Mould Survey
Northern Beaches Police Station
November 2022

QBuild – Mackay District Office

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Revision/History
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Revision:
08-12-22 - Final

Executive Summary

A mould survey was conducted for Modular teaching blocks at Northern Beaches Police Station by a QOHS Certified Occupational Hygienist on 28 November 2022.

The survey included the following;

- Visual observation of mould and moisture related conditions;
- Measurement of temperature and relevant humidity under typical air-conditioning operations;
- Pinless screening and subsequent direct measurement of moisture to wall and ceiling linings in each surveyed room within buildings;
- Airborne testing for mold spores; and
- Surface testing for mold spores.

Survey findings **did** indicate;

- Localised occurrences of surface mould to the Drug room ceiling vent surrounds (condensate related with no underlying excess moisture); and
- A potential for condensate to form due to excess humidity and dew point conditions within the Drug room causing the previously mentioned localised surface mould; and
- That moisture levels are within acceptable ranges for all tested building ceiling and wall linings with no identified potential for structural-borne mould growth.

Survey findings **did not** indicate;

- Airborne concentrations of mould that were in either in a likely or chronic amplification range, or of species significantly different to those measured in the external air environment.

Survey results **do not** indicate mould precursor conditions (e.g. retained moisture to materials) or mould contamination that would be considered either sub-optimum or atypical from other environments building occupants might encounter in either the external environment or other well-controlled indoor air environments.

There is **no recommendation** to either cease or alter current occupancy of building areas based on the findings of the current survey program.

Recommendations are made for the removal of localised mould and other maintenance actions based on survey findings.

Table of Contents

1. Introduction

A mould contamination survey was conducted for selected locations at Northern Beaches Police Station, by CTPI [redacted] – Certified Occupational Hygienist of Queensland Occupational Hygiene Sciences (QOHS) at the request of QBuild – Mackay District Office representatives. Survey of the station was conducted on 28 November 2022.

The purpose of the assessment was to;

a. Visually assess residual mould contamination that may require further action to remove/remediate.

b. Assess temperature and relative humidity levels in areas where air-conditioning units were installed under operational conditions.

c. Determine residual moisture in relevant building fabrics/structures that may give rise to the ongoing promulgation or mould, or the recurrence of mould contamination.

d. Assess airborne & surface concentrations of mould spores and identify mould species to determine indoor air quality and atypical mould contaminations.

2. Limitations

On all sites, varying degrees of non-uniformity of conditions are encountered. Hence no monitoring, common testing or sampling technique can totally eliminate the possibility that monitoring or testing results/samples are not totally representative of actual situations. The conclusions are based upon the data and the field monitoring and/or testing and are therefore merely indicative of the conditions of the site at the time of preparing the report.

Current survey/inspection was limited to selected locations of the building only, namely;

- Drug room
- Property room
- Lodgment room
- Day room
- Admin area (south-west building area)

Other internal building compartments at the station were not surveyed, and therefore observations, findings and recommendations are limited to the aforementioned areas only.

3. Method

3.1 Visual Inspection, Moisture Testing & Temperature – Relative Humidity Testing

Visual non-destructive inspection was conducted to selected indoor building compartments.

Moisture screening (pinless) and subsequent invasive (pin-mode) Moisture Content (MC%) measurements were obtained utilizing a Protimeter MMS3 meter (SN: 980007220054).

Pinless moisture screening was conducted across wall linings in all surveyed compartments, with further pin-mode invasive testing conducted – either equidistant wall locations, or at

supplementary locations where pinless moisture screening indicated a potential elevated/excessive moisture condition was present.

Ceilings were also pin-mode MC% tested at equidistant non-affected locations, as well as at locations that visually indicated the historical presence of moisture (e.g. water stained surfaces).

Temperature and relative humidity testing was also conducted utilizing the Protimeter MMS meter incorporating a stick hygrometer (SN: 6246607).

3.2 Airborne Mould Testing

Airborne mould was assessed utilising a Zefon BioPump (SN: 8371) utilising compatible Air-O-Cell cassette sampling media. Air samples were obtained at a calibrated (ZBP-302 cassette SN: B-18053) flow rate of 15L/min over a 5-minute period at each sample location.

A total of 8 samples were obtained for analysis (see results tables for specific locations) incorporating 2 external control samples for external air locations, and 6 internal building compartment samples. Samples were submitted for analysis to AEML Pty Ltd Microbiology Laboratories for analysis in accordance with their in-house method AEML Test A001: *Air Sample Analysis.*

Analytical results are located in Attachment Two of this report.

3.3 Surface Mould Testing

Surface mould was assessed using sterile biotape film slides, which were applied to both selected visually affected and non-visually affected mould surfaces in representative areas. A total of 3 samples were obtained for analysis (see results tables for specific locations). Samples were submitted for analysis to AEML Pty Ltd Microbiology Laboratories for analysis in accordance with their in-house method AEML Test T001: *Tape Lift Analysis*.

Analytical results are located in Attachment Two of this report.

4. Assessment Guidelines

4.1 Visual Inspection, Moisture, Temperature & Relative Humidity Guidelines

The visual confirmation of surface mould, or indications of water damage (e.g. water staining from underlying moisture) during an inspection shall typically result in a recommendation to;

- Remediate the affected structural element or building fabric where an appropriate/recognised guideline (e.g. ANSI/IIRC Reference Guide R520 – *Reference Guide for Professional Mould Remediation*) provides for a remediation alternative;
- Remove (i.e. strip out and dispose) the affected structural element, fabric, lining, or item where no viable/likely satisfactory remediation technique exists.

Normal moisture ranges for various building materials may vary depending on ambient meteorological conditions (e.g. background and seasonal Relative Humidity (RH%)). MC% ranges for building products include;

- Gypsum (Plaster) and fibre cement board – 5-12% optimal, 12-17% moderate/acceptable, >17% probable moisture saturation.
- Wood, including particle boards/MDF <20% acceptable, >20% primarily mould colonisation, >35% rapid mould colonisation.

As per visual inspection outcomes, excess moisture in building structural elements/fabrics would typically result in a recommendation to further remediate or remove these materials.

As mould growth and promulgation requires moisture, the assessment of humidity is given primacy above temperature in consideration of whether ambient environmental conditions are such that the likelihood for mould contamination exists, or may come to exist at some stage, within an assessable indoor air space.

Australian jurisdictions (State or Federal) do not maintain regulations as to required humidity maintenance levels for indoor workplace air environments. Workplace Health and Safety Queensland (WHSQ) does refer to guidance outlined in the *Guidelines for Managing Mould and Dampness Related Public Health Risks in Buildings* (Government of Western Australia - Department of Health). This guideline recommends maintenance of humidity levels "below 65% as much as possible" to mitigate the growth of mould.

In relation to temperature the *Managing the work environment and facilities Code of Practice 2021* does state the following "*Optimum comfort for sedentary work is between 20 and 26 degrees Celsius, depending on the time of year and clothing worn*" as guidance.

4.2 Airborne Mould

Regulatory authorities within Australia (State or Federal) do not endorse, nor recommend, standards for what are considered acceptable concentrations of mould for indoor air environments.

Various international agencies and publications provide a broad range of guidelines against which airborne mould and bacteria can be compared. US industry associations such as the AIHA (American Industrial Hygiene Association) and the American Conference of Government Industrial Hygienists (ACGIH) provide quality and proficiency programs available to laboratories to ensure consistency in data being analysed.

The American Conference of Government Industrial Hygienists (ACGIH) *does not* support any numerical guidelines for the interpretation of bioaerosol data from non-manufacturing environments. The ACGIH Bioaerosol Committee recommendations are to gather the best data possible and use knowledge, experience, expert opinion, logic and common sense to assist in the interpretation of results. The ACGIH suggests the indoor and outdoor concentrations should be within an order of magnitude of the outdoor reference samples.

The AIHA reference multiple guidelines including the ACGIH and ANSI/IIRC Reference Guide R520 – *Reference Guide for Professional Mould Remediation*, under their enforceable regulations section, do not support any numerical values/thresholds for airborne mould concentrations.

For the purposes of this assessment, threshold values for typical/atypical airborne mould activity/ecology are considered based on three (3) criteria as follows:

1. As a general rule, total indoor airborne spore concentrations in a typical clean HVAC supplied building are less than the "average" regional outside concentrations, and/or less than approximately 1,500 cts/m^3, and Aspergillus /Penicillium and other hyaline spores are on average less than 700 cts/m^3.

   Based on validated interpretation advice contained in the Air-O-Cell Method Interpretation Guide, the following typical concentration ranges have been observed for corresponding mould contamination scenarios.

Table 1 – Typical Indoor Airborne Mould Spore Concentrations

Description	Spores (cts/m^3)	Predominant Species
"Clean" building	<2,000 <700	Total for all spore types Penicillium, Aspergillus
Possible indoor amplification	1,000-5,000	Penicillium, Aspergillus, Cladosporium
Indoor amplification likely present	5,000-10,000	Penicillium, Aspergillus, Cladosporium

Description	Spores (cts/m^3)	Predominant Species
Chronic indoor amplification	10,000-500,000	Penicillium, Aspergillus, Cladosporium
Inadequate demolition of contaminated surfaces	500,000 – 10,000,000	Penicillium, Aspergillus, Stachybotrys, Cladosporium, Chaetomium, Basiomycetes, Tricoderma, Ulocladium, other water indicating species.

