WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

VOLUME 1 - REPORT

OCTOBER 2021

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TABLE OF CONTENTS

Page No.

Cont'd Over

TABLE OF CONTENTS (Cont'd)

Page No.

LIST OF FIGURES
(BOUND IN VOLUME 2)

Cont'd Over

LIST OF FIGURES (Cont'd)
(BOUND IN VOLUME 2)

Cont'd Over

LIST OF FIGURES (Cont'd)
(BOUND IN VOLUME 2)

Note on flood frequency

The frequency of floods is generally referred to in terms of their Annual Exceedance Probability (**AEP**) or Average Recurrence Interval (**ARI**). For example, for a flood magnitude having ten per cent AEP, there is a ten per cent probability (or 1 in 10 chance) that there would be floods of greater magnitude each year. As another example, for a flood having a 10 year ARI, there would be floods of equal or greater magnitude once in ten years on average. The approximate correspondence between these two systems is provided in the table below.

Annual Exceedance Probability (AEP) per cent	**Average Recurrence Interval (ARI) years**
0.2	500
0.5	200
1	100
5	20
20	5

In this technical working paper the frequency of floods is referred to in terms of their AEP, for example a 1% AEP flood.

The technical working paper also refers to the Probable Maximum Flood (**PMF**). This flood occurs as a result of the Probable Maximum Precipitation (**PMP**) over Wee Waa. The PMP is the result of the optimum combination of the available moisture in the atmosphere and the efficiency of the storm mechanism as regards to rainfall production. The PMP is used to estimate PMF discharges using a catchment hydrologic model which simulates the conversion of rainfall to runoff. The PMF is defined as the upper limiting value of floods that could reasonably be expected to occur and defines the extent of flood prone land (ie the floodplain).

Reference is also made in the technical working paper to the Extreme Flood. It approximates the PMF and defines the upper limit of flooding that could reasonably be expected to occur on the broader Namoi River floodplain. The discharge hydrographs of the Extreme Flood were derived by applying a multiplication factor of three (3) to the corresponding 1% AEP discharge hydrographs.

Glossary of terms and abbreviations

Term	Definition
AEP	Annual exceedance probability. The chance of a rainfall or a flood event exceeding a nominated level in any one year, usually expressed as a percentage. For example, if a peak flood level has an AEP of five per cent, it means that there is a five per cent chance (that is one-in-20 chance) of being exceeded in any one year. The frequency of floods is generally referred to in terms of their AEP or ARI. In this technical working paper the frequency of floods generated by runoff from the study catchments is referred to in terms of their AEP, for example a 1% AEP flood.
Afflux	Increase in water level resulting from a change in conditions. The change may relate to the watercourse, floodplain, flow rate, tailwater level etc.
AHD	Australian Height Datum. A common national surface level datum approximately corresponding to mean sea level.
ARI	Average recurrence interval. An indicator used to describe the frequency of a rainfall or a flood event, expressed as an average interval in years between events of a given magnitude. For example, over a long period of say 200 years, a flood equivalent to or greater than a 20 year ARI event would occur 10 times. A 20 year ARI flood has a one-in-20 chance of occurrence in any one year. See also AEP.
ARR 1987	Australian Rainfall and Runoff (Institute of Engineers Australia 1987)
ARR 2019	Australian Rainfall and Runoff (Geosciences Australia 2019)
BoM	Bureau of Meteorology
Box culvert	A culvert of rectangular cross section
Catchment	The land area draining through the mainstream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
CEMP	Construction environmental management plan. A site specific plan developed for the construction phase of the proposal to ensure that all contractors and sub-contractors comply with the environmental conditions of approval for the proposal and that the environmental risks are properly managed.
Climate change	A change in the state of the climate that can be identified (for example by statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period of time, typically decades or longer (IPCC 2007).
Climate projection	A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases and aerosols, generally derived using climate models. Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/radiative forcing scenario used, which in turn is based on assumptions concerning, for example, future socio-economic and technological developments that may or may not be realised (IPCC 2007).
Construction footprint	The land above and below the ground that is required to construct the proposal.
DCP	Development control plan
DECC	Department of Environment and Climate Change (formerly OEH, now Department of Planning, Industry and Environment (Environment, Energy and Science)
DECCW	Department of Environment, Climate Change and Water (formerly, DECC and OEH, now Department of Planning, Industry and Environment (Environment, Energy and Science)
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving, for example metres per second (m/s).

Term	Definition
DP	Deposited plan
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
Earthworks	All operations involving the loosening, excavating, placing, shaping and compacting of soil or rock.
Emergency management	A range of measures to manage risks to communities and the environment. In the flood context it may include measures to prevent, prepare for, respond to and recover from flooding.
EIS	Environmental impact statement
Embankment	An earthen structure where the road (or other infrastructure) is located above the natural surface.
Extreme Flood	The Extreme Flood approximates the PMF and defines the upper limit of flooding that could reasonably be expected to occur on the broader Namoi River floodplain. The discharge hydrographs of the Extreme Flood were derived by applying a multiplication factor of three (3) to the corresponding 1% AEP discharge hydrographs.
Fill	The material place in an embankment.
Flash flooding	Flooding which is sudden and unexpected. It is often caused by sudden local or nearby heavy rainfall. Often defined as flooding which peaks within six hours of the causative rain.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
Flood affectation	The extent to which a property or area of land is affected by flooding.
Flood fringe area	The remaining area of flood prone land after floodway and flood storage areas have been defined.
Flood immunity	Relates to the level at which a particular structure would be clear of a certain flood event.
Flood mitigation standard	The average recurrence interval of the flood, selected as part of the floodplain risk management process that forms the basis for physical works to modify the impacts of flooding.
Flood prone land	Land susceptible to flooding by the Probable Maximum Flood. Note that the flood prone land is synonymous with flood liable land.
Flood storage area	Those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas.
Floodplain	Area of land which is subject to inundation by floods up to and including the probable maximum flood event (ie flood prone land).
Floodplain Risk Management Plan	A management plan developed in accordance with the principles and guidelines in the NSW Floodplain Development Manual (FDM), (DIPNR 2005). Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defined objectives.
Floodway area	Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.
Flow velocity	A measure of how fast water is moving, for example, metres per second (m/s).
FPA	Flood planning area. The area of land inundated at the Flood Planning Level.
FPL	Flood planning level.

Term	Definition
	A combination of flood level and freeboard selected for planning purposes, as determined in floodplain risk management studies and incorporated in floodplain risk management plans.
Freeboard	A factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. It is usually expressed as the difference in height between the adopted Flood Planning Level and the peak height of the flood used to determine the flood planning level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour and impacts that are specific event-related, such as levee and embankment settlement, and other effects such as future climate change. Freeboard is included in the FPL.
Hazard	A source of potential harm or a situation with a potential to cause loss. In relation to the NSW Floodplain Development Manual (FDM), (DIPNR 2005) the hazard is flooding which has the potential to cause damage to the community.
Headwater	The upper reaches of a drainage system.
Hydraulics	The term given to the study of water flow in waterways, in particular the evaluation of flow parameters such as water level and velocity.
Hydrograph	A graph which shows how the discharge or stage/flood level at any particular location varies with time during a flood.
Hydrology	The term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.
Local Drainage	Smaller scale drainage systems in urban areas. Commonly defined as areas where the depth of inundation along overland flow paths is less than 150 millimetres during a 1% AEP storm.
LGA	Local government area
LiDAR	Light Detection and Ranging. A form of aerial survey used to measure ground elevations.
m	Metres
m AHD	Metres above Australian Height Datum
m/s	Metres per second
m^2	Square metres
m^3	Cubic metres
m^3/s	Cubic metres per second
Mathematical/computer models	The mathematical representation of the physical processes involved in runoff generation and stream flow. These models are often run on computers due to the complexity of the mathematical relationships between runoff, stream flow and the distribution of flows across the floodplain.
Merit approach	The merit approach weighs social, economic, ecological and cultural impacts of land use options for different flood prone areas together with flood damage, hazard and behaviour implications, and environmental protection and well-being of the State's rivers and floodplains.
Mainstream flooding	Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam.
OEH	Office of Environment and Heritage (now Department of Planning, Industry and Environment (Environment, Energy and Science)
Overland flooding	Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.
Peak discharge	The maximum discharge occurring during a flood event.
Peak flood level	The maximum water level occurring during a flood event.
PMF	Probable Maximum Flood. The flood that occurs as a result of the Probable Maximum Precipitation (PMP) on a

Term	Definition
	study catchment. The PMF is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land (ie the floodplain).
PMP	Probable Maximum Precipitation. The PMP is the result of the optimum combination of the available moisture in the atmosphere and the efficiency of the storm mechanism as regards rainfall production. The PMP is used to estimate PMF discharges using a catchment hydrologic model which simulates the conversion of rainfall to runoff.
Probability	A statistical measure of the expected chance of flooding (see annual exceedance probability).
Proposal footprint	The land above and below ground required to construct the proposal, for temporary ancillary construction facilities, and the land required to accommodate permanent infrastructure including shared cycle and pedestrian pathways.
RCP	Reinforced Concrete Pipe
RCBC	Reinforced Concrete Box Culvert
Risk	Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of the Floodplain Development Manual (DIPNR, 2005) it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
RL	Reduced Level. The reduced level is the vertical distance between an elevation and an adopted datum plane such as the Australian Height Datum (AHD).
Runoff	The amount of rainfall which actually ends up as stream flow, also known as rainfall excess.
Scour	The erosion of material by the action of flowing water.
SEARs	Secretary's environmental assessment requirements and specifications for an environmental assessment prepared by the Secretary of the NSW Department of Planning, Industry and Environment under section 115Y of the *Environmental Planning and Assessment Act 1979* (NSW)
NSW SES	NSW State Emergency Services
Spoil	Surplus excavated material
Stockpile	Temporarily stored materials such as soil, sand, gravel and spoil/waste.
Surface water	Water flowing or held in streams, rivers and other water bodies in the landscape.
Swale	A shallow, grass-lined drainage channel.
Water surface profile	A graph showing the flood stage at any given location along a watercourse at a particular time.
Waterway	Any flowing stream of water, whether natural or artificially regulated (not necessarily permanent).

EXECUTIVE SUMMARY

This report deals with the findings of an investigation that was undertaken to assess flooding related issues associated with the construction and operation of the Wee Waa High School project (**the proposal**).

This report has been prepared to support the environmental impact statement for the proposal. **Chapters 1** to **3** provide details of the background to the assessment, as well as a description of the proposal works that have the potential to influence flood behaviour. A more detailed description of the proposal is contained in Chapter 3 (Project description) of the environmental impact statement.

Existing environment

The proposal is located in the township of Wee Waa, which is located on the Namoi River floodplain approximately 34 kilometres to the west (downstream) of Narrabri. Wee Waa is protected from Namoi River flooding by an earthen ring levee, which for the purpose of this report has been denoted "**the Town Levee**". The investigation found that while the Town Levee would not be overtopped for Namoi River floods up to about 0.2% Annual Exceedance Probability (**AEP**) in magnitude, the proposal site would still be subject to relatively frequent inundation as a result of local catchment runoff.

Chapter 4 contains a brief description of the Namoi River floodplain at Wee Waa, the Town Levee and also the stormwater drainage system which controls local catchment runoff in the urbanised parts of the town. Also contained in this Chapter is a description of the nature of Namoi River and local catchment flooding under present day (or pre-proposal) conditions for events of 20% and 1% AEP, as well as for the Probable Maximum Flood (**PMF**).

Assessment of construction related impacts

Chapter 5 summarises the flood risk that is associated with the construction of the proposal. The assessment found that while works would be undertaken prior to the construction of the proposal (under a separate planning pathway) to reduce the degree to which the proposal site is flood affected (denoted herein as "**the flood mitigation works (FMW)**",[1] it would still be subject to relatively frequent inundation that has the potential to:

- Cause damage to the proposal works
- Cause delays in construction programming
- Inundate site sheds and limit access to the proposal site
- Pose a safety risk to construction workers
- Detrimentally impact the downstream waterways through the transport of sediments and construction materials by floodwater
- Alter the characteristics of flooding in adjacent development.

While the impact of construction activities external to the proposal site would be limited, **Chapter 8** sets out a recommended set of measures for assessing and managing the impact of construction related impacts on flood behaviour.

[1] Note that while the flood mitigation works are linked to the proposal, they are subject to approval via a separate planning pathway.

Assessment of operational related impacts

Inundation of the proposal by floodwater during its operation has the potential to cause damage to infrastructure, impact on the safe operation of the school and also pose a safety risk to both staff and students. The proposal also has the potential to exacerbate flooding conditions in adjacent development, albeit only during relatively extreme flooding conditions. An assessment was carried out of the flood risk to the proposal in its as-built form, as well as the impact it would have on the characteristics of flooding in adjacent developments.

The assessment found that once constructed, the proposal in combination with the FMW would result in a significant reduction in both the extent and depth of inundation in existing development that is located to its north and west for local catchment floods with AEPs up to 1% in magnitude. The assessment also found that while the proposal would result in a minor increase in peak 1% AEP local catchment flood levels, the impacts would be confined to the proposal site and adjacent road reserves of Mitchell and George streets.

Projected changes in the intensity of flood producing rainfall have the potential to impact on the characteristics of flooding in the vicinity of the proposal. The potential impacts of future climate change on flooding were assessed in accordance with the recommended procedures set out in the NSW Department of Planning, Industry and Environment *Floodplain Risk Management Guideline – Practical Considerations of Climate Change* (NSW Department of Environment and Climate Change (DECC), 2007).

The assessment found that potential increases in rainfall intensities associated with future climate change would have only a minor impact on peak 1% AEP flood levels in the vicinity of the proposal. The assessment also found that the proposal would generally only have a minor impact on peak post-climate change 1% AEP flood levels, with the impacts limited to the Mitchell Street frontage of the Wee Waa Public School, as well as a vacant parcel of land that is located immediately to its north.

The trunk drainage system which controls flow that discharges through the proposal site has the potential to experience a partial blockage by debris during periods of heavy rainfall. An assessment was therefore carried out whereby a blockage factor was applied to a key element of the trunk stormwater drainage system to assess the impact that a partial blockage would have on flood behaviour. The degree to which the trunk stormwater drainage system could block during a 1% AEP storm event was assessed based on the procedures set out in the latest edition of *Australian Rainfall and Runoff*. The potential for floating debris to cause either a partial or complete blockage of the proposed perimeter fencing and the likely impacts that this would have on flood behaviour were also assessed.

The assessment found that while a partial blockage of the twin 1350 millimetre pipes which would be installed as part of the FMW would result in a minor increase in peak 1% AEP flood levels both internal and external to the proposal site, flooding conditions would not be more severe than presently occur in Wee Waa. The assessment also found that:

a) the impacts associated with a partial blockage of the perimeter fencing would be limited to the proposal site, the road reserves of Mitchell and George streets, as well as the aforementioned vacant parcel of land that is located immediately to its north; and

b) there is sufficient capacity within the George Street road reserve for floodwater to flow around the outside of the perimeter fence without exacerbating flooding conditions in existing residential development that is located on the eastern (upstream) side of the road reserve.

While the procedures set out in the 1987 edition of *Australian Rainfall and Runoff* were used as the basis for carrying out the flooding investigation for the proposal, a check was carried out to assess whether the adoption of procedures set out in the recently released 2019 edition of the document would alter predicted flood behaviour in its vicinity. The assessment found that the application of the procedures set out in the latest addition of *Australian Rainfall and Runoff* would result in a reduction in peak flows and hence flood levels on the proposal site and that the use of the procedures set out in the earlier edition of the document therefore represents a worse-case scenario in terms of predicted flood behaviour.

Chapter 8 sets out a recommended set of measures for assessing and managing the impact of operational related impacts on flood behaviour.

Assessment of cumulative impacts

Chapter 7 identifies that while there are no other proposed projects that are of a scale that would influence flood behaviour in the vicinity of the proposal, the *Wee Waa Levee Risk Management Study and Plan* (Lyall & Associates, 2019) contains a recommendation to raise the crest height of the Town Levee, which would have the effect of further reducing the flood risk at Wee Waa.

Management of impacts

Chapter 8 sets out the environmental management measures that will be implemented during the construction and operation of the proposal in order to minimise its flooding and drainage related impacts.

1 INTRODUCTION

1.1 Overview

This section provides an overview of the proposed Wee Waa High School project, including its location and key features. It also includes a brief description of flood mitigation works that would be constructed in advance of the proposal, as well as the Secretary's environmental assessment requirements that are addressed in this technical working paper.

1.2 The proposal

Students and staff were evacuated from the current Wee Waa High School site due to ongoing health issues in late 2020. Students are currently co-located within the town's primary school in an overcrowded site. A Ministerial announcement made on 3 June 2021 committed to the construction of a new High School at Wee Waa on existing Department of Education owned land and adjacent Crown land as an urgent priority (collectively referred to herein as "**the proposal site**"). The proposal site is located on Mitchell Street/Kamiliaroi Highway and is legally described as Lot 1 DP577294, Lot 2 DP550633 and Lots 124-125 DP757125.

This report accompanies a State Significant Development Application (**SSD**) which seeks consent for the construction of a new high school servicing 200 students in a two-storey building, an Indigenous learning centre, sporting fields and associated civil and utilities works. For a detailed project description of the proposal refer to the EIS prepared by Ethos Urban.

1.3 Proposal setting

The proposal is located in the township of Wee Waa, which is located on the Namoi River floodplain about 34 kilometres to the west (downstream) of Narrabri in north-western NSW (refer **Figure 1.1**). Wee Waa is located within the Narrabri Shire Local Government Area (**LGA**).

The township of Wee Waa is protected from riverine type flooding by an 8.6 kilometre long earthen ring levee, the alignment of which is shown on **Figure 1.2**, sheet 2 (**Town Levee**). The land upon which the proposal is located is presently undeveloped and is bounded by Mitchell Street/Kamiliaroi Highway to the south, George Street to the east, Charles Street to the west and existing residential type development to the north (refer **Figure 1.2** (sheets 1 and 2)).

1.4 Key features of the proposal and flood mitigation works

The SSD Application seeks consent for the construction of a new high school which will service 200 students with potential to grow to a total capacity of 300 students, subject to further funding and service need, and 61 staff. Specifically, the SSD Application seeks approval for the following development:

- Site preparation, earthworks and remediation as required.
- Construction of the following:
  - A new two-storey school building arranged in a U-shape courtyard typology, including teaching spaces, library/admin, staff facilities, and a multi-purpose gymnasium/hall.
  - A Covered Outdoor Learning Area (COLA).
  - One grass sport field with a perimeter running track and asphalt playing courts.
  - A standalone single-storey Agricultural and Environment Centre building.

  - A standalone single-storey Aboriginal Education Community and Learning Centre.
  - Internal vehicular access from George Street running east-west through the site.
  - Two at-grade car parking areas with a total of 40 parking spaces.
- Augmentations to the road network as required to ensure road safety, including a dedicated drop off/pickup area and bus bay along George Street.
- Removal of trees as required and retention where possible.
- Installation of landscaping, additional tree planting and fencing to integrate with the design of the new school.
- Installation and augmentation of associated services infrastructure to service the new school.

The key features of the proposal are shown on **Figure 1.2**. sheet 2.

The key features of the flood mitigation works (**FMW**) which will be constructed in advance of the proposal (under a separate planning pathway) are shown on **Figure 1.2**, sheets 2 and 3 and include:

- Extension of the existing transverse drainage structure which crosses George Street about 50 metres to the north of its intersection with Mitchell Street
- Construction of a low flow channel and high flow conveyance / flood storage area which would run along the southern and western boundaries of the proposal site (denoted herein as "the **Low Flow Channel**" and the "**High Flow Conveyance / Flood Storage Area**", respectively).
- Installation of twin 1350 millimetre diameter pipes which would run in a northerly direction along Charles Street, commencing in the north-west corner of the proposal site and ending on the northern side of Boundary Street.
- The lowering of the invert level of the existing engineered channel which runs in a northerly direction from the northern side of Boundary Street to the Namoi River (**engineered channel**).
- The upgrade of the existing pipe which presently conveys flow in the engineered channel beneath the Town Levee to twin 1500 millimetre diameter pipes.
- The installation of a duplicate flood evacuation pump on the Town Levee.
- The upgrade of the existing pipe which presently conveys flow in the engineered channel beneath an existing access track which is located external to the Town Levee to twin 1500 millimetre diameter pipes.
- The installation of scour protection measures in the form of dumped rock riprap at the confluence of the engineered channel and the Namoi River.
- The placement of excavated material on Crown land internal to the proposal site for later use in the construction of the proposal

Figure 1.3 (2 sheets) shows the proposed cut/fill strategy, while **Figure 1.4** (3 sheets) comprises a series of cross sections showing existing and proposed surface levels associated with the proposal and the FMW. **Figure 1.5** (2 sheets) is a longitudinal section along the channel which would run from George Street to the Namoi River.

While a detailed description of the proposal is provided in Chapter 3 (Project description) of the environmental impact statement, it is noted that the FMW is subject to approval via a separate planning pathway.

1.5 Purpose of this technical working paper

This report has been prepared to support the environmental impact statement for the proposal and to address the environmental assessment requirements of the Secretary of the Department of Planning, Industry and Environment ('the Secretary's environmental assessment requirements').

This technical working paper presents the state of the existing flooding and drainage environment as a baseline and then identifies the potential impacts that may arise from the construction and operation of the proposal in combination with the FMW, as well as measures that are aimed at managing the potential impacts.

1.6 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to flooding and drainage, and where these requirements are addressed in this technical working paper, are outlined in **Table 1.1**, noting that they were issued in two parts.

Table 1.1
Secretary's environmental assessment requirements (SEARS) - flooding

SEARs	Where addressed in this report
17. Flooding • Identify any flood risk on-site in consultation with Council and having regard to the most recent flood studies for the development area and the potential effects of climate change, sea level rise and an increase in rainfall intensity. • Assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions to mitigate flood risk where required. *Relevant Policies and Guidelines:* • NSW Floodplain Development Manual (DIPNR, 2005).	Chapter 3 sets out the approach that was adopted to define the nature of flooding in the vicinity of the proposal under both current and future climatic conditions. Chapter 3 also sets out the approach that was adopted to assess the impact the proposal would have on flood behaviour during both its construction and operation. Chapter 5 contains an assessment of the flood risk during the construction of the proposal and the potential for construction activities to impact flood behaviour in adjacent development. Chapter 6 contains an assessment of the flood risk during the operation of the proposal and the potential for it to impact flood behaviour in adjacent development.
10. The EIS must map the following features relevant to flooding as described in the *NSW Floodplain Development Manual 2005* (NSW Government, 2005) including:	Figures containing maps of features relevant to flooding are listed below.
i. Flood prone land	Figure 4.12 (2 sheets) shows the extent of flood prone land internal to the Town Levee (i.e. the extent of land that is susceptible to flooding during a Probable Maximum Flood (**PMF**) event).
ii. Flood planning areas, the area below the flood planning level;	Figure 4.16 shows the extent of land which is located below the 1% Annual Exceedance Probability (**AEP**) flood level plus 0.5 m.
ii. Hydraulic categorisation (floodways and flood storage areas); and	Figure 4.14 shows a hydraulic categorisation of the 1% AEP design flood into floodway, flood storage and flood fringe areas.
v. Flood Hazard.	Figure 4.15 shows flood hazard vulnerability categorisation of the 1% AEP.
11. The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP, flood levels and the probable maximum flood, or an equivalent extreme event.	Chapter 3 sets out the approach that was adopted to assess the impact the proposal would have on flood behaviour during both its construction and operation. Section 3.2 describes the methodology that was used to define flood behaviour under present day (i.e. pre-proposal and FMW) conditions, while sections 3.3 and 3.4 describe the methodology that was adopted to assess the impact of the proposal on flood behaviour during the construction and operational phases, respectively.
12. The EIS must model the effect of the proposed project (including fill) on the flood behaviour under the following scenarios: a) Current flood behaviour for a range of design events as identified in 11 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.	Chapter 3 sets out the approach that was adopted to assess the impact the proposal would have on flood behaviour during both its construction and operation. Section 3.5 sets out the approach that was adopted to assess the impact that future climate change would have on flood behaviour.

SEARs	Where addressed in this report
13. Modelling in the EIS must consider and document:	
a) Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.	Chapter 3 sets out the approach that was adopted to assess the impact the proposal would have on flood behaviour during both its construction and operation. It identifies that the flood models that were developed as part of the *Wee Waa Levee Risk Management Study and Plan* (Lyall & Associates, 2019) were used as the basis for the present investigation.
b) The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood, or an equivalent extreme flood.	Sections 5.3 and 6.2 present the findings of an assessment of the potential impacts on flood behaviour during the construction and operational phases of the proposal, respectively for a range of flood events up to the PMF.
c) Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories.	Sections 5.3 and 6.2 present the findings of an assessment of the potential impacts on flood behaviour during the construction and operational phases of the proposal, respectively.
d) Relevant provisions of the NSW Floodplain Development Manual 2005.	Chapter 3 sets out the approach that was adopted to assess the impact the proposal would have on flood behaviour during both its construction and operation. Section 2.3.1 describes the relevant provisions of the NSW Floodplain Development Manual 2005 and how they have been taken into consideration in the assessment of the proposal.
14. The EIS must assess the impacts on the proposed project on flood behaviour, including:	
a) Whether there will be any detrimental increases in the potential flood affectation of the other properties, assets and infrastructure.	Sections 5.3 and 6.2 present the findings of an assessment of the potential impacts on flood behaviour in surrounding property, assets and infrastructure during the construction and operational phases of the proposal, respectively.
b) Consistency with Council floodplain risk management plans.	Section 6.4 presents the findings of a review of the proposal in terms of its consistency with Council floodplain risk management plans.
c) Consistency with any Rural Floodplain Risk Management Plans.	The proposal would not impact flood behaviour on the Namoi River floodplain external to the Town Levee.
d) Compatibility with the flood hazard of the land;	Sections 4.5.2 and 4.5.3 describe the existing flood behaviour in the vicinity of the proposal, including an overview of the provisional flood hazard for a 1% AEP flood. Section 5.2 includes discussion on the potential flood hazard at proposed construction support sites, while Section 6.2 includes discussion on the findings of the assessment in terms of the impact that the operation of the proposal would have on the hazard categorisation of the floodplain.

SEARs	Where addressed in this report
e) Compatibility with the hydraulic functions of flow conveyance in floodways and storage areas of the land.	Sections 4.5.2 and 4.5.3 describe the existing flood behaviour in the vicinity of the proposal, including the hydraulic categorisation of the floodplain into floodways, flood storage and flood fringe for a 1% AEP flood. Sections 5.3 and 6.2 describe the impacts on flood behaviour as a result of changes to flow conveyance and flood storage across the floodplain.
f) Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, or adjacent to or downstream of the site;	Due to the urbanised nature of the floodplain no areas have been identified where there would be an adverse effect caused by a reduction in inundation. Sections 5.3 and 6.2 present the findings of an assessment of more general impacts of the proposal on flood behaviour, including changes in the extent of inundation.
g) Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.	Section 5.3 identifies potential impacts that the construction of the proposal could have on erosion, siltation and the stability of watercourses, while section 6.2 presents the findings of an assessment of the corresponding impacts during the operation of the proposal.
h) Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters must be discussed with the NSW SES and Council.	Section 6.2 provides an assessment of the proposed works and its impact on transport infrastructure that may be relied upon as part of community emergency management arrangements. The EIS and accompanying documents identify Narrabri Shire Council and NSW SES as key stakeholders, with engagement to continue into the next phases of the proposal.
i) Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council.	Section 2.5 sets out the criteria that were adopted to manage the flood risk associated with the proposal, while Section 6.2 describes the flood risk associated with the proposal in its as-built form.
j) Emergency management, evacuation and access, and contingency measures for the development considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the NSW SES.	Section 2.5 sets out the criteria that were adopted to manage the flood risk associated with the proposal, while Section 6.2 describes the flood risk associated with the proposal in its as-built form.
k) Any impacts the development may have on the social and economic costs to the community as consequence of flooding;	Section 5.3 and 6.2 present the findings of an assessment of the potential impacts on flood behaviour during the construction and operational phases of the proposal, respectively, including consideration of social impacts (such as impacts on emergency response arrangements and disruption to the community) and economic impacts (such as the potential for increases in flood damages in adjacent development due to an increase in above floor inundation).

1.7 Study area

The study area includes the Namoi River floodplain at Wee Waa, as well as the area that lies internal to the Town Levee.

1.8 Structure of this report

The layout of this technical working paper is as follows:

- **Chapter 1** provides a brief overview of the proposal and the associated FMW, as well as the purpose of this technical working paper. The section also sets out the flooding and drainage related Secretary's environmental assessment requirements which were issued by the Department of Planning, Industry and Environment for the preparation of the environmental impact statement
- **Chapter 2** sets out the relevant government legislation, policies and guidelines that were taken into consideration during the assessment. The section also contains a summary of the criteria and standards that have been adopted for the assessment based on consideration of the relevant government legislation, policies and guidelines
- **Chapter 3** sets out the methodology that has been adopted in the definition of flood behaviour in the vicinity of the proposal and also the impact the proposal would have on flood behaviour
- **Chapter 4** contains a brief description of the drainage systems that control runoff in the vicinity of the proposal. This section of the technical working paper also provides an overview of flooding and drainage patterns under present day (ie pre-proposal and FMW) conditions
- **Chapter 5** deals with the flood risk during the construction phase of the proposal, as well as the impact that construction activities would have on flood behaviour
- **Chapter 6** deals with the impact that the proposal would have on flood behaviour following its construction, as well as the hydrologic standard which is proposed for its various components. The section also presents the findings of an assessment of the potential for the proposal to increase the risk of scour in the receiving drainage lines, the potential impact of future climate change on flood behaviour and the impacts that a partial blockage of the local stormwater drainage system would have on flood behaviour in its vicinity
- **Chapter 7** describes the potential cumulative impacts on flooding and drainage patterns that would result from the proposal in combination with other projects in its vicinity
- **Chapter 8** outlines potential measures to mitigate the construction and operational (ie post-construction) related impacts of the proposal on flooding conditions in adjacent development and to manage the risk of flooding to the proposal
- **Chapter 9** contains a list of references.

Figures referred to in **Chapters 1** to **8** are located at the end of the report.

The scales on figures referred to in this report are applicable when printed at A3 size.

2 LEGISLATIVE AND POLICY CONTEXT

2.1 Overview

This section of the technical working paper provides an overview of national, state and local government legislation, policies and technical guidelines that have been considered as part of the current assessment. The section also contains a summary of the criteria and standards that have been adopted for the assessment based on consideration of the relevant government legislation, policies and technical guidelines.

2.2 National guidelines

2.2.1 Australian Rainfall and Runoff (ARR)

Australian Rainfall and Runoff (**ARR**) is a national guideline for the estimation of design flood characteristics in Australia. The application of the procedures, inputs and parameters set out in ARR is an important component in the provision of reliable and robust estimates of design flood behaviour to ensure that projects such as the proposal are designed in a manner that manages the impact of flooding.

The third edition of ARR was released in 1987 (**ARR 1987**) (Institute of Engineers Australia [IEAust], 1987), while a fourth edition of ARR was released more recently in 2019 (**ARR 2019**) (Geoscience Australia [GA], 2019). While the procedures that were adopted for defining the nature of flooding on the broader Namoi River floodplain as part of the recently completed *Wee Waa Levee Risk Management Study and Plan* (Lyall & Associates, 2019) are consistent with those set out in ARR 2019, flood behaviour that was assessed as part of the same study internal to the Town Levee was based on procedures and rainfall intensities that are consistent with ARR 1987.

While the flood models that were developed as part of Lyall & Associates, 2019 to define flood behaviour internal to the Town Levee have been used as part of the present assessment, a sensitivity analysis was carried out to compare flood behaviour based on the procedures set out in ARR 2019 for a 1% AEP 36 hour design storm event. The analysis showed that the procedures set out in ARR 2019 result in lower peak flows and flood levels on the proposal site than have been relied upon for the present flood assessment for the proposal. Further details of the assessment are contained in **Section 6.8** of this technical working paper.

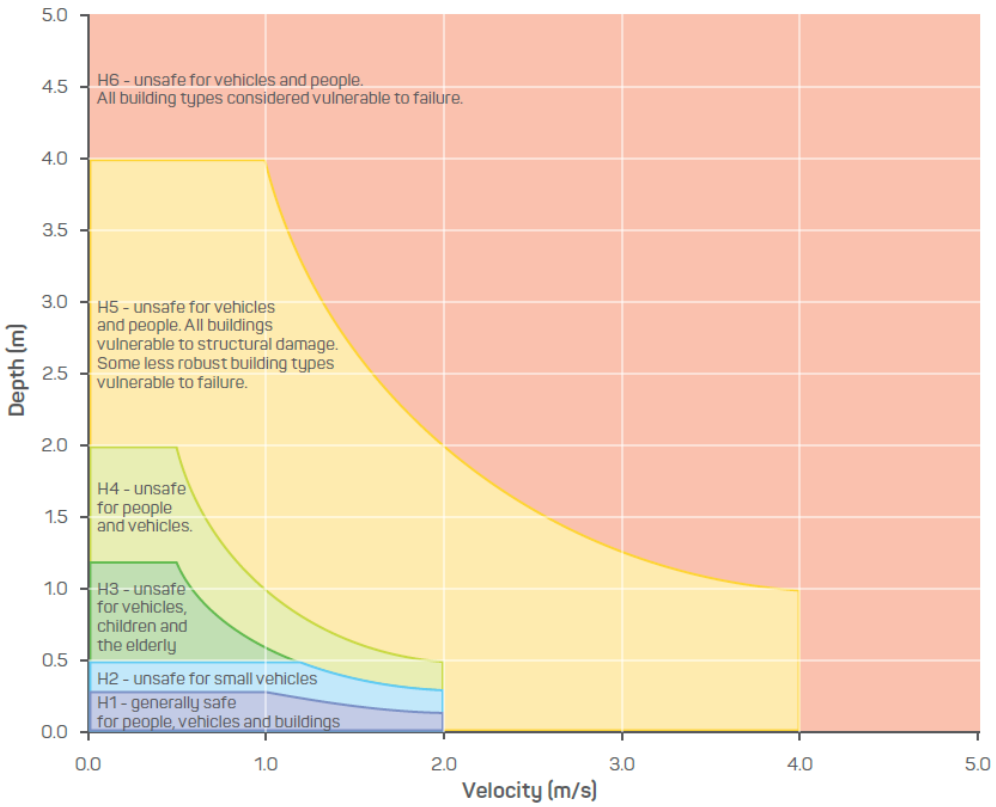
2.2.2 Australian Disaster Resilience Handbook 7: Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia

The *National Strategy for Disaster Resilience* (Council of Australian Governments [COAG], 2011) aims to provide a national, coordinated and cooperative approach to enhance Australia's capacity to withstand and recover from emergencies and disasters. *National Strategy for Disaster Resilience* recognises that disaster resilience is the collective responsibility of all sectors of society, including all levels of government, business, the non-government sector and individuals.

The *Australian Disaster Resilience Handbook Collection* comprises 12 handbooks that were developed by the Australian Institute for Disaster Resilience (AIDR) to support the *National Strategy for Disaster Resilience* by providing a set of principles, strategies and actions to help the management and delivery of support services in a disaster context.

Handbook 7: Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia (Handbook 7) (AIDR 2017) provides guidance on best practice principles, as presently understood in Australia, for managing flood risk and formulating floodplain management plans. The key aim of Handbook 7 is that floodplains are strategically managed for the sustainable long-term benefit of the community and the environment and to improve community resilience to floods.

The principles set out in both Handbook 7 and the state government-based *Floodplain Development Manual* (FDM) (Department of Infrastructure, Planning and Natural Resources [DIPNR], 2005) have been taken into consideration when establishing the standards adopted for managing the risk of flooding to the proposal, as well as its impacts on flooding under present day conditions. For example, the illustration below is taken from Handbook 7 and shows the relationship between velocity and depth that has been used to define the flood hazard vulnerability of the area internal to the Town Levee for a 1% AEP local catchment flood event, noting that the same approach is documented in ARR 2019. **Section 2.3.1** contains an overview of the FDM, while **Section 2.5** provides a summary of the assessment criteria and standards that have been adopted for the proposal.



2.3 State legislation, policies and guidelines

2.3.1 Floodplain development manual (FDM)

The *Floodplain Development Manual* (**FDM**) (DIPNR, 2005) incorporates the NSW Government's Flood Prone Land Policy, the primary objectives of which are to reduce the impact of flooding and flood liability on owners and occupiers of flood prone property and to reduce public and private losses resulting from floods, whilst also recognising the benefits of use, occupation and development of flood prone land.

The FDM forms the NSW Government's primary technical guidance for the development of sustainable strategies to support human occupation and use of the floodplain, and promotes strategic consideration of key issues including safety to people, management of potential damage to property and infrastructure and management of cumulative impacts of development. Importantly, the FDM promotes the concept that proposed developments be treated on their merit rather than through the imposition of rigid and prescriptive criteria.

Flood and floodplain risk management studies carried out by local councils as part of the NSW Government's Floodplain Management Program are carried out in accordance with the merits based approach promoted by the FDM. A similar merits based approach has been adopted in the assessment of the impacts that the proposal would have on existing flood behaviour and also in the development of a range of potential measures which would be aimed at mitigating its impact on the existing environment. In accordance with the FDM, the hydraulic categorisation of the floodplain was also considered when assessing the impact of the proposal on existing flood behaviour, as well as the impact of flooding to the proposal and its users.

2.3.2 Guideline on development controls on low risk flood areas

In July 2021 the NSW Government issued Planning Circular PS 21-006 *Considering flooding in land use planning: guidance and statutory requirements*. The circular provides advice on a package of changes regarding how land use planning considers flooding and flood-related constraints. The package includes:

- an amendment to clause 7A of Schedule 4 to the *Environmental Planning and Assessment Regulation 2000* (the Regulation)
- a revised local planning direction regarding flooding issued under section 9.1 of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**)
- two local environmental plan clauses which introduces flood related development controls
- a new guideline: *Considering Flooding in Land Use Planning (2021)*
- revoking the *Guideline on Development Controls on Low Flood Risk Areas (2007)*.

Planning proposals are required to be consistent with directions issued under section 9.1 of the EP&A Act. *Local Planning Direction 4.3—Flooding* requires, among other matters, a planning proposal to be consistent with the principles of the FDM. The direction has been revised to remove the need to obtain exceptional circumstances to apply flood-related residential development controls above the 1% Annual Exceedance Probability (AEP) flood event. It also ensures planning proposals consider the flood risks and do not permit residential accommodation in high hazard areas and other land uses on flood prone land where the development cannot effectively evacuate. The direction also makes provision for special flood considerations where councils have chosen to adopt the optional *Special flood considerations* clause in an LEP. The revised direction will apply to planning proposals that have not been issued with a gateway determination under section 3.34(2) of EP&A Act.

The guideline supports the principles of the FDM and provides advice to councils on land use planning on flood-prone land. It provides councils with greater flexibility in defining the areas to which flood-related development controls apply, with consideration of defined flood events, freeboards, low-probability/high-consequence flooding and emergency management considerations. The FDM states that a defined flood event (**DFE**) of 1% AEP, or a historic flood of similar scale, plus a freeboard should generally be used as the minimum level for setting residential flood planning levels (**FPL**). Choosing different DFEs and freeboards requires

justification based on a merit assessment that is consistent with the floodplain risk management process and principles of the FDM. Special flood considerations apply to sensitive and hazardous development in areas between the flood planning area (**FPA**) and the PMF and to land that may cause a particular risk to life and other safety considerations that require additional controls. These controls relate to the management of risk to life and the risk of hazardous industry/hazardous storage establishments to the community and the environment in the event of a flood.

2.3.3 Environmental Planning and Assessment Act 1979

The EP&A Act and associated regulations set out the system of environmental planning and assessment for the state of New South Wales.

In July 2009 the NSW Minister for Planning issued a list of directions to local councils under section 117(2) of the EP&A Act. These directions were later amended on 14 July 2021 as part of the NSW Government's update of its Flood Prone Land package. *Direction 4.3 - Flood Prone Land* (**Direction 4.3**) applies to all councils that contain flood prone land within their LGA and requires that:

A planning proposal must include provisions that give effect to and are consistent with:

(a) the NSW Flood Prone Land Policy,

(b) the principles of the Floodplain Development Manual 2005,

(c) the Considering flooding in land use planning guideline 2021, and

(d) any adopted flood study and/or floodplain risk management plan prepared in accordance with the principles of the Floodplain Development Manual 2005 and adopted by the relevant council.

A planning proposal must not rezone land within the flood planning area from Recreation, Rural, Special Purpose or Environmental Protection Zones to a Residential, Business, Industrial or Special Purpose Zones.

A planning proposal must not contain provisions that apply to the flood planning area which:

(a) permit development in floodway areas,

(b) permit development that will result in significant flood impacts to other properties,

(c) permit development for the purposes of residential accommodation in high hazard areas,

(d) permit a significant increase in the development and/or dwelling density of that land,

(e) permit development for the purpose of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas where the occupants of the development cannot effectively evacuate,

(f) permit development to be carried out without development consent except for the purposes of exempt development or agriculture. Dams, drainage canals, levees, still require development consent,

(g) are likely to result in a significantly increased requirement for government spending on emergency management services, flood mitigation and emergency response

measures, which can include but are not limited to the provision of road infrastructure, flood mitigation infrastructure and utilities, or

(h) permit hazardous industries or hazardous storage establishments where hazardous materials cannot be effectively contained during the occurrence of a flood event.

