Report

Chiller Relocation Feasibility

CITY OF MELVILLE, CIVIC CENTRE - EXISTING CHILLER REPORT
City of Melville

CONFIDENTIAL

Revision: 2.0 - FINAL
Issued: 14 October 2020

Norman Disney & Young
A TETRA TECH COMPANY

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1 EXECUTIVE SUMMARY

1.1 Purpose

This report has been produced following Norman Disney & Young's proposal of 2nd September 2020.

The purpose of this report is to evaluate the options available to relocate the chillers in the existing external enclosure located to the north east of the Civic Centre buildings. The building will need to remain operational during the relocation works and guidance is required on the likely costs of the relocation.

1.2 Authority

Authority to undertake this report was provided by Mario Murphy of City of Melville on 2nd September 2020.

1.3 Major Recommendations

While a number of optional locations were considered for relocation of the chillers the option considered the most cost effective and least disruptive is to reposition the chillers into a new compound immediately north of the civic centre building – approximately 10 – 15 metres west of their present location.

This solution assumes the existing chillers are still in reasonable condition after relocation. Costs in the order of $745,000 excluding GST are expected to achieve this relocation. If the relocation was to occur further into the future when existing equipment has very little future life then another option of installing water cooled chillers also becomes feasible at an increased cost of approximately $1,007,000 excluding GST.

The proposals involving the relocation of the existing chillers assumes the work is undertaken in Winter when the demand for chilled water is lower and the works can be staged to avoid significant disruption to the building operation.

2 BACKGROUND

The City of Melville owns and operates the City's Civic Centre facilities on Almondbury Road in Booragoon. The building contains air conditioned civic spaces as well as administrative offices over 4 levels.

The southern section of the Civic Centre building was constructed in 1968 and the northern section of the building was constructed in 1999. The entire building is serviced by a chilled water based air conditioning system. The existing chiller enclosure is situated at ground level to the north east of the Civic Centre and houses 2 TRANE chillers with associated pumps, ducting and electrical infrastructure. Chilled water is reticulated underground from the enclosure to two different locations – one running under the northern part of the building rising to serve air handling plant in the lower ground plant room and a second running around the eastern boundary of the building before rising inside the building to serve air handling equipment in the level 2 plant room.

The City has received proposals to extend the neighbouring Westfield Booragoon Shopping Centre. The proposals require the demolition and re-siting of the existing chiller compound. To support evaluation of these proposals this report considers the options available for relocating the chillers and provides high-level cost estimates and works methodology to replace and re-site the affected chiller equipment.

2.1 Information Sources

1. Site inspection carried out with Mario Murphy on 11th September 2020
2. Drawings of existing chiller installation – Dalkia Energy Solutions drawings 4238-101 and 102 dated 2012
3. Building Sections - Hames Sharley drawing 9837 A503 dated 1996
4. Trane Technical Brochure for R series Air Cooled Liquid Chillers

