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Implications for the Tasmanian electricity system of the proposal to restore Lake Pedder

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Overview

The paper analyses the implication for the Tasmanian electricity system of the proposal by the Lake Pedder Restoration Committee (LPRC) to restore the original Lake Pedder. It provides information on the current contribution of the Gordon Scheme to Tasmanian electricity generation and energy storage and provides some information and estimates on alternatives to replace this generation if the original Lake Pedder was restored.

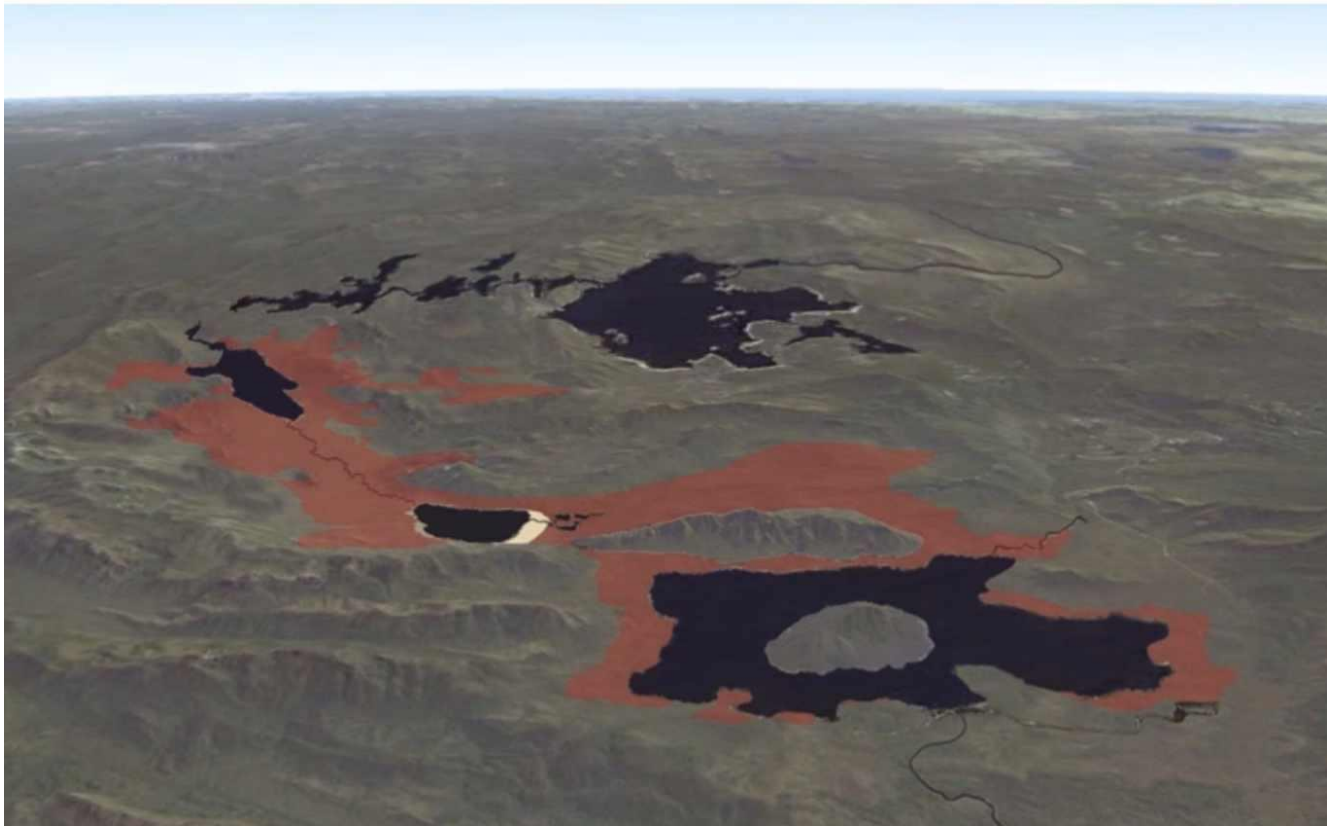
Background

The original Lake Pedder was flooded in 1972 as part of an expansion of the Tasmanian hydro-electric scheme. The flooded area created is still officially known as Lake Pedder although the LPRC prefer the name Huon-Serpentine Impoundment. In this paper we will use the term 'new Lake Pedder'. The new Lake Pedder at 242 sq km is vastly bigger than the original Lake Pedder at 10 sq km.

