Riverland Emergency Works

General Design Specification for Levee Bank Remediation

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Status: Endorsed by Riverland levee remediation working group (with representation from SASES, DEW, LGFSG & EFSG)

Government of South Australia

Contents

Introduction

This design requirement specification was developed to support the emergency remediation works of levee banks along the Riverland. This work is required to augment the levee banks along the region in anticipation of of incoming high flows in 2022/23. This work is intended to provide a degree of protection along the river bank and is intended to be fit for this intention. The remediated levee bank shall be a dependable and consistent structure that is suitable for emergency vehicle access. The specifications provided herein are designed to provide temporary protection, and should not be relied upon for permanent protection. There may be variation to the usual Australian Standards and Guidelines for such a structure in consideration of the intended short to medium term design lifespan.

The remediation works shall still be constructed in accordance to the regulatory WHS and all required safety consideration during all stages of pre, post and during construction works.

This specification aligns with SA Water TS0460, and TG0641, both of which are linked below:
TS 0460 – Liners and Floating Covers for EBS
TG 0641 – General Technical Information for Geotechnical Design – Earth Dams

This design requirement specification is intended to be a guideline for the design engineer/consultants undertaking the works to ensure that there is consistency of design approach along the riverland.

1 Site investigation

1.1 Survey works

Site survey works shall be carried out prior to design documentation which includes a survey of the existing topography of the levee bank. This includes obtaining information on the existing batter slope (both water facing and land facing), ground levels surrounding the levee bank, the crest height, crest cross fall, crest width, existing obstruction on and around the levee bank which may include buried assets and infrastructure or trees and vegetation.

In the event that a site survey is not achievable due to time and site conditions, a drone survey shall be conducted to obtain as much information as possible.

This information shall be used as the basis for the design considerations by the design engineer.

2 Material and Compaction

2.1 Foundation Preparation

Prior to placement of material, all vegetation and loose or soft material is to be cleared. In addition to this, the foundation shall be excavated to 200 mm below natural ground level, to enable keying in of levee. Where constructing over an existing gradient, the existing slope shall be benched at 200 mm intervals to enable keying in of material.

Where constructing on soft or saturated ground, and it is infeasible to clear the material, specialist geotechnical advice to be sought

2.2 Material Selection

The imported clay material that is used to repair the levee bank shall be free of silt, organic materials and any other impurities such as (tree roots, grass, construction materials and any other rubbish items) and shall be imported from an appropriate quarry area.

The imported clay material is recommended to be in accordance with Table 1 below from SA Water Specification TG 0641; “General Technical Information for Geotechnical Design – Earth Dams”. Due to the urgent nature of this project, material specification requirements can be assessed and approved onsite to be generally in accordance with the SA Water specification by the Project Superintendent.

Parameter	Test	Acceptance Limit
Permeability	AS 1289.6.7.3	≤ 1 x 10^{-9} m/sec
Grading	AS 1289.3.6.3 AS 1289.3.6.1	≥ 30% passing the 75 µ sieve ≤ 20 % passing the 19 mm sieve
Emerson Class	AS 1289.3.8.1	≥ Class 4 – (non-dispersive)
Atterberg Limits	AS 1289.3.1.2, 3.2.1, 3.3.1, 3.4.1	Low to medium plasticity CLAY
Remoulded Undrained Shear Strength	AS 1289.6.4.1	≥ 75 kN/m^2

Table 1: Performance Requirements for Single Zone Embankment Materials, SAW TG 0641

Note: The permeability and shear strength testing is to be undertaken on remoulded samples at 98% standard maximum dry density

2.3 Compaction Specification

The imported clay material used for the levee reconstruction shall be placed in accordance with the requirements documented in Table 2 below from SA Water Specification TG 0641; "General Technical Information for Geotechnical Design – Earth Dams". All material placements will require Level 1 Supervision in accordance with Australian Standard AS3798. Material shall be placed in 250 mm loose layers.