2.2 Revision History

	Date Issued	Comment
1.0	7th October 2020	Draft
2.0	14th October 2020	Final

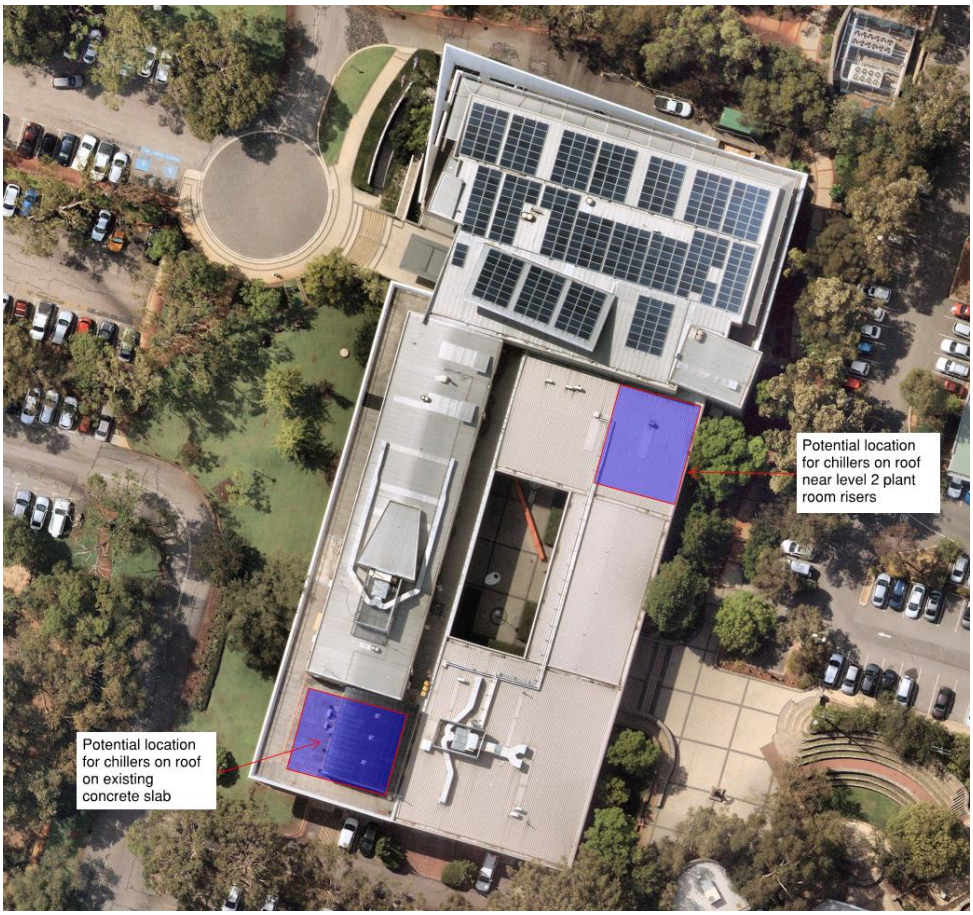
3 OPTIONS AND CONSIDERATIONS

The following options have been considered to allow the City to remove the chillers from the existing external enclosure location along the site's eastern boundary. All these options must allow the building to continue in operation on the understanding that the chillers are often required all year round, but acknowledging the load in winter is significantly less and that the building could operate during this period on just a single chiller.

We have also noted during our inspection that the existing chillers still appear to be in reasonable condition and have a future life in the range 8 -13 years. The larger chiller (Trane RTAC 170 HE – 537 kW) was replaced in 2012 and the smaller machine (Trane RTAB 212 HE - 385 kW) is older but still appears to be in reasonable condition. As a consequence there is a good financial reason to retain these chillers in operation for that time span. It should be noted however that there is a small risk that upon relocation the chillers may be damaged in which case delays may be experienced while repairs are undertaken.

3.1 Roof Location

We have considered the implications of relocating the existing chillers to the roof of the building. The only section of roof that appears to have concrete slab under it and hence capable of supporting the required weight and providing the necessary acoustic isolation is at the south western corner of the building. This location is however remote from the majority of the plant it serves. Another roof location that may be feasible is the north eastern section of the old southern building, as this location it closer to the existing chilled water riser and does not have PV solar cells on it. These locations are shown below.



The location in the south west corner would be in the area where the existing level 2 bar and staff break out area is and so if this area was used then its use as an outdoor space by staff would no longer be available. A

