Flood Emergency Response Sub-Plan

Glenwood High School

SCP Ref: S220004-GHS-CV-SW-RPT-02

Client Richard Crookes Construction

Project Glenwood High School

Date 30 August 2022

Revision table

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1 Introduction

SCP Consulting has been engaged by Richard Crookes Construction to prepare a **Flood Emergency Response Sub-Plan (FERSP)** for the proposed Glenwood High School (GHS) development to satisfy Condition B20 of the SSDA Conditions (reference: **SSD-23512960**).

Excerpt below:

> B20. The Construction Flood Emergency Management Sub-Plan must address, but not be limited to, the following:
>
> (a) be prepared by a suitably qualified and experienced person(s);
>
> (b) address the provisions of the *Floodplain Risk Management Guidelines* (EHG);
>
> (c) include details of:
>
> (i) the flood emergency responses for both construction phases of the development;
>
> (ii) predicted flood levels;
>
> (iii) flood warning time and flood notification;
>
> (iv) assembly points and evacuation routes;
>
> (v) evacuation and refuge protocols; and
>
> (vi) awareness training for employees and contractors, and users/visitors.

The purpose of this FERSP is to promote a satisfactory awareness of expected flood behaviour and risks, identify measures to become flood prepared and recommended courses of action before, during, and after flood events.

This FERSP relies on flood modelling and studies completed by Enstruct (reference: Glenwood High School – Civil Engineering Flood Study Report, dated 10/11/2021).

This FERSP addresses the provisions of the Floodplain Risk Management Guidelines (EHG) as discussed in Section 3.2.

The following table identifies sections of the report which address details listed above

ITEM ADDRESSED	RELEVANT SECTION
i) the flood emergency responses for both construction phases of the development	Section 4
ii) predicted flood levels	Section 3
iii) flood warning time and flood notification	Section 3.2, Section 4
iv) assembly points and evacuation routes	Section 4.3
v) evacuation and refuge protocols; and	Section 4.3, Section 4.4
vi) awareness training for employees and contractors, and users/visitors	Section 5

1.1 Site Context

The proposed development is within the grounds of the existing Glenwood High School and is located on the corner of Glenwood Park Drive and Forman Avenue, Glenwood, NSW. The site is bound by residential development to the east (Glenwood Park Drive) and south (Forman Avenue). To the west and north of the site is Glenwood Reserve. Refer to Figure 1 for an aerial view of the site boundary.

Figure 1: Aerial View of Site Boundary (Source: Aerial Survey)

2 Abbreviations

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARR	Australian Rainfall and Runoff
BCC	Blacktown City Council
BOM	Bureau of Meteorology
FFL	Finished Floor Level
FPL	Flood Planning Level
GHS	Glenwood High School
IL	Invert Level
L/s	Flow in Litres per second
m3/s	Flow in cu.m per second
OSD	On-Site Detention
PSD	Permissible Site Discharge
RL	Reduced Level

3 Flood Behaviour

3.1 Flooding Source and Extent

As per the Blacktown City Council Maps Online platform, the site is not identified as flood prone (refer **Figure 2**). The closest flooding extent from Corbin Reserve is considered high risk but is over 2 kilometres away from the site boundary of GHS.

Furthermore, as the site is not in a flood affected area and is not in proximity to any tidal affected or perennial watercourses, the site is not expected to be impacted by rising sea levels due to climate change.

