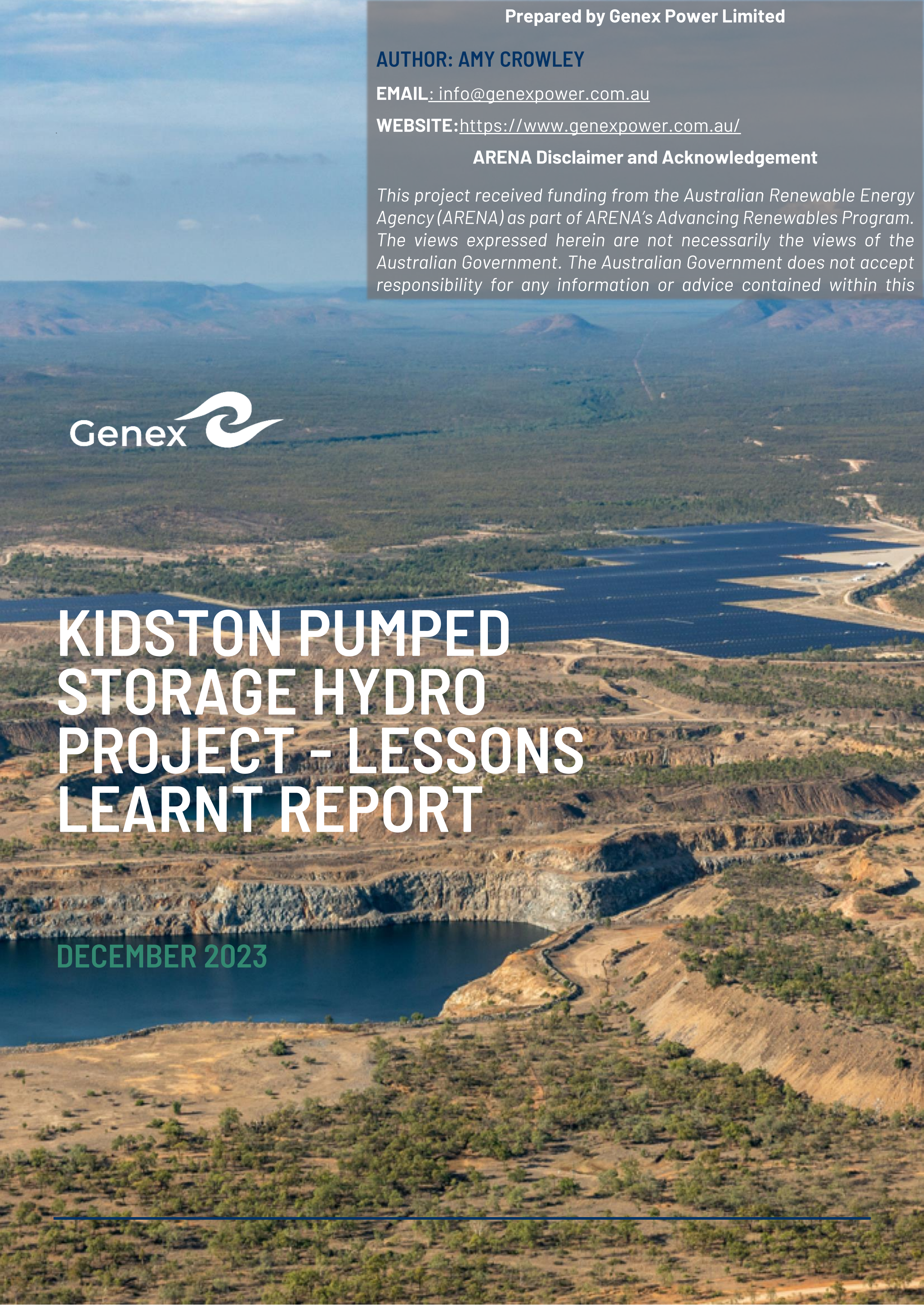

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ARENA Disclaimer and Acknowledgement