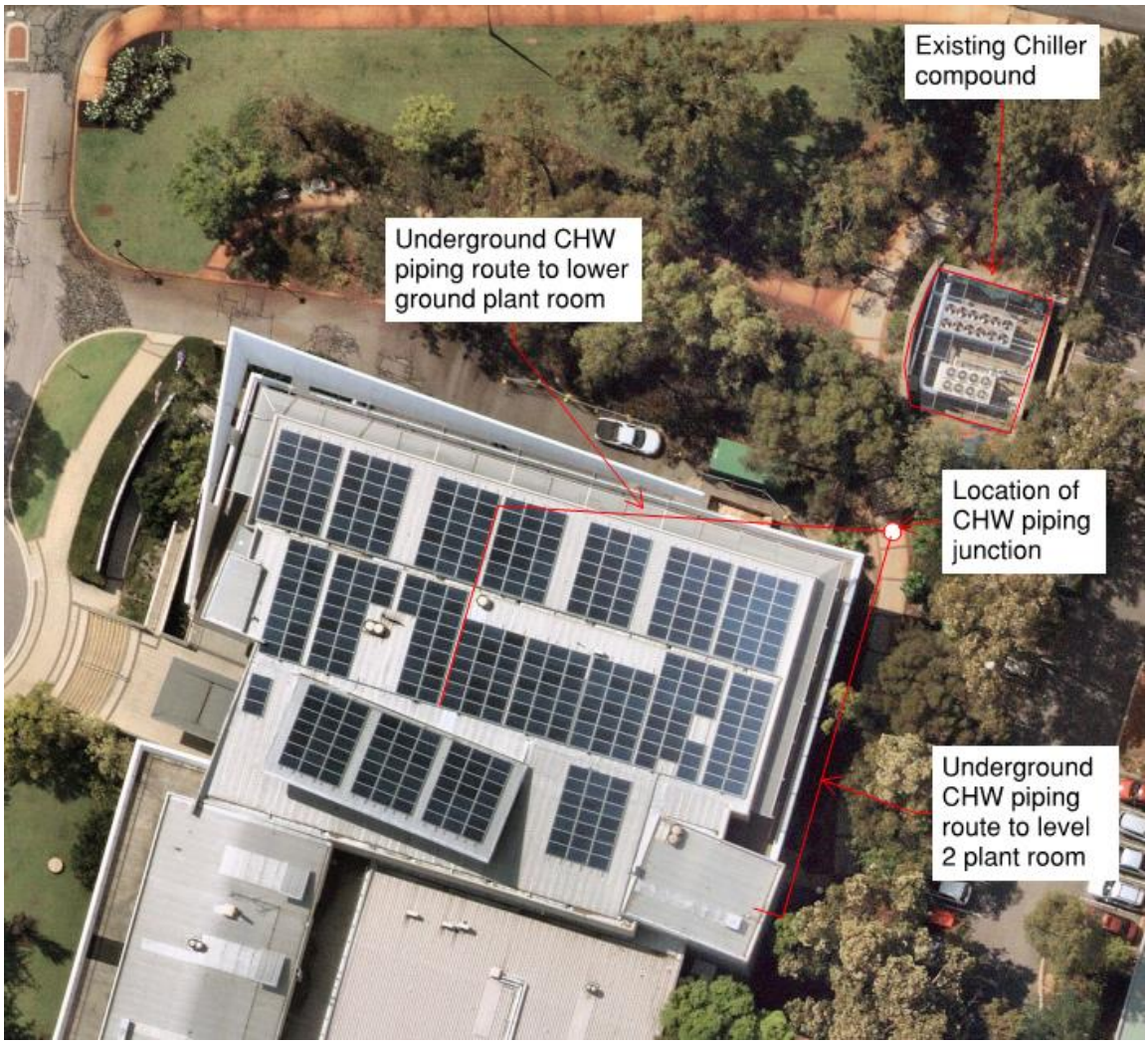
reasonably long run of new chilled water pipework would also be required to be run over the roof to the level 2 plant room.

The location in the north east corner of the old building would require significant structural modification to create a platform of sufficient strength to support the chillers (estimated total weight of 10 tonne) and considerable acoustic treatment would be required to the roof. New chilled water risers would then need to drop to the lower ground plant room for both these roof top options – the existing risers are not adequately sized. There would also be significant disruption within the building to accommodate the redirecting of the chilled water from the new roof top locations.

We believe these obstacles make a roof top relocation uneconomical given the extent of disruption and work required to redirect power supplies and chilled water piping to a roof top location.

