Meadowbank Education and Employment Precinct Schools Project
Civil SSDA Report

SSD 18_9343
Prepared by enstruct
For School Infrastructure NSW
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MEADOWBANK EDUCATION AND EMPLOYMENT PRECINCT SCHOOLS PROJECT

STATE SIGNIFICANT DEVELOPMENT APPLICATION – CIVIL

ISSUE AUTHORISATION

PROJECT: Meadowbank Education and Employment Precinct Schools Project
Project No: 5645

Rev	Date	Purpose of Issue / Nature of Revision	Prepared by	Reviewed by	Issue Authorise by
01	20/07/18	Draft SSDA	PR	QEJ	QEJ
02	22/08/18	SSDA Issue	PR	QEJ	QEJ
03	31/08/18	SSDA Issue	PR	BH	BH
04	10/04/19	Draft SSDA	KH	PR	PL
05	18/04/19	Submission for SSDA Test of Adequacy	KH	PR	PL
06	02/05/19	SSDA	KH	PR	PL
07	7/06/19	SSDA	TH	PL	PL
08	11/06/19	SSDA	TH	PL	PL
09	28/06/19	SSDA	TH	PL	PL
10	2/10/19	SSDA	TH	PL	PL
11	11/10/19	SSDA	TH	PL	PL
12	24/01/20	Response to SSDA submissions	TH	PL	PL
13	7/02/20	Response to SSDA submissions	TH	PL	PL

Executive Summary

This civil report has been prepared by enstruct on behalf of the NSW Department of Education and Schools Infrastructure NSW (the Applicant). It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD 18_9343) for the new Meadowbank Education and Employment Precinct Schools Project at 2 Rhodes Street, Meadowbank (the site).

The purpose of this Report is to cover

- Secretary's environmental assessment requirements (SEARs) No. 9343 issued on 7 June 2018 for site development including the following key issues:
    - 16. Drainage
    - 17. Flooding
    - 19. Sediment, Erosion and Dust Controls
- Proposed development stormwater drainage
- Flood risk management

Existing Site Conditions

Stormwater

The total site area is approximately 3.34 ha and is approximately 57% impervious in its existing state.
The topography of the site is generally undulating, with the surface elevation ranging from RL 4.2m AHD through the centre of the site, rising to RL 19m AHD on the eastern and western flanks. There is a railway fill embankment on the western side of the site, the top of which is approximately RL 19m AHD and the base is approximately between RL 5m and RL 10m AHD. There is a north-east / south-west trending gully through the site at an RL of approximately 4.2m AHD. This wide depressed channel runs through the site from the north-east to south-west. Two depressions exist across the existing car parks, which fall towards the ultimate low point in the south-west corner of the site.

The proposed Meadowbank Education and Employment Precinct Schools Project is located within the Charity Creek subcatchment area. It was noted that the Charity Creek catchment area includes 229 subcatchments, covering a total catchment area of approximately 242 ha.

Key existing drainage structures at the site include:

- A rectangular box culvert (3.3m x 1.8m upsizing to 4.5m x 2.1m) upstream of the outlet from Victoria Road to the small open channel located at the east side of Railway, and
- A rectangular box culvert (4.5m x 1.8m) under the railway line from the TAFE site to the Charity Creek open channel.

Flooding

The potential for flooding, design mitigation measures and evacuation strategies to suitably address this risk will require a detailed analysis; as outlined in Clause 6.3 of the City of Ryde LEP.

The site is located within the Parramatta River – Ryde Sub-Catchment and Charity Creek Catchment. The Flood Study Report prepared by Sinclair Knight Merz identified the site as a Flooding Hot-Spot, where existing development is at risk from flood damage and capital works may be feasible for flood mitigation. The report stated the following:

- Flood modelling indicated that there would be a number of areas within the study area where development would be subject to flood depths exceeding 2m in the 1% AEP event, including parts of Meadowbank TAFE.
- Downstream of the industrial complex, Rhodes Street and Meadowbank TAFE was built on fill which traps floodwaters on the industrial property (11 Rhodes Street), particularly in the 20% AEP event.
- Further downstream, there are irregularities in the ground surface on the TAFE grounds which obstruct flow in the 20% and 5% AEP events, while the Northern Railway embankment is a significant obstruction to flow in the 5% and 1% AEP events, with backwater effects up into the industrial area.

ARUP had conducted detailed flood modelling for existing and post-development site conditions. The aim of such study was to assess:

- The impact on the existing overland flow paths within the development site i.e. from the trapped low points on or near Rhodes Street and See Street.
- Consistency with Council's floodplain risk management studies and plans.
- Consistency with recommendations made within the Parramatta River- Ryde Sub-catchments Flood
- Study and Floodplain Risk Management Plan (SKM, 2013)

The proposed development design shows the main school building at the eastern extent of the site with a ground floor building level of FFL16.3 mAHD, which is above the probable maximum flood (PMF) level at the site. The remainder of the site is occupied by open, outdoor learning and play facilities.

Potential Impacts

Excavation

Bulk excavation is for the schools carpark and adjacent external works that will require excavation to an RL of approximately BE9.2 m AHD. Landscaped areas of the oval playing fields has been designed to minimise earthworks.

The design will consider measures to control soil erosion and sediment transportation to mitigate the risk of sediment affecting the site or areas off-site during construction. Such measures will include sediment fences, settlement ponds and shaker grates in accordance with Landcom's Managing Urban Stormwater: Soils and Construction (Blue Book).

Erosion and Sediment Control will also be further addressed during detailed design and construction.

Dewatering

Preliminary geotechnical investigation of site did not indicate the presence of groundwater at the required excavation depths. During wet season, rain infiltration may introduce perched groundwater inflow to the northern end of the basement excavation at a rate of less than 3 m3/day.
Stormwater dewatering is required within the excavated areas and any sediment basins. Excavation dewatering may require treatment to reduce the amount of suspended solids prior to disposal to local stormwater connections.

For protection of receiving waters, quality of the drainage water is to meet the ANZECC Water Quality Guidelines for Fresh and Marine Waters 2000 (95% freshwater).

Flood Planning

Based on Table 1 in Section 8.2 of the City of Ryde Development Control Plan 2014, “Educational establishments” are defined as “Sensitive Uses and Facilities”. Thus, specific flooding and overland flow planning controls apply to the proposed School development as in the following features:

- Development will not be permitted within Medium and High Flood Risk Precincts at the site. New buildings and car parking should be located away from this area which follows the low point from northeast to southwest through the site;
- PMF flood level at the site was estimated to be 16.16m AHD;
- Open parking areas to be located above 1% AEP flood levels;
- Enclosed parking areas are to be above the 1% AEP flood level plus 150mm freeboard;
- Basement parking access is to be above the PMF level; and
- Building components below the PMF level will need to be designed structurally to withstand the force of the PMF.

Parts of the building are below the PMF level. The building below PMF level includes car parking, plant and storage. Classrooms, offices and libraries are all located on floors that are above the PMF level.

The car park and car park entrance are approximately 850mm higher than the 0.05% AEP (2000-year) flood level and approximately equal to the 0.02% AEP (5000-year) flood level, however they are below the PMF level. While the car park does not strictly comply with the DCP, the design has addressed the flood risk of extreme rainfall events.

Water Quality

Suggested water quality provisions for the proposed development are outlined in the City of Ryde Council – Water Sensitive Urban Design (WSUD) Guidelines. These treatment types include gross pollutant traps, rainwater tanks, vegetated swales, bioretention basins and constructed wetlands. Recommended treatment targets for stormwater for this project are:

- Total Suspended Solids (TSS): 85%
- Gross Pollutants (GP): 90%
- Total Nitrogen (TN): 45%
- Total Phosphorous (TP): 60%

Mitigation Measures

Construction

Prior to commencement of excavation works, a Soil and Water Management Plan (SWMP) must be prepared as part of the Contractor’s Construction Environmental Management Plan (CEMP) for the works. The SWMP must include an Erosion and Sediment Control Plan (ESCP) prepared in accordance with the ‘Blue Book’. Preliminary ESCP is included in this report.
Contaminated soil has been identified on the site. The site will require remediation prior to the main construction works.

Stormwater Drainage

Runoff from the roof and building podiums will be collected by the building hydraulics system and conveyed into local stormwater drain pits. A system of pits and pipes will be provided to collect the runoff generated in the ground areas. Prior to any stormwater discharge, the stormwater flows will pass through a silt arrestor pit or Gross Pollutant Trap (GPT).

The stormwater drainage system will be designed in accordance with City of Ryde Council guidelines with a 5% and 1% AEP minor and major system design.

Water Quality

The stormwater system proposed for the site will discharge into Charity Creek drains. The development will achieve the pollution reduction targets by utilising WSUD treatment. The combination of vegetated buffer, vegetated swales, and filtration devices will be used through a treatment train approach to improve water quality before stormwater discharges from the site. These elements of the Stormwater Quality Management Strategy for the proposed development will achieve all the pollution reduction targets (Gross Pollutants, Total Suspended Solids, Total Phosphorus and Total Nitrogen) required to discharge stormwater to council’s stormwater network.

Flood Mitigation

Stormwater from the development will be discharged into existing Council infrastructure (Charity Creek drainage). Review of site flooding conditions suggests that there is significant overland flow within the site area. Flooding mitigation results indicate that:

- Project design is not anticipated to increase flooding impacts (or levels) on private property external to the site during rainfall events
- Final building design and its impact on flooding is required to be assessed by using detailed TUFLOW model.

Flood Risk Management

The site is flood affected, so the risk to site users must be appropriately managed. A flood emergency response plan should be prepared as part of the detailed design with the following general principles:

- When extreme weather is forecast, the school day should be cancelled
- During a rainfall event, site users should leave the open areas and shelter initially in undercroft areas. During a flood event, site users should evacuate the undercroft areas via the stairs and shelter in place in classrooms and libraries.

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1 INTRODUCTION

This civil report has been prepared by enstruct on behalf of the NSW Department of Education and School Infrastructure NSW (the Applicant). It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD 18_9343) for the Meadowbank Education and Employment Precinct Schools Project (hereafter referred to as MEEPSP) at 2 Rhodes Street, Meadowbank (the site).

MEEPSP will cater for 1,000 primary school students and 1,620 high school students. The proposal seeks consent for:

- A multi-level, multi-purpose, integrated school building with a primary school wing and high school wing. The school building is connected by a centralised library that is embedded into the landscape. The school building contains:
  - Collaborative general and specialist learning hubs, with a combination of enclosed and open spaces;
  - Adaptable classroom home bases;
  - Four level central library, with primary school library located on ground floor and high school library on levels 1 to 3.
  - Laboratories and workshops;
  - Staff workplaces;
  - Canteens;
  - Indoor gymnasium;
  - Multipurpose communal hall;
  - Outdoor learning, play and recreational areas (both covered and uncovered).
- Associated site landscaping and public domain improvements;
- An on-site car park for 60 parking spaces; and
- Construction of ancillary infrastructure and utilities as required.

