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Our Ref: P2007829JC03V06
Pages: 5
cc.

6 September 2021

Crookwell 3 Development Pty Ltd
ABN 70 631 831 297
ACN 631 831 297
Suite 4 Level 3, 24 Marcus Clarke Street
Canberra, ACT 2600

Dear Gideon,

RE: CROOKWELL 3: STORMWATER DESIGN STRATEGY SUMMARY

1. Overview and Purpose

Martens & Associates has developed a drainage strategy for Crookwell 3 (refer to PlanSet P2007829PS01-R03,MapSet P2007829MS01-R04 P2007829JR01V03) to be incorporated into the road design by others, which is compliant with the consent conditions issues by the Land and Environment Court of NSW (relating to SSD 6695).

Table 1 outlines the stormwater management related conditions of consent and how they have been addressed within the design.

Table 1: Condition of consent

Condition		Response
(a) Be prepared by an appropriately qualified engineer.		The stormwater design strategy has been prepared and reviewed by suitably qualified engineers to be used by others to inform the road design.
(b) Demonstrate a Neutral of Beneficial Effect on the receiving environment in terms of water quality.		Modelling (MUSIC) results demonstrates that the NorBE objective is achieved for the receiving environment, hence no impacts are expected.
(c) Include the following;	Details of existing site hydrology and drainage systems;	PlanSet P2007829MS01-R04 identifies existing site hydro lines from Six Maps and catchment characteristics from Lidar survey.
	Details of internal access road locations, temporary and permanent structures, existing erosion control works and expected earthworks and related infrastructure;	Access road and other structure locations are outlined in concept plans by Global Power Generation. These elements, including earthworks, are currently undergoing detailed design. Once complete these designs will be submitted.

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Condition		Response
	Specifications of all existing and proposed sediment and erosion control works. All sediment and erosion control works should be designed in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) and *Managing Urban Stormwater: Soils and Construction Volume 2A Installation of Sercvices and Volume 2C Unsealed Roads* (DECC, 2007 – the 'Blue Book Vol 2);	PlanSet P2007829PS01-R03 drawing No. PS03-B310 specifies proposed sediment and erosion control details. The location and arrangement of these details are to be provided once the road design has been finalised.
	Specifications and designs for all stormwater management structures required to provide ongoing water quality control for the development;	Details of the proposed water quality treatment devices are provided in the MUSIC model (P2007829MUS02V02). The location and arrangement of these details are to be provided once the road design has been finalised.
	Stormwater quality modelling (using the MUSIC software) consistent with Using MUSIC in Sydney Drinking Water Catchment (WaterNSW, 2019) to demonstrate that all stormwater management structures will achieve a neutral or beneficial effect on the receiving water catchments; and	The stormwater treatment train has been designed in accordance with Using MUSIC in Sydney Drinking Water Catchment (WaterNSW, 2019) guideline. MUSIC modelling results demonstrates that the NorBE objective is achieved on receiving water catchments (the pollutant loads and concentrations from the post-development scenario is less than the pre-development scenario).
	A maintenance and management plan required to be implemented to ensure the long-term performance of all permanent stormwater management infrastructure.	A maintenance and management plan (P2007829JC04V03) has been developed for the proposed drainage system and water quality treatment devices. This will ensure all permanent stormwater management infrastructures will continue to function as required.

2. Design Strategy

It is important to note that the drainage design for the development is heavily dependent on the final road levels and formation (i.e. crowned or single crossfall, width of carriageway etc).

Considering the road design is yet to be undertaken, the preliminary concept road design has informed this drainage strategy.

This drainage strategy has been developed to assist the project road design engineer to incorporate the required stormwater elements into the road design. The design includes culvert, swale, mitre drain and dam sizing for water quality treatment.

The drainage strategy addresses stormwater conveyance and water quality for the proposed road. The strategy consists of:

- Upstream diversion swales along the higher side of the road to capture the upstream catchment flows and convey them through the culvert crossings thereby bypassing the road and not requiring water quality treatment.