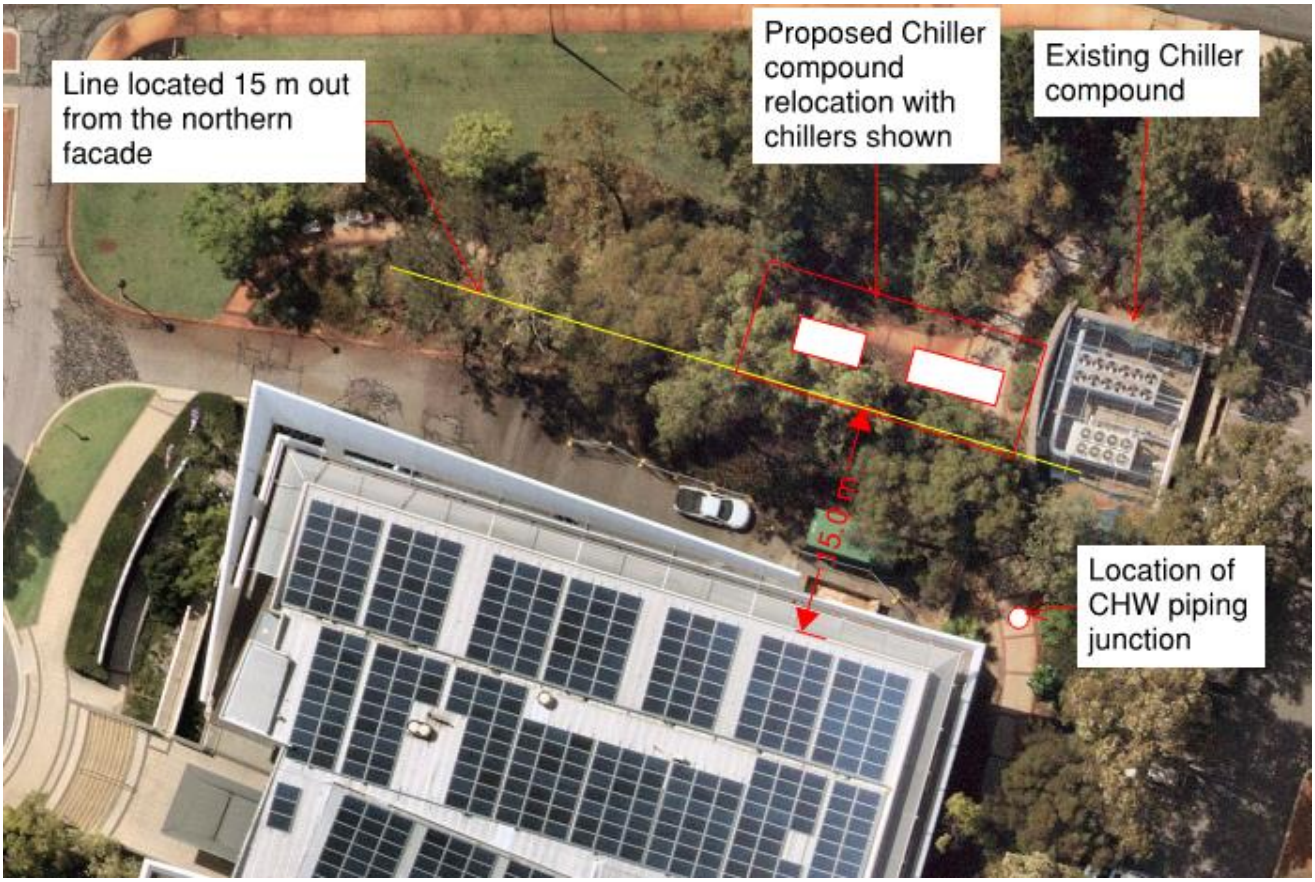
3.2 Revised Location at Ground level

Given that the existing chillers reticulate chilled water out to the building via two sets of risers from the north eastern corner of the site the most economical options for chiller relocation is to reposition the chillers to a location close to where the existing chilled water piping enters the ground and then the piping reticulation splits to serve the two riser locations. The aerial photograph below shows these locations.

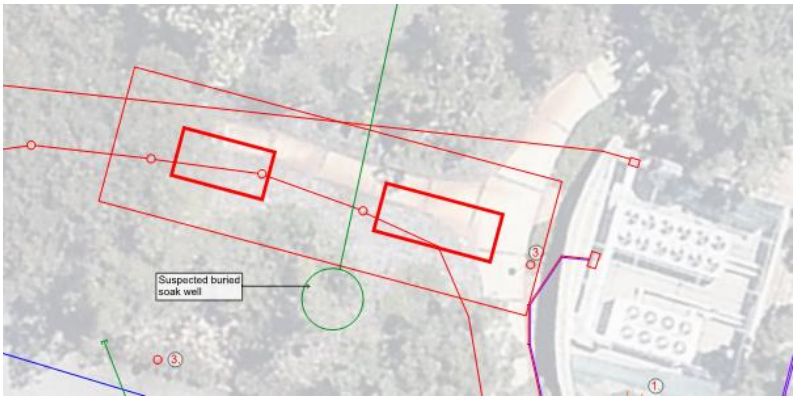


In selecting a location for the chillers consideration needs to be given to the acoustic implications of relocation closer to the building as the noise produced by air cooled chillers is significant and will need to be controlled in most situations. We are also conscious that the chillers should not be relocated any closer to the residential areas north of Almondbury Road to avoid the potential for noise complaints from the occupants.

