SDP Capital Works
Project Summary

Project Title / Asset	Drinking Water Pumping Station - Electrical Cooling
Project Driver	Reliability / Durability

Purpose

The purpose of this document is to provide a high-level overview for major projects, further detailed information is available on request. Major projects have been defined as any capital expenditure that includes the addition of new assets to the Sydney Desalination Plant (Plant).

Information/justification on other elements of the proposed capex program (e.g. refurbishments and replacements of existing assets) are available on request.

Project Background

The Drinking Water Pump Station (DWPS) was constructed by an Alliance between Sydney Water Corporation and other private sector constructors/designers and was designed to different standards and to a lower availability than the balance of the Plant. The lack of air conditioning inherent in the original design and construction of the DWPS electrical building can lead to an excessively hot environment for electrical assets, particularly in the summer months. This has contributed to historical failures of the DWPS primarily via one or both of the drinking water pump variable speed drives (VSDs) overheating, which in turn can limit or stop transfer of water to customers.

The option to improve the building and ventilation was considered in 2019 but put on hold as the costs had not been identified in the regulatory period (RP2) capital forecast and the Expansion planning, in progress at the time, presented uncertainty in that the building may change appreciably as a result of the Expansion.

As a result, since the Plant returning to operation in 2019, temporary air conditioning was installed during the summer periods and modifications made to the VSD exhaust ductwork to reduce the risk of an outage and allow the Plant to meet its Emergency Response and water supply requirements.

Along with the overheating issues experienced, due to design and construction of the shed like building, salt laden air can enter the building, coat the electrical equipment and contribute to reduced life of the assets.

Asset Details

Asset	DWPS Electrical Building and Ventilation.
Asset durability/ design intent/ asset management Strategy	Buildings structures: 50 years Mechanical & electrical assets: 25 years Preventative maintenance will be required on the new assets, consistent with the current/existing maintenance schedules and original equipment manufacturer (OEM) recommendations.
Asset Function/ Subsystem/ System	BLD02 – Electrical/VSD Room is mechanically ventilated with 100% outside air to cool two high voltage contactor panels, two VSDs and two power

	transformers as well as cooling solar loads on the building. The DWPS design parameters were based on external ambient conditions of 35.0°C Dry Bulb (DB) and 24.0°C Wet Bulb (WB). Historical data shows temperatures in excess of this. BLD03 – Fan Room has three 11kW fans and acoustic louvre with filters to provide the ventilation for BLD02. Two of these fans run at all times regardless of whether or not the VSDs are operating. The standby fan does not automatically start in the event of failure of one fan. The fan selector switch must be manually turned to select two operational fans in this event. The VSD Room ventilation fans have three modes of control, "Run" "Off" and "Auto". There are no start/stop buttons for these fans. As soon as the fan is selected to "Run" the fan will operate. Two of the fans will operate if all are available and selected to "Auto". The fans which run in this mode are selected by the fan selector switch at the main low voltage (LV) board which allows two of the three fans to operate.
Asset Failure and its consequence	Failure of the ventilation system could lead to high temperatures in the VSD Room and subsequently overheating of the equipment (VSDs & transformers). Overheating of the equipment results in a controlled shutdown (software protection setting) and loss of the drinking water pumping station, thus loss of Plant production.

Justification

The equipment located inside the VSD Room building should remain under a maximum temperature of 40 degree Celsius. A high temperature alarm is generated at 41 degrees Celsius and the equipment shuts down under its protection settings. It should be noted that these protection settings have been increased to the maximum allowable through consultation and advice from the equipment supplier to prevent frequent 'trips' during summer.

On numerous summer days, the temperature inside the building can near 50 degrees Celsius, which impacts on the equipment life span and operability.

