Wee Waa High School – Public Health Investigation

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NSW Department of Education Note:
Some data in this report has been redacted for the sole purpose of protecting individual privacy and confidentiality.

Document History and Status

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Glossary of Terms and Acronyms

Adverse Health Effect	A change in body function or cell structure that might lead to disease or health problems
ASC NEPM	National Environmental Protection (Assessment of Site Contamination) Measure
Chronic Exposure	Contact with a substance that occurs over a long time (more than 1 year) (compare with acute exposure and intermediate duration exposure)
Dermal Contact	Contact with (touching) the skin (see route of exposure).
Detection Limit	The lowest concentration of a chemical that can reliably be distinguished from a zero concentration (compare with LOR).
Dose	The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An “exposure dose” is how much of a substance is encountered in the environment. An “absorbed dose” is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.
Exposure	Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term (acute exposure), of intermediate duration, or long-term (chronic exposure).
Exposure Assessment	The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.
Exposure Pathway	The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as chemical leakage into the subsurface); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.
Guideline Value	Guideline value is a concentration in soil, sediment, water, biota or air (established by relevant regulatory authorities such as the National Health and Medical Research Council (NHMRC), Australia and New Zealand Environment and Conservation Council (ANZECC) and World Health Organisation (WHO)), that is used to identify conditions below which no adverse effects, nuisance or indirect health effects are expected. The derivation of a guideline value utilises relevant studies on animals or humans and either relevant factors to account for inter- and intra-species variations and uncertainty factors or (for ecological receptors) a species sensitivity distribution to statistically determine an accepted level of protection. Separate guidelines may be identified for protection of human health and the environment. Dependent on the source, guidelines will have different names, such as investigation level, trigger value, ambient guideline etc.
Ingestion	The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way (see route of exposure).
Inhalation	The act of breathing. A hazardous substance can enter the body this way (see route of exposure).
Mould	Mould is a common term for fungi that are found virtually everywhere in nature, including in soil and on plants, food, and wet materials.
NHMRC	National Health and Medical Research Council

Point of Exposure	The place where someone can come into contact with a substance present in the environment (see exposure pathway).
Population	A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).
Risk	The probability that something will cause injury or harm.
Route of Exposure	The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin (dermal contact)
Toxicology	The study of the harmful effects of substances on humans or animals.
USEPA	United States Environmental Protection Agency
WHO	World Health Organisation

Executive summary

Environmental Risk Sciences Pty Ltd (enRiskS) and Dr Tony Brown (University of Sydney) have been engaged by the NSW Department of Education to undertake an investigation of a number of health incidents related to Wee Waa High School that have occurred between 2018 (and potentially earlier) and 2021.

Wee Waa High School is a small, co-educational, comprehensive rural secondary school in North-West NSW that services students from the town of Wee Waa, Burren Junction and Pilliga. Approximately 36% of the students at Wee Waa High School are indigenous and the school is committed to promoting its cultural diversity through a strong educational program for Aboriginal students. Approximately 150 students attend the school, and the school has approximately 30 staff (Wee Waa High School Annual Report 2020).

Various staff and students have reported the following types of symptoms (of varying severity) at times over the last 5 years:

- irritation (skin/eyes)
- respiratory difficulties
- rashes
- fatigue/lethargy.

An investigation has been undertaken using a range of information to evaluate potential hypotheses that might explain the coincidence between these symptoms and attendance at the school. The approach taken is that of an outbreak investigation commonly used in public health investigations. This approach is normally used to identify the causes of an infectious disease, but the framework is also useful for health impacts that may be caused by environmental factors with some limitations.

The information used in this investigation included:

- Background information about the site and Wee Waa itself
- Anecdotal discussions of the history of the situation at the school with staff
- Photographic evidence
- Notification reports from Department of Education regarding health effects and building issues
- Site investigation reports from a range of consultants
- Interviews with individuals (staff, students and other visitors) with supporting information from medical practitioners where available
- Rainfall data from the Bureau of Meteorology
- Health statistics from Australian Bureau of Statistics and Australian Institute of Health and Welfare
- Literature reviews and background information from reputable organisations

Using all these information sources, the investigation determined that the following hypotheses could be relevant for this situation:

- moisture issues in the buildings are leading to mould growth and exposure to mould has contributed to the effects seen in individuals
- these symptoms may have resulted from random chance unrelated to any particular environmental factors.

The findings of this investigation included:

- Measurements of moisture in the buildings at the former Wee Waa High School site were elevated.
- Plumbing issues and excess stormwater were common at the school which supported the moisture measurement information.
- Reports of health symptoms were much lower in times of drought.
- Reports of health symptoms often appeared to occur shortly after significant rain events in Wee Waa.
- Significant rain events in Wee Waa commonly occur in February/March or October/November.
- Ventilation in indoor areas was not controlled by mechanical ventilation systems (as is common in many school buildings), so if windows were not opened then ventilation was likely to be limited. In addition, rooms that were not designed for habitation (e.g. storage areas) were sometimes repurposed as offices when required. Such rooms may have had even lower levels of ventilation.
- Symptoms common in at least 4 respondents (staff) were:
    - Watery eyes
    - Dry/itchy eyes
    - Headache
    - Sinus congestion
    - Skin irritation/itching
    - Rash
    - Breathlessness/difficulty breathing
    - Fatigue
    - Difficulty sleeping
    - Impacts on concentration or memory.
- Most common symptoms were generally consistent with allergic responses.
- Health statistics about allergies in Australia may provide some support that the levels of these symptoms are higher than would normally be expected on average. However, it is noted that this is a very small group of people, so applying such statistics in this way is not particularly robust.

This mix of findings does provide some support for the hypothesis that significant moisture within the fabric of the buildings at the school may have resulted in mould growth (seen or unseen) which impacted on individuals who were sensitive to allergic reactions.

There were limitations to the investigation (as with any public health investigation for small groups). These limitations mean that it is not possible to be definitive about the specific situations in which these symptoms may return. However, actions can be considered based on the possible mechanism – i.e. excess moisture and related mould.

Even if these issues are not the main explanation for the health symptoms seen in staff and students, ensuring good management of moisture issues to the extent practicable is good practice.

One particular aspect of managing moisture/damp well that is difficult in Wee Waa is the characteristics of the area. The town is located in the flood plain for the Namoi River and a levee bank has been built around the town which limits how quickly water can drain away from the area after large rain events. In addition, the gradient between Wee Waa and the final point where water from the Namoi River reaches the ocean is very shallow. The gradient between Wee Waa and Menindee Lakes is a decrease of around 100 m (i.e. 0.1 km) in vertical height over 700 km horizontal (i.e. about 14 cm per km). This means when significant rainfall events occur it can take a long time before standing water drains away. This means management of water and associated moisture will be an ongoing issue for Wee Waa.

It is noted that a range of control measures have been taken at the school including

- supporting individuals while they took time off to recover
- moving individuals from one room to another if there were obvious issues related to a particular location at the school
- organising work rosters to allow individuals to work at home for some days during the week where this is possible
- establishment of demountable replacement rooms at the former high school site so that the most problematic areas no longer needed to be used
- relocation of the entire high school community from the former site to the public school site
- commitment to build a new high school in a new location close to the public school site in 2022
- consultation with the school community about the design of the new high school.

These measures had some success until the significant rain event in October/November 2021.

Ensuring that the proposed new school is constructed with all appropriate measures to control moisture and dampness as well as ensuring the school grounds are managed to minimise the potential for standing water are likely to be the most effective approaches to managing the potential for health effects at the school. A commitment to manage plumbing problems in a timely manner into the future and avoiding the use of evaporative air conditioning will also be important to consider.

Section 1. Introduction

1.1 Background

Environmental Risk Sciences Pty Ltd (enRiskS) and Dr Tony Brown (University of Sydney) have been engaged by the NSW Department of Education to undertake an investigation of a number of health incidents related to Wee Waa High School that have occurred between 2018 (and potentially earlier) and 2021.

Wee Waa High School is a small, co-educational, comprehensive rural secondary school in North-West NSW that services students from the town of Wee Waa, Burren Junction and Pilliga. Approximately 36% of the students at Wee Waa High School are Indigenous and the school is committed to promoting its cultural diversity through a strong educational program for Aboriginal students. Approximately 150 students attend the school, and the school has approximately 30 staff (Wee Waa High School Annual Report 2020).

Various staff and students have reported the following types of symptoms (of varying severity) at times over the last 5 years:

- irritation (skin/eyes)
- rashes
- respiratory difficulties
- fatigue/lethargy.

Between 2015 and 2019, reports of symptoms were generally occasional. In 2018, mould was observed in some locations at the school. In 2019, again occasional incidents were reported for some staff.

In 2020, an increase in the number of reported incidents occurred shortly after a significant rain event. This continued throughout the year. Investigations of mould levels and building characteristics were undertaken on multiple occasions through the year. During the year, students as well staff reported symptoms at various times. During the second half of 2020, a health committee worked with the Department to look into possible causes of these complaints. This work resulted in the transfer of the high school to the public school in Wee Waa.

Even after the relocation, symptoms have continued at times throughout 2021 for some individuals. This report details a health investigation that has been conducted in 2021 to further evaluate the health complaints and issues reported.

1.2 Objectives

The objectives of the health investigation conducted are:

- To undertake a systematic investigation of health complaints made by staff and students in relation to the Wee Waa High School, at the High School site and following relocation.
- Communicate the process and outcomes of the investigation with the local committee, which would be expected to include the Department of Education, high school representatives (principal, P&C etc) and NSW Health.

1.3 Approach

The investigation has been undertaken in accordance with relevant guidelines / protocols endorsed by Australian regulators, including the following:

- Commonwealth Department of Health (2010) Guidelines for the public health management of gastroenteritis outbreaks due to norovirus or suspected viral agents in Australia (Chapter 7) https://www1.health.gov.au/internet/publications/publishing.nsf/Content/cda-cdna-norovirus.htm-l~cda-cdna-norovirus.htm-l-7
- US CDC (2012) Principles of Epidemiology in Public Health Practice (third edition) https://www.cdc.gov/csels/dsepd/ss1978/index.html
- WHO Disease outbreak toolboxes https://www.who.int/emergencies/outbreak-toolkit/disease-outbreak-toolboxes and https://www.who.int/emergencies/outbreak-toolkit/data-collection-standards and https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjD3-LTwdD0AhW7xzgGHZndAVAQFnoECB4QAQ&url=https%3A%2F%2Fwww.who.int%2Fhac%2Ftechguidance%2Ftraining%2Foutbreak%2520investigation_en.pdf&usg=AOvVaw0n3YatuizlskiB_O0gQO6c
- European Centre for Disease Prevention and Control (ECDC) (2019) Field epidemiology manual wiki https://wiki.ecdc.europa.eu/fem/Pages/Outbreak%20investigations%2010%20steps,%2010%20pitfalls.aspx and https://wiki.ecdc.europa.eu/fem/Pages/Outbreak%20Investigations.aspx
- enHealth 2012, Environmental Health Risk Assessment, Guidelines for Assessing Human Health Risks from Environmental Hazards (enHealth 2012).

To achieve the objectives, the project involved the following:

- Review of all existing information
- Outline of chronology of the incidents
- Review and summarise the site investigation findings
- Conduct interviews with individuals who may have been affected (including those who have presented to GPs and hospital with health complaints) to understand and document their health concerns
- Gathering of health information from the GPs and specialists relevant for affected individuals
- Gathering of hospital and ambulance statistics with assistance from NSW Health
- Preparation of a report outlining the steps (as relevant) in an outbreak investigation including things like:
    - confirm the diagnosis
    - case definition
    - case interviews documentation
    - systematically describe the key characteristics of the cases
    - generate hypotheses using descriptive findings
    - test hypotheses with an analytical study
    - compare hypothesis with established facts, additional studies

- implement control/prevention measures, if required
- initiate/maintain surveillance, if required
- communicate findings.

Meeting(s) have also been held with a local reference committee in Wee Waa.

The impact of COVID in 2021 resulted in some changes to the proposed approach, which included:

- Fewer meetings were conducted with the local reference committee in Wee Waa
- Individual interviews had to be changed to be conducted via online video conferencing
- The availability of information from NSW Health was limited due to resourcing of works outside of the COVID response.

Section 2. Background information

Wee Waa is located in the floodplain of the Namoi River. The town is at an elevation of 192-193 m AHD including the school site. The Namoi River drains to the Darling River which eventually reaches the ocean in South Australia after joining with the Murray River. The average gradient of the land between Wee Waa and the Menindee Lakes (a relevant location along the Darling River) is about 14 cm per km. This means when significant rainfall events occur it can take a long time before standing water drains away.

The town is surrounded by a levee bank to manage flooding and this will also limit how water drains after rain. A study of the levee bank was undertaken in 2015 by URS on behalf of Narrabri Shire Council. It provides hazard maps for flooding which indicate that most of the town (including the high school) can be classed as at high risk for flooding (URS 2015).

The original location of the high school is at the eastern end of the town adjacent to the levee (see **Figure 2.1**). O'Briens Channel appears to be a drainage line running along the outside of the levee bank in the vicinity of the school. The location of the Wee Waa Public School, which is closer to the centre of town, is also shown on this figure. The location of the levee bank in the vicinity of the high school site is shown in **Figure 2.2**.

Anecdotally, it is believed that the high school was built on a site that was more low lying than those around it ("a swamp"). The school was constructed after fill was brought onto the site to raise the ground level. The school was constructed in the 1970s.

The idea that this site was low lying or swampy is supported by the design of the main school building which was constructed with a sub-floor space or void that raises the building to a higher level and allows flood water to pass beneath the building. This sub-floor space/void collects water during periods of rainfall and flooding. It is not known if:

- this space was intended to collect water as well as allowing water to flow through, or
- this space included a pumping system to remove water as it collected, or
- the design intended the water to remain in place to evaporate over time.

A map of the overall layout of the high school is provided in **Figure 2.3**. More detailed maps of each part of the school are provided in **Appendix A**.

The main building at the site is located in the southwest corner of the site and includes A, B, C and D block. The demountable buildings were laid out across the northwest corner of the site.

The administration, principal and deputy principal offices are on the ground floor of block A also known as B00A. Staff rooms and other facilities were located on the first floor of this block.

B block included the hall and toilet blocks.

C block included the art space, additional toilet blocks, storerooms and the metal work area on the ground floor and various classrooms on the first floor.

D block included a laboratory, the food tech and hospitality spaces and storerooms on the ground floor and the library, storerooms and plant room on the first floor.

Wee Waa Public School

Wee Waa High School

O'Briens Channel


Kamilaroi Hwy
Kamilaroi Hwy
Wee Waa Skatepark
Rose St
Purcell Ave
Wee Waa High School Sports Grounds
Wee Waa High School
Wee Waa Museum
Quinns Billabong
Rose St
Alma St
Purcell Ave
Alma St
Servo
Levee

8270 - Wee Waa High School

Site Plan (11390)

Section 3. Outbreak identification

3.1 General

This section outlines the process for identifying an outbreak in public health situations.

This process is normally applied to outbreaks of infectious diseases (like gastroenteritis outbreaks) which does not appear to be relevant for this situation. However, the principles are useful for presenting and evaluating the information gathered in this investigation in a way that can identify plausible explanations for the situation that has arisen at Wee Waa High School.

3.2 Approach to an outbreak investigation

Guidance is widely available from major government organisations about how to undertake an outbreak investigation including:

- Commonwealth Department of Health (2010) Guidelines for the public health management of gastroenteritis outbreaks due to norovirus or suspected viral agents in Australia (Chapter 7) https://www1.health.gov.au/internet/publications/publishing.nsf/Content/cda-cdna-norovirus.htm-l~cda-cdna-norovirus.htm-l-7
- US CDC (2012) Principles of Epidemiology in Public Health Practice (third edition) https://www.cdc.gov/csels/dsepd/ss1978/index.html
- WHO Disease outbreak toolboxes https://www.who.int/emergencies/outbreak-toolkit/disease-outbreak-toolboxes and https://www.who.int/emergencies/outbreak-toolkit/data-collection-standards and https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjD3-LTwdD0AhW7xzgGHZndAVAQFnoECB4QAQ&url=https%3A%2F%2Fwww.who.int%2Fhac%2Ftechguidance%2Ftraining%2Foutbreak%2520investigation_en.pdf&usg=AOvVaw0n3YatuizlskiB_O0gQO6c
- European Centre for Disease Prevention and Control (ECDC) (2019) Field epidemiology manual wiki https://wiki.ecdc.europa.eu/fem/Pages/Outbreak%20investigations%2010%20steps,%2010%20pitfalls.aspx and https://wiki.ecdc.europa.eu/fem/Pages/Outbreak%20Investigations.aspx

There is a generally agreed process for such investigations which includes 10 steps as follows:

- confirm the diagnosis
- case definition
- case interviews documentation
- systematically describe the key characteristics of the cases
- generate hypotheses using descriptive findings
- test hypotheses with an analytical study
- compare hypothesis with established facts, additional studies
- implement control/prevention measures, if required
- initiate/maintain surveillance, if required

- communicate findings.

The information gathered across this investigation has been used to follow this process through to allow development of plausible hypotheses for the effects seen in individuals attending Wee Waa High School. Some of the steps are not relevant for this investigation and this is discussed, where relevant, in the following section.

3.3 Steps in the investigation

This report has been laid out in accordance with these steps as much as possible.

Table 3.1 shows the investigation steps and where discussions related to each step are addressed in the report.

Table 3.1: Outbreak investigation steps

Investigation step	Where this is addressed in this report
1. Confirm the diagnosis/outbreak (i.e. discuss the issue)	Sections 4, 5 and 6
2. Case definition	Section 8
3. Case interviews documentation	Section 7
4. Systematically describe the key characteristics of the cases	Section 8
5. Generate hypotheses using descriptive findings	Section 9
6. Test hypotheses with an analytical study	Given the situation, it is not possible to undertake this step.
7. Compare hypothesis with established facts, additional studies	Section 9
8. Implement control/prevention measures, if required	Section 10
9. Initiate/maintain surveillance, if required	Not required in this case as control/prevention measures have been put in place.
10.Communicate findings	This report constitutes the main approach to communication of the findings. Other tools that might be relevant will be discussions with the local reference group, presentations to the school staff and/or Department of Education team.

Section 4. Overview of environmental incidents

4.1 Introduction

This section provides an introduction to the incidents that have occurred at Wee Waa High School over the last few years. This section provides information in regard to step 1 of the outbreak investigation process – i.e. *confirm the diagnosis/outbreak*.

Usually step 1 of the investigation process involves identification of a clinical disease (and the relevant pathology/symptomology used to identify it) to allow the definition of a case to be developed. This works well for infectious disease outbreaks like gastroenteritis. However, for environmental drivers of disease, this step is not straightforward.

For Wee Waa High School, the range of symptoms reported, the nature of the clinical supporting information and identifying connections to a triggering situation is difficult. Primarily individuals have reported allergic type symptoms and they have anecdotally related those symptoms to situations where excess moisture has been present – e.g. floods, significant rain events, plumbing problems, roof leaks.

4.2 Supporting photographs

The potential for excess moisture (and related mould) to be present at the school is provided in the following photographs.

In October 2020, there was a day when mould appeared to grow over just a few hours on the outside of the main building at the high school site on the concrete and also the windows. **Figure 4.1** shows the concrete plinth in the morning and in the afternoon.

Another useful photo taken on this day (October 2020) showed the extent of rising damp within the external bricks. This photo is included in **Figure 4.2**. The darker coloured bricks on the edge of the wall show that there is dampness rising up the entire height of the wall.

Photo taken at 11.30 am

Photo taken at 2 pm

Figure 4.1: Photographs of concrete plinth from 20 October 2020

Figure 4.2: Photograph showing rising damp in external brick (20 October 2020)

Management of stormwater at the school site has been difficult at times. **Figure 4.3** shows a staff member canoeing across the site during a flood event to reach the location of the stormwater pump on/off switch. This situation arose in 2011 so is not related to the current time frame but it indicates how much water can be present at the site. **Figures 4.4 and 4.5** show that such large amounts of standing water were also present on site in 2020 and 2021.

Figure 4.3: Photograph of flooding at school in 2011, and access to pump switch

Figure 4.4: Photograph of flooding at the school in February 2020

Figure 4.5: Photograph of flooding at the school in March 2021

Other situations have occurred within the buildings at the school resulting in excess moisture. **Figures 4.6 and 4.7** show a roof leak in 2020 in A block as an example of what can occur when large rainfall events occur.

Figure 4.6: Roof leak A block in February 2020 – water damage

Figure 4.7: Roof leak A block in February 2020

4.3 General discussion of the issues over recent years

The following information was gathered from discussions with senior staff at the school.

Various staff and students have reported the following types of symptoms (of varying severity) at times over the last 5 years:

- rashes
- fatigue/lethargy
- respiratory difficulties
- irritation (skin/eyes).

Between 2015 and 2018, reports of symptoms were generally occasional.

In 2018, mould was observed in the library and the librarian reported symptoms at that time. An investigation into the presence of mould was commenced.

Air conditioning units were installed at the high school. Some of the units were large evaporative coolers installed in ceilings/plant rooms and attached to the exterior of the buildings. To supplement these units, mobile air conditioners were being used in specific rooms. Both of these types of units

have the potential to generate water (condensing water is the process for cooling the air). These units could have been contributing to moisture levels indoors and in the building materials (bricks etc). During the various investigations, it was recommended that the mobile units which were present in classrooms and staff rooms be removed. This occurred.

In addition to potential moisture and mould issues, the high school site also had a pigeon infestation toward the end of the drought (i.e. 2018). The evaporative air conditioners provided a source of water for the birds which was otherwise quite difficult to find. The birds were found to be nesting in the roof spaces and accessing the air conditioning ducting.

At the time of relocating the high school population to the primary school site, it had already been planned to convert all air conditioning at the high school into reverse cycle units. This work did not proceed due to the move away from these buildings.

In 2019, again various incidents were reported for some staff.

In 2020, an increase in the number of reported incidents occurred shortly after a significant rain event – the breaking of the drought. This continued throughout the year. Further investigations of mould levels and building characteristics were undertaken on multiple occasions through the year. During the year, staff and students reported symptoms at times.

Some building maintenance was undertaken in 2020 that included:

- plumbing review
- additional hardstand was installed around building edges
- guttering was repaired
- water was pumped out of the building void on a number of occasions at the end of term 1 and start of term 2 resulting in a total of approximately 200,000 L being removed from the void (approximately 80,000 L per pump out event).

Also in 2020, there was a sewage spill during term 2. Cleaning and repairs occurred following the sewage spill. The cleaner remembered that a similar spill had occurred some years prior and that when that occurred the carpet was not replaced.

As the year progressed and incidents continued, different parts of the high school were designated restricted access and classes were moved to other locations. Demountable classrooms were brought to the high school site to assist in this process. Some classes were moved to the primary school site with senior students remaining at the high school. Issues appeared to settle, and the junior school students returned to the high school site into the demountable buildings.

The initial transfer of junior students to the primary school site in 2020 did not include movement of equipment or resources.

The cleaner had been cleaning the concrete playground area at the high school site using a leaf blower but during 2020 this stopped when she reported that she got skin irritation on the days when she undertook this activity.

In term 4 of 2020, when the junior students came back to the high school site and into the demountable buildings, the general assistant (GA) wanted to prepare the area well for the return

and used a leaf blower on the playground which seemed to restart some health issues for some individuals.

Over the first few weeks of term 4 in 2020, increases in symptoms and numbers of affected individuals occurred including some hospitalisations. This coincided with increased rain.

Finally, all students were moved to the primary school site along with some of the demountable buildings (following cleaning). All of the high school students have attended school at the primary school site for the duration of 2021 (excluding COVID lockdowns). This transfer of all students from the high school to the primary school did include movement of some of the equipment/ resources.

Incidents continued to occur in 2021, particularly after accessing equipment and resources (including books and paper) transferred from the high school to the primary school.

To date, the following additional steps were taken in 2021:

- demountable buildings were to be deep cleaned prior to being moved to primary school – it is unclear exactly what was involved in this cleaning
- all equipment/resources that were brought from the high school site have been progressively removed from the primary school site (including all paper) after observations of individuals reporting symptoms following contact with these materials
- forensic clean of all classrooms being used at the primary school for the high school students was commenced in late April 2021.

4.4 Weather

Understanding rainfall patterns in Wee Waa is important supporting information for this investigation. As described above, there appears to be a link between the incidents for staff and students and higher amounts of rainfall.

Data describing rainfall are available from the Bureau of Meteorology. Yearly rainfall totals for 2011 through to 2021 for Wee Waa are provided in **Table 4.1**.

Table 4.1: Yearly rainfall at Wee Waa

Year	Rainfall total (mm)
2011	675.9
2012	541.1
2013	417.8
2014	372
2015	598.1
2016	656.4
2017	435.9
2018	338.9
2019	202.7
2020	741.1
2021	777.7

These yearly totals for rainfall indicate that 2020 and 2021 were particularly wet years.

In addition to the yearly data, the Bureau of Meteorology provides graphs showing daily rainfall across a particular year. **Figures 4.8 to 4.12** show these graphs for 2017 to 2021.