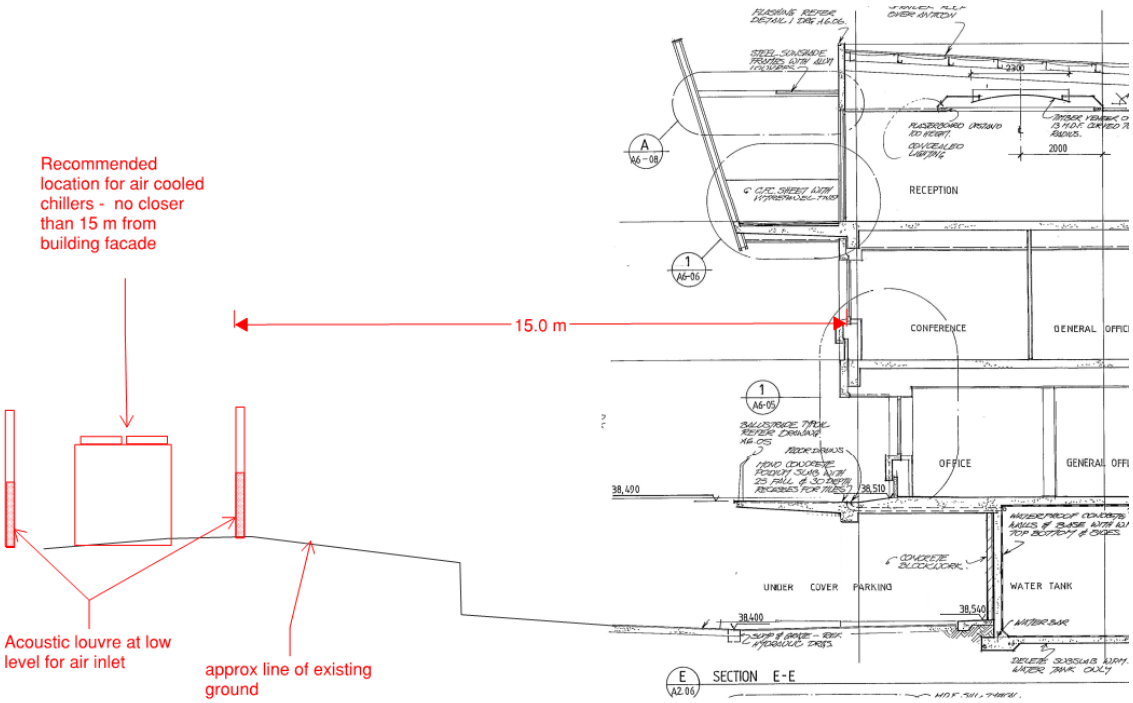
We have carried out a high level acoustic review of the noise created by the chillers and determined that if they are located closer than 15 m from the glazed façade of the building that noise levels inside the building will be impacted. While it may be possible to screen and attenuate the noise from the chillers this will add cost and have a significant aesthetic impact to the northern parts of the building. Applying these constraints we have identified the area shown on the aerial photograph below as being suitable to relocate the chillers to.



We have plotted this location on to the survey of below ground services to determine what other services this may impact on and the results are shown below.



Our observation is that this location only impacts the landscaping and the associated footpath lighting and potentially a soak well and stormwater pipe both of which would need to be re arranged to suit the creation of the new enclosure. A walled enclosure is still recommended to assist in control of noise and provide security to the enclosure. A section of the proposed location (subject to confirmation of levels) is also provided. We would not expect that the enclosure would need to be substantially sunk into the ground but that acoustic louvre intakes be provided at low level in the screening.



We believe the above solution is workable and have produced the following high level costings for this solution. Continued operation would be assured by locating one chiller at a time and running a parallel power feed to the new enclosure. There would be requirements over several weekends to shut the systems down to cut in new chilled water connections underground to branch off to the new location, and to establish a temporary power supply to the new chiller compound. The second shut down would be required when the first chiller is relocated. New pumps would be provided to avoid the need for further shutdowns.

