Construction Soil and Water Management Plan

Kingscliff Public School Redevelopment
SSD-8378620

May 2022

RICHARD CROOKES
CONSTRUCTIONS

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Glossary / Abbreviations

Abbreviations	Expanded text
ASS	Acid Sulphate Soil
ASSMP	Acid Sulfate Soil Management Plan
CEMP	Construction Environmental Management Plan
CLMP	Contaminated Land Management Plan
CSWMSP	Construction Soil and Water Management Sub-Plan
DoE	Department of Education
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DSI	Detailed Site Investigation
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESCP	Erosion and Sediment Control Plan
EEC	Endangered Ecological Community
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EWMS	Environmental Work Method Statements
OEH	Office of Environment and Heritage
PASS	Potential Acid Sulphate Soil
PIRMP	Pollution Incident Response Management Plan
POEO Act	*Protection of the Environment Operations Act 1997*
SINSW	School Infrastructure NSW
SWMP	Soil and Water Management Plan
TSC Act	*Threatened Species Conservation Act 1995*

1 Introduction

1.1 Context

The Kingscliff Primary School Upgrade Project obtained approval SSD-8378620 under Section 4.38 of the Environmental Planning and Assessment Act 1979 by the Minister of Planning on the 15th February 2022.

This Construction Soil and Water Management Sub Plan (CSWMSP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Kingscliff Primary School (KPS) Upgrade (the Project).

This CSWMSP has been prepared to address the requirements of the Kingscliff Primary School Upgrade Environmental Impact Statement, and all applicable legislation.

1.2 Background and Project Description

As part of the NSW Governments $7 billion School Infrastructure Package, the proposed Kingscliff Public School (KPS) upgrade will include the construction of 32 permanent innovative learning spaces with upgrades to the core facilities to cater for future enrolment growth in the area. A new library will also be constructed and will feature a variety of study, teaching and learning spaces that have the potential to open onto an outdoor terrace and garden. The design (Figure 1-1) of the new areas will incorporate future focused learning strategies that support the needs of the community and provide a learning-centred approach to education.

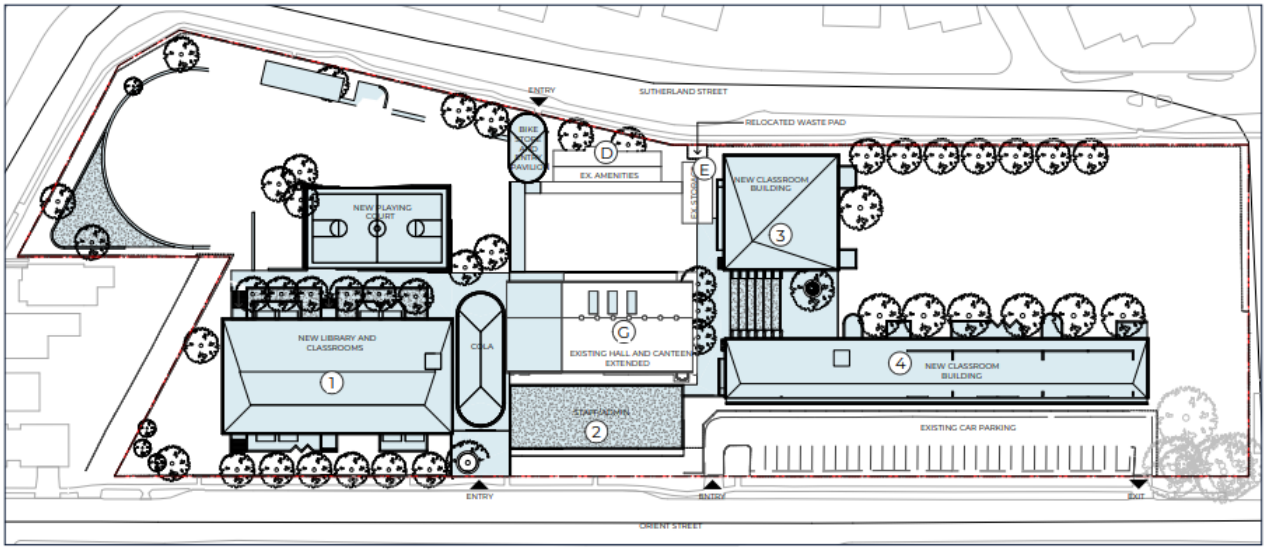


Figure 1-1 Proposed Design

To accommodate the proposed upgrade to the school, the following construction methodology shall be adopted:

- Demolition (removal) of 11 demountable buildings, as well as the library and administration building, multiple classrooms, maintenance store and program room.
- Construction of the following new buildings and structures:
  - New main entry off Orient Street and covered outdoor learning area (COLA);
  - New secondary entry and bike store off Sutherland Street to the west;
  - New two (2) storey building to the north, with ground floor library, 12 homebases, one (1) special programs room;
  - Two (2) x new two (2) storey buildings to the south, with 20 homebases and two (2) special programs rooms; and
  - New play court.
- Tree removal, tree replacement and landscape embellishment to school playgrounds and site;

- Offsite works to the public domain and on Sutherland and Orient Streets, including:
  - Additional pedestrian crossing;
  - Relocation of bus zones and kiss n drop areas; and
  - New pedestrian pathways.

The Project site is located in the town of Kingscliff, in the Northern Rivers region of New South Wales (NSW), within the Tweed Shire Local Government Area (LGA).
The Environmental Impact Statement (EIS) prepared by SJB Planning on behalf of the NSW Department of Education (DoE) in support of State Significant Development Application (SSD) SSD-8378620, assessed the impacts of construction and operation of the Project on soils and water, within Chapter 6.15 of the primary EIS document.

The EIS identified the potential for direct and indirect impacts on water quality but concluded that provided the proposed mitigation and management measures are implemented, no significant long-term impacts would be expected.

This plan is to meet condition B19 of SSD-8378620. A compliance matrix is set out in Table 1.

Table 1: Condition B19 Compliance Table

Condition	Condition Requirements	Document Reference (Page Number)
B19	The Applicant must prepare a Construction Soil and Water Management Sub-Plan (CSWMSP) and the plan must address, but not limited to the following:	
	(a) be prepared by a suitably qualified expert, in consultation with Council	Appendix D
	(b) measures to ensure that sediment and other materials are not tracked onto the roadway by vehicles leaving site	17 Appendix A
	(c) describe all erosion and sediment controls to be implemented during construction, including as a minimum, measures in accordance with the publication Managing Urban Stormwater: Soils & Construction (4th edition, Landcom 2004) commonly referred to as the 'Blue Book'	13
	(d) include an Acid Sulfate Soils Management Plan, if required, including measures for the management, handling, treatment and disposal of acid sulfate soils, including monitoring of water quality at acid sulfate soils treatment areas as set out in section 13 of the Detailed Site Investigation for Contamination Far North Coast Schools Project Kingscliff Public School, 12 Orient Street, Kingscliff NSW 2487, dated August 2021 prepared by Douglas Partners.	Appendix C
	(e) provide a plan of how all construction works will be managed in a wet-weather events (i.e. storage of equipment, stabilisation of the Site)	Section 6.4 Appendix A
	(f) detail all off-site flows from the site	10-14-15-19
	(g) describe the measures that must be implemented to manage stormwater and flood flows for small and large sized events, including but not limited to 1 in 5-year ARI.	Section 6.3 15+19 Appendix A

2 Purpose and Objectives

2.1 Purpose

The purpose of this Plan is to describe how Richard Crookes Construction proposes to manage and protect soil and water quality during construction phase of the Project.

2.2 Objectives

The key objective of the SWMP is to ensure that impacts on soil and water quality during construction are minimised.

To achieve this objective, Richard Crookes Constructions will ensure that:

- Appropriate controls and procedures are implemented and maintained during construction activities to avoid or minimise potential erosion and sedimentation impacts, impacts to water quality and marine environments adjacent to the Project site.
- Safeguards outlined in the EIS documentation prepared for the Project are addressed and assigned responsibility in this Plan.
- Compliance with Condition 19 of the SSD application number SSD-8378620.

2.3 Targets

The following targets have been established for the management of soil and water impacts during the Project:

- Ensure full compliance with the relevant legislative requirements and the Conditions of Consent.
- Minimise and manage potential soil and water quality impacts from the construction phase of the Project.
- Manage water quality impacts attributable to the project (i.e. maintain waterway health by avoiding the introduction of nutrients, sediment and chemicals outside of that permitted by the environmental protection licence and/or ANZECC guidelines).
- Ensure training on best practice soil and water management is provided to all construction personnel through site inductions.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

All legislation relevant to this SWMP is included in the CEMP.

3.1.2 Guidelines and standards

The main guidelines, specifications and policy documents relevant to this plan include:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000)
- Department of Environment and Conservation (DEC): Bunding & Spill Management. Insert to the Environment Protection Manual for Authorised Officers - Technical section "Bu" November 1997
- Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition) March 2004 (reprinted 2006) (the “Blue Book”). Volume 1 and Volume 2
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW – March 2004
- Tweed Heads Development Control Plan (DCP) 2008.
- Protection of the Environment Operations (POEO) Act 1997
- Contaminated Land Management Act 1997

4 Existing Environment

The following sections summarise what is known about factors influencing soils and water within and adjacent to the Project site.

The key reference document is the EIS prepared by SJB Planning, dated May 2021.

4.1 Existing Soil Landscape

The site is situated on the Cudgen (cu) soil landscape. This soil landscape is characterized sandy, deep (>100 cm), well-drained Krasnozems. The Cudgen (cu) landscape is characterized low hills and rises formed on top of lamington basalts (eSPADE 2021).

4.2 Geology

The NSW Government moil map index shows the site to be located on Lamington Volcanics - Tertiary basalt, with members of rhyolite, trachyte, tuff, agglomerate & conglomerate (eSPADE 2021).

4.3 Groundwater

The Detailed Site Investigation (DSI) carried out by Douglas Partners (May 2021) states that there are five registered groundwater bores located within 1 km of the site, with the nearest groundwater bore located approximately 256 m northwest of the site and used for domestic purposes. The depth to groundwater in the bores ranged from 1.8m bgl to 8 m bgl, and yields ranged from 0.25 to 0.5 L/s.

4.4 Acid Sulphate Soils

The Detailed Site Investigation carried out by Douglas Partners in May 2021 states that the location is situated in with a Class 5 ASS Rick Envelop therefore indicative of a low chance of ASS being present at the site.

4.5 Climate and Rainfall

The Kingscliff climate is sub-tropical with mean temperatures ranging between a mean minimum of 12°C in July and a mean maximum of 29°C in January. The annual mean rainfall is 1718 mm, with the highest monthly mean rainfall (383.8mm) recorded in March (Weatherzone, 2021).

4.6 Surface Water

The Detailed Site Investigation carried out by Douglas Partners in May 2021 states that the location and regional topography of the site indicates that excess surface water and groundwater flows have the potential to enter Cudgen Creek, located approximately 150 m east of the proposed development area.

4.7 Flooding

The Flood Assessment undertaken by GHD ref:12517737-3542-22 dated 21 September 2020 found that the proposed development was mostly unaffected by overland flow originating from upstream catchments and surcharge of the existing stormwater network.

4.8 Contamination

The DSI for the site states based on site history information and a site inspection, the potential for contamination at the site is considered to be relatively low and arise primarily from two sources:

- Fill material of unknown origin;
- Residual pesticides in soil as a result of pest control practices for former buildings; and
- Hazardous building material such as asbestos containing material (ACM) in soil following the demolition of structures.

Contaminants of potential concern (CoPC) include:

- Metals/metalloids (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc);
- Total Recoverable Hydrocarbons (THR);
- Benzene, Toluene, Ethylbenzene and Xylenes (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAH);
- Organochlorine Pesticides (OCP) and Organophosphate pesticides (OPP) and
- Asbestos.

The Douglas Partners Report concludes that the contamination investigation did not indicate the presence of broadscale soil contamination at the site considered likely to present a significant risk of harm to human health or the environment.

Pre-Demolition testing was undertaken by ENV solutions to assess soils beneath structural envelopes (where pesticides may have been applied. The pre-demolition testing program comprised cutting of concrete cores at select location and collection of soil samples.

Contaminants of potential concern (CoPC) included OCPs.

The ENV Report concluded that contamination was not present beneath the structure envelopes.

5 Environmental aspects and impacts

The key aspects and potential impacts associated with the management of soil and water during the delivery of works are listed in Table 2.

These potential impacts and opportunities have been considered in the development of this SWMP and site-specific procedures for the works.

Table 2: Aspects, Potential Impacts and Mitigation Measures

Aspects	Potential impacts	Mitigation Measures
Discharge of contaminated water from within site boundary during rainfall.	• Contamination of downstream watercourses • Contamination of soils	Section 6.1 and 6.3
Concrete washout	• Contamination of downstream watercourses • Contamination of soils	Bunded area to be provided
Dust from the worksite or from vehicles	• Potential pollution of waterways and air	Section 6.1.2.2
Earthworks/Embankment works/platform excavation works	• Potential spread of contamination into soils /surface or groundwater • Personnel exposure to contaminants • Sediment degrading surrounding environment • Change to flooding characteristics	Section 6.1.3
Flooding of worksites	• Contamination of floodwaters by sewage, fuels and/or chemicals onsite	Section 6.3 and Section 6.4
Leaks or spillages of fuels, oils and grease from construction plant and equipment at compounds.	• Contamination of soil • Contamination of stormwater systems, watercourses, riparian environment • Personnel exposure to contaminants	Section 6.4
Sediment laden runoff during rainfall	• Runoff entering drainage lines causing pollution and impacting aquatic life downstream.	Section 6.1
Sediment tracking onto public roads from vehicles leaving site.	• Potential impact on traffic safety • Potential for sediment laden runoff during rainfall • Potential for generation of dust	Section 6.1.2
Storage of hazardous substances	• Contamination as a result of a spill • Impact to stormwater systems and watercourses from pollution	Section 6.4
Construction laydown spills	• Contamination as a result of a spill • Impact to stormwater systems and watercourses from pollution	Section 6.4

Aspects	Potential impacts	Mitigation Measures
Inappropriate management (handling, stockpiling, transport, and disposal) of identified contamination or contaminated materials encountered during demolition/construction works.		Section 6

6 Environmental mitigation and management measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EIS. Specific actions and processes which will be implemented to comply and address the requirements and measures are outlined below and summarised in Table 3.

6.1 Erosion and Sediment Control

This section outlines the erosion and sediment control measures to be implemented during the construction phase of the Project.

6.1.1 General principals

Erosion and sediment control measures are to be implemented and maintained in accordance with *Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines* (the Blue Book).

Erosion and sediment control measures on land are to be implemented and maintained to:

- Prevent sediment moving off-site and sediment laden water entering any water course, draining line, or drain inlets.
- Reduce water velocity and capture sediment on-site.
- Capture all site stormwater within the southern catchment into a sediment basin for treatment and discharge within 5 days of rainfall.
- Minimise the amount of the material transported from site to surrounding pavement surfaces.
- Divert clean water around the site.

6.1.2 Sediment Loss

Calculations on the sediment loss for the proposed earthworks phase of the project indicate the Erosion Hazard is very low to low. Soil loss has been calculated at 269 t/ha/year in the southern catchment and 116 t/ha/year in the northern catchment. The value calculated in the southern sub catchment is modelled to exceed the threshold (150 t soil loss/ hectare / year) whereby the requirement to install a sediment basin is required. Calculations confirm the volume specified within the Civil and Stormwater Plans completed by ACOR Consultants which determined that a sediment basin volume of 270 m^3 is required for the works. Calculations for the northern sub-catchment indicate that the threshold for a sediment basin was not exceeded and therefore 2nd and 3rd level erosion and sediment control measures shall be required to be implemented as per the ESCP for the site. A copy of the soil loss calculation is provided as Appendix B.

6.1.3 Erosion and Sediment Controls

Sediment control measures (e.g. sediment fencing, silt curtain, mesh or gravel “sausage”) must be installed prior to any construction activities commencing to prevent sediment and any other material (e.g. concrete, grout) moving off-site and entering any water course, drainage line or drain inlets. Dirty water or foreign material must not be released into drainage lines and/or waterways.