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Genex

KIDSTON PUMPED STORAGE HYDRO PROJECT - LESSONS LEARNT REPORT

DECEMBER 2023

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1. EXECUTIVE SUMMARY

Genex Power Limited (**Genex**, **Company** or **Owner**) is the 100% owner of the Kidston Clean Energy Hub, located in North Queensland (the **Kidston Hub**). Stage 1 of the Kidston Hub was completed in the form of the 50MW Stage 1 Kidston Solar Project, which was energised in November 2017. Stage 2 of the Kidston Hub is the 250MW Pumped Storage Hydro Project (**K2-Hydro** or **Project**) which is currently under construction, having reached financial close in May 2021. A further Stage 3 of the Kidston Hub, being a wind project of approximately 258MW which Genex is developing in a 50:50 partnership with Electric Power Development Co. Ltd (trading as **J-POWER**), is currently in feasibility stages along with a potential co-located solar farm of up to 270MW.

This report will serve as a Lessons Learnt Report, discussing issues and learning with respect to the Wises Dam works at the project.

2. DESCRIPTION OF WISES DAM

Wises Dam forms the upper reservoir of K2-Hydro and surrounds the existing Wises Pit. The dam is approximately 6km in length and comprises a rockfill embankment with an upstream high density polyethylene (HDPE) liner, cut-off and reinforced concrete plinth to limit seepage losses through the dam walls. The rockfill embankment utilises both newly constructed free standing embankment and existing waste rock stockpiles that are reshaped to allow the liner placement. During construction, a temporary cofferdam will be constructed to separate the main reservoir with the intake canal, which in turn contains the two intake shafts which link to the powerhouse and convey water from upper reservoir to lower reservoir during generation mode and vice versa in pumping mode. The cofferdam will be decommissioned upon commencement of operations. Wises Dam is not connected to any river and therefore the catchment is limited to the immediate dam surface and surrounding ground profile. Kidston is in an area that is in rainfall deficit, with net evaporation outstripping rainfall inflows. As such, there is a pipeline from the Copperfield Dam (raw water supply dam approximately 15km away) that feeds the local community and will also be utilised to top up Wises Dam under an existing water licence agreement. Refer to Figure 1 through Figure 4 inclusive for general arrangement and details for Wises Dam.

