APPENDIX V
Allawuna Landfill Works Approval Reconciliation with the EPA Victoria BPEM

This document summarises the requirements of the Victorian EPA Publication 788.1, *Siting, Design, Operation and Rehabilitation of Landfills* as published in October 2014 (Vic-BPEM) and discusses relevance for the *Works Approval Application Supporting Document – Allawuna Landfill*, Golder Associates, March 2015 (Allawuna WAA) and the Allawuna WAA's conformance (with justifications for deviations or alternatives).

SITA Australia Pty Ltd, as a result of this reconciliation, considers that the Allawuna Landfill WAA submitted satisfies the relevant requirements of the Vic-BPEM.

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1	Introduction	Introduces the Vic-BPEM as EPA Victoria's Best Practice Environmental Management publication and is to be considered the source document for best- practice environmental management measures for landfills. The Vic-BPEM is intended to give direction on the best-practice siting, design, operation, performance and rehabilitation standards for landfills in Victoria.	The Vic-BPEM was used to guide development of the proposed Allawuna Landfill design and preparation of the corresponding WAA, including supporting studies, as required by the WA DER.	
1.1	Objectives of the Vic-BPEM	The Vic-BPEM is a guideline aimed to provide existing and future operators of landfills, planning authorities and regulating bodies with information on potential impacts on the environment and how these are to be mitigated, a clear statement of environmental performance objectives, and information on how to avoid or minimise environmental impacts. In Victoria the Vic-BPEM is intended to be used as a default position for landfill siting, design, operation and rehabilitation. Landfill operators are required to meet the objectives and required outcomes by implementing the relevant best-practice measures, described as suggested measures, contained in the Vic-BPEM. The Vic-BPEM goes on to say that where a landfill operator believes that alternative means can achieve the objectives and required outcomes, a risk- based assessment can be proposed as an alternative measure.	■ The Vic-BEPM has been developed for use under Victorian regulations and environmental conditions ■ The Allawuna Landfill Works Approval Application (WAA) has been developed based on guidance provided by the DER during a scoping meeting in October 2014 ■ The Vic-BPEM was adopted as the guidance document for technical direction. Methods used that were alternatives to the Vic-BEPM produced the required outcomes and were methods familiar to the DER ■ The DER's Technical Validation Checklist was used to ensure all environmental concerns were addressed.	
2	Waste Management Framework	Vic-BPEM summarises the statutory requirements for Victoria.	The key guiding documents for the development of the Works Approval application have been: ■ DER, PPMS_CL0593v1.0, Technical Validation Checklist ■ The Western Australian Environmental Protection Act 1986 ■ The Federal Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) ■ WA EPA, 2005, Separation Distances between Industrial and Sensitive Land Uses ■ Department of Environment and Conservation, 2009, Landfill Waste Classification and Waste Definitions 1996 (As amended December 2009), and ■ The Victorian EPA, 2014, Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills Guideline (Vic-BPEM).	Guidance documents used as recommended by the DER.
3	Community Engagement	Vic-BPEM discusses the need for community engagement and provides community engagement models for consideration.	A comprehensive program of face to face meetings, public presentation, mail outs, website advertisement, public display, newspaper editorials and a site tour were conducted as part of the development of this project. These activities were supported by willingness by SITA staff to answer any queries from the community, neighbouring premises or other interested parties. SITA is aware of opposition to the landfill and has endeavoured to address opponent's concerns, refer Allawuna WAA Appendix L. SITA is also aware of a large portion of the community that is quietly supportive of the landfill.	Complies. Consultation undertaken complies with DoE, 2003, *Interim Industry Guide to Community Involvement*.
4	Classification of Landfills	Vic-BPEM describes three types of landfills: ■ Type 1 – Prescribed Industrial Wastes (not covered by Vic-BPEM. ■ Type 2 – Putrescible Landfills (WA equivalent classification is Class II and Class III Landfills). ■ Type 3 – Inert Landfills (WA equivalent classification is Class I Landfills).	The Allawuna WAA proposes a Category 64 Class II putrescible landfill equivalent to Vic-BPEM Type 2 Landfill.	Complies. Appropriate Category and Class nominated.

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5	Best Practice Siting Considerations	The Vic-BPEM requires a preliminary investigation of all possible landfill sites to identify those sites with the best potential to be developed for landfilling. The investigation is to be conducted by the regional waste management group (RWMG) during development of the Regional Waste Management Plan (RWMP). To date and to our knowledge Western Australia has not developed a RWMP.	With the main guidance from the WA State Government being the directive of the DER to locate any new landfill developments off the Swan Coastal Plain SITA identified 26 potential sites with 19 of these sites shortlisted for assessment based on the following criteria: ■ Located off the Swan Coastal Plain ■ Land for sale (freehold), or possibly for sale, subject to approaching the owner ■ A large site to maintain ownership of buffer distances ■ Low and manageable environmental risk profile ■ Close to a main road for truck access ■ Realistic travel distance from the Welshpool Transfer Station to the landfill, and ■ Not in an area where landfill is explicitly prohibited. Upon further investigation of site specific features SITA selected Allawuna Farm as the best option. The Allawuna Farm site has been subjected to a thorough environmental investigation. The investigation has shown no significant environmental impacts are likely to arise from the establishment or long term operation of the Allawuna Landfill. A copy of the confidential investigation matrix was provided in an email to the DER on 21 May 2013. The confidential matrix can be resubmitted to the DER if necessary.	Complies. Appropriate preliminary investigation undertaken.
5.1.2	Landfill Types	Vic-BPEM mentions four landfill types. Listed in preferred order they are: 1) Area method where an existing quarry hole is utilised 2) Trench fill landfill where waste is placed in excavated trenches 3) Mound landfill where waste is placed above ground, and 4) Valley landfill where natural topography assists to provide the void for landfill.	SITA investigated 26 potential sites, including quarry voids, for a replacement landfill for the Shale Road Landfill and settled on Allawuna Farm as the most appropriate location. The chosen location on Allawuna Farm does not clearly fit into any of the four categories. Correspondence from the DER dated 3rd July 2012, which provided direction for site assessment, included as an attachment a map of watercourses in the area. The unnamed seasonally dry land depression (October to May) at the chosen location is described on the map as a minor watercourse. The landfill has been positioned predominantly on a side slope to the north of the depression to allow surface water from the relatively small upstream catchment to be diverted around the proposed landfill. The Allawuna WAA has been developed with thorough consideration of environmental factors and specifically surface water management.	Complies. Hydrology can be adequately managed.
5.1.3	Groundwater	Vic-BPEM requires new landfills to have an unsaturated zone of at least 2 m above the long-term undisturbed depth to groundwater unless: ■ Additional design and management practices to protect groundwater quality are to be implemented, or ■ Regional circumstances exist that warrant the development of a landfill to be sited otherwise. Where a 2 m unsaturated zone does not exist the base of the landfill should be raised to at least 2 m above the water table using a sub-base material with a cation exchange capacity (CEC) of about 10 mEq/100g. This CEC allows the sub-base to remove some contaminants from leachate seeping through the base of the liner, and further minimises the risk of groundwater pollution from the landfill.	The Allawuna Farm Landfill has been designed to provide a minimum unsaturated zone of 2 m below the bottom of waste. An additional 0.5 m buffer has been allowed for in the design of the landfill base. The clayey material on the site is not suitable for use as a clay liner material due to the relatively high permeability and low CEC value. The clayey material can however be used in conjunction with a geosynthetic clay liner (GCL) to form a system with similar performance to a 1.0 m thick compacted clay liner. This will be used with a geomembrane layer to form a composite liner system that will have a similar performance to the liner system suggested by the Vic-BPEM. The results of geotechnical investigations by Golder included as additional information (refer to the Allawuna WAA Appendix D).	Complies.
5.1.4	Alternative Potential	The Vic-BPEM suggests that former extractive sites may be preferable for	SITA has considered the use of an expired quarry void at the Lakes west of Allawuna Farm and	Complies.