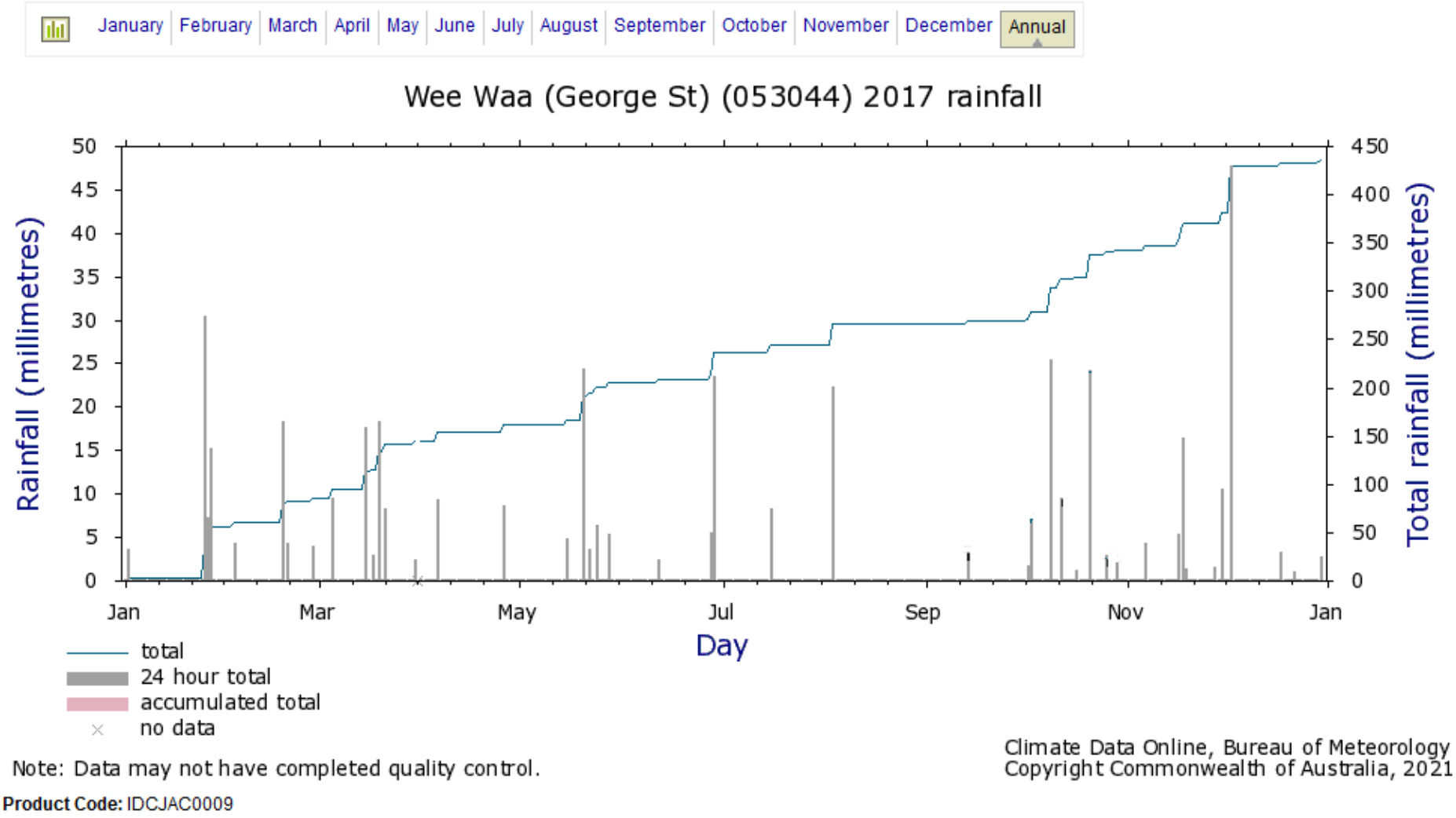


Figure 4.8: Daily rainfall data for Wee Waa – 2017 (source: Bureau of Meteorology)

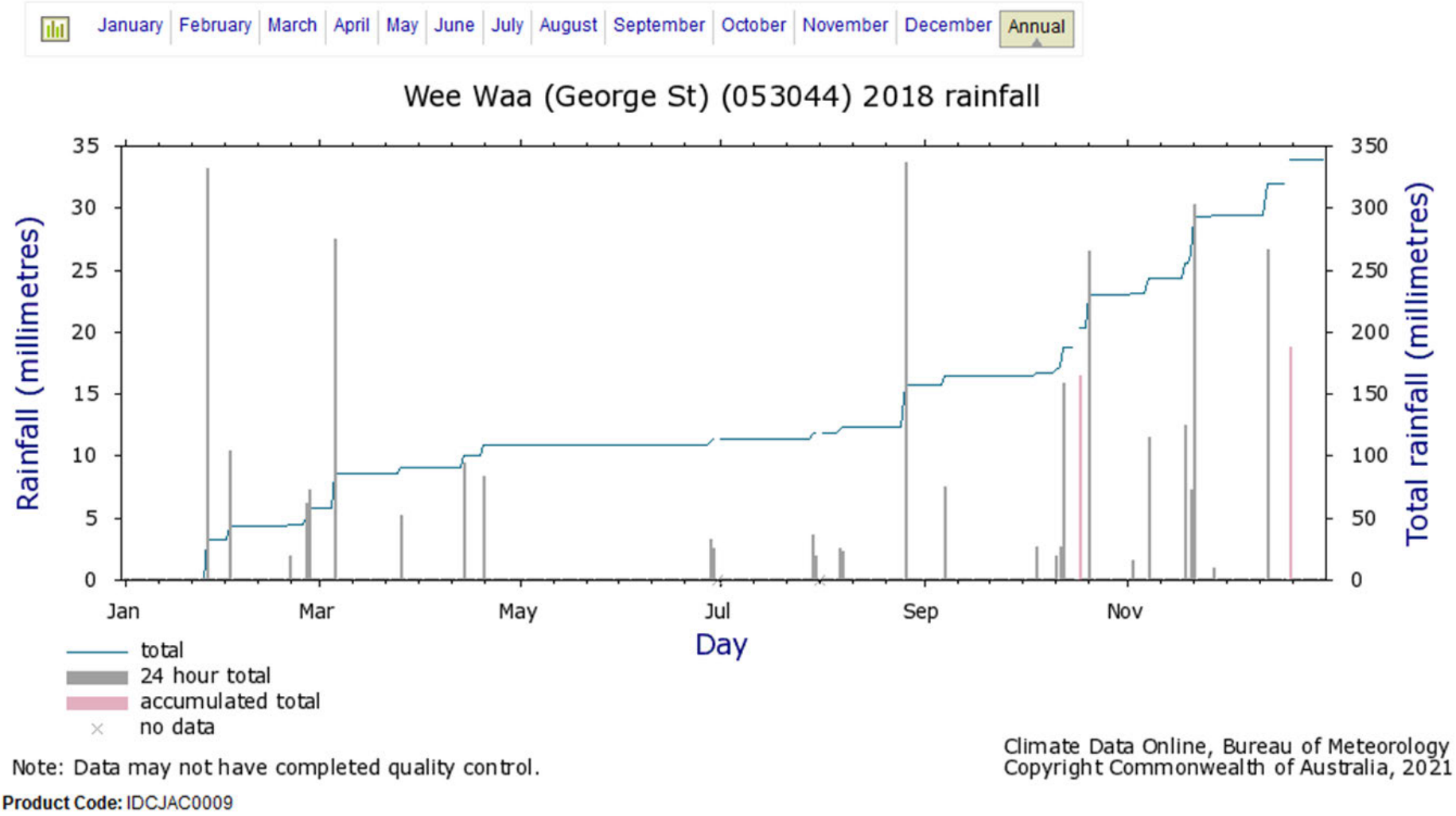


Figure 4.9: Daily rainfall data for Wee Waa – 2018 (source: Bureau of Meteorology)

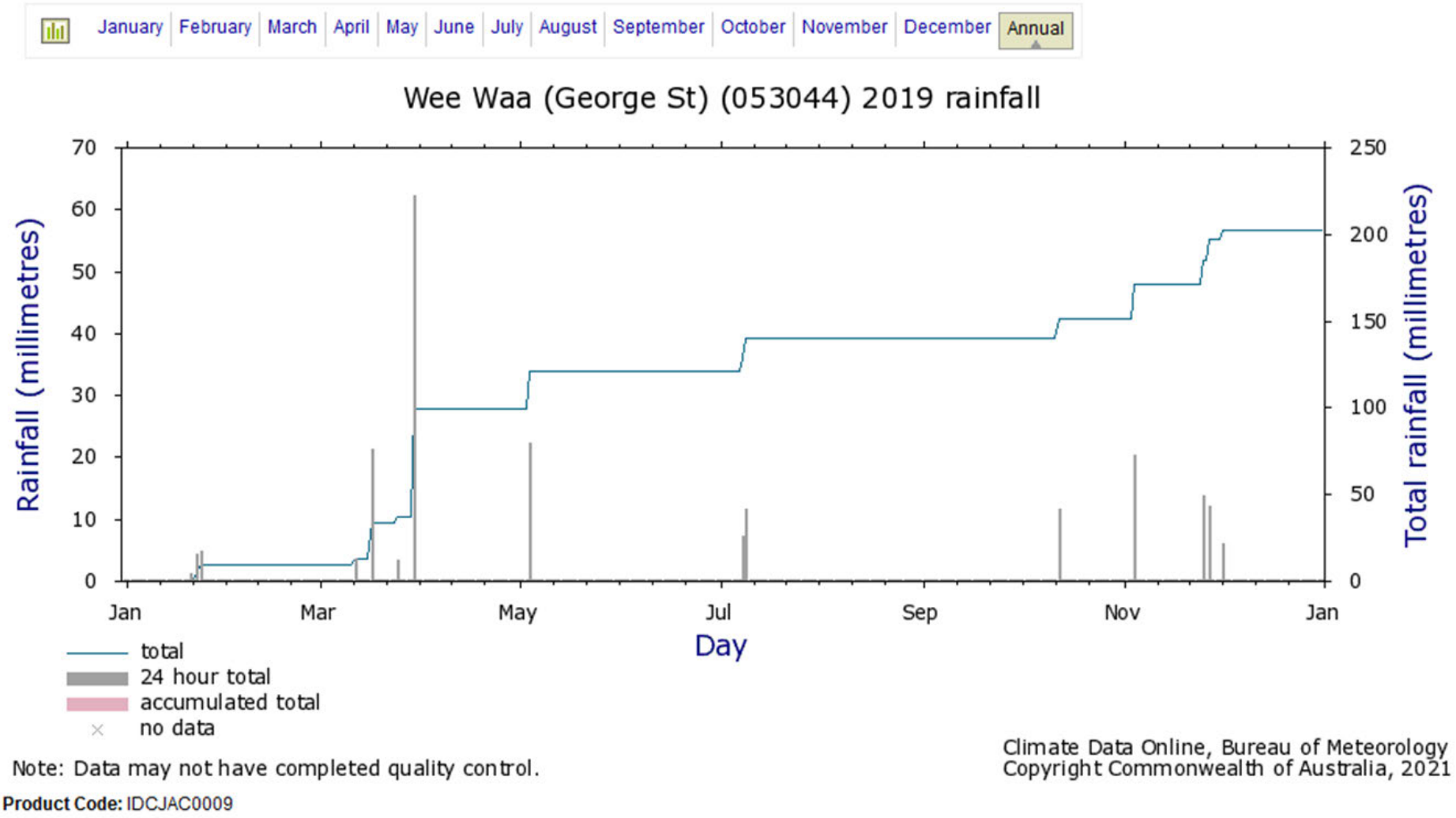


Figure 4.10: Daily rainfall data for Wee Waa – 2019 (source: Bureau of Meteorology)

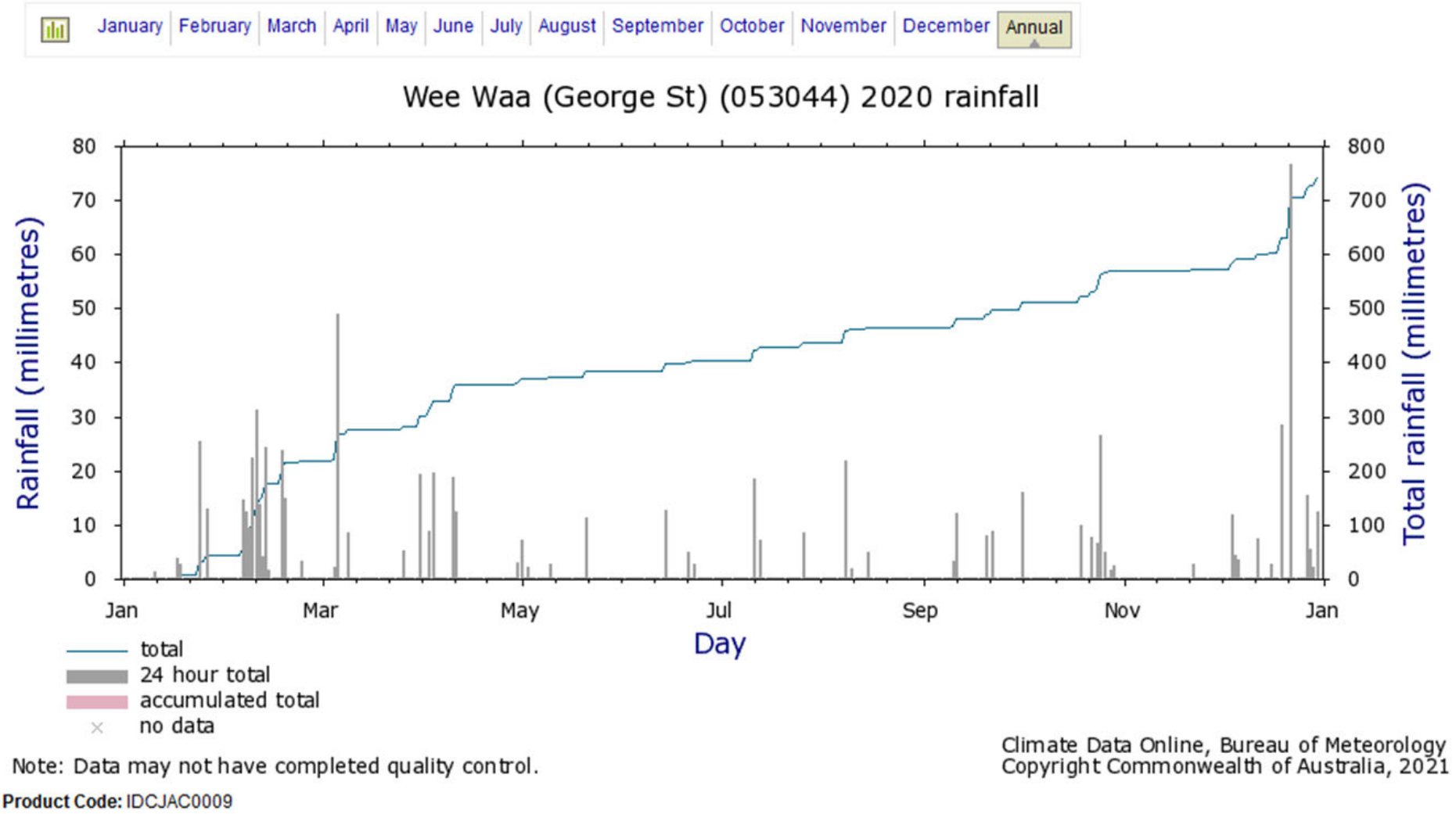


Figure 4.11: Daily rainfall data for Wee Waa – 2020 (source: Bureau of Meteorology)

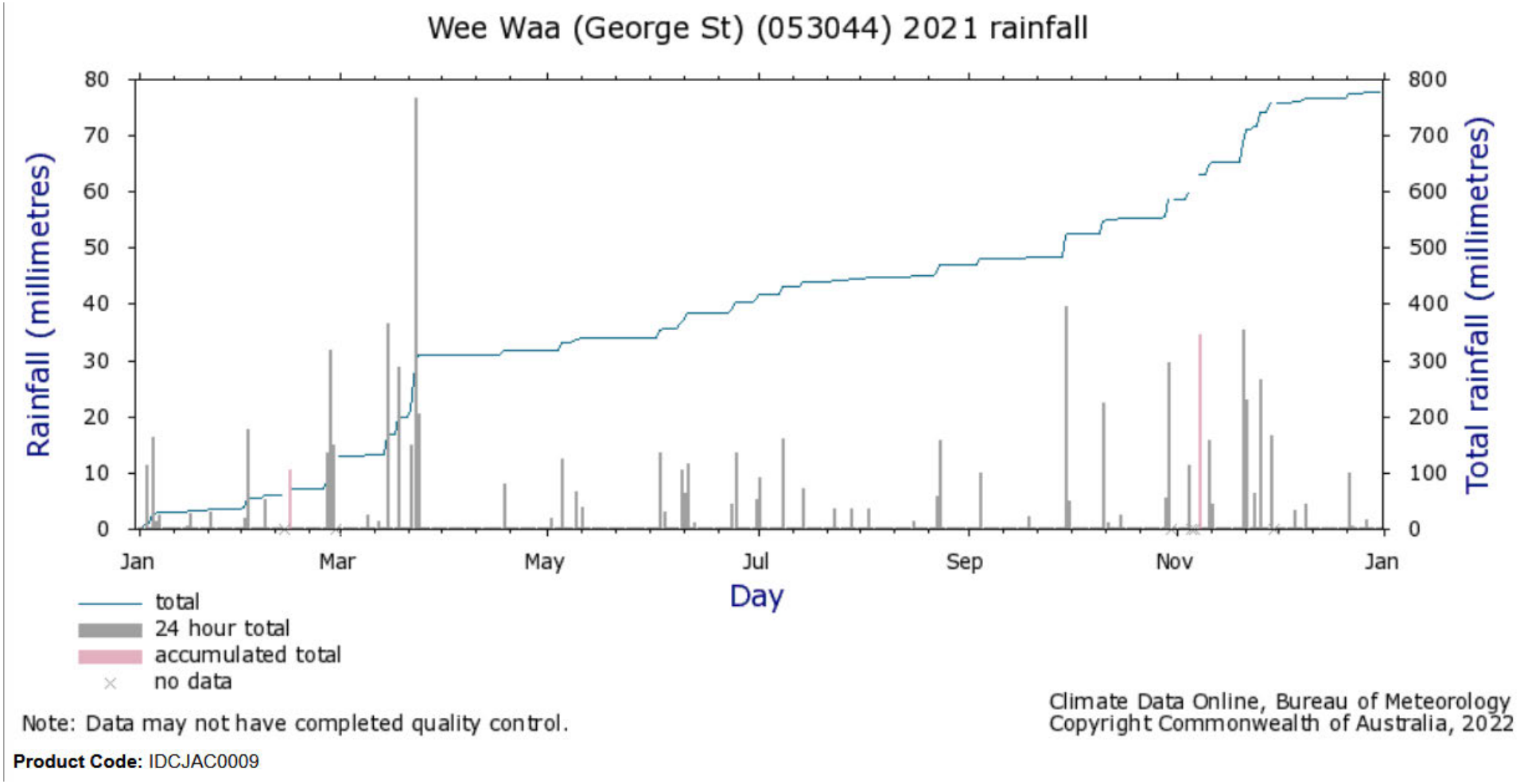


Figure 4.12: Daily rainfall data for Wee Waa – 2021 (source: Bureau of Meteorology)

Figures 4.8 to 4.12 show that:

- In 2017, there were a number of larger rain events in February/March and November/December (2 occasions with more than 30 mm in 24 hours)
- In 2018, there were a number of larger rain events in February and March as well as in September and November (3 occasions with more than 30 mm in 24 hours)
- In 2019, rain fell in March, but little rain fell through the rest of the year (1 occasion with more than 30 mm in 24 hours)
- In 2020, a lot of rain fell in the first 3 months of the year (2 days >30 mm in 24 hours and 9 additional days >10 mm to end of March) with much lower amounts through the rest of the year until October (around 60 mm across second half of month)
- In 2021, large rainfall events occurred toward the end of February and through March (6 occasions with more than 30 mm in 24 hours). The end of October into November also saw significant rainfall.

Section 5. Chronology of notifications

5.1 General

This section provides a summary of the reports of symptoms using the data from the NSW Department of Education SHIELD system and related information.

This section also provides information in regard to step 1 of the outbreak investigation process – i.e. *confirm the diagnosis/outbreak*.

5.2 2018

5.2.1 Health notifications

A notification was made to SafeWork NSW indicating that a number of workers (number unspecified) were being affected with allergic reactions at the school.

5.2.2 Building/site notifications

In April 2018 an initial notification was received about issues at the school. Regional Enviroscience were engaged to undertake an investigation at the school. After the initial investigation was undertaken, further monitoring was commissioned and remediation of some areas within the school was recommended using a biocide to clean surfaces. In addition, maintenance on some of the air conditioning units was undertaken. Work was completed by July 2018.

A range of repairs on plumbing related services were undertaken at the school across 2018 including (refer to **Appendix A** for room ID locations):

- water leak from the ground under Block A
- leaking hot water service in Block C
- sewage blockage in junior toilet block
- sewage blockage in CR0027
- air conditioning repairs – replacement of pads (various), repair of copper pipes what had been bent
- leak from air conditioning unit in HR00001.

5.3 2019

5.3.1 Health notifications

A notification was made for an individual person in October 2019 indicating allergic reactions were occurring for her within the school.

5.3.2 Building/site notifications

The following notifications were made, and investigations conducted during 2019 that relate to air conditioners (evaporative), water and plumbing issues, moisture and mould (refer to **Appendix A** and **Figure 2.3** to see locations of specific areas):

- January – leak in pipe near B000A
- February – leak in shipping container near H block
- February – leak coming from under A block

- March – removal of 9 portable evaporative coolers (evidence of mould) and steam clean of carpets in AR0006, AR0009, CR1001, CR1007, CR1008, CR1009, CR1010, CR1011 and CR1012
- March – roof leak during rain event in demountable
- March – water leaking in a toilet
- May – mould reported in library area, inspection identified leaking air conditioning duct which was repaired. No mould was observed inside the duct.
- May – mould investigation in A block and library
- May – pipe leak under ramp to B00A
- May – water leak from pipe behind wall in CR0017
- June – WSP undertook sampling in AR0006, AR0009 and DR1005
- June – leak near shipping container near H block
- June – leaking tap in FR0003 and in BR1005
- July – water leaks from basin taps in toilets (CR0017)
- July – WSP report on sampling provided for June sampling. No issues were identified but a range of recommendations were made including:
    - Consider use of a building surveyor to identify issues relating to moisture across these rooms
    - Consider keeping windows open in these rooms to improve ventilation, lower carbon dioxide and reduce likelihood of mould
    - Dehumidifiers should be considered for AR0006
    - Consider cleaning all surfaces within the air conditioning units
    - Routine housekeeping should include cleaning of surfaces with disinfectants, vacuuming of floors and furniture throughout the school
- August – hot water system repair
- September – quotes to implement the WSP recommendations were sought
- September – air conditioning service resulted in a hose being left running
- September – water leak outside DR0011
- September – water leak in groundwater bore pipes to ag plot
- October – various water leaks in AR1007
- November – roof leak from earlier in the year reoccurred after repair (resulted in mould appearing)
- December – building inspection identified need to repair some air conditioning ducts
- December/January (2020) – cleaning of ducts in A block and the top floor of D block was undertaken.

5.4 2020

5.4.1 Health notifications

More than 40 notifications in total were made in 2020 by staff reporting a range of symptoms they related to exposure to mould and/or sewage.

More than 30 notifications were made in regard to students reporting symptoms while at the high school. In addition, a number of contractors or volunteers also made notifications about their symptoms across 2020.

Given the number of notifications in 2020, a more detailed review of the reports has been undertaken.

About half of the staff notifications were for those who came forward to be interviewed (as discussed in **Section 7**) and half were from other people. Also, some individuals were impacted on multiple occasions throughout 2020.

Notifications were clustered around the following dates:

- 14 February (1 staff)
- 26 to 28 February (2 staff; 1 student)
- 9 to 11 March (2 staff)
- 12 May (1 staff)
- 5 June (1 staff)
- 20 August-2 September (19 staff; 13 students; 1 volunteer; 1 contractor)
- 28 to 29 October, 3 to 10 November (12 staff; 19 students; 1 contractor)
- 11 December (3 staff; 1 student).

The symptoms reported in these notifications include:

- Itchy eyes (10 reports)
- Sore eyes (9 reports)
- Swollen eyes (4 reports)
- Irritated/watery eyes (11 reports)
- Runny nose (6 reports)
- Tightness of chest (6 reports)
- Shortness of breath (3 reports)
- Asthma (3 reports)
- Sores/pain in nose (3 reports)
- Rashes/eczema (6 reports)
- Headache (15 reports)
- Fatigue (8 reports)
- Sinus pain (1 report)
- Loss of concentration/memory fog (2 reports)
- Difficulty sleeping (2 reports)
- Itchiness all over (4 reports)
- Ache – back, face, all over (5 reports)
- Sore throat (1 report)
- Swollen face/nose (1 report)

It is likely that these short reports may not include all symptoms a person may be experiencing. It is also likely that a person may not make a notification into the system every time they experience one or more of these symptoms.

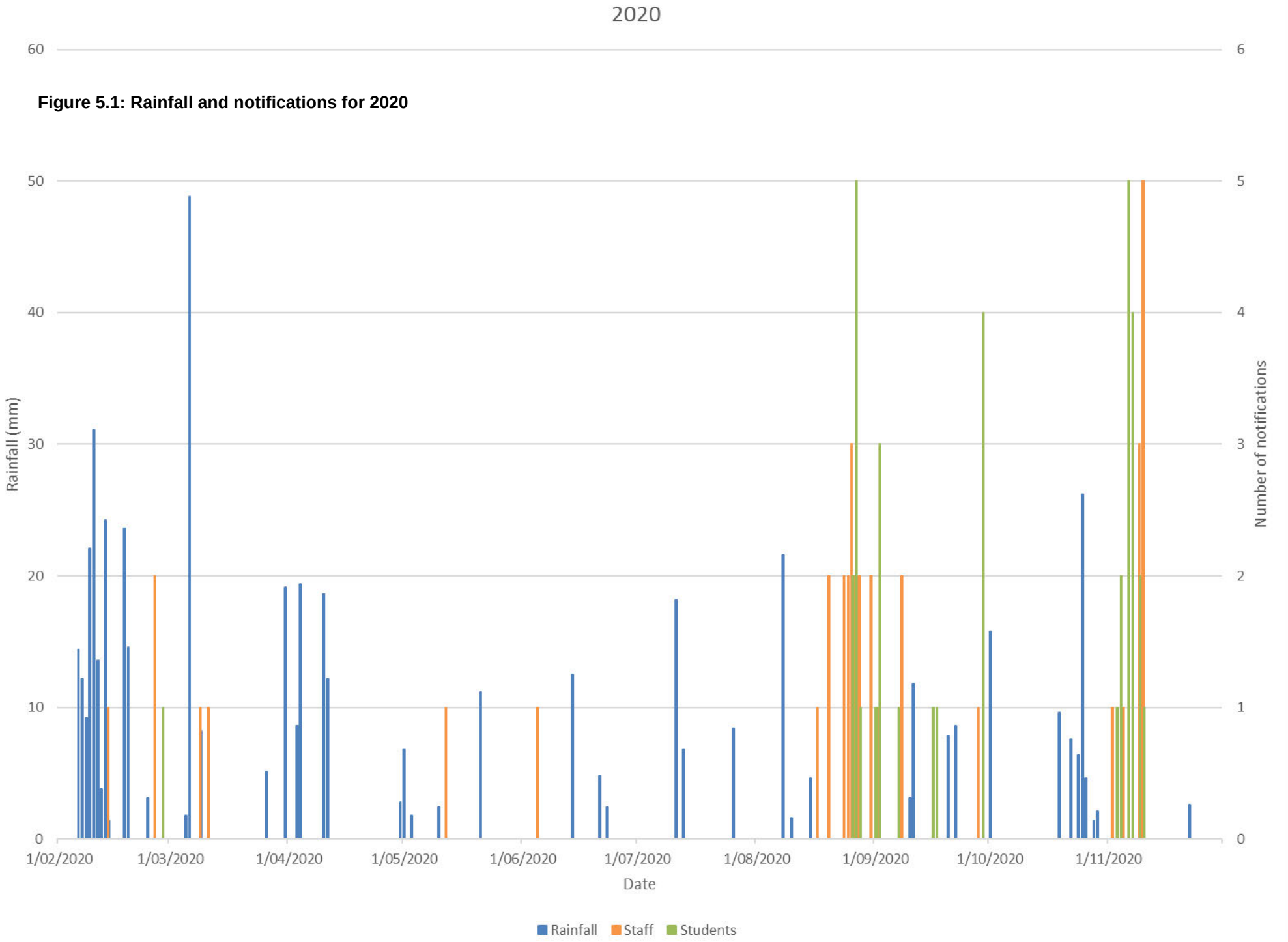
The most common symptoms in 2020 were headaches, various impacts on eyes, rashes, fatigue and respiratory impacts.

Rainfall events of more than 10 mm occurred as follows:

- 6 to 14 February – 131 mm
- 18 to 19 February – 39 mm
- 5 to 6 March – 51 mm
- 31 March – 19 mm
- 3 to 4 April – 28 mm
- 10 to 11 April – 31 mm
- 21 May – 11 mm
- 14 June – 13 mm
- 11 July – 18 mm
- 8 August – 22 mm
- 11 September – 15 mm
- 24 to 29 October – 48 mm
- 4 to 6 December – 19 mm
- 19 December – 28 mm
- 22 December – 76 mm
- 27 to 30 December – 34 mm.

There appears to be a correlation between some of the larger rainfall events with the clusters of notifications (which follow the rain) particularly those in February/March and in early November – i.e. particularly when significant rain occurs during warmer months. **Figure 5.1** shows the timing and amount of rainfall and the timing/numbers of notifications for 2020 for staff and students.

