaints received from site operations staff, neighbours and customers. A target of zero complaints is adopted.

The DER sets a target of 500 odour units emitted for a single source and this will be used as the benchmark if any olfactory monitoring is undertaken.

Environmental Risk – Low.

22.4. Noise Emissions

Offsite noise is governed by the *Environmental Protection (Noise) Regulations 1997*.

The *Environmental Protection (Noise) Regulations 1997*, require that sensitive premises including dwellings in non industrial areas are not subjected to noise levels exceeding 45 dBA for more than 10% of the time, 55 dBA for more than 1% of the time and never exceeding 65 dBA during normal working hours. There are penalties for tonality of 5 dB, modulation 5 dB and 10 dB for impulsiveness, although impulsiveness is not likely to be relevant.

In December 2010, Herring Storer Acoustics undertook an environmental assessment of the potential noise emissions from the proposed development. This assessment concluded that the only residence that was likely to be negatively impacted by the proposed development was the farm manager's residence to the south west of the site. This residence being with Lot 11, is not considered as a neighbouring property as it is owned by the landowner who has granted permission for the landfill development to proceed.

Appendix No. 31 – Environmental Noise Assessment provides additional information on the study.

Composition and Quantity – Occasional single noise, the noise level being dependant on the incident and also the sound of mobile equipment being driven around the site. These noises are not anticipated to be loud or heard from the nearest neighbouring residential property.

Treatment Method – Increased care when moving waste bins and ensuring that mobile equipment is maintained in an appropriate manner to reduce operational noise and if necessary, reversing beacons will be "croaker" type to reduce noise carry.

Monitoring – The site will be monitored on a daily basis by the onsite attendant. The facility will also maintain a comprehensive complaints register, which will be used as a gauge of success with regards to noise emissions management. In the event that there be a noise emissions issue identified, formal acoustics monitoring will be undertaken by an independent third party to determine the extent of the problem and to propose appropriate improved dust management solutions.

Contingency Plans – Increased training of site operators to reduce operational noise.

It is not deemed necessary to try and eliminate the impact of a heavy item being dropped in an empty waste bin.

Environmental Receptors – Nearest neighbouring residential property is 1,350 m north east, this is a significant distance and well beyond the required landfill buffer zone. It is not anticipated that this property will be negatively impacted.

Fugitive Emissions – Nil.

Cumulative Impact – Nil.

Targets and Limits – Noise Regulation applicable limits.

Environmental Risk – Nil.

22.5. Light Emissions

All construction and the vast majority of the operations will occur during daylight hours; hence, the proposed activity will not impact on the surrounding environment.

The ongoing operation of the site may require some flood lighting during fringe winter periods. Due to the size of the property, lighting will not be aimed beyond the site boundary and hence will not impact on the surrounding environment.

Security lighting around the weighbridge will be left on after hours; however, this is not external to the property.

22.6. Discharge to Water

There are no permanent surface water bodies flowing through the site. There is only the ephemeral creek line running to the north of the proposed landfill development site. There will be some limited discharge into the creek line, the vast majority thereof will be collected in the downstream storage dam and utilised on site for operational purposes in the landfill and clay extraction activities. There is the potential that this water could also be utilised for stock watering.

Potential sources of discharge to water include:

- Discharge from underdrainage blanket (intentional);
- Uncontaminated stormwater being discharged to the natural creek line (intentional)
- Leachate generated within the waste mass (unintentional); and,
- Contaminated stormwater runoff being discharged to the natural creek line (unintentional).

Composition and Quantity – The landfill underdrainage blanket is unlikely to generate any surface water flow, however, if it does, this flow will be very low. There is the potential that it could be brackish. This discharge will end up in the storage dam where it will be used for operational purposes such as dust suppression and fire fighting.

The uncontaminated surface water will be generated from around the site and within the existing clay pit. The quality of the surface water runoff will be substantially fresh; however, there may be some naturally occurring salinity. If the runoff generated from within the clay pit is causing elevated salinity, this source will be managed separately, with the higher salt content water used for dust suppression on the landfill and the fresh water discharged to the creek line.

The quantity of surface water runoff will be a function of the rainfall that is received on site.

Any discharge of leachate or contaminated surface water runoff will be accidental. The composition and quantity of the contaminated runoff will depend on the source and type of spillage.