Erosion and sedimentation controls are to be checked daily and maintained as required (including clearing of sediment from behind barriers). Records of daily inspections and maintenance works undertaken are to be kept on-site and provided to SINSW on request.

6.1.4 Vehicle Access

The site access point shall be stabilised, and fencing (e.g. sediment fence or barrier) used to restrict all vehicular movements to that point. Any temporary access points shall be constructed in accordance with Standard Drawing SD 6-14, Appendix A. Stabilised access points with rumble grids or wheel washes to prevent mud tracking on roads will be established. Longer term and/or heavily used haul roads will generally be sealed. Sealed haul roads will be regularly cleaned.

6.1.5 Stockpile management

The following stockpile management measures shall be applied:

- Stockpiles must be located at least 5 m from likely areas of concentrated water flows, and more than 10 m from any waterway.
- Stockpile heights shall not exceed 4 m where possible, and slopes shall not be steeper than 2:1.
- Adequate sediment control measures must be installed prior to stockpiling material.
- Stockpiles that will be in place for more than 20 days, or which are susceptible to wind or water erosion, shall be covered or otherwise protected from erosion, within 10 days of forming each stockpile.

6.1.6 Sediment Basins

Sediment basins are designed to capture and provide settlement time for colloidal suspended particles with treatment. These basins are located to achieve maximum water flows from the disturbed catchments only and require other controls to ensure that clean water from undisturbed catchments is not directed to these basins.

All basins will be constructed in accordance with the principles of Managing Urban Stormwater: Soils and Construction (Landcom 2004).

As a minimum, one basin is to be constructed in accordance with the blue book design capacity based on the 80th percentile 5 day rainfall depth for Tweed Heads (Blue Book Table 6.3a). Rainfall above the basin design rainfall depth of 48.5mm.

Once runoff into the basin has ceased, treatment of the basin with an approved flocculent can commence. Once the flocculent has been added, the basin will be re-tested to check total suspended solids and pH levels.

The sediment basin must have capacity returned rainfall depth marked in the basin within the required number of days (5 days) within runoff into the basin ceasing. Where an initial rainfall event ceases and a second rainfall event commences within 5 days of the first event, the 5 day time limit will re-start.

Basin flocculation takes approximately 3 days to achieve settlement, leaving 2 days to return the basin (pumping or other methods) to capacity in normal conditions, however where extended rainfall periods occur or during higher rainfall periods, some basins may not be able to return to capacity.

RCC intend to treat the sediment basin as soon as practical and safe to access the site. In addition, pre-rainfall actions which will assist in treating basins, these include:

- Adding gypsum to the floor and walls of all basins prior to commissioning the basins.
- Adding gypsum to the inlets of all basins prior to forecast rainfall.
- Pre rainfall controls inspections.

6.1.7 Sediment Controls

- Sediment controls will be installed around stormwater inlet pits where appropriate and where they will not cause or exacerbate flooding. Traffic management and safety will need to be considered if installing such devices on or near live traffic.
- Turbid construction runoff will be diverted into sediment retention devices such as sediment basins, sediment fences and other sediment traps where feasible to prevent surface run-off from leaving the site.

- Sediment removed from any trapping device will be relocated where further pollution to downslope lands and waterways cannot occur.
- Mulch bunds will not be used in concentrated flow areas or if they have the potential to result in tannin leachate into waterways.
- All erosion and sediment controls will be inspected at least weekly, before a site closure of two days or more, and after rainfall exceeding 20 mm in 24 hours. Maintenance will be carried out as required prior to the next forecast rainfall event. Details of inspection will be maintained via the Site Manager's weekly diary.
- Concrete washout will be confined to designated concrete washout locations or using a Concrete Waste Separation Unit (CWSU), which allows for recycling of concrete waste.
- Clean water diversions to be constructed and stabilised around work areas.
- No stockpiles of materials or storage of fuels or chemicals would be located adjacent to the existing culverts.
- Stockpiles will not be placed within 2 m of hazards areas including likely areas of high velocity flows such as paved areas and driveways.
- Temporary sediment traps will be retained until after revegetation/rehabilitation.

6.2 Water quality monitoring program

Water quality monitoring will take place for all dewatering works in accordance with the ANZG water quality guidelines. Where practicable any water collected in excavations / site works will be used within the premises (e.g. dust suppression, water retained vegetation).

For reuse of water onsite, the following criteria must be met:

- pH – 6.5 to 8.5
- No visible oil and grease
- No potential for water to leave the premises
- No surface runoff will be generated from the reuse (reuse includes dust suppression, watering retained vegetation etc.)
- No potential for water to reach any watercourse

If stormwater is collected within the sediment storage basin and can not be beneficially reused onsite, then the following water quality objectives in accordance with the ANZG water quality guidelines for freshwater 95% percentile required prior to discharge:

- pH – 6.5 to 8.5
- Total Suspended Solids (TSS) <50mg/L
- No visible oil and grease
- Aluminium <0.007mg/L

Treatment, validation and discharge is required within 5 days of rainfall causing run-off that exceeds the sediment storage basin zone. (300mm or 10% of volume from base of sediment basin)

6.3 Flooding

The following measures will be implemented to mitigate the impacts of stormwater and flood flows during large rainfall events:

- Stockpiling and storage of materials to occur outside potential flood areas.
- Temporary facilities and hazardous material storage to be above flood levels.
- Maintain overland flow paths.
- Construction equipment (or excess material) would be removed from prone areas where significant events are predicted.

- Site sheds and chemical stores will be protected from the anticipated flood events.
- Site inspections will be completed to ensure all erosion and sediment controls are place prior to the event.
- Where applicable, temporary levees or bunds would be strategically placed to contain potential flooding impacts resulting from any temporary works on the floodplain and minimise the risk to surrounding properties which might otherwise be affected.
- In extreme flood events, such as 1 in 100 year ARI, temporary sandbags or diversions will be strategically placed to partially divert excessive floodwater flows away from the site and prevent overloading of stormwater drains and loss of large amounts of soil from site. Internal drainage systems will be inspected, reviewed and bolstered as necessary.

6.4 Wet Weather Event Procedure

RCC will undertake the following monitoring and inspections detailed in Table 3 relating to wet weather events.

Monitoring	Description
Daily Weather Forecast	Daily monitoring of BOM website for weather forecasts including hourly monitoring of the rainfall radars in the lead up and during a wet weather event
Pre rain Inspection	Pre rainfall inspection of the entire site to ensure that all erosion/sedimentation and stabilisation controls are in place and in effective working order. This is to occur prior to a forecast rainfall event where it is a >80% probability of a 10mm or greater rainfall event on the BOM website forecast. The pre rainfall inspection includes the relocation of materials that could cause environmental incidents such as potential pollution incidents onto higher ground and away from flood prone areas.
Inspections during rainfall event	Inspections of the site daily during a prolonged rainfall event to ensure that the all erosion/sedimentation and stabilisation controls functioning effectively and no emergency repairs or maintenance is required. Note that this inspection during rainfall is subject to obtaining safe access to site and should not occur if it will increase the environmental or safety risk, for example mud tracking on public roads.
Post rain inspection	Post rainfall inspection are to occur after a rainfall event >10mm has occurred. These inspections should occur within 24 hours after the rainfall event and should identify any maintenance requirements for the erosion/sedimentation and stabilisation controls. The post rainfall inspections will also identify dewatering requirements onsite including testing and treatment of water captured in construction sediment basins and sumps.

Table 3 Wet Weather Event Procedure

6.5 Acid Sulphate Soils

According to the DSI, PASS is present in the southwestern section of the development are below a depth of 1.5m BGL. Although major excavation of soil below this depth I not expected to be required for the development, if any minor excavation of soil below 1.5m occurs within the southwestern section of the site, neutralisation with lime will be required.

An ASS management plan (ASSMP) has been prepared as a part of the DSI and is to be implemented where the excavation of soils from a depth of 1.5m or greater within the southwestern section is required to facilitate the Project. An excerpt of the ASSMP is provided as Appendix C.

6.6 Spill prevention and response

The following control measures shall be implemented to minimise the risk of pollution caused by accidental leaks or spills:

- No vehicle wash-down shall occur on-site.
- The lowest volume of hydrocarbons (oil, grease, petrol and diesel) practicable will be stored on-site.
- Chemical storage areas will be bunded and chemicals will be stored in accordance with the products Safety Data Sheet (SDS). All fuels, chemicals and hazardous liquids must be stored away from drainage lines, within an impervious bunded area, and not on slopes steeper than 1:10.
- Refuelling and maintenance of vehicles, plant, and equipment shall not be undertaken at any location which drains directly to waters without appropriate temporary bunding being provided. Refuelling operations must not be left unattended.
- An emergency spill kit is to be kept on site at all times and maintained throughout the construction work. The spill kit must be appropriately sized for the volume of substances at the work site.
- Any leaks or spills must be managed and cleaned up in accordance with the RCC's Spill Response Procedure outlined in the CEMP.
- All construction equipment must be inspected by qualified personnel prior to the commencement of work to reduce the risk of hydrocarbon spills or leaks.
- Vehicles and plant must be properly maintained and regularly inspected for fluid leaks.
- Portable toilets must be positioned securely within approved compound areas and emptied on a regular basis using a licensed service provider and human waste disposed of to a local sewerage treatment plant.

Table 4: Soil and Water management and mitigation measures

ID	Environmental Aspect	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference
SW1	Sediment laden runoff during rainfall	Erosion and sediment control measures are to be implemented and maintained in accordance with *Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines* (the Blue Book)	Environmental Consultant	Ongoing	Project Manager or their delegate	Best practice, EIS, Conditions of Consent B19c
SW2	Sediment laden runoff during rainfall	Sediment control measures (e.g. sediment fencing, silt curtain, mesh or gravel “sausage”) must be installed prior to any construction activities commencing.	Sediment fencing, silt curtain etc.	Ongoing	Project Manager or their delegate	Best practice, EIS, Conditions of Consent B19c
SW3	Sediment tracking onto public roads from vehicles leaving site.	A stabilised site access point shall be established prior to construction works commencing. Measures must be in place to ensure that sediment and other materials are not tracked onto roadway by vehicles leaving the site.	Temporary fencing etc.	Pre-construction	Project Manager or their delegate	Best practice, EIS, Conditions of Consent B19b

ID	Environmental Aspect	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference
SW4	Inappropriate management (handling, stockpiling, transport, and disposal) of identified contamination or contaminated materials encountered during demolition / construction works.	Any stockpiles must comply with the requirements outlined in Section 6.1.2.		Ongoing	Project Manager or their delegate	Best practice, EIS
SW5	Leaks or spillages of fuels, oils and grease from construction plant and equipment at compounds.	Any leaks or spills must be managed and cleaned up in accordance with the RCC Spill Response Procedure.		As required	Project Manager or their delegate	Best practice, EIS
SW6		Vehicles and plant must be properly maintained and regularly inspected for fluid leaks.		As required	All staff	Best practice, EIS
SW7	Storage of hazardous substances	The lowest volume of hydrocarbons (oil, grease, petrol and diesel) practicable will be stored on-site.		Ongoing	Project Manager or their delegate	Best practice, EIS
SW9		Chemical storage areas will be bunded and chemicals will be stored in accordance with the products Safety Data Sheet (SDS). All fuels, chemicals and hazardous liquids must be stored away from drainage lines, within an impervious bunded area, and not on slopes steeper than 1:10.		Ongoing	Project Manager or their delegate	Best practice, EIS

ID	Environmental Aspect	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference
SW8	Leaks or spillages of fuels, oils and grease from construction plant and equipment at compounds.	All construction vehicles and equipment must be inspected by qualified personnel prior to the commencement of work to reduce the risk of hydrocarbon spills or leaks.		Ongoing	Project Manager or their delegate	Best practice, EIS,
SW9	Flooding of worksites & Sediment laden runoff during rainfall	Provide a plan of how all construction works will be managed in a wet-weather event (i.e. storage of equipment, stabilisation of the site).		Ongoing	Project Manager or their delegate	Best Practice, Conditions of Consent B19e
SW10	Discharge of contaminated water from within site boundary during rainfall. & Sediment laden runoff during rainfall	Detail all of-site flows from the site		Ongoing	Project Manager or their delegate	Best Practice, Conditions of Consent B19f
SW11	Discharge of contaminated water from within site boundary during rainfall. Sediment laden runoff during rainfall	Describe the measures that must be implemented to manage stormwater and flood flows for small and large sized events, including, but not limited to 1 in 5-year ARI		Ongoing	Project Manager or their delegate	Best Practice, Conditions of Consent B19g

7 Compliance Management

7.4 Roles and responsibilities

The Richard Crookes Project Team's organisational structure and overall roles and responsibilities are outlined in the CEMP and Table 3 of this plan.

7.5 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to soil and water management issues. The induction training will address elements related to soil and water management including the mitigation and management measures outlined in Section 6.

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in soil and water management.

7.6 Monitoring and inspection

Routine inspections of erosion and sediment controls will occur weekly and prior to significant (>25mm) rainfall over a 24-hour period to determine if controls are adequate. Monitoring of surface water will be required if water discharge off site is necessary. Water quality must meet the ANZECC Water Quality Guidelines or Section 120 of the POEO Act

7.7 Weather monitoring

Rainfall at the premises will be measured and recorded in millimetres per 24-hour period at the same time each day from the time that the site office associated with the activities is established.

7.8 Reporting

Reporting requirements are outlined in the CEMP.

8 Review and Improvement

8.4 Continuous improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance.
- Determine the cause or causes of non-conformances and deficiencies.
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement.
- Make comparisons with objectives and targets.

References:

ASSMAC,1998, *NSW Acid Sulfate Soils Manual*.

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000

Bureau Of Meteorology, Gold Coast Seaway Summary Statistics 2021

Douglas Partners,2021,Detailed Site Investigation, Far North Coast Schools Project Kingscliff Public School , 12 Orient Street, Kingscliff NSW

ENV Solutions (2021) Pre Demolition Testing Report. Document reference 216173 – Kingscliff School – Pre Demolition Testing_20211021

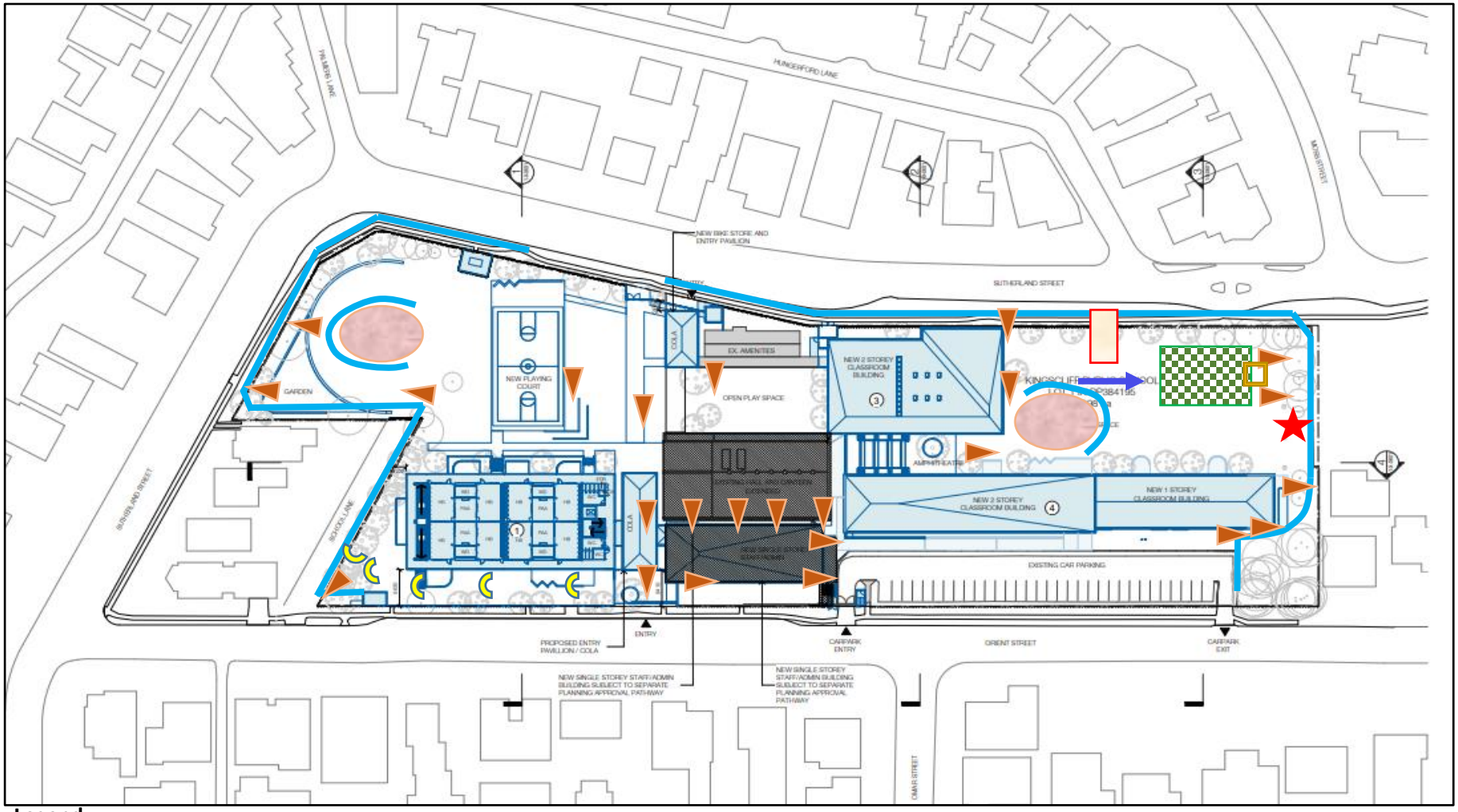
GHD, 2021,*Kingscliff Schools Drainage and Flooding Assessment.*

Landcom (2004), Managing Urban Stormwater: Soils and Construction (Blue Book).