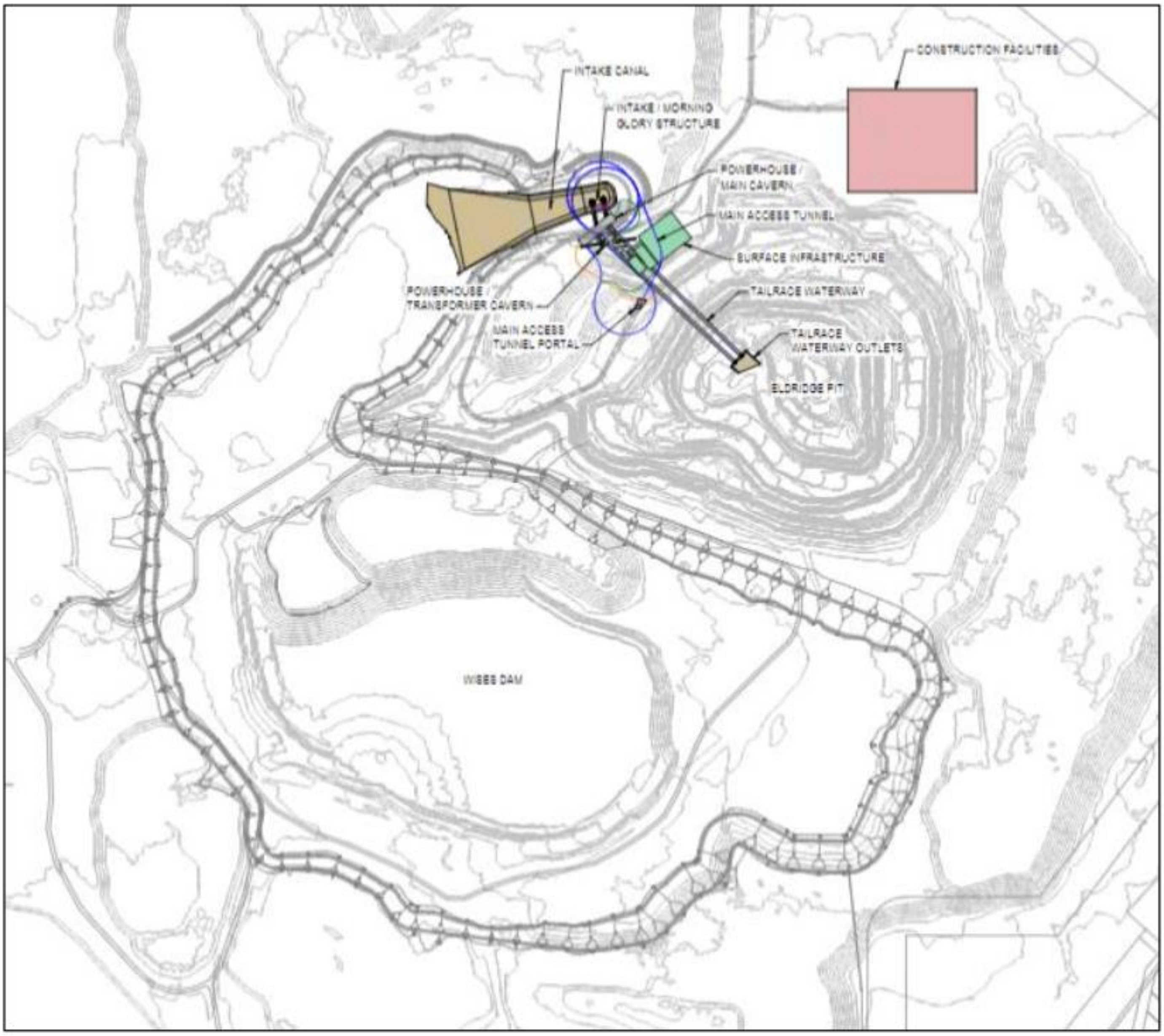

Figure 1: General Arrangement of Wises Dam and Eldridge Pit

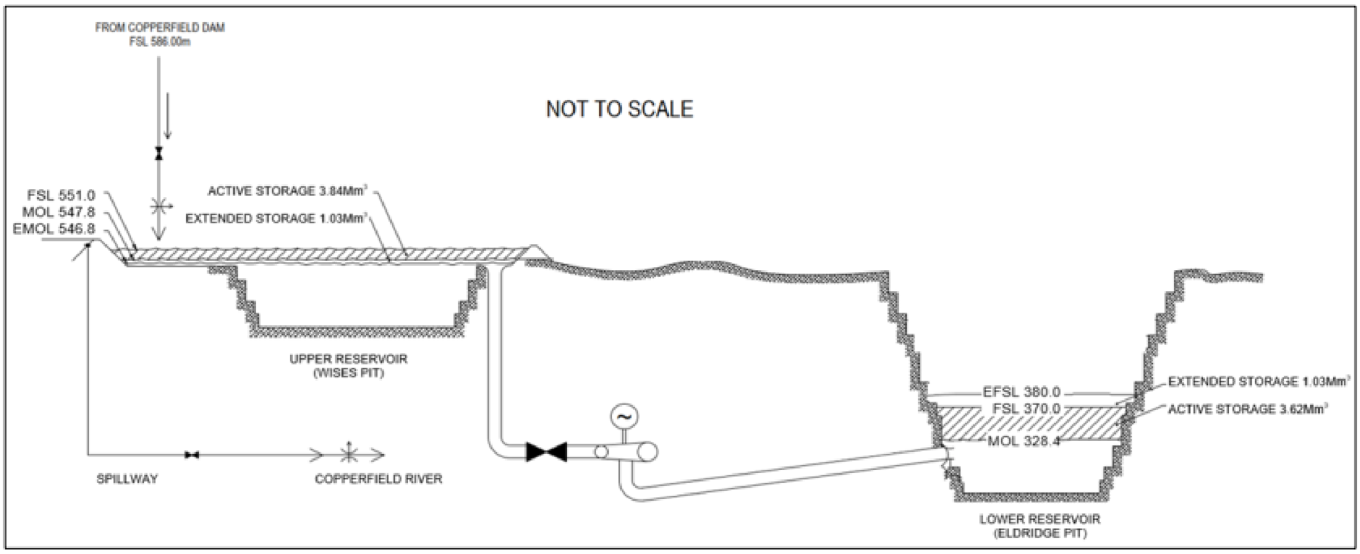

Figure 2: Project Section – Idealised Schematic showing upper and lower reservoir

