Mr Jamie Merrick
Director General
Department of Environment, Science and Innovation
GPO Box 2454, Brisbane QUEENSLAND 4001

Email: RRS.Consultation@des.Queensland.gov.au

8 March 2024

Dear Mr Merrick

Re: *Landfill siting, design, operation and closure* guideline review

Thank you for the opportunity to provide feedback on the Department of Environment, Science and Innovation's (DESI) *Landfill siting, design, operation and closure* guideline review. The Waste Management and Resource Recovery Association of Australia (WMRR) is the national peak body representing Australia's $15.8 billion waste and resource recovery (WARR) industry. With more than 2,200 members from over 400 entities nationwide, we represent the breadth and depth of the sector, including representation from business organisations, the three (3) tiers of government, universities, and Non-Government Organisations (NGOs), including research bodies.

WMRR appreciated the briefing offered to the WMRR landfill working group on 19 February 2024 and reiterate that the guideline must be contemporary and have a greater understanding of current management of sites. We recognise the department has taken guidance from other state guidelines however these are under review and discussion themselves to modernise.

We note consultation comments from DES that many of the guideline prescriptive items throughout were meant to be considered as suggested measures and not mandatory. As we have not been provided a list of what is to be changed to suggested measures it is difficult to know if some may still remain in the final document as mandatory. We would appreciate the opportunity for a second review period prior to the document being issued as a final version.

Industry seeks clarification on how the guideline is to be used. Consultation comments to date are that the document is for application/approval purposes and not a compliance document. Experience is that any document, including non-statutory guidelines, are picked up and used by Environmental Services and Regulation Division for compliance matters. Particularly for compliance assessments it should be clarified that the document contains recommended measures – not required measures.

We note consultation comments from DES that many of the guideline prescriptive items throughout were meant to be considered as suggested measures and not mandatory. As we have not been provided a list of what is to be changed to suggested measures it is difficult to know if some may still remain in the final document as mandatory. We would appreciate the opportunity for a second review period prior to the document being issued as a final version. If DESI's intent is to apply the guideline as a minimum standard or code, then it is possible that DESI assumes a level of liability and accountability for the performance of that element. The prescriptive minimum requirements presented in the guideline represent a prescriptive standard or code and therefore may be exempt from RPEQ requirements (in the same way that electricians and plumbers do not need to be engineers). We would recommend ensuring that any minimum standard required by the guideline does not absolve a design engineer from ensuring a competent design approach and undertaking their duties as a professional engineer.

WMRR's responses to the consultation questions can be found at **Annexure A**. Please contact the undersigned if you wish to further discuss WMRR's submission.

Yours sincerely

Gayle Sloan
Chief Executive Officer
Waste Management and Resource Recovery Association of Australia

Annexure A
Submission:

Draft Guideline Section	**Comments**
1.3 table 1	Geotechnical slope stability should be "Global slope stability…" as includes stability of waste which is not geotechnical.
1.4 Key roles and responsibilities **Certifying engineer role not considered.**	Table 2 identifies that only the design engineer and CQA engineer have roles in landfill development. Depending on construction contractual arrangements, a third "Certifying engineer" may be involved. Although commonly the design engineer also completes the role of certifying engineer during construction, this is not necessarily the case. Common requirements is to include in landfill construction contracts that the contractor is to provide certification by a registered engineer at the completion of the construction that the construction has been completed following all requirements of the design and technical specifications.
1.4 Key roles and responsibilities **Table 2. CQA Report line**	Table 2 identifies that both the design engineer and the CQA engineer are responsible for the CQA report. Only the independent CQA engineer is responsible for the CQA report. The certifying engineer (see comments above) is responsible for a separate report and certification at the completion of construction.
2 Landfill Classification	The classification "Regulated" in column 1 needs to be divided into two (2) separate categories to match other jurisdictions liner types. This is not the current liner type approved in Queensland. The current Queensland liner approval is for "double liner" which comprises two (2) of either clay, GCL, of geomembrane. Type 1 – Regulated waste only Type 2 – Regulated waste and a combination of the following waste Type 1 regulated waste landfills (sometimes called monofils) are dedicated landfills for accepting a hazardous waste and should have dual liner with leak detection. Type 2 regulated waste landfill is the type of landfill operated by councils and private industry which accept predominantly general waste but can also accept some regulated wastes. These types of landfills have a minimum of a double liner (triple is standard) comprising of Clay, GCL, HDPE. No leak detection layer is included.
3. Siting -In selecting a site for a new landfill, the aim is to maximise the advantageous use of natural barriers (e.g., hydrogeological barriers) and buffers, with engineering and management controls being considered as secondary measures.	Not necessarily an accurate statement based on practicalities. This is a 'ideal' or 'nice to have' situation but not always the most beneficial outcome or achievable for a location.
3. Siting	A short list of alternative locations is not beneficial. The applicant needs to demonstrate that the selected location is suitable.