The purpose of this civil reports is to address the SEARS for stormwater and flooding.

1.1 Response to SEARs

The civil report is required by the Secretary's Environmental Assessment Requirements (SEARs) for SSD 18_9343. This table identifies the SEARs and relevant reference within this report.

Table 2. SEARs requirements

SEARs Requirements		Related Report Sections
Key Issues	16. Drainage • Detail measures to minimise Operational water quality impacts on surface waters and groundwater. • Provide stormwater plans detailing the proposed methods of drainage without impacting on the downstream properties. • Relevant Policies and Guidelines: o Guidelines for development adjoining land and water managed by DECCW (OEH, 2013)	
	17. Flooding • Identify flood risk on-site (detailing the most recent flood studies for the project area) and consideration of any relevant provisions of the NSW Floodplain Development Manual (2005), including the potential effects of climate change, sea level rise and an increase in rainfall intensity. If there is a material flood risk, include design solutions for mitigation.	Section 3.2.1 Section 4.3
	19. Sediment, Erosion and Dust Controls • Detail measures and procedures to minimise and manage the generation and off-site transmission of sediment, dust and fine particles. • Relevant Policies and Guidelines: o Managing Urban Stormwater— Soils & Construction Volume 1 2004 (Landcom) o Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA) o Guidelines for development adjoining land and water managed by DECCW (OEH, 2013)	Section 4.1 Appendix B
Plans & Documents	Stormwater Drainage Plan	Appendix A
	Sediment and Erosion Control Plan	Appendix B

Figure 1. Locality plan

1.2 Site Description

The site is owned by the NSW Department of Education (as shown on Figures 1 & 2) and has an approximate area of 3.34 hectares. The site is located approximately 12 km northwest of Sydney's CBD.

Meadowbank Education and Employment Precinct Schools Project (MEEPSP) site is to be located adjacent to the Meadowbank TAFE campus, on land acquired by the Department of Education from TAFE. The subdivided land is described as 2 Rhodes Street, Meadowbank. Additional site details is included in Table 1 below.

Table 1 – Site description

Attribute	Detail
ADDRESS	2 Rhodes Street, Meadowbank
LEGAL DESCRIPTION	Lot 10 in DP 1232584 being part of Lot 1 in DP 837179
SITE AREA	Approximately 33,300m^2 3.3Ha
SUBURB	Meadowbank
LOCAL GOVERNMENT AREA	City of Ryde
SURROUNDING LAND USES	North: Ryde Pump Station and site – 948 Victoria Road, and an industrial precinct on the opposite side of Rhodes Street.
	South: Meadowbank train station and The Shepherds Bay Precinct, previously known as the Meadowbank Employment Area (Shepherds Bay). The whole precinct is currently undergoing redevelopment as an urban renewal project with a series of high density residential flat buildings.
	East: Consists of low density residential, detached dwellings.
	West: Site abuts the Sydney Trains rail corridor, beyond that is a mix of low density residential and walk up style flat buildings.

The existing topography of the site grades naturally to the south-west. A wide depressed channel runs through the site from the north-east to south-west. Two depressions exist across the existing car parks, which fall towards the ultimate low point in the south-west corner of the site. The high points of the site are the south-eastern and north-western corners along Rhodes Street. At the western site boundary the raised railway embankment forms a physical bund. Levels at the site range from RL6 mAHD at the south-western site extent to RL17 mAHD at the south-eastern site extent.

Figure 2. Location of proposed development

2 EXISTING CONDITIONS

2.1 Stormwater

CRC stormwater plans identified council owned stormwater infrastructure within the subject site. A major trunk drainage box culvert runs beneath the central depression at the site within an easement, as shown on Figure 3. This trunk drainage line runs from the low point at Rhodes Street to the south western corner of the site. A previous flood study (Parramatta River – Ryde Sub-Catchments Flood Study and Floodplain Risk Management Plan (SKM, 2013 and 2015)) found that this trunk drain had a capacity roughly equivalent to the 1 in 20 year ARI storm. A council drainage line from See Street also connects into this trunk culvert.

Figure 3. Existing site drainage

Beyond the subject site, but within the Meadowbank TAFE site, this trunk discharges into an overgrown, partially concrete lined, creek as shown in Figure 4.

From this channel the creek passes beneath the railway embankment through a large (approximately 4m wide) box culvert. Downstream of the railway embankment, the box culvert discharges into the concrete lined channel which is referred to as Charity Creek. The culvert outlet downstream of the railway line to an open channel from railway embankment towards Parramatta River.

Local site drainage including pits, pipes and dish drains have also been identified at the site. These are assumed to discharge into the trunk drainage line.

Figure 4. Trunk culvert outlet within the Meadowbank TAFE site

2.2 Flooding

The site is part of the Charity Creek catchment (Figure 5). Charity Creek Catchment has an area of 247ha and is typically 1.7km wide and about 0.9km long. It originates from Denistone and runs through the residential areas of West Ryde and Meadowbank. Land use is mainly residential with industrial and commercial developments in the West Ryde area. The catchment consists mainly of a piped drainage system with developed flow paths through the urban areas.

The Northern Railway Line runs through the south-western portion of the catchment. The Railway is constructed on a raised fill embankment just to the north of Meadowbank Station and is an obstruction to overland flows. Also it represents an informal flood storage in this area. Victoria Road between Falconer Street and Linton Avenue is a raised control to overland flow from the north.

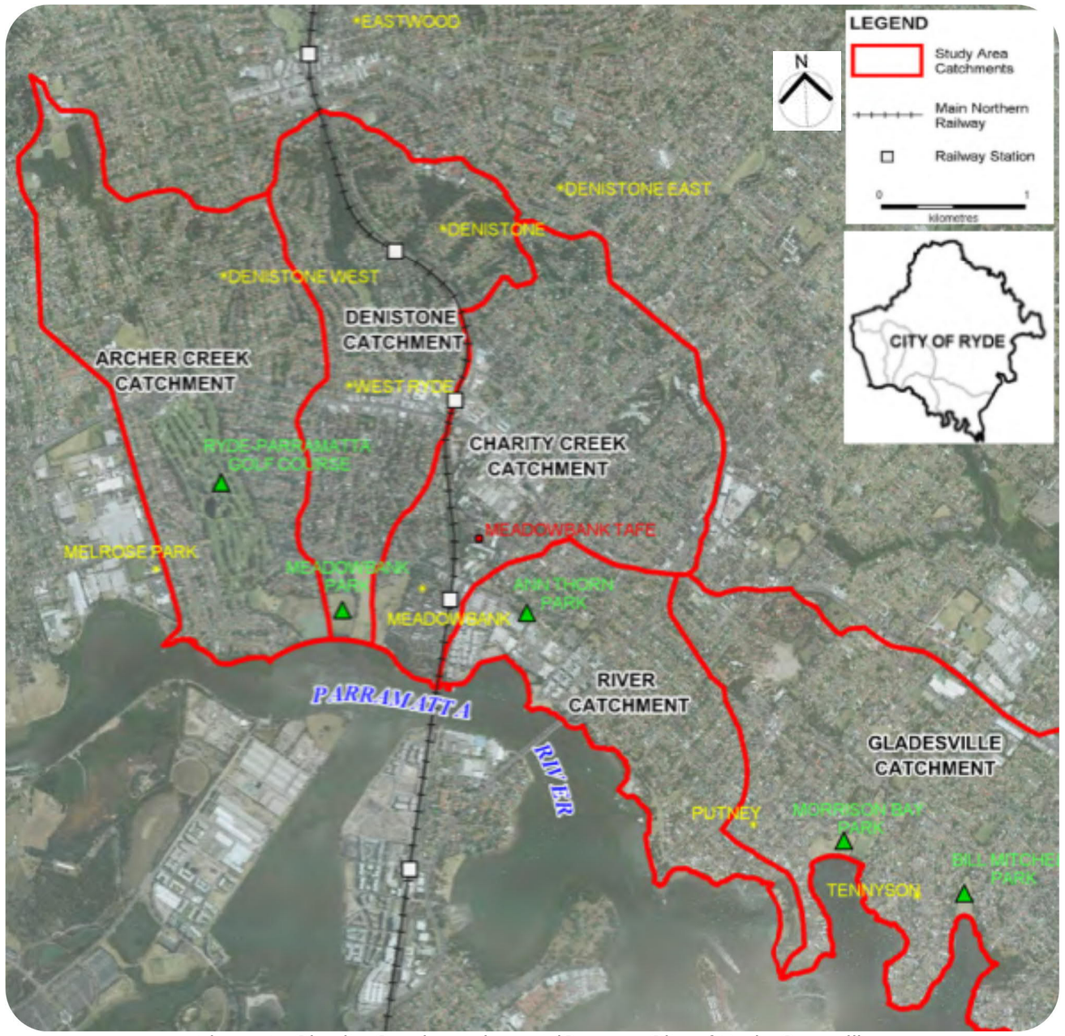


Figure 5. Charity Creek catchment (Source: City of Ryde Council)

For the proposed development site, the key drainage structures include:

- A rectangular box culvert (3.3m x 1.8m upsizing to 4.5m x 2.1m) upstream of the outlet from Victoria Road to the small open channel located at the east side of Railway, and
- A rectangular box culvert (4.5m x 1.8m) under the railway line from the TAFE site to the Charity Creek open channel.

These key drainage structures are shown in Figure 6.

