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2 May 2024

Enquiries: Bayzid Khan
Project No: 300304094

School Infrastructure NSW
22 Giffnock Avenue
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Attention: **Mina Gadelrab (Project Lead, Infrastructure Delivery)**

Dear Mina,

RE: **Hunter River High School Upgrade**
Flood Evacuation Transport Assessment

1. Introduction

1.1 Background

It is understood that the Hunter River High School is undergoing development on land located at 36 Elkin Avenue, Heatherbrae. The proposed development incorporates three new buildings (administration, gymnasium, and support learning hub), a new access road and external landscaping, in addition to refurbishments to existing buildings.

Stantec was commissioned by School Infrastructure NSW (SINSW) in February 2024 to undertake a flood evacuation transport assessment for the proposed development.

1.2 Purpose

As per advice received from the NSW State Emergency Service (SES) in a letter dated 26 March 2024 (ID 2342), it was recommended to undertake an evacuation capability assessment which considers the ability of buses and cars to evacuate the whole school to a flood-free location.

This letter sets out an assessment of the anticipated transport implications for the proposed development and entire school student population during a flood evacuation, including consideration of the following:

- existing traffic and parking conditions surrounding the site
- number of students and staff to be evacuated and travel mode share
- evacuation procedures and their associated event times
- the traffic generating characteristics during a flood evacuation
- suitability of the proposed access arrangements for the site.

2. Existing Conditions

The subject site is located at 36 Elkin Avenue, Heatherbrae. The site of approximately 9.2ha has a frontage of approximately 175m to Elkin Avenue. The site currently has a land use classification as R2 Low Density Residential and is occupied by Hunter River High School.

The surrounding properties predominantly include residential uses and greenfield areas.

The location of the subject site and its surrounding environs is shown in Figure 2.1.

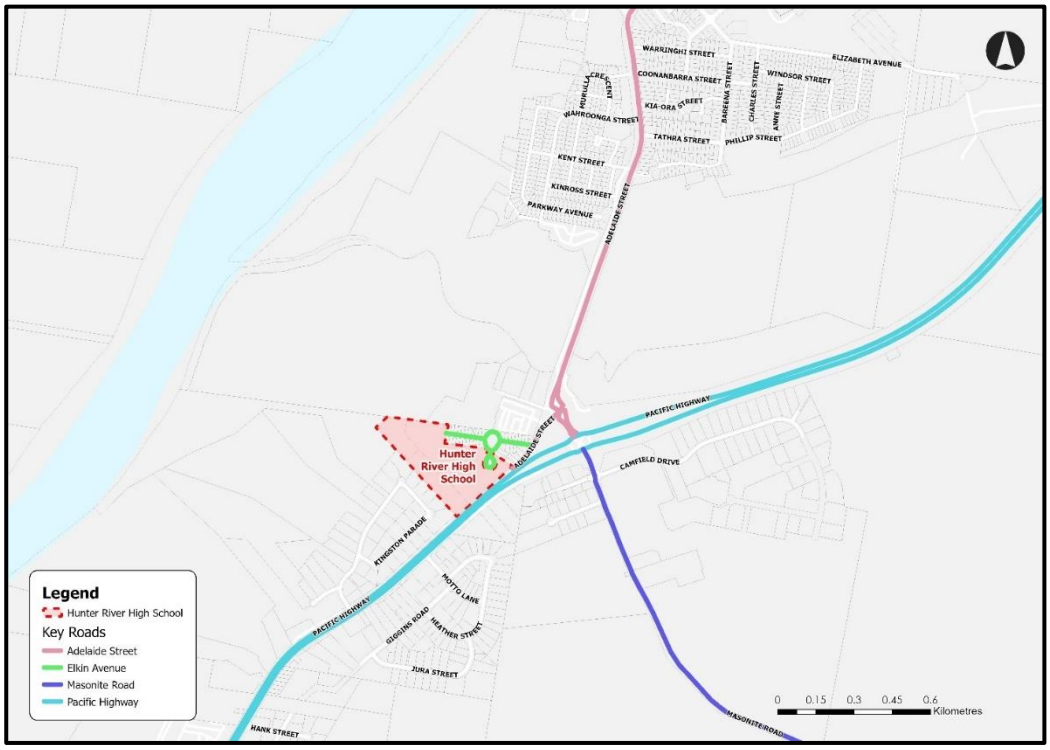
Figure 2.1 – Subject site and its environs

Base image source: Nearmap

2.1 Road Network

The location of Hunter River High School is relation to the surrounding road network is displayed below in Figure 2.2 and detailed in Table 2.1.

Figure 2.2 – Site location and the surrounding network



Base image source: ArcGIS

Table 2.1: Road network surrounding Hunter River High School

Road Name	Road Type	Details
Elkin Avenue	Local road	Elkin Avenue is a local road running east to west to the north of the site. It provides access to the school's dedicated bus zone in a one-way loop configuration. It connects with Adelaide Street to the east. Elkin Avenue has a speed limit of 50km/h and a 40km/h school zone applies on the entire road segment on school days. It has one lane of traffic in each direction with unrestricted kerbside parking.
Adelaide Street	Local road	Adelaide Street is a local road that is generally aligned in a north-south direction and stretches from Bellevue Street to the north in Raymond Terrace and ends at a cul-de-sac to the south in Heatherbrae. It acts as entry to local streets of Heatherbrae residential areas north of the school site. Further to the north, it provides connections for residents in the western portion of Raymond Terrace and to the local centre of Raymond Terrace. Near the site, there is one lane of traffic on each side.
Pacific Highway	State road (MR10)	Pacific Highway is classified as a state road that is generally aligned in a north-east to south-west direction and has speed limits ranging from 80km/h to 110km/h. Currently, the Pacific Highway provides connection to key employment areas in Tomago, Newcastle Airport and the Williamtown Royal Australia Air Force (RAAF) Base.

2.2 Transport Planning Approvals

Hunter River High School – Transport Planning Approval (June 2023)

Stantec has previously completed a transport planning assessment report in relation to the proposed school upgrade works at Hunter River High School, supporting the planning approvals for the construction of a gymnasium, new administration building, student learning hub and new link road between Adelaide Street and Elkin Avenue.

The report identified that:

- The school upgrade development does not lead to an increase of the student capacity, and the projected student population does not increase.
- The total student enrolment for Hunter River High School in 2023 was 842 students, with a bus mode share of 66%, car mode share of 26% and remaining bicycle/ walking mode share of 8%.
- The dwell time per pick-up bus is 5 minutes, and bus capacity is 60 passengers.
- 31% of students enrolled at Hunter River High School reside in Raymond Terrace, and 2% reside in Heatherbrae.

