Proposed Lake Cathie Public School Upgrade,
1240 Ocean Drive, Lake Cathie, NSW.

Stormwater Management and Sediment & Erosion Control Report

for

SHAC

September 2018

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1. Background Information

1.1 Basis of Report
This report has been prepared by MPC Consulting Engineers (‘MPC’) to address changes to the Stormwater Management systems for the proposed upgrade in Lake Cathie Public School NSW.

1.2 Preamble
The site is located at No.1240 Ocean Drive, Lake Cathie, NSW. Architectural site plans used in the preparation of the stormwater infrastructure design have been provided by SHAC. A copy of the architectural site plan is included in Appendix A of this report.

The proposed development includes new classroom buildings, covered walkways, storage spaces, outdoor learning spaces, a covered bus bay and paved areas.

1.3 Stormwater Management Plan
In devising this Stormwater Management Plan for the proposed upgrade, the following issues have been addressed:

- Water Quality Management;
- Stormwater Management;
- Sediment and Erosion Control;
- Stormwater Harvesting.

The stormwater and environmental management philosophy employed in the Stormwater Management Plan is discussed in Section 3 of this report.

As well as permanent water management controls, construction phase controls are also addressed, in Section 5 of this report.

1.4 Background Information
MPC has reviewed previous stormwater management reports for the site, and considered the information within those reports in designing the proposed improvements to the existing drainage network. (Relevant reports are included in Appendix F)

- The report titled Rainbow Beach Stormwater Treatment and Functionality Report, by AECOM (Ref: 06502366.03, revision 4, dated 6 July 2010) describes the stormwater treatment measures previously designed for the subdivision in which the school property is located. Those measures include a constructed wetland (denoted as “Wetland W3” in the report) to the south of the subdivision.
- The report titled Lake Cathie Public School, Stormwater Management Concept Plan, by NSW Public Works (Report No. DC13105 dated 29/08/2013) describes
the proposed stormwater management infrastructure for the original Lake Cathie Public School development in 2013.

The NSW Public Works report of 2013 makes reference to a holistic design philosophy for the original school development, whereby it relied on the stormwater treatment facilities provided at the downstream end of the Rainbow Beach subdivision. The report also makes reference to the original design for the Rainbow Beach stormwater management facilities being based on a 70% impervious area on the Lake Cathie Public School property.

MPC has reviewed the Port Macquarie-Hasting Council’s Development Control Plan and Design Specifications and has determined the following to be applicable to the proposed development.

- Disposal of site stormwater, gathered from the developed site, into the adjacent Rainbow Beach drainage system is acceptable provided the stormwater is:
  - Treated for sediment, gross pollutants and other impurities to the limits specified in the Port Macquarie-Hasting Council’s Development Design Specification, D7 “Stormwater Management” document;
  - Managed to meet the objectives in Section D5 of the Development Control Plan (“Stormwater Drainage Design”);

- Internal stormwater management pipework is to be designed to convey the 1:20 year storm event (Minor Storm);
2. Site and Catchment Details

2.1 The Existing Site
The existing site comprises a total plan area of approximately 42,000 m² based on boundaries included on the available survey drawings (Detail Survey 7728 – Issue No: A on 31.05.2018 by Land Dynamics Australia).

The existing site topography incorporates a mixture of grassed areas, school buildings, paved areas and road pavements. Surface slopes are in the order of 3.1% from the north boundary towards the centre of the site. The site then slopes at approximately 0.85% towards the south east corner of the site. The average site slope is typically under 2%.

MPC’s site plan in Appendix B illustrate the general existing topographical arrangement of the site.

2.2 The Proposed Site
Architectural drawings by SHAC have been provided to MPC and show the site layout for the proposed development. These have been used as the basis of the stormwater management, sediment and erosion control concept designs. A copy of the architectural site plan is included in Appendix A of this report.

2.3 Catchment Description
The project site area is in the order of 42,000 m², of which 75% is estimated “pervious” for modelling the pre-developed stormwater runoff characteristics. The total fraction impervious for the developed site will be approximately 25%.

The proposed site generally comprises four sub catchments as shown in Figure 1.
Each of the sub catchment areas is described below.

2.3.1 Sub Catchment 1

Sub catchment 1 comprises plan area of 14,800 m² (approximately) with an average surface slope of 1.8%. This catchment mainly consists of grassed areas and trees and will be separated from the other catchments by a rock-lined and partially vegetated swale running roughly parallel to the western boundary of the site.

