BESIX Watpac

Soil and Water Management Plan

N230

New Shellharbour

21 January 2025

Revision history

Version	Date	Revision Description	Release Sign off
00	23/09/24	First Issue	Ilse Luypaert
01	21/01/25	Deleted appendix/added reference to ERSED plant	James O'Brien

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1 Introduction

1.1 Context

Rubicon Enviro Pty Ltd (Rubicon) has been engaged by Besix Watpac (BW) to assist with the development of a Soil and Water Management Plan (SWMP) to support the construction of the New Shellharbour Hospital in Shellharbour.

This SWMP has been prepared to detail strategies and measures to assist with the management of soil and water impacts for the duration of earthworks, service installations and construction works at the Project site. This SWMP is required to support the CEMP and has been prepared to address the requirements of a Development Application - State Significant Development (SSD) 57064458.

1.2 Project Background

The New Shellharbour Hospital (NSH) will deliver contemporary and expanded hospital services and integrated health facilities for the Illawarra Shoalhaven Local Health District. The NSW Government has committed to develop Shellharbour Hospital, a new health hub for the entire Illawarra region. The site is located at 86 Dunmore Road, Dunmore NSW, 2529 near the intersection of the M1 and B65.

1.3 Project Overview

The new hospital will provide the majority of emergency, critical care, acute, subacute, and non-admitted services locally, reducing the need to transfer patients to Wollongong and Sydney.

In addition to the construction of external areas as well as multideck carpark. the new building scope includes a new 6-level building of approximately 40,000m2 GFA, with rooftop plant accommodating the following:

- Level 00 Perioperative Service, Mental Health Unit, SSD, Back of House (BOH), Loading Dock, Plant and Food Services.
- Level 01 Acute Mental Health IPU, Emergency Department, Medical Imaging and Pathology.
- Level 02 Whole of Hospital Workspace Hub, Ambulatory Care, Retail and Pharmacy.
- Level 03 Surgical IPU, ICU/Cardiology IPU, Ambulatory Care and Renal.
- Level 04 In-Patient Unit (IPU), Rehabilitation/GEM Unit and Plant
- Level 05 Medical/Surgical IPU and Acute/GAP IPU
- Level 06 Plant and Equipment

The works include augmentation to Dunmore Road, including new roundabout to facilitate access to the facility for Ambulance, Patient Transport, service vehicles, staff and patient vehicles.

1.4 Environmental management systems overview

The SWMP forms part of BW's CEMP and the environmental management framework for the project.

The Primary Erosion and Sediment Control Plan (ESCP) has been prepared and is attached to this SWMP as Appendix B. The ESCP describes the intentions and fundamental principles for erosion and sediment control management for the duration of the entire project.

An Progressive Erosion and Sediment Control Plans (PESCPs) has also been prepared and is attached to ESCP as *Appendix E*. The PESCP has been developed by Rubicon (Certified Professional in Erosion

& Sediment Control – CPESC) in consultation with the BW construction & environmental personnel engaged on the Project. BW will also seek the assistance of Rubicon to review and oversee revisions of the PESCPs as required by the progression of work stages.

The PESCP's will be developed prior to any construction works commencing in the work zone and will be modified as required when:

- Site conditions evolve.
- Flow paths change.
- Construction activities that affect the characteristics of ground conditions change.

Management measures identified in these plans will be incorporated into site or activity specific Environmental Work Method Statements (EWMS) where required. EWMS will be developed and signed off by environment and management representatives prior to associated works.

Rubicon will be engaged throughout construction to provide advice on erosion and sediment control design, installation, maintenance, and the development of PESCPs.

Used together, the CEMP, SWMP strategies, ESCP procedures, PESCP's and EWMS form management guides that clearly identify required environmental management actions for reference by the BW's personnel and sub-contractors.

The BW document review and control processes for this Plan are described in the Project CEMP.

2 Purpose & Objectives

2.1 Purpose

The purpose of the soil and water management procedure is to minimise potential adverse soil and water environmental impacts occurring during BW's construction activities. The document has been developed by BW professionals, in consultation with a Certified Professional in Erosion & Sediment Control (CPESC). The curriculum vitae of the engaged CPESC is attached as Appendix A.

2.2 Objectives

The key objective of the SWMP is to ensure that the potential impacts to soil and water quality are minimised. To achieve this objective, BW is required undertake the following:

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise erosion and sedimentation impacts and potential impacts to water quality in creeks, waterways, and groundwater adjacent to the Project.
- Ensure compliance with the Consent Conditions of the State Significant Development Application No. SSD-57064458 approved by NSW DPHI.
- Ensure appropriate measures are implemented to address the relevant mitigation measures detailed in the CEMP, SWMP, ESCP, PESCP's & EWMS.
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this Plan.
- Ensure that any contaminated soil is managed in accordance with relevant legislation and the Spoil Management Plan Sampling, Analysis & Quality Plan (SMPSAQP);

2.3 Targets

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

- Ensure compliance with the relevant legislative requirements and environmental safeguards.
- Meet New South Wales Environment Protection Authority (NSW EPA) water quality discharge parameters for all planned water discharges and site dewatering.
- Manage downstream 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 NSW EPA and ANZECC guidelines).
- Ensure training on soil and water management is provided to all construction personnel through targeted training, site inductions and toolbox talks.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

Legislation and regulations relevant to soil and water management includes:

- Environmental Planning and Assessment Act 1979 (EP&A Act).
- Environmental Planning and Assessment Regulation 2000.
- Protection of the Environment Operations Act 1997 (POEO Act).
- Water Management Act 2000.
- National Parks and Wildlife Act 1974

Section 120 of the NSW POEO Act states that it is illegal to pollute waters. Under the POEO Act, 'water pollution' includes introducing litter, sediment, oil, grease, wash water, debris, and flammable liquids such as paint etc. into waters or placing such material where it is likely to be washed or blown into waters or the stormwater system or percolate into groundwater. All feasible steps should be taken to minimise the risk of pollution of waters.

3.1.2. Guidelines and standards

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

- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA, March 2004).
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000).
- 'Bunding & Spill Management. Insert to the Environment Protection Manual for Authorised Officers' - Department of Environment and Conservation (DEC) 1997.
- Draft Technical Guidance for achieving Wianamatta South Creek Stormwater Management Targets (NSW Government, 2022);
- 'Managing Urban Stormwater: Soils and Construction. Volume 1' (known as the "Blue Book") (Landcom 2006).

- ‘Managing Urban Stormwater: Soils and Construction - Volume 2A Installation of Services’ (DECCW 2008).
- Water quality guidelines for the protection of aquatic ecosystems for lowland rivers and estuaries. (ANZECC, 2000).

4 Environmental Control Matrix

4.1 Environmental management measures

The requirement for environmental safeguards and management measures are detailed in Development Consent SSD 57064458. The environmental management measures relevant to this Plan are listed Table 4-1 below. This includes reference to required outcomes, the timing of when the commitment applies, and the mitigation and management measure summary.

Table 1 Management measures relevant to construction soil and water management for the Development Consent SSD 57064458.

Issue	SSDA Condition No.	SSD Conditions of Consent requirement	SWMP & ESCP Management Measures
Dust Minimisation	B14 (A) (iii)	The Applicant must take all reasonable steps for the management of dust and odour to protect the amenity of the neighbourhood;	EMP - Protocol 7.3 ESCP – Table 9
Construction Soil and Water Management Sub-Plan	B14 (G)	The CEMP must include..... Construction Soil and Water Management Sub-Plan	This SWMP
Qualified expert required	B18 (a)	The SWMP must be prepared by a suitably qualified expert, in consultation with Council;	This SWMP has been prepared by a Certified Professional in Erosion & Sediment Control (Andrew Littlewood - CPESC No. 5988)
Dust Minimisation	B18 (b)	The SWMP addresses measures to ensure that sediment and other materials are not tracked onto the roadway by vehicles leaving the site;	ESCP –Section 8 ESCP – Table 9 – Section 2 & Section 7
Erosion and Sediment Control	B18 (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';	This SWMP – Table 8-1 ESCP at Appendix B of this SWMP.
Acid Sulfate Management	B18 (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;	See Acid Sulfate Soil Management Plan
Wet weather	B18 (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);	ESCP –Section 7.4 ESCP – Table 9 – Section 2 ESCP – Appendix D - Wet weather contingency procedure

Issue	SSDA Condition No.	SSD Conditions of Consent requirement	SWMP & ESCP Management Measures
Off-site flows	B18(f)	Detail all off-site flows from the site.	ESCP – Appendix E - Progressive Erosion and Sediment Control Plans
Stormwater Management	B18 (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 and 1 in 100-year ARI.	ESCP –Section 7.4 ESCP – Table 9 ESCP – Appendix E - Progressive Erosion and Sediment Control Plans
Soil and Water	B24	Prior to the commencement of construction, erosion and sediment controls must be installed and maintained, as a minimum, in accordance with the publication Managing Urban Stormwater: Soils & Construction (4th edition, Landcom 2004) commonly referred to as the 'Blue Book'.	SWMP – Table 8 – SW7 Site Inspection to be undertaken by a CPESC.
Soil and Water	B25	Prior to the commencement of construction, the Applicant must implement measures to manage Acid Sulfate Soils. These measures must include handling, treatment, monitoring of water quality at treatment areas and disposal of Acid Sulfate Soils.	See Acid Sulfate Soil Management Plan SWMP Section 7.2 SWMP – Table 8 – SW4 ESCP – Appendix C - Sediment Basin Management & Dewatering Procedure

5 Environmental aspects and impacts

Construction activities occurring on site may result in negative impacts to soil and water including soil contamination, soil erosion, and water pollution.

5.1 Construction activities

Key aspects of the project that could result in adverse impacts to soils and water include:

- Installation of preliminary erosion and sediment controls and establishment of water diversions.
- Establishment of compounds, exclusion zones, and stockpile areas.
- Minor earthworks, site preparation and site access/temporary access roads.
- Trenching and earthworks for service installation.
- In-situ concrete works and concrete curing.
- Operation of internal haulage and access routes.
- Stormwater construction and drainage stabilisation, including temporary sediment controls.
- Dewatering 'dirty' water from site areas and sediment control operations
- Importing, handling, stockpiling, and transporting materials & resources.
- Compound operation including fuel and chemical storage, refuelling and chemical handling.
- Plant maintenance and spills & leaks of fuels & oils from mobile and static machinery.
- Generation of building and construction waste
- General putrescible waste from compound/s & works areas
- Noxious weed treatment including herbicide spraying.
- Topsoil replacement, revegetation, and landscaping
- Landscaping.

5.2 Impacts

The potential for impacts on soil and water will depend on a number of factors. Primarily, impacts will be dependent on the nature, extent and magnitude of construction activities and their interaction with the natural environment. Potential impacts attributable to construction might include:

- Exposure and disturbance of soils during earthworks, creating the potential for off-site transport of eroded sediments and pollutants.
- Alteration of surface and subsurface flows that could cause disturbances to hydrology and hydraulics.
- Off-site discharge of water containing sediment from dewatering activities.
- Contamination of soils, and surface and groundwater from accidental spills or oil leaks. This might include grease or fuel from machinery and vehicles, construction sites or compounds, or spills of other chemicals that may be used during the course of construction.
- Disturbance of unidentified contaminated land e.g. pesticide/chemical concentrations in soil from historical land use practices, and subsequent generation of contaminated runoff.
- Litter and gross pollutants from construction activities.
- Erosion and sedimentation of active construction zones during construction of the project as a result of a large rainfall event or storm event.

6 Roles and Responsibilities

6.1 Key BESIX Watpac Personnel

An overview of the specific responsibilities of the BESIX Watpac project team for water and soil management as they relate to each role on the project are outlined below:

Table 2 Roles and Responsibilities

Role	Authority and Responsibility
Project Director **Construction Managers**	• Manage the delivery of New Shellharbour Hospital including overseeing the implementation of the SWMP, associated sub-plans and procedures. • Authority to discharge water offsite under the Controlled Overflow Strategy
	• Oversee the implementation of all environmental, soil, water and groundwater management initiatives. • Report on environmental performance. • Authority to direct personnel and subcontractors to carry out actions to avoid or minimise environmental impacts. • Review of water quality monitoring reports (CWQMR) prepared by the water quality monitoring consultant • Conduct an investigation in the event of a water quality exceedance. • Authority to discharge water offsite under the Controlled Overflow Strategy
Site Manager **Project Engineers** **Construction Foremen**	• Daily weather monitoring • Visual inspection to establish whether mitigation measures are required • On site environmental monitoring and visual inspections of mitigation measures in place • Records keeping and reporting in implemented mitigation measures • Collection of water quality samples and undertaking of field analysis of certain samples collected • Coordinate on site testing with agencies undertaking testing and laboratories analysing sampling results
	• Visual inspections of mitigation measures in place • Establishment of mitigation measures • Record keeping in relation to mitigation measures • Ensure compliance with the CEMP and soil and water procedure • Conduct inductions and toolbox talks in relation to soil and water responsibilities • Authority to direct personnel and subcontractors to carry out actions to avoid or minimise environmental impacts • Authority (Site Manager only) to discharge water off site under the Controlled Overflow Strategy
Sustainability Manager	• Track and report soil and water elements against sustainability targets
Commercial Manager	• Ensure that relevant soil and water and groundwater management requirements are considered in procurement

6.2 Specialist Consultants

Rubicon Enviro Pty Ltd (Rubicon), a provider of consulting services as a Certified Professional in Erosion & Sediment Control (CPESC) has been engaged by BESIX Watpac. Rubicon will be consulted throughout construction to provide advice and review SWMP preparation, erosion and sediment control design, installation, maintenance, and the development of PESCPs. The curriculum vitae of the engaged CPESC is attached as Appendix A.

7 Existing Environment

7.1 Topography & Geology

The proposed development is for a new greenfield hospital for the Shellharbour region, known as the New Shellharbour Hospital (NSH). Health Administration Corporation (HAC) acquired land at 50 and 86 Dunmore Road, Dunmore (formally described as Lot 1 DP302910 and Lot 10 DP1281639) for a new health campus in June 2022. The NSH is proposed to occupy Lot 10 DP1281639.

The Project site is located on Lot 10 DP1281639 known as 86 Dunmore Road, Dunmore NSW 2529. The Project site comprises approximately 10.56 hectares of land, of which 39,452m2 will be occupied by multi-storey buildings, vehicle parking and landscaped areas.

The site is generally trapezoidal in shape with preparatory earthworks completed by third party contractors. The pre-existing topography has been significantly altered during the preparatory earthworks. The pre-disturbance landform had a relatively uniform slope with moderate grade, falling from the northeast to the southwest. A large construction sediment basin has also been constructed on the western boundary of the site which intercepts runoff from the majority of the site.

The topography of the area is characterised by rolling low hills with local relief ranging from 40–100 m, with slope gradients commonly 15–25%. The hillcrests are narrow and convex ridgelines are generally elongated and gently inclined, with moderately inclined slopes with scattered benches and terracettes on upper slopes.

The geology of the area is anticipated to transition from the rolling hills overlaying the Bumbo Latite Member consisting of alphanitic to porphoryitic latite or Budgong Sandstone consisting of red brown and grey volcanic sandstones, ranging to Quaternary unconsolidated sediments, including alluvium, gravel, beach and dune sand at lower elevations.

The EIS notes the following at Section 6.13.1.1;

> *'The Kiama 1:50,000 Geological Series Sheet 9028-I indicates that the near-surface geology at the site generally comprises volcanic latite bedrock of the Bumbo Latite Member with the exception of the north-eastern portion where the overlying Budgong Sandstone is present. An area of Quaternary alluvial soils above the bedrock is indicated towards the western boundary of the site.*
>
> *The results of the investigation revealed a generally consistent profile across the site, comprising cohesive soils overlying relatively shallow bedrock. The soil thickness across the site ranges from 0.3m to 4m and comprise a relatively thin layer of topsoil that grades into typically residual silty clays, although clayey soils assessed as alluvial in origin were encountered in some boreholes at the base of the hill towards the western boundary.*
>
> *Underlying the natural clays across most of the NSH site is weathered latite bedrock, with the exception of the higher areas (generally above RL 18m AHD) in the northeast portion of the site where Budgong Sandstone was encountered above the latite.*

Further reference to NSW Office of Environment & Heritage website resource '*eSPADE'*, identified that the Project site is mapped as having three different Soil Landscapes present. The Soil Landscape Mapping indicates the following soil landscape units occur within the project footprint, being;

- 'Bombo' (bo) Soil Landscape
- 'Killalea' (ki) Soil Landscape

- ‘Shellharbour’ (sh) Soil Landscape

The majority of the eastern sector of the Project is comprised of the ‘Bombo’ (bo) Soil Landscape which when undisturbed has shallow Structured Loams occurring on crests, with moderately deep Krasnozems on upper slopes and benches. Brown Podzolic Soils and Red Podzolic Soils occur on mid and lower slopes. The Project site area has had extensive modification during preparatory earthworks, with the natural ‘‘Bombo’ soil profile likely to be almost entirely absent from the area of initial earthworks.

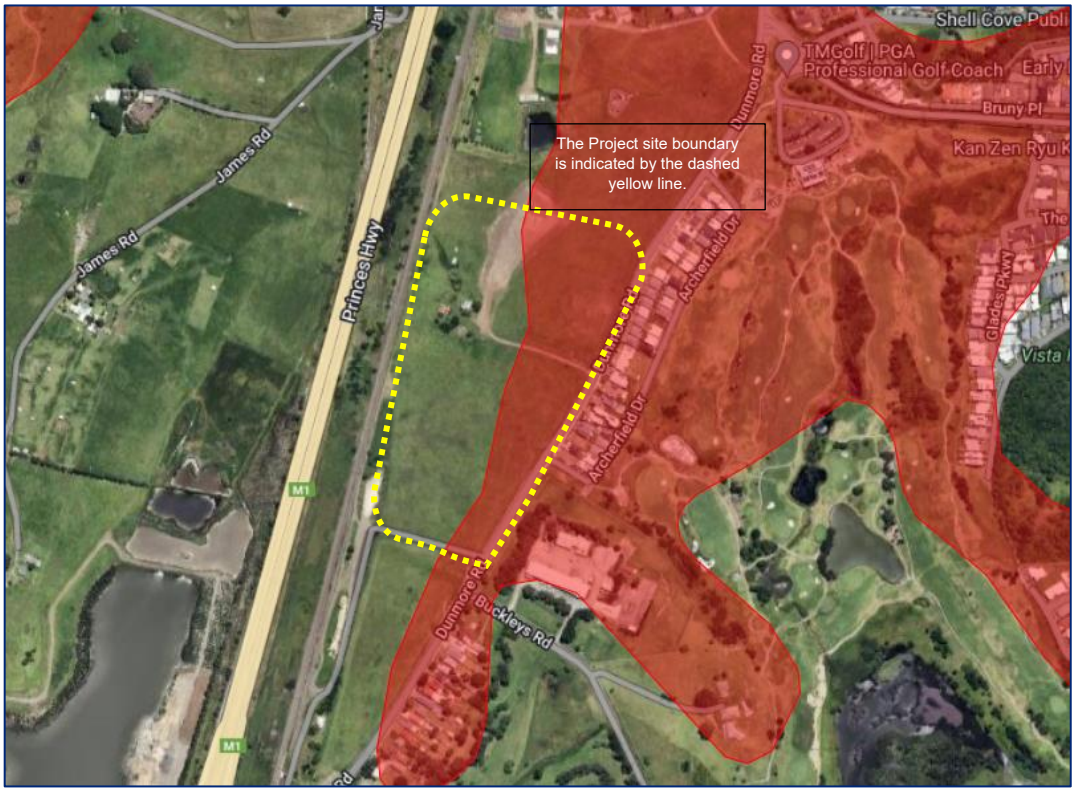


Figure 1 *Extract map of the occurrence of the ‘Bombo’ (bo) Soil Landscape unit from NSW Office of Environment & Heritage website resource ‘eSPADE’*

The central area of the northern sector of the Project is comprised of the Shellharbour’ (sh) Soil Landscape which normally consists of deep Prairie Soils occurring on crests and upper slopes, with Brown Krasnozems occurring on midslope areas, with Red Podzolic Soils and Prairie Soils found on lower slopes and drainage plains.

Figure 2 *Extract map of the occurrence of the 'Shellharbour' (sh) Soil Landscape unit from NSW Office of Environment & Heritage website resource 'eSPADE'*

The western boundary of the Project area adjoins the rail corridor with some potential for remnant intact 'Killalea' soils to occur as the western boundary area is less disturbed. The soils generally consist of —moderate to deep Prairie Soils (Gn3.21) occurring on drainage plains, with Alluvial Soils occurring on the alluvial plains. Humic Gleys may also occur in swamps and low lying areas.

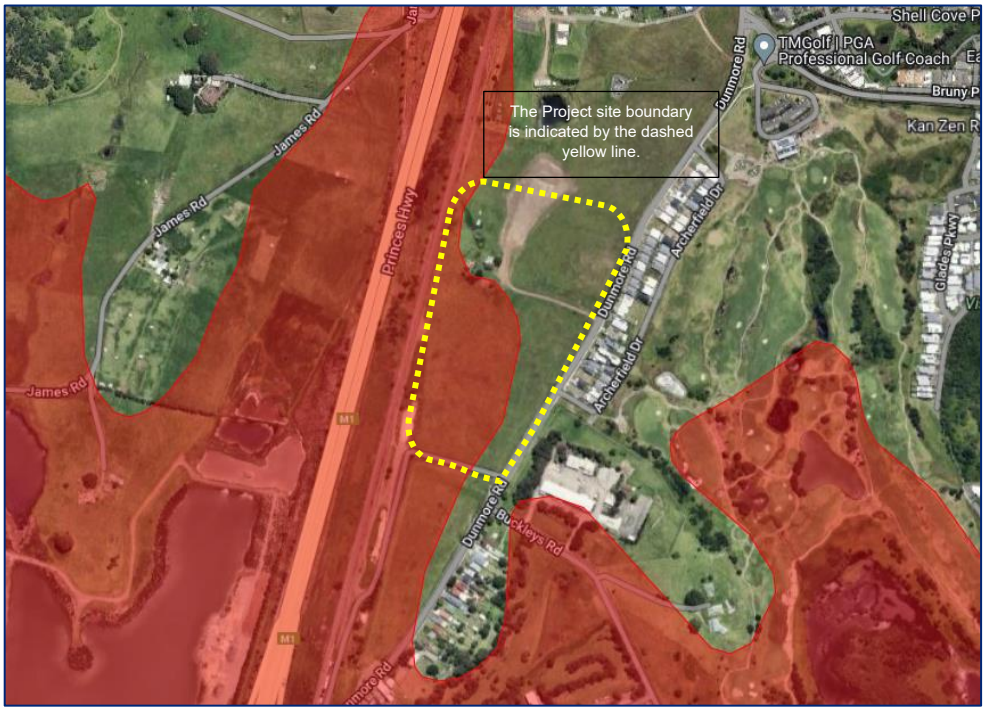


Figure 3 *Extract map of the occurrence of the 'Killalea' (ki) Soil Landscape unit from NSW Office of Environment & Heritage website resource 'eSPADE'[Insert Figure Caption]*

7.2 Acid Sulphate Soils

Potential Acid Sulfate Soils are soils that have concentrations of iron sulphide layers that can oxidise when exposed to oxygen generating sulphuric acid. In general, these soils occur less than 5 metres elevation above sea level and are predominantly restricted to low-lying coastal areas, adjoining estuarine areas. More recently, acid sulphate soils have been identified in long-term, drought-affected inland areas where water levels have dropped in waterways and wetlands, exposing acid sulphate material that has subsequently oxidised.