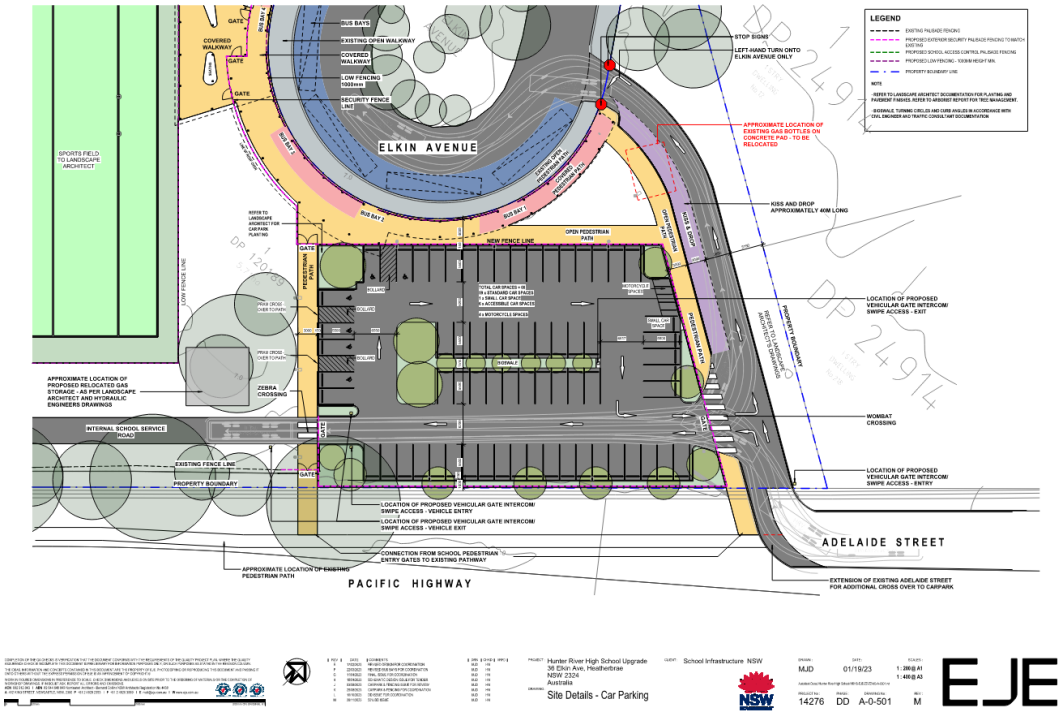
2.3 Car Parking

There are currently no formal kiss-and-drop spaces available within the vicinity of the site for school drop-off and pick-up activity. As part of the school upgrade works, a short-stay drop-off/pick-up zone with capacity of 6 car spaces is provided within the school grounds and accessible via new driveway extension from Adelaide Street.

In addition, a new staff and visitor car park (66 parking spaces including 6 accessible parking spaces) will be provided as part of the school upgrade works, with access via the new driveway extension from Adelaide Street.

The locations of the proposed car park and drop-off/ pick-up zone are shown in Figure 2.3.

Figure 2.3 – Proposed car park and kiss-and-drop zone off Adelaide Street



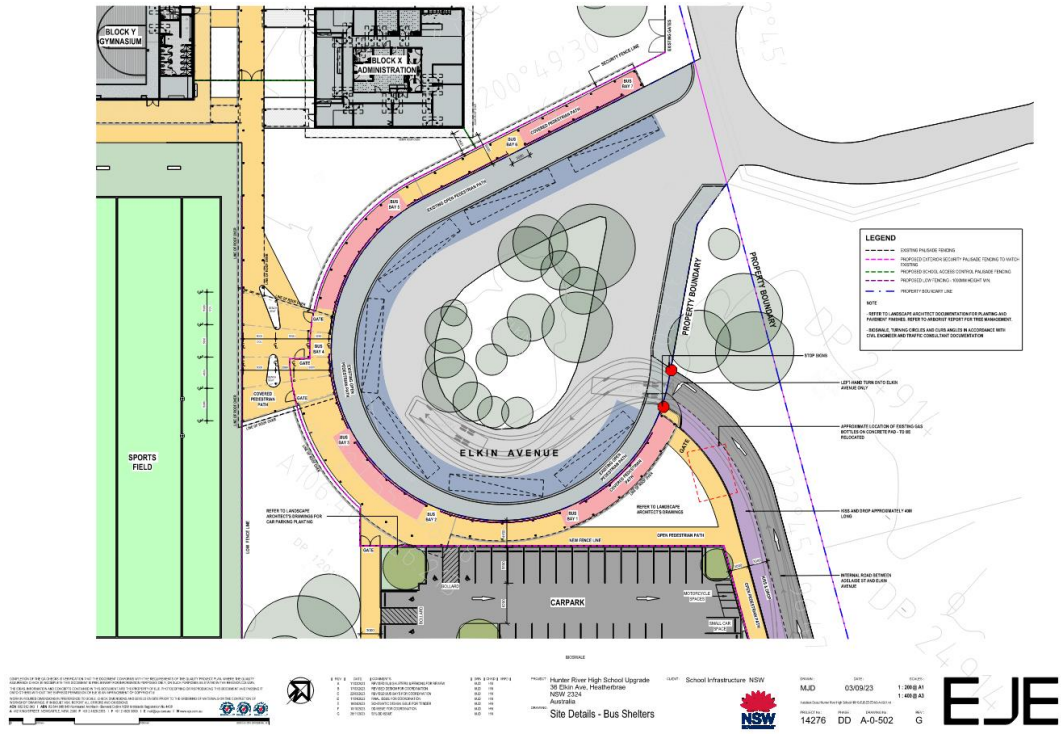
Source: EJE Architecture, *Hunter River High School Upgrade – Site Details – Car Parking*, Drawing No: A-0-501, Rev M, dated 28/11/2023

2.4 Public Transport

There is an existing loop road on Elkin Avenue, in the north-eastern corner of the site, which is signposted as a Bus Zone. The bus stop caters for a number of buses in the morning and afternoon school drop-off and pick-up periods (approximately 11-12 services in each period) and can accommodate approximately seven buses at any one time.

There are no major bus infrastructure changes proposed as part of the school upgrade works. Minor works will include formalisation of the seven bus spaces and pedestrian connectivity works between the bus bays and the school.