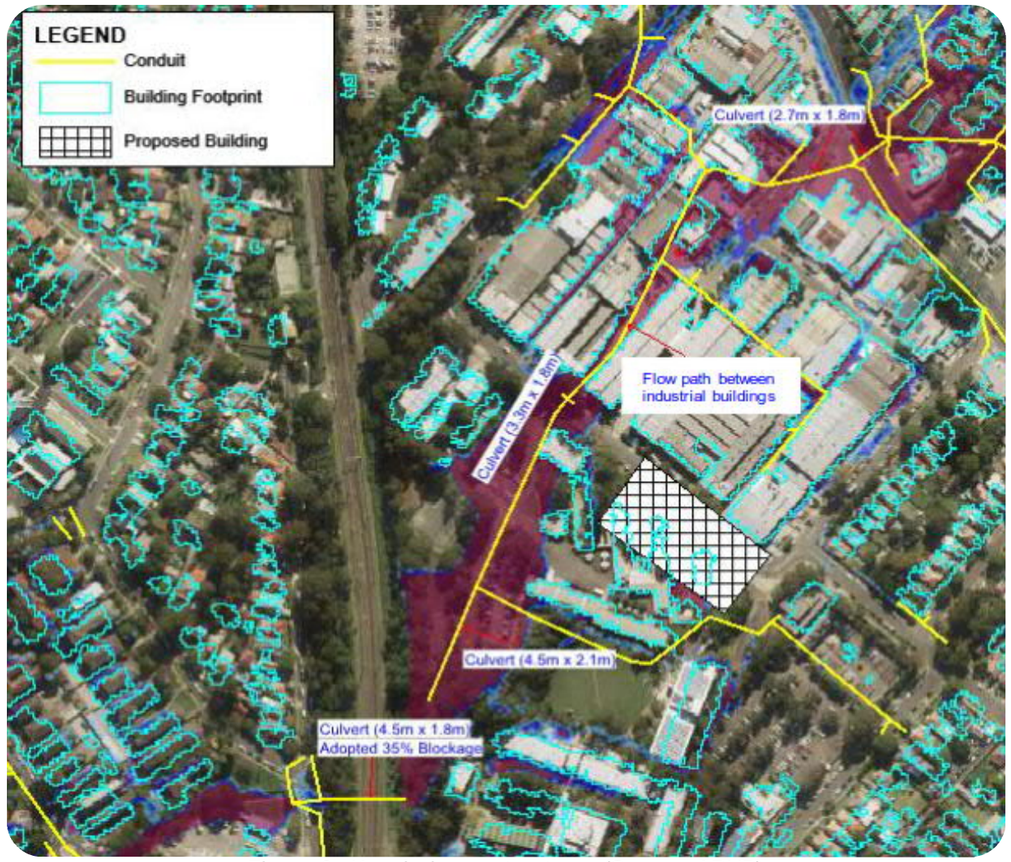


Figure 6. Key drainage structures (Source: ARUP)

2.2.1 Conceptual Flood Modelling

Based on information contained in the Preliminary Flood Impact Assessment report prepared for the Stage 1 of project design (ARUP, 2018), the site is subject to inundation due to flooding from Charity Creek in events 20% AEP (5-year ARI) up to 1% AEP (100-year ARI) events.

Flood modelling has been undertaken using the revised City of Ryde Council TUFLOW model to ascertain the flood behaviour under existing conditions for the 20% AEP, 1% AEP and PMF events. The storm durations considered are 15, 25, 60, 90 and 120 minutes for the 20% AEP and 1% AEP events, and 15 to 360 minutes for the PMF event. The storm duration which yields the maximum peak flood level for the development site is deemed as the critical storm.

It was found that the critical storm duration for the site is 2 hours for the 5% and 1% AEP events, and 90 minutes for the PMF event.

2.2.2 Existing Flooding Patterns

The key findings of the investigation as they relate to present-day conditions are as follows:

The flood model results for the 20% AEP event showing peak depths and levels at the site for the existing case are shown in Figure 7. Significant overland flow path passing through the middle of the proposed development site in the 20% AEP event are assessed. This flow path follows the large central depression through the site along the existing car parks. Runoff from the upstream catchment flows through the upstream industrial estate and crosses Rhodes Street at its low point. It then passes through the site via the main vehicle access driveway, where it ponds in the depressed car park areas with a maximum depth of 1.55m. From the car park areas flood waters flow towards the 4500mm x 1800mm culvert underneath the railway embankment. This culvert then discharges into Charity Creek, which is an engineered concrete lined open channel which discharges to the Parramatta River.

Figure 7. Overland flooding under existing conditions for 20% AEP event

The flood model results for the 1% AEP event showing peak depths and level at the site for the existing case are shown in Figure 8. The results show a constant peak water level at the site of RL8.15 mAHD. This indicates that the capacity of the culvert beneath the railway embankment is exceeded at this event resulting in flood waters building up behind the railway embankment. As in the 20% AEP event, the peak depth at the site occurs at the car park with a peak depth of 2.35m in this event.

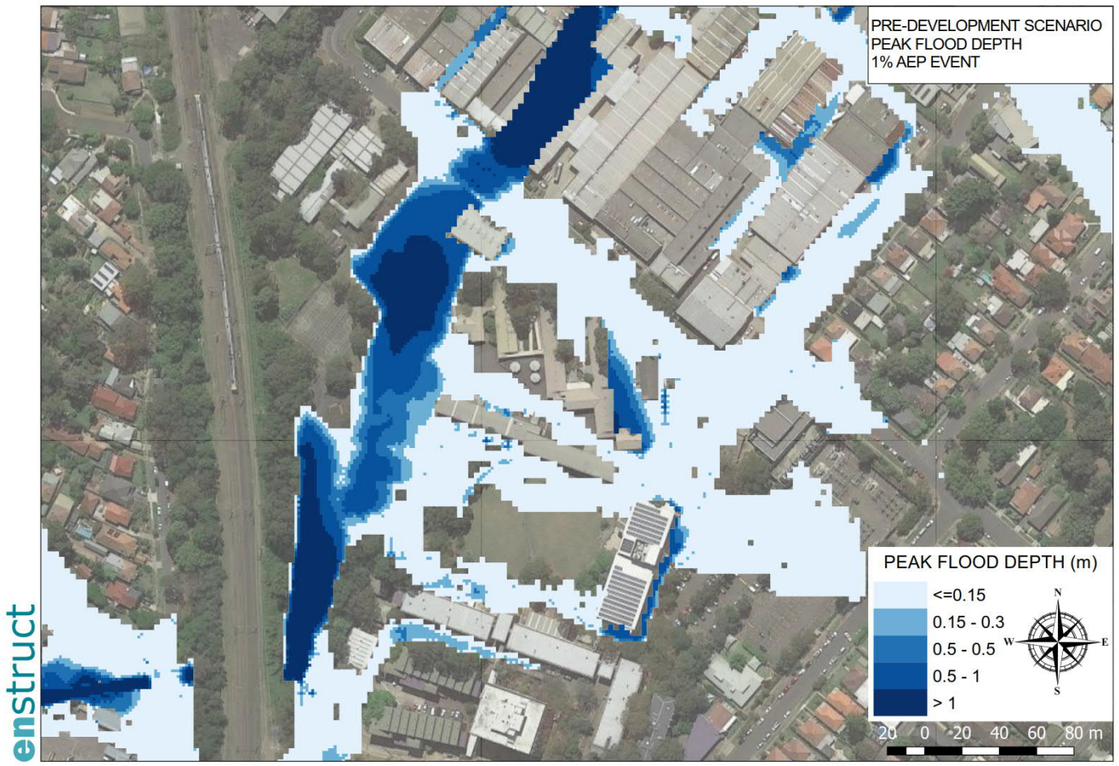


Figure 8. Overland flooding under existing conditions for 1% AEP event

The flood model results for the PMF event showing peak flood depths and levels at the site for the existing case are shown in Figure 9. These results show that the majority of the site is affected by flooding in the PMF event. Similar to the flood behaviour in the 1% AEP event, the capacity of the culvert under the railway line is exceeded resulting in floodwaters accumulating behind the railway embankment with a peak flood level of between RL16.24 -RL16.30 m AHD. Peak flood depths across most of the site exceed 2m. In the critical PMF event, the site floods to 1m depth in approximately 20 minutes, and reaches its peak flood level approximately 90 minutes after the start of the storm event.

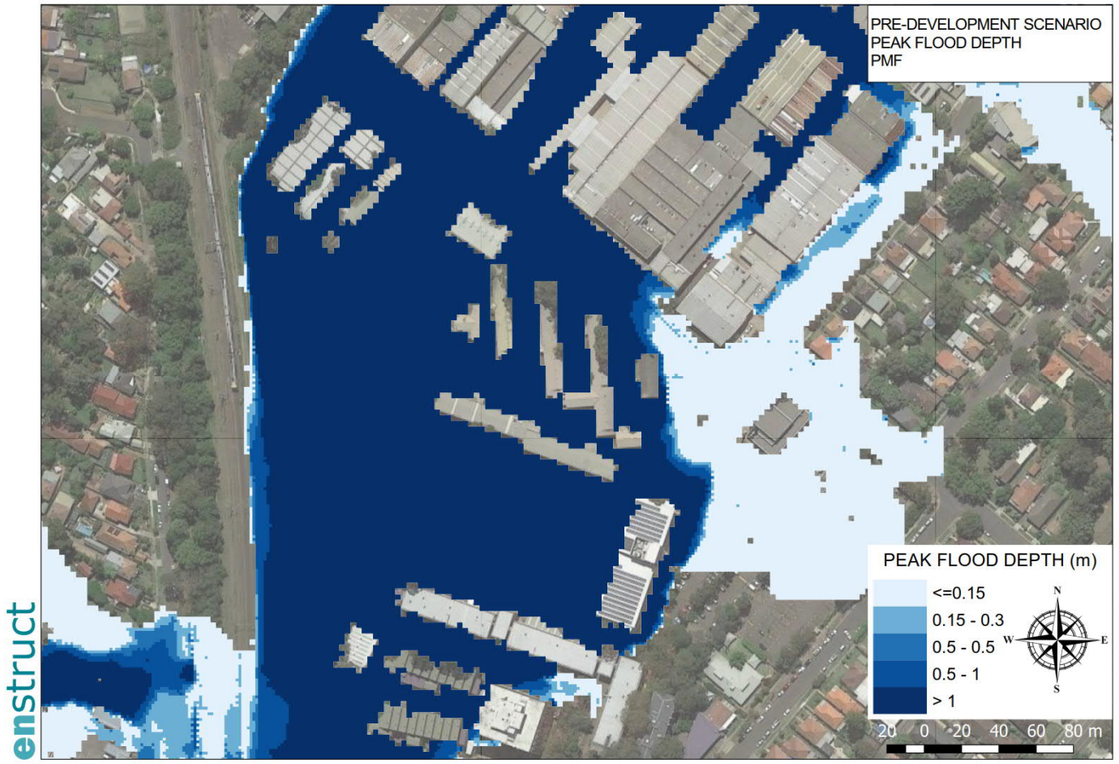


Figure 9. Overland flooding under existing conditions for PMF event

2.3 Water Quality

The stormwater quality within the study area is expected to be typical of an urban environment. The majority of the area is industrial with high sealed/paved and therefore stormwater runoff flowing overland is expected to be impacted by any pollutants present in the surface (road dirt, litter, etc.)

3 POTENTIAL IMPACTS

3.1 Construction

3.1.1 Excavation and Contaminated Ground

Preliminary geotechnical investigation of the area by ARUP (2018) indicated that existing site is underlain by fill material depths of between 0.5 m and 4.4 m. A 1 m to 10 m thick layer of natural granular alluvium underlain by low to medium strength siltstone to depth of geotechnical investigation. The location of basement excavation, with reference to geological section, is depicted on Figure 10.

Based on NSW published maps and subsurface conditions encountered to date, acid sulphate soils and saline soils are unlikely to be a geotechnical issues at this site.