Richard Crookes Constructions,2021*, Construction Environmental Management Plan, Kingscliff Public School Upgrade*

SJB Planning, 2021, *Environmental Impact Statement, Kingscliff Public School*

Appendix A – ESCP Drawing



Legend

- Sediment Fence
- Rock Check Dam
- Stockpile
- Stabilized Site Access
- Discharge point
- Spillway
- Filter Drop Sediment Trap
- Sediment Basin Area

0 20 40 m

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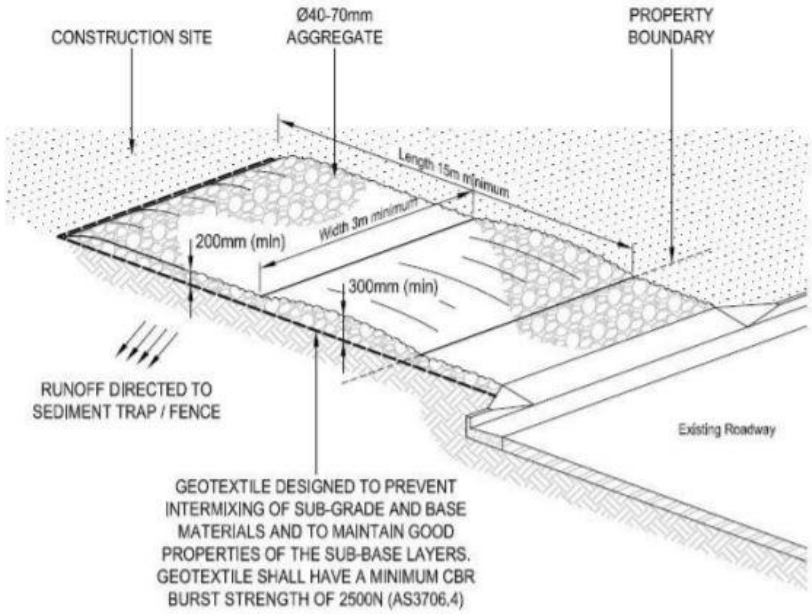
Figure 1 – ESCP Drawing
12 Orient Street, Kingscliff 2487

Project: Kingscliff Public School Upgrade
Client: Richard Crookes Construction
ENV Project Number: 216223

STABILISED SITE ACCESS SD 6-14

CONSTRUCTION NOTES

1. Strip the topsoil, level the site and compact the sub-grade
2. Cover the area with geotextile
3. Construct a 200mm thick pad over the geotextile with Ø40-70mm aggregate
4. Ensure the structure is at least 15m long or to the building alignment and at least 3m wide
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence
6. If required, inclusion of a shaker grid may be included at the construction site end of the stabilised site access



Appendix B – Soil Loss Calculations

Site area	Sub-catchment or Name of Structure						Notes
	South	North					
Total catchment area (ha)	0.8	0.9					
Disturbed catchment area (ha)	0.8	0.9					

Soil analysis (enter sediment type if known, or laboratory particle size data)

Sediment Type (C, F or D) if known:	F	F					From Appendix C (if known)
% sand (fraction 0.02 to 2.00 mm)	25	25					Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)	25	25					
% clay (fraction finer than 0.002 mm)	50	50					
Dispersion percentage							E.g. enter 10 for dispersion of 10%
% of whole soil dispersible							See Section 6.3.3(e). Auto-calculated
Soil Texture Group	F	F					Automatic calculation from above

Rainfall data

Design rainfall depth (no of days)	5	5					See Section 6.3.4 and, particularly, Table 6.3 on pages 6-24 and 6-25.
Design rainfall depth (percentile)	85	85					
x-day, y-percentile rainfall event (mm)	57	57					
Rainfall R-factor (if known)	8200	8200					Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)							

RUSLE Factors

Rainfall erosivity (*R*-factor)	8200	8200					Auto-filled from above
Soil erodibility (*K*-factor)	0.015	0.015					RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	100	100					
Slope gradient (%)	6	3					
Length/gradient (*LS*-factor)	1.68	0.72					
Erosion control practice (*P*-factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (*C*-factor)	1	1	1	1	1	1	

Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)

Storage (soil) zone design (no of months)	2	2					Minimum is generally 2 months
Cv (Volumetric runoff coefficient)	0.51	0.51					See Table F2, page F-4 in Appendix F

Calculations and Type D/F Sediment Basin Volumes

Soil loss (t/ha/yr)	269	116					
Soil Loss Class	3	1					See Table 4.2, page 4-13
Soil loss (m^3/ha/yr)	207	89					Conversion to cubic metres
Sediment basin storage (soil) volume (m^3)	28	13					See Sections 6.3.4(i) for calculations
Sediment basin settling (water) volume (m^3)	233	262					See Sections 6.3.4(i) for calculations
Sediment basin total volume (m^3)	261	275					

Appendix C – Acid Sulfate Soils Management Plan

Excerpt from Section 13.0 of Report Detailed Site Investigation for Contamination by Douglas Partners dated May 2021

12.1 Unexpected Finds

There is considered to be a relatively low potential for contamination-related unexpected finds to occur at the site during the proposed development works. Unexpected finds would typically be able to be identified by visual or olfactory indicators and could include:

- Waste materials in fill, including building and demolition waste;
- Fibre cement fragments/sheeting (e.g. asbestos containing material);
- Stained fill/soil;
- Malodorous soils (e.g. hydrocarbon odours); and/or
- Ash, slag and/or coal wash.

The following should be implemented in the event of an unexpected find:

- All work in the immediate vicinity should cease and temporary barricades should be erected to isolate the area; and
- A suitably qualified contaminated land consultant should be engaged to inspect the find and provide advice on the appropriate course of action; and
- Any actions should be implemented and validated to demonstrate that there are no unacceptable risks to identified receptors.

13. Acid Sulfate Soil Management Plan (ASSMP)

As detailed above, PASS is present in the southwestern section of the development area below a depth of approximately 1.5 m bgl. Although major excavation of soil below this depth is not expected to be required for the development, if any minor excavation of soil from below 1.5 m occurs (e.g. building piles and footings, underground service trenches) the procedures detailed in this ASSMP should be implemented.

The objective of the ASSMP is to reduce the potential on- and off-site environmental impacts associated with the disturbance of PASS identified at the site.

13.1 Management Strategy

13.1.1 Overview

If natural soil below a depth of 1.5 m is excavated within the southwestern section of the site it is required to be neutralised with lime. Liming is required to control the oxidation of pyritic material contained within the soil when released into aerobic conditions, with the associated generation of acid.

It follows that, where lime neutralisation treatment is to be undertaken, it will require management in a controlled environment, in a bunded and lined pad with perimeter drainage and a sump, in order to enable the collection and separate treatment of any acid leachate formed during the soil drying and liming process.

It should be noted that saturated soil cannot be neutralised effectively with lime, particularly where it is cohesive. This is because the lime must be well mixed into the soil and this cannot be performed when the soil is overly wet and 'sticky'. Hence, the excavated soil must be dried back on a lined pad before effective mixing can take place with earthmoving machinery.

All water draining from the soil, once it is removed from the excavation, should be considered as potentially acidic and should be separated in a controlled area, such as the aforementioned bunded and lined pad, and not be allowed to flow back into waterways or stormwater until it has been tested for pH and for any other environmental tests required by the appropriate regulatory authority.

If soil is to be removed to be dried and neutralised off-site it should be transported in trucks appropriately lined to prevent leakage of wet soil, slurry or drainage water during its transportation.

13.1.2 Neutralisation Pads

Whether performed on- or off-site, neutralisation of ASS should be carried out as follows:

- Prepare a liming pad/stockpile site of appropriate area for the volume of soil to be treated. The pad should be prepared on relatively level or gently sloping ground to minimise the risk of any potential instability issues, with a natural (or shaped) fall to the local drainage sump.
- The surface of the pad should be lined with selected approved compacted clay (at least two layers to a combined compacted thickness of 0.5 m) or a geosynthetic liner.
- A guard layer of fine agricultural lime (i.e. aglime) should be applied over the clay subgrade or compacted clay liner, to neutralise downward seepage. The guard layer of lime should be applied at a rate of approximately 5 kg lime per square metre of surface area for every 1 m height of stockpiled soil.
- The excavated soil should then be spread onto the guard layer in layers of 200 mm to 300 mm thickness, leaving a 1 m flat area between the toe of the spread soil and the containment bund or drain. When spreading the first soil layer, care should be taken not to churn up the lime guard layer.
- Let the soil dry back to facilitate lime mixing (if too wet, then adequate mixing of lime cannot be undertaken).
- Apply aglime to the stockpiled soil over each spread layer and harrow for thorough mixing prior to spreading the next layer. An overall liming rate of 17 kg / t should be applied to neutralise PASS within the area.
- Continue the spreading/liming/harrowing cycle until excavation is complete.
- Liming pads should be bunded off, and a circumference drain excavated to collect and localise leachate. The drain and inner bund slopes should be covered with a layer of fine lime applied to neutralise any possible leachate migrating from the stockpiled material.
- When testing indicates that lime neutralisation is complete, then the stockpiled soil may be removed from the liming/neutralisation pad.

Figure 1 below shows a schematic cross section of a treatment pad, extracted from Dear et al (2014)[10].

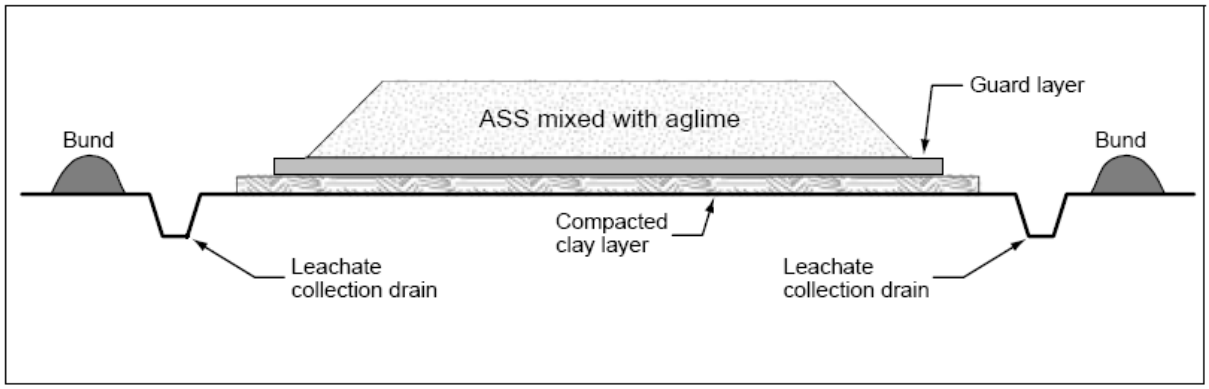


Figure 1: Schematic cross section of treatment pad

Liming of each area of excavation should be pre-planned and appropriate liming pads constructed. Allowances should be made during construction planning to resume sufficient land to allow for these liming pads. Leachate collection location, lining and construction should be similarly pre-planned.

13.1.3 Neutralising Materials

Aglime should be used as the preferred neutralisation material for the management of ASS as it is usually the cheapest and most readily available product available for soil neutralisation. This material is mildly alkaline (pH of 8.5 to 9), of low solubility, and does not present any handling problems if used correctly. The aglime comprises calcium carbonate typically made from limestone that has been finely ground and sieved to a fine powder.

The aglime purity should preferably be 95% or better, (i.e. NV >95, where NV is the neutralising value, a term used to rate the neutralising power of different forms of materials relative to pure, fine calcium carbonate which is designated NV = 100). Aglime is typically sold at an NV of 95% to 98%. There could be economic justification for using a less pure grade of aglime; however, under these circumstances, the individual lime dosing rates should be increased by a factor of 100/NV.

Due to its low solubility in water, aglime is not suitable for the neutralisation of leachate, which requires a product with a very quick reaction and high solubility. The most suitable neutralising agent for leachate and stockpile drainage water is slaked or quicklime (calcium hydroxide). This is made by treating burnt lime with water (slaking) and comes as a fine white powder. It has a typical NV of about 135. Due to its high alkalinity (pH of about 12.5 to 13), slaked or quicklime should not be allowed to come into contact with the skin or be inhaled.

13.2 Validation Testing

Validation testing of the soil and drainage water is required to be conducted after the addition of lime to test whether or not mixing has been adequate, and to reduce the risk of acidic water being returned to watercourses. Based on an existing plus potential acidity of <0.5%, validation samples of soil should

[10] Dear SE, Ahern CR, O'Brien LE, Dobos SK, McElnea AE, Moore NG and Watling KM (2014) *Queensland Acid Sulfate Soils Technical Manual: Soil Management Guidelines*, QLD Department of Science, Information, Technology, Innovation and the Arts.

be collected and tested for field pH screening and chromium suite at a minimum frequency of one sample per batch of mixed soil, with a minimum of one sample per 1,000 m^3 of treated soil.

In accordance with Dear et.al. (2014) single non-random grab samples are not recommended for this type of testing. Composite samples should be collected according to either a random or stratified-random protocol. Within each sample for laboratory analysis, a minimum of six subsamples of consistent volume should be collected. The subsamples should extend through the total depth of the treated material but avoid the underlying guard layer. The subsamples should be thoroughly mixed together in a container with a secure lid. Following the compositing of the material, a composite sample should be collected for laboratory analysis.

In addition, the pH of all ponded drainage water around the confines of the treatment bunds should be measured daily.

The soil and water contained within the treatment bunds should not be removed until the target values have been achieved as presented in Table 6 below. Similarly, additional layers of soil should not be added to the bunded stockpile for treatment until the underlying layers have been validated.

Table 6: Target Levels of Neutralised Soil and Water

Test	Target Level
Acid neutralising capacity (ANC)	To exceed existing plus potential acidity of the soil by at least a safety factor of 1.5.
pH_F of soil	6.5 to 8.5
pH_{KCL} of soil	Greater than 6.5
pH of water	6.5 to 8.5

It should be noted that validation testing (i.e. chromium suite tests) will require at least four days turn-around, possibly longer, and hence sufficient time should be allowed in the treatment programme for such verification testing. Only appropriately skilled operatives, such as available through DP, should collect and test verification samples. In addition to normal daily supervision of the soil management process, it is suggested that regular formal inspections be undertaken.