An assessment of acid sulphate soils risk was undertaken for the site during the preparation of the Environmental Impact Statement (EIS), undertaken by GeoLINK Consulting Pty Ltd in September 2023. That EIS states that:

'A small portion of the western boundary of the site is located within a Class 3 ASS risk area. Works in a Class 3 risk area that could pose an environmental risk in terms of ASS include works at depths beyond 1m below existing ground level or works by which the water table is likely to be lowered beyond 1m below existing ground level.

The remainder of the site and wider property was not identified to be in an ASS risk area. The western driveway and detention basin extend through the potential acid sulfate soils (PASS) area, and it should be noted that landscaping and pathways are unlikely to disturb PASS. It is possible that service trenches may be required through this area.

Although net acidity results exceeded the action criteria in a majority of natural soil samples, based on an assessment of multiple lines of evidence, the natural soils at the site (to the maximum depth of sampling/analysis for the ASS assessment) were not considered to be actual ASS (AASS) or PASS. The acidity in the soils was attributed to organic/ humic acids and the soils analysed were not considered to be PASS.

Nevertheless, as the area is mapped as PASS. An ASSMP has been prepared and for the purposes of management under the ASSMP, natural soils from/ below a depth of 1m below ground level in the west section of the site is to be considered PASS unless demonstrated otherwise via additional sampling and analysis.

No management is considered to be required for the soils outside of the PASS area, or for the soils at the surface down to a depth of 1m below ground level within the PASS Area.

JKE have prepared an ASSMP for the site (refer to Appendix BB of the EIS). As part of a separate scope of works, previous investigations of the site and wider property were undertaken by Cardno and JBS&G. JKE have also previously undertaken a Preliminary Site Investigation (PSI), a hazardous building materials survey (HAZMAT), a Detailed (Stage 2) Site Investigation and Additional Groundwater Assessment, and an Asbestos Management Plan (AMP) and a Remediation Action plan (RAP) for the site. This information has been used to assist with the preparation of the ASSMP.

Further reference to the online soil mapping resource 'eSpade' (NSW Department of Environment & Heritage) indicate that a small portion of the site near the western boundary is situated in an area at risk of Acid Sulphate soils occurring with High Probability within 1-3 metres of the soil surface. Please refer to Figure 4 below which illustrates the mapped ASS risk area.

Figure 4 *Extract map of the occurrence of Acid Sulphate Soils from NSW Office of Environment & Heritage website resource 'eSPADE'.[Insert Figure Caption]*

7.3 Surface water

The proposed development is located within the Rocklow Creek catchment, which forms part of the larger Minnamurra River basin. The Minnamurra River is the largest riverine watercourse between Port Hacking and Nowra. Rocklow Creek flows on a general north to south alignment, with runoff in tributaries in the upper catchments generally intercepted and controlled by agricultural dams. The water quality of Rocklow Creek is likely to be impacted by the extent of development in the catchment which includes large-scale quarrying operations and intensive agriculture including grazing and cropping activities.

The pre-disturbance landform would have been a relatively uniform, western facing slope, falling to the boundary with the heavy rail corridor, with stormwater flowing as sheet flow towards the railway line as opposed to being concentrated in a watercourse. The Project site catchment is delineated on the eastern boundary by Dunmore Road which is located along the local ridge line. Runoff from areas east of Dunmore Road drain via ephemeral waterways to coastal areas.

Reference to the online resources being 'NSW Water Management (General) Regulation 2018 hydroline spatial data 1.0' indicates a minor watercourse centrally traverses the site however, the pre-existing topography has been significantly altered during the preparatory earthworks, and the former watercourse indicated is now a series of excavated benches. This former drainage line does not appear to have had the attributes of a creek or ephemeral watercourse, i.e.. defined embankments or riparian vegetation present.

Please refer to Figure 7.5 below which illustrates the mapped watercourse in relation to the footprint of the preparatory earthworks.

Figure 5 *Extract map of the watercourses in the Projects Site area sourced from 'NSW Water Management (General) Regulation 2018 hydroline spatial data 1.0.'[Insert Figure Caption]*

7.4 Water Quality and Receiving Environment Assessment

The Project activities that have the potential risk of negative impacts on water quality parameters include:

- Installation of erosion and sediment controls.
- Vegetation clearing, debris removal & maintenance of access to site areas/temporary access roads.
- Ancillary site preparation, establishment, and operation.
- Establishing or relocating 'dirty' water drains and 'clean' water diversions.
- Trenching and earthworks for piling works and service installation.
- In-situ concrete works and concrete curing.
- Stormwater construction and drainage stabilisation.
- Dewatering 'dirty' water from site areas and sediment basin operations.
- Spills & leaks of fuels & oils from mobile and static machinery.
- Storage of chemicals, fuels & oils.
- Generation of building and construction waste.
- Importing, handling, stockpiling and transporting materials & resources.
- Plant maintenance.
- General waste generation from compound/s & works areas.

The determination of the assessment of the drainage patterns, the heavily modified existing receiving environments, and the attributes of the receiving waters in the vicinity of the Project have been assessed as 'Sensitive' in accordance with Blue Book Volume 1- Sect. 6.3.4 – (f) & Volume 2D – Table 6.1.

7.5 Groundwater

The presence of groundwater primarily impacts on erosion and sediment control during construction with regard to piling, foundation earthworks, trenching for drainage and services, culvert construction, and sediment basin construction. There are no obvious indicators of shallow groundwater sources, however the detectable presence of groundwater at or near the soil surface is highly dependent on seasonality and rainfall rates.

Further reference to the EIS provides an adequate examination of the groundwater conditions of the Project site. The EIS notes the following at Section 6.13.3.

> *'Investigations indicate that the regional aquifer on-site, and in the areas immediately surrounding the site, includes porous, extensive highly productive aquifers. There was a total of 108 registered bores within 2km of the site and wider property. The nearest of these being approximately 155m from the site and utilised for stock purposes. The majority of the remaining bores were utilised for monitoring purposes. A review of information pertaining to other groundwater users did not indicate any above ground tank area or tank points at the site or in the immediate vicinity of the site within a 1km buffer.*
>
> *Subsurface conditions at the site are generally expected to consist of low to moderate permeability (residual) soils overlying shallow bedrock. Abstraction and use of groundwater at the site or in the immediate surrounds may be viable under these conditions, however the use of groundwater is not proposed as part of the development. There is a reticulated water supply in the area and human consumption of groundwater is not expected to occur.*
>
> *Considering the local topography, surrounding land features and existing site information, groundwater beneath the site is anticipated to flow towards the south and south-west.*
>
> *There is an ephemeral creek line that drains towards the south-west, to a tributary west of the highway which appears to connect to a surface water body located approximately 200m south-west of the site and wider property, relating to the Boral Dunmore quarry, and to Rocklow Creek approximately 1.1km south of the site. These water bodies are down-gradient from the site.*
>
> *There were no Groundwater Dependant Ecosystems (GDE) or Inflow Dependant Ecosystems (IDE) identified on-site. There are however terrestrial areas mapped as having high potential GDE and high likelihood of IDE located in proximity to the west and southwest of the site.'*
>
> *Overall, no significant impediments or impacts were identified, however the development is to be carried out in accordance with the recommendations to ensure appropriate construction and environmental management outcomes.*

7.6 Rainfall & temperature

Rainfall data was assessed from the Albion Park (Shellharbour Airport) Automatic Weather Station (AWS), located approximately 6.5 kilometres northwest of the Project at Albion Park Rail NSW 2527. This data was generally recorded between 1999 to 2024. (Bureau of Meteorology, 2024). The Albion Park (Shellharbour Airport) AWS was also selected for the Project as it will provide real time weather monitoring during the proposed construction period.

Rainfall data collected shows that typically rainfall is higher during summer and autumn. Winter and spring are generally drier periods during the year. February is the wettest month, with an average rainfall of 149.2 millimetres. The mean annual rainfall total is 1018.6mm, with a mean number of rain days >1mm of 83 days. Table 3 below provides a summary of climate data at the weather station.

Table 3 Summary of rainfall records

Summary of weather records from 1999 - 2024													
	Summer		Autumn			Winter			Spring			Summer	
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Year
Mean rainfall (mm)	81.6	149.2	148.0	82.6	72.4	87.6	70.1	56.9	45.1	73.9	86.2	69.0	1018.6
Mean rain days >1mm	8.3	8.9	9.1	7.2	5.1	6.3	5.0	4.5	5.5	7.2	7.9	8.0	83.0
Mean 9am Temp	22.5	22.0	20.2	19.2	15.8	13.0	12.5	14.0	17.1	19.0	19.7	21.4	18.0
Mean 3pm Temp	24.8	24.5	23.5	21.3	18.8	16.7	16.2	17.3	19.3	20.4	21.6	23.5	20.7

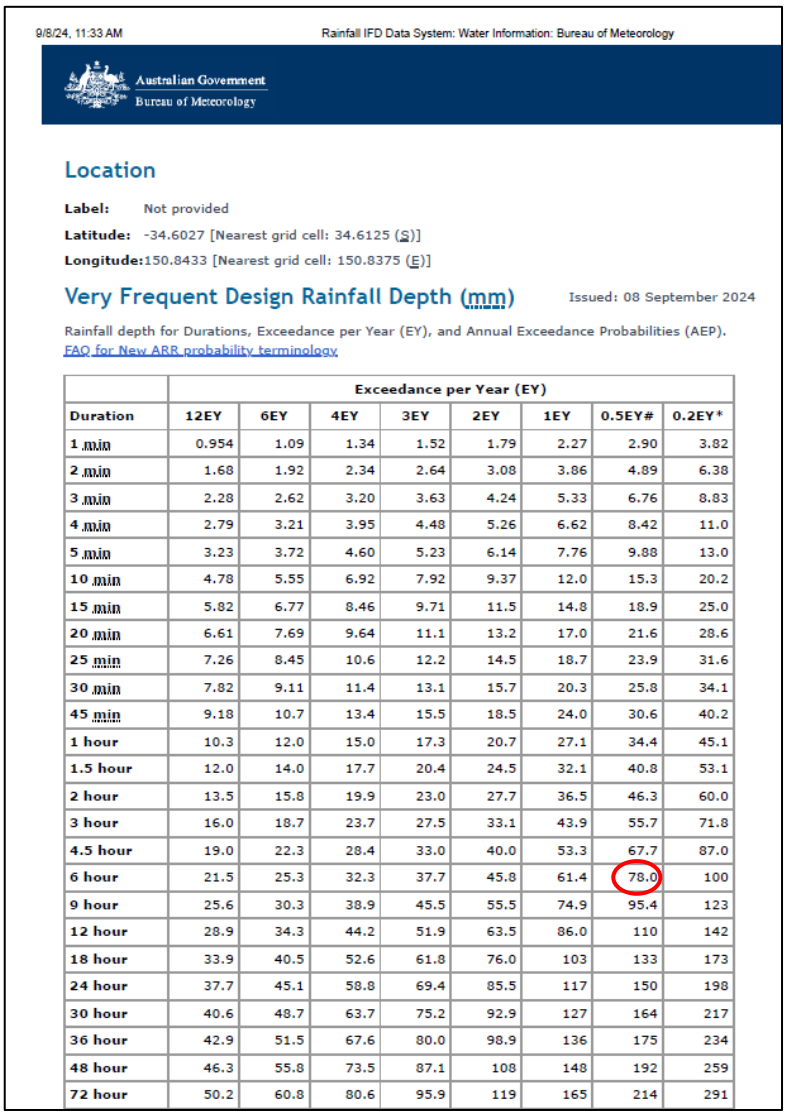
Red = highest value blue = lowest value

7.7 Rainfall erosivity factor and design rainfall depth

The rainfall erosivity factor is a measure of the ability of rainfall to cause erosion (referred to as “R” in the Revised Universal Soil Loss Equation - RUSLE). The rainfall erosivity factor is used to determine the soil loss in tonnes per hectare over one year and is used in calculations when sizing construction sediment basins.

The rainfall erosivity factor which is referred to as the ‘R’ Factor has been assessed from an Intensity Frequency Duration Table (see below) prepared for the site based on the 2-year, 6 hours storm event of 13 mm/hour. The R Factor value of 3625 is calculated from the 0.5 ‘Exceedances per year’, 6 Hour storm of 13mm/hour being ‘S’, where R = 164.74(1.1177)sS0.6444, as per the Blue Book - Appendix A2 & B.

The nearest ‘Blue Book’ centre for detailed rainfall depths is Kiama which is approximately 7.5kms south of The Project (Blue Book Volume 1- Table 6.3a). As noted above at Section 4.3, the Project was assessed as ‘sensitive’ in accordance with Blue Book Volume 1- Sect. 6.3.4 – (f) & Volume 2D – Table 6.1. The 85th percentile rain event has been adopted despite the advanced nature of preparatory earthworks, and the anticipated duration of construction earthworks being between 6-12 months. The 5-day 85th percentile rainfall depth for Kiama is 42.1mm.



9/8/24, 11:33 AM Rainfall IFD Data System: Water Information: Bureau of Meteorology

Australian Government
Bureau of Meteorology

Location

Label: Not provided

Latitude: -34.6027 [Nearest grid cell: 34.6125 (S)]

Longitude: 150.8433 [Nearest grid cell: 150.8375 (E)]

Very Frequent Design Rainfall Depth (mm)

Issued: 08 September 2024

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

	Exceedance per Year (EY)							
Duration	**12EY**	**6EY**	**4EY**	**3EY**	**2EY**	**1EY**	**0.5EY#**	**0.2EY***
1 min	0.954	1.09	1.34	1.52	1.79	2.27	2.90	3.82
2 min	1.68	1.92	2.34	2.64	3.08	3.86	4.89	6.38
3 min	2.28	2.62	3.20	3.63	4.24	5.33	6.76	8.83
4 min	2.79	3.21	3.95	4.48	5.26	6.62	8.42	11.0
5 min	3.23	3.72	4.60	5.23	6.14	7.76	9.88	13.0
10 min	4.78	5.55	6.92	7.92	9.37	12.0	15.3	20.2
15 min	5.82	6.77	8.46	9.71	11.5	14.8	18.9	25.0
20 min	6.61	7.69	9.64	11.1	13.2	17.0	21.6	28.6
25 min	7.26	8.45	10.6	12.2	14.5	18.7	23.9	31.6
30 min	7.82	9.11	11.4	13.1	15.7	20.3	25.8	34.1
45 min	9.18	10.7	13.4	15.5	18.5	24.0	30.6	40.2
1 hour	10.3	12.0	15.0	17.3	20.7	27.1	34.4	45.1
1.5 hour	12.0	14.0	17.7	20.4	24.5	32.1	40.8	53.1
2 hour	13.5	15.8	19.9	23.0	27.7	36.5	46.3	60.0
3 hour	16.0	18.7	23.7	27.5	33.1	43.9	55.7	71.8
4.5 hour	19.0	22.3	28.4	33.0	40.0	53.3	67.7	87.0
6 hour	21.5	25.3	32.3	37.7	45.8	61.4	78.0	100
9 hour	25.6	30.3	38.9	45.5	55.5	74.9	95.4	123
12 hour	28.9	34.3	44.2	51.9	63.5	86.0	110	142
18 hour	33.9	40.5	52.6	61.8	76.0	103	133	173
24 hour	37.7	45.1	58.8	69.4	85.5	117	150	198
30 hour	40.6	48.7	63.7	75.2	92.9	127	164	217
36 hour	42.9	51.5	67.6	80.0	98.9	136	175	234
48 hour	46.3	55.8	73.5	87.1	108	148	192	259
72 hour	50.2	60.8	80.6	95.9	119	165	214	291

Figure 6 Intensity Frequency & Duration Table

7.8 Flooding

As noted above, the Project Site is located within the Rocklow Creek catchment, which forms part of the larger Minnamurra River basin. The Project EIS notes that 'There is no council/ publicly available flood mapping or modelling for the site or surrounding area'. In response, Enstruct Group were engaged to prepare a flood study and analysis for the Project site. The EIS notes the following at Section 6.13.3 summarising the flood study and analysis in the Civil Engineering Design Report;

> '*The flood study and associated modelling identifies that the low-lying fringe/ western part of Lot 10 DP1281639 is affected by the Probable Maximum Flood (PMF) and 1% Annual Exceed Probability (AEP) extents from drainage lines/ overland flow both internal and west of the Princes Highway and associated with the South Coast Railway. The proposed hospital has been designed to be above the PMF level to comply with the requirements of the Shellharbour DCP and the NSW Flood Risk Management Manual 2023.*
>
> *The Civil Engineering Design Report confirms that the hospital footprint is outside of the 1% AEP flood extents (refer to Figure 6.18), and therefore will have no impact on flooding. With reference to the NSW Flood Risk Management Manual 2023, a flood impact and risk assessment (FIRA) is not required due the development being outside of the 1% AEP flood*

extents and therefore not changing flood behaviour or impacting on flood risk for the existing community.

The flood study concludes that the risk of unfavourable flood conditions impacting the hospital buildings in their current locations lies below acceptable thresholds. It is also noted that there is flood free access to/from the site. It is expected that there will be no impact on the operation of the hospital as a result of flooding.'

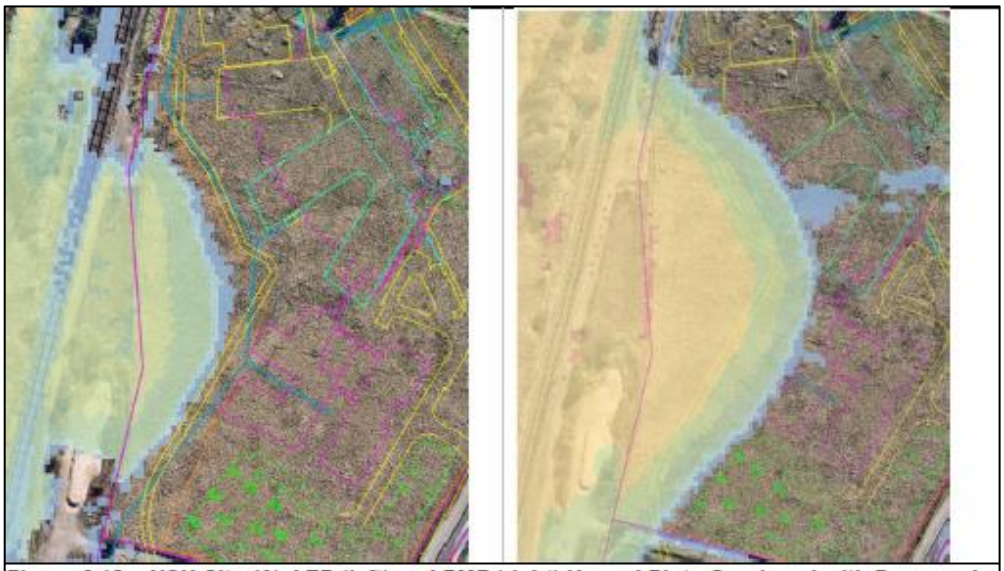


Figure 6.18 NSH Site 1% AEP (left) and PMF (right) Hazard Plots Overlayed with Proposed Building Footprint (Enstruct 2023).

Figure 7 Extract of flood mapping prepared by Enstruct Group which is shown at Section 6.15 of the EIS

In summary, significant flooding is not anticipated to affect the Project area for the duration of construction with exception of the temporary haul road and sediment basin which is located adjacent to the lowest area of the western boundary.

7.9 Wind erosion hazard

There is no known documented method for assessing or ranking wind erosion hazard in Australia. Sandy soils are more at risk of wind erosion due to the larger soil particles drying more rapidly than smaller particles and single grained particles are easier to detach by the wind. The erosive power of wind increases exponentially with velocity and the length of unobstructed terrain (fetch) over which the wind flows is important in allowing the wind to gain momentum and increase its erosive power. Movement of highly erosive soils typically starts at a wind velocity of 25–30 kilometres per hour (km/hr) at a height of 0.3 cm above the soil surface. The presence of soil surface cover (vegetation, aggregates, or mulch) is mitigating factor as surface roughness decreases the velocity of the wind at the soil surface. Alternatively, hydraulically applied soil binders can also be effective at mitigating dust emissions.

Wind speed data was assessed from Albion Park (Shellharbour Airport) Automatic Weather Station (AWS), located approximately 6.5 kilometres northwest of the Project at Albion Park Rail NSW 2527, This data was recorded between 1999 to 2010 (Bureau of Meteorology, 2024). Mean wind speed data collected shows that windier conditions typically occur during Winter and Spring. The 9am wind speeds indicate calmer conditions during the Autumn months, with less variation between the other seasons. The 3pm wind speeds indicate calmer conditions during Autumn, with a marked increase of wind speeds during Spring & Summer. Table below provides a summary of wind data at the weather station.

Table 4 Albion Park (Shellharbour Airport) AWS.

Summary of wind condition records from 1999 - 2010													
	Summer		Autumn			Winter			Spring			Summer	
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Mean 9am wind speed (km/h)	11.6	9.8	8.1	10.7	12.4	13.6	14.4	15.0	15.3	14.4	12.9	12.7	12.6
Mean 3pm wind speed (km/h)	21.6	20.0	18.9	17.7	17.1	17.6	18.1	21.8	22.6	20.9	20.9	21.5	19.9

Red = highest value blue = lowest value

The following Figure are the BOM wind rose diagrams that depict the mean 9am and 3pm wind speeds and directions recorded at the Albion Park (Shellharbour Airport) AWS.

The 9am wind rose indicates that westerly winds are most prevalent, however the wind speed velocities rarely exceed 30km/h. Southerly and southwesterly winds are the second most dominant winds, but again the wind speed velocities rarely exceed 30km/h.

The 3pm wind rose indicates that northeasterly winds are the most prevalent wind direction, and the wind speed velocities rarely exceed 30km/h. Southerly winds are the second most dominant winds, however the wind speed velocities are rarely in excess of 30km/h.

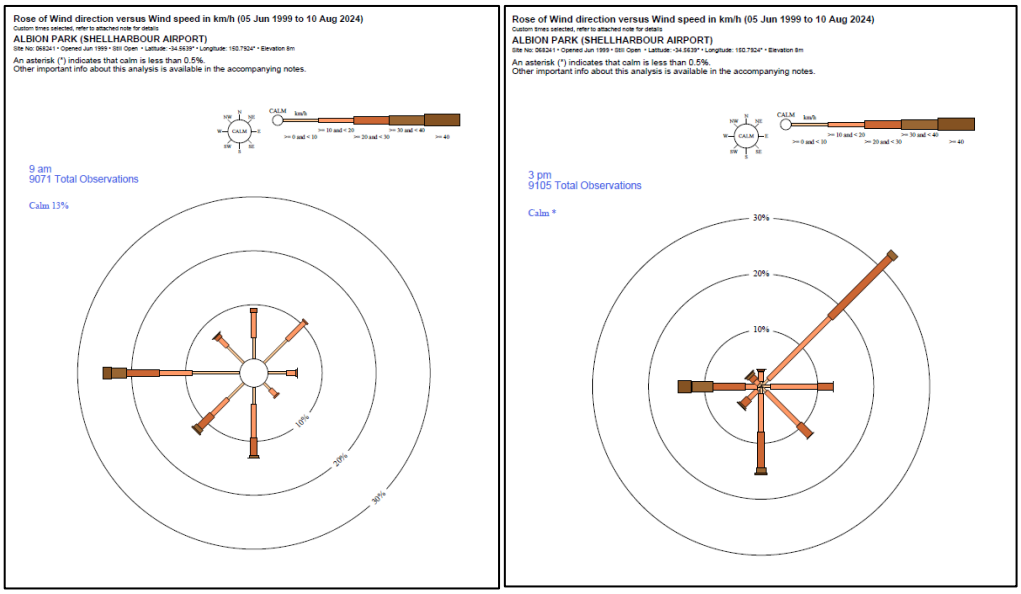


Figure 8 9am & 3pm wind speeds and directions recorded at the Albion Park (Shellharbour Airport) AWS

8 Environmental Control Measures

Specific measures and requirements to address soil and water management are outlined in the Table below.