A planning proposal must not contain provisions that apply to areas between the flood planning area and probable maximum flood to which Special Flood Considerations apply which:

(a) permit development in floodway areas,

(b) permit development that will result in significant flood impacts to other properties,

(c) permit a significant increase in the dwelling density of that land,

(d) permit the development of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas where the occupants of the development cannot effectively evacuate,

(e) are likely to affect the safe occupation of and efficient evacuation of the lot, or

(f) are likely to result in a significantly increased requirement for government spending on emergency management services, and flood mitigation and emergency response measures, which can include but not limited to road infrastructure, flood mitigation infrastructure and utilities.

For the purposes of preparing a planning proposal, the flood planning area must be consistent with the principles of the Floodplain Development Manual 2005 or as otherwise determined by a Floodplain Risk Management Study or Plan adopted by the relevant council.

Direction 4.3 also states that a planning proposal may be inconsistent with the terms of this direction only if the planning proposal authority can satisfy the Secretary of the Department of Planning, Industry and Environment (or their nominee) that:

(a) the planning proposal is in accordance with a floodplain risk management study or plan adopted by the relevant Council in accordance with the principles and guidelines of the Floodplain Development Manual 2005, or

(b) where there is no council adopted floodplain risk management study or plan, the planning proposal is consistent with the flood study adopted by the council prepared in accordance with the principles of the Floodplain Development Manual 2005 or

(c) the planning proposal is supported by a flood and risk impact assessment accepted by the relevant planning authority and is prepared in accordance with the principles of the Floodplain Development Manual 2005 and consistent with the relevant planning authorities' requirements, or

(d) the provisions of the planning proposal that are inconsistent are of minor significance as determined by the relevant planning authority.

2.3.4 Floodplain risk management guidelines

Scientific evidence shows that climate change is expected to lead to sea level rise and an increase in flood-producing rainfall intensities. The significance of these effects on flood behaviour would vary depending on geographic location and local topographic conditions.

Climate change impacts on flood-producing rainfall events show a trend for larger scale storms and increased depths of rainfall. Future impacts on sea levels are likely to result in a continuation of the rise in levels which has been observed over the last 20 years.

The NSW Government's *Floodplain Risk Management Guideline: Practical Considerations of Climate Change* (DECC, 2007) recommends that until more work is completed in relation to the climate change impacts on rainfall intensities, sensitivity analyses should be carried out based on increases in rainfall intensities of between 10 and 30 per cent. Under current climatic conditions, increasing the 1% AEP design rainfall intensities by 10 per cent would produce about a 0.5% AEP flood; and increasing those rainfalls by 30 per cent would produce about a 0.2% AEP flood. On current projections the increase in rainfalls within the design life of the proposal is likely to be around 10 per cent, with the higher value of 30 per cent representing an upper limit.

Based on the recommendations set out in DECC (2007), the 0.5% AEP and 0.2% AEP design storms were adopted as being analogous to an increase in 1% AEP design rainfall intensities of 10 and 30 per cent respectively, for assessing the impact future climate change could have on flooding conditions in the vicinity of the proposal. This range of potential increases also encompasses the values given in ARR 2019, which suggests a potential increase in rainfall intensities of between 10.8 per cent and 22.8 per cent by 2090 for Representative Concentration Pathways of between 4.5 and 8.5.

2.4 Council policies and guidelines

2.4.1 Flood planning controls

As noted in **Section 1.3**, the proposal is located in the local government area of Narrabri Shire.

The *Narrabri Local Environment Plan 2012* (***Narrabri LEP 2012***) contains the newly adopted flood planning clause that applies to land within the FPA. Clause 5.21 of *Narrabri LEP 2012* titled "Flood planning" states the following:

1. *The objectives of this clause are as follows—*
   - *(a) to minimise the flood risk to life and property associated with the use of land,*
   - *(b) to allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change,*
   - *(c) to avoid adverse or cumulative impacts on flood behaviour and the environment,*
   - *(d) to enable the safe occupation and efficient evacuation of people in the event of a flood.*
2. *Development consent must not be granted to development on land the consent authority considers to be within the flood planning area unless the consent authority is satisfied the development—*
   - *(a) is compatible with the flood function and behaviour on the land, and*
   - *(b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and*
   - *(c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and*
   - *(d) incorporates appropriate measures to manage risk to life in the event of a flood, and*

(e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.

3. In deciding whether to grant development consent on land to which this clause applies, the consent authority must consider the following matters—

(a) the impact of the development on projected changes to flood behaviour as a result of climate change,

(b) the intended design and scale of buildings resulting from the development,

(c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood,

(d) the potential to modify, relocate or remove buildings resulting from development if the surrounding area is impacted by flooding or coastal erosion.

4. A word or expression used in this clause has the same meaning as it has in the Considering Flooding in Land Use Planning Guideline unless it is otherwise defined in this clause.

5. *In this clause—*

***Considering Flooding in Land Use Planning Guideline** means the Considering Flooding in Land Use Planning Guideline published on the Department's website on 14 July 2021.*

***flood planning area** has the same meaning as it has in the Floodplain Development Manual.*

***Floodplain Development Manual** means the Floodplain Development Manual (ISBN 0 7347 5476 0) published by the NSW Government in April 2005.*

2.4.2 Flooding and drainage related standards

Narrabri Shire Council's *Landfill Development DCP* states that the aims and objectives of the document are to set reasonable environmental standards in respect to flood liable land, privacy, on-site drainage, streetscape and other impacts on adjoining land uses. The *Landfill Development DCP* requires that a Statement of Environmental Effects be prepared which demonstrates that consideration has been given to the environmental impact of the development, including the probable effect on natural and stormwater drainage, flood water flows, privacy, soil erosion and management, and any other identifiable impacts on adjoining lands. It also requires that all batters of the landfill edges are to be stabilised in a manner to prevent surface erosion from storm or flood water events.

The *Interim Floodplain Management Policy* referred to in Council's *Exempt & Complying Development DCP* was first adopted in October 1987 and later updated in March 1988 and October 1998. The interim policy states the following (**bold** and <u>underlined</u> text has been added for emphasis):

> *1 All habitable rooms as described under clause A1.1 of the Building Code of Australia, for new houses and residential flat buildings are to be constructed at least 0.5 of a metre above the 1:100 ARI flood level.* ***This <u>does not</u> apply in the Town of Wee Waa, which is protected by the flood levee.***

2 *Alterations and additions to dwelling houses constructed prior to the enactment date for Council's current flood policy adopted in 1987 and requiring the floor levels of houses and residential flat buildings to be 0.5 of a metre above the 1:100 ARI flood level will be considered on an individual merit basis up to an area equal to 50% of the existing floor area of habitable rooms.* ***This provision <u>does not</u> apply to the Town of Wee Waa, which is protected by the flood levee.***

3 *All Commercial and Industrial buildings whether new or additions, are considered on merit generally.*

4 *All building materials, for all types of development, that are to be utilised below the 1:100 ARI flood level, must be floodwater tolerant or resistant. Further, Council recommends that all electrical fittings and equipment be installed above the 1:100 ARI flood height for that land.*

5 *In the areas which may be affected by the 1:100 ARI flood landholders land filling in excess of 225mm.of material will be required to provide a permanent drain to the street from backyard run off and the backyard be graded to a sump which is to be drained by permanent piping to the street or by concrete dish drains or other approved drainage systems of permanent material, Such provisions must not restrict natural drainage from adjoining lands. Where the installation of land filling adversely affects the drainage of the adjoining site or sites a provision for drainage of the adjoining site or sites shall be incorporated in the drainage system provided by the person carrying out land filling.* ***This provision <u>also applies</u> to the Town of Wee Waa.***

6 *Where, in the opinion of the Director of Environmental Services or Council Planner, Council holds insufficient information to provide reasonably accurate flood information to enable compliance with Item 1 of this Policy, any applicant for the erection of new dwellings or residential flat buildings must provide to Council accurate information as to the level of the land, where the development is to occur and the 1955 flood level for that particular area.*

7 *With respect to new dwellings and residential buildings, where, in the opinion of Council, a proposed development could sustain structural damage by flooding, no work on the development will be allowed to commence until the applicant obtains and submits a Certificate of Structural Adequacy of the proposed dwelling or residential building from a qualified Structural/Civil Engineer.*

8 *With respect to commercial and industrial development, new and existing, in flood liable areas, applications for development are to be accompanied by a Certificate from a qualified practising Structural or Civil Engineer stating that the building will not sustain structural damage from the forces and impact of debris associated with flood waters equal to the 1:100 ARI flood, except - with respect to extensions and alterations to commercial buildings, shops, offices, motels, hotels, and the like having a floor area of 50 m^2 or less or industrial buildings including workshops, stores associated with such workshops, warehouses and bulk stores having an area of 100 m^2 or less.*

NOTE: Major residential and rural areas of this Shire were affected by the 1955 flood peak. The Council has details of the depth of flooding in Narrabri Township (Narrabri Shire Council 1:100 ARI Flood Contour Map, Town of Narrabri) and the extent of flooding with respect to the 1955 flood at the Town of Boggabri. Council's records relating to Narrabri and Boggabri may be inspected by any interested person. ***With respect to the residue of the Shire, the Town of Wee Waa is protected by a levee bank which at the time of construction was designed in accordance with the requirements of the then Water Resources Commission of New South Wales, The integrity of the Wee Waa levee bank depends on the future nature of flooding in the area.***

With respect to rural areas, Council holds very little information regarding the depth of flooding in portions of the Shire affected by the 1955 flood event and reference should be made to the Department of Land and Water Conservation who may hold useful Information in this regard.

THE FILLING OF LAND AT NARRABRI WITH FILL OF A GREATER DEPTH THAN 225mm IN AREAS AFFECTED BY THE 1:100 ARI YEAR FLOOD EVENT REQUIRES COUNCIL'S DEVELOPMENT CONSENT PRIOR TO WORK BEING COMMENCED.

DEFINITION AS PER BCA

Habitable room means a room used for normal domestic activities, and–

(a) includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room and sunroom; but

(b) excludes a bathroom, laundry, water closet, pantry, walk–in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes–drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.

Based on the controls set out in Council's *Exempt & Complying Development DCP* and the *Interim Floodplain Management Policy*, there is no requirement to set the floor level of any new development or extension in Wee Waa above the peak 1% AEP flood level. This requirement does not take into account the depth to which stormwater will pond behind the Town Levee during a 1% AEP storm event and assumes that it has the required freeboard to protect new development from inundation by a 1% AEP Namoi River flood.

Development Design Specification D5 titled "*Stormwater Drainage*" sets out Council's requirements for the design of new stormwater drainage systems. It adopts the "major/minor" system concept set out in ARR 1987.

2.5 Summary of adopted assessment criteria and standards

Table 2.1 sets out the flooding and drainage related assessment criteria and standards that have been established for the proposal with due consideration of the policies and guidelines outlined in the preceding sections of this technical working paper.

In accordance with Handbook 7 and the FDM, the hydrologic standards adopted are based on matching the level of protection to the likelihood and consequence of flooding. A merits based approach has been adopted in the assessment of the impacts the proposal would have on existing flood behaviour and also in the development of a range of potential measures which are aimed at mitigating its impact on the existing environment.

Table 2.1
Summary of adopted assessment criteria and standards

Aspect	Criterion or standard
Flood risks to the proposal	
Proposed construction activities	• Construction related flood risks need to be evaluated in the context of the construction period in order to set requirements that are commensurate to the period of time that the risk exposure occurs. To this end, this technical working paper identifies the risks associated with each construction activity such that informed decisions can be made on the flood criteria that are set as part of the Flood Management Strategy for the construction of the proposal.
Minimum Floor Level Requirements	• Habitable floor levels associated with the proposal have been set at or above the peak 1% AEP flood level plus 0.5 metres freeboard.
Impact of future climate change on flooding to the proposal	• The assessment of the potential impact future climate change could have on flood behaviour in the vicinity of the proposal was based on increases in 1% AEP design rainfall intensities ranging between 10 and 30 per cent in accordance with the NSW Government's Floodplain Risk Management Guideline: Practical Considerations of Climate Change (DECC, 2007)[1]
Impact of the proposal on flood behaviour	
Impact of construction activities on flood behaviour	• Construction related flood impacts need to be evaluated in the context of the construction period in order to set requirements that are commensurate to the period of time that the exposure to the potential impacts occurs. To this end, this technical working paper identifies the potential impacts associated with each construction activity such that informed decisions can be made on the flood criteria that are set as part of the flood risk management plan for the construction of the proposal.
Impact of proposal on flood behaviour in existing development	• Floods up to 1% AEP in magnitude are to be considered in the assessment of measures which are required to mitigate any adverse impacts on flood behaviour attributable to the proposal. • Changes in flood behaviour under larger floods up to the PMF event are also to be assessed in order to identify impacts on critical infrastructure (such as hospitals) and vulnerable development (such as aged care facilities and schools), as well as to identify potentially significant changes in flood hazard as a result of the proposal.
Impact of the proposal on flood behaviour under future climate change conditions	• The assessment of the impact of the proposal on flood behaviour under future climate change conditions was based on assessing the effect of the proposal on present day flood behaviour during a 0.5 % and 0.2 % AEP event, which is consistent with the requirement of the SEARs[1]

1. For the purpose of this assessment the 0.5% and 0.2% AEP events were adopted as being analogous to increases in 1% AEP design rainfall intensities of 10 and 30 per cent, respectively.

3 ASSESSMENT METHODOLOGY

3.1 Key tasks

The key tasks comprising the flooding and drainage assessment are broadly described as follows:

- Review of available data including existing flood studies and associated hydrologic and hydraulic models (collectively referred to as 'flood models') for Wee Waa
- Update of the existing flood models where required to more accurately define flooding and drainage behaviour in the vicinity of the proposal
- Preparation of exhibits showing flood behaviour under present day conditions for design floods with AEPs of 20%, 5% and 1%, as well as the Extreme and Probable Maximum floods.
- Assessment of the potential impact the proposal in combination with the FMW would have on flood behaviour during the formers' construction and operation
- Assessment of the impact future climate change would have on flood behaviour under operational conditions
- Assessment of the impact a partial blockage of the trunk drainage system downstream of the proposal site would have on flood behaviour under operational conditions
- Assessment of potential measures which are aimed at mitigating the risk of flooding to the proposal and its impact on existing flood behaviour
- Assessment of potential measures which are aimed at mitigating the risk of scour in the d receiving drainage lines and the Namoi River.

The following sections of this technical working paper set out the methodology that was adopted in the assessment of flooding and drainage behaviour under present day conditions and during both the construction and operational phases of the proposal.

3.2 Assessment of present day flooding and drainage patterns

While the definition of flood behaviour external to the Town Levee is based on the findings of Lyall & Associates, 2019, the two-dimensional (in plan) hydraulic model that was used to define flooding and drainage patterns internal to the Town Levee as part of the same study (**Wee Waa TUFLOW Model**) was updated in order to more accurately define flood behaviour in the vicinity of the proposal. This involved the incorporation of a digital elevation model of the proposal site into the Wee Waa TUFLOW Model that was based on detailed ground survey.

Flood behaviour internal to the Town Levee was defined as part of the present investigation for storm events with AEPs of between 20% and 1% in intensity, as well as the PMF. Figures were prepared for each event showing the indicative extent and depth of inundation, as well as the direction and relative velocity of flow. Figures were also prepared showing the hydraulic and flood hazard vulnerability categorisations during a 1% AEP event.

A description of flood behaviour under present day conditions is presented in **Chapter 4**.

3.3 Assessment of construction related impacts

A qualitative assessment was made of the impact of flooding based on indicative construction areas and activities as provided in the concept design. The locations of surface works were overlaid onto the indicative flood extents during a 20%, 5% and 1% AEP event, as well as the PMF. This provided an understanding of the likelihood that flooding could occur in the vicinity of construction activities.

An assessment was made on the potential for flooding to affect the construction process and the potential for construction activities to impact flood behaviour in nearby properties.

Chapter 5 of this technical working paper deals with the impact that flooding could have on construction activities. It also includes an assessment of the impact that construction activities could have on flood behaviour external to the proposal footprint.

3.4 Assessment of operational related impacts

The structure of the Wee Waa TUFLOW Model that was originally developed to define flood behaviour under present day conditions was adjusted to incorporate details of the proposal and FMW. The results of modelling a range of storm events with AEPs of between 20% and 1%, as well as the PMF, were used to prepare a series of figures showing flooding patterns under operational conditions and afflux[2] diagrams showing the impact the proposal in combination with the FMW would have on flood behaviour.

Details of the concept design arrangements that were incorporated into the Wee Waa TUFLOW Model to define flood behaviour in the vicinity of the proposal, as well as a description of its impact on flood behaviour is contained in **Chapter 6** of this technical working paper. **Chapter 8** sets out the recommended approach to mitigating the impacts of the proposal on scour potential in the affected receiving drainage lines.

3.5 Impact of future climate change on flood behaviour

The following sections describe the approach that was adopted to assess the potential impact of future climate change on flooding to the proposal, as well as the impact that the proposal may have on flood behaviour under future climate change conditions. The findings of this assessment are contained in **Section 6.5** of this technical working paper.

3.5.1 Impact of future climate change on flooding to the proposal

Based on the adopted assessment criteria set out in **Table 2.1**, the following scenarios were adopted as being representative of the likely lower and upper estimates of future climate change related impacts over the design life of the proposal:

- Scenario 1 – based on an assumed 10 per cent increase in currently adopted design rainfall intensities
- Scenario 2 – based on an assumed 30 per cent increase in currently adopted design rainfall intensities.

[2] Afflux is an increase in peak flood levels caused by a change in floodplain or catchment conditions. A positive afflux represents an increase and conversely a negative afflux represents a decrease in peak flood levels when compared to present day conditions. Differences in peak flood levels of ±0.01 metres (equal to one centimetre or ten millimetres) are considered to be within the accuracy of the hydraulic model. The proposal is therefore considered to have a negligible or nil effect on flood behaviour in areas where an afflux of ±0.01 metres is shown to be present.

3.5.2 Impact of the proposal on flood behaviour under future climate change conditions

In accordance with the Secretary's environmental assessment requirements, the predicted impact that the proposal may have on flood behaviour under potential future climate change conditions was based on assessing its effect on present day (ie pre-proposal) flood behaviour during a 0.5% (1 in 200) and 0.2% (1 in 500) AEP event as proxies for assessing the sensitivity to an increase in rainfall intensity on the 1% AEP event due to future climate change.

3.6 Impact of elevated flood levels on the Namoi River floodplain on flood behaviour internal to the Town Levee

During periods when the Namoi River is in flood, the fourteen existing flood gates that are located around the perimeter of the Town Levee are closed in order to prevent backwater flooding of Wee Waa. Furthermore, if rainfall occurs coincident with the flood gates being closed, then a series of stormwater evacuation pumps are used to pump stormwater to the river side of the Town Levee.

An investigation was undertaken to assess the impact that the closure of flood gates in combination with the stormwater evacuation pumps being both operable and inoperable during a 1% AEP storm event would have on local catchment flooding, the findings of which are contained in **Section 6.6**.

3.7 Impact of blockage on flood behaviour

The assessment of the impact that a partial blockage of the trunk drainage system downstream of the proposal site would have on flood behaviour was based on procedures that are set out in ARR 2019. Also assessed was the sensitivity of flood behaviour to both a partial and complete blockage of the proposed perimeter fencing during a 1% AEP storm event.

The findings of the blockage related impact assessment are contained in **Section 6.7**.

4 EXISTING ENVIRONMENT

4.1 General

This section of the report contains a brief description of the Namoi River floodplain at Wee Waa, as well as the existing drainage system internal to the Town Levee. The section also contains a brief description of the two primary mechanisms that influence flood behaviour at Wee Waa.

4.2 Namoi River Floodplain

Figures 1.1 shows the layout of the drainage system in the vicinity of Wee Waa.

Flooding patterns at Wee Waa are largely dependent on the source of the flow. For example, floodwater originating from the upper Namoi River catchment commences to spread out across the wider Namoi River floodplain near the Myall Vale homestead which is located about 10 km upstream of the township. At this location major outflows occur from the river, with the largest breakout occurring toward the north.

The floodwater that moves north from Myall Vale inundates large tracts of land on the north-western floodplain, through Spring Plains to the Doreen area and eventually into Pian Creek, while the floodwater which breaks to the south develops a flood runner along the side of the Kamilaroi Highway. The flow which breaks out to the south initially runs alongside the road before entering O'Briens Channel and then Wee Waa Lagoon. Wee Waa is effectively isolated by road once this flow breakout develops.

Immediately upstream and downstream of Wee Waa flood flows leave the Namoi River via a number of effluent streams, the most significant of which are Gunidgera and Pian Creeks. With the exception of 'high' ridges which are located adjacent to and to the north of Pian Creek, virtually all of the land to the west of Wee Waa is inundated during a major flood.

An alternative flood pattern is caused by local catchment runoff from the streams draining the south-western slopes of the Nandewar Ranges to the east of Narrabri. Spring, Bobbiwaa and Galathera Creeks form the main drainage patterns of this region. All have quite small channels and when in flood, spread over wide areas of agricultural land. The majority of the flood flow generated by the local catchment does not join the Namoi River, but rather turns to the north-west where it ultimately joins flow in the Thalaba Creek system.

While the Pilliga Road can be cut by backwater flooding from the Namoi River, runoff from the Pilliga Scrub area can be sufficient to inundate the low level causeway crossing of Wee Waa Lagoon.

It is noted that Wee Waa usually has up to three days warning of a peak flood height, as well as up to two days warning of when the town may be isolated by road

4.3 Town Levee

The Town Levee was built in response to the damaging flooding that was experienced at Wee Waa in February 1971. Construction of the Town Levee, which is approximately 8.6 km in length, was completed in 1978. The Town Levee is an earth embankment which generally varies in height between about 2 m and 4 m. The river side of the earth embankment generally has a slope of 3:1 (Horizontal:Vertical), while the town side has a slope of 2:1 (Horizontal:Vertical). The crest of the Town Levee, which was originally set 1 m above the peak of the 1971 flood, is typically 3 m in width. The side slopes of the earth embankment are grassed, while its crest typically comprises a gravel surface. **Figure 4.1**, sheet 1 shows the alignment of the Town Levee, while **Figure 4.2** is a long section showing its elevation relative to the adjacent floodplain.

There are fourteen penstock gated stormwater drainage pipes and six stormwater evacuation pumps located around the perimeter of the Town Levee, the locations of which are shown on **Figure 4.1**, sheet 1. **Figure 4.2** shows the diameters of the fourteen penstock gated stormwater drainage pipes, as well as their approximate invert levels, while **Table 4.2** sets out the details of the six stormwater evacuation pumps.

In addition to the six stormwater evacuation pumps located along the Town Levee, Council also maintains a number of small trailer mounted pumps that are mobilised on an as-needs basis following heavy rainfall events. The trailer mounted pumps are used to reduce the depth of ponding in several areas where the rate at which stormwater runoff drains toward the penstock gated pipes is considered by affected residents and business owners to be too slow.

TABLE 4.2
EXISTING STORMWATER EVACUATION PUMP DETAILS

Pump Identifier	Maximum Pump Rate (m^3/s)	Pump Ownership	Pump Type
P_01	1.0	Council	2001 Deutz Lift Pump
P_02	1.0	Council	2001 Deutz Lift Pump
P_03	0.1	Council	2006 Ford Water Cooled Lift Pump
P_04	1.0	Council	2001 Deutz Lift Pump
P_05	0.15	Namoi Cotton Alliance	40 Isuzu Turbo
P_06	0.1	Namoi Cotton Alliance	22 Isuzu

4.4 Local Drainage in the vicinity of the proposal

Figure 4.1, sheet 1 shows the layout of the existing stormwater drainage system both internal and external to the Town Levee, while **Figure 4.1**, sheet 2 shows greater detail in the immediately vicinity of the proposal site.

Runoff generated by relatively frequent storm events discharges to the proposal site via a series of small diameter pipes which cross George Street, Mitchell Street and Charles Street. A network of shallow channels have been built to convey this flow through to the north-west corner of the proposal site where twin 600 millimetre diameter pipes run in a northerly direction along the eastern side of Charles Street.

Flow conveyed in the twin 600 millimetre diameter pipes discharges to a short section of channel which is located in the south-east corner of the intersection of Charles Street and Boundary Street, before being conveyed across the latter mentioned road via twin 750 millimetre diameter pipes.

Flow discharging from the twin 750 millimetre diameter pipes is conveyed to the Namoi River via the engineered channel which is about 15 metres in width and 1 metre in depth. Flow in the engineered channel is conveyed through the Town Levee via a single 750 millimetre pipe. A pipe(s) of unknown diameter is also located beneath an unsealed access track that crosses the engineered channel a distance of about 60 m to the north of the Town Levee.[3]

[3] Lyall & Associates, 2019 adopted a single 750 millimetre diameter pipe at this location so as to match the waterway area beneath the Town Levee.

4.5 Description of existing flooding and drainage behaviour

4.5.1 General

The following sections of the technical working paper provide a brief description of patterns of both riverine and local catchment flooding under present day (ie pre-proposal and FMW) conditions. The following figures are referred to in the following discussion:

- **Figures 4.3**, **4.4** and **4.5** (two sheets each) show the indicative extent and depth of riverine flooding external to Town Levee for floods with AEPs of 5% and 1% AEP, as well as the Extreme Flood, respectively. It should be noted that the mapping assumes that the flood gates along the Town Levee are in their closed position, therefore preventing backwater flooding internal to the Town Levee for floods which do not surcharge its crest.
- **Figure 4.6** (two sheets) shows the indicative extent and depth of inundation, while **Figure 4.7** (two sheets) shows maximum flow velocities internal to Town Levee for a 20% AEP local catchment flood event. **Figures 4.8** to **4.13** show simular information for local catchment floods with AEPs of 5% and 1%, as well as the PMF. It should be noted that the mapping assumes that the flood gates are in their fully open position (i.e. there is no coincident flooding on the Namoi River floodplain).
- **Figures 4.14** (two sheets) shows the hydraulic categorisation of the floodplain internal to the Town Levee for a 1% AEP local catchment flood event.
- **Figures 4.15** (two sheets) shows the flood hazard vulnerability categorisation of the floodplain internal to the Town Levee for a 1% AEP local catchment flood event.
- **Figure 4.16** shows the extent of the flood planning area which has been defined as land which lies below the 1% AEP flood level plus 0.5 metres.

As mentioned in **Section 3.2**, flood behaviour has been defined using the Wee Waa TUFLOW Model that was developed as part of Lyall & Associates, 2019, with minor changes made to its structure in order to improve the definition of flooding and drainage patterns within the extent of the proposal footprint.

4.5.2 Namoi River Flooding

The key features of Namoi River flooding at Wee Waa are as follows:

- While floodwater would generally not exceed 1.2 m depth along the northern side of the Town Levee during a 5% AEP flood, it would exceed 2 m depth along its southern side.
- Flood levels would exceed the Imminent Failure Flood (**IFF**) level of the Town Levee at its eastern end by up to 130 mm in a 5% AEP flood.[4]
- Floodwater would pond up against the flood protection barriers on the Narrabri-West Walgett railway crossings at Chainage 4700 by about 0.3 m in a 5% AEP flood event and at Chainage 7000 by about 0.2 m in a 2% AEP flood event.
- The minimum available freeboard to the crest of the Town Levee reduces from about 0.9 m at the 5% AEP level of flooding to about 0.5 m at the 1% AEP level of flooding.

[4] The IFF is the flood which would compromise the freeboard provision in the levee design, which based on the findings of Lyall & Associates, 2019 is taken to be equal to 1.0 m. The prediction of a flood higher than the IFF would trigger the evacuation of the protected area, as NSW SES would have deemed the levee to be at risk of failure.

- The Town Levee would in the absence of any wind or wave action not be overtopped for floods up to a 0.2% AEP in magnitude.
- Peak flood levels are about 0.5-1.0 m higher in the Extreme Flood when compared to those at the 1% AEP level of flooding. As a result, floodwater would overtop the Town Levee at five locations, where it would inundate the town to depths of between 0.7 and 3.5 metres.

4.5.3 Local Catchment Flooding

The key features of local catchment flooding in the vicinity of the proposal are as follows:

- An overland flow path develops along Mitchell Street which extends upstream (east) of the proposal site as far as the Wee Waa Showground.
- Flooding on the proposal site is generally of a ponding nature, with depths of inundation controlled by the capacity of the twin 600 millimetre pipes which extend north from its north-west corner in combination with the elevation of Charles Street which is generally about 0.5 metres higher than natural surface levels internal to the proposal site. As a result, depths of inundation remote from the network of low flow channels are a maximum of about 0.4 metres in a 20% AEP local catchment flood event, increasing to a maximum of about 0.5 metres in a 1% AEP local catchment flood event.
- The peak 1% AEP flood level on the proposal site is a maximum of RL 191.0 m AHD.
- Peak flows discharging through the proposal site increase from about 1 m^3/s during a 20% AEP local catchment flood event to about 4 m^3/s during a 1% AEP local catchment flood event.
- Flow velocities on the proposal site are highest during more frequent local catchment flood events when backwater effects from the twin 600 millimetre pipes are less. For example, maximum flow velocities remote from the network of low flow channels generally reduce from a maximum of about 0.3 m/s during a 20% AEP event to less than 0.15 m/s during a 1% AEP event.
- Depths of inundation on the proposal site would generally exceed 1 metre during a PMF event, with flow velocities generally not exceeding about 0.4 m/s.
- The proposal site generally functions as a flood storage area during a 1% AEP local catchment flood event, with floodway areas limited to the network of low flow channels which run through it.
- The flood hazard vulnerability classification on the proposal site would generally be no higher than H2 (generally safe for people, but unsafe for small vehicles) during a 1% AEP local catchment flood event, with the exception that H3 (unsafe for vehicles, children and the elderly) conditions would be present along the network of low flow channels which run through it. Isolated pockets of H3 type conditions areas are also shown to be present, generally in the north-western portion of proposal site.
- The whole of the proposal site lies within the extent of the FPA.

5 ASSESSMENT OF CONSTRUCTION IMPACTS

5.1 General

This section provides an assessment of the flood risk during the construction of the proposal. It also provides an overview of the potential impacts that the proposed construction activities could have on flood behaviour.

5.2 Potential flood risks at construction site

Figure 5.1 (two sheets) shows the extent to which floods of varying magnitude affect the proposal site, noting that it reflects conditions prior to the construction of the FMW.

While the construction of the FMW would significantly reduce the extent, depth and duration of inundation on the proposal site, especially for the more frequent events, there is still the potential for floodwater to impact construction activities.

Without the implementation of appropriate management measures, the inundation of the proposal site by floodwater has the potential to:

- Cause damage to the proposal works and delays in construction programming
- Inundate site sheds and limit access to the proposal site
- Pose a safety risk to construction workers
- Detrimentally impact the downstream waterways through the transport of sediments and construction materials by floodwaters
- Obstruct the passage of floodwater and overland flow through the provision of temporary measures such as site sheds and stockpiles, which in turn could exacerbate flooding conditions in existing development located outside the construction footprint.

A range of potential measures that are aimed at managing the flood risk on the proposal site during the construction of the proposal are set out in **Chapter 8**.

5.3 Potential impacts of construction activities on flood behaviour

Provided construction activities do not obstruct the Low Flow Channel and High Flow Conveyance / Flood Storage Area, then construction activities should not exacerbate flooding conditions external to the proposal site for all storms up to 1% AEP in intensity. That said, materials and heavy machinery should not be stored on George Street where it borders the proposal site as during very intense storm events there is the potential for floodwater to surcharge the road, with any obstruction of this flow potentially exacerbating flooding conditions in existing residential development that is located on its eastern (upstream) side.

6 ASSESSMENT OF OPERATIONAL IMPACTS

6.1 General

This section provides an assessment of the flood risk to the proposal and the impact it would have on flood behaviour during operation. The findings of an assessment into the potential impact of future climate change and impacts of a partial blockage of the trunk stormwater drainage system downstream of the proposal site, as well as the proposed perimeter fencing on flood behaviour under operational conditions are also presented.

Figure 6.1 (two sheets) shows the indicative extent and depth of inundation, while **Figure 6.2** (two sheets) shows maximum flow velocities under post-proposal and FMW conditions, while **Figures 6.3** and **6.4** (two sheets each) show the impact that the proposal and FMW would have on flood behaviour and maximum flow velocities, respectively internal to the Town Levee for a 20% AEP flood event. **Figures 6.5** to **6.16** show similar information for floods with AEPs of 5% and 1%, as well as the PMF.

Figures 6.17 and **6.18** (two sheets each) show the hydraulic and flood hazard vulnerability categorisation of the floodplain internal to the Town Levee under post-proposal and FMW conditions for a 1% AEP local catchment flood event, respectively.

6.2 Potential flood risk to the proposal and its impacts on flood behaviour

The potential flood risk to the proposal as a result of Namoi River flooding is summarised as follows:

- While flood levels would exceed the IFF level of the Town Levee during a 5% AEP flood on the Namoi River, it would not be overtopped during a 0.2% AEP flood in the absence of wind or wave action. Given that the geotechnical investigation that was undertaken as part Lyall & Associates, 2019 found the Town Levee to be in good condition, this means that it would likely not fail during a flood event, meaning the proposal would likely not be impacted by riverine type flooding for all floods up to about 0.2% AEP in magnitude.
- Major overtopping of the Town Levee would occur for floods larger than 0.2% AEP in magnitude, with the land upon which the proposed school buildings would be located, as well as the main vehicular access internal to the proposal site inundated to a maximum depth of about 2 metres during an Extreme Flood event.
- While the ground floor level of the proposed buildings would be inundated to a maximum depth of about 1.5 metres during an Extreme Flood event, the first floor level would remain flood free.
- As previously mentioned, Wee Waa usually has up to three days warning of a peak flood height, as well as up to two days warning of when the town may be isolated by road, meaning there is sufficient time to close the school and advise staff and students of the potential flood risk.

The potential flood risk to the proposal as a result of local catchment flooding is summarised as follows:

- Flooding would generally be confined to the Low Flow Channel and High Flow Conveyance / Flood Storage Area for local catchment floods up to 5% AEP, with the

exception of the landscaped area at the eastern end of the proposal site and the proposed swale that is located immediately to the east of the basketball courts.

- Depths of inundation within the area that is bounded by the 2.1 m high perimeter fence would be a maximum of about 0.2 metres in a 20% AEP local catchment flood event, increasing to about maximum of about 0.5 m during a 1% AEP local catchment flood event.
- The land upon which the proposed school buildings would be located, as well as the main vehicular access internal to the proposal site would remain flood free for local catchment flood events up to 1% AEP in magnitude, as would the sports field and the majority of the athletics track.
- The land upon which the proposed school buildings would be located, as well as the main vehicular access internal to the proposal site would be inundated by a maximum of 0.6 metres during a local catchment PMF event. This would result in a maximum depth of above-floor inundation in the ground floor of the proposed school buildings of about 0.1 metres.
- The floodway area is confined to the Low Flow Channel and High Flow Conveyance / Flood Storage Area, with only flood storage and flood fringe areas located within the areas bounded by the 1.2 metre and 2.1 metre high perimeter fencing.
- The flood hazard vulnerability classification internal to the area that is bounded by the 2.1 metre high perimeter fencing is generally no higher than H2 (generally safe for people, but unsafe for small vehicles), with small pockets of H3 (unsafe for vehicles, children and the elderly) present in the landscaped area which is located at the eastern end of the proposal site.
- The flood hazard vulnerability classification internal to the area that is bounded by the 1.2 metre high perimeter fencing is generally no higher than H1 (generally safe for people, vehicles and buildings), with small pockets of H2 (generally safe for people, but unsafe for small vehicles) and H3 (unsafe for vehicles, children and the elderly) present along the line of the swale that is proposed immediately to the east of the basketball courts.

While the proposal in combination with the FMW would not have a significant, if any impact on Namoi River flooding for events that overtop the Town Levee, it has the potential to impact local catchment flooding in the following areas:

- The improvements in the conveyance capacity of the trunk drainage system would result in a insignificant reduction in the extent and depth of inundation experienced in existing development that is located to the north and west of the proposal for all local catchment floods up to 1% AEP in magnitude.
- The filling of the land upon which the proposed buildings would be located imposes a minor constriction on flow, which in turn would result in an increase of up to about 50 millimetres in peak 1% AEP flood levels. Whilst the impact on peak flood levels would extend beyond the proposal site, they would be confined to the adjacent road reserves of Mitchell Street and George Street (i.e. they would not extend into the Wee Waa Public School that is located to the south of Mitchell Street or existing residential development that is located to the east of George Street).

- The blocking effects of the proposed buildings and the 2.1 m high perimeter fencing would result in a maximum increase of about 35 millimetres in existing development that is located to the east as far as Cormie Avenue and south as far as Rose Street during a local catchment PMF event.[5]

6.3 Potential impacts of the proposal on scour potential

Due to the relatively flat nature of the land upon which the proposal would be located, flow velocities under operational conditions would be relatively mild. As a result, once the area has been fully landscaped, which would include the rock lining of the Low Flow Channel, there would be limited opportunity for scour to occur during a flood event.

6.4 Consistency with council and state government flood plans and policies

In accordance with the Secretary's environmental assessment requirements, a flood planning area has been defined as the extent of land that lies below the peak 1% AEP flood level plus 0.5 metres under present day conditions. The flood planning area shown on Figure 4.16 is based on Namoi River flooding external, and local catchment flooding internal to the Town Levee.

The findings of the assessment presented in Section 6.2 of this technical working paper show that the proposal would have only a minor impact on peak 1% AEP flood levels. As a result, the proposal would have no significant impact on the extent of the flood planning area and therefore the area of land to which clause 5.21 of *Narrabri LEP 2012* would apply.

The assessment also demonstrated that the proposal would not adversely impact flood behaviour in existing development that is located in the vicinity of the proposal for all local catchment floods up to 1% AEP in magnitude. To the contrary, the assessment demonstrated that the proposal in combination with the FMW would significantly reduce the extent and depth of inundation in existing development in Wee Waa which is consistent with the aims and objectives of Lyall & Associates, 2019.

The *Narrabri Shire Local Flood Plan* (NSW SES, 2015) states that the Wee Waa Public School on Cowper Street, the Church Hall on Cowper Street, the Sports Complex on the Kamilaroi Highway, the Country Women's Association Rooms in Rose Street, and the Namoi Cotton Co-Op and Cotton Grower Services on Boolcarrol Road are suitable flood evacuation centres. It is noted that the proposal would not exacerbate flooding conditions at these locations for all local catchment floods up to 1% AEP in magnitude.

Provided the flood mitigation measures set out in **Chapter 8** of this technical working paper are incorporated into the design of the proposal, then it would not increase the flood hazard in existing development for all events up to the 1% AEP event. It would also not have an adverse impact on NSW SESs emergency response arrangements.

[5] The impact shown to extend west across Charles Street into private property on **Figure 6.15** is a result of an instability in the Wee Waa TUFLOW Model and is not considered to be representative of conditions that would arise as a result of the proposal during a PMF event.

6.5 Impact of future climate change on flood behaviour

6.5.1 Impact of future climate change on flooding to the proposal

Figures 6.19 and **6.20** (two sheets each) show the impact that a 10% and 30% increase in the intensity of a 1% AEP storm event would have on flooding patterns under post-proposal and FMW conditions, respectively. As previously mentioned, the 0.5% AEP and 0.2% AEP storms have been used as proxies to assess the impact that a 10% and 30% increase in 1% AEP rainfall intensities would have on flood behaviour in the vicinity of the proposal.

The key findings of the assessment in terms of a potential 10% increase in 1% AEP rainfall intensities were as follows:

- Peak flood levels internal to the proposal site would be increased by a maximum of about 70 millimetres, with the land upon which the proposed buildings are located remaining flood free.
- The main vehicular access to the proposal site would be subject to relatively shallow inundation near the George Street road reserve.
- The reminder of the basketball courts would be inundated, while the northern portion of the athletics track would also be inundated, albeit both to a relatively shallow depth.

The key findings of the assessment in terms of a potential 30% increase in 1% AEP rainfall intensities were as follows:

- Peak flood levels internal to the proposal site would be increased by a maximum of about 120 millimetres, with the land upon which the proposed buildings are located inundated in its south-west corner.
- The main vehicular access to the proposal site, as well as the parking spaces adjacent to the indigenous learning centre would be subject to relatively shallow inundation near the George Street road reserve.
- A greater extent of the athletics track would also be inundated, albeit to a relatively shallow depth.

6.5.2 Impact of the proposal on flood behaviour under future climate change conditions

Figures 6.21 and **6.22** (two sheets each) show the impact that the proposal in combination with the FMW would have on flood behaviour should 1% AEP rainfall intensities be increased by 10% and 30%, respectively.

The assessment found that while the proposal in combination with the FMW would generally result in a reduction in peak flood levels to the north and west of the proposal site, it would result a maximum increase of about 30 millimetres in peak flood levels in Wee Waa Public School and about 70 millimetres in the vacant parcel of land that is located immediately to the north of the proposal site.

While the impacts attributable to the proposal would extend to an existing building that is located in the Wee Waa Public School, it is noted that its floor level is set about 0.5 metres above the adjacent ground level, meaning it would not be subject to above-floor inundation under these conditions.

6.6 Impact of Flood Gates Closed on Flood Behaviour

During periods when the Namoi River is in flood, Narrabri Shire Council and Namoi Cotton Alliance close the fourteen flood gates that are located around the perimeter of the Town Levee. Furthermore, if rainfall occurs coincident with the flood gates being closed, then one or more of the six stormwater evacuation pumps would be used to pump stormwater to the river side of the Town Levee.

An assessment was undertaken whereby the structure of the Wee Waa TUFLOW Model was updated to reflect conditions where the flood gates were in their closed position and all six existing stormwater evacuation pumps plus the proposed duplicate flood evacuation pump are operational.

