FLOOD EMERGENCY RESPONSE PLAN

NEWCASTLE GRAMMAR SCHOOL – PARK CAMPUS

Client: Newcastle Grammar School c/o APP Corporation Pty Limited
Project: Newcastle Grammar School Park Campus
Project No: 00016194
Report: 16194-LD-RP-C-0001

Member of: CONSULT AUSTRALIA

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Client: Newcastle Grammar School C/- APP Corporation Pty Limited – Newcastle

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Contents

1. Introduction

APP Corporation Pty Limited – Newcastle (the Client) has engaged Lindsay Dynan Consulting Engineers to undertake a Flood Emergency Response Plan (FERP) Report for the proposed updated site layout for Newcastle Grammar School Park Campus at 127 Union Street, Cooks Hill, 2300 (the Subject Site).

The proposed development at the Subject Site includes the demolition of three buildings, construction of a new building multi-storey building (Union Street building as part of Stage 1), a new multi-storey building with a basement carpark (Corlette Street building as part of Stage 2), refurbishment of two existing buildings, a student drop-off driveway and new landscape areas.

The development will be assessed for approval as a State Significant Development (SSD), for which the Secretary's Environmental Assessment Requirements (SEARs) includes an updated FERP to reflect the new building arrangement proposed as part of this development. A previous FERP Report was prepared to address issues raised by City of Newcastle (CN) in their Development Application (DA) advice concerning the development lodged under Ref: DA 98/048.

This FERP has been prepared in accordance with the following guidelines:

- CN DCP 4.01 Flood Management 2012.
- The NSW Government Floodplain Development Manual – the management of flood liable land (2005).

A Flood Assessment Report has been prepared for this development by Torrent Consulting Pty Ltd, including a detailed flood model of the surrounding catchment, focusing on the open concrete drain that is located to the south of the Subject Site. The Flood Assessment Report's contents, particularly relating to flood levels and velocities has been adopted for use in this Flood Emergency Response Plan.

2. Project Background, Site and Catchment Description

The Newcastle Grammar School's Park Campus serves as the primary programme facilitating classes from Kindergarten to Year 4. The school is normally occupied from 7:30am to 5:30pm with students being in attendance from 8:30am to 3:00pm. Occupation during holidays may occur but staff would be always present. Staff and visitor car parking is reliant on the surrounding streets, primarily being Union Street to the west, Corlette Street to the East and Parkway Avenue to the south of the Subject Site.

Extra curricula activities undertaken at the school would include a minimal increase in students during normal hours and may include both school and third-party performances in the Hall outside school hours.

The school campus is situated at the edge of the Lower Cottage Creek floodplain and is subject to backwater flooding and overland flow from upstream catchments. Cottage Creek drains a largely urbanised area including Merewether and adjacent suburbs immediately west of the coastal ridge that encompasses The Hill. The drainage system has also been highly urbanised into multiple concrete lined channels and enclosed drains. The main branch runs from its mouth in Newcastle Harbour to Watkins Street, approximately 2.3 kilometres. Major tributaries include the Broadmeadow Racecourse, Merewether Street, Mitchell Street, Frederick Street and Bruce Street branches.

Design and construction of the drainage system commenced in the 1890's with a lined channel up to Hunter Street and was substantially completed in the 1950's, some 60 years later. The catchment was less developed at the time the drains were designed and constructed, and like many established urban areas, the drainage system fails to provide for major storm events, resulting in uncontrolled flooding.

The upper reaches of the catchment experience fast moving floodwaters once the embankments of the drains are overtopped, causing excess flows to run along streets and other unplanned and undesigned overland flow paths. The lower reaches may experience some of these characteristics for short periods as the flood hydrograph develops, however, they are more significantly affected by slower moving inundation or backwater flooding from downstream. The flatter terrain, constrictions and bridges along the drainage path and the downstream tidal influence all combine to slow the egress of floodwaters causing a build-up on the floodplain. These backwater effects can extend upstream beyond the National Park sporting fields, within proximity of the Subject Site. It is particularly common for the hockey fields across Union Street from the Subject Site to become inundated and act as flood storage areas.

An additional factor relevant to small, urbanised catchments such as this catchment, is that of flash flooding. Runoff from the extensive impervious surfaces in the catchment, combined with hydraulically efficient lined channels, can lead to rapid rates of rise of floodwaters. That is to say, the lower floodplain encompassing the National Park playing fields and surrounding properties have the potential to become inundated in a very short period. Rates of rise of backwater flood levels can be as much as 0.5m in 10 minutes.

3. Flood Emergency Response Plan

3.1 Selection of Evacuation Route and Refuge Facilities

Lindsay Dynan Consulting Engineers (LDCE) has considered the most suitable flood evacuation route and refuge facilities based on building finished floor levels (FFL), accessibility and location to ensure the safest FERP is achieved. Refer to Figure 1 for the Subject Site building locations and proposed evacuation routes discussed in this section.

The evacuation of students and staff is the primary flood response. In the unlikely event that the school is unable to evacuate the site, then on-site refuge would be sought. Once a backwater lake develops directly across from the Park Campus on the National Park No. 4 Sports Ground, and is seen to rise and expand noticeably, students will be marshalled within their classrooms while the nominated staff monitor and assess the rise of floodwater. Students are to remain in their classrooms to limit movement around the site. Where flood waters rise at a considerable rate and encroach into the playgroundoccupants in the Union St building will be relocated to the Hall in preparation to be evacuated.

The Hall provides a large space which can be used to marshal students and staff prior to evacuation. It is located central to other buildings at the Subject Site, enabling orderly access from all directions. The Hall provides an FFL of 3.3 m (AHD) and connection to Corlette Street at RL 3.1, equivalent to the street level. The primary evacuation route has therefore been selected, as shown in Figure 1, as the safest and most effective option for the FERP.

If on-site refuge is needed above the PMF, then occupants in the Block B and Union Street Building would be directed to the first floor, while occupants in Block A would be directed to the first floor of either the Block B or Union Street Building at the discretion and supervision of the well-informed staff.

The Union Street Building is a proposed multi-storey building with a first floor FFL above the probable maximum flood (PMF) level. Similarly the existing Block B first floor FFL is above the PMF. Discussion of the PMF and other flood events are provided in Sections 4 and 6. The buildings provide a suitable on-site flood refuge in the event of a flash flood where there is insufficient time to marshal students and staff prior to evacuating the site via the primary evacuation route. If it has not been undertaken already, a structural engineer will be required to certify that the existing building is able to withstand the floodwater forces imposed during the Probable Maximum Flood (PMF) event.

Access to the Union Street building is proposed via the Block A northern staircase and adjoining footpath as it provides the closest proximity and most elevated route between Block A and the Union Street Building. Access to Block B is proposed via the stairs and footpaths on the eastern side of the site. Movement to the Union Street building and Block B building should be undertaken at the discretion and supervision of the well-informed staff on-site with consideration of the floodwater levels and rate of rise.