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	Sites	use as a landfill rather than farming land and that the rehabilitation of an extractive industry site by landfill is not in itself sufficient justification for a landfill.	identified insurmountable engineering challenges and unacceptable environmental risks rendering the site unviable. SITA also investigated the potential of transporting waste by rail from Welshpool to sites further afield from Allawuna Farm; however the costs to completely redevelop SITA's existing infrastructure for this mode of transport and developing rail siding infrastructure at each end were prohibitively high and not commercially viable. Refer to Best Practice Siting Considerations above for further discussion.	
5.1.5	Buffer Distances	The Vic-BPEM sites the following buffer distances from the landfill to sensitive land uses (receptors): ■ 100 m from surface waters ■ 500 m from building or structures ■ 1500 m from an aerodrome for piston-engine propeller-driven aircraft, and ■ 3000 m from an aerodrome for jet aircraft.	The Allawuna WAA details the following attributes: ■ 600 m from Landfill to Lot Boundary at the closest point ■ 1900 m from Landfill to nearest neighbouring dwelling ■ 4600 m from Landfill to Mount Observation Picnic Area ■ 1000 m from Landfill to Wandoo National Park ■ 270 m from leachate dams to 13 Mile Brook, and ■ 350 m from Landfill to 13 Mile Brook. The landfill's stormwater retention and sedimentation structure, the stormwater dam, is sited 50 m from the landfill. The stormwater dam is considered part of the landfill operational infrastructure. There are no aerodromes in the area. The facility buildings are sited approximately 150 m from the landfill cells. This is not considered an issue as these facilities are associated with the landfill and hence not a sensitive land use receptor requiring a buffer under the Vic-BEPM.	Complies.
5.1.6	Geological Setting	The Vic-BPEM requires a reasonable degree of assurance of the long-term protection of the landfill from an earthquake with landfills sited at least 100 m of a fault line. A further part of the assessment of the suitability of a potential site is the geotechnical stability of the ground on which the landfill will be placed	There is no record of any earthquakes within 4 km of the Site boundary, with the nearest being a magnitude 2.5 earthquake 4 km to the north-east of the site. The area from the Darling Scarp to Merredin is an area of notable seismic activity. The location of the landfill is to the south-western edge of this zone of activity. A detailed geotechnical assessment has been conducted by Golder and has been included as part of the additional information (Allawuna WAA Appendix D).	Complies.
5.1.7	Flora and Fauna Protection	The Vic-BPEM states that landfills should not be sited on areas of critical habitats.	A comprehensive Level 2 flora investigation of the affected works areas was undertaken by ENV Australia. The key findings of the investigation were: ■ The area is dominated by cleared cropland (87%) with low fauna habitat value ■ The remaining area (13%) is a seasonally dry minor watercourse, also with low fauna habitat value ■ No declared weeds, threatened or priority flora were identified at the site, and ■ The proposed development is likely to have minimal impact on the flora and fauna of the survey area and surrounds. ENV completed a Level 1 fauna survey in the landfill development area. The key findings of the fauna investigation were: ■ Both habitat types present in the study area are of low fauna habitat value ■ A comprehensive Black Cockatoo species specific assessment found minor evidence of	Complies. Site investigations satisfy flora and fauna investigation requirements.