13.3 Training and Induction

Training and induction sessions should be conducted for all contractors and staff involved in the excavation, transport or handling of soils or earthworks on the site. The sessions should be designed to ensure that staff are made aware of relevant issues and are familiar with their responsibilities.

13.4 Record Keeping

Current good management practices should be adopted by the appointed contractor. Complete records of all testing and treatment should be maintained by the contractor, and such records should be made available as required.

Appendix D – Dewatering Management Plan

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DEWATERING MANAGEMENT PLAN (DMP)

Kingscliff Public School

12 Orient Street, Kingscliff NSW 2487

For:

Richard Crooks Constructions

By:

ENV Solutions Pty Ltd

Date:

22/03/2022

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Document Control:

Filename:	20211130 Dewatering Management Plan KPS 216187		
Job No:	ENV216187		
Client:	Richard Crooks Constructions		
File/Pathname:	ENV Solutions.com.au\Synergy - SynergyProjects\ENV216187\03 Documentation\e. Reports\		
Revision No:	**Author:**	**Date:**	**Signed:**
0	Robert Mark Mitchell	30/11/2021	
	Reviewed By:		
1	Stephen Bourne	30/11/2021	
2	Robert Mark Mitchell	30/11/2021	
3	Rhys Riches	22/03/2022	

Scope of Engagement and Limitations:

This report has been prepared by ENV Services PTY LTD (ENV) ABN 98 649 278 977 at the request of Richard Crooks Constructions for the development of a suitable Dewatering Management Plan. No other parties may rely on the contents of this report for any purposes except those stated.

This report has been prepared based on the information provided to us and from other information obtained because of enquiries made by us. ENV accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for a purpose other than that described above.

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To avoid this advice being used inappropriately, it is recommended that you consult with ENV before conveying the information to another who may not fully understand the objectives of the report. This report is meant only for the subject site/project and should not be applied to any other.

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1 Introduction

1.1 Background

ENV Services Pty Ltd (ENV) has been engaged by Richie O'Gorman on behalf of Richard Crookes Constructions (Richard Crookes) to prepare a Dewatering Management Plan (DMP) for the Kingscliff Public School (KPS) State Significant Development (SSDA).

Hereon referred to as 'the site', the Kingscliff Public School is located at 12 Orient Street, Kingscliff NSW 2478 (Lot 1 DP384195). Reference to the site can be found in Figure 1, Attachment 1.

The purpose of the DMP is to address items raised by the Tweed Shire Council (Council) on the SEARs for this development and successfully identify, determine, and describe best practice dewatering & dewatering water treatment methodologies.

1.2 Proposed Development

Following high level review of site-specific architectural drawings, historic reports and site markups provided Richard Crookes - it is understood that the proposed development includes;

- Demolition of 11 demountable buildings (not including the three located in the vicinity of the proposed administration building);
- Demolition of existing permanent buildings designated as Buildings A, C, E and F;
- Construction of a new pedestrian entry and bike store,
- Construction of three new two-storey buildings; and
- Landscaping works including a new playing court.

It is understood that as the proposed development potentially requires dewatering of three (3) lift over run excavations (Building 1, Building 3 and Building 4).

1.3 Stakeholder Identification

Table 1 outlines immediate direct (internal) and indirect (external) stakeholders with an interest or concern in construction works associated with the proposed woks outlined in section 1.2.

Table 1: Stakeholder Identification

Stakeholder	Role or Position	Internal/ External
Richard Crooks Constructions	Client	Internal
ENV Solutions	Consultant	Internal
Tweed Shire Council	Local Authority	External
School Infrastructure NSW	State Authority	External

1.4 Previous Environmental & Geotechnical Investigations

As part of the DMP preparation process ENV conducted an initial desktop review. In addition to stakeholder consultation, the following documentation were reviewed to ensure DMP management structure(s) addressed engineering, environmental, development and other constraints:

- Douglas Partners (2020). Report of Preliminary Geotechnical Investigation (Document No. R.001.Rev0), Kingscliff Public School, 12 Orient St, Kingscliff NSW;

- Douglas Partners (2021). Report on Detailed Site Investigation for Contamination Kingscliff Public School (SSDA Development) (Document No. R.002.Rev3), Kingscliff Public School, 12 Orient St, Kingscliff NSW.

1.5 Relevant Standards, Guidelines & Literature

This DMP has been developed referencing the following Standards & Guidelines.

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality: The Guidelines, Paper No. 4, Volume 1 (Chapters 1 – 7), Australian and New Zealand Environment and Conservation Council (ANZECC) & Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000;

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality: The Guidelines, Paper No. 4, Volume 2 (Chapter 8), Australian and New Zealand Environment and Conservation Council (ANZECC) & Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000;

- Dewatering in the Tweed, A Guideline for the Management of Dewatering Operations, Version 1.0, (October, 2020);

- National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) ('NEPM'; NEPC, 2013);

- Managing Land Contamination Planning Guidelines (Department of Urban Affairs [DUAP] and Environment Protection Authority [EPA] 1998) and the Guidelines for Consultants Reporting on Contaminated Sites (EPA, 2000); and,

- State Environmental Planning Policy (SEPP) 55 – Remediation of Land (under the Environmental Planning and Assessment Act (EP&A Act) 1979).

- Tchobanoglous, G. et al, 2003, Wastewater Engineering Treatment and Reuse: Metcalf & Eddy, 4th edn, McGraw-Hill, New York; and,
-
- Cachman, M. & Preene, M. 2013, Groundwater Lowering in Construction: A Practical Guide to Dewatering, 2nd Edition, CRC Press, New York.

1.6 Dewatering Management Plan Objectives

The objectives of the DMP are to address the considerations required per the Tweed Shire Council review of the Environmental Impact Statement (Condition B37) which includes the following:

a. Considers Council's Dewatering in the Tweed Guideline available at https://www.tweed.nsw.gov.au/Documents/Planning/TSC12355_Dewatering_in_the_Tweed_Guideline.pdf;

b. Meets the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) available at www.waterquality.gov.au/anzguidelines;

c. Includes site plans which indicate the extent of the excavation area and estimated zone of influence of the dewatering activity relative to any adjoining buildings together with an assessment of any impacts likely to occur to any adjoining buildings as a result of the dewatering activities;

d. The location to be indicated on the site plan of the area that will be utilised for the positioning of any treatment tank or sedimentation pond on the site including any reserve area to be used for such purpose in the event of the need for additional treatment facilities to be incorporated on the site;

e. Details of the proposed method of mechanical aeration to be used in the event that it is necessary to aerate the groundwater to achieve an acceptable Dissolved Oxygen level prior to the offsite discharge of groundwater and where this will be incorporated on the site;

f. The provision of written advice from the operator of any on site groundwater treatment system stating that the system to be used will be able to treat the groundwater to the required treatment level prior to discharge. Note. Particular attention is to be given to achieving the required detention times prior to discharge of the groundwater. Advice that the system is simply capable of achieving the necessary treatment will not be acceptable; and

g. Considers the Detailed Site Investigation for Contamination for Kingscliff Public School, 12 Orient St, Kingscliff prepared by Douglas Partners dated 4th May 2021 (Project No. 97611.00, Document No. R.002.Rev2), the Preliminary Geotechnical Investigation and Acid Sulfate Soils Assessment for Kingscliff Public School, 12 Orient St, Kingscliff, prepared by Douglas Partners dated 3 April 2020 (Project No. 98084.00, Document No. R.001.Rev0), and Acid Sulfate Soil (ASS) intercepted during dewatering activities.

2 Site Characteristics

2.1 Site Description

The site is located at 12 Orient Street, Kingscliff, NSW 2487, and is referred to by the Tweed Shire Council as Lot 1 DP 384195 and has an approximate area of 2.044 ha. A figure of the site location is shown in Figure 1, Attachment 1.

The site is located east of Orient St and west and south of Sutherland St. The site is approximately rectangular in shape and contains buildings, pavements, asphalt, grassed areas. The north sections of the site contain the majority of buildings and walkways. The school buildings and proposed development area are located in the northern portion of the site, with the remainder (southern) areas of the site comprising of a sports field and carpark (south-west).

2.2 Surrounding Environment

The Councils Land Environment Plan (LEP) (2014) presents the site as located in an area zone R3 – Medium Density Residential area and is surrounded in all directions (north, south, east and west) with what appears to be medium density residential houses. Extending beyond the immediate area surrounding the site, the land use is described in Table 2.

Table 2: Surrounding Land Use

Direction	Environment
North	Mixed Use Area and Local Recreation Area
East	Cudgen Creek
South	Medium Density Residential Area
West	Medium Density Residential Area

2.3 Topography & Drainage

The site is located on the eastern slope of a hillside and slopes downwards towards Cudgen Creek to the east. The site appeared to be undulated with various elevations and flattened terrace platforms. On-site elevations range between approximately 26 m to 18 m from north-west to south-east respectively, relative to Australian Height Datum (AHD). The topology of the site can be seen in Attachment 1.

The Detailed Site Investigation and topology mapping indicate that the major surface water receptor of surface water flows and excess groundwater will be the Cudgen Creek, located approximately 150 m east of the proposed development area.

2.4 Geology & Soils

The site is located within a geological unit mostly characterised by Coastal deposits of fine to coarse grain sand. Per the DSI, groundwater was encountered at Borehole 5 at a depth of 2.4 m in their 2020 investigation. It is also noted that these groundwater conditions can vary in space and time. Table 3 presents a summary of the encountered subsurface profile.

Table 3: Subsurface Condition Summary

Material Description	Depth (m)	
	From	To
FILL: Loose silty sand was observed through the majority of the site.	0 m	0.8 m
ALLUVIAL: silty sand and sandy clay soil was encountered beneath the fill, underlain by clayey/silty sand.	0.8 m	2 m
POSSIBLE RESIDUAL SOIL: Clay and Sandy Clay	> 2 m	

2.5 Acid Sulfate Soils (ASS)

Referencing Council Local Environmental Plan (LEP) Acid Sulfate Soils Planning Maps and the Detailed Site Investigation (DSI) (Douglas Partners, 2021), the investigation area is situated in a Class 5 ASS Risk envelop. Therefore, there is a low chance of ASS being present at the site.

2.6 Saturated Hydraulic Conductivity

Hydraulic conductivity (ksat) is a quantitative measure of a saturated soils ability to transmit water when subject to a hydraulic gradient. A key factor (input) in determining estimate extraction volumes during both the draw-down dewatering phase and groundwater maintenance phase (steady-state dewatering).

Utilising data obtained from the sites underlain geology (see section 2.4) in-ground ksat values are described in Table 4.

Table 4: Permeability (ksat)

Geology	Permeability (m /s) - Upper	Permeability (m /s) - Lower
Alluvial Sand/Clay	4×10^{-5}	4×10^{-8}

Permeability figures have been cross referenced using values recommended by Engineers Australia (2006) and Cachman & Preene's: Practical Guidelines Towards Lowering Groundwater in Construction (2013).

Due to the limitations associated with the homogenous nature of inground conditions, and other assumptions regarding inground geology, changes in permeability (ksat) are highly volatile. Therefore, natural variations in the permeability between each different sub-surface material are likely to occur due to the variations in silt or clay content, and variations in grain size of the sand as well as the positioning and interrelation of the secondary porosity features such as, joints / fractures or defects.

Any changes in underlain geology may result in changes in saturated hydraulic conductivity and therefore groundwater extraction flow rate. On this basis, calculations (discussed in following sections) have been used as an approximation for both the draw-down dewatering phase and groundwater maintenance phase (steady-state dewatering).

2.7 Groundwater

2.7.1 Groundwater Well Drilling & Construction

Two (2) boreholes (MW01 and MW02) were drilled on 1st of October 2021 to depths of 3.5 m and 9.0 m respectively. A location plan showing drilling location plan is presented in Figure 2, Attachment 1. A trailer mounted drill rig and solid flight augers were used at each location.

At each of the borehole locations, groundwater wells were installed once the target depth, or auger refusal, had been reached. The wells were constructed by placing 50 mm diameter slotted PN18 PVC casing and solid casing into the borehole; and installing a gravel pack, with bentonite seals to the ground surface. Drilling logs describing the soil profiles encountered and construction details for the wells are provided in Attachment 2.

The soils at each location were logged in general accordance with the Unified Soil Classification System (USCS), with reference to any odours or other field indicators of potential contamination (See Attachment 2).

After well construction, each newly installed well was developed using a steel bailer and surging techniques, to ensure that as many fines were removed from the gravel pack surrounding the screened interval as possible.

2.7.2 Standing Water Level (SWL)

Once installed, groundwater monitoring wells (MW) were dipped using a surface interface probe where no groundwater was encountered within MW01 and MW02 (Attachment 2). According to preliminary geotechnical investigations (Douglas Partners, 2020), Groundwater was encountered within Bore 5 at 2.4 mbgl (Approximately RL 22.2 AHD). The locality of Bore 5 is located at the southern end of the site. Following consideration of Bore location, geology (high clay content) and the absence of groundwater at all other boreholes investigated on the site, the water encountered at Bore 5 is possibly due to a small, perched water table. Thus, ENV assumes the standing water level remains below the depth of investigation during the testing period.

Furthermore, given the sites proximity to the Cudgen Creek and the Pacific Ocean, fluctuations in SWL are anticipated. It is also safe to assume that fluctuations in SWL may also occur following periods of high rainfall (or in the wetter months of the year).

2.8 Water Quality

During the time of investigation, no water was encountered within monitoring wells. Therefore, no water quality data has been collected from within boreholes on the site.

2.9 Receiving Environment Water Quality

The site location and regional topography indicate that excess surface water and groundwater flows have the potential to enter Cudgen Creek, located to the south of the site and approximately 150 m east of the proposed development area.

A receiving environment (RE) sample was collected from Cudgen Creek (accessed via Moss Street, Kingscliff) on the 1st of October 2021. Here, receiving environment waters can be described as slightly alkaline (Analytical pH = 8.00) and saline (Analytical electrical conductivity (EC) = 47,000 uS/cm). Total Suspended solids (TSS) were recorded at 9 mg/L.

Presented in Attachment 3, analytical results show (receiving environment) Aromatic Hydrocarbons (BETEX), Total Recoverable Hydrocarbons (TRH), and Polycyclic Aromatic Hydrocarbons (PAHs) to be below laboratory Limits of Reporting (LOR). Furthermore, detections in Arsenic (Total) and Chromium (Total) were noted at small levels (3 µg/L and 2 µg/L respectively). All other metals analysed were below laboratory LOR.

2.10 Discharge Location

Based of EC values presented in section 2.9 of this report, Cudgen Creek can be defined as a marine (estuarine) environment where thresholds for physical and chemical Water Quality Objectives (WQO's) have been selected to suit.

In assessing human disturbance, guided by both the ANZG (2018) and ANZECC/ ARMCANS (2000), this report recognises Cudgen Creek as being slightly to moderately disturbed. On this basis, for toxicants in water, a 95% species protection default guideline values have been presented for toxicants of potential concern.

3 Water Quality Objectives (WQO)

Since no groundwater was intercepted during borehole investigations, Baseline groundwater quality could not be considered in this section. Following review of receiving environment water quality, Table 5 outlines discharge WQOs developed in consultation with the ANZG (2018) and ANZECC/ ARMCANZ (2000). Note that if groundwater, a large, perched water table or surface water (large rain event) is encountered, extracted water will need to be treated to meet WQOs prior to discharge into the stormwater network (discharging into Cudgen Creek).

Physical and chemical WQOs for pH, turbidity and TSS have been developed using default trigger values for marine-estuarine environments (i.e., South-east Australia flowing rivers) presented in tables 3.3.2 – 3.3.3 of the ANZECC/ ARMCANZ (2000), as recommended by the ANZG (2018). As

outlined in section 2.10 DGVs have been developed utilising a 95th percentile level of species protection.