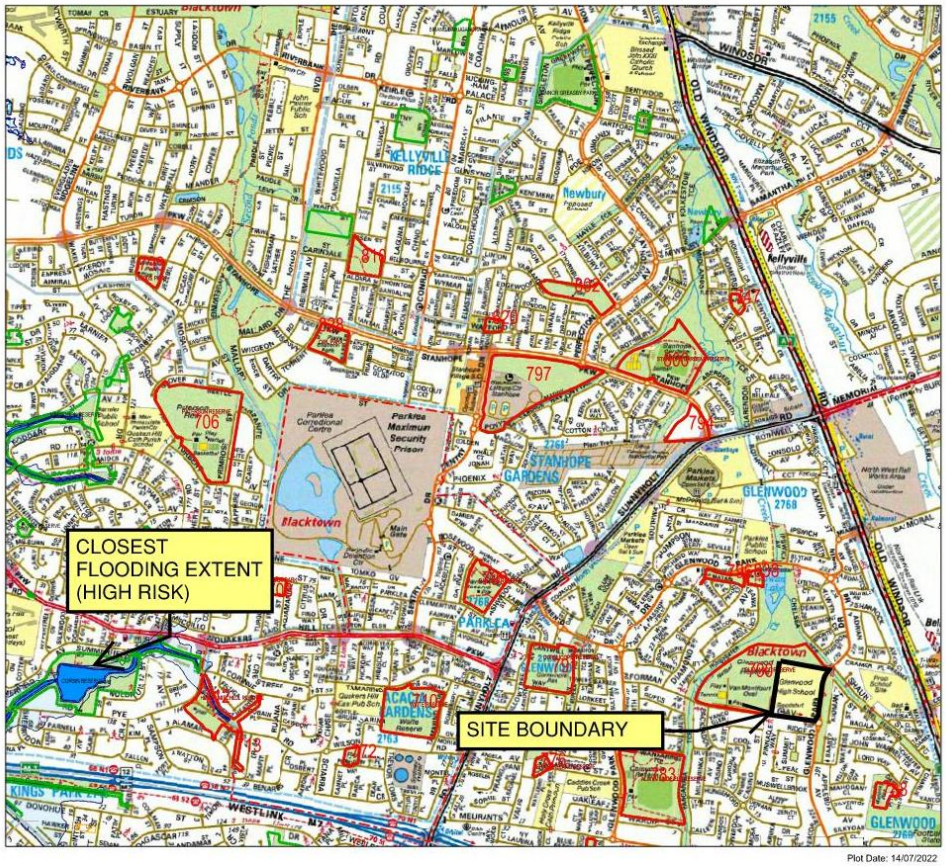

Figure 2: Flood Prone Land Extent (Source: BCC Online Maps)

3.2 Flood Categorisation

The school site is designated as a **Low Hazard Risk** area due to the predicted extents of the 1% AEP flood as shown in Figure 3. The development site is approximately 50m away from the 1% AEP flood extent within Glenwood Reserve to the north. The development site is also generally RL 64.00 to 60.90. This is at least 1.6m above the adjacent flood level in Glenwood Reserve of RL 58.30.

Flood results demonstrate that the proposed new building location is not susceptible to flooding during the 1% AEP, 0.5% AEP and 0.2% AEP flood events as the flood water is contained within the road reserve of Glenwood Park Drive and the drainage channel/water course. Minor flooding is observed in the PMF flood event. A maximum flood depth of 0.5m is expected throughout the

school campus with between 0-0.5m of flooding through the Main Works Building area during the PMF.

Refer to Figure 3, Figure 4, Figure 5 and Figure 6 for the 1% AEP, 0.5%, AEP 0.2% AEP and PMF flood extents, respectively. The critical storm duration has not been identified in the project flood report however based on the site being in an urban environment it is understood that flood presented below would occur as flash flooding over the course of minutes and hours rather than days.

Figure 3: 1% AEP Flood Extent and Levels (Source: Enstruct)

Figure 4: 0.5% AEP Flood Extent and Levels (Source: Enstruct)

Figure 5: 0.2% AEP Flood Extent and Levels (Source: Enstruct)

Figure 6: PMF Flood Extent and Levels (Source: Enstruct)

In accordance with the Floodplain Risk Management Guidelines, the site can be categorised in an emergency response planning (ERP) context for the following events:-

- 20% AEP: Indirectly Affected Areas (IAA)
- 1% AEP: Indirectly Affected Areas (IAA)
- PMF: Areas with Overland Escape Routes (OER)

IAAs are areas which are outside the limit of flooding and therefore will not be inundated nor will they lose road access. However, they may be indirectly affected as a result of flood damaged infrastructure or due to the loss of transport links, electricity supply, water supply, sewerage or telecommunications services and therefore may require resupply or evacuation.

OERs are areas where access roads to flood free land cross lower lying flood prone land. Evacuation can take place by road only until access roads are closed by floodwater. Escape from rising flood water is possible but only by walking overland to higher ground. Anyone not able to walk must be able to be reached by boat or aircraft.

4 Flood Response

4.1 Flood and Evacuation Warnings

A network of rainfall gauge stations is maintained throughout the Georges River and Woronora River catchment (Flood Watch Area No. 54). These stations provide information to the Bureau of Meteorology (BOM) as one source of information informing their flood warning system.