Note: cts/cm^2 = mould count per cubic metre of air

2. The presence of water indicating species within collected indoor samples such as *Chaetomium*, *Stachybotrys*, and *Ulocladium* (and others discussed subsequently) and;
3. Fundamental differences between the species detected in the indoor samples and the outdoor reference samples.

Water indicating species (as described in guidance criterion 2), are well known to be predominantly associated with mould growth within buildings and may be an indicator of an ongoing and unresolved materials/structural moisture issue. Moreover, the majority of these species can produce potential allergenic health effects and may also produce mycotoxins.

Mycotoxins are non-volatile secondary metabolites with various chemical compounds and are a natural defence mechanism to give a mould spore an advantage over surrounding spores that may be competing for the same food source. These toxins can also cause serious health effects in humans, and as such it is important to identify these mould species within the built environment.

Certain species of mould are considered to be water damage indicators in particular where materials with cellulose organic fibre composition (e.g. particle hardboards, plasterboard) are affected including;

- *Alternaria*
- *Chaetomium*
- *Epicoccum*
- *Fusarium*
- *Memnoniella*
- *Stachybotrys*
- *Ulocladium*

The World Health Organisation (WHO) classifies the above mould species as tertiary colonizers and generally indicators of serious condensation problems. These problems may be due to construction faults, including inadequate insulation, in combination with poor ventilation, or water damage from leaks, flooding and groundwater intrusion.

More common moulds including most species of *Aspergillus/Penicillium*, and *Cladosporium* may be considered water indicating species, but in the absence of identifiable water/moisture affected building materials, are more strongly associated with excess humidity conditions.

4.3 Surface Mould

As for airborne mould, regulatory authorities within Australia (State or Federal) do not endorse or recommend standards for what are considered acceptable concentrations of mould for building interior surfaces.

Guidelines published by the New York Committee for Occupational Safety and Health (NYCOSH) in their publication *Methods for Evaluation of Indoor Mould Growth* have been referenced for the purposes of the current assessment as a general guide to airborne and surface mould contamination.

It is important to note that the threshold guidelines are not legally enforceable. They provide guidance on the likely presence of contamination and indoor air quality objective aims.

The nominated guidance thresholds for contaminants and parameters are listed in Table 2 below.

Table 2: Guidance Threshold for Contaminants (NYCOSH)

Mould Contaminant	Guidance Threshold	Reference Standard
Surface Yeast & Mould	<1500 cts/cm^2 – Normal (Background Level) >1500 cts/cm^2 – Probable Contamination	NYCOSH

Note: cts/cm^2 = mould count per square centimetre of surface area

As for airborne mould sampling, where surface sampling confirms the presence of mould species - such as *Chaetomium*, *Stachybotrys*, *Ulocladium* - this would typically indicate the presence of high moisture content on the sampled surface with a high probability of mould and moisture permeation into the substrate of the underlying material.

5. Results

5.1 Visual Inspection & Moisture Testing

Active surface mould growth (localized) was only observed at the following location/s;

- Localised occurrences of surface mould to Drug room ceiling vent surrounds – see Attachment One – Photos.

Moisture content levels in tested wall and ceiling linings were within acceptable ranges for all tested block compartments – including the location that was visually mould affected.

5.2 Temperature and Relative Humidity Testing

Temperature and relative humidity levels in all tested indoor air compartments (with supplied air-conditioning) were within guidance limits with average levels detailed following;

- Drug room – 20.4°C, 72%RH
- Property room – 25.8°C, 86%RH
- Lodgment room – 23°C, 62%RH
- Day room -23.4°C, 62%RH
- Admin area (south-west offices) - 24°C, 61%RH

5.3 Airborne Mould Results

The results from airborne sampling are summarised in Table 3 below. Analytical Reports are located in Attachment Two of this report. Table cells have been highlighted red, amber or green for reference dependent on the result for each test based on each of the 3 nominated evaluation criteria outlined in Section 4.2 of this report. Red cell highlights indicate an "atypical" result, green cell highlights a "typical" result. Amber cell highlights (if any) include a potential "atypical" result, with further interpretation notes/footnotes included for reference.

Table 3: Airborne Microbiological Results

Sample #	Location	Test 1 Total Spore Count (cts/m^3)	Test 2 Water Indicating Species Present?	Test 3 Indoor Species Different to External?
			(Yes/No)	(Yes/No)
External Air Reference Samples				
External air - Reference EXT1	External front of station #1	Average count = 2,320	Yes*	Not applicable
External air - Reference EXT2	External front of station #2		Yes*	
Internal Building				
1 – S1	Drug room (sample #1)	1,293	No	No
2 – S2	Drug room (sample #2)	360	No	No
3 – S3	Property room	573	No	No
4 – S4	Lodgment room	3,987	Yes*	No
5 – S5	SW office admin area	413	No	No
6 – S6	Day room - centre	427	No	No

Note: * Minor count of *Alternaria, Epicoccum* or *Ulocladium*

5.4 Surface Mould Assessment

The results from the surface swab sampling are summarised in Table 4 below. Analytical Reports are located in Attachment Two of this report. Table cells have been highlighted red for reference where excessive mould count result (as compared to NYCOSH Guidelines), or a water indicating species of mould, or a species with known elevated mycotoxic potential has been detected above minor concentrations.

Table 4: Surface Test Results

Sample #	Location	Mould Concentration (cts/cm^2)	Water Indicating Mould Species Present Above Minor Contamination Threshold?
T1	Drug room, SE ceiling vent	13,121	No
T2	Drug room, SW ceiling vent	6,653	No
T3	Day room, adjacent vent	477	No

6. Conclusion & Recommendation

a. Localised active mould growth was noted to vent surrounds in the Drug room as detailed in Section 5.1 of this report.

b. Mould affected areas around the vents **did not** return an excessive MC% (all <12MC% when tested). The wall area was dry at the time of survey, and the mechanism of mould growth in the area appears to be water condensate leakage around the vents.

c. Moisture levels were **within acceptable ranges** for all tested building ceiling and wall linings, with no tested location recording a moisture content reading exceeding 12MC%.

d. Humidity levels in the Drug room and Property room **were outside of guidance ranges** (>65%RH). The operation of the air conditioning unit in the drug room (which is a relatively small volumetric space) at low temperatures when excess humidity is present is likely to result in periods of condensate accumulation on certain surfaces with low surface temperatures (e.g. metal vent frames).

e. All other internal air environments with operable air-conditioning were **within acceptable ranges** for both temperature and relative humidity (as compared to guidance limits).

f. Airborne concentrations of mould that were excessive, or of species significantly different, to those measured in the external air environment around the station grounds **were not recorded** during monitoring.

   Concentrations were either in the **"clean building"** or **"possible mould amplification"** range. Consideration for the latter finding needs to be interpreted in the context that mould concentrations and species were similar to those found in the external air environment samples, with no significant rank order difference in airborne mould concentration that might give an indication that an undetected reservoir of mould growth is present.

g. Probable surface mould contamination **was only recorded** to those localised areas of active mould growth that were directly sampled.

h. Survey results **do not** indicate mould precursor conditions (e.g. retained moisture to materials) or mould contamination that would be considered either sub-optimum or atypical from other environments building occupants might encounter in either the external environment or other well-controlled indoor air environments.

Recommendation

R1 There is **no recommendation** to either cease or alter current occupancy of surveyed building areas based on the findings of the current survey program.

R2 Mould affected ceiling sections adjacent vents in the Drug room should be prioritized for cleaning.

R3 Control of humidity levels within the drug room to <65% should be maintained to prevent the development of condensation of room surfaces as are result of dew point conditions. Use of a dehumidifier, or adjusting the Drug room air-conditioning temperature to a higher setting (e.g. 25-26°C) will likely mitigate the formation of condensate within the room.

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QOHS

7. References

World Health Organisation (2009) – *WHO Guidelines for Indoor Air: Dampness & Mould*

ANSI/IIRC Reference Guide R520 – *Reference Guide for Professional Mould Remediation*

Guidelines for Managing Mould and Dampness Related Public Health Risks in Buildings (Government of Western Australia - Department of Health).