Table 5 Management and mitigation measures

ID	Measure / Requirement	When to implement	Responsibility	Reference
General				
SW1	Training will be provided to all project personnel, including relevant sub-contractors on sound erosion and sediment control practices and the requirements from this plan through inductions, toolboxes, and pre-start briefings.	Pre-construction Construction	Project Manager / Environmental Site Representative	Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
SW2	A Project Soil Conservationist (CPESC) will be engaged and consulted throughout construction to provide advice and review SWMP preparation, erosion and sediment control design, installation, maintenance, and the development of PESCPs.	Pre-construction Construction	Project Manager / Environmental Site Representative	SSDA Condition B18 (a) Best Practice
SW3	EWMSs may be prepared and implemented to manage soil and water impacts that include but are not limited to: Activities assessed as having high environmental risk; Activities that impact on environmentally sensitive areas; Activities that pose a risk to receiving water quality; Earthworks including temporary stockpiling and disposal of excavated material and protocols for the management of contaminated material; Work around drainage lines and where construction water may be discharged into natural waterways; Construction and operation of sediment basins including connecting drainage for the associated catchment area; and drainage works.	Construction	Project Engineer / Supervisor / Environmental Site Representative	SSDA Condition B18 (e) Best Practice
SW4	Contaminated soils and Acid Sulfate Soils and / or Potential Acid Sulfate Soils are to be managed in accordance with the Erosion and Sediment Control Plan, which forms Appendix B of this SWMP.	Pre-construction / Construction	Project Manager / Supervisor / Environmental Site Representative	SSDA Condition B18 (d) & B25 Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
Erosion and sediment control				

ID	Measure / Requirement	When to implement	Responsibility	Reference
SW5	A Primary Erosion and Sediment Control Plan (ESCP) has been prepared by the Soil Conservationist (CPESC) and are included in Appendix B of this Plan. The plan includes arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in wet weather. The Primary Erosion and Sediment Control Plan is to be referred to and considered when preparing progressive erosion and sediment control plans.	Pre-construction and construction	Environmental Site Representative / Project Soil Conservationist	SSDA Condition B18 (b), (c) & (f) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
SW6	Progressive Erosion and Sediment Control Plans (PESCPs) will be prepared and implemented in advance of construction. PESCPs will be updated as required.	Pre-construction and construction	Environmental Site Representative / Project Soil Conservationist	SSDA Condition B18 (c) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
SW7	Prior to the commencement of any earthworks, construction or other surface disturbance for the development, the nominated erosion and sediment control measures will be installed across the site. The PESCP designated erosion and sediment control measures installed on site will be monitored and maintained for the duration of construction of the development.	Pre-construction and construction	Environmental Site Representative / Project Soil Conservationist	SSDA Condition B24 Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
SW8	Hardstand material, rumble grids or similar will be provided at exit points from construction areas onto public roads to minimise the tracking of soil and particulates onto public roads.	Pre-construction / Construction	Project Engineer / Supervisor	SSDA Condition B18 (b) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
SW9	Site compounds, access tracks, stockpile sites and temporary work areas will be designed and located to minimise erosion.	Pre-construction / Construction	Project Manager / Supervisor / Environmental Site Representative	SSDA Condition B18 (b) & (e) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
SW10	Works will be programmed to minimise the extent and duration of unstabilised soil surfaces.	Pre-construction / Construction	Project Manager / Supervisor / Environmental Site Representative	SSDA Condition B18 (b) & (e) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
SW11	Clean and dirty water runoff will be adequately separated to avoid mixing where possible through the use of diversions, clean water drains, and the early installation of permanent drainage infrastructure.	Pre-construction / Construction	Supervisor	SSDA Condition B18 (e), (f) & (g) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A

ID	Measure / Requirement	When to implement	Responsibility	Reference
SW12	Stabilisation will be implemented for dormant areas exposed for four weeks or more (including stockpiles and batters); by providing soil surface protection (i.e., geotextile fabric, stabilised mulch, soil binder or spray grass)	Construction	Project Engineer / Supervisor	SSDA Condition A B14 (A) (iii) & B18 (c) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
SW13	Drains, banks, or diversions will be formed (and stabilised where required) to direct runoff from disturbed areas to sediment basins or to areas with adequate sediment control devices, and away from watercourses or tributary drainage lines. Lip berms and batter chutes with velocity dams will be progressively formed and maintained on fill formations.	Construction	Project Engineer / Supervisor	SSDA Condition B18 (e), (f) & (g) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
SW14	Staged re-vegetation and/or other permanent stabilisation will be implemented in Site areas as work proceeds.	Construction	Project Engineer / Supervisor / Environmental Site Representative	SSDA Condition A B14 (A) (iii) & B18 (c) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
Stockpiles				
SW15	Stockpiles will be: located in designated stockpile sites, above 10-year flood levels, located at least 5 m from likely areas of concentrated water flows and drainage lines, Topsoil stockpiles formed to heights to no greater than 2 m, and all other soil materials to be no higher than 5m, and batter slopes to be no steeper than 2:1, established so that any slump of the stockpile will not affect erosion and sediment control measures or infringe on specified minimum clearance requirement, covered or otherwise protected from erosion where stockpiles will be in place for more than 20 days, or temporary stockpiles that are susceptible to wind or water erosion, within 5 days of forming each stockpile. Managed to avoid contamination with noxious weeds and cross-mixing with other stockpiled materials. Weed growth on stockpiles will be monitored and suppressed as required.	Construction	Project Engineer / Supervisor / Environmental Site Representative	SSDA Condition A B14 (A) (iii) & B18 (c) Managing Urban Stormwater: Soils and Construction Volumes 1 & 2A
Sediment basins				
SW16	Construction sediment basins will be designed and constructed in accordance with the requirements and procedures detailed in the Blue Book Volume's 1 & 2D. The construction sediment basin design/s, restoration and revegetation methodology will be formulated and/or reviewed by the Project Soil Conservationist.	Pre-construction / Construction	Project Soil Conservationist / Supervisor	SSDA Condition B18 (c) Managing Urban Stormwater: Soils and Construction Volume 1

ID	Measure / Requirement	When to implement	Responsibility	Reference
SW17	All sediment basins will have depth indicators installed that clearly show the sediment storage zone together with basin identification signage basin number.	Construction	Project Engineer / Supervisor / Environmental Site Representative	Best Practice Managing Urban Stormwater: Soils and Construction Volume 1
SW18	Run-off from areas within catchments (that are controlled by sediment basins) is to be diverted to the sediment basins in stabilised drainage lines where possible.	Construction	Supervisor	SSDA Condition B18 (c), (f) & (g) Managing Urban Stormwater: Soils and Construction Volume 1
SW19	Suitable all-weather access will be constructed and maintained to sediment basins to allow for basin testing, treatment, discharge, and maintenance.	Pre-construction / Construction	Project Engineer / Supervisor / Environmental Site Representative	Best Practice Managing Urban Stormwater: Soils and Construction Volume 1
SW20	Water quality basins shall be flocculated with an appropriate approved flocculant (eg. gypsum) using an early dosing system to minimise the settling time of suspended dispersible and small sediment particles and to maximise the efficiency of the basins.	Construction	Supervisor	NSW POEO Act 1997 SSDA Condition B18 (c) & (f), and E14 Managing Urban Stormwater: Soils and Construction Volume 1
SW21	Prior to discharging any water from a sediment basin, representative water samples will be obtained and tested to ensure that it meets the NSW EPA water quality criteria.	Construction	Environmental Site Representative / Supervisor	NSW POEO Act 1997 SSDA Condition B18 (c) & (f), and E14 Managing Urban Stormwater: Soils and Construction Volume 1
SW22	Flocculant or coagulant (whether gypsum or another approved material) will be applied to settle suspended sediments within 24 hours of the conclusion of each rain event causing runoff. The cycle time to treat, dewater and return the maximum storage capacity to any individual construction water quality basin prior to the next rainfall event shall not exceed 5 days.	Construction	Environmental Site Representative / Supervisor	NSW POEO Act 1997 SSDA Condition B18 (c) & (f), and E14 Managing Urban Stormwater: Soils and Construction Volume 1
SW23	Subsequent to the initial series of basin sample tests, where a statistical correlation can be demonstrated between turbidity and Total Suspended Solids (TSS), an application will be made to the Principal to allow for the discharge of supernatant waters based on turbidity measurements before confirmatory laboratory data is available.	Construction	Environmental Site Representative	NSW POEO Act 1997 Best Practice Managing Urban Stormwater: Soils and Construction Volume 1

ID	Measure / Requirement	When to implement	Responsibility	Reference
SW24	A sediment basin management register will be maintained for each sediment basin that records; personnel approving the dewatering activities; time & date; water quality test results and estimated volumes for each discharge.	Construction	Environmental Site Representative / Project Engineer	NSW POEO Act 1997 SSDA Condition B18 (c) & (f), and E14 Managing Urban Stormwater: Soils and Construction Volume 1
Dewatering				
SW25	Personnel responsible for approval and/or carrying out dewatering activities will be adequately trained and inducted on the dewatering procedures and requirements.	Construction	Environmental Site Representative / Supervisor	Best Practice Managing Urban Stormwater: Soils and Construction Volume 1
SW26	Water to be discharged from site will be discharged in accordance with a Site Dewatering Procedure. In accordance with NSW EPA water quality criteria, the water quality parameters for discharge from site discharge points will be: Total Suspended Solids <50mg/L, pH 6.5 - 8.5, Oil & grease – not visible.	Construction	Environmental Site Representative / Supervisor	NSW POEO Act 1997 SSDA Condition B18 (c) & (f), and E14 Managing Urban Stormwater: Soils and Construction Volume 1
SW27	A site dewatering register will be maintained for site areas (other than sediment basins) that require treatment, dewatering and discharge to off-site areas. The register will record; dewatering procedure, date and time for each discharge at each location, water quality test results for each discharge, personnel approving the dewatering activities, evidence of discharge monitoring, or risk assessment and mitigation measures used to eliminate the risks of pollution or erosion.	Pre-construction / Construction	Environmental Site Representative / Project Engineer	NSW POEO Act 1997 SSDA Condition B18 (c) & (f) Managing Urban Stormwater: Soils and Construction Volume 1
SW28	Water captured in sediment basins and other site works areas will be reused for dust suppression, compaction, or other construction activities where possible. If a proposed source, other than a town water supply or natural water source, procedures will be developed for regular testing to ensure that the water is suitable for the purpose and is not hazardous to health and the environment.	Construction	Environmental Site Representative / Project Engineer / Supervisor	Best Practice Managing Urban Stormwater: Soils and Construction Volume 1

ID	Measure / Requirement	When to implement	Responsibility	Reference
SW29	All dewatering activities will be subject to prior approval from relevant project personnel. The dewatering activities will be monitored to ensure: intake suction devices are positioned to prevent extraction or disturbance of settled sediments, no erosion is occurring at discharge locations and/or downstream areas, no inadvertent or intentional controlled discharge of untreated waters occurs.	Construction	Environmental Site Representative / Supervisor	NSW POEO Act 1997 SSDA Condition B18 (c) & (f), and E14 Managing Urban Stormwater: Soils and Construction Volume 1
Stabilisation				
SW30	Management and procedures for site stabilisation will be in accordance with the primary Erosion and Sediment Control Plan at Appendix B of this SWMP.	Construction	Environment Manager / Project Soil Conservationist	SSDA Condition B14 (A) (iii) & B18 (c) & (e) Managing Urban Stormwater: Soils and Construction Volume 1
SW31	The rehabilitation of disturbed areas will be undertaken progressively as construction stages are completed and in accordance with procedures detailed in the Blue Book Volume's 1 & 2D.	Construction / Post construction	Environmental Site Representative / Supervisor	SSDA Condition B14 (A) (iii) & B18 (c) & (e) Managing Urban Stormwater: Soils and Construction Volume 1
SW32	Restoration of these areas includes; topsoiling of the areas; seeding, planting, watering, and maintenance; removal of temporary erosion control devices and of accumulated sediments removal of unused construction materials and waste materials.	Construction / Post construction	Environmental Site Representative / Supervisor	SSDA Condition B14 (A) (iii) & B18 (c) Managing Urban Stormwater: Soils and Construction Volume 1
Spill prevention and response				
SW33	Management for spill prevention and response will be in accordance with the CEMP. An Emergency Spill Response Procedure has been developed in the CEMP.	Pre-construction / Construction	Environmental Site Representative / Supervisor / Project Manager	NSW POEO Act 1997 SSDA Condition E14 Best Practice
SW34	Emergency wet and dry spill kits will be kept on site at locations described within the Emergency Spill Response Management Procedures (ie at compounds). All personnel will be made aware of the spill kit locations and will be trained in their use.	Construction	Environmental Site Representative / Supervisor	NSW POEO Act 1997 SSDA Condition E14 Best Practice

ID	Measure / Requirement	When to implement	Responsibility	Reference
SW35	A schedule of all hazardous materials kept on site during construction will be maintained for the duration of the project.	Construction	Environmental Site Representative / Supervisor	NSW POEO Act 1997 SSDA Condition E10 & E12 Best Practice
SW36	The ancillary facilities will be managed within the ESCP. The following measures will be included to limit sediment and other contaminations entering receiving waterways: Chemicals will be stored within a sealed or bunded area not within 5 m of any aquatic habitat, any areas of concentrated water flow, flood prone or poorly drained areas, or on slopes steeper than 1:10, Vehicle movements will be restricted to designated pathways where feasible and appropriate controls will be in place where plant is stored, Areas that will be exposed for extended periods, such as car parks and main access roads, will be stabilised where feasible.	Contractor	Construction	NSW POEO Act 1997 SSDA Condition E10 & E14
SW37	All spills and associated environmental incidents are to be reported in accordance with the CEMP, and where applicable, in accordance with Section 148 of the NSW POEO Act 1997.	Construction	Environmental Site Representative / Supervisor	NSW POEO Act 1997 SSDA Condition A23 & A26
Monitoring and inspections				
SW38	Nominated project personnel will conduct site inspections of erosion and sedimentation controls at least weekly.	Construction	Environmental Site Representative / Supervisor	SSDA Condition B18 Managing Urban Stormwater: Soils and Construction Volume 1
SW39	All disturbed areas, revegetated/stabilised areas and all permanent and temporary erosion and sediment control works will be inspected: At least weekly, Immediately before extended site shut down, At the conclusion of all rainfall events exceeding 10mm and during periods of prolonged rainfall as soon as practicable.	Construction	Environmental Site Representative / Supervisor	SSDA Condition B18 Managing Urban Stormwater: Soils and Construction Volume 1
SW40	Any rectification measures which are identified will be addressed and / or recorded to ensure appropriate rectification within the nominated timeframe. The timeframe for rectification works is based on a risk assessment of deficiencies in controls, being; High: within 24 hours of inspection, Medium: within 3 working days of inspection; and, Low: within 3 working days of inspection.	Construction	Environmental Site Representative / Supervisor	NSW POEO Act 1997 SSDA Condition B18 Managing Urban Stormwater: Soils and Construction Volume 1

ID	Measure / Requirement	When to implement	Responsibility	Reference
SW41	Monitoring of rainfall events (with observations of rainfall in millilitres) will be undertaken daily during normal work days.	Construction	Environmental Site Representative	NSW POEO Act 1997 SSDA Condition B18 Managing Urban Stormwater: Soils and Construction Volume 1

9 Compliance Management

9.1 Roles and responsibilities

The Contractor's Project Team's organisational structure and overall roles and responsibilities will be outlined in the CEMP to be developed by the selected Contractor for the Project works. Specific responsibilities for the implementation of environmental controls are detailed in Section 6 of this Plan.

9.2 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 including:

- Existence and requirements of this sub-plan.
- Relevant legislation.
- Incident response, management, and reporting.
- Roles and responsibilities for soil and water management.
- Water quality management and protection measures.

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. Examples of training topics include:

- ERSED control installation methodology.
- Sediment basin construction.
- Sediment basin operation.
- Sediment basin maintenance.
- Working near or in drainage lines.
- Emergency response measures in high rainfall events.
- Preparedness for high rainfall events.
- Lessons learnt from incidents and other event e.g. high rainfall/flooding.
- Spill response.
- Stockpile location criteria.

Further details regarding staff induction and training are outlined in the CEMP.

9.3 Monitoring and inspection

Regular monitoring and inspections will be undertaken during construction. Monitoring and inspections will include, but not be limited to:

- Immediate areas and drainage lines adjacent to the Project area

- Construction sediment basin water quality prior to discharge.
- Weekly and post rainfall inspections to evaluate the effectiveness of erosion and sediment controls measures in accordance with Table 6.

Table 6 Inspection Schedule

Activity	Frequency	Location	Responsibility	Record
Environmental Site Inspection	Weekly	Site wide	Environmental Site Representative	Site inspection log
Rainfall Inspection (10mm or greater rainfall).	Prior to rainfall event, during event, within 24 hours after the event	Site wide	Environmental Site Representative	Site inspection log

Additional requirements and responsibilities in relation to inspections, in addition to those in Table 6-1, are documented in the CEMP.

9.4 Licences and permits

The water quality discharge criteria for the project are listed below, in Table 7.

Table 7 Discharge water quality criteria

Parameter	Criteria	Sampling method	Frequency
pH	6.5 –8.5	Probe	Daily during any discharge
Turbidity	TBA following correlation with TSS results	Probe or Grab Sample	Likely to be required daily during any discharge
Total Suspended Solids*	Below 50 mg/L	Grab Sample	Daily during any discharge
Oil and Grease*	No visible	Visual inspection	Daily during any discharge

Any other relevant licences or permits will be obtained in the lead up to and during construction as required.

9.5 Weather monitoring

A rain gauge to be installed in the Contractor's compound that will be used in the monitoring of rainfall events. The Wet Weather Contingency Procedure is detailed in Appendix E of the Project ESCP, found in Appendix B of the SWMP.

9.6 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental mitigation and management measures, compliance with this plan and other relevant approvals, licences, and guidelines. Audit requirements will be detailed in the CEMP to be developed by the selected Contractor for the Project works.

9.7 Reporting

Reporting requirements and responsibilities will be detailed in the CEMP to be developed by the selected Contractor for the Project works.

10 Review and Improvement

10.1 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.

10.2 SWMP update and amendment

The processes detailed in the CEMPs developed for the Project may result in the need to update or revise this Plan. This will occur as needed.

Any revisions to the SWMP will be in accordance with the process detailed in the CEMP to be developed by the selected Contractor for the Project works.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure detailed in the CEMP to be developed by the selected Contractor for the Project works

11 Record Management

Records will be maintained by the project Planning and Environment Manager and Environmental Co-ordinator and transmitted to VNSW via Aconex for compliance tracking purposes, as follows:

- Copies of current ESCPs for all active construction sites and areas
- Records of soil and water inspections undertaken
- Records of testing (monitoring program results) of any water prior to discharge and quality of water discharged in the CWQMR
- Records of the release of the hold point to discharge water from the construction site to the receiving environment
- Records of the treatment of contaminated material in accordance with the SMPSAQ
- Records of the treatment of acid sulfate soils in accordance with the ASSMP
- Copies of waste classification reports
- Copies of all trucking and tipping dockets for spoil that is tipped at landfill.
- Discharge under the COS will be recorded in a Controlled Overflow Strategy Summary Report (COSSR).
- Waste Tracking Register
- Water Quality Monitoring Reports

APPENDIX A - Curriculum Vitae of Certified Professional in Erosion and Sediment Control (CPESC)

Table 8 List of CV's included in the CPESC

Position	Curriculum Vitae
Document Reviewer	Andrew Littlewood – Senior Soil Conservationist
Qualification	Certified Professional in Erosion and Sediment Control (CPESC No. 5988). Certified Erosion, Sediment and Storm Water Inspector (CESSWI) No. 12101
Relevant Training	SEEC and IECA (Australasia) – 'Water Management on Construction sites' & 'Preparing and Reviewing Plans for Soil and Water Management' – 2009 University of Western Sydney and Hawkesbury Global Ltd – Certificate of Attainment in Soil and Water Management for Urban Development – 2000
Experience – Years	24 years (2000 – 2024)
Current Employment	Director & Principal – Rubicon Enviro Pty Ltd (2016-2022)
Previous Employment	Senior Soil Conservationist & CPESC – TREES Pty Ltd (2008-2016)
Previous Employment	Erosion and Sediment Control Officer – Lake Macquarie City Council (2000 – 2007)
Professional Affiliations	Member of International Erosion Control Association (Australasia)

APPENDIX B - Erosion and Sediment Control Plan

A **Site Characteristics & Revised Universal Soil Loss Equation Assessment**

B **RUSLE Catchment Assessment & Sediment Basin Calculations**

C **Sediment Basin Management & Dewatering Procedure**

D **Wet Weather Contingency Procedure**

E **Progressive Erosion & Sediment Control Plans**

F **Standard drawings**

Refer Aconex Document: SH-OO-RUB-EN-PL-00-99-0001- EROSION & SEDIMENT CONTROL PLAN

ACONEX DOCUMENT : SH-OO-RUB-EN-PL-00-99-0001
ACONEX REVISION: B
REVISION DATE : 16/01/2025

RUBICON ENVIRO PTY LTD
ABN: 75 616 518 211

NEW SHELLHARBOUR HOSPITAL

EROSION & SEDIMENT CONTROL PLAN

January 2025 – Revision 2

Prepared for:

BESIX Watpac

Prepared by:

ANDREW LITTLEWOOD

CPESC & Senior Soil Conservationist

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Document Control Details

Project Name	New Shellharbour Hospital
Document Type	Management Plan
Document Name	Erosion & Sediment Control Plan
Prepared by	Andrew Littlewood
Document Approver	
Original Issue Date	09/09/2024
Revision Number	1
Current Issue Date	16/01/2024

Revision Control Table

Version	Sections Amended & Description of Changes	Date
1	First Issue	09/09/2024
2	Standard drawings updated with additional details	16/01/2025

Document Authorship Information

Document Author	Andrew Littlewood – Senior Soil Conservationist
Qualification	Certified Professional in Erosion and Sediment Control (CPESC No. 5988). Certified Erosion, Sediment and Storm Water Inspector (CESSWI) No. 12101
Relevant Training	• SEEC and IECA (Australasia) – 'Water Management on Construction sites' & 'Preparing and Reviewing Plans for Soil and Water Management' – 2009 • University of Western Sydney and Hawkesbury Global Ltd - Certificate of Attainment in Soil and Water Management for Urban Development - 2000
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Appendices

Glossary & Abbreviations

ABBREVIATIONS	EXPANDED TEXT
ANZECC	Australian and New Zealand Environment and Conservation Council
ASS	Acid Sulfate Soil
AWS	Automatic Weather Station
BOM	Bureau of Meteorology
Construction	Includes all activities required to construct the CSSI as defined in the Project Description described in the documents listed in Condition A1, including commissioning trials of equipment and temporary use of any part of the CSSI, but excludes Low Impact Work which is carried out or completed prior to approval of the CEMP and works approved under a Site Establishment Management Plan.
SWMP	Soil and Water Management Sub-plan
CSWGMP	Construction Surface Water and Groundwater Monitoring Program
CSSI	Critical State Significant Infrastructure
DCCEEW	Department of Climate Change, Energy the Environment and Water
DECC	Former NSW Department of Environment & Climate Change
DPI - Fisheries	NSW Department of Primary Industries - Fisheries
DP&E	NSW Department of Planning and Environment (formerly NSW Department of Planning, Industry and Environment)
Dredging	Removal of waterway sediments for the purposes of changing the waterway bathymetry
EC	Electrical conductivity
EIS	Environmental Impact Statement
EMS	Environmental Management System
Environmental Assessment Documentation	Collective reference to the Environmental Impact Statement Documents
Environmental aspect	Defined by AS/NZS ISO 14001:2004 as an element of an organisation's activities, products or services that can interact with the environment.
Environmental impact	Defined by AS/NZS ISO 14001:2004 as any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.