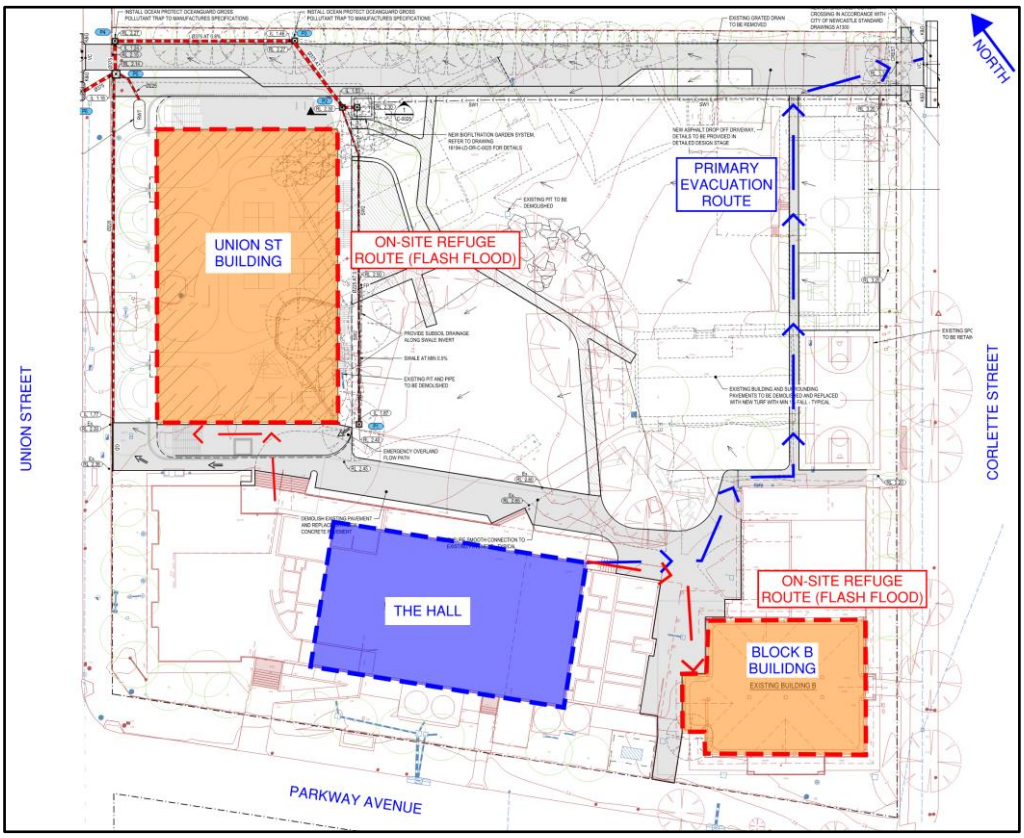


Figure 1 – Subject Site Plan and evacuation routes

Any Stage 2 building constructed on the western side of the site shall have a shorter emergency evacuation path to Corlette Street than the Union Street building and The Hall.

The Hall, Union Street building and block B should be equipped with adequate available drinking water, emergency lighting, backup power, first aid kits, long life food, firefighting equipment and copies of student records (documenting medical needs and contact information to parents). The school Principal and Deputy Principal shall oversee enforcing the emergency flood management procedures as part of the process, with float triggers to be installed on-site (if not present already) and sufficient alarm and communication systems to be utilised to inform other members of staff, students and other occupants on-site.

LDCE recognises that the NSW State Emergency Service (SES) is the primary rescue and assistance department in the event of natural disasters. As a requirement of the FERP, any direction or instruction issued by an SES officer shall be followed without question or hesitation. For reference, the NSW SES emergency line for emergency assistance in storm and flood events is 132 500, with the non-emergency and general enquiry helpline is 138 737 (138 SES). It is the responsibility of the person-in-charge on-site at NGS to contact the NSW SES as necessary.

The school will be evacuated to the Hill Campus via the NGS school bus and other buses that are booked by the school. On arrival at the Hill Campus, the student's welfare would be the responsibility of the staff until collected by parents. The nominated staff representative will notify the SES that the evacuation was successful.

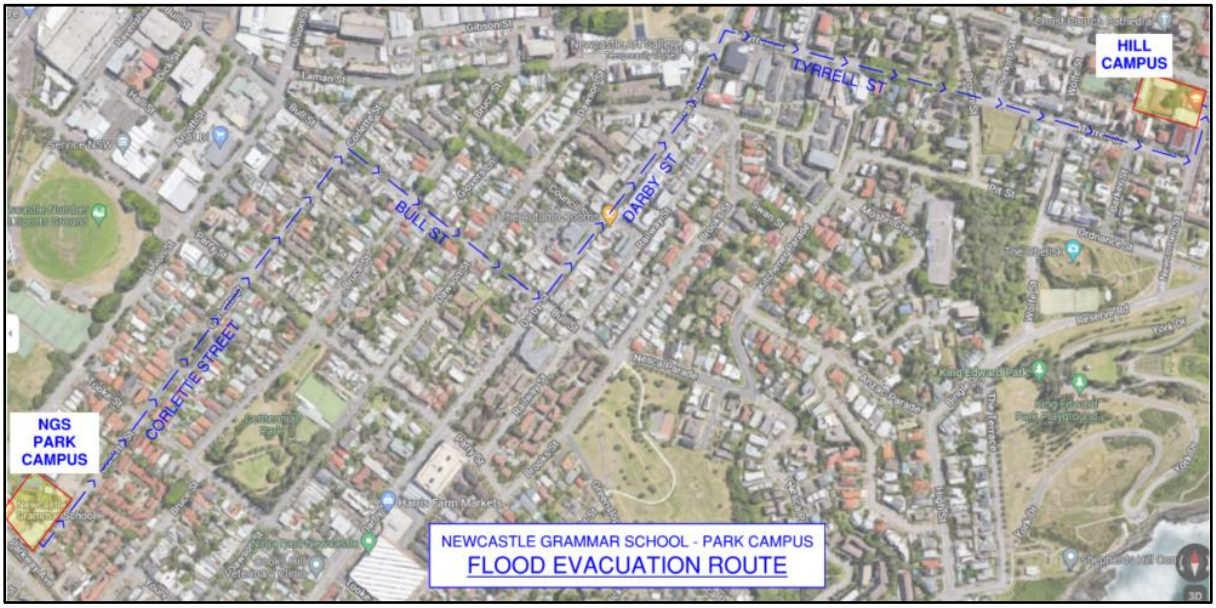


Figure 2 – Flood Evacuation Route Schematic

3.2 Flood Warning

Official flood warnings are provided directly to the media by the State Emergency Service (SES) and the Bureau of Meteorology (BOM), reliance should therefore be placed on relevant media and the BOM website for flood information and warnings. In the event of severe weather warnings, flood watches and weather forecasts of heavy rain that may lead to flash flooding, the school should consider proactively encouraging students and staff not to attend the site to reduce the number of students at risk during a major flush flood event. The school should offer online learning in the event of severe weather warnings.

The catchment is relatively small, and flooding will generally occur quickly as flash flooding, staff and adult site occupants should be vigilant in extreme weather conditions. In the advert of such weather conditions, nominated staff are to monitor flow conditions within the Parkway Avenue storm channel and flood inundation backing up across the National Park playing fields.

Torrent Consulting, as part of its modelling of the catchment and flood impacts for the site, has provided LDCE with flood hydrographs for a range of storms. The hydrographs depict the floodwater level over time and provide indications to the warning times expected for each storm event modelled, with Figures 3-6 presenting the flood hydrographs in graphical format.