Figure 6.23 shows the impact that the closure of the flood gates in combination with the operation of the stormwater evacuation pumps would have on flood behaviour for a 1% AEP local catchment flood event, noting that it is relative to flood behaviour under post-proposal and FMW conditions with the flood gates in their open position.

The assessment shows that peak 1% AEP flood levels would only be increased by a maximum of about 60 millimetres on the proposal site, noting that there would still be a maximum of about 440 millimetres of freeboard to the floor level of the proposed buildings which form part of the proposal.

The Wee Waa TUFLOW Model was also run for the case where the flood gates are closed and the stormwater evacuation pumps are inoperable. **Figure 6.24** shows the impact that the closure of the flood gates in the absence of the stormwater evacuation pumps would have on flood behaviour for a 1% AEP local catchment flood event, noting that it is relative to flood behaviour under post-proposal and FMW conditions with the flood gates in their open position.

The assessment shows that peak 1% AEP flood levels would only be increased by a maximum of about 160 millimetres on the proposal site, noting that there would still be a maximum of about 340 millimetres of freeboard to the floor level of the proposed buildings which form part of the proposal.

6.7 Impact of a partial blockage on flood behaviour

The potential for the trunk drainage system that controls flood flows which discharge through the proposal site was assessed based on procedures set out in ARR 2019. It was found that it would be reasonable to apply a 25% blockage factor to the inlet of the proposed twin 1350 millimetre diameter pipes in Charles Street, with zero blockage applied to the other major hydraulic structures that are located along its length.

Figure 6.25 shows that peak 1% AEP flood levels would be increased by a maximum of up to 50 millimetres on the proposal site and in residential development that is located to its north, while increases of up to 75 millimetres would be experienced in existing residential and commercial development that is located immediately to the west. It is noted that the flooding that would result from a partial blockage of the twin 1350 millimetres pipes would not be as severe as occurs under pre-proposal and FMW conditions.

An assessment was also undertaken whereby the hydraulic roughness value used to represent the blocking effects of the perimeter fence where it borders the High Flow Conveyance / Flood Storage Area, as well as the George Street road reserve of 0.2 was increased to a value of 2.0. This value was considered to be representative of conditions should the perimeter fence experience a partial blockage by floating debris.

Figure 6.26 (two sheets) shows that peak 1% AEP flood levels would be increased by a maximum of about 140 millimetres in the George Street road reserve and by a maximum of about 40 millimetres in the vacant parcel of land which lies immediately to the north of the proposal site.

In addition to the above, an assessment was undertaken whereby the section of 2.1 metre high security fence which runs along the common boundary with the George Street road reserve was assumed to become completely blocked by debris. **Figure 6.27** (two sheets) shows that while peak 1% AEP flood levels would be increased by a maximum of about 200 millimetres on the eastern (upstream) side of the fence, there is sufficient capacity within the George Street road reserve for flow which overtops the centreline of the road to flow south toward the High Flow Conveyance / Flood Storage Area.

It is noted that under both scenarios the impacts would not extend into the Wee Waa Public School or existing residential development that is located on the eastern side of George Street.

6.8 Application of ARR 2019 to design flood estimation

As mentioned, the flood models that were developed as part of Lyall & Associated, 2019 were used to assess the flood risk and impact that the proposal would have on flood behaviour at Wee Waa, noting that these models were developed based on procedures set out in ARR 1987.

As the procedures set out in ARR 2019 will be used by Narrabri Shire Council to carry out new flood studies and to update previous studies, a sensitivity study was carried out as part of the present investigation to assess the likely changes that would occur in predicted flood behaviour.

The procedures set out in ARR 2019 were applied to the Wee Waa TUFLOW Model which was then run for the 1% AEP storm event. The investigation found that there would be a reduction in the rate of runoff which would be generated by the area internal to the Town Levee, which in turn would result in a reduction in peak flood levels.

Based on the above finding, the adoption of the procedures set out in ARR 1987 represents a worse-case scenario in terms of assessing flood behaviour in the vicinity of the proposal.

7 ASSESSMENT OF CUMULATIVE IMPACTS

While there are no other proposed projects that are of a scale that would influence flood behaviour in the vicinity of the proposal, Lyall & Associates, 2019 contains a recommendation to raise the crest height of the Town Levee, thereby further reducing the impact that Namoi River flooding has on the township of Wee Waa, which would include the proposal.

8 MANAGEMENT OF IMPACTS

The environmental management measures that would be implemented to minimise flooding and drainage related impacts of the proposal during construction and operation are presented in **Table 8.1** over the page.

Table 8.1
Summary of environmental management measures

Impact	Environmental management measure
Flood impacts to construction site	It is recommended that a *"Construction Soil and Water Management Plan"* (or similar) be developed as part of a *Construction Environmental Management Plan* for the proposal. The former document would set out the measures that are to be implemented to manage erosion and sediment, as well as stormwater runoff during the construction of the proposal, while the latter would identify the existing flood risk on the proposal site and include measures that are aimed at mitigating the impact that flooding would otherwise have on site personnel, equipment and work areas.
	While flooding of the proposal site is generally of a low hazard nature, it will be important to locate site sheds in areas that lie above an elevation of RL 191.0 m AHD. Access off George Street will also be raised in order to prevent the frequent and potentially prolonged inundation of the access road into the proposal site. As this will require the filling of a portion of the proposal site, it is recommended that construction activities commence in its north-eastern corner, as this corresponds with the location of the proposed main vehicular entrance.
	If not already incorporated in the construction of the FMW, it is recommended that temporary earth bunding be provided along the northern and eastern sides of the High Flow Conveyance / Flood Storage Area, as well as along the eastern side of the proposed fill platform upon which the school buildings would be constructed, as this will reduce the frequency floodwater impacts the remainder of the proposal site, and hence reduce the impact that flooding has on construction activities.
	Spoil stockpiles will be located in areas which are not subject to frequent inundation by floodwater, ideally outside the 5% AEP flood extent. The exact level of flood risk accepted at stockpile sites will depend on the duration of stockpiling operations and the type of material stored.
Impact of flooding on the proposal	Minimum habitable floor levels to be set no lower than RL 191.5 metres AHD, noting that this would provide 0.5 metres freeboard to the peak 1% AEP local catchment flood level.
	The underside of Pedestrian Footbridge No. 1 and Pedestrian Footbridge No. 2 to be set no lower than RL 191.0 metres AHD (i.e. no lower than the peak 1% AEP local catchment flood level.
	The northern abutments of Pedestrian Footbridge No. 1 and Pedestrian Footbridge No. 2 are to be set no further south than 4 metres off the southern face of the proposed buildings, while the southern abutments are to be set as close as practical to the road reserve boundary
	Flood emergency management measures for construction and operation of the proposal will be incorporated into relevant environmental and/or safety management documentation.
Impact of the proposal on flood behaviour	Materials and heavy machinery should not be stored on George Street where it borders the proposal site as during very intense storm events there is the potential for floodwater to surcharge the road, with any obstruction of this flow potentially exacerbating flooding conditions in existing residential development that is located on its eastern (upstream) side.
	Impact of the proposal on flood behaviour during construction and operation will be confirmed during further proposal development. This will include the consideration of future climate change and a partial blockage of the local stormwater drainage system. If appropriate, additional feasible and reasonable management measures will be identified and implemented.

9 REFERENCES

AIDR (Australian Institute for Disaster Resilience), 2017. *"Managing the Floodplain: A Guide ti best practice in Flood Risk Management in Australia"*

DECC (Department of Environment and Climate Change), 2007. "*Floodplain Risk Management Guideline – Practical Considerations of Climate Change"*

DIPNR (Department of Infrastructure, Planning and Natural Resources), 2005. "*Floodplain Development Manual"*

DoP (Department of Planning), 2010b. "*Coastal Risk Management Guideline – Incorporating Sea Level Rise Benchmarks in Coastal Risk Assessments*"

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IEAust (The Institution of Engineers, Australia), 1987. *"Australian Rainfall and Runoff – A Guide to Flood Estimation"*, Volumes 1 and 2.

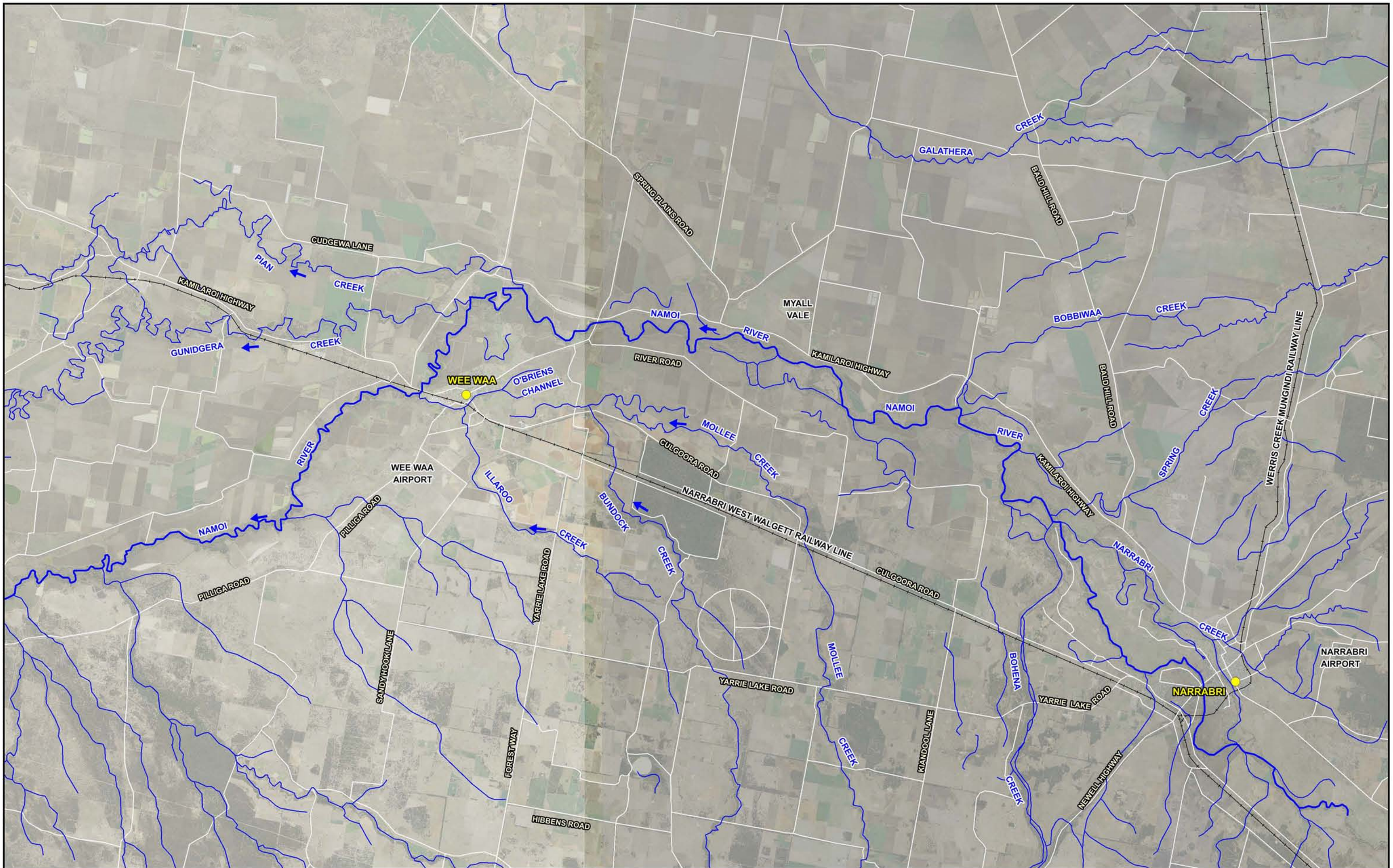
Lyall & Associates, 2019. *"Wee Waa Levee Risk Management Study and Plan"*

NSW Government, *Flood Prone Land Policy.*

NSW Government. *Section 117(2) Local Planning Direction 4.3 Flood Prone Land.*

NSW SES (NSW State Emergency Service), 2015. *"Narrabri Shire Local Flood Plan"*

FIGURES



N

1.5 0 1.5 3.0 4.5 km

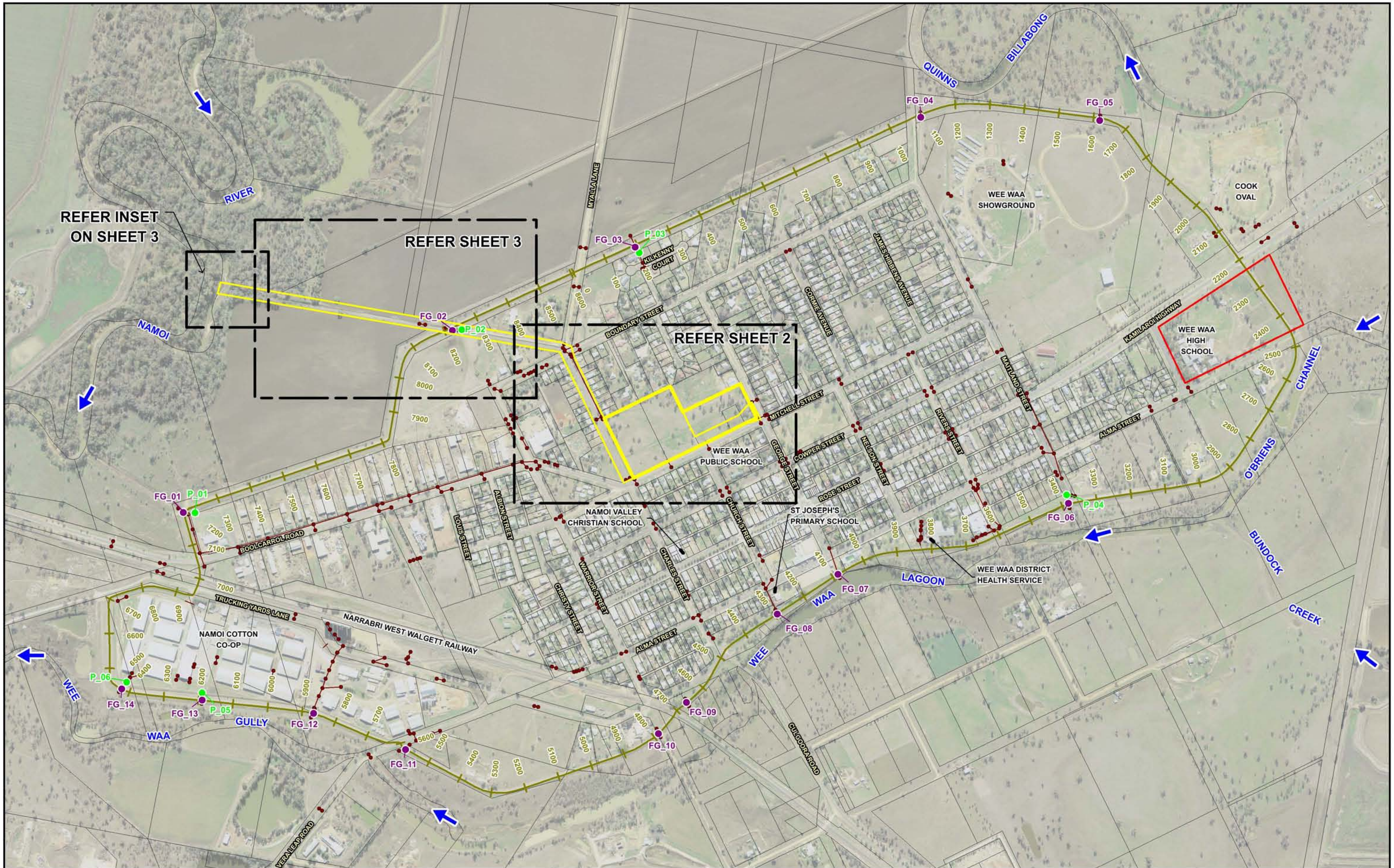
Scale: 1:150,000

Lyall & Associates

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 1.1

LOCATION PLAN


REFER INSET ON SHEET 3
REFER SHEET 3
REFER SHEET 2
NAMOI RIVER
QUINNS BILLABONG
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP
NARRABRI WEST WALGETT RAILWAY
TRUCKING YARDS LANE
BOOLCARROL ROAD
KAMILAROI HIGHWAY
O'BRIENS CHANNEL
BUNDOCK CREEK
WEE WAA LAGOON
WEE WAA GULLY
MYALLA LANE
CULGOORA ROAD
KILKENNY COURT
BOUNDARY STREET
MITCHELL STREET
ALMA STREET
CHARLES STREET
CHURCH STREET
GEORGE STREET
ROSE STREET
COWPER STREET
NELSON STREET
RIVERS STREET
MAITLAND STREET
CORMIE AVENUE
JAMES HIBBENS AVENUE
LOUIS STREET
ALBION STREET
CHRISTY STREET
WARRIOR STREET
FG_01 FG_02 FG_03 FG_04 FG_05 FG_06 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 FG_14
P_01 P_02 P_03 P_04 P_05 P_06

N

100 0 100 200 300 m

Scale: 1:10,000

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LEGEND

- Existing Levee Centre Line and Chainage
- Existing Drainage System
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Extent of FMW

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 1.2
(Sheet 1 of 3)

KEY FEATURES OF THE PROPOSAL AND FMW

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposed Grassed Catch Drain / Swale
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 1.2
(Sheet 2 of 3)

KEY FEATURES OF THE PROPOSAL AND FMW

INSET

RIVER

NAMOI

JOINS MAIN WINDOW

JOINS INSET

NEW 2 OFF 1500 RCPs

NEW 2 OFF 1500 RCPs
FITTED WITH PENSTOCK GATES

FG_02

P_02

P_02A

8400

8300

8200

8100

8000

JOINS SHEET 2

KEY FEATURES

- Downstream Channel Works
- Scour Protection Works

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

LEGEND

- 1000 1100 — Existing Levee Centre Line and Chainage
- FG_02 — Existing Flood Gate Location and Identifier
- P_02 — Existing Pump Location and Identifier
- P_02A — Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 1.2
(Sheet 3 of 3)

KEY FEATURES OF THE PROPOSAL AND FMW

JOINS SHEET 3

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

NEW 2 OFF 1350 RCPs

MAIN VEHICLE ACCESSWAY

MAIN PEDESTRIAN ACCESS

INDIGENOUS LEARNING CENTRE

ENVIRO. CENTRE

SCIENCE / TAS

ART / LIBRARY

CANTEEN

STAFF / ADMIN

GLS / HOSP. PEAT. / ILS

PEDESTRIAN FOOTBRIDGE No. 1

PEDESTRIAN FOOTBRIDGE No. 2

WEE WAA PUBLIC SCHOOL

VEHICLE ACCESSWAY

NEW 2 OFF 2700 x 1200 RCBCs

KAMILARIO HIGHWAY

CHARLES STREET

MITCHELL STREET

CHURCH STREET

COWPER STREET

A

B

C

D

E

Depth of Cut/ Fill (m)

- < -1.0
- -1.00 to -0.80
- -0.80 to -0.60
- -0.60 to -0.40
- -0.40 to -0.30
- -0.30 to -0.20
- -0.20 to -0.10
- -0.10 to 0.10
- 0.10 to 0.20
- 0.20 to 0.40
- 0.40 to 0.60
- > 0.60

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint
- Cross Section and Identifier

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 1.3
(Sheet 1 of 2)

PROPOSED CUT/FILL STRATEGY

INSET

NAMOI RIVER

JOINS MAIN WINDOW

JOINS INSET

H

H

G

G

NEW 2 OFF 1500 RCPs

NEW 2 OFF 1500 RCPs
FITTED WITH PENSTOCK GATES

FG_02

P_02

P_02A

8400

8300

8200

8100

8000

F

F

JOINS SHEET 1

Depth of Cut/ Fill (m)

- < -1.0
- -1.00 to -0.80
- -0.80 to -0.60
- -0.60 to -0.40
- -0.40 to -0.30
- -0.30 to -0.20
- -0.20 to -0.10
- -0.10 to 0.10
- 0.10 to 0.20
- 0.20 to 0.40
- 0.40 to 0.60
- > 0.60

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

LEGEND

1000 1100 Existing Levee Centre Line and Chainage

Existing Drainage System

Proposed Drainage System

H H Cross Section and Identifier

FG_02 Existing Flood Gate Location and Identifier

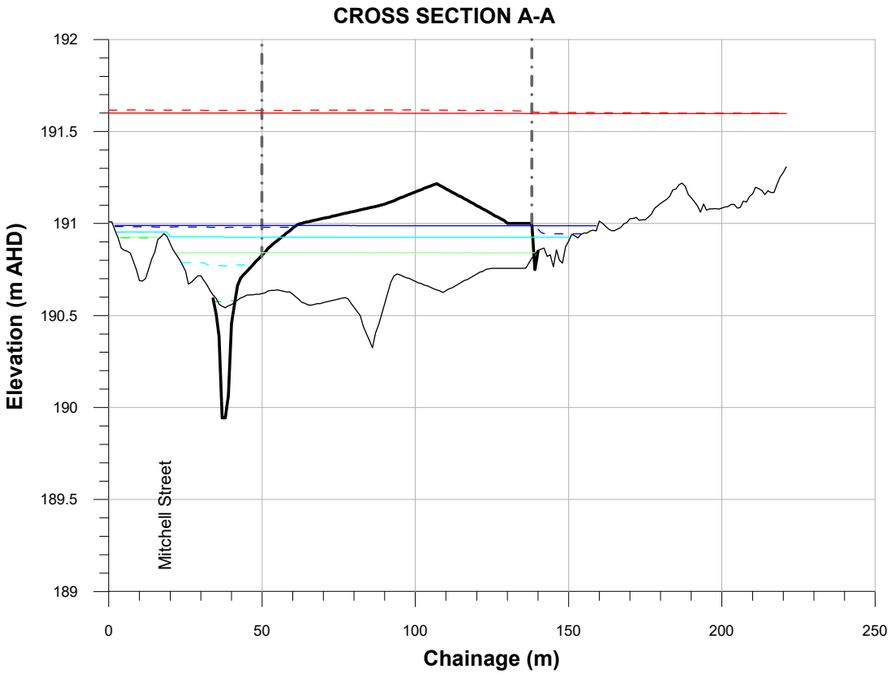
P_02 Existing Pump Location and Identifier

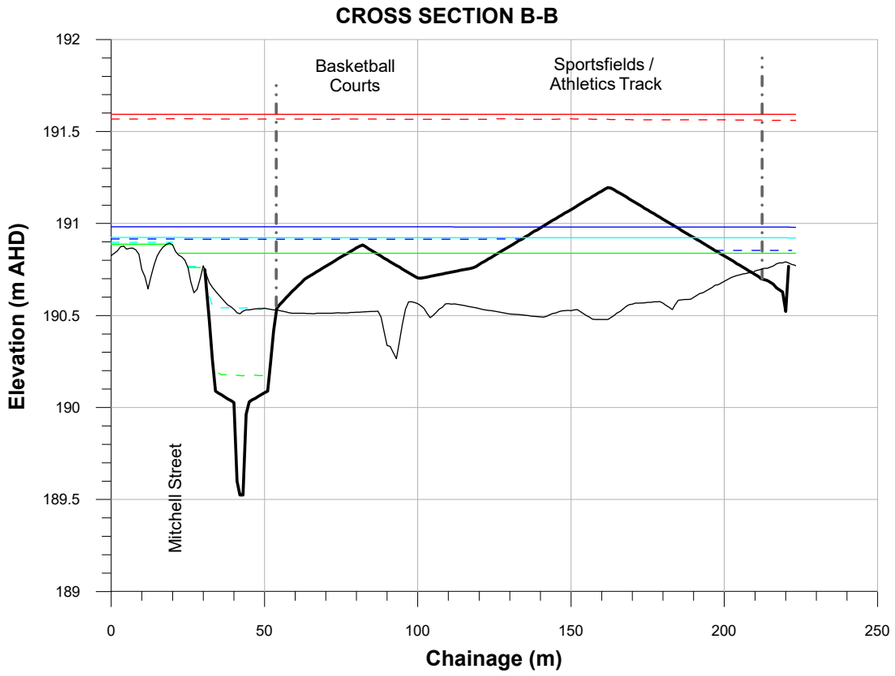
P_02A Proposed Duplicate Pump Location and Identifier

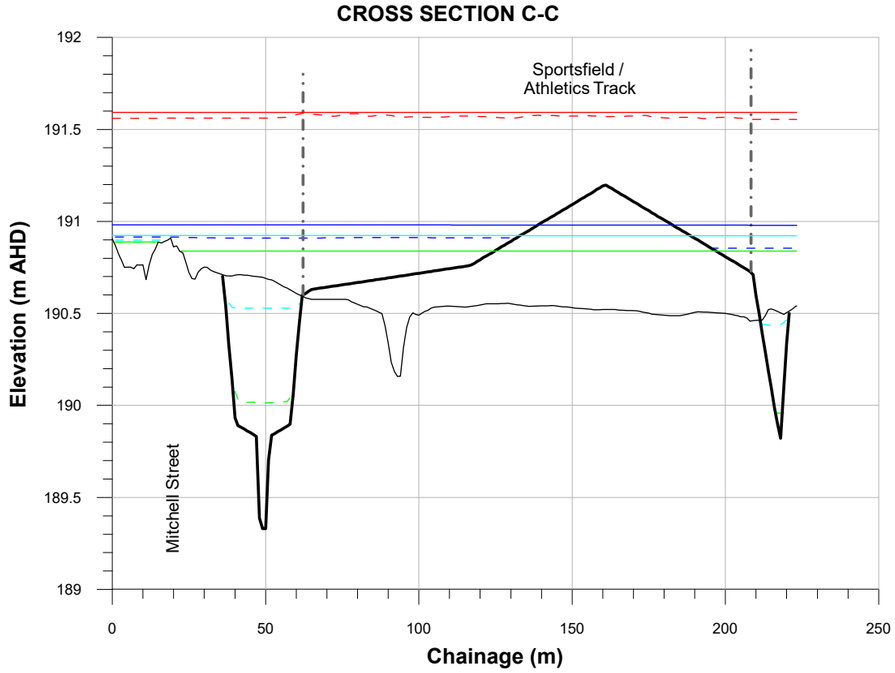
WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 1.3
(Sheet 2 of 2)

PROPOSED CUT/FILL STRATEGY







LEGEND

	Pre-Proposal and FMW Conditions	Post-Proposal and FMW Conditions
		PMF
		1% AEP
		5% AEP
		20% AEP

Alignment of Proposed Perimeter Fence
Finished Surface
Existing Surface

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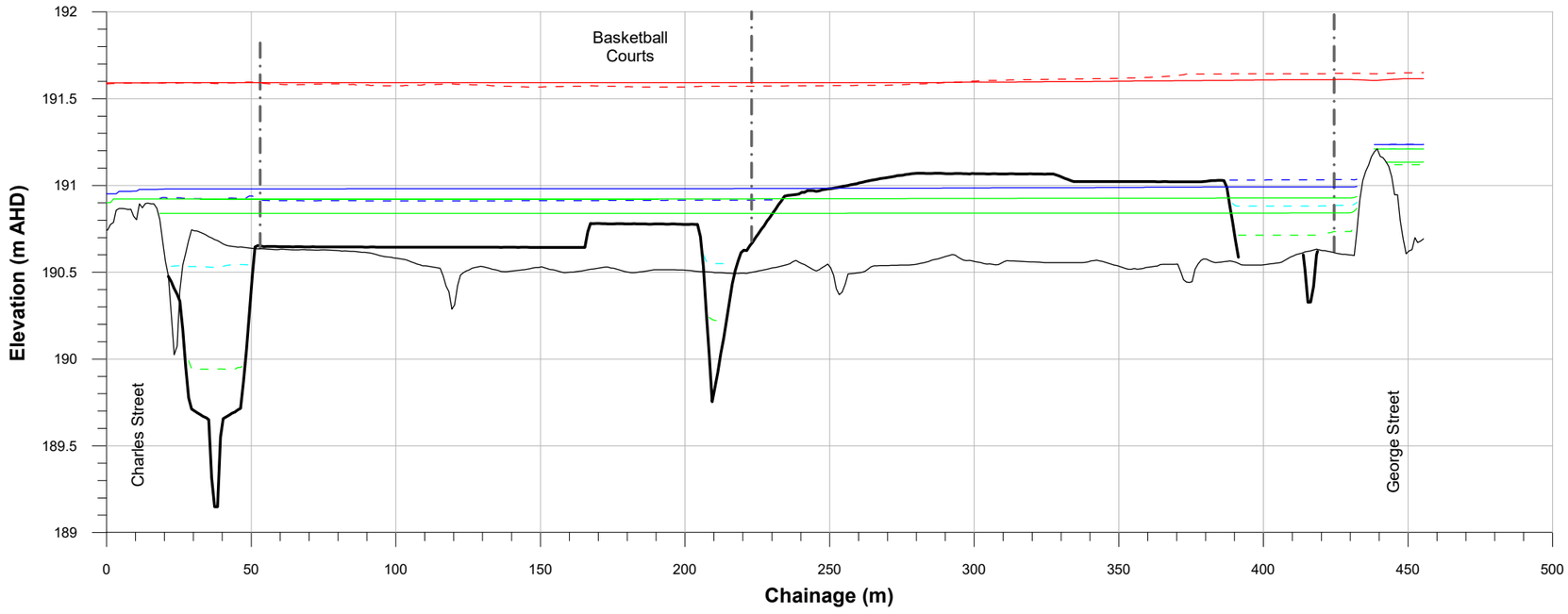
WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

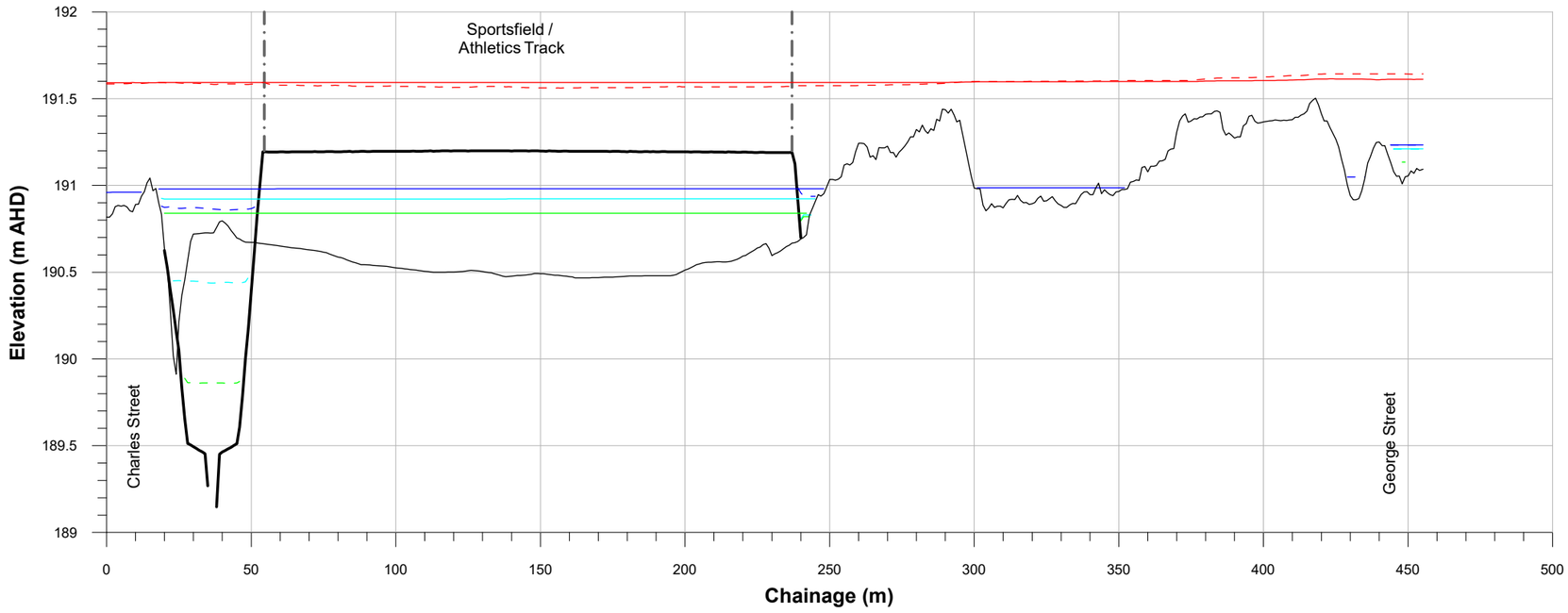
Figure 1.4
(Sheet 1 of 3)

CROSS SECTIONS SHOWING EXISTING AND FINISHED SURFACE LEVELS IN VICINITY OF THE PROPOSAL AND FMW

CROSS SECTION D-D



CROSS SECTION E-E



LEGEND

	Pre-Proposal and FMW Conditions	Post-Proposal and FMW Conditions
Alignment of Proposed Perimeter Fence		
Finished Surface		
Existing Surface		
		PMF
		1% AEP
		5% AEP
		20% AEP

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 1.4
(Sheet 2 of 3)

CROSS SECTIONS SHOWING EXISTING AND FINISHED SURFACE LEVELS IN VICINITY OF THE PROPOSAL AND FMW

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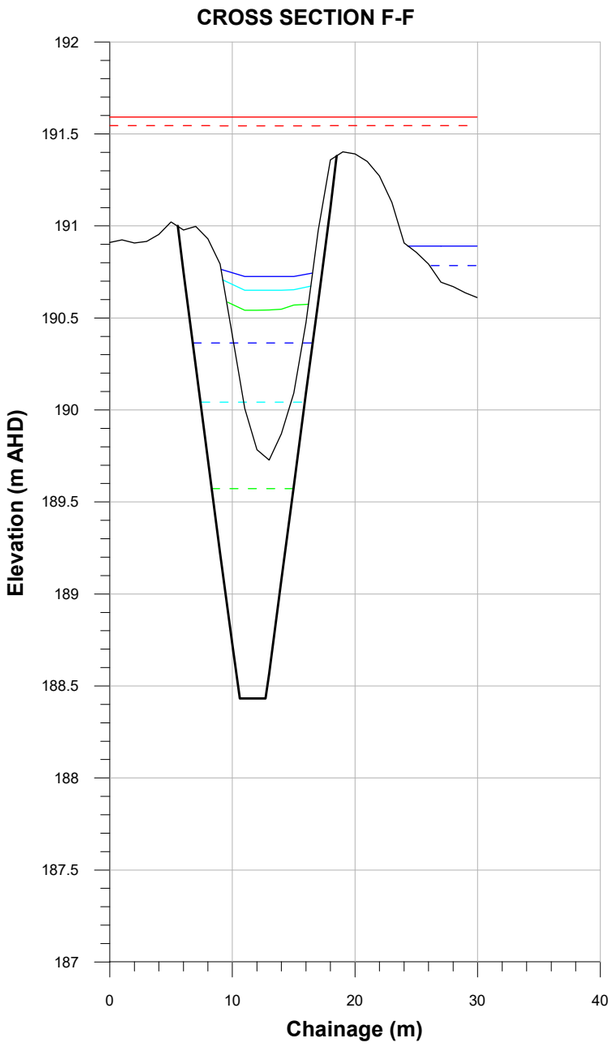

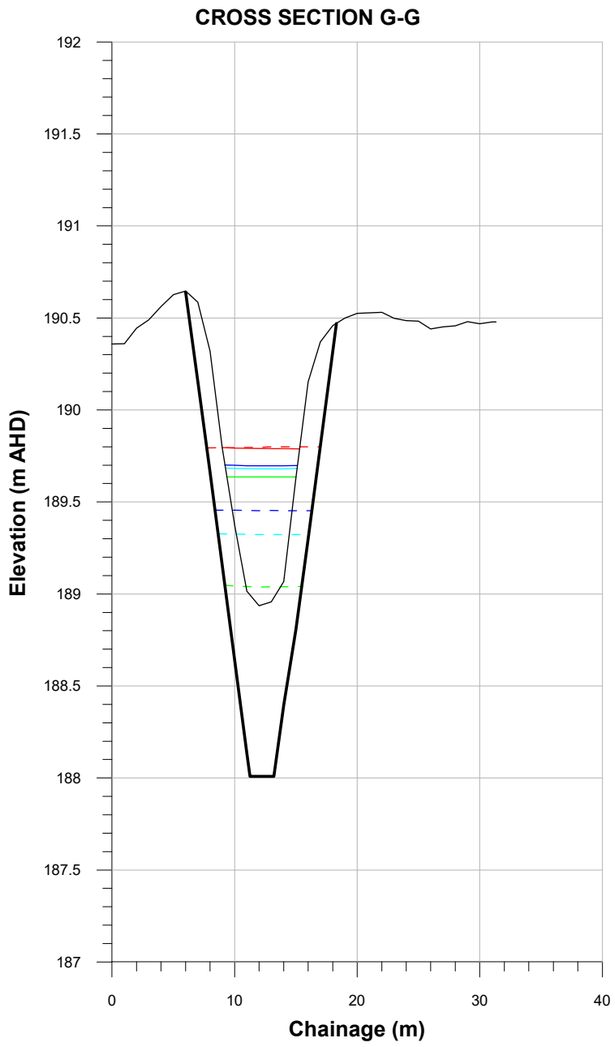

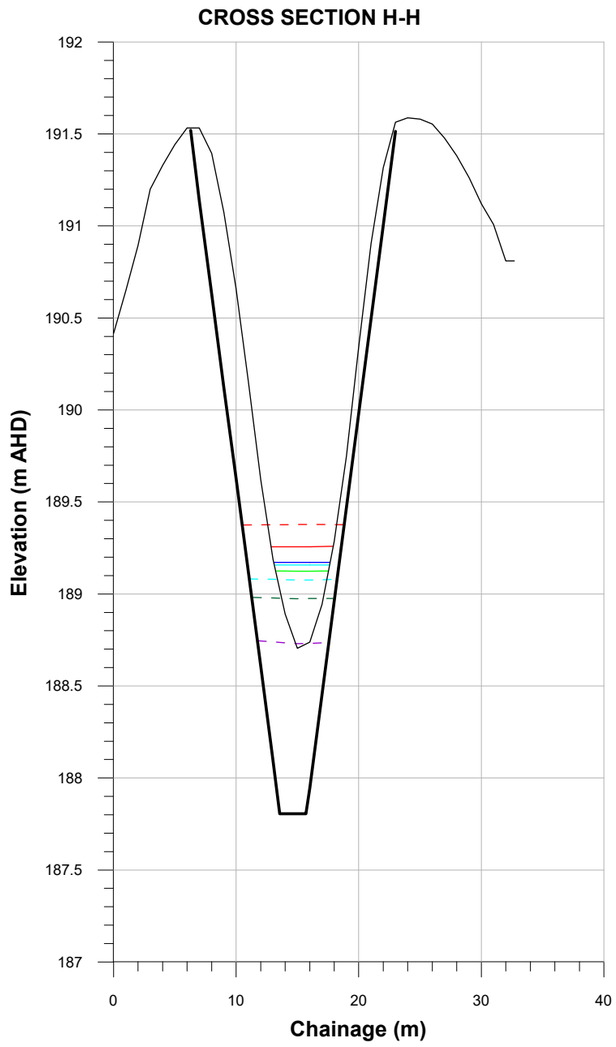

LEGEND

	Pre-Proposal and FMW Conditions	Post-Proposal and FMW Conditions
Finished Surface		PMF
Existing Surface		1% AEP
		5% AEP
		20% AEP

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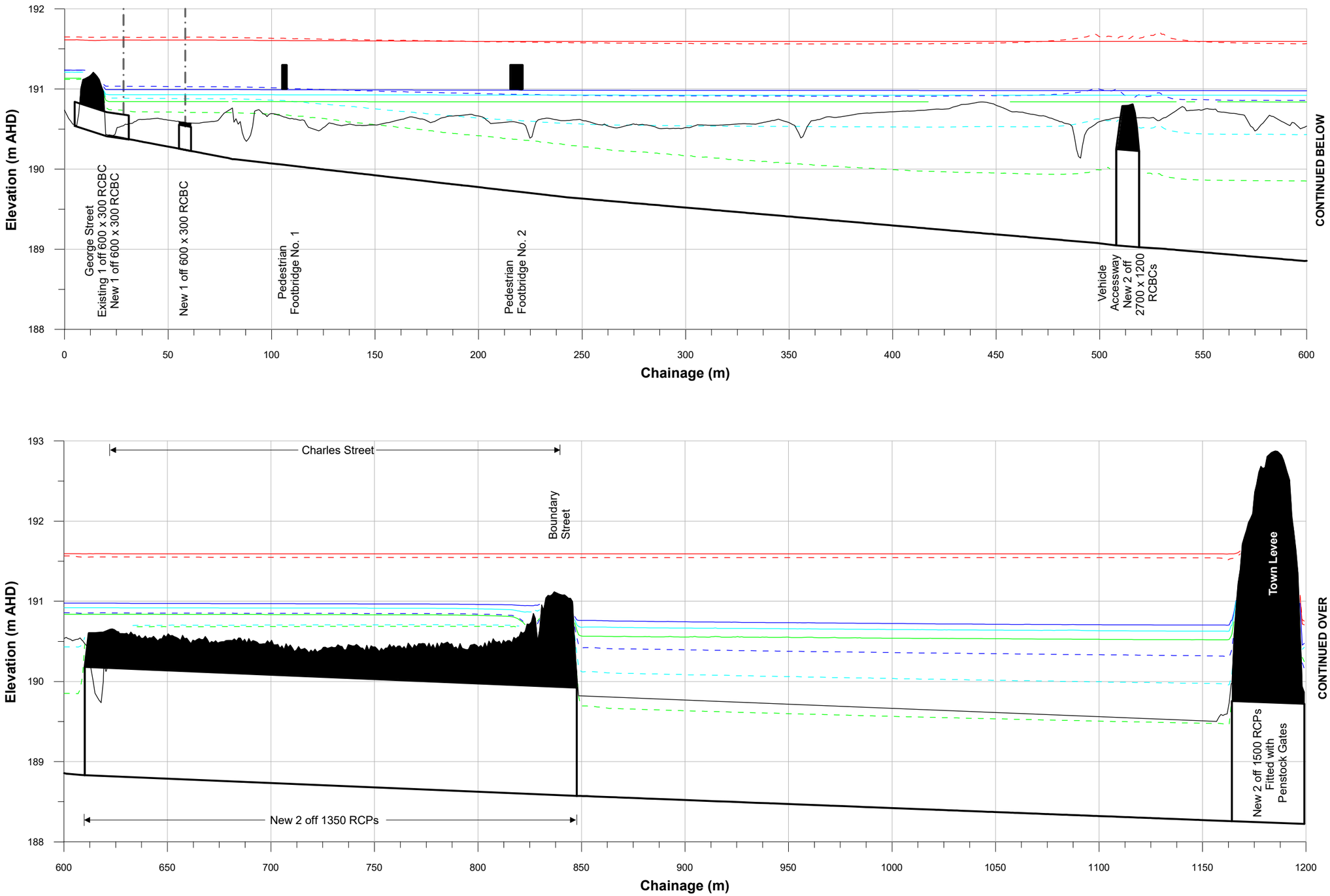
WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 1.4
(Sheet 3 of 3)