- Roadside swales along the downstream side of the road to capture the flows from the road and convey to mitre drains prior to discharging to the proposed small dams for water quality treatment.

- MUSIC modelling to size the required dam.

The concept drainage strategy for the proposed road design at Crookwell was developed using the rational method to obtain flow rates for the respective catchments for the culvert crossings and swale designs. The flow rates were then used to size the corresponding components of the concept drainage strategy. The frequency factors and runoff coefficients used for the rational method analysis are summarised in Table 2 below.

Table 2: Frequency factor and runoff coefficients used for the concept drainage strategy.

Parameter	1 yr ARI	2 yr ARI	5 yr ARI	10 yr ARI	100 yr ARI
Frequency Factor [1]	0.52	0.64	0.82	1.00	1.78
Runoff Coefficient [2]	0.15	0.18	0.23	0.28	0.50

Notes

[1.] Frequency factors were calculated as typical values for the site region and elevation.

[2.] Runoff coefficients were calculated multiplying the frequency factor by the 10 year discharge coefficient (C_{10}). The C_{10} value used in calculations was 0.28 as a typical value for the Crookwell region.

3. Details of Drainage System

3.1. Culvert Crossing Design

The culvert crossing locations are positioned at natural low points on the proposed road design established through elevation information obtained from Sixmaps and Lidar data for the site. The culvert crossings were designed in accordance with the following considerations:

- Culvert catchment sizing was modelled based on the DA road design, information obtained from Sixmaps and Lidar data and suggested culvert crossing locations.

- Catchment flow rates were calculated using the rational method and used to determine the minimum pipe diameter required to convey the catchment flows through the culvert.

- Culverts and pipe diameters are sized for the 10 year ARI design storm events consistent with Crookwell 2 drainage plan.

- Riprap will be used at culvert outlets to disperse the flows.

- Culverts sizing and location are subject to change based on future road design.

3.2. Upstream Diversion Swale Design

Upstream diversion swales divert surface runoff from the upstream catchments through the culverts to bypass the road. This strategy has been developed for water quality purposes: the upstream catchment bypasses the road and therefore will not require treatment. Water quality treatment is provided for runoff from roads only.

Four swale types divert upstream surface runoff alongside the proposed road and towards a culvert crossing. Swale Type 1 – 4 (refer to P2007829PS01-R03 for details) have been designed to accommodate flows from catchments of various sizes. The upstream diversion swales were designed in accordance with the following considerations:

- Catchment sizing for the upstream diversion swales was modelled based on the DA road design, information obtained from Sixmaps and Lidar data and suggested culvert crossing locations.

- Catchment flow rates were calculated using the rational method and used to determine the swale type required to convey the catchment flows through the culvert.

- Swales are sized for the 10 year ARI design storm events consistent with the culvert sizing.

- Swale catchment sizing has been modelled based on the preliminary road design by others and assumed culvert crossing locations.

- The turbine pad should be constructed such that it is adequately protected from erosion. Protocols such as including the provision ofupstream diversion swales to divert runoff to bypass turbine pads should be implemented. Refer to Figure A2.4 in P207829JR01V03 Attachment B – Turbine Pad for all protocols that can be implemented to protect the turbine pad from erosion.

- Swale sizing and location are subject to change based on future road design.

It is recommended that swale sizing be confirmed via 2D Tuflow flood modelling (following road design completion) to ensure no overtopping to the road due to localised steep upstream catchment and hydraulic losses along the channel. Considering the road design is yet to be completed, road overtopping flows cannot be assessed.

3.3. Roadside Swale, Mitre drain and Dam Design

Roadside swales are to be positioned along the downstream side of the proposed road to divert road runoff to mitre drains prior to discharging to small dams for treatment. The proposed swales, mitre drains and small dams will improve the water quality of the surface runoff from the road to ensure the proposed road does not have a negative impact on the water quality at the site.