Table 1 – Modelled Available Warning Times

Storm Event	Warning Time (hr)
1% AEP	1.65
0.5% AEP	1.43
0.2% AEP	1.23
PMF	0.33

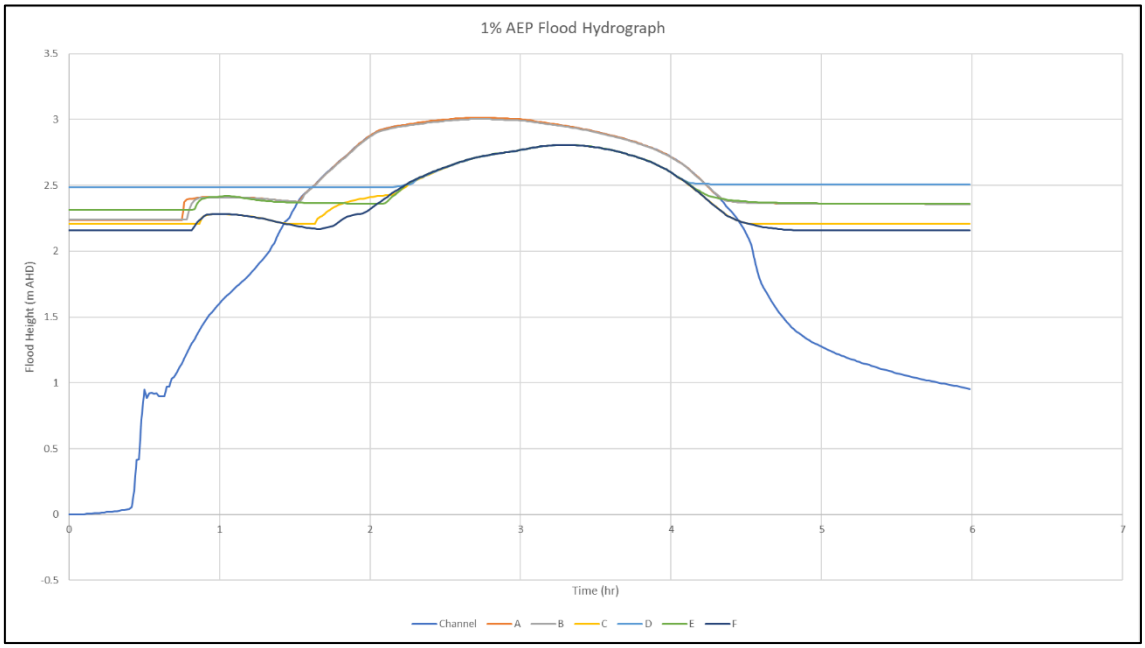


Figure 3 – 1% AEP Flood Hydrograph

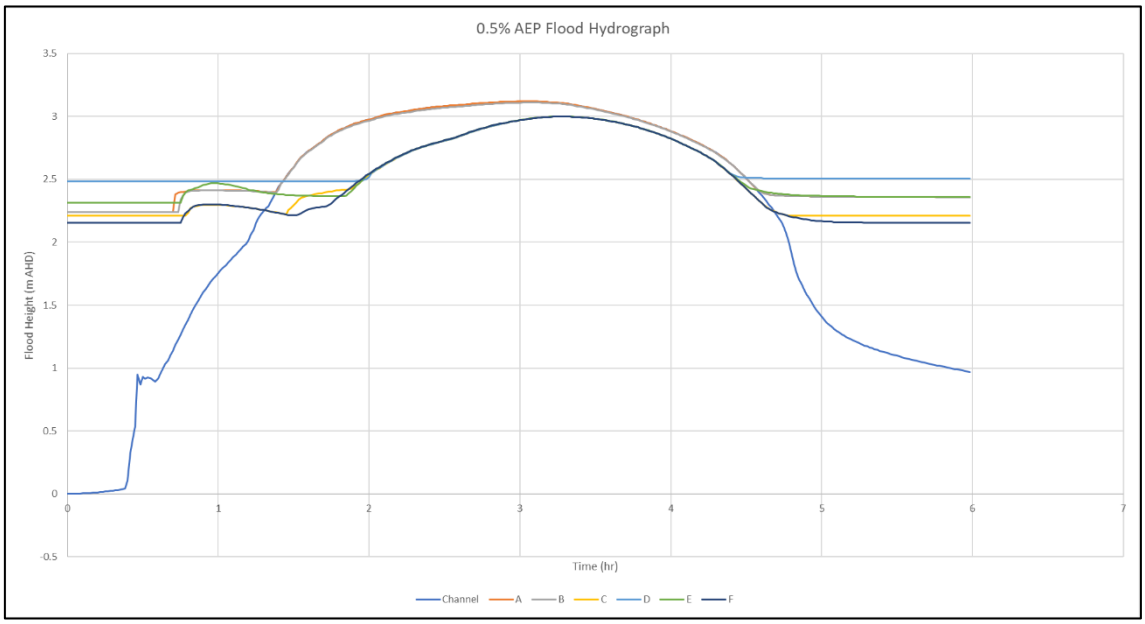


Figure 4 – 0.5% AEP Flood Hydrograph

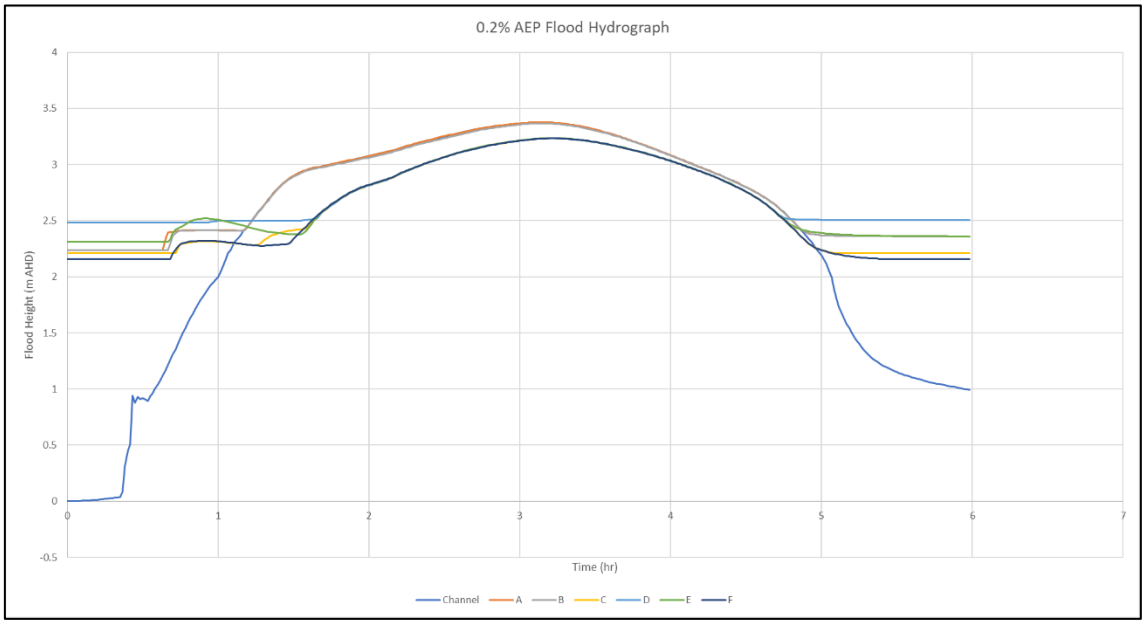


Figure 5 – 0.2% AEP Flood Hydrograph

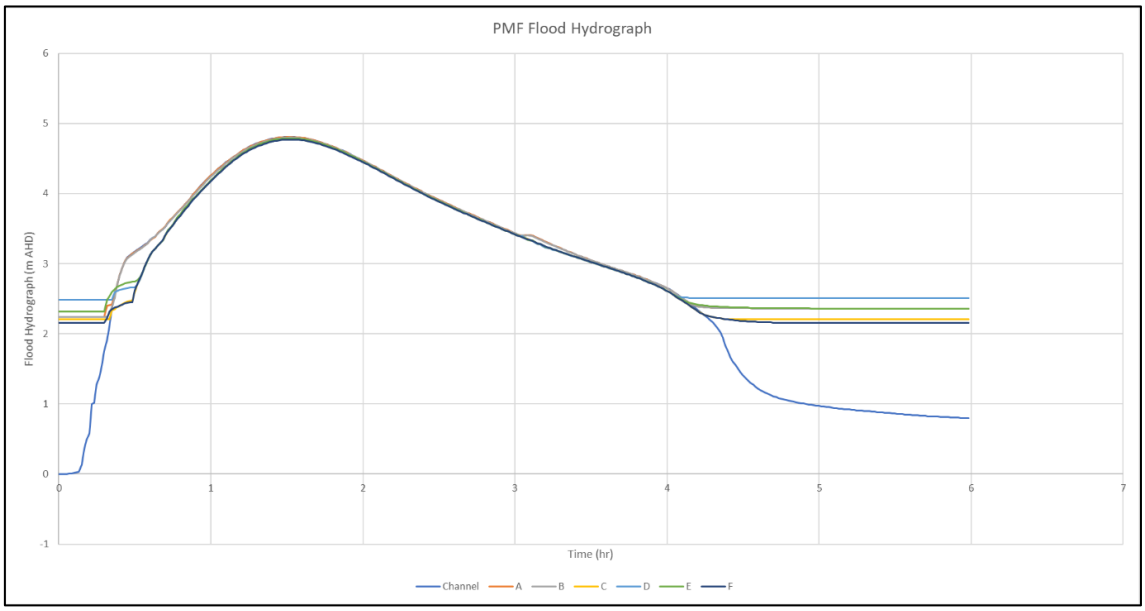


Figure 6 – PMF Flood Hydrograph

3.3 Flood Preparedness

The school should assign appropriately trained staff members to manage the flood emergency response for the school. Duties involve monitoring flood progress and implementing the evacuation procedures. Once backwater lake develops on National Park No. 4 Sports Ground directly across Union Street, the head of Park Campus will contact the head of the Hill campus to coordinate their NGS school bus and booking of stand-by buses. At this stage, staff will commence marshalling students within their classrooms in preparation to be evacuated.

When floodwaters encroach into the playground area (likely at the northwest corner where it is lowest), nominated staff should note the time this occurs, and all immediately proceed to the Hall where the students have been marshalled by the teachers.

The SES should be notified if this level of preparedness is executed, and the main campus of the school contacted.