BOM should issue flash flood warnings through radio, television and through their website: http://bom.gov.au. Additionally, the NSW State Emergency Service (SES) may issue a flood bulletin, evacuation warning or evacuation order.

The BOM warning types are as follows:

4.1.1 Flood Watch

A 'flood watch' is issued when forecast rainfall suggests that local flash flooding and/or riverine flooding is possible. The purpose of a flood watch is to provide early advice of a developing situation that may lead to flooding. A flood watch isn't a warning of imminent flooding.

A flood watch can be issued up to four (4) days in advance of expected flooding. Flood watches are updated daily (minimum) and are finalised once all areas covered by flood warnings, or the risk of flooding has passed.

4.1.2 Flood Warning

A 'flood warning' is issued when flooding is expected at a particular location. Flood warnings are more targeted and are issued for specific catchments and locations within catchments. The severity of the flood is also forecasted in each flood warning as minor, moderate or major.

- Minor flooding: causes inconvenience, low-lying areas next to water courses are inundated, minor roads closed and low-level bridges submerged.
- Moderate flooding: evacuation may be required, traffic routes may be affected, some buildings may be affected above floor level.
- Major flooding: evacuation may be required, many buildings affected above floor level, traffic routes closed, utility services may be affected.

Flood warnings cover larger rivers that take more than six hours to respond to rainfall.

4.1.3 Severe Weather Warning

BOM does not issue warnings for flash flooding. Instead, a Severe Weather Warning may be issued. Severe weather warnings are provided for potentially hazardous or dangerous weather including very heavy rain that may lead to flash flooding. They are issues whenever severe weather is occurring or is expected to develop or move into an area.

This type of warning is anticipated to be the main trigger for flood response protocols to be implemented on this project due to the flash nature of flooding that could occur.

4.2 Flood Response Personnel

Flood wardens are to be appointed who will be available to monitor river/creek and rainfall conditions and who will have access to contact details for all personnel on site. It is recommended that the flood wardens be persons who are frequently on site and who are familiar with the daily construction activities and operations.

4.3 Assembly and Evacuation Routes

4.3.1 Emergency Assembly Area

The northern edge of the site has been nominated as the emergency assembly point as shown in **Figure 7**. Levels in this area are approximately RL 59 mAHD. This is at least 1 m above the adjacent 1% AEP flood level. This location is easily accessible and within view of staff and contractors.

Once everyone has assembled and been accounted for, evacuation will be undertaken as required to the agreed refuge location.

4.3.2 Evacuation Route

From the emergency assembly area, staff and contractors can evacuate via Glenwood Park Drive, which is expected to be free from flooding in storm events up to the 1% AEP.

In larger storm events, i.e. the PMF event, it is recommended to evacuate to the quadrangle in the existing site, as this is further away from the flooded area including Glenwood Reserve. Staff and contractors are then to evacuate in a southerly direction, towards Forman Avenue, away from expected flood waters.

It is unlikely that staff or contractors will be on site during a PMF event. It is expected that works will be suspended well ahead of the PMF event occurring. Staff and contractors will be required to evacuate in a PMF event prior to inundation occurring.

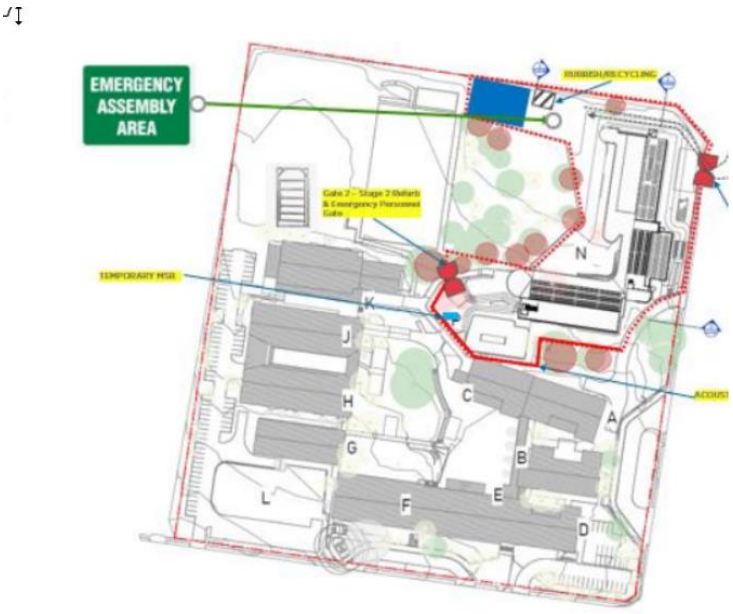

Figure 7: Proposed Emergency Assembly Area and Evacuation Route

4.4 Emergency Contact

For emergency assistance during flood events, contact SES on 132 500.