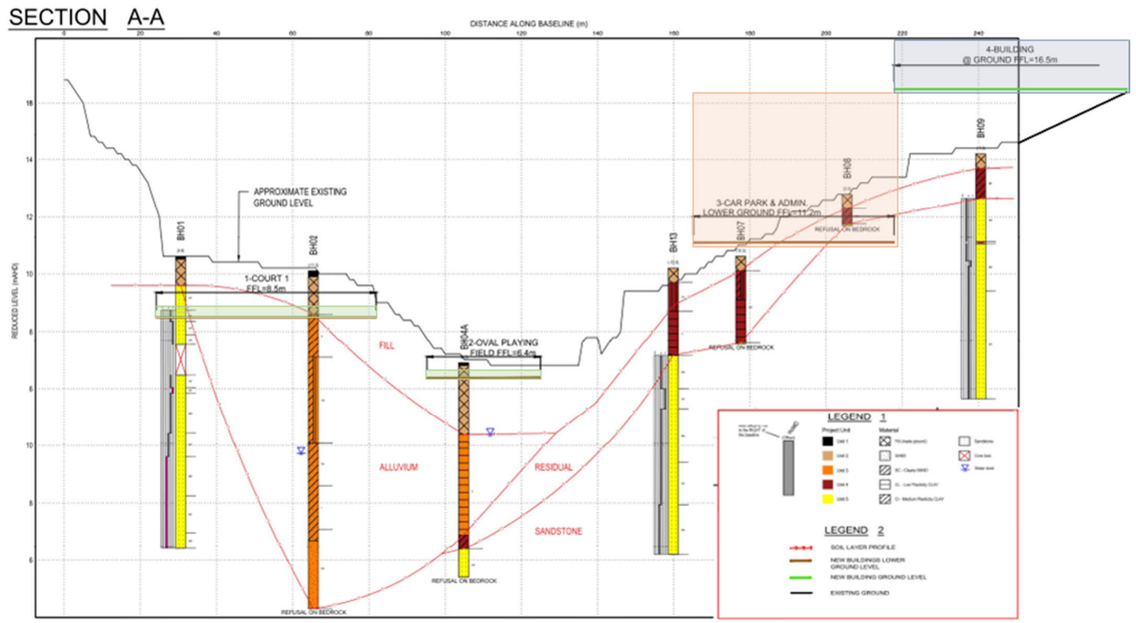


Figure 10. Interpreted geological model for site

The contamination report prepared by Alliance Geotechnical shows the fill on the site is generally contaminated with low levels of asbestos. Given the proposed use as a school, the site will need to be remediated prior to construction of the MEEPSP.

The excavation work required for the MEEPSP has the potential to cause erosion and sedimentation which have will have a negative impact on water quality leaving the site. Additional construction impacts may result from fuel or chemical spills from construction vehicles and equipment. Water management controls will be implemented while the stormwater diversion and amplification works are underway to prevent erosion and sedimentation adversely affecting local drainage networks and water courses. Controls will comply with City of Ryde Council DCP Part 8.2: Stormwater and Floodplain Management.

3.1.2 Dewatering

Measurements of groundwater in boreholes and monitoring wells indicated groundwater is expected at levels of between RL -0.35 m AHD and RL 4.4 m AHD. The maximum depth of excavation is RL 11.2 m AHD. Geotechnical investigation of the area, did not indicate the presence of groundwater at this depth. Thus, these conditions may change based on rain infiltration during rainy season at nearby areas. Based on the current preliminary information on geology and groundwater at this site, groundwater inflow to the carpark excavation is estimated to be less than 3 m^3/day. It is, however, noted that construction techniques such as shoring or sheet piling will reduce groundwater infiltration in the excavated zone.

Stormwater dewatering may be required following significant rainfall within the excavated area and any sediment basins. Potential impacts on water quality could occur if dewatering activities are undertaken in an uncontrolled manner. Based on available data, excavation dewatering may require treatment to reduce the amount of suspended solids prior to disposal to local stormwater connections.

3.2 Operation

3.2.1 Flooding and Stormwater

Flood mitigation will be provided through amplification of the stormwater network. During operation, the proposed design (as detailed in Section 4) will reduce the potential for flooding during major storm events.

3.2.2 Onsite Stormwater Detention (OSD)

Due to proximity to receiving water in the catchment and due to the site being flood affected, attenuation of stormwater flow is deficient.

Further, as the new development works is having a reduction to the total area of impervious surfaces from approximately 57% to approximately 49%, no increase in site flow is anticipated.

Due to the above, no OSD is being provided.

3.2.3 Flood Planning

Based on Table 1 in Section 8.2 of the City of Ryde DCP 2014, “Educational establishments” are defined as “Sensitive Uses and Facilities”. Due to this land use categorisation, specific flooding and overland flow planning controls apply to the proposed MEEPSP development. The design is required to incorporate the following features:

- Development will not be permitted within Medium and High Flood Risk Precincts at the site. New buildings and car parking should be located away from this area which follows the low point from northeast to southwest through the site;
- All building floor levels to be above the PMF level at the site. Note that no distinction is provided in Clause 4.4.8 (b) between habitable and non-habitable floor levels, therefore, it is assumed to apply to all floor levels;
- PMF flood level at the site in the developed condition was estimated to be RL16.16m AHD;
- Open parking areas to be located above 1% AEP flood levels;
- Enclosed parking areas (depending on the design, this may include building undercroft parking) are to be above the 1% AEP flood level plus 150mm freeboard;
- Basement parking access is to be above the PMF level. Therefore, any access to basement car parking would be limited to the western extent of the site at Rhodes Street which is outside of the extent of the PMF; and
- Building components below the PMF level will need to be designed structurally to withstand the force of the PMF.

Parts of the building are below the PMF level. The building below PMF level includes car parking, plant and storage. Classrooms, offices and libraries are all located on floors that are above the PMF level. This ensures that in the event of a PMF event, the school can return to normal operations without the need for substantial works to repair the facilities. The structure has been designed to withstand the impact of a PMF.

Climate change and rising sea water levels consideration is required to be assessed for flood planning levels. Office of Environment and Heritage (OEH) recommends that its guideline Practical Considerations of Climate Change (DECC, 2007) be used as the basis for examining climate change induced increases in rainfall intensities in projects undertaken under the State Floodplain Management Program, according to procedures set out in NSW Government’s Floodplain Development Manual (NSWG, 2005). The principal issue regarding climate change is the potential increase in peak flood levels adjacent to the proposed development and how this will impact on the available freeboard to finished floor levels.

The guideline recommends applying sensitivity analyses based on increases in rainfall intensities ranging between 10 and 30 percent. On current projections, the increase in rainfalls within the service life of developments or flood management measures is likely to be around 10 percent, with the higher value of 30 percent representing an upper limit. Under present day climatic conditions, increasing the 1% Average Exceedance Probability (AEP) design rainfall intensities by 10 percent would produce a 0.5% AEP flood; and increasing those rainfalls by 30 per cent would produce a 0.2% AEP event.

3.2.4 Water Quality

Council's (Part 8.2 of DCP) water quality requirements along with measures outlined in the 'Guidelines for development adjoining land and water managed by the Office of Environment and Heritage (OEH 2012)' are established to minimise operational quality impacts on surface waters. These guidelines require no increase in the natural annual average load of nutrients and sediments of stormwater discharged from proposed developments.

Recommended treatment targets for stormwater for this project are summarised in Table 3. These targets ensure the loads of stormwater pollutants discharged to receiving waters do not adversely impact on the ecological health of these waterways.

Table 3. Stormwater pollution reduction target (% of typical urban annual load)

Pollutant	Best Practice Performance Objective (%)
Total Suspended Solids (TSS)	85
Gross Pollutants (GP)	90
Total Phosphorous (TP)	60
Total Nitrogen (TN)	45

4 MITIGATION MEASURES

4.1 Construction

4.1.1 Soil and Water Management Plan

Prior to commencement of excavation works, a Soil and Water Management Plan (SWMP) must be prepared as part of the Contractor's Construction Environmental Management Plan (CEMP) for the works. The SWMP must include an Erosion and Sediment Control Plan (ESCP) prepared in accordance with the 'Blue Book'. Preliminary ESCP is included in Appendix B.

The SWMP must address the following requirements:

- Provision of sediment and erosion controls at downstream locations from the construction areas (e.g. sediment fences, sediment basins, other as required).
- Provision of stormwater diversion to divert clean run-off from undisturbed areas around any disturbed areas.
- Designated stockpile location away from gutters, stormwater pits, site boundary, footpaths and roadways or traffic areas.
- Coverage and/or stabilisation of stockpiles as required to minimise erosion.
- Sediment control barriers to be established around the stockpile area to restrict runoff from the stockpile area entering areas beyond the project site.
- Protection of on-site drains and exposed areas using erosion control mats or similar.
- Work staging to limit the area and duration that soils are exposed.
- Disturbed areas to be stabilised progressively to ensure that no areas remain exposed for any extended period of time.
- Where available and practicable, stormwater, recycled water or other water sources shall be used in preference to potable water for construction activities, including dust control.
- Provision of dewatering requirements as further discussed below.
- Any water collected from the site and requiring disposal is to be tested and discharged in compliance with ANZECC (2000) water quality guidelines for protection of aquatic ecosystems.
- Any truck transporting dusty loads, including excavated materials, must be covered.
- Soil not to leave the site as a result of vehicle, plant and equipment movements.
- Regular maintenance and inspection of plant and equipment and of sediment and erosion controls.
- Provision of a spill kit on site
- Provision of vapour monitors for unexpected finds; such as chemical contamination.

4.1.2 Contamination remediation

A soil contamination remediation plan has been prepared to address contaminated soil discovered on the site. The plan has been prepared with the competing goals of removal of contaminated ground and the retention of established trees. Where possible, the plan proposes a layer of clean fill around trees, rather than removing the established trees and the surrounding contaminated soil.

In the location of future buildings, the contaminated ground will simply be removed to a depth where contaminants are no longer detected.

A Remediation Action Plan (RAP) has been prepared by Alliance Geotechnical

4.1.3 Dewatering

As stated in Section 3.1.2 of this report, groundwater dewatering is not required for this project. However, stormwater dewatering of the excavated area is anticipated.

Management options for potential dewatering activities include:

- Pumping, transport and disposal off-site at a licensed liquid waste facility;
- On-site treatment and discharge to stormwater connections in accordance with acceptable criteria (e.g. ANZECC (2000), the 'Blue Book', and ANZECC Water Quality Guidelines for Fresh and Marine Waters 2000); or
- On-site treatment and discharge to Council stormwater drains to criteria acceptable to relevant authorities.
- Treated dewatering effluent may be allowed to be used for dust suppression.

Monitoring of discharged water will also be required to demonstrate compliance with the acceptable criteria.