A shortlist of alternative site locations, overlain with scaled preliminary site layouts and topography, including the following for each alternative site location **Information about environmental and social receptors and the receiving environment as shown in Table 4.** **Initial assessment of potential impacts to environmental values such as shown in Table 5.** **The proposed landfill method and filling plan (see Section 6.2 for more information).**	The location selection does not consider the filling plan. Possibly the intent of this comment was to consider the 'staging plan' or 'development plan'. This should be clarified.
Table 5 – Water **Where landfills are within the 1% annual exceedance probability (AEP) floodplain, consider additional engineering and management controls to ensure that the facility will be protected from flooding, erosion by floodwaters and infiltration from perched water tables.**	Landfills should not be placed in flood zones. Potentially this section should be changed to state that landfills should avoid being placed within flood zones, unless additional engineering and management controls can demonstrate the facility will be protected. Land – spelling mistake for 'through'.
Section 3 Appendix 1 minimum expectations.	The proposed minimum distance from sensitive receptor to a landfill of 1.5km is excessive. This will be almost impossible, and likely unachievable for most areas.
Section 4, p.16 CSM **Requirements of a CSM**	Comment should be included that the extent of CSM requirements will be dependent on the proposed size and waste types of the landfill. I.e. a small inert waste landfill will require less CSM background information compared to a regulated waste landfill.
Section 4, p.17 Assessment **Key assessments**	Point 3 requires a "geotechnical slope stability assessment". Better wording would be "global slope stability assessment" to remove doubt that the assessment needs to include assessment of stability of placed waste.
Section 5	Appreciate the importance of achieving a SLO and agree that this needs to be the object. WMRR has undertaken significant work in this area as to how to gain and maintain, its vital however that there is a reasonable approach taken to this also by government in order that opponents to any new development could use this expectation to demonstrate to simply prevent any new development from occurring. The wording of this should be changed.

Section 6.1 p.23 Design report	The term "design report" is being used incorrectly in this situation and may lead to confusion. We presume that an "engineering report" or "impact assessment report", or a combination of the two (2), are being considered here. We suggest that an alternative descriptor is used in this section. For example, "Engineering and impact assessment report". The term "design report" is used to define a report which accompanies a detailed design to set out the base assumptions and calculations used in the design. This for example would be done for a detailed design of a landfill cell. The content of this design report differs to a development application (DA) report.
Section 6.1 p.23 Design report **The design report should accompany the design drawings and technical specifications and be developed and approved by a design engineer (a RPEQ). The design report is accompanied by a declaration by the design engineer that the minimum expectations of this guideline are met by the design report.**	These paragraphs are referencing a typical design report which is provided when a detailed design is completed, for example of an individual landfill cell. A design report of this type would not be available yet for a DA for a new landfill.
Section 6.2 site layout **Consider the following in the design of the site layout:** **Layout of landfill gas collection system, if required.**	Design and layout of landfill gas system is detailed work and not completed during development application. At DA stage the supporting documents should identify if a gas system will be required and identify the location of any supporting infrastructure such as gas flares. The actual gas pipe network layout is progressively installed and updated as waste filling progresses.
Section 6.3.1 Liner Sub-base	Add: Where the liner performance is dependent on and intergraded with the subbase properties (e.g. GCLs), the liner subbase should fulfill the criteria of the liner design and performance requirements. See Appendix 5.
Section 6.3.2 Groundwater depressurisation	Add: Where the liner performance is dependent on and intergraded with the subbase properties (e.g. GCLs), the groundwater depressurisation should be designed in a way not to affect the performance of the liner. Add: The effect of the groundwater depressurisation system on the performance of the Clay or GCL liner and vice versa should be investigated and addressed and the liner and groundwater depressurisation system should be designed to fulfill those criteria. They may include but not limited to: potential bentonite erosion, potential moisture loss from clay or GCL into the drainage layer, potential reduction in the drainage capacity of the groundwater depressurisation system during the landfill design life due to bentonite erosion from the liner, intrusion of the liner into the drainage layer (e.g. for geonets), creep of the groundwater depressurisation system, and clogging of the separation layer. If the clay liner is in direct contact with the