Glossary & Abbreviations

ABBREVIATIONS	EXPANDED TEXT
Environmental incident	An unexpected event that has, or has the potential to, cause harm to the environment and requires some action to minimise the impact or restore the environment.
Environmental objective	Defined by AS/NZS ISO 14001:2004 as an overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve.
Environmental target	Defined by AS/NZS ISO 14001:2004 as a detailed performance requirement, applicable to the organisation or parts thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPL	Environment Protection Licence
ESCP	Primary Erosion and Sediment Control Plan
EWMS	Environmental Work Method Statements
DP&E	NSW Department of Planning and Environment (DP&E)
OFM	Organic Fibre Mulches
PASS	Potential Acid Sulfate Soil
PESCP	Progressive Erosion and Sediment Control Plan
PIRMP	Pollution Incident Response Management Plan
POEO Act	*Protection of the Environment Operations Act 1997*
RECP	Rolled Erosion Control Products
RUSLE	Revised Universal Soil Loss Equation
RTA	NSW Roads & Traffic Authority. Now Transport for NSW
MSDS	Material Safety Data Sheet
SEPP	NSW State Environmental Planning Policy
TfNSW	Transport for New South Wales

1 Introduction

Rubicon Enviro Pty Ltd (Rubicon) has been engaged by Besix Watpac (BW) to assist with the development of a Primary Erosion and Sediment Control Plan (ESCP) to support the construction of New Shellharbour Hospital in Shellharbour (the Project). The Project has been approved as a State Significant Development (SSD No. 57064458) and is located on land at 50 and 86 Dunmore Road, Dunmore NSW 2529 (formally described as Lot 1 DP302910 and Lot 10 DP1281639).

The extent of works considered under this SSD application include the following:

- A new hospital, with the main building being a maximum of seven storeys, including rooftop plant.
- Internal road network and car parking, including at-grade and multi-deck carparks.
- Public domain works, including landscaping, amenities, and crushing/ reuse of excavated material.
- Signage.
- Utility/services works and connections.
- External road upgrades and connections.

This ESCP has been prepared in accordance with the Project SWMP and referred to as Appendix A in the SWMP. This Sub-plan has been prepared to reduce the potential for risk of environmental impacts caused by erosion and sedimentation associated with project activities.

2 Purpose

The purpose of this Sub-plan is to outline the planning, methodologies, techniques, and monitoring to minimise the potential environmental impacts of erosion and sedimentation arising from the Project construction activities.

3 Scope

The scope of the Primary ESCP will;

- Provide a strategy and framework for construction to be planned, implemented and maintained to mitigate any adverse environmental impacts,
- Propose control measures and management procedures to be implemented during construction, to avoid or minimise potential adverse impacts to soils, surface water and groundwater,

This Primary ESCP has been prepared in accordance with the requirements of the ‘Blue Book’ being a collective of;

- Managing Urban Stormwater: Soils and Construction 4th Edition Volume 1 – Landcom, reprinted 2006
- Volume 2A: Installation of Services – NSW Department of Environment & Climate Change (DECC), 2007

4 Objectives

The key objectives of the Primary ESCP is to;

- Identify potential impacts to soil and water quality such as erosion and sedimentation arising from construction activities,
- Outline the soil and water management strategy for the construction phase of the development,
- Promote the adoption of sound principles and criteria for planning and implementation of erosion and sediment controls,
- Ensure the design and construction of controls is undertaken in accordance with the relevant guidelines,
- Minimise the adverse risks to soils and water by detailing mitigation measures and strategies,
- Provide an outline of a monitoring, inspection and reporting framework for the ongoing assessment of adherence to the ESCP.

5 Performance Criteria

The performance criteria for the ESCP are to:

- Limit potential for adverse environmental impacts on downstream waterways, riparian zones, and other identified sensitive areas,
- Minimise the risk and subsequent occurrence of erosion and sedimentation, to mitigate the impacts on project areas, sensitive areas, and downstream environments,
- Prevent the occurrence of pollution incidents causing environmental harm,
- Maintain existing downstream waterway attributes and water quality parameters,
- Manage erosion and sedimentation with sound management practices of effective planning and formation of relevant controls
- Ensure compliance with legislative & regulatory requirements, and to maintain liaison and communication with statutory authorities and/or delegates.

6. Guidelines, Standards and Procedures

Name of Document/Publication	Author	Published
Acid Sulfate Soil Manual	ASSMAC	1998
Approved Methods for the Sampling and Analysis of Water Pollutants in NSW	NSW EPA	2004
Australian and New Zealand Guidelines for Fresh and Marine Water Quality	ANZECC and ARMCANZ	2000
Bunding & Spill Management	NSW DEC	1997
Environmental Best Management Practice Guideline for Concreting Contractors	NSW DEC	2004
Guidelines for the Management of Acid Sulphate materials: Acid Sulphate Soils, Acid Sulphate Rock and Monosulphidic Black Ooze	NSW RTA	2005
Guideline for Environmental Management - Spraying Bituminous Materials	VIC EPA	2002
Guideline for Handling Liquids	NSW DECCW	2007
Managing Urban Stormwater ('Blue Book'): Soils and Construction Volume 1, 4th Edition	NSW Landcom	2004
'Blue Book' - Volume 2A Installation of Services	NSW DECCW	2008
'Blue Book' - Volume 2D Main Roads Construction	NSW DECCW	2008

7. Environmental Planning

Erosion and sediment control planning is based on the principle that preventing erosion where possible provides the best environmental outcomes, is more economical, and effective than controlling the capture of sediment. This is a significant goal, given the Project topography, drainage patterns and soils that have a significant proportion of sodic soils that are highly erodible.

7.1 Construction Activities

The scope and anticipated duration of the Project works present risks of environmental impacts to the environment. Key aspects of the project that could result in adverse impacts to soils and water include:

- Installation of preliminary erosion and sediment controls and establishment of off-site water diversions.
- Establishment of compounds, exclusion zones, stockpile areas, and soils treatment area/s.
- Minor earthworks, site preparation and site access/temporary access roads.
- Trenching and earthworks for service installation.
- In-situ concrete works and concrete curing.
- Operation of internal haulage and access routes.
- Stormwater construction and drainage stabilisation, including temporary sediment basins and a permanent bio-basin.
- Dewatering ‘dirty’ water from site areas and sediment basin operations.
- Importing, handling, stockpiling and transporting materials & resources.
- Compound operation including fuel and chemical storage, refuelling and chemical handling.
- Storage of chemicals, fuels & oils.
- Spills & leaks of fuels & oils from mobile and static machinery.
- Plant maintenance.
- Generation of building and construction waste
- General putrescible waste from compound/s & works areas
- Noxious weed treatment including herbicide spraying.
- Topsoil replacement, revegetation, and landscaping
- Landscaping.

7.2 Impacts

The possible impacts on soil and water from the activities described include;

- Unnecessary disturbance of existing areas outside the Project footprint,
- Erosion of soils that degrade the water quality of runoff to downstream receivers, dependant flora and fauna, and sensitive areas,
- Degraded soil or water quality from exposure to contaminated soils or ASS material, or run-off from these soils,
- Contamination of soils, and surface and groundwater from accidental spills or oil leaks
- Disturbance or degradation of groundwater aquifers,
- Litter and gross pollutants from construction activities
- Atmospheric dust pollution affecting air quality of areas surrounding the Project.

7.3 'Blue Book' receiving waters classification and design criteria

The recommended minimum design criteria for temporary erosion and sediment control measures are based upon an assessment of the sensitivity of receiving environments. In accordance with the SWMP assessment, the attributes of the receiving waters in the vicinity of the Project have been assessed as 'sensitive'. The design criteria adopted will be in accordance with Blue Book Volume 1- Sect. 6.3.4 – (f) & Volume 2A – Table 5.1. which is a 5-day – 85th percentile rainfall depth for Kiama of 42.1mm. The 85th percentile rain event has been adopted despite the advanced nature of preparatory earthworks, and the anticipated duration of construction earthworks being between 6-12 months.

7.4 Key Management Strategies

The following list outlines the Key Management Strategies that will be implemented to mitigate potential erosion and sediment impacts;

- Specialist expertise and advice will be sought from an accredited Project Soil Conservationist (CPESC) in regard to the broad spectrum of erosion and sediment control issues, including but not limited to site establishment, temporary access routes, off-site water diversion, on-site drainage, sediment basin construction/operation/decommissioning, soil handling and storage, water management, stabilisation and rehabilitation/revegetation of Project areas.
- Implementation of structured erosion and sediment control training program for all relevant site personnel in the form of inductions, toolbox talks and workshops/training presentations.
- Minimising the extent and duration of construction disturbance.
- Control and diversion of off-site water flows around or across site.
- Control and diversion of on-site flows to installed sediment controls and sediment basins.
- Conservation of topsoils for site rehabilitation and revegetation.
- Implementation of progressive erosion methods & techniques throughout various work stages.
- Construction and management of suitable sediment controls including sediment filters, traps, sumps and basins.
- A thorough inspection and maintenance program to monitor, record and schedule actions for maintenance and upgrades of controls, rectification works, and sediment removal and handling.
- Establishing a procedure to monitor forecast weather events and implementing response plans for significant wind or rainfall events and flooding.
- Timely and progressive stabilisation of disturbed areas prior to final landscaping.
- Monitoring stabilisation measures and promoting prompt & effective revegetation and permanent stabilisation.

7.5 Preparation of Progressive Erosion and Sediment Control Plans (PESCP's)

This ESCP will be supplemented with Progressive Erosion and Sediment Control Plans (PESCP's) prepared as required for the relevant work areas. The PESCP's illustrate the strategy for erosion and sediment control and provides detail on structures and controls to be implemented in concert with construction activities. The PESCP's will outline structural and non-structural measures to;

- Intercept and divert clean water runoff around worksites,
- Prevent erosion,
- Limit the movement of sediment,
- Remove or filter sediment from runoff,

- Detain or control the discharge of runoff from site,
- Promote timely rehabilitation or stabilisation of disturbed areas.

There are a number of control measure options available for selection and use. The selection of controls will be in accordance with sound management practices to achieve the desired outcomes.

The PESCP's will be revised as necessary to address changes in the site conditions and nature of works. The PESCP's will be formulated in conjunction with construction personnel prior to the commencement of specific onsite activities. The plans will be prepared to manage the various works or construction stages such as:

- Compound, access, stockpile operations, and construction facilities
- Bulk earthworks for road formation, drainage, services, etc.
- Major off-site and on-site water drainage works or structures such as diversions, drains, outfalls and treatment/sediment basins
- Construction activities such as paving, kerbing/guttering, stormwater drainage and outlets, etc.
- Stabilisation of disturbed areas, access and works areas, and perimeter areas
- Decommissioning of temporary erosion and sediment controls.

The formulation of Environmental Work Method Statements (EWMS) will be sub-ordinate to the requirements of the primary ESCP, supplement the PESCP's, and will outline methods and strategies for works in critical areas such as clearing & grubbing, topsoil stripping & earthworks, works around watercourses & culvert works, construction & operation of sediment basins, drainage works and dewatering.

7.6 Erosion and Sediment Control Training for Site Personnel

Prior to the commencement of onsite activities, all site personnel will be instructed to observe site constraints and be made aware of environmental controls, in particular;

- Avoidance of disturbing or damaging 'No-Go' zones
- Effects of erosion and sedimentation and off-site or downstream impacts
- Environmental legislation, responsibilities, and 'due diligence'
- Correct establishment and maintenance of erosion and sediment controls
- 'End-of-day' site maintenance, emergency procedures, and spill response
- Personnel to monitor, review and improve controls as appropriate.

Key construction personnel would undertake additional environmental training including a specific training session for erosion and sediment control addressing:

- Environmental impacts
- Relevant legislation
- Principles and techniques of erosion and sediment control
- Preparation of PESCP's.

The structure and content of the Erosion and Sediment Control training would be developed in conjunction with Project management and construction personnel.

7.7 Inspection and Maintenance

A self-auditing program will be established for erosion and sediment control based on a check sheet developed for the site. A site inspection using the developed check sheet will be undertaken by relevant Project personnel:

- At least weekly
- Immediately before extended site shut down or prior to forecast rainfall exceeding 10mm
- At the conclusion of all rainfall events exceeding 10mm 20mm. and during periods of prolonged rainfall as soon as practicable).

The self-audit will include:

- Noting the condition of installed erosion and sediment controls onsite
- Detailing maintenance requirements (if any) for installed erosion and sediment controls
- Recording the volumes of sediment removed from sediment controls and sediment traps, where applicable
- Recording the location to where extracted sediments are disposed.

8. Erosion Control Measures and Sediment Control Methods

The formulation of the ESCP assumes that controls will generally be installed in the following progression;

- Installation of preliminary erosion and sediment controls and exclusion fencing to nominated site areas ,
- Establishing any temporary roads and machinery access points in addition to those existing,
- Installation of stabilised site access, site compound and facilities,
- Forming temporary drains or banks to maximise diversion of off-site flows away from works area to watercourses, existing drainage lines or to temporary drainage diversion structures,
- Construction of on-site water diversion drains or banks to direct runoff to the installed sediment controls,
- Installation of diversion drains/banks upslope and sediment controls down slope of proposed topsoil and spoil stockpile areas,
- Bulk earthworks such as cut excavations, filling, trenching, and engineered formation are controlled with a suite of erosion controls such as exclusion bunding, surface stabilisation treatments, trench stops, batter berms/chutes, contour banks, check dams, etc.,
- Drainage and run-off from site areas directed to adequately designed and constructed sediment controls with regular maintenance and repair as required,
- Completed areas are progressively stabilised as soon as practical with emphasis on critical areas such as drainage outlets, batters, etc.,
- Sediment controls are to be maintained until adequate soil surface protection levels (>70% ground cover) are achieved in the catchment.

The erosion and sediment control measures required for Project areas during the various construction areas will be determined by reference to the guidance and measures detailed in Appendix D – in the Blue Book Volumes 2A - 2D:– DECC 2007. Commonly employed methods and techniques that may be likely to be utilised on the Project are detailed in the following table;

Table 8

Erosion Control – Raindrop Impact	
Situation	Control measure or method
Soil surface protection - Vegetation	• Temporary vegetation (cover crop only) • Permanent vegetation – introduced (exotic) pasture species or native (endemic) species
Soil surface protection - Batter protection	• Organic rolled erosion control products (RECP's) such as jute mesh, jute mat, coir fibre blankets • Non-organic RECP's such as non-woven geotextile membrane or heavy grade plastic sheeting.
Soil surface protection - Mulching	• Hydromulch or hydraulic bonded-fibre matrix • Straw mulching with bitumen tack • Rock or gravel mulch
Soil surface protection - geobinders	• Organic tackifiers • Co-polymer emulsions • Bitumen emulsion
Erosion control - Concentrated Water Flow	
Up-slope diversions	• Excavated channel-type bank • Back push-type bank or windrow • Catch drains
Soft armour channels	• Trapezoidal or parabolic shape design drain cross sections • Organic rolled erosion control products (RECP's) such as jute mesh, jute mat, coir fibre blankets • Non-organic RECP's such as non-woven geotextile membrane or heavy grade plastic sheeting • Organic tackifiers & co-polymer emulsions • Bitumen emulsion • Hydro mulch • Standard or reinforced turf
Hard armour channels	• Loose rock – hard quarry rock • Rock-filled wire mattresses • Grouted rock • Cast in-situ concrete • Underlays utilising heavy grade plastic lining or geotextile lining
Check dams	• Stacked rock • Sandbags and aggregate filter bags • Geotextile covered straw bales • Coir logs
Batter drainage	• Geotextile lined or heavy grade plastic chutes • Pipes and Half pipes • Loose-rock rip rap • Concrete (pre-cast or on-site) • Rock-filled wire mattresses

Table 8

Situation	Control measure or method
Grade control structures and flumes	• Geotextile lined or heavy grade plastic chutes • Pipes and Half pipes • Concrete chutes • Loose-rock rip rap • Gully pits and field inlets • Sandbag drop structures • Rock-filled wire gabions and mattress structures
Outlet dissipation structures	• Loose-rock rip-rap apron diffusers • Rock-filled wire mattresses • Pinned geotextile aprons • Level spreaders
Revetments and retaining walls	• Rip rap • Rock-filled wire gabions and mattresses
Sediment control - Sheet Flows	
Vegetative filters	• Turf strips
Sediment barriers/filters	• Sediment fencing • Topsoil berms stabilised with vegetation or geotextile with filter outlets at intervals • Excavated and geotextile lined sediment traps • Geotextile covered rock or gravel windrows • Coir logs
Site exit points	• Shaker grids with paved or rock aprons and sediment sumps • Wheel wash equipment and designated/controlled areas
Sediment control - Concentrated Flows	
Sediment traps	• Sediment basins • Stacked rock with geotextile • Excavated and geotextile lined sediment traps • Straw bale or sand bag structures • Gully pit, field inlet and kerb inlet traps

9 Soil & Water Management Activities & Controls

The following table outlines the environmental management and mitigation measures proposed to be implemented, together with responsibilities and frequency of actions;

Table 9

1. Planning, permits & personnel		
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**
1. All necessary licences, permits and approvals required by legislation will be obtained prior to works commencing.	Project Manager / Site Manager	Duration
2. Copies of any relevant licences, permits and approvals will be kept on site for inspection upon request or otherwise, as required.	Project Manager / Supervisor / Environmental Site Representative	Site establishment
3. All works and site activities will comply with the explicit requirements of any relevant licence, permit or approval.	Site Manager/ Supervisor / Environmental Site Representative	Duration
4. Recordings and data from site inspections, testing, audits, and monitoring will be retained, with associated documentation maintained to demonstrate remedial action/s have occurred.	Site Manager/ Supervisor / Environmental Site Representative	Duration
5. Erosion and sediment control planning is required prior to the commencement of works. The approved CEMP & SWMP is supplemented by concept Progressive Erosion & Sediment Control Plans (PESCP's) which have been developed in accordance with the requirements of '*Soils and Construction: Managing Urban Stormwater' 4th Edition.* - Landcom 2006.	Project Manager / Site Manager/ Environmental Site Representative	Site establishment & duration
6. The CEMP & SWMP & construction PESCP's may be supplemented by site-specific Environmental Management Plans (EMP's) which would be developed in response to a significant environmental issue emerging. The EMP's would outline the relevant environmental risks and issues, mitigation of potential risks, and detail strategies for remediation and/or management.	Project Manager / Site Manager/ Environmental Site Representative	Site establishment & duration
7. The induction of employees and contractors to include a component promoting environmental awareness, legislative requirements & penalties, and basic erosion and sediment control tasks	Supervisor / Environmental Site Representative	Site establishment & duration
8. Toolbox talks will regularly focus on specific works, associated risks, potential impacts, and mitigation measures. Specific erosion and sediment control awareness training and workshops will be undertaken by personnel with direct involvement with erosion and sediment control.	Site Manager/ Supervisor /	Site establishment & duration

Environmental Management Controls	Person Responsible	Timing / Frequency
9. Promote planning for seasonal restrictions for high-risk areas and/or activities ((i.e., late summer/autumn rainfall events for culvert works or cold winter temperatures affecting revegetation)	Site Manager/ Environmental Site Representative	Site establishment & duration
2. Clearing, site establishment, topsoil stripping & stockpiling		
1. Exclusion areas ('No Go' zones) to be identified, delineated where practical, and personnel instructed to avoid disturbance in these areas.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment
2. Temporary fencing or barricading such as parawebbing or perimeter tape is to be utilised on the perimeter with accompanying signage as required.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment
3. Areas of proposed works with identified noxious weed infestations to be treated with appropriate herbicide, in accordance with product directions. The weed treatment will occur in sufficient time prior to disturbance to ensure complete 'die back' prior to topsoil handling.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment
4. In areas requiring weed control, spray drift will be mitigated by conducting spraying activities in calm weather and application by hand sprayer unit where practical.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment
5. The extent of earthworks will be demarcated to the footprint necessary for the proposed works.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment & duration
6. Construct erosion resistant access routes, site access/egress points, and compound roads to be formed and stabilised as early works. Car parking areas and frequently utilised areas should be stabilised (e.g., geotextile with asphaltic millings, rock aggregate overlay, bitumen chip seal or similar) to prevent soil churning, where required. Any rock or aggregate required for vehicle access should be clean and free from soil or other contaminants.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment & duration
7. Temporary drains, banks or diversions are to be formed and stabilised to divert concentrated 'clean' flows around disturbed works areas.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment & duration
8. The installation of preliminary sediment controls such as perimeter sediment fencing, excavated sediment traps, check dams, coir log/straw bale filters, etc, will be implemented prior to disturbance within the catchment.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment
9. Stockpiles and material will not be located within the 1 in 10-year ARI floodplain and the stockpile locations are to avoid concentrated surface flows or areas subject to inundation during wet weather.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment & duration
10. The long-term soil stockpile locations are to be located 5 metres away from major drainage lines and at least 10 m from waterways. The stockpiles will not be established in areas subject to concentrated surface flows, waterlogging or prolonged inundation during wet weather.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment & duration

Environmental Management Controls	Person Responsible	Timing / Frequency
11. Stockpiles should be stabilised if they are to remain in place for more than 20 days. Rolled Erosion Control Products (RECP's such as geotextile, jute mesh, coco fibre mat, etc) or soil binders can be used on smaller stockpiles, however, larger stockpiles should be formed into crowned structures to minimise erosion and be subsequently stabilised with cover crop seeding or applied geobinders. Plastic covers should only be utilised for short term cover for wind or storm protection.	Site Manager/ Supervisor / Environmental Site Representative	Site establishment & duration
12. Maintain minor benches or contour berms on fill batter formations until profiling for topsoiling is imminent	Site Manager/ Supervisor / Environmental Site Representative	Duration
13. Temporary scour protection lining for major 'dirty' drains for steep or long drains to sediment basins or other controls.	Site Manager/ Supervisor / Environmental Site Representative	Duration
14. Access to the works area, and movements on the site during construction will be limited to the defined access and project areas, where possible. Minimise vehicle movements & speed on unsealed areas and access tracks.	Site Manager/ Supervisor / Environmental Site Representative	Duration
15. Earthworks and hauling, and vehicular movements to be limited in wet conditions.	Site Manager/ Supervisor / Environmental Site Representative	Duration
16. Appropriate sediment tracking controls such as an aggregate/geotextile apron, shaker grid, etc will be installed at exit points from the site, where required.	Site Manager/ Supervisor / Environmental Site Representative	Duration
17. The adjoining local road network to be regularly monitored for tracked sediments with affected areas cleaned as soon as possible in a safe manner.	Site Manager/ Supervisor / Environmental Site Representative	Duration
18. Vehicles transporting bulk materials such as soils and fill are to correctly cover loads to prevent loss of load and/or dust generation on public roads.	Site Manager/ Supervisor / Environmental Site Representative	Duration
19. Imported quarry products and fill materials required for construction are to be clean, and free of contaminants (i.e.. weeds, waste, liquids, etc).	Site Manager/ Supervisor / Environmental Site Representative	Duration
20. Water carts are to regularly spray access tracks, works areas, & temporary stockpiles, during dry weather conditions.	Site Manager/ Supervisor / Environmental Site Representative	Duration
21. Bunded or controlled areas for re-fuelling, material stockpiling, (and contaminated soil treatment area if required) are to be formed prior to commencement of those works in the relevant risk areas.	Site Manager/	Site establishment & duration
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**