Figure 5.1: Rainfall and notifications for 2020



5.4.2 Building/site notifications

The following notifications were made, and investigations conducted during 2020 that relate to air conditioners (evaporative), water and plumbing issues, moisture and mould (refer to **Appendix A** for room ID locations):

- February – roof leak through air conditioning units
- February – carpet removed from AR0008 and the floor in this room was treated
- February – leak in corridor outside AR1001, water pooled in Careers staffroom and MC Classroom – roof leak identified
- February – smells from mould were identified in CR1006, CR1004, DR002 and CR1001
- February – dampness in ceiling cavity identified
- February – leak near ag farm shed (not the groundwater bore infrastructure)
- February – water in the exhaust of a fan/air conditioner (fan underwater)
- February – area under B00C and B00D flooded – potentially due to leaks in taps in the girls toilet (CR0017)
- February – mould odour reported near B00C, B00D, B00A, LAB1 (maths staffroom) – inspection initiated including inspection of ceiling spaces
- February/March – carpets in a range of rooms were cleaned and sanitised (CR1001, CR1002, CR1004, CR1006, all rooms in A block and the library in D block)
- March – water leaking near CR0003 – near air conditioning unit (B00C and B00D)
- March – rainwater entered the building (book room) – mould and water damage observed (B00H)
- March – water seeping to ground surface from underground infrastructure
- March – water dripping onto light fitting (B00A)
- March – rotten egg smell coming from under D block
- March – water leak at ag farm
- March – water leak between B000I and covered basketball court
- March – mould testing was undertaken (Regional Enviroscience)
- March – carpets were removed and floors and furniture were cleaned and sanitised
- March – asbestos was removed from AR0001 and AR0004 (vinyl floor coverings)
- March – CR1001, CR1002, CR1004, CR1006, all rooms in A block and the library in D block were all cleaned and sanitised again
- March – additional mould testing was undertaken
- March – water leak near water meter
- March – water was pumped out of void under the main building
- March – overflowing toilet – sewage leak
- March – outdoor taps in various locations were repaired to minimise moisture
- March – investigation of the stormwater system at the site along with clearing of some of the lines was undertaken along with repair of some stormwater lines where they connected to the street
- March – water was pumped out of void under the main building
- April – water was pumped out of void under the main building
- April – range of works were undertaken to seal concrete pits and prevent water ingress to sub-floor of main building (north side A block)
- April – leak from second floor of hall observed

- April – inspection of ducts in A and D block for mould
- May – water was pumped out of void under the main building on 2 more occasions (on second occasion thick silt was removed as well as water)
- May/June – stormwater repairs for A, B, C and D block
- May – concrete/drainage works to south end D block and north end A block completed
- May – leak from roof into woodwork room
- May – additional sewage leaks (AR0001/AR0002)
- May/June/July – concrete/drainage works to east side C block undertaken
- June – further works in A and D blocks to fill penetrations
- June – leak observed from pipe in ground outside hospitality room
- June – blocked drain at DR0011
- June – ongoing issues with various toilets
- June – swab sampling within evaporative air conditioning ducts in A block to assess mould (Regional Enviroscience)
- July – swab sampling on glass surfaces in the library to assess mould (Regional Enviroscience)
- July – blocked drains behind demountable 10897
- July – leak in roof in AR1001 observed
- August – mould notification on door of DR0007 and sampling (Regional Enviroscience)
- August – leaks from various air conditioning units reported/repaired
- August – additional swab sampling around the school to assess mould (Regional Enviroscience)
- August – welding bay roof leak observed
- September – decision to limit access to A, B, C and D blocks (fence installed)
- September – additional swab sampling around the school to assess mould (WSP)
- September – metal work room roof leak observed
- September – water leak from newly installed air conditioning unit observed
- October – blocked drain (and bad odour) in demountable
- October – new demountable used for library – roof leak observed
- October – various issues with water leaks around ag farm part of the school
- October – repairs to overflow pipe from air conditioning unit to prevent water entering building
- November – further issues with various toilets
- November – relevant pipes to be terminated to prevent water reaching building.

School relocated to primary school site during latter part of 2020.

5.5 2021

5.5.1 Health notifications

Throughout 2021 Wee Waa High School operated out of the Wee Waa Primary School site.

More than 30 notifications (or staff members within a notification) were made to the end of March 2021.

More than 10 notifications were made in regard to symptoms in students to the end of March 2021.

Notifications were clustered around particular days including 18/19 February, 5, 8 to 10, 17, 25/26 and 29/31 March.

Rainfall in excess of 10 mm across a day occurred on 14 February (10.2 mm), 25 to 27 February (60 mm across the 3 days), 15 March (36 mm), 18 March (28 mm) and 22 to 24 March (111 mm across the 3 days). These rain events line up quite well with the clustered notifications.

Rainfall totals in February and March were 94 and 179 mm respectively. Rainfall in November was similar to March (172 mm) and this coincided with additional incidents which triggered additional interviews with some staff members.

5.5.2 Building/site notifications

The following notifications were made during 2021 that relate to water and plumbing issues, moisture and mould:

- February – major water leak from main brick building – water supply turned off to the former school site
- February – various mould remediation and storm repairs
- February – leak in roof of science lab 1 demountable at primary school site
- March – water leak in and around boys toilet at primary school site
- March – stormwater entering through unsealed window in boys toilet at primary school site
- May/June – septic overflow as pump not working at primary school site.

Section 6. Site investigations

6.1 General

A range of investigations have been undertaken at the high school commencing in 2018. More detailed summaries of the results from each report are provided in **Appendix B**. An overall summary is provided in this section.

This section also provides information in regard to step 1 of the outbreak investigation process – i.e. *confirm the diagnosis/outbreak*.

Given the nature of the reported symptoms and the expectation that issues with moisture may be the cause, most of the investigations have focused on assessing the presence of mould at the school. Other matters that have been investigated include moisture, humidity, carbon dioxide, volatile organic compounds and formaldehyde.

6.2 Investigation reports

The reports detailing the results of the various studies include:

- Regional Enviroscience (2018a) School Infrastructure NSW, Wee Waa High School, Wee Waa, NSW 2388, Microbial Testing Dated 14 June 2018
- Regional Enviroscience (2018b) School Infrastructure NSW, Wee Waa High School, Wee Waa, NSW 2388, Microbial Testing Dated 20 June 2018
- Regional Enviroscience (2018c) School Infrastructure NSW, Wee Waa High School, Wee Waa, NSW 2388, Microbial Testing Dated 10 July 2018
- WSP (2019) Joss Facility Management, Wee Waa High School Indoor Air Quality (Mould) Investigation Dated June 2019
- Edwards and Froud Building Services (2019) Special Purpose Report Number: SP19034 Premises: Wee Waa High School, Purcell Avenue, Wee Waa for Joss Facility Management Dated December 2019
- Regional Enviroscience (2020) School Infrastructure NSW, Wee Waa High School, Wee Waa, NSW 2388, Microbial Testing Dated 5 March 2020
- Enviroscience Solutions (2020a) School Infrastructure NSW, Wee Waa High School, Wee Waa, NSW 2388, Microbial Testing Dated 17 March 2020
- Enviroscience Solutions (2020b) Joss Facilities Management, Tamworth, Wee Waa High School, Wee Waa, NSW 2388, Microbial Testing Dated 13 July 2020
- Enviroscience Solutions (2020c) School Infrastructure NSW, Wee Waa High School, Wee Waa, NSW 2388, Microbial Testing Dated 31 July 2020
- WSP (2020a) NSW Department of Education, Wee Waa High School Indoor Air Quality (Mould) Investigation Dated September 2020
- WSP (2020b) NSW Department of Education, Wee Waa High School Indoor Environment Quality (Mould) Investigation Dated December 2020
- WSP (2021a) NSW Department of Education, Engineering and Environmental Assessment of Moisture, Wee Waa High School, NSW 2388 Dated February 2021.
- WSP (2021b) Wee Waa Public School, Mycometer air testing results Dated 3 August 2021.
- NSW Department of Education (2021) email reporting sampling results for 23 November 2021

- enRisks (2021) Letter report detailing wipe sample results

A summary of the information gathered during 2018, 2019, 2020 and 2021 are provided in **Tables 6.1 to 6.4**.

Table 6.1: Summary of investigations conducted during 2018

Reports	Parameters targeted	Results
Regional Enviroscience (2018a) (14 June 2018)	Mould and bacteria in air in library and related areas	• Mould levels indoors lower than outdoor sample • Different species present in indoor samples compared to outdoor sample • While total counts in indoor samples were lower than outdoor sample and screening guideline, a number were at levels above screening guideline for individual species of mould • Sampling thought to be impacted by use of air conditioner immediately before
	Mould in surface samples in library and related areas	• No mould identified
	Moisture	• Measured in carpets and found to be low
Actions recommended	Professional cleaning with HEPA and biocide on surfaces Resampling to check for impact of air conditioner	
Regional Enviroscience (2018b) (20 June 2018)	Mould and bacteria in air in library and related areas	• Mould levels indoors same or lower than outdoor sample • Different species present in indoor samples compared to outdoor sample • Mould levels lower with air conditioning off compared to when air conditioning was on • Levels in air conditioner itself were higher than outdoors and higher than all indoor areas • While total counts in indoor samples were lower than outdoor sample and screening guideline, a number were at levels above screening guideline for individual species of mould
	Mould in surface samples in library and related areas	• Mould species were present in some surface samples – particularly the filters in the air conditioner
	Mould in swabs from vents and ducts in library and related areas	• Mould species were present in all swab samples
Actions recommended	Professional cleaning of the air conditioning system (including ducts) with HEPA and biocide on surfaces	
Regional Enviroscience (2018c) (10 July 2018)	Mould and bacteria in air in library and related areas	• Mould levels indoors lower than outdoor sample • Somewhat similar species present in indoor samples compared to outdoor sample • Mould levels similar/lower with air conditioning off compared to when air conditioning was on • Levels in air conditioner itself were higher than outdoors and higher than all indoor areas • While total counts in indoor samples were lower than outdoor sample and screening guideline, a small number were at levels above screening guideline for individual species of mould • Bacterial counts quite high in outdoor sample
	Mould in surface samples in library and related areas	• No mould identified
	Mould in swabs from vents and ducts in library and related areas	• No mould identified
Actions recommended	No further action required although report doesn't document that any of the previously recommended cleaning had been undertaken. This does not mean that such cleaning did not occur, just that it was not documented in the reports from Regional Enviroscience.	

Table 6.2: Summary of investigations conducted during 2019

Reports	Parameters targeted	Results
WSP (2019)	Temperature	• No identified issues
	Relative humidity	• No identified issues
	Carbon dioxide	• No identified issues
	Mould in air	• Samples in most locations indoors were the same as the outdoor sample. • One indoor sample was higher than outdoor sample (Room AR0006) • Different guidelines for mould in air used by WSP compared to Regional Enviroscience
	Mould on surfaces	• Surface sample in room AR0006 was elevated
	Moisture	• Moisture content in floor coverings was acceptable but in brick walls was elevated
Actions recommended	Installation of dehumidifier in most affected room (AR0006)	
Edwards and Froud Building Services (2019)	Site inspection	• Only minor issues were observed but this inspection was limited to easily accessed areas

Table 6.3: Summary of investigations conducted during 2020

Reports	Parameters targeted	Results
Regional Enviroscience (2020) (5 March 2020)	Mould and bacteria in air	• Mould levels indoors same or lower than outdoor sample • Somewhat similar species present in indoor samples compared to outdoor sample • While total counts in indoor samples were lower than outdoor sample and screening guideline, a number were at levels above screening guideline for individual species of mould
	Mould in surface samples	• Mould species were present in some surface samples
	Mould in swabs from vents and ducts	• Mould species were present in some swab samples
Actions recommended	Restricted access for maths staff room but other areas fit to occupy	
Enviroscience Solutions (2020a) (17 March 2020)	Mould and bacteria in air	• Mould levels indoors lower than outdoor sample • Somewhat similar species present in indoor samples compared to outdoor sample • While total counts in indoor samples were lower than outdoor sample and screening guideline, a number were at levels above individual species screening guideline
	Mould in surface samples	• Mould species were present in some surface samples
	Legionella	• Mentioned in the front of the report but no results reported
Actions recommended	Maths staff room had been remediated and all areas were now fit to occupy	
Enviroscience Solutions (2020b) (13 July 2020)	Mould and bacteria in air in air conditioning	• Mould levels in the air conditioning ducts were lower than outdoor sample • Somewhat similar species present in indoor samples compared to outdoor sample • While total counts in indoor samples were lower than outdoor sample and screening guideline, a number were at levels above screening guideline for individual species of mould
	Mould in surface samples	• Mould species were not present in surface samples
	Mould in swab samples	• Mould species were present in some swab samples
Actions recommended	Additional cleaning of air conditioning ducts may be useful	
Enviroscience Solutions (2020c)	Mould in swab samples	Mould species were not present in swab samples taken in the library

Reports	Parameters targeted	Results
(31 July 2020)		
Actions recommended	No actions recommended	
WSP (2020a) (September 2020)	Temperature	• No identified issues
	Relative humidity	• No identified issues
	Carbon dioxide	• No identified issues
	Mould in air	• Levels quite different from those reported by Regional Enviroscience/Enviroscience Solutions • Samples in most locations indoors were the same or lower than the outdoor samples. • The room AR0006 ceiling sample was significantly higher than outdoor sample but the air in the room had much lower levels • Different guidelines and analytical method for mould in air used by WSP compared to Regional Enviroscience/Enviroscience Solutions (this included the different laboratories reporting different mix of species)
	Mould on surfaces	• Surface sample on floor of room AR0006 was elevated
	Moisture	• Moisture content in brick walls and flooring materials was elevated • Levels indicative of water transfer from under building
	Volatile organic compounds	• No identified issues
	Formaldehyde	• No identified issues
Actions recommended	Ground floor of Block A, rooms on ground floor and first floor of Block C and a storeroom and the library in Block D should be designated restricted access Moisture issues in these buildings need to be resolved	
WSP (2020b) (December 2020) (This study focused on the demountables being used at the high school site not the existing buildings)	Temperature	• No identified issues
	Relative humidity	• No identified issues
	Carbon dioxide	• No identified issues
	Mould in air	• Samples in demountable building were the same or lower than the outdoor samples
	Mould on surfaces	• Surface samples did not show mould
	Moisture	• Moisture content in demountable buildings in line with normal levels
	Volatile organic compounds	• No identified issues
	Formaldehyde	• No identified issues
Actions recommended	No issues were identified for the demountable buildings	

In addition to the investigations detailed in **Table 6.3**, a number of soil samples were collected at the high school site. These samples were analysed but it is still a bit unclear where at the high school these samples were collected and whether all the results are available in the reports provided. The results that have been provided do not identify any particular issues. In one sample elevated bacterial levels were identified but those could be related to the sewage spill in Term 2 in 2020 or due to the keeping of livestock at the school site.

Table 6.4: Summary of investigations conducted during 2021

Reports	Parameters targeted	Results
WSP (2021a) (February 2021)	Moisture	• Range of drainage issues were identified leading to the excess moisture levels identified in the building structure • Issues included: ○ channel drain under Block C not being clear of rubble

Reports	Parameters targeted	Results
		○ damp proofing course not installed in some areas ○ hardstand and soil installed adjacent to building above the damp proofing course where the damp proofing was present ○ unsealed joints ○ cracked sealing
Actions recommended	Drainage issues need to be rectified	
WSP (2021b) (August 2021) (sampling was undertaken at Public School site on 28 July 2021)	Mould in air	• Mycometer used to assess mould counts in air. The results for this technique indicated no obvious issues related to mould counts in the rooms tested. This technique did not identify individual mould species.
	Temperature	• No identified issues
	Relative humidity	• No identified issues
	Carbon dioxide	• No identified issues
	Moisture	• Excess moisture levels were present in some of the walls and ceilings in the existing public school buildings which were being used by the high school community
Actions recommended	Nil	
Email report for testing undertaken 23 November 2021	Mould in air	• Email indicates results for sampling undertaken after some remediation was undertaken. • It indicates some sampling was undertaken prior to the remedial actions • The results for mould in air prior to the remediation indicated that a number of rooms were at or above outside levels of mould. • Follow up testing was undertaken on 23 November to check on success of the remedial actions. • The results showed high levels of mould in the outdoor air samples (7,000-8,000 spores/m^3) which was attributed to the wet spring weather. • Results inside various rooms were above 1,000 spores/m^3 but not as high as the outdoor results. • Rooms with windows open had lower results than those which had windows closed during sampling. • The mix of species was similar inside and out. • Email does not describe in detail methodology adopted in this sampling or the actual remedial actions that were undertaken – presumably a deep clean.
Actions recommended	Ensure ventilation in rooms is maintained.	
enRisks (2021)	Surface wipe samples – metals	• Surface wipe samples were collected by enRiskS staff at the High School site to check for a range of chemical contaminants that had not been covered by previous investigations. • Sampling occurred on 11 May 2021 • Wipe samples were tested for a range of metals including arsenic, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium and zinc • Metals are naturally occurring elements that are common in soils • Metals that were detected in the wipe samples included boron, copper, lead, manganese and zinc • All except lead are micronutrients in soil that plants need to grow well. A small amount of dust from outdoors would yield these results.

Reports	Parameters targeted	Results
		• Lead is also commonly present in soils so again a small amount of dust from outdoors would yield these results. • The single detection for lead is below relevant guidelines for dust on surfaces from the USEPA.
	Surface wipe samples – organic compounds scan	• Surface wipe samples were collected by enRiskS staff at the High School site to check for a range of chemical contaminants that had not been covered by previous investigations. • Sampling occurred on 11 May 2021. • These wipe samples were analysed using gas chromatography and liquid chromatography which look at a wide range of chemicals. The method used identifies chemicals using a library of results but cannot quantify the amount of a chemical present. • Chemicals identified by liquid chromatography were those from normal cleaning products which would be expected to occur in any areas where cleaning occurs regularly. • While there a range of chemicals identified by gas chromatography, they are, in the main, naturally occurring ones and ones that are normally present in indoor air. No pesticides or any other chemicals of concern were identified.
Actions recommended	Monitoring data only so no recommendations	

Section 7. Case interviews

7.1 General

This section summarises the findings from the one-on-one interviews that have been undertaken with impacted staff (and some students).

This section constitutes Step 3 in the outbreak identification process – i.e. *case interviews and their documentation*.

7.2 Interviews

Staff, students (and their parents) and relevant community members were invited to participate in interviews to further document potential health impacts.

The questionnaire used in the interviews was developed by enRiskS staff with review by Dr Tony Brown (University of Sydney) and Dr Craig Dalton (NSW Health). An outline of the questionnaire was also provided to the local reference group in the initial stages of development. The questionnaire that was used is included in **Appendix C**.

The invitation to participate was provided via a fact sheet delivered to all members of the school body and this was followed up by an information session held on one evening to answer questions about the process. The school has around 30 staff and 150 students (Wee Waa High School Annual Report 2020).

Interviews were held via video conference with 13 staff members, 7 students and 2 members of the community who spent time at the school. The interviews were undertaken in September 2021 – at the end of term 3.

The interviews were held via video conference due to travel restrictions imposed due to COVID in 2021. This did not appear to detract from the process from the perspective of those conducting the interviews. Further consideration of the robustness of this approach might be useful once the interviewees have the opportunity to look at this report.

A second set of interviews were undertaken in term 4 of 2021 with a smaller number of individuals who had already been interviewed but who had a fresh outbreak of symptoms when they returned to the school after the COVID lockdown ended. Return to school coincided with significant rainfall. The questionnaire that was used is included in **Appendix C**.

After the interviews were complete, the data were entered into a summary spreadsheet to inform discussion of the results in a way that was deidentified.

7.3 Results for staff members

7.3.1 Demographics

The staff who were interviewed were predominantly female who had worked at the school for at least 5 years and were aged in their 40s or 50s. The employment roles/duties at the school were quite varied.

Table 7.1: Demographics

Parameter	Number of staff	Percentage of interviewees
Age		
Less than 20	[redacted]	[redacted]
20 – 29 years	[redacted]	[redacted]
30 – 39 years	[redacted]	[redacted]
40 – 49 years	[redacted]	[redacted]
50 – 59 years	[redacted]	[redacted]
60 years and over	[redacted]	[redacted]
Gender		
Female	[redacted]	[redacted]
Male	[redacted]	[redacted]
Length of time worked at the school		
<1 year	[redacted]	[redacted]
1-<5 year	[redacted]	[redacted]
5-<10 year	[redacted]	[redacted]
10 year or more	[redacted]	[redacted]
Role		
Senior staff	[redacted]	[redacted]
Teacher	[redacted]	[redacted]
Student learning support (including tech support)	[redacted]	[redacted]
Administration	[redacted]	[redacted]

7.3.2 Medical history (individual and family)

Around 46% of the staff reported no particular health issues before the ones that have triggered this investigation. The remaining staff had a range of issues including seasonal hay fever, some food intolerances, allergy to seafood, asthma and thyroid issues.

Around 30% of these staff reported no particular health issues in their families. The remaining staff reported a range of family history matters including asthma, seasonal hay fever, diabetes (Type 2), cardiovascular disease, cancer, thyroid issues, osteoporosis, glaucoma or polymyalgia.

7.3.3 Social history

Of the 13 staff members interviewed, no one was a current smoker. Approximately 30% of these individuals did smoke for a period of time – primarily in their teen years only. No one reported that they currently lived with someone who smokes. Most of the staff members interviewed reported some minor consumption of alcohol.

Almost all of the staff keep pets at home (dogs, cats, chickens). These pets predominantly live outside. Only 1 staff member did not keep a pet of any kind.

Most of the staff undertook some form of exercise. More than half of the stuff interviewed undertook regular vigorous exercise with the next largest group undertaking occasional vigorous exercise. Some staff discussed their exercise levels before and after the impacts on their health being investigated in this assessment. They indicated that these health impacts had significantly changed the amount of exercise they were able to do.

7.3.4 Symptoms and health concerns – types

The individuals who were interviewed for this investigation had all experienced at least some health impacts that they related to attendance at the school.

A wide range of symptoms were described including:

- Allergic type symptoms
- Respiratory symptoms
- Mental health/neurological symptoms
- Other symptoms

Allergic type symptoms

Symptoms included in this group were sinus congestion, runny nose, hay fever/itchy nose, skin irritation/itching, rashes, dry/flaking skin, dry or itchy eyes, watery eyes, irritated/swollen eyes and/or stinging eyes.

Table 7.2: Allergic type symptoms

Parameter	Number of staff	Percentage of interviewees
Nose/sinus		
Sinus congestion	[redacted]	[redacted]
Runny nose	[redacted]	[redacted]
Hay fever / itchy nose	[redacted]	[redacted]
Skin		
Skin irritation / itching	[redacted]	[redacted]
Rash	[redacted]	[redacted]
Dry/flaking skin	[redacted]	[redacted]
Other	[redacted]	[redacted]
Eyes		
Dry and itchy eyes	[redacted]	[redacted]
Watery eyes	[redacted]	[redacted]
Irritated/swollen	[redacted]	[redacted]
Stinging	[redacted]	[redacted]
Other	[redacted]	[redacted]

Respiratory symptoms

Symptoms included in this group were asthma (exacerbation), breathlessness, cough.

Table 7.3: Respiratory symptoms

Parameter	Number of staff	Percentage of interviewees
Asthma exacerbation	[redacted]	[redacted]
Breathlessness/difficulty breathing	[redacted]	[redacted]
Cough	[redacted]	[redacted]

Mental health/neurological symptoms

Symptoms included in this group were headache, fatigue, dizziness, difficulty sleeping, impacts on concentration or memory and mood changes.

Table 7.4: Mental health/neurological symptoms

Parameter	Number of staff	Percentage of interviewees
Headache	[redacted]	[redacted]
Fatigue	[redacted]	[redacted]
Dizziness	[redacted]	[redacted]
Difficulty sleeping	[redacted]	[redacted]
Impacts on concentration/brain fog	[redacted]	[redacted]
Impacts on memory/brain fog	[redacted]	[redacted]
Mood changes	[redacted]	[redacted]

Other symptoms

Symptoms included in this group were ear infections, joint pain, changes in menstrual cycles, changes in blood pressure.

Table 7.5: Other symptoms

Parameter	Number of staff	Percentage of interviewees
Ear infections	[redacted]	[redacted]
Joint pain	[redacted]	[redacted]
Changes in menstrual cycle	[redacted]	[redacted]
Changes in blood pressure	[redacted]	[redacted]

7.3.5 Symptoms and health concerns – frequency

The majority of the individuals reporting symptoms indicated that the symptoms happened daily or weekly. They also indicated that it would take at least a few days for them to recover from an incident.

Early on in the process, some level of recovery occurred after a weekend or after term breaks but, as the number of times the responses occurred increased, the longer recovery took to occur. Many of them described feeling much better when they were away from the school for an extended period such as the Christmas school holidays but that, for some, the term breaks were not long enough to feel fully well prior to returning to the school.

Many staff members indicated that they had taken time off work to recover from the symptoms. For some, the time off work was quite extended ranging up to a term or even a number of terms.

Many staff members have sought help from medical practitioners including their GPs and a range of specialists when symptoms did not resolve with the assistance of their GP.

On occasion, breathlessness or similar symptoms resulted in some individuals being taken to hospital directly from the school.

Staff reported that their symptoms diminished in frequency or severity after times when significant "deep cleaning" was undertaken at the site. In particular, symptoms at the primary school site diminished following removal of all paper and other materials that had been taken from the high school site and a deep clean of all surfaces which occurred in April/May 2021.

7.4 Results for students and other school visitors (volunteers/ contractors)

The number of students and other school visitors who were able to be interviewed was smaller than the number of staff. While 7 students were interviewed, some were siblings which limited the group to 4 families. As a result, a narrative discussion of the results has been provided.

For the volunteers/visitors, the individuals were involved with the school for extended periods (more than 10 years). They had similar demographics to staff and experienced symptoms when they visited the school that were similar to the ones reported by staff. One individual would make sure to take their asthma medication prior to attending the school for meetings to minimise likelihood of symptoms.

For the students, the individuals interviewed (with their parents) had been present at the school only for the years they were attending school, so they spent less time at the school than staff or other visitors. Symptoms described by the students included headache, leg pain, nausea, rash, nose bleeds, fatigue, dizziness, irritated or painful eyes, itching, difficulty concentrating or mood changes. These symptoms are similar to those reported by staff.

Section 8. Systematic description of the key characteristics of the cases

8.1 General

This section has considered the information provided in **Sections 4, 5, 6** and **7** in order to put together a description of the key characteristics of these incidents at Wee Waa High School.

This section includes discussions relevant for Steps 2 and 4 in the outbreak identification process – i.e. *case definition*; *systematically describe key characteristics of the cases*.

8.2 Key characteristics of the cases/case definition

The key characteristics of these cases include:

- timing of incidents usually related to rain events
- overall, around 50% of the staff have reported symptoms on one or more occasions
- others attending the site have also been impacted at times including students, volunteers and contractors
- the most common symptoms in 2020 were headaches, impacts on eyes, rashes, fatigue and respiratory impacts based on the Department of Education reporting system
- the case interviews indicated that the symptoms common in at least 4 respondents were:
    - Watery eyes
    - Dry/itchy eyes
    - Headache
    - Sinus congestion
    - Skin irritation/itching
    - Rash
    - Breathlessness/difficulty breathing
    - Fatigue
    - Difficulty sleeping
    - Impacts on concentration or memory.
- most common symptoms were generally consistent with allergic responses
- symptoms occurred on a daily or weekly basis when conditions were relevant
- as the number of times the allergic response occurred increased, recovery from symptoms (with or without medication) took longer
- many of the symptoms occurred to levels that had significant impacts on the staff to the extent that they had to take time off work – sometimes significantly extended time off work – to recover enough to come back to work.

8.3 Background information on these key characteristics

Background information on the rate of these symptoms in the Australian population as a whole can be obtained for some of these symptoms.

The Australian Institute of Health and Welfare (AIHW) indicates:

- around 1 in 5 people have hay fever in Australia (i.e. allergic rhinitis)[1]. Women have slightly higher rates of hay fever than men from around 35 years and older. NSW statistics showed a slightly lower average than Australia as a whole.
- chronic respiratory conditions contribute about 8% of the total disease burden in Australia[2]. For chronic respiratory conditions in adults, asthma impacts around 10% of the population[3]. Women have a slightly higher rate for asthma than men.
- asthma and hay fever are some of the most widespread chronic conditions[4] for children with about 10% impacted for each of these conditions. Allergies (other than food ones) and chronic sinusitis were also identified in the top 10 chronic conditions for children at around 2-3 % of children impacted for each of these.

These data indicate that somewhere between 10% and 20% of people might be expected to be impacted by chronic respiratory conditions.

Information on allergic reactions like rashes and eczema was not able to be gathered from the AIHW or the Australian Bureau of Statistics. However, the support organisation Allergy and Anaphylaxis Australia indicates that up to around 30% of children have eczema with a total of around 1 million people having this condition (i.e. adults plus children)[5]. A report from 2018 indicated that one study found that around 1% of the population had dermatitis/eczema (not specifically allergy related), while another study indicated a rate of allergy related eczema at around 7% in adults, 10% in children and 30% in pre-schoolers (International Centre for Community Driven Research 2018).