3.4 Flood Evacuation

The rise of what would now be considered an expanse of backwater flooding should be continually monitored against the flood marker or monument visible from the classrooms, also in conjunction with the Bureau of Meteorology forecast and relevant weather warnings for the Newcastle area. The time taken for floodwaters to rise from the lowest land at the northwest corner of the playground (approximately 2.2m AHD), until it reaches the 2.5m mark (300mm rise in floodwater depth) should be measured. The following actions should be adopted through the assessment of floodwater rising rates, as follows:

1. If this increase takes less than 15 minutes, then evacuation should proceed without further consideration.
2. If this increase is between 15 and 20 minutes, then evacuation could be delayed until a level of 2.6m is reached. Students/staff within the Union Street Building are to evacuate to the hall in preparation to evacuate the site.
3. Should this increase take significantly longer than 20 minutes, the flood may be peaking and there may be no need to evacuate, however, should the level reach 2.8m, evacuation should proceed as a matter of course.

Once the evacuation is underway up Corlette Street, staff cars can be moved up Corlette Street into Tooke Street by one of the staff or selectively by the car owners.

On arrival at the refuge (Hill Campus) the students' welfare would be the responsibility of the staff until collected by parents. SES should again be notified that evacuation was successful.

In the event of a flash flood, where backwater from the National Park No.4 Sports Ground begins to encroach on Union Street without sufficient warning, students should immediately be escorted to the Union Street building. The students' welfare would be the responsibility of the staff until the flood passes and they can be safely collected by parents. The SES should be notified that evacuation was successful.

3.5 Occupation Outside School Hours

3.5.1 School Personnel

Flood emergency response procedures for occupation by school personnel of any of the school premises during evenings, weekends and holidays should proceed in a similar fashion to that described above in Section 3.4. The need to evacuate by foot would depend on the circumstances of the flood and the number of persons involved. The welfare of any children involved should be considered paramount.

3.5.2 Third Parties

Flood emergency procedures for occupation of the Hall by small groups e.g., rehearsals etc., would be the responsibility of the group. Procedures for monitoring and evacuation would be as above in Section 3.4.

During school performances or events where there is a significant population involuntarily exposed and potentially unaware of the flood threat, a school staff member should always be present to monitor any potential flood threat and to manage any necessary evacuation.

The assumedly unprepared audience will be less easily managed than the aware school population and will require more time to evacuate. Evacuation of the Hall would need to be executed once noticeable backwater ponding on the sports field became apparent. In the event of poor visibility (darkness or heavy rainfall), occupant and staff discretion should be employed to ensure the warning signs are recognised.

3.6 Ongoing Review of FERP

The FERP shall be reviewed by staff members of the school annually and after major flood events. The annual review should document date of the review, date of the last evacuation drill, issues identified and proposed refinements and state of on-site refuge requirements.

The FERP is to be incorporated into all staff inductions. The assignment of roles and responsibilities in managing a flood emergency should be reviewed annually.

3.7 Previous Flood Emergency Response Plan

The previous 1988 Flood Emergency Response Plan (Patterson Britton & Partners Pty Ltd) and the Newcastle grammar School Emergency Procedures – Flood (NGS Nov 2021) included measures to manage the flood risk and associated hazards at the site. The following measures in the previous flood emergency response plan address the risk to property, the risk to life, awareness and education and updates and reviews of the plan.

3.7.1 Risk to Property

Risk to property was addressed by confirming that the only building with a floor level below the 1% AEP flood event is the library and the depth of flooding for the 1% AEP event is 0.5m in the library which can be managed by rising threatened items onto high shelves and tables. The Updated FERP states the FPL at the location of the Union Street building is 3.55m AHD, occupiable rooms are located on the first floor and above, all of which have FFLs over 3m above the FPL.

3.7.2 Risk To Life

Risk to life was addressed mentioning that Newcastle Grammar School has a duty of care to keep staff and students advised of the potential for flooding and ensure that in the event of a major flood, mechanisms for evacuation can be implemented. Reliance was placed on severe weather and storm events and the condition of the stormwater channel on Parkway Avenue and the National Park Playing fields being frequently monitored which is also part of the updated FERP which also includes float triggers. The triggers levels for implementing the evacuation plan were as follows:

- Students to be marshalled into classrooms as the National Park No. 4 Sports Ground across Union Street from the school fills as a lake encroaching on Union Street.
- Evacuation as flood levels within the school ground reaches 2.6 to 2.9m (depending on rate of rise) as marked by a prominent marker.

The evacuation would proceed along Corlette Street then right along Bull Street, left along Darby Street, right onto Tyrrell Street then left onto Newcomen Street to the Hill Campus where parents would be able to collect their children. The route is upwards and away from rising floodwaters and the refuge location is above PMF levels.

3.7.3 Awareness and Education

The previous FERP report specified that staff will be made aware of the flood emergency response plan including monitoring and evacuation procedures. Rather than rely on one individual or a staff position to act as flood monitor, the administrative staff present at the onset of potential flooding will collectively monitor flood progress and institute the evacuation procedures in accordance with the plan. Education of staff and students for emergency response procedures is maintained by means of three annual evacuation drills. This awareness and education. The awareness and education measures have been adopted in the updated FERP but with only 1 annual evacuation drills required.

3.7.4 Updates and Reviews

The previous FERP was to be reviewed as a component of every evacuation drill and be recorded as part of the drill response report. Updating of the plan to address changes in site use, population or facilities was to be undertaken as required. The updated FERP shall be reviewed by staff members of the school annually and after major flood events, see section 6.3.

4. The Flood Hazard

As discussed above in Section 3, Flood hazards at the Subject Site are generated by multiple factors including backwater inundation, fast moving overland flows and rapid rates of flood water rise. The risk to life is increased by the distance and the gradual gradient of access to flood free land and suitable refuge. In a rapid flash flood scenario, risk to life is increased by the relatively low height of the elevated access path to the Union Street building, to be used as an alternative flood refuge.

The modelled flood conditions show that the Subject Site is not flood affected at the 20% Annual Exceedance Probability (AEP) or 10% AEP storm events. Flooding was shown to occur at the Subject Site for all storms above the 5% AEP storm event. During the 5% AEP design storm event, the capacity of Cottage Creek along Parkway Avenue is exceeded, resulting in overbank inundation along Parkway Avenue encroaching the Subject Site. The trunk drainage capacity along Bruce Street to the east of the Subject Site is also exceeded during the 5% AEP storm event, which results in overland flow westwards through to Corlette Street and then through the Subject Site along the northern boundary, where the new driveway is proposed as part of the development works. Through the Subject Site the flood levels reduce from 3.4m AHD to 2.3m AHD, which is equal to the backwater flood level in National Park. LDCE is of the opinion that the driveway should not be utilised as a pick-up/drop-off area during flood events due to the nature of floodwaters modelled by Torrent during the 1% AEP storm event.

Peak flood velocities within the Subject Site during the 5% AEP storm event are around 0.1 m/s within the Cottage Creek floodplain along Parkway Avenue and Union Street. Along the overland flow path from Corlette Street along the northern boundary of the Subject Site the modelled peak velocities are higher, at around 0.2m/s to 0.4m/s.

The flood behaviour at the 5% AEP storm event at the Subject Site is exhibited for all rarer design flood events, albeit with typically increased flood levels, depths and velocities. The peak flood level conditions are summarised in Table 2 below. Peak flood levels are provided for four locations, as follows:

- Adjacent the north-east corner of the Subject Site in Corlette Street.
- Adjacent the south-east corner of the Subject Site at the corner of Corlette Street & Parkway Avenue.
- Adjacent the south-west corner of the Subject Site at the corner of Parkway Avenue & Union Street.
- Adjacent the north-west corner of the Subject Site in Union Street, i.e., the National Park backwater.

Table 2 – Peak flood levels at the Subject Site (m AHD, Torrent Consulting, 2021)

Design Event (AEP)	NE Corner	SE Corner	SW Corner	NW Corner
20%	N/A	N/A	N/A	N/A
10%	N/A	N/A	N/A	2
5%	3.4	2.8	2.7	2.3
2%	3.5	2.9	2.8	2.6
1%	3.5	3	2.9	2.8
0.50%	3.5	3.2	3.1	3
0.20%	3.5	3.4	3.3	3.2
Probable Maximum Flood (PMF)	4.8	4.8	4.8	4.8

Flood hazards have been determined by Torrent Consulting (2021) in accordance with Guideline 7-3 of the Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia (AIDR, 2017). This produces a six-tier hazard classification, based on modelled flood depths, velocities and velocity-depth product. The hazard classes relate directly to the potential risk posed to people, vehicles and buildings. Refer to Torrent Consulting's Flood Impact Assessment Report (2021) for mapping of the modelled peak flood hazard for each of the simulated design flood events.