Managing the work environment and facilities Code of Practice 2021 (Workplace Health and Safety Queensland)

Methods for Evaluation of Indoor Mould Growth (New York Committee for Occupational Safety and Health (NYCOSH))

Attachment One – Survey Photographs

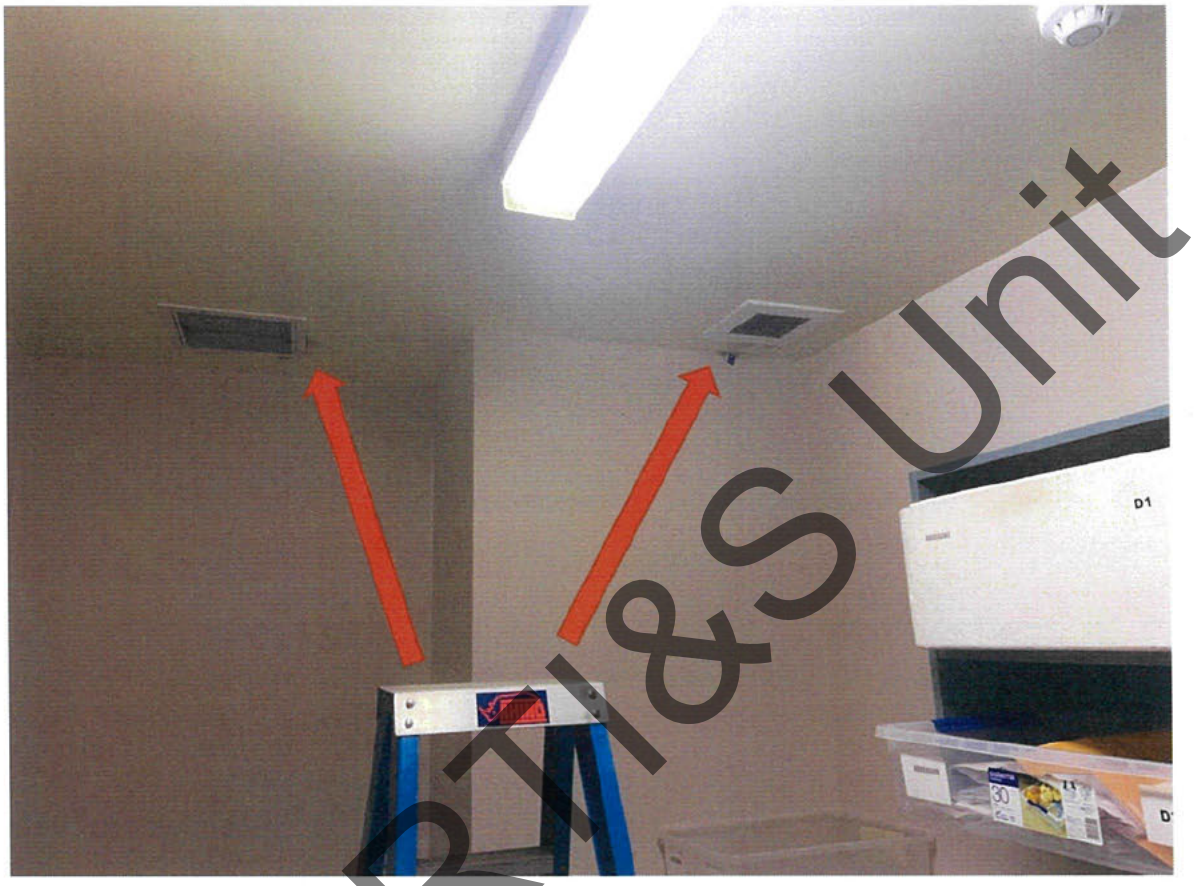

Photo 1 – Mould affected sections of ceiling adjacent vents

Attachment Two - Analytical Results

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Project: Northern Beaches Police. J0003-237.

Batch: 230978

Sampled: 28/11/2022
Received: 02/12/2022
Analysis Date: 02/12/2022
Report Date: 02/12/2022

AEML Test: A001 (AEML-DOC-18)

Sample ID:	230978-01	230978-02	230978-03	230978-04
Client Sample ID:	1 - Drug Room (S1)	2 - Drug Room (S2)	3 - Property Room	4 - Lodgment Room
Volume Sampled (L):	75	75	75	75
Media:	Air-O-Cell	Air-O-Cell	Air-O-Cell	Air-O-Cell
Percent of Trace Analysed:	100% at 600X Magnification	100% at 600X Magnification	100% at 600X Magnification	100% at 600X Magnification

Spore Types	Raw Count	Count/m³	%	Raw Count	Count/m³	%	Raw Count	Count/m³	%	Raw Count	Count/m³	%
Alternaria	—	—	—	—	—	—	—	—	—	1	13	<1
Arthrinium	—	—	—	—	—	—	—	—	—	—	—	—
Ascospores	7	93	7	4	53	15	13	173	30	162	2,160	54
Aspergillus/Penicillium-Like	45	600	46	15	200	56	20	267	47	73	973	24
Basidiospores	—	—	—	1	13	4	1	13	2	9	120	3
Bipolaris/Dreschlera	—	—	—	—	—	—	—	—	—	—	—	—
Botrytis	—	—	—	—	—	—	—	—	—	—	—	—
Chaetomium	—	—	—	—	—	—	—	—	—	—	—	—
Cladosporium	42	560	43	2	27	7	6	80	14	41	547	14
Curvularia	—	—	—	2	27	7	1	13	2	2	27	1
Epicoccum	—	—	—	—	—	—	—	—	—	—	—	—
Fusarium	—	—	—	—	—	—	—	—	—	—	—	—
Ganoderma	—	—	—	—	—	—	—	—	—	—	—	—
Memnoniella	—	—	—	—	—	—	—	—	—	—	—	—
Nigrospora	—	—	—	2	27	7	1	13	2	—	—	—
Oidium/Peronospora	—	—	—	—	—	—	—	—	—	—	—	—
Pithomyces	—	—	—	—	—	—	—	—	—	—	—	—
Rust	—	—	—	—	—	—	—	—	—	—	—	—
Smut/Myxomyces/Periconia	3	40	3	1	13	4	1	13	2	11	147	4
Stachybotrys	—	—	—	—	—	—	—	—	—	—	—	—
Torula	—	—	—	—	—	—	—	—	—	—	—	—
Ulocladium	—	—	—	—	—	—	—	—	—	—	—	—
Unidentified Spores	—	—	—	—	—	—	—	—	—	—	—	—
Total Spores	**97**	**1,293**		**27**	**360**		**43**	**573**		**299**	**3,987**	
Hyphal Fragments	5	67		—	—		2	27		7	93	
Pollen	—	—		—	—		—	—		—	—	
Debris Rating	3			2			3			3		
Detection Limit	13			13			13			13		

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AEML Test: A001 (AEML-DOC-18)

Sample ID:	230978-05	230978-06	230978-07	230978-08
Client Sample ID:	5 - SW Office Admin Area	6 - Centre Office Day Room Ar	EXT 1 - Ext Air Ref 1	EXT 2 - Ext Air Ref 2
Volume Sampled (L):	75	75	75	75
Media:	Air-O-Cell	Air-O-Cell	Air-O-Cell	Air-O-Cell
Percent of Trace Analysed:	100% at 600X Magnification	100% at 600X Magnification	100% at 600X Magnification	100% at 600X Magnification

Spore Types	Raw Count	Count/m³	%	Raw Count	Count/m³	%	Raw Count	Count/m³	%	Raw Count	Count/m³	%
Alternaria	—	—	—	—	—	—	—	—	—	1	13	1
Arthrinium	—	—	—	—	—	—	—	—	—	—	—	—
Ascospores	6	80	19	7	93	22	37	493	23	40	533	21
Aspergillus/Penicillium-Like	2	27	6	5	67	16	52	693	32	66	880	35
Basidiospores	—	—	—	—	—	—	5	67	3	7	93	4
Bipolaris/Dreschlera	—	—	—	1	13	3	—	—	—	—	—	—
Botrytis	—	—	—	—	—	—	—	—	—	—	—	—
Chaetomium	—	—	—	—	—	—	—	—	—	—	—	—
Cladosporium	7	93	23	13	173	41	58	773	36	58	773	31
Curvularia	1	13	3	2	27	6	—	—	—	1	13	1
Epicoccum	2	27	6	—	—	—	—	—	—	—	—	—
Fusarium	—	—	—	—	—	—	—	—	—	—	—	—
Ganoderma	—	—	—	—	—	—	1	13	1	4	53	2
Memnoniella	—	—	—	—	—	—	—	—	—	—	—	—
Nigrospora	—	—	—	—	—	—	—	—	—	—	—	—
Oidium/Peronospora	—	—	—	—	—	—	—	—	—	—	—	—
Pithomyces	1	13	3	—	—	—	—	—	—	—	—	—
Rust	—	—	—	—	—	—	—	—	—	—	—	—
Smut/Myxomyces/Periconia	12	160	39	4	53	13	8	107	5	10	133	5
Stachybotrys	—	—	—	—	—	—	—	—	—	—	—	—
Torula	—	—	—	—	—	—	—	—	—	—	—	—
Ulocladium	—	—	—	—	—	—	—	—	—	—	—	—
Unidentified Spores	—	—	—	—	—	—	—	—	—	—	—	—
Total Spores	**31**	**413**		**32**	**427**		**161**	**2,147**		**187**	**2,493**	
Hyphal Fragments	4	53		2	27		—	—		—	—	
Pollen	—	—		—	—		—	—		—	—	
Debris Rating	3			3			3			2		
Detection Limit	13			13			13			13		