CROSS SECTIONS SHOWING EXISTING AND FINISHED SURFACE LEVELS IN VICINITY OF THE PROPOSAL AND FMW



LEGEND

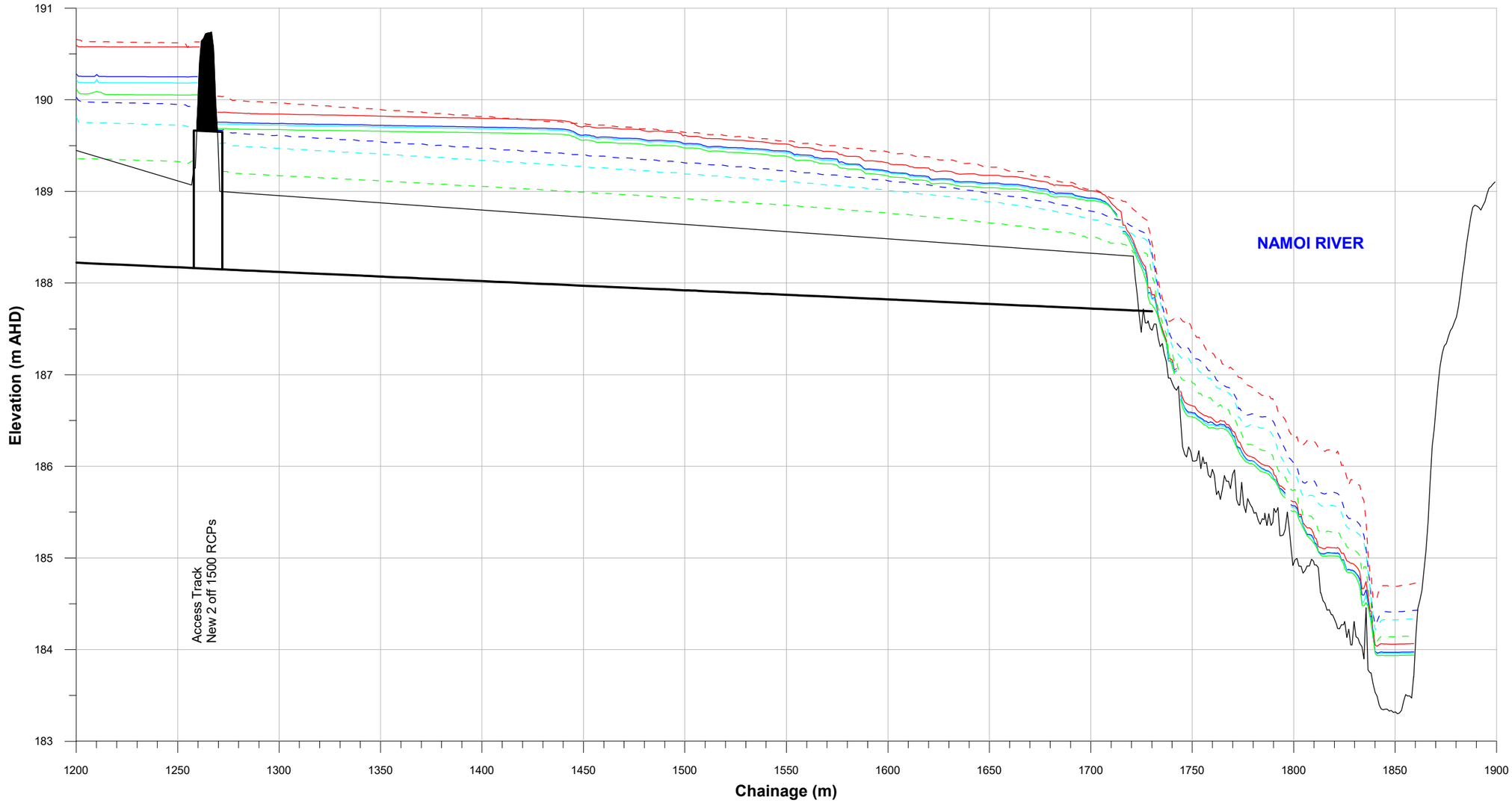
	Pre-Proposal and FMW Conditions	Post-Proposal and FMW Conditions
Alignment of Proposed Perimeter Fences		
Finished Surface		PMF
Existing Surface		1% AEP
		5% AEP
		20% AEP

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 1.5
(Sheet 1 of 2)

LONGITUDINAL SECTION ALONG LINE OF ENGINEERED CHANNEL
GEORGE STREET TO NAMOI RIVER

Lyall & Associates



LEGEND

	Pre-Proposal and FMW Conditions	Post-Proposal and FMW Conditions
Finished Surface		PMF
Existing Surface		1% AEP
		5% AEP
		20% AEP

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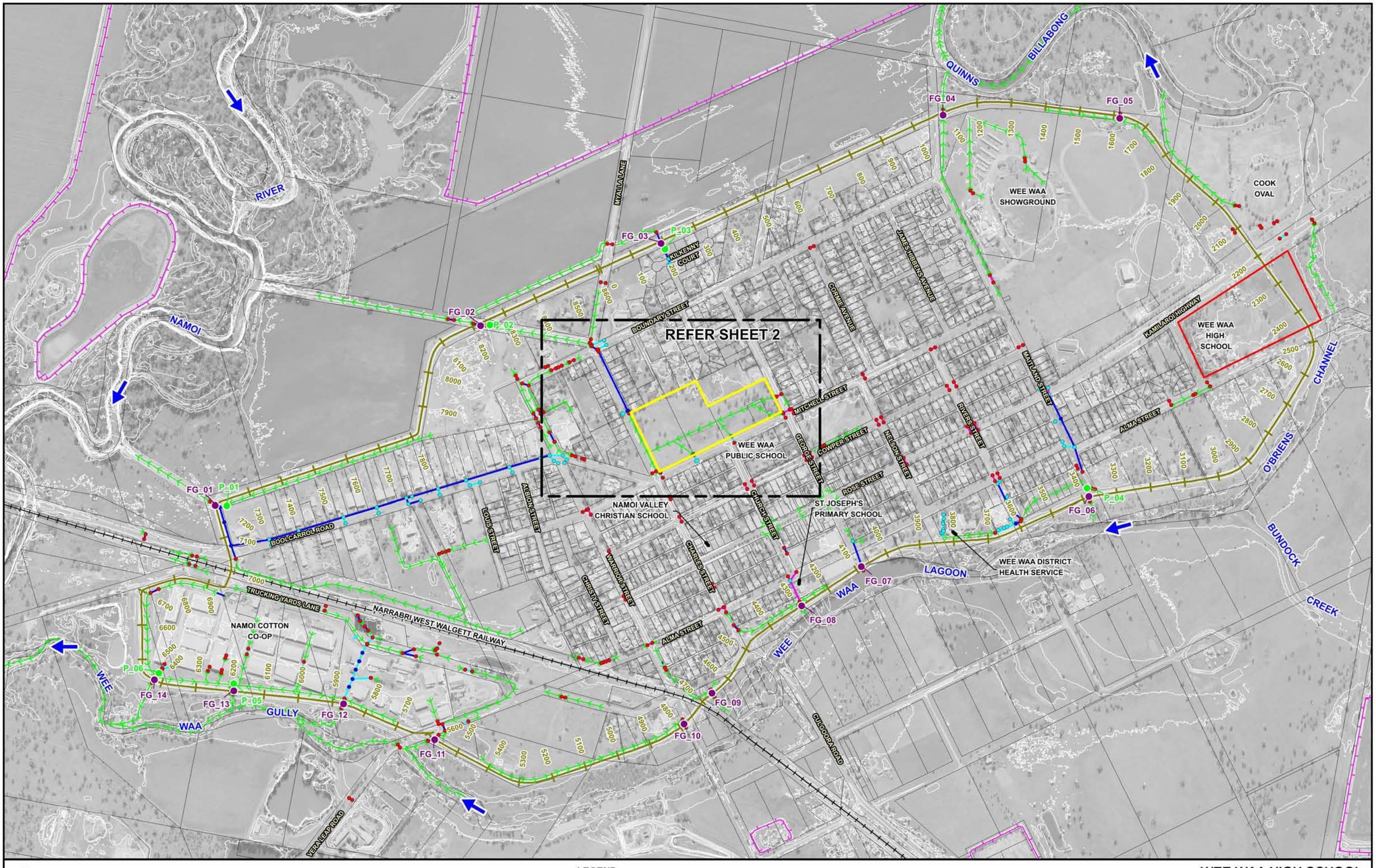
TECHNICAL WORKING PAPER: FLOODING

Figure 1.5
(Sheet 2 of 2)

LONGITUDINAL SECTION ALONG LINE OF ENGINEERED CHANNEL
GEORGE STREE TO NAMOI RIVER



N

100 0 100 200 300 m

Scale: 1:10,000

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LEGEND

- Town Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- Flood Gate Location and Identifier
- Pump Location and Identifier
- Junction Pit
- Inlet Pit
- Headwall
- Box Culvert
- Pipe (Diameter < 450 mm)
- Pipe (Diameter ≥ 450 mm)
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Existing Channel

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.1
(Sheet 1 of 2)

LAYOUT OF EXISTING LEVEE AND STORMWATER DRAINAGE SYSTEM

BOUNDARY STREET
TUCKEY CRESCENT
GEORGE STREET
CHARLES STREET
KAMILARIO HIGHWAY
WARRIOR ST
MITCHELL STREET
CHURCH STREET
COWPER STREET
WEE WAA
PUBLIC SCHOOL

N
20 0 20 40 60 m
Scale: 1:2,000

Lyall & Associates

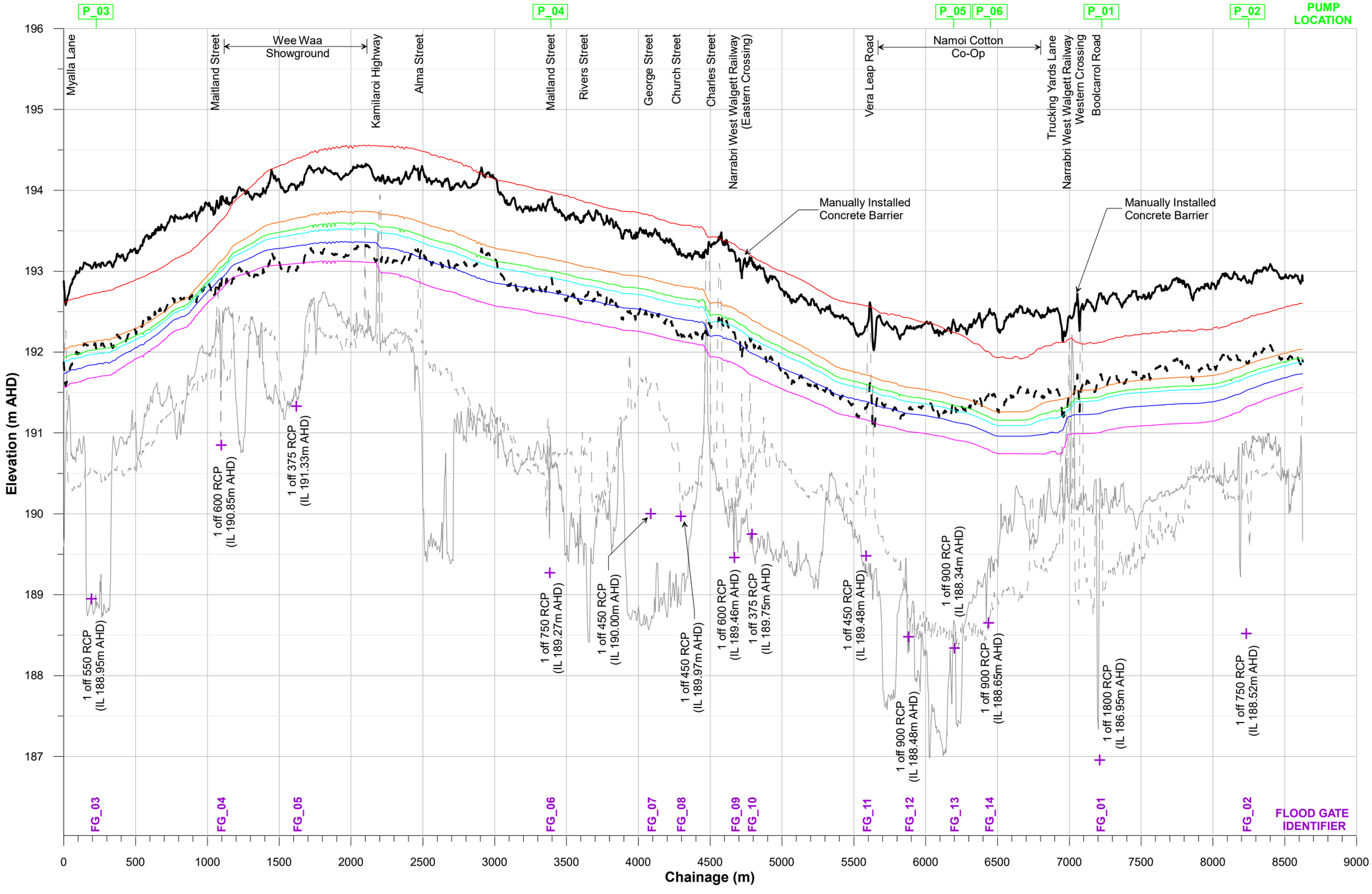
LEGEND

- Junction Pit
- Inlet Pit
- Headwall
- 1 off 330 RCP
- 1 off 375 RCP
- 2 off 375 RCPs
- 1 off 450 RCP
- 3 off 450 RCPs
- 2 off 600 RCPs
- 2 off 750 RCPs
- 1 off 300 x 225 RCBC
- 1 off 450 x 225 RCBC
- 1 off 500 x 225 RCBC
- 1 off 600 x 250 RCBC
- 1 off 900 x 300 RCBC
- Existing Channel
- Proposal Site Boundary
- 1 off 900 x 600 RCBC
- 2 off 330 RCPs

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.1
(Sheet 2 of 2)

LAYOUT OF EXISTING LEVEE AND STORMWATER DRAINAGE SYSTEM



WATER SURFACE PROFILES

- Extreme Flood
- 0.2% AEP
- 0.5% AEP
- 1% AEP
- 2% AEP
- 5% AEP

GROUND PROFILES

- Crest of Existing Town Levee
- Imminent Failure Flood Level
- Toe of Levee (River Side)
- Toe of Levee (Town Side)
- Invert of Pipe

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WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.2

LONGITUDINAL SECTION ALONG CREST OF EXISTING TOWN LEVEE

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- 1.00 to 1.20
- 1.20 to 1.40
- 1.40 to 1.60
- 1.60 to 1.80
- 1.80 to 2.00
- > 2.00

PIAN CREEK
GUNIDGERA CREEK
NAMOI RIVER AT GLENCOE (GS419900)
NAMOI RIVER
RIVER ROAD
KAMILAROI HIGHWAY
NARRABRI WEST-WALGETT RAILWAY
REFER SHEET 2
O'BRIENS CHANNEL
WEE WAA LAGOON
WEE WAA GULLY
BILLABONG
QUINNS
GOLF CLUB ROAD
MYALL LANE
COTTON LANE
CUDGEWA LANE
TULLADUNNA LANE
CARDENS ROAD
LEAP ROAD
OLD PILLIGA ROAD
PILLIGA ROAD
VERA
ILLAROO CREEK
SANDY HOOK LANE
BUNDOCK CREEK
CULGOORA ROAD
CARPENDORE CREEK
MOLLEE CREEK
NICHOLSON'S AIRPORT
THE PINES
YARRIE LAKE ROAD
LYNCHS LANE

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 20m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

600 0 600 1200 1800 m

Scale: 1:60,000

Lyall & Associates

LEGEND

- Two-Dimensional Model Boundary
- Water Surface Elevation Contours (m AHD)
- WaterNSW Stream Gauge
- Existing Town Levee Centre Line
- Existing Rural Levees on Namoi River Floodplain
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.3
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION EXTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 5% AEP

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- 1.00 to 1.20
- 1.20 to 1.40
- 1.40 to 1.60
- 1.60 to 2.00
- > 2.00

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 20m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

LEGEND

- Existing Town Levee Centre Line and Chainage
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Modelled Stormwater Network
- Water Surface Elevation Contours (m AHD)
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.3
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION EXTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 5% AEP

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- 1.00 to 1.20
- 1.20 to 1.40
- 1.40 to 1.60
- 1.60 to 2.00
- > 2.00

PIAN CREEK
GUNIDGERA CREEK
CUDGEWA LANE
COTTON LANE
TULLADUNNA LANE
NAMOI RIVER AT GLENCOE (GS419900)
NAMOI RIVER
RIVER ROAD
KAMILAROI HIGHWAY
NARRABRI WEST-WALGETT RAILWAY
MYALLA LANE
QUINNS
BILLABONG
GOLF CLUB ROAD
O'BRIENS CHANNEL
REFER SHEET 2
WEE WAA GULLY
WEE WAA LAGOON
BUNDOCK CREEK
CARPENDORE CREEK
MOLLEE CREEK
BUNDOCK CREEK
CULGOORA ROAD
GARDENS ROAD
LEAP ROAD
OLD PILLIGA ROAD
VERA
ILLAROO CREEK
PILLIGA ROAD
SANDY HOOK LANE
NICHOLSON'S AIRPORT
THE PINES
YARRIE LAKE ROAD
LYNCHS LANE

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 20m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

600 0 600 1200 1800 m

Scale: 1:60,000

Lyall & Associates

LEGEND

- Two-Dimensional Model Boundary
- Water Surface Elevation Contours (m AHD)
- WaterNSW Stream Gauge
- Existing Town Levee Centre Line
- Existing Rural Levees on Namoi River Floodplain
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.4
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION EXTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- 1.00 to 1.20
- 1.20 to 1.40
- 1.40 to 1.60
- 1.60 to 2.00
- > 2.00

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 20m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Town Levee Centre Line and Chainage
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Modelled Stormwater Network
- Water Surface Elevation Contours (m AHD)
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.4
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION EXTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- 1.00 to 1.20
- 1.20 to 1.40
- 1.40 to 1.60
- 1.60 to 1.80
- 1.80 to 2.00
- > 2.00

PIAN CREEK
GUNIDGERA CREEK
NAMOI RIVER AT GLENCOE (GS419900)
NAMOI RIVER
RIVER ROAD
KAMILAROI HIGHWAY
NARRABRI WEST-WALGETT RAILWAY
GARDENS ROAD
REFER SHEET 2
O'BRIENS CHANNEL
WEE WAA LAGOON
WEE WAA GULLY
BUNDOCK CREEK
CARPENDORE CREEK
MOLLEE CREEK
CULGOORA ROAD
OLD PILLIGA ROAD
ILLAROO CREEK
NICHOLSON'S AIRPORT
THE PINES
YARRIE LAKE ROAD
PILLIGA ROAD
SANDY HOOK LANE
LYNCHS LANE
LEAP ROAD
VERA
COTTON LANE
GUDGEWA LANE
TULLADUNNA LANE
GOLF CLUB ROAD
MALLA LANE
QUINNS
BILLABONG

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 20m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N
600 0 600 1200 1800 m
Scale: 1:60,000

LEGEND

- Two-Dimensional Model Boundary
- Water Surface Elevation Contours (m AHD)
- WaterNSW Stream Gauge
- Existing Town Levee Centre Line
- Existing Rural Levees on Namoi River Floodplain
- Existing WWHS Site Boundary
- Proposal Site Boundary

Lyall & Associates

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.5
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION EXTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - EXTREME FLOOD

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- 1.00 to 1.20
- 1.20 to 1.40
- 1.40 to 1.60
- 1.60 to 2.00
- > 2.00

RIVER
NAMOI
QUINNS
BILLABONG
MYALLA LANE
FG_04
FG_05
P_03
FG_03
KILKENNY COURT
P_02
FG_02
BOUNDARY STREET
JAMES HIBBENS AVENUE
CORMIE AVENUE
WEE WAA SHOWGROUND
COOK OVAL
KAMILAROI HIGHWAY
WEE WAA HIGH SCHOOL
MAITLAND STREET
CHANNEL
MITCHELL STREET
RIVER STREET
ALMA STREET
WEE WAA PUBLIC SCHOOL
GEORGE STREET
COWPER STREET
NELSON STREET
ROSE STREET
CHURCH STREET
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
O'BRIENS
P_04
FG_06
FG_07
LAGOON
BUNDOCK
CREEK
WAA
WEE
FG_08
FG_09
FG_10
CULGOORA ROAD
FG_11
FG_12
P_05
FG_13
P_06
FG_14
GULLY
NAMOI COTTON CO-OP
NARRABRI WEST WALGETT RAILWAY
TRUCKING YARDS LANE
BOOLCARROL ROAD
FG_01
P_01
ALBION STREET
LOUIS STREET
WARRIOR STREET
CHRISTY STREET
CHARLES STREET
VERALEAP ROAD

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 20m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Town Levee Centre Line and Chainage
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Modelled Stormwater Network
- Water Surface Elevation Contours (m AHD)
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.5
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION EXTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - EXTREME FLOOD

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40
- 0.40 to 0.50
- 0.50 to 0.60
- 0.60 to 0.70
- 0.70 to 0.80
- 0.80 to 0.90
- 0.90 to 1.00
- > 1.00

REFER SHEET 2

RIVER
NAMOI
WEE WAA GULLY
WEE WAA LAGOON
BILLABONG
QUINNS
BUNDOCK CREEK
O'BRIENS CHANNEL
MYALLA LANE
BOUNDARY STREET
KILKENNY COURT
CORMIE AVENUE
JAMES HIBBENS AVENUE
MITCHELL STREET
GEORGE STREET
COWPER STREET
NELSON STREET
RIVER STREET
MAITLAND STREET
ALMA STREET
KAMILAROI HIGHWAY
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
CUTGOODA ROAD
VERALEA ROAD

WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

FG_01 FG_02 FG_03 FG_04 FG_05 FG_06 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 FG_14
P_01 P_02 P_03 P_04 P_05 P_06

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.6
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 20% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

WEE WAA
PUBLIC SCHOOL

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40
- 0.40 to 0.50
- 0.50 to 0.60
- 0.60 to 0.70
- 0.70 to 0.80
- 0.80 to 0.90
- 0.90 to 1.00
- > 1.00

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

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LEGEND

- Modelled Stormwater Network
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.6
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 20% AEP

Maximum Velocity (m/s)

- < 0.05
- 0.05 to 0.10
- 0.10 to 0.15
- 0.15 to 0.20
- 0.20 to 0.25
- 0.25 to 0.30
- 0.30 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- > 1.00

RIVER
NAMOI
QUINNS
BILLABONG
MYALLA LANE
FG_04
FG_05
FG_03
P_03
KILKENNY COURT
FG_02
P_02
BOUNDARY STREET
REFER SHEET 2
CORMIE AVENUE
JAMES HIBBENS AVENUE
WEE WAA SHOWGROUND
COOK OVAL
KAMILAROI HIGHWAY
WEE WAA HIGH SCHOOL
MAITLAND STREET
MITCHELL STREET
RIVER STREET
ALMA STREET
CHANNEL
O'BRIENS
WEE WAA PUBLIC SCHOOL
COWPER STREET
GEORGE STREET
NELSON STREET
ROSE STREET
CHURCH STREET
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
FG_01
P_01
BOOLCARROL ROAD
ALBION STREET
LOUIS STREET
WARRIOR STREET
CHRISTY STREET
CHARLES STREET
FG_06
P_04
BUNDOCK
WEE WAA DISTRICT HEALTH SERVICE
LAGOON
FG_07
WAA
CREEK
FG_08
WEE
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
NAMOI COTTON CO-OP
FG_14
P_06
FG_13
P_05
GULLY
FG_12
FG_09
FG_10
FG_11
GUILGOORA ROAD
VERALEA ROAD

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

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N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.7
(Sheet 1 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 20% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

WEE WAA
PUBLIC SCHOOL

Maximum Velocity (m/s)

< 0.05
0.05 to 0.10
0.10 to 0.15
0.15 to 0.20
0.20 to 0.25
0.25 to 0.30
0.30 to 0.40
0.40 to 0.60
0.60 to 0.80
0.80 to 1.00
> 1.00

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

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LEGEND

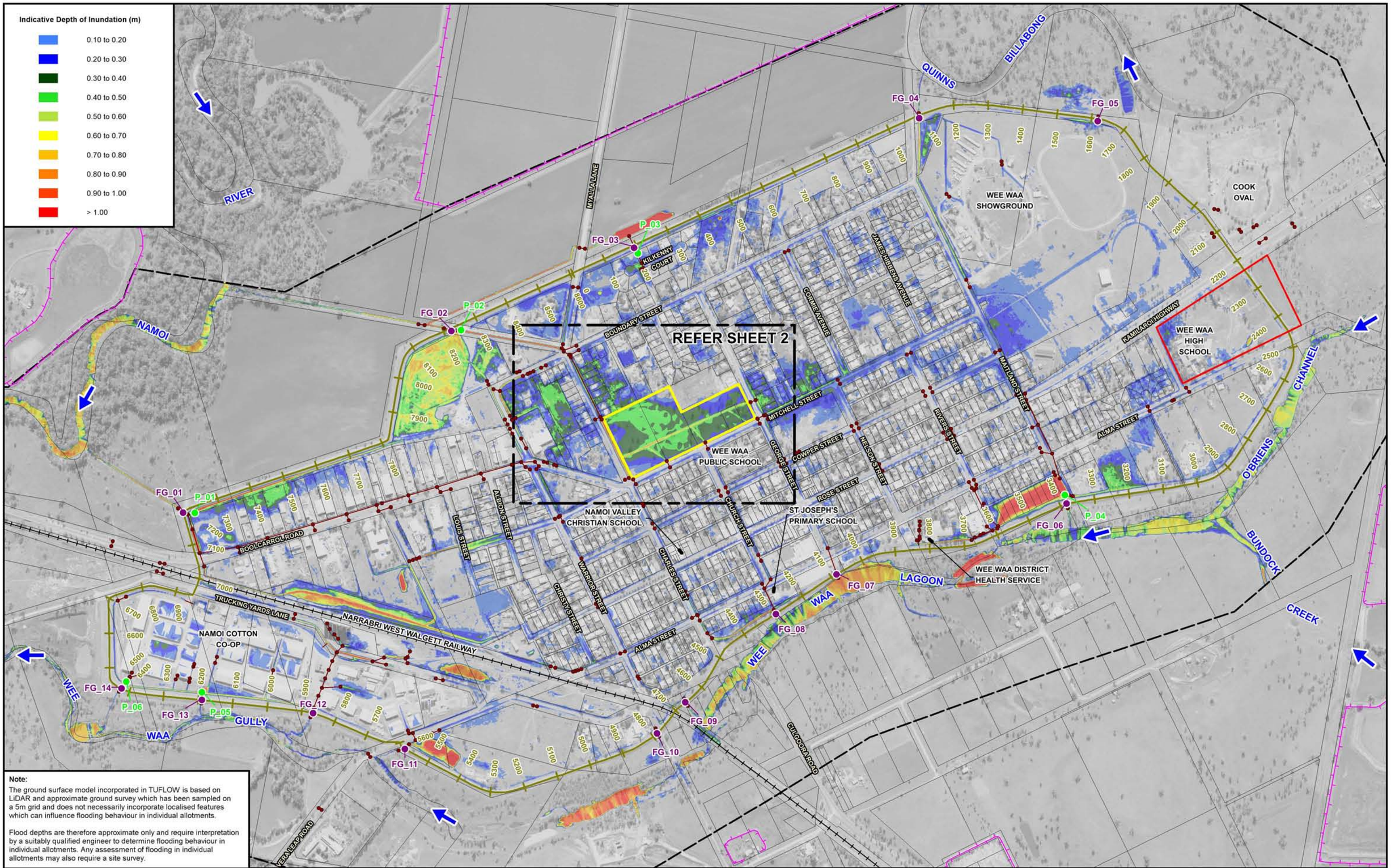
Modelled Stormwater Network

Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.7
(Sheet 2 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 20% AEP



Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

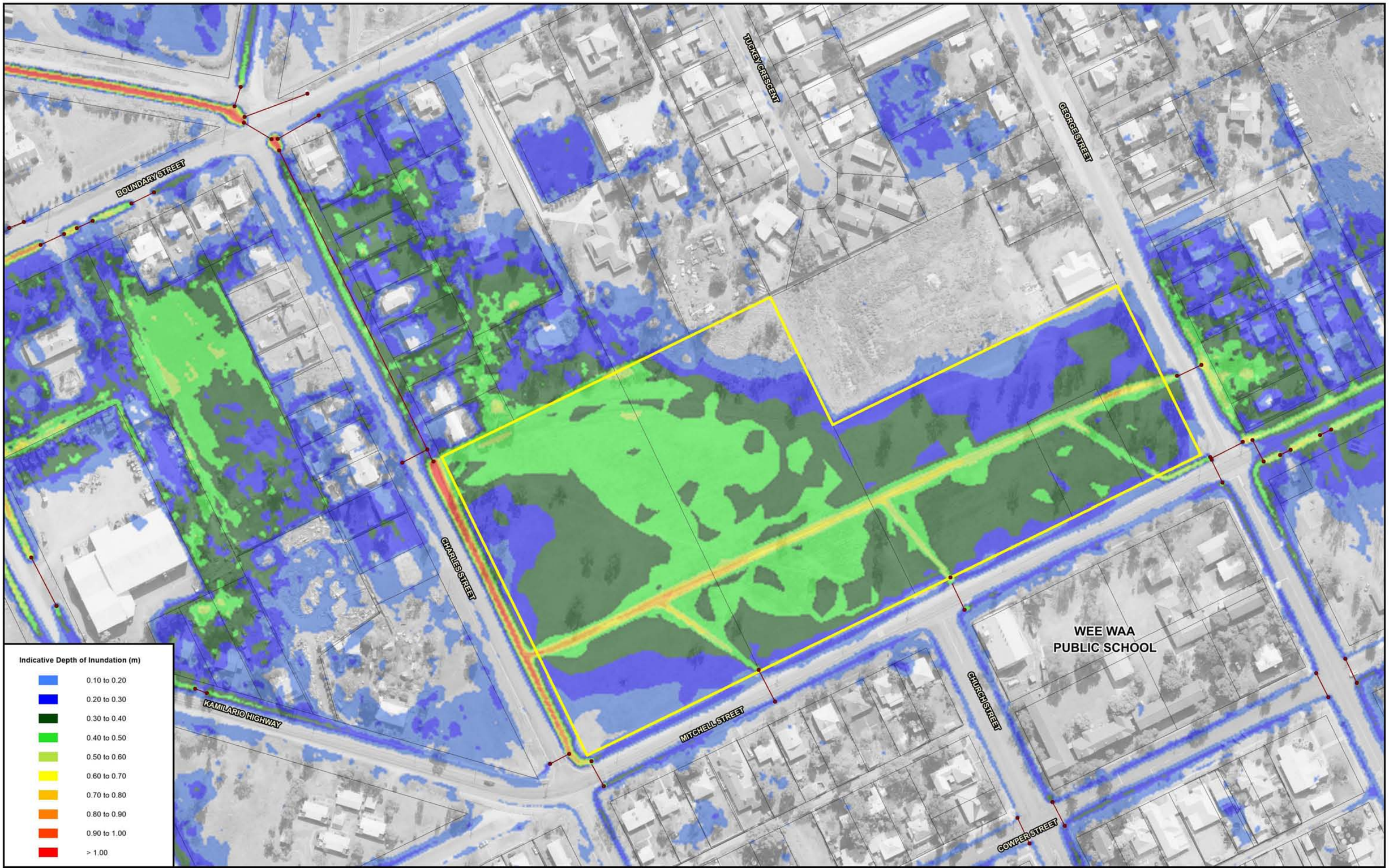
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.8
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 5% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

Modelled Stormwater Network

Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.8
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 5% AEP

Maximum Velocity (m/s)

- < 0.05
- 0.05 to 0.10
- 0.10 to 0.15
- 0.15 to 0.20
- 0.20 to 0.25
- 0.25 to 0.30
- 0.30 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- > 1.00

RIVER
NAMOI
WAA
GULLY
WEE
CREEK
LAGOON
CHANNEL
BILLABONG
QUINNS
O'BRIENS
BUNDOCK

FG_01 P_01 FG_02 P_02 FG_03 P_03 FG_04 FG_05 FG_06 P_04 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 P_05 FG_14 P_06

REFER SHEET 2

WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

BOUNDARY STREET
MYALL LANE
KILKENNY COURT
CORMIE AVENUE
JAMES HIBBENS AVENUE
KAMILAROI HIGHWAY
MAITLAND STREET
MITCHELL STREET
RIVER STREET
ALMA STREET
COWPER STREET
GEORGE STREET
NELSON STREET
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
CULGOORA ROAD
VERALEAP ROAD

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

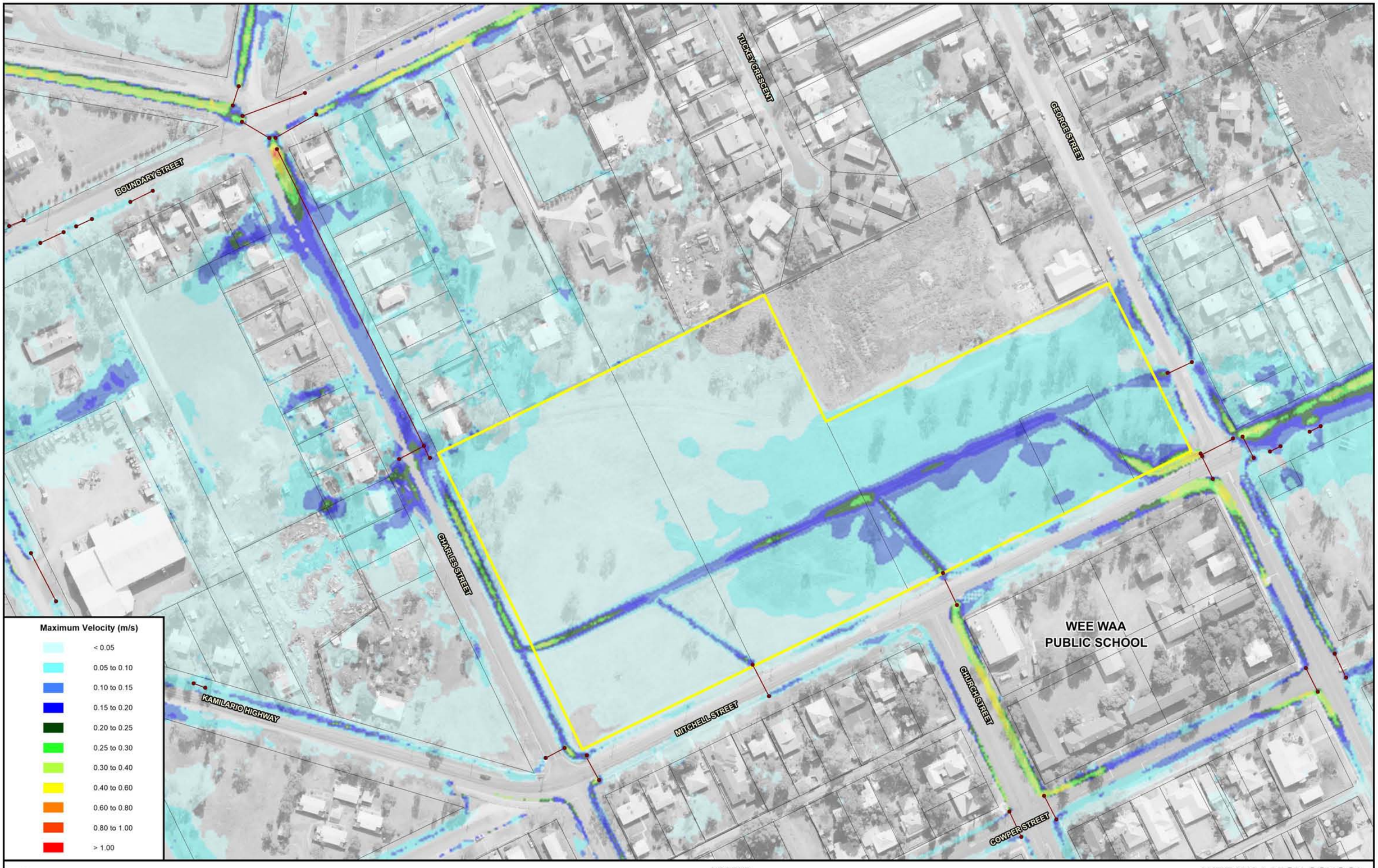
LEGEND

- Existing Levee Centre Line and Chainage (1000 1100)
- Existing Rural Levees on Namoi River Floodplain
- FG_01 Existing Flood Gate Location and Identifier
- P_01 Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.9
(Sheet 1 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 5% AEP



Lyall & Associates

Note:

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Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Modelled Stormwater Network
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.9
(Sheet 2 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 5% AEP

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40
- 0.40 to 0.50
- 0.50 to 0.60
- 0.60 to 0.70
- 0.70 to 0.80
- 0.80 to 0.90
- 0.90 to 1.00
- > 1.00

RIVER
NAMOI
WEE WAA GULLY
WEE WAA CHANNEL
BILLABONG
QUINNS
O'BRIENS
BUNDOCK CREEK
WEE WAA LAGOON
MYALL LANE
BOUNDARY STREET
KILKENNY COURT
JAMES HIBBENS AVENUE
CORMIE AVENUE
KAMILAROI HIGHWAY
MAITLAND STREET
RIVER STREET
ALMA STREET
MITCHELL STREET
COWPER STREET
NELSON STREET
GEORGE STREET
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST-WALGETT RAILWAY
CULGOORA ROAD
VERALEAP ROAD
FG_01
FG_02
FG_03
FG_04
FG_05
FG_06
FG_07
FG_08
FG_09
FG_10
FG_11
FG_12
FG_13
FG_14
P_01
P_02
P_03
P_04
P_05
P_06
REFER SHEET 2
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.10
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

WEE WAA
PUBLIC SCHOOL

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40
- 0.40 to 0.50
- 0.50 to 0.60
- 0.60 to 0.70
- 0.70 to 0.80
- 0.80 to 0.90
- 0.90 to 1.00
- > 1.00

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

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LEGEND

- Modelled Stormwater Network
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.10
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP

Maximum Velocity (m/s)

- < 0.05
- 0.05 to 0.10
- 0.10 to 0.15
- 0.15 to 0.20
- 0.20 to 0.25
- 0.25 to 0.30
- 0.30 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- > 1.00

RIVER
NAMOI
WAA
GULLY
WEE
CREEK
LAGOON
BILLABONG
QUINNS
O'BRIENS
CHANNEL
BUNDOCK

FG_01 P_01 FG_02 P_02 FG_03 P_03 FG_04 FG_05 FG_06 P_04 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 P_05 FG_14 P_06

REFER SHEET 2

WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
KAMILAROI HIGHWAY
CULGOORA ROAD
VERALEAP ROAD
BOUNDARY STREET
KILKENNY COURT
MYALL LANE
CORMIE AVENUE
JAMES HIBBENS AVENUE
MITCHELL STREET
MAITLAND STREET
RIVER STREET
ALMA STREET
COWPER STREET
NELSON STREET
ROSE STREET
CHURCH STREET
GEORGE STREET
ALBION STREET
LOUIS STREET
WARRIOR STREET
CHRISTY STREET
CHARLES STREET

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

Lyall & Associates

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.11
(Sheet 1 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

WEE WAA
PUBLIC SCHOOL

Maximum Velocity (m/s)

- < 0.05
- 0.05 to 0.10
- 0.10 to 0.15
- 0.15 to 0.20
- 0.20 to 0.25
- 0.25 to 0.30
- 0.30 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- > 1.00