The new Lake Pedder does not have its own hydro-electric generation. Its purpose is to trap and raise the level of the water that would otherwise flow down the Huon and Serpentine rivers. The water is raised to the level where it flows through a channel created at McPartlan Pass into the Gordon Dam and contributes to the storage and generation of the Gordon Scheme. As a result the level of the new Lake Pedder does not vary more than a few metres. This makes it more visually attractive and more suitable for recreational use than the adjacent Gordon Reservoir. Actively used hydro-electric storages have a devegetated zone as the water level goes up and down.[1]

The impoundment is created by the Serpentine Dam on the Serpentine River, the Scotts Peak Dam on the Huon River and the Edgar Dam. The LPRC originally proposed a 'partial restoration' in which spillways would be added to the Serpentine and Scotts Peak Dams to lower the levels, create two separate lower lakes, uncovering the original Lake Pedder.

[1] see image at https://lakepedder.org/maps/



Partial restoration showing smaller Serpentine and Huon storages with restored Lake Pedder. Red indicates area that would need assistance with revegetation.[2]

The LPRC is now proposing 'full restoration' which has not been spelt out in detail but assumes the removal of the Serpentine and Scotts Peak Dams.

Implications for the electricity system

The Gordon Scheme, of which the new Lake Pedder is a part, is a significant contributor to the overall generation and storage capacity of Tasmania. The Gordon Power Station at 432 MW provides 19% of Tasmania's hydro-electric generation capacity.[3] The Gordon Dam with storage equivalent to 4,700 GWh of energy provides storage equivalent to 32.5% of the nominal total storage capacity of the hydro system.[4]

A thorough analysis of the implications of restoring Lake Pedder would need to address the implications for both energy generation and storage capacity.

In the following sections we provide some order of magnitude alternatives for energy generation. Because only the top few metres of the new Lake Pedder is diverted to Lake Gordon, restoration of Lake Pedder would not significantly reduce the nominal storage capacity of the system. However the reduced water (and hence energy) availability in the Gordon Dam would impact its versatility to act as both generation and storage.

Contribution to Tasmania's electricity generation

In the period 1 July 2018 to 26 June 2019 (ie very nearly a year), the Gordon Power station generated 1,485 GWh of energy, which is 16.1% of total hydro generation for the same period. Hydro Tasmania have previously stated that water from Lake Pedder contributes 42% of the energy produced by the Gordon Power Station. On this basis Lake Pedder contributed 624 GWh of energy. This is 6.7% of hydro generation in this period. 624 GWh is 5.7% of total Tasmanian electricity demand for 2017-2018 which was 10,909 GWh.

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[2] Still taken from 6:10 in https://www.youtube.com/watch?v=Q9wiGkaTOtQ

[3] derived from https://en.wikipedia.org/wiki/List_of_power_stations_in_Tasmania#Hydroelectric

[4] derived from https://www.hydro.com.au/water/EnergyInStorageHistoricalXls/ as at 1 Jul 2019.

Alternative ways of generating energy from the Huon and Serpentine catchments

The summary presented by the HEC to Parliament at the time did not canvass in detail any alternative to the proposed scheme but did mention two other possible schemes in the area, an “Upper Gordon Scheme” of 25 MW and an “Olga Scheme” on the Lower Gordon River (HEC 1967, p19-20).

The partial restoration proposal from LPRC suggested two possible ways of generating energy from the water in a reduced size Serpentine Dam. Both of these involved pumping water from the Serpentine Dam up to Lake Gordon. Because of the drop from Lake Gordon to the Gordon Power Station, more energy would be generated from this water than was required to pump it up to Lake Gordon.

An alternative which does not appear to have been investigated is to put generators below the Serpentine and Scotts Peak Dams. Because of the much reduced storage capacity these would probably have to be operated largely as ‘run of river’ schemes. They would capture energy from the water that was no longer diverted to Lake Gordon, but they would not provide significant energy storage. Feasibility studies for these alternatives would need to investigate how much energy could be generated and what new transmission lines would be required.

Alternative sources of energy generation

If full or partial restoration of Lake Pedder proceeded, there is no particular reason why replacement generation would be located in the same area.