The number of staff at Wee Waa High School is around 30 and around 15 have reported symptoms relevant to this investigation (13 that have been interviewed and a number of others mentioned in notifications discussed in **Section 5**). This is around 50% of the school staff. This level is higher than would be expected for an average group, so it is possible that this rate is higher than the Australian average. It is noted, however, that this is a very small group compared to the Australian population as a whole. The frequency and severity of these symptoms also point to these symptoms having significant impacts on daily life for the affected individuals.

As with any health study on a small group, it is difficult to determine with confidence that the symptoms seen are definitely linked to a particular cause or situation. However, the health statistics

[1] https://www.aihw.gov.au/reports/chronic-respiratory-conditions/allergic-rhinitis-hay-fever/contents/allergic-rhinitis
[2] https://www.aihw.gov.au/reports-data/health-conditions-disability-deaths/chronic-respiratory-conditions/about
[3] https://www.aihw.gov.au/reports/australias-health/chronic-respiratory-conditions
[4] https://www.aihw.gov.au/reports/children-youth/australias-children/contents/health/chronic-conditions
[5] https://allergyfacts.org.au/allergy-anaphylaxis/eczema-atopic-dermatitis/management

do indicate that it might be possible that the levels of allergic type symptoms (and related ones) seen in staff at Wee Waa High School (and students, volunteers etc) are above the national average and there may be a cause related to environmental conditions at the school.

Section 9. Hypotheses

9.1 General

This section includes discussions relevant for Step 5 in the outbreak identification process – i.e. *Generate hypotheses using descriptive findings*. This section also covers Step 7 in the outbreak identification process – i.e. *compare hypothesis to established facts and additional studies* – providing a discussion of supporting information from the scientific literature.

9.2 Potential hypotheses

Based on the key characteristics discussed in **Section 8.2** and other information in **Section 8**, it appears that there may be an increased level of allergic type responses compared to what might normally be expected. The hypotheses that could be relevant for this situation are:

- moisture issues in the buildings are leading to mould growth and exposure to mould has contributed to the effects seen in individuals
- these symptoms may have resulted from random chance unrelated to any particular environmental factors.

9.3 Background – immune system and mould

9.3.1 Mould

A common allergen is mould. Exposure to excess mould can trigger allergic reactions such as those described here. Given the issues with moisture at the high school site and in Wee Waa as a whole and the likely increase in mould levels in wet conditions, one potential hypothesis that may explain the health impacts seen is exposure to mould triggering allergic reactions.

Mould are fungi. There are moulds that grow on foods or that grow in damp/high moisture areas. There are also moulds that are present in outdoor areas which are involved in breaking down vegetation to return nutrients to the soil and other processes that keep ecosystems functioning well.

Just like any other organism, mould are made up of cells which contain proteins inside them and on their surface.

Some photos showing what moulds look like are shown in **Figures 9.1, 9.2** and **9.3**. The first 2 are close up photos of the structure of a mould and the final photo shows an outbreak of mould on a damp wall.

Figure 9.1: Close up of mould structure

Figure 9.2: Close up of mould structure

Figure 9.3: Mould growing on a damp wall

When moulds are present inside a building, they grow by sending out filaments (hyphae) (the white/clear filaments in **Figure 9.2**) across the surface on which they are growing. Fruiting bodies then grow up from the surface (the black balls in **Figure 9.2**). These structures produce the spores which are then released into the air to spread the mould further.

What ends up in the air inside a building when mould is growing will be:

- spores (whole or broken parts)
- whole fruiting bodies
- parts of the fruiting bodies that have broken off
- filaments/hyphae (or parts of filaments/hyphae that have broken off)
- broken pieces of filaments/hyphae and fruiting bodies

What types of fragments will be present will depend on:

- the extent of the mould
- the species of mould
- how air moves around near the surface where the mould is growing (fast or slow movement, presence of fans/air conditioners or not, high movement area)
- how a person might interact with the surface (can they knock off pieces from the mould surface)
- whether equipment commonly used might be able to knock off fragments.

Where larger pieces of the mould get knocked away from the mould contaminated area, they will move into the air but rapidly settle out onto surfaces. These pieces contribute to the dust inside a building. Such dust also includes skin cells, fragments from clothes and furniture, soil brought inside from outdoor locations, pieces (e.g. legs) of insects (dust mites etc) and a range of other small particles. A person may come into contact with these mould pieces when they touch a surface where such pieces have settled.

Where smaller fragments are released from the mould contaminated area, they will stay in the air and a person may breathe in the fragments.

Other variations in the nature of the mould are whether the material:

- is alive or dead
- is freshly released from growing mould
- has been present in air or on surfaces for some time (i.e. weathered).

Another interesting finding during this investigation was the release of information by CSIRO about some species of a rare plant that were newly discovered in the Wee Waa area (near Narrabri) in 2020 as the drought broke[6]. Three new species of hornworts were discovered. **Figure 9.4** shows the small plants and **Figure 9.5** shows the spores they produce.

It is not being suggested that these plants are likely to be the cause of the symptoms seen at Wee Waa High School – this just shows there are a wide range of small pieces of different types of plant material that may be present in air compared with what can actually be measured.

Figure 9.4: Hornwort plants

[6] https://ecos.csiro.au/three-new-species-of-hornworts-in-australia/

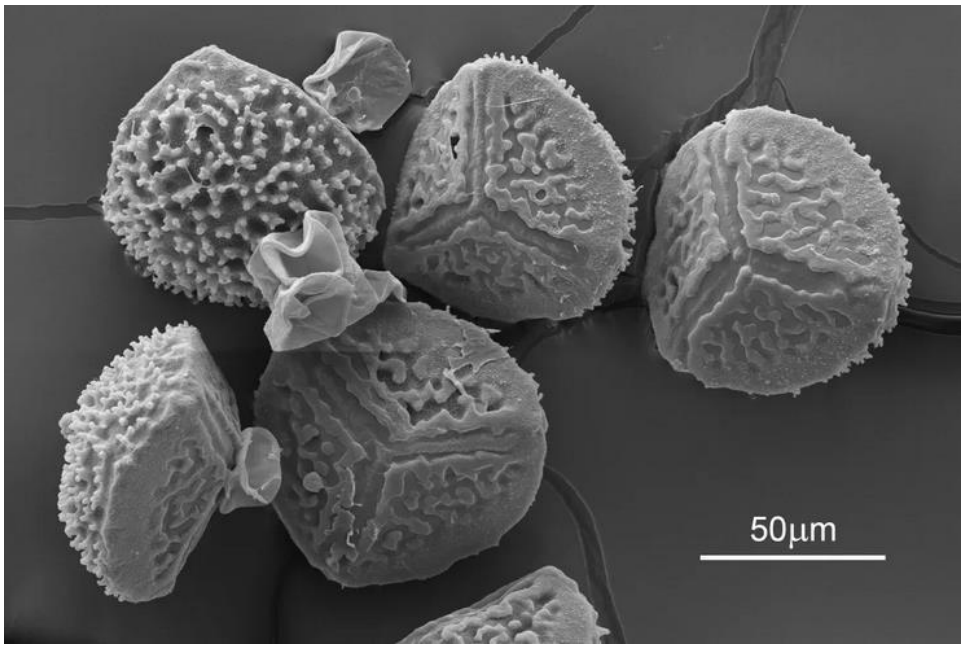


Figure 9.5: Hornwort spores

The investigations undertaken by occupational hygienists at the school targeted the presence of mould using a range of methods. None of the reports identified that mould as a significant issue except in small areas on some occasions.

Mould levels in indoor areas were at or below the levels found in outdoor reference samples. Often the mix of mould species in the outdoor reference samples was similar to that found in the indoor samples. There were some individual samples where there was a difference in the mix of species between outdoor and indoor mould.

Mould in air is measured by sampling a known amount of air in a way that collects the mould for later culturing, counting and identification back at the laboratory. There are a range of ways to do this including particular traps (spore trap) or pumping the air across/into an agar plate. Mould on surfaces is investigated by using tape to lift of material from a known surface area and then that material is studied back at the laboratory (Hess-Kosa 2019).

Even though measurements are possible, recent international guidance on mould has concluded that there are significant limitations to the usefulness of the existing methods for measuring the presence of mould (AIHA 2020a; Hess-Kosa 2019).

9.3.2 Immune system basics

The immune system is the system in our bodies that recognises, attacks and destroys entities that could endanger our health – like flu viruses, COVID-19, bacteria or chicken pox.

Useful background information on the immune system is available at https://www.science.org.au/curious/video/immune-system-explained and in the following references (ASCIA 2020; British Society for Immunology 2017; Joubert et al. 2020; Mak et al. 2014).

The system recognises and protect us from foreign substances like bacteria and viruses. It does this by recognising large molecules like proteins. These are often on the surface of the bacteria or virus cell – like the spike protein on the COVID-19 virus.

The system makes antibodies that match the large molecules so they can be easily recognised. When one of these foreign substances docks with the antibody with the right shape, that triggers a range of cells to come and eliminate/attack the bacteria or virus.

There are several classes of antibodies and they each work differently. When we have a bacterial or viral infection, we make IgM (immunoglobulin M) or IgG (immunoglobulin G) antibodies. These direct the white blood cells to find and attack the virus or bacteria.

An allergy is an unnecessary immune response to a substance that is normally harmless[7]. The antibodies produced in these situations are IgE type.

Not everyone has these responses (i.e. to produce IgE type antibodies). Individuals who have a tendency toward allergies are described as atopic. They are more prone to asthma, eczema and hay fever. There are genetic factors and environmental factors that may combine to make a person more prone to have these allergic responses.

The substance the immune system responds to during an allergic reaction is called an allergen. Allergens are usually proteins. Proteins are present in all living things. Most do not trigger any immune response. They are present in the food we eat – e.g. meat and dairy. Specific proteins can also be on the outside of a cell (pollen, dust mite, mould) or in a fragment of a cell. Some proteins can trigger the immune system in one person who has this tendency but not another.

Proteins are large molecules. They get carried on or are part of particles present in air. Such particles can be mould spores, pollen or fragments of these. Particles can also include dust or combustion particles to which proteins from pollen, dust mites or mould can attach. There are always a wide variety of particles in the atmosphere.

Mould spores can be small enough to get into the lower airways (i.e. they are fine particles). Recently, it has been shown that the allergic response may be due to a combination of the protein itself and the nature of the particle to which it is attached – increasing the complexity in trying to understand this process in detail.

Depending on how the immune system is triggered the reaction can occur in minutes or may take much longer.

To become allergic to a particular substance, firstly a person must be exposed to the substance on an initial occasion (or a number of occasions).

[7] At the level of exposure common to the population or situation evaluated. It should be noted that exposure to any substance at very high levels can result in an adverse reaction or response.

During this first exposure (sensitisation stage):

- the substance enters the body
- relevant immune cells recognise the protein as something which could be harmful
- the immune cells then start making antibodies to the substance
- antibodies are a protein that has a particular shape/structure that lets it recognise the trigger substance
- antibodies get stored in the body so the body can respond more quickly the next time it is exposed to the trigger.

There are usually no health impacts at this stage.

Sensitisation is a highly individual response, so it is difficult to predict who might be sensitised in a particular situation or the extent to which they are sensitised. As noted, there are many people who do not have this tendency at all.

Once this sensitisation step has been triggered in a person, the antibodies they have stored make them more prone to a reaction whenever they are exposed again. While the first exposure (i.e. sensitisation) requires a higher level of exposure, exposure thereafter can be smaller but still trigger the reaction.

Once sensitised, if a person gets exposed again, the trigger substance attaches to the relevant part of the antibody. The antibody is attached to various immune system cells. These cells contain inflammatory agents – like histamines. These are ready and waiting to be released into the blood stream when needed. The trigger for them to be released is when the trigger substance matches up with the antibody. They link together and that turns on the release of the inflammatory agents.

These agents cause inflammation to occur – i.e. a reaction where blood vessels dilate (get wider) allowing more blood to flow to an area. When that happens the area gets warm, red in colour and, depending on the extent of the reaction, swollen. The presence of these agents irritates the nerves leading to pain in the area. The agents also signal to other immune cells to come to the affected area where they may engulf the trigger substance (or what it is attached too) or may cause other reactions that help us get rid of the trigger substance – like coughing, sneezing and tearing of the eyes to get the trigger substance out of the lungs or itchiness so we scratch at the skin to get the trigger substance away from the skin surface or even diarrhea to allow us to rid ourselves of a trigger substance we may have eaten.

Immune system reactions are very useful when there is something we have been exposed to that could cause us harm but are quite problematic when they are allergic responses to something that is not likely to cause harm.

Most people do not react to exposures to proteins (allergen types), but some people make immunoglobulin E based (IgE) antibodies. No one knows why some people have this tendency but others don't. In the US, it is thought that around 25% of the population is likely to have this tendency, so it is not rare. While it is possible to measure IgE levels in blood, such information is not necessarily a good predictor of allergies.

Various types of proteins have been identified as causing allergic responses in people who have this tendency but there is no clear pattern as to what part or parts of these protein molecules are most problematic.

Some allergic responses involve the whole body while others are localised to the area that encountered the triggering agent. Some people have a tendency to a particular type of response as well – such as commonly getting asthma whenever they have an allergic reaction while other people commonly get a rash. Understanding is limited as to why some people respond one way and not another or why a person reacts to one allergen but not another.

Many of the reactions in the staff at Wee Waa appear to be allergic reactions especially the irritated/sore/swollen/watery/itchy eyes and respiratory impacts.

9.3.3 International guidance

American Industrial Hygiene Association (AIHA)

The American Industrial Hygiene Association (AIHA) provides detailed guidance to their members on a range of matters relevant for industrial hygienists including matters related to mould (https://www.aiha.org/).

Detailed guidance in relation to mould is provided at their Mold[8] Resource Centre (https://www.aiha.org/public-resources/consumer-resources/disaster-response-resource-center/mold-resource-center).

The opening statement at this site is:

> *Considerable advances in science on molds and their potential health effects continue. The U.S. Centers for Disease Control and Prevention (CDC), the Institute of Medicine of the U.S. National Academy of Sciences, the World Health Organization, and Health Canada all agree that living or working in a building with mold damage results in an increased risk of respiratory disease. There are no accepted national or international standards for mold investigation, evaluation, or remediation, though several guideline documents exist.*

The AIHA undertook a review of the latest science and updated their guidance documents around 2020. The full set of guidance documents now includes:

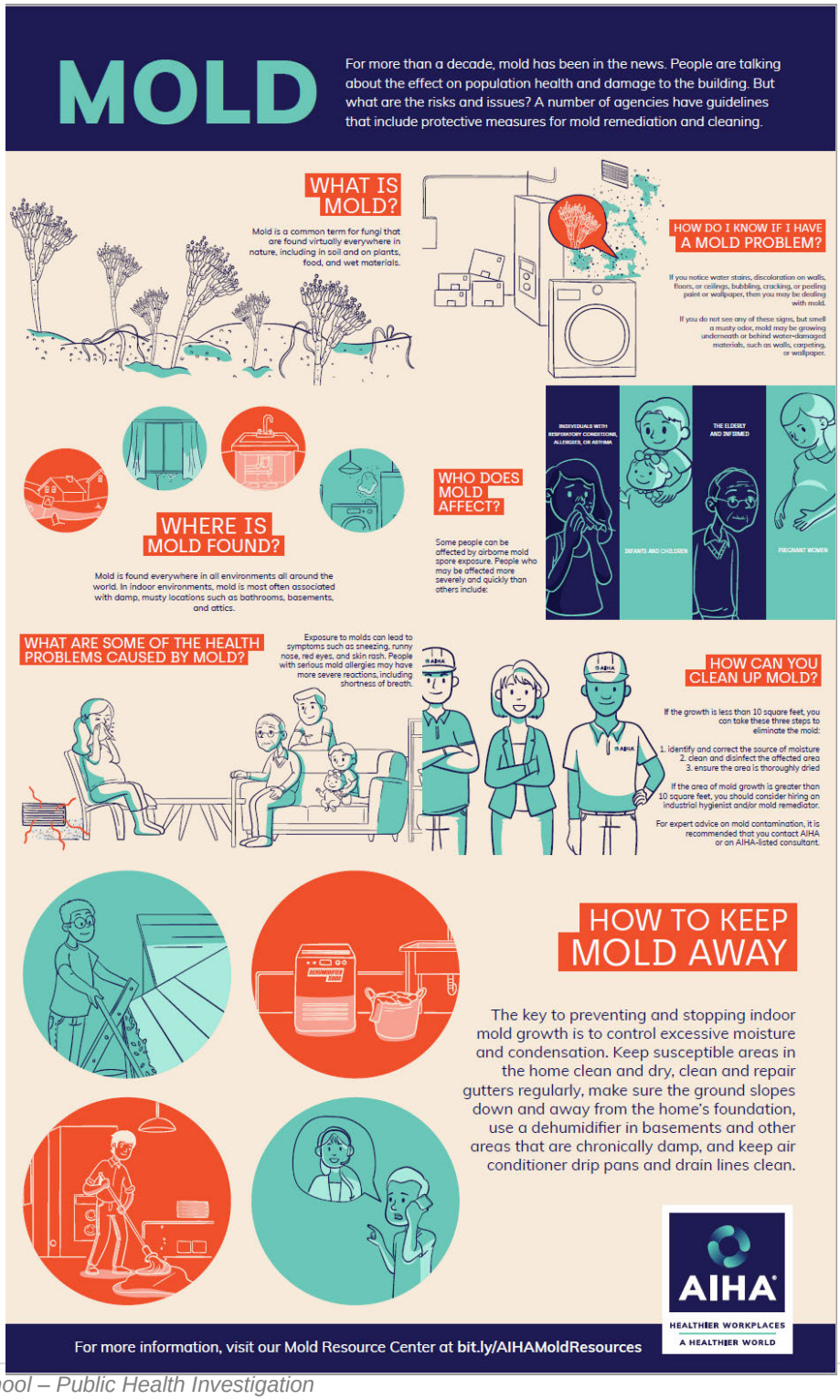
- Facts About Mold: An AIHA Perspective for IEQ Investigators, Physicians, and Engineers (2020) (AIHA 2020b)
- Facts About Mold: A Consumer Focus (2020) (AIHA 2020c)
- FAQs About Spore Trap Air Sampling for Mold for Direct Microscopical Examination (2019) (AIHA 2019)
- Mold and Dampness in the Built Environment – Position Statement (2020) (AIHA 2020d)

[8] It is noted that the spelling for mould used in the US is mold, so where text has been copied directly from US guidance (i.e. text in italics) or is referring to specific pages on websites, this spelling has been retained so that that sources can be found more easily.

- Recognition, Evaluation and Control of Indoor Mold Second Edition (2020) (AIHA 2020a).

Summaries provided in these materials have been used as the major source of information for this review as they are the most recently updated guidance available from reputable and appropriate sources.

The AIHA provides this infographic to explain some of the mold basics. Copies of the consumer focus document (AIHA 2020c) and this infographic are provided in **Appendix E**.



The position statement from the AIHA (AIHA 2020d) notes the following:

- Modest wetting and drying in buildings and ventilation systems is normal.
- Episodes of more significant wetting, if managed well (i.e. rapid drying etc), may not cause problems.
- Dampness is defined as the presence of unwanted and excessive moisture in a building and can result in growth of mould, fungi, environmental bacteria or dust mites.
- Mould is a generic term used for filamentous fungi common on food or wet materials.
- Well conducted studies in several countries have shown a link between exposures to dampness/mould and respiratory symptoms, asthma, hypersensitivity pneumonitis, rhinosinusitis, bronchitis and respiratory infections.
- Symptoms have been shown to get worse over time, if dampness in a building is not recognised as a potential cause and a person's exposure continues.
- Addressing dampness in a building has been linked to improved health outcomes.
- These findings have been agreed by a range of organisations including the World Health Organisation, Health Canada, US National Institute for Occupational Safety and Health (NIOSH).
- AIHA position is that persistent dampness and mould damage in non-industrial workplaces, including schools, and in residential housing require prevention, management and effective remediation. If visible mould is present, it should be remediated regardless of species (AIHA 2020d).

The AIHA make a series of recommendations based on this information (AIHA 2020d).

1. *While the design and location of a building have the greatest impact on the onset of serious mould damage, maintenance and effective management of mould and dampness requires an ongoing strategy involving occupants, building owners and managers, ventilation experts and occupational hygiene professionals.*
2. *It has long been recognized that, based on the application of existing methods to analyse air or dust samples, there are no quantitative, health-based microbial exposure guidelines or thresholds. Sampling data that may be developed during an investigation must be comprehensive and communicated in a form useful to physicians and allied professionals, building occupants and decision-makers.*
3. *Investigation and remediation of mould and moisture damage in buildings must be based on an informed inspection augmented by the judicious use of existing sampling methods, primarily for the purpose of detecting any hidden damage. The protection of remediation workers and occupants during renovations is essential. In case of occupants with more serious pre-existing respiratory conditions, relocation may be appropriate.*
4. *It is not unusual for buildings to have a number of concurrent problems that affect indoor environmental quality (IEQ) or the perception of IEQ. Water and moisture damage can result in the release of gases from some building materials. Investigations of apparent or suspected mould-related health complaints must consider all possibilities. While mould damage comprises a large percentage of problem situations, studies of occupant complaints find that a high percentage have an outdoor air make up below the American Society for*

Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) standard[9], inappropriate and inadequate temperature and humidity levels, inadequate control of contaminants from outdoor air (including ozone, traffic pollutants, etc.), contaminants arising from equipment or activities within the building or house (including cooking activities), and poor air distribution (AIHA 2020d).

The consumer focus document (AIHA 2020c) provides the following basic information about moulds:

- Moulds are fungi that grow on food or wet materials.
- All of us are exposed to spores from a wide range of mould every day – indoors and outside.
- The fungal spores found in outdoor air are usually those from moulds that live on leaves and those from mushrooms – these are not the species usually found in damp areas indoors.
- A clean, well ventilated building should have similar species of mould inside as are found outside in that location (i.e. the ones outside are the source of the ones inside).
- Health effects from mould are thought to be due to touching or breathing in mould fragments – i.e. fragments of the filaments/hyphae and fruiting bodies of the mould as well as fragments of the spores etc.
- People are exposed to fragments from a mixture of species at all times.
- Responses to exposure to mould are highly variable. Individuals who have respiratory conditions, allergic tendencies or asthma as well as other sensitive groups (elderly, infirm etc) are more likely to be impacted than others.
- There are also moulds that produce toxic compounds or mycotoxins but these species are not usually common inside damp buildings and do not appear to be relevant for this investigation.
- If moulds are present, there can be a musty odour.
- Testing for moulds is not recommended, given the lack of agreed guidelines – the preference is to tackle moisture problems specifically.
- Recommended approach for dealing with mould comprises 3 main elements
    - Proper investigation to locate and understand the cause of mould damage in a building (and the investigation should be fully documented).
    - Qualified person should remove mould damage using relevant approaches along with addressing the underlying cause of moisture – this must be addressed before restoring the building.
    - Mould contaminated parts of a building must be thoroughly cleaned using a HEPA vacuum and damp wiping of hard surfaces. The original investigator/independent

[9] The ASHRAE standard is the standard used in the US to determine ventilation requirements. In Australia, ventilation requirements are defined in the Building Code of Australia and its supporting standards such as AS1668. The comment made by the AIHA just indicates that actual ventilation in many buildings is often well below the levels that should be present.

expert should be used to monitor/evaluate that the remediation and follow up cleaning have been done appropriately.

- There are no validation sampling techniques that are relevant for evaluating remedial actions (AIHA 2020c).

More detailed guidance from AIHA

A more detailed review of the potential health effects due to mould by AIHA is provided in:

- Recognition, Evaluation and Control of Indoor Mold Second Edition (2020) (AIHA 2020a).

This is the detailed handbook used by industrial hygienists to guide investigations and remediation of mould related problems.

The relationship between mould and health effects is still quite difficult to assess well. There are many studies that show associations between health effects and mould. On the other hand, there are some situations where mould appears to reduce health effects in some individuals (i.e. protective effects). It is estimated that 10-20% of asthma, respiratory infections and related symptoms in the US are due to mould and damp and, as a result, are preventable (AIHA 2020a).

Discussion of health effects from exposure to mould and damp has been an ongoing conversation in the scientific literature for more than 30 years. It is agreed that there is strong evidence of a link to adverse respiratory effects, however, it is also agreed that methods for measuring mould do not show consistent relationships with these health effects. This makes it very difficult to determine guidelines which work well (AIHA 2020a).

The most robust link between indicators of exposure and health effects is shown when people report the presence of musty/mouldy odours (AIHA 2020a).

The lack of linkage between measured mould levels and health effects is thought to be due to fact that it may be that only fragments may be the cause of the effects and that we don't know what the relevant types of fragments are nor do we have ways of measuring them (AIHA 2020a).

Even if the same mould species may be present at a site and are counted in a measurement, it does not mean the same types of fragments are present. This may lead to different effects. Different fragment types arise from differences in how a particular building works – e.g. ventilation rates, food levels for the mould, moisture levels in the different building materials, what types of building materials are present etc. As a result, the same measured count could actually be related to quite different levels of exposure to the fragments that are most important (AIHA 2020a).

Findings of a range of comprehensive reviews (and summarised by AIHA), in regard to exposure to dampness/mould and health effects, have concluded:

- There is sufficient evidence to support an association or a causal link between dampness/mould and exacerbation of existing childhood asthma.
- There is sufficient evidence of an association between dampness/mould and exacerbation of existing asthma, asthma development, current asthma, ever-diagnosed asthma, bronchitis,

respiratory infections, allergic rhinitis, shortness of breath, wheeze, cough, upper respiratory tract symptoms and eczema.

- There is limited or suggestive evidence for an association between dampness/mould and common cold or allergy/atopy (increased tendency for allergic response) (AIHA 2020a).

This guidance clearly notes that there is no well defined type of measurement for mould that increases with increasing levels of health symptoms (i.e. shows a good dose response relationship). The guidance also acknowledges that buildings still need to be managed, despite this lack of agreed guidelines.

Instead, the AIHA notes that there are 3 approaches to decision making in regard to whether or not a building requires actions including:

1. Observe indicators of dampness/mould that have shown consistent association with increased risk of symptoms such as visible mould, water damage or musty/mouldy odour (odour in particular). The higher the levels of these different indicators the more likely health symptoms will be present in the people using a building.
2. Measuring moisture in building structures has been identified as useful but it is acknowledged that it is an indirect measure and that meters that measure moisture use different methodologies which can limit the understanding provided by such measures.
3. Measuring actual mould levels in buildings has generally been found to not be useful due to the limitations in these methods. A range of new methods are being developed but links with health effects have still not been established (AIHA 2020a).

The first approach may be the most useful for identifying when remediation is required. The AIHA recommend remediating any indoor dampness or mould that can be seen or smelled without a threshold (AIHA 2020a).

Other international assessment/remediation guidance

The AIHA has reviewed and summarised 7 recent guidance documents (AIHA 2020a) relevant for mould including:

- Health Canada (2004) Fungal contamination in public buildings: health effects and investigation methods https://publications.gc.ca/site/eng/9.649353/publication.html
- Health Canada (2007) Residential indoor air quality guidelines: Moulds https://www.canada.ca/en/health-canada/services/publications/healthy-living/residential-indoor-air-quality-guideline-moulds.html
- Texas Mold Regulations (2004) Texas mold assessment and remediation rules, Publication #2-15 https://www.tdlr.texas.gov/mld/laws-rules.htm
- Canadian Construction Association (CCA) (2004) Mould guidelines for the Canadian construction industry (CCA 82-2004) https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjmnYjPmeL0AhXCT2wGHRrPB-IQFnoECAcQAQ&url=https%3A%2F%2Fwww.cca-acc.com%2Fwp-content%2Fuploads%2F2019%2F02%2FMould-guidelines2018.pdf&usg=AOvVaw0-vanB4Adc_R5XPK79oTf4

- New York State Labor Law (2015) Licensing of mold inspection, assessment and remediation specialists and minimum work standards https://dol.ny.gov/mold-program
- NYCDOHMH (New York City Department of Health and Mental Hygiene) (2008) Guidelines on assessment and remediation of fungi in indoor environments https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjomaiAo-L0AhXIs1YBHbC6C78QFnoECAQQAQ&url=https%3A%2F%2Fwww1.nyc.gov%2Fassets%2Fdoh%2Fdownloads%2Fpdf%2Fepi%2Fepi-mold-guidelines.pdf&usg=AOvVaw3U9hdJj6jXDL32ygk7K6UZ
- IICRC (Institute of inspection, cleaning and restoration certification) (2015) ANSI/IICRC Standard for professional mold remediation 3rd Edition (S520)
- IICRC (Institute of inspection, cleaning and restoration certification) (2015) IICRC Reference guide for professional mold remediation 3rd Edition (S520)

Some of these guidance documents are focused on remediation of mould rather than the assessment of whether mould requires remediation and, as such, don't provide guidance on initial decision making.