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

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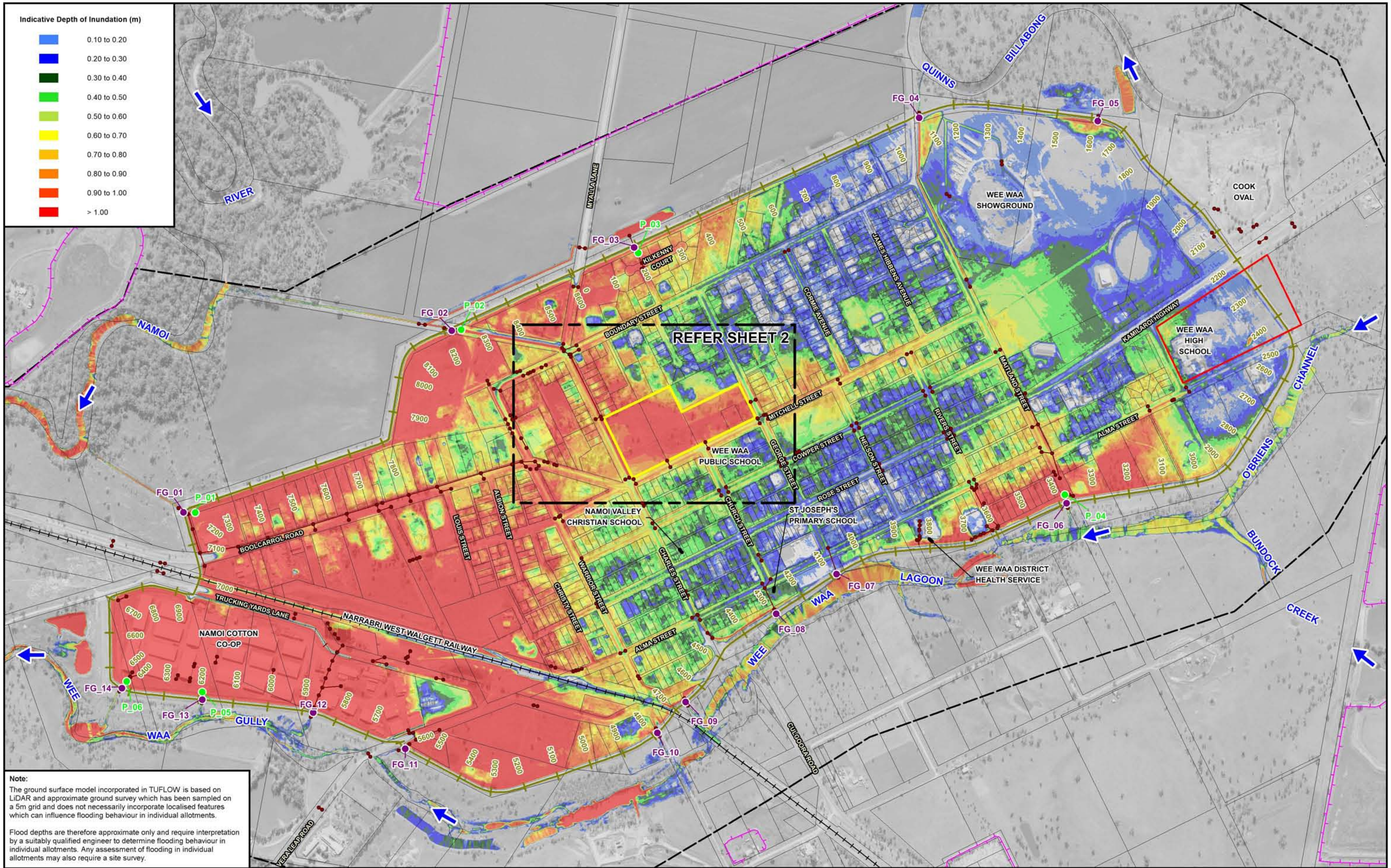
LEGEND

- Modelled Stormwater Network
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.11
(Sheet 2 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP



Note:

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Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

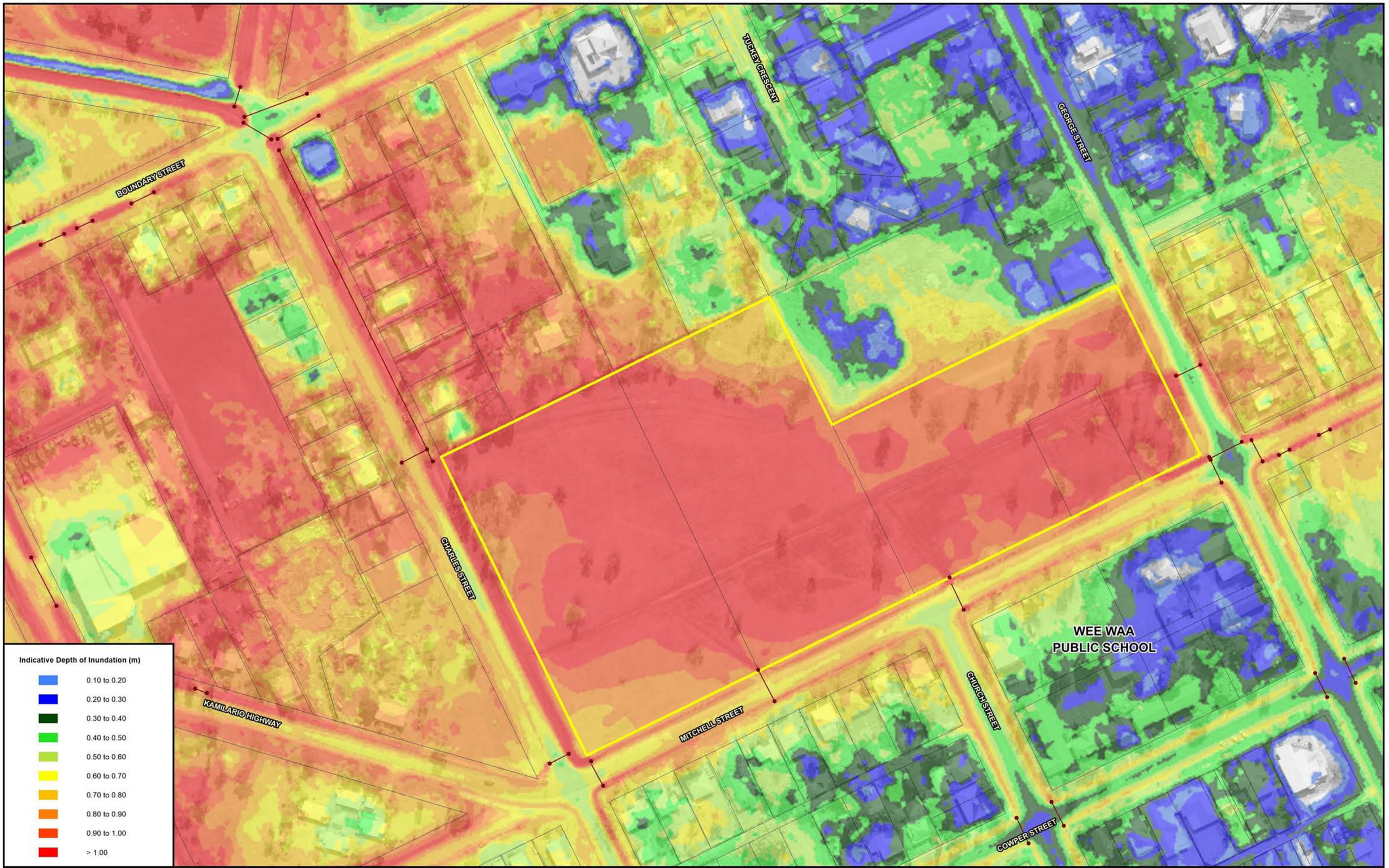
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- FG_01 Existing Flood Gate Location and Identifier
- P_01 Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.12
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - PMF



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

Modelled Stormwater Network

Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.12
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - PMF

Maximum Velocity (m/s)

- < 0.05
- 0.05 to 0.10
- 0.10 to 0.15
- 0.15 to 0.20
- 0.20 to 0.25
- 0.25 to 0.30
- 0.30 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- > 1.00

REFER SHEET 2

RIVER
NAMOI
QUINNS
BILLABONG
MYALLA LANE
BOUNDARY STREET
KILKENNY COURT
JAMES HIBBENS AVENUE
CORMIE AVENUE
KAMILAROI HIGHWAY
MAITLAND STREET
MITCHELL STREET
RIVERS STREET
ALMA STREET
COWPER STREET
GEORGE STREET
NELSON STREET
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
CUTTABOOMA ROAD
VERALEAP ROAD
O'BRIENS CHANNEL
BUNDOCK CREEK
WEE WAA LAGOON
WEE WAA GULLY
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

FG_01 FG_02 FG_03 FG_04 FG_05 FG_06 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 FG_14
P_01 P_02 P_03 P_04 P_05 P_06

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

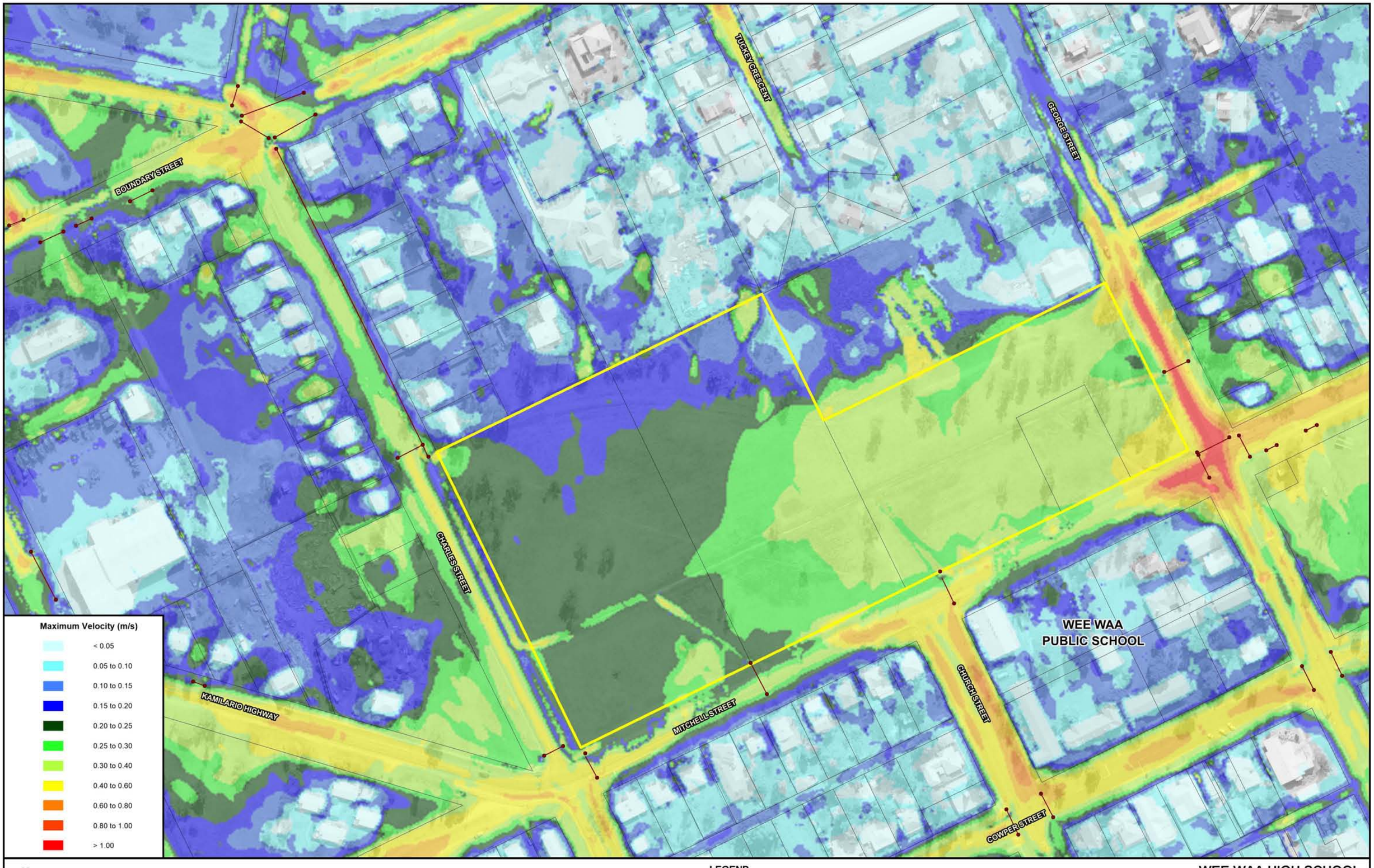
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.13
(Sheet 1 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - PMF



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

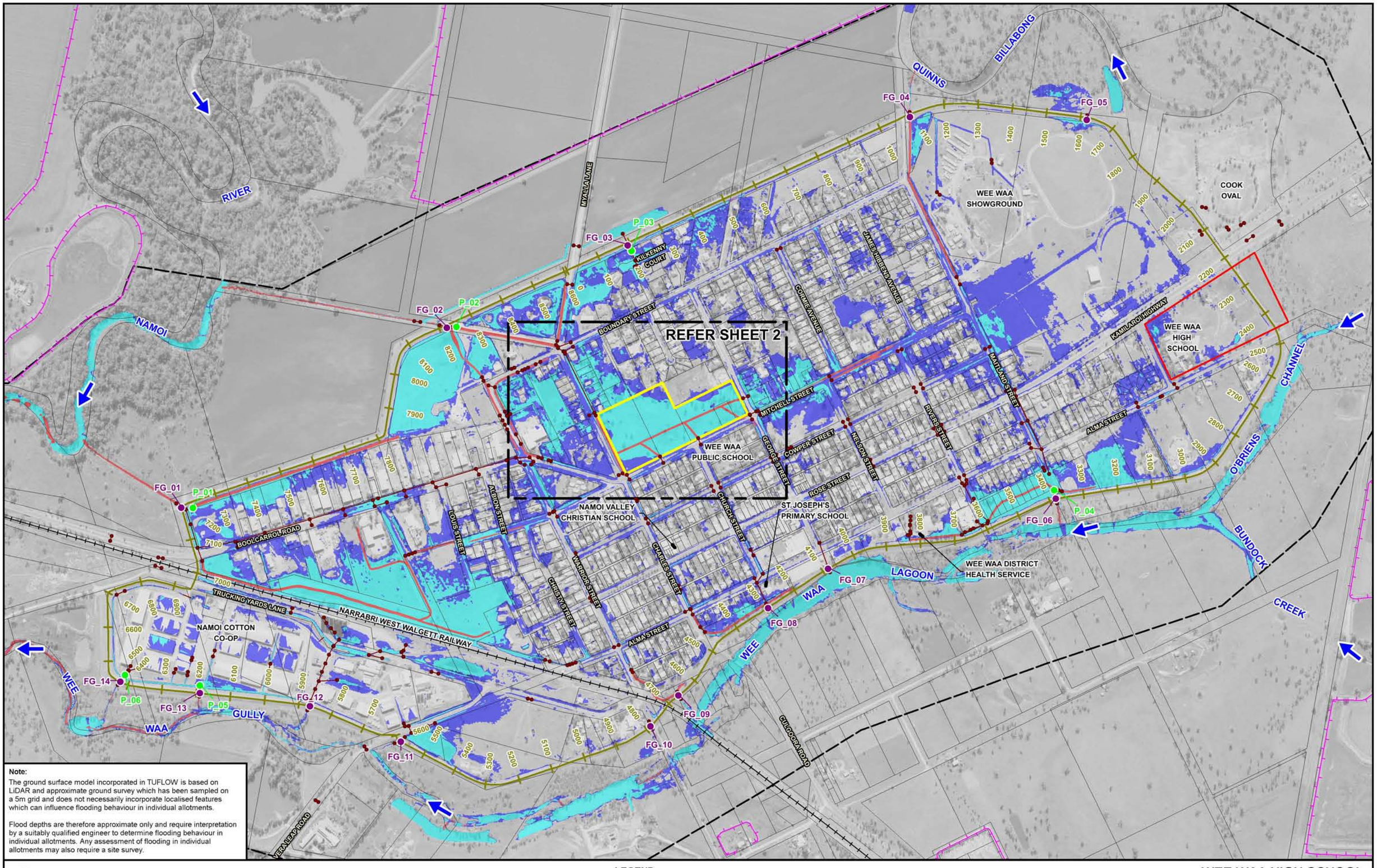
Modelled Stormwater Network

Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.13
(Sheet 2 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS - PMF



Note:

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Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

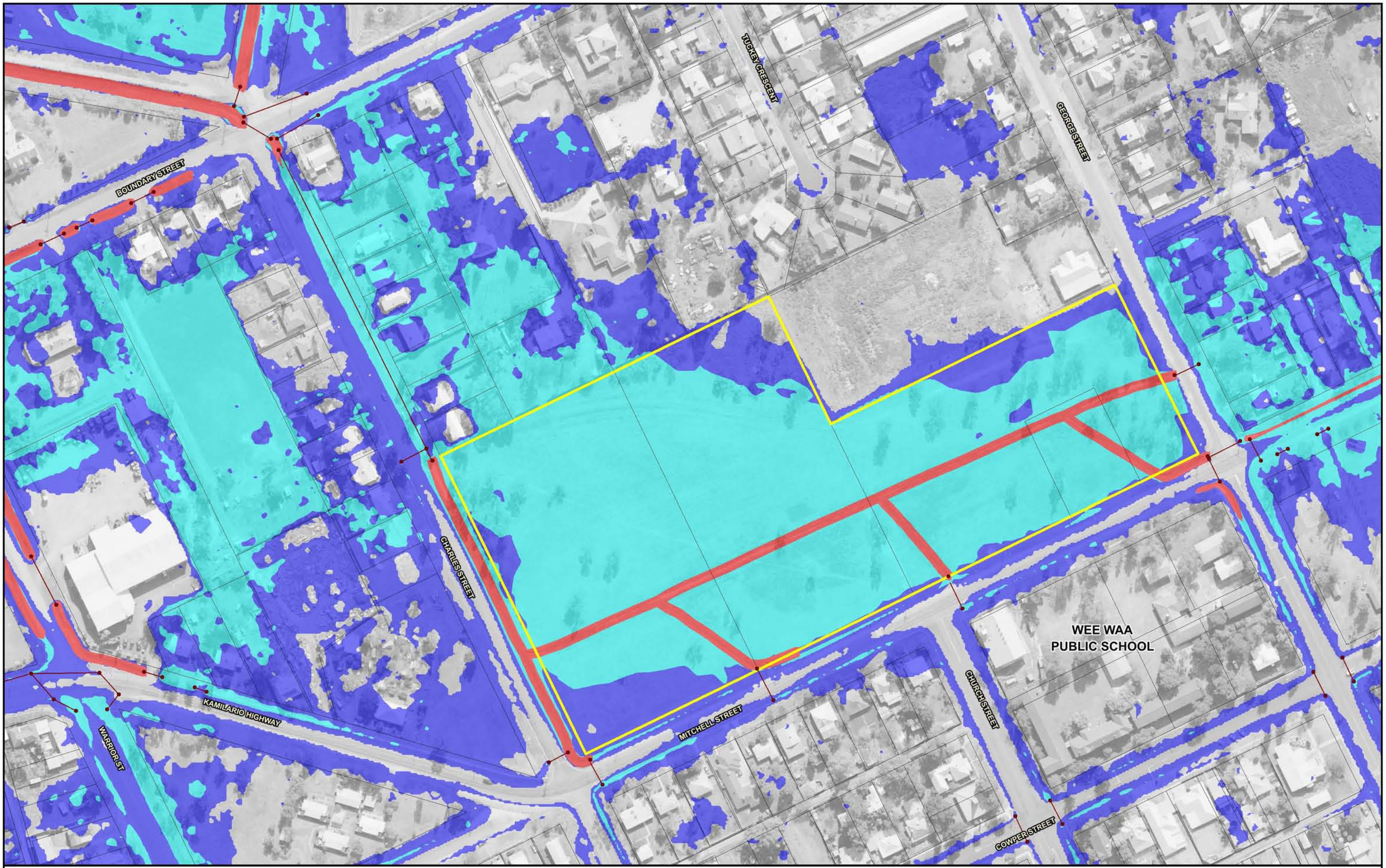
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Floodway
- Flood Storage
- Flood Fringe

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.14
(Sheet 1 of 2)

HYDRAULIC CATEGORISATION IN VICINITY OF THE PROPOSAL AND FMW
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

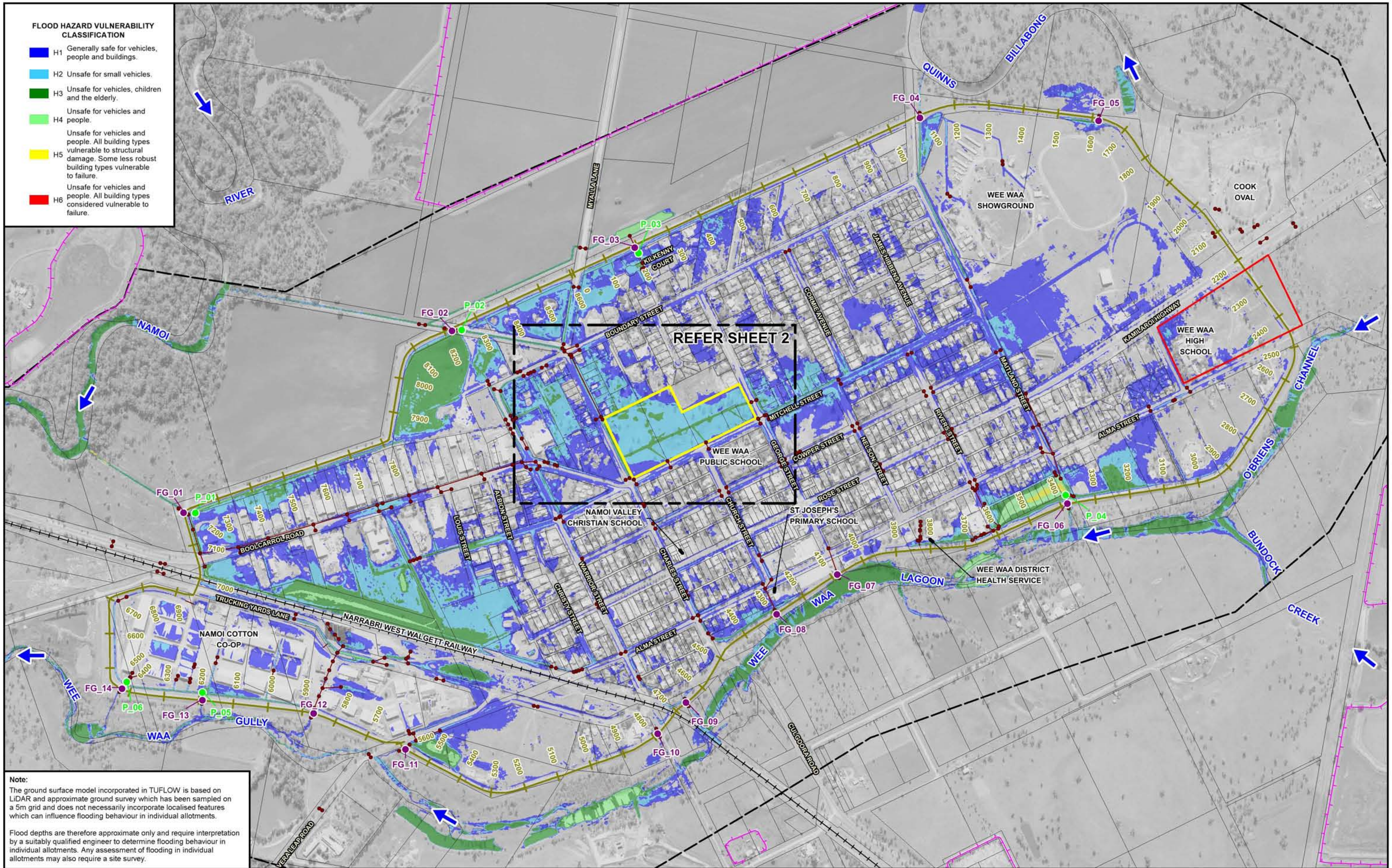
LEGEND

- Modelled Stormwater Network
- Proposal Site Boundary
- Floodway
- Flood Storage
- Flood Fringe

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.14
(Sheet 2 of 2)

HYDRAULIC CATEGORISATION IN VICINITY OF THE PROPOSAL AND FMW
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP


FLOOD HAZARD VULNERABILITY CLASSIFICATION
H1 Generally safe for vehicles, people and buildings.
H2 Unsafe for small vehicles.
H3 Unsafe for vehicles, children and the elderly.
H4 Unsafe for vehicles and people.
H5 Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure.
H6 Unsafe for vehicles and people. All building types considered vulnerable to failure.
REFER SHEET 2
NAMOI RIVER
QUINNS BILLABONG
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
KAMILAROI HIGHWAY
CHANNEL
O'BRIENS
BUNDOCK
CREEK
LAGOON
WEE WAA
WEE WAA GULLY
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP
NARRABRI WEST WALGETT RAILWAY
TRUCKING YARDS LANE
BOOLCARROL ROAD
MYALLA LANE
KILKENNY COURT
BOUNDARY STREET
CORMIE AVENUE
JAMES HIBBENS AVENUE
MITCHELL STREET
COWPER STREET
GEORGE STREET
ROSE STREET
NELSON STREET
RIVERS STREET
MAITLAND STREET
ALMA STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALSTON STREET
LOUIS STREET
CULGOORA ROAD
FG_01 FG_02 FG_03 FG_04 FG_05 FG_06 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 FG_14
P_01 P_02 P_03 P_04 P_05 P_06

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N
100 0 100 200 300 m
Scale: 1:10,000

Lyall & Associates

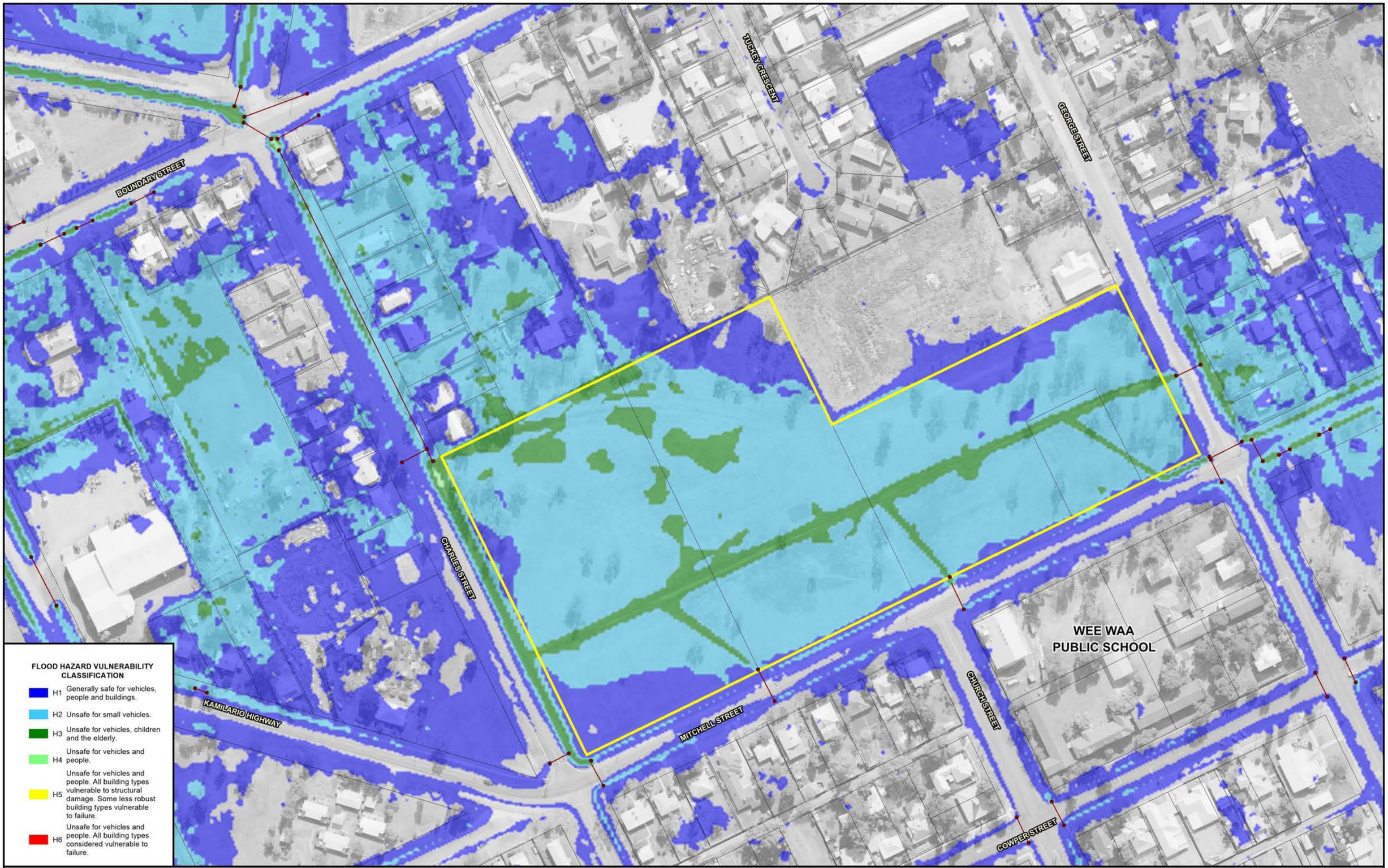
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- FG_01 Existing Flood Gate Location and Identifier
- P_01 Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.15
(Sheet 1 of 2)

FLOOD HAZARD VULNERABILITY CATEGORISATION IN VICINITY OF THE PROPOSAL AND FMW
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP



Note:

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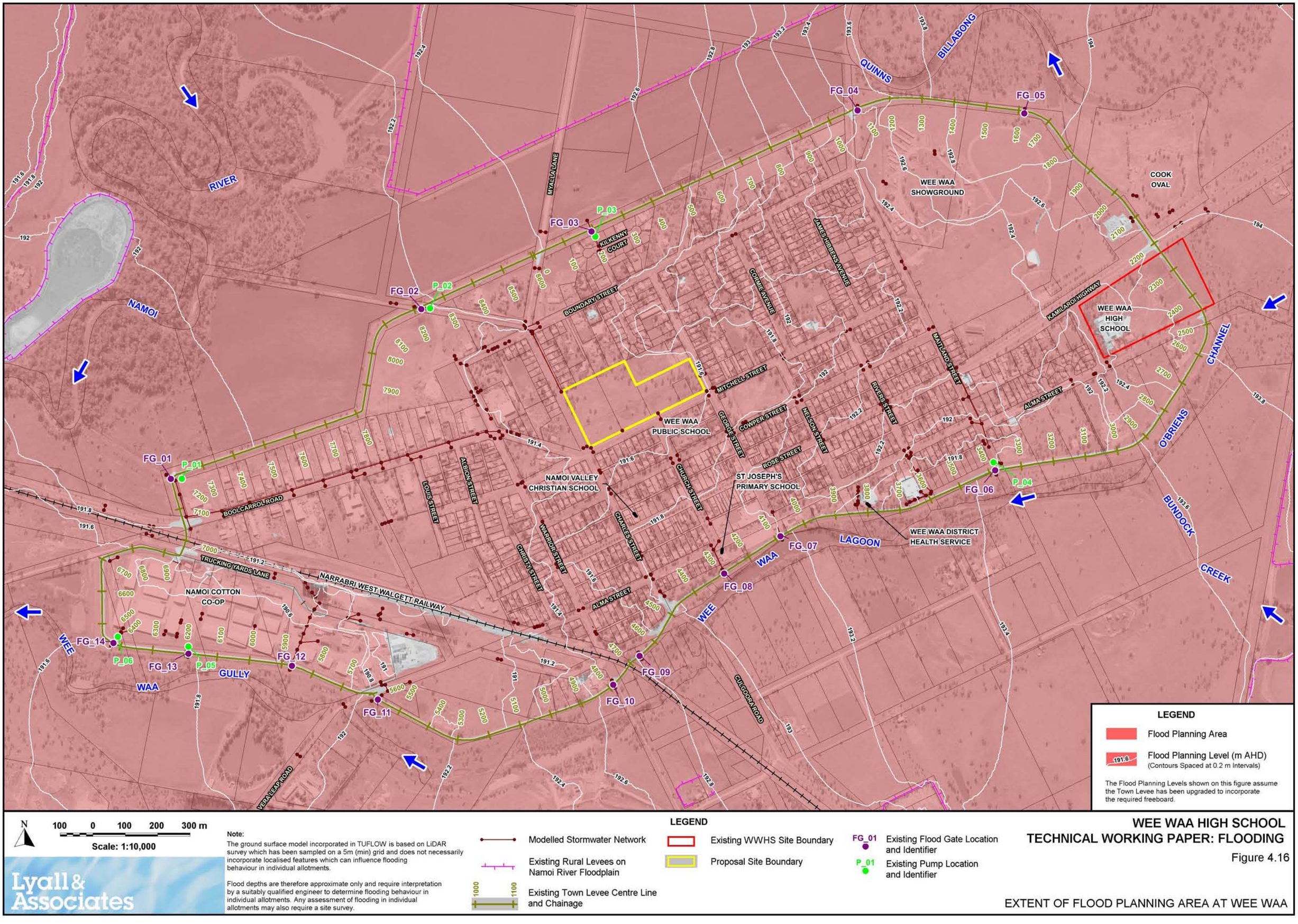
Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

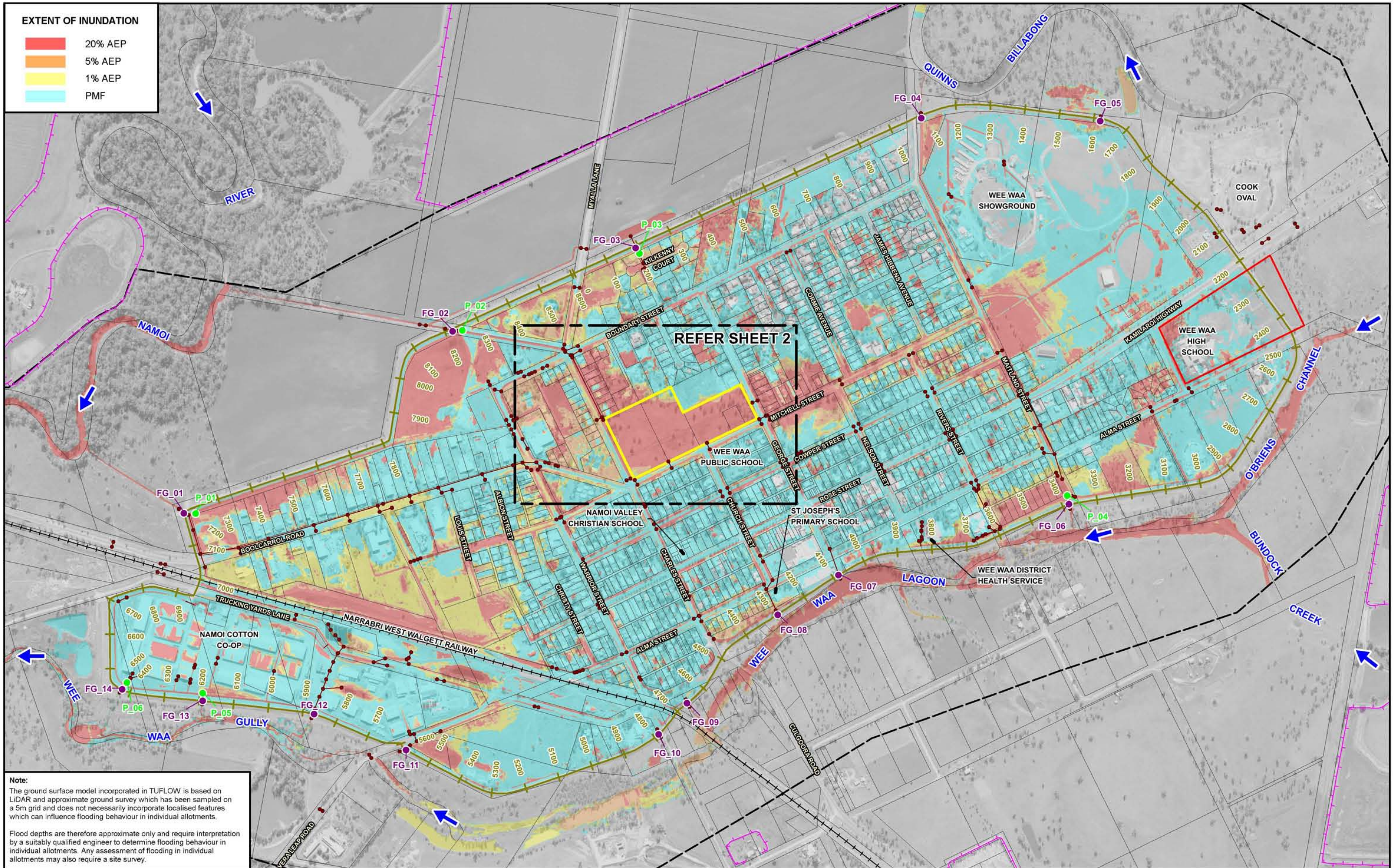
Lyall & Associates

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 4.15
(Sheet 2 of 2)

FLOOD HAZARD VULNERABILITY CATEGORISATION IN VICINITY OF THE PROPOSAL AND FMW
PRE-PROPOSAL AND FMW CONDITIONS - 1% AEP


RIVER
NAMOI
MYALLA LANE
QUINNS
BILLABONG
FG_04
FG_05
FG_03
P_03
FG_02
P_02
FG_01
P_01
KILKENNY COURT
BOUNDARY STREET
JAMES HIBBENS AVENUE
CORMIE AVENUE
WEE WAA SHOWGROUND
COOK OVAL
KAMILAROI HIGHWAY
WEE WAA HIGH SCHOOL
CHANNEL
O'BRIENS
MAITLAND STREET
ALMA STREET
RIVERS STREET
MITCHELL STREET
COWPER STREET
ROSE STREET
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
BOOLCARROL ROAD
LOUIS STREET
ALBION STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
NAMOI COTTON CO-OP
FG_06
P_04
FG_07
FG_08
FG_09
FG_10
FG_11
FG_12
FG_13
P_05
FG_14
P_06
LAGOON
WAA
WEE
GULLY
BUNDOCK
CREEK
GULGOORA ROAD
VERA LEAP ROAD
LEGEND
Flood Planning Area
Flood Planning Level (m AHD)
(Contours Spaced at 0.2 m Intervals)
The Flood Planning Levels shown on this figure assume the Town Levee has been upgraded to incorporate the required freeboard.
N
100 0 100 200 300 m
Scale: 1:10,000
Note:
The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 5m (min) grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.
Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.
LEGEND
Modelled Stormwater Network
Existing Rural Levees on Namoi River Floodplain
Existing Town Levee Centre Line and Chainage
Existing WWHS Site Boundary
Proposal Site Boundary
Existing Flood Gate Location and Identifier
Existing Pump Location and Identifier
Lyall & Associates
WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING
Figure 4.16
EXTENT OF FLOOD PLANNING AREA AT WEE WAA



EXTENT OF INUNDATION
20% AEP
5% AEP
1% AEP
PMF
NAMOI
RIVER
QUINNS
BILLABONG
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
KAMILAROI HIGHWAY
REFER SHEET 2
BOUNDARY STREET
MITCHELL STREET
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP
NARRABRI WEST WALGETT RAILWAY
TRUCKING YARDS LANE
BOOLCARROL ROAD
KILKENNY COURT
MYALLA LANE
CORMIE AVENUE
JAMES HIBBENS AVENUE
MAITLAND STREET
RIVERS STREET
NELSON STREET
GEORGE STREET
COWPER STREET
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
ALMA STREET
CULGOORA ROAD
WEE WAA LAGOON
O'BRIENS CHANNEL
BUNDOCK CREEK
WEE WAA GULLY
FG_01
FG_02
FG_03
FG_04
FG_05
FG_06
FG_07
FG_08
FG_09
FG_10
FG_11
FG_12
FG_13
FG_14
P_01
P_02
P_03
P_04
P_05
P_06
Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.
Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- FG_01 Existing Flood Gate Location and Identifier
- P_01 Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 5.1
(Sheet 1 of 2)

INDICATIVE FLOOD EXTENTS INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS

EXTENT OF INUNDATION

- 20% AEP
- 5% AEP
- 1% AEP
- PMF

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

WARRIOR ST

MITCHELL STREET

CHURCH STREET

COWPER STREET

WEE WAA
PUBLIC SCHOOL

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Modelled Stormwater Network
- Proposal Site Boundary

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 5.1
(Sheet 2 of 2)

INDICATIVE FLOOD EXTENTS INTERNAL TO TOWN LEVEE
PRE-PROPOSAL AND FMW CONDITIONS

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40
- 0.40 to 0.50
- 0.50 to 0.60
- 0.60 to 0.70
- 0.70 to 0.80
- 0.80 to 0.90
- 0.90 to 1.00
- > 1.00

RIVER
NAMOI
NYMILLA LANE
BILLABONG
QUINNS
FG_04
FG_05
WEE WAA SHOWGROUND
COOK OVAL
P_03
FG_03
KILKENNY COURT
JAMES HIBBENS AVENUE
CORMIE AVENUE
BOUNDARY STREET
FG_02
P_02
P_02A
REFER SHEET 2
KAMILAROI HIGHWAY
WEE WAA HIGH SCHOOL
CHANNEL
MAITLAND STREET
MITCHELL STREET
RIVER STREET
ALMA STREET
WEE WAA PUBLIC SCHOOL
GEORGE STREET
COWPER STREET
NELSON STREET
ROSE STREET
O'BRIENS
FG_01
P_01
BOOLCARROL ROAD
LOUIS STREET
ALBION STREET
NAMOI VALLEY CHRISTIAN SCHOOL
CHURCH STREET
CHARLES STREET
WARRIOS STREET
CHRISTY STREET
ST JOSEPH'S PRIMARY SCHOOL
P_04
FG_06
BUNDOCK
CREEK
WEE WAA DISTRICT HEALTH SERVICE
LAGOON
FG_07
WAA
WEE
FG_08
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
NAMOI COTTON CO-OP
ALMA STREET
FG_14
P_06
FG_13
P_05
GULLY
FG_12
FG_09
FG_10
FG_11
GUNNEDAH ROAD
VERALEAP ROAD