Figure 2.4 – Proposed formalisation of bus bays on Elkin Avenue



Source: EJE Architecture, *Hunter River High School Upgrade – Site Details – Bus Shelters*, Drawing No: A-0-502, Rev G, dated 28/11/2023

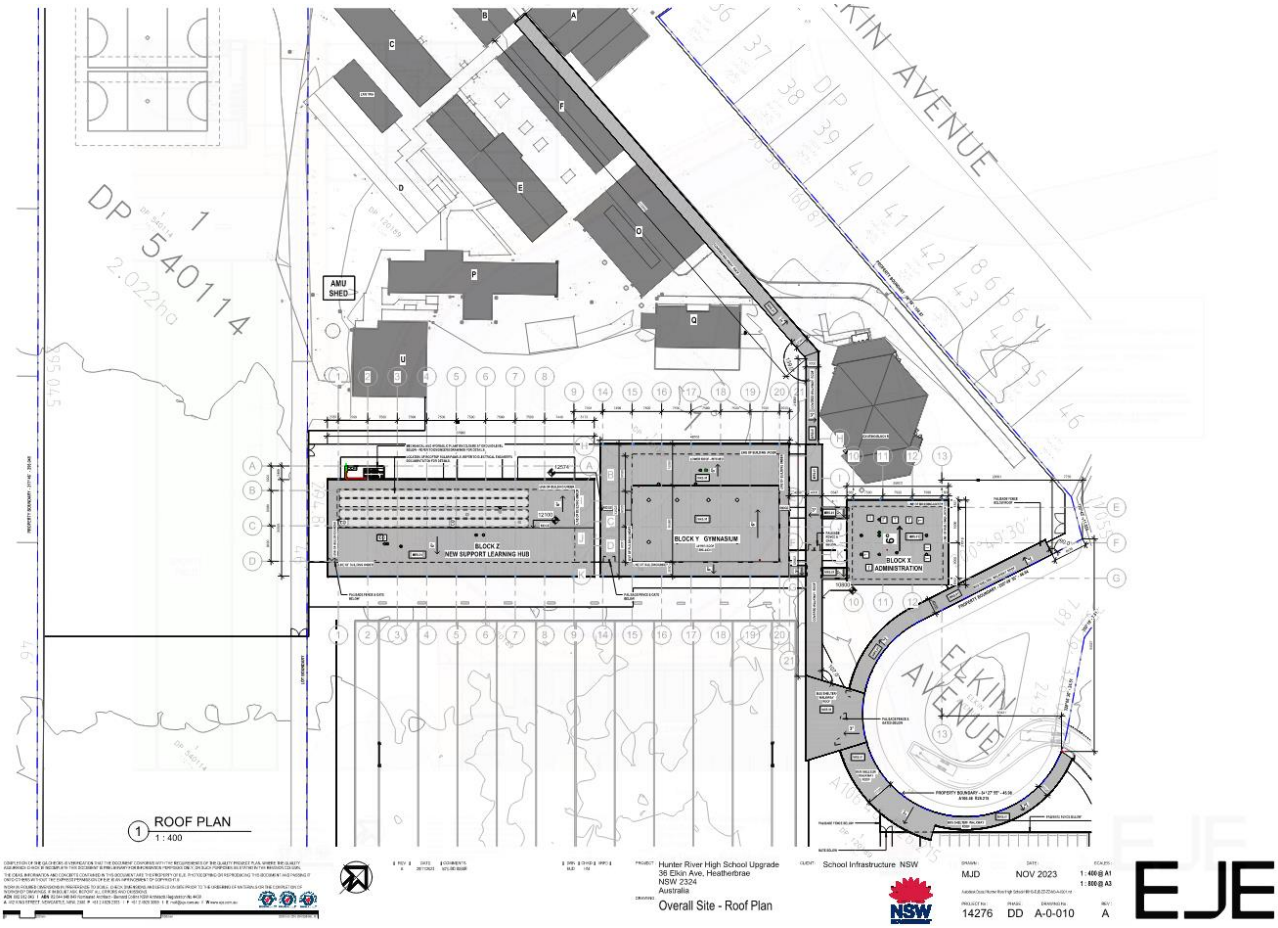
3. Development Proposal

The proposed development incorporates three new buildings (administration, gymnasium and support learning hub), in addition to refurbishments to existing buildings, at Hunter River High School in Heatherbrae. These three new buildings are:

- Block X (Administration unit – staff only)
- Block Y (Gymnasium – ancillary to other school buildings)
- Block Z (Support Learning Hub – up to 240 students).

Bus pick-up operations will continue to occur in the loop road (Elkin Avenue); however car pick-up operations will occur in a new link road from Adelaide Street to Elkin Avenue. Figure 3.1 below shows the site layout.

Figure 3.1 – Site layout



Source: EJE Architecture, *Hunter River High School Upgrade – Overall Site – Roof Plan*, Drawing No: A-0-010, Rev A, dated 28/11/2023

4. Flood Evacuation Transport Assessment

4.1 Context

The purpose of the following flood evacuation transport assessment is to approximate the time needed to evacuate Hunter River High School in the unlikely scenario of a Probable Maximum Flood (PMF) event. This type of flood is the largest possible flood that could occur at any given location.

One of the reasons Hunter River High School needs to be evacuated to an off-site evacuation point is due to the closures of the Seaham Bridge (located on the west of Raymond Terrace Road) and Hexham Bridge (located on the south side on Pacific Highway) during a PMF event. Due to the bridge closures, it is anticipated that some parents may be isolated and parents who reside to the west and south of Hunter River High School may not be able to pick-up their children during a PMF event.

This explains the purpose of evacuating most, if not all, students to a safer place of refuge on the northern side of Raymond Terrace. Details of the evacuation route and location of interim shelters are discussed in the following sections of the letter.

To estimate this evacuation time required, evacuation procedures have been assumed on a first-principles basis. For each individual task/ phase in the procedure, an event time has either been assumed or approximately calculated based on traffic engineering knowledge and experience.

In this particular assessment, two evacuation scenarios have been assessed based on the magnitude of students being evacuated:

- Evacuation of students only in the Project's new buildings (i.e. Block X, Block Y and Block Z) – this is estimated to be approximately 240 students. It is noted that all of these students would originate from Block Z, as there are no formal classrooms in Block X (an administration block) and Block Y (a gymnasium).
- Evacuation of all school students – a conservative value of 842 students will be used, which was the total student population in 2023. The total student population is forecast to decrease over the coming years (reaching 691 students in the year 2027).