We note that relocating the existing chillers needs to occur during winter, as to not affect operation of the centre. One unit should remain connected and operational at all times. There is also the inherent risk of delay should the chillers be damaged during relocation. Should this relocation not occur in the near future (i.e within 5 years) then new chillers will have to be purchased, as the old chillers will be at the end of economic life. If new chillers are purchased then the relocation can occur at any time of the year. In the event that this is actioned the additional cost for new air cooled chillers will be as indicated below.

Drain chilled water, cut in new tapings (after hours work)	$ 35,000
Extend chilled water underground to new location (25m)	$ 50,000
New above ground chilled water piping and valves in compound	$ 40,000
New primary and secondary pumps and weather proofing	$ 22,000
New MSSB and electrical works in compound	$ 50,000
New controls to secondary chilled water valves	$ 15,000
Craneage to relocate chillers (2 separate days)	$ 40,000
New electrical submain and temporary supply	$ 120,000
Recommissioning	$ 18,000
Installation labour and other equipment hire	$ 30,000

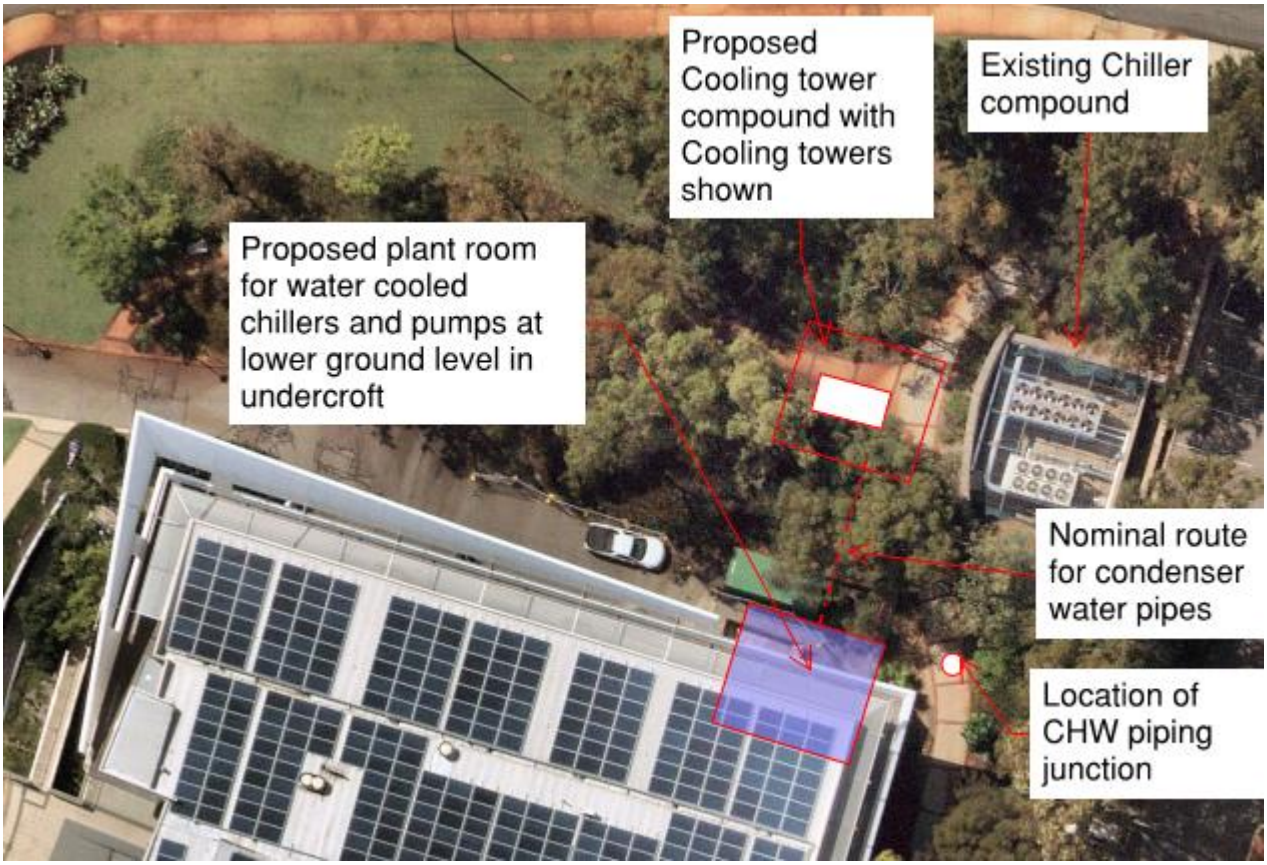
New external enclosure (150 m2)	$ 50,000
Acoustic louvres (50 m2)	$ 30,000
Clearing and landscaping	$ 40,000
Demolition	$ 15,000
Revisions to external lighting	$ 10,000
Stormwater alterations	$ 5,000
Sub Total	**$570,000.00**
Preliminaries @ 10%	$ 57,000.00
Contingency @10%	$ 57,000.00
Total Construction Value	$684,000.00
Allowance for Professional Fees @ 9% of construction value	$ 61,560.00
Total	**$745,560.00**