	groundwater depressurisation system, a suitably designed separation geotextile will be required between the groundwater depressurisation system and Clay liner. If the risk of bentonite erosion and/or reduction in the drainage capacity of the groundwater depressurisation system due to the above reasons is high, a membrane may be required between the groundwater depressurisation system and clay liner.
Section 6.3.3 Landfill liner **Appendix 5 – landfill types**	The landfill types in Appendix 5 are not defined. Specifically, it is not clear what constitutes a "general landfill" or a "regulated landfill". It is considered based on the liner requirements set out in Appendix 5 that "general landfill" includes a landfill accepting general waste, putrescible waste, and regulated waste. While "regulated landfill" includes a landfill for accepting high hazard wastes, single waste streams (i.e. monofils). A double composite lined landfill is not a requirement for a combined general waste and regulated waste landfill in other jurisdictions. Queensland has no "double composite lined landfills" currently constructed for MSW and commercial wastes. It is recommended that the terminology is refined and clarified.
Section 6.3.3 Landfill liner	Single liner: Compacted clay is not a good single liner. There are many concerns and challenges with compacted clay (both in the base and cap) and is not recommended to be used as a single liner (supporting documents available). It is suggested for compacted clay should be used only in composite liners. As single liner, there are other options.
Section 6.4 Leachate collection system	Outcomes, line 9. "closing" to be changed to "clogging".
6.4.1 Leachate drainage layer	Add: An appropriately designed drainage geocomposite may be used as an alternative to the gravel drainage layer in sidewall leachate drainage systems (minimum expectations for all relevant applications to add to the appendix).
6.4.2 Leak detection layer	Add: The effect of the leak detection layer on the performance of the Clay or GCL liner and vice versa should be investigated and addressed and the liner and leak detection layer should be designed to fulfill those criteria. They may include but not limited to: potential bentonite erosion, potential moisture loss from clay or GCL into the drainage layer, potential reduction in the drainage capacity of the leak detection layer during the landfill design life due to bentonite erosion from the liner, intrusion of the liner into the drainage layer (e.g. for geonets), creep of the leak detection layer, and clogging of the separation layer. If the clay liner is in direct contact with the leak detection layer, a suitably designed separation geotextile will be required between the leak detection layer and Clay liner. If the risk of bentonite erosion and/or reduction in the drainage capacity of the leak detection layer due to the above reasons is high, a membrane may be required between the leak detection layer and clay liner.
6.5 Capping	Figure 2: Add a liner subbase between the landfill gas collection and barrier layer. (Reason: The liner first layer is a Clay layer or GCL. Clay or GCL is not suggested to be in direct contact with gravel or drainage geosynthetic due to potential bentonite erosion into the drainage layer, as well as decrease in the drainage capacity). Adjustments need to be made in section 6.5.3 and appendix 6, accordingly. Note: the capping subbase (below gas drainage layer) may be used as the liner subbase, if there is enough intimate contact between the liner and capping subbase.