In addition to students, staff and visitors also need to be evacuated from the school. As per Stantec's transport planning assessment (June 2023), there are currently 89 full-time equivalent staff members at the school, majority of which are anticipated to be located within proposed Block F. However, it is anticipated that the majority of staff and visitors would have their own private vehicle transport to evacuate the school, concurrently with the student evacuation. The remaining staff would be needed to supervise students on buses to the off-site evacuation point (to be considered in the emergency school evacuation plan).

It is assumed that the trigger for commencing school evacuation proceedings would be upon the issue of a Minor Flood level Classification at the closest flood gauge in Raymond Terrace. If the Minor Flood level Classification were to be issued outside of school hours, it is assumed that the school would close, and students would therefore not travel to school.

4.2 Travel Mode Share

During a PMF event, it is likely that there would be heavy rainfall, which eliminates walking and cycling as safe evacuation transport modes. The remaining evacuation transport modes are bus or car pick-up.

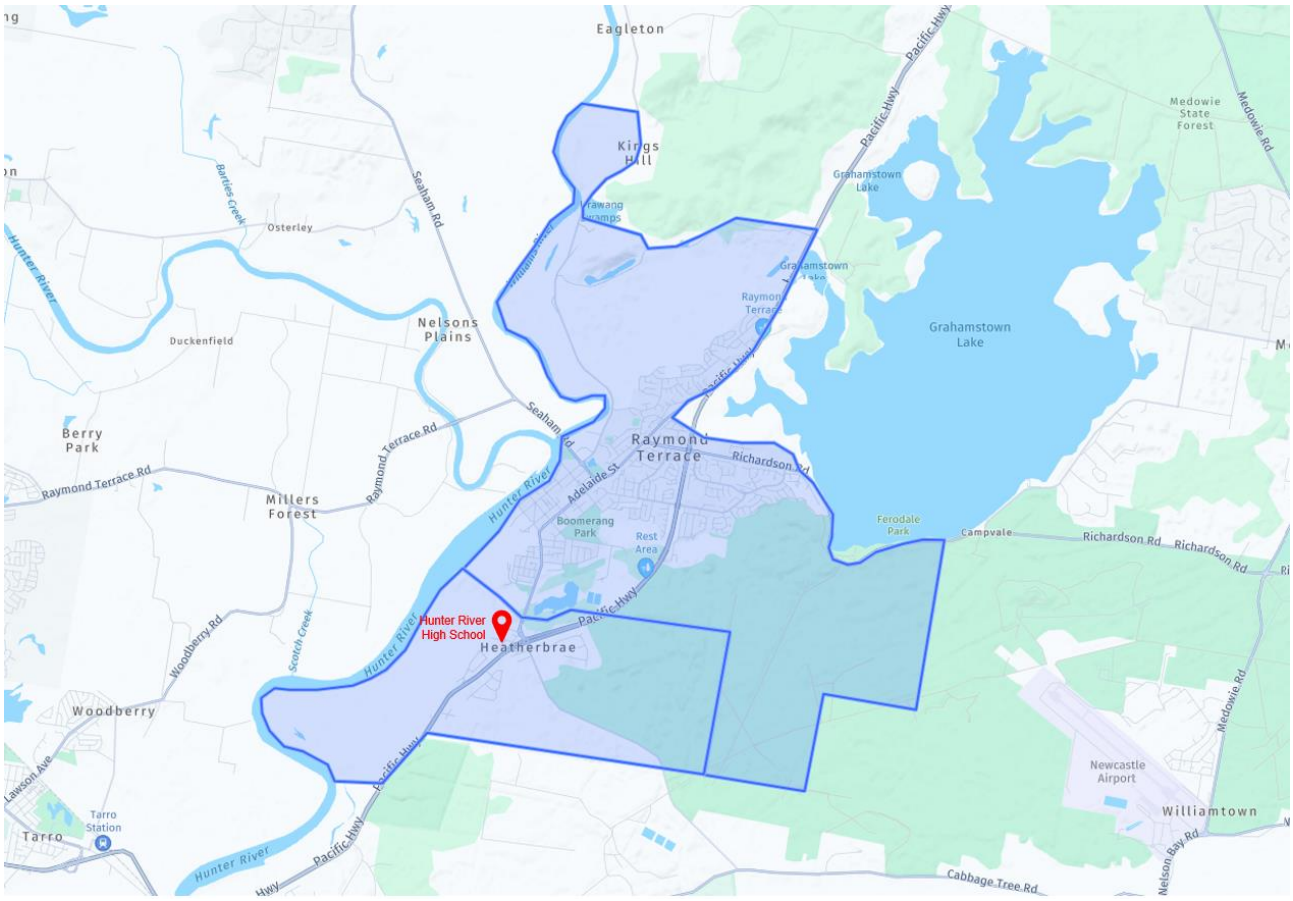
It is understood that the school currently permits parents to pick-up from the school duration an evacuation. However, allowing parents to travel towards a site which is being evacuated could be viewed as putting additional members of the public at risk. For this reason, this assessment considers two mode share scenarios:

- Where parents are not permitted to pick-up their children at the school site (i.e. all students would be bused to an off-site evacuation point)
- Where a restricted number of parents would be permitted to pick-up their children at the school site (however most students would still be bused to an off-site evacuation point).

In the scenario where parents are able to pick-up, the number of parents arriving at the school would need to be restricted, given the limited time available to evacuate the school. This assessment has indicatively assumed that only parents living in Raymond Terrace or Heatherbrae would be permitted to pick-up. Under regular driving conditions, residential properties in these suburbs would be no more than a 15-minute drive away from the school.

Given there is anticipated to be a set time window before students are bused to an off-site evacuation point (if not immediately), it is considered unlikely that parents would be driving to the school through unsafe flood waters.

Figure 4.1 – Suburb extents of Raymond Terrace and Heatherbrae



Base image source: Nearmap

Using the school's depersonalised student data from August 2022, it is known that approximately 33% of students live in either Raymond Terrace or Heatherbrae (Stantec, 2023). Furthermore in the scenario of a PMF event, it is assumed that approximately half the parents that live in Raymond Terrace or Heatherbrae may be unable to reach the school in time to pick-up (e.g. preoccupied at their own workplaces).

This assessment has therefore considered that, if permitted, 15% of students may be able to be picked up via private vehicle at the school (hence the remaining 85% would be bused off-site).