The dams should be sized conditional on the area of road required to be treated. Therefore, the roadside swales, mitre drains and dams and will be sized dependant on the distance between dams. They are to be incorporated into the road design with the following considerations:

- The location of and distance between small dams alongside the proposed road will determine the swale, mitre drain and dam sizing.

- A preliminary water quality assessment has been undertaken to determine the dam sizing for a 20m unsealed road. The results indicates that NorBE will be met by the proposed treatment train, which includes the following:

    - 20m roadside swale.

    - 5m mitre drain.

    - 60m^3 small dam (surface area: 60m^2).

  The above results are to be used as a guide to assist the road designer determine the sizing and distance between dams.

4. Conclusion

The final location and sizing of swales, mitre drains and dams will be determined at the detailed design stage by the road designer in accordance with this strategy.

Please call our offices if you have any further queries regarding this matter.

For and on behalf of

MARTENS & ASSOCIATES PTY LTD

STANLEY LEUNG

BEng(Hons), MIEAust, CPEng, NPER

Senior Engineer

Crookwell Development Pty Ltd

Erosion and Sediment Control Plan: Crookwell 3 Wind Farm

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P2007829JR01V03
September 2021

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to prepare a Erosion and Sediment Control Plan in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and Crookwell Development Pty Ltd (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources which may include for example site inspections, correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a revaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, Martens & Associates Pty Ltd may have relied upon and presumed accurate certain information (or absence thereof) relative to the site. Except as otherwise stated in the report, Martens & Associates Pty Ltd has not attempted to verify the accuracy of completeness of any such information (including for example survey data supplied by others).

The findings, observations and conclusions expressed by Martens & Associates Pty Ltd in this report are not, and should not be considered an opinion concerning the completeness and accuracy of information supplied by others. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings and conclusions are based solely upon site conditions, information and drawings supplied by the Client *etc*. in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Martens & Associates Pty Ltd and the Client. Martens & Associates Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

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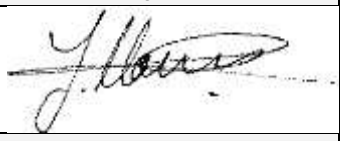
Golam Mostofa Erica Zhu Brenna Nichols	Stanley Leung	Terry Harvey	

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All enquiries regarding this project are to be directed to the Project Manager.

Contents

1 Introduction

1.1 Overview

Martens & Associates has prepared this broad-based Erosion and Sediment Control plan that outlines the intentions and fundamental principles that will be followed in the planning and implementation of erosion and sediment control measures for the proposed Crookwell 3 Wind Farm development.

A drainage strategy for The Crookwell 3 Wind Farm development (refer to PlanSet P2007829PS01-R03) has been developed for the site. It is important to note that the final sediment control selection and location for the development is heavily dependent on the final road and drainage design. Considering the road design is yet to be undertaken the time of preparing this report, this plan has been developed to assist the construction contractor to incorporate the required sediment controls element during construction.

Contractor will be responsible for the final selection and location of temporary sediment control measures such as sediment fences, straw bale, sediment traps and temporary diversion bank, which are expected to change regularly during construction. The contractor would specifically address the location and management of different measures in their progressive ESCPs.

1.2 Project Description

The subject site is located approximately 17 km south east of Crookwell town centre. The site is bounded to the north, east and south by existing regional farm lands and the west by Woodhouselee Road. An aerial photograph of the site is provided in Figure 1. The proposal comprises 21 individual wind turbines with associated access tracks.

Figure 1: Subject Site (SIX Maps).

1.3 Reference Guidelines

This sediment and erosion control plan has been prepared in general accordance with the following guidelines:

- Landcom (2004a). Managing urban stormwater: soils and construction, vol. 1 (BlueBook).
- Managing Urban Stormwater: Soils and Construction Volume 2A Instillation of Services and Volume 2C Unsealed Roads (DECC, 2007 - the 'Blue Book Vol.2'), and
- Using MUSIC in Sydney Drinking Water Catchment (WaterNSW, 2019).