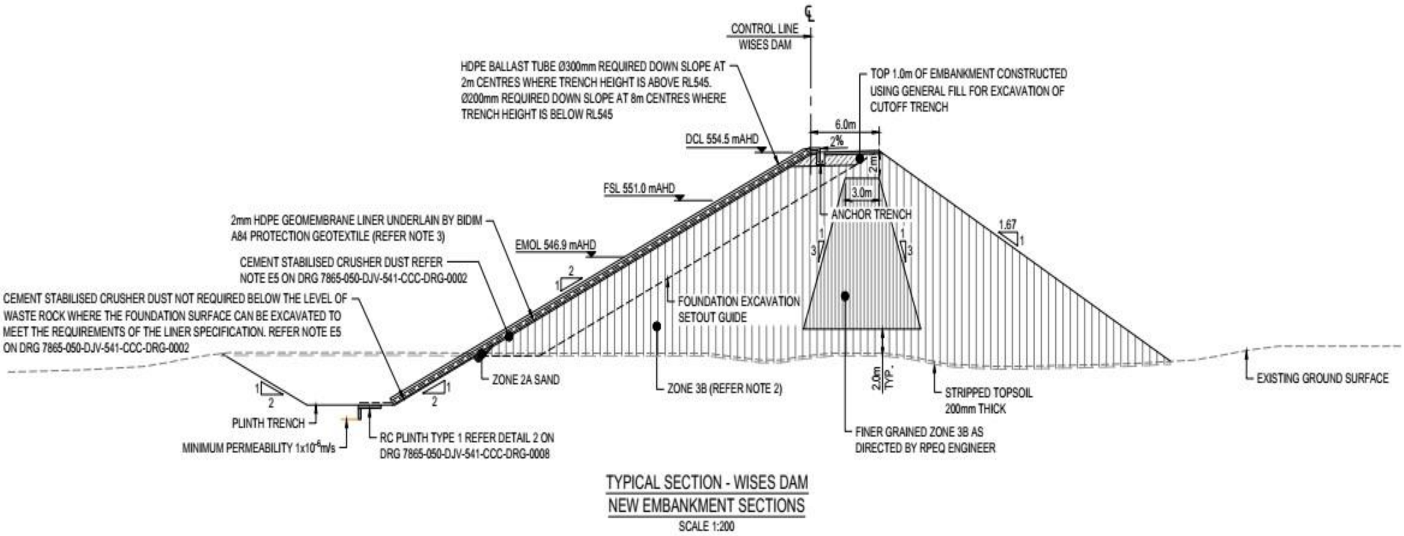

Figure 3: Typical Section of Freestanding Embankment

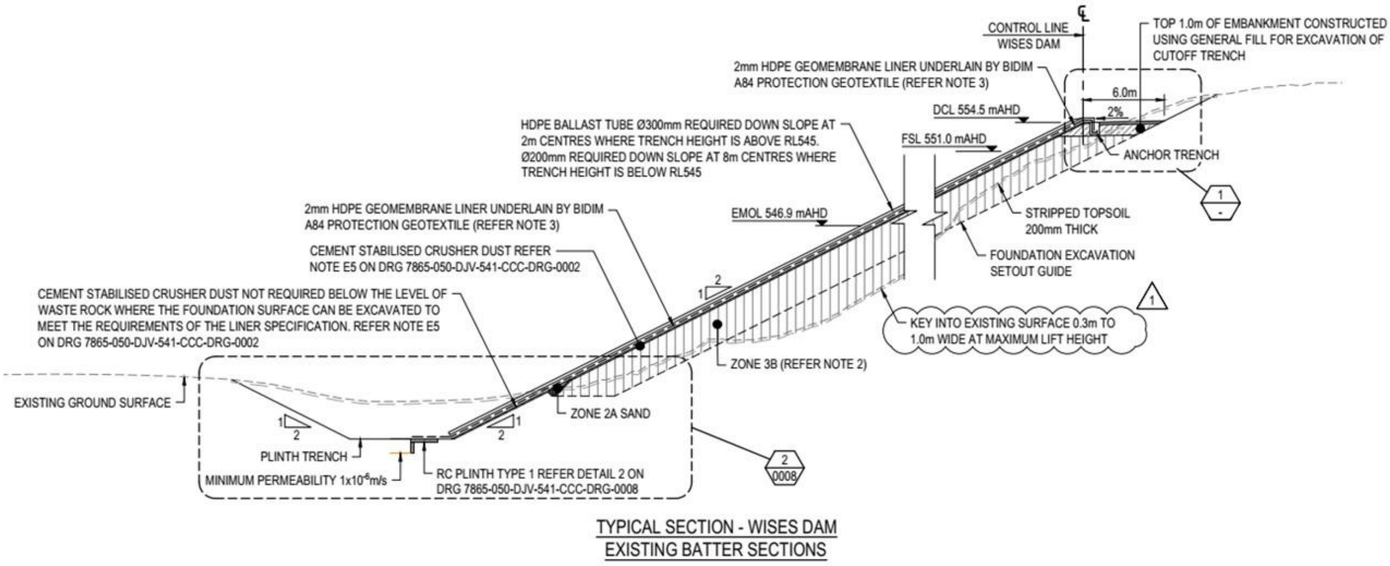

Figure 4: Typical Section of Embankment placed against existing waste rock stockpile

3. KEY CHALLENGES AND LESSONS LEARNED

The following key challenges and lessons learned relate to the construction of Wises Dam.

3.1 Embankment Placement

The main embankment comprises rockfill material sourced from existing mine waste stockpiles. The design is based on the embankment being a compacted free draining embankment material. To ensure settlement of the embankment material was controlled a minimum density of 1950kg/m^3 was specified. In practice, the density achieved was much higher. The grading of the rockfill needed to comply with a grading limit specification to ensure a reasonably well graded material was utilised to ensure compaction requirements were achieved but did not contain too many fines as to reduce the permeability of the material, noting that it was required to be free draining. A trial embankment section (on permanent works) was undertaken to ensure a method specification for compaction was understood based on layer placement height and number of passes of specific machinery and quantity of water added. Increased testing frequency was adopted during the trial embankment section.

Ensuring material and placement compliance is achieved consistently is very much a function of the construction team and machinery operators. In practice, this really means that the operator loading dump trucks with rockfill material has significant control over what types of materials are being loaded at any one time to blend rock types for achieving material compliance. Initially this was very much a learning curve with testing to confirm compliance. To expediate the process and reduce risk, a materials ready reckoner was prepared by the engineering team for the operators to refer to in terms of material compliance expectations. This involved a simple sheet together with photos as to types of suitable rockfill blends. The importance of achieving rock fill material compliance was communicated and workshopped with the construction team and operators so that the whole dam construction team understood its importance. Once implemented, the level of rework for ensuring compliance drastically reduced.