Table 5: Water Quality Objectives (WQO's)

Parameter	Water Quality Objective (WQO)
Physicochemical	
pH	7.0 – 8.5[1]
Total Suspended Solids (TSS)	< 20
Turbidity (NTU)	< 20
Dissolved Oxygen (% Saturation)	80-100[1]
Dissolved Metals	
Chromium (ug/L)	4.4[3]
Lead (ug/L)	4.4[3]
Zinc (ug/L)	8[3]

Table notes:

1. Derived from ANZECC/ ARMCANZ (2000) Estuaries – (Table 3.3.2)
2. Derived from Dewatering in the Tweed – Table 2.
3. Derived from ANZG (2018) – Marine 95th Percentile (DGV)
4. Derived from ANZG (2018) – Freshwater 95th Percentile (DGV)
5. Derived from ANZECC/ ARMCANZ Volume 2 – Low Reliability (Iron)

4 Dewatering Management Plan

4.1 Site Characteristics & Desktop Summary

Following desktop review of the proposed development, sub-surface geology, groundwater conditions and receiving environment condition - the following has been established:

- Groundwater investigations suggest that no groundwater will be intercepted during excavation works at KPS. For the purpose of this report, ENV has assumed SWL will remain below the base of excavations over the duration of the works. Fluctuations in SWL due to increased rainfall and other factors stated may affect these conditions.

- Historical onsite investigation data, and values recommended by 'A Practical Guide to Dewatering (Cashman & Preene, 2013), saturated hydraulic conductivity (Alluvial Sand/Clay) is expected to be within the range of 4×10^{-5} and 4×10^{-8} meters per second (m/s) (if SWL increases above base of excavation).

- Likely receptor water bodies of dewatering, surface and sub-surface water flows include the Cudgen Creek, approximately 150 m to the east of the site.

4.2 Dewatering Process

ENV groundwater investigations suggest the SWL at the Kingscliff Public School is below the base of excavations and will not interrupt excavation works. Fluctuating SWL may occur due to inclement weather, seasonal variations, and due to other reasons, that may not have been apparent at the time of the site investigation. It is unlikely that groundwater will affect excavation works. Therefore, no in ground dewatering system has been proposed.

An open pit dewatering system is recommended for surface water management caused by rainfall. Here, a submersible pump or equivalent should be installed at the deepest location (sump) in the excavation area. A sump may need to be incorporated into the excavation area for effective water management. If a perched water table is intercepted, this dewatering system will effectively manage inflow from such a water source. A secondary pump could be installed to manage higher inflows if deemed necessary by a suitably qualified engineer or scientist.

To minimise blockages and suspended solids uptake, a filtration casing can be applied around the submersible pump.

Extracted surface water will then be directed into the front end of the dewatering water treatment plant. A mark-up of approximate water treatment area is presented in Figure 3, Attachment 1.

4.3 Flow Rates

Due to the absence of groundwater during the time of investigations and thus lack of data, drawdown calculations, steady state calculations, totalised flow rates and dewatering zone of influence could not be calculated. Water affecting excavations caused by rainfall or a perched water table should be managed appropriately and may require the use of a pump appropriate for managing surface water (i.e., Submersible Pump). These will have varying flow rates according to pump specifications and volume of water.

4.4 Groundwater Treatment Process

Discussed in earlier sections of this DMP, extracted groundwater and surface water (if intercepted) will require treatment prior to release into the receiving environment. Treated groundwater and surface water will need to meet WQO's presented in Table 5.

To achieve this, a Dewatering Water Treatment Plant (WTP) will need to be established onsite & commissioned by suitably qualified engineer or scientist. At a minimum ENV would recommend processes that include:

- Solid's removal capability.
- pH correction control/ aeration capability.
- Polishing & metals removal capability (groundwater extraction only).

Please note additional treatment units or processes may be required to meet WQO's.

Dewatering water treatment plant should be sized according to anticipated flow rates (dependent on water pump specifications).

However, should flow rates exceed plant capabilities or fail to meet WQO's specified in Table 5, additional plant may be required.

4.5 Coagulant Assisted Tilt Separation (Solids Removal)

Assisted utilising an appropriately selected flocculant, coagulant and/or polymer, the tilt separation process primarily works to removed suspended solids prior to discharge. Although sediment loads should be managed upfront (i.e., socking, or backfilling spears), the system should be suitably sized to handle flow rates specified in the earlier sections of this report.

As recommended by the NSW Blue Book - flocculant, coagulant and/or polymer dose rates should be determined & managed by an appropriately qualified person (i.e., chemical engineer/ industrial chemist or equivalent). A material safety data sheet (MSDS) for a typical aluminium based coagulant is presented in Attachment 4.

4.6 pH Correction & Metals Removal

Dewatering contractors are expected to meet a pH WQO of 7.0 – 8.5 (Table 5). Contractors are encouraged to maintain pH toward the higher end of this range to aid in metals precipitation.

To achieve this, dewatering contractors shall include an automated pH dosing system, coupled with a suitably selected alkaline chemical such as 50% caustic (an MSDS a typical caustic solution is presented in Attachment 5).

Furthermore, dewatering contractors should ensure setpoints are programmed by a suitably qualified engineer, scientist, or operator to prevent pH moving outside of the prescribed range

4.7 Polishing

As a final process prior to stormwater discharge, a media or sand polishing process is recommended to polish groundwater prior to discharge. Here, any residual contaminants, solids or aesthetic elements will be removed prior to discharge into the receiving environment.

Should media filtration be selected, an empty bed contact time of at least two minutes should be considered. As the absorbent fouls over time, it is recommended the dewatering contractor have additional media onsite for vessel change out.

4.8 Groundwater Dependant Ecosystems

The Cudgen Creek is proposed receiving environment for the treated water discharged to the SW system onsite, where the proposed dewatering and water treatment methodology works minimise any impact extracted water volumes and quality pose to the greatest possible & practicable extent (i.e. increased water quality, reduced flow rates & zone of influence).

4.9 Subsidence

It is understood that proposed shoring & dewatering design if needed will work to minimise the zone of influence. Therefore mitigating (to the greatest possible extent) dilapidation & subsidence of any adjacent structures & infrastructure. Note that this will only apply if dewatering works are needed.

5 Validation & Monitoring

The purpose of the validation and monitoring process is to provide a framework for dewatering contractors to collect, interpret, act and report on the performance of the dewatering process. Ultimately to ensure treatment measures are satisfactory and meet WQOs outlined in Table 5. the DMP promotes a combination of collection techniques including analytical field sampling and telemetric data collection (i.e. real time).

5.1 Analytical Field Sampling Frequency

Prior to discharge, a sample will need to be collected from the outlet of the WTP and validated (utilising NATA certified laboratory) against WQO's presented in Table 5.

Once discharge has commenced, an additional sample will be collected and validated every seven (7) days (or as required under the guidance of a suitably qualified person) for the duration of dewatering works onsite as part of the continual discharge monitoring program. Standard turn-around-time (TAT) for sample analysis should be a maximum three (3) days for all sample analytes.

5.1.1 Analytical Sampling Methodology

At the frequency outlined above, laboratory samples will be collected from the discharge point. The samples will:

- Represent a waste or element of the environment from which it is taken;
- Not be contaminated during collection, where analyte concentrations will not change between the time of collection and analysis;
- Be collected by an appropriately qualified person;
- Include sampling utilising correct sampling methodologies;
- Include representative sample(s); and,
- Be labelled, preserved, stored, and transported appropriately for analysis.

Samples will be analysed by a National Association of Testing Authority (NATA) laboratory and will be inclusive of analytes outlined in Table 5.

5.1.2 Daily Field Monitoring (Daily)

To ensure management of the treatment processes, daily field monitoring will be included as part of the ongoing monitoring process. Daily monitoring will cover aspects of all treatment steps, these include but are not limited to:

- Visual inspection of treatment process;
- pH assessment;
- Turbidity (NTU) assessment; and,
- Flow (m/s OR m^3/ hour) assessment. Flow measurements are taken from a calibrated flow meter included in the dewatering water treatment plant.

Daily observations will be recorded and stored onsite where a 'daily report' will be provided and presented to the principal contractor outlining physiochemical changes across the process, high level plant function/ performance summary and flow (rate & totalised volume).

5.1.3 Telemetric Date Collection

In addition to daily monitoring, data will be collected using an online PLC system (such as HOBO Link ™). As part of this system, physiochemical and physical parameters such as; pH, turbidity and flow rate will be measured in real time where analysis will be provided to a dewatering treatment expert.

Should physiochemical or physical parameters fall 'out of spec', the dewatering subcontractor will be notified via SMS or an alternative method (i.e. Email) where action will be required as outlined in the following section.

6 Action & Analysis

The following section aims to provide dewatering water treatment operators with the ability to effectively assess treatment performance following receipt of monitoring data and make accurate decisions to ensure risk treatment processes are upheld. Analysis and action processes are detailed in the sections below.

6.1 pH Correction/ Metals Precipitation

Daily Check:

- Telemetric OR physiochemical check (pH1 OR pH2) out of specification.

Action:

- Check and re calibrate pH1 OR pH2 probe.
- Check chemical (NaOH) dosing pump to ensure its functionality.
- Check chemical drum to ensure chemical volume is sufficient.

IF pH1 OR pH2 still out of specified range;

- Replace pH2 probe with critical spare.
- Notify relevant stakeholders of change.
- Dewatering Manager to note in daily dewatering management plan report.

Analytical Check:

- Analytical pH results outside of specified WQO's .

Action:

- Shut down or put into recycle.
- Re-calibrate pH probes.
- Check proportional bands (or equivalent pH control process).
- Implement changes and monitor.
- Notify relevant stakeholders (internal & external).
- Dewatering Manager to note in daily dewatering management plan report.
- Re-sample and validated once pH corrections have occurred.
- Re assess risk and treatment methodology (if pH challenges persist).
- Additional treatment units or methodologies may need to be employed.

6.2 Dissolved Oxygen (DO) – Physiochemical Only

Daily Check:

- Dissolved Oxygen (DO) physiochemical check outside of specified limit.

Action:

- Check Dissolved Oxygen probe on Horiba U-52 meter (or equivalent).
- Re measure DO in fresh sample collected from discharge of treatment train (post Air and Post media Polishing Unit).
- Assess result.

IF DO still out of specified range:

- Review DO treatment methodology.
- Implement DO treatment methodology change.
- Dewatering Manager to note in daily dewatering management plan report.
- Re – evaluated the following day, and if required.
- Re assess risk and treatment methodology.
- Implement revised solution and validate methodology.

6.3 Turbidity (NTU) & Total Suspended Solids (TSS)

Daily Check & Analytical Check:

- Turbidity (NTU) physiochemical check outside of specified limits.
- Turbidity (NTU) analytical check out of specification.
- Turbidity (NTU) telemetric result out of specification.

Action:

- Check and Turbidity probe (PLC Unit and Horiba U-52 meter).
- Re measure Turbidity in fresh sample collected from discharge of treatment train.

- Assess result.
- Check chemical dosing pump(s) to ensure its functionality.
- Check chemical drum to ensure chemical volume is sufficient.
- Check sediment level in treatment tank.

IF NTU still out of specified range;

- Review NTU treatment methodology.
- Conduct assisted flocculation checks (i.e. Jar Test) to re define and optimise dose rates.
- Implement NTU treatment methodology change.
- Dewatering Manager to note in daily dewatering management plan report.
- Additional treatment units or methodologies may need to be employed.

7 Reporting & Record Keeping

A dewatering summary report will be supplied, summarising the results of monitoring within two weeks of cessation of discharges.

During the dewatering process, a daily report will need to be completed by the onsite Dewatering Management. The report will note any exceedance in discharge criteria, as well as any other comments relating to the dewatering process.

Any complaints shall be noted in the site logbook and corrective action taken (where appropriate and practicable) to prevent recurrence. Complaints and complaints management are the responsibility of the principal contractor where their policy will be adopted as best practice.

8 Attachments

Attachment Reference	Attachment Title
Attachment 1	Figure 1: Site location Figure 2: Existing well locations Figure 3: Topology of site
Attachment 2	Bore Hole Logs
Attachment 3	Receiving Environment Water Quality Analysis
Attachment 4	Alum MSDS
Attachment 5	Caustic MSDS

9 Attachment 1 – SITE FIGURES

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 1 – Site Location Plan
Kingscliff Public School
12 Orient Street, Kingscliff, NSW 2487

Client: Richard Crookes Constructions
Project: Dewatering Management Plan (DMP)
Job No: 216187

Image source: Sixmaps

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 2 –Sampling Location
Kingscliff Public School
12 Orient Street, Kingscliff, NSW 2487

Client: Richard Crookes Constructions
Project: Dewatering Management Plan (DMP)
Job No: 216187

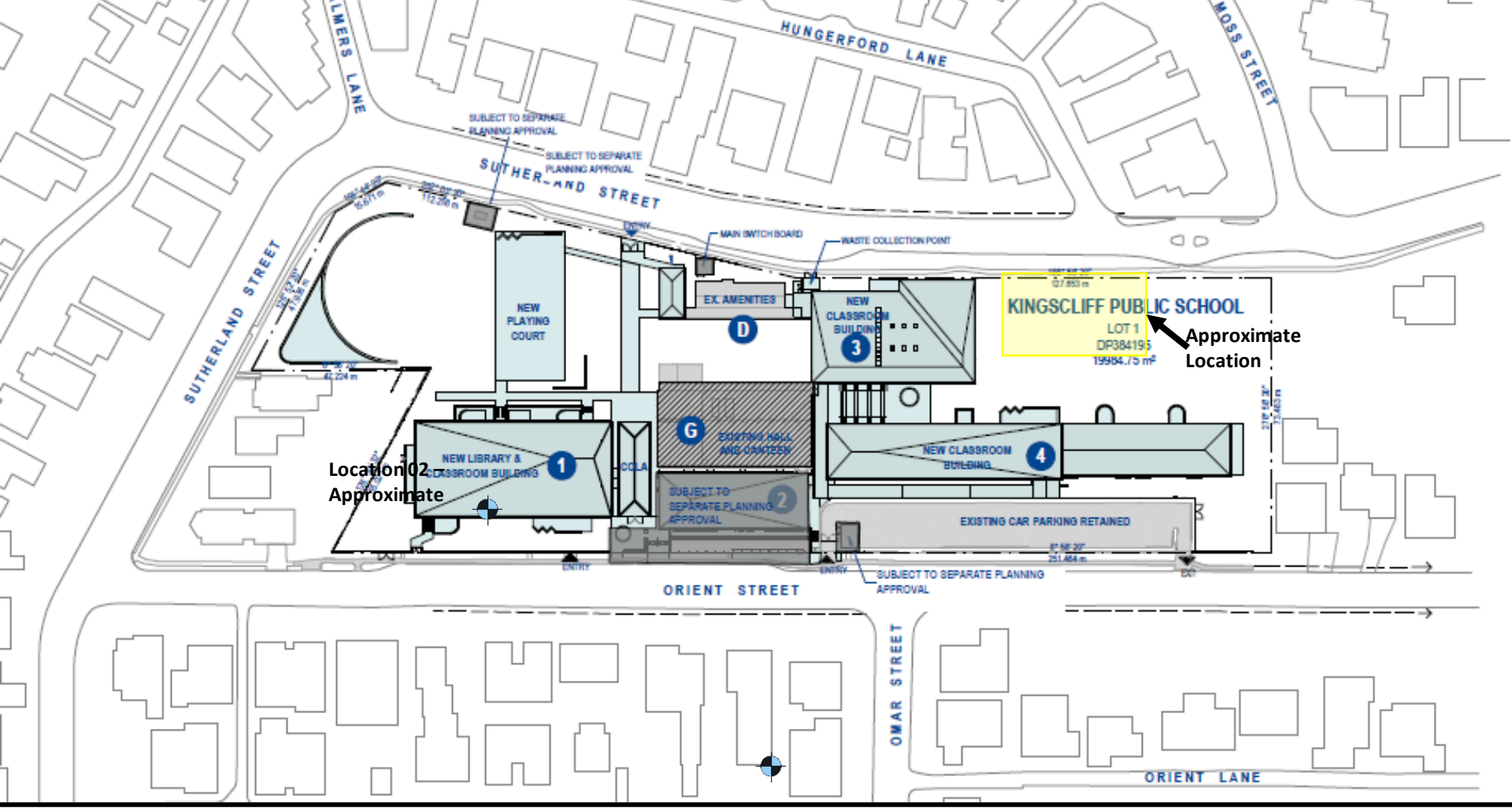
Image source: Sixmaps

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 3 – Receiving Environment & Discharge Location
Kingscliff Public School
12 Orient Street, Kingscliff, NSW 2487