For both mode share scenarios (100% bus, and 85% bus/ 15% car), Table 4.1 and Table 4.2 below calculate the number of vehicles and trips required to evacuate the students.

Table 4.1: Number of evacuation trips for 100% bus mode share

	Scenario 1 – Evacuate students in new buildings only	Scenario 2 – Evacuate all students
Mode share	100% bus, 0% car	
Number of students	240	842
Students per vehicle	60	60
Number of vehicle trips	4	15
Number of buses required	**4**	**8 (assuming buses complete two trips)**

Table 4.2: Number of evacuation trips for 85% bus, 15% car mode share

	Scenario 1 – Evacuate students in new buildings only		Scenario 2 – Evacuate all students	
	Bus	**Car**	**Bus**	**Car**
Mode share	85%	15%	85%	15%
Number of students	204	36	716	126
Students per vehicle	60	2	60	2
Number of vehicle trips	4	**18**	12	**63**
Number of buses required	**4**	N/A	**6 (assuming buses complete two trips)**	N/A

As shown above, between 4-8 buses will be required to evacuate the students in a PMF event. In the whole-school evacuation scenario, buses are assumed to complete two evacuation trips (that is, a bus would be expected to evacuate one group of students to the off-site evacuation point first, before returning to the school to evacuate a second group of students).

In terms of the number of cars picking up students (if permitted), roughly 18-20 or 63-65 vehicles could be expected, depending on the number of students being evacuated.

4.3 Analysis of Travel Times

4.3.1 Evacuation by Bus

Based on a first-principles methodology, the events listed in Table 4.3 are assumed to occur in a PMF event school evacuation via bus.

Table 4.3: Bus evacuation procedure and event times

#	Event	Anticipated Time
1	The school notifies the bus company (assumed to be Busways Heatherbrae) of the number of students to be evacuated and number of buses required.	15 minutes
2	The bus company organises for bus drivers and acquires the number of buses required.	15 minutes
3	Travel time for buses to reach the school from the bus depot.	10 minutes
4	Loading time of buses.	Differs based on the number of students
5	Travel time for buses to reach off-site evacuation point from the school.	20 minutes
6	*(if required) Travel time for buses to return back to the school from the off-site evacuation point.*	*20 minutes*
7	*(if required) Loading time of buses for a second group of students.*	*Differs based on the number of students*
8	*(if required) Travel time for buses to reach off-site evacuation point from the school.*	*20 minutes*
9	Unloading time of the last bus at off-site evacuation point.	10 minutes

Based on assumptions provided from school information, the preferred bus company for Hunter River High School to use in a PMF event is Busways Heatherbrae, who have a bus depot within close proximity to the school. Figure 4.2 below shows the route for buses to reach the Hunter River High School for student pick-up.

It is understood that bus companies generally have their own plan and procedures to follow during any emergency situation. It is also understood that a bus depot generally has additional buses and drivers available to provide support during any emergency/incidents as part of their emergency response plan. This should include coordinating with other large businesses, schools etc. that may need to be evacuated over the coming days/ hours, prior to the evacuation. SES

has indicated that the Bureau of Meteorology (BoM) has a target warning lead time of 6 hours for a Minor Flood Classification at the Raymond Terrace gauge.

Given the median island on the Pacific Highway, buses will need to turn left out of the depot onto Pacific Highway (travelling westbound) and then left into Motto Lane to change their direction of travel. Buses would then navigate a right turn back onto the Pacific Highway to travel eastbound and reach the bus pick-up bays via Adelaide Street and Elkin Avenue. This is approximately a 2.3km drive. In poor travel conditions during a flood, this trip is estimated to take up to 10 minutes.

Figure 4.2 – Bus route from depot to the school

Base image source: Google Maps, accessed 8 March 2024

After each bus is loaded up, they will transport the students to an off-site evacuation point. Based on advice from the flood engineers, the following two schools in Raymond Terrace are deemed the most accessible and efficient evacuation locations that will not be inundated during a PMF event:

- Grahamstown Public School
- Irrawang High School.

Both schools can be reached via the Pacific Highway and exiting the highway at the Richardson Road exit. Once this exit is taken, there are two right turns onto Richardson Road and then Benjamin Lee Drive, both of which are roundabouts.

Both schools also have adequate bus drop-off facilities to accommodate the number of evacuation buses from Hunter River High School. These bus drop-off facilities are shown below in Figure 4.3 and Figure 4.4.

Figure 4.3 – Grahamstown Public School bus drop-off

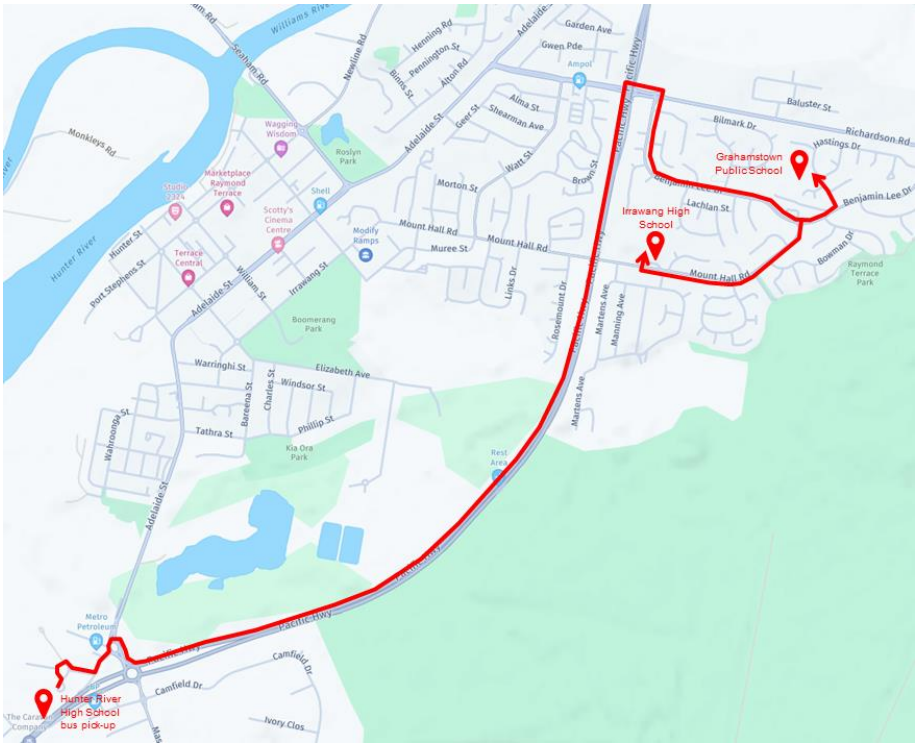
Base image source: Nearmap

Figure 4.4 – Irrawang High School bus drop-off

Base image source: Nearmap

The bus route from Hunter River High School to the potential off-site evacuation points is shown below in Figure 4.5. The overall travel distance is approximately 6.8km – 7.3km. In poor travel conditions during a flood, this trip is estimated to take up to 20 minutes.