Stormwater generated within catchment 1 will be directed to a shallow detention basin (volume 60 m³) located at the south west corner of the site. The purpose of the shallow basin will be to buffer the flow from the rock-lined swale (from sub-catchment 1) and to act as a level spreader to minimise risk of downstream erosion.

Outflows from the shallow basin will be directed to the adjacent property via an in-ground pipe and overflow weir, and will be discharged into the existing drainage system to the south of the school property. Rock mattress scour protection and landscaping will be constructed at the downstream end of the basin.

2.3.2 Sub Catchment 2

Sub catchment 2 comprises a plan area of 9,900 m² (approximately) with an average slope of 1% down to the east.
This catchment mainly consists of new learning neighbourhood buildings and new sheltered bus bay. New roof and paved areas are about 2,300 m² and 2,400 m², respectively.

Stormwater generated within sub catchment 2 will be directed to the south east corner of the site using new pits and pipes and will be discharged to the subdivision’s existing drainage network via a new pipe culvert being constructed as part of the new road works (round-about) adjacent to the site.

2.3.3 Sub Catchment 3

Sub catchment 3 comprises a plan area of approximately 17,600 m² (approximately) with an average slope of 1.2% down to the south-east.

This catchment mainly consists of existing blocks A, B, C, D existing outdoor learning areas and new sports hall building. Roof and paved areas are about 1,900 m² and 4,300 m², respectively.

Stormwater generated within sub catchment 3 will be directed to the existing pipe network at the southern boundary.
3. **Stormwater Management Philosophy**

In preparing this Stormwater Management Plan MPC has reviewed the Port Macquarie-Hasting Development Control Plan, in relation to stormwater management for the proposed school upgrade. The key requirements to be addressed are summarised as follows:

- Ensure that rainwater runoff from the developed site for all design storms up to a 1:100 year ARI event is directed through the drainage network in accordance with Port Macquarie-Hasting Council’s Development Control Plan (‘DCP’) and AS/NZS 3500.3-2003;

- Ensure contaminated water from new impervious areas is passed through an appropriate pollution and sediment control system, and meets the water quality targets of the Port Macquarie-Hasting Council’s DCP;

- Employ suitable stormwater harvesting measures. This will incorporate new above-ground rainwater collection tanks with a water re-use facility to service toilets and irrigation;

- Ensure that overland flow in the event of a choked or blocked piped system does not adversely impact on buildings located on the site and does not cause a nuisance to neighbouring properties;

- Ensure the design of stormwater pits and pipes considers long term maintenance issues, such as ensuring suitable pipe slopes are specified so as to lower the risk of accumulation of debris and obstructions.
4. Proposed Stormwater Management Facilities

4.1 Description of Proposed Stormwater Management Facilities

The stormwater management concept plans are shown in Appendix B to this report. The principal stormwater management components are listed below.

4.1.1 Local Drainage Description

- Stormwater runoff from impervious areas of the proposed development will be directed through the existing site in-ground drainage network. The existing drainage network however will be upgraded to ensure stormwater pits have adequate freeboard during minor storm events;

- Runoff from roof areas of the proposed new classroom buildings will be directed to above-ground rainwater re-use tanks via a first-flush device. Re-use water will be available for use in toilets and some garden irrigation;

- Overflow from the new rainwater tanks will be directed to the in-ground piped network;

- Stormwater runoff from hardstands, car parks and vehicle access roads will be directed to grated surface inlet pits and into the in-ground piped network. Pits will be fitted with drop-in filter baskets as part of the overall water quality management system;

- Sub-soil drainage lines will be installed throughout the site, for example behind kerbs, along road edges, and within landscaped areas. The sub-soil drains will be connected to the stormwater management system;

- Surface levels of grated inlet pits in pavement areas have generally been specified so as to provide at least 300 mm freeboard to adjacent building finished floor levels. In the event of a blocked system or a major storm, overland flow paths have been provided that will ensure surface flows do not travel through buildings;

- Sub catchments 2 and 3 will each be provided with an in-line Low Flow Ecosol Gross Pollutant Trap which, in conjunction with above-ground rainwater tanks with first flush devices, and drop-in filter baskets for stormwater pits, will ensure the relevant water quality targets are met;

- The rock-lined swale acting as a diversion bank along the eastern edge of sub catchment 1 has been assessed with the following characteristics:
  - Peak minor storm flow = 364 l/s
  - Longitudinal slope = 0.5%
  - Manning ‘n’ = 0.040 (rock-lined)
  - Peak flow depth = 0.27 m
  - Peak flow velocity = 0.53 m/s
  - V x d = 0.14 m²/s < 0.4 m²/s => acceptable
The site stormwater drainage works are also illustrated on the Site Stormwater Plans by MPC Consulting Engineers, which are included in Appendix B of this report. Stormwater quality requirements have been addressed in Section 4.5 of this report.

