Design considerations – Source: Mallee, 2014

In developing options for the project, the following were considered:

A. Maximising environmental benefit from operation of the proposed works by:

- targeting areas that are difficult to reach with run of River Murray flows
- considering lifting water from areas flooded by works to higher elevations with temporary pumps
- providing the ability to deliver water to high value target areas without requiring large storage releases to generate overbank flow and without relying on removal of system constraints.
- ensuring that works can be used to magnify the effects of natural flows or regulated releases with minimal additional water use and
- designing infrastructure which will be flexible in its use to allow implementation of operational strategies developed through adaptive management of the site.

B. Maximising cost effectiveness, environmental benefits and water efficiency returns for investors through:

- Analysis of existing environmental works in the region and incorporating lessons learned from the construction and operation of these projects.
- Pragmatic analysis of available infrastructure options.
- Striking a balance between capital investment and ongoing operating costs to deliver a cost effective solution.

C. Ensuring practical and economic constructability of the project by:

- Siting structures on existing access tracks and provision of construction access plans.
- Utilisation of locally obtainable construction materials where practical.
- Use of advantageous geological features within the landscape where possible.
- Incorporating information and experience obtained during the construction and operation of nearby works regarding seepage, structure settlement and stability, construction dewatering and downstream erosion control.

D. Ensuring compatibility with nearby existing infrastructure and operational practice by:

- Use of common design features with nearby infrastructure.
- Taking into account operational capabilities of existing infrastructure which is integral to the operation of the proposed works.
- Development of operational access plans.
- Working with G-MW during options selection and development of concept designs.

E. Minimising negative impacts on the environment, cultural heritage and other river users by:

- Striving to maintain natural flow paths and capacities on the floodplain to minimise impact on natural floods.
- Using existing disturbed footprints where possible.
- Minimising site disturbance and the size of the footprint of any new infrastructure that is required.
- Considering the use of multiple cascading structures to mimic hydraulic gradient and avoiding extensive networks of tall levees.

Design criteria used

In addition to the broad considerations above, specific design criteria have been developed to inform the development of concept designs. These criteria have been developed through reference to current literature and best practice guidelines and through targeted workshops. Detailed descriptions

of design rational and criteria are provided in the Appendix E concept design report. A summary of key design criteria is provided below.

Capacity and Flow Conveyance

The structures (including levees) were designed to meet a range of hydraulic criteria. Generally there was no single design flow. Criteria that influenced the structure size and geometry were:

- erosion control (head differential) of the combined system
- capacity to fill the forest
- fish passage and
- erosion control (defined spillways) at the structures.

The arrangement of structures, levees and overflow sills has been designed to minimise the potential for erosion over the whole range of flow conditions. This is consistent with the intent of making the system reasonably transparent to natural overbank flows. This required a tiered approach to hydraulic design for through flow, as follows:

i. Pass low and medium flows through hard structures (regulators) until a tailwater develops.

ii. Pass higher flows through purpose designed overflow sills, with rock protection, located on natural flow paths.

iii. Overtop the earthen levee only after the tail water is fully developed and the levee/track is near submerged by the tail water.

The head differential that is acceptable for a given structure type ranges from high at concrete regulators to low at earthen levees (Jacobs, 2014a).

Fish Passage

A fish passage workshop was held on 16 July 2014 involving key fish ecologists, representatives from design consultancies and constructing authorities. All seven of the proposed supply measures within the Mallee CMA region were considered.

Specific outcomes from the workshop relevant to design of the Nyah works included the following:

i. Engineering designs will incorporate appropriate and practical mechanisms to ensure fish passage to and from the river through regulating structures can occur.

ii. The operation of regulator N2 will allow for passive fish passage. Structure N2 has been designed to allow fish passage when fully opened and also during regulating events.

Gate Design

A gate assessment workshop was held in Tatura on 26 August 2014 and included representatives from G-MW operations and major projects as well as from Jacobs and Mallee CMA. The object of this workshop was to determine appropriate design criteria for each of the regulating structures within the project.

During this workshop the adoption of the dual leaf gate system in use on the existing TLM Hattah Lakes Environmental Regulators was confirmed.

Design of smaller regulators at the site was standardised to use mechanically actuated penstock gates installed on the upstream face of box culvert structures.

Freeboard

The design crest level for each of the structures has been set based upon the maximum design water level (DWL) and a freeboard allowance of up to 0.5m.

Minimum freeboard of 0.3m above DWL has been adopted for levees and allows for a clay core to extend to 0.15m minimum above the DWL plus protective cover.

Defined spillways have been incorporated into levees to direct flow to appropriately protected areas during overtopping events.