4.1.4 Water Quality

For protection of groundwater and receiving waters, the threshold concentrations are based on the ANZECC Water Quality Guidelines for Fresh and Marine Waters 2000 (95% freshwater).

In order to ensure adequate response times in the event of detection of undesirable concentrations of contaminants, a Trigger and Action level for target contaminants has been formulated. The trigger level being 50% of the recommended threshold with the action level set at 75% of the relevant threshold.

Table 4. Stormwater disposal criteria

Water Parameter	Objective	Units
pH	6.5 – 8.5	pH
Total Suspended Solids (TSS)	<50	TSS
Turbidity (where correlation established through sampling and analysis at a NATA accredited laboratory)	86	NTU
Hydrocarbons	No hydrocarbon sheens observed	N/A

Other treatment methods can be deployed depending on the contaminant levels. If onsite treatment is not feasible, offsite disposal and treatment is recommended.

4.2 Operation

4.2.1 Stormwater Management

Internal stormwater drainage system consists of building gutters and downpipes will be designed by the building hydraulics consultant. The roof drainage system of gutters, downpipes and associated pipework is to be designed in accordance with AS/NZS 3500.3.

The collection and conveyance of runoff generated in different areas within the MEEPSP development are described as follows:

- Roof and podium levels – Runoff from the roof will be collected by the building hydraulics system and conveyed into stormwater pits leading to a main drain.
- Ground areas – A system of pits and pipes will be provided to collect the runoff generated in the ground areas.
- Other areas - Courtyards and terraces at ground level and lower ground Level will be collected and conveyed via a downpipe system via floor pits to the stormwater drainage system. Surface water will also be routed to the stormwater drainage system.

The stormwater drainage system will be designed in accordance with Council guidelines with a 5% and 1% AEP minor and major system design.

4.2.2 Water Quality

The stormwater system proposed for the site will discharge into Charity Creek culvert drainage. The development will achieve the pollution reduction targets by utilising WSUD treatment targets.

Measures that can help minimise operational water quality impacts on surface waters and groundwater include:

- Restricting surface water flows in its existing streams (subcatchment) and minimise discharge into adjacent subcatchments.
- Maintaining the time of concentration (flow velocity) of each subcatchment; with reference to pre-development and post-development hydrographs.

The combination of vegetated buffer, bioretention swales, vegetated swales, and filtration devices will be used through a treatment train approach to improve water quality before stormwater discharges from the site. These elements of the Stormwater Quality Management Strategy for the proposed development will achieve all the pollution reduction targets (Gross Pollutants, Total Suspended Solids, Total Phosphorus and Total Nitrogen) required to discharge stormwater to Charity Creek drainage.

4.3 Flood Mitigation

4.3.1 Site Drainage

The minor site drainage system for the new development will be designed in accordance with requirement of CRC DCP 2014 – Stormwater and Floodplain Management Technical Manual.

A system of pits and pipes will be provided to collect roof water and runoff generated in the ground areas. Hard surface areas will discharge into GPT to stormwater drainage system. Full detain of system design is included in Appendix A.

4.3.2 Flood Mitigation Options

The proposed MEEPSP development and landscape plan is shown in Figure 11.

Source: Urbis

Figure 11. – Post development site model

Further to the landscaping plan, the site requires remediation works. This involves some filling above the existing surface levels. To minimise the impact on flooding, the ground levels in the floodway have been retained, with contaminated ground proposed to be removed and replaced with clean fill. Outside of the main floodway, and in an effort to retain established trees, an area in the southern portion of the site includes some filling to achieve a separation between contaminated ground and the final finished surface.

Changes to the terrain for both the contamination remediation and the landscaping works were integrated into the flood model to determine the impact on flooding.

The site is subject to inundation due to flooding from Charity Creek in events 20% AEP up to 1% AEP events. Flood modelling has been undertaken using the revised City of Ryde Council TUFLOW model to ascertain the flood behaviour under existing conditions for the 20% AEP, 1% AEP and PMF events. Multiple storm durations were considered. The storm duration which yielded the maximum peak flood level for the development site is deemed as the critical storm.

It was found that the critical storm duration for the site is 2 hours for the 5% and 1% AEP events, and 90 minutes for the PMF event.

4.3.2.1 Post-Development Flooding Patterns

The flood model results for the 20% AEP event showing peak depths and levels at the site for post development case are shown in Figure 12. These results show a significant overland flow path passing through the middle of the proposed development site in the 20% AEP event. This flow path follows the large central depression through the site along the existing car parks.

The modelling results were similar to existing conditions and indicated that the capacity of the trunk box culvert drain through the development site and industrial area north of Rhodes Street is exceeded in the 20% AEP flood event.

Figure 12. Overland flooding under post-development conditions for 20% AEP event

The flood model results for the 1% AEP event showing peak depths and level at the site for the existing case are shown in Figure 13. The results show a constant peak water level at the site of RL7.50 m AHD. This indicates that the capacity of the culvert beneath the

railway embankment is exceeded at this event resulting in flood waters building up behind the railway embankment.

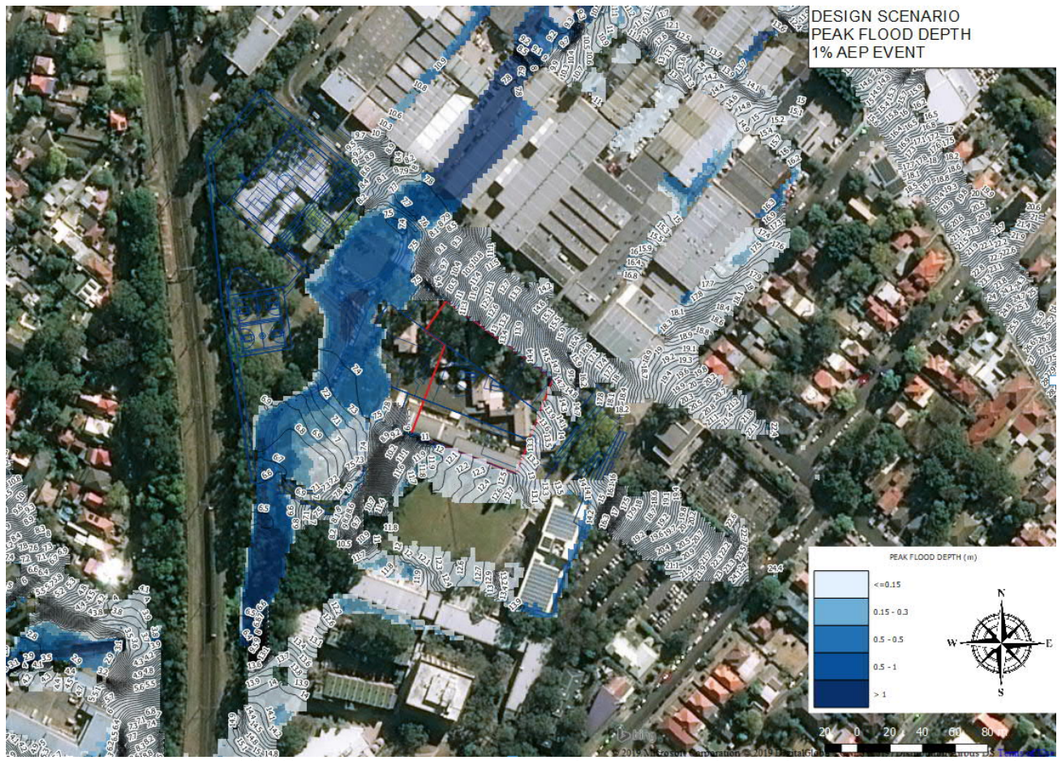


Figure 13. Overland flooding under post-development conditions for 1% AEP event

The flood model results for the PMF event showing peak flood depths and levels at the site for the existing case are shown in Figure 14. These results show that the majority of the site is affected by flooding in the PMF event. Similar to the flood behaviour in the 1% AEP event, the capacity of the culvert under the railway line is exceeded resulting in floodwaters accumulating behind the railway embankment with a peak flood level of RL16.16 mAHD in the developed conditions model. Peak flood depths across most of the site exceed 2m. In the critical PMF event, the site floods to 1m depth in approximately 20 minutes, and reaches its peak flood level approximately 90 minutes after the start of the storm event.

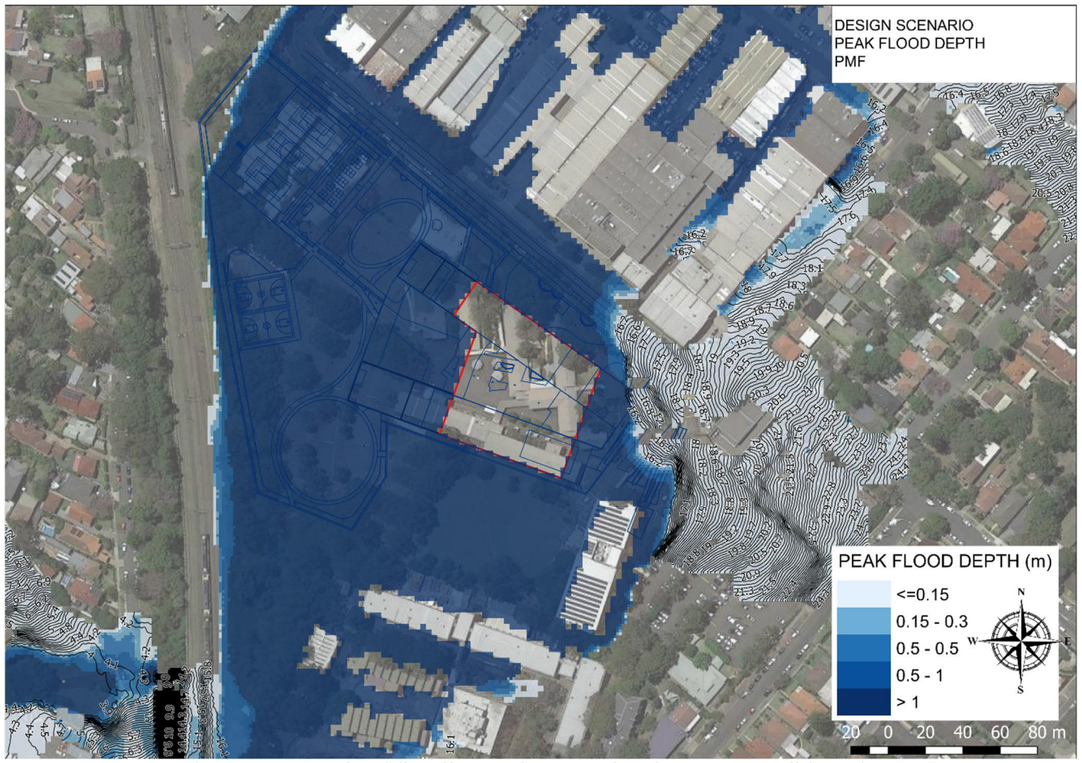


Figure 14. Overland flooding under post-development conditions for PMF event

4.3.2.2 Flood Planning Levels

The goal of the flood mitigation design is to maintain:

- overland flow within road reserves and prevent entry to school access driveways to basement; and
- continuous school operation during major storm events.