22. The progress of earthworks will minimise slope lengths and gradients where practical utilising contour berms, batter berms, diversion banks, etc.	Site Manager/ Supervisor / Environmental Site Representative	Duration
23. Personnel to ensure visual dust monitoring is maintained during works, and dust suppression is undertaken regularly.	Site Manager/ Supervisor / Environmental Site Representative	Duration
24. Minimise earthworks, soil handling and general disturbance during periods of strong and/or gusty winds.	Site Manager/ Supervisor / Environmental Site Representative	Duration
25. Apply water sprays for dust suppression where works, soil handling and/or potentially contaminated soils are generating dust.	Site Manager/ Supervisor / Environmental Site Representative	Duration
3. Drainage and water management		
1. Construct diversion drains or banks upslope of proposed works to direct off-site water flows to existing drainage or adequately stable vegetated areas.	Site Manager/ Supervisor / Environmental Site Representative	Duration
2. Immediately line any constructed off-site water diversion with appropriate RECP's, OFM's and/or geobinders. Temporary spillways and associated structures to be suitably stabilised for the volume and turbulence of flows.	Site Manager/ Supervisor / Environmental Site Representative	Duration
3. Sheet flows in work areas have erosion measures such as surface roughening, scribed drains and/or contour banks to reduce slope lengths. Flows from diversions to have velocities controlled and directed to sediment controls.	Site Manager/ Supervisor / Environmental Site Representative	Duration
4. Temporary 'dirty' water drainage will be adjusted progressively to maximise flows to sediment filters and traps.	Site Manager/ Supervisor / Environmental Site Representative	Duration
5. Permanent storm water drains and outlet structures will be stabilised as soon as possible following completion.	Site Manager/ Supervisor / Environmental Site Representative	Duration
6. Check dams are to be constructed from geotextile/aggregate bags, sandbags, staked coir logs/straw bales or geotextile/rock formations to reduce flow velocities in unlined drains and other areas of concentrated flow (i.e. against diversion banks). Check dams are to be installed at the required intervals in drains with the frequency of the dams increasing as the grade increases	Site Manager/ Supervisor / Environmental Site Representative	Duration
7. Trenching works on grade will be controlled with methods detailed in the 'Blue Book' – Volume 2A' - Section 6	Site Manager/ Supervisor / Environmental Site Representative	Duration
8. Flooded excavations, ponded water, etc will be extracted as required and utilised for site purposes or treated to achieve acceptable water quality prior to discharge.	Site Manager/ Supervisor / Environmental Site Representative	Duration
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**

9. Flooded excavations and groundwater encountered in ASS areas or potentially contaminated areas will be tested and assessed prior to being extracted for treatment & subsequent discharge or conveyed to a licensed liquid waste facility.	Site Manager/ Supervisor / Environmental Site Representative	Duration
10. Site water that is to be discharged directly to a flow line, drain, watercourse, etc, will be tested, treated, and recorded prior to discharge.	Site Manager/ Supervisor / Environmental Site Representative	Duration
11. Water quality should meet the following minimum criteria prior to discharge to any waterway or drainage line: • Total suspended solids (TSS) – less than 50 mg/L • pH – 6.5 to 8.5 • oil and grease – not visible and less than 10 mg/L	Site Manager/ Supervisor / Environmental Site Representative	Duration
12. Dewatering devices or transfer pumps will be positioned to ensure that settled sediments are not disturbed or extracted. Discharge of concentrated, treated flows to lands will occur in well vegetated areas with diffusers or level spreaders to prevent erosion. Flows transferred from in-stream works to downstream areas be released in a diffused manner.	Site Manager/ Supervisor / Environmental Site Representative	Duration
13. The appearance of water quality at the discharge outlet will be regularly monitored for any increase in turbidity, and dewatering suspended until acceptable water quality levels are regained	Site Manager/ Supervisor / Environmental Site Representative	Duration
14. Adequately designed and constructed concrete washout facilities will be constructed in a suitable location away from drainage lines and 40m from waterways. Concrete wash down to occur directly into lined receptacles or formed washouts.	Site Manager/ Supervisor / Environmental Site Representative	Duration
4. Sediment Controls		
1. Commonly used sediment control devices are outlined in Section 8 – Table 8, and some construction details are shown in the Standard Drawings shown at Appendix F. Alternative controls or methods may be employed in certain circumstances for practicality or efficiency purposes. Alternative controls or methods must demonstrate efficacy and be in accordance with the intent and objectives of the 'Blue Book'.	Site Manager/ Supervisor / Environmental Site Representative	Duration
2. Substitute materials may be utilised in the construction of erosion or sediment controls where functionality is not affected.	Site Manager/ Supervisor / Environmental Site Representative	Duration
3. Sediment fencing, non-woven geotextile, mulch berms, etc, will be installed on down slope work boundaries, down slope of stockpiles, cut/fill batters, access tracks, etc, to filter sheet flows.	Site Manager/ Supervisor / Environmental Site Representative	Duration
4. Sediment filters will be formed from rock & shade cloth/geotextile structures, aggregate & geotextile filter bags, coir logs, etc, to control concentrated on-site water flows as required	Site Manager/ Supervisor / Environmental Site Representative	Duration
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**
5. Excavated sediment traps may be utilised at critical locations at the toe of the contributing catchment. They will be desilted	Site Manager/ Supervisor /	Duration

at 60% capacity and are to be dewatered prior to the onset of further rainfall.	Environmental Site Representative	
6. The excavated sediment traps should be regarded as a secondary control, relying on retention of coarse sediment in upslope controls within the construction area.	Site Manager/ Supervisor / Environmental Site Representative	Duration
7. Aggregate filter bags or sandbag inlet traps are to be deployed on roadside pit inlets or other inlets to the drainage system.	Site Manager/ Supervisor / Environmental Site Representative	Duration
8. Gully pit inlets will be protected with filter inlet controls formed from sediment fence, filter bags, straw bales & geotextile, coir logs, etc.	Site Manager/ Supervisor / Environmental Site Representative	Duration
9. The sediment captured by control devices is to be removed when 40% of capacity is reached. Regular desilting is also to maintain catchment and settling capacity, and to reduce re-entrainment of settled materials in subsequent rain events.	Site Manager/ Supervisor / Environmental Site Representative	Duration
5. Soil Contamination & Material Importation		
1. Excavation of sub-soils to be inspected and monitored as works proceeds, to identify potential contamination. Any potentially contaminated soils to be stripped or excavated separately and transported directly to the designated stockpile, treatment area or licensed waste facility.	Site Manager/ Supervisor / Environmental Site Representative	Duration
2. Where unexpected contamination in the form of contaminated soil, ASS or asbestos is discovered on site, the Unexpected Finds Procedure, subplan to the Environmental Management Plan, will be implemented to mitigate environmental risks from unexpected contamination.	Site Manager/ Supervisor / Environmental Site Representative	Duration
3. Potentially contaminated soils are to be stored within an appropriately bunded area and covered with heavy grade plastic or other impermeable covers for the duration of rainfall.	Site Manager/ Supervisor / Environmental Site Representative	Duration
4. Potentially contaminated excavated material that are required to be removed from site are to be assessed and classified in accordance with the Protection of the Environment Operations Act 1997 and '*Waste Classification Guidelines: Parts 1 and 2* (DECC 2008)'.	Site Manager/ Supervisor / Environmental Site Representative	Duration
5. Soils to be disposed of off-site will be classified in accordance with the POEO Act (including the NSW EPA Waste Classification Guidelines, where applicable) prior to leaving the site.	Site Manager/ Supervisor / Environmental Site Representative	Duration
6. Each excavated area / stockpile will be tracked on the Material Tracking Register to identify where the material was excavated from and document the soil classification and volumes of each stockpile. The Material Tracking Register will be read in conjunction with a site map mark-up of the stockpiles, to assist in managing where material was excavated from and tracking the different classification of materials on site.	Site Manager/ Supervisor / Environmental Site Representative	Duration
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**
7. Excavated soils and materials (that have been assessed, classified, treated, and re-assessed on site) will be re-used as fill material on site where appropriate.	Site Manager/ Supervisor /	Duration

	Environmental Site Representative	
8. Vehicles transporting potentially contaminated soils both on internal access tracks and public roads will correctly cover loads to mitigate dust generation or spillage.	Site Manager/ Supervisor / Environmental Site Representative	Duration
9. All material that is taken to licenced landfills will be tipped at locations licenced to take the classification of spoil. Tipping dockets from the licenced landfill will be provided by the civil subcontractor and be recorded in the Material Tracking Register.	Site Manager/ Supervisor / Environmental Site Representative	Duration
10. The ground disturbance and machinery/vehicle movements in potentially contaminated areas will be minimised to essential works.	Site Manager/ Supervisor / Environmental Site Representative	Duration
11. Earthworks, soil handling and general disturbance in potentially contaminated areas are to be avoided during periods of strong and/or gusty winds.	Site Manager/ Supervisor / Environmental Site Representative	Duration
12. Water sprays are to be utilised to mitigate dust from contaminated soils in works areas, contaminated soil handling or temporary stockpile areas.	Site Manager/ Supervisor / Environmental Site Representative	Duration
13. Soil imported to the site • must be legally able to be imported onto the site in accordance with the Protection of the Environment Operations (Waste) Regulation 2014 and any required works specific approvals. • The soils must meet the geotechnical requirements for their proposed use. • The soils must be classified as VENM, Excavated Natural Material (ENM) or other materials legally able to be imported onto the site based on a Resource Recovery Order and Exemption. Soils must be assessed in accordance with the EPA requirements. For VENM this generally includes having no signs of concern, metal concentrations at background levels and organic compounds below appropriate laboratory limits of reporting. For non-VENM materials the EPA requirements would generally include assessment in accordance with the appropriate Resource Recovery Order. • Prior to importation, appropriate documentation should be provided to, and approved by, the Environmental Site Representative or Construction Manager and the materials should, where practicable, be inspected at the source site to confirm that there are no signs of contamination. Quarried materials (i.e., materials sourced from a quarry that are not recycled) need not be subject to assessment by the Environmental Site Representative, however other inspection and record keeping requirements still apply to these materials. • The material must be inspected during importation, and any materials not meeting the description given in the provided documentation or displaying signs of contamination will be rejected. The Environmental Site Representative may also conduct inspections during and /or following importation.	Site Manager/ Supervisor / Environmental Site Representative	Duration

• Additional testing of the imported material may be required, as recommended by the Environmental Site Representative, commensurate with the documentation provided for review and the material type/ classification. The contractor will track and keep a record of all soil materials imported onto the site in the material tracking register		
6. Soil & Water pollution control		
1. All waste will be handled, stored, and disposed of in accordance with the '*Waste Classification Guidelines: Parts 1 and 2* (DECC 2008)'.	Site Manager/ Supervisor / Environmental Site Representative	Duration
2. Waste construction materials such as steel, concrete, etc will be removed to an appropriate recycling facility, to a suitable location for appropriate re-use, or to a licensed waste disposal facility.	Site Manager/ Supervisor / Environmental Site Representative	Duration
3. All putrescible, construction, and food wastes are to be immediately captured and stored correctly, prior to removal to a licensed waste facility. Putrescibles and food wastes will be removed from site on a least a weekly basis.	Site Manager/ Supervisor / Environmental Site Representative	Duration
4. The effluent from concrete wash down is to be captured by an excavated wash out pit lined with an impervious membrane at least 5 metres away from any waterway or major drainage lines. The pit is to be protected by a diversion bund to prevent entry of site run-off that may subsequently displace alkaline water/slurry. Concrete washouts to be covered for the duration of significant or prolonged rainfall.	Site Manager/ Supervisor / Environmental Site Representative	Duration
5. The water levels in concrete washout pits will be monitored and dewatered regularly. The water pH will be tested and treated where it is outside the parameters of pH 6.5-8.5. Where suitable pH is attained, the water can then be used site purposes.	Site Manager/ Supervisor / Environmental Site Representative	Duration
6. The site machinery 'lay-up' area, re-fuelling areas and chemical storage areas are to be located at least 5 meters away from major drainage line.	Site Manager/ Supervisor / Environmental Site Representative	Duration
7. The re-fuelling and servicing of machinery is to be undertaken at approved premises off-site where possible. Onsite refuelling and servicing only to occur with appropriate spill control measures at hand, or where established or temporary bunded areas are available.	Site Manager/ Supervisor / Environmental Site Representative	Duration
8. Mobile plant, machinery and vehicles are to be regularly inspected and maintained to manufacturer's specifications.	Site Manager/ Supervisor / Environmental Site Representative	Duration
9. Appropriate spill kits are to be always kept on site and any spillage is to be immediately cleaned up. In the event of a large or hazardous spill, contact will be made with emergency and relevant authorities, where required.	Site Manager/ Supervisor / Environmental Site Representative	Duration
10. All site personnel will be instructed about emergency spill procedures, spill kit locations and requirements. The location of spill response kits will be established close to works or operations areas.	Site Manager/ Supervisor / Environmental Site Representative	Duration
11. Storage of liquid construction materials (chemicals, fuels, oils, etc) will be provided in appropriately bunded areas on	Site Manager/ Supervisor /	Duration

site to prevent leaching into soils, leaking or other transfer of material into waterways.	Environmental Site Representative	
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**
12. Containment bunds are to be monitored regularly and captured materials removed as required to ensure bund capacity is maintained.	Site Manager/ Supervisor / Environmental Site Representative	Duration
13. Bunded areas will satisfy requirements of the relevant Australian Standards and 'Bunding and Spill Management (DEC, 1997)'	Site Manager/ Supervisor / Environmental Site Representative	Duration
14. The requirements of the Australian Dangerous Goods Code will be observed for storage and transport of any hazardous materials. The compatibility of all chemicals, pesticides and fuels transported and stored will be assessed to avoid potential risk from reactions, explosion, etc.	Site Manager/ Supervisor / Environmental Site Representative	Duration
15. All chemicals, pesticides and fuel will be stored and transported in approved containers. Chemicals, pesticides and fuels are to be labelled correctly and clearly, including using approved warning symbols etc.	Site Manager/ Supervisor / Environmental Site Representative	Duration
16. A MSDS register and will be maintained and be readily accessible on site for all hazardous chemicals transported, handled or applied.	Site Manager/ Supervisor / Environmental Site Representative	Duration
17. An adequate record or log of all environmentally hazardous chemicals received, used and/or disposed of will be maintained.	Site Manager/ Supervisor / Environmental Site Representative	Duration
18. Substitution of less hazardous materials or chemicals or modifying methods of use/storage etc. will be implemented where possible.	Site Manager/ Supervisor / Environmental Site Representative	Duration
19. The quantities of hazardous materials and chemicals stored or used will be minimised as far as practical.	Site Manager/ Supervisor / Environmental Site Representative	Duration
20. Sensitive areas (ie. drainage lines) will be identified before utilising or applying chemicals. Where sensitive areas are identified, appropriate guidance and relevant restrictions will be formulated for chemical use or applications.	Site Manager/ Supervisor / Environmental Site Representative	Duration
21. The application methods and dilution ratios specified in manufacturer's directions and/or associated MSDS will be observed by personnel.	Site Manager/ Supervisor / Environmental Site Representative	Duration
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**
7. Stabilisation		
1. Promote efficient staging planning for early stabilisation of perimeter or completed areas. (i.e. stabilisation of permanent drains, batters, Sealing & paving, and decommissioning of temporary controls)	Site Manager/ Supervisor / Environmental Site Representative	Duration

2. Stabilisation of areas is to occur progressively in conjunction with the completion of earthworks.	Site Manager/ Supervisor / Environmental Site Representative	Duration
3. Suitable design and construction techniques are to be selected for stabilisation of relevant areas such as drain linings, batter treatments, etc.	Site Manager/ Supervisor / Environmental Site Representative	Duration
4. Completed earthworks areas will be backfilled and compacted in a staged manner as soon as possible. Adjacent disturbed areas will be suitably trimmed and stabilised as required.	Site Manager/ Supervisor / Environmental Site Representative	Duration
5. Erosion and sediment controls are to be maintained until the relevant catchments are stabilised, re-vegetated, or sealed adequately to achieve soil surface protection factors as per the 'Blue Book', SWMP & ESCP requirements.	Site Manager/ Supervisor / Environmental Site Representative	Duration
6. Any aggregate placed for vehicle access or as a work platform should be removed to a suitable location for recycling, appropriate re-use, or to a licensed waste disposal facility.	Site Manager/ Supervisor / Environmental Site Representative	Duration
7. Cover crop seeding to occur dependent on the seasonal conditions and timing of final landscaping.	Site Manager/ Supervisor / Environmental Site Representative	Duration
8. Monitoring & Reporting		
1. General observations for the daily management of erosion and sediment controls shall be documented in site dairies.	Site Manager	Duration
2. Regular inspection of erosion and sediment controls shall be undertaken using the Weekly Environmental Management Inspection Checklist and uploaded to Project Pack Web.	Supervisor / Environmental Site Representative	Weekly, and after storm events >10mm in 24 hours
3. Effectiveness of erosion and sediment controls shall be regularly reviewed for adequacy having regard for changing circumstances.	Supervisor / Site Manager/ Environmental Site Representative	Duration
4. Details of field observations shall be reported via the Enviro Inspection Checklist, and communicated to all staff during pre-starts, toolbox and/or team meetings.	Site Manager/ Supervisor / Environmental Site Representative	Following receipt of incident/compl aint
5. All complaints / incidents regarding soil & water shall be reported immediately to the ESR.	Site Manager Supervisor / Environmental Site Representative	Following receipt of incident/compl aint
6. The Senior Project Manager shall be notified immediately of all incidents and valid complaints. Relevant BESIX Watpac procedures for incidents and complaints handling reporting shall be followed.	Site Manager / Supervisor / Environmental Site Representative	Following Incident
7. BESIX Watpac NSW WHSE Team is to be immediately informed of any incident that has caused or is likely to cause material harm to the environment and will advise on the notification of relevant regulators and stakeholders (As required by the Protection of the Environment Operations Act 1997).	Senior Project Manager	Following Incident

8. The BESIX Watpac Senior Project Manager shall notify the client of all significant incidents and valid complaints, verbally within 2 hours, and in writing within 24 hours.	Project Manager	Verbally -2 hours. In writing - 24 hours
9. All monitoring results are to be recorded on the BESIX Watpac internal record system (Aconex). Agencies will be provided results if requested,	Supervisor	Throughout works
10. A summary of soil and water management to be included in the project monthly environmental report and issued to the Senior Project Manager.	Senior Project Engineer	Monthly
11. A summary of incidents, valid complaints and monitoring results (if any) shall be provided monthly to the client and include the actions that were taken to address the incident/complaint.	Project Manager	Monthly

Appendix A

Site Characteristics & Revised Universal Soil Loss Equation Assessment

Site Characteristics Table & Revised Universal Soil Loss Equation (RUSLE) Data

Location	New Shellharbour Hospital
Construction duration	<12 months earthworks – 85th%ile adopted (Sect. 6.3.4 – (f). Blue Book)
Erosion Hazard	Low (On slopes <6%) (Sect 4.4.1 & Figure 4.6 – Blue Book)
Soil Loss Class	Class 4 (Sect 4.4.2. & Table 4.2 – Blue Book)
Batter Restrictions	Yes Generally, >5m batter length @ 2H:1V ranging to >9m @ 3H:1V (Sect 4.4.2 – (a) & Figure 4.7 – Blue Book)
Seasonal erosion hazard	No (Sect 4.4.2 – (c), Figure 4.9 & Table 4.3 – Blue Book)
Soil texture group – In order of dominance	
'Bombo' (bo) Soil Landscape: Moderate to Extreme Erosion Hazard Generally; • Low permeability • Low wet bearing strength • Shrink-swell hazard • Strongly acid • Sodicity • High aluminium toxicity	bo1—Friable reddish brown sandy clay loam (topsoil)
	bo2—Hard setting brownish black sandy loam (topsoil)
	bo3—Reddish brown light medium clay (subsoil)
	bo4—Reddish brown sandy clay (subsoil)
	bo5—Brown strongly pedal medium clay(subsoil)
'Killalea' (ki) Soil Landscape: Slight to Low Erosion Hazard Generally; • Low permeability • Low wet bearing strength • Shrink-swell hazard • Strongly acid • Strong sodicity	ki1—Friable brown strongly pedal silty clay loam (topsoil)
	ki2—Organic black massive sandy loam (topsoil)
	ki3—Very dark strongly pedal brown medium clay (subsoil)
	ki4—Loose bleached light grey sand with iron staining (subsoil)