Table 2:

Property	Acceptable Limits	Note
Maximum Dry Density	98%	Standard Maximum Dry Density, SMDD ratio of 98%. The material should be compacted with a vibrating smooth drum roller or other approved equipment until the required density is achieved.
Optimum Moisture Content	+/- 2% OMC	The optimum moisture content of the material should be the moisture content that is required to achieve the peak dry density when tested in accordance with the method given in AS 1289.5.2.1.
Max Layer Thickness	250 mm	The embankment material should be compacted in uniform horizontal lifts.
Unsuitable materials	hard clay lumps, organic matter, and industrial by-products	Where these materials are encountered, they should be broken down or removed before being transported to the embankment.

Compaction Requirements for Embankment Materials, SAW TG 0641

Site compaction trials shall be undertaken on the proposed embankment material prior to the placement of any embankment material. The purpose of the trial will be to establish the suitability or otherwise of the compaction equipment proposed, the number of passes required and to determine the optimum layer thickness

3 Levee Bank

3.1 Crest

The crest width of the levee bank shall be designd to a minimum of of 4m wide where possible. Where there is a requirement to reduce the resultant footprint, trafficable crests may be reduced to 3 m. Where footprint restrictions require a narrower crest with, specialist geotechnical advice shall be sought, and it shall be demonstrated that the bank will be stable under the required loading. Crest to have a fall of minimum 2% centre cross fall bothways and incorporated into the design documentation. Crest to be capped with 100mm (min) depth of PM1/20QG as top dress in accordance to the compaction specification as above.

3.2 Batter Slope

The batter slope of the levee bank shall be 1 in 3 (min) on both sides (water and land facing). Where this is not viable, the design shall incorporate measures to ensure that the slope will not collapse and in the case of the water facing slope, risk mitigation measures shall be provided in the event that the embankement will be at risk of rapid drawdown failures post flooding. Under no circumstance shall the batter be steeper than 1V:2H gradient.

Levees shall be built out 0.5 m further on either side than the design batter. After construction, the levee banks shall be trimmed to the design batter. This ensures the design slope is achieved, and confirms that the slope batter consists of well compacted material.

3.3 Batter Protection

Rip rap shall be incorporated into the design to ensure that the water facing slopes are protected from erosion. Where this is not viable due to the time constraints of this work, measures shall be planned and scheduled, post flooding to ensure that the slopes are protected.

3.4 Access Ramp

Access ramps shall be constructed to enable access either side of the levee. The ramp shall be constructed to the same specifications as the levee, with a ramp gradient at 1V:5H or flatter.

4 Construction Supervision

It is the responsibility of SA Water to ensure all works are completed satisfactorily and in accordance with the specifications outlined herein to protect SA Water assets. To ensure that the works above are undertaken, a Level 1 supervision engagement shall take place which includes engaging an appropriately qualified geotechnical, dams or construction expert to represent SA Water at the following construction points:

- Observation of final trimmed foundation on which levee will be constructed
- Observation of demonstration that required compaction has been achieved
- Observation that final embankment has achieved design dimensions, including minimum gradient.

Each of these points shall constitute a HOLD POINT, and works shall not continue until the above has been observed to be satisfactory by the SA Water representative.

The business unit responsible for coordinating the works shall be responsible for sourcing an appropriate SA Water representative for these works.

5 Ongoing Requirements

During and post construction, the levee banks shall be regularly inspected and monitored to ensure no significant cracking, slumping or movement occurs. Where any of this is identified, specialist geotechnical advice should be sought immediately.

Throughout the life of the levees, the surfaces shall be regularly maintained to prevent vegetation growth over the levees. Additionally any animal activity should be closely monitored to prevent burrows from being created.

Seepage may occur, depending on the extent of flood waters and quality of embankment and foundation material. In this event, seepage shall be closely monitored to ensure internal erosion is not occurring. To prevent buildup of watyer within leveed area, pumping may be required to drain water from behind levee.

Any damage to the embankment crest caused by surficial erosion or vehicle access shall be backfilled and remediated as soon as possible.

After any rapid reduction in water levels, the levees shall be inspected and monitored in the event of any rapid drawdown causing a slumping failure.

These structures are designed to be temporary. Where regular access is required, or the levees are to be maintained after the flooding event, measures to ensure oncgoing safe access should be considered.