Client: Richard Crookes Constructions
Project: Dewatering Management Plan (DMP)
Job No: 216187

Image source: Sixmaps



ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 3 – Water Treatment Plant Approximate Location (If Required)
Kingscliff Public School
12 Orient Street, Kingscliff, NSW 2487

Client: Richard Crookes Constructions
Project: Dewatering Management Plan (DMP)
Job No: 216187

Image source: Richard Crookes Constructions

10 Attachment 2 – BORE HOLE LOGS

YOUR LOGO

GROUNDWATER LOG MW01

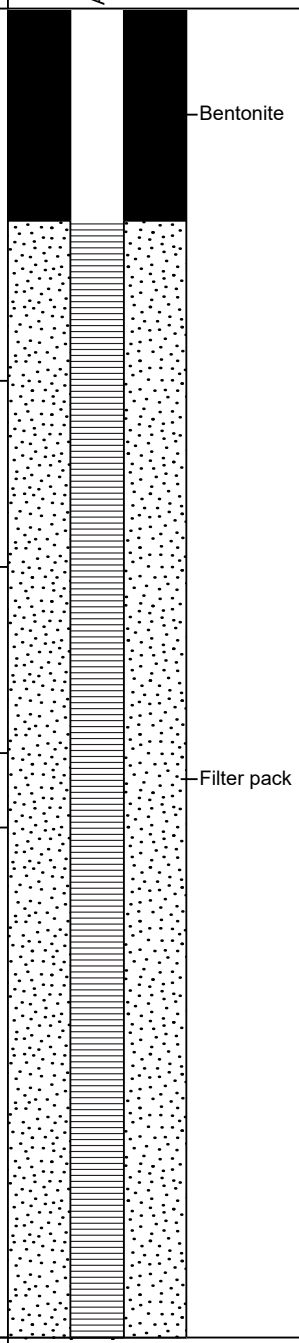
PROJECT NUMBER 216186	**DRILLING DATE** 30/09/2021 - 1/10/2021	**COORDINATES**
PROJECT NAME Kingscliff Public School	**TOTAL DEPTH** 3.57	**COORD SYS**
CLIENT Richard Crooks	**DIAMETER** 50 mm	**COMPLETION**
ADDRESS 12 Orient Street, Kingscliff NSW 2487	**CASING** uPVC	**SURFACE ELEVATION** 22.9 mAHD
	SCREEN uPVC Factory Slotted	**WELL TOC**
LICENCE NO.		

COMMENTS Buried under grass near playground, reference photos/metal detect to locate

LOGGED BY JS

CHECKED BY

Depth (m)	Graphic Log	Moisture	Material Description
0.2		D	CLAYEY SAND: brown, dry
1		M	CLAY: Orange/brown, becoming moist with depth
1.6		W	GRAVELLY CLAY: Dark grey, wet
2		W	WEATHERED SHALE: Grey, wet
2.2		D	SANDY CLAY: Orange/red, dry
3.6			Termination Depth at: 3.57



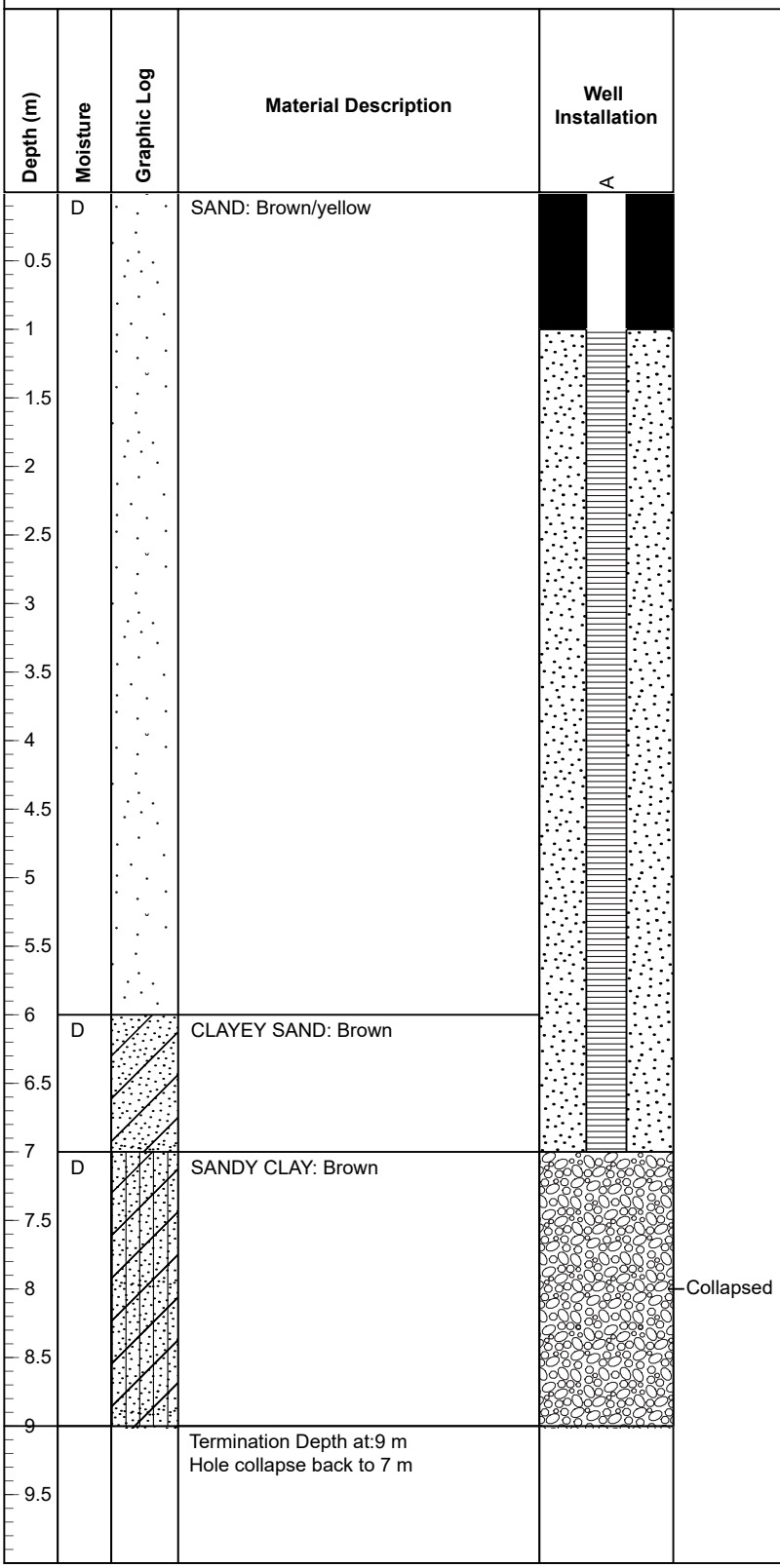
Well Diagram

YOUR LOGO

GROUNDWATER LOG MW02

PROJECT NUMBER 216186	**DRILLING COMPANY** ENV Solutions	**COORDINATES**
PROJECT NAME Kingscliff Public School	**DRILLER** J. Stainlay/B Pieterse	**COORD SYS**
CLIENT Richard Crooks	**DRILL RIG**	**SURFACE ELEVATION**
ADDRESS 12 Orient Street, Kingscliff NSW 2487	**DRILLING METHOD** Solid Flight Auger	**WELL TOC**
	TOTAL DEPTH 7	**LOGGED BY** JS
DRILLING DATE 30/09/2021 - 01/10/2021	**DIAMETER** 50 mm	**CHECKED BY**
LICENCE NO.		
COMPLETION	**CASING** uPVC	**SCREEN** uPVC Factory Slotted

COMMENTS Buried under grass near playground, reference photos/metal detect to locate



Disclaimer This bore log is intended for environmental not geotechnical purposes.

produced by ESlog.ESdat.net on 05 Oct 2021

11 Attachment 3 - RECEIVING ENVIRONMENT WATER QUALITY ANALYSIS

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 279814

Client Details

Client	ENV Solutions Pty Ltd
Attention	Stephen Bourne
Address	313 River St, Ballina, NSW, 2478

Sample Details

Your Reference	**216187 - Kingscliff Public School**
Number of Samples	1 Water
Date samples received	07/10/2021
Date completed instructions received	07/10/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	14/10/2021
Date of Issue	13/10/2021

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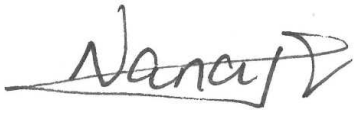
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Dragana Tomas, Senior Chemist
Hannah Nguyen, Metals Supervisor
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water		
Our Reference		279814-1
Your Reference	UNITS	Creek
Date Sampled		1/10/2021
Type of sample		Water
Date extracted	-	08/10/2021
Date analysed	-	11/10/2021
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	117
Surrogate toluene-d8	%	89
Surrogate 4-BFB	%	102

svTRH (C10-C40) in Water		
Our Reference		279814-1
Your Reference	UNITS	Creek
Date Sampled		1/10/2021
Type of sample		Water
Date extracted	-	08/10/2021
Date analysed	-	09/10/2021
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	<100
TRH C_{29} - C_{36}	µg/L	<100
Total +ve TRH (C10-C36)	µg/L	<50
TRH >C_{10} - C_{16}	µg/L	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Total +ve TRH (>C10-C40)	µg/L	<50
Surrogate o-Terphenyl	%	72

PAHs in Water		
Our Reference	UNITS	279814-1
Your Reference		Creek
Date Sampled		1/10/2021
Type of sample		Water
Date extracted	-	08/10/2021
Date analysed	-	08/10/2021
Naphthalene	µg/L	<1
Acenaphthylene	µg/L	<1
Acenaphthene	µg/L	<1
Fluorene	µg/L	<1
Phenanthrene	µg/L	<1
Anthracene	µg/L	<1
Fluoranthene	µg/L	<1
Pyrene	µg/L	<1
Benzo(a)anthracene	µg/L	<1
Chrysene	µg/L	<1
Benzo(b,j+k)fluoranthene	µg/L	<2
Benzo(a)pyrene	µg/L	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1
Dibenzo(a,h)anthracene	µg/L	<1
Benzo(g,h,i)perylene	µg/L	<1
Benzo(a)pyrene TEQ	µg/L	<5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	94

HM in water - total		
Our Reference		279814-1
Your Reference	UNITS	Creek
Date Sampled		1/10/2021
Type of sample		Water
Date prepared	-	08/10/2021
Date analysed	-	08/10/2021
Arsenic-Total	µg/L	3
Cadmium-Total	µg/L	<0.1
Chromium-Total	µg/L	2
Copper-Total	µg/L	<1
Lead-Total	µg/L	<1
Mercury-Total	µg/L	<0.05
Nickel-Total	µg/L	<1
Zinc-Total	µg/L	<1

Method ID	Methodology Summary
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date extracted	-			08/10/2021	[NT]	[NT]	[NT]	[NT]	08/10/2021	[NT]
Date analysed	-			11/10/2021	[NT]	[NT]	[NT]	[NT]	11/10/2021	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	105	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	105	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	106	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	82	[NT]	[NT]	[NT]	[NT]	82	[NT]
Surrogate toluene-d8	%		Org-023	111	[NT]	[NT]	[NT]	[NT]	85	[NT]
Surrogate 4-BFB	%		Org-023	95	[NT]	[NT]	[NT]	[NT]	108	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			08/10/2021	[NT]	[NT]	[NT]	[NT]	08/10/2021	[NT]
Date analysed	-			09/10/2021	[NT]	[NT]	[NT]	[NT]	09/10/2021	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	102	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	103	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	102	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	103	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
Surrogate o-Terphenyl	%		Org-020	80	[NT]	[NT]	[NT]	[NT]	71	[NT]

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			08/10/2021	[NT]	[NT]	[NT]	[NT]	08/10/2021	[NT]
Date analysed	-			08/10/2021	[NT]	[NT]	[NT]	[NT]	08/10/2021	[NT]
Naphthalene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Acenaphthylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	78	[NT]
Fluorene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Phenanthrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	78	[NT]
Pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Benzo(a)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	68	[NT]
Benzo(b,j+k)fluoranthene	µg/L	2	Org-022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	75	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	96	[NT]	[NT]	[NT]	[NT]	88	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date prepared	-			08/10/2021	[NT]	[NT]	[NT]	[NT]	08/10/2021	[NT]
Date analysed	-			08/10/2021	[NT]	[NT]	[NT]	[NT]	08/10/2021	[NT]
Arsenic-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Cadmium-Total	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Chromium-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Copper-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Lead-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Mercury-Total	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	100	[NT]
Nickel-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Zinc-Total	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

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Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 279814-A

Client Details

Client	ENV Solutions Pty Ltd
Attention	Joshua Stainlay
Address	313 River St, Ballina, NSW, 2478

Sample Details

Your Reference	**216187 - Kingscliff Public School**
Number of Samples	additional analysis
Date samples received	07/10/2021
Date completed instructions received	25/10/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	25/10/2021
Date of Issue	21/10/2021

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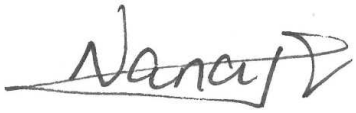
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics		
Our Reference		279814-A-1
Your Reference	UNITS	Creek
Date Sampled		1/10/2021
Type of sample		Water
Date prepared	-	20/10/2021
Date analysed	-	20/10/2021
pH	pH Units	8.0
Electrical Conductivity	µS/cm	47,000
Total Suspended Solids	mg/L	9

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			20/10/2021	[NT]	[NT]	[NT]	[NT]	20/10/2021	[NT]
Date analysed	-			20/10/2021	[NT]	[NT]	[NT]	[NT]	20/10/2021	[NT]
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	[NT]	[NT]	[NT]	[NT]	96	[NT]

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RPD	Relative Percent Difference
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12 Attachment 4 – MSDS ALUM

SAFETY DATA SHEET

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name:	**LIQUID ALUMINIUM CHLOROHYDRATE**
Other Names:	Aluminium Chloride Hydroxide, Aluminium Chlorohydrate, Aluminium Hydroxychloride, Aluminium Chlorohydroxide.
Manufacturers Product Code:	MegaPac 23™.
Recommended use of the chemical and restrictions on use:	Flocculent for the treatment of municipal water supplies, waste water and industrial effluents; removal of phosphate in sewage treatment; paper manufacture; chemical manufacture.
Supplier:	Omega Chemicals
ABN:	32 982 143 022 / A.C.N 005 032 744 T/A
Street Address:	55 FITZGERALD ROAD, LAVERTON NORTH VIC 3026
Telephone Number:	+61 3 8368 8000
Facsimile:	+61 3 8368 8020
Emergency Telephone:	1300 131 001 (24 Hours) Poisons Information Centre Australia: 131 126

2. HAZARD IDENTIFICATION

Hazard Classification:	Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS. Classified as hazardous according to Safe Work Australia; HAZARDOUS SUBSTANCE.
GHS Classification:	No available data
Signal Word (s):	No available data
Hazard Statement(s):	H320 Causes eye irritation H316 Causes mild skin irritation
Precautionary Statement(s):	
Prevention Statement(s):	P102 Keep out of reach of children P103 Read Label before use P104 Read Safety Data Sheet before use P234 Keep only in original container P264 Wash hand thoroughly after handling. P280 Wear protective gloves/protective clothing/eye protection/face protection

Response Statement(s): P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P337+P313 If eye irritation persists: Get medical advice/attention.
P302+P352 IF ON SKIN: Wash with plenty of soap and water.
P362 Take off contaminated clothing and wash before use.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P301+P330+P331 IF SWALLOWED: Rinse mouth. Do not induce vomiting.
P313 Get medical advice/attention
P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P262 Do not get in eyes, skin or on clothing.