2 Existing environment

2.1 Topography

The site has a hilly terrain which varies from elevations of approximately 860 to 930 mAHD. The site forms a large gully that is bisected by Steeves Creek which is fed by runoff from the elevated areas of the site and to the north east. There are a number of local drainage paths across the site. Local hills typically have relatively flat plateaus.

2.2 Soil Condition

Based on the review of the Geotechnical Investigation Report prepared by SMEC (31 March, 2014), subsurface conditions encountered across the site is described as Crookwell Basalt or material derived from the basalt, comprised clay, with variable quantities of cobbles and boulders to depths of approximately 0.9 m to 2.4 m over sedimentary rocks or approximately 1.1 m to 4.85 m overlying Basalt rock.

2.3 Sensitive Areas

Based on the review of the Geotechnical Investigation Report prepared by SMEC (31 March, 2014), the site shows significant signs of erosion within the existing gullies and along access tracks. A number of locations with evidence of erosion close to the proposed access roads and pads were noted by WaterNSW (letter dated 26 May 2021) at the following locations shown in the following figures.

Figure 2: Chainage 150.

Figure 3: Chainage 170.

Figure 4: Chainage 109.

Figure 5: Chainage 205.

Figure 6: Chainage 220.

Figure 7: Chainage 240.

Some of the existing erosion control works at these locations may be disturbed by construction activities and may lead to large scale erosion after site earthworks.

Appropriate measures should be adopted during construction to limit potential erosion and sedimentation. These works include:

- Existing erosion control works should not be disturbed or reinstated immediately following construction works.
- Limiting the extent of site stripping, where possible and reduce clearing of vegetation.
- Areas closed to proposed construction works, especially along the drainage channels, with existing signs of erosions to be protected by revegetation and rock armouring.
- Installation of earth dykes, silt fences and drainage swales to redirect and dissipate surface flows to protect against potential erosion areas and over steepening of exposed faces.
- Installation of silt fences, sediments basins or other sediment traps to remove sedimentation prior to runoff entering local drains or retaining waters.
- Permanent cut slopes will also require face protection using proprietary systems and/or revegetation.

Further to above, the site may also contain areas of high salinity and sodicity as noted by WaterNSW. Geotechnical investigation with soil testing is required prior and during construction works, if the following signs of saline conditions were observed near the proposed structures:

- No vegetation or vegetation across some portions of the site appeared unhealthy and growth appeared inhibited.
- White material (salt) appeared on the surface.
- Evidence of concentrated surface erosion.

In the cases of high saline or sodic soils are encountered on site, saline soil management measures are required to be implemented during construction works, which include a combination of, but not be limited to, the following:

- Limiting soil disturbance, such as cut and fill, so saline or sodic subsoils are not exposed or groundwater is not intercepted.
- Planting of suitable salt-tolerant plant species.

- Retention of existing deep-rooted vegetation.
- Treating soils with gypsum before landscaping to suit selective species.
- Planting of deep-rooted, preferably native, trees to increase water absorption.
- Replacing excavated soils in their original order.

Typical management strategies for the proposed turbines structures should consider the following:

- Limiting soil disturbance, such as compaction of soils, cutting and filling.
- Designing building structures to limit interference with natural water flow on site.
- Using appropriate construction materials and techniques to salt proof buildings and infrastructure.
- Utilising damp proof courses and water proofing of slabs.
- Using exposure grade bricks / masonry below damp course or in retaining walls.
- Providing concrete strength and cover to steel reinforcing in accordance with AS 3600 (2009) and the exposure classifications.

3 Key Strategies

The following list outlines principles and control measures that will be employed on this project for minimising erosion and sedimentation. The project methodology will include:

3.1 Permanent Stormwater Management

Martens & Associates have developed a drainage strategy for Crookwell 3 (refer to PlanSet P2007829PS01-R01) to be incorporated into the road design which is yet to be completed. This drainage strategy contains the following for long - term erosion and sediment controls:

- Upstream diversion swales along the higher side of the road to capture the upstream (clean) catchment flows and convey them through the culvert crossings.
- Riprap protection at the headwall outlet for energy dissipation.
- Final location of the culvert crossings will be determined following final detailed road design is completed.
- Roadside swales along the downstream side of the road to capture the flows from the road and enter the mitre drains directing to sediment basins.