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			foraging under 10 of the 144 scattered Marri and Wandoo trees ■ No evidence of roosting or breeding in any trees ■ Closest known Carnaby's Cockatoo roosting site is over 16 km away, and ■ No evidence of Graceful Sun Moth habitat in the area. The Vegetation and Fauna Assessment Report has been included in the Allawuna Landfill WAA (Appendix K). Clearing in the development area has been determined as a 'not controlled action' under the Federal EPBC Act (refer to the Allawuna WAA Appendix U).	
5.1.8	Infrastructure	Vic-BPEM requires consideration of the capacity of the road network to safely accommodate the increased traffic load, and with a minimum of disturbance to the local community by minimising the transport of waste through residential and other sensitive areas.	The development of the site will have a negligible effect on the road network in the metropolitan area and a minimal impact on Great Southern Highway vehicle volumes. The landfill is located approximately 20 km to the west of York negating the need for haulage trucks to go through or near York. The existing RAV Network 4 intersections along the haulage route are all sufficiently developed to accommodate the predicted 3% increase in local road traffic associated with the landfill development. Light vehicle movements for facility staff entering and departing the site from York represents a 2-3% increase in traffic between York and Allawuna at specific times in the morning and afternoon. A Traffic Impact Statement is included in the Allawuna WAA as Appendix J.	Complies. Traffic impact assessed as minimal.
5.1.9	Surface Waters	Vic-BPEM states that putrescible waste landfills must be located more than 100 m from surface waters. Landfills should not be located in a floodplain. Where landfills are within a floodplain, additional engineering and management controls must be in place to ensure that the facility will be protected from flooding, erosion by floodwaters and infiltration from perched water table.	The landfill is sited no less than 350 m from Thirteen Mile Brook. The Thirteen Mile Brook flood plain does not extend to the landfill. There is a stormwater dam proposed to be constructed within 100 m of the landfill. The stormwater dam is part of the landfill infrastructure and will act as a water storage and retardation structure. It will have a storage capacity of approximately 36 000 m^3. A small retention pond (temporary stormwater storage dam) is also part of the landfill infrastructure. The retention pond will collect shallow ground water from the landfill footprint. A self-draining sediment management structure is proposed downstream of the stormwater dam to manage sediment from the landfill site. Diversion bunds will be constructed as part of the stormwater management system above the landfill to divert the majority of the catchment around the landfill site directly to the stormwater dam. The surface water management systems proposed will ensure that the landfill presents no risk of contaminating surface water. For further detail refer to the Surface Water, Groundwater and Leachate Management Plan (Allawuna WAA Appendix E).	Complies. Landfill not located within 100 m of natural surface waters.
5.1.10	Land Ownership	Vic-BPEM describes requirements for landfills on Crown land.	The current owner of Allawuna Farm, Robert Henry Chester, and SITA has a Memorandum of Understanding in place providing a binding agreement to transfer ownership of the property subject to certain conditions.	Not applicable

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			SITA will be the owner of Allawuna Farm prior to construction work commencing.	
6	Best Practice Design	The Vic-BPEM states that the design of a landfill facility will be influenced by the existing natural environment, adjacent land uses, available infrastructure, waste to be received and the need to provide integrated waste management facilities for both disposal and recycling options.	Addressed in the following sections.	Complies. Technical aspects of landfill design comply with the requirements of the Vic-BPEM.
6.1	Environmental Assessment	Vic BPEM states that environmental assessment should contain: ■ Meteorological data ■ Hydrogeological assessment ■ Water management information including: • Water balance for the site and estimated volume of leachate to be generated • Leachate collection, storage facilities, treatment and disposal • Stormwater diversion banks and/or cut-off drains and storage dams • Fire-fighting equipment and water supply • Wheel washes ■ Landfill gas and odour control, and ■ Noise assessment.	The Allawuna WAA has included the following environmental assessments: ■ Rainfall, temperature and solar radiation data was established from the Bureau of Meteorology (BOM) thirty year climate normal dataset for the years 1961-1990 for the York Post Office weather station (meteorological data was determined and used as input data in the HELP model to predict leachate generation) (refer to WAA Appendix E) ■ Hydrogeological assessment, a network of bores were developed over the landfill footprint and surrounding area to determine the local geology, water table and groundwater flow pattern (refer to WAA Appendix E) ■ Water management information including: • Water balance for the site and estimated volume of leachate to be generated • Leachate collection, storage facilities, treatment and disposal • Stormwater diversion banks and/or cut-off drains and storage dams • Fire-fighting equipment and water supply (refer to WAA Appendix R) • Wheel wash ■ Landfill gas (refer to WAA Appendix G) ■ Odour assessment (refer to WAA Appendix I) and ■ Noise assessment (refer to WAA Appendix I).	Complies.
6.2	Site Layout	The Vic-BPEM states that the landfill and associated facilities should be designed to minimise potential environmental impacts, health and safety risks, encourage recycling and make the most efficient use of resources on site. A series of cells each taking less than two years to fill, after which they are immediately rehabilitated. A weighbridge is required at landfill sites in Municipalities listed in Schedule C of the Victorian EP Act.	The Allawuna Farm Landfill will serve as a final disposal site for waste delivered to the Welshpool Waste Transfer Station and the Lansdale Waste Transfer Station. SITA has an extensive investment in resource recovery in the Perth region resulting in predominantly unrecyclable materials being delivered to its waste transfer stations. Prior to being loaded on trucks for transport to landfill SITA sorts waste at the waste transfer stations to recover recyclable material contained in the waste. The Allawuna Farm Landfill will be developed in a series of cells. The Allawuna WAA relates to the first two cells of the development. Each cell is designed to accommodate 3-4 years of waste prior to the next cell being built. Cell 1 will have a total fillable airspace of approximately 781 000 m^3 which represents 3 to 4 years operational capacity however it will be comprised of sub-cells 1a (approx. 433 000 m^3) and 1b (approx. 348 000 m^3), each of which are expected to operate for a maximum of 2 years before being capped and rehabilitated. The fillable capacity of Cell 2 will be approximately 968 000 m^3 however this will also be comprised of sub-cells (2a and 2b) that will be constructed and operated in a manner that minimises as much as possible the duration of cell use before capping and rehabilitation. The Allawuna landfill facility will include a weighbridge to weigh incoming and outgoing transport movements.	Complies.
6.3	Liner and Leachate Collection System	The Vic-BPEM requires landfill liners to comprise of up to five components: ■ Sub-base	The material properties of the liners have been nominated in the Technical Specification for the construction of cells 1 and 2 (WAA Appendix M) and have been specified to meet the requirements of the Vic-BPEM.	Complies.