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

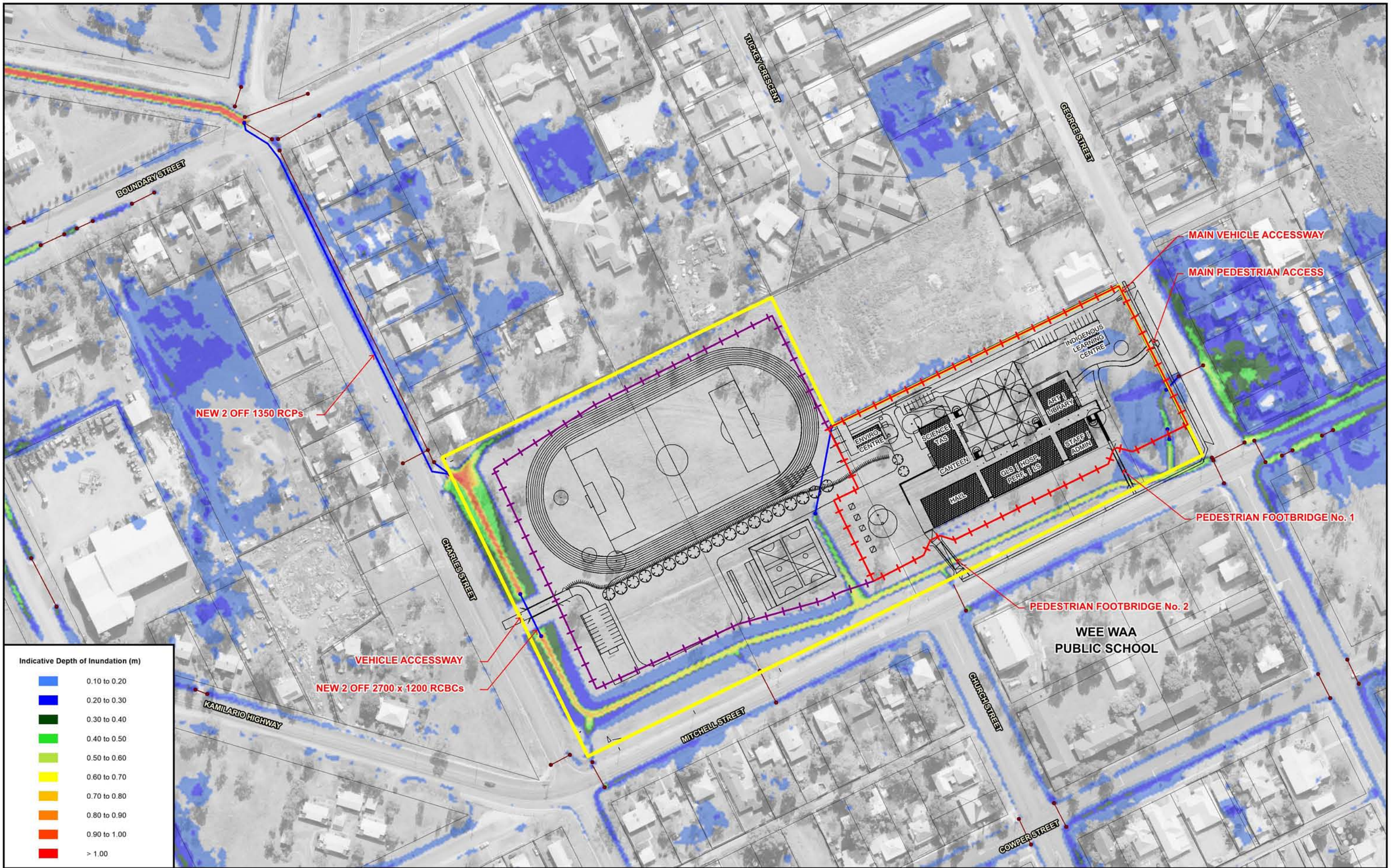
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.1
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 20% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.1
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 20% AEP

Maximum Velocity (m/s)
< 0.05
0.05 to 0.10
0.10 to 0.15
0.15 to 0.20
0.20 to 0.25
0.25 to 0.30
0.30 to 0.40
0.40 to 0.60
0.60 to 0.80
0.80 to 1.00
> 1.00
NAMOI
RIVER
QUINNS
BILLABONG
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
KAMILAROI HIGHWAY
CHANNEL
O'BRIENS
BUNDOCK
CREEK
LAGOON
WEE WAA
GULLY
REFER SHEET 2
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP
NARRABRI WEST WALGETT RAILWAY
TRUCKING YARDS LANE
BOOLCARROL ROAD
MYALLA LANE
KILKENNY COURT
BOUNDARY STREET
MITCHELL STREET
COWPER STREET
ROSE STREET
ALMA STREET
GEORGE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
LOUIS STREET
ALBION STREET
CORMIE AVENUE
JAMES HIBBENS AVENUE
MAITLAND STREET
RIVERS STREET
NELSON STREET
CULGOORA ROAD
VERALEAP ROAD
FG_01
FG_02
FG_03
FG_04
FG_05
FG_06
FG_07
FG_08
FG_09
FG_10
FG_11
FG_12
FG_13
FG_14
P_01
P_02
P_02A
P_03
P_04
P_05
P_06
Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.
Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

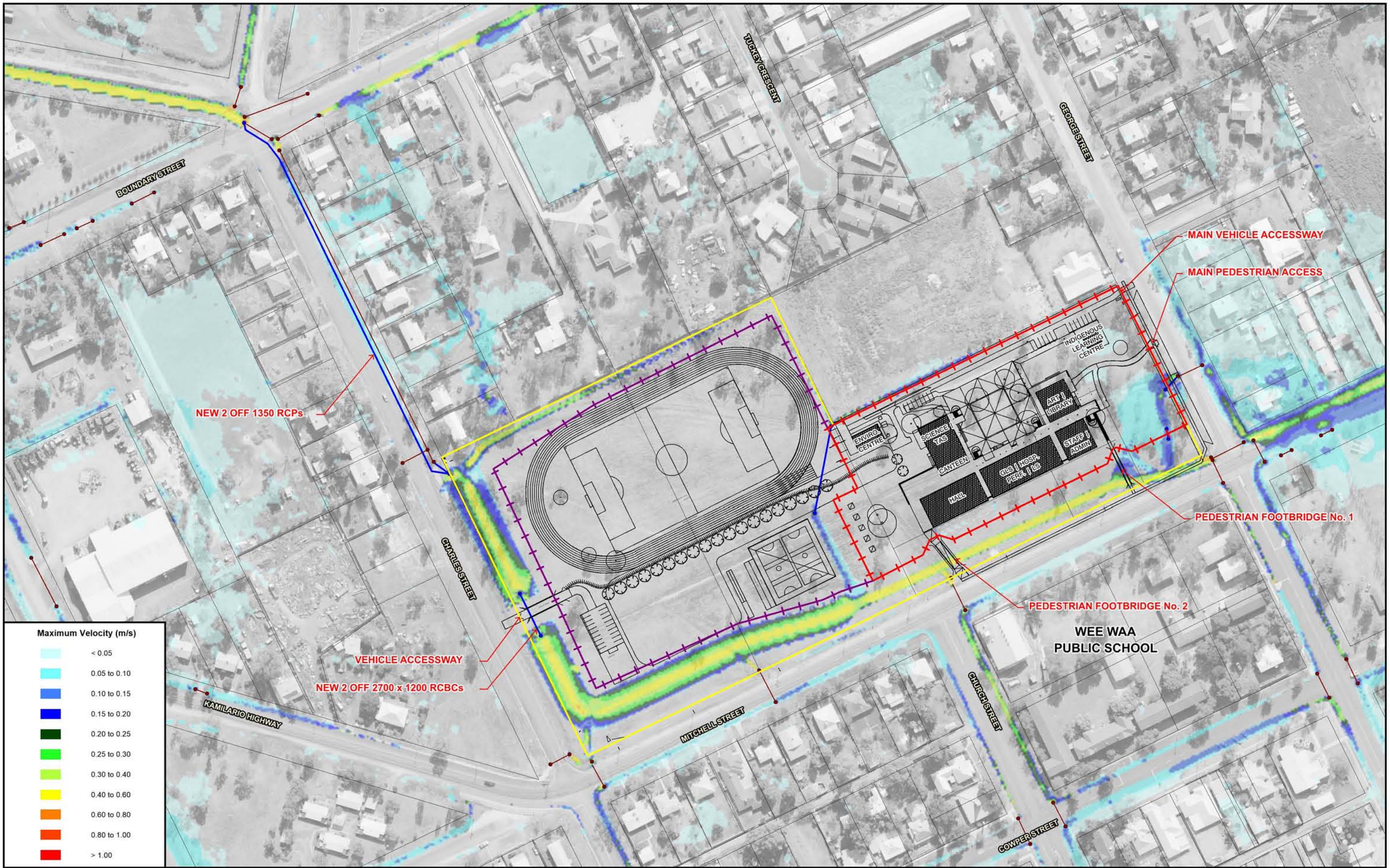
LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.2
(Sheet 1 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 20% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.2
(Sheet 2 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 20% AEP

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

RIVER
NAMOI
BILLABONG
QUINNS
MYALLA LANE
KILKENNY COURT
BOUNDARY STREET
REFER SHEET 2
CORMIE AVENUE
JAMES HIBBENS AVENUE
WEE WAA SHOWGROUND
COOK OVAL
KAMILAROI HIGHWAY
WEE WAA HIGH SCHOOL
MAITLAND STREET
ALMA STREET
CHANNEL
O'BRIENS
MITCHELL STREET
RIVER STREET
POWER STREET
GEORGE STREET
NELSON STREET
ROSE STREET
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRIST STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
NAMOI COTTON CO-OP
WEE WAA DISTRICT HEALTH SERVICE
LAGOON
BUNDOCK CREEK
WEE WAA GULLY
GULGOORA ROAD
VERALEA ROAD
FG_01 FG_02 FG_03 FG_04 FG_05 FG_06 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 FG_14
P_01 P_02 P_02A P_03 P_04 P_05 P_06

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.3
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
20% AEP

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.3
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
20% AEP

Velocity Afflux (m/s)
< -0.2
-0.20 to -0.10
-0.10 to -0.01
-0.01 to 0.01
0.01 to 0.02
0.02 to 0.05
0.05 to 0.10
0.10 to 0.20
0.20 to 0.30
0.30 to 0.50
> 0.50
Land Rendered Flood Free as a Result of Change
Additional Area of Land Flooded as a Result of Change
REFER SHEET 2
NAMOI RIVER
QUINNS BILLABONG
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP
O'BRIENS CHANNEL
BUNDOCK CREEK
WEE WAA LAGOON
WEE WAA GULLY
KAMILAROI HIGHWAY
NARRABRI WEST WALGETT RAILWAY
TRUCKING YARDS LANE
BOOLCARROL ROAD
BOUNDARY STREET
MITCHELL STREET
COWPER STREET
ROSE STREET
ALMA STREET
MAITLAND STREET
RIVERS STREET
NELSON STREET
GEORGE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
CORMIE AVENUE
JAMES HIBBENS AVENUE
MYALLA LANE
KILKENNY COURT
CULGOORA ROAD
YERALEAP ROAD
FG_01
FG_02
FG_03
FG_04
FG_05
FG_06
FG_07
FG_08
FG_09
FG_10
FG_11
FG_12
FG_13
FG_14
P_01
P_02
P_02A
P_03
P_04
P_05
P_06
Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.
Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.4
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOW VELOCITIES INTERNAL TO TOWN LEVEE
20% AEP

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.4
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOW VELOCITIES INTERNAL TO TOWN LEVEE
20% AEP

Indicative Depth of Inundation (m)

- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.40
- 0.40 to 0.50
- 0.50 to 0.60
- 0.60 to 0.70
- 0.70 to 0.80
- 0.80 to 0.90
- 0.90 to 1.00
- > 1.00

RIVER
NAMOI
WEE WAA
GULLY
CHANNEL
O'BRIENS
BUNDOCK
CREEK
LAGOON
BILLABONG
QUINNS
MYALLA LANE
BOUNDARY STREET
KILKENNY COURT
JAMES HIBBENS AVENUE
CORMIE AVENUE
MITCHELL STREET
MAITLAND STREET
RIVER STREET
ALMA STREET
KAMILAROI HIGHWAY
COOK OVAL
WEE WAA SHOWGROUND
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
COWPER STREET
GEORGE STREET
NELSON STREET
ROSE STREET
ALBION STREET
LOUIS STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
NAMOI COTTON CO-OP
CUGGOOA ROAD
VERALEA ROAD
REFER SHEET 2
FG_01
FG_02
FG_03
FG_04
FG_05
FG_06
FG_07
FG_08
FG_09
FG_10
FG_11
FG_12
FG_13
FG_14
P_01
P_02
P_02A
P_03
P_04
P_05
P_06

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.5
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 5% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

NEW 2 OFF 1350 RCPs

VEHICLE ACCESSWAY

NEW 2 OFF 2700 x 1200 RCBCs

MAIN VEHICLE ACCESSWAY

MAIN PEDESTRIAN ACCESS

PEDESTRIAN FOOTBRIDGE No. 1

PEDESTRIAN FOOTBRIDGE No. 2

WEE WAA
PUBLIC SCHOOL

INDIGENOUS LEARNING CENTRE

ENVIRO. CENTRE

SCIENCE TAS

ART / LIBRARY

CANTEEN

GLS / HOSP. PERF / TAS

STAFF / ADMIN

HALL

Indicative Depth of Inundation (m)

	0.10 to 0.20
	0.20 to 0.30
	0.30 to 0.40
	0.40 to 0.50
	0.50 to 0.60
	0.60 to 0.70
	0.70 to 0.80
	0.80 to 0.90
	0.90 to 1.00
	> 1.00

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.5
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 5% AEP

Maximum Velocity (m/s)

- < 0.05
- 0.05 to 0.10
- 0.10 to 0.15
- 0.15 to 0.20
- 0.20 to 0.25
- 0.25 to 0.30
- 0.30 to 0.40
- 0.40 to 0.60
- 0.60 to 0.80
- 0.80 to 1.00
- > 1.00

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

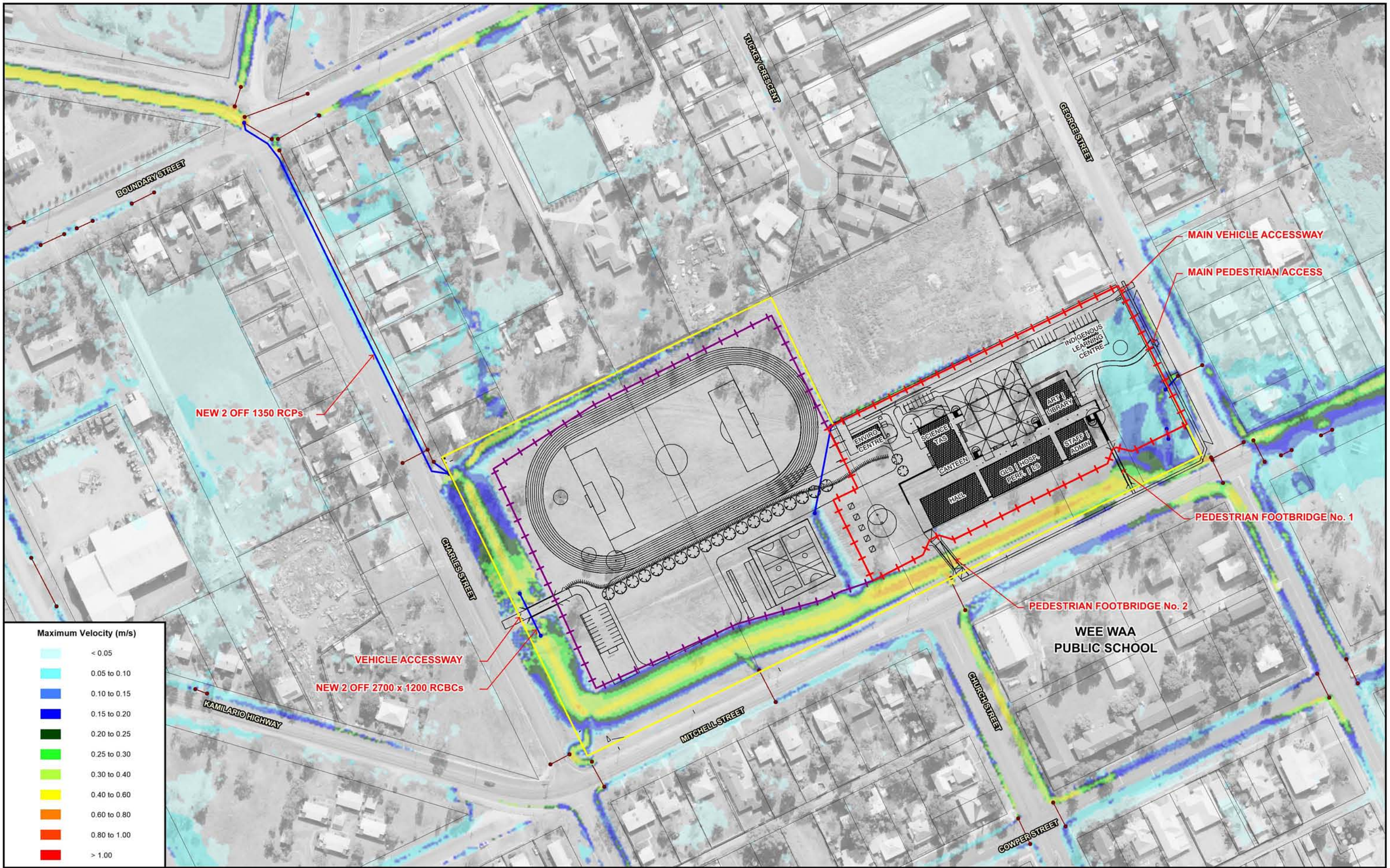
LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.6
(Sheet 1 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 5% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.6
(Sheet 2 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 5% AEP

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.7
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
5% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILAROI HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

NEW 2 OFF 1350 RCPs

VEHICLE ACCESSWAY

NEW 2 OFF 2700 x 1200 RCBCs

MAIN VEHICLE ACCESSWAY

MAIN PEDESTRIAN ACCESS

PEDESTRIAN FOOTBRIDGE No. 1

PEDESTRIAN FOOTBRIDGE No. 2

WEE WAA
PUBLIC SCHOOL

INDIGENOUS LEARNING CENTRE

ART / LIBRARY

ENVIRO. CENTRE

SCIENCE / TAS

CANTEEN

HALL

CLS / HOSP. PERF. / LS

STAFF / ADMIN

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.7
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
5% AEP

Velocity Afflux (m/s)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

RIVER
NAMOI
WAA
GULLY
WEE
LAGOON
BUNDOCK
CREEK
CHANNEL
O'BRIENS
BILLABONG
QUINNS

FG_01 P_01 FG_02 P_02 P_02A FG_03 P_03 FG_04 FG_05 FG_06 P_04 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 P_05 P_06 FG_14

REFER SHEET 2

BOOLCARROL ROAD
BOUNDARY STREET
KILKENNY COURT
NYMILLA LANE
CORMIE AVENUE
JAMES HIBBENS AVENUE
KAMILAROI HIGHWAY
MAITLAND STREET
MITCHELL STREET
COWPER STREET
RIVER STREET
ALMA STREET
GEORGE STREET
NELSON STREET
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALMA STREET
LOUIS STREET
AUBIN STREET
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
GUILGOOAROAD
VERALEAPROAD

WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N
100 0 100 200 300 m
Scale: 1:10,000

Lyall & Associates

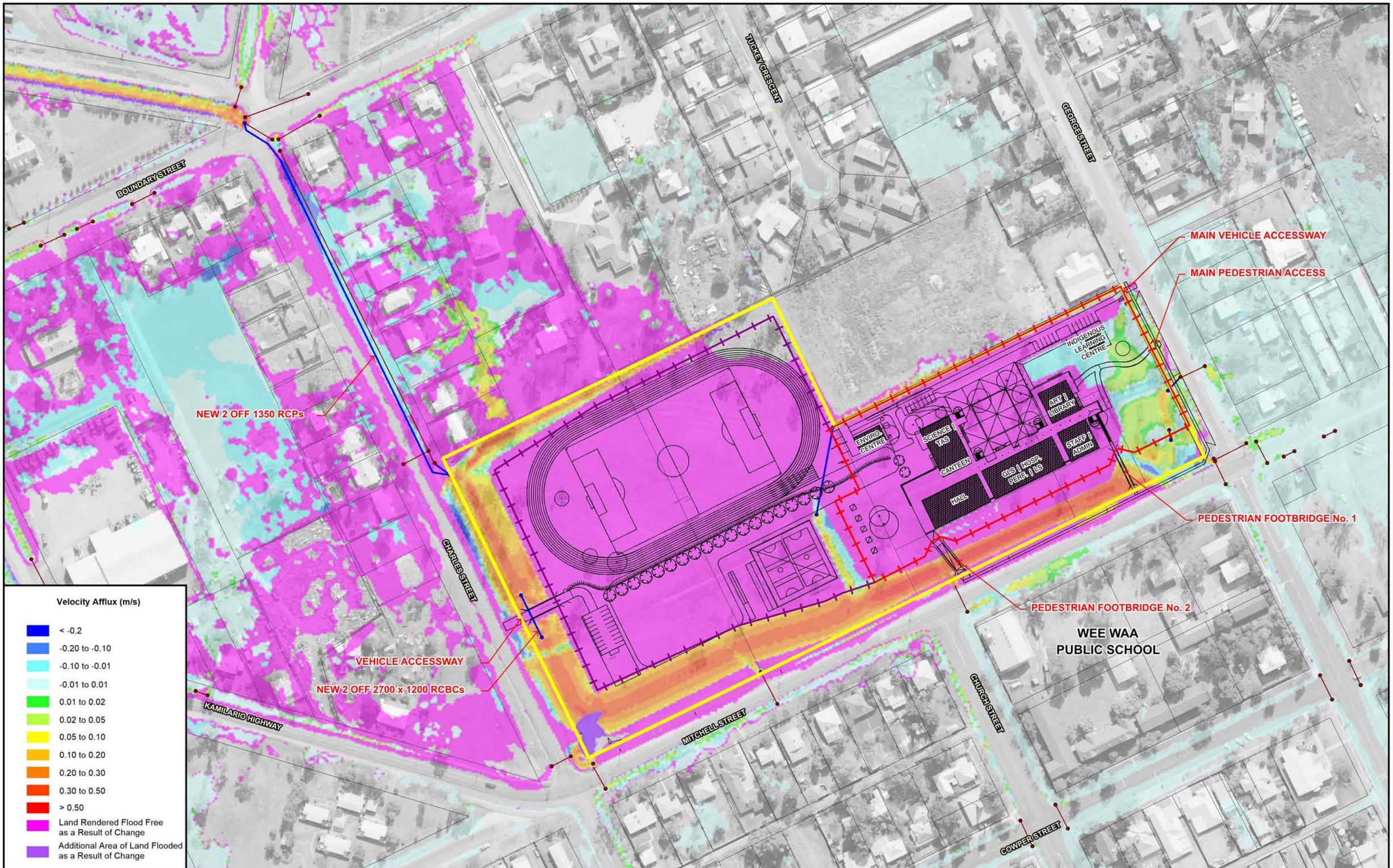
LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.8
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOW VELOCITIES INTERNAL TO TOWN LEVEE
5% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

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LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.8
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOW VELOCITIES INTERNAL TO TOWN LEVEE
5% AEP

Note:

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N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

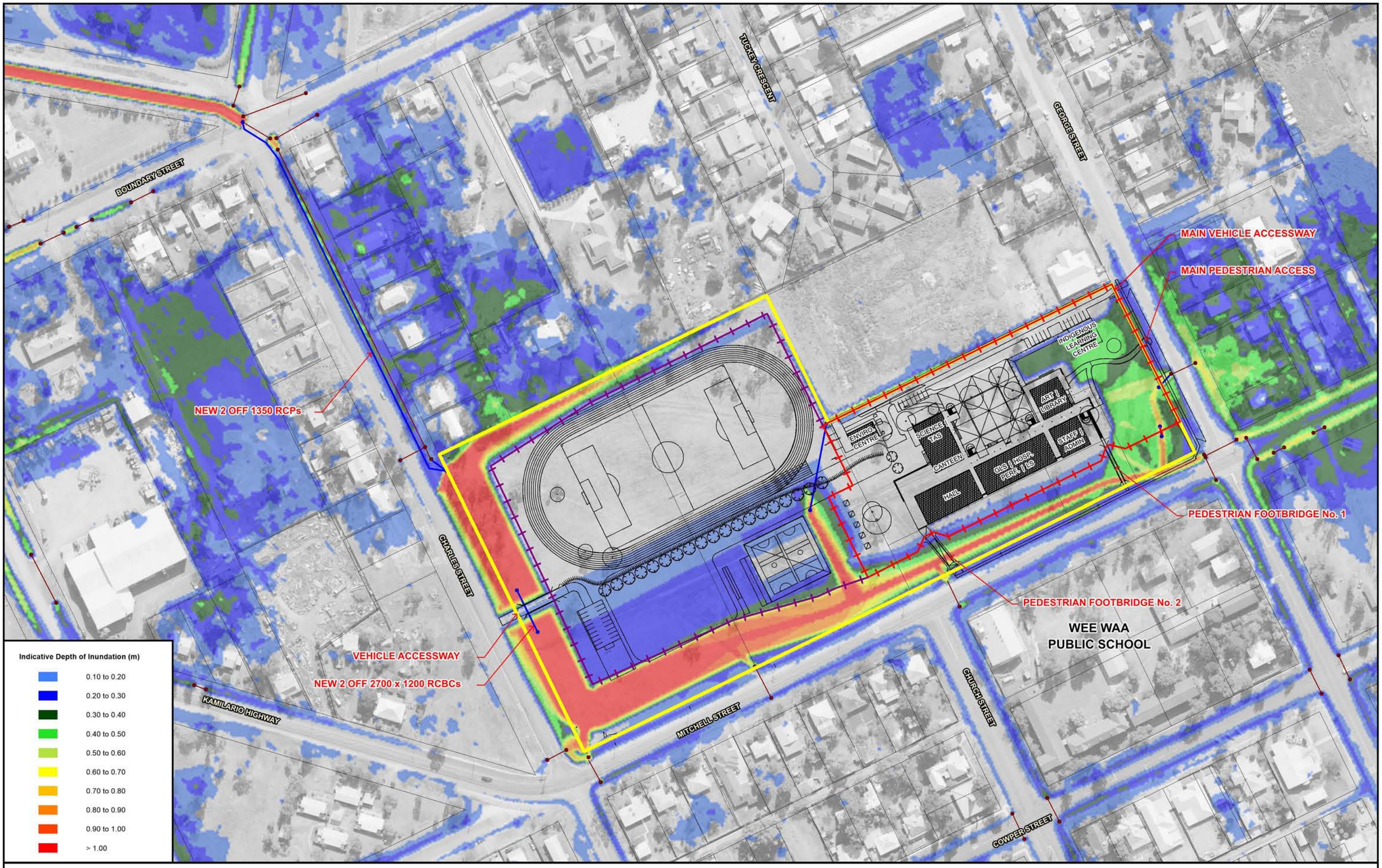
LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.9
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

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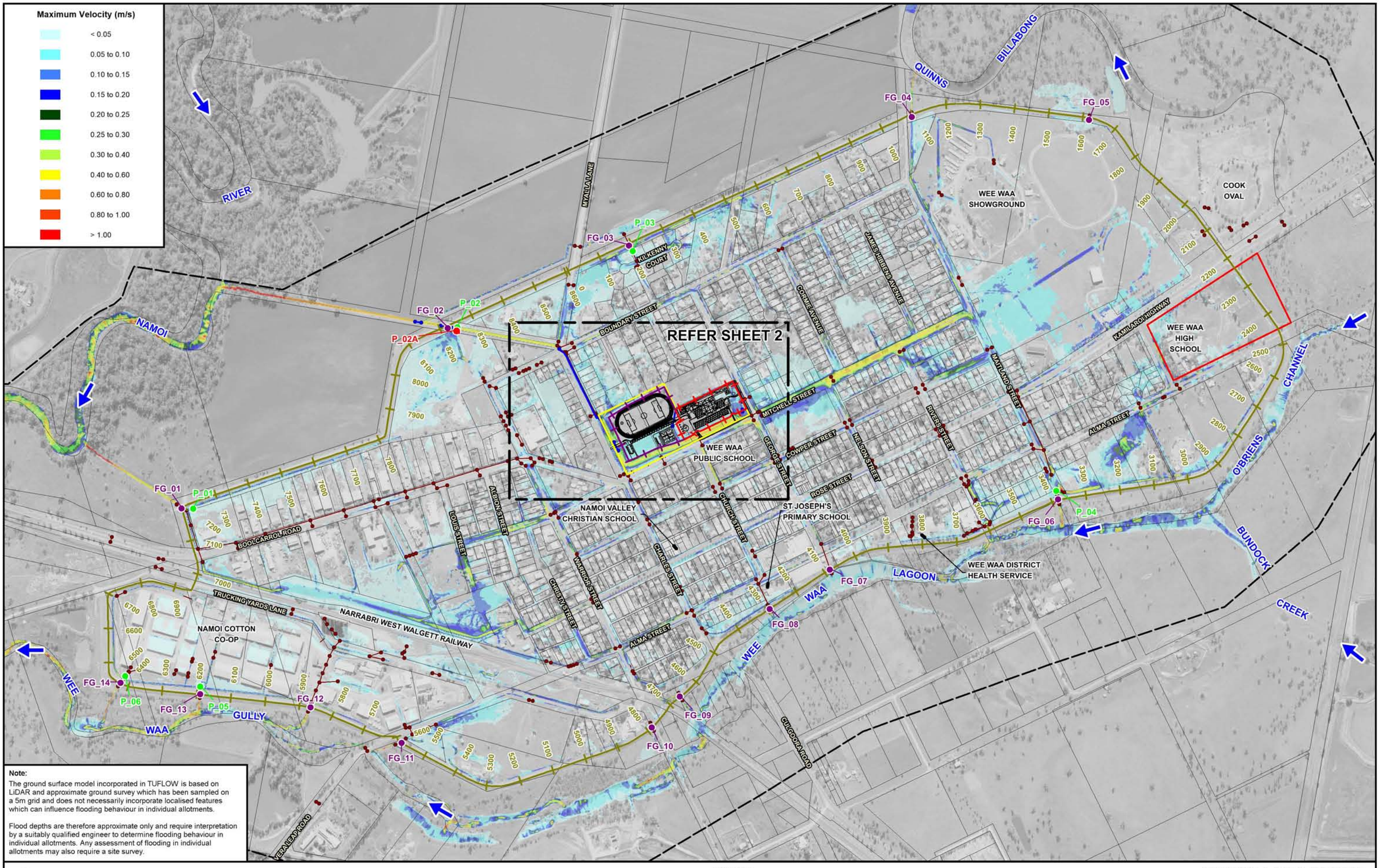
LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.9
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP



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N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.10
(Sheet 1 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

NEW 2 OFF 1350 RCPs

MAIN VEHICLE ACCESSWAY

MAIN PEDESTRIAN ACCESS

INDIGENOUS LEARNING CENTRE

ENVIRO CENTRE

SCIENCE TAS

ART LIBRARY

CANTEEN

GLS HOSP PERF TAS

STAFF ADMIN

HALL

PEDESTRIAN FOOTBRIDGE No. 1

PEDESTRIAN FOOTBRIDGE No. 2

CHARLES STREET

VEHICLE ACCESSWAY

NEW 2 OFF 2700 x 1200 RCBCs

WEE WAA PUBLIC SCHOOL

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

Maximum Velocity (m/s)

< 0.05
0.05 to 0.10
0.10 to 0.15
0.15 to 0.20
0.20 to 0.25
0.25 to 0.30
0.30 to 0.40
0.40 to 0.60
0.60 to 0.80
0.80 to 1.00
> 1.00

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

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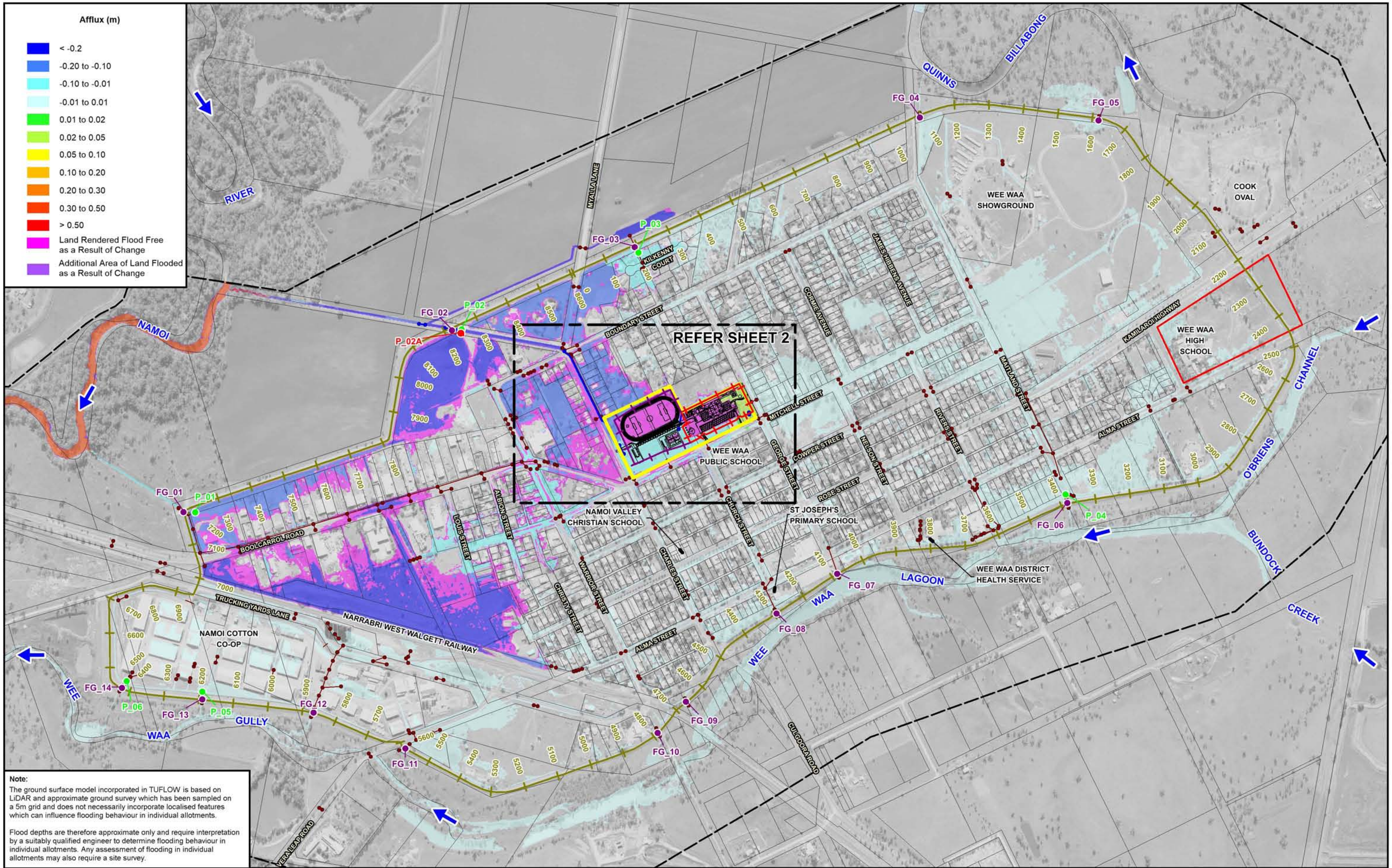
LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.10
(Sheet 2 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP



Note:
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N

Scale: 1:10,000 (100 0 100 200 300 m)

LEGEND

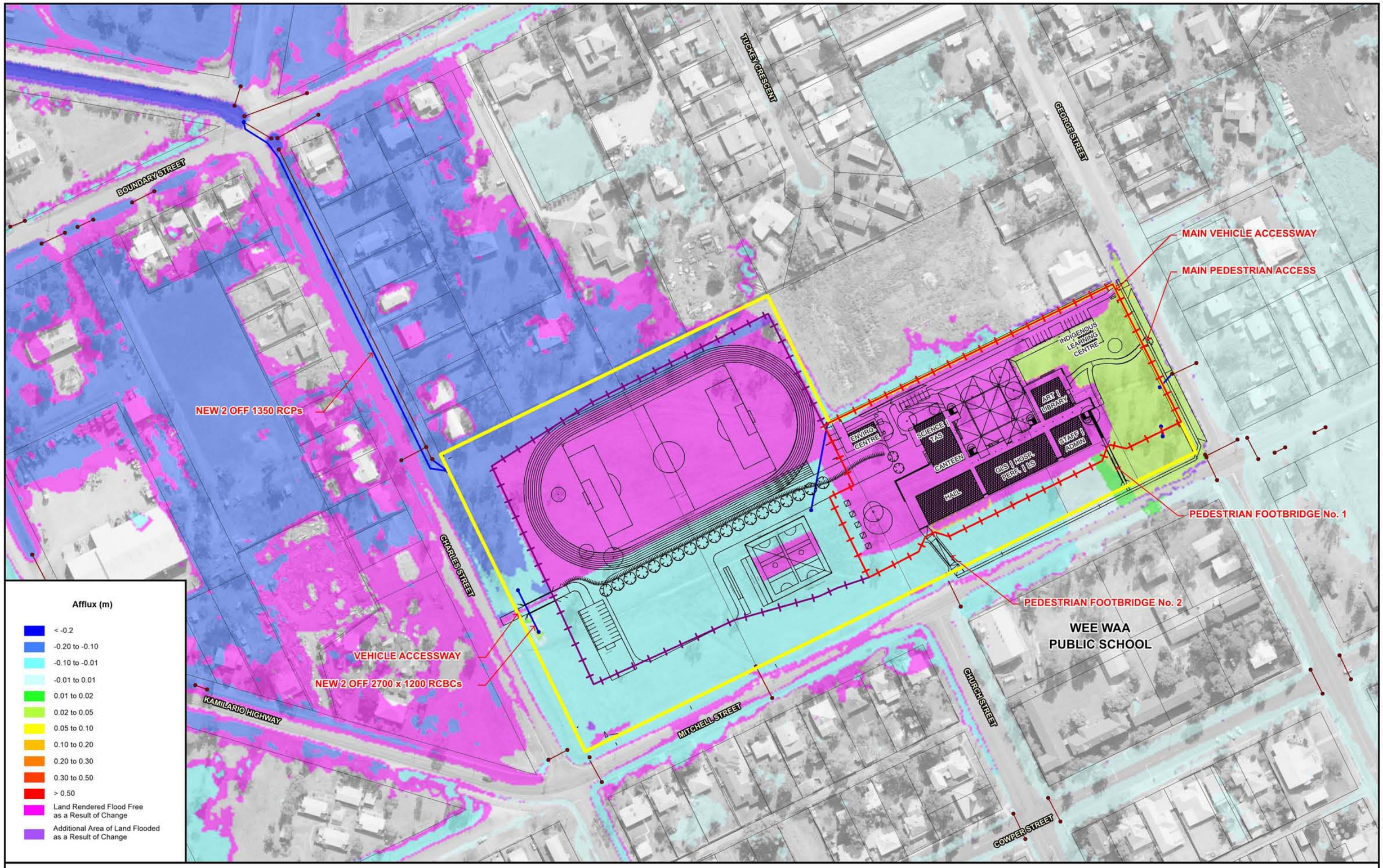
- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

Lyall & Associates

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.11
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
1% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

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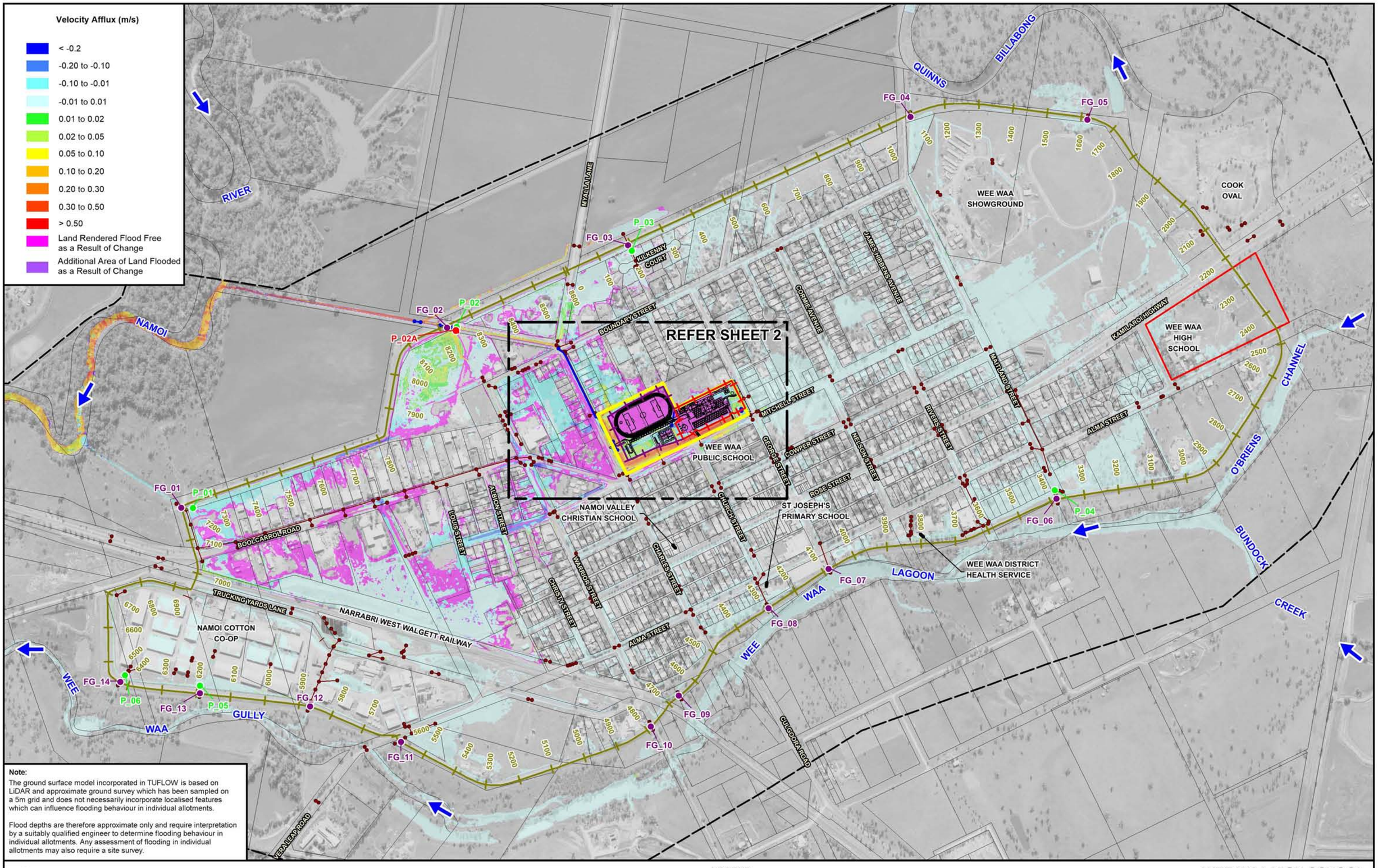
LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.11
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
1% AEP