Mitre drain spacing is dependent on the slope and location of swale, soil type and erodibility, and rainfall characterstics. An appropriate method to determine maximum spacing allowed between mitre drains is the following equation (Sydney Catchment Authority, 2011):

$$Max\ Spacing = 300 \div Slope\ as\ Percentage$$

Table 1 provides a guide for road designers to determine the maximum mitre drain spacing.

Table 1: Maximum mitre drain spacing.

Slope	Maximum Mitre Drain Spacing (m)
<= 6%	50
7%	43
8%	38
9%	33
10%	30
11%	27
12%	25

Slope	Maximum Mitre Drain Spacing (m)
13%	23
14%	21

The final spacing and size of mitre drain will be determined by a qualified engineer or contractor, during or before construction, following the final detailed road and drainage design is completed.

3.2 Training and Induction

- Form a specialist labour team to construct temporary controls including sediment fences, batter drains on fill batters and sediment basins, etc.
- Hold site inductions highlighting the importance of soil conservation issues.
- Schedule half-day awareness seminars early in the project for all personnel involved in construction. The program will include the following components:
    - Environmental impacts.
    - Relevant legislation.
    - Principles of erosion and sediment control.
    - Techniques of erosion and sediment control.

More detail on the program appears in Attachment C.

- Convene regular toolbox meetings during the course of the project to address relevant matters.

3.3 Minimising Disturbance/Delineating Limits of Clearing

- Minimise disturbance of vegetation along the access road with special emphasis on construction activity adjacent to watercourses.
- Leave watercourses undisturbed until culvert and bridge construction has begun. Where vegetation clearance is necessary and approved, the cut stump method will be preferred to stump removal to maintain stream bank stability.
- Leave the soil surface in a reasonably rough condition with some vegetative cover following initial clearing and grubbing.

- Use cleared vegetation for timber windrow sediment traps and filters.

3.4 Topsoil Management

- Ensure good topsoil management to improve post-project revegetation.
- Place stockpiles of soil material in low-hazard areas clear of watercourses, and provide additional protection with vegetation, diversion banks and sediment fences if required.

3.5 Implementation schedule

- Construct permanent drainage structures early in the project including:
    - Sediment basins and traps
    - Catch drains
    - Culverts and associated inlet and outlet protection (e.g. dissipators)
- Progressively implement temporary erosion and sediment controls (e.g. sediment fences, diversion banks, diversion drains, sediment traps, etc.)

3.6 Control of Runoff

- Keep clean water and turbid runoff separate.
- Maximise the diversion of turbid construction runoff into sediment basins.
- Construct erosion control measures as close as possible to the potential source of sediment.
- Control runoff during the construction of embankments (e.g. using fill shaping, temporary dykes and batter drains).
- Construct erosion controls within the various sub-catchments to complement and increase the effectiveness and efficiency of sediment controls in the lower areas (e.g. sediment basins* and traps).
- Use geotextile linings to temporarily protect the land surface protection in areas of concentrated flows (e.g. batter drains and when constructing culverts).

- Divert formation runoff into pits and the stormwater drainage system as soon as practical to reduce surface flow lengths.
- Progressively revegetate disturbed areas with appropriate plant species.
- Implement erosion and sediment control at associated construction sites, which may include:
    - Access roads and tracks
    - Office and compound sites

3.7 Site Management

- Control dust using progressive revegetation techniques, water tankers etc.
- Regulate water quality during dewatering activities (ie. by using filtering techniques and flocculating with gypsum).
- Place sediment cleaned from structures, including sediment basins, in a secure location to prevent further pollution.
- Control the deposition of mud and soil material onto sealed public roads adjacent to the site.