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		■ Clay or geosynthetic clay layer ■ Geomembrane and protection layer ■ Drainage layer/leachate collection system, and ■ Geotextile. In designing a landfill liner, the landfill designer must ensure that the liner system is geotechnically stable between components and as a total system.	The proposed liner configuration is listed below: ■ Compacted and rolled subgrade ■ A GCL installed over the subgrade and side slopes ■ A 2.0 mm thick double textured HDPE geomembrane liner will be placed directly above the GCL ■ A non-woven geotextile cushion layer will be placed on top of the HDPE liner to serve as a protective layer ■ A 300 mm aggregate layer will be laid on top of the cushion layer to act as a leachate drainage layer ■ Leachate collection pipes will be installed in the drainage layer, and ■ A separation geotextile layer will be placed on top of the aggregate to serve as a separation layer from the waste. Stability modelling for the complete landform has previously been undertaken as part of the Part IV EPA Referral process. For the Allawuna WAA stability modelling was undertaken to validate the embankment design and interim waste batters during the construction and filling of sub-Cells 1A and 1B and Cell 2. Both circular slope and sliding block (shear) failure modes were considered. Pseudo static modelling was also undertaken to test the stability of the structures under lateral seismic loading, as would be experienced during an earthquake.	
6.3.1	Sub-Base	The Vic-BPEM states that all plans for the construction of a sub-base must be verified and approved by a geotechnical engineer. Construction of the sub-base must be included in the construction quality assurance (CQA) plan.	Geotechnical information is provided by Golder as part of the additional information (refer to WAA Appendix D). Golder concludes that the lateritic materials present at the landfill site compact well and are suitable for civil construction works. A Technical Specification has been included in the Allawuna WAA Appendix M and the requirements for construction quality assurance are detailed in the CQA Plan (Allawuna Landfill WAA Appendix M) The requirements for the landfill sub-base are defined in these documents.	Complies.
6.3.2	Clay Liner	The Vic-BPEM requires the clay component to be at least 1 m thick and have a hydraulic conductivity of less than 10^{-9} m/s.	The Allawuna WAA proposes the use of GCL in conjunction with 500 mm thick layer of compacted clayey site material.	Not applicable.
6.3.3	Geosynthetic Clay Liner (GCL)	The Vic-BPEM states the GCL can be used as an element of composite base and side liners. The suitability of GCL lining for bottom, side slope and capping of landfills requires an assessment of water and gas flow, contaminant transport and stability.	The GCL will be installed over the base of the landfill cells and on the side slopes. The GCL shall have properties as nominated in the Technical Specification in accordance with the Vic-BPEM requirements. Installation of GCL will be observed and verified by an appropriately qualified third party (Quality Assurance Inspector, QAI) independent of the construction contractor and liner contractor. The GCL will be covered by a layer of HDPE which is intended to act as the attenuation layer for landfill gas migration.	Complies.
6.3.4	Geomembranes	The Vic-BPEM states that the key properties required for geomembranes are thickness, strength, the ability to resist or accept stress and deformation, tensile strength, puncture resistance, slope stability-interface friction, long term mechanical performance, durability and resistance for degradation. Geomembranes are to be used only as a barrier and not to serve any load-bearing or structural function. Landfill design should minimise stress on the geomembrane.	A 2 mm thick HDPE geomembrane liner will have properties as in the Technical Specification in accordance with the Vic-BPEM requirements. The HDPE will be placed directly above the GCL which will also limit contaminant migration and control landfill gas migration. The key properties of the HDPE are detailed in the Technical Specification (Allawuna Landfill WAA Appendix M). Installation of the HDPE liner will be observed and verified by an appropriately qualified third party independent of the construction contractor and liner contractor. Two dimensional modelling was undertaken using the SLOPE/W modelling package to assess the stability of the landfill at the following stages of development:	Complies.

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			■ Sub-Cell 1A filled with waste ■ Cell 1 complete and partially capped, and ■ Cell 2 complete and partially capped. For each stage, safety factors associated with circular slope and sliding block failure were evaluated. Typical values for material properties of each material were used in the modelling. To minimise stress on both the GCL and the HDPE liners the plane of weakness was designed to be between the upper surface of the HDPE and the protective non-woven geosynthetic cushion layer. For further detail refer to the Stability Analysis and Liner System Integrity Assessment Report (Allawuna WAA Appendix D).	
6.5.3	Leachate Collection System	The Vic-BPEM states that the maximum leachate head on the liner is 0.3 m. The liner is to be sloped into the leachate collection pipes which in turn are sloped to the leachate collection sump. These slopes should be a minimum 3% to the pipes and 1% to the sump. The drainage layer is to be at least 300 mm in depth and with a hydraulic conductivity of greater than 1x1 x10^{-3} m/s. Properties of aggregate used in the drainage layer are: ■ Aggregate size to be less than 50 mm and greater than 20 mm ■ Fines content to be less than 1%, and ■ Should not contain calcareous material that would be subject to chemical attack. The recommended maximum pipe spacing is 25 m. Giroud's equation to be used to design the liner slope and pipe spacing to ensure the maximum design leachate head is not exceeded. Manning's equation is used to derive the required pipe size based on leachate flow rate and pipe slope. Leachate flow rate is derived using a model such as the Hydrological Evaluation of Landfill Performance (HELP) model. The volume of leachate generated should be based on a 1-in-20 year storm event after one lift of waste has been placed in the landfill.	Operational management practices will be adopted to ensure the maximum head of leachate over the liner is less than 0.3 m. The Vic-BPEM landfill liner slope requirements are determined based on an idealised landfill shape with ridges on the cell floor between collection valleys, enabling the use of Giroud's equation. The proposed Allawuna Landfill cell design takes advantage of the natural slope of the site to create a uni-directional fall towards the landfill sump without intermediary ridge lines. Giroud's equation is not applicable under such a scenario. The fall of the base of the cells is generally 3% towards the landfill sump, with a minimum of 2.5%. This is considered sufficient to provide appropriate drainage and prevent ponding on the liner. Using Manning's equation and the leachate generation output from the HELP model, an appropriate leachate pipe sizing was determined. The thickness requirements and the buckling pressure of the leachate pipes have been determined using the American Society of Mechanical Engineers *ASME Boiler and Pressure Vessel Code Case N-755*. The leachate system has been appropriately stress tested for typical, 1-in-10 and highest on record rainfall cycles. To ensure a 'worst case scenario' in the model the waste mass is initialised at saturation, with no capacity to retain incoming rainwater. The leachate dam was sized to contain two consecutive wet (90th percentile) years of rainfall generated leachate. The freeboard capacity required in the leachate dam was evaluated by determining the response of the leachate system to a 1-in-20 year storm. A 300 mm aggregate layer will be laid on top of the cushion layer to act as a leachate drainage layer. The hydraulic conductivity of the drainage layer will be greater than 1 x10^{-3} m/s. The Technical Specification (Allawuna Landfill WAA Appendix M) stipulates the required aggregate properties to be used. Also refer to the Allawuna Landfill Surface Water, Groundwater and Leachate Management Plan (Allawuna Landfill WAA Appendix E) for more detail.	Complies.
6.4	Construction Quality Assurance	Vic-BPEM requires the development and implementation of a construction quality assurance (CQA) plan.	A Construction Quality Assurance (CQA) Plan, included in the Allawuna Landfill WAA in Appendix M, will be used by the QAI and Superintendent when overseeing the construction	Complies.