Figure 4.5 – Bus route from school to potential off-site evacuation points



Base image source: Google Maps, accessed 8 March 2024

4.3.2 Evacuation by Car

Based on a first-principles methodology, the events listed in Table 4.4 are assumed to occur in a PMF event school evacuation via car.

Table 4.4: Car evacuation procedure and event times

#	Event	Anticipated Time
1	The school notifies the parents of the school evacuation via SMS, email etc.	15 minutes

2	Parents respond to the evacuation notice and prepare to drive immediately to the school.	5 minutes
3	Average travel time for parents to travel from their home to the school.	20 minutes
4	School pick-up and queuing time.	Differs based on the number of students
5	Average travel time for parents to travel from the school back to their home.	20 minutes

As stated previously, this assessment assumes that only parents living in Raymond Terrace or Heatherbrae would be permitted to pick-up their children. Under regular driving conditions, it is estimated that on average, residential properties in these suburbs would be approximately a 10-minute drive away. In poor travel conditions during a flood, this average trip is estimated to take up to 20 minutes.

4.4 Overall Evacuation Times

4.4.1 Scenario 1: Evacuate Students in New Buildings Only

In Scenario 1, occupants within the new buildings Block X and Block Z would be evacuated (Block Y is also a new building, but subject to approval under a different development application). There is estimated to be approximately 240 students in Block Z (8 teaching spaces with capacity for approximately 30 students in each teaching space). Supervising staff in Block Z and administration staff in Block X would either be expected to supervise students on buses to the off-site evacuation point, or evacuate the school via their own private vehicle.

If students are all evacuated via bus (Scenario 1A), four buses would be required. The same number of buses would also be required in the alternate 15% car mode share scenario (Scenario 1B). Whilst it is recognised that the time to load each bus would not be linear, it is assumed that on average, each bus would take 5 minutes to load up with students. This results in a loading time of 20 minutes at the school in both Scenarios 1A and 1B.

The overall breakdown of evacuation times in Scenario 1A and 1B are as follows:

- Phase 1 – Initial response time – 15 minutes
- Phase 2 – Evacuation of school – 45 minutes
- Phase 3 – Travel period until occupants are safe – 30 minutes
- **Total evacuation time – 90 minutes.**

The procedure to evacuate by car is not expected to be as long as the procedure to evacuate by bus, and hence the total evacuation time is effectively governed by the bus evacuation time.

A summary of the evacuation timelines for the 100% bus mode share (Scenario 1A) and 85% bus/ 15% car mode share (Scenario 1B) are shown in Figure 4.6 and Figure 4.7 respectively.

Figure 4.6 – Scenario 1A: Evacuate students in new buildings via bus

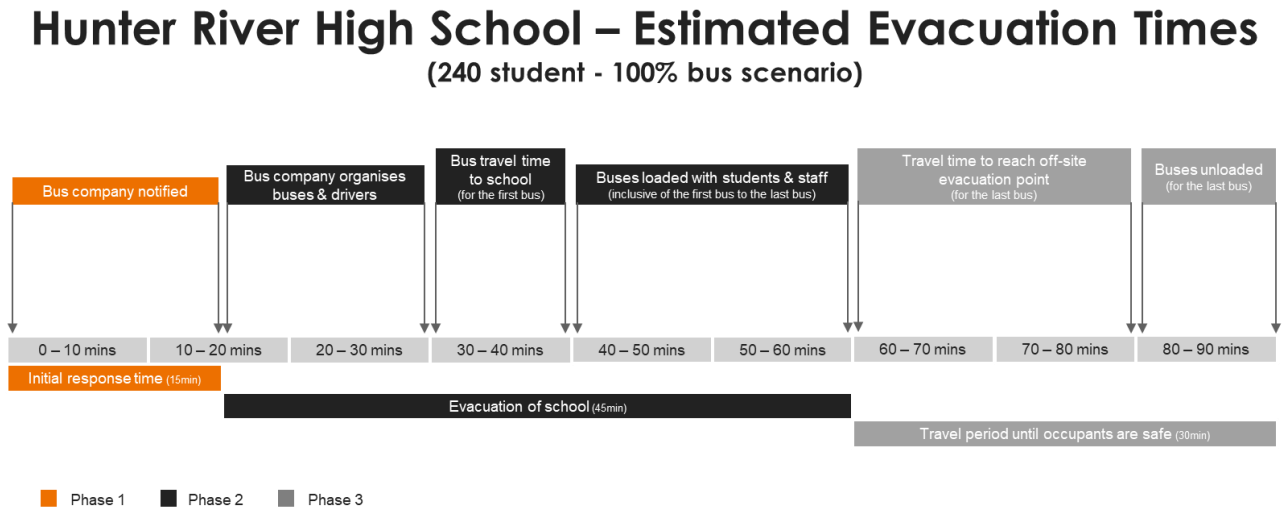
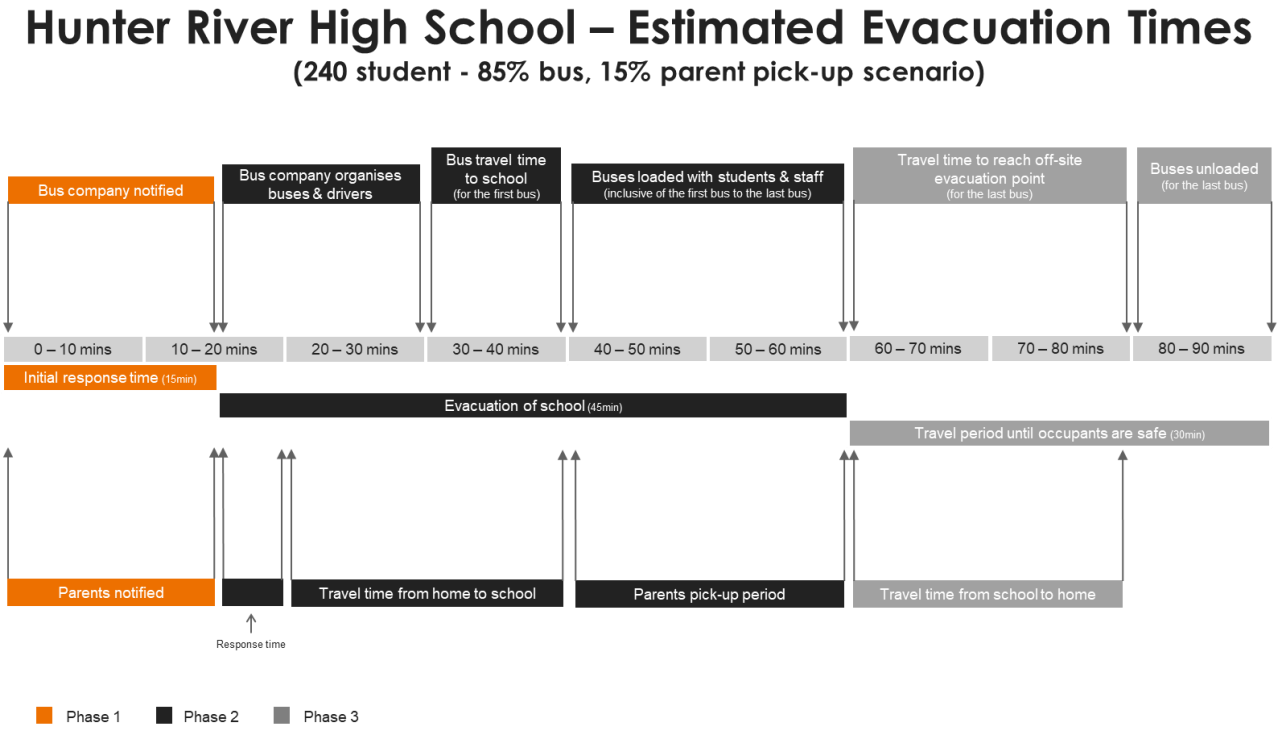