Once the equipment trips on over temperature, it typically takes between 1 to 2 hours before the unit cools down enough to enable operation. This involves opening the roller door to assist with the air displacement but exposes the equipment to unfiltered outside air. This disruption can result in the equivalent of 11 to 22ML of reduction in water production. In an extended outage, it would be necessary to reduce production of desalinated water through the Plant as on-site storage may be exceeded. This leads to additional risk in restarting process units and increasing production back to original capacity, and may lead to further reductions in daily capacity. It is important to note also that customer water demand is typically higher during periods of high temperature when equipment trips would be more common.

Temporary air-conditioning has been used for the 2019/20 and 2020/21 summer periods with great success, however there is a need to provide a permanent solution to ensure the electrical equipment remains in a suitable operating environment. Each year the temporary solution costs SDP

approximately [redacted] in Opex (which was not proposed in SDP's 2017 Regulatory Submission and has not been proposed in SDP's 2023-2027 Regulatory Submission on the basis of this project being delivered). In SDP's 2021 insurance audit, it was identified that the temporary installation requires improvements to ensure the appropriate fire ratings are maintained. This will increase the temporary air-conditioning costs in future. Additionally, the equipment must be installed on a roadway which blocks access and egress around the DWPS area. It is not appropriate for a facility of this complexity to continue with temporary solutions over the long term, particularly as climate risks are expected to intensify.

In 2021/22, modification to the VSDs and associated air flow equipment were implemented to improve heat removal from the VSDs by increasing the air flow through the VSD units and preventing reverse air flow through the building. The modifications have been successful, however as observed by the Bureau of Meteorology "summer 2020–21 was much cooler than recent summers".

A permanent solution is required to allow the Plant to remain readily available to respond to Sydney Water's production requests and to ensure the installation complies with the required building standards, protects the equipment from overheating and ensures the durability can be achieved.

Options Considered

SDP considered the ongoing cost of temporary air-conditioning versus a permanent solution with a design life of 25yrs. Based on an estimated [redacted] for temporary air-conditioning the return on investment could be realised within 17 to 19 years not including the labour costs of ongoing management of the temporary air-conditioning solution. As such it was considered prudent to proceed with optioneering for a permanent solution.

EPES Consulting Engineers were engaged to investigate options and propose a concept design for a permanent solution to cool the DWPS electrical building.

The following options were considered:

1) Building Sealing & insulation:
   a) Expanding foam sealing of building eaves + min. R1.5 wall-blanket insulation installed
   b) Cool Room Panel (min. R1.5)

2) Air Conditioning Technology:
   a) Direct Expansion (DX)
   b) Air-Cooled Chilled Water
   c) Water-Cooled Chilled Water

Full details are available on request in the EPES Technical Memo, DWPS Electrical Building – Air Conditioning Upgrade, Design Report.

Proposed Scope

The proposed solution addresses the extremes in the ambient temperature, humidity and air salt content that can be expected in the Plant environment. The objectives, assumptions, detailed solution, design calculations and tendering documentation are available on request.

In summary the solution will be achieved though the implementation of options 1b and 2a, as per below:

- Sealing and insulating the building with cool room panelling (min R1.5).
- False ceiling with same cool room panelling and extraction vents positioned directly above the VSDs heat exhaust.
- Indoor and outdoor packaged Direct Expansion (DX) air conditioning units with the air volume ducted into the space.
- 3 x 100kW arrangement (2 duty + 1 standby) to provide N+1 redundancy.
- external steel structures designed to suit the wind load and support the ductwork.
- concrete raft slab foundation located immediately to the west of the building to support external steel structures and equipment.

Cost Estimate

The estimated budget price for the works is [redacted]. The estimate was prepared by the Operator in consultation with the design consultant using first principles. The estimated key costs (installed & commissioned) include:

- Air Conditioning Units [redacted]
- Site Establishment, Preliminaries, Builders Margin, etc. [redacted]
- Ductwork [redacted]
- Steelwork [redacted]
- Concrete / excavation works - [redacted]
- Foundation works - [redacted]
- Insulated Panels - [redacted]
- Electrical - [redacted]
- SCADA - [redacted]
- Geotechnical review & design - [redacted]
- Management - [redacted]

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Proposed Layout