Note:
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N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.12
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOW VELOCITIES INTERNAL TO TOWN LEVEE
1% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

NEW 2 OFF 1350 RCPs

VEHICLE ACCESSWAY

NEW 2 OFF 2700 x 1200 RCBCs

MAIN VEHICLE ACCESSWAY

MAIN PEDESTRIAN ACCESS

PEDESTRIAN FOOTBRIDGE No. 1

PEDESTRIAN FOOTBRIDGE No. 2

WEE WAA
PUBLIC SCHOOL

INDIGENOUS LEARNING CENTRE

ART / LIBRARY

ENVIRO. CENTRE

SCIENCE / TAS

STAFF / ADMIN

CANTEEN

CLS / HOSP. PERF. / LS

HALL

Velocity Afflux (m/s)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

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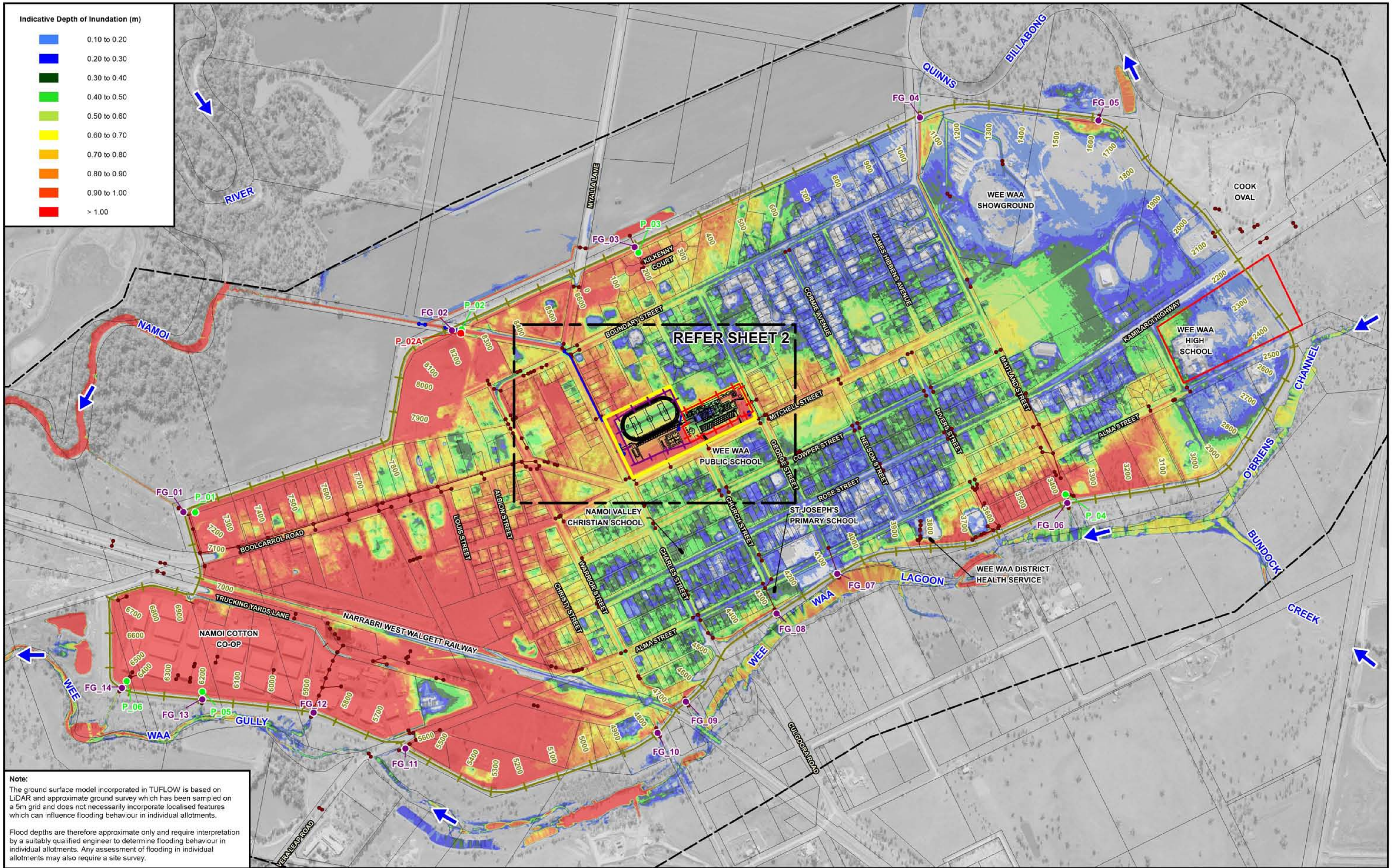
LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.12
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOW VELOCITIES INTERNAL TO TOWN LEVEE
1% AEP



Indicative Depth of Inundation (m)
0.10 to 0.20
0.20 to 0.30
0.30 to 0.40
0.40 to 0.50
0.50 to 0.60
0.60 to 0.70
0.70 to 0.80
0.80 to 0.90
0.90 to 1.00
> 1.00
NAMOI
RIVER
QUINNS
BILLABONG
WEE WAA SHOWGROUND
COOK OVAL
KAMILAROI HIGHWAY
WEE WAA HIGH SCHOOL
CHANNEL
O'BRIENS
BUNDOCK
CREEK
REFER SHEET 2
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
LAGOON
WEE WAA GULLY
NAMOI COTTON CO-OP
NARRABRI WEST WALGETT RAILWAY
TRUCKING YARDS LANE
BOOLCARROL ROAD
MYALLA LANE
KILKENNY COURT
BOUNDARY STREET
MITCHELL STREET
COWPER STREET
ROSE STREET
ALMA STREET
CORMIE AVENUE
JAMES HIBBENS AVENUE
MAITLAND STREET
RIVERS STREET
NELSON STREET
GEORGE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
CULGOORA ROAD
YERALEAP ROAD
FG_01
FG_02
FG_03
FG_04
FG_05
FG_06
FG_07
FG_08
FG_09
FG_10
FG_11
FG_12
FG_13
FG_14
P_01
P_02
P_02A
P_03
P_04
P_05
P_06
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N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

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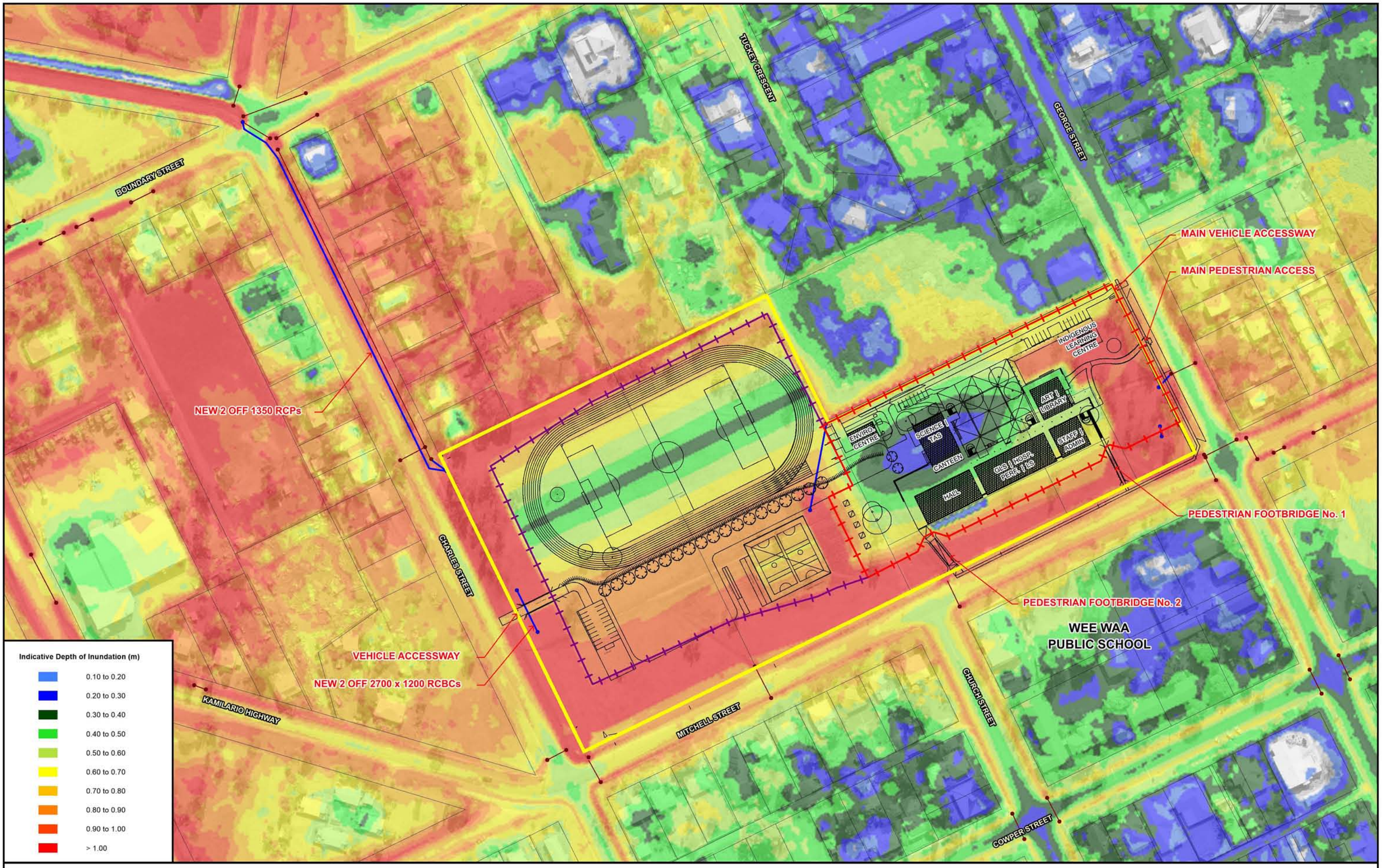
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.13
(Sheet 1 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - PMF



Lyall & Associates

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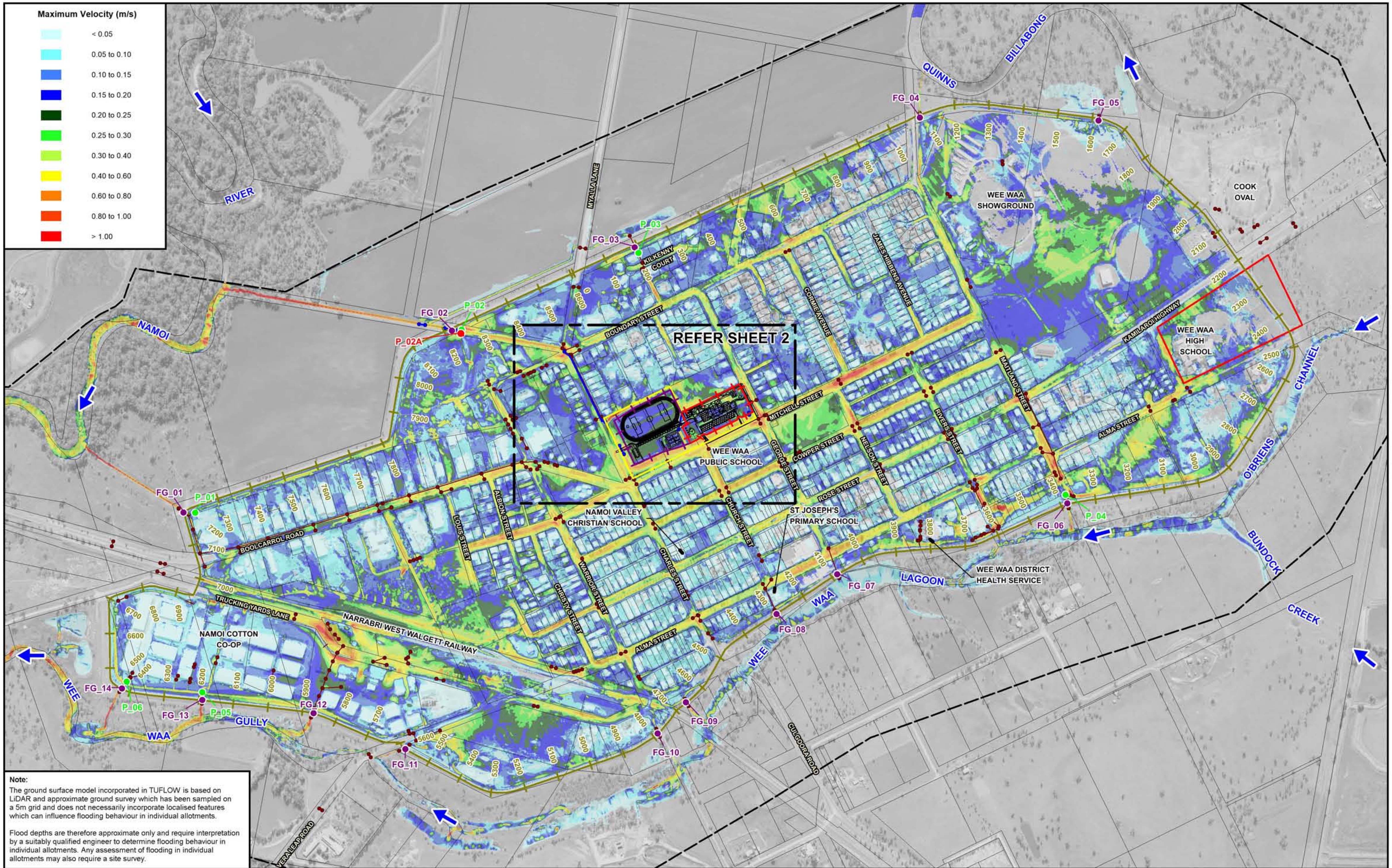
LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.13
(Sheet 2 of 2)

INDICATIVE EXTENT AND DEPTH OF INUNDATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - PMF



Maximum Velocity (m/s)
< 0.05
0.05 to 0.10
0.10 to 0.15
0.15 to 0.20
0.20 to 0.25
0.25 to 0.30
0.30 to 0.40
0.40 to 0.60
0.60 to 0.80
0.80 to 1.00
> 1.00
REFER SHEET 2
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP
NAMOI RIVER
QUINNS BILLABONG
O'BRIENS CHANNEL
BUNDOCK CREEK
WEE WAA LAGOON
WEE WAA GULLY
KAMILAROI HIGHWAY
NARRABRI WEST WALGETT RAILWAY
BOOLCARROL ROAD
CULGOORA ROAD
MYALLA LANE
KILKENNY COURT
BOUNDARY STREET
MITCHELL STREET
ALMA STREET
ROSE STREET
COWPER STREET
GEORGE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
NELSON STREET
RIVERS STREET
MAITLAND STREET
CORMIE AVENUE
JAMES HIBBENS AVENUE
TRUCKING YARDS LANE
FG_01
FG_02
FG_03
FG_04
FG_05
FG_06
FG_07
FG_08
FG_09
FG_10
FG_11
FG_12
FG_13
FG_14
P_01
P_02
P_02A
P_03
P_04
P_05
P_06
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N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

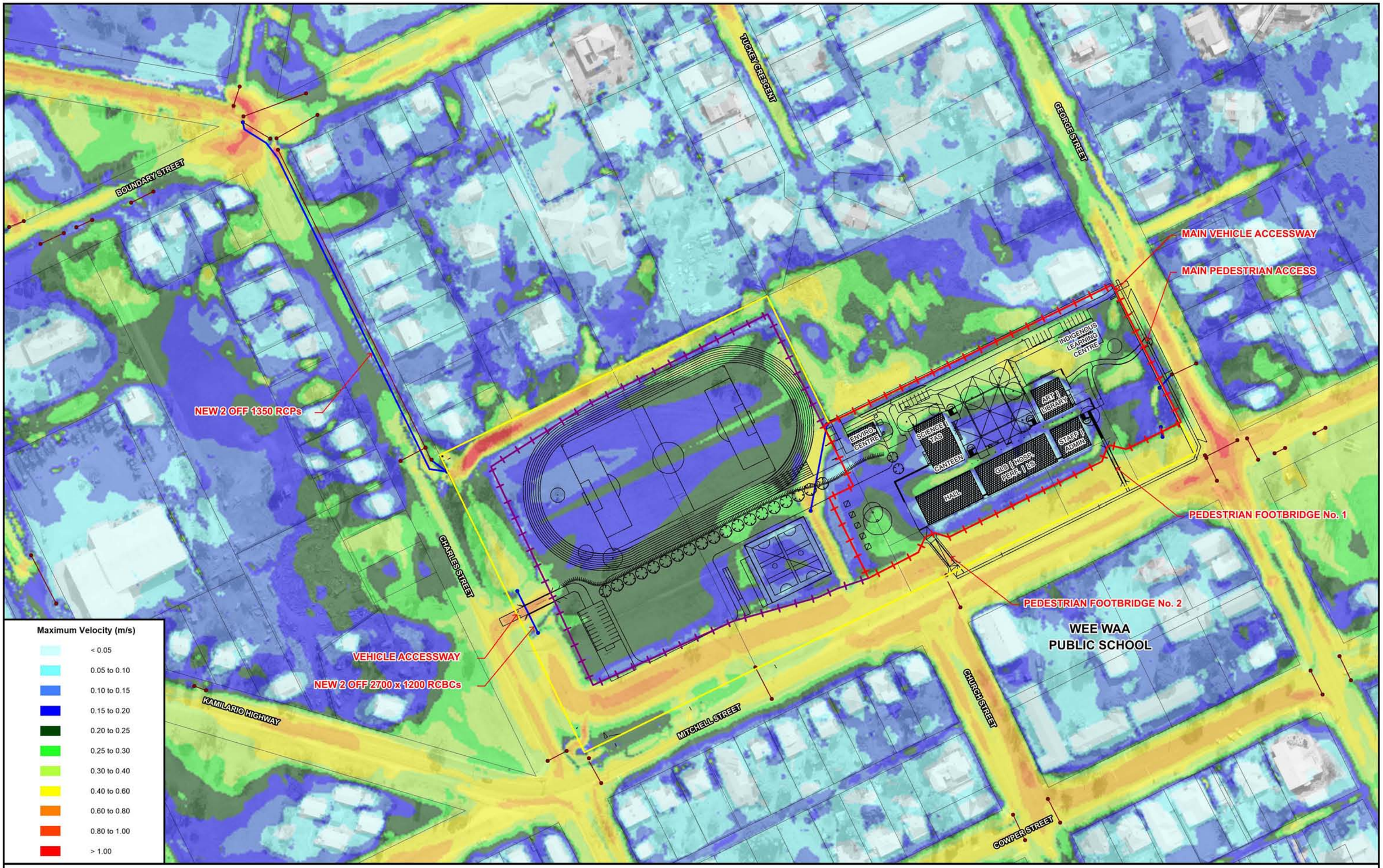
LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.14
(Sheet 1 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - PMF



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

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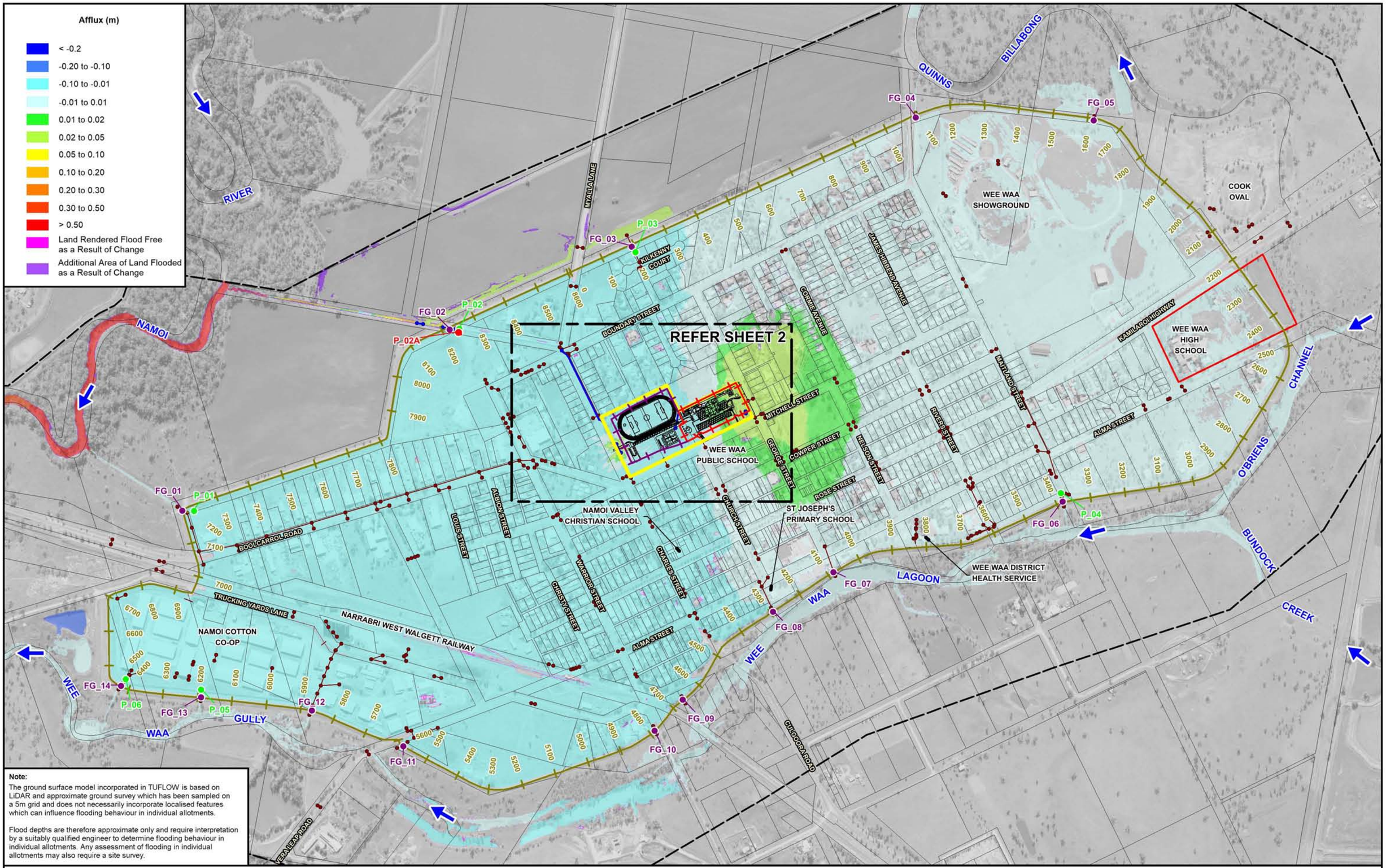
LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.14
(Sheet 2 of 2)

MAXIMUM FLOW VELOCITIES INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - PMF



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N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.15
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
PMF

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

NEW 2 OFF 1350 RCPs

MAIN VEHICLE ACCESSWAY

MAIN PEDESTRIAN ACCESS

PEDESTRIAN FOOTBRIDGE No. 1

PEDESTRIAN FOOTBRIDGE No. 2

VEHICLE ACCESSWAY

NEW 2 OFF 2700 x 1200 RCBCs

WEE WAA PUBLIC SCHOOL

INDIGENOUS LEARNING CENTRE

ART / LIBRARY

ENVIRO. CENTRE

SCIENCE / TAS

CANTEEN

HALL

GLS / HOSP. PERF / LS

STAFF / ADMIN

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

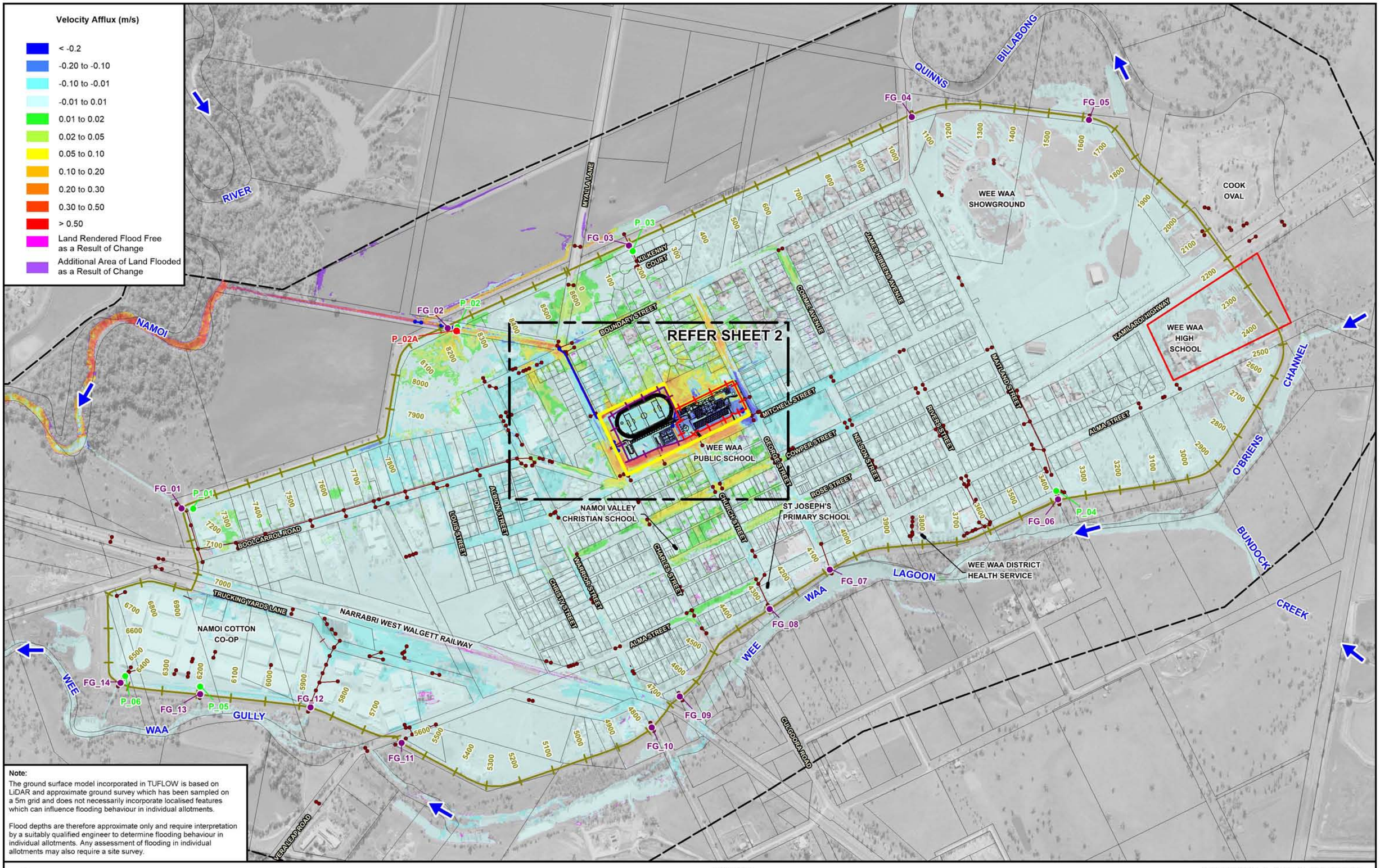
LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.15
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE PMF



Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.16
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOW VELOCITIES INTERNAL TO TOWN LEVEE
PMF

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

NEW 2 OFF 1350 RCPs

MAIN VEHICLE ACCESSWAY

MAIN PEDESTRIAN ACCESS

PEDESTRIAN FOOTBRIDGE No. 1

PEDESTRIAN FOOTBRIDGE No. 2

VEHICLE ACCESSWAY

NEW 2 OFF 2700 x 1200 RCBCs

WEE WAA
PUBLIC SCHOOL

INDIGENOUS LEARNING CENTRE

ENVIRO. CENTRE

SCIENCE / TAS

ART / LIBRARY

CANTEEN

STAFF / ADMIN

HALL

CLS / HOSP. PERF. / LS

Velocity Afflux (m/s)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

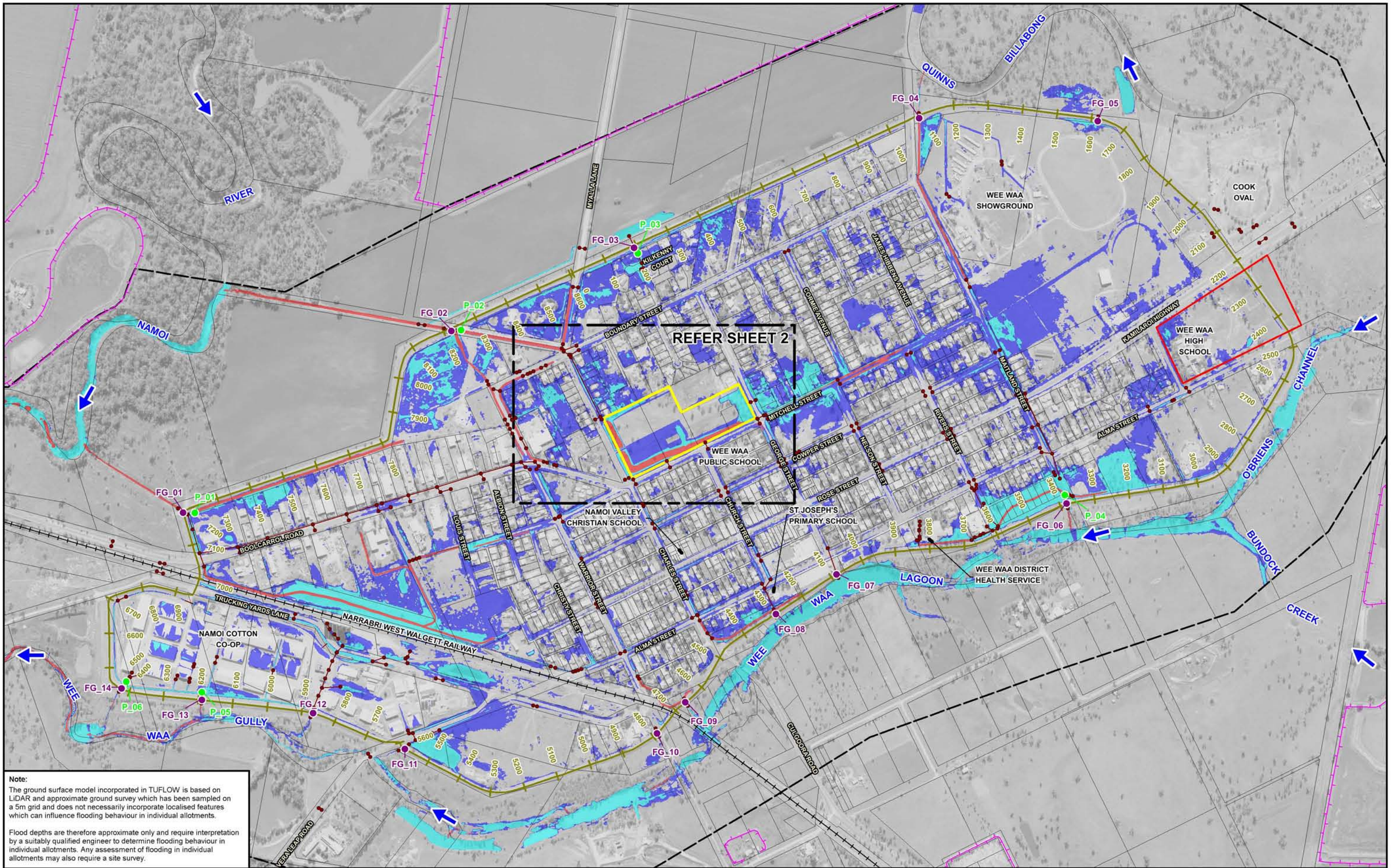
LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.16
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOW VELOCITIES INTERNAL TO TOWN LEVEE PMF



Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Rural Levees on Namoi River Floodplain
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Two-Dimensional Model Extent
- Modelled Stormwater Network
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Floodway
- Flood Storage
- Flood Fringe

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.17
(Sheet 1 of 2)

HYDRAULIC CATEGORISATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Modelled Stormwater Network
- Proposal Site Boundary
- Floodway
- Flood Storage
- Flood Fringe

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.17
(Sheet 2 of 2)

HYDRAULIC CATEGORISATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP

FLOOD HAZARD VULNERABILITY CLASSIFICATION

- H1 Generally safe for vehicles, people and buildings.
- H2 Unsafe for small vehicles.
- H3 Unsafe for vehicles, children and the elderly.
- H4 Unsafe for vehicles and people.
- H5 Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure.
- H6 Unsafe for vehicles and people. All building types considered vulnerable to failure.

REFER SHEET 2

RIVER
NAMOI
WEE WAA
BILLABONG
QUINNS
CHANNEL
O'BRIENS
BUNDOCK
CREEK
LAGOON
GULLY
MYALLA LANE
KILKENNY COURT
BOUNDARY STREET
CORMIE AVENUE
JAMES HIBBENS AVENUE
KAMILAROI HIGHWAY
MAITLAND STREET
MITCHELL STREET
GEORGE STREET
COWPER STREET
NELSON STREET
RIVER STREET
ALMA STREET
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
GUNNEDAH ROAD
VERA LEAP ROAD

WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

FG_01 FG_02 FG_03 FG_04 FG_05 FG_06 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 FG_14
P_01 P_02 P_02A P_03 P_04 P_05 P_06

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N
100 0 100 200 300 m
Scale: 1:10,000

Lyall & Associates

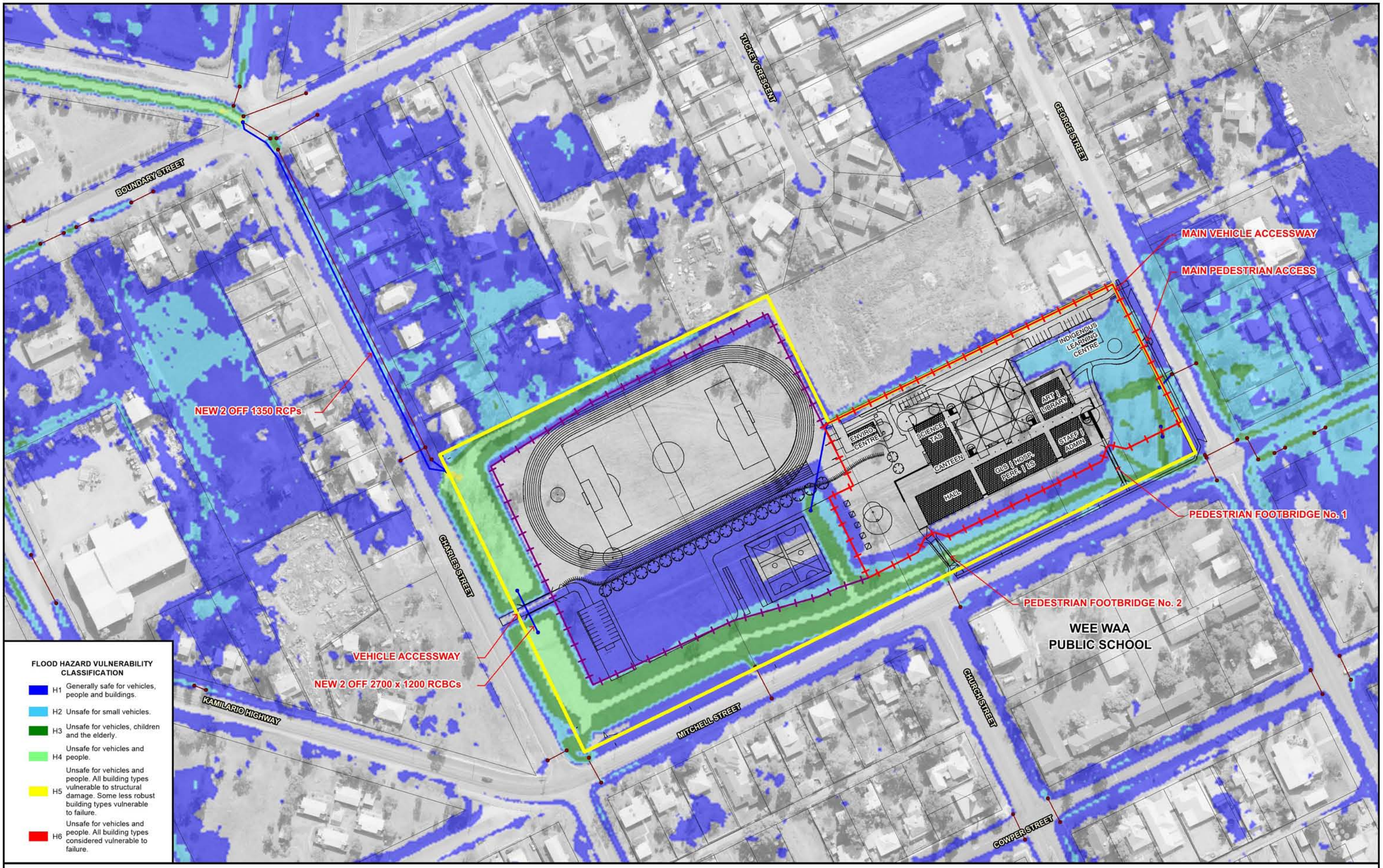
LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.18
(Sheet 1 of 2)

FLOOD HAZARD VULNERABILITY CATEGORISATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Existing Drainage System
- Proposed Drainage System
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.18
(Sheet 2 of 2)

FLOOD HAZARD VULNERABILITY CATEGORISATION INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

RIVER
NAMOI
WAA
WEE
GULLY
CHANNEL
O'BRIENS
BUNDOCK
CREEK
LAGOON
QUINNS
BILLABONG
MYALLA LANE
BOUNDARY STREET
KILKENNY COURT
JAMES HIBBENS AVENUE
CORMIE AVENUE
MITCHELL STREET
GEORGE STREET
COWPER STREET
NELSON STREET
RIVER STREET
MAITLAND STREET
ALMA STREET
KAMILAROI HIGHWAY
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
GUILGOORA ROAD
VERALEA ROAD

REFER SHEET 2

WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

FG_01 FG_02 FG_03 FG_04 FG_05 FG_06 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 FG_14
P_01 P_02 P_02A P_03 P_04 P_05 P_06

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N
100 0 100 200 300 m
Scale: 1:10,000

Lyall & Associates

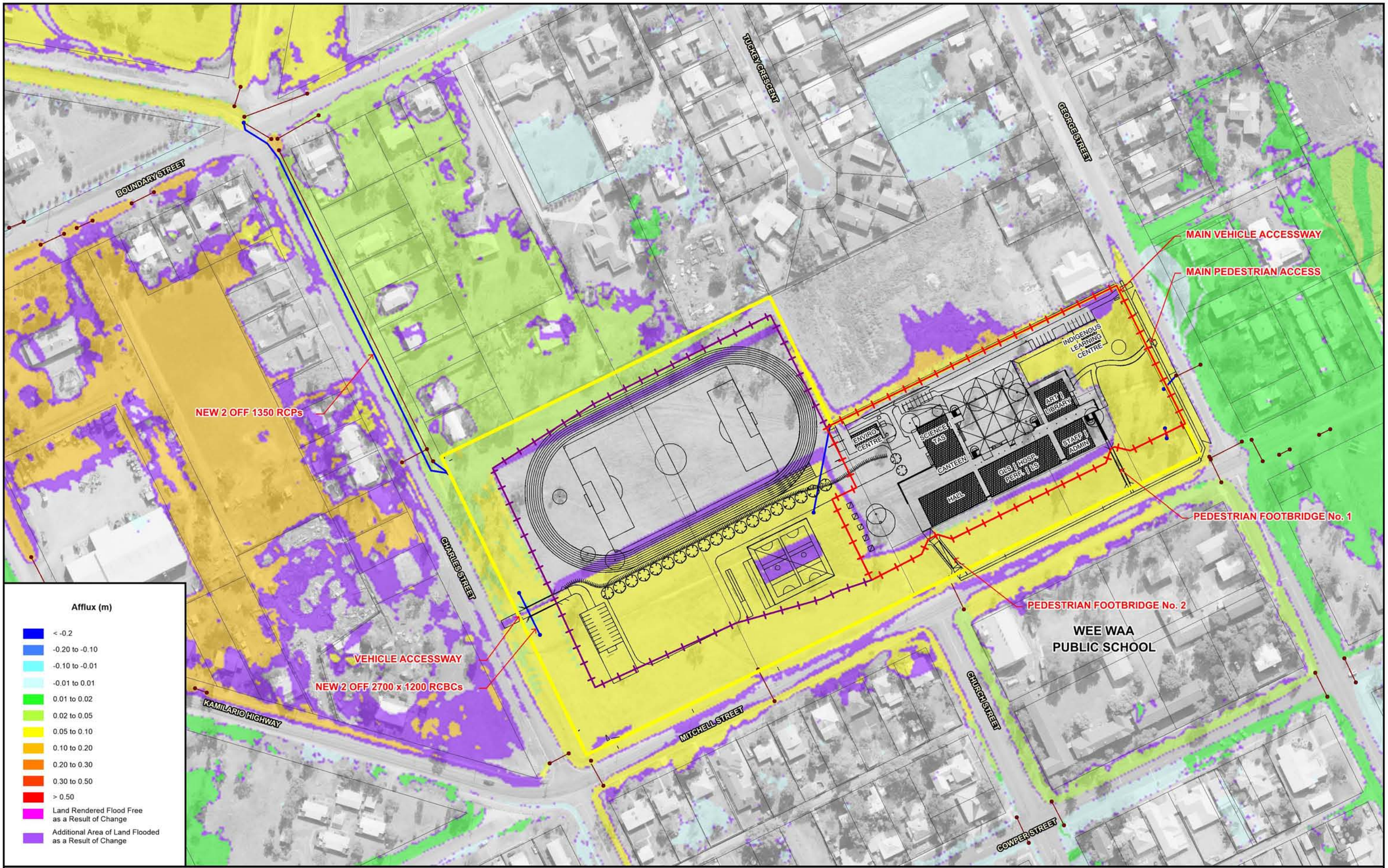
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.19
(Sheet 1 of 2)

