

NORTH AUSTRALIAN WATER STRATEGIES

ABN 52 007 200 721

Post Office Centre, Mareeba, Queensland

Client: Henson Union Investment Pty. Ltd.

Address: P.O. Box 1358 MAREEBA QLD.

**Project: Further Investigation and Design of an
Earth and Rock-fill Dam at Site #2
"Mutchilba Downs", Mutchilba, Queensland.**

July 2017

Project Description

Preliminary on-site investigations of several dam-sites, including the subject site #2, were conducted on 21st June 2016 for the purpose of confirming the preliminary storage, earthworks and cost estimates. This document up-dates that preliminary information regarding Dam-site #2 and describes the principal elements of the final design of the proposed embankment and ancillary works.

Dam-site #2

The site is located on a westerly-flowing tributary of McLeod Ck., in a broad gully with a deeply-incised channel:- UTM Co-ordinates: 55K309070E, 8112140S

Brief field surveys were plotted and integrated with archival contour mapping that was compiled from aerial photo interpretation in the 1960's by the then Irrigation and Water Supply Commission. The preliminary design, embankment-section drawings, earthworks estimates and storage volume determination have been based upon this topographic information.

The attached drawings, (HEN_004_A3 and HEN_005_A4), depict the proposed embankment design at this site. A general arrangement plan, longitudinal section of the axis-line and a typical cross-section appropriate for a zoned, earth and rock-fill embankment are shown in the drawings. The embankment will be of zoned earth and rock-fill design, with a central core zone comprising compacted medium plasticity clay or sandy clay. The core zone will be located directly above a cut-off trench foundation comprising well-compacted, medium to highly plastic clay or sandy clay. The outer, or batter, zones of the embankment will comprise lesser quality materials such as sandy and gravelly clays and clayey gravel, grading progressively outwards from the core zone to an outer shell of coarse gravelly top-soil and quarry-rock. An embankment height of 13.1metres has been selected, (as measured from the crest of the dam to natural surface at the down-stream batter toe). This results in an embankment length of approximately 237 metres. The embankment will be constructed approximately 5% higher to allow for post-construction settlement. It is estimated that the embankment will contain an estimated 43 500 cubic metres of earth and rock-fill, including the settlement allowance and stripping of topsoil and organic matter to a depth of 0.2 metre. In addition, approximately 900 cubic metres of permeable material will be excavated from beneath the embankment to create the cut-off trench to approximately 1.0 metre nominal depth.

A dual spillway arrangement has been designed to cater for the anticipated storm discharge from the 432 ha catchment. Spillway facilities will comprise the main, southern spillway bench some 42 metres wide at EL 509.10 and the auxiliary northern spillway bench of

18 metres in width at EL 509.40. The northern spillway also incorporates a fish-way inlet, (at EL 509.10), and channel to allow fish passage for the duration of over-flow events.

The topographic information indicates that for a maximum storage depth of 11.0 metres, (at the up-stream toe of the embankment), the impoundment will have a natural storage volume of approximately 477 ML. Excavation of suitable construction materials from within the ponded area will be limited to shallow stripping of clayey sands from the minor alluvial terraces and from rock excavation. As such, it is expected that perhaps only around 20% of the construction material will be sourced from within the ponded area; the majority will be derived from excavation of spillways and from external clay borrow-pits. Therefore only about 9 ML of storage will be gained from excavation of construction material from within the storage area. Thus the total storage volume will be approximately 486 ML. This volume represents 112.5 mm of run-off yield from the contributing catchment area. Based upon estimates of run-off for the last 30 years, it is likely that this volume of annual run-off would have occurred in only about 50% of years.

Cost Estimate

The following earthworks rates have been used to arrive at the estimated cost of construction based upon the current design:

Excavate and place selected, compacted clay fill, (Zones 1 & 2)	\$ 6.50 per m ³
Excavate and place general earth fill, (Zones 3A & 3B)	\$ 4.50 per m ³
Excavate and place rock fill, (Zones 3B & 4)	\$ 8.50 per m ³

Additional costs associated with mobilization and de-mobilization of machinery, site preparation and construction of the fish-way have been included in the estimate. The cost estimate does not include clearing of vegetation from the works area.

Compacted clay fill, (Zones 1 & 2)	11 300 m ³ @ \$ 6.50 per m ³	\$ 73,450
General earth fill, (Zones 3A & 3B)	19 800 m ³ @ \$ 4.50 per m ³	89,100
Rock fill, (Zones 3B & 4)	13 300 m ³ @ \$ 8.50 per m ³	113,050
Mobilization/de-mobilization		2,000
Fish-way construction, (machinery hire & manual labour)		4,500
		\$ 282,100

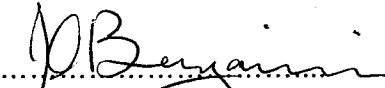
NOTE: This estimate excludes GST

You should be aware that the above is simply an estimate of the likely cost of construction of the dam to an acceptable standard as described in the "Construction Specification for Construction of an Earth and Rock-fill Dam", by NAWS June 2017. It is expected that quotations received from earth-moving contractors will vary considerably depending upon their work-load, level of experience and machinery inventory.

Government Permits & Fees

Development Applications, (D.A.) will be required to be submitted to the Mareeba Shire Council who is the Assessment Manager for the State Assessment and Referral Agency under the Queensland Government's Sustainable Planning Act, 2009. As the DA's will involve clearing native vegetation, water-way barrier and operational works, earthworks, the following application fees will be levied for each project:

- Application fee relating to clearing native vegetation – \$11,686.
- Application fee relating to operational work – 1.5% of the value of the earthworks, i.e. for Dam-site #2 – \$4,230 .


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