Site Characteristics Table & Revised Universal Soil Loss Equation (RUSLE) Data

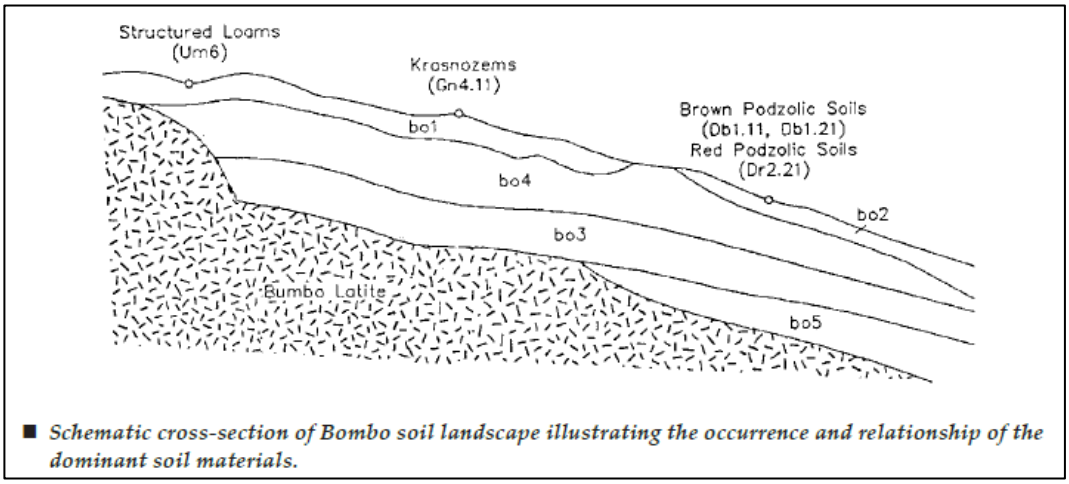
Location	New Shellharbour Hospital
Soil texture group – In order of dominance	
'Shellharbour' (sh) Soil Landscape: High to Extreme Erosion Hazard Generally; • Low permeability • Low wet bearing strength • Shrink-swell hazard • Strongly acid • Sodicity • Stoniness	sh1—Friable brownish black sandy loam(topsoil)
	sh2—Hard setting organic rich black light clay (topsoil)
	sh3—Mottled dull reddish brown, sandy clay (subsoil)–with characteristic stone line
	sh4—Brown strongly pedal heavy clay (subsoil)
	sh5—Very sticky strongly pedal dull reddish brown sandy clay loam (subsoil)
USCS Class	'Bombo' (bo) Soil Landscape (Dominant): CL (Inorganic Clays – Low Plasticity) 'Killalea' (ki) Soil Landscape: CL (Low Plasticity Clays) to ML (Inorganic silts/Clayey Silts 'Shellharbour' (sh) Soil Landscape: ML (Inorganic silts/Clayey Silts to CL (Low Plasticity Clays) (Appendix C – Table 22 – Kiama Soil Landscapes – Blue Book)
Soil erodibility factor – K factor	'Bombo' (bo) Soil Landscape (Dominant): Not Supplied 'Killalea' (ki) Soil Landscape: 0.034 'Shellharbour' (sh) Soil Landscape: 0.035 (0.055 Adopted) (Appendix C – Table 22 – Kiama Soil Landscapes – Blue Book)
Sediment Type	'Bombo' (bo) Soil Landscape (Dominant): Type F 'Killalea' (ki) Soil Landscape: Type F 'Shellharbour' (sh) Soil Landscape: Type D (Type D Adopted) (Appendix C – Table 22 – Kiama Soil Landscapes – Blue Book)
Soil hydrologic group	'Bombo' (bo) Soil Landscape (Dominant): Group B 'Killalea' (ki) Soil Landscape: Group C 'Shellharbour' (sh) Soil Landscape: Group C (Group C Adopted) (Appendix C – Table 22 – Kiama Soil Landscapes – Blue Book)
85th %ile, 5-day rainfall event	42.1 mm - Kiama (Sect 6.3.4 – Table 6.3a - Blue Book)
Rainfall Intensity - millimetres per hour	13mm/hour (2 Year, 6 Hour storm – BOM IFD Table)

Site Characteristics Table & Revised Universal Soil Loss Equation (RUSLE) Data

Location	New Shellharbour Hospital
Rainfall Erosivity – R factor	3625 (Calculated from 2-year ARI, 6 Hour storm, where S=9.26mm/hour and where $R = 164.74(1.1177)^{s}S^{0.6444}$ Blue Book - Appendix A2 & B)
Volumetric runoff coefficient - Cv	0.58 (Blue Book – Appendix F: Table F2
Grade	'Bombo' (bo) Soil Landscape (Dominant): 15–25%: 'Killalea' (ki) Soil Landscape <3% 'Shellharbour' (sh) Soil Landscape: commonly <20%
Slope Length	80 metres adopted
LS Factor	Variable
Erosion control practice factor – P factor	1.3
Ground cover – C Factor	1.0
Sediment Storage Zone Volume design	2 months soil loss (Sect 6.3.4.- I (ii) - Blue Book)

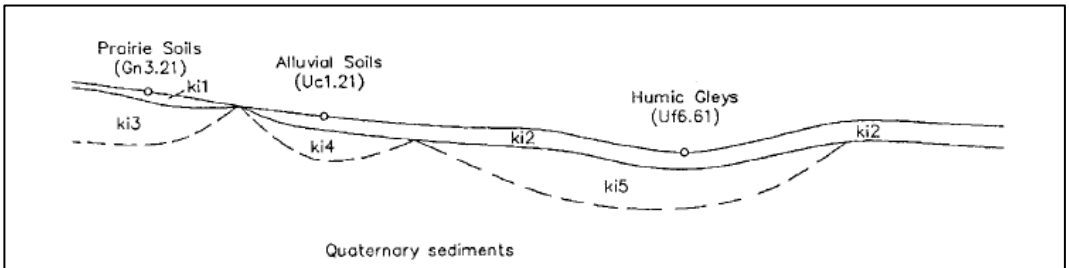
Typical Soil Profile diagrams

'Bombo' (bo) Soil Landscape (Dominant)



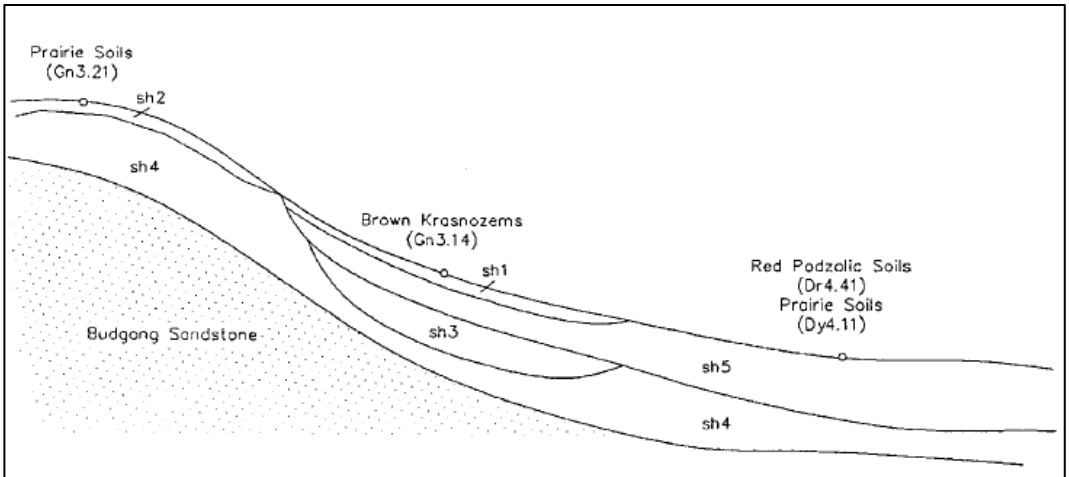
■ *Schematic cross-section of Bombo soil landscape illustrating the occurrence and relationship of the dominant soil materials.*

'Killalea' (ki) Soil Landscape



■ *Schematic cross-section of Killalea soil landscape illustrating the occurrence and relationship of the dominant soil materials.*

'Shellharbour' (sh) Soil Landscape



■ *Schematic cross-section of Shellharbour soil landscape illustrating the occurrence and relationship of the dominant soil materials.*

Appendix B

RUSLE Catchment Assessment & Sediment Basin Calculations

1. Erosion Hazard and Sediment Basins

Site Name: New Shellharbour Hospital

Site Location: Dunmore Road, Dunmore

Precinct/Stage: Stage 1 & Stage 2

Other Details: Stage 1 - Overall site area, no 'clean' water diversion. Stage 1 - Overall site area with 'clean' water diversion, Stage 2

Site area	Sub-catchment or Name of Structure						Notes
	O/all	Clean	Stg 2				
Total catchment area (ha)	10.25	7.5	10.25				
Disturbed catchment area (ha)	7.7	7.5	10.25				

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

Sediment Type (C, F or D) if known:	D	D	D				From Appendix C (if known)
% sand (fraction 0.02 to 2.00 mm)							Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
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	D	D	D				Automatic calculation from above

Rainfall data

Design rainfall depth (no of days)	5	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	85				
x-day, y-percentile rainfall event (mm)	42.1	42.1	42.1				
Rainfall R-factor (if known)	3625	3625	3625				Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)	13	13	13				

RUSLE Factors

Rainfall erosivity (*R*-factor)	3625	3625	3625				Auto-filled from above
Soil erodibility (*K*-factor)	0.055	0.055	0.055				RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	80	80	80				
Slope gradient (%)	7.5	7.5	7.5				
Length/gradient (*LS*-factor)	1.90	1.90	1.90				
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	2	2	2	2	Minimum is generally 2 months
Cv (Volumetric runoff coefficient)	0.58	0.58	0.58				See Table F2, page F-4 in Appendix F

Calculations and Type D/F Sediment Basin Volumes

Soil loss (t/ha/yr)	494	494	494				
Soil Loss Class	4	4	4				See Table 4.2, page 4-13
Soil loss (m^3/ha/yr)	380	380	380				Conversion to cubic metres
Sediment basin storage (soil) volume (m^3)	487	475	649				See Sections 6.3.4(i) for calculations
Sediment basin settling (water) volume (m^3)	2503	1831	2503				See Sections 6.3.4(i) for calculations
Sediment basin total volume (m^3)	2990	2306	3152				

NB for sizing of Type C (coarse) sediment basins, see Worksheet 3 (if required).

1. Erosion Hazard and Sediment Basins

Site Name: New Shellharbour Hospital

Site Location: Dunmore Road, Dunmore

Precinct/Stage: Stage 1 - Construction Carpark

Other Details: Stage 1 - Stockpile Destocking and Construction Carpark Development

Site area	Sub-catchment or Name of Structure						Notes
	O/all						
Total catchment area (ha)	2.5						
Disturbed catchment area (ha)	2.5						

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

Sediment Type (C, F or D) if known:	D						From Appendix C (if known)
% sand (fraction 0.02 to 2.00 mm)							Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
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	D						Automatic calculation from above

Rainfall data

Design rainfall depth (no of days)	5						See Section 6.3.4 and, particularly, Table 6.3 on pages 6-24 and 6-25.
Design rainfall depth (percentile)	85						
x-day, y-percentile rainfall event (mm)	42.1						
Rainfall R-factor (if known)	3625						Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)	13						

RUSLE Factors

Rainfall erosivity (*R*-factor)	3625						Auto-filled from above
Soil erodibility (*K*-factor)	0.055						
Slope length (m)	80						
Slope gradient (%)	5.5						
Length/gradient (*LS*-factor)	1.33						RUSLE LS factor calculated for a high rill/interrill ratio.
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	2	2	2	2	Minimum is generally 2 months
Cv (Volumetric runoff coefficient)	0.58	0.58	0.58				See Table F2, page F-4 in Appendix F

Calculations and Type D/F Sediment Basin Volumes

Soil loss (t/ha/yr)	344						
Soil Loss Class	3						See Table 4.2, page 4-13
Soil loss (m^3/ha/yr)	265						Conversion to cubic metres
Sediment basin storage (soil) volume (m^3)	110						See Sections 6.3.4(i) for calculations
Sediment basin settling (water) volume (m^3)	610						See Sections 6.3.4(i) for calculations
Sediment basin total volume (m^3)	720						

NB for sizing of Type C (coarse) sediment basins, see Worksheet 3 (if required).

Appendix C

Sediment Basin Management & Dewatering Procedure

1.1 Purpose

The purpose of the Sediment Basin Management & Dewatering Procedure (the Procedure) is to detail the actions to be taken in regard to site dewatering in general and specific measures for the construction and maintenance of sediment basins including steps to be taken prior to any discharge.

Adherence to the methodology outlined in the procedure will ensure that works are carried out in accordance with industry standard and environmental conditions.

1.2. Scope

The Procedure applies to the following works:

- Sediment basin management and maintenance; and
- Acid sulfate leachate ponds in the event that acid sulfate soils or rock is encountered.

Based on the Geotechnical report it is not anticipated that excavations will intercept the water table.

In the event that groundwater is intercepted by the Project and dewatering is required, the following will be obtained prior to any water take occurring (unless an exemption applies):

- a Water Access Licence under the Water Management Act 2000.
- a Water Supply Work approval under the Water Management Act 2000.

1.3. Objectives

The objectives of this Procedure are to:

- Ensure all Project personnel are aware of the requirements of this procedure,
- Detail personnel responsible for undertaking actions relating to sediment basin, construction dewatering and acid sulfate leachate management on the site,
- Providing a uniform, controlled methodology and clear criteria for water releases from the site,
- Implement industry standard methods for managing sediment basins and dewatering in accordance with best practice guidelines such as Managing Urban Stormwater Soils and Construction (Landcom 2004) and Acid Sulfate Soil Manual (ASSMAC 1998),
- Ensure water discharges from site are compliant with:
    - the NSW EPA Water Quality Criteria,
    - Managing Urban Stormwater Soils and Construction (Landcom 2004),
    - Approved Erosion and Control Plan; and
- Comply with environmental requirements of the Project, including all legal requirements and contractual obligations.

The procedure shall ensure appropriate environmental protection measures are in place relating to sediment basins, construction water management (dewatering of excavations, culverts, etc) and management of leachate collected in ponds from acid sulfate material stockpiles.

2. Sediment Basin Management & Dewatering Procedure

Environmental Management Controls	Person Responsible	Timing / Frequency
Planning		
A copy of this Sediment Basin Management and Discharge Procedure will be kept on site and be made available to all relevant project personnel	Supervisor / Environmental Site Representative	Site Establishment / Duration
All relevant project personnel will be made aware of this document during the site induction and again in Toolbox Talks and targeted training sessions.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Training and Awareness		
Training, instruction and equipment familiarisation for environmental personnel undertaking water quality monitoring, equipment calibration and maintenance will be the responsibility of the Environmental Site Representative. This will be completed prior to the initial use of equipment or as new equipment arrives on site.	Environmental Site Representative	Site Establishment / Duration
Training sessions will be conducted with Supervisors, Foreman, and Environmental Work Crew and relevant personnel. The training will address: • Construction of Sediment Basins • Preliminary post-rainfall inspections • Testing and recording • Treatment methods and recording • Details of the Water Discharge Permit • Dewatering requirements, methods, and recording • Maintenance requirements, methods, and recording • Storage, Handling and Application of Flocculants	Supervisor / Environmental Site Representative	Site Establishment / Duration
Any personnel that are responsible for monitoring pumps during dewatering activities, and that have not undertaken training described above, will undertake a specific toolbox talk to ensure awareness of requirements.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Construction of Sediment Basins		
Refer to the relevant PESCPs for the location of the sediment basin/s.	Supervisor / Environmental Site Representative	Site Establishment / Duration
The location and design criteria (volume – length, width & depth) for the sediment basin/s will be outlined in the relevant PESCP. The following criteria will be observed: • All requirements of Landcom's - Managing Urban Stormwater: Soils and Construction Volume 1 (the Blue Book). Refer to Section 6.3.3 volume 1 of the Blue Book for detailed design of the sediment basin. • Impervious clay to be used where required in construction of the internal basin invert and embankments. • Inlet and outlet structures will be appropriately constructed to cater for the nominated rainfall event. • Markers will be present to indicate sediment storage volume and to ensure adequate capacity levels are available.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Sediment basins will be constructed in a way that predominantly only site run-off is collected, and clean water is diverted around them. Earthworks will be conducted in a way so as to avoid ponding of water.	Supervisor / Environmental Site Representative	Site Establishment / Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
The sediment basin/s to be constructed prior to any earthworks or topsoil stripping in the catchment being undertaken. Necessary clearing to access the basin location and associated earthworks will occur with appropriate erosion and sediment controls installed.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Where applicable, the formation of operational sediment basins will be partially or fully constructed in early stages of works and managed as a temporary sediment basin to capture construction runoff.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Effective diversions such as drains and berms will be implemented to ensure that the diversion of site runoff is maximised to basins during all stages of construction.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Water Quality Testing, Treatment & Criteria for Discharge		
Captured water to be discharged from sediment basins must meet the following criteria: • pH between 6.5 – 8.5 • TSS < 50mg/L and • Oil and grease - no visible trace.	Supervisor / Environmental Site Representative	Duration
<u>Correlation between TSS and Turbidity</u> A correlation between TSS and turbidity may be developed for the basin/s to allow discharge based on turbidity levels. This correlation will be submitted to the relevant Approval Authority for approval prior to implementation. If approved, a TSS sample will be taken from every tenth discharge and tested to confirm compliance with required criteria. These results will be used to check and revise the correlation. If these tests indicate an exceedance of TSS criteria, discharges on the basis of turbidity measurements will be suspended until the correlation can be re-established and approved.	Environmental Manager/ Environmental Site Representative	Duration
Potential contamination of any basin or ponded waters will be considered prior to discharge. Where the main source is from storm water, TSS and oil and grease are considered to be the likely pollutants. Where groundwater is a significant contributing source, influence from ASS/PASS, or other contaminants will be considered as potential pollutants and additional testing in the form of pH and metals may be undertaken.	Supervisor / Environmental Site Representative	Duration
Water Treatment		
The drain inverts upslope from sediment basin inlets will be pre-dosed with suitable flocculants/coagulants (Gypsum or Calcium Chloride broadcast in the drain invert and/or Anionic Polyacrylamide gel blocks suspended in cages in locations of turbulent water flow.) to pre-treat run-off before it enters the basin during rainfall	Supervisor / Environmental Site Representative	Duration
The implementation of rain-activated, passive dosing units will deploy suitable liquid flocculants/coagulants during prolonged rainfall events to promote rapid coagulation/flocculation of sediment laden water in the treatment forebay of sediment basins.	Supervisor / Environmental Site Representative	Duration
Onsite reuse of ponded stormwater or infiltrated groundwater should always be the first dewatering option considered. Onsite reuse may include application for dust suppression, earthworks compaction and vegetation establishment.	Supervisor / Environmental Site Representative	Duration
If water is to be used for construction purposes (e.g. compaction, dust control) no treatment is required. However, the water should be removed to re-secure design capacity of sediment basins within 5 days.	Supervisor / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
All sediment basins to be inspected for capacity and water quality daily on work days and within 24 hours (out of site hours) following cessation of a rain period.	Supervisor / Environmental Site Representative	Duration
Before any de-watering of site areas, excavations, etc, the parameters of pH, T.S.S. and oil and grease are to be tested and meet the following criteria: • pH between 6.5 – 8.5 • TSS < 50mg/L; and • Oil and grease < 10mg/L (and no visible trace). Treatment should commence as soon as practical following cessation of a rain to allow enough time for settlement of suspended solids.	Supervisor / Environmental Site Representative	Duration
Records of water quality management must be maintained, and the required records include: • The date(s) on which the sample was taken; • The time(s) at which the sample was collected; • The name of the person who collected the sample.	Supervisor / Environmental Site Representative	Duration
pH Treatment should be undertaken as follows: • Test basin water with a suitable pH meter. No action is required if the pH reading is between 6.5 and 8.5, • Lime to be added if pH below 6.5 or Hydrochloric Acid (32% Muriatic) or Sulfuric Acid to be added if pH above 8.5, • Determine volume of water to be treated in the sediment basin, • Determine the percentage of lime or acid required by taking a 10-litre sample of basin water and adding a known amount of lime or acid (initially 0.004%). If the pH is still not acceptable, vary the amount of lime or acid until within the limits, • Once the required percentage has been determined, calculate the actual amount of lime or acid to be added by multiplying the volume of water in the basin by the determined percentage, • Add the required amount of lime or acid to the basin and mix the water in the sediment basin well, • Treat for pH prior to T.S.S.	Supervisor / Environmental Site Representative	Duration
Total Suspended Solids • Test the sediment basin water initially for NTU using a turbidity tube, nephelometer (Turbidity tester) or by comparing with water samples contained in jars with representative readings up to 100mg/l, • When the comparative NTU readings indicate T.S.S. levels are <50mg/l obtain a grab sample in accordance with approved sampling methods. The water sample to be promptly analysed by a laboratory that is NATA certified in T.S.S. testing, • No further treatment action is required if T.S.S. results are <50mg/l,	Supervisor / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
Total Suspended Solids • Test the sediment basin water initially for NTU using a turbidity tube, nephelometer (Turbidity tester) or by comparing with water samples contained in jars with representative readings up to 100mg/l. • When the comparative NTU readings indicate T.S.S. levels are <50mg/l obtain a grab sample in accordance with approved sampling methods. The water sample to be promptly analysed by a laboratory that is NATA certified in T.S.S. testing. • No further treatment action is required if T.S.S. results are <50mg/l. • If basins require flocculation (e.g. T.S.S. >50mg/l), a flocculant/coagulant is to be utilised at the determined dosage initially, then treated with incremental doses should more flocculants be required. • Basins should be monitored daily after flocculation until desired TSS is achieved and to assist in determination of optimal dosage levels. Methods of application to include: • broadcast by shovels on small sumps and excavations is acceptable. This method requires spreading powdered coagulants (i.e., gypsum, calcium chloride, etc) evenly and thinly (i.e. “dusting”) over as much of the water surface as possible. • For sediment basins or areas with a large water surface area. The powdered or flake style coagulants should be pre-mixed thoroughly in a drum with clean water and sprayed over the maximum surface area of water as possible. • When spraying coagulant mixtures, the mixture should hit the water at between 10 to 20 degrees to increase surface areas exposure to the water column. • Alternative water treatment utilising liquid flocculants/coagulants will require the assessed dosage to be pre-mixed and discharged into the basin. Following dosing, the basin water is to be gently re-circulated for a suitable period (2-4 hours) to allow chemical reaction time, and to keep precipitated flocculant/coagulant in suspension a sufficient time to collect the maximum quantity of fine suspended particles into floc clusters. • The process outlined may need to be repeated if acceptable water quality is not achieved initially. **Oil and Grease** • Examine surface of water for evidence (e.g., sheen, discoloration). • No action if no visual contamination. • Oil absorbent material to be spread if there is contamination (e.g., cell-u-sorb). Leave basins to compensate for 24 to 48 hours.	Supervisor / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
After retesting, and once the above field tests indicate, the water quality is acceptable, pumping or siphoning can commence with the water extraction inlet protected to prevent extraction of sediment.	Supervisor / Environmental Site Representative	Duration
Discharging Water		
Where possible ponded water and sediment basin water will be reused on site for compaction, dust suppression, and irrigation.	Supervisor / Environmental Site Representative	Duration
The whole process of water quality management in sediment basins will be completed within 5 days of cessation of a rain period.	Supervisor / Environmental Site Representative	Duration
Water may be discharged from site where the tested water quality meets NSW EPA criteria and the Site Representative gives approval. The discharge outlet will be constructed to prevent erosion and scour.	Supervisor / Environmental Site Representative	Duration
The Supervisor is to ensure that treated water has been re-tested for pH and turbidity (NTU) in-situ immediately prior to discharge.	Supervisor / Environmental Site Representative	Duration
The preferred method for dewatering a sediment basin is using a static siphon system with sufficient flow capacity to discharge the volume of supernatant water within a reasonable timeframe (i.e. 12 to 24 hours). The siphon inlet is to be positioned so that settled sediments are not extracted during dewatering. The siphon system is to be installed above the sediment basin embankment and not within the basin spillway.	Supervisor / Environmental Site Representative	Duration
Where sediment basins are to be dewatered by pump, suitable inlet protection devices (i.e. float & housing or extraction tube) will be provided to prevent the extraction of settled sediments within the basin. The flows from the pump outlet and basin are to be constantly monitored during discharge.	Supervisor / Environmental Site Representative	Duration
Only personnel who have undertaken the relevant training and been approved by the Supervisor may operate pumps and discharge sediment basins. During dewatering pumps must be always monitored to ensure that settled sediment is not disturbed or extracted, and that water is discharged in a diffused manner to prevent erosion.	Supervisor / Environmental Site Representative	Duration
A Sediment Basin Management Register will be maintained for each basin that details discharge volumes, dates, water treatment. The Sediment Basin Management Register will be updated when treated water is discharged from the basin.	Supervisor / Environmental Site Representative	Duration
Maintenance		
Maintenance of the sediment basins will be ongoing for the duration of the Project and will comprise the following: • The sediment storage capacity limit will be defined through the installation of a marker inside the basin. Sediment will be removed from the basin in accordance with the maintenance schedule, or when the accumulated sediment exceeds 60% of the sediment storage zone. • Sediment removed from basins may be reused on site by incorporating into spoil. • All sediment that will not be reused on site will be disposed of in locations that it will not be conveyed back into the construction areas or watercourses. • Maintenance inspections will be undertaken, and the results incorporated into the Weekly Environmental Inspection Checklist.	Supervisor / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
The stormwater capacity of sediment basins will be reinstated within 5 days of the cessation of a rainfall event that causes runoff to occur	Supervisor / Environmental Site Representative	Duration
Assessment and use of Coagulants & Flocculants		
Coagulation is the neutralisation and/or destabilisation of electrical charge on suspended soil colloids, whereas flocculation utilises bridging type interactions involving polyelectrolyte chains adsorbing to multiple colloid particles and aggregates through electrostatic charge interactions. The following procedure will be implemented to determine the suitability and effectiveness of the various water treatment products. • The product will be sourced from a reputable and traceable supplier together with MSDS and any other supporting documentation. • Controlled 'jar testing' will be undertaken using site sourced water from the sediment basin. The jar testing will establish the site-specific dosing rates for any given products. • Initial dosing will be undertaken incrementally up to the site specific/determined dosing rate if the basin water responds to a lower dose in the 'real world' application. • Settling rates in the basin will be assessed to determine the efficiency of each product. • On site water sampling and testing will progressively assess the water's pH and turbidity in NTU's prior to lab testing. • NATA certified lab testing for TSS, NTU & pH will be completed prior to any dry weather/controlled discharge to downstream waterways.	Supervisor / Environmental Site Representative	Duration
The range and type of suitable flocculants/coagulants (including typical dosing rates described as product required to water volume) that may be utilised include: • Calcium Sulphate (Gypsum - powder) – 300ppm (30kg/100m3) • Anionic Polyacrylamide (gel blocks) – 200ppm (20kg/100m3) • Calcium Chloride (solid - flakes), – 200ppm (20kg/100m3) • Aluminium Chlorohydrate (liquid) – 40ppm (4L/100m3) • PAC23 (poly aluminium chloride 23% - solution) - 50ppm (12.5L/100m3) • Aluminium Sulphate (crystals) – 200ppm (20kg/100m3)	Supervisor / Environmental Site Representative	Duration
Storage and Handling of Flocculants		
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**
Gypsum and agricultural lime will be stored on site as either bagged or bulk product. Storage of bulk gypsum and agricultural lime will be covered, within erosion and sediment controls in a position where run on water will not erode the stockpiles.	Supervisor / Environmental Site Representative	Duration
All treatment chemicals particularly acids and basics will be stored in appropriately bunded and covered locations that are locked to prevent unauthorised access.	Supervisor / Environmental Site Representative	Duration
All chemicals on site will be stored with MSDSs for ease of reference in the event of a spill or irritation/injury to handlers.	Supervisor / Environmental Site Representative	Duration
Requirements of the Material Safety Data Sheets (MSDSs) will be met to ensure compatible storage with other chemicals to ensure safety.	Supervisor / Environmental Site Representative	Duration