If the chillers required replacement due to age or condition then additional costs of $250,000 should be added for supply of new chillers.

3.3 Change to Water Cooled Option

We have also considered one additional more efficient option which would involve replacing the air cooled chillers with two water cooled chillers of nominally 430 kW capacity each. They would be installed in an enclosed and covered plant area of approximately 60m2 with heat rejection provided by a cooling tower located in a similar location that is being proposed for the chillers. With this option the external space required and the noise levels produced are significantly less for the cooling tower. To allow for maintenance two cooling towers would be proposed but total area required would be in the order of 60 m2 compared to the 150 m2 required for the air cooled option (total area required 120m2 – 60m2 external 60m2 internal)

We envisage the chillers could be housed at lower ground level complete with condenser and chilled water pumps in the area occupied by the last 3 car bays at the front of the building. This option would have the advantage of reduced energy use due to the higher efficiency of the water cooled machines, although the cost savings will partially be offset by an increase in maintenance requirements created by the cooling towers. The marked up aerial photograph below shows the general arrangement of the proposal.



The estimated cost of this alternative is detailed below

Drain chilled water, cut in new tapings (after hours work)	$ 35,000
Extend chilled water underground to new location (10m)	$ 15,000
New above ground chilled water piping and valves in compound	$ 30,000
New primary and secondary pumps	$ 20,000
New MSSB and electrical works in compound	$ 60,000
New controls to secondary chilled water valves	$ 15,000
New condenser water pumps and piping to cooling towers	$ 30,000
New Cooling towers	$ 50,000
Two new water cooled chillers	$ 200,000
Craneage to remove chillers	$ 20,000
New electrical submain and temporary supply	$ 130,000
Recommissioning	$ 25,000
Installation labour and other equipment hire	$ 30,000
New external enclosure (150 m2)	$ 25,000
New plant room (60 m2) with acoustically treated ventilation	$ 35,000
Clearing and landscaping	$ 20,000
Demolition	$ 15,000
Revisions to external lighting	$ 8,000
Stormwater alterations	$ 5,000
Sub Total	**$770,000.00**
Preliminaries @ 10%	$ 77,000.00
Contingency @10%	$ 77,000.00
Total Construction Value	$924,000.00
Allowance for Professional Fees @ 9% of construction value	$ 83,160.00

Total	**$1,007,160.00**

This alternative only becomes more attractive when the costs of replacement chillers are taken into consideration. Water cooled chillers generally have an expected life of 25+ years compared to air cooled chillers at 20 years and so could be considered a more effective long term proposition.

4 CONCLUSIONS

Our review indicates that the preferred location for the chillers remains at the northern end of the building as this is where the existing chilled water reticulation is located. Options to install on the roof introduce major issues regarding structural loading and acoustic control as well as requiring extensive modifications to the chilled water infrastructure.

If the relocation was to occur within the next couple of years then the existing chillers could be relocated, provided they are shifted within the winter months. The most effective location is between the existing building and Almondbury Road is feasible with an estimated cost of approximately $745,000 (excludes GST).

If the relocation was to occur at a time when the existing chillers are close to the end of the economic life then an option of installing water cooled chillers in the existing under croft area with cooling towers located further out from the building is also feasible at an estimated cost of $1,007,000 (also excludes GST) which would be similar to the cost of installing new air cooled chillers. Introducing water cooled equipment introduces increased energy efficiency but also increases maintenance requirements and the risks associated with having to maintain a cooling tower. In this option you can also move the chillers at any time of the year, not just during winter.

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