At the 5% AEP storm event, the Subject Site is only impacted by a low hazard H1 flood environment, which presents a low risk to people, vehicles and buildings. At the 2% AEP storm event the increased flood depth creates some low hazard H2 flood conditions along Parkway Avenue in the north-west corner of the Site, which presents a potential risk for small vehicles.

During the 1% AEP design storm event the Subject Site is exposed to some medium hazard H3 flooding in the north-west corner, which presents a potential risk for all vehicles, children, and the elderly. There is no risk to buildings presented by the modelled flood hazards except during the PMF design storm event when most of the Subject Site is impacted by a high hazard H5 flood environment.

There is no risk to buildings presented by the modelled flood hazards except at the PMF event when most of the Site is impacted by a high hazard H5 flood environment. This hazard level is unsafe for all vehicles and people, and presents a risk to less robust building structures, the heavy building constructions within the Subject Site would not be expected to suffer significant damage.

5. Flood Emergency Management Issues

LDCE considers that a reasonable response for flood evacuation of institutions, such as schools, is for a warning to be delivered in sufficient time for the staff to marshal the students for evacuation by a prescribed approach with assistance from SES where appropriate. The potential for flash flooding in the Cottage Creek catchment precludes the effective delivery of individual warnings by agencies leasing a community-based warning system, such as a siren, as the only appropriate means. In the absence of such a system, the school recognises it must rely on its own resources within the directives of a prepared plan to effect evacuation.

Another factor which bears on the method of evacuation within a populated urban environment subject to flash flooding is that of traffic congestion and a reliance on vehicular transport for evacuation. LDCE identifies potential issues with relying on evacuation by vehicle out of flood affected zones. It will likely not be possible to bring evacuation transport in as there may be insufficient time for emergency response agencies to affect traffic management.

Given the nature of the flood hazard and the constraints imposed by the potential rapid nature of flooding, the school has developed an appropriate evacuation protocol in consideration of the following factors:

- Monitoring for potential flooding during heavy rainfall and storm events, bearing in mind that the heaviest rain may not be failing at the Subject Site but further upstream in the catchment.
- Articulation of a trigger or specific observation that would decide the implementation of the evacuation plan.
- Staff responsibilities and co-ordination within the school to ensure an orderly pattern of evacuation, effective control, minimum of confusion and the avoidance of any potential for panic.
- An effective means and location for marshalling the students under staff control.
- A well-defined evacuation route.
- Consideration of the adverse weather conditions likely to be prevalent at the time of evacuation.
- Selection of a suitable refuge site protected from the elements and accessible to parents waiting to collect their children, except for the alternative Union Street building refuge.
- A contingency plan for evacuation accidents and mishaps including some form of communication with emergency response agencies.
- Appropriate procedures for night-time occupation of the school when flood monitoring may be difficult.

6. Management of Flood Risk

The Newcastle Grammar School, Park Campus FERP Report provides a set of measures and controls to manage the flood risk and associated hazards at the Subject Site in accordance with Council's DCP 4.01 Flood Management and the NSW Government's Floodplain Development Manual. The following measures address the risk to property, the risk to life, and awareness and education of the plan.

Section 4.01 of CN DCP 4.01 Flood Management identifies four key sets of controls:

- Floodways.
- Flood storage areas.
- Management of risk to property.
- Management of risk to life.

Torrent Consulting's Flood Impact Assessment (2021) states that no parts of the Subject Site are identified as being a floodway. Additionally, the proposed development does not include filling of the flood storage area. Hence, the requirements for development within floodways and flood storage areas from CN's DCP 4.01 are readily satisfied.

6.1 Risk To Property

The CN DCP considers a P1-P5 risk to property classification, which directly correlates to CN H1-H5 hydraulic hazard categories at the 1% AEP event. The risk to property hazard category is a combination of the hydraulic behaviour threshold (hydraulic hazard categories) and its effect on property. Whilst the hydraulic hazard categories are not identical to the current best practice AIDR guidelines (adopted in Torrent Consulting's modelling), there are some similarities. Figure 7 is a reproduction of the AIDR classifications with the CN risk to property classes superimposed.

The Union Street building is only subject to a H3 hazard (P3 CN risk to property) at the 1% AEP storm event and so readily satisfies the requirements relating to building construction. Only hazards above H4 (P3 CN risk to property) are considered to expose buildings to risk of damage.

The 'planning flood' for all developments in Newcastle is the 1% AEP storm event, from which the flood planning level (FPL) is derived. The planning flood is generally regarded as the flood for which the cost of elevating a development outweighs the economic benefits afforded by increased flood protection to stock, equipment, etc. The FPL at the location of the Union Street building is 3.55m AHD, occupiable rooms are located on the first floor and above, all of which have FFLs over 3m above the FPL.

Refer to Torrent Consulting's Flood Impact Assessment (2021) for further discussion of the management of risk to property measures adopted for the Subject Site.

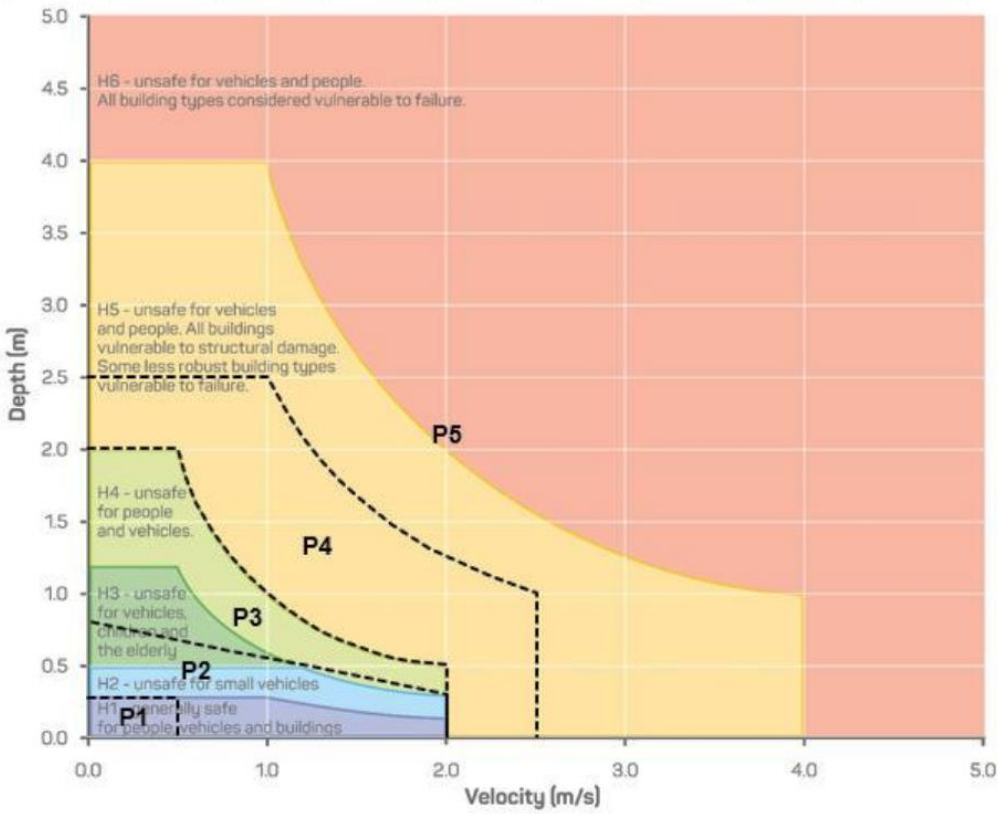


Figure 7 – CN risk to property classification correlation to hydraulic hazards classifications from AIDR (2017)

6.2 Risk To Life

The CN DCP 4.01's management of risk to life controls seek to ensure that the full potential risk to life can be managed up to and including the PMF event. This is guided by a risk to life classification of L1-L5 and is based on the CN H1-H5 hydraulic hazard categories at the PMF event. For the PMF event the entire Site is classified as H3 to H5 on the AIDR hazard classification, which becomes an L4 or L5 CN risk to life classification. Based on the peak flood depth, velocity and velocity depth product, Torrent Consulting determined the Union Street building to be classified as an L4 risk to life hazard. The CN L4 classification is be defined as:

"Short duration flash flooding with no warning time and enclosing waters during the PMF not suitable for wading or heavy vehicles. On site refuge is necessary and if hydraulic threshold exceeds H3, heavy frame construction or suitable structural reinforcement required."