The flood planning levels for the site based on the flood modelling results and the requirements of the City of Ryde Council DCP are as follows:

- Sensitive use facility floor level (PMF level): RL16.16 mAHD
- Enclosed parking area (1% AEP + 150mm): RL7.65 mAHD

Note that the flood planning level adopted for the site is the pre-development PMF level of 16.30 mAHD. This flood level is slightly conservative, at 140mm above the predicted post-developed PMF level.

The car park is located below the PMF level at 9.50 mAD with an entrance at 10.30 mAHD. The carpark has been designed such that any water entering the basement can flow out of the basement as flood waters recede. That is unlike a basement, water will not pond in the car park following and extreme flood event.

Given the huge backwater effect of the rail embankment, the entire site, including the car park and car park entry, is impacted by the PMF. Additional flood modelling has shown

that the 0.05% AEP event (2,000-year ARI) results in a flood level of 8.65m AHD. The car park entry has 1.65m freeboard to this level. The car park floor level is 0.85m above the 0.05% AEP flood level. Extrapolating between the flood levels of the 0.05% AEP and the PMF gives an AEP of 0.02% (5,000-year ARI) flood level of 9.50mAHD, equal to the finished floor level of the car park.

It is expected that the site would be evacuated (or school cancelled) prior to a PMF event, which minimises the risk to site occupants.

While the car park does not strictly comply with the DCP, the design has addressed the flood risk of extreme rainfall events. Other management solutions are not available given the unique situation of the rail embankment holding back flood waters in an extreme event that leads to the PMF being over 8m higher than what is experienced in a 1% AEP event.

While any cars in the car park during an event larger than the 0.02% AEP event may be flooded, there is adequate space for the site occupants to move to higher levels within the building (libraries and classrooms) to shelter in place during an extreme flood event. As flood waters recede, water will drain out of the carpark.

4.3.2.3 Flood Impact

Development impact on flood for the 20% AEP event is shown in Figure 15. These results show no increases in flood levels at the industrial area north of Rhodes Street. Some minor impacts of less than 0.05m are shown within the MEEPSP development site around the grassed area and adjacent to new building. These flood impacts are shown in areas that are significantly higher than the overland flow path and therefore would not be associated with overland flooding through the site. These flood impacts result due to the proposed positioning of the building which diverts a portion of the overland flows towards the south. Flood depths in these areas are less than 0.5m and these impacts are not anticipated to increase the flood risk at any buildings. It is likely that these impacts could be mitigated by providing additional drainage at the site to the south-west of the building. This site drainage could then be incorporated in the flood model to verify that these impacts are mitigated.

Figure 15. 20% AEP event flooding impact

Flood impact for the 1% AEP event is shown in Figure 16. This figure shows some off-site decreases in peak flood levels in the order of 0.1m at Rhodes Street adjacent to the site. As Rhodes Street is already flooded and impassable in events as small as a 20% AEP event, this change in flood levels in the 1% AEP event would not impact on flood evacuation routes. Therefore, it is not anticipated that these impacts would contravene the objectives of the Council DCP. As in the 20% AEP event, minor localised flood impacts are also shown at the MEEPSP development site.

As discussed in relation to the 20% AEP impacts, these impacts would not be anticipated to increase the flood risk at the development site and could likely be mitigated through the provision of additional local drainage in these areas.

Some increase in flood levels in seen in the southern corner of the site as a result of the contamination remediation fill. The flood level increase is related to the ground surface. The flood depth in this area remains below 150mm in a 1% AEP event.

Figure 16. 1% AEP event flooding impact

Flood impact for the PMF event is shown in Figure 17. This map shows that no off-site flood impacts are anticipated due to the proposed development.

Figure 17. PMF flooding impact

4.3.2.4 Detailed Stage 2 Flood Study

Further detailed hydraulic modelling for the study area will be carried out using TUFLOW modelling software at the detailed design stage. TUFLOW is an industry standard hydraulic modelling software system, which is used for fully dynamic modelling of floodplains by representing one (1D) and two dimensional (2D) elements of a floodplain.

In this detailed design phase, the final building location and configuration, landscaping and bulk earthworks would be established. Several flood management options will be optimised and modelled to try to eliminate the impact of the development and achieve satisfactory outcomes regarding management of flooding, including extreme flooding (PMF) event.

The fence between the primary and secondary school playgrounds is subject to detail design, cognisant of the need to minimise any detrimental impact of the fence on flood behaviour. The fence will be an open palisade style fence to allow flood water to pass through. Consideration will be given to the risk of debris reducing the flow area through the fence.

4.4 Flood Risk Management

The site is flood affected, and therefor there is a risk to site occupants. The risk can be managed through staged controls for various levels of flooding.

It is anticipated that when extreme weather conditions associated with a PMF event are forecast, school will be cancelled. If the site were occupied in a PMF, the strategy is to shelter in place, with the libraries and classrooms all located above the PMF level. While there is no need for an immediate evacuation, an evacuation route is available via Rhodes and McPherson Streets to the east of the site.

For less extreme rainfall events, including regular storms and flood events up to 1% AEP (100-year), the following general procedure should be adopted:

- During a rainfall event, the open spaces and sports fields will be closed, with the two undercroft areas available for outdoor play.
- Should an overland flow event occur, students will be instructed to evacuate the undercrofts up to the classrooms.
- A shelter in place policy should be adopted in the event the undercroft areas become submerged.

A formal flood emergency response plan can be prepared as part of the detailed design process.

It is understood that NSW Department of Education Policy is to encourage community use of school facilities outside of school hours. For organised events under this community use policy, event organisers should be provided with a copy of the flood risk and flood emergency response plan and adapt the plan to the particular site use. For casual users of the playground, it is anticipated that outdoor recreation will be limited during rainfall events, minimising the risk to casual users.

5 Greenstar

To meet greenstar targets for stormwater, water pollutant removal devices and systems are incorporated into the design. Further, Water Sensitive Urban Design measures have been considered.

5.1 Water Sensitive Urban Design and Water Quality

Water Sensitive Urban Design includes water reuse, pollutant removal via natural systems, and the minimisation of hard structures to control stormwater and improve aesthetic and recreational appeal. Bioretention filter swales have been incorporated into the design to remove nutrient pollutants. In addition, gross pollutants will be removed by the incorporation of litter baskets in stormwater pits and litter screens.

5.2 Rainwater Reuse

Refer to the hydraulic consultant for rainwater reuse for toilet flushing and landscaping irrigation.

6 SUMMARY

Stormwater from the development will be discharged into existing Council infrastructure (Charity Creek drainage).

Review of site flooding conditions suggests that there is significant overland flow within the site area. In addition:

- Project design is not anticipated to increase flooding impacts (or levels) on private property external to the site during rainfall events.
- The PMF level is critical for school operation.
- Carpark will be flooded during PMF event, however it is located above the 0.05% AEP flood level.

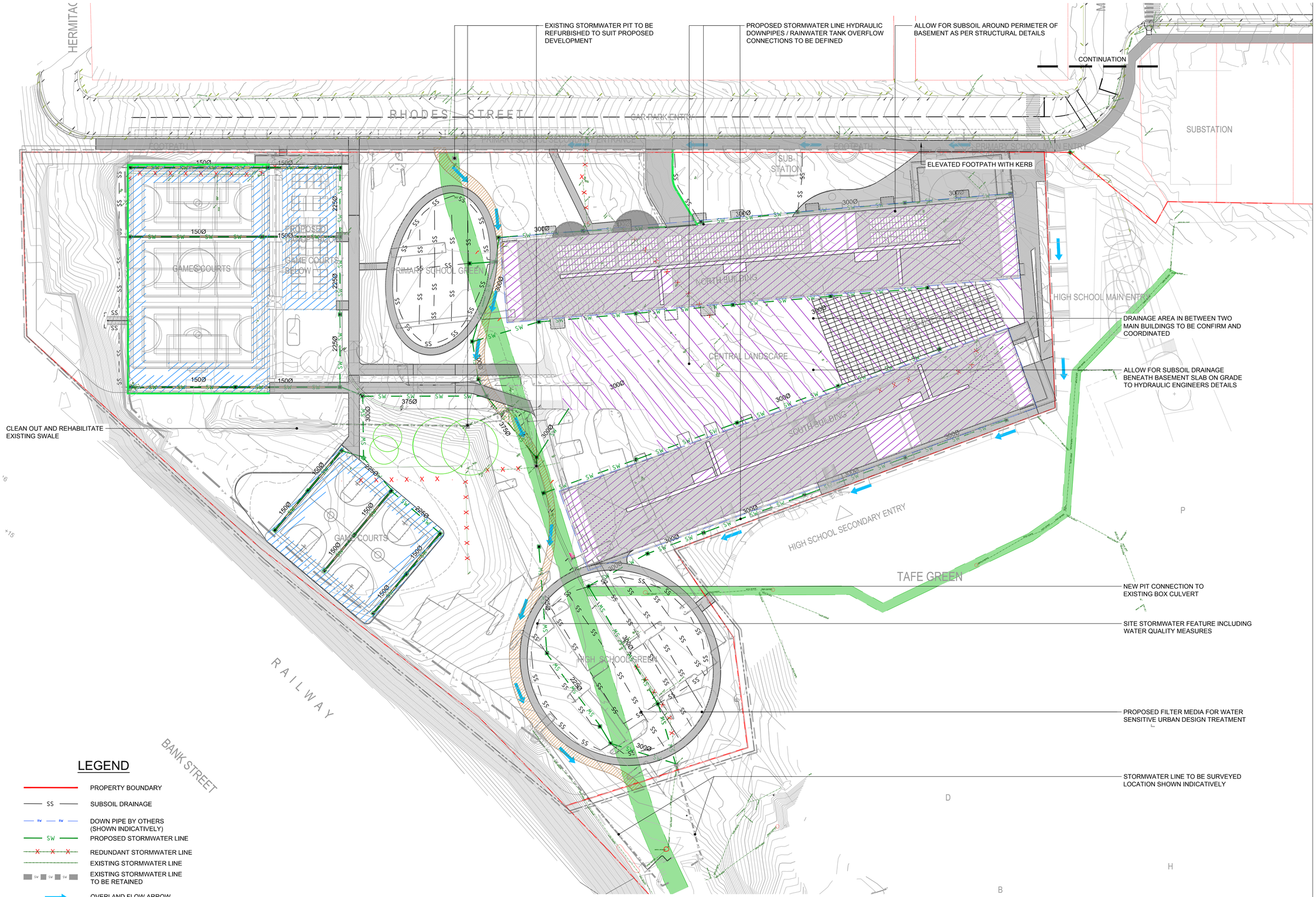
This report provides technical content to support the SSDA for the MEEPSP development. The attached plans show the proposed stormwater and flood mitigation works.