If a life-threatening situation emerges, contact Police, Fire and/or Ambulance on 000.

5 Flood Response Preparation

All staff and contractors on site are to be familiar with the contents of the FERSP. Reading of the FERSP should be part of the site induction.

5.1 Evacuation Drills

Evacuation drills are designed to increase flood awareness. Evacuation drills are to be undertaken within the first three months of site activities commencing, and twice yearly to familiarise all staff and contractors with the procedures when responding to a flood event.

All staff and contractors are to be aware of the emergency assembly point and the emergency refuge point.

5.2 Flood Emergency Kit

The SES recommends that the following items are prepared in a flood emergency kit:

- Air horn and handheld loudspeaker
- Portable radios with spare batteries
- A torch with spare batteries
- A first aid kit
- Candles and waterproof matches
- Waterproof bag for valuables

When leaving or evacuating, the following are to be placed into the emergency kit:

- Sign in book for visitors and contractors
- Individual Health Care items such as asthma puffers, diabetes medication and Epi pens, etc.
- Drinking water and non-perishable food items.

The flood emergency kit should be kept in a waterproof container in an easily accessible location. The contents of the kit and management during a flood event will be the responsibility of the **Flood Wardens**.

The flood emergency kit is to be checked periodically (monthly) to ensure all items are in suitable working order.

5.3 Monitoring of Weather

It is the responsibility of the Flood Wardens to monitor the weather situation to be aware if any warnings have been issued. This is to be actioned by checking of radio, television and the BOM website.

6 Flood Response Actions

6.1 Before Flooding

In order to mitigate the risk to life of staff and contractors, it is recommended that works be suspended on any day there is reasonable chance of rainfall up to 150mm (i.e. greater than 50% of rainfall of 100-150mm). This number represents the amount of rainfall required to produce a 1% AEP flood event.

The Flood Warden is responsible for reviewing weather forecasts daily and distributing notification of cancellation of staff and contractors.

Consideration should also be given to:

- Securing objects/plant that are likely to float and cause damage.
- Turning off mains power, water and gas
- Relocating chemicals above the predicted water level

6.2 During Flooding

If a flood warning is issued:

- Flood Warden to active project siren/hooter to raise alarm.
- Flood Warden to collect attendance register.
- Flood Warden to emergency assembly point
- Flood Warden to conduct roll call to establish if anyone is missing.
- Evacuate to refuge point as required.
- Wait at refuge point until the flooding has passed.
- Maintain regular communication with staff and contractors.

6.3 After Flooding

Once a Final Flood Warning or SES “All Clear” has been provided:

- A thorough check of services such as electricity, sewer, water and gas should be undertaken by qualified persons.
- Advice should be sought from a suitably qualified engineer as to the structural integrity of surrounding buildings.
- Personal protective equipment should be worn during the clean and disinfection should be used.

7 Revision of the FERSP

This plan should be revised if the expected flood behaviour within the catchment changes.

The FERSP should also be reviewed periodically and updated to reflect site activities and/or changes in personnel on site.

8 References

1. Blacktown City Council (2022, June 29) *BCC MapsOnline,* Blacktown City Council, https://maps.blacktown.nsw.gov.au/
2. Bureau of Meteorology (2022, June 29) *Flood Warning Services.* Bureau of Meteorology. http://www.bom.gov.au/water/floods/floodWarningServices.shtml
3. Department of Environment and Climate Change (2007) *Flood Emergency Response Planning Classification of Communities,* Department of Environment and Climate Change, https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Floodplains/floodplain-risk-management-guideline-flood-emergency-response-160732.pdf?la=en&hash=07081CD0D12ABA36C56C7BDBBA4F829FA2D86738
4. Department of Planning and Environment (2022, June 29) *Floodplain Risk Management Guidelines*, Department of Planning and Environment, https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-guidelines
5. Enstruct (2021), Glenwood High School – Civil Engineering Flood Study Report
6. NSW State Emergency Service (2022, June 29) *Emergency Kit.* NSW State Emergency Service. https://www.ses.nsw.gov.au/floodsafe/prepare-your-home/emergency-kit/