6.5.2 Landfill gas collection	Minimum expectations for geocomposite drain to add to the appendix.
6.5.3 Landfill capping	Compacted Clay is not very suitable as single liner for landfill caps. More information is provided in the comments for Table 19, Barrier layer. Adjustments due to the comment about section 6.5 (liner subbase) to be made.
6.6 Construction quality assurance (CQA) plan and report	A definition for CQA engineer may be needed.
Section 7.4	Objections; 'stormwater monitoring' repeated / written twice. Under heading 'Landfill gas' (page 46), and regarding comments, '…which need to be monitoring for odour and flammability'. Should this be testing of confined spaces for LEL? Under heading 'Landfill gas' (page 46, dot points), what is the difference between subsurface emissions monitoring and off-site migration monitoring? Under heading 'Landfill gas' (page 46, dot points), 'enclosed structure monitoring' should reference confined space. Under the heading of 'Leachate' (page 46), with reference to 'leachate head wells', these should not be an automatic requirement. There are significant challenges and risk around leachate head wells and the operation of a landfill. In most situations leachate levels are best monitoring from the sump. There is also no mention of leachate head monitoring wells in Section 6. Under the headings of 'Stormwater' and 'Surface water' (page 47), appreciate the definitions of each, however this is confusing. There is also inconsistency in the spelling of stormwater (e.g. stormwater, storm water).
Section 8.2.2	Second dot point; 'Placing waste at the base of the tipping face with a compactor pushing waste up the face compacting it in thin layers'. Disagree with this point. Depending on the configuration of the landfill face at any given time (and noting that the face moves daily), waste can be place at the top, at the bottom or both top and bottom. Suitable compaction can still be achieved with pushing waste from the top. Also, there is a great fuel burn in pushing waste up from the bottom. This dot point should be removed or reworded. Fourth dot point; 'Complying with the end geotechnical design'. Should this be 'any' geotechnical design? Fifth dot point; 'Terracing the unconfined face to enhance the stability of the waste and cover material'. Should be removed.
Section 8.3	Last dot point on page 56; comments '… to avoid waste containment perched leachate….' Reword, this does not make sense.
Section 10 Closure	We support the closure planning and assessment of landfill facilities to continue under specific closure plans and, where required, RPEQ certification. And for the facility to then transition to the ERA60 for closed facilities. Although landfill facilities are registered on the environmental management register, modern landfill facilities are planned and not similar to unplanned 'dumps' common place at the time of the commencement of the EP Act. Additionally, the introduction of an ERA 60 for closed facilities then still requires facility owners to appropriately manage the facility into the future. The alternative of requiring closure planning under the Environmental Protection Act 1994 contaminated land provisions is not considered suitable. The provisions of contaminated land apply to a site which has been poorly managed and resulted in