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		The CQA plan must be able to verify that: ■ Materials used comply with specifications, and ■ Method of construction/installation is appropriate and design requirements have been met. The CQA plan must contain the material/construction specifications, testing methods, testing frequency, corrective action and provide for appropriate documentation procedures. CQA documentation will be verified by an environmental auditor and the plan will be used by the environmental auditor as part of auditing cell construction.	works. The QAI of the project will be responsible for CQA of the earthworks and liner installation. A Construction Plan for liner installation will be prepared by the lining contractor in accordance with the Technical Specification (Allawuna Landfill WAA Appendix M) and approved by the Superintendent. The lining contractor will conduct all destructive and non-destructive testing which will be witnessed by the Superintendent. The Superintendent will prepare a CQA report at the completion of the construction to confirm that the required construction quality is met.	
6.5.1	Stormwater Management	Storage ponds and other drainage measures should be designed to contain and control rainfall run-off for a 1-in-20-year storm event. Storm events up to 1-in-100-year recurrence intervals should also be considered.	A stormwater dam embankment will be constructed of low permeability clay material and positioned south and downstream of the landfill. The stormwater dam will collect surface runoff from around (outside) the landfill and double as a sediment control structure. The sizing of the stormwater dam has been based on construction water needs and not stormwater retention characteristics as the dam is sited below the landfill. An appropriately sized overflow weir has been designed for the stormwater dam to allow retention and controlled release of water into the minor watercourse leading to the Thirteen Mile Brook. The surface water drainage systems have been designed to prevent the interaction of stormwater and leachate. Appropriately sized culverts and drains will be used to control stormwater from the roads, embankments, hardstands, buildings and hill slopes at the site. Refer to the Allawuna Landfill Surface Water, Groundwater and Leachate Management Plan (Allawuna Landfill WAA Appendix E) for more detail.	Complies.
6.5.2	Leachate Management	The Vic-BPEM states that a water balance should be modelled over at least two consecutive wet years (90th percentile) and any ponds containing leachate should have a freeboard of at least 0.5 m.	The leachate dam was modelled for 2 consecutive wet (90th percentile) years of rainfall generated leachate. The leachate dam will be managed to ensure a minimum freeboard of 500 mm is maintained at all times.	Complies.
6.5.3	Groundwater Management	The Vic-BPEM requires consideration of groundwater in situations where sites extract groundwater, landfills below the water table.	There are no plans to extract groundwater from beneath the site for use on the farm. The groundwater on the site will be protected from landfill leachate by a layer of HDPE geomembrane, a layer of GCL overlain on natural low permeability clayey soils. The landfill liner will be a minimum of 2 m above the drainage constrained groundwater level below the landfill. Further discussion on the groundwater beneath the landfill is included in the Hydrogeological Site Characterisation Report (Allawuna Landfill WAA Appendix E).	Complies.
6.6	Groundwater	Vic-BPEM states that a landfill must not impact on beneficial uses of groundwater, the design of the landfill must consider the local hydrogeological environment. Issues to be considered include:	There will be no less than a 2 m thick unsaturated zone below the landfill liner; hence there will be no uplift forces on the liner.	Complies

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		■ Liner uplift ■ Groundwater monitoring bores, and ■ Groundwater recovery bores.	A series of nineteen monitoring bores have been installed. The complete record of groundwater sampling events is included in the additional information. Generally groundwater is not used on Allawuna Farm as it is too saline. Currently there is no proposed future use for groundwater on Allawuna Farm.	
6.7	Air Quality	The Vic-BPEM states that landfills can pose a risk to air quality through landfill gas, odour and dust.	Addressed in the following sections.	Complies.
6.7.1	Landfill Gas	The Vic-BPEM states that the most appropriate way to evaluate the level of risk posed by landfill gas from an individual site is to conduct a site-specific landfill gas risk assessment.	The landfill gas quantities have been estimated using the GasSim V2.5 (GasSim) model. The landfill gas generation modelling was carried out by Golder Associates as detailed in the Allawuna Landfill Gas Assessment Report (Allawuna Landfill WAA Appendix G). During landfill operation landfill gas will be collected and flared to convert the methane into the less harmful carbon dioxide. When a sufficient quantity and quality of landfill gas is being produced the gas may be used as fuel for electricity generation. A Landfill Gas Management Plan has been prepared specifically for Allawuna Farm Landfill and describes the gas collection network, monitoring and includes landfill gas generation predictions (refer to the Allawuna Landfill WAA Appendix G).	Complies.
6.7.2	Air Toxics	The Vic-BPEM recommends that assessment of air toxics should be undertaken as part of the landfill gas risk assessment (LFGRA). Also, if necessary, a monitoring plan consistent with world best practice to ensure protection of public health should be developed and implemented for air toxics. Air toxics monitoring should include ambient air at the boundary of the site.	It is generally accepted that air toxins are present in landfill gas emitted from most putrescible landfills. The type and quantity of toxins is a function of the landfill construction (base lining system and capping system), the type of waste disposed of within the landfill, the quantity of waste and the efficiency of landfill gas extraction and destruction. The consequence of the emitted toxins is a function of the quantity of toxins emitted and the proximity of a receptor to the source of emission. With the proposed landfill being fully lined, having an active landfill gas extraction system, receiving only Class II waste and at relatively low annual tonnages as well as the fact that the nearest neighbouring residential property is in excess of 10 times the EPA required buffer distance from the landfill facility (1.8 km vs 150 m), air toxins are not deemed to be a health concern.	Not applicable.
6.7.3	Odour	The Vic-BPEM states that, at all times, a landfill must be managed to prevent offensive odours beyond the boundary of the premises.	Detailed odour modelling for the proposed landfill was undertaken by Environmental Alliances Pty Ltd. The complete report is attached to the Allawuna WAA as Appendix G. The modelling indicates that for the proposed operational times, procedures and waste volumes, all odour generated would be maintained well within the Farm boundary.	Complies.
6.7.4	Dust Emissions	The Vic-BPEM discusses mitigating measures to minimise dust and suggests that in certain circumstances dust monitoring may be required.	The Allawuna WAA discusses mitigation measures for dust both during construction and operation of the landfill (refer to the Allawuna Landfill WAA Appendix N for the Environmental Risk Assessment).	Complies.
6.8	Bioreactor Landfills	The Vic-BPEM states that waste degradation in a conventional ‘dry tomb’ landfill is inhibited by the lack of moisture within the waste and outlines the benefits of leachate recirculation and/or fresh water infiltration in a ‘bioreactor landfill’ to promote the conditions necessary for micro-organisms to achieve rapid rates of waste decomposition.	Most landfills incorporate some degree of leachate recirculation and/or fresh water infiltration however, are not classified as bioreactor landfills and hence are also not “dry tomb” landfills. Leachate recirculation is widely used in WA to manage leachate volumes and wet the dry waste to increase the rate of waste decomposition and landfill stabilisation. There will be a degree of fresh water infiltration and leachate recirculation within the waste mass but not to the extent that the landfill will be classified as a bioreactor landfill.	Not applicable.
6.9	Noise	Vic-BPEM states that site operations should be set out to minimise noise impacts by using natural and/or constructed features such as earthen bunds and depressions as well as minimising steep-haul roads and alternative types of reversing beepers could be adopted.	A comprehensive noise assessment found that predicted noise levels at the nearest residence were within the guideline limits for times of day during both the construction and operational phases of the landfill (refer to the Allawuna Landfill WAA Appendix I).	Complies.
6.10	Traffic Considerations	The Vic-BPEM suggests limiting speed of trucks, site layout, traffic islands, recessed entrance and wheel wash facilities will minimise impact on local community.	A detailed traffic assessment was undertaken by Shawmac Traffic Engineers (refer to the Allawuna Landfill WAA Appendix J). The intersection of the site access road and Great Southern Highway will be upgraded to meet the requirements of Main Roads WA. Appropriate signage will be installed along Great Southern Highway identifying the landfill and warning of	Complies