The lessons learned with the embankment placement was the importance of undertaking a trial embankment for the purposes of developing a methods specification for material placement and the implementation of a materials compliance ready reckoner to allow the operators to better determine in the field the material to be selected for utilisation.

3.2 Seepage Pipe

Underneath the dam liner, a seepage pipe is located within the rockfill material to collect any leakage that may find its way underneath the concrete cut-off and plinth. The seepage pipe contains a number of outlets which were engineered to allow the flow rate of any discharge to be monitored and appropriately disposed of.

The installation of the seepage pipe and backfill details were developed in joint consultation between the design and construction teams. Upon initial installation, it was observed that a better, faster and safer way for install could be achieved. This involved modification to the pipe backfill configuration without any lessening of design intent. The ability of the design and construction teams to work together post design enabled this solution to be worked through and ultimately adopted.

The lesson learned relates to the ongoing design and construction interface both during the design and construction phases to ensure methods for constructability improvements ensuring a better, faster and safer outcome is continuously promoted, and if economically viable, then adopted.

3.3 Material Preparation under the Liner

Providing a suitable substrate for the HDPE liner to found on is fundamental for the performance and longevity of the liner.

The original design specified a select fill layer that was to be placed and compacted in layers to the upstream face of the rockfill material. The specification of such a layer is common for HDPE lined structures, though has known constructability issues (if the main embankment is unable to be constructed using similar materials) and risk of rework due to erosion should rain occur and the face is not protected with the liner.