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Analysis Date: 02/12/2022
Report Date: 02/12/2022

AEML Test: T001 (AEML-DOC-19)

Sample ID:	230978-09	230978-10	230978-11
Client Sample ID:	T1 - Drug Room, SE Vent	T2 - Drug Room, SW Vent	T3 - Day Rm, Adj Vent
Detection Limit:	15	15	15
Media:	Tape	Tape	Tape
Sample Analysis:	Analyzed at 600X Magnification	Analyzed at 600X Magnification	Analyzed at 600X Magnification

Spore Types	Raw Count	Count/cm²	%	Raw Count	Count/cm²	%	Raw Count	Count/cm²	%
Alternaria	17	262	2	3	46	1	1	15	3
Arthrinium	—	—	—	—	—	—	—	—	—
Ascospores	148	2,279	17	52	801	12	3	46	10
Aspergillus/Penicillium-Like	23	354	3	46	708	11	—	—	—
Basidiospores	42	647	5	31	477	7	1	15	3
Bipolaris/Dreschlera	7	108	1	—	—	—	—	—	—
Botrytis	—	—	—	—	—	—	—	—	—
Chaetomium	—	—	—	—	—	—	—	—	—
Cladosporium	416	6,406	49	246	3,788	57	3	46	10
Curvularia	32	493	4	4	62	1	11	169	35
Epicoccum	11	169	1	—	—	—	—	—	—
Fusarium	—	—	—	—	—	—	—	—	—
Ganoderma	—	—	—	1	15	<1	—	—	—
Memnoniella	—	—	—	—	—	—	—	—	—
Nigrospora	4	62	<1	2	31	<1	—	—	—
Oidium/Peronospora	—	—	—	—	—	—	—	—	—
Pithomyces	14	216	2	2	31	<1	—	—	—
Rust	—	—	—	—	—	—	—	—	—
Smut/Myxomyces/Periconia	133	2,048	16	41	631	9	10	154	32
Spegazzinia	—	—	—	1	15	<1	1	15	3
Stachybotrys	5	77	1	1	15	<1	—	—	—
Tetraploa	—	—	—	—	—	—	1	15	3
Torula	—	—	—	—	—	—	—	—	—
Ulocladium	—	—	—	2	31	<1	—	—	—
Unidentified Spores	—	—	—	—	—	—	—	—	—
Total Spores	**852**	**13,121**		**432**	**6,653**		**31**	**477**	
Hyphal Fragments	94	1,448		78	1,201		6	92	

CTPI

NATA

QBuild Technical Services

Investigation Report

Mechanical Services Engineering
Heating, Ventilation and Air-Conditioning System

Project: Mackay Northern Beaches Police Station
2 Carl Court, Rural View QLD 4740

Project/ WO no: 17391676

DOCUMENT HISTORY

Version	Date	Author	Description of changes
Version 0	06/07/2022	Barry Yeo	Initial issue
Version 1	19/07/2022	Barry Yeo	Final issue

DOCUMENT CONTROL

Role/Position	Name	Approved/Endorsed	Signature	Date
Author	Barry Yeo	Endorsed		
Reviewer/Project Manager	Angelo Salgado	Endorsed		
Principal	Alan Chau	Endorsed		

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0.0 EXECUTIVE SUMMARY

The Mackay Northern Beaches Police Station is located at 2 Carl Court, Rural View, Qld 4740. It is a single level building constructed around 2005. It has been reported that the existing building HVAC system have ongoing issues with condensation and mould outbreaks with increasing maintenance and repairs.

QBuild TS has been appointed to inspect the facility and prepare a detailed mechanical services report to assess the HVAC system, investigate the reported issues and provide recommendations to modify or upgrade the system where necessary to mitigate and resolve the reported issues.

QBuild TS staff have visited the site, discussed with the occupants and checked the available ePlan drawings. A hard copy folder of the O&M manual was located inside the mechanical board and equipment data sheets were copied.

The building AC system comprises five main zones each served by a DX unit that distributes conditioned air to each zone via ductwork and ceiling diffusers and grilles. The units are installed inside a plant room in the roof space with acceptable stairs access. They were installed in 2005. The three larger units are cooling only with duct heaters while the smaller units are reverse cycle type (see Fig. E1 with the zones colour coded with unit details). Mechanical ventilation consist of the main toilet exhaust system with plant room fan EF-1. In addition, there is a small system with a roof fan EF-1 serving the Property Store and Strong Room.

Figure E1 Floor Layout with air-conditioning zones and equipment details

Mould occurrence in air-conditioned spaces are mainly due to excessive moisture in the air and condensation on surfaces. The correct OA flow is critical as excessive OA will lead to humid air and higher risk of condensation especially if temperature set-points are lower than recommended. The installed plant especially DX type might not be suitable if OA flows are high. The temperature set-points need to be checked to ensure they are per recommendation.

From the site observation and analysis, the existing HVAC system design is acceptable and appear of adequate capacities to maintain desired space conditions. The main points to note are as follows;

- The HVAC plant dates from 2005 with obsolete refrigerant and standalone analogue controls and is passed its useful life and needs to be replaced. It is not viable to continue the expensive maintenance and repairs.
- Condensation has been observed on the main supply ductwork which has internal insulation but it is difficult to determine the cause without dismantling the entire duct for inspection. The duct will need to be re-insulated externally.
- There is some surface corrosion on existing ductwork which needs to be removed and the duct coated.
- The existing roof space ventilation louvres is not considered as a possible cause of the condensation issues. It can help to ventilate the roof space with added whirly birds.
- The OA flows to the units might not be balanced correctly as there are no proper dampers. This need to be rectified with new OAF speed controller and new dampers.
- The proportion of OA compared to total SA is not high and the DX units are expected to have the capacity to condition the RA and OA mix.
- The existing OA intake louvre may let in rain during storms and can be replaced with a rain louvre.
- AC-4 is currently not working and a new ceiling cassette has been installed but it is unclear if outdoor air been provided.
- AC-5 is manually controlled and not running all the time but doors are left opened which will affect the other zones. Door closers can be installed to ensure the doors are closed.
- The Heat Recovery Wheel (HRW) was replaced in 2019 but has been tagged out. This needs to be investigated and the unit rectified and returned to service. The HRW can be deleted in future as the relatively low energy savings does not appear to justify the capital and operating cost of the unit. After sales service is also lacking locally.
- The Exhibit store has a wall split unit but the roller door has ventilation slots which need to be closed off when the wall split is running to prevent condensation.

It is recommended that some immediate site maintenance work comprising checking set-points, new door closers for the dining area, blank off exhibit store roller door, new speed controller for the OAF and new balancing dampers to rebalance correct OA flows, rectify the HRW, and provide OA to the cassette unit be carried out at total estimated cost of $13,800 (excl GST).

In the shorter term, it is recommended to install roof whirly birds to improve roof space ventilation and also replace the OA louvre with a rain louvre at total estimated cost of $11,000. The existing duct need new external insulation due to the observed condensation. This is a labour intensive work due to site constraints and estimated to cost $75,000 utilising more robust close cell rubber insulation.

The main recommendation is capital improvement work to replace all the ageing and obsolete plant with design check and necessary upgrade but retain the ductwork, grilles and electrical board with duct clean and repair. In addition, new digital controls with remote monitoring and additional sensors, where required, will improve control of the system. The estimated capital cost is $620,000 (excl GST) and estimated professional fees for external consultant and QBuild TS up to practical completion is $45,000 (excl GST). The approximate project time frame from client's confirmation of project to issue of CD documentation is 22 to 25 weeks and procurement, plant delivery and construction is a further 26 to 30 weeks. QBuild project management and delivery fee is approximately 13% of capital cost and the total project budget allocation with allowance for contingencies is recommended at $800,000 (excl GST).

1.0 INTRODUCTION

The Mackay Northern Beaches Police Station is located at 2 Carl Court, Rural View, Qld 4740. It is a single level building constructed around 2005. The building is under the jurisdiction of the Queensland Police Service. It has been reported that the existing building HVAC system have ongoing issues with high space humidity, condensation and mould outbreaks with increasing maintenance and repairs.

QBuild TS has been appointed to inspect the facility and prepare a detailed mechanical services report to assess the HVAC system, investigate the reported issues and provide recommendations to modify or upgrade the system where necessary to mitigate and resolve the reported issues.

The scope of this report concentrates on the readily apparent major plant and equipment located within easily accessible plant rooms and platforms but not within concealed spaces. The review and assessment of the existing mechanical services contain visual inspection of the installed plant and control systems, review of existing as-built drawings and documentation available, review of available service reports and documentation available and discussion with relevant staff on site.

QBuild TS staff have visited the site, discussed briefly with relevant staff, collated and studied available documentation and supplied information, and checked technical details of the installation to prepare this report.