	contamination. The site is to be remediated to a standard which will not require any further ongoing management. The structure of closure under contaminated land provisions is not suitable and will not lead to a better outcome but will result in significant third-party consultants' costs and investigation costs which are not required and of no benefit and would be passed on to the community. Existing historic dump locations which do not have an ERA 60 issued (or never have) and will not transition to an ERA 60 for closed facilities may be suitable for closure management under contaminated landfill provisions if contamination has occurred and requires remediation.
Appendix 1	Separation distances to general and regulated excessive. We do not believe that a putrescible waste facility will ever be built in the future at the required buffer distance in populated areas. This minimum buffer distance will require future landfill facilities to be in regional locations, away from the generating source. We understand that the buffer distance is based on Victorian landfill and complaints research. We do not consider this a suitable basis as Victorian landfill facilities have the historical reputation as being some of the worst developed and managed in the country. This then will result in higher waste management costs for Queensland residents based on the regulation and management regime of a separate State.
Appendix 5 lining system	"Regulated landfill" should be split into two types to reflect that higher risk regulated only waste landfills require a liner system with leak detection and general waste landfill which can also accept some regulated waste does not.
Appendix 5 table 14	Table 14, under Primary Liner, Compacted Clay, and the referenced to 'Required', this should be 'Required [9] (A suitable designed GCL may be used as an alternative). Observations of clay lined Inert Landfills historically indicates that a Leachate Drainage Layer should be implemented. A compacted clay liner does provide a hydraulic barrier that will ensure water is maintained within the inert waste mass. This is extraordinarily hard to drain post occurrence. This will be especially prevalent in Queensland's high rainfall regions, and a leachate drainage layer should be considered based on site climate, not prescribed as an unnecessary minimum expectation.
Appendix 5 table 15	First sentence change to "GCL may be used as an alternative or in combination with…" Remove 4th and 6th dot point. Design of GCL section. Remove fully as prescriptive. The RPEQ designer will specify requirements. Installation of GCL section. As above, remove entire section. Table 15, under Compacted clay and the reference to 'undertake installation in thin compacted layers of 150mm or less'. 150mm is too thin for a compaction layer with suitable compaction equipment for thicker layers. Layer thicknesses need to take into account total thickness and compaction equipment. Table 15, under Geomembrane, last dot point and the reference to '…..following placement of the **leak detection** and leachate…..' the words 'leak detection' should be replaced with 'geomembrane'.
Appendix 5 lining system – Table 15 Geosynthetic Clay Liner	This lack of Bentonite prescription for GCLs in this draft guideline when compared to Victorian/NSW and SA EPA Guidelines means that Queensland will not have the quality of lining systems evident in these states. The groundwater leakage rate risk will be higher. Some sort of quality control measures like the SA EPA Guidelines should be implemented with some sort of CQA process as per below.

Appendix 5, Table 15	The lack of prescription in terms of Geomembrane properties, will mean that QUEENSLAND stands alone in using Geomembranes that are substandard to NSW/Victoria and SA EPA jurisdictions. The GRI GM13 and GRI GM17 guidelines referenced are considered vastly inadequate when considering a Geomembrane that is suitable for landfill function. Some basic prescription should be recommended to consider the properties for OIT / HPOIT with associated CQA as per the Victorian, NSW and SA EPA Guidelines. Example reference can be found in the SA EPA Environmental Management of Landfill Facilities – Solid Waste Disposal Table 2 p60.
Appendix 5 – Minimum expectations for a lining system, Table 14	Note 7: Why only slopes with more than 25% grade? “Compacted Clay Liner” to be changed to “Compacted Clay Liner or GCL” in the whole table. Compacted Clay Liner for primary liner: - Add superscript “9”, which says the clay can be replaced with suitably designed GCL. - Add an extra superscript (11) for Compacted Clay Liner for primary liner and secondary liner saying: • If compacted clay liner or GCL is used with drainage layer (e.g. gravel or geocomposite drain), the effect of the drainage layer on the performance of the Clay or GCL liner and vice versa should be investigated and addressed and the liner and drainage layer should be designed to fulfill those criteria. They may include but not limited to: potential bentonite erosion, potential moisture loss from clay or GCL into the drainage layer, potential reduction in the drainage capacity of the drainage layer during the landfill design life due to bentonite erosion from the liner, intrusion of the liner into the drainage layer (e.g. for geonets) and clogging of the separation and drainage layer. • If the clay liner is in direct contact with the drainage layer, a suitably designed separation geotextile will be required between the leak detection layer and Clay liner. If the risk of bentonite erosion and/or reduction in the drainage capacity of the drainage layer due to the above reasons is high, a membrane may be required between the leak detection layer and clay liner.
Appendix 5 – Minimum expectations for a lining system, Table 15, Liner sub-base	Add: Where the liner performance is dependent on and intergraded with the subbase properties (e.g. GCLs), the liner subbase should fulfill the criteria of the liner design and performance requirements. These include nut not limited to: - Subgrade maximum particle size, subgrade moisture content, subgrade clay content and mineralogy, subgrade macro structure, subgrade cations, pore water chemistry, subgrade compaction and density.
Appendix 5 – Minimum expectations for a lining system, Table 15, Groundwater depressurisation	Add: The effect of the groundwater depressurisation system on the performance of the Clay or GCL liner and vice versa should be investigated and addressed and the liner and groundwater depressurisation system should be designed to fulfill those criteria. They may include but not limited to: potential bentonite erosion, potential moisture loss from clay or GCL into the drainage layer, potential reduction in the drainage capacity of the groundwater depressurisation system during the landfill