The majority of these documents list the following as triggering events for a mould investigation:

- visible mould (one document indicated that >2 m^2 of visible mould requires assessment by a licensed professional)
- water damage
- health complaints
- musty odours.

All of these triggers were reported at Wee Waa High School.

In addition:

- No numerical guidelines for mould levels in air or on surfaces were identified in any of these guideline documents.
- In regard to fungal or mould measurements, the summary indicates that all of these guidance documents flag that such measurements are difficult to use. In the case of the most recent guidance from Health Canada, the guidance specifically recommends against undertaking any such measurements. The other documents recommend or require that such sampling only be undertaken by qualified professionals and/or that the samples must be analysed by laboratories registered/accredited for such work.
- In regard to remediation, the various documents recommend that, if there is visible mould covering less than 1 m^2, then no special requirements for the cleaning are required. However, if visible mould covers an area larger than this, careful remediation is required. This should be undertaken by qualified professionals with appropriate personal protective equipment (including relevant respirators for highly contaminated locations) and such areas may need to be vacated until the remediation is complete.

Guidance is also available from other US sources including:

- USEPA (2012) A brief guide to mold, moisture and your home. https://www.epa.gov/mold
- USEPA (2008) Mold remediation in schools and commercial buildings https://www.epa.gov/mold/printable-version-mold-remediation-schools-and-commercial-buildings
- NIOSH (2019) Dampness and mold assessment tool – school buildings https://www.epa.gov/mold/dampness-and-mold-assessment-tool-schools-and-general-buildings
- NIOSH (2019) Dampness and mold assessment tool – general buildings https://www.epa.gov/mold/dampness-and-mold-assessment-tool-schools-and-general-buildings

All of these documents provide qualitative tools for assessing whether mould may pose a problem in a building used as a home or school or for other purposes. They note that controlling moisture in a building is key to controlling the potential for mould. In most of these documents, the term guidelines was mentioned but it referred to qualitative guidance about how best to clean mould from different types of materials (i.e. guidance) rather than to numerical guidelines for the acceptable numbers of mould in an air or surface sample.

9.3.4 Australian sources

The Australian Institute of Occupational Hygienists (AIOH) is the Australian organisation equivalent to the US AIHA. The AIOH do not have specific guidance on mould assessment on their publications page.

State health departments provide summary information for home owners in regard to mould such as that from NSW Health https://www.health.nsw.gov.au/environment/factsheets/Pages/mould.aspx .

One article by occupational hygienists in Australia provides some interesting case studies (Bird et al. 2012). This team evaluated methods for looking at mould contamination using a number of specific examples. This article notes that Australia does not have relevant mould exposure guideline values which is in line with the international guidance discussed in **Section 9.3.2**.

- The first example was an 8-storey office building that was impacted by flooding of the Brisbane River in 2011. The building was evacuated and remained unoccupied while the flooding occurred. One of the tenants in the building wanted to ensure conditions were appropriate for workers to return. All standing water had been pumped out by the time of this assessment. Given the short time since flooding, there was no visible mould but there was significant odour on all floors up to the 4th floor. Moisture levels were measured in walls on all floors. All floors up to floor 5 had elevated moisture levels which were above relevant outdoor locations and above the levels measured in the top floors of this building (unaffected by the flooding). Relative humidity and the temperatures in the air on each of these floors were also at levels that were conducive to mould growth. The tenant decided to move their operations as it was possible that mould was present or would be present shortly, given the conditions identified.

- The second example was a workplace where used timber was processed. At least some of the used timber was shown to be mould contaminated. This example is not relevant for this investigation.
- The third example was a kindergarten where water damage had occurred and there was visible mould. In this case, the visible mould triggered a sophisticated detailed investigation using DNA sequencing to understand the species of mould that were present. Strains of mould that have been shown to be related to health effects were identified. Such detailed work indicated that the property needed to be fully remediated and that the building should be shut down until that occurred.

9.4 Supporting information for the hypothesis

Determining whether a hypothesis (as outlined in **Section 9.2**) might be supported requires information on:

- whether the effects seen in students and staff are definitely at levels that are above normal
- whether the effects are likely to be caused by mould
- whether the effects could also be caused by other factors

The investigation outlined in this report has considered site investigation reports, notifications in regard to health impacts and notifications in regard to building issues and has interviewed relevant staff.

The findings (as per **Section 8.2**) are as follows:

- Measurements of moisture in the buildings at the former Wee Waa High School site were elevated.
- Plumbing issues and excess stormwater were common at the school which supported the moisture measurement information.
- The site investigations at the site did not report mould levels in air or on surfaces that generally indicated a potential risk to health except for the occasions and in the locations where visible mould was present. However, as discussed in **Section 10**, there are significant limitations to both the methods used to undertake such measurements and the guidelines available to allow interpretation of such results.
- Reports of health symptoms were much lower in times of drought.
- Reports of health symptoms often appeared to occur shortly after significant rain events in Wee Waa.
- Significant rain events in Wee Waa commonly occur in February/March or October/November.
- Ventilation in indoor areas is not controlled by mechanical ventilation systems, so if windows are not opened then ventilation is likely to be limited (this is a common characteristic in many Australian buildings including schools).
- In addition, rooms that were not designed for regular occupation (e.g. storage areas) have been repurposed as offices at times. Such rooms may have had even lower levels of ventilation.

- Symptoms common in at least 4 respondents (staff) were:
    - Watery eyes
    - Dry/itchy eyes
    - Headache
    - Sinus congestion
    - Skin irritation/itching
    - Rash
    - Breathlessness/difficulty breathing
    - Fatigue
    - Difficulty sleeping
    - Impacts on concentration or memory.
- Most common symptoms were generally consistent with allergic responses.
- Symptoms such as headache, fatigue, difficulty sleeping or loss of concentration are not commonly linked to allergic responses but can be general indicators of not feeling well.
- Health statistics about allergies in Australia indicate that levels of these symptoms in staff at the school are higher than would normally be expected on average (~50% compared to 10-20%). However, this is a very small group of people, so applying such statistics in this way is not robust. Given the size of the school community, it is not possible to gather more data or undertake statistical assessment to definitively determine that levels of these effects are higher than would normally be expected.

This mix of findings does provide some support for the hypothesis that significant moisture within the fabric of the buildings at the school may have resulted in mould growth which may have impacted on individuals who were sensitive to allergic responses.

It is, however, not currently possible to establish a case that moisture and mould have definitely contributed to the effects seen at the school. Equally though, it is not currently possible to establish a case that they have not contributed to such effects.

9.5 Limitations

It is acknowledged that, while impacts from mould is a plausible explanation, there are significant limitations to determining with confidence any specific explanation for these effects including:

- Normal background levels of allergic reactions – between 10 and 20% of the Australian population are likely to be susceptible to having such reactions in certain situations.
- The numbers attending the school are small – around 30 staff and 150 students with small numbers of volunteers and contractors – this places significant limitations on understanding the variability between individuals for symptoms and exposure which is important when evaluating whether an effect might be due to chance or a specific cause.
- There are no available guidelines that indicate levels of mould in air that are definitely unlikely to cause health effects or definitely likely to cause health effects.
- Detailed assessment of everyone's homes was not undertaken as part of this investigation, but a number of indicative characteristics were covered in the interviews. These did not indicate environmental factors that might be relevant to this investigation at the homes of those being interviewed.

The study limitations mean that it is not possible to be definitive about the specific situations in which these symptoms may return. However, actions can be considered based on the possible mechanism – i.e. excess moisture and related mould. Even if these issues are not the main explanation for the health symptoms seen in staff and students, ensuring good management of moisture issues to the extent practicable is good practice.

Section 10. Control/prevention measures

10.1 General

This section discusses the control/prevention measures that can be taken to address mould issues in buildings and those measures which have already been taken for the Wee Waa High School community.

This section addresses Step 8 in the outbreak identification process – Implement control/prevention measures.

10.2 Guidance

The guidance documents that have been reviewed as part of this investigation make it clear that the primary tool in managing the potential for mould in a building is management of moisture as noted in this section of the AIHA infographic.

10.3 Actions taken

Numerous actions have been taken by the school and by the Department to manage the potential for moisture to be at problematic levels. Actions have included:

- supporting individuals while they took time off to recover
- moving individuals from one room to another if there were obvious issues related to a particular location at the school
- organising work rosters to allow individuals to work at home for some days during the week where this is possible
- establishment of demountable replacement rooms at the former high school site so that the most problematic areas no longer needed to be used
- relocation of the entire high school community from the former site to the public school site

- commitment to build a new high school in a new location close to the public school site in 2022
- consultation with the school community about the design of the new high school.

The health impacts in many of the affected staff and students improved with the move to the public school site, especially after the removal of all materials that had been relocated from the former high school site, followed by significant cleaning of all areas.

Unfortunately, significant rainfall occurred in Wee Waa in October/ November 2021 which ended up cutting the town off for around 10 days up to 13 December 2021. Standing water has been significant as shown in the photo below taken from https://www.abc.net.au/news/2021-12-13/flooded-wee-waa-residents-celebrate-freedom/100689160 . The start of the rain coincided with the school returning to on-site classes after a lockdown due to COVID-19 across NSW.

Symptoms returned for some individuals at this time. This provides some support for the proposed hypothesis as the return of significant moisture/damp (with the potential for limited ventilation in some rooms in the school) coincided with the return of symptoms.

Figure 10.1: Photograph of flooding at Wee Waa in December 2021

Section 11. Conclusions

Environmental Risk Sciences Pty Ltd (enRiskS) and Dr Tony Brown (University of Sydney) have been engaged by the NSW Department of Education to undertake an investigation of a number of health incidents related to Wee Waa High School that have occurred between 2018 (and potentially earlier) and 2021.

Wee Waa High School is a small, co-educational, comprehensive rural secondary school in North-West NSW that services students from the town of Wee Waa, Burren Junction and Pilliga. Approximately 36% of the students at Wee Waa High School are indigenous and the school is committed to promoting its cultural diversity through a strong educational program for Aboriginal students. Approximately 150 students attend the school, and the school has approximately 30 staff (Wee Waa High School Annual Report 2020).

Various staff and students have reported the following types of symptoms (of varying severity) at times over the last 5 years:

- irritation (skin/eyes)
- respiratory difficulties
- rashes
- fatigue/lethargy.

An investigation has been undertaken using a range of information to evaluate potential hypotheses that might explain the coincidence between these symptoms and attendance at the school. The approach taken is that of an outbreak investigation commonly used in public health investigations. This approach is normally used to identify the causes of an infectious disease, but the framework is also useful for health impacts that may be caused by environmental factors with some limitations.

The information used in this investigation included:

- Background information about the site and Wee Waa itself
- Anecdotal discussions of the history of the situation at the school with staff
- Photographic evidence
- Notification reports from Department of Education regarding health effects and building issues
- Site investigation reports from a range of consultants
- Interviews with individuals (staff, students and other visitors) with supporting information from medical practitioners where available
- Rainfall data from the Bureau of Meteorology
- Health statistics from Australian Bureau of Statistics and Australian Institute of Health and Welfare
- Literature reviews and background information from reputable organisations

Using all these information sources, the investigation determined that the following hypotheses could be relevant for this situation:

- moisture issues in the buildings are leading to mould growth and exposure to mould has contributed to the effects seen in individuals
- these symptoms may have resulted from random chance unrelated to any particular environmental factors.

The findings of this investigation included:

- Measurements of moisture in the buildings at the former Wee Waa High School site were elevated.
- Plumbing issues and excess stormwater were common at the school which supported the moisture measurement information.
- Reports of health symptoms were much lower in times of drought.
- Reports of health symptoms often appeared to occur shortly after significant rain events in Wee Waa.
- Significant rain events in Wee Waa commonly occur in February/March or October/November.
- Ventilation in indoor areas was not controlled by mechanical ventilation systems (as is common in many school buildings), so if windows were not opened then ventilation was likely to be limited. In addition, rooms that were not designed for habitation (e.g. storage areas) were sometimes repurposed as offices when required. Such rooms may have had even lower levels of ventilation.
- Symptoms common in at least 4 respondents (staff) were:
    - Watery eyes
    - Dry/itchy eyes
    - Headache
    - Sinus congestion
    - Skin irritation/itching
    - Rash
    - Breathlessness/difficulty breathing
    - Fatigue
    - Difficulty sleeping
    - Impacts on concentration or memory.
- Most common symptoms were generally consistent with allergic responses.
- Health statistics about allergies in Australia may provide some support that the levels of these symptoms are higher than would normally be expected on average. However, it is noted that this is a very small group of people, so applying such statistics in this way is not particularly robust.

This mix of findings does provide some support for the hypothesis that significant moisture within the fabric of the buildings at the school may have resulted in mould growth (seen or unseen) which impacted on individuals who were sensitive to allergic reactions.

There were limitations to the investigation (as with any public health investigation for small groups). These limitations mean that it is not possible to be definitive about the specific situations in which these symptoms may return. However, actions can be considered based on the possible mechanism – i.e. excess moisture and related mould.

Even if these issues are not the main explanation for the health symptoms seen in staff and students, ensuring good management of moisture issues to the extent practicable is good practice.

One particular aspect of managing moisture/damp well that is difficult in Wee Waa is the characteristics of the area. The town is located in the flood plain for the Namoi River and a levee bank has been built around the town which limits how quickly water can drain away from the area after large rain events. In addition, the gradient between Wee Waa and the final point where water from the Namoi River reaches the ocean is very shallow. The gradient between Wee Waa and Menindee Lakes is a decrease of around 100 m (i.e. 0.1 km) in vertical height over 700 km horizontal (i.e. about 14 cm per km). This means when significant rainfall events occur it can take a long time before standing water drains away. This means management of water and associated moisture will be an ongoing issue for Wee Waa.

It is noted that a range of control measures have been taken at the school including

- supporting individuals while they took time off to recover
- moving individuals from one room to another if there were obvious issues related to a particular location at the school
- organising work rosters to allow individuals to work at home for some days during the week where this is possible
- establishment of demountable replacement rooms at the former high school site so that the most problematic areas no longer needed to be used
- relocation of the entire high school community from the former site to the public school site
- commitment to build a new high school in a new location close to the public school site in 2022
- consultation with the school community about the design of the new high school.

These measures had some success until the significant rain event in October/November 2021.

Ensuring that the proposed new school is constructed with all appropriate measures to control moisture and dampness as well as ensuring the school grounds are managed to minimise the potential for standing water are likely to be the most effective approaches to managing the potential for health effects at the school. A commitment to manage plumbing problems in a timely manner into the future and avoiding the use of evaporative air conditioning will also be important to consider.

Section 12. References

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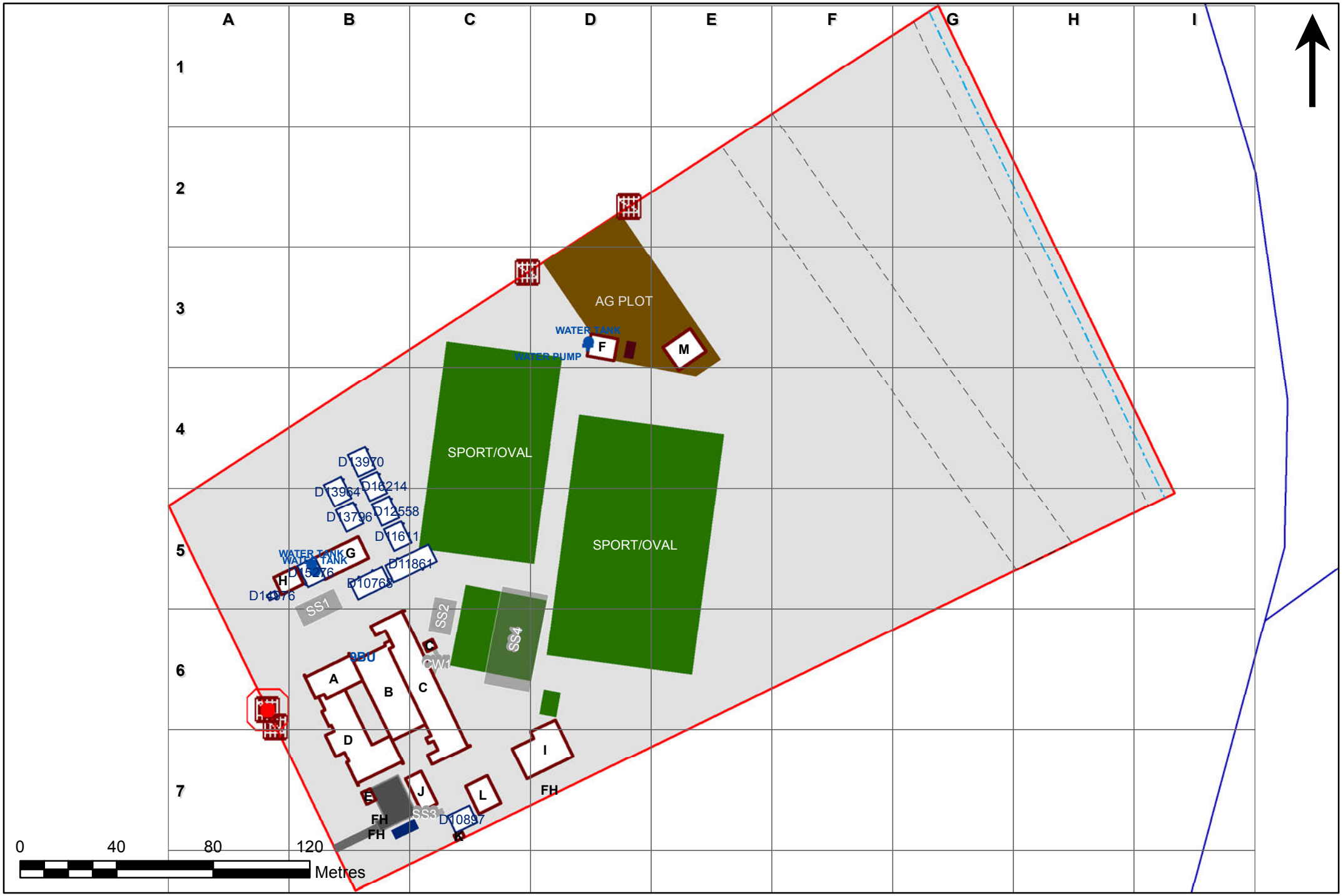
Appendix A Detailed maps of the school

8270 - Wee Waa High School

Site Plan (11390)



1:1,960

Printed: 13-Jul-2021

8270 - Wee Waa High School

Administration/Staff Facilities (B00A) - Ground Floor (Room Function)

1:109

Printed: 13-Jul-2021

8270 - Wee Waa High School

Administration/Staff Facilities (B00A) - 1st Floor (Room Function)

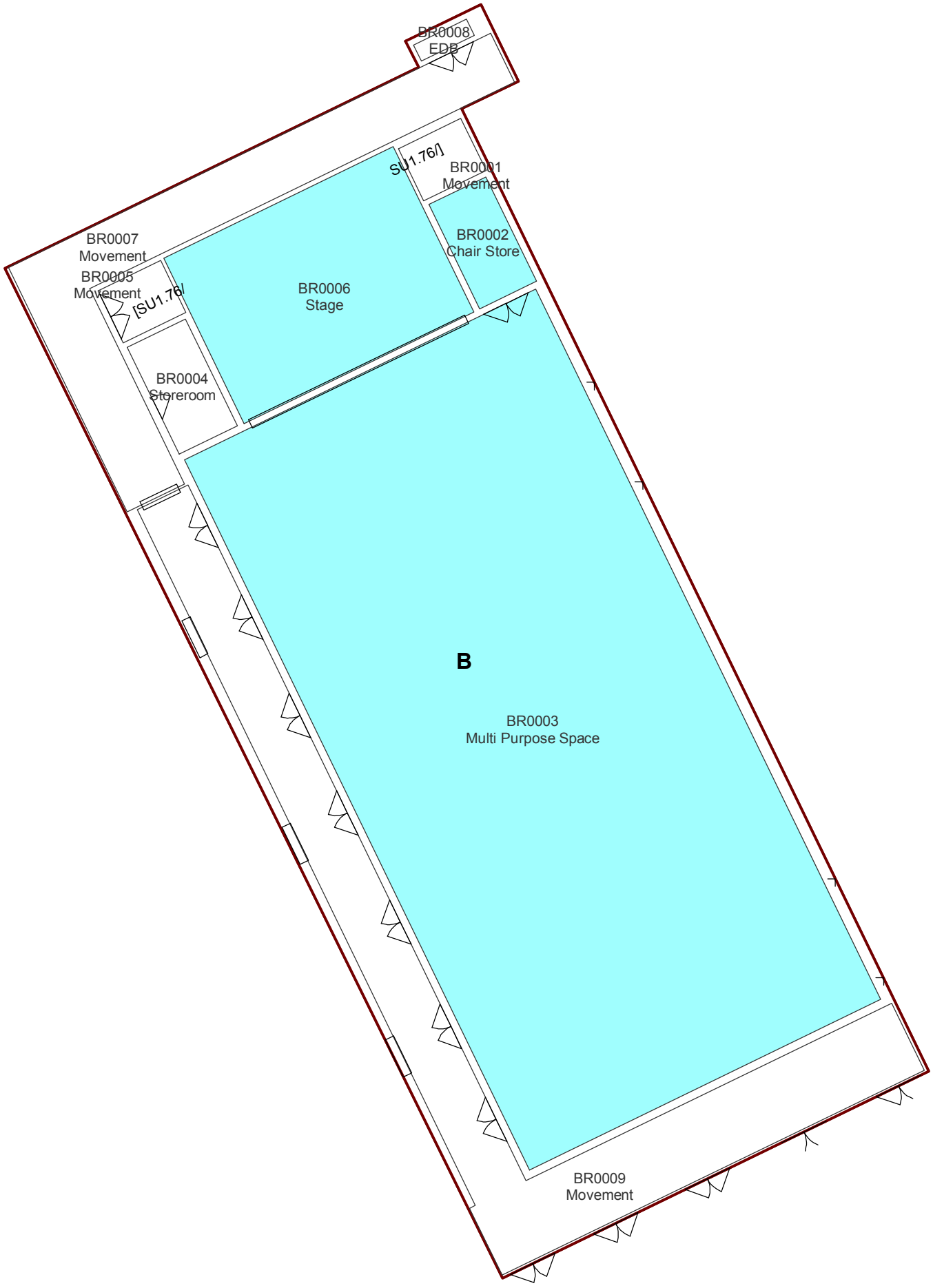
0 2 4 6 Metres

1:109

Printed: 13-Jul-2021

8270 - Wee Waa High School

Multi Purpose Facilities (B00B) - Ground Floor (Room Function)

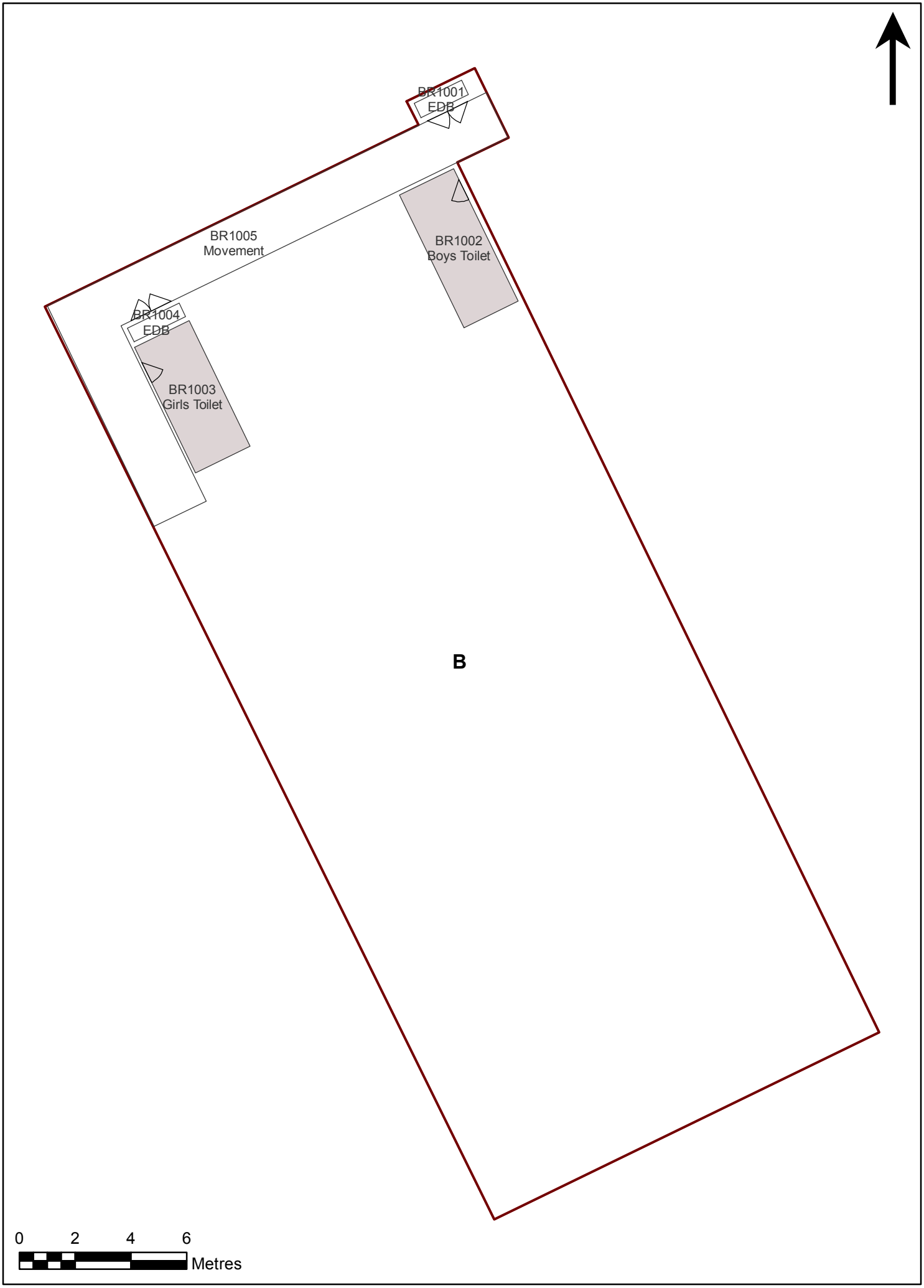


1:169

Printed: 13-Jul-2021

8270 - Wee Waa High School

Multi Purpose Facilities (B00B) - 1st Floor (Room Function)