The K2-Hydro project established a crushing and screening plant for production of road base materials and concrete aggregates using the material found in the existing waste stockpiles. As part of the crushing process, a fines by product was produced providing a relatively consistent fines gravel (ie <5mm in size). The percentage of manufactured product to by product waste fines was approximately a 70 to 30 split respectively. As such, considerable quantity of waste fine material was available.

To utilise the by product and reduce construction risk from rework of the original design select fill layer, an alternate cement screed product was developed comprising a combination of cement and waste fine material to produce a low slump cementitious material that could be applied to the upstream dam face. This was an environmentally friendly solution as it used waste material which would otherwise have a limited use for the balance of the works and provided a rain resistant surface.

The installation of the cement screed utilised a combination of two long reach excavators working a tandem, one excavator taking the product from the concrete truck and placing the cement screed on the dam face and roughly spread it to level using a normal mud bucket attachment, whilst the other excavator smoothed out the screed to a final finish utilising a project developed customised screed attachment. With the excavators having a finite reach for placement, the screed was installed in sections as the dam embankment was placed to final level.

Figure 5: Placement of Cement Screed

The lesson learned relates to investigating opportunities for reuse of materials onsite to provide a product that satisfies design requirements / intent and also provides a protective surface to completed works in the event of wet weather. The design / construction interface and out of the box thinking enabled this solution to progress.

3.4 HDPE Liner Placement

The upstream face of the entire dam is lined with a 2mm high density polyethylene (HDPE) liner membrane.

The liner product and installation specification was developed combining the expertise of the design team, manufacturers, and installation experts. This provided for a robust product that satisfied the K2-Hydro's requirement for a 30 year design life.

The placement of the liner systems comprises a geofabric membrane placed underneath the liner to provide cushioning. The trench is secured under a trench backfilled with stabilised backfill on the dam crest and secured at the bottom with a stainless steel fixing and battening system and affixed to the reinforced concrete plinth. Whilst this is a proven anchoring system, care needs to be taken to ensure that the liner is secured at a relatively neutral temperature (prior to being filled with water) to ensure that the expansion and contraction of the liner reminds within certain limits and does not pull away from the fixings.

Individual rolls of HDPE are seam welded together to ensure a continuous liner membrane. Each seam is tested onsite, together with off site testing undertaken on HDPE liner samples that are cut from the HDPE rolls.

The lesson learned for the HDPE liner is the early engagement of subject matter experts to ensure that the liner specification is fit for purpose and ensures the specified 30 year design life.

3.5 Transfer of Water from Eldridge Pit to Wises Dam

Wises Dam will be filled using water existing within Eldridge Pit. This will occur via a one off transfer of water using a bespoke pumping system comprising six 3.3KV x 850kW electric pumps, mounted on a pontoon structure. In total, approximately 28GL of water is required to be pumped. The dewatering pumping station has been designed to provide a flow rate ranging from 1,700 L/s to 1,250 L/s at the lowest RL (when the pumping head is greatest), where the dewatering will allow access to the tail race tunnel portal. This is approximately 200m of water level that will be pumped into Wises Pit over a planned period of approximately 200 days under continuous operation.

The pumping system includes the following:

- Dewatering pumps and motors (x6);
- Pontoon to support the pumps;
- 200mm diameter pipework to manifold that combines to single 700mm diameter pipe allowing discharge to Wises Dam;
- Instrumentation including flow meters at the manifold;
- Electrical supply 22kV/3.3kV including transformer, protection and soft starters;
- Earthing system; and
- Electrical study to confirm 8MVA draw from the Ergon network will not cause instability under fault conditions.

The pumping system was designed, manufactured, installed and commissioned using a panel of international suppliers and experts. Overall the system has functioned well to date. Initial concerns with high bearing temperatures was overcome with the replacement of a larger bearing arrangement. This minor downtime did not impact the overall K2-Hydro program.

The pontoon which houses the pumps and motors is controlled into position utilising three winches which can locate the pontoon within Eldridge Pit. This is fundamental to being able to control the position of the pontoon as the water level drops as the pontoon needs to navigate away from known features in the pit which are remanent haul roads and platforms from mining operations.

Figure 6: Dewatering System

The key lesson learned for the dewatering system related to the integral commitment by all involved to utilise their respective expertise and input into the design, manufacture, install and commissioning phases for a successful outcome.