	design life due to bentonite erosion from the liner, intrusion of the liner into the drainage layer (e.g. for geonets), and c logging of the separation layer.
Appendix 5 – Minimum expectations for a lining system, Table 15, Compacted clay	Change the first sentence to: The compacted clay should have a total thickness of 1 m and a uniform permeability of less than 1x10-9 m/s across the whole area and through the whole thickness, when tested in accordance with AS1289 6.7.3. Add: The clay should keep its hydraulic conductivity, performance, and degree of efficiency during the whole design life of the landfi ll (including the operating and post-closure periods).
Appendix 5 – Minimum expectations for a lining system, Table 15, Geosynthetic clay liner (GCL)	In the first section where it says "In addition, the GCL should:", Add: Meet the requirements of ISO/TS 13434:2020: Geosynthetics, Guidelines for the assessment of durability. In the section where it says "The design of the GCL should:", add: - Fulfill design requirements in the relevant guidelines and references from time to time, including but not limited to "GRI-GCL5 Design Considerations for Geosynthetic Clay Liners (GCLs) in Various Application", published by Geosynthetic Research Institute (GRI) as minimum requirements, and ISO/TR 18228-9:2022: Design using geosynthetics, Part 9: Barriers
Appendix 5 – Minimum expectations for a lining system, Table 15, Geosynthetic clay liner (GCL), page 84.	First sentence about exposure to UV etc.: To be deleted. Not relevant to GCLs. GCLs should be covered immediately according to the installation guidelines. To the section "The installation of the GCL should:", Add: - Adopt procedures for the GCL to be covered as soon as possible. - Follow manufacturer's installation guidelines.
Appendix 5 – Minimum expectations for a lining system, Table 15, Geomembrane, page 84.	In the first section where it says, "In addition, the geomembrane should:", Add: Meet the requirements of ISO/TS 13434:2020: Geosynthetics, Guidelines for the assessment of durability. In the section where it says, "The design of the GCL should:", Add: Fulfill design requirements in the relevant guidelines and references from time to time, including but not limited to ISO/TR 18228-9:2022: Design using geosynthetics, Part 9: Barriers.
Appendix 5 – Minimum expectations for a Protection Geotextile, Table 15, Geomembrane, page 87-88.	In the first paragraph, remove the polymer type for the geotextile and change it to: The protection geotextile should consist of a non-woven, needle-punched geotextile, formulated to meet landfill conditions and not contain recycled materials. In the first section where it says, "In addition, the protection geotextile should:", Add: - The effect of landfill real temperature, chemicals, and potential damages from gravel placement and compaction need to be addressed and considered in the design and assessment, including the compression test. - Meet the requirements of ISO/TS 13434:2020: Geosynthetics, Guidelines for the assessment of durability. - Meet requirements of LFE7 - Using nonwoven protector geotextiles in landfill engineering, and ISO/TR 18228-6:2023: Design using geosynthetics — Part 6: Protection