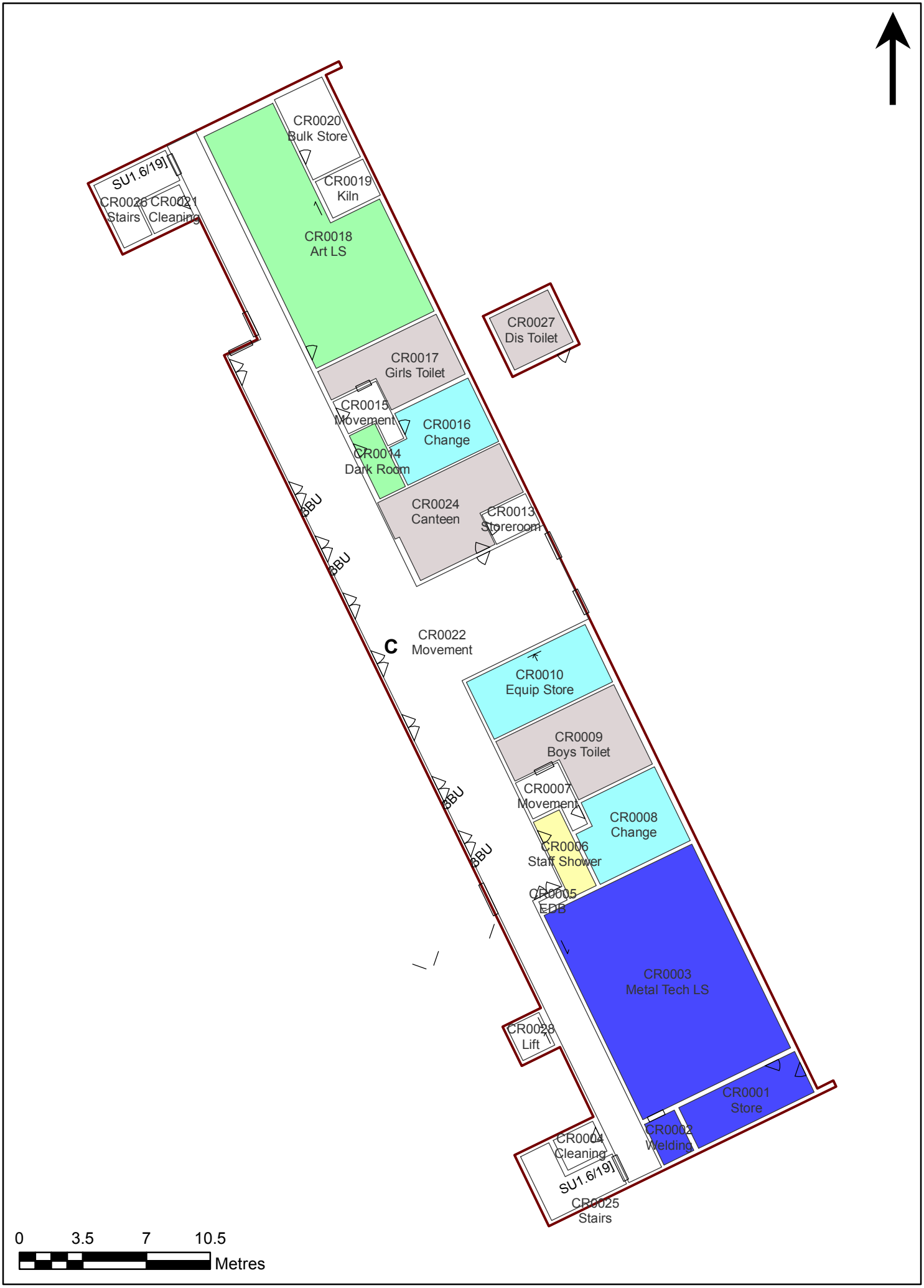


1:169

Printed: 13-Jul-2021

8270 - Wee Waa High School

Various (B00C) - Ground Floor (Room Function)

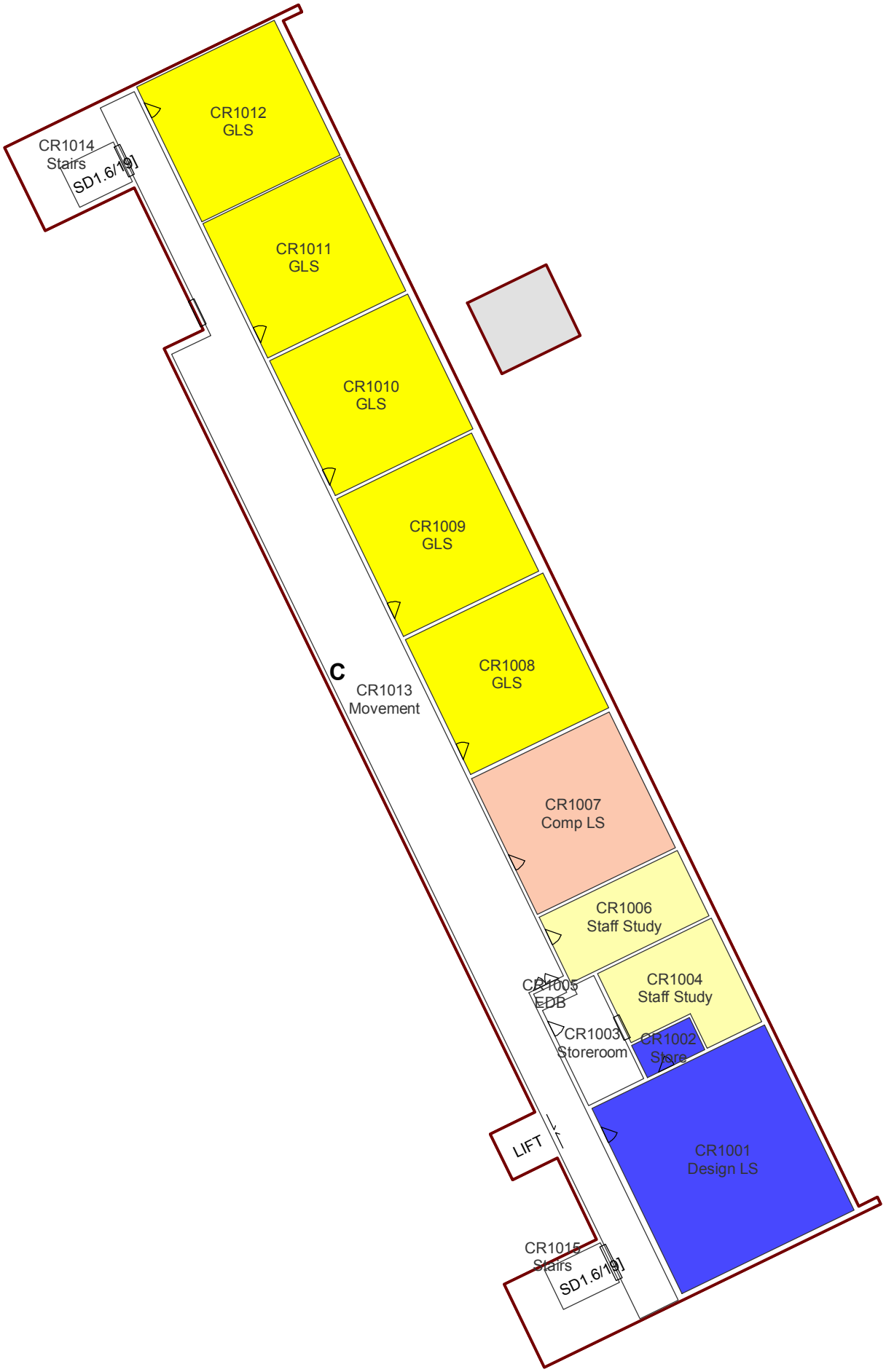


1:259

Printed: 13-Jul-2021

8270 - Wee Waa High School

Various (B00C) - 1st Floor (Room Function)



0 3.5 7 10.5

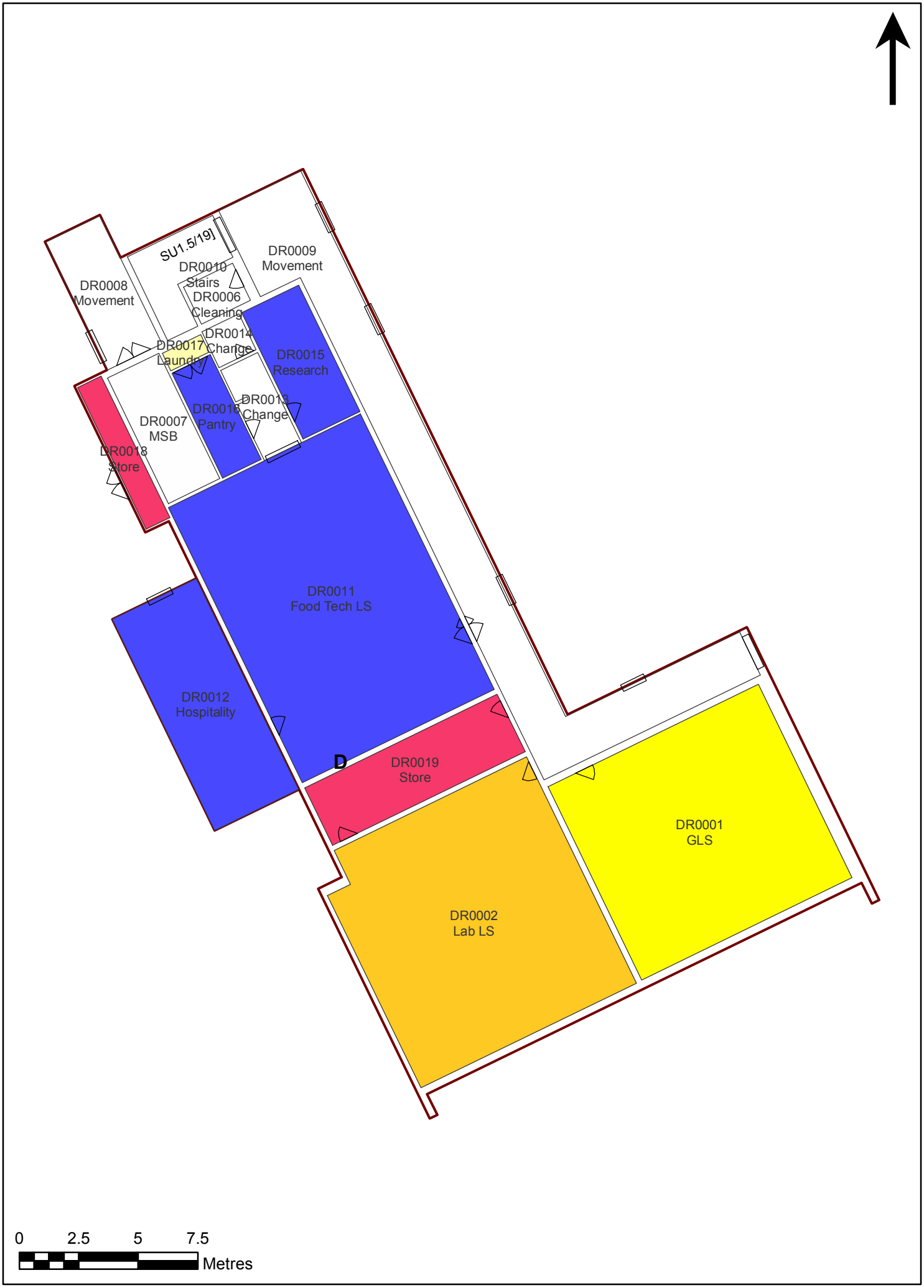
Metres

1:259

Printed: 13-Jul-2021

8270 - Wee Waa High School

Various (B00D) - Ground Floor (Room Function)



1:198

Printed: 13-Jul-2021

8270 - Wee Waa High School

Various (B00D) - 1st Floor (Room Function)

0 2.5 5 7.5

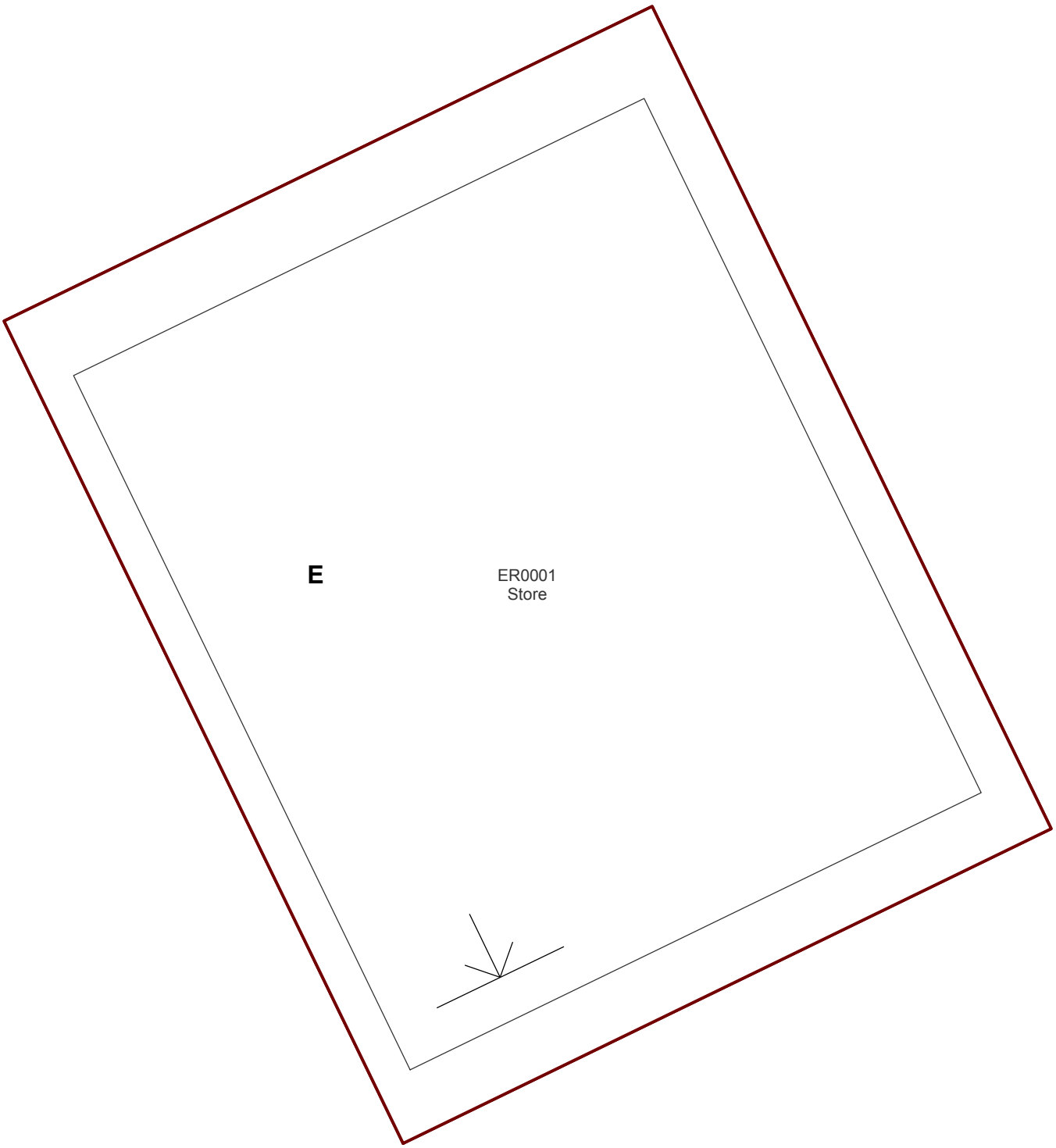
Metres

1:198

Printed: 13-Jul-2021

8270 - Wee Waa High School

Building Services (B00E) - Ground Floor (Room Function)



0 0.45 0.9 1.35

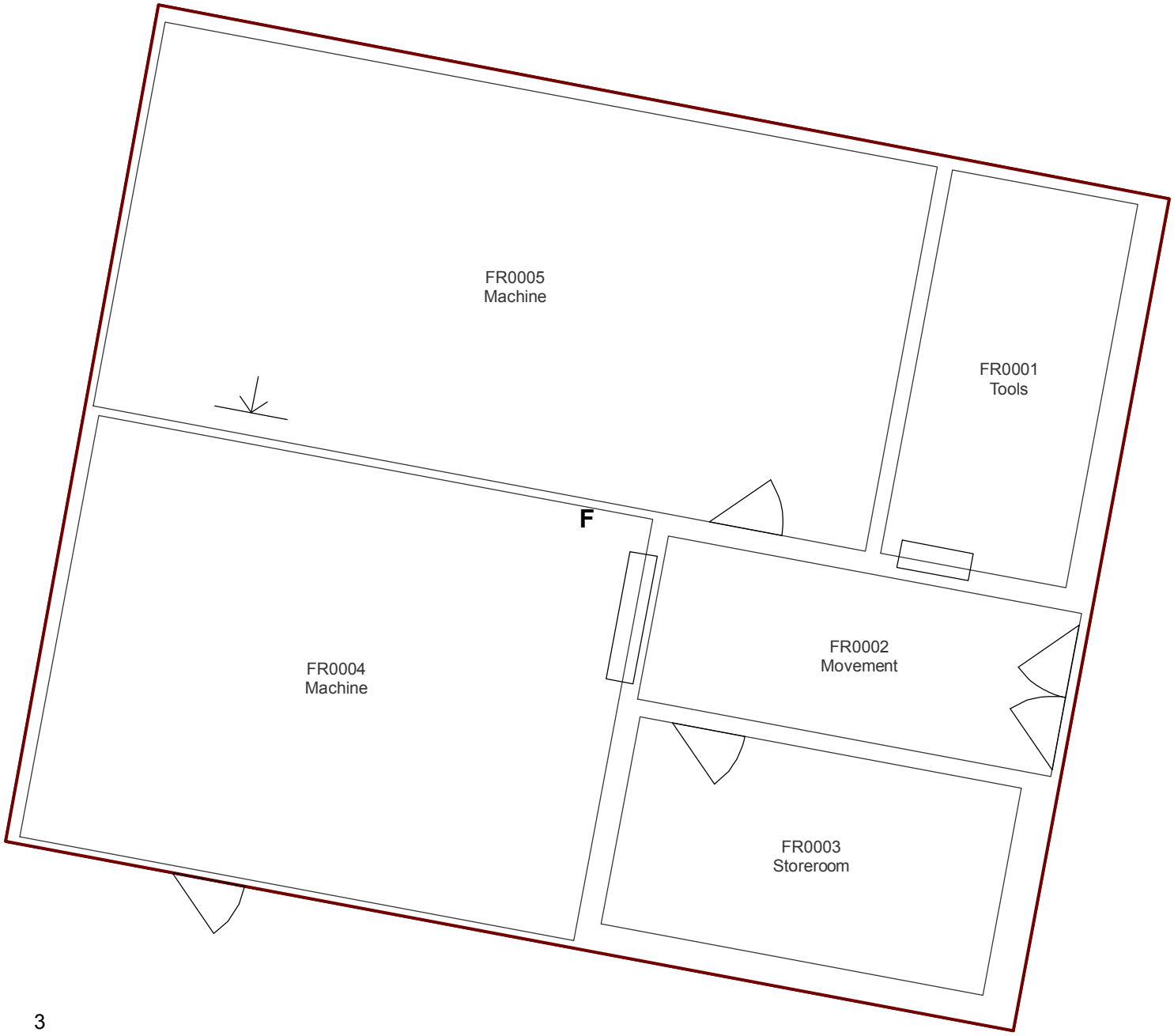
Metres

1:34

Printed: 13-Jul-2021

8270 - Wee Waa High School

Agricultural Science (B00F) - Ground Floor (Room Function)



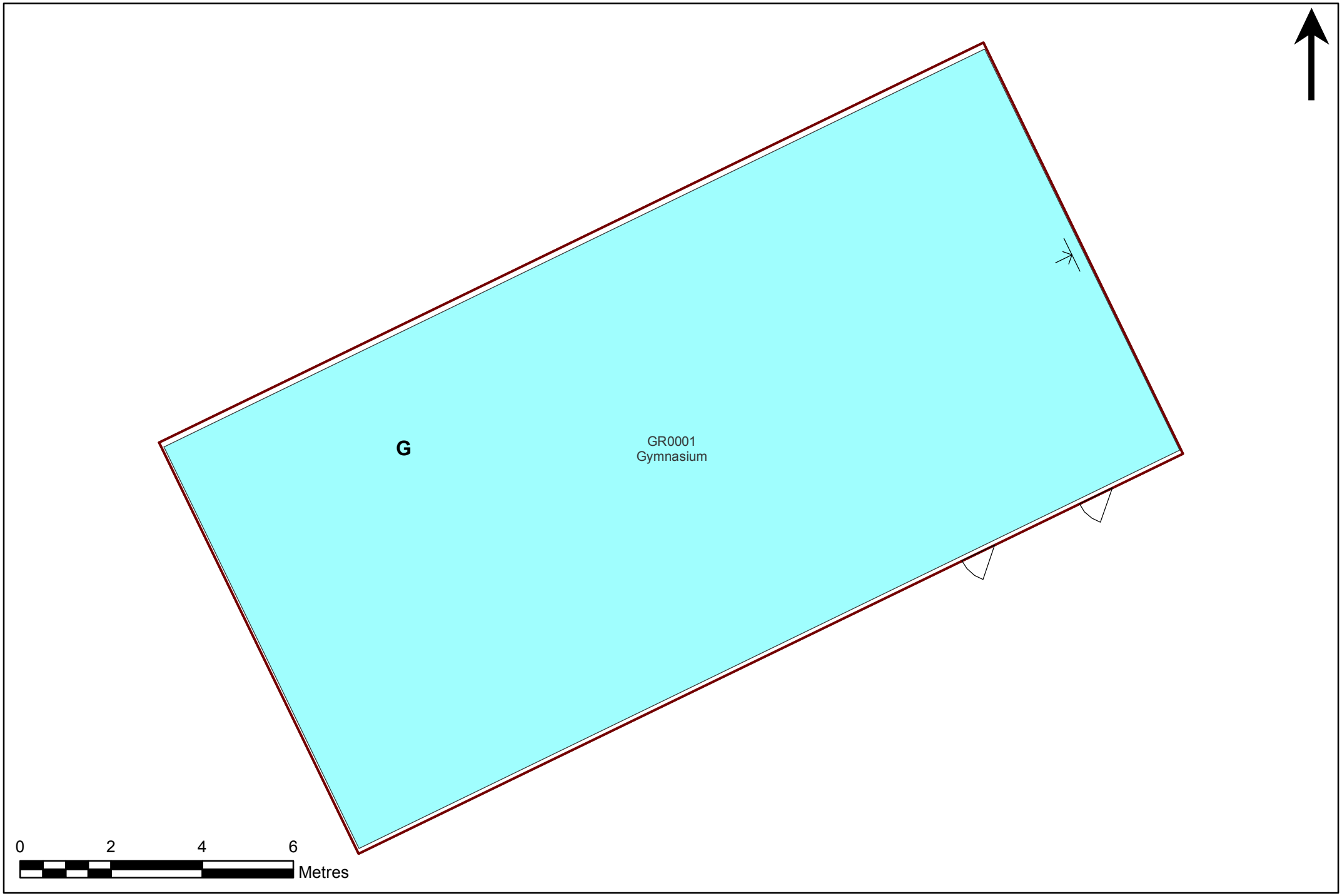
0 1 2 3 Metres

1:65

Printed: 13-Jul-2021

8270 - Wee Waa High School

Multi Purpose Facilities (B00G) - Ground Floor (Room Function)

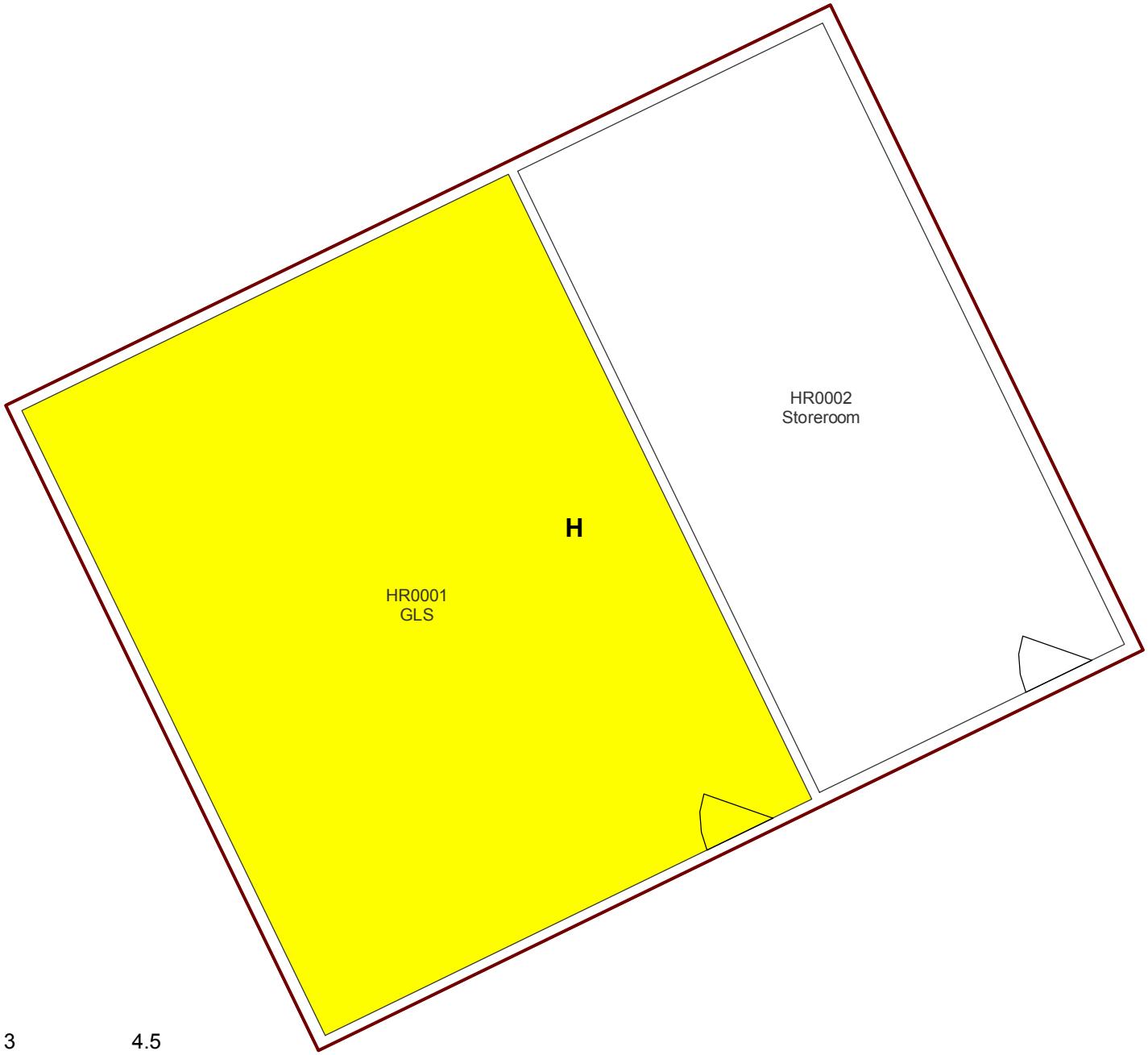


1:104

Printed: 13-Jul-2021

8270 - Wee Waa High School

General Learning (B00H) - Ground Floor (Room Function)



0 1.5 3 4.5

Metres

1:67

Printed: 13-Jul-2021

8270 - Wee Waa High School

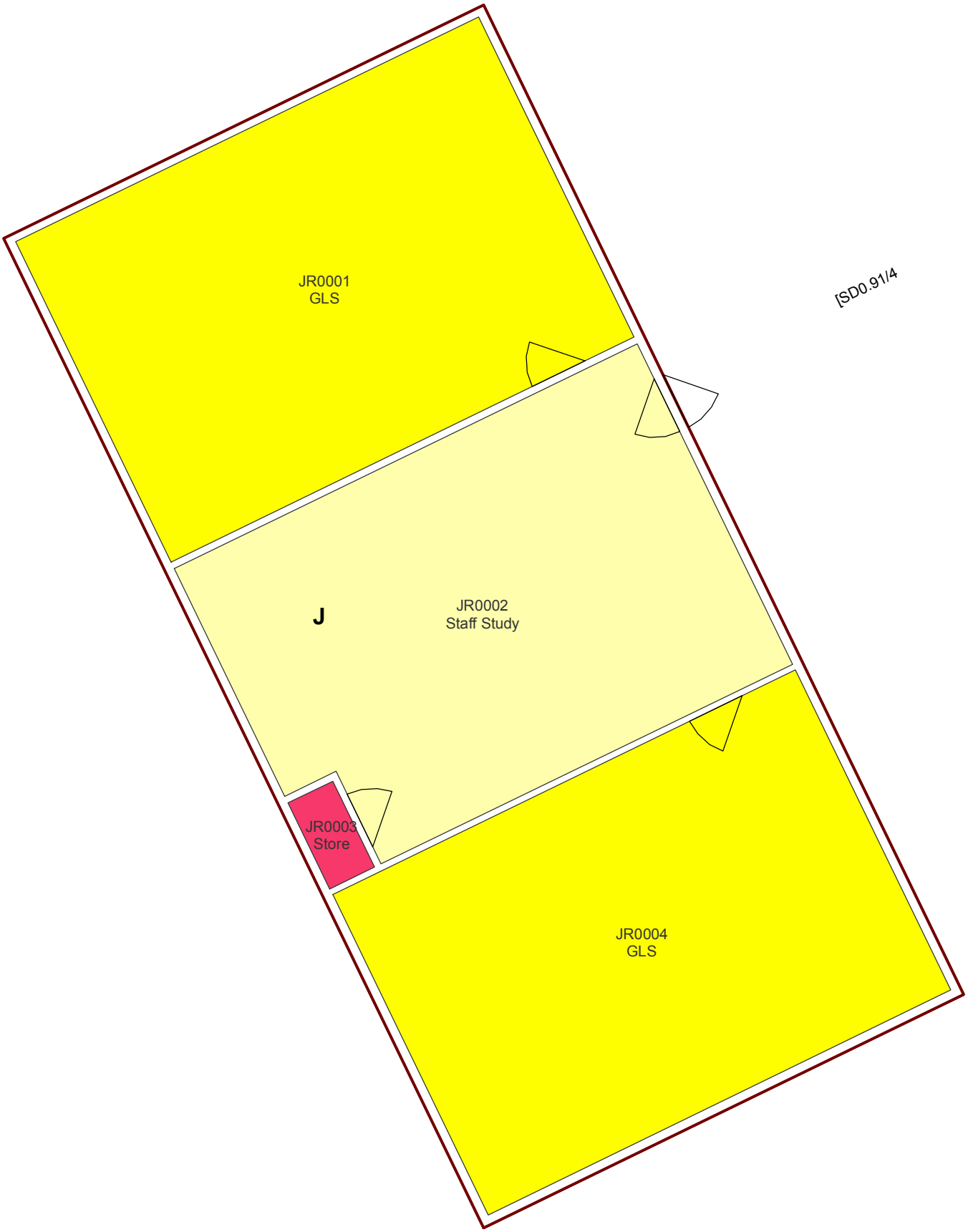
Science Learning (B00I) - Ground Floor (Room Function)