4.2 Design Storm Events

The stormwater management system will collect runoff for all design events up to the 100 year ARI for subsequent storage, re-use and disposal (as appropriate).

In-ground pits and pies have been designed for a Minor Storm event of 1:20 years ARI, as per the Port Macquarie-Hasting Council’s Development Design Specification, D5 “Stormwater Drainage Design” document.

The site has been designed for a 1:100 year ARI Major Storm event.

4.3 Site Catchment Parameters

The total area of the subject site (is approximately 4.2 ha). Approximated sub catchment areas are shown in Table 1.

<table>
<thead>
<tr>
<th>Sub catchment No.</th>
<th>Area (ha)</th>
<th>% Impervious</th>
<th>tc (min) minor storm</th>
<th>tc (min) major storm</th>
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<td>1.48</td>
<td>0</td>
<td>18</td>
<td>16</td>
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<td>3</td>
<td>1.76</td>
<td>35</td>
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<td>Site total</td>
<td>4.23</td>
<td>25</td>
<td>-</td>
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</table>

The time of concentration for sub catchment 1 was calculated using the Rational Method, combining sheet flow travel time and concentrated flow travel time through rock swale. (A summary of the calculations is shown in Appendix C – under Area 1 catchment analysis)

Stormwater system in catchments 2 and 3 were modelled in DRAINS software. All stormwater pits were modelled in using a 50% pit blockage factor.

A summary of the relevant stormwater calculations, including schematics and results from the DRAINS model, are provided in Appendix C of this report.

4.4 Stormwater Detention

Stormwater generated within sub catchment 1 will be directed to a shallow detention basin (peak water depth = 400 mm, stored volume = 77 m³) located at the south west corner of the site. The purpose of the shallow basin will be to buffer the flow from the rock-lined swale (from sub-catchment 1) and to act as a level spreader to minimise risk of downstream erosion.

Outflows from the shallow basin will be directed to the adjacent property via an in-ground pipe and overflow weir, and will be discharged into the existing drainage system to the south of the school property. Rock mattress scour protection and landscaping will be constructed at the downstream end of the basin.
The basin geometry has been set using slopes not exceeding 1V:6H as per Council requirements. Given the depth of the basin is less than 500 mm, a child-proof fence is not required around the basin as per Council’s stormwater design manual.

Major Storm Overflow Weir from the Basin

Consideration was given to the possibility of 50% blockage of the outlet pipe system draining the basin during a major storm. In this event, it was assumed that the basin filled completely and the post-developed major storm flow rate flows over the weir of the basin.

Surface overflow of the basin would be directed towards the adjacent property to the south (in a similar manner to the existing pre-developed site) under the following conditions:

- Peak major storm flow into basin = 583 l/s
- Pipe outflow = 180 l/s
- Weir length, \( L = 15 \) m
- Maximum Flow depth = 0.057 m
- Maximum Flow velocity = 0.48 m/s
- Velocity – depth product = \( v \times d = 0.03 \) m²/s < 0.4 m²/s therefore okay.

4.5 Stormwater Quality

Water quality measures for the site have been modelled using MUSIC software and include the following:

- ‘Ecosol’ litter baskets for surface stormwater inlet pits;
- Above-ground rainwater tanks with a first-flush device and provision for re-use of stored water;
- Proprietary “Ecosol” Low Flow 4750 Gross Pollutant Traps have been specified in two locations on the stormwater management plans;

Whilst the 2013 stormwater report by NSW Department of Works makes reference to a “holistic” design approach and relies on the downstream wetlands for treatment of the runoff from the school catchment, it is evident from review of the MUSIC model schematics in the AECOM report (specifically, Figure 26 on page 29 of the AECOM report) that the school catchment was intended to rely on bio-retention facility on the school grounds (Basin No. W3a in the report). This Bioretention basin was nominated to have a plan area of 800 m² on page 24 of the AECOM report.

Subsequently, in order to ensure stormwater outflows from the school property do not compromise the water quality outcomes for the Rainbow Beach subdivision, MPC has specified additional water treatment devices to be installed as part of the proposed school development works.
The stormwater quality devices and systems have been specified on the stormwater management plans included in Appendix B, which collectively achieve the water quality targets listed in Table 2.