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			trucks entering and departing the site. An access road across Allawuna Farm, from the intersection with the highway to the landfill area, will be constructed as part of the works. The road will be aligned to minimise disruption to cropping, minimise the removal of remnant vegetation, maintain a safe geometry for truck movements. The road pavement will be sealed to an appropriate standard for regular heavy vehicle movements. The access road will be fenced to keep livestock and other fauna off the road. A dual lane creek crossing will also be installed on the property across the Thirteen Mile Brook to enable all weather vehicle access to the landfill. The general configuration of the office and other infrastructure areas is indicated in the WAA. A truck wheel cleaner/mud shaker will be constructed adjacent to the leachate dams and a hardstand area will be established for the storage of equipment.	
6.11	Site Security and Fencing	The Vic-BPEM recommends fencing requirements as a wire mesh fence at least 2 m high constructed around the landfill site perimeter.	A 1.8 m high security fence topped with barbed wire will be erected around the perimeter of the landfill operations area to prevent unauthorised site access, capture windblown litter and prevent access by livestock and native fauna.	Complies.
6.12	Low-Risk Rural Landfills	The Vic-BPEM states that small rural municipal Type 2 landfills may use Type 3 landfill design criteria for capping and lining systems in the following circumstances: ■ It meets or exceeds the Vic-BPEM buffer requirements ■ It receives less than 20 000 tonnes of waste per annum ■ Wastes are at least two metres above the long-term undisturbed groundwater level ■ It is not located in Segment A groundwater, and ■ Financial assurance to the satisfaction of EPA is in place. All the above criteria must be met for a landfill to be considered a low-risk rural landfill.	This is a specific class of landfills in Victoria. It is not relevant to WA or the site.	Not applicable.
7	Best Practice Operation	The Vic-BPEM requires protection of the environment from landfilling activities in addition to the landfill design and construction. Elements of a landfill's operations that need to be considered are: ■ Environmental management ■ Financial assurance ■ Waste minimisation ■ Waste acceptance ■ Waste pre-treatment ■ Waste placement ■ Waste cover ■ Litter control ■ Dust and air emission control ■ Fires ■ Contingency planning ■ Management of chemicals and fuel ■ Disease vector control	Landfill operations are described in the Allawuna Landfill WAA with reference to the Waste Acceptance Manual (Appendix Q) and Emergency Procedures Guide and Contingency Plan (Appendix Q). Additional information relating to emission management can be found in the Surface Water, Groundwater and Leachate Management Plan (Allawuna Landfill WAA Appendix E) and the Landfill Gas Management Plan (Allawuna Landfill WAA Appendix G).	Complies.