Design Life of works

The design life of the concrete and embankment structures within the project is 100 years when appropriately maintained. Mechanical components will have a design life of 25 to 30 years (Jacobs, 2014a).

Water Management Options Assessment and Concept Designs, Source: GHD, 2014

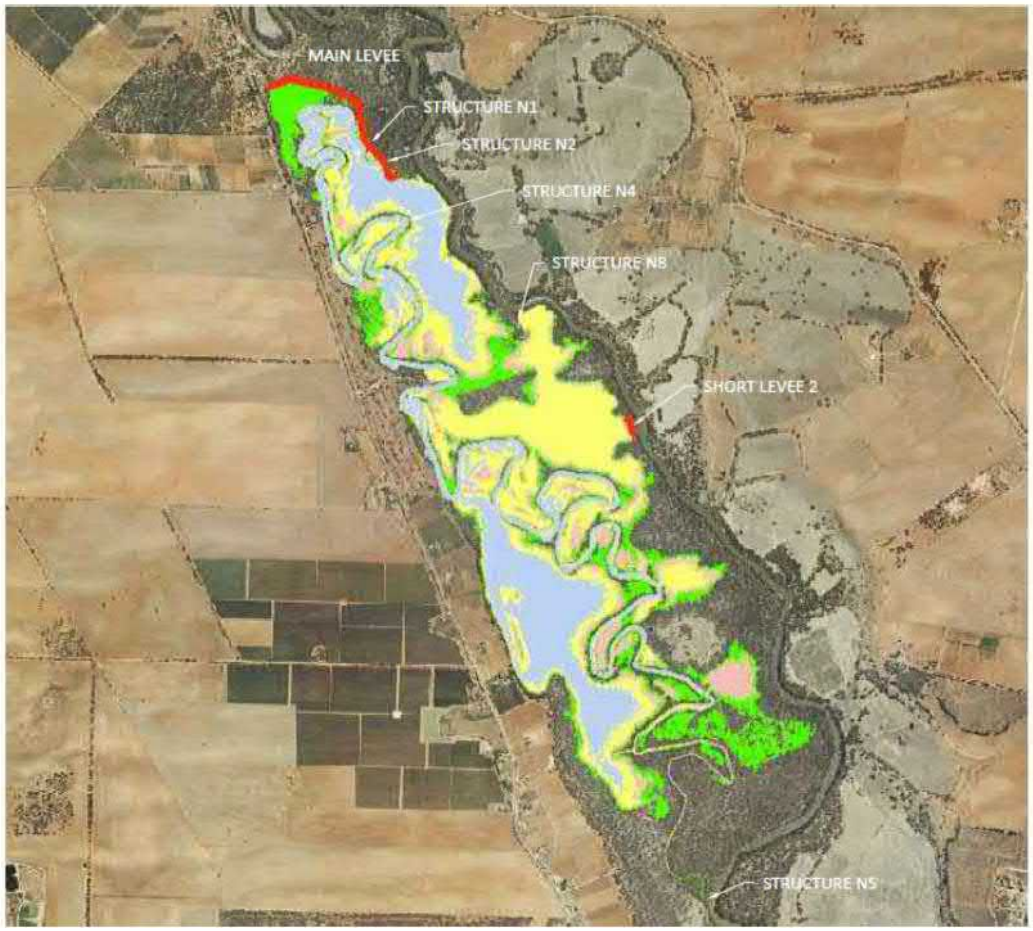

Figure 1 Nyah north extent of flooding – Option 1 (figure sourced from GHD, 2014 and reproduced from Alluvium, 2013)