Monitoring and Record Keeping		
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**
All sediment basins will be inspected on a weekly basis as a minimum, with any defects or maintenance requirements reported immediately. Sediment basins will be inspected immediately after rainfall events to assess: • Water Storage capacity and water quality treatment requirements prior to discharge • Following treatment and discharge from the sediment basin the sediment storage capacity and requirement for clean out will be assessed.	Supervisor / Environmental Site Representative	Duration
Records to be kept of the rainfall events, inspections undertaken, field tests undertaken, dosage rates and when basin water is released etc.	Supervisor / Environmental Site Representative	Duration
The results of all inspections, including inspection reports will be retained in the site environmental inspection register	Supervisor / Environmental Site Representative	Duration
All discharges will be recorded on a discharge permit which will include: • Volume to be discharged • Treatment details (e.g. Coagulant/ flocculant used, dosage, duration and treatment date) • Water quality monitoring results (including date and time of testing) • Discharge water quality results • Date and time of discharge	Supervisor / Environmental Site Representative	Duration
Pumped discharge of any water off site will be monitored regularly to ensure that tested water quality meets all applicable criteria.	Supervisor / Environmental Site Representative	Duration
Decommissioning Construction Sediment Basins		
Construction sediment basins will remain in place until all upstream areas have been stabilised to achieve a 'C' Factor of 0.05 which equates to 70% groundcover as per Blue Book 7.1	Supervisor / Environmental Site Representative	Duration
All operational sediment basins will be desilted and reformed as per design requirements prior to completion of major works within the catchment.	Supervisor / Environmental Site Representative	Duration
Construction Sediment basins will be removed by restoring the ground disturbed by the construction of the basin similar to pre-existing conditions. This will be achieved by: • Removing all redundant basin equipment such as basin markers, siphons, spillway linings, etc. • Spreading and compacting the embankment material in the basin area • Disturbed ground will be compacted to at least the relative density of the material in the ground adjacent to it.	Supervisor / Environmental Site Representative	Duration

3. Procedure Review

The procedure will be regularly reviewed as part of the CEMP audit requirements. This document will be updated when needed in response to audit findings or changes to site conditions. The Environmental Site Representative will modify the procedure where improvements are identified.

Sediment Basin Management and Discharge Record

Date Inspected		Basin/discharge point ID:	
Date of last rainfall event:		Amount of rainfall received:	
Estimated basin level in %?		Approximate volume of water in basin prior to treatment:	
Initial turbidity reading of the basin in NTU's		Initial pH of the basin? (range of 6.5 -8.5 required)	
The initial amount of acid/lime used if pH correction is required.		Date & time of acid/lime dosing	/ / am/pm
Subsequent amount of acid/lime used if pH correction is required.		Date & time of acid/lime dosing	/ / am/pm

Type of flocculant or coagulant product used (and typical dosing volume)	Yes	No	Flocculant or coagulant product used	Date & time of flocculant or coagulant dosing
Calcium Sulphate (Gypsum - powder) 300ppm (30kg/100m3)				/ / am/pm
Anionic Polyacrylamide (gel blocks) 200ppm (20kg/100m3)				/ / am/pm
Calcium Chloride (solid - flakes) 200ppm (20kg/100m3)				/ / am/pm
Aluminium Chlorohydrate (liquid) 40ppm (4L/100m3)				/ / am/pm
PAC23 (poly aluminium chloride 23% - solution) 50ppm (12.5L/100m3)				/ / am/pm
Aluminium Sulphate (crystals) 200ppm (20kg/100m3)				/ / am/pm

Turbidity reading of the basin in NTU's		Laboratory TSS Result: (if applicable)	
Time and Date of dewatering (i.e. siphon valve opened for discharge or commencement of pump operation)			/ / am/pm
Supervisor responsible for discharge:	Name:		
Date:	Signed:		
Comments? (E.g. next rainfall predicted – slight, moderate, severe?) Was rainfall received during treatment period affecting basin (start a new sheet)			

Appendix D

Wet weather contingency procedure

1.1 Purpose

The purpose of the Wet Weather Contingency Procedure (the Procedure) is to detail the actions to be taken by construction personnel in response to an imminent severe rainfall event as forecast by the Australian Government - Bureau of Meteorology (BOM). The procedure provides guidance for monitoring BOM rainfall & storm event forecasts and other resources, to assist with Project preparations to minimise adverse site impacts where practical.

Adherence to the methodology outlined in procedure will ensure that works for wet weather contingency planning & implementation will be carried out in accordance with contract specifications and to maximise adherence to environmental obligations.

The purpose of the Wet Weather Contingency Procedure is to:

- Identify rainfall events which may cause significant precipitation over the site areas which would result in flash flooding and/or exacerbate erosion and sediment impacts.
- Include monitoring procedures of the Bureau of Meteorology (BOM) weather forecasts to predict severe rainfall events.
- Ensure emergency procedures are developed for the management of work areas, facilities and materials in a severe rainfall event that has the potential to impact areas of the Site.
- Ensure hazardous chemical & fuel/oil storage and stockpile areas are positioned in locations to limit the potential for adverse impacts from major runoff flows and/or flash flooding.
- Outline control measures for the protection of water quality in the event of a flood over the site.
- Ensure progressive stabilising methods for areas that may be potentially affected by flash flooding and/or significant scouring & erosion are implemented.

1.2. Scope

The Procedure applies to the following:

- Weather forecast monitoring and works planning,
- Implementation, monitoring and maintenance of erosion and sediment controls,
- Stockpile and hazardous materials storage,
- Sediment basin management, dewatering and maintenance.

1.3. Objectives

The objectives of this Procedure are to:

- Ensure all Project personnel are aware of the requirements of this procedure,
- Detail personnel responsible for undertaking actions relating to works planning, erosion and sediment control management, sediment basin management & construction dewatering on the site,
- Comply with environmental requirements of the Project, including all legal requirements and contractual obligations.

2. Wet Weather Contingency & Management

Environmental Management Controls	Person Responsible	Timing / Frequency
Planning		
A copy of this Wet Weather Contingency Procedure will be kept on site and be made available to all relevant project personnel	Supervisor / Environmental Site Representative	Site Establishment / Duration
All relevant project personnel will be made aware of this document during the site induction and again in Toolbox Talks and targeted training sessions.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Training and Awareness		
Training & instruction of site personnel will be the responsibility of the Environment Manager/ Environmental Site Representative.	Environmental Site Representative	Site Establishment / Duration
Training sessions will be conducted with Supervisors, Foreman, Environmental Work Crew and relevant personnel. The training will address • Weather forecast monitoring procedures and interpretation of forecasting by BOM and other sources • Site erosion and sediment control status and high-risk areas • Roles and responsibilities for wet weather preparation • Temporary measure selection for augmentation or additional ERSED measures • Pre & post-rainfall inspections and recording • Dewatering requirements, methods and recording • Identification of stabilisation and rectification works required.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Identification of significant rainfall events		
The daily BOM forecasts for the local area are issued each morning and late afternoon. The forecasts will be monitored daily, at the start of the shift and prior to shut down. The BOM three-day forecast outlook will be reviewed daily.	Supervisor / Environmental Site Representative	Duration
BOM forecasts indicating a high likelihood of storm fronts or rainfall events of >10mm with an occurrence probability of more than 50% will be regarded as a potential rainfall event.	Supervisor / Environmental Site Representative	Duration
In periods of forecast storm weather or likely rainfall events, the tracking and intensity of approaching weather fronts is to be monitored regularly (where possible) to anticipate the time of the onset of wet weather.	Supervisor / Environmental Site Representative	Duration
Wet Weather Management Procedures		
Where a potential rainfall event is deemed likely in the BOM three-day outlook, Project personnel are to review the scope and progress of existing and imminent site works to determine high risk areas and prioritise works to stabilise the nominated areas. High risk works include culvert works, scour protection installation, permanent drainage installation, trenching on grade, and sediment basin construction or maintenance.	Project Manager / Senior Engineer / Supervisors / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
Wet Weather Management Procedures		
The high-risk work areas that are identified will be managed by; • Completion and temporary/permanent stabilisation of the high-risk work areas where time & resource constraints allow, prior to the onset of the potential rainfall event. • Re-allocating resources from low-risk activities to assist with completion of high risk works prior to the onset of a rainfall event. • Implementation of erosion controls in high-risk areas to minimise sediment control requirements. Erosion controls will be employed such as; o temporary geotextile linings or soil binders will be installed around culverts, scour protection works and drain junctions, o sandbag check dams, rock baffles, trench stops, etc will be utilised in open trenching on grade, temporary diversion drains, or concentrated flow paths over unstabilised areas.	Project Manager / Senior Engineer / Supervisors / Environmental Site Representative	Duration
The site sediment controls, and sediment basins are to be inspected and any necessary rectification works undertaken such as; • Sediment basins are to be managed in accordance with Sediment Basin Management Procedure to regain the maximum runoff capacity parameters, where possible, • Sediment traps and filters to be desilted where more than 60% storage capacity is exceeded, • Spillways and discharge points from sediment traps to be inspected and reinstated as required. • Sediment fences, mulch bunds, earth berms to be inspected and repairs or reinstatement implemented as required.	Supervisor / Environmental Site Representative	Duration
The chemical, fuel and other hazardous material storage areas to be inspected to ensure their location is protected from the ingress of rainfall or concentrated overland flows. Bund controls to be inspected and accumulated liquids or other residues removed to a controlled waste location on site or for offsite disposal at licensed premises.	Supervisor / Environmental Site Representative	Duration
Following the onset of a significant storm event or rainfall event, the site controls to be inspected as soon as site conditions and safety requirements allow. The inspection to focus on high-risk areas to review the function and status of the installed erosion and sediment controls.	Supervisor / Environmental Site Representative	Duration
Post-Rainfall/Storm Procedure		
The Post Rainfall Inspection will be conducted in accordance with the PESCP. The identified high-risk areas will be prioritised for any rectification or maintenance works, followed by areas with lower risk.	Supervisor / Environmental Site Representative	Duration
Records detailing the necessary works to reinstate the controls will be conducted in accordance with the PESCP.	Supervisor / Environmental Site Representative	Duration
Sediment basins are to be managed in accordance with Sediment Basin Management Procedure. Flocculation of the sediment basins may occur soon after the cessation of a rainfall event to improve the water quality parameters in circumstances where further significant rainfall is anticipated.	Supervisor / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
High risk work areas that are inundated will be prioritised for dewatering by; • Dewatering to a sediment basin where sufficient capacity is available, • Flocculated in-situ and discharged at a licensed discharge point when EPL water quality parameters are attained, • Dewatered by water cart and utilised for construction purposes.	Supervisor / Environmental Site Representative	Duration
Repair and reinstatement of erosion and sediment controls to be implemented as site conditions allow, proceeding from high-risk areas to lower risk areas on site.	Supervisor / Environmental Site Representative	Duration

3. Procedure Review

The procedure will be regularly reviewed as part of the CEMP audit requirements. This document will be updated when needed in response to audit findings or changes to site conditions. The Project Environmental Representative in consultation with the Client will modify the procedure where improvements are identified.

Appendix E

Progressive Erosion and Sediment Control Plans

NOTES - Administration & General

1. This progressive plan is to be read in conjunction with the SWMP, CEMP, relevant specifications, and procedures.
2. Works programming to maximise the mitigation of erosion by the early implementation of permanent drainage measures, temporary and permanent soil surface stabilisation measures, and minimising the area and duration of soil disturbance.
3. Bureau of Meteorology weather forecasting to be monitored daily for the local 7-Day weather outlook. Site management measures to be planned for imminent storm/rainfall/flood/wind events include, but are not limited to;
   - avoiding additional soil disturbance immediately prior to an event,
   - provision of additional erosion and sediment controls in critical locations,
   - installing, repairing, and/or adjusting 'clean' (off site water) and 'dirty' (on site) water drainage measures,
   - desilting and re-instating sediment controls as required,
   - implementing stockpile protection measures,
   - stabilising and sealing disturbed soil surfaces,
   - minimising dry soil handling in windy conditions,
   - evacuating or protecting erodible materials in lower lying area.
4. The plan is to be revised as necessary (i.e. progression of works, altered site conditions or weather). **The controls depicted are subject to staging and the controls may be progressively implemented or removed according to progression of works. The symbols depicting controls are not to scale and are only indicative of the general location and type of control selected.**
5. All erosion and sediment controls generally to be constructed in accordance with `Blue Book' specifications and standard drawings & RMS Specifications being
   - MANAGING URBAN STORM WATER: SOILS AND CONSTRUCTION - 4th EDITION, LANDCOM, MARCH 2004;
   - MANAGING URBAN STORM WATER: SOILS AND CONSTRUCTION – VOLUME 2D MAIN ROAD CONSTRUCTION, DEC, 2008;
6. Substitute materials may be utilised in the construction of erosion or sediment controls where functionality is not affected, i.e. compacted mulch bunds in place of sediment fences, stabilised earth Berms in place of excavated drains near underground services or timber pegs in place of star pickets where electrical or gas.
7. Personnel constructing controls to have demonstrated competence and experience. Specific awareness training and workshops to be undertaken by personnel with direct involvement with erosion and sediment control. Toolbox talks to regularly focus on erosion and sediment control for specific works, associated risks, potential impacts and mitigation measures.
8. All existing vegetated or undisturbed areas outside of the works area to be regarded as "No Go" zones and to be delineated with fencing, tape or other markers, as required. All site personnel to be instructed to avoid "No Go" zones or damaging installed controls.

Erosion Control

9. Prior to commencement of significant works, install surface drains, sediment traps, sumps & filters, and other surface runoff control measures to control runoff onto, across, and from the works zones to prevent the loss of sediment from the site.
10. Construction zones in constrained areas to be managed in smaller, defined sub-catchments to reduce slope lengths and minimise sediment loads to boundary controls.
11. Stripped topsoil to be stripped and stockpiled generally as per SD 4-1. Any viable stripped topsoil to be stored in stockpiles, preferably less than two metres in height.
12. Short term on-site stockpiles to be located away from drains and flow lines and be controlled with sediment fence or storm covers.
13. Any significant (long & steep) cut/fill batters should be progressively overlaid with Rolled Erosion Control Products (RECP's such as jute mesh, coir fibre mesh, etc), mulching, Organic Fibre Mulches (OFM's) or geobinders to reduce erosion and rilling, prior to permanent stabilisation with cover crops, mulching or other long-term surface protection
14. Vehicles transporting bulk materials on public roads are to correctly cover loads to prevent loss of load and/or dust generation.
15. Temporary controls in addition to those shown may be required at strategic locations as required by the progression of works or weather conditions

Water Management (Cont'd)

16. Maximise the interception and diversion of 'clean' (off site water) away from works areas. The 'clean' flows to be conveyed in stabilised drainage lines to suitable discharge points. The flows to be discharged to off-site areas at non-erosive velocities with adequate diffusers, level spreaders, etc. Ensure drainage paths and controls are adjusted as required to maximise the separation of 'clean' (off site) and 'dirty' (on site) water flows through/off site.
17. Flows paths with high velocity flows over unstabilised areas to be controlled with
    - applied soil surface stabilisers i.e. geotextile lining, applied soil binders, coarse rock lining, etc
    - suitably constructed check dams placed at intervals to maximise flow suppression and settling of coarse sediment.
18. Where possible, provide sand bag or other bunding controls at on-site collection points & pit inlets to prevent flows bypassing controls to downslope areas.
19. Protect all existing and constructed inlets to pits & culverts from sediment ingress.
20. Where practical, maintain and/or improve existing stabilised drains to assist in the diversion of 'clean' (off site) flows.
21. Flooded excavations, ponded water, etc. to be extracted where required and utilised for site purposes, or treated to achieve acceptable water quality prior to discharge.

Sediment Control

22. The installation of preliminary sediment controls such as perimeter sediment fencing, excavated sediment traps, check dams, coir log filters, etc, will be implemented prior to soil disturbance within the catchment.
23. Accumulated water in sediment traps/sumps cannot be pumped, discharged or released from site without completing a dewatering checklist or approval by an authorised Site Manager.
24. Appropriate sediment tracking controls such as an aggregate/geotextile apron, shaker grid, etc. will be installed at exit points from the site. Personnel to monitor roadways & tracked sediments to be removed as required.
25. Personnel to ensure visual dust monitoring is maintained during works, and dust suppression is undertaken regularly. Dust control to be regularly conducted with water carts and soil stockpiles to suitably covered. Additional dust suppression measures to be utilised to minimise dust pollution during periods of high winds.
26. Temporary 'dirty' water drainage will be adjusted progressively to maximise flows to sediment control devices.

Contamination

29. Excavation of sub-soils to be inspected and monitored as works proceeds, to identify potential contamination. Any potentially contaminated soils to be stripped or excavated separately and transported directly to the designated stockpile, treatment area or licensed waste facility.
30. Potentially contaminated soils are to be stored within an appropriately bunded area and covered with heavy grade plastic or other impermeable covers for the duration of rainfall.
31. Ground disturbance and machinery/vehicle movements in potentially contaminated areas will be minimised to essential works.

Monitoring & Reporting and Inspection & Maintenance

32. Inspections of erosion and sediment controls will occur following rainfall events >10mm (daily on work days or as soon as practical during site shutdown periods), with any necessary repairs implemented as soon as possible.
33. Relevant checklists and records to be maintained noting details such as rainfall received, repairs to controls and amounts of sediments cleaned from controls.
34. Sediment traps, sumps and filters are to be desilted when 60% of storage capacity is reached.
35. All site personnel to report any spill, leaks, or other failure to relevant response staff as soon as possible.

Stabilisation

36. Erosion and sediment controls are to be maintained until the relevant catchments are stabilised, re-vegetated, or sealed adequately to achieve soil surface protection factors as per the 'Blue Book' and SWMP requirements.
37. Completed earthworks areas will be backfilled and compacted in a staged manner as soon as possible. Adjacent disturbed areas will be suitably trimmed and stabilised as required.
38. Stabilisation of areas is to occur progressively in conjunction with the completion of earthworks.
39. Areas subject to heavy compaction and disturbance from vehicle movements and machinery to be scarified to a depth >100mm prior to topsoiling and seeding.