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		■ Noxious weed control, and ■ Performance monitoring and reporting.		
7.1	Environmental Management	The Vic-BPEM requires in accordance with the Waste Management Policy (*Siting, Design and Management of Landfills*), which is a Victorian document; the holder of a licence for a landfill site is required to develop an environment improvement plan.	SITA is certified for the management of the Environment (ISO 14001), Health and Safety (AS 4801) and Quality (ISO 9001). SITA is accredited to ISO Standard 14001:2004 for its landfill and transfer station environmental management system. SITA intends to use its wealth of experience in the effective operation of landfill facilities via its accredited systems to operate the facility. Environmental improvement measures will be incorporated into the facility's operational plans.	Complies.
7.2	Financial Assurance	The Vic-BPEM requires financial assurance for all licensed landfills.	It is not the practice in Western Australia that all landfills have financial assurance.	Not applicable.
7.3	Waste Minimisation	The Vic-BPEM states that landfilling is the least preferred option in the waste hierarchy. Every practicable opportunity should have already been taken to avoid waste production and remove recyclable material from the waste stream before it arrives at the landfill.	SITA was the recipient of the Australian Business 2013 Environmental Sustainability Award. In 2013 SITA diverted 130 000 tonnes of waste from landfill in Perth. The Allawuna Farm Landfill will serve as a final disposal site for residual waste that has previously been sorted at SITA's waste transfer station to recover recyclable materials.	Complies.
7.4	Waste Acceptance	The Vic-BPEM requires resources and infrastructure to adequately manage the arrival and receipt of waste.	A 30 m long weighbridge certified to 100 tonnes will be installed for the weighing of incoming material. Signs will be established, random verification inspections, video cameras will be strategically installed and procedures will be implemented to deal with such wastes. Details of staff responsibilities and waste acceptance criteria are included in the Allawuna Landfill Waste Acceptance Manual (refer to the WAA Appendix Q).	Complies.
7.5	Waste Pre-treatment	The Vic-BPEM requires pre-treatment of waste prior to landfilling is intended to reduce the long-term risk posed by the waste and to improve general landfill performance.	The Allawuna Farm Landfill will serve as a final disposal site for residual waste that has previously been sorted at SITA's waste transfer station to recover recyclable materials.	Complies.
7.6	Waste Placement	The Vic-BPEM requires that the thickness of the waste layer should not exceed 0.5 m and the compactor should make 3-5 passes over the waste to maximise compaction. The tipping face should be kept to less than 30 m in length. The total height of the layers combined in the lift should be less than 2 m.	This is SITA's standard operating practice on all its landfills.	Complies.
7.7	Waste Cover	The Vic-BPEM states that an essential part of landfilling operations is the placement of cover over wastes.	SITA will use soil as the daily cover material. All waste will be covered to a thickness of 300 mm.	Complies.
7.8	Litter Control	The Vic-BPEM requires a litter control strategy.	Litter control measures are proposed in detail in the WAA (refer to the Environmental Risk Assessment in Appendix N).	Complies.
7.9	Fires	The Vic-BPEM requires a fire control strategy.	Fire management procedures for the facility are included in the Emergency Procedures Guide and Contingency Plan (Allawuna Landfill WAA Appendix Q). A site specific Fire Management Plan has also been developed in consultation with DFES. A copy of the Fire Management Plan has been included in the WAA as Appendix R).	Complies.
7.10	Contingency Planning	The Vic-BPEM requires contingency plans to be developed.	Contingency measures are discussed in the Emergency Procedures Guide and Contingency Plan (Allawuna Landfill WAA Appendix Q).	Complies.
7.11	Management of Chemicals and Fuels	The Vic-BPEM requires storage and handling of flammable and combustible liquids should be in accordance with the provisions of AS 1940–2004 *The storage and handling of flammable and combustible liquids and Bunding guidelines* (EPA publication 347).	Fuel stored on site will be kept in an approved bunded tank, in line with the *Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007* and Australian Standard *AS 1940 The storage and handling of flammable and combustible liquids*.	Complies

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7.12	Disease and Vector Control	The Vic-BPEM requires the control of birds and other vermin at the facility.	Disease vectors and vermin control is discussed in the WAA (refer to the Environmental Risk Assessment in Appendix N).	Complies.
7.13	Noxious Weed Control	The Vic-BPEM requires measures to control weeds.	As part of managing the Allawuna Farm Landfill, SITA has undertaken to improve the quality of Thirteen Mile Brook. Weed management strategies will be developed and implemented at the site. Keeping the area dieback free will also be an important aspect of the operations at the facility and the wheel wash for departing trucks will reduce the risk of vehicles transporting the fungus.	Complies.
7.14	Monitoring and Reporting	The Vic-BPEM requires performance monitoring and annual reporting.	A biannual monitoring program for the bores installed on the Allawuna landfill site is currently in effect. Seven bores were installed in winter 2012 and an additional six bores were installed in autumn 2013. This has been followed more recently by the installation of a further six bores in December 2014. Monitoring and reporting requirements imposed on the facility by the operating licence will be adhered to. Monitoring will include groundwater, surface water, dust, noise, landfill gas and leachate.	Complies.
8	Best Practice Rehabilitation and Aftercare	The Vic-BPEM requires rehabilitation and aftercare to be considered very early in the landfill design and operation phase.	Addressed in the following sections.	Complies.
8.1.1	Rehabilitation Plan	The Vic-BPEM requires a conceptual rehabilitation plan to be developed as part of the initial landfill design. The rehabilitation plan should include: ■ The potential after uses of the site, taking into consideration current and likely future land use in the area surrounding the site ■ Operational requirements, to ensure that the capping is designed to suit the intended after use ■ Surface contours before and after settlement ■ Specifications and materials to be used in the final cap, and ■ Preservation/installation of environment performance control or monitoring features.	The Allawuna WAA includes a conceptual rehabilitation plan for the proposed landfill.	Complies.
8.1.2	Progressive Rehabilitation	Landfill cell rehabilitation works include: ■ Capping and revegetation in accordance with regulatory requirements ■ Installation and ongoing maintenance and replacement of gas and leachate collection infrastructure, and ■ Decommissioning of infrastructure no longer required.	The landfill will be capped progressively throughout its operational life (the landfill cap design facilitates this activity) and the leachate and landfill gas management systems will be maintained and amended or replaced when necessary (refer to the WAA Appendix E and Appendix G).	Complies.
8.1.3	Triggers for Rehabilitation	The Vic-BPEM makes the following recommendations for initiating rehabilitation of a landfill cell: ■ The landfill cell contents have reached the approved pre-settlement contours, allowing sufficient height to build the landfill capping within the pre-settlement contours ■ Further filling of the cell is operationally no longer required or feasible ■ There has been a lawful direction to cease filling the cell ■ The landfill is to be closed, or ■ Two years have elapsed since commencement of filling. A landfill licence-holder should, where operationally practicable, sequence operations to complete the filling of each cell in turn, rather than leaving	The Allawuna WAA includes a conceptual rehabilitation plan for the proposed landfill. Progressive closure and rehabilitation consistent with these requirements will be carried out.	Complies.