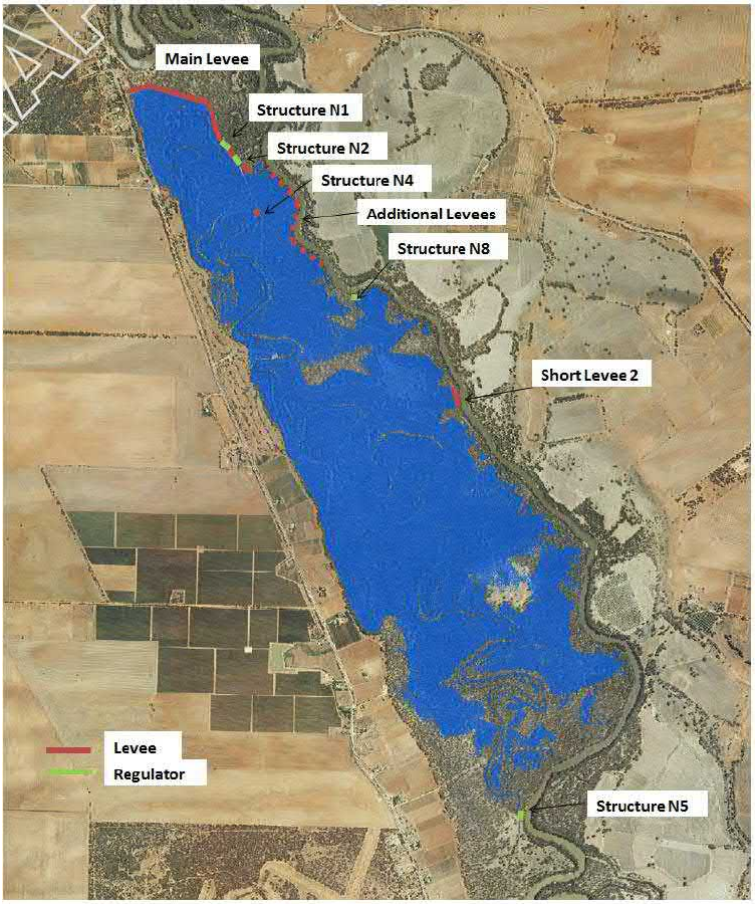

Figure 2 Nyah north extent of flooding – Option 2 (figure sourced from GHD, 2014 and reproduced from Alluvium, 2013)

Figure 3 Nyah north extent of flooding – Option 3 (figure sourced from GHD, 2014 and reproduced from Alluvium, 2013)

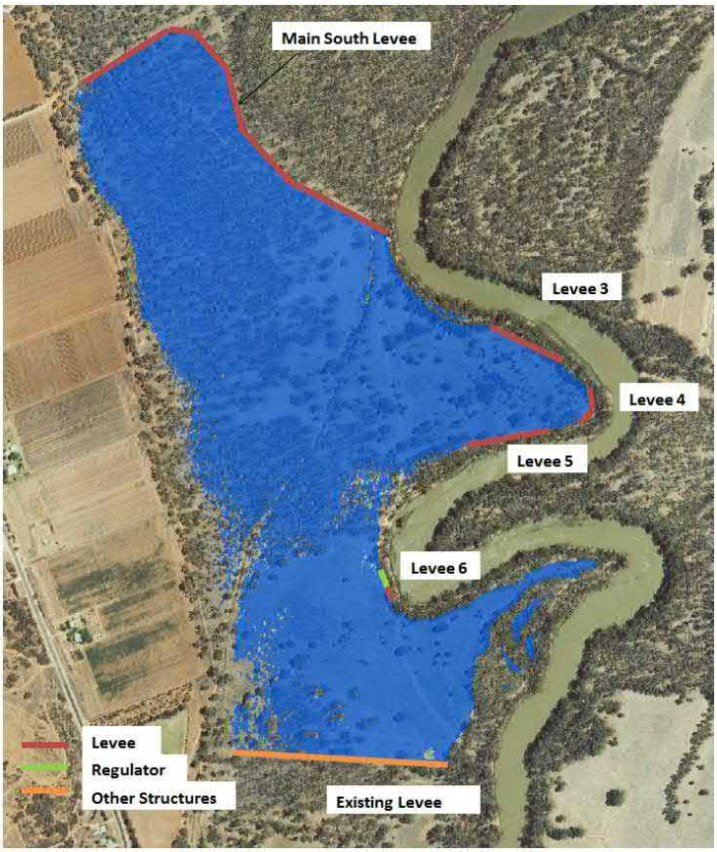

Figure 4 Nyah south extent of flooding – Option 4 (figure sourced from GHD, 2014 and reproduced from Alluvium, 2013)