Tasmania currently generates less electricity from renewable sources than it uses and is dependent on the gas-fire Tamar Valley Power Station and imports on Basslink to make up the difference.

We are currently working on a paper to explore the options for Tasmania to become over 100% self-sufficient in renewable energy and to be a net exporter on Basslink without requiring the construction of additional interconnection (as proposed in TasNetworks’ Project Marinus and the Hydro Tasmania Battery of the Nation proposal.

For the sake of this paper we have assumed that at least the energy equivalent lost from restoration of Lake Pedder would need to be generated by other means. Future renewable energy generation projects in Tasmania are likely to rely on wind and solar. This assumption is based on the need for diversity of supply, the likely economics and likely controversy about any future large scale hydro developments.

The Cattle Hill wind farm currently under construction consists of 48 turbines totalling 148.5 MW. Assuming a capacity factor of 35% this would generate 455 GWh of electricity a year. So it would take approximately 66 turbines of this size to replace the energy generated by water from Lake Pedder.

To replace the 624 GWh/year contribution from the new Lake Pedder with solar PV would require about 500 MW of new solar. This is about six times Tasmania’s currently installed small scale solar, or the equivalent of 40 of the proposed 12.5 MW Wesley Vale Solar Farm.

References

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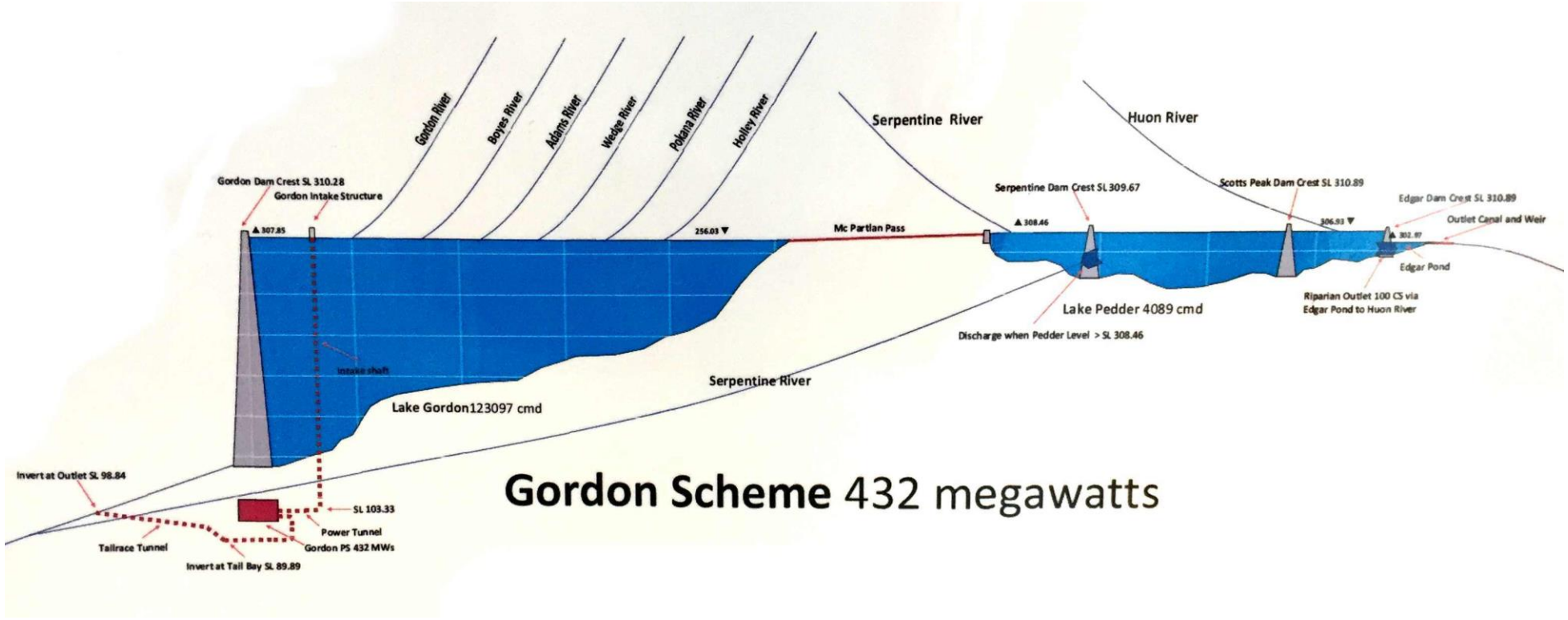

The Gordon Scheme, extracted from wall chart “Hydro Schemes of Tasmania” produced by Hydro Tasmania.