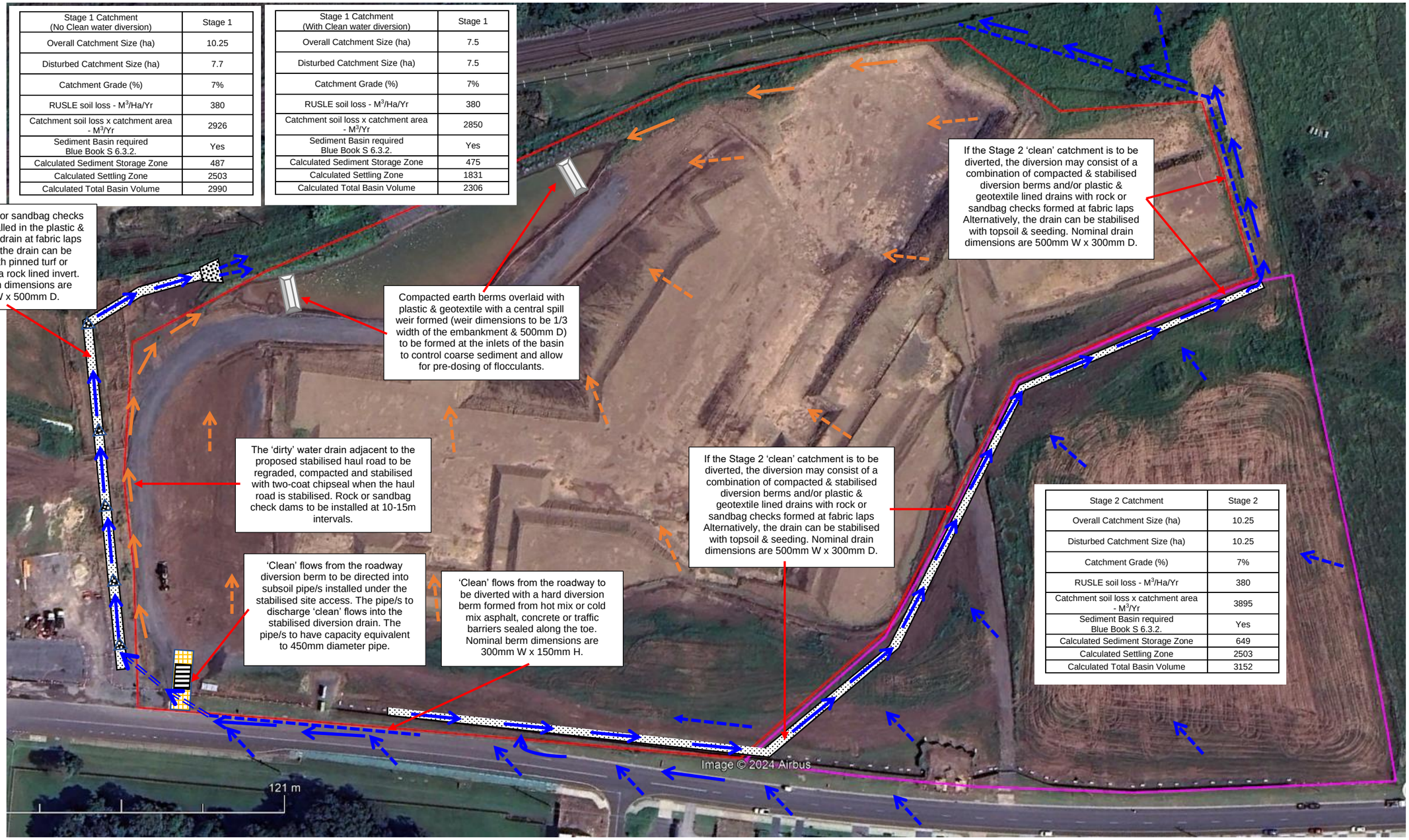
Version	Drawn by	Date	Signed	Reviewed by	Date
01	A. Littlewood	09/09/2024			
02	A. Littlewood	20/09/2024			

New Shellharbour Hospital - Progressive Erosion & Sediment Control Plan

Main Construction Area at 86 Dunmore Road, Dunmore NSW 2529

Stage 1 Catchment (No Clean water diversion)	Stage 1
Overall Catchment Size (ha)	10.25
Disturbed Catchment Size (ha)	7.7
Catchment Grade (%)	7%
RUSLE soil loss - M^3/Ha/Yr	380
Catchment soil loss x catchment area - M^3/Yr	2926
Sediment Basin required Blue Book S 6.3.2.	Yes
Calculated Sediment Storage Zone	487
Calculated Settling Zone	2503
Calculated Total Basin Volume	2990

Stage 1 Catchment (With Clean water diversion)	Stage 1
Overall Catchment Size (ha)	7.5
Disturbed Catchment Size (ha)	7.5
Catchment Grade (%)	7%
RUSLE soil loss - M^3/Ha/Yr	380
Catchment soil loss x catchment area - M^3/Yr	2850
Sediment Basin required Blue Book S 6.3.2.	Yes
Calculated Sediment Storage Zone	475
Calculated Settling Zone	1831
Calculated Total Basin Volume	2306



Stage 2 Catchment	Stage 2
Overall Catchment Size (ha)	10.25
Disturbed Catchment Size (ha)	10.25
Catchment Grade (%)	7%
RUSLE soil loss - M^3/Ha/Yr	380
Catchment soil loss x catchment area - M^3/Yr	3895
Sediment Basin required Blue Book S 6.3.2.	Yes
Calculated Sediment Storage Zone	649
Calculated Settling Zone	2503
Calculated Total Basin Volume	3152

Legend											
Off Site Water – Sheet Flows		Piped Drainage		Coffer Dam / Compacted Earth Bund		Stabilised Topsoil Berm (geo/jute/seed)		Sediment Fence Geotextile Apron		Sediment basin / large sump	
Off Site Water – Concentrated Flow/Drain		Off-site & onsite water cross-over		Geo-lined drain or lined spillway		Filter bag / coir log kerb pit sediment filter		Bucket compacted mulch bund		Stabilised access/shaker grid	
On Site Water - Concentrated Flow/Drain		'Off site' water exclusion bank		Vegetated drain Rock lined drain		Compacted Mulch / Rock & Geotextile / topsoil sediment trap		Coir Log/s Straw bale or coir log filter		Stabilised Haul Road/Compound/Access Track	
On Site Water – Sheet Flows		Level Spreader / Diffuser		Coarse rock / sandbag check dam		Excavated sediment trap with spill weir		Filter bag or sediment fence inlet filter		Vegetated filter	

New Shellharbour Hospital - Progressive Erosion & Sediment Control Plan

Stockpile destocking and Vehicle Parking Area Construction at 50 Dunmore Road, Dunmore NSW 2529 (Lot 1 DP 302910)

Construction Carpark Catchment (With Clean water diversion)	Stage 1
Overall Catchment Size (ha)	2.5
Disturbed Catchment Size (ha)	2.5
Catchment Grade (%)	5.5%
RUSLE soil loss - M^3/Ha/Yr	265
Catchment soil loss x catchment area - M^3/Yr	663
Sediment Basin required Blue Book S 6.3.2.	Yes
Calculated Sediment Storage Zone	110
Calculated Settling Zone	610
Calculated Total Basin Volume	720

A compacted & stabilised topsoil diversion berm to divert site runoff to the sediment basin and exclude 'clean' flows from offsite areas. The location and alignment of the 'clean' diversion berm to be determined on site.

A series of rock or sandbag checks dams to be installed in the plastic & geotextile lined drain at fabric laps Alternatively, the drain can be stabilised with pinned turf or geotextile with a rock lined invert. Nominal drain dimensions are 1500mm W x 500mm D.

A diversion berm or drain to be formed to direct site runoff into the basin inlet drain.

'Clean' flows from the roadway to be diverted with a hard diversion berm or stabilised drain. The location of the 'clean' diversion berms/drains to be determined on site.

Stabilised site access formed with suspended steel shaker grid and aggregate apron

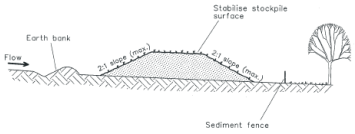
'Clean' flows from the roadway to be diverted with a hard diversion berm or stabilised drain. The location of the 'clean' diversion berms/drains to be determined on site.

65 m

Legend											
Off Site Water – Sheet Flows		Piped Drainage		Coffer Dam / Compacted Earth Bund		Stabilised Topsoil Berm (geo/jute/seed)		Sediment Fence Geotextile Apron		Sediment basin / large sump	
Off Site Water – Concentrated Flow/Drain		Off-site & onsite water cross-over		Geo-lined drain or lined spillway		Filter bag / coir log kerb pit sediment filter		Bucket compacted mulch bund		Stabilised access/shaker grid	
On Site Water - Concentrated Flow/Drain		'Off site' water exclusion bank		Vegetated drain Rock lined drain		Compacted Mulch / Rock & Geotextile / topsoil sediment trap		Coir Log/s Straw bale or coir log filter		Stabilised Haul Road/Compound/Access Track	
On Site Water – Sheet Flows		Level Spreader / Diffuser		Coarse rock / sandbag check dam		Excavated sediment trap with spill weir		Filter bag or sediment fence inlet filter		Vegetated filter	

Appendix F
Standard drawings

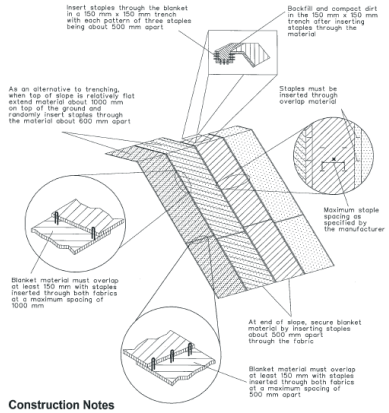
Standard Drawings



Construction Notes

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

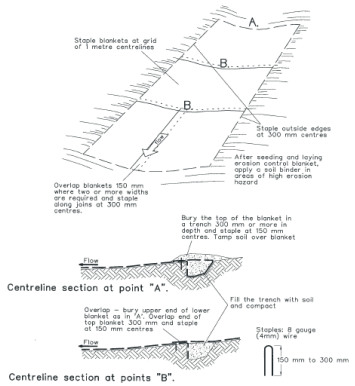
STOCKPILES **SD 4-1**



Construction Notes

1. Remove any rocks, clods, sticks or grass from the ground surface before laying the matting.
2. Spread topsoil to at least 75 mm depth.
3. Where appropriate, complete fertilising and seeding on a properly prepared seedbed (Standard Drawing 7-1) before laying the matting.
4. Ensure the fabric can be continuously in contact with the soil by grading the surface carefully first.
5. Lay the matting in "shingle-fashion" with the ends of each upstream roll overlapping the next roll downslope.
6. Ensure sufficient staples are used to maintain a good contact between the soil and the matting.

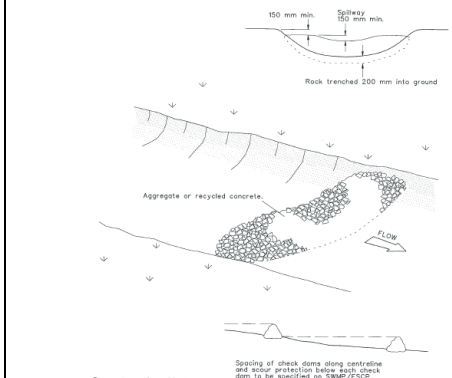
RECP : SHEET FLOW **SD 5-2**



Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

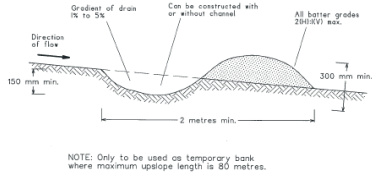
RECP : CONCENTRATED FLOW **SD 5-7**



Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.
3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.
4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM **SD 5-4**

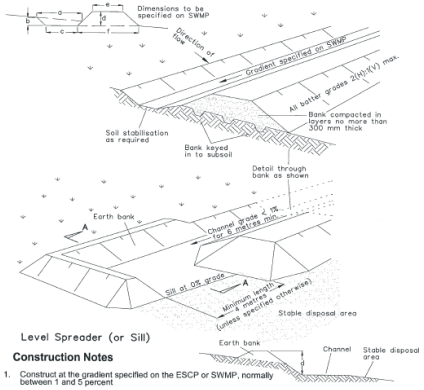


NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

EARTH BANK (LOW FLOW) **SD 5-5**

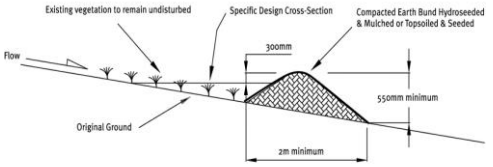


Construction Notes

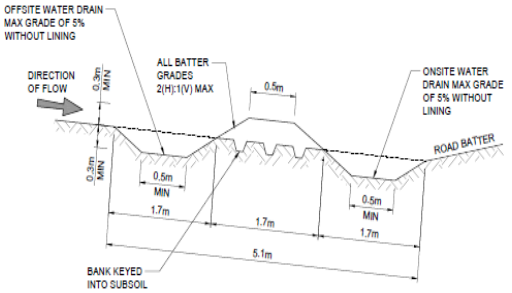
1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

EARTH BANK (HIGH FLOWS) **SD 5-6**

Stabilised topsoil diversion bank



Cross Section

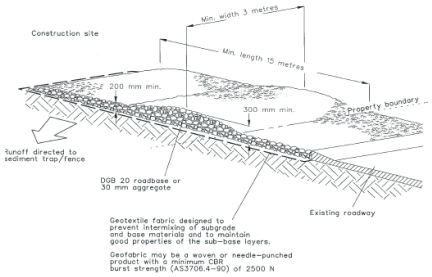


EARTH BANK (ONSITE & OFFSITE COMBINED)
N.T.S.

GENERAL CONSTRUCTION NOTES

1. CONSTRUCT WITH GRADIENT OF 1% TO 5%.
2. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE - WORK AROUND THEM
3. DRAINS TO BE CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTION NOT V-SHAPED.
4. EARTH BANK TO BE ADEQUATELY COMPACTED IN ORDER TO PREVENT FAILURE.
5. PERMANENT OR TEMPORARY STABILISATION OF THE EARTH BANK TO BE COMPLETED WITHIN 10 DAYS OF CONSTRUCTION.
6. ALL OUTLETS FROM DISTURBED LANDS ARE TO BE FED INTO A SEDIMENT BASIN OR SIMILAR.
7. DISCHARGE RUNOFF COLLECTION FROM UNDISTURBED LANDS ONTO EITHER A STABILISED OR AN UNDISTURBED DISPOSAL SITE WITHIN THE SAME SUBCATCHMENT AREA FROM WHICH THE WATER ORIGINATED.
8. COMPACT BANK WITH A SUITABLE IMPLEMENT IN SITUATIONS WHERE THEY ARE REQUIRED TO FUNCTION FOR MORE THAN FIVE DAYS.
9. EARTH BANK TO BE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT WILL IMPEDE NORMAL FLOW.

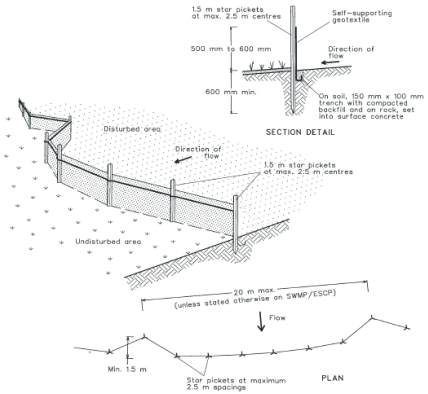
Standard Drawings



Construction Notes

1. Strip the topsoil, level the site and compact the subgrade.
2. Cover the area with needle-punched geotextile.
3. Construct a 200-mm thick pad over the geotextile using road base or 30-mm aggregate.
4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres 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

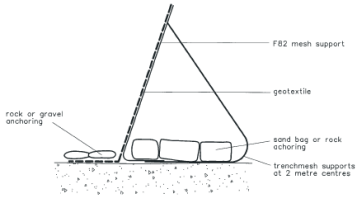
STABILISED SITE ACCESS **SD 6-14**



Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

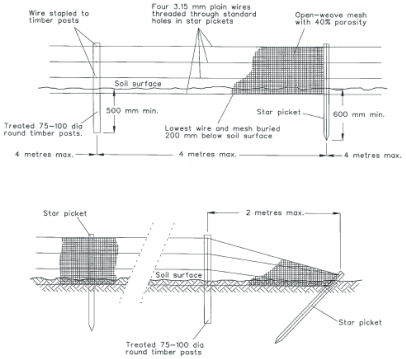
SEDIMENT FENCE **SD 6-8**



Construction Notes

1. Install this type of sediment fence when use of support posts is not desirable or not possible. Such conditions might apply, for example, where approval is granted from the appropriate authorities to place these fences in highly sensitive estuarine areas.
2. Use bent trench mesh to support the F82 welded mesh facing as shown on the drawing above. Attach the geotextile to the welded mesh facing using UV resistant cable ties.
3. Stabilise the whole structure with sandbag or rock anchoring over the trench mesh and the leading edge of the geotextile. The anchoring should be sufficiently large to ensure stability of the structure in the design storm event, usually the 10 year event.

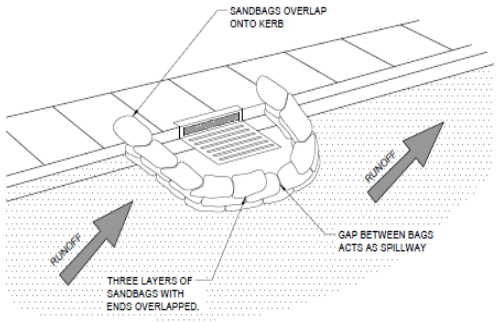
ALTERNATIVE SEDIMENT FENCE **SD 6-9**



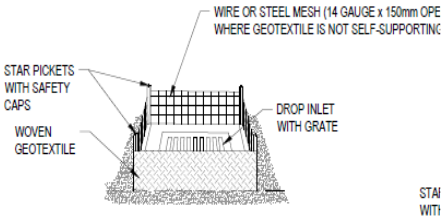
Construction Notes

1. Install the fence to the height specified in the ESCP/SWMP.
2. Cut a channel 200 mm deep along the fence line.
3. Place wire and light resistant, open-weave polymer mesh with 40 percent porosity on the prevailing wind side of fence.
4. Fasten the mesh to all wires using ring fasteners at 100 mm to 150 mm intervals on top wire and 300 mm intervals on other wires.
5. Use one 75-mm to100-mm diameter treated round timber post every 20 metres.
6. Where star pickets are used, ensure they are fitted with safety caps.

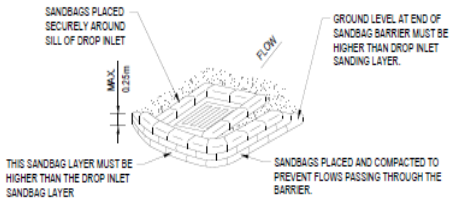
CONTROL OF WIND EROSION **SD 6-15**



SANDBAG SEDIMENT TRAP FOR KERB INLET
N.T.S.

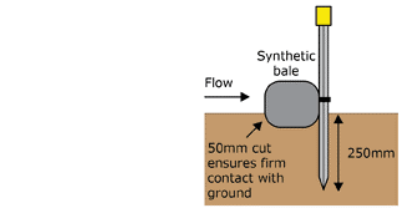


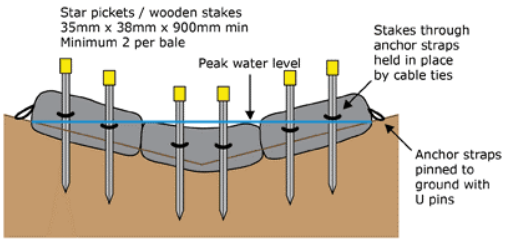
GEOTEXTILE INLET FILTER (SD 6-12) - PERSPECTIVE
NTS



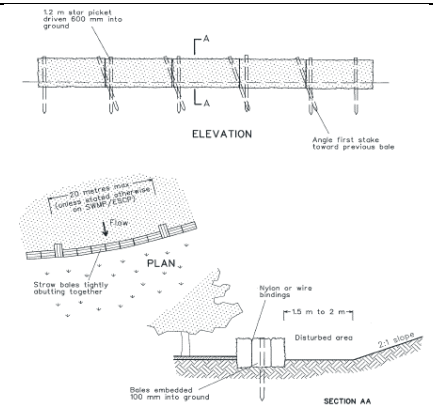
SEDIMENT BARRIER (SD 5-4) DETAIL

Coir Log Filter





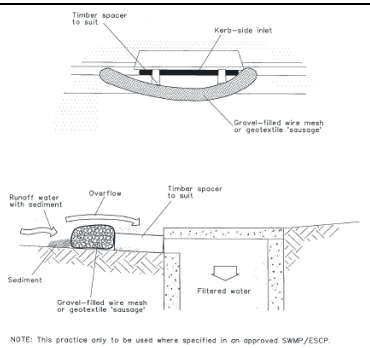
Standard Drawings



Construction Notes

1. Construct the straw bale filter as close as possible to being parallel to the contours of the site.
2. Place bales lengthwise in a row with ends tightly abutting. Use straw to fill any gaps between bales. Straws are to be placed parallel to ground.
3. Ensure that the maximum height of the filter is one bale.
4. Embed each bale in the ground 75 mm to 100 mm and anchor with two 1.2 metre star pickets or stakes. Angle the first star picket or stake in each bale towards the previously laid bale. Drive them 600 mm into the ground and, if possible, flush with the top of the bales. Where star pickets are used and they protrude above the bales, ensure they are fitted with safety caps.
5. Where a straw bale filter is constructed downslope from a disturbed batter, ensure the bales are placed 1 to 2 metres downslope from the toe.
6. Establish a maintenance program that ensures the integrity of the bales is retained - they could require replacement each two to four months.

STRAW BALE FILTER **SD 6-7**

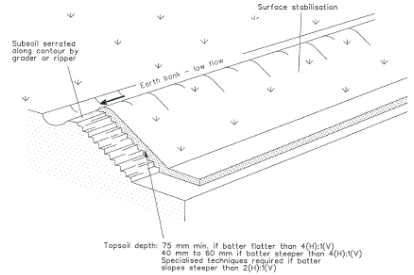


NOTE: This practice only to be used where specified in an approved SWMP/ESCP.

Construction Notes

1. Install filters to kerb inlets only at sag points.
2. Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 25 mm to 50 mm gravel.
3. Form an elliptical cross-section about 150 mm high x 400 mm wide.
4. Place the filter at the opening leaving at least a 100-mm space between it and the kerb inlet. Maintain the opening with spacer blocks.
5. Form a seal with the kerb to prevent sediment bypassing the filter.
6. Sandbags filled with gravel can substitute for the mesh or geotextile providing they are placed so that they firmly abut each other and sediment-laden waters cannot pass between.

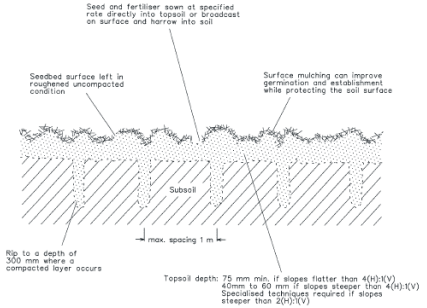
MESH AND GRAVEL INLET FILTER **SD 6-11**



Construction Notes

1. Scarify the ground surface along the line of the contour to a depth of 50 mm to 100 mm to break up any hardsetting surfaces and to provide a good bond between the respread material and subsoil.
2. Add soil ameliorants as required by the ESCP or SWMP.
3. Rip to a depth of 300 mm if compacted layers occur.
4. Where possible, replace topsoil to a depth of 40 to 60 mm on lands where the slope exceeds 4(H):1(V) and to at least 75 mm on lower gradients.

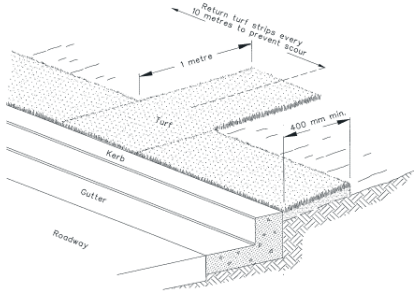
REPLACING TOPSOIL **SD 4-2**



Construction Notes

1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
2. Work the ground only as much as necessary to achieve the desired tilth and prepare a good seedbed.
3. Avoid cultivation in very wet or very dry conditions.
4. Cultivate on or close to the contour where possible, not up and down the slope.

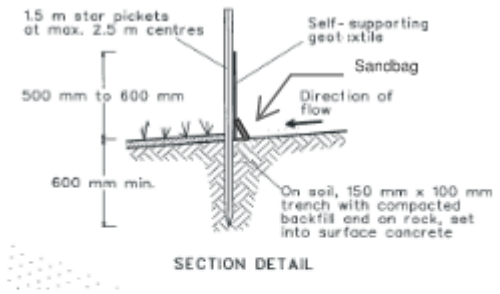
SEEDBED PREPARATION **SD 7-1**



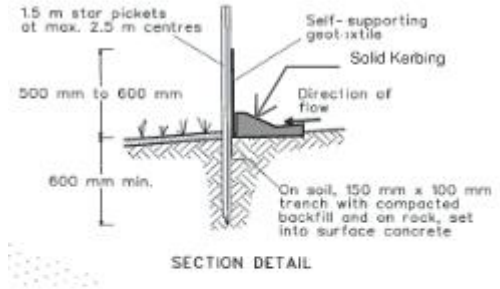
Construction Notes

1. Install a 400-mm minimum wide roll of turf on the footpath next to the kerb and at the same level as the top of the kerb.
2. Lay 1.4 metre long turf strips normal to the kerb every 10 metres.
3. Rehabilitate disturbed soil behind the

KERBSIDE TURF STRIP **SD 6-13**



Fencline Detail



Hard Diversion Berm