1.1 TERMINOLOGY & ABBREVIATIONS

The following terminology and abbreviations are used in the report:

QBuild TS	Q Build Technical Services
HVAC	Heating, ventilation, and air-conditioning
ePlan	Q Build electronic storage system for plans and other built assets' documents
AC	Air-conditioning
DX	Direct Expansion
EDH	Electric Duct Heater
kWr	Total cooling capacity in kW
EF	Exhaust Fan
HRW	Heat Recovery Wheel
SA	Supply Air
EA	Exhaust Air
OA	Outdoor Air
RA	Return Air
OAF	Outdoor Air Fan
MSSB	Mechanical Services Switch Board
RAG	Return Air Grille
DDC	Direct Digital Control
O&M	Operation and Maintenance
l/s	Litres per second
COP	Coefficient of Performance

1.2 AVAILABLE DOCUMENTS

Fig.1 show the available mechanical servicers drawings from ePlan. The drawings are shown in the Appendices for general information. Original 2005 architectural plans were available through ePlan but not listed below. They provide a general understanding of the building layout and assist to understand the mechanical as-installed drawings.

Drawing Number	Vsn	Title	Drawing Date	Discipline Types
46502/34988/M01		MECHANICAL SERVICES AIR CONDITIONING AND VENTILATION	09/02/2005	MECHANICAL ENGINEERING Air Conditioning
46502/34988/M02		MECHANICAL SERVICES SECTIONS AND DETAILS	09/02/2005	MECHANICAL ENGINEERING Air Conditioning Ventilation

Figure 1 List of Mechanical Services drawings on ePlan

2.0 SITE OVERVIEW & REPORTED ISSUES

2.1 LOCATION

The Mackay Northern Beaches Police Station is located at 2 Carl Court, Rural View which is about 12 km by road north of Mackay town centre. Fig.2 shows the site plan extracted from architectural drawing 34988/ A01.01.

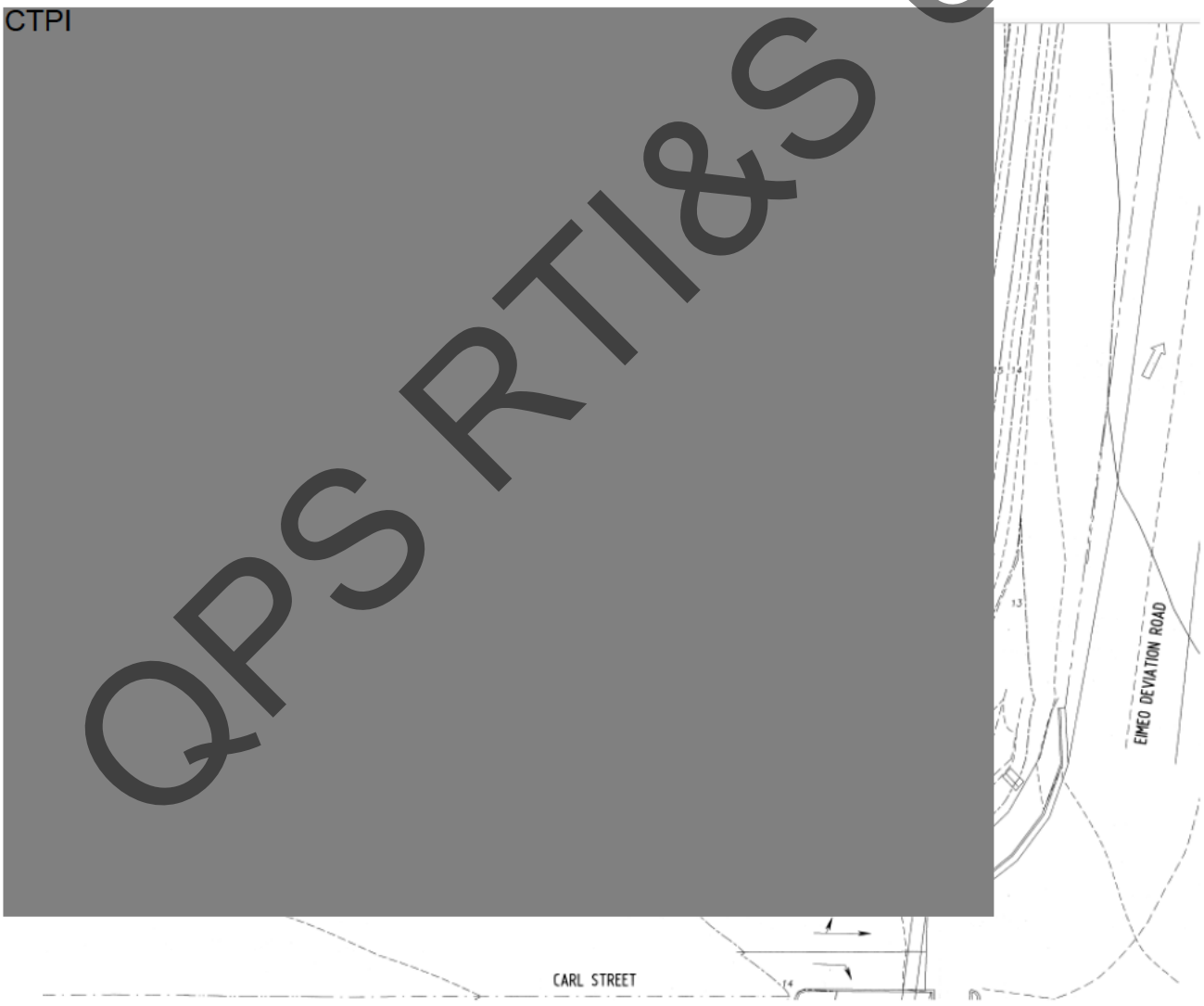


Figure 2 Mackay Northern Beaches Police Station Site Plan

The building is almost square in shape and comprises a main floor with an upper plant room within the roof space. The main floor is a typical small police station with offices, cells, locker, stores and amenities. The upper plant room houses the main HVAC indoor equipment. The outdoor equipment is located at ground level outside the east wall in an enclosure.

2.2 EXISTING HEATING, VENTILATION AND AIR-CONDITIONING SYSTEM

The building AC system comprises DX split units with a mix of ducted units and high wall units. The main floor have five AC zones each served by one ducted unit. The five ducted units are located inside the upper plant room and connected with refrigerant piping to the outdoor units located at ground level outside the east wall. They are dated June 2005 and uses obsolete R-22 refrigerant. In addition there are three high wall single split units serving the strong room, radio room and comms room respectively. The system was installed with the original building in 2005. The main floor equipment are listed in Table 1 with the air-conditioning zones shown in Fig.3. The make/model and unit capacity are from the unit name plates.

Table 1 Mackay Northern Beaches Police Station existing ducted AC units

Unit	Type	Make/ Model/ MM-YYYY	Total Capacity (kWr)	Area served
AC-1	DX split ducted single zone with EDH	APAC/ S2580/ 06-2005	25.0	West perimeter zone
AC-2	DX split ducted single zone with EDH	APAC/ S3080/ 06-2005	30.0	Main internal zone
AC-3	DX split ducted single zone with EDH	APAC/ S2580/ 06-2005	25.0	Lockers and back rooms
AC-4	DX split ducted single zone (reverse cycle)	APAC/ H0970-033596/ 06-2005	9.0	CIB room
AC-5	DX split ducted single zone (reverse cycle)	APAC/ S0161RDO 33596/ 06-2005	16.0	Conference and dining

Figure 3 Existing floor air-conditioning zones

Mechanical ventilation comprises the main toilet and amenities exhaust system with a plant room fan EF-1, riser duct and branch ducts. The exhaust is through a Heat Recovery Wheel (HRW) which is a heat exchanger that uses the relatively cooler EA to precool the OA to the AC units which is supplied by an outdoor air fan OAF-1. In addition, there is a small roof exhaust fan EF-2 serving the exhibit store and the strong room. The exhibit/property store has no original air-conditioning but a wall split has been added.

2.3 REPORTED ISSUES

The reported issues are as follows:

- Condensation inside ceiling space resulting in ceiling damage
- Mould outbreaks observed
- Ageing equipment
- Increasing maintenance calls and costs

3.0 SITE INSPECTION, OBSERVATIONS & COMMENTS

A site inspection was carried out on 21 June 2022 with a short follow up visit on 22 June 2022. Observations and comments are listed in Table 2 and Table 3 with photographs shown in Fig.4, Fig.5 and Fig.6.