1:143

Printed: 13-Jul-2021

8270 - Wee Waa High School

Support Unit (Is) (B00J) - Ground Floor (Room Function)



0 1 2 3

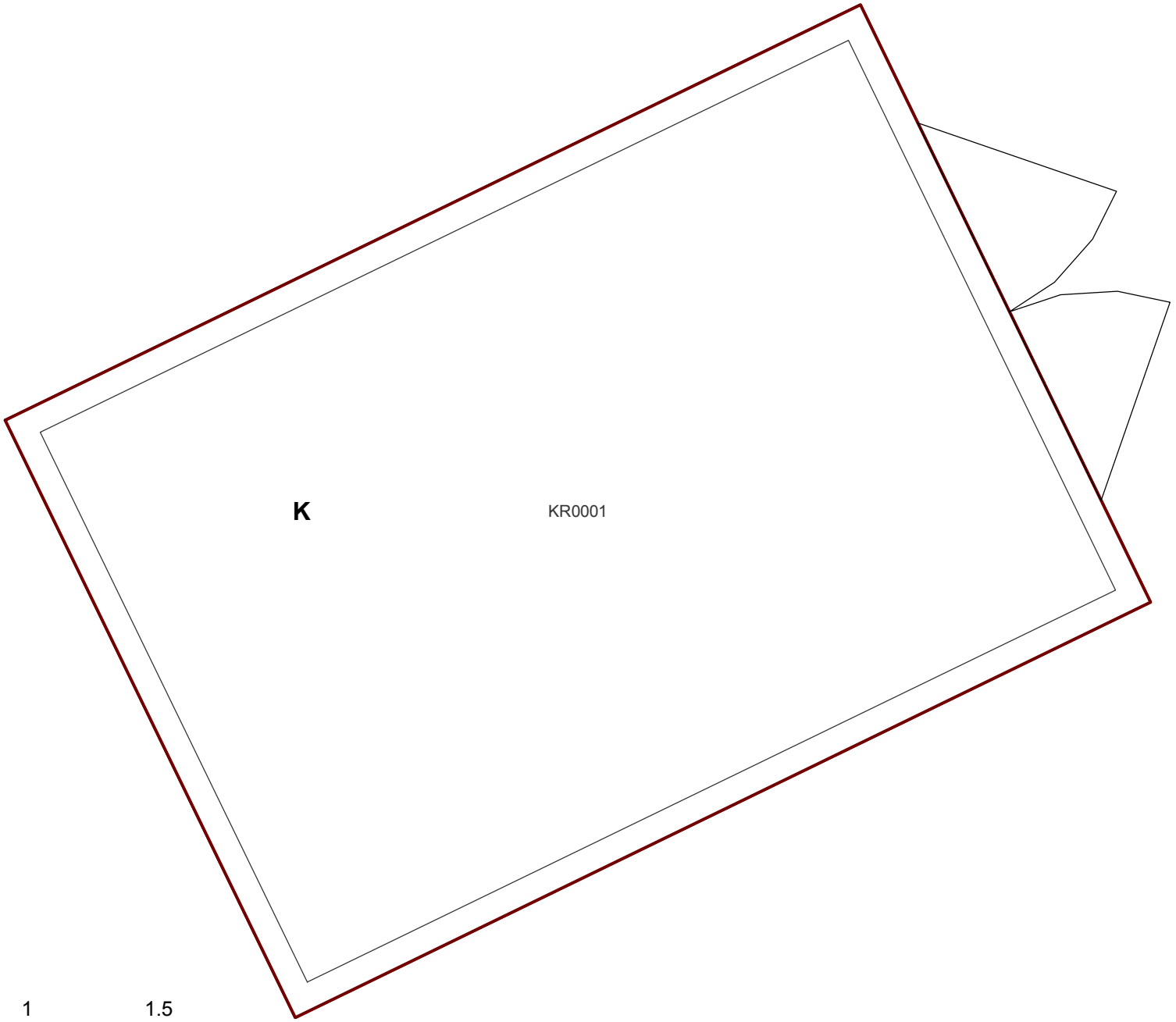
Metres

1:74

Printed: 13-Jul-2021

8270 - Wee Waa High School

Mechanical Services (B00K) - Ground Floor (Room Function)



0 0.5 1 1.5 Metres

1:23

Printed: 13-Jul-2021

8270 - Wee Waa High School

Storage (B00L) - Ground Floor (Room Function)

0 1 2 3

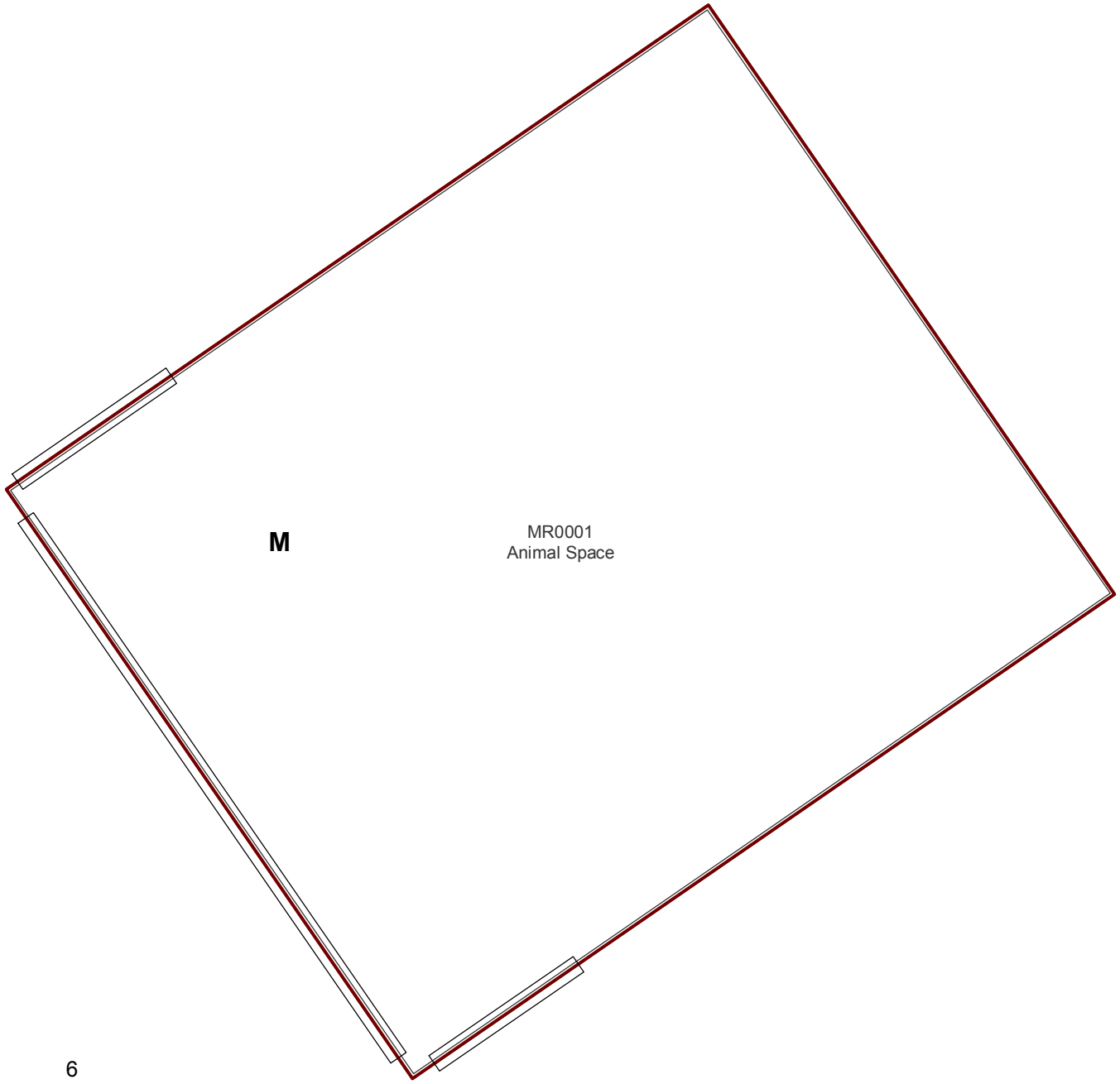
Metres

1:82

Printed: 13-Jul-2021

8270 - Wee Waa High School

Agricultural Science (B00M) - Ground Floor (Room Function)



0 2 4 6 Metres

1:101

Printed: 13-Jul-2021

Appendix B Investigation summaries

Works conducted in 2018

An investigation was commenced in 2018. The school was assessed for the presence of mould by Regional Enviroscience. Three reports were prepared in June and July 2018.

- Report 1 – Initial sampling occurred on 14 June. At the time of sampling there was no evidence of mould (discolouration or odour). Air was sampling through the library (8 locations) and at one location outside as control. Surface samples were also taken in 2 locations. Samples (plates exposed to air or the surface samples) were taken back to the laboratory and incubated for 5 days and then fungal colonies were identified and counted in line with standard procedures. No fungal spores were reported for the 2 surface samples. The sample collected outside had a total spore count of 380 cfu/m^3. All of the indoor air samples had lower total counts ranging from 70-280 cfu/m^3. However, almost all of the species present in the indoor samples were different to those detected in the outdoor control. The report indicated that a total count less than 500 cfu/m^3 was reasonable for indoor environments with the additional requirement that individual species should be less than 50 cfu/m^3 in a sample unless the species were *Cladosporium* or *Alternaria*). *Aspergillus niger* was present at or above 50 cfu/m^3 in all the indoor samples. *Mucor* spp was reported at or above 50 cfu/m^3 in about half of the samples. The report noted that moisture levels were low in the building. The report also noted that the evaporative air conditioning unit was turned on to allow identification of which unit serviced the library and that this may have contributed to the levels in air so repeat testing was recommended. It was also recommended that the library be professionally cleaned (HEPA vacuum and all surfaces to be cleaned with biocide) prior to reoccupation. The classification applied to the results based on IICRC guidance was "condition 2". This refers to an indoor area where mould is present due to there being a more contaminated area nearby ("condition 3") and spores or fragments from that location have moved into this area. However, the report does not indicate where the "condition 3" area was located.
- Report 2 – the school was revisited for testing on 20 June which was targeted at the air conditioning unit that services the library and which was assumed to be the source of *Aspergillus niger* identified in the samples. Samples were collected in 3 locations with and without the unit being operated. In addition, swabs of ceiling vents were collected as were surface samples. The outdoor sample on this occasion contained 90 cfu/m^3. The indoor samples with the air conditioning off ranged from 50-70 cfu/m^3 and with the air conditioning on ranged from 70-100 cfu/m^3. Air within the air conditioning unit reported 310 cfu/m^3. *Aspergillus niger* was detected in all indoor samples but not in the outdoor sample. It was the major species detected in all the indoor samples, however, not the sample collected within the air conditioning unit. There were spores of this species in the surface samples and in most of the swabs from the vents. The report concluded that the air conditioning unit should be professionally cleaned and that the vents taken cooled air to the library should be cleaned/fogged with a biocide. There was no indication that cleaning of the library in line with the recommendations in the previous report had been undertaken, however, it is noted that this work only occurred about 1 week after the previous sampling/inspection.
- Report 3 – the school was visited for further testing on 10 July. The report notes that the library appeared fresh and clean but there is no discussion as to whether the cleaning

previously recommended had been undertaken. *Advice from the principal indicated that a deep clean of the library was undertaken in 2018.* There is also no discussion as to whether or not the large air conditioning unit that services the library had been cleaned in line with the previous recommendations (although one photo notes that it shows the A/C after the clean – image 4). The report does note that a portable air conditioner had been removed from the library along with the carpet it was standing on as water had spilled from it and there was mould present. The outdoor sample on this occasion contained 400 cfu/m^3. The indoor samples with the air conditioning off ranged from 40-120 cfu/m^3 and with the air conditioning on ranged from 10-150 cfu/$m^{3.}$. These results appear to indicate that there was no longer any difference with the air conditioning on. Bacterial counts in the outdoor sample on this occasion were 1,200 cfu/m^3 which was significantly higher than any previous results none of which had exceeded 100 cfu/m^3 indoors or outdoors. No fungal growth/spores was observed on the swabs or surface samples. The report concludes that the facilities are now of appropriate quality and staff and students can now reoccupy.

Works conducted in 2019

In 2019, there were ongoing reports of symptoms. More work was undertaken to investigate the potential source of the issues:

- In June 2019, an indoor air quality investigation was undertaken by WSP. Sampling was undertaken on 24 June 2019. The investigation included testing for temperature, relative humidity, carbon dioxide and air and surface sampling for microorganisms. Moisture content in building materials was also assessed. This investigation used different guidelines for screening for mould compared to Regional Enviroscience in 2018. This report noted that levels <1,000 cfu/m^3 indicated normal levels. The air samples showed total mould counts between 80 and 267 cfu/m^3 for the indoor locations and 80 cfu/m^3 for the outdoor sample. The surface samples also showed levels of various moulds with AR0006 reported quite elevated levels. The report noted that the total mould counts were within normal levels but that room AR0006 was higher than outdoor levels. It was also noted that the bricks in the walls appeared to have elevated moisture levels but further work was needed to confirm this finding. It was suggested that dehumidifiers be installed in AR0006.
- Building inspection was undertaken in December 2019 – no observations of moisture issues were found during this inspection in relation to the walls, roof or guttering. The report noted that the air conditioning units and associated ducting may need to be inspected/tested/cleaned.

Works conducted in 2020

In 2020, the drought broke and there was an increase in frequency and number of symptoms reported. More work was undertaken to investigate the potential source of the issues:

- Regional Enviroscience undertook further sampling on 5 March 2020. Sampling of air was undertaken in 16 locations plus 1 outdoor control along with 5 surface samples and 4 swabs of vents etc. No visible mould was observed in any location other than the maths staff room where a water leak had occurred. The outdoor sample on this occasion contained 200 cfu/m^3. The indoor samples ranged from 60-160 cfu/m^3 for locations other than the maths

staff room and 180-190 cfu/m^3 in this location. Bacterial counts were almost all below 100 cfu/m^3 with 1 location at 120 cfu/m^3. Spores were found on some surface samples and some swabs. Some of the air samples contained mould species at greater than 50 cfu/m^3. The species that were most elevated were *Rhyzopus* and *Mucor* (other than the 2 species identified to which this guideline does not apply). The report concluded that, because *Aspergillus* was not reported above 50 cfu/m^3 in any sample, most of the spaces were of appropriate condition for use by staff and students. The report did note that the maths staff room should be remediated prior to reoccupation.

- Further sampling was undertaken by Regional Enviroscience on 17 March 2020. The report noted that carpets had been removed in the Admin offices, library, other offices and tutorial rooms as well as the maths staff rooms. Each of these areas was treated with a biocide. Air was sampled (16 locations plus outdoor control) and some swabs were taken (15). The outdoor sample on this occasion contained 210 cfu/m^3. The indoor samples ranged from 70-150 cfu/m^3 for most locations. One room had a very low reading of 10 cfu/m^3 in this location (CR1001). The species that were most elevated were *Fusarium*, *Bipolaris* and *Rhyzopus* (other than the 2 species identified to which this guideline does not apply). In some samples these species were individually above 50 cfu/m^3. The species present in the outdoor sample were somewhat different to the indoor samples. Most of the swabs showed no fungal growth. The report concluded that all locations were now safe for occupation. Bacterial counts were almost all below 100 cfu/m^3 with 1 location at 120 cfu/m^3.
- Further sampling was undertaken by Regional Enviroscience on 13 July 2020. This appears to be follow up sampling. Air samples were collected from 6 indoor locations within air conditioning ducts with an outdoor control. Swabs and surface samples were collected in 12 locations. The outdoor sample on this occasion contained 230 cfu/m^3. The indoor samples ranged from 20-120 cfu/m^3. The surface samples showed little indication of mould while the swabs did show growth of mould in most of the samples. *Aspergillus* was present in one air sample above 50 cfu/m^3. Bacterial counts were all below 50 cfu/m^3. The report concluded that some additional cleaning of air conditioning ducts may be useful.
- WSP was engaged to further investigate this matter in September 2020. The investigation included testing for temperature, relative humidity, carbon dioxide and air and surface sampling for microorganisms. Moisture content in building materials was also assessed. Formaldehyde and other volatile organic compounds were also investigated. This assessment found that moisture content in a range of building materials in a variety of rooms was outside of the relevant range – predominantly in brick walls or in flooring. In most rooms where moisture was high the rooms were clean and dry with no apparent staining, no odours and no observed mould growth. The moisture levels in Block A and C were concluded to be indicative of moisture transfer from beneath the building including from the retention drain in Block C.

  The outdoor air samples on this occasion contained 1,227-2,307 cfu/m^3 (3/9/20) and 1,987-3,360 cfu/m^3 (16-17/9/20). The indoor samples ranged from 627-71,813 cfu/m^3 (3/9/20) and 147-6,387 cfu/m^3 (16-17/9/20). It is not entirely clear why the levels in this sampling event are so significantly different to the previous investigations. The methods for collecting the samples were different (100 L passed over an agar plate over 5 minutes compared to 75 L of

air drawn into a collection device over 5 minutes with the sample collected onto a small slide holding the collection media) and this may have contributed but it seems unusual. The highest value from 3/9/20 was collected in the ceiling of the room AR0006. An air sample was also collected in the room itself with a value of 80 cfu/m^3 being reported. The mould species present at the most elevated levels was aspergillus/penicillium. This room was not resampled in the sampling on 16-17/9/20. It is not clear why this was the case. The flooring in AR0006 was also sampled using surface wipes on 3/9/20. Again, elevated levels were reported particularly for aspergillus/penicillium. A similarly elevated surface level was collected on that date from the concrete fascia outside.

This report concluded that the ground floor of Block A should remain as restricted access until remediation. First floor rooms in this block were considered safe to occupy. It was considered important that moisture issues in this building be resolved. Block B was considered safe to occupy. A number of rooms on the ground floor and on the first floor of Block C needed to remain as restricted access until remediation. The rest of the rooms in that block were considered safe to occupy. Again the moisture issue was considered critical to resolve. One storeroom and the library in Block D needed to remain as restricted access until remediation occurred. Other rooms were considered safe to occupy. Blocks H, I and J had no further requirements for action.

- WSP returned in December 2020 to do further work. The program used similar processes to previous work. This investigation focused on demountable rooms. The outdoor air samples on this occasion contained 600-1,240 cfu/m^3. The indoor samples ranged from 133-1,760 cfu/m^3. Moisture content in all the building material was within recommended levels. It was considered that the air and surface sample results for mould during this work reflect normal mould ecology.

Works conducted in 2021

- In February 2021, WSP undertook an assessment of the moisture content in the buildings at the high school. This investigation looked at the moisture content of the ground and characteristics of groundwater as well as a review of the building structure. Cores were drilled in 3 locations to evaluate the soil profile and depth to groundwater. The soil cores were drilled to a depth of 17-18 m below ground level with no groundwater observed indicating groundwater is only present very deep within the soil profile. The soil profile is made up of sandy clay and clay predominantly with river gravels at around 12 m below ground level. This work was undertaken during a period of wet weather. The moisture content of the soil was as would be expected for clays under normal conditions (13-18%).

  Concrete cores were drilled (using dry method) at relevant locations to assess the relevant characteristics. The concrete cores did not indicate significant moisture content at depth.

  The building inspection identified a range of drainage issues including blocked drains and down pipes, drains with reverse falls, pipes with holes, stormwater runoff from the road draining back onto the site and a range of plumbing maintenance issues. In addition, the channel drain under C block (void as mentioned in **Section 2**) is not clear of debris and so water cannot flow through it to drain away. As a result of these issues, it is possible that

water can enter into the bricks and concrete making up the building at locations where failures were present. The inspection noted unsealed joints, cracking around joints and cracks in the building fabric. It also appears there were issues with the damp proof course including hardstand and gardens at levels above the damp proof course which could allow water to move from these areas directly into the walls above the course. In addition, the damp proof course could not be found in some buildings so it may not have been installed during construction. The report concluded that there were multiple ways for water to enter into the building fabric.

- In May 2021, surface swabs were collected in a number of locations by enRiskS to assess potential for a range of chemicals to be present on such surfaces. No chemicals of concern were identified.
- In July 2021, additional air monitoring for mould was undertaken by WSP.
- In November 2021, additional air monitoring for mould was undertaken by WSP that identified levels indoors above levels outdoors. Remediation occurred and follow up sampling was undertaken which showed that all rooms tested had returned to mould levels below outdoor levels. It was noted that outdoor levels were high which was probably a result of the wet spring weather. It was also noted that rooms with open windows (i.e. well ventilated) had lower levels than rooms which had windows closed during sampling. The email advice noted that ensuring adequate ventilation would be important.

Appendix C Investigation questionnaire(s)

Wee Waa High School - Health Incident Investigation Questionnaire

Interviewer: **Dr Jackie Wright**

Date: **13 September 2021**

A - Participant information	
Participant name:	
Participant No:	
Participant:	☐ Staff ☐ Student ☐ Other (specify)
Age:	
Gender:	☐ Female ☐ Male ☐ Other (specify)

Students:

School years and age:	
2018	
2019	
2020	

Staff:

Length of time working at school	
Role at school	

Others:

Involvement with school (dates and activities as relevant):

B - Medical history

Existing health issues

Asthma:	
Preventer medication	
Reliever medication	

Allergies (please specify):

General health issues including existing skin conditions (please specify):

Prescribed medications:

Over the counter medications:

Does your family have a history of health issues (specify)?

Have you ever been formally diagnosed with?

☐ Epilepsy	☐ ADHD	☐ Other:

General health

Have you ever smoked? ☐ Yes ☐ No

Are you a current smoker? ☐ Yes ☐ No

Does someone at home smoke? ☐ Yes ☐ No

Do you drink alcohol? ☐ Yes ☐ No If yes, specify frequency:

Exercise:

☐ Sedentary (no exercise)

☐ Mild exercise

☐ Occasional vigorous exercise (work or recreational less than 4 x per week for 230 mins)

☐ Regular vigorous exercise

Do you have pets? ☐ Yes ☐ No If yes, specify:

C - Classrooms/areas regularly accessed at school (reference maps)

2018: A B C D E G H I J L Ag plot area: F M Sports oval Other

Additional detail

2019: A B C D E G H I J L Ag plot area: F M Sports oval Other

Additional detail

2020: A B C D E G H I J L Ag plot area: F M Sports oval Other

Additional detail

D - Health issues related to school

Have you experienced health symptoms at the school during the years

2018: ☐ Yes ☐ No

2019: ☐ Yes ☐ No

2020: ☐ Yes ☐ No

If no, then move to Section F

Have the symptoms required emergency medical attention?

☐ Ambulance ☐ Hospital emergency visit ☐ Hospital admission

Details:

E - Type of symptoms reported in 2018-2020									
Symptom	**Has this occurred at least 2 times while at school?**	**If yes, was this better away from school?**	**Frequency of symptoms (while at school)**					**Did these symptoms resolve once the school relocated?**	**Comments, including duration of symptom, any need for medication or medical attention, time off work or away from school**
			Every day	**Weekly**	**Fortnightly**	**Monthly**	**Other**		
Eyes									
Dry and itchy	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Watery	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Irritated/ swollen	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Infections	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Other	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Skin									
Irritated/ itchy	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	

E - Type of symptoms reported in 2018-2020									
Symptom	**Has this occurred at least 2 times while at school?**	**If yes, was this better away from school?**	**Frequency of symptoms (while at school)**					**Did these symptoms resolve once the school relocated?**	**Comments, including duration of symptom, any need for medication or medical attention, time off work or away from school**
			Every day	**Weekly**	**Fortnightly**	**Monthly**	**Other**		
Rash	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Dry/flaky	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Other	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Respiratory									
Breathless or short of breath	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Asthma exacerbation	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Cough	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	

E - Type of symptoms reported in 2018-2020									
Symptom	**Has this occurred at least 2 times while at school?**	**If yes, was this better away from school?**	**Frequency of symptoms (while at school)**					**Did these symptoms resolve once the school relocated?**	**Comments, including duration of symptom, any need for medication or medical attention, time off work or away from school**
			Every day	**Weekly**	**Fortnightly**	**Monthly**	**Other**		
Difficulty breathing	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Dry/sore throat	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Sinus congestion	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Runny nose	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Hay fever/ itchy nose	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Dry nose	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Other	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	

E - Type of symptoms reported in 2018-2020									
Symptom	**Has this occurred at least 2 times while at school?**	**If yes, was this better away from school?**	**Frequency of symptoms (while at school)**					**Did these symptoms resolve once the school relocated?**	**Comments, including duration of symptom, any need for medication or medical attention, time off work or away from school**
			Every day	**Weekly**	**Fortnightly**	**Monthly**	**Other**		
Neurological									
Headache	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Fatigue/lethargy	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Dizziness	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Seizures	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Difficulty sleeping or staying asleep	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Memory issues	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	

E - Type of symptoms reported in 2018-2020									
Symptom	**Has this occurred at least 2 times while at school?**	**If yes, was this better away from school?**	**Frequency of symptoms (while at school)**					**Did these symptoms resolve once the school relocated?**	**Comments, including duration of symptom, any need for medication or medical attention, time off work or away from school**
			Every day	**Weekly**	**Fortnightly**	**Monthly**	**Other**		
Difficulty concentrating	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Behavioural changes	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Mood changes	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Other	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Other symptoms									
Upset stomach or nausea	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Diarrhoea	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	

E - Type of symptoms reported in 2018-2020									
Symptom	**Has this occurred at least 2 times while at school?**	**If yes, was this better away from school?**	**Frequency of symptoms (while at school)**					**Did these symptoms resolve once the school relocated?**	**Comments, including duration of symptom, any need for medication or medical attention, time off work or away from school**
			Every day	**Weekly**	**Fortnightly**	**Monthly**	**Other**		
Vomiting	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Nose bleeds	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Ear infections	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Other infections	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Fever	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Chills	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	

E - Type of symptoms reported in 2018-2020									
Symptom	**Has this occurred at least 2 times while at school?**	**If yes, was this better away from school?**	**Frequency of symptoms (while at school)**					**Did these symptoms resolve once the school relocated?**	**Comments, including duration of symptom, any need for medication or medical attention, time off work or away from school**
			Every day	**Weekly**	**Fortnightly**	**Monthly**	**Other**		
Joint pain or weakness	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Muscle pain or weakness	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	
Other	☐ Yes ☐ No	☐ Yes ☐ No	☐	☐	☐	☐	☐	☐ Yes ☐ No	

Other notes:

F - Observations or other information (include details including locations if observed)

Have you ever noticed mould at the school?