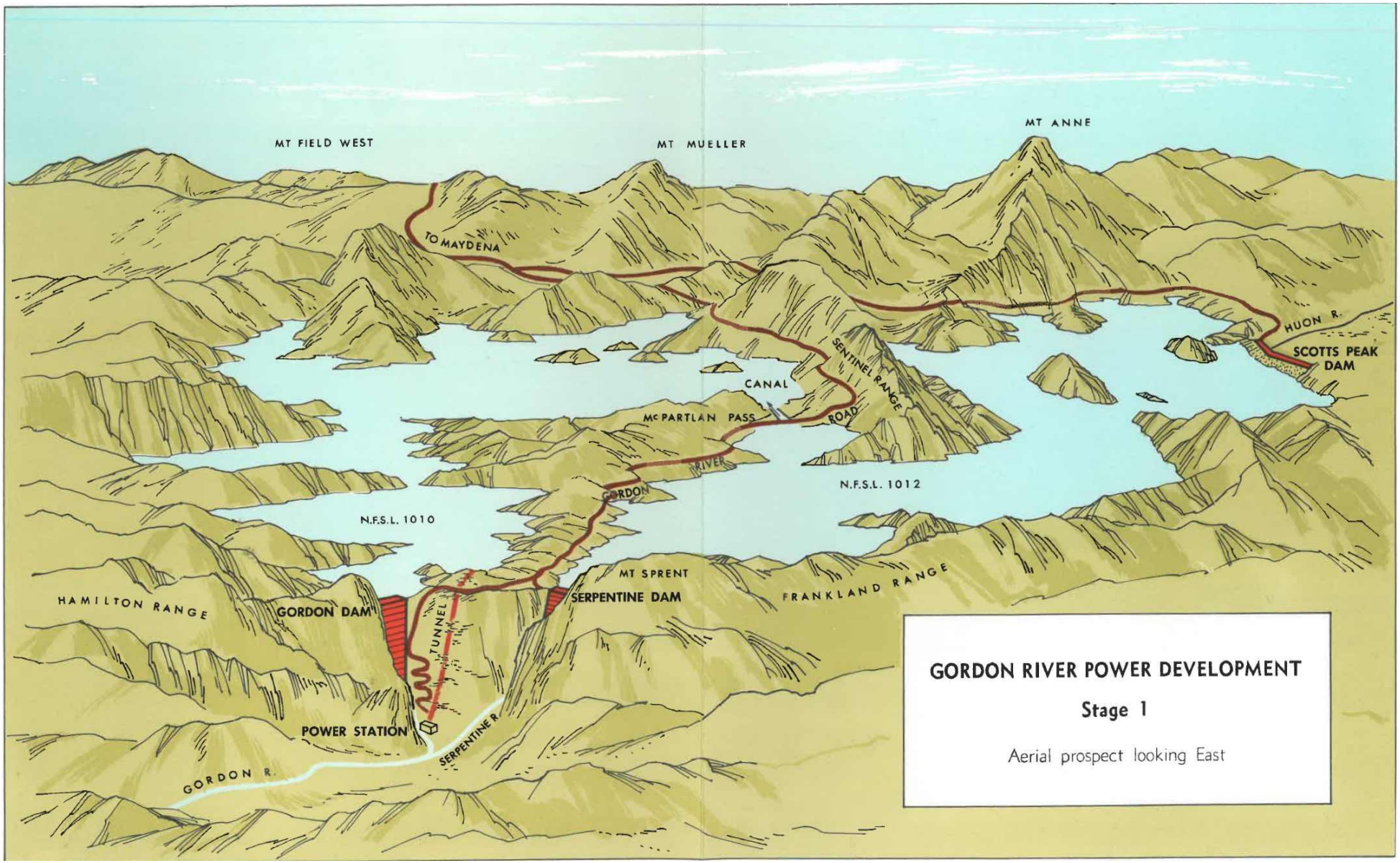

Illustration appended to HEC 1967