Figure 4.7 – Scenario 1B: Evacuate students in new buildings via bus or car



In the evacuation of 240 students where parent pick-up is permitted (i.e. Scenario 1B), the parents have a defined amount of time they have to arrive at the school before their child/ren are transported to the off-site evacuation location. In Scenario 1B, it is anticipated parents would be informed they have 40 minutes to reach the school (from when they are notified until the last bus begins to load with students). On average, it is estimated that the parent response time may be approximately 5 minutes and the travel time to school may be 20 minutes, leaving the parents an additional 15-minute grace period to reach the school.

In terms of queuing once parents reach the school, the following first-principles assumptions have been assumed:

- 50% of cars arrive at the same time (i.e. 9 vehicles, based on Table 4.2) – not all vehicles will arrive at the same time.
- 3 vehicles can be loaded simultaneously (given the constrained number of staff supervision resources)
- 4 minutes to load each vehicle:
  - 1 minute response time for student's name to be communicated and marked off the student roll
  - 2-minute walk from the gymnasium (Block Y) to the car
  - 1 minute to load bags etc into the car.

This results in a worst-case pick-up time at the school of approximately 12 minutes (for the last car in a pick-up queue), which can be satisfactorily accommodated within the parent pick-up period.

4.4.2 Scenario 2: Evacuate All Students

In Scenario 2, all school students would be evacuated. This assessment conservatively considers 842 students, which was the total student population in 2023 (noting a future decrease in student numbers).

If the students are all evacuated via bus (Scenario 2A), eight buses would be required. In the alternate 15% car mode share scenario (Scenario 2B), only six buses would be required. Given the much higher number of students to evacuate relative to Scenario 1, it is anticipated that each bus would complete two evacuation trips (i.e. a bus would be expected to evacuate one group of students to the off-site evacuation point first, before returning to the school to evacuate a second group of students).

The same bus loading time of 5 minutes is assumed (i.e. eight buses would take 40 minutes, six buses would take 30 minutes etc.).

The overall breakdown of evacuation times in Scenario 2A is as follows:

- Phase 1 – Initial response time – 15 minutes

- Phase 2 – Evacuation of school – 140 minutes
- Phase 3 – Travel period until occupants are safe – 30 minutes
- **Total evacuation time – 185 minutes.**

The overall breakdown of evacuation times in Scenario 2B is as follows:

- Phase 1 – Initial response time – 15 minutes
- Phase 2 – Evacuation of school – 125 minutes
- Phase 3 – Travel period until occupants are safe – 30 minutes
- **Total evacuation time – 170 minutes.**

Similar to Scenario 1, the procedure to evacuate by car is not expected to be as long as the procedure to evacuate by bus, and hence the total evacuation time is effectively governed by the bus evacuation time.

A summary of the evacuation timelines for the 100% bus mode share (Scenario 2A) and 85% bus/ 15% car mode share (Scenario 2B) are shown in Figure 4.8 and Figure 4.9 respectively.