Table 2: Water quality results from MUSIC modelling

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<th>Pollutant</th>
<th>Target % Reduction</th>
<th>Achieved % Reduction</th>
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<td>Total Suspended Solids</td>
<td>80%</td>
<td>87%</td>
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<tr>
<td>Total Phosphorus</td>
<td>45%</td>
<td>61.9%</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>45%</td>
<td>49.9%</td>
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<tr>
<td>Gross Pollutants</td>
<td>100%</td>
<td>100%</td>
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</table>

A copy of the MUSIC model diagram, including the receiving node pollution reductions achieved, are included in Appendix D.

4.6 Maintenance of Stormwater Management Facilities

Maintenance of concrete pits, pipes and paved flow paths will be minimal however will still involve occasional cleaning. Concrete pipes have generally been designed with a minimum fall of 1% so as to minimise build-up of sediment and debris and therefore minimise long maintenance requirements.

Ideally, pits and pipes should be inspected (and cleaned if necessary) at 3 month intervals and following large rainfall events.

Information relating to maintenance requirements for the Ecosol Gross Pollutant Traps is included in Appendix D of this report.
5. Construction Phase Erosion and Sediment Controls

The construction phase approach adopted for this site will incorporate principles recommended by the NSW Department of Housing, namely:

- Plan for erosion and sediment control concurrently with engineering design and in advance of earthworks proper assessment of site constraints and integration of the various needs;
- Minimise the area of soil exposure;
- Conserve the topsoil where possible;
- Control water flow from top of the development area, through the works and out the bottom of the site, for example,
  - divert clean runoff above denuded areas
  - minimize slope gradient and length. Excavated batter slopes of 3H:1V are considered acceptable provided they are turfed and landscaped as soon as possible;
  - keep runoff at non-erodible velocities
  - trap soil and water pollutants
- Rehabilitate disturbed lands quickly.

A sediment and erosion control plan is shown on MPC Drawings included in Appendix E of this report.

General controls will be provided on the site prior to and during all earthworks in accordance with EPA Site Work Practices. Features of the construction phase erosion and sediment controls adopted for this site include:

- Prevention of sediment and polluted runoff water from entering the existing adjacent watercourse. This involves the provision of silt fences, catch drains and sediment traps.
- Control of actual and potential soil erosion – grassing and stabilization of embankments and drainage outlets where required.
- Stabilised stockpile areas towards the lower end of the site (rather than the higher and more exposed areas of the site) to prevent wind and water erosion.
- Scour protection at discharge locations, comprising combinations of geofabrics (jute mesh), rock-filled mattresses and macrophyte planting.
- Stabilised site access to provide a firm base for vehicle entry/exit and to prevent the main access from becoming a source of sediment;
- Sediment control measures are to be constructed prior to any other site disturbance works.
6. Summary

This stormwater management plan has been prepared by MPC Consulting Engineers for Port Macquarie-Hasting Council’s for the proposed Lake Cathie Public School Upgrade, 1240 Ocean Drive, Lake Cathie NSW.

This report has been prepared to assist with the Development Approval of the proposed stormwater management works. Further detailed design and documentation would be conducted once approval of the Development Approval has been advised and any specific Development Conditions issued by Port Macquarie-Hasting Council.

For further information in relation to this stormwater management plan please contact the undersigned.

Signed:

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Appendix A

Architectural Site Plan
The signed control copy of this drawing is held by SHAC Pty Ltd.
Appendix B

Stormwater Management Plans
PROPOSED LAKE CATHIE PUBLIC SCHOOL UPGRADE AT;
LOT 2, DP 1193553, No.1240 OCEAN DRIVE, LAKE CATHIE

CIVIL DRAWING INDEX
C01.00 - COVER SHEET, SITE PLAN AND DRAWING INDEX
C02.00 - SEDIMENTATION AND EROSION CONTROL PLAN SHEET 1
C02.01 - SEDIMENTATION AND EROSION CONTROL PLAN SHEET 2
C02.50 - SEDIMENTATION AND EROSION CONTROL DETAILS
C03.00 - STORMWATER CATCHMENT PLAN
C03.01 - STORMWATER PLAN SHEET 1
C03.02 - STORMWATER PLAN SHEET 2
C03.50 - STORMWATER DETAILS

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STORMWATER CATCHMENT PLAN

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Appendix C

Stormwater Management Calculations