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		one or more partly filled cells inactive and not fully rehabilitated. Where cells cannot be fully rehabilitated due to the layout of the site and the sequencing of filling, intermediate (temporary) capping must be installed.		
8.1.4	Site After Use	The Vic-BPEM requires proposals for the use of the filled landfill site to be flexible enough to allow for changes in community attitudes or planning requirements in the long period between commencement of landfilling and final rehabilitation. This may necessitate regular reviews of after use options as a way of ensuring that the operation of the landfill does not alienate desired after uses of the site.	Due to the rural setting of the landfill, it is most unlikely that there will be any change in community attitudes or planning requirements that would change the ultimate site after use.	Not applicable.
8.1.5	Settlement and Final Surface Profile	The Vic-BPEM states that the gradient of a completed cap should be sufficient to prevent water ponding on the cap to minimise infiltration through the cap (gradients of about five per cent will adequately shed water). The Vic-BPEM provides the following guidance for designing the pre-settlement cap and final surface profile: ■ Where the proposed after use of the landfill require a gradient of less than 5% the cap design may need to incorporate additional levels of protection ■ Caps should not be steeper than 20% ■ Since compaction of wastes along near-vertical side walls is difficult, the wastes along the walls of the landfill may exhibit the highest initial rate of settlement. The landfill cap needs to make allowance for this by providing sufficient thickness of the cap to ensure that run-off from the cap is not collected in depressions along the perimeter of the landfilled area ■ The landfill aftercare program must include inspections of the cap, checking for differential settlement and indicators that the integrity of the low-permeability cap has been compromised, and ■ The use of plants on the landfill caps must consider the particular requirements of the cap design, and vegetation used must be compatible with the cap design.	The pre-settlement landfill cap has been designed at a slope of 1 vertical in 5 horizontal (20%), which is seen as the optimum configuration to achieve reasonable landfill airspace and a long-term stable slope that can easily be rehabilitated and is also able to accommodate waste settlement whilst maintaining the ability to shed excess surface water off the capped surface. The finished and capped landfill surface will be progressively rehabilitated to become suitable for post closure land use. If planting of native species is required the plants will be selected from an approved locally endemic species mix. Plants will be selected with root structures that do not pose a threat of penetrating the LLDPE geomembrane and GCL capping layers.	Complies.
8.1.6	Landfill Cap	The Vic-BPEM requires that the design seepage rate of the cap does not exceed 75 per cent of the design seepage rate of the landfill liner. It also stipulates topsoil, vegetation and drainage considerations to minimise erosion and seepage.	Golder Associates has undertaken the leakage rate assessment of the landfill lining and capping systems and confirmed the appropriate leakage rates have been achieved. The proposed basal liner is deemed best-practise.	Complies.
8.1.7	Alternative Landfill Cap	The Vic-BPEM stipulates the considerations in relation to the soil properties and other criteria, including compaction, when designing phytocaps.		Not applicable.
8.1.8	Low-Risk Rural Landfills – Indicative Phytocap Design	The Vic-BPEM stipulates the considerations in relation to the soil properties and other criteria, including compaction, when designing phytocaps for low-risk rural landfills.	The proposed Allawuna landfill is not deemed a low-risk rural landfill.	Not applicable.
8.2	Aftercare Management	The Vic-BPEM states that until the waste within the landfill has sufficiently decomposed or stabilised such that it no longer presents a risk to the environment, the landfill must be managed to prevent any environmental impact. The following aftercare management requirements must be considered: ■ Maintenance of landfill cap, in particular to: • Prevent/control erosion	Once the proponent is of the opinion that the landfill has stabilised to such a degree that there is no longer the need to undertake further site maintenance and monitoring, a report prepared by an appropriately experienced consultant will be presented to the DER setting out the justification for the request to cease maintenance and monitoring activities. The DER will then make a determination as to whether the maintenance and monitoring can be ceased. There are no Environmental Auditors in WA specifically in relation to landfills (in WA there is the Contaminated Sites Legislation). If regular groundwater monitoring indicates that there is a contaminated groundwater plume below the landfill, the site will be registered as a	Complies.

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		• Restore depressions and seal and monitor cracks in the cap caused by settlement, and • Restore/maintain vegetation. ■ Maintenance and operation of leachate collection and treatment system ■ Maintenance and operation of landfill gas-extraction system ■ Environmental monitoring of: • Groundwater • Surface water • Landfill gas • Leachate, and • Settlement. ■ Funds should be allocated during the operational life of the landfill to provide for aftercare management ■ Environmental auditing to examine, among other things, the results of monitoring of groundwater, surface water, landfill gas and leachate.	Contaminated Site.	
8.2.1	Buffers and Measurements	To manage landfill gas impacts the Vic-BPEM stipulates the post-closure buffer required for different types of landfill. ■ Type 2 Landfill = 500 metres from building or structures ■ Type 3 Landfill = 200 metres from buildings and structures.	There is a 1.9 km buffer to the nearest neighbouring structure. The landfill buffers will remain in place at least until the site is no longer required to undertake any maintenance and monitoring (as determined by the DER).	Complies.
8.2.2	Buffer Distances and Encroachment	The Vic-BPEM requires consideration of any proposed developments or any other works within the landfill buffer that might pose a safety risk by potentially providing preferential pathways for subsurface landfill gas migration, or providing an environment where landfill gases can accumulate to dangerous levels.	Due to the rural setting, it is not anticipate that there will be any buffer encroachment around the landfill.	Not applicable.
B	Appendix Technical Guideline	Appendix B of the Vic-BPEM details the technical requirements for landfill design.	A Construction Specification has been prepared in accordance with the technical requirements of Appendix B of the Vic-BPEM and is included in the Allawuna Landfill WAA as Appendix M.	Complies.
D	Appendix Geomembranes	Appendix D of the Vic-BPEM details the technical requirements for geomembranes. The quality of the geomembranes shall be in accordance with the requirements of the Geosynthetic Research Institute (GRI) – *GM13* and *GM17*.	Details of liner specifications, installation and quality control are included in the Technical Specification in the Allawuna Landfill WAA Appendix M. A 2 mm thick HDPE geomembrane liner will have properties as nominated in the Technical Specification in accordance with the Vic-BPEM requirements. The contractor will be required to prepare and submit a liner construction plan to the Superintendent and QAI of the project. Third party quality surveillance is proposed during the construction of the composite liner system.	Complies.
E	Appendix Geosynthetic Clay Liners	Appendix E of the Vic-BPEM details the technical requirements for Geosynthetic Clay Liners. The quality of the geosynthetic clay liner (GCL) shall be in accordance with the requirements of the Geosynthetic Research Institute *GRI-GCL3*.	Details of liner specifications, installation and quality control are included in the Technical Specification in the Allawuna Landfill WAA Appendix M. The GCL will have properties as nominated in the Technical Specification in accordance with the Vic-BPEM requirements.	Complies.
F	Appendix Geotextiles	Appendix F of the Vic-BPEM details the technical requirements for Geotextiles. The quality of the geotextile shall be in accordance with the requirements of the Geosynthetic Research Institute (GRI) — *GT12(b)* or *GT12 (a)*.	The cushion geotextile layer will have properties as nominated in the Technical Specification in accordance with the Vic-BPEM requirements.	Complies.