In accordance with CN DCP 4.01, the proposed development is required to provide on-site flood-free refuge given it's located within a flash flood environment and further than 40m from flood-free land above the PMF. The DCP requires the on-site refuge to comply with the following minimum standards:

- *"The minimum on-site refuge level is the level of the PMF. On-site refuges are designed to cater for the number of people reasonably expected on the development site and are provided with emergency lighting."* i.e. a minimum finished floor level of 4.8m AHD.

- *"On-site refuges are of a construction type able to withstand the effects of flooding. Design certification by a practising structural engineer that the building is able to withstand the hydraulic loading due to flooding (at the PMF)."*

Because the upper levels of the Union Street building (including the first floor) are all located above the PMF design storm level, it inherently provides suitable flood-free refuge for the occupants. Torrent Consulting's Flood Impact Assessment (2021) further discusses the management of risk to life measures adopted for the Subject Site.

In accordance with the principles of the NSW Government's Floodplain Development Manual, the SES and Council have a duty of care to ensure that individuals residing in floodplain areas are advised of the likelihood of a flood, given sufficient warning of its predicted arrival where practical, and are provided estimates of the peak height at key locations throughout the over system. Council also have the responsibility of ensuring that any development within the floodplain is compatible with the flood hazard and meets Council's planning requirements (as set out in Council's DCP).

As occupier of the proposed development site and in accordance with the NSW Government Policies, Newcastle Grammar School has a duty of care to keep staff and students advised of the potential for flooding which may affect them and to ensure that in the advent of a major flood, mechanisms for evacuation can be implemented. Therefore, the primary function of the emergency response plan for the Park Campus is to provide Newcastle Grammar School with a mechanism for implementing safe evacuation of its staff and students.

The NSW SES Hunter Region Headquarters issues NSW SES Flood Bulletins, evacuation warnings and evacuation orders to media outlets and agencies on behalf of all NSW SES units in the Region, including the NSW SES City of Newcastle Local Headquarters. Additionally, the Bureau of Meteorology (BOM) issue various warnings including sever weather warnings for flash flooding, flood watches, and flood warnings direct to the media and SES. Reliance should therefore be placed on relevant media and the BOM for flood information and warnings, with conditions in the stormwater channel on Parkway Avenue and the National Park playing fields being frequently monitored.

Evacuation of primary aged students from the school under severe weather conditions involves its own hazards and whilst it is critical to ensure there is sufficient time for safe and early evacuation of students under flash flood conditions, it is equally important not to be overly conservative and expose the students to frequent unnecessary evacuations. It is therefore essential to identify appropriate trigger levels for the various stages of evacuation in consideration of rates of rise of flood waters and the time required for executing the evacuation.

Preparation for evacuation would involve marshalling all students in the Hall. The Hall is connected to the higher side of the Subject Site adjacent to Corlette Street, offering direct access at an equivalent elevation to the evacuation route. Once marshalled in the Hall, the students and staff can be moved onto Corlette Street in less than 5 minutes by foot.

The evacuation would then proceed via bus along Corlette Street then right along Bull Street, left onto Darby Street, right onto Tyrrell Street then left onto Newcomen Street to the Hill Campus (60 Newcomen Street) where parents would be able to collect their children. The

route is upwards and away from rising floodwaters and the refuge location is above PMF levels.

The trigger levels for implementing the evacuation plan would be as follows:

- Marshalling students into the Hall: National Park No. 4 Sports Grounds across Union Street from the school fills as a lake encroaching on Union Street.
- Evacuation: Flood level within school grounds reaches 2.5 to 2.8 m (depending on rate of rise) as marked by a prominent monument or marker.
- Evacuation to onsite refuge: Floodwater levels encroaching from National Park No.4 Sports Ground reaches Union Street without sufficient warning to marshal students. Evacuation to proceed to Union Street building.

The main campus of Newcastle Grammar School would be informed of the marshalling stage and SES would be alerted. SES would again be contacted if evacuation proceeded.

Occupation of the school hall by groups not directly associated with the school and outside school hours, for rehearsals and performances will also require flood awareness, monitoring and evacuation planning. The flood monitoring and evacuation plan will need to be posted within the Hall and for rehearsals, the responsibility for monitoring and evacuation would rest with the users after having been made aware of the flooding potential. In the care of performances where an audience is in attendance, a member of the school staff needs to be present and undertake the task of monitoring the rise of floodwaters. A rechargeable torch will need to be included in the Hall prominently located and labelled as part of the safety and emergency equipment.

6.3 Awareness and Education

The successful implementation of the emergency response measures described above is highly dependent on the flood awareness of the staff and their knowledge of the protocols that need to be followed during a major flood.

As part of the school's general hazard emergency response procedures, all staff will be made aware of the FERP including monitoring and evacuation procedures. Rather than rely on one individual or a staff position to act as flood monitor, the administrative staff present at the onset of potential flooding will collectively monitor flood progress and institute the evacuation procedures in accordance with the plan. Details of the plan will be posted in a prominent site together with fire and earthquake evacuation procedures, the unique component of flooding being the monitoring and triggering aspects.

Education of staff and students for emergency response procedures is maintained by means of one annual evacuation drill.

6.4 Flood Response Facilities

To support effective execution of the FERP, the following facilities are to be established on site:

- Pathways leading from the Hall to Corlette Street at an elevation no lower than that of the footpath on Corlette Street.

- A flood marker or monument, visible from the classroom buildings and the Hall with markings between 2.5m and 3.0m at 0.1m intervals.
- A rechargeable torch in the Hall situated with other emergency equipment.
- The evacuation procedures displayed in the Hall and the administrative building.

7. Conclusion and Recommendations

As discussed above in this Report, LDCE has been engaged by APP Corporation Limited – Australia on behalf of Newcastle Grammar School to undertake and prepare a Flood Emergency Response Plan for the proposed development of additional general-purpose buildings and landscaping areas.

This Report addresses the provisions outlined within the following documentation:

- CN DCP 4.01 Flood Management 2012.d
- The NSW Government Floodplain Development Manual – the management of flood liable land (2005).

As such, LDCE has made several recommendations and requirements within this Report that NGS, as the occupier of the Subject Site, should review and adopt for the purposes of flood evacuation and site management in accordance with the above policies and procedures. These recommendations outline the general evacuation procedure during the event of a flood that inundates the Subject Site and potential evacuation routes to the east.

References

Australian Institute for Disaster Resilience, Australian Disaster Resilience Handbook Collection, Handbook 7 ***"Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia"***, 2017.

City of Newcastle, ***"Development Control Plan: Section 4.01 Flood Management"***, 2012.

City of Newcastle, ***"Newcastle Local Environmental Plan 2012"***, 2021.

NSW Government, ***"Floodplain Development Manual: the management of flood liable land"***, April 2005.

NSW State Emergency Service, ***"City of Newcastle Flood Emergency Sub Plan"***, June 2013.

Torrent Consulting, ***"Newcastle Grammar School Flood Impact Assessment"***, R.T2030.001.03, March 2022, Revised Draft Report.