As part of the normal operating activities, all contaminated surface water runoff will be retained on the landfill site and all leachate contained within the leachate sump, recirculated onto the active landfill are or pumped to the evaporation ponds. It is highly unlikely that there will be any accidental discharges.

Variability of Emissions – The surface water runoff will be dependent on the intensity and duration of rainfall events. The contaminated runoff and leachate will be dependent on the accidental event.

Treatment Methodology – All discharge will flow into the water storage dam where it will be reused for operational purposes. During heavy rainfall events, there is the possibility that the storage dam will overtop and some flow enter the creek line downstream of the storage dam.

There will be no treatment of the intentional discharge (uncontaminated runoff); however, depending on the extent of any unintentional discharge, the treatment will depend on the contamination level and quantity of discharge. The treatment methodology may entail doing nothing for a minor spill through to pumping out collected discharge and removal of contaminated soil to be used in the landfill as daily cover.

Monitoring – The salinity content of the surface water runoff in the clay pit will be monitored monthly and the leachate management system will be inspected daily.

Contingency Plans – In the event of an unintentional discharge to the creek line, the contingency plan is to, where applicable, clean up the accidental spillage as soon as practical after the event as well as through the incident investigation process, identify and rectify the cause of the discharge.

Environmental Receptors – Minimal, depending on the extent of the accidental discharge.

Cumulative Impact – Nil

Targets and Limits – Nil accidental discharge.

Environmental Risk – Nil.

22.7. Discharge to Land

These potential sources of discharge to land include:

- Litter generated from the landfill activities.

The environmental impact of windblown litter is only seen as a temporary discharge to land and appropriate site management is able to adequately address this issue. If litter is not collected in a timely manner, it is easily observed and cannot be "covered over" and hidden. Ultimately, all litter will be collected and placed in the landfill.

Composition and Quantity –

The composition will be light wind-blown items such as paper and plastic film. The quantity will be a function of the waste type, ambient weather and efficiency of litter prevention activities on site.

Treatment Methodology –

Litter control on site is achieved via the following mechanisms:

- Regular pushing up and compaction of the waste.
- Regular collection of uncontrolled tipping and placing of the material into the active tipping face.
- Application of adequate cover material.
- Site fencing acting as a litter collection device.
- Regular clearing of litter from fences and other areas of site.
- Progressive closure of completed landfill areas.
- Planting vegetative screens (tall trees) around the landfill to reduce wind impact.

All of these activities will be undertaken on site.

There will be a 2 m high litter fence around the perimeter of the active landfill area as ordered by SAT.

Litter collections will be carried out at least weekly or more regularly if required.

With there being other site users within close proximity of the landfill site, the Proponent will be required to continuously ensure that there is no litter blowing or washing beyond the active landfill area.

Due to the size of the greater Lot 11, it is highly unlikely that any litter will blow or wash beyond the property boundary. If this does occur, the Proponent will immediately collect the litter and return it to the landfill.

Monitoring – The area surrounding the landfill site will be inspected on a weekly basis or more regularly during strong wind events.

Contingency Plans – If litter management becomes problematic, the Proponent will investigate and implement additional litter management systems to improve the containment and reduction of litter.

Environmental Receptors – Other site users (clay extraction companies and the stock farmer as well as neighbouring properties.

Fugitive Emissions – Nil.

Cumulative Impact – Nil.

Targets and Limits – No litter beyond the site boundary and only minimal litter on site.

Environmental Risk – Low.

23. Vermin Management

The potential sources of vermin include:

- In material being delivered to the site; and,
- Living in and around the landfill site.

Preventative measures include:

- Regular pushing up and compaction of the waste.
- Regular collection of uncontrolled tipping and placing the material into the active tipping face.
- Application of adequate cover material.
- Progressive closure of completed landfill areas.
- Vermin control such as baiting and trapping.

Should vermin be identified on site, the appropriate eradication procedures are to be undertaken, this may involve professional pest controllers being utilised to manage the situation. Typically vermin could include:

- Rats and mice;
- Cats;
- Birds; and,
- Cockroaches.

On occasion it may be appropriate to use both mouse and rat traps around the site even if vermin have not been identified. This will assist in identifying the presence of any rats or mice.