The civil engineering components of the works will be designed in accordance with the following Australian standards and guidelines:

- Australian Rainfall & Runoff: Volumes 1 & 2
- NSW Government Floodplain Development Manual (2005)
- AS3500.3 Plumbing and Drainage: Stormwater Drainage
- Managing Urban Stormwater, Soils and Construction, Volume 1, 4th edition, Landcom, March 2004
- Concrete Pipe Selection and Installation - Concrete Pipe Association 1990
- City of Ryde Council Development Control Plan 2014 – Stormwater and Floodplain Management Technical Manual
- Guidelines for developments adjoining land managed by the Office of Environment and Heritage (OEH 2013)

APPENDIX A

STORMWATER DRAINAGE DESIGN



LEGEND

- PROPERTY BOUNDARY
- SS — SUBSOIL DRAINAGE
- RW — DOWN PIPE BY OTHERS (SHOWN INDICATIVELY)
- SW — PROPOSED STORMWATER LINE
- REDUNDANT STORMWATER LINE
- EXISTING STORMWATER LINE
- EXISTING STORMWATER LINE TO BE RETAINED
- OVERLAND FLOW ARROW
- PROPOSED BUILDING OUTLINE
- PROPOSED SPORT COURTS OUTLINE
- PROPOSED BIO RETENTION SWALE
- PROPOSED FILTRATION MEDIA
- EXISTING STORMWATER PIT TO REMAIN
- EXISTING STORMWATER PIT TO REMAIN
- PROPOSED STORMWATER DRAIN
- EXISTING STORMWATER CULVERT

FOR STORMWATER TYPICAL DETAILS REFER TO DRAWINGS CV-085X

STORMWATER PLAN SUBJECT TO CHANGES ON LANDSCAPE AND ARCHITECTURAL PLANS

NOT FOR CONSTRUCTION

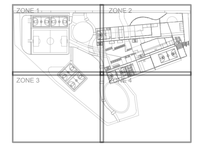
Recent revision history

Revision	Description	Date
01	ISSUE FOR INFORMATION	06/07/18
02	50% SD ISSUE	13/07/18
03	80% SD ISSUE	31/08/18
04	FOR COSTING	25/03/19
05	SSDA ISSUE	10/04/19
06	SSDA ISSUE	15/04/19
07	SSDA ISSUE	15/05/19
08	DRAFT 90% SD	29/05/19
09	SD ISSUE	14/06/19

Notes & Legend

Refer to drawing CV-0002 for General Notes
These drawings are intended to be read in colour.
Do not scale drawings. Written dimensions govern
All dimensions are in millimeters unless noted otherwise
This drawing to be read in conjunction with all relevant contracts, specifications, reports and drawings.

KEY PLAN



KEY PLAN IS NOT TO SCALE

HDC & Architectural
WOODS BAGOT

Structural & Civil Engineering
ENSTRUCT

Mechanical Engineering & ESD/Energy Modelling
STEENSEN VARMING

Electrical Engineering
WSP

Hydraulic & Fire Engineering
WARREN SMITH & PARTNERS

Landscape & Heritage
URBIS

Project
MEADOWBANK SCHOOLS PROJECT

Client
NSW GOVERNMENT Education School Infrastructure

Project number	Size check		
5645	25mm		
Checked	Approved	Sheet size	Scale
PR	PR	A1	1:500

Sheet title
STORMWATER PLAN

Sheet number
MSP-EN-CV-00201

Revision
09

Status
FOR INFORMATION ONLY

APPENDIX B

EROSION AND SEDIMENT CONTROL PLAN

LEGEND:

- SITE BOUNDARY
- PROPOSED SEDIMENT FENCE
- PROPOSED TEMPORARY CATCH DRAIN
- PROPOSED STRAW BAIL SEDIMENT FENCE
- PROPOSED TEMPORARY SHAKER GRID AND WASH DOWN FACILITY
- TEMPORARY SANDBAGS AROUND PITS:
  1. AFTER PAVEMENT WORKS ARE COMPLETE IF WORKS ARE ONGOING UPSTREAM
  2. TO EXISTING GRATED PITS DOWNSTREAM OF CONSTRUCTION WORKS
- PROPOSED STRAW BALE AROUND PIT
- OPTIONAL STOCKPIPLE LOCATION WITH SEDIMENT FENCE
- PRIMARY OVERLAND FLOW DIRECTION
- SECONDARY OVERLAND FLOW DIRECTION
- FALL
- SEDIMENT BASIN

Recent revision history

Revision	Description	Date
01	ISSUE FOR INFORMATION	06/07/18
02	50% SD ISSUE	13/07/18
03	ISSUE FOR DEMOLITION	18/07/18
04	80% SD ISSUE	31/08/18
05	FOR COSTING	25/03/19
06	SSDA ISSUE	15/05/19
07	DRAFT 90% SD	29/05/19
08	SD ISSUE	14/06/19
09	ISSUED FOR APPROVAL	02/10/19
10	ISSUED FOR APPROVAL	11/10/19

Notes & Legend

Refer to drawing CV-0002 for General Notes
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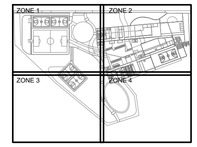
KEY PLAN



KEY PLAN IS NOT TO SCALE

HDC & Architectural
WOODS BAGOT

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Mechanical Engineering & ESD/Energy Modelling
STEENSEN VARMING

Electrical Engineering
WSP

Hydraulic & Fire Engineering
WARREN SMITH & PARTNERS

Landscape & Heritage
URBIS

Project
MEADOWBANK SCHOOLS PROJECT

Client
NSW GOVERNMENT Education School Infrastructure

Project number
5645

Size check
25mm

Checked	Approved	Sheet size	Scale
TH	PL	A1	1:500

Sheet title
SEDIMENT AND EROSION CONTROL PLAN

Sheet number
MSP-EN-CV-00401

Revision
10

Status
FOR APPROVAL

NOT FOR CONSTRUCTION

EROSION AND SEDIMENT CONTROL:

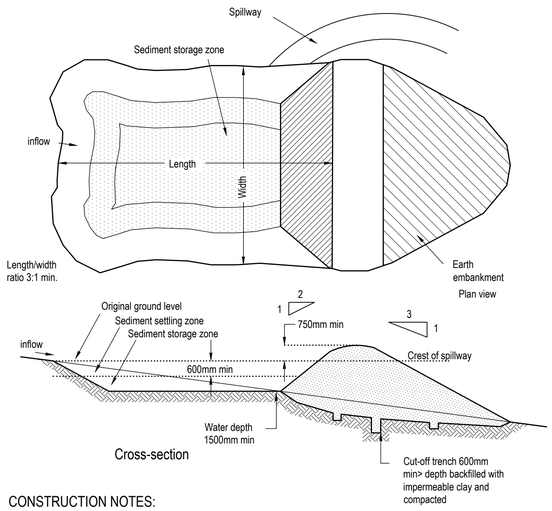
1. THE CONTRACTOR SHALL PROVIDE ADEQUATE TRUCK WASH FACILITIES AT THE SITE EXIT AND SHALL CLEAN ALL VEHICLES EXITING THE SITE TO ENSURE MATERIALS AND MUD IS NOT TRANSPORTED AND DEPOSITED OFF SITE. WATER FROM ANY WASHBAY IS TO BE DIVERTED TO THE SEDIMENT FENCE OR TO THE SEDIMENT BASIN PRIOR TO DISCHARGE.
2. NOTWITHSTANDING THE EROSION AND SEDIMENT CONTROL NOTES THE CONTRACTOR SHALL NOTE THEIR OVERARCHING OBLIGATION WITH THE CITY OF RYDE COUNCIL IN RESPECT OF ENVIRONMENTAL CONTROLS. PARTICULARLY ONGOING TESTING OF DISCHARGE, MAINTENANCE, DREDGING OF SEDIMENTATION PONDS AND FINAL FILTRATION AT OUTLETS.
3. THE CONTRACTOR SHALL TAKE ALL STEPS NECESSARY TO PROTECT THE ENVIRONMENT AND IN PARTICULAR SHALL CONTROL EROSION, SEDIMENTATION AND POLLUTION DURING CONSTRUCTION IN ACCORDANCE WITH THE REQUIREMENTS OF THE EPA, DEC, COUNCIL, AND THE EROSION AND SEDIMENT CONTROL PLAN.
4. EROSION AND SEDIMENT CONTROL DEVICES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH "MANAGING URBAN STORMWATER - SOILS AND CONSTRUCTION' (2004 - BLUE BOOK), AND CITY OF RYDE COUNCIL'S DCP.
5. EROSION AND SEDIMENT CONTROL DEVICES SHALL BE CONFIRMED IN THE QUALITY PLAN PRODUCED BY THE CONTRACTOR AND SHALL BE IMPLEMENTED AND ADJUSTED TO SUIT CONSTRUCTION ACCESS AND STAGING.
6. FOLLOWING EVERY RAINFALL EVENT EXCEEDING 10mm OR WHEN BASINS ARE GREATER THAN 50% FULL, WATER SHALL BE TESTED FOR COMPLIANCE WITH EPA'S STANDARDS AND, IF FOUND NOT TO COMPLY, WATER SHALL BE TREATED BY APPROPRIATE FLOCCULATION, FILTRATION OR OTHER APPROVED METHODS.
7. WATER SHALL NOT BE REMOVED FROM SEDIMENT BASIN UNTIL TESTED WATER MEETS EPA WATER QUALITY REQUIREMENTS e.g <50 MG/L SUSPENDED SOLIDS.
8. CONTRACTOR TO PROVIDE ALL PERIMETER SITE FENCING FOR SECURITY & SAFETY PURPOSES AS REQUIRED.
9. OBTAIN APPROVALS FROM SYDNEY WATER OR COUNCIL TO PUMP TO RECEIVING PIT.
10. EMPTY SEDIMENT BASIN WITHIN 72 HOURS OF RAINFALL. TREAT WATER AS NECESSARY TO ACHIEVE REQUIRED WATER QUALITY STANDARDS.