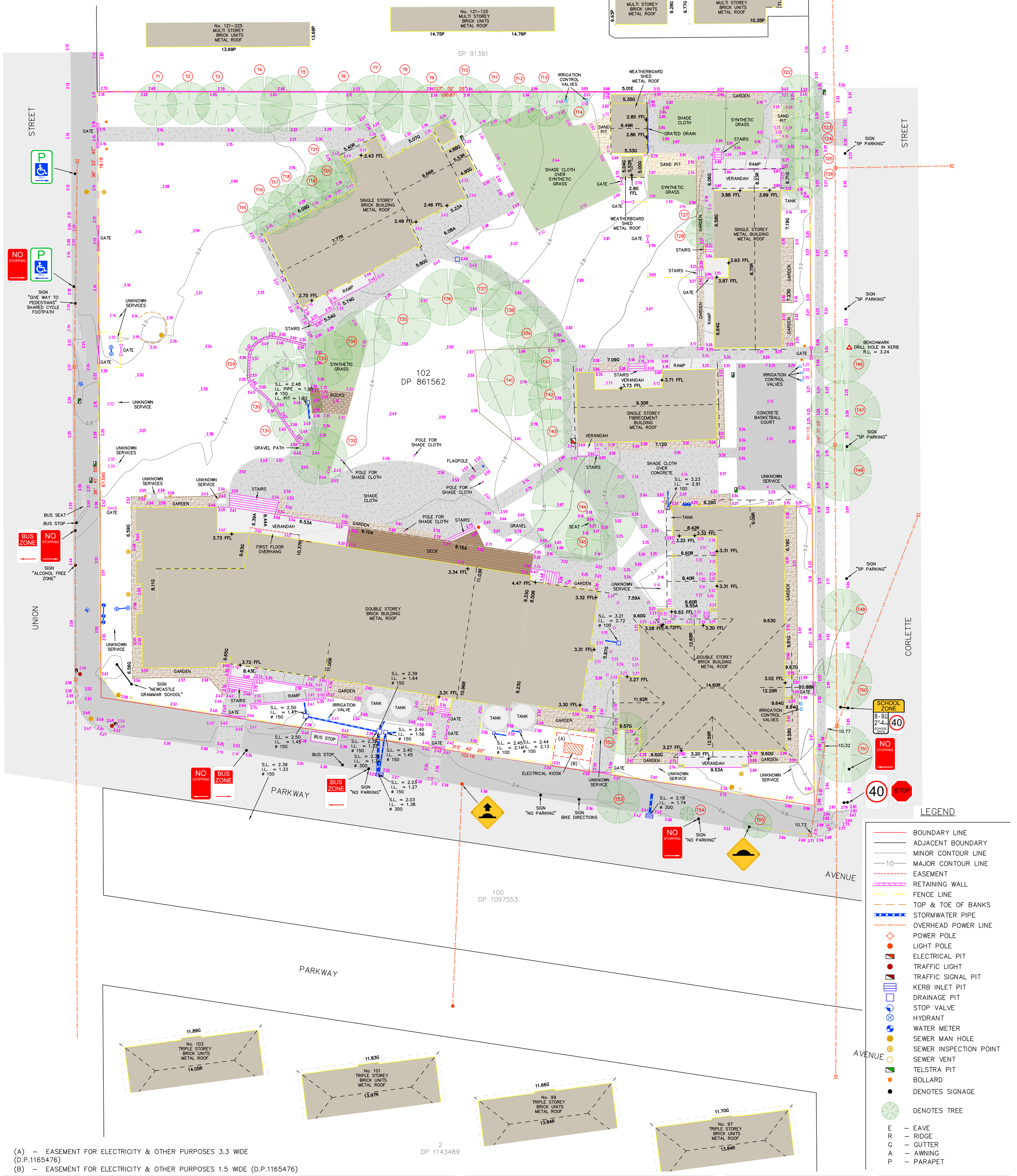
Appendix A – Existing Site Detail Survey

TREE TABLE

TREE NO.	SPREAD	TRUNK	HEIGHT	TREE NO.	SPREAD	TRUNK	HEIGHT	TREE NO.	SPREAD	TRUNK	HEIGHT	TREE NO.	SPREAD	TRUNK	HEIGHT
T1	6	0.4	4	T15	4	0.1	4	T29	8	0.4	4	T43	6	0.5	5
T2	6	0.4	4	T16	6	0.3	4	T30	8	0.4	4	T44	15	1.0	5
T3	6	0.3	4	T17	6	0.2	4	T31	8	0.4	4	T45	6	0.4	5
T4	8	0.5	4	T18	6	0.2	4	T32	8	0.4	4	T46	8	0.6	4
T5	8	0.5	4	T19	6	0.2	4	T33	8	0.4	4	T47	10	1.0	4
T6	6	0.3	4	T20	6	0.2	4	T34	8	0.4	4	T48	8	0.5	4
T7	8	0.4	4	T21	6	0.2	4	T35	8	0.4	5	T49	6	0.3	3
T8	8	0.4	4	T22	6	0.4	0.4	T36	8	0.4	5	T50	8	0.3	3
T9	6	0.4	4	T23	6	0.4	0.4	T37	8	0.4	5	T51	8	0.3	4
T10	8	0.5	4	T24	6	0.4	0.4	T38	8	0.4	5	T52	6	0.6	3
T11	6	0.4	4	T25	6	0.4	0.4	T39	8	0.4	5	T53	6	0.3	3
T12	6	0.4	4	T26	6	0.4	0.4	T40	8	0.5	5	T54	2	0.1	3
T13	6	0.4	4	T27	3	0.1	3	T41	10	1.0	5	T55	4	0.3	3
T14	4	0.3	3	T28	4	0.2	3	T42	6	0.4	5				

NOTES:

1. FEATURES SHOWN TO SCALE ACCURACY.
2. THIS PLAN IS SUITABLE FOR DETAILED PLANNING AND DESIGN AT THE SCALE/S STATED. THE PLAN MAY NOT BE SUITABLE FOR ANY OTHER PURPOSE OR FOR USE AT ANY OTHER SCALE/S.
3. SERVICES LOCATED ONLY WHERE VISIBLE.
4. THE LOCATION OF ALL UNDERGROUND SERVICES WHETHER SHOWN ON THE PLAN OR NOT, SHOULD BE PRECISELY DETERMINED BEFORE ANY CONSTRUCTION WORK COMMENCES AND MEASURES TAKEN TO PROTECT THESE SERVICES FROM DAMAGE.
5. CONTOUR INTERVAL – 0.2m
6. THE BOUNDARIES SHOWN ARE APPROXIMATE ONLY. THE BOUNDARIES SHOWN HAVE BEEN COMPILED FROM THE RELEVANT DEPOSITED PLANS. FURTHER SURVEY WILL BE REQUIRED IF CONSTRUCTION IS TO TAKE PLACE ON OR ADJACENT TO THE BOUNDARIES.



(A) – EASEMENT FOR ELECTRICITY & OTHER PURPOSES 3.3 WIDE (D.P.1165476)
(B) – EASEMENT FOR ELECTRICITY & OTHER PURPOSES 1.5 WIDE (D.P.1165476)

LEGEND

- BOUNDARY LINE
- ADJACENT BOUNDARY
- MINOR CONTOUR LINE
- 10 MAJOR CONTOUR LINE
- EASEMENT
- RETAINING WALL
- FENCE LINE
- TOP & TOE OF BANKS
- STORMWATER PIPE
- OHP OVERHEAD POWER LINE
- POWER POLE
- LIGHT POLE
- ELECTRICAL PIT
- TRAFFIC LIGHT
- TRAFFIC SIGNAL PIT
- KERB INLET PIT
- DRAINAGE PIT
- STOP VALVE
- HYDRANT
- WATER METER
- SEWER MAN HOLE
- SEWER INSPECTION POINT
- SEWER VENT
- TELSTRA PIT
- BOLLARD
- DENOTES SIGNAGE
- DENOTES TREE

E – EAVE
R – RIDGE
G – GUTTER
A – AWNING
P – PARAPET

REV.	DATE	AMENDMENT(S)	SUR	DFT	CHK
A	15.10.19	ORIGINAL ISSUE	PM	JD	MW

S:\Administration\Logos\DelfsLascelles Logo_2019\Delfs Logo Colour.jpg

260 MAITLAND ROAD, T: (02) 4964 4886
MAYFIELD NSW 2304 E: admin@delacs.com.au
ABN: 28 164 260 102 delacs.com.au

CAD REF: 19586 – DET

DETAIL SURVEY OF NEWCASTLE GRAMMAR SCHOOL – PARK CMPUS LOT 102 DP 861562

SITE ADDRESS:
127 UNION STREET
COOKS HILL

CLIENT:
KDC

POSITION DATUM:	PM 8488
ORIENTATION:	MGA (GROUND)
EASTING:	384 330.537
NORTHING	6 355 148.452
CLASS: B	ORDER: 2
HEIGHT DATUM:	PM 8488
CLASS: LB	ORDER: L2
RL: 2.637 (AHD)	DATE: 24.09.19