24. Fire Management

Under no circumstances will waste be burnt on site. Burning of waste does not form part of the site waste management activities.

Fire management is a critical activity on all landfills. A significant portion of Class II waste is combustible and due to the wide variety of waste received, it is possible that there could be spontaneous combustion within the waste mass. Consequently there is a risk of fire within the landfills.

The risk of landfill fires can be managed in the following ways:

- Adherence to the DER waste acceptance criteria;
- Appropriate compaction and covering of waste;
- Collection of litter from up against the litter fences;
- Not placing significant quantities of flammable material in a single area within the landfill (piles of tyres);
- Appropriate site security to reduce the likelihood of vandals entering the site;
- Appropriate fire fighting equipment on site:
    - The water cart will be the primary fire fighting piece of equipment on site;
    - Sufficient stockpiles of cover material will be maintained close to the active tipping area to facilitate rapid covering of the waste in the event of a fire;
    - Adequate water storage will be maintained on site (in storage dam); and,
    - The water cart will always be left full to be able to react immediately to a fire; and,
- Adequate training for site operating staff.

Prior to the commencement of landfill operations the Proponent will develop a Fire Management Plan. The Fire Management Plan will include the following:

Preventative measures

- Maintenance of fire breaks;
- Waste placement and materials handling; and,
- Appropriate signage.

During operating hours:

- Actions to be taken by staff following the identification of a fire;
- Appropriate PPE and fire fighting equipment;
- Actions to be taken in the event of a large scale fire:
    - Evacuate facility;
    - Notify Fire Brigade;
    - Notify senior management;
    - Notify the DER;
    - Notify Shire; and,
    - Control fire as appropriate; and,
- Actions to be taking following a fire:
    - Identification of potential fire source;
    - Notify the police in the event of vandalism;
    - Report to the DER;
    - Notify the Shire; and,
    - Lessons learnt.

After operating hours:

- Appropriate signage advising the general public of actions to be taken if fires are noticed on site:
    - Emergency number(s) to call; and,
    - Do not enter site.

25. Solid/Liquid Waste

25.1. Solid Waste

It the context of the proposed development, "solid waste" is not seen as an emission as "solid waste" acceptance is the core business behind the proposed development and not a potential emission from the proposed development. The activities on site will not produce any solid waste.

The type, quantity and environmental management of solid waste being received on site is covered extensively in the above documentation.

Composition and Quantity – Not applicable as there are no solid wastes produced as a function of the proposed site activities.

Variability of Emissions – Not applicable.

Treatment Method – Not applicable.

Controlled Waste Tracking – Not applicable.

Contingency Plans – Not applicable.

Environmental Receptors – Nil.

Comparison Against Relevant Standards – Not applicable.

Cumulative Impact – Not applicable.

Waste Reuse – Not applicable.

Targets and Limits – Not applicable.

Environmental Risk - Not applicable.

25.2. Liquid Waste

It the context of the proposed development, "liquid waste" produced as a result of the proposed development and associated activities will consist of leachate and contaminated surface water runoff. Both of there waste streams have been covered extensively in the above documentation.

Composition and Quantity – Not applicable as there are no solid wastes produced as a function of the proposed site activities.

26. Hydrocarbon/Chemical Storage

26.1. Hydrocarbon Storage

Initially fuel is not proposed to be kept on site. Normally machinery and plant accessing the site will be fuelled from mobile refueling, with fuel being placed directly into each machine/plant.

At some time in the future, should fuel be required to be stored it will be kept on an adjoining farm or fenced compound/shed to maintain security.

If fuel is to be stored at some point it will be stored in an overhead tank bunded and lined with an impermeable membrane, to DER standards, in a manner similar to all farming properties and designed to contain >110% of the storage volume. See Documents specific to fuel storage in the mining and quarrying operations, DOW – DMP Water Quality Protection Guidelines for Mining and Mineral Processing (10 Above-ground fuel and chemical storage) and Water and Rivers Commission Water Quality Protection Note for Skid Mounted Tanks.

On detection of a leak, the fuel source will be closed, and any contaminated clay promptly placed into the landfill.