Appendix A – CV

James Clare

Associate Director | Civil
Stormwater & Flood Modelling Specialist

Bachelor of Engineering (Civil, Construction)
Diploma in Engineering Practice
Member, Institute of Engineers Australia (MIEA)
National Engineering Register (NER)

James has honed his impressive Civil Engineering skills working over the last ten years with some of Australia's largest engineering groups, such as Lendlease Building and ACOR Consultants. He has also spent a year working for a small civil contractor providing James with valuable construction knowledge which he now applies to his current projects.

Joining SCP Consulting in 2016, James' knowledge and experience assisted him in achieving the position of Associate in June 2017. James is a highly proficient project manager and regularly manages multi-disciplinary projects delivered by SCP as a single point of contact for clients. This leads to successful development of engineering concepts through to construction and strong client relationships. James is known for his design expertise, attention to detail and enthusiasm to produce excellent results. Specialising in stormwater management and flood modelling, James has a wealth of knowledge across many stormwater and flood modelling software packages including HEC-RAS, DRAINS, WBNM and TUFLOW allowing him to provide in depth analysis of stormwater and flooding issues.

Skills and Expertise

- Flood modelling using hydrodynamic software models
- Stormwater hydraulics
- Environmental treatment systems
- Innovative approach to achieve significant cost benefits and best practice solutions to complex engineering problems
- Disciplined on-time and on-budget professional delivery on all projects
- Sound understanding of Local Government and Defence requirements
- Broad knowledge base across multiple disciplines resulting in the holistic delivery of projects

Value Add

- Recent experience at HMAS *Watson* Redevelopment creating the stormwater management plan
- Major project experience as civil engineering lead and stormwater designer
- Lead Civil Design Consultant on BaptistCare Affordable Housing (500 units across 8 sites) for Lendlease displaying a strong capacity for prioritising project elements across multiple large-scale developments
- Lead Civil Design Consultant on South Coast Correctional Centre for Lendlease optimising and finalising design for fast-tracked commencement of works on-site

Key Projects

- **South Coast Correctional Centre, NSW / $170M**
  360 bed expansion of existing correctional centre, civil, stormwater, pavements and earthworks.
- **BaptistCare Affordable Housing, NSW / $260M**
  500 units across 8 sites, master planning of civil infrastructure including stormwater, earthworks, pavements, and services coordination.
- **Royal Randwick Racecourse, NSW / $50M**
  Multi-storey car park, Kensington Track upgrade, earthworks, water quality and quantity management.
- **ATC Warwick Farm, NSW / $8M**
  Grass Track (A-Track), Stables Precinct, multiple sheds within the site, earthworks, water quality and quantity management.
- **University of Sydney Regiment, NSW / $80M**
  Mixed use development, civil and stormwater.
- **Hornsby Kuring-gai Hospital, NSW / $20M**
  Multi-storey car park, civil, stormwater, pavement and earthworks.
- **EST00346 TDL Redev & EST00347 KC-30A Facilities Project, NT**
  Civil, Traffic, Aerodrome Pavements, Hydraulic Building Services, Hydraulic Infrastructure, Hydraulic Building Services and Fire Protection (Wet) services were provided.
- **N2232 HMAS Watson Redevelopment, NSW / $160M**
  Development of a Stormwater Management Plan as part of the civil works.
- **Base Security Improvement Program (BSIP) / $200M**
  16x Defence bases / establishments across NSW, VIC, ACT and QLD.
- **Moorebank Units Relocation (MUR) Project, Holsworthy Army Base NSW / $800M**
- **MH-60R Romeo Seahawk Aviation Facilities Project, HMAS Albatross & Twofold Bay NSW / $200M**
  Naval Airfield Station Base including taxiways and Aprons.