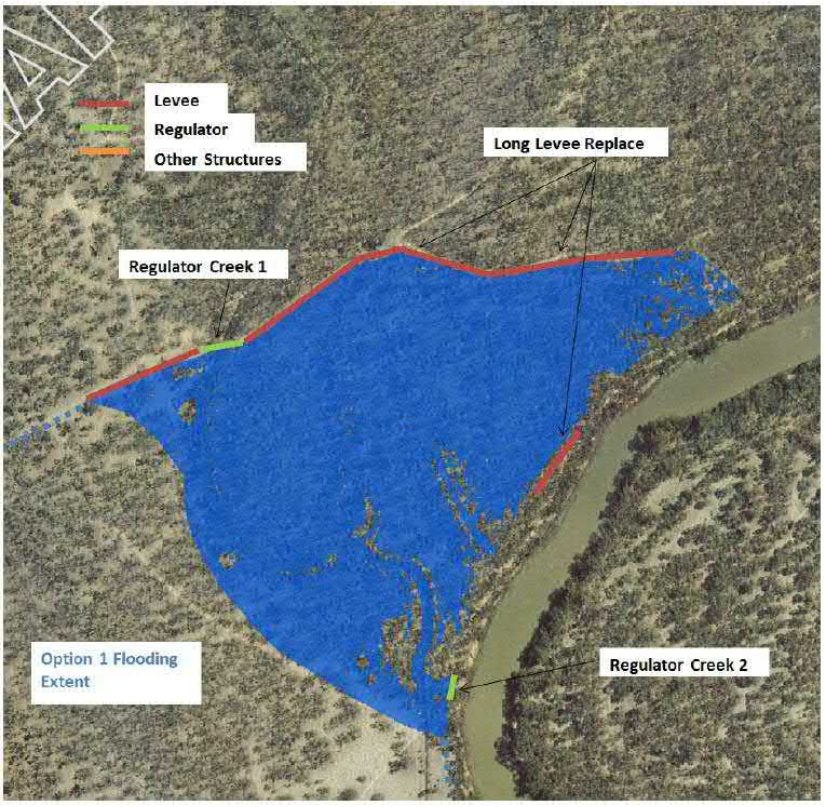

Figure 5 Nyah south extent of flooding – Option 5 (figure sourced from GHD, 2014 and reproduced from Alluvium, 2013)

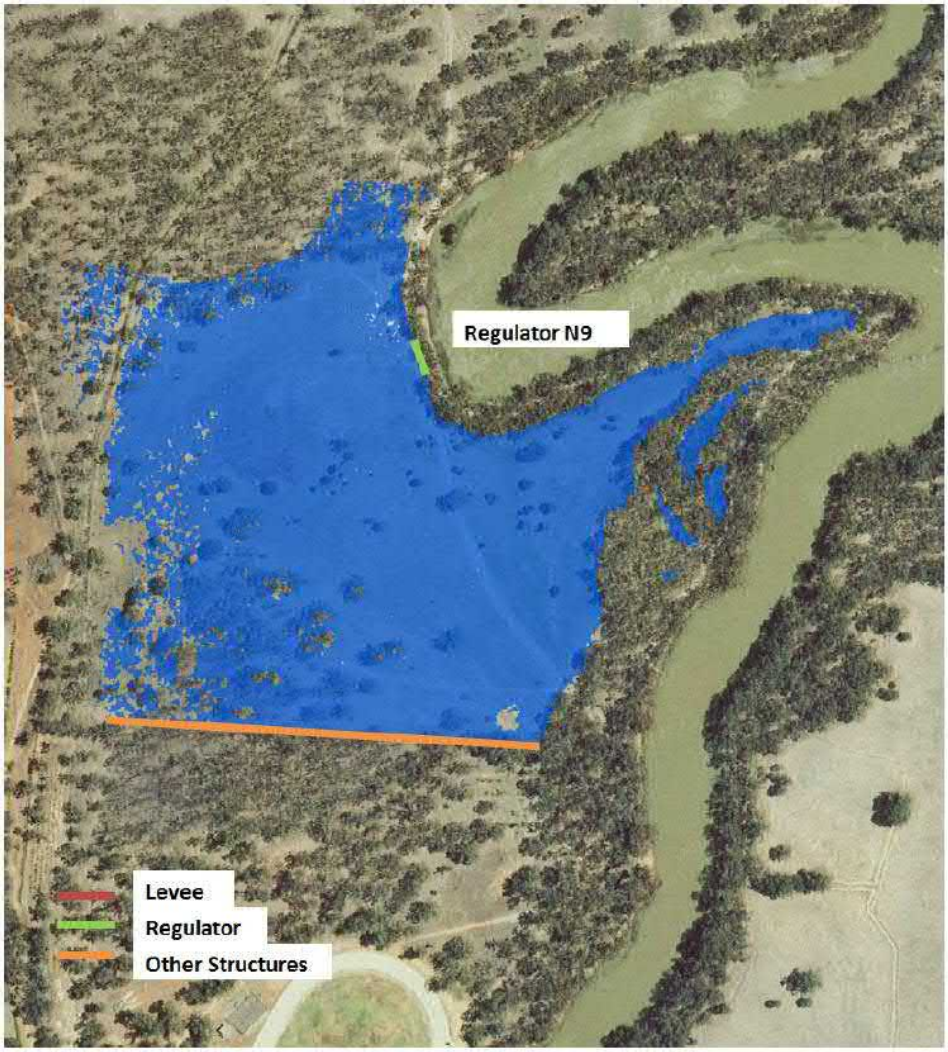

Figure 6 Nyah south extent of flooding – Option 6 (figure sourced from GHD, 2014 and reproduced from Alluvium, 2013)