	The "Maximum allowable strains for various geomembrane materials" table to be removed. This table is old and out of date and not correct any more. The most recent and most comprehensive reference on protection geotextile, relevant test methods and strain values is: Bennett, S.A., Brachman, R.W.I., 2024. Test method and strain calculation effects on geomembrane strain from gravel indentations. Geotextiles and Geomembranes, 52(1): 145-155.
Appendix 5 – Minimum expectations for a Protection Geotextile, Table 16, Separation geotextile, page 90.	In the first paragraph, remove the polymer type for the geotextile and change it to: The protection geotextile should consist of a non-woven, needle-punched geotextile, formulated to meet landfill conditions and not contain recycled materials. In the first section where it says "In addition, the separation geotextile should:": - There is a typo in the GRI specification. It should be GRI Test Method GT13(a) and GRI Test Method GT13(b). - Also add "QUEENSLAND Technical Specification Transport and Main Roads Specifications MRTS27: Geotextiles Separation and Filtration" after GRI specifications. In the first section where it says, "In addition, the separation geotextile should:", Add: Meet the requirements of ISO/TS 13434:2020: Geosynthetics, Guidelines for the assessment of durability. In the section where it says "The design of the separation geotextile should:", Add: Fulfill design requirements in the relevant guidelines and references from time to time, including but not limited to ISO/TR 18228-2:2021: Design using geosynthetics — Part 2: Separation, ISO/TR 18228-3:2021: Design using geosynthetics — Part 3: Filtration, and "Queensland Technical Specification Transport and Main Roads Specifications MRTS27: Geotextiles Separation and Filtration" after GRI specifications.
Appendix 5 – Minimum expectations for a Protection Geotextile, Table 16, Drainage geocomposite	The first paragraph limits the application of drainage geocomposite to slopes more than 25%. drainage geocomposite are popular in slopes less than 25% as well. The section where it says "drainage geocomposite should consist of:" only contains one specific type of drainage geocomposite (Geonets). There are other drainage geocomposites being available and popular for this application (reference: ASTM D7931, Standard Guide for Specifying Drainage Geocomposites). Please change it to "drainage geocomposite components should not contain any recycled material. In the section saying, "the drainage geocomposite should:", add: - Meet the requirements of ISO/TS 13434:2020: Geosynthetics, Guidelines for the assessment of durability. - Meet the requirements of ASTM D7931, Standard Guide for Specifying Drainage Geocomposites. In the section saying, "The design of the drainage geocomposite should:", add: - Meet or exceeds the requirements of (but not limited to) GRI Standard GC8-Standard Guide for Determination of the Allowable Flow Rate of a Drainage Geocomposite, and ISO/TR 18228-4:2022: Design using geosynthetics Part 4: Drainage. - The effect of the leak detection layer on the performance of the Clay or GCL liner and vice versa should be investigated and addressed and the liner and leak detection layer should be designed to fulfill those criteria. They may include but not limited to: potential bentonite erosion, potential moisture loss from clay or GCL into the drainage layer, potential reduction in the drainage capacity of the leak detection layer during the landfill design life due to bentonite erosion from the liner,

	intrusion of the liner into the drainage layer (e.g. for geonets), creep of the leak detection layer, and clogging of the separation layer. - If the clay liner is in direct contact with the leak detection layer, a suitably designed separation geotextile will be required between the leak detection layer and Clay liner. If the risk of bentonite erosion and/or reduction in the drainage capacity of the leak detection layer due to the above reasons is high, a membrane may be required between the leak detection layer and clay liner. - If GCL is used as the liner, the GCL alone cannot be used against a drainage layer by itself unless it includes polyethylene coating, with the coating facing the drainage layer, according to GRI-GCL5, section 11.4. In the section saying, "The design of the drainage geocomposite should:", remove the minimum transmissivity value. It can be used as design value by mistake. In the section about installation add: - Follow international specifications such as GRI-GN2 and GRI-GC13 - Standard Guide for "Joining and Attaching Geonets and Drainage Composites. - Follow manufacturers installation guidelines.
Appendix 11	PFAS monitoring should align with the PFAS NEMP 2.0 as Queensland is a signatory. Consider adding BOD and COD to landfill leachate and other mediums sampled.
Appendix 13	Remove requirements to reduce working face size on extreme fire danger days. Unachievable and not required. Remove 'compact all waste deposited in the landfill'. Examples of waste unable to be directly compacted include asbestos, biosecurity waste. Biosecurity regulations prohibit landfill equipment contacting biosecurity waste. Remove requirement to "place waste at the base of each lift and compact waste in layers less than 2m". Waste can be placed at the top of a lift and lift heights of greater than 2m have better efficiencies in day cover use for larger landfills.
Appendix 14	Remove maximum for 500mm day cover. Remove "Maintain a stockpile of daily cover on site sufficient for at least two (2) weeks of waste disposal operations". Remove "waste should note be used as cover".
Table 17, Design	Add: - Address and analysis all the possible short term and long-term performance of the geosynthetics during the design life and pos-closure of the landfill, in accordance with the national and international design guidelines and latest publicly published research findings. - Address and analyse the effect of external components such as rainfall, high or low temperature, temperature variation, temperature gradient, chemicals, installation damages, subgrade conditions, differential settlements, additives, etc. on the short term and long-term performance and internal stability of the geosynthetics, as well as the interface stability between different geosynthetics.