Lovdeep Singh

Senior Civil Engineer

Bachelor of Engineering (Civil Construction)/Diploma in Engineering Practice (Hons)

Member, Institute of Engineers Australia (MIEA)

Lovdeep comes from a design background, having worked with WMAwater and Warren Smith and Partners (WS+P) over a period of five years. Since joining SCP in January 2020, Lovdeep has applied her skills and knowledge in the areas of flood modelling, hydraulic systems design, stormwater management planning and stormwater quality treatment system specification. Recently, Lovdeep has undertaken stormwater management design, including stormwater quantity and quality modelling, and flood modelling on the RAAF Base Tindal Redevelopment and RAAF Point Cook Redevelopment projects. Lovdeep is reliable and strives to work within a team to produce high quality deliverables within a given timeframe.

Skills and Expertise

- Flood modelling using hydrodynamic software models.
- Stormwater hydraulics.
- Environmental/WSUD treatment systems.
- Innovative approach to achieve significant cost benefits and best practice solutions to complex engineering problems.
- Disciplined on-time and on-budget professional delivery on all projects.
- Sound understanding of Local Government and Defence requirements.

Value Add

- Project experience as the Lead Civil Engineering Design Consultant and stormwater designer.
- Holistic approach to stormwater management and flood mitigation to reduce impacts as a result of proposed developments.
- Stormwater management designs to comply with Local Government stormwater and flood immunity criteria.

Key Projects

- **N2232 HMAS Watson Redevelopment, NSW**

  Civil and Stormwater Lead

  Stormwater management system for this coastal location including water quality and quantity management in accordance with local council criteria and foreshore harbour trust requirements.

- **EST00346 RAAF Base Tindal Redevelopment Stage 6 and EST00347 US Force Posture Initiatives (USFPI) RAAF Base Tindal Airfield Works and Associated Infrastructure Projects, NT**

  Civil, Hydrology and Stormwater Lead

  Basewide flood modelling and stormwater design to inform sitewide infrastructure upgrades including new Living-In Accommodation, Security Force Amenities, Visiting Squadron Facilities, Defence Communications Facilities, and Workers Accommodation Village.

- **RAAF Base Point Cook Redevelopment, VIC**

  Flood Modeller

  Establishment of basewide flood model including groundwater, sea level tidal affects, storm surge and climate change adaption factors. Stormwater quality modelling for selection of stormwater improvement devices.

- **Calvary Ryde ILUs, RACF, NSW**

  Civil and Stormwater Lead

  Development of aged care nursing homes including civil, stormwater, WSUD analysis, pavements, earthworks and associated public domain design.

- **RSL LifeCare Labuan ILUs, Narrabeen, NSW**

  Civil and Stormwater Lead

  Development of aged care nursing homes including civil, stormwater, WSUD analysis, pavements and earthworks.

- **Warwick Farm Course Proper, NSW**

  Flood Modeller

  Flood modelling and options assessment of proposed tracks and stormwater basins at the Warwick Farm racecourse to ensure no impacts are observed external to the racecourse.

- **Chatswood Education Precinct (CEP), NSW**

  Civil and Stormwater Lead

  Staged Chatswood High School and Chatswood Public School redevelopments, including temporary works development, civil, stormwater, WSUD analysis, flood mitigation, pavements and earthworks.

- **BaptistCare Carlingford, NSW**

  Civil and Stormwater Lead

  162-unit development across three buildings, including civil, stormwater, WSUD analysis, pavements, earthworks and significant downstream catchment analysis to Vineyard Creek.

- **Royal Randwick Racecourse, NSW**

  Civil and Stormwater Lead

  Multi-storey function centre within existing Ledger Lawn including civil, stormwater, WSUD analysis, pavements and earthworks.

- **University of New South Wales (UNSW) D14 Redevelopment, NSW**

  Civil and Stormwater Lead

  Redevelopment of the UNSW University Hall in accordance with Randwick City Council requirements including civil, stormwater, WSUD analysis, pavements, earthworks and combined services.

- **McCarrs Creek Road, Church Point, NSW**

  Stormwater Lead

  Design and construction services of stormwater associated with approximately 300m of realigned public roadway and a two-level carpark, taking into account significant upstream catchment.

- **Rainbow Street Public School, Randwick, NSW**

  Stormwater Lead

  Peer review of stormwater management plan and proposal of stormwater/OSD upgrades to ensure compliance with Randwick City Council requirements.