S:\Administration\Logos\Logos for base.jpg

SURVEYED	DRAFTED	CHECKED
PM	JD	MW

SCALE	PAGE SIZE	DATE
1:250	A1	15.10.19

SHEET	REV.	PROJECT No.
1	A	19586

Appendix B – Civil Site Plan

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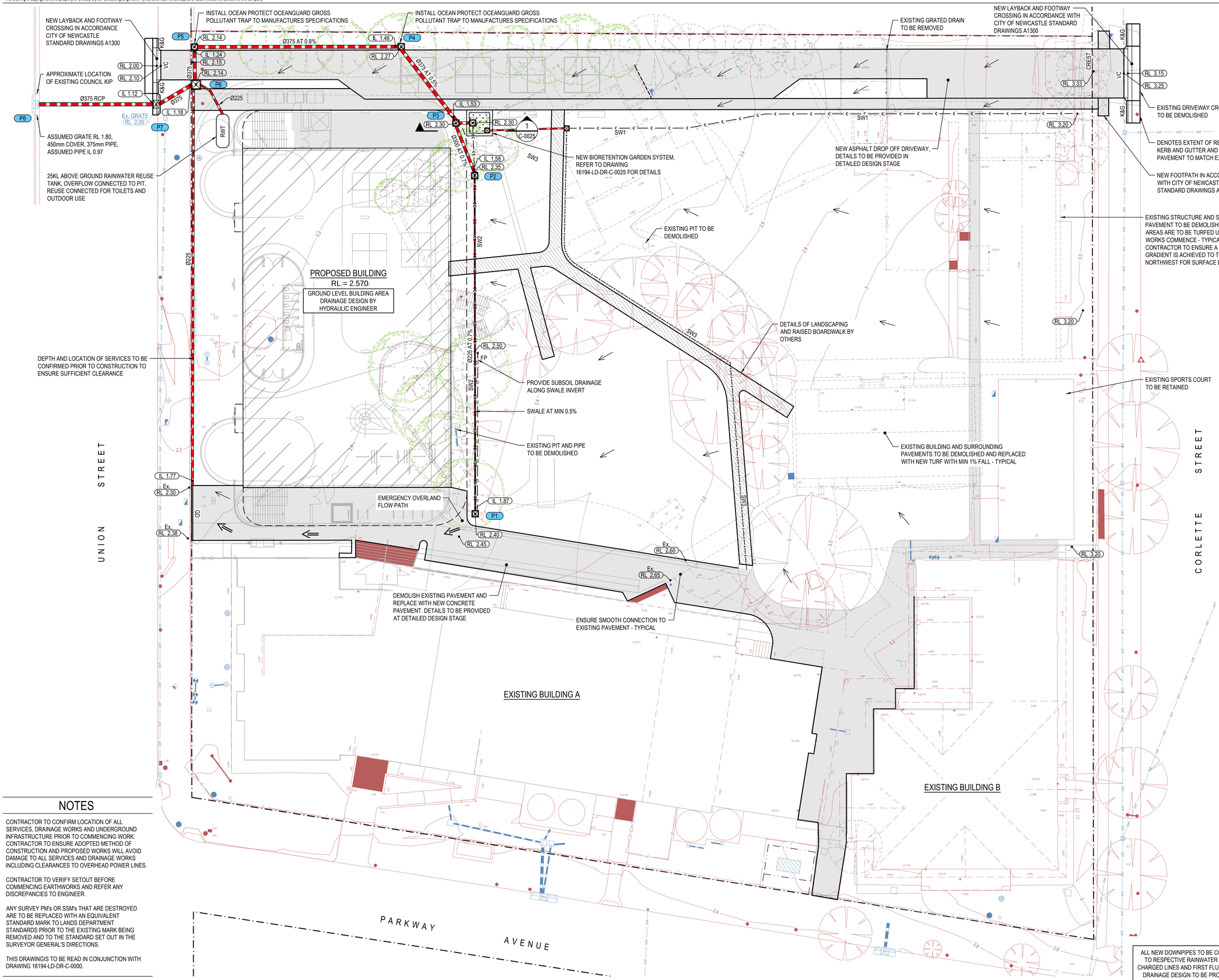

NOTES

CONTRACTOR TO CONFIRM LOCATION OF ALL SERVICES, DRAINAGE WORKS AND UNDERGROUND INFRASTRUCTURE PRIOR TO COMMENCING WORK. CONTRACTOR TO ENSURE ADOPTED METHOD OF CONSTRUCTION AND PROPOSED WORKS WILL AVOID DAMAGE TO ALL SERVICES AND DRAINAGE WORKS INCLUDING CLEARANCES TO OVERHEAD POWER LINES.

CONTRACTOR TO VERIFY SETOUT BEFORE COMMENCING EARTHWORKS AND REFER ANY DISCREPANCIES TO ENGINEER.

ANY SURVEY PM's OR SSM's THAT ARE DESTROYED ARE TO BE REPLACED WITH AN EQUIVALENT STANDARD MARK TO LANDS DEPARTMENT STANDARDS PRIOR TO THE EXISTING MARK BEING REMOVED AND TO THE STANDARD SET OUT IN THE SURVEYOR GENERAL'S DIRECTIONS.

THIS DRAWINGIS TO BE READ IN CONJUNCTION WITH DRAWING 16194-LD-DR-C-0000.

0 4 8 12 16m

1:200 (A1)

STORMWATER DRAINAGE PLAN

SCALE 1:200

NOT FOR CONSTRUCTION

Lindsay Dynan

Sydney | Perth | Newcastle | Central Coast

PROJECT

NEWCASTLE GRAMMAR SCHOOL
PARK CAMPUS STAGE 1
127 UNION ST. COOKS HILL, NSW, 2300

CLIENT

NEWCASTLE GRAMMAR SCHOOL
APP CORPORATION PTY LTD

THIS DRAWING CONTAINS COLOURED INFORMATION C M Y

LEGEND

- 2.00 — EXISTING CONTOUR (0.2m INTERVALS)
- 2.40 EXISTING SPOTLEVEL
- 3.00 — DESIGN CONTOUR
- RL 3.25 DESIGN SPOTLEVEL
- PROPOSED IMPERVIOUS PAVEMENT
- PROPOSED RAISED BOARDWALK
- PX NEW STORMWATER DRAINAGE PIT, REFER TO DRAWING 16194-LD-DR-C-0025 FOR PIT SCHEDULE AND DETAILS
- PX NEW STORMWATER DRAINAGE KERB INLET PIT, REFER TO DRAWING 16194-LD-DR-C-0025 FOR DETAILS
- NEW STORMWATER DRAINAGE PIPE LAID AT MIN 1% U.N.O. REFER TO DRAWING 16194-LD-DR-C-0025 FOR DETAILS
- GD GRATED DRAIN 150 MIN. (WIDE) X 150 MIN. (DEEP). 1% MIN FALL TO OUTLET
- SW1 NEW STORMWATER DRAINAGE SWALE SW1, REFER TO DRAWING 16194-LD-DR-C-0025 FOR DETAILS
- SW2 NEW STORMWATER DRAINAGE SWALE SW2, REFER TO DRAWING 16194-LD-DR-C-0025 FOR DETAILS
- SW3 NEW STORMWATER DRAINAGE SWALE SW3, REFER TO DRAWING 16194-LD-DR-C-0025 FOR DETAILS
- FP NEW Ø100 SUBSOIL DRAINAGE PIPE WITH FLUSHING POINT. REFER TO DRAWING 16194-LD-DR-C-0025 FOR DETAILS
- OVERLAND FLOW PATH
- DIRECTION OF SURFACE FALL
- RWT 25kL ABOVE GROUND RAINWATER TANK FOR WATER RE-USE, REFER TO SCHEMATIC ON DRAWING 16194-LD-DR-C-0025 FOR DETAILS
- NEW BIORETENTION GARDEN, REFER TO SECTION 1 ON DRAWING 16194-LD-DR-C-0025 FOR DETAILS
- EXISTING STORMWATER PIPE AND PIT
- EXISTING FENCE LINE
- EXISTING FENCE LINE TO BE DEMOLISHED
- BOUNDARY LINE
- EXISTING FEATURE TO BE DEMOLISHED
- EXISTING TREE
- EXISTING TREE TO BE DEMOLISHED
- PROPOSED TREE

REV	DATE	DESCRIPTION	DRN	APP
P03	30/03/2022	RE-ISSUED FOR APPROVAL	A.V.	N.L.
P02	13/10/2021	RE-ISSUED FOR APPROVAL	A.V.	N.L.
P01	29/07/2021	ISSUED FOR APPROVAL	I.J.	N.L.

TITLE

STORMWATER DRAINAGE PLAN

DOCUMENT STATUS			SHEET SIZE
FOR SSD APPROVAL			A1
DRAWN	DESIGNED	APPROVED	SCALE
I.Judd	L.Kleyn	N.Lane	1:200
DOCUMENT No.			REVISION
16194-LD-DR-C-0020			P03

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