Table 17, Installation	Add: Follow manufacturers installation guidelines.
Table 19, Capping sub-base	If the capping sub-base may act as the liner sub-base as well (e.g. using strip drain as gas drainage), and the liner performance is dependent on and intergraded with the subbase properties (e.g. GCLs), The liner subbase should fulfill the criteria of the liner design and performance requirements. These include nut not limited to: Subgrade maximum particle size, subgrade moisture content, subgrade clay content and mineralogy, subgrade macro structure, subgrade cations, pore water chemistry, subgrade compaction and density.
Table 19, Gas collection	Add: Drainage geocomposite may be used as an alternative to gravel and pipework. In addition, the drainage geocomposite should: - Have adequate long-term flow capacity for the estimated gas flow rate. - If relevant, meet or exceed the requirements for manufacture and performance contained in the relevant specifications published by the Geosynthetic Research Institute (Folsom, PA, USA) from time to time, or in equivalent recognised industry standard specifications. See GRI Test Method GN4, ISO/TS 13434:2020: Geosynthetics, Guidelines for the assessment of durability, and ASTM D7931, Standard Guide for Specifying Drainage Geocomposites. In addition to the below, the general geosynthetic requirements in Table 17 should be considered. The design of the drainage geocomposite should: - Account for an allowable flow rate determined from a standard 100-hour test simulating field conditions (adjacent layers, loads and hydraulic gradient). This should account for decreases in flow capacity due to intrusion of the geotextile into the geonet core. - Account for reduction factors that will further reduce the thickness and capacity of the drainage core under long-term field conditions, including long-term creep deformation, and chemical and biological clogging. In addition to these specific reduction factors, adequate general safety factors should be applied to account for overall design uncertainties. - Meet or exceeds the requirements of (but not limited to) GRI Standard GC8-Standard Guide for Determination of the Allowable Flow Rate of a Drainage Geocomposite, and ISO/TR 18228-4:2022: Design using geosynthetics Part 4: Drainage - The effect of the gas collection layer on the performance of the Clay or GCL liner and vice versa should be investigated and addressed and the liner and leak detection layer should be designed to fulfill those criteria. They may include but not limited to: potential bentonite erosion, potential moisture loss from clay or GCL into the drainage layer, potential reduction in the drainage capacity of the gas collection layer during the landfill design life due to bentonite erosion from the liner, intrusion of the liner into the drainage layer (e.g. for geonets), creep of the leak detection layer, and clogging of the separation layer. - If the clay liner is in direct contact with the gas collection layer, a suitably designed separation geotextile will be required between the gas collection layer and Clay liner. If the risk of bentonite erosion and/or reduction in the drainage capacity of the leak detection layer due to the above reasons is high, a membrane may be required between the leak detection layer and clay liner.

	The installation of the drainage geocomposite should: - Adopt procedures to be adopted to prevent soil intrusion. - Include measures to prevent bentonite intrusion from GCL. - Include measures to prevent separation of adjacent panels and slope instability. - Include measures to prevent damage to the geocomposite due to the loads imposed by construction and operational plant. - Include measures to prevent damage due to UV exposure of the material before covering. - Include measures to prevent uncontrolled release of LFG. - Follow international specifications such as GRI-GN2 and GRI-GC13 - Standard Guide for “Joining and Attaching Geonets and Drainage Composites. - Follow manufacturers installation guidelines.
Table 19, Growing medium	In the section saying, “Consideration given to”, add: Controlling surface erosion due to the wind, rainfall and surface flows before, during and after vegetation growth.