Figure 4.8 – Scenario 2A: Evacuate all students via bus

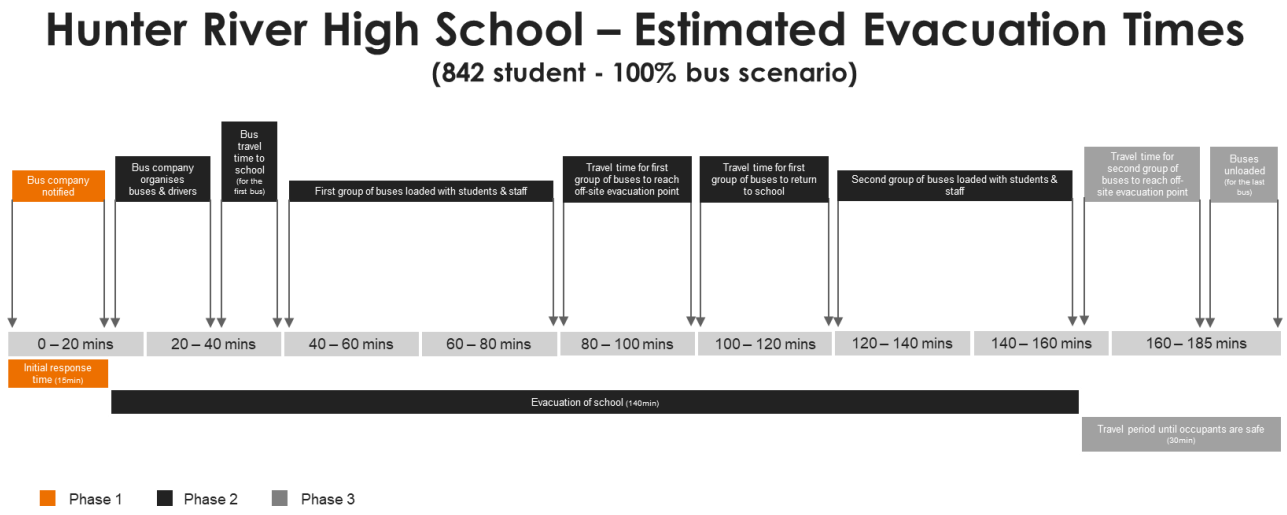
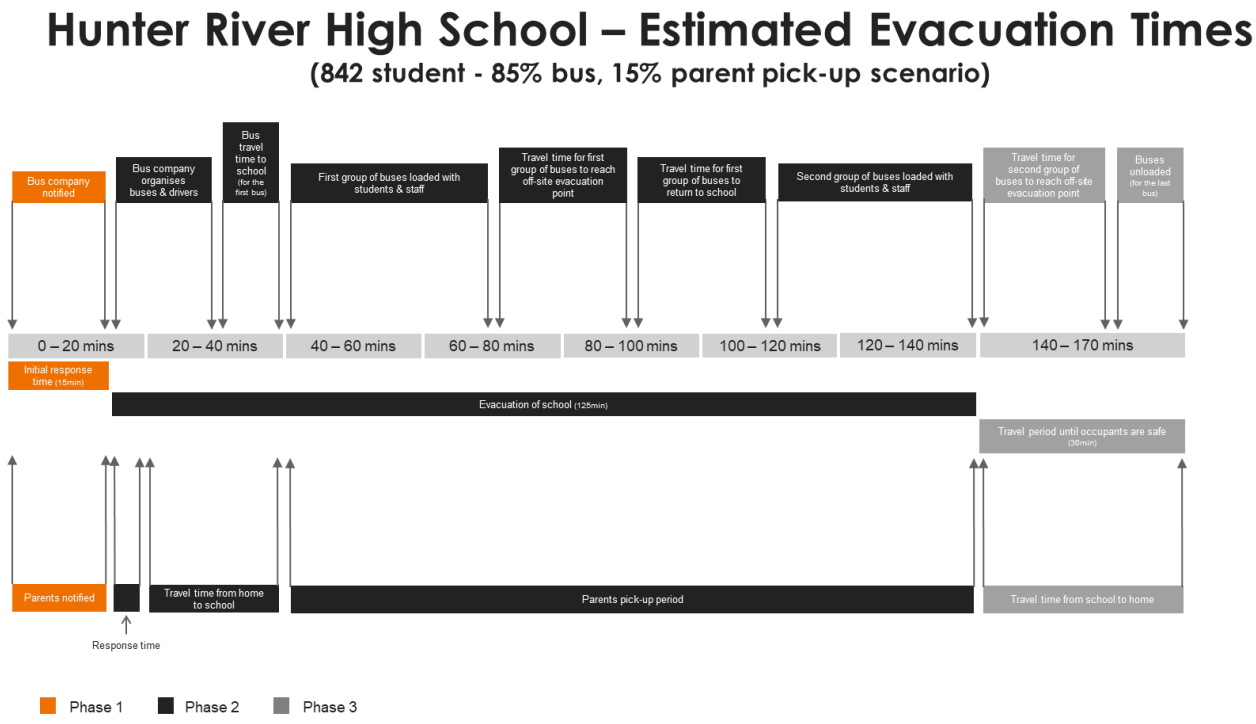


Figure 4.9 – Scenario 2B: Evacuate all students via bus or car



Similar to Scenario 1, the parents have a defined amount of time (in Scenario 2B) they have to arrive at the school before their child/ren are transported to the off-site evacuation location. In Scenario 2B, it is anticipated parents would be informed they have 2 hours to reach the school (from when they are notified until the last bus begins to load with students).

Given the more elongated time window for parents to arrive, queuing is not anticipated to be as much of an issue compared to Scenario 1. As a worst-case assuming 25% of cars arrive at the same time (i.e. 16 vehicles, based on Table 4.2), the pick-up time at the school may be up to 20 minutes (for the last car in the pick-up queue). This time can be comfortably accommodated within the parent pick-up period.

5. Conclusion

As a result of the calculations based on a range of first-principle assumptions, the following conclusions are deduced:

- The total evacuation time of students in the Project's new buildings (240 students) is estimated to be 90 minutes. Allowing parents to pick-up their children would have no impact to the total evacuation time.
- The total evacuation time for all students based on the 2023 total enrolment (842 students) is estimated to be:
  - 185 minutes if all students are bused to the off-site evacuation point.
  - 170 minutes if parents in Raymond Terrace and Heatherbrae are permitted to pick-up their children from the school.

Based on the above, the worst-case evacuation time is estimated to be approximately 3 hours. As advised by the flood engineers, there is a 5-hour window between when the Minor Flood level Classification at the Raymond Terrace gauge is reached and when the evacuation route (Pacific Highway travelling northbound) is predicted to be inundated with floodwaters (i.e. not-trafficable) in the PMF. It is assumed a longer total evacuation time would be available due to the issue of flood warnings preceding the event.

It is also to be noted that in this assessment, it is assumed that the nearby bus depot will be able to provide the required number of buses during emergency evacuation procedures. While it is typically understood that such a bus depot typically has additional buses as well as drivers available during an emergency as part of their own plan and procedures, it is recommended to coordinate with the bus companies to consider such additional demand as well as location of emergency shelter points as part of emergency school evacuation plan.

It is also anticipated that a wider flood evacuation plan will be implemented during a flood emergency, which is likely to include an emergency traffic management plan. The emergency traffic management plan should be able to assist in reducing the travel time between the Hunter River High School and the identified emergency shelters, thus further reducing the total evacuation time.

Overall, an evacuation time of 3 hours is anticipated to be satisfactory in evacuating Hunter River High School students to Raymond Terrace once the Minor Flood level Classification at the Raymond Terrace gauge is reached during a PMF event.

I trust this is satisfactory; however, should you have any questions please do not hesitate to contact me directly.

Yours sincerely

Stantec Australia Pty Ltd

Bayzid Khan
Principal Transport Engineer