Have you ever noticed areas of dampness or staining inside the school (wet carpet, wet walls etc)

Have you ever noticed any unusual odours at the school?

Are you aware of anything else relating to the school buildings (history, construction etc) that you think we should be aware of

Second Interview – follow up Questionnaire

Name

Dates of symptoms

Observations about the weather when symptoms started/ Have you been at the school during lockdown – was there something that changed when the symptoms started?

Symptoms

Did you have time off due to symptoms? How much?

Did you seek medical help for the symptoms? Were you prescribed anything?

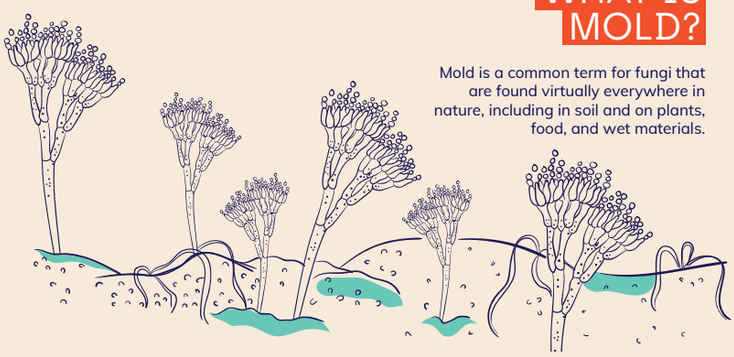
Have the symptoms resolved?

Appendix D Useful documents from AIHA

MOLD

For more than a decade, mold has been in the news. People are talking about the effect on population health and damage to the building. But what are the risks and issues? A number of agencies have guidelines that include protective measures for mold remediation and cleaning.

WHAT IS MOLD?



Mold is a common term for fungi that are found virtually everywhere in nature, including in soil and on plants, food, and wet materials.

HOW DO I KNOW IF I HAVE A MOLD PROBLEM?

If you notice water stains, discoloration on walls, floors, or ceilings, bubbling, cracking, or peeling paint or wallpaper, then you may be dealing with mold.

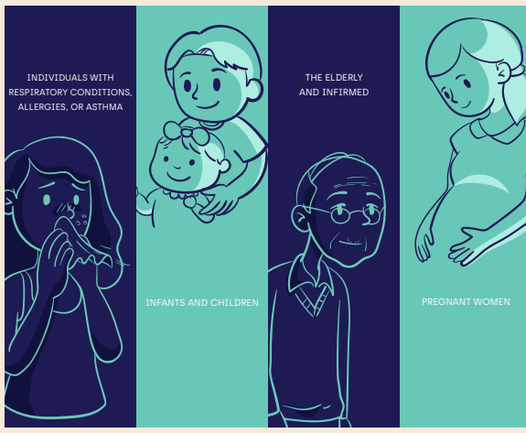
If you do not see any of these signs, but smell a musty odor, mold may be growing underneath or behind water-damaged materials, such as walls, carpeting, or wallpaper.

WHERE IS MOLD FOUND?

Mold is found everywhere in all environments all around the world. In indoor environments, mold is most often associated with damp, musty locations such as bathrooms, basements, and attics.

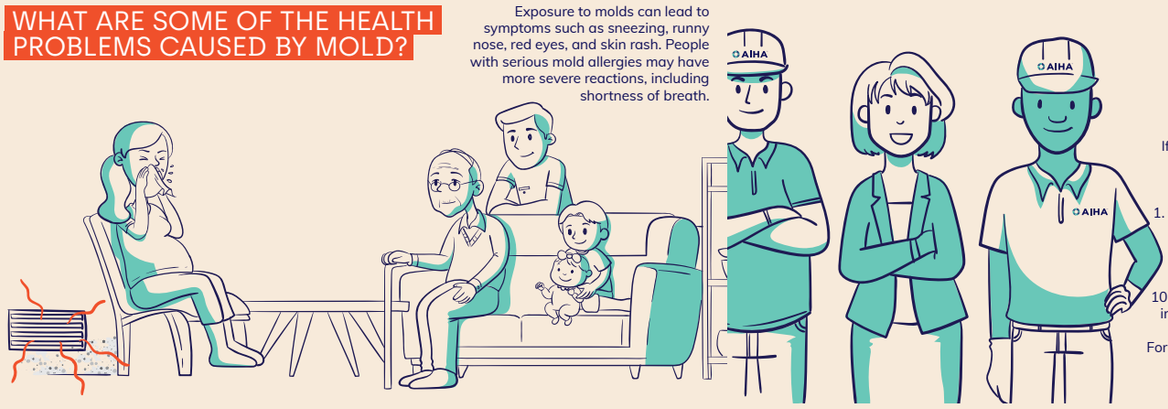
WHO DOES MOLD AFFECT?

Some people can be affected by airborne mold spore exposure. People who may be affected more severely and quickly than others include:



WHAT ARE SOME OF THE HEALTH PROBLEMS CAUSED BY MOLD?

Exposure to molds can lead to symptoms such as sneezing, runny nose, red eyes, and skin rash. People with serious mold allergies may have more severe reactions, including shortness of breath.



HOW CAN YOU CLEAN UP MOLD?

If the growth is less than 10 square feet, you can take these three steps to eliminate the mold:

1. identify and correct the source of moisture
2. clean and disinfect the affected area
3. ensure the area is thoroughly dried

If the area of mold growth is greater than 10 square feet, you should consider hiring an industrial hygienist and/or mold remediator.

For expert advice on mold contamination, it is recommended that you contact AIHA or an AIHA-listed consultant.

HOW TO KEEP MOLD AWAY

The key to preventing and stopping indoor mold growth is to control excessive moisture and condensation. Keep susceptible areas in the home clean and dry, clean and repair gutters regularly, make sure the ground slopes down and away from the home's foundation, use a dehumidifier in basements and other areas that are chronically damp, and keep air conditioner drip pans and drain lines clean.

AIHA®
HEALTHIER WORKPLACES
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For more information, visit our Mold Resource Center at **bit.ly/AIHAMoldResources**

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Facts About Mold: A Consumer Focus

Fact Sheet

aiha.org

Version 1 | July 8, 2020

Sponsored by the AIHA® Indoor Environmental Quality Committee and the AIHA® Biosafety and Environmental Microbiology Committee

The U.S. Centers for Disease Control and Prevention, the Institute of Medicine of the U.S. National Academy of Sciences, the American Academy of Allergy Asthma and Immunology, Health Canada, and the World Health Organization all agree that living or working in a building with mold-damaged building materials results in an increased risk of respiratory diseases such as asthma.

The American Industrial Hygiene Association (AIHA) has worked to translate the advice from these public health and medical authorities into state-of-the-art inspection and sampling protocols. These protocols are captured in AIHA's second edition of the *Recognition, Evaluation and Control of Indoor Mold* publication, also known as the Green Book. These methods are suitable for assessing visible and hidden mold contamination, and for developing a mold remediation plan.

Assessments and reports based on the Green Book protocols are useful for industrial hygiene, occupational medicine, and allergy and respiratory medicine as well as the owners and engineers tasked with repairing and/or remediating buildings with mold growth. The information in this document represents a carefully reviewed summary of potentially useful information on the management and remediation of mold and dampness in buildings.

When extensive mold damage has occurred, it is recommended that business and homeowners seek professional guidance before attempting to clean large amounts of contaminated materials. Industrial hygienists and other safety and health professionals can anticipate health and safety concerns, and they can design solutions to prevent exposures using guidelines established by government agencies and recognized authorities such as relevant professional associations. A list of useful guidelines and other publications is found at the end of this document.

Based on more than 25 years of AIHA experience studying the mold and dampness problem, this publication addresses general information about management of mold and dampness in buildings, with a special focus on residential housing.

What is mold?

The term *mold* is a colloquial term for fungi that are commonly found on food or wet materials. This includes the green *Penicillium* mold that produces penicillin, the fungi (or mold) that spoil our bread, fruit, cheese and crops, and most importantly, the mold that recycles dead organic matter, including wood from fallen trees and leaves.

The molds that grow on damp building materials are most often found naturally in the soil. There are thousands of species of mold, and they can be any color. Besides different "food" preferences, molds are adapted to thrive under different moisture conditions ranging from soaking wet to just damp. Many times, mold growth can be detected by a musty odor in some areas, for example, a basement or a crawl space.

Live spores act like seeds, forming new growth (colonies) under the right conditions. All of us are exposed to a variety of fungal spores daily in the air we breathe, both outdoors and indoors. In outdoor air, the most commonly found fungi are those that live on the surfaces of leaves as well as mushroom spores. These fungi are not generally found on damp building materials. In a clean, properly ventilated, and well-maintained building, the fungal species in a building should be similar to those found in outdoor air.

Who is affected by exposure to mold?

Living or working in building with mold and moisture damage can increase the relative risk for respiratory disease and asthma in the general population. Although individual response is dependent on a

number of variables, including duration and extent of mold and moisture damage as well as individual health status, at particular risk are people who are allergic to mold or are genetically predisposed to allergy. For those people who are already sensitized to mold, inhaling fungal fragments can cause allergic reactions, including sneezing, runny nose, red eyes, and skin rash. People with serious mold allergies may have more severe reactions, including shortness of breath.

There is a wide variability in how people are affected by airborne mold spore exposure. People who may be affected more severely and quickly than others include:

- individuals with respiratory conditions, allergies, or asthma
- infants and children
- the elderly and infirm
- pregnant women

People with symptoms commonly associated with mold exposure and who have been informed that they have been living or working in a building with serious mold damage should consult their doctor. In particular, allergists are best positioned to address specific concerns. Symptoms believed to be from mold exposure may be due to other causes, such as bacterial or viral infections or other allergies.

All agencies or professional groups working in public or occupational health in the United States and Canada agree that living or working in a building with active mold growth can affect respiratory health. These effects include making asthma worse in mold-sensitive asthmatics as well as increased risk of allergic and upper-respiratory disease. All of the guidelines referenced in the appendix state that if you see visible mold growth, this should be addressed promptly. Based on extensive research conducted all over the world, the authorities and guidelines acknowledge that the risk of mold-related health effects is somehow proportional to the extent of mold and moisture damage. Hence the risk, as well as the complexity of managing a mold and dampness problem, is proportional to the nature and extent of mold growth.

A few square inches of visible mold on, for example, a window frame should be cleaned up as described by the Environmental Protection Agency (EPA) and other agency's guidelines. If extensive mold growth or mold-related damage is discovered, the risk of exposure, including during the removing and cleaning of these moldy building materials, is a serious matter. In these cases, it is recommended that the remediation should be handled by someone qualified and experienced in this area of practice.

However, regardless of the amount of growth and related damage, the underlying moisture problem must be addressed. After the moisture problem is resolved, and any mold growth or damage is removed, the space must be given a thorough cleaning to remove fine particles. This can normally be accomplished with a good-quality vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter and damp wiping of hard surfaces.

What causes the health effects?

The health effects of mold generally relate to breathing fragments of the mixture of fungi that inevitably occur on a damp surface. Experience has shown that it is never one species of mold on these damp surfaces. The fragments get into the air when the moisture dries and by the movement of air across a surface. If there is carpet present, the fungal fragments will accumulate and then will be resuspended by normal room activity.

Molds can also produce a number of biochemicals. There is a broad consensus that allergic reactions

associated with mold exposures in buildings are mainly due to mold glucan (a component of fungal cell walls), allergens (parts of mold that cause allergic reactions), and other mold proteins.

Some molds can also produce mycotoxins under certain conditions. The news media and some contractors often refer to "black mold" or "toxic black mold." This usage is typically associated with *Stachybotrys*, a greenish-black fungus always associated with water-saturated building materials. In the United States and Canada, extensive damage by *Stachybotrys* is much less common than, for example, the *Penicillium* species.

Stachybotrys can produce mycotoxins, but the known health effects from exposure to *Stachybotrys* are similar to those caused by other molds, except in occupational exposures such as have occurred in agriculture. The fungi that produce mycotoxins on food and feed do not grow on damp building materials, so these exposures seldom, if ever, occur in buildings. An exception is if remediation is carried out without appropriate precautions.

Mold damage in houses

Apart from floods, there are four major causes of mold damage in residences: leaks in the building envelope (e.g., around window frames, roof); condensation; unattended plumbing leaks; and so-called "household mold" (e.g., mold growth on kitchen and bathroom surfaces, on window frames, in basements). Common causes of excessive indoor moisture that can lead to mold problems include:

- insufficient or improper insulation
- condensation on cold surfaces
- flooding from surface waters (e.g., overflowing rivers) or from severe storms
- roof leaks from damaged or missing roofing materials, ice dams, or blocked gutters
- storm-driven rain through window frames, exterior walls, or door assemblies
- leaking pipes, sewer backups or overflows
- damp basements or crawl spaces

How can I prevent mold growth?

The key to preventing and stopping indoor mold growth is to control excessive moisture and condensation. Keeping susceptible areas in the home clean and dry is critical. In general, mold will not grow indoors without water, dampness, or excessive moisture. Other things that can be done are to clean and repair gutters regularly; make sure the ground slopes down and away from the home's foundation; and keep air conditioner drip pans and drain lines clean.

In the case of floods or leaking pipes, any standing water should be promptly removed, and water-damaged materials should either be dried out and cleaned or removed and replaced. Porous materials that are wet for more than 48 hours are likely to produce mold growth and should normally be discarded. In instances where the water damage is extensive, it is recommended that professional help, such as a qualified commercial restoration company, be consulted.

For mold growth in the walls from floods or unnoticed leaks around windows, it is often hard to open up walls around floors that have been subject to a flood that seems to recede quickly, and where the occupied space has dried according to FEMA and related guidelines. However, normally it is necessary to open up the bottom of the wall cavity to ensure the inside actually dries. Another source of hidden mold is slow leaks in plumbing inside walls and sometimes around window frames if they were not

properly sealed when installed or if the caulking has failed with time.

Whether in cold climates during the heating season or in climates that require air conditioning, condensation is often a major issue in homes. Condensation can lead to mold growth on window frames, which is easily seen, but can also be a problem in carpets and areas that are not easily seen, such as behind bookshelves or other items of furniture beside a cold wall.

In the course of daily living, the average family generates more than100 pounds of water vapor per day into the air from cooking, showers, and cleaning. In the summer, absent air conditioning, outdoor air is a source of humidity, which can become an issue in cool basements. Usually, the major reason for condensation leading to mold growth is inadequate or improper ventilation. Even if mold growth is in a basement used for storage or laundry, fragments of the mold will find their way upstairs.

There are three main factors that contribute to condensation of water on building surfaces:

- **Poor Ventilation.** Indoor relative humidity can build up if there is not enough ventilation, there is an inadequate exchange of indoor and outdoor air, or the air is not properly conditioned. Where there is little or no air movement, such as behind dressers and cabinets, surfaces can remain cooler than surrounding areas. This can lead to increased condensation and mold growth. It is recommended that the area of concern be ventilated, and that the occupants use exhaust fans (vented to the outdoors) to remove moisture from high-humidity areas, particularly in bathrooms, kitchens, and laundry areas. Furniture should be moved slightly away from walls so that air can freely pass behind it.
- **Humidity Control.** Where possible, localized sources of humidity, such as clothes dryers, should be directly vented to the outdoors. To lower indoor humidity during warm, humid weather, it is recommended that air conditioners and/or dehumidifiers be used, where practical. In chronically damp areas, such as basements or crawl spaces, it is often recommended that dehumidifiers be used to maintain humidity levels below 60%.
- **Temperature.** Warm air holds more moisture than cold air. Condensation occurs when warm humid air comes into contact with a cold surface and the moisture condenses into water. This can often be seen on single-pane windows, where the water condenses and then runs down, causing the wood frames and sills to rot and the wall under the windows to blister. If left unattended, mold growth around the frame can be seen. If there is condensation around windows, this can mean there is condensation elsewhere, in less visible places. In addition, condensation can occur on exterior walls, particularly north-facing walls, if they are not properly insulated. Other chronically cold surfaces, such as cold-water pipes, should be covered with insulation to help prevent condensation.

What should I do if I see or smell mold in my home?

The most important step is to identify the source(s) of moisture which have resulted in mold growth and to make the necessary repairs to stop them. If you only clean up the mold and do not stop the source of moisture, it is most likely that the mold growth will recur. If the source of the moisture is related to a building failure or fault, such as a burst pipe or leaking roof, it is recommended that a professional and qualified contractor be consulted.

In instances where the moisture source does not appear to be related to leaks, floods, structural faults, or rising dampness, it is most likely due to condensation. If you do not see mold growth but smell a musty odor, mold may be growing underneath or behind

water-damaged materials, such as walls, carpeting, or wallpaper.

If possible, once the source of the moisture has been identified and fixed, decide if removing the mold from the affected areas is something that can be done without professional assistance. If the mold growth was caused by sewage backup or other contaminated water, potential pathogens may be present. In these circumstances, the work should be performed by a professional contractor that has previous work experience in cleaning buildings or houses damaged by contaminated water.

In the case where the mold growth is due to condensation or a small-scale leak and is limited to a small area (less than 10 square feet), you can probably do the work yourself following guidelines such as those prepared by the EPA, Health Canada, and AIHA. On hard surfaces, such as countertops and wood furniture, it is recommended to use detergent and water to wipe the mold off and then dry the surface completely.

The use of biocides or chemical disinfectants (such as chlorine bleach) is not recommended as these may be hazardous to occupants. They also may not kill or render inert the suspect microorganisms and their associated toxins. Moldy porous or absorbent materials, such as ceiling tiles, wallboard, and carpeting, should be removed and replaced.

Persons cleaning mold should wear suitable gloves, goggles, and an approved respirator to protect against breathing airborne spores (an N-95 respirator would be appropriate for most simple cleanup projects). If you have health concerns, such as asthma, you should consult your doctor before doing any mold cleanup.

How do I know if there is hidden mold?

Hidden mold damage usually prompts complaints when fragments of the mold find their way into occupied space, often around electrical outlets and other cracks. This happens because wind and sun on the outside of the wall can make air pressure inside the wall cavity higher than indoor air. Fungal fragments can accumulate in dusts and people can be exposed this way. Active mold growth produces odors, which also will find their way into the building.

Investigators detect mold in wall cavities in several ways. First, they ask the occupant for any history of floods and get as much information as possible about how often the mold is found and the location of the mold growth. They also will inspect baseboard areas including the electrical outlets very carefully for any sign of previous water damage. If inspection and possibly sampling provide evidence that there might be a significant amount of mold in the wall cavity, they may ask permission to cut small holes and investigate. There are detailed protocols for doing this in a safe manner.

Should I test my home for mold or mycotoxins?

No. This is seldom useful in homes and some agencies (e.g., Health Canada) specifically recommend against testing of any kind in homes as a priority. Looking for evidence of water damage and visible mold growth, particularly when moldy odors are detected must be your first step. Testing for mold is expensive, and you should have a clear reason for doing so prior to hiring a consultant.

In addition, there are no standards for “acceptable” levels of mold in the indoor environment. When air testing is done, it is used to compare the types of mold spores found inside the home with those found outdoors. If you know you have a mold problem, it is more important to spend time and resources solving the moisture problem and getting rid of the mold than to spend it on sampling.

In the absence of an informed inspection, air sampling alone cannot support any path forward. Also, air, bulk, and swab sampling for mold spores does not evaluate potential health risks for the occupants in a building or house with mold damage.

What about mold in nonindustrial workplaces and schools?

Some of the reasons why mold damage occurs in the nonindustrial workplace are the same as in homes: floods, leaks in the building envelope, and condensation from inadequate ventilation. However, there are important differences between three broad categories of buildings mentioned: homes, offices, and schools. These include the nature and complexity of the heating, ventilation and air-conditioning (HVAC) systems and the very different array of moisture generating activities in such buildings. Investigating mold and dampness problems in these three categories of buildings requires a different toolbox for each. The AIHA Green Book has extensive descriptions on the acceptable range of practice of mold and dampness investigations for each building type, together with information on appropriate testing and documentation.

Are there standards for assuring the space is safe for occupancy?

Yes. For almost 30 years, the standard of care for mold remediation has had three main elements.

- First, the space must be properly investigated to locate and understand the cause of the mold damage in the building, and this must be documented properly.
- Second, a qualified remediator must remove the mold damage using defined protocols from appropriate professional organizations. The underlying cause of the water or condensation must be addressed before any build-back is initiated.
- Third, the mold-contaminated portion of the building must have a thorough cleaning with a vacuum cleaner equipped with a HEPA filter to remove fine particles. Importantly, this process should be monitored or evaluated by the indoor air professional who did the investigation. Unless the building owner has specifically agreed to use employees of the remediation company for this inspection, it should be done by an independent expert.

Unlike many other contaminants, there are no sampling-based methods that are used to assure that the space has been properly remediated from a health perspective. There are two reasons for this. The sampling methods that exist outside research studies are not able to quantitatively determine exposure. The second and very important issue is that people vary a great deal in their response to mold exposures. As noted above, if you are allergic to mold, your response is likely to be much more immediately severe than that of someone who is not allergic.

Who do I contact to investigate mold growth in a building?

If mold damage has been reported or a mold-related complaint has been made by occupants, it may be time to seek outside help. As a general rule, you should seriously consider calling a qualified and experienced industrial hygienist if any of the following statements are true:

- In-house efforts have not solved the problem; that is, occupant reports of health symptoms or discomfort continue, and it is believed to be due to unresolved mold contamination. Therefore, the problem has not been resolved. An expert in this field may be able to assist with a thorough investigation.
- The problem is too serious to delay response. If there is suspected mold contamination that is not visible because it is inside walls or above ceilings,

you will need outside resources. In addition, if the health complaints are widespread and persistent, the situation must be resolved in a rapid and professional manner.

- There is mistrust between occupants and the building management. Mold concerns can escalate to the point where independent investigation is needed to develop a credible diagnosis and recommendations.
- Litigation claims are likely. When problems are not addressed and resolved early, minor occupant discomfort or illness may become more serious. Increasing numbers of occupants are willing to initiate legal actions if mold problems persist. Retain a qualified expert as early as possible if litigation is likely to occur.
- There is a need for specialized equipment or expertise. If the initial investigation has produced a hypothesis that the cause of occupant discomfort or health symptoms was potentially harmful mold contamination, then you will need outside resources such as a consultant to test this hypothesis. Verification might require special sampling media and equipment as well as people who are qualified to collect, analyze, and interpret such samples correctly.

An industrial hygienist who practices in this area (i.e., mold investigation and remediation) is usually qualified and experienced to deal with this kind of situation and has access to current best-practice guidelines. If you use an outside professional, make sure that expert has pertinent work experience addressing mold issues in buildings.

Many individuals and companies represent themselves as mold experts. Some may be certified in various aspects of mold investigation and remediation, but it is important to note that not all "certifications" are equal. For example, someone who has taken a one- or two-week training course in mold investigation and remediation can be far less qualified than a Certified Industrial Hygienist (CIH) with extensive mold investigation and remediation experience.

Most CIHs have a graduate degree, have taken specialized courses, and have passed a written exam after an apprenticeship. If you hire a consultant to help identify your problem, or a contractor to perform the cleanup in your home, make sure that the individual has specific work experience in dealing with, and cleaning up, mold. It is always recommended that you check consultants' references before hiring them to provide technical assistance.

The following are suggested steps based on AIHA's *Guidelines for Selecting an Indoor Air Quality Consultant* to assist in selecting a qualified mold consultant:

First, verify that the consultant has appropriate training and project experience. Ask for references and contact clients to verify that the consultant has helped them solve their mold problem. Find out whether the most experienced personnel will be onsite or in direct contact with the site investigation staff.

Be wary of consultants who may overstep the bounds of their expertise or who have a financial stake in the outcome of the investigation, such as ownership in a mold remediation firm or laboratory. Also, you should be aware of applicable state or federal certification and/or training requirements, and make sure that the consultant has fulfilled these requirements.

Second, clearly define what you expect from the consultant you hire. It helps to define the scope of services upfront; however, mold investigations may not always be simple or predictable. Your proposed scope may be modified based on question-and-answer sessions with prospective consultants. The scope of the project may not be definable until more information is obtained through inspection and (if necessary) testing.

Third, solicit proposals and interview candidates if time permits. A telephone interview is usually sufficient; however, it may be necessary to have the consultant perform a preliminary site visit to fully understand the problem and generate an appropriate scope of work. Ask the consultant for his or her general approach to resolving the problem. A general but systematic approach based on a thorough visual inspection is usually more effective than relying on extensive air, bulk, or swab testing.

Proposals should indicate the estimated consulting fees and expenses for the specified phase of the project. Pay attention to the project approach and ask questions if some of the scope items do not make sense to you. Find out how decisions for testing or remediation will be made and what potential follow-up investigation activities may cost.

Fourth, for larger projects involving extensive mold growth, draw up a request for proposal (RFP) or contract specifications. This may take time, but it helps avoid surprises. The contract may specify the following (at a minimum):

- the project scope, specifying activities to be included, such as sampling
- the frequency of status reports and meetings
- the work product, such as drawings, reports, tables, and supporting information
- quality control procedures
- project budget estimates and fee schedules
- a reasonable schedule that is agreeable to all parties

AIHA provides a Consultants Listing at https://www.aiha.org/public-resources/consultants-listing where indoor air quality consultants may be found. However, note that AIHA does not recommend specific consultants.

Useful Reference Materials

American Industrial Hygiene Association

Disaster Response Resource Center. https://aiha.org/public-resources/consumer-resources/disaster-response-resource-center

FAQs About Spore Trap Air Sampling for Mold for Direct Examination. https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/FAQs-About-Spore-Trap-Air-Sampling-for-Mold-for-Direct-Examination-Guidance-Document.pdf

Health and Safety Guidelines for Selecting an Indoor Air Quality Consultant. https://eec.ky.gov/Environmental-Protection/Air/Documents/GuidelinesforSelectingAnIndoorAirQualityConsultant.pdf

Health and Safety in Natural Disasters (publication). https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Health-and-Safety-Issues-in-Natural-Disasters-Guidance-Document.pdf

Health and Safety Issues in Natural Disasters (website). https://aiha.org/public-resources/consumer-resources/disaster-response-resource-center/health-and-safety-issues-in-natural-disasters

Mold and Dampness in the Built Environment Position Statement. https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Mold-and-Dampness-in-the-Built-Environment-Position-Statement.pdf

Mold Resource Center (website). https://www.aiha.org/public-resources/consumer-resources/disaster-response-resource-center/mold-resource-center

Canadian Centre for Occupational Health and Safety

OSH Answer Fact Sheets: Indoor Air Quality – Moulds and Fungi. https://www.ccohs.ca/oshanswers/biol_hazards/iaq_mold.html

Centers for Disease Control and Prevention

Homeowner's and Renter's Guide to Mold Clean-up After Disasters. https://www.cdc.gov/mold/pdfs/homeowners_and_renters_guide.pdf

Mold After a Disaster. https://www.cdc.gov/disasters/mold/index.html

Environmental Protection Agency

A Brief Guide to Mold, Moisture, and Your Home. https://www.epa.gov/mold/brief-guide-mold-moisture-and-your-home

Federal Emergency Management Agency

After the Flood. https://www.fema.gov/media-library-data/20130726-1511-20490-0446/after_a_flood.pdf

Dealing With Mold & Mildew in Your Flood Damaged Home. https://www.fema.gov/pdf/rebuild/recover/fema_mold_brochure_english.pdf

Health Canada

Residential Indoor Air Quality Guidelines: Moulds. https://www.canada.ca/content/dam/canada/health-canada/migration/healthy-canadians/publications/healthy-living-vie-saine/mould-moisissure/alt/mould-moisissures-eng.pdf

National Institute for Occupational Safety and Health

NIOSH Recommendations for the Cleaning and Remediation of Flood-Contaminated HVAC Systems: A Guide for Building Owners and Managers. https://www.cdc.gov/niosh/topics/emres/Cleaning-Flood-HVAC.html

Occupational Safety and Health Administration

OSHA Fact Sheet: Fungi Hazards and Flood Clean-up. https://www.osha.gov/OshDoc/data_Hurricane_Facts/Bulletin3.pdf