Minor spills fuel (< 5 litres) will be cleaned up and placed in the landfill but will not affect the groundwater because of the low permeable nature of the liner and underlying clay. Bacteria breakdown will dissipate small quantities of fuel or lubricants in the same manner as any other organic waste stream.

Any spillages of greater than 5 litres will be reported to the DER as soon as practicable, but within 24 hours. The spillage clean up methodology will be dependent on the size of the spill and in accordance with the DER requirements.

There will be limited quantities of oils and greases stored on site for daily equipment maintenance activities. These hydrocarbons will be up to a maximum of 5L containers, but more typically small cans and spray cans of lubricants.

26.2. Chemical Storage

Quantity and Type – There will be no chemicals stored on site.

27. Contaminated Site Identification

A review of the DER Contaminated Sites Data Base (www.dec.wa.gov.au/contaminatedsites) has indicated that the site is not a registered Contaminated Site.

28. Works Approval Content

Due to the progressive nature of the proposed landfill development, there are a number of components of the works that will be constructed over a number of years.

With a three-year validity period of the Works Approval, The Proponent would need to have the ability to construct the first three landfill cells during the validity period of the initial Works Approval. On the completion of construction of each landfill cell, the Proponent would submit a Compliance Document to the DER and obtain a licence or licence amendment to commence landfilling in the new area.

In order to cater for the possible future need for additional evaporation ponds, it is necessary that the ability to construct all three ponds be included in the initial DER Works Approval. With a three year validity period of the Works Approval, the Proponent will have the ability to construct the additional evaporation ponds as and when required (however, within the Works Approval validity period) and not be delayed by the time it would take to obtain a specific Works Approval for the construction of an additional evaporation pond. It may be that there is an operational requirement to construct an evaporation pond within relatively short notice as a result of a particular weather event.

The inclusion of the above flexibility in the initial Works Approval (and subsequent Works Approvals) will simplify the approval process for the progressive development of the landfill. This will be to the benefit of both the Proponent and the DER due to the reduced number of Works Approvals required to complete the project.

Appendices

Appendix No. 1 - Location - Land Uses and Buffers

Appendix No. 2 - Ground Water Assessment, 11 Chitty Road January 2012 VR 1.3

Appendix No. 3 - Earthquake Stability Assessment Report 16 August 2012

Appendix No. 4 - Earthquake Stability Assessment Report 11 February 2013

Appendix No. 5 – Martinick McNaulty Geotechnical Report June 1998

Appendix No. 6 - Site Bore Locations

Appendix No. 7 - SGS Permeability Results

Appendix No. 8 - SAT Agreed Bore Locations

Appendix No. 9 - Groundwater Monitoring Bore Levels

Appendix No. 10 - DWG 001 Opal Vale Site Layout Rev 1

Appendix No. 11 - OV-WA-01B Landfill Overall Site Plan

Appendix No. 12 - OV-WA-02B Landfill Earthworks Layout Plan

Appendix No. 13 - OV-WA-03B Liner Details - Sheet 1 of 2

Appendix No. 14 - OV-WA-04B Liner Details - Sheet 2 of 2

Appendix No. 15 - OV-WA-05B Leachate Extraction Layout Plan

Appendix No. 16 - OV-WA-06B Leachate Extraction Details - Sheet 1 of 2

Appendix No. 17 - OV-WA-07B Leachate Extraction Details - Sheet 2 of 2

Appendix No. 18 - OV-WA-08B Landfill Underdrainage Blanket

Appendix No. 19 - OV-WA-09B Landfill Underdrainage Details

Appendix No. 20 - BoM IFD Data System - Opal Vale

Appendix No. 21 - Opal Vale Evaporation Calculations

Appendix No. 22 - DWG 040 Opal Vale Landfill Leachate Pond Concept Detail

Appendix No. 23 - DWG 020 Opal Vale Landfill Cap Contours Rev 1

Appendix No. 24 - DWG 030 Opal Vale Landfill Typical Section

Appendix No. 25 - Rehabilitation Management Plan

Appendix No. 26 - CQA Plan

Appendix No. 27 - Contour Plan

Appendix No. 28 - Section Lines

Appendix No. 29 - Stakeholder and Community Submissions July 2010

Appendix No. 30 - Stakeholder and Community Submissions June 2012

Appendix No. 31 - Environmental Noise Assessment