Table 2 Observations and comments on Roof Level Plant Room

Item	Observations	Comments
Access	CTPI	The access to the plant room is acceptable.
Noise levels	The noise levels in the plant room is acceptable. No abnormal noises were observed.	The operating plant appears normal with no major issue.
MSSB-1	The mechanical board has selector switches, indicating lights and adequate labelling. One unit AC-4 has been tagged out. AC unit controls are standalone (Innotech IMT5011) with timeclock and monitoring. The O&M manual is located inside the board.	The MSSB is acceptable. AC-4 has failed and is not operating. Main plant details were extraced from the O&M manual.
OAF-1	The OAF is running. It is Fantech model PCE506ER and the name plate has a May 2010 manufacturing date.	The OAF appears not to be the original installed in 2005. It is 12 years old and has a few years of service life left.
HRW HE-1	The HRW has been tagged out at the local isolator and the unit is not running. However the indicating light is on at the MSSB and the selector switch is at Auto mode. The model is DRI Eco-Fresh HRW-1000 MS270A and the name plate has a 03-2019 manufacturing date. The unit is therefore relatively new.	The HRW was only replaced in 2019 but is tagged out for unknown reasons. This requires further investigation. It is only 3 years old and would have more than 10 years of service life left.
Exhaust fan EF-1	The main EF is running. It is Fantech model PCE456ER and has a Jul 2005 date so it appears to be the original installation.	EF-1 is 17 years and passed its useful life.
AC-1 to AC-5 (see Table 1 for details)	The units are all running except AC-4. They are APAC DX models made by Carrier Australia and uses obsolete R22 refrigerant. They are the original units installed in 2005. Some corrosion is observed on the unit casings.	The installed APAC units under Carrier are no longer in the market. The APAC brand is currently available but under different ownership. They are 17 years old and well passed their useful life.
Ductwork	Some corrosion is observed on the ductwork.	The surface corrosion can be removed and the ductwork cleaned and painted.
OA ductwork	The OAF supplies OA to each of the AC units but there is no balancing damper other than the scoop at the branch take-off.	The OA ducts to each AC unit should be fitted with a proper volume control damper to balance the correct amount of OA to each unit.
OA intake	Some marks on the wall is observed below the OA wall intake blanking plate. Some leakage many have occurred. The OA louvre as observed from outside has wide gaps (see Fig. 6).	Rain may have leaked into the plant room through the OA intake louvre. This can be observed and the louvre changed if necessary.

Table 3 Observations and comments on the main floor

Item	Observations[1]	Comments
General	Zone temperatures and noise levels appear acceptable. There is a remote manual control panel located at the Duty Officer station. Equipment can be manually operated from here.	Remote manual control is not recommended for a modern HVAC system as it needs to be supervised to avoid tampering. The equipment scheduling is best achieved with existing time-clock for automatic control and 365 day programming. After-hours operation is best achieved with local push button controls with two hour (adjustable) timer.
Zoning	The designed AC zones is acceptable except for AC-3 which serves different occupancies (office and lockers).	The lockers is a different type of occupancy compared to office space and could have its own zone but may be acceptable here as there is no return air from the lockers that may affect air quality. The supplied air is exhausted at the toilets.
Ductwork	Some ceiling tiles were removed and the ductwork and cushion boxes were inspected. Some surface corrosion was observed. The ductwork are internally insulated but the condition of the insulation cannot be ascertained.	Condensation on the ductwork was reported in the past leading to damaged ceilings. It was mainly observed in the main duct of unit AC-2. This is possibly due to a deterioration of the ductwork internal insulation.
AC-1 zone	The SA layout is acceptable. There is one RAG above Passage 3 and one wall temperature sensor located in Passage 6 outside the Station OIC.	It is preferred to locate the RAG in the actual zone. It can be shifted to the Sergeant's Day Room ceiling. The wall sensor is not in the ideal location and can be relocated to a more open area. Another sensor can also be installed for better control using averaging or high select.
AC-2 zone	The SA layout is acceptable. There is one central RAG with temperature sensor located inside.	Location of RAG is acceptable. It is preferred to locate temperature sensor in the conditioned space for accurate space temperature monitoring but may not be critical in this application as the occupancy is variable due to staff movements.
AC-3 zone	The SA layout is acceptable. There is one central RAG above Passage 1 with wall temperature sensor located in Passage 2.	Overall layout is acceptable.
AC-4 zone	The SA layout is acceptable. There is one central RAG with temperature sensor located on perimeter wall near O.I.C. A new DX ceiling cassette has been installed in the middle of the room	The original AC-4 is not running and the zone is now served by a DX ceiling cassette. This was only installed a few weeks ago. It is unclear whether there is OA supplied to this unit but likely to be none and needs to be rectified.
AC-5 zone	The SA layout is acceptable with a wall temperature sensor in the dining room. There is a manual controller with adjustable timer. The unit was not running. The dining room is used for recreation. The doors are left opened.	As the wall sensor is in one part of the room, the movable partition must be left opened if the unit is running to enable correct room temperature sensing. When the unit is not running, all doors should be closed to prevent leakage of unconditioned air to the other zones.
Wall splits	The small rooms with wall splits are running normal. No issues were observed.	The wall splits can remain. The age of the units cannot be fully ascertained but should be replaced if they are the original 2005 installation.
Toilets	The toilets and shower doors have grilles.	This is acceptable for spill air from the lockers.
External condensers	AC-1 to AC-5 external condensers have badly corroded condenser fins and coils. All name plates are no longer visible. Some corrosion on the casings are observed.	The site is near the sea with more corrosive ambient conditions. The units are passed their useful life and should be replaced.
Exhibit store	A wall split is installed with manual control. The external roller door has large open slots for natural ventilation.	This room was originally naturally ventilated. The roller door needs to be sealed when the AC is running otherwise condensation may occur and lead to mould outbreaks.

Note 1 – see Fig.3 for floor layout descriptions

Access stairs

General view – Clockwise AC-2, AC-1, HRW & AC-3

Gene`ral view – AC-5 & AC-2

MSSB-1

OAF-1 (duct corrosion on right)

EF-1

AC plant corrosion

HRW with isolator tagged-out

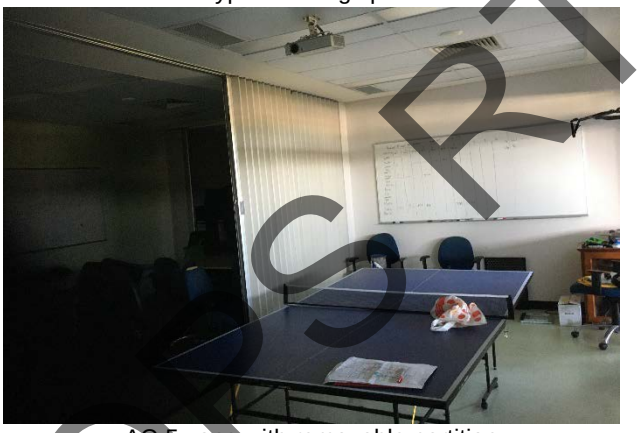
Figure 4 Plant Room

Typical ceiling diffuser with smudging

Typical diffuser cushion box

Typical ceiling space

AC local master control panel



AC-5 zone with removable partition

AC-5 local manual controller

New ceiling cassette in AC-4 zone

Exhibit/ Property Store with vented shutter and wall split

Figure 5 Main floor

Main entrance

AC-1, AC-2 & AC-3 external condensers

AC-2 condenser corrosion

AC-1 condenser corrosion

Other AC unit condensers

OA intake louvre to OAF-1

Figure 6 External views

4.0 DISCUSSION AND ANALYSIS

4.1 INSTALLED HVAC SYSTEM – GENERAL

The installed HVAC system is a typical design, which is suitable for smaller buildings. The plant capacities appear adequate. The system (except OAF-1, HRW-1 and some wall splits) is 17 years old and well passed its useful life. OAF-1 has a few years' service life left. The main DX units AC-1 to AC-5 and the main fans OAF-1 and EX-1 should be replaced within the next one or two years before they fail as had happened for AC-4. The obsolete R-22 refrigerant can be recovered and stored for maintenance of other existing units. A full heat load calculation is recommended when the plant is documented to be replaced.

The existing ductwork, electric duct heaters, diffusers and grilles can be retained with general maintenance and a duct clean. Condensation on the air-conditioning supply air ductwork has been observed in the past. This happened due to humid air inside the ceiling space (which is also the roof space) contacting the cold

ductwork metal surface which is below the dew point of the ceiling air. It implies the ductwork internal insulation may have deteriorated and also implies the supply air temperature inside the ductwork may be below design. The condition of the internal insulation is difficult to ascertain unless access hatches are cut into the ductwork at several locations for inspection. This would be cumbersome site work and it is also difficult to repair or reinstate internal insulation without dismantling the entire ductwork section. It is recommended that the ductwork be reinsulated externally. Adhesive type close cell rubber insulation with faced vapour barrier foil is recommended instead of standard mineral wool as they are of higher quality and more robust to prevent condensation

The ceiling cum roof space has two ventilation louvres at the opposite North and South walls. In principle the louvres will allow the roof space to be ventilated to reduce the heat build-up. It has been suggested by others that the louvres may have led in excessive humid air leading to the condensation on the duct. This might not be entirely true as the roof space is not expected to be of air-tight construction and OA will leaked in regardless of the louvres. The roof space ventilation is not a mandatory design feature but in lieu of the condensation issues, it can be improved by installing several whirly birds to create some air movement. This can be carried out in the short term as the units are fairly inexpensive and do not require any power.