REMEDIATION NOTES:

1. REMOVE ALL DEBRIS AND SMOOTH ALL EXPOSED AREAS TO GRADE EVENLY TO EXTENT OF EXPOSED AREA TO MATCH EXISTING SURROUNDING GROUND LEVELS
2. SPRAY GRASS EXTENT OF DISTURBED AREA
3. MAINTAIN AND WATER SPRAY GRASS UNTIL ESTABLISHMENT OF DENSE GRASS COVER

NOTE:

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH MSP-ENS-CV-0401

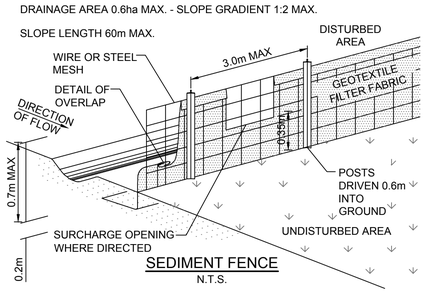


CONSTRUCTION NOTES:

1. REMOVE ANY VEGETATION AND TOPSOIL FROM UNDER THE DAM WALL AND FROM WITHIN THE STORAGE AREA.
2. CONSTRUCT A CUT-OFF TRENCH 500 MM DEEP AND 1200 MM WIDE ALONG THE CENTRELINE OF THE EMBANKMENT EXTENDING TO A POINT ON THE GULLY WALL LEVEL WITH THE RISER CREST.
3. MAINTAIN THE TRENCH FREE OF WATER AND RECOMPACT THE MATERIALS WITH EQUIPMENT AS SPECIFIED IN THE SWMP TO 95 PER CENT STANDARD PROCTOR DENSITY.
4. SELECT FILL FOLLOWING THE SWMP THAT IS FREE OF ROOTS, WOOD, ROCK, LARGE STONE OR FOREIGN MATERIAL.
5. PREPARE THE SITE UNDER THE EMBANKMENT BY RIPPING TO AT LEAST 100 MM TO HELP BOND COMPACTED FILL TO THE EXISTING SUBSTRATE.
6. SPREAD THE FILL IN 100 MM TO 150 MM LAYERS AND COMPACT IT AT OPTIMUM MOISTURE CONTENT.
7. CONSTRUCT THE EMERGENCY SPILLWAY.
8. REHABILITATE THE STRUCTURE FOLLOWING THE SWMP.

EARTH BASIN - WET
(APPLIES TO 'TYPE D' AND TYPE F' SOILS ONLY)

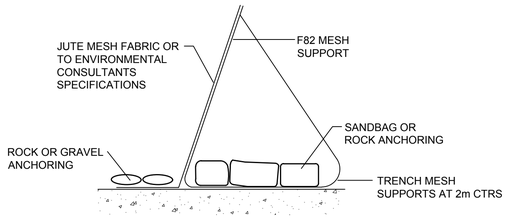
DRAINAGE AREA 0.6ha MAX. - SLOPE GRADIENT 1:2 MAX.



SEDIMENT FENCE
N.T.S.

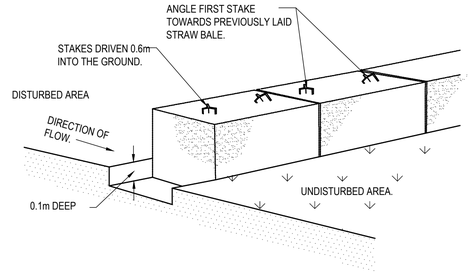
INSTALLATION
1. EXCAVATE A TRENCH 200mm DEEP.
2. DRIVE POSTS 500-700mm INTO GROUND AT A MAXIMUM SPACING OF 3.0m CENTRES.
3. PLACE AND FIX SUPPORT MESH (F52) TO POST.
4. LAY BIDIM GEOFABRIC (SF 2000) AGAINST THE SUPPORT MESH AND FIX BY TIE WIRE, STAPLES OR HOG RINGS.
5. PLACE BIDIM IN TRENCH AND BACKFILL WITH SOIL.

NOTE:
POSITION OF SEDIMENT FENCE AS DIRECTED BY SUPERINTENDENT. FENCE TO REMAIN IN PLACE UNTIL EXCAVATION IS BELOW FOOTPATH LEVEL.

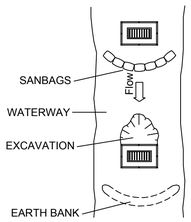


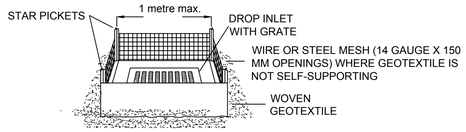
ALTERNATIVE SEDIMENT FENCE
N.T.S.

ALTERNATIVE SEDIMENT FENCE NOTES
1. INSTALL THIS TYPE OF SEDIMENT FENCE WHEN USE OF SUPPORT POSTS IS NOT DESIRABLE OR NOT POSSIBLE. SUCH CONDITIONS MIGHT APPLY, FOR EXAMPLE, WHERE APPROVAL IS GRANTED FROM THE APPROPRIATE AUTHORITIES TO PLACE THESE FENCES IN HIGHLY SENSITIVE ESTUARINE AREAS.
2. USE BENT TRENCH MESH TO SUPPORT THE F82 WELDED MESH FACING AS SHOWN ON THE DRAWING ABOVE. ATTACH THE JUTE MESH TO THE WELDED MESH FACING USING UV-RESISTANT CABLE TIES.
3. STABILISE THE WHOLE STRUCTURE WITH SANDBAG OR ROCK ANCHORING OVER THE TRENCH MESH AND THE LEADING EDGE OF THE JUTE MESH. THE ANCHORING SHOULD BE SUFFICIENTLY LARGE TO ENSURE STABILITY OF THE STRUCTURE IN THE DESIGN STORM EVENT, USUALLY THE 10 YEAR EVENT.

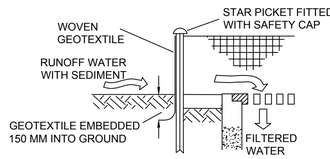


STRAW BALE SEDIMENT FILTER
CONSTRUCT AS SHOWN ON PLAN
NTS



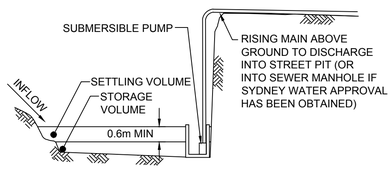


FOR DROP INLETS AT NON-SAG POINTS, SANDBAGS, EARTH BANK OR EXCAVATION USED TO CREATE ARTIFICIAL SAG POINT



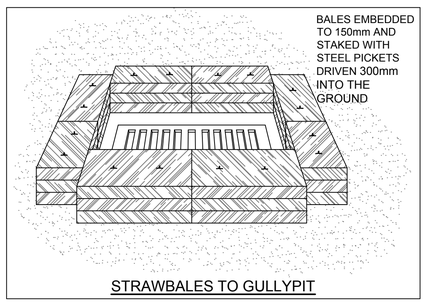
CONSTRUCTION NOTES
1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE OR STRAW BALES.
2. FOLLOW STANDARDS DRAWING 6-8 FOR INSTALLATION PROCEDURES FOR GEOFABRIC. REDUCE THE PICKET SPACING TO 1 METRE CENTRES.
3. IN WATERWAYS, ARTIFICIAL SAG POINTS CAN BE CREATED WITH SANDBAGS OR EARTH BANKS AS SHOWN IN THE DRAWING.
4. DON NOT COVER THE INLET WITH GEOTEXTILE UNLESS THE DESIGN IS ADEQUATE TO ALLOW FOR ALL WATERS TO BYPASS IT.

GEOTEXTILE INLET FILTER
N.T.S.



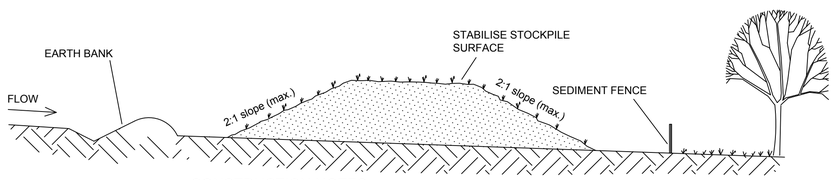
TYPICAL SECTION THROUGH SEDIMENT BASIN
N.T.S.

NOTE:
BASIN SIZE AND DEPTH TO SUIT EXCAVATION CONSTRAINTS



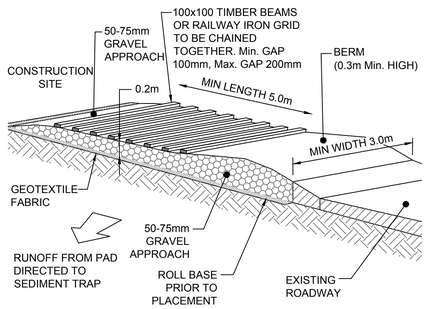
STRAWBALES TO GULLYPIT

SANDBAG SEDIMENT TRAP
N.T.S.

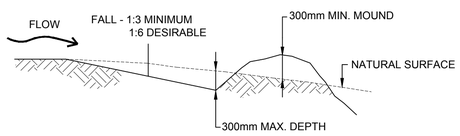


CONSTRUCTION NOTES
1. PLACE STOCKPILES MORE THAN 2 (PREFERABLY 5) METRES FORM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2 METRES IN HEIGHT.
4. WHERE THEY ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED ESCP OR SWMP TO REDUCE THE C-FACTOR TO LESS THAN 0.10.

STOCKPILES
N.T.S.



TEMPORARY CONSTRUCTION EXIT/ENTRANCE
N.T.S.



CATCH DRAIN
N.T.S.

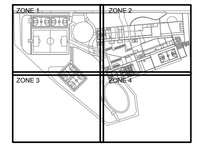
NOT FOR CONSTRUCTION

Recent revision history

Revision	Description	Date
01	ISSUE FOR INFORMATION	06/07/18
02	50% SD ISSUE	13/07/18
03	80% SD ISSUE	31/08/18
04	FOR COSTING	25/03/19
05	SSDA ISSUE	15/05/19
06	DRAFT 90% SD	29/05/19
07	SD ISSUE	14/06/19

Notes & Legend
Refer to drawing CV-0002 for General Notes
These drawings are intended to be read in colour.
Do not scale drawings. Written dimensions govern
All dimensions are in millimeters unless noted otherwise
This drawing to be read in conjunction with all relevant contracts, specifications, reports and drawings.

KEY PLAN



KEY PLAN IS NOT TO SCALE

HDC & Architectural
WOODS BAGOT

Structural & Civil Engineering
ENSTRUCT

Mechanical Engineering & ESD/Energy Modelling
STEENSEN VARMING

Electrical Engineering
WSP

Hydraulic & Fire Engineering
WARREN SMITH & PARTNERS

Landscape & Heritage
URBIS

Project
MEADOWBANK SCHOOLS PROJECT

Client
NSW GOVERNMENT Education School Infrastructure

Project number 5645
Size check 25mm
Checked MD
Approved PR
Sheet size A1
Scale NOTED

Sheet title
SEDIMENT AND EROSION CONTROL DETAILS

Sheet number MSP-EN-CV-00451
Revision 07
Status FOR INFORMATION ONLY