Storage Statement(s): P405 Store locked up.
P406 Store in corrosive resistant/compatible container.
P403+P235 Store in well-ventilated place. Keep cool.

Disposal Statement(s): Dispose of contents/container according to jurisdictional regulations.

Poison Schedule (SUSMP): None Allocated

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients:	CAS Number	Proportion:	Hazard Codes
Aluminium Chlorohydrate	12042-91-0	50%	H320, H316
Water	7732-18-5	Balance to 100%	

4. FIRST - AID MEASURES

For advice, contact Poisons Information Centre on 131 126 or a Doctor.

Ingestion: Immediately rinse mouth with water. Give plenty of water to drink. **DO NOT** induce vomiting. If vomiting occurs give further water. Never give anything by mouth if victim is rapidly losing consciousness. **Seek immediate medical attention.**

Eyes: Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Remove clothing if contaminated and wash skin. **Seek medical assistance.**

Skin: Remove all contaminated clothing without delay. Wash skin gently and thoroughly with copious amounts of water. If irritation occurs, seek medical attention.

Inhalation: Remove the source of contamination or move the victim to fresh air; avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. Seek medical attention.

Advice to Doctor: Treat symptomatically.

Additional Information

Aggravated medical conditions caused by exposure: No information available on medical conditions which are aggravated by exposure to this product. Repeated skin exposure may lead to dermatitis. Repeated ingestion of this product may cause phosphate deficiency which can weaken bones.

5. FIRE FIGHTING MEASURES

Extinguishing Media: In case of fire, use an appropriate extinguishing media (water fog or if unavailable fine water spray, foam, carbon dioxide, dry chemical powder) that is the most suitable for surrounding fire conditions. Keep containers cool with water spray. If safe to do so, remove containers from path of fire. Suppress (knock-down) gases, vapours and mists with a water spray jet.

Hazchem Code: N/A.

Specific Hazards arising from the substance or mixture:

Hazards from Combustion: Product is non-flammable and stable under normal conditions of use and storage. Under fire conditions this product may emit toxic and/or irritating vapours and gases including hydrogen chloride gas.

Flammability Conditions: Product is a non-flammable liquid.

Special Protective Precautions and Equipment for Fire Fighters: Fire fighters should wear a self-contained breathing apparatus and full protective clothing along with protective equipment. Prevent fire extinguishing water from contaminating surface water or the ground water system.

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures/Protective Equipment/Personal Precautions: Evacuate all unnecessary personnel. Work upwind. Increase ventilation. Use water spray to disperse vapours. Personnel involved in the clean-up should wear full protective clothing; self-contained breathing apparatus may be needed for prolonged periods of exposure. Avoid walking through spilled product as it may be slippery. Cover drains. Collect, bind and pump off spills.

Environmental Precautions:	Do not allow product to enter drains, sewers, waterways or soil. If contamination of drains has occurred, advise the local emergency services.
Methods and Materials for Containment and Clean Up:	Contain spilled product using absorbent (soil or sand). Prevent run off into drains, sewers waterways or soil. Collect and seal in properly labelled drums ready for appropriate disposal. Dilute remaining product with water, then carefully neutralize with lime. For large spills notify local emergency services.

7. HANDLING AND STORAGE

Precautions for Safe Handling:	Irritant liquid. Ensure an eye bath and safety shower are available and ready for use. Use only in a well-ventilated area. Prevent the build-up of mists in the work atmosphere. Avoid inhalation of mists, and skin or eye contact. Wear appropriate protective equipment to prevent inhalation, skin and eye contact when mixing and using. Ensure a high level of personal hygiene is maintained when using this product, that is, always wash hands before eating, drinking, smoking or using the toilet. Keep containers sealed when not in use.
Container Type:	Packaging must comply with requirements of Hazardous Substances (Packaging) Regulations 2001. Store in original packaging as approved by manufacturer. Store and transport in corrosion resistant containers such as stainless steel, rubber lined steel, PVC, fibreglass or polyethylene.
Conditions for Safe Storage, including any Incompatibles:	Store in a cool, dry, well-ventilated area out of direct sunlight. Do not store with incompatible products such as chlorite, hypochlorite, sulphite, oxidizing agents and cyanides; Avoid contact with unalloyed steels, galvanized or aluminium surfaces. Do not store with any foodstuffs.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters:

National Exposure Standards:	Aluminium Chlorohydrate: No specific exposure standard. Aluminium soluble salts (as Aluminium): AU OEL: 2 mg/m^3.
Biological Limit Values:	No data available

Appropriate Engineering Controls:	Select suitable materials for the construction of storage tanks, containers, pipe valves and fittings. Ensure adequate ventilation. Natural ventilation should be adequate under normal use conditions. Keep containers closed when not in use in a well-ventilated area.

Individual Protection Measures, such as Personal Protective Equipment (PPE):	**Respirator:**	If engineering controls are not effective in controlling airborne exposure then an approved respirator with a replaceable mist filter should be used.
	Eyes:	Chemical splash goggles or safety glasses with side shields and a full-face shield as appropriate should be used.
	Hands:	Wear elbow-length gloves of impervious material, PVC or rubber should be suitable.
	Clothing:	Protective overalls, splash apron and rubber boots.

After using this product always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Core Information

Appearance:	Colourless to slightly cloudy liquid.
Formula:	$Al_2(OH)_5Cl$.
Odour:	Odourless.
pH:	2.5 – 3.5.
Vapour Pressure:	No data available.
Vapour Density:	No data available.
Boiling Point:	>100°C.
Freezing Point:	ca. -5°C.
Solubility (in Water):	Miscible.
Specific Gravity:	1.33 – 1.34 (at 20°C).
Flash Point:	N/A.
Flammability Limits (as Percent Volume in Air):	**Lower Explosive Limit** N/A. **Upper Explosive Limit** N/A.
Ignition Temperature:	No data available.

Additional Information

Specific Heat Value:	No data available.
Particle Size:	No data available.
Volatile Organic Compounds Content (VOC):	No data available.
Viscosity:	No data available.
Percent Volatile:	No data available.
Octanol/Water Partition Coefficient:	No data available.
Saturated Vapour Concentration:	No data available.
Additional Characteristics:	Insoluble in alcohol.
Flame Propagation/Burning Rate of Solid Materials:	No data available.
Properties that may Initiate or Contribute to the Intensity of a Fire:	No data available.
Potential for Dust Explosion:	N/A.
Reactions that Release Flammable Gases or Vapours:	Thermal decomposition will produce hydrogen chloride gas.
Fast or Intensely Burning Characteristics:	No data available.
Non-Flammables that Could Contribute Unusual Hazards to a Fire:	No data available.
Release of Invisible Flammable Vapours and Gases:	No data available.
Decomposition Temperature:	No data available.
Evaporation Rate:	No data available.

10. STABILITY AND REACTIVITY

Reactivity:	
Chemical Stability:	Stable under normal conditions of storage and handling. This product can hydrolyse and form a precipitate of aluminium hydroxide in very dilute aqueous solutions. The solubility is dependent on the pH.

Possibility of hazardous Reactions:	Strong aqueous solutions of the product will readily react with sodium hydroxide and other alkali to form a thick slippery paste or gel. When involved in a fire, the product will undergo thermal decomposition to produce hydrogen chloride gas.
Conditions to Avoid:	Heat-sensitive, avoid exposure to extreme heat and high temperatures. Avoid sources of ignition.
Incompatible Materials:	Avoid contact with unalloyed steels, galvanized or aluminium surfaces. Do not expose to chlorite, hypochlorite, sulphite, sodium hydroxide, alkalis, oxidizing agents and cyanides. Keep away from all foodstuffs.
Hazardous Decomposition Products:	Hydrogen chloride gas.

11. TOXICOLOGICAL INFORMATION

Toxicity Data

LD50: 13000 mg/kg (rat, oral).

Acute (short term)

Ingestion:	May be harmful if swallowed. May cause abdominal pain, nausea, vomiting, bleeding stomach, incoordination, muscle spasm and kidney damage.
Eye:	Can cause moderate to severe irritation and inflammation to the eyes.
Skin:	Can cause irritation and stinging to open cuts and wounds.
Inhalation:	This product has a very low vapour pressure at ambient temperature and therefore cannot normally be inhaled. Inhalation of mists from the product can cause sore throat, coughing and irritation of nose. High concentration of mists may cause congestion and restriction of airways.

Chronic (long term)

Skin:	Repeated or prolonged exposure may cause dermatitis.
Ingestion:	Repeated ingestion of this product may cause phosphate deficiency which can weaken bones.

12. ECOLOGICAL INFORMATION

Ecotoxicity: No data available.

Persistence and Degradability: No data available.

Mobility: No data available.

Additional Information

Environmental Fate (Exposure): No data available.

Bio accumulative Potential: No data available.

Other Adverse Effects: Discharge into the environment must be avoided. Avoid contaminating waterways, drains and sewers. This product is an inorganic compound. A metal hydroxide precipitate is formed during hydrolyses in the pH range 5 to 7; due to this reaction the pH of the water decreases. If phosphates are present then metal phosphate complexes may form.

13. DISPOSAL CONSIDERATIONS

Disposal Methods: Dispose of in accordance with all local, state and federal regulations. Refer to appropriate State Waste Disposal Authority. Observe local regulations. After dilution and careful neutralisation, approved liquid waste land fill site may be suitable.

Special Precautions for Landfill or Incineration: No data available.

14. TRANSPORT INFORMATION

UN Number: None allocated.

UN Proper Shipping Name: Aluminium Chloride Hydroxide.

Dangerous Goods Class: None allocated.

Subsidiary Risk: None allocated.

Packaging Group: None allocated.

Special Precautions for User: Irritant.

Hazchem Code: N/A.

APPROVED FOR AIR CARGO by IATA.

15. REGULATORY INFORMATION

Poisons Schedule: N/A.

EPG: N/A.

AICS Name: Aluminium Chloride Hydroxide.

Additional information: No data available.

16. OTHER INFORMATION

Revision Details

Reason for Revision:

Version 1	5 year review. Updated to a new format. Additional information added.
Version 2	Alignment to GHS requirements.
Version 3	Reclassified as Hazardous.

Literature References

Chemical Rubber Company:	Handbook of Chemistry and Physics, 85th Edition.
Safe Work Australia:	Hazardous Chemicals Information System (HCIS) Exposure Standards and GHS Classifications Data-Base, 25 June 2016.
National Transport Commission:	Australian Code for the Transport of Dangerous Goods by Road and Rail, Volume 7.

Abbreviations

CAS Number:	Chemical Abstract Service Registry Number.
GHS	Globally Harmonized System of Classification and Labelling of Chemicals.
EPG:	Emergency Procedure Guide.
LD50:	Lethal Dose 50%: The lowest concentration at which approximately 50% of test animals will die when given the specified dose by mouth.
ADG Code:	Australian Code for the Transport of Dangerous Goods by Road and Rail, Volume 7.
AICS Name:	Australian Inventory of Chemical Substances Name.
OEL:	Occupational Exposure Level.
N/A:	Not Applicable.

Disclaimer

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The information contained herein is based on data available to Omega Chemicals from both our own technical sources and recognised published references and is believed to be both accurate and reliable. Omega Chemicals however provides no warranties, either expressed or implied, and assumes no responsibility for the accuracy or completeness of this information.

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DOCUMENT END

13 Attachment 5 – MSDS CAUSTIC

SAFETY DATA SHEET

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: **LIQUID CAUSTIC SODA 46 - 50%.**

Other Names: Sodium hydroxide - liquid (46 - 50%), Soda lye solution (46 - 50%), Caustic soda solution (46 - 50%), Sodium hydroxide solution (46 - 50%), Liquid caustic soda (46 - 50%).

Manufacturers Product Code: Liquid Caustic Soda 46 - 50%.

Recommended use of the chemical and restrictions on use: Neutralising acids; making sodium salts (e.g. removing sulphuric and organic acids during petroleum refining); treating cellulose for production of viscose rayon and cellophane; reclaiming rubber by dissolving out the fabric; dissolving casein for plastics production; hydrolysing fats to manufacture soaps; precipitating alkaloids (bases) and most metals (hydroxides) from aqueous solutions of their salts; laboratory reagent; alkalizer in pharmaceutical production. Veterinary therapeutic category – dehorning of cows.

Supplier: Omega Chemicals
ABN: 32 982 143 022 / A.C.N 005 032 744 T/A
Address: 55 Fitzgerald Road, Laverton North, Victoria 3026.
Telephone Number: +61 3 8368 8000
Facsimile: +61 3 8368 8020

Emergency Telephone: 1300 131 001 (24 Hours)
Poisons Information Centre Australia: 131 126

2. HAZARD IDENTIFICATION

Hazard Classification: Classified as Hazardous according to the criteria of Safe Work Australia.

Classified as Dangerous according to the ADG Code.

GHS Classification: Skin corrosion/irritation – Category 1A
Eye damage/irritation – Category 1
Corrosive to metals – Category 1

Signal Word (s): DANGER

Hazard Statement(s): H314 Causes severe skin burns and eye damage.
H290 Maybe corrosive to metals
H302 Harmful if swallowed

Precautionary Statement(s):

Prevention Statement(s):
P102 Keep out of reach of children.
P103 Read label before use.
P234 Keep only in original container.
P260 Do not breathe fume/vapours/spray.
P264 Wash hand thoroughly after handling
P270 Do not eat, drink smoke when using this product.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

Response Statement(s):
P301+P330+P331 IF SWALLOWED: Rinse mouth. Do not induce vomiting.
P303+P361+P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P363 Wash contaminated clothing before reuse.
P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P310 Immediately call a POISON CENTER or doctor/physician.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P321 Specific treatment (see First Aid Measures on Safety Data Sheet).
P390 Absorb spillage to prevent material damage.

Storage Statement(s):
P405 Store locked up.
P406 Store in corrosive resistant container with resistant inner liner.

Disposal Statement(s):
P501 Dispose of contents/container in accordance with local/regional regulations.

Poisons Schedule (SUSMP): **6: POISON**

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients:	CAS Number	Proportion	Hazard Codes
Sodium Hydroxide	1310-73-2	46 - 50%	H314, H290, H302, H318
Water	7732-18-5	Balance to 100%	

4. FIRST - AID MEASURES

For advice, contact Poisons Information Centre on 131 126 or a Doctor.

Ingestion: Immediately rinse mouth with water. Give water to drink. DO NOT induce vomiting. If vomiting occurs, place victim's face downwards, head lower than hips to prevent vomit entering lungs. **Seek immediate medical attention.**

Eyes: Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Remove clothing if contaminated and wash skin. Risk of blindness. **Urgently seek medical assistance. Transport to hospital or medical centre.**

Skin: Remove all contaminated clothing without delay. Immediately wash contaminated skin gently and thoroughly with copious amounts of water or

swab with polyethylene glycol 400. For gross contamination, immediately drench with water and remove clothing. If swelling, redness, blistering or irritation occurs immediate seek medical advice. For skin burns, immediately flood burnt area with plenty of water and cover with a clean, dry dressing. Seek medical advice. Ensure contaminated clothing is washed before re-use or discarded.

Inhalation: Remove the source of contamination or move the victim to fresh air; avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. **For all but the most minor symptoms arrange for patient to be seen by a doctor as soon as possible, either on site or at the nearest hospital.**

Advice to Doctor: Treat symptomatically and for exposure to strongly alkaline substances and corrosive material. **Can cause corneal burns.**

5. FIRE FIGHTING MEASURES

Extinguishing Media: Not combustible, however reaction with metals will produce flammable hydrogen gas, which will burn if ignited. Use water fog (or if unavailable then fine water spray), foam or dry agent (carbon dioxide or dry chemical powder).

Hazchem Code: 2R

Specific Hazards arising from the substance or mixture:

Hazards from Combustion: Product is non-flammable and stable under normal conditions of use and storage. Reacts violently with acids. Reacts with ammonium salts liberating ammonia gas. Corrosive to aluminium, zinc and tin liberating flammable hydrogen gas. Absorbs carbon dioxide from air. Reacts exothermically (produces heat) on dilution with water.

Flammability Conditions: Product is a non-flammable liquid; however, flammable hydrogen gas may be formed in contact with aluminium, zinc and tin.