The existing MSSB-1 can be retained with modifications and replacement of components where necessary. A new DDC system are recommended for the AC unit control with ability for remote monitoring. The existing wall sensors can be checked and recalibrated if necessary to be reused. However, these components are relatively inexpensive and it would be preferred to replace all of them. Additional sensors can be specified to improve the temperature control for larger zones such as AC-1, AC-2 and AC-3. This is not possible currently with the standalone controls.

The use of the Heat Recovery Wheel is theoretically a recommended energy saving measure. In practice however, most of these wheels are poorly maintained especially in regional centres where there is little or no after-sales support. This is already evident in the current installation where HRW-1 has been tagged out. In addition, the energy saved may be minimal compared to the capital and operating cost if the airflows are relatively low. The existing HRW should be repaired and put back to service but not recommended to be replaced should it failed again in future (see next section).

The indoor temperature set-points are recommended at 23±1°C for cooling and 21±1°C for heating. The cooling set-point for all units should not be set any lower, as a low set-point might increase risk of condensation when warm humid OA infiltrates the space and the dew point is higher than room walls and furniture that have been excessively cooled due to low room set-point temperature (typically 19°C to 21°C).

4.2 HVAC SYSTEMS AIR BALANCE

The existing main plant airflows are shown in Table 5. The calculated OA flow in column 6 is based on the population per the furniture layout drawing (see Appendix C) at 10 l/s per occupant (AS1668.2) with allowance for staff movement.

Table 5 Main plant air-flows

Plant	**SA (l/s)** (sum of diffusers from design drawing)	**OA (l/s)** (from O&M manual)	**EA (l/s)** (sum of exhaust grilles per design drawing)	**OA/SA** (calculated)	**Calculated OA (l/s) from furniture layout**
AC-1	1145	140		12 %	120
AC-2	1760	220		13 %	110
AC-3	1065	165		15 %	100
AC-4	485	45		9 %	30
AC-5	900	105		12 %	60
OAF-1		675 (sum of above)			420 (sum of above)
EF-1			525		

The analysis of the air flows are as follows:

- For DX units there is a limited capability to condition OA. If the OA flow is high compared to total SA flow, a pre-conditioner or chilled water unit would be required. In this case, the design OA/SA % is relatively low (column 5) and the DX unit should have no issue to condition the OA air. Pre-cooling the OA with use of the HRW is not really necessary in terms of the AC unit performance.
- The calculated OA (column 6) is less than the design OA flows. This will further reduce the OA flow through the DX units and enhanced its performance.
- The EA flow is 525 l/s. Assuming it is exhausted at 24°C (spill air from locker area) and the incoming OA is at 31.9°C (Mackay comfort design temperature) the total energy [sensible heat=1.23x525x(31.9-24) watts] is calculated as 5.1 kW. The efficiency of the HRW is around 88% from the equipment technical data and the net recovered heat energy is around 4.5 kW. This can be translated to an electrical energy of around 1.5 kW if we assume a typical COP of 3.0 for the DX unit. As the wheel ages this figure will go down. The energy savings is therefore minimal and depending on the hours of usage and the electricity tariff it might average around $400 to $500 a year which will likely not result in a favourable payback period for the incurred capital and operating cost of the HRW.

From the above analysis, the HRW is not fully justified and not recommended to be replaced if it fails again in future.

4.3 MOULD ISSUES

Mould outbreaks on a surface occur mainly due to excessive moisture and favourable temperatures. Excessive moisture is usually due to leaking building structure or services (mainly water pipes) or condensation on the surface due to humid air.

In most indoor spaces with a HVAC system, mould outbreaks occur due to condensation on the surface. Usually, the surrounding air is more humid than normal with a high dew point and moisture will condense on any surface with a temperature below that dew point. For example, air at 26°C and 75% RH has a dew point of 21.2°C which is high and any surface with a temperature below that will see moisture condensation. The HVAC controls must work to maintain normal comfort design conditions of 23°C and 55% RH which is above 21.2°C and no condensation will occur. If the room set-point is lowered to 20°C then the room surfaces will possibly be at that temperature and condensation will then occur. It is therefore critical that in air-conditioned rooms, the temperatures set-points must not be lower than the recommended 23°C.

Additionally, the amount of OA introduced into the space needs to be correct to suit the occupancy, as excessive OA will make it difficult for the AC system to maintain the design conditions. Excessive OA that is not properly conditioned will increase the room space RH which in turns increases the risk of condensation and mould growth. The OA quantity can be also be excessive due to infiltration through the building structure (openings or cracks) especially in unseen spaces such as above the ceiling. It is therefore important that buildings be constructed fairly air-tight.

5.0 COURSES OF ACTION AND RECOMMENDATION

From the above investigation, the main areas of concern are the age of the plant, the obsolete refrigerant used and the possible deterioration of duct insulation. The controls can be also improved. The viability of the HRW is questionable and recommended to be deleted in future.

The courses of action and recommendation are shown in Table 6. The immediate work can be carried out under maintenance. Funding for the short term work can be sourced now and the work carried out once it is available. The duct external insulation will prevent future condensation which was a key issue. QBuild TS can assist to issue Scope of Works for the immediate and short term work for pricing and procurement.

The capital improvement work will require the engagement of an external engineering consultant to design and document the work. It will modernise the HVAC plant and controls and maintain satisfactory conditions for years to come. Again, QBuild TS can fully assist in the procurement and management of the external consultant up till Contract Documentation stage. QBuild regional can manage the tender and construction stages with technical support from QBuild TS and the external consultant.

Table 6 Courses of Action and Recommendation

No	Scope	Estimated cost (excl GST)	Comment & Recommendation
1	**Immediate work** to improve the HVAC system and mitigate reported issues:		This is immediate lower cost work.
	• Check and ensure room set-points are to the recommended 23±1°C for cooling and 21±1°C for heating. This include the wall splits.	$2,500	RECOMMENDED
	• Investigate why the HRW has been tagged out, rectify and operate the unit.	$2,500	
	• Check if OA is provided to the CIB room (AC-4 zone) with the new ceiling cassette. Install OA duct to the unit if necessary.	$2,500	
	• Install door closers to ensure doors to the Dining/Recreation/Conference area (AC-5 zone) remain close at all times.	$300	
	• Blank off the roller door openings at the Exhibit Store when the wall split is running.	$500	
	• Install an electronic speed controller to OAF-1 to enable flow control. Install opposed blade volume control dampers on all OA droppers to the AC units and rebalance to the correct quantities.	$5,500	
2	**Short term work** to mitigate reported issues:		**T**his is short term higher cost work.
	• Install four (4) whirly birds on the roof to improve roof space ventilation.	$3,000	RECOMMENDED
	• Replace OA intake louvre with a rain louvre.	$8,000	
	• Insulate externally the main AC ductwork for AC-1, AC-2 and AC-3 with close cell rubber insulation to avoid condensation on the ductwork.	$75,000	
3	**Capital improvement works comprising the following**:		**T**his work is to replace the ageing and obsolete plant with new modern plant and a new control system to efficiently serve the building for the next 15 years.
	• Replace all the DX units with similar unit with coated coils and latest refrigerants.	$620,00 for capital works	RECOMMENDED
	• Install new DDC controls with additional sensors where required, after-hours push button and remote monitoring.	$32,000 for external consultant fee	
	• Carry out duct clean, repair corroded duct sections and reuse existing ductwork and diffusers with relocation of RAG where necessary.	$13,000 for QBuild TS fee	
	• Instal new EF-1 and OAF-1 with speed control.	QBuild regional delivery fee of 13%	
		Total capital improvement project budget is estimated at $800,000 which include contingencies	