IMPACT OF A 10% INCREASE IN 1% AEP RAINFALL INTENSITIES ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

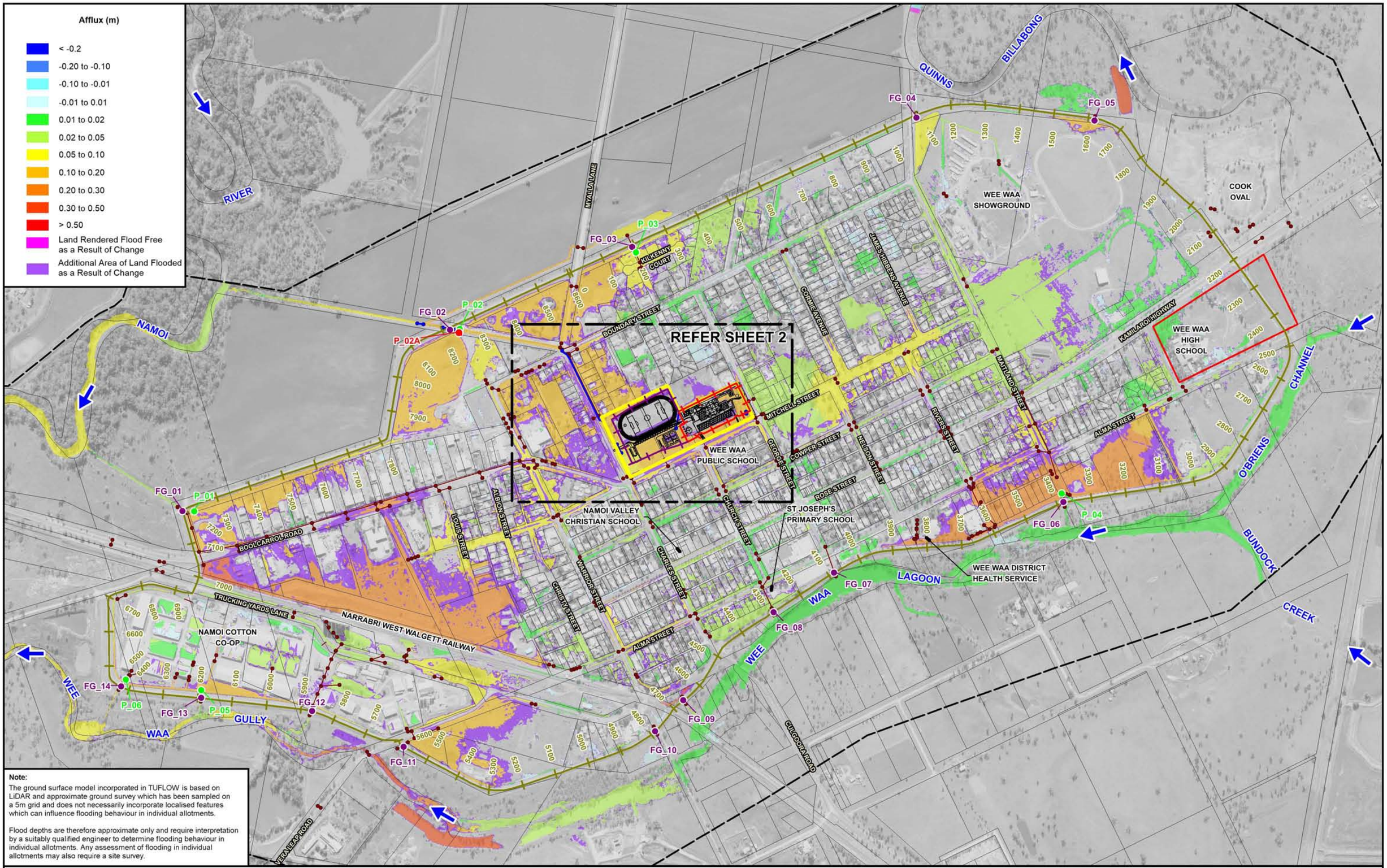
LEGEND

- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.19
(Sheet 2 of 2)

IMPACT OF A 10% INCREASE IN 1% AEP RAINFALL INTENSITIES ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS



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Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.20
(Sheet 1 of 2)

IMPACT OF A 30% INCREASE IN 1% AEP RAINFALL INTENSITIES ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS

BOUNDARY STREET
TUCKEY CRESCENT
GEORGE STREET
CHARLES STREET
KAMILAROI HIGHWAY
MITCHELL STREET
CHURCH STREET
COWPER STREET
NEW 2 OFF 1350 RCPs
MAIN VEHICLE ACCESSWAY
MAIN PEDESTRIAN ACCESS
PEDESTRIAN FOOTBRIDGE No. 1
PEDESTRIAN FOOTBRIDGE No. 2
VEHICLE ACCESSWAY
NEW 2 OFF 2700 x 1200 RCBCs
WEE WAA PUBLIC SCHOOL
INDIGENOUS LEARNING CENTRE
ENVIRO. CENTRE
SCIENCE / TAS
ART / LIBRARY
CANTEEN
STAFF / ADMIN
HALL
GLS / HOSP. PERF / TAS

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.20
(Sheet 2 of 2)

IMPACT OF A 30% INCREASE IN 1% AEP RAINFALL INTENSITIES ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

REFER SHEET 2

RIVER
NAMOI
WAA GULLY
WEE WAA LAGOON
WEE WAA CREEK
BUNDOCK CHANNEL
BILLABONG
QUINNS
MYALLA LANE
KILKENNY COURT
BOUNDARY STREET
CORMIE AVENUE
JAMES HIBBENS AVENUE
KAMILAROI HIGHWAY
MAITLAND STREET
RIVER STREET
ALMA STREET
O'BRIENS
MITCHELL STREET
GEORGE STREET
COWPER STREET
NELSON STREET
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
GILGOOMAR ROAD
VERALEAP ROAD
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

FG_01, FG_02, FG_03, FG_04, FG_05, FG_06, FG_07, FG_08, FG_09, FG_10, FG_11, FG_12, FG_13, FG_14
P_01, P_02, P_02A, P_03, P_04, P_05, P_06

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N
100 0 100 200 300 m
Scale: 1:10,000

Lyall & Associates

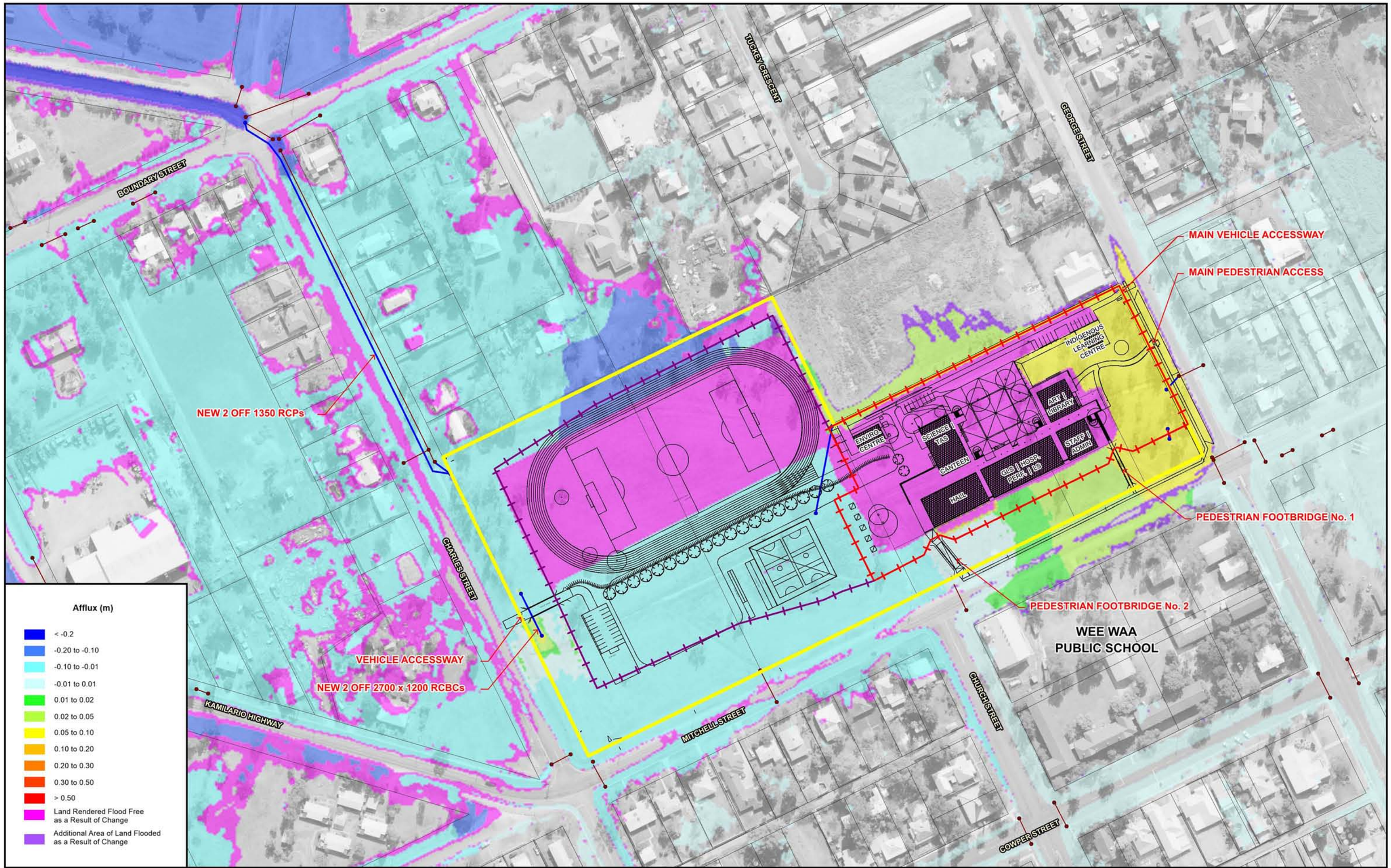
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.21
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-10% INCREASE IN 1% AEP RAINFALL INTENSITY CONDITIONS



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.21
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-10% INCREASE IN 1% AEP RAINFALL INTENSITY CONDITIONS

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

RIVER
NAMOI
WAA GULLY
WEE WAA LAGOON
WEE WAA CREEK
BUNDOCK CHANNEL
BILLABONG
QUINNS
MYALLA LANE
BOUNDARY STREET
KILKENNY COURT
CORMIE AVENUE
JAMES HIBBENS AVENUE
KAMILAROI HIGHWAY
MAITLAND STREET
ALMA STREET
RIVER STREET
MITCHELL STREET
COWPER STREET
NELSON STREET
ROSE STREET
CHURCH STREET
CHARLES STREET
CHRISTY STREET
WARRIOR STREET
GEORGE STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
CULGOORA ROAD
VERALEAP ROAD
O'BRIENS

REFER SHEET 2

WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

FG_01 FG_02 FG_03 FG_04 FG_05 FG_06 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 FG_14
P_01 P_02 P_02A P_03 P_04 P_05 P_06

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N
100 0 100 200 300 m
Scale: 1:10,000

Lyall & Associates

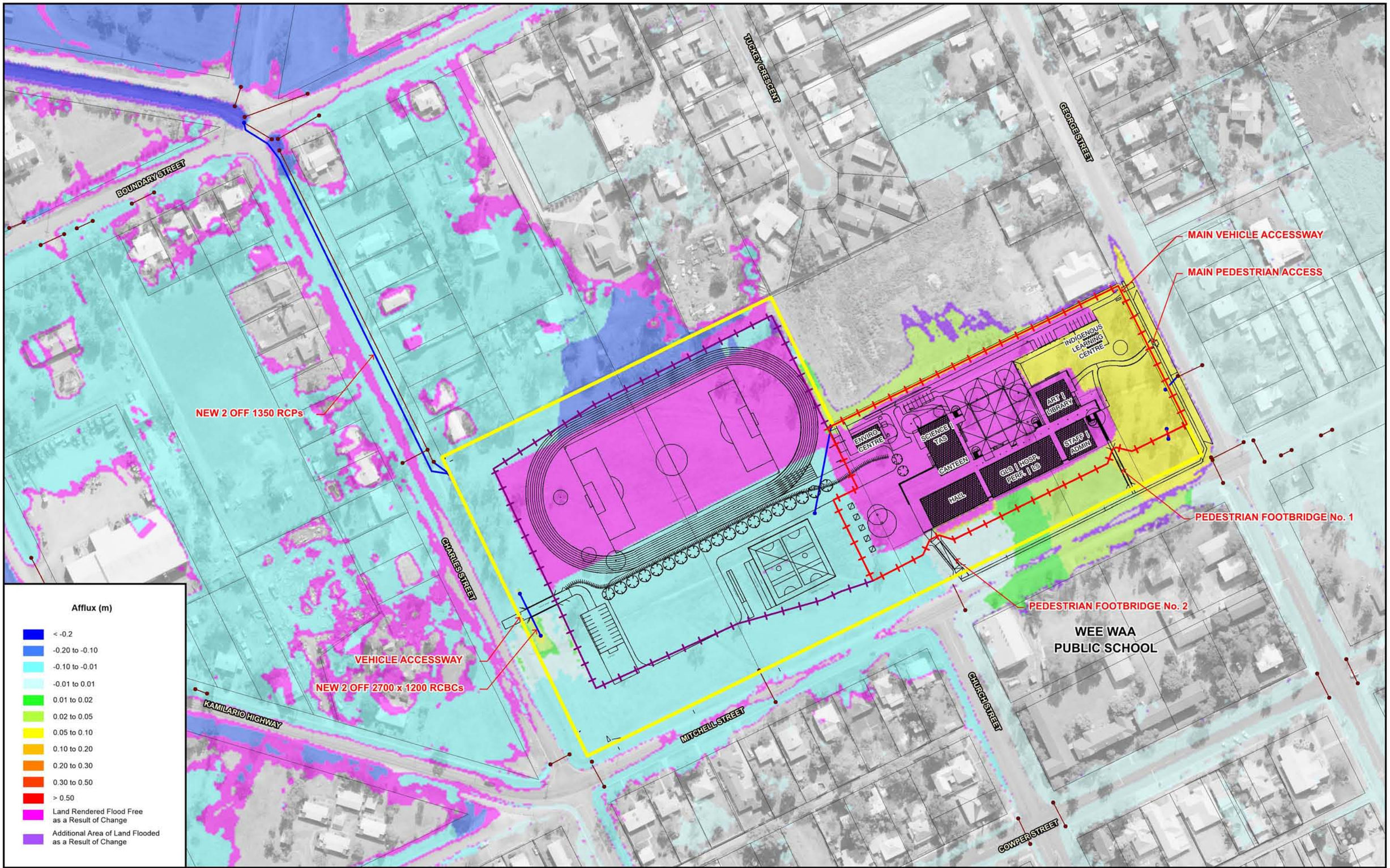
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.22
(Sheet 1 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-30% INCREASE IN 1% AEP RAINFALL INTENSITY CONDITIONS



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.22
(Sheet 2 of 2)

IMPACT OF PROPOSAL AND FMW ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-30% INCREASE IN 1% AEP RAINFALL INTENSITY CONDITIONS

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

REFER SHEET 2

RIVER
NAMOI
WEE WAA GULLY
WEE WAA LAGOON
BUNDOCK CREEK
CHANNEL
O'BRIENS
BILLABONG
QUINNS
MYALLA LANE
BOUNDARY STREET
KILKENNY COURT
JAMES HIBBENS AVENUE
CORMIE AVENUE
KAMILAROI HIGHWAY
MAITLAND STREET
MITCHELL STREET
RIVER STREET
ALMA STREET
COOPER STREET
GEORGE STREET
NELSON STREET
ROSE STREET
CHURCH STREET
CHARLES STREET
WARRIOR STREET
CHRISTY STREET
ALBION STREET
LOUIS STREET
BOOLCARROL ROAD
TRUCKING YARDS LANE
NARRABRI WEST WALGETT RAILWAY
VERALEA ROAD
GUILGOORA ROAD
WEE WAA SHOWGROUND
COOK OVAL
WEE WAA HIGH SCHOOL
WEE WAA PUBLIC SCHOOL
NAMOI VALLEY CHRISTIAN SCHOOL
ST JOSEPH'S PRIMARY SCHOOL
WEE WAA DISTRICT HEALTH SERVICE
NAMOI COTTON CO-OP

FG_01 FG_02 FG_03 FG_04 FG_05 FG_06 FG_07 FG_08 FG_09 FG_10 FG_11 FG_12 FG_13 FG_14
P_01 P_02 P_02A P_03 P_04 P_05 P_06

Note:
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N
100 0 100 200 300 m
Scale: 1:10,000

Lyall & Associates

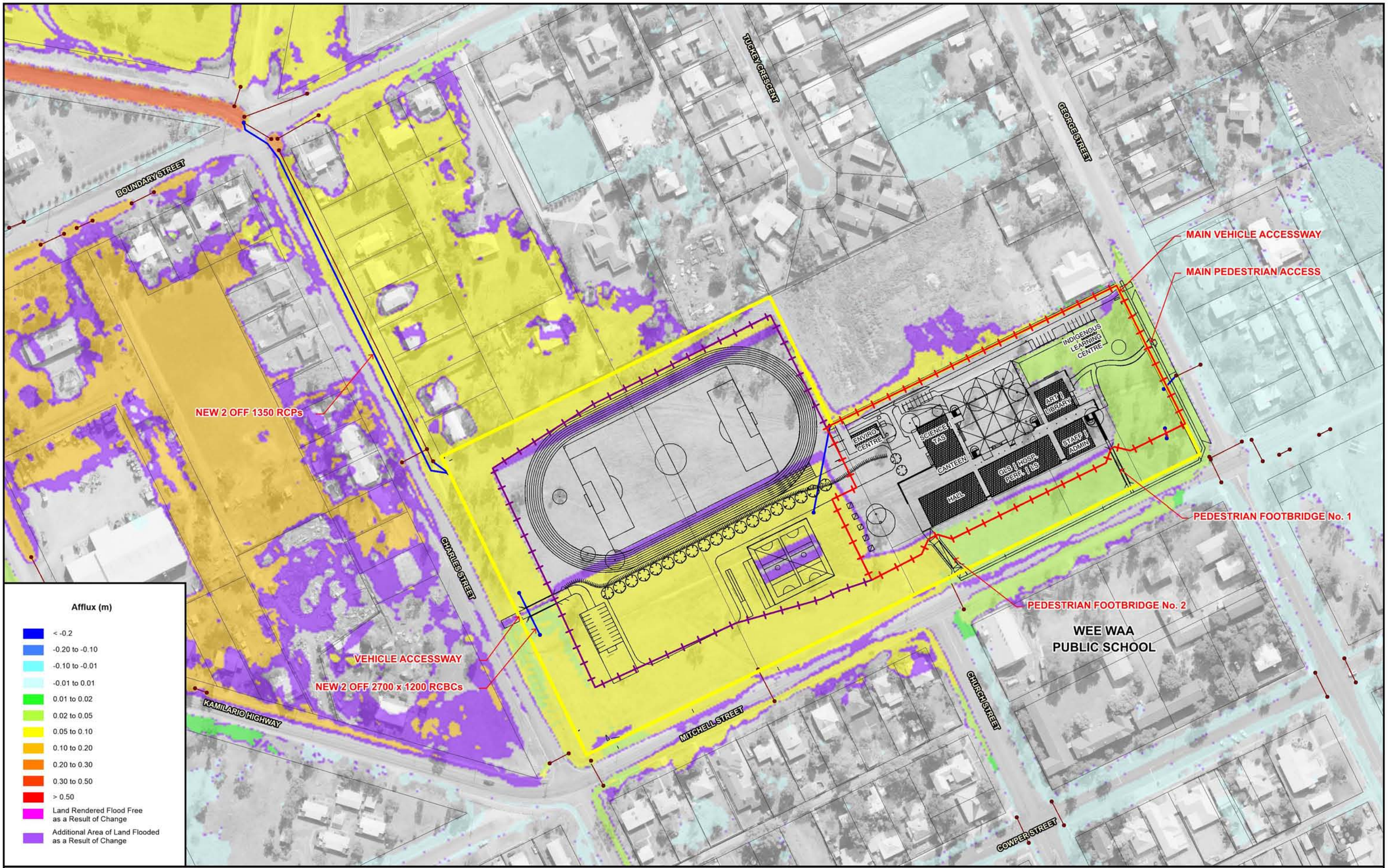
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.23
(Sheet 1 of 2)

IMPACT OF FLOOD GATES CLOSED AND FLOOD EVACUATION PUMPS OPERABLE ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

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Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

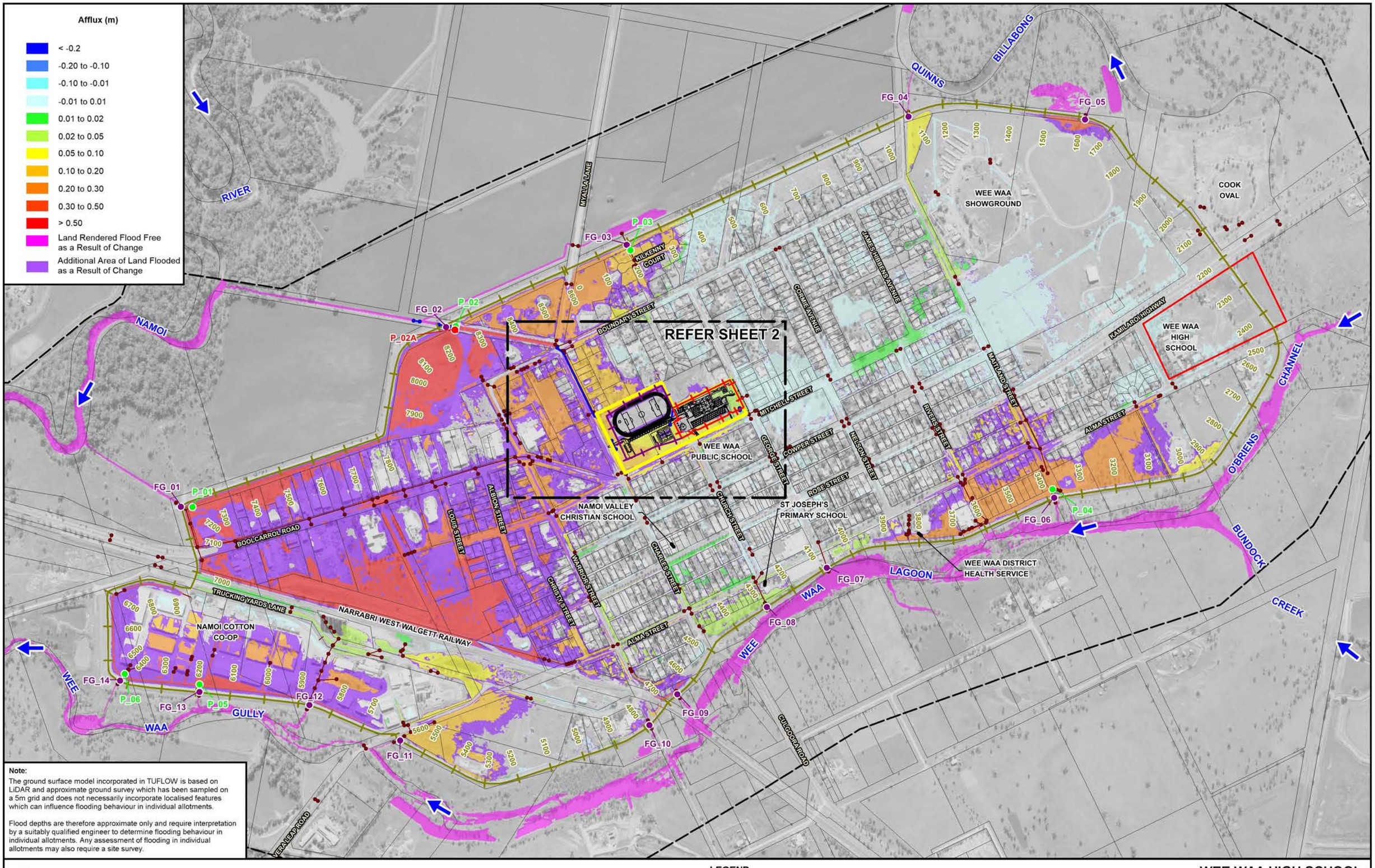
LEGEND

- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.23
(Sheet 2 of 2)

IMPACT OF FLOOD GATES CLOSED AND FLOOD EVACUATION PUMPS OPERABLE ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP



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Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

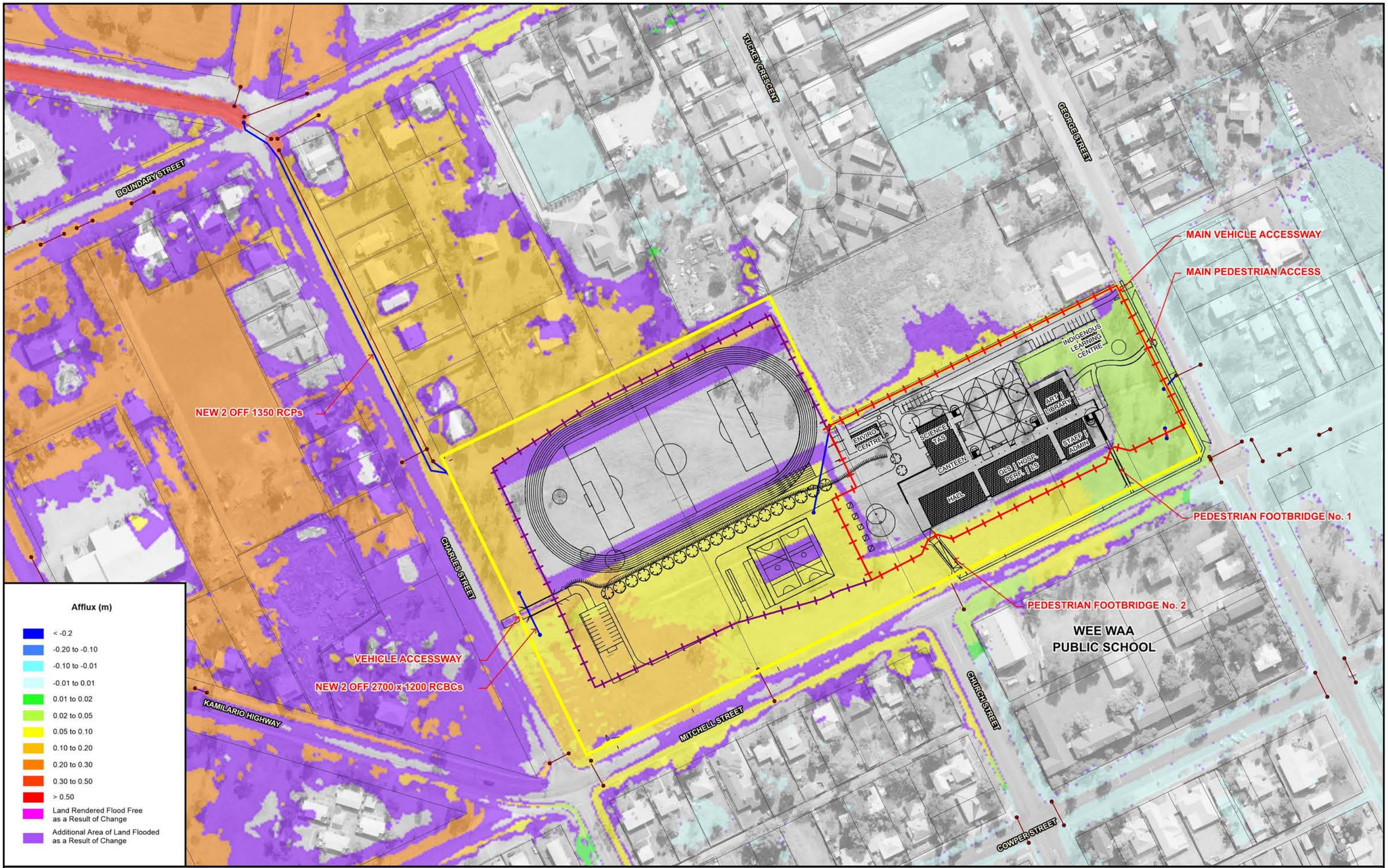
LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.24
(Sheet 1 of 2)

IMPACT OF FLOOD GATES CLOSED AND FLOOD EVACUATION PUMPS INOPERABLE ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.24
(Sheet 2 of 2)

IMPACT OF FLOOD GATES CLOSED AND FLOOD EVACUATION PUMPS INOPERABLE ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

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N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.25
(Sheet 1 of 2)

IMPACT OF A PARTIAL BLOCKAGE OF MAJOR HYDRAULIC STRUCTURES ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

CHARLES STREET

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

NEW 2 OFF 1350 RCPs

VEHICLE ACCESSWAY

NEW 2 OFF 2700 x 1200 RCBCs

MAIN VEHICLE ACCESSWAY

MAIN PEDESTRIAN ACCESS

PEDESTRIAN FOOTBRIDGE No. 1

PEDESTRIAN FOOTBRIDGE No. 2

WEE WAA
PUBLIC SCHOOL

INDIGENOUS LEARNING CENTRE

ART / LIBRARY

ENVIRO. CENTRE

SCIENCE / TAS

STAFF / ADMIN

CANTEEN

GLS / HOSP. PERF / ILS

HALL

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

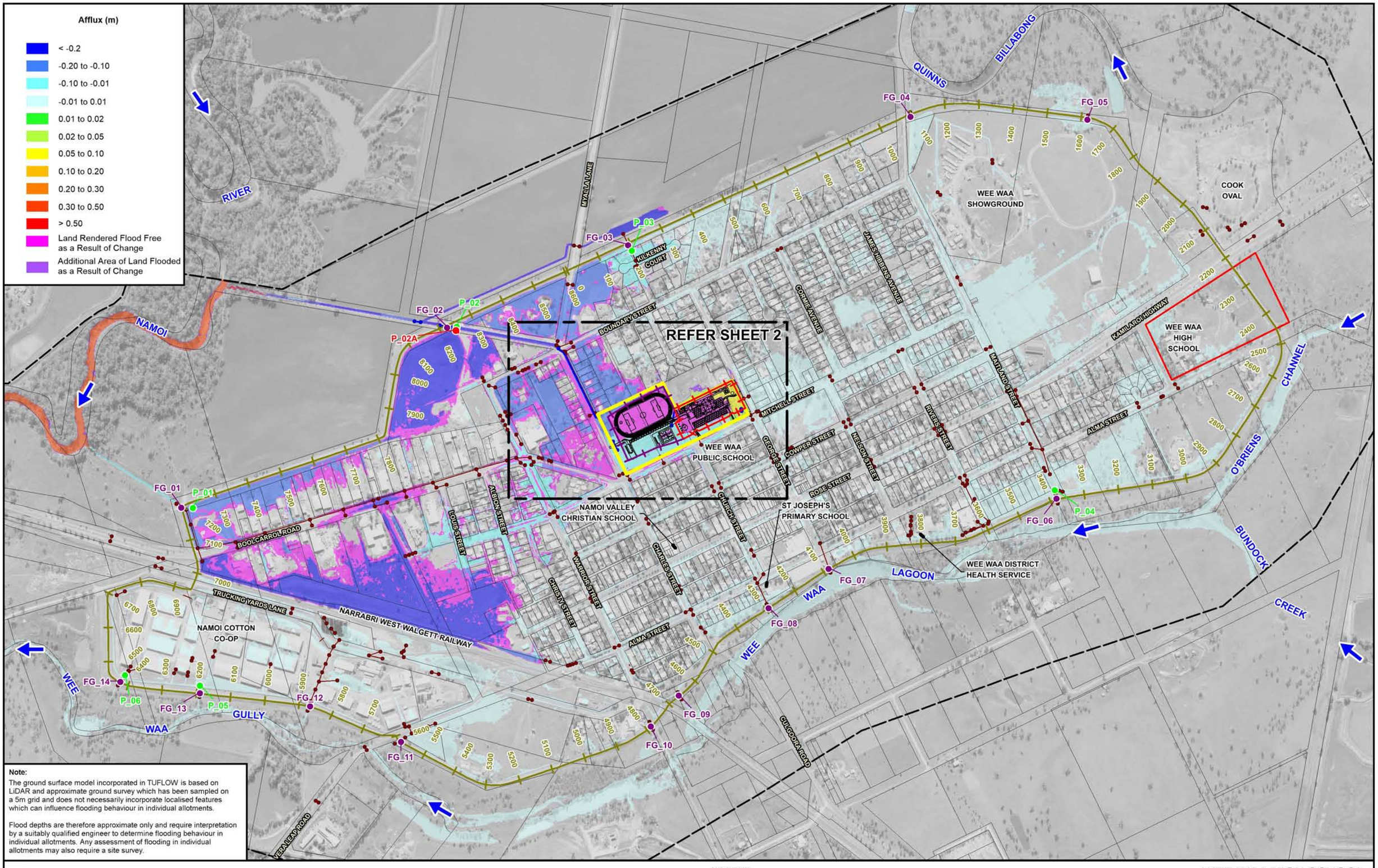
LEGEND

- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.25
(Sheet 2 of 2)

IMPACT OF A PARTIAL BLOCKAGE OF MAJOR HYDRAULIC STRUCTURES ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP



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N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

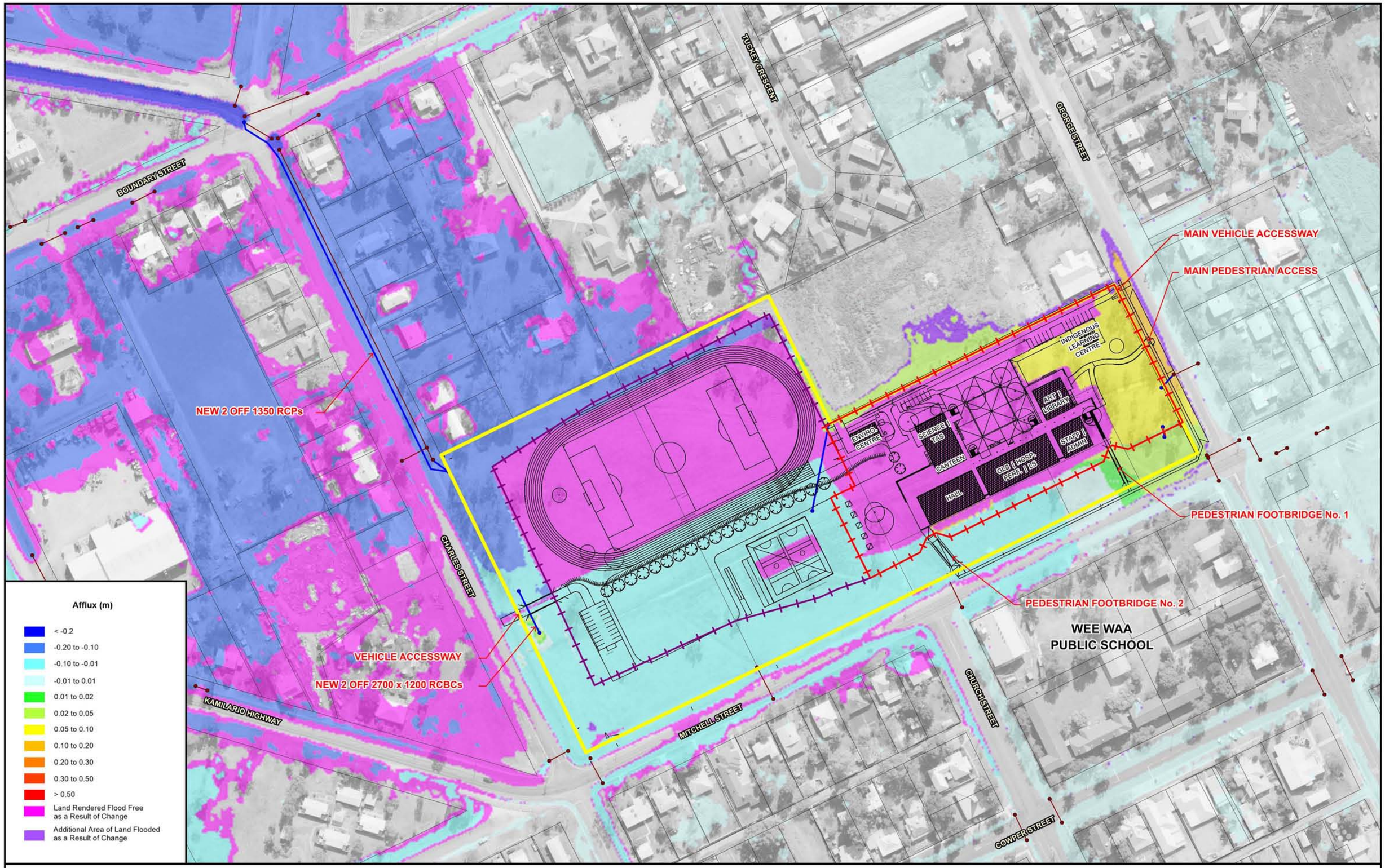
LEGEND

- Existing Levee Centre Line and Chainage
- Existing Flood Gate Location and Identifier
- Existing Pump Location and Identifier
- Proposed Duplicate Pump Location and Identifier
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.26
(Sheet 1 of 2)

IMPACT OF A PARTIAL BLOCKAGE OF PERIMETER FENCING ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP



N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.26
(Sheet 2 of 2)

IMPACT OF A PARTIAL BLOCKAGE OF PERIMETER FENCING ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

Note:
The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

LEGEND

- Existing Levee Centre Line and Chainage
- FG_02 Existing Flood Gate Location and Identifier
- P_02 Existing Pump Location and Identifier
- P_02A Proposed Duplicate Pump Location and Identifier
- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing WWHS Site Boundary
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.27
(Sheet 1 of 2)

IMPACT OF A COMPLETE BLOCKAGE OF GEORGE STREET PERIMETER FENCING ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP

BOUNDARY STREET

TUCKEY CRESCENT

GEORGE STREET

NEW 2 OFF 1350 RCPs

MAIN VEHICLE ACCESSWAY

MAIN PEDESTRIAN ACCESS

INDIGENOUS LEARNING CENTRE

ART / LIBRARY

ENVIRO. CENTRE

SCIENCE / TAS

STAFF / ADMIN

CANTEEN

GLS / HOSP. PERF. / LS

HALL

PEDESTRIAN FOOTBRIDGE No. 1

CHARLES STREET

PEDESTRIAN FOOTBRIDGE No. 2

WEE WAA PUBLIC SCHOOL

VEHICLE ACCESSWAY

NEW 2 OFF 2700 x 1200 RCBCs

KAMILARIO HIGHWAY

MITCHELL STREET

CHURCH STREET

COWPER STREET

Afflux (m)

- < -0.2
- -0.20 to -0.10
- -0.10 to -0.01
- -0.01 to 0.01
- 0.01 to 0.02
- 0.02 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.30
- 0.30 to 0.50
- > 0.50
- Land Rendered Flood Free as a Result of Change
- Additional Area of Land Flooded as a Result of Change

N

20 0 20 40 60 m

Scale: 1:2,000

Lyall & Associates

Note:

The ground surface model incorporated in TUFLOW is based on LiDAR and approximate ground survey which has been sampled on a 5m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

LEGEND

- Proposed 1.2 m High Perimeter Fence
- Proposed 2.1 m High Perimeter Fence
- Existing Drainage System
- Proposed Drainage System
- Proposal Site Boundary
- Proposal Design Strings
- Proposal Building Footprint

WEE WAA HIGH SCHOOL
TECHNICAL WORKING PAPER: FLOODING

Figure 6.27
(Sheet 2 of 2)

IMPACT OF A COMPLETE BLOCKAGE OF GEORGE STREET PERIMETER FENCING ON FLOOD BEHAVIOUR INTERNAL TO TOWN LEVEE
POST-PROPOSAL AND FMW CONDITIONS - 1% AEP