Special Protective Precautions and Equipment for Fire Fighters: Fire fighters should wear a self-contained breathing apparatus operated in positive pressure mode and full protective clothing along with protective equipment. Water spray may be used to keep fire exposed containers cool. Prevent fire extinguishing water from contaminating surface water or the ground water system.

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures/Protective Equipment/Personal Precautions: Evacuate all unnecessary personnel. Work upwind. Increase ventilation. Personnel involved in the clean-up should wear full protective clothing including respiratory protection. Stop leak if safe to do so. Avoid walking through spilled product as it will be slippery. Cover drains. Collect, bind and pump off spills.

Environmental Precautions:	Do not allow product to enter drains, waterways, sewers or soil. If contamination of drains has occurred, advise the local emergency services.
Methods and Materials for Containment and Clean Up:	Slippery when spilt. Avoid accidents, clean up immediately. Wear protective equipment to prevent skin and eye contact and breathing in vapours. Self-contained breathing apparatus may be needed for prolonged periods of exposure. Work up wind or increase ventilation. Contain spilled product using absorbent (sand or kitty litter). Prevent run off into drains, waterways, sewers or soil. Collect and seal in properly labelled containers or drums ready for appropriate disposal. Caution - heat may be evolved on contact with water. For large spills notify local emergency services.

7. HANDLING AND STORAGE

Precautions for Safe Handling:	Ensure an eye bath and safety shower are available and ready for use. Avoid skin and eye contact and breathing in vapour, mists and aerosols. Wear appropriate protective equipment to prevent inhalation, skin and eye contact. Ensure a high level of personal hygiene is maintained when using this product, that is, always wash hands before eating, drinking, smoking or using the toilet.
Container Type:	Packaging must comply with requirements of Hazardous Substances (Packaging) Regulations 2001. Store in original packaging as approved by manufacturer. Do not store in aluminium or galvanised containers or use die-cast zinc or aluminium bungs. Plastic bungs should be used.
Conditions for Safe Storage, including any Incompatibles:	Store in a cool, dry, well-ventilated area out of direct sunlight. Do not store with incompatible products such as acids and ammonium salts. Keep containers securely sealed at all times and protected against physical damage. Reacts exothermically (produces heat) with water. Heat evolved may cause boiling and spattering. Do not store with any foodstuffs At temperatures greater than 40°C, tanks must be stress relieved. Check regularly for spills and leaks. Over a period of time, sludge may develop in the base of storage tanks. The sludge may contain mercury in a finely divided form, spread throughout the particulate matter in the sludge.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters:

National Exposure Standards:	Sodium hydroxide: AU OEL Peak Limitation: 2 mg/m³.
Biological Limit Values:	No data available.

Appropriate Engineering Controls:	Ensure ventilation is adequate to maintain air concentrations below exposure standards. Use with local exhaust ventilation or while wearing mist respirator. Keep containers closed when not in use in a well-ventilated area.	
Individual Protection Measures, such as Personal Protective Equipment (PPE):	**Respirator:**	If there is a risk of inhalation of mists, wear an approved canister-type respirator suitable for particulates and alkaline gases.
	Eyes:	Splash-proof chemical goggles or full-face shield.
	Hands:	Elbow-length impervious nitrile gloves.
	Clothing:	Protective overalls, splash apron and rubber boots. Launder frequently. Change clothing if required.

After using this product always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Core Information

Appearance:	Colourless to slightly coloured clear liquid.
Formula:	NaOH.
Molecular Weight:	40.00.
Odour:	Odourless.
pH:	>14.
Vapour Pressure:	No data available.
Vapour Density:	>1 (where air = 1).
Boiling Point:	ca. 140°C.
Freezing Point:	ca. 12°C.
Solubility (in Water):	100% g/L (at 25°C).
Specific Gravity:	1.48 – 1.52 (at 20°C).
Flash Point:	N/A.
Flammability Limits (as Percent Volume in Air):	**Lower Explosive Limit** N/A. **Upper Explosive Limit** N/A.
Ignition Temperature:	No data available.

Additional Information

Specific Heat Value:	No data available.
Particle Size:	No data available.
Volatile Organic Compounds Content (VOC):	No data available.
Viscosity:	ca. 180 centipoise (at 25°C).
Percent Volatile:	No data available.
Octanol/Water Partition Coefficient:	No data available.
Saturated Vapour Concentration:	No data available.
Additional Characteristics:	No data available.
Flame Propagation/Burning Rate of Solid Materials:	No data available.
Properties that may Initiate or Contribute to the Intensity of a Fire:	Reacts violently with acids. Reacts with ammonium salts liberating ammonia gas. Corrosive to aluminium, zinc and tin liberating flammable hydrogen gas.
Potential for Dust Explosion:	No data available.
Reactions that Release Flammable Gases or Vapours:	Corrosive to aluminium, zinc and tin liberating flammable hydrogen gas. Reacts with ammonium salts liberating ammonia gas.
Fast or Intensely Burning Characteristics:	No data available.
Non-Flammables that Could Contribute Unusual Hazards to a Fire:	No data available.
Release of Invisible Flammable Vapours and Gases:	No data available.
Decomposition Temperature:	No data available.
Evaporation Rate:	<1.0 (where n-butyl acetate = 1).

10. STABILITY AND REACTIVITY

Reactivity:	Reacts violently with acids. Reacts exothermically on dilution with water.
Chemical Stability:	Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Possibility of hazardous Reactions:	Reacts violently with acids. Reacts exothermically (produces heat) on dilution with water. Corrosive to aluminium, zinc, lead and tin liberating flammable hydrogen gas. Reacts with ammonium salts liberating ammonia gas. Results in explosion when heated in the presence of zirconium. Reacts vigorously with chloroform/methanol mixtures.
Conditions to Avoid:	Contact with aluminium, zinc, tin, lead, acids, ammonium salts. Reacts exothermically (produces heat) on dilution with water.
Incompatible Materials:	Reacts violently with acids. Reacts exothermically (produces heat) on dilution with water. Corrosive to aluminium, zinc, lead and tin liberating flammable hydrogen gas. Keep away from all foodstuffs.
Hazardous Decomposition Products:	No data available.

11. TOXICOLOGICAL INFORMATION

Toxicity Data

LD50:	40 mg/kg (mouse, intrapertioneal, solid).
LD50:	500 mg/kg (rabbit, oral, 10% solution).
LD50:	500 mg/kg (mouse, 10% solution).
Skin (severe irritation):	500 mg/24 hours (rabbit, solid).
Eyes (severe irritation):	1 mg/30 seconds rinse (rabbit, solid).

Concentrated solutions are irritant and corrosive to all tissues with which they come into contact; producing burns, deep ulceration and gelatinous necrotic areas at the site of contact; it will cause severe burns to the eyes and skin. Solutions as low as 5% (w/v) can damage eyes severely. Ingestion of this product will cause severe internal irritation and damage. Inhalation of the mist will cause irritation and damage to the respiratory tract. Low systemic toxicity.

Acute (short term)

Ingestion: May be harmful if swallowed. Ingestion of this product may cause nausea, vomiting, diarrhoea, abdominal pain and chemical burns to the mouth, throat and stomach, perforation of the gastrointestinal tract, cardiovascular collapse and coma.

Eye: Causes serious eye damage. Corrosive to eyes, contact can cause corneal burns. **Can result in permanent injury. Risk of blindness.**

Skin: Corrosive to skin. May cause skin burns. Contact with skin will result in severe irritation. Repeated or prolonged skin contact may lead to irritant contact dermatitis.

Inhalation: Inhalation of mists will result in severe respiratory irritation and possible harmful corrosive effects including lesions of the nasal septum, pulmonary oedema, pneumonitis and emphysema. Inhalation of mists at elevated temperatures will increase these symptoms.

Chronic (long term)

Ingestion: Repeated or prolonged exposure can cause erosion of teeth and ulceration of the nose and gums.

Skin: Repeated or prolonged exposure may lead to dermatitis in some individuals.

Inhalation: Repeated or prolonged exposure can lead to respiratory disorders, or it may aggravate existing respiratory disorders such as emphysema and chronic bronchitis.

12. ECOLOGICAL INFORMATION

Ecotoxicity: Harmful effect due to pH shift.

Persistence and Degradability: No data available.

Mobility: No data available.

Additional Information

Environmental Fate (Exposure): No data available.

Bio accumulative Potential: No data available.

Other Adverse Effects: Discharge into the environment must be avoided. Avoid contaminating waterways.

Aquatic toxicity: 125 ppm/96 hours (mosquito fish, TL_m, fresh water).
180 ppm/23 hours (oysters, lethal, salt water).

13. DISPOSAL CONSIDERATIONS

Disposal Methods: Dispose of in accordance with all local, state and federal regulations. Refer to appropriate State Waste Disposal Authority. Observe local regulations. After dilution and careful neutralisation, approved liquid waste land fill site may be suitable. Empty containers must be decontaminated.

Special Precautions for Landfill or Incineration: No data available.

14. TRANSPORT INFORMATION

UN Number: 1824.

UN Proper Shipping Name: Sodium Hydroxide Solution.

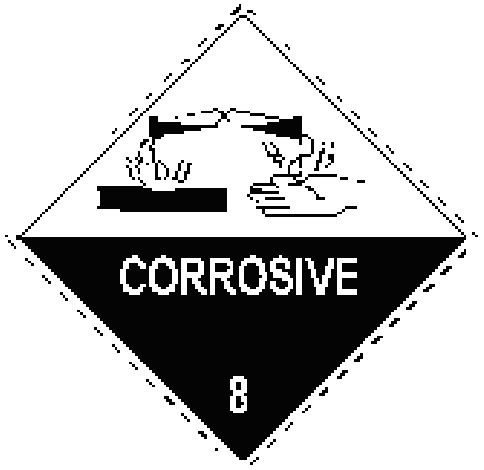
Dangerous Goods Class: 8.

Subsidiary Risk: None allocated.

Packaging Group: II.

Special Precautions for User: CORROSIVE.

Hazchem Code: 2R.



Incompatible Classes

This product is incompatible in a placard load with any of the following:

- Class 1 – Explosives.
- Class 4.3 - Dangerous when Wet Substances.
- Class 5.1 - Oxidising Agents.
- Class 5.2 - Organic Peroxides.
- Class 7 - Radioactive Substances.
- All food and food packaging in any quantity.

15. REGULATORY INFORMATION

Poisons Schedule: 6.

EPG: 37.

AICS Name: Sodium Hydroxide.

Additional information: No data available.

16. OTHER INFORMATION

Revision Details

Reason for Revision:

Version 1	5 year review. Updated to a new format. Additional information added.
Version 2	Alignment to GHS requirements.

Literature References

Chemical Rubber Company:	Handbook of Chemistry and Physics, 85th Edition.
Merck:	The Merck Index, 14th Edition.
Weiss, G.:	Hazardous Chemicals Data Book, 2nd Edition.
Luxon, S. G.:	Hazards in the Chemical Laboratory, 5th Edition.
Sax, N. Irving:	Dangerous Properties of Industrial Materials, 3rd Edition.
Safe Work Australia:	Hazardous Chemicals Information System (HCIS) Exposure Standards and GHS Classifications Data-Base, 25 June 2016.
National Transport Commission:	Australian Code for the Transport of Dangerous Goods by Road and Rail, Volume 7.

Abbreviations

CAS Number:	Chemical Abstract Service Registry Number.
GHS:	Globally Harmonized System of Classification and Labelling of Chemicals.
EPG:	Emergency Procedure Guide.
LD50:	Lethal Dose 50%: The lowest concentration at which approximately 50% of test animals will die when given the specified dose by mouth.
TL_m:	Medium Tolerance Limit, approximately 50% of fish will show abnormal behaviour including death under the given concentration and time.
ADG:	Australian Code for the Transport of Dangerous Goods by Road and Rail, Volume 7.
AICS Name:	Australian Inventory of Chemical Substances Name.
OEL:	Occupational Exposure Level.
N/A:	Not Applicable.

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DOCUMENT END

Appendix E - Consultant Qualification

Ben Pieterse

Environmental Scientist

Qualifications

Bachelor of Environmental Science. Southern Cross University, 2019.

National Acid Sulfate Soils Guidance - Identification and Assessment Course. Southern Cross University, 2021.

Conduct Backhoe/Loader Operations. Lawrence Davis Industry Training, 2021.

Asbestos Awareness Training. Alert Force, 2020.

Construction Induction. Workplace Health and Safety QLD, 2019.

Certificate II Information Technology. TAFE NSW, 2008

Key areas of Experience:

- Desktop and field- based site assessment
- Technical report writing
- Contaminated land investigation and remediation
- Resource recovery and waste management
- Project management
- Stakeholder engagement
- Environmental management
- On-site wastewater assessment

Career Summary

A multi-skilled and accomplished Environmental Scientist, Ben is approaching three years of environmental consulting experience in the northern NSW region. A member of the Australasian Land and Groundwater Association (ALGA) Association of NSW – Ben's expertise is crucial in identifying environmental issues and delivering the correct solution.

Ben's recent experience includes; Leading the preparation of Construction Environmental Management Plans, Management of works contracts and subcontractor engagement, Routinely applying resource recovery options for materials generated by local Councils and private enterprise, leading the successful assessment and of a local Council site, routinely applying resource recovery options for materials generated by local Councils and private enterprise.

Environmental Project Highlight

2021 - Detailed site investigation and acid sulfate soil assessment associated with the development of a constructed wetland at Byron Bay, NSW.
Client: Byron Shire Council

- Consultation with stakeholders to establish target project outcomes.
- Develop project budget, contract procurement and engagement and coordination of subcontractors.
- Lead site investigation program (borehole drilling and soil sampling program).
- Preparation of Detailed Site Investigation Report and Acid Sulfate Soils Management Plan.
- Ongoing consultation with client on project outcomes and requirements for management of excavation spoil.

JENNY HELLYER

Environmental Scientist |

Resource Recovery Manager

Qualifications & Training

Bachelor of Science (Environmental Health)
Griffith University

Graduate Certificate Waste Management (Academic Excellence)

EHA – Noise Management Course

EHA- Dangerous Goods Management Course

Asbestos Assessor Course

Asbestos Awareness Course

Contract Supervisors and Inspectors Course

Professional overview

Jenny is an Environmental Specialist with 19 years' experience in the fields of environmental management including noise, erosion and sediment control, air quality, waste management and project management. She has an enthusiastic and methodical approach in providing key outcomes to the project and technical advice to stakeholders.

Key areas of expertise

- Environmental Management
- Erosion and Sediment Control
- Waste Management
- Beneficial Reuse
- Project Management
- Environmental Monitoring
- Data Analysis
- Surface Water Quality
- Noise Management

Recent experience

Environmental Management – Management of environmental investigations including noise, groundwater, surface water and air quality. Provision of environmental advice to stakeholders in order to meet environmental compliance. Clients include Local Government (Ballina, Tweed and Gold Coast City Councils)

Beneficial Reuse – Management of resource recovery projects including the beneficial reuse of concrete washout waste. Provision of a high level of project management including coordinating transportation operations, field sampling, and invoicing. Clients include Holcim Australia (NSW), Boral, Bens Bobcats, Richmond Sand and Gravel, Wearx.

Waste Management – Coordination of waste management facilities and waste collection services. Provision of expert technical advice and development of waste management practices for Local Government (Ballina, Tweed and Gold Coast City Councils)

Project Management – Provision of technical advice to all stakeholders to ensure compliance with the regulatory framework specific to the project. Projects managed include numerous local government areas and civil construction sites.

Professional History

- 2018 – Present: ENV Solutions (Environmental Scientist)
- 2015 – 2018: Ballina Shire Council (Waste Management Coordinator)
- 2012 – 2015: Ballina Shire Council (Environmental Health Officer - Contract)
- 2010 – 2012: Gold Coast City Council (Technical Officer)
- 2008 – 2010: Gold Coast City Council (Waste Strategy Officer)
- 2003-2008: Gold Coast City Council (Environmental Health Officer)

Contact

0415558975

Connect with Jenny on LinkedIn

References available upon request