APPENDIX A – Drawing M01 Floor Plan 2005

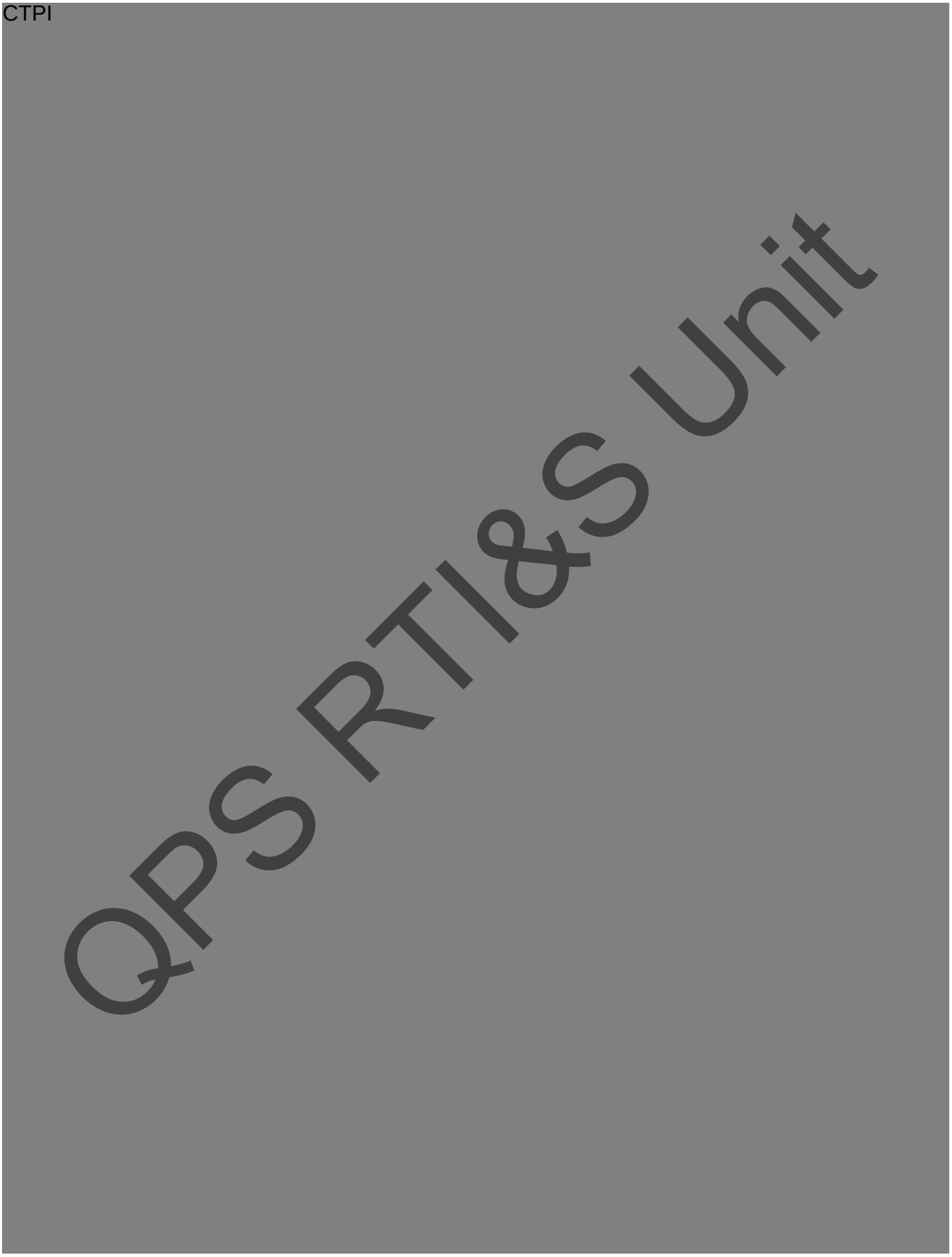
CTPI

APPENDIX B – Drawing M02 Section and details 2004

CTPI

APPENDIX C – Furniture Layout Arch Part Drawing A02.05 – 2005

CTPI



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GPO BOX 1440
BRISBANE 4000

BAS Quote Reference: CQ0007911

Program Code: M00638
Date: 07-Mar-2017
WIC Number: 46502000

BAS Work Request Number: 3863977

Dear German Moya

RE: Your quotation for Replacement of heat recovery wheel.

Thank you for the opportunity to provide this quotation for **MACKAY NORTHERN BEACHES POLICE STATION, MACKAY** for the above mentioned works. Your request was provided to Building and Asset Services on 7 March 2017.

The quotation is based upon our understanding of your project requirements set out in the **Detailed Extent of Works** section (refer over page). This quote is based on information available to Building and Asset Services in documentation (provided by Customer) and/or ascertained in a site visit by BAS, but does not include any work that could not be clearly identified/specified. Any work outside this scope of works may be subject to a variation.

To accept this quotation, please confirm by completing all required details in the **Client Acceptance** section of this quotation and return to this office. Upon receipt of your acceptance, we will contact you to plan the work to suit your needs. In the meantime if you would like to discuss this quote further or if you do not wish to proceed with these works, please contact Jennifer Champion on CTPI You may also wish to contact your estimator, Mark Takagaki on CTPI @hpw.qld.gov.au if you have any queries. Please note that this quote is valid for 30 days only.

Regards

CTPI

Chris Brigg
District Manager
Building and Asset Services

Quotation Summary for Recommended Option

Price for work to be performed:	**$17,841.57**
GST:	**$1,784.15**
Total Price (GST inclusive):	**$19,625.72**

Client Acceptance

Name	German Moya
Contact Number and Email	CTPI
Customer Purchase Order Number	
BAS Customer Program Code	M00658
All required funding/subsidy approved	
If applicable, please indicate which option(s) you approve	CTPI
Signature	Date 01/02/19

DETAILED EXTENT OF WORKS

BAS Quote Reference: CQ0007911

Site: MACKAY NORTHERN BEACHES POLICE STATION, MACKAY

Activity	Detailed Description	Cost
Replacement of heat recovery wheel	*Replacement of the heat wheel at the Northern Beaches Police Station.* *Price include:* *- Disconnect and remove existing heat recovery wheel.* *- Supply and Installation of a DRI Heat Recovery Wheel M/N: HRW-1000-ms270.* *- Supply and Installation of flanges to adapt to existing ductwork.* *- Connect electrically and test.* *- Removal and disposal of any rubbish upon completion.*	
	Subtotal	$15,789.00
	Delivery Charge (13.0%)	$2,052.57
	GST	$1,784.16
	Total (GST inclusive)	$19,625.73

Please Note:

A contingency amount of $0.00 should be retained by the customer in addition to the above total. If the total value of work exceeds $150,000 (GST Exclusive), a Portable Long Service Levy will apply. This quote is valid for 30 days only.

Queensland Government

QBuild
Department of Energy and Public Works
Whitsunday Region (WS)
PO Box 86, Mackay 4740
Phone 07 CTPI **Fax 07 4967 1031**
https://www.epw.qld.gov.au/
ABN: 65266806703

QBuild | QUOTE

To: German Moya
QPS (GM)
GPO Box 1440
BRISBANE QLD 4001

QBuild Quote Reference: CQ0093096

Program Code: V01652
Date: 02-Jun-2022
WIC Number: 46502000

QBuild Work Request Number: 6621443

Dear German Moya

RE: Your quotation for Fee Proposal Investigate & provide recommendations humidity/condensation issues.

Thank you for the opportunity to provide this quotation for **MACKAY NORTHERN BEACHES POLICE STATION, MACKAY** for the above mentioned works. Your request was provided to QBuild on 20 August 2021.

The quotation is based upon our understanding of your project requirements set out in the **Detailed Extent of Works** section (refer over page). QBuild complies with the QPP principles by seeking to obtain best value for money in its procurement. QBuild confirms that relevant statutory regulations and legislation will be complied with for this work. This quote is based on information available to QBuild in documentation (provided by Customer) and/or ascertained in a site visit by QBuild, but does not include any work that could not be clearly identified/specified. Any work outside this scope of works may be subject to a variation.

To accept this quotation, please confirm by completing all required details in the **Client Acceptance** section of this quotation and return to this office. Upon receipt of your acceptance, we will contact you to plan the work to suit your needs. In the meantime if you would like to discuss this quote further or if you do not wish to proceed with these works, please contact Jennifer Champion on (07) CTPI . You may also wish to contact your estimator, Kevin J Cox on CTPI @epw.qld.gov.au if you have any queries.

Regards

CTPI

for **Mark McDermott**
District Manager
QBuild

Quotation Summary for Recommended Option	
Price for work to be performed:	**$14,633.50**
GST:	**$1,463.35**
Total Price (GST inclusive):	**$16,096.85**

Client Acceptance

Name			
Contact Number and Email	CTPI		
Customer Purchase Order Number			
QBuild Customer Program Code			
All required funding/subsidy approved			
If applicable, please indicate which option(s) you approve	CTPI		
Signature		**Date**	

DETAILED EXTENT OF WORKS

QBuild Quote Reference: CQ0093096

Site: MACKAY NORTHERN BEACHES POLICE STATION, MACKAY

Activity: Fee Proposal Investigate & provide recommendations humidity/condensation issues	
Detailed Description	**Cost**
NORTHERN BEACHES POLICE STATION-Investigate & provide recommendations humidity/condensation issues. **Price Includes:** - Attend site, to fully understand the operation of the facility and the existing conditions. - Establish and make safe site work area including the installation of barricading and signage as required. - Review available information on the condition of the current HVAC system. - Review the reported issues with the current HVAC system. - Review the appropriateness of the existing system. - Review the existing HVAC system with regard to operating efficiency and remaining economic life. - Propose mechanical engineering solutions (with options) to address the reported issues. - Prepare preliminary cost estimates for the proposed solutions. - Provide a report of the above investigations including recommendations for upgrading works with estimated timeline and cost. - On completion of works, remove all trade related waste from site and leave all area in a clean and tidy condition. - Make good all new and disturbed works.	
Subtotal	**$12,950.00**
Delivery Charge (13.0%)	**$1,683.50**
GST	**$1,463.35**
Total (GST inclusive)	**$16,096.85**

Please Note:

A contingency amount of $0.00 should be retained by the customer in addition to the above total. If the total value of work exceeds $150,000 (GST Exclusive), a Portable Long Service Levy will apply.
QBuild complies with the QPP principles by seeking to obtain best value for money in its procurement.
QBuild confirms that relevant statutory regulations and legislation will be complied with for this work.