3.8 Inspection and Maintenance

- Implement a program to ensure regular maintenance of all erosion and sediment control measures.
- Have the project soil conservationist regularly inspect, review and update control measures. Conduct additional inspections during or immediately following significant rainfall events to monitor the functioning of controls.
- Manage sediment basins immediately after rain as required by:
    - Flocculating with gypsum.
    - Pumping out water after settling for construction purposes or dust control
    - Retain water in sediment basins until water quality criteria are achieved (see Attachment D).

    - Use a sediment level stave is to measure sediment levels in basins and determine whether or not the sediment basin needs to be cleaned out.

- Implement a water quality monitoring program in the adjacent watercourses and analyse results to determine the efficiency and effectiveness of implemented controls.

- Document and record erosion and sediment control activities with:

    - Progressive ESCPs (see Attachment B)

    - Inspection reports from the project soil conservationist (see Attachment E for a sample format, including sections for location, control, recommendations, comment, action and 'close-out').

    - ESCP plan maintenance checklists completed by nominated construction personnel each fortnight (see Attachment F sample format).

    - Site notes forwarded internally between Environmental and Construction personnel meeting minutes.

    - Formal correspondence (e.g. with WaterNSW, Department of Planning, local council, etc).

    - Change, Department of Primary Industries, local councils etc.).

    - Water quality monitoring results (e.g. sediment basins, upstream and downstream).

Attachment G provides a sample guide to scheduling erosion and sediment controls during construction for a 13-month period.

4 Conclusion

The relatively high erodibility of the soils in some areas the site presents a high erosion potential. The strategies in this plan has addressed erosion and sediment control issues appropriately and will minimise the potential impact of the project.

5 Attachments

- Attachment A Sample Register of Progressive Erosion and Sediment Control Plans
- Attachment B Sample Progressive Erosion and Sediment Control Plans
- Attachment C Sample Program for Erosion and Sediment Control Awareness Seminars
- Attachment D Procedure for Water-Quality Management in Sediment Basins
- Attachment E Sample Maintenance Checklist for Project Soil Conservationist
- Attachment F Sample Maintenance Checklist for Construction Personnel Nominated in ESCP
- Attachment G Erosion and Sediment Control Checklist and Schedule

6 References

Landcom (2004a). Managing urban stormwater: soils and construction, vol. 1 (the 'Blue Book').

Managing Urban Stormwater: Soils and Construction Volume 2A Instillation of Services and Volume 2C Unsealed Roads (DECC, 2007 - the 'Blue Book Vol.2'), and

Sydney Catchment Authority (2011) Water Sensitive Design Guide for Rural Residential Subdivisions

WaterNSW (2019) Using MUSIC in Sydney Drinking Water Catchment (WaterNSW, 2019).

7 Attachment A – Sample Register of Progressive Erosion and Sediment Control Plans

PLAN NO	CHAINAGE / DESCRIPTION	PERSONNEL INVOLVED IN PREPARATION	DATE OF PREPARATION	SOIL CONSERVATIONIST INITIALS & DATE	PROJECT MANAGER INITIALS & DATE	SUPERSEDED BY PLAN NO / COMMENT

8 Attachment B – Sample Progressive Erosion and Sediment Control Plans

Introduction

Notes such as the following are usually included on an ESCP, not separately, to simplify use of the plan in the field and because some management techniques need to be represented diagrammatically.

Bulk earthworks

1. Erosion and sediment control measures will be implemented and maintained in accordance with Managing urban stormwater: soils and construction vol. 1 (Landcom 2004a).

2. Disturbance will be kept to a minimum (within the limits of clearing).

3. Additional control measures will be installed as required.

4. A more specific ESCP will be prepared for the culvert works shown on this plan.

5. Control measures will be inspected regularly (e.g. weekly, before a long weekend and after rain) with maintenance undertaken as necessary.

6. Disturbed areas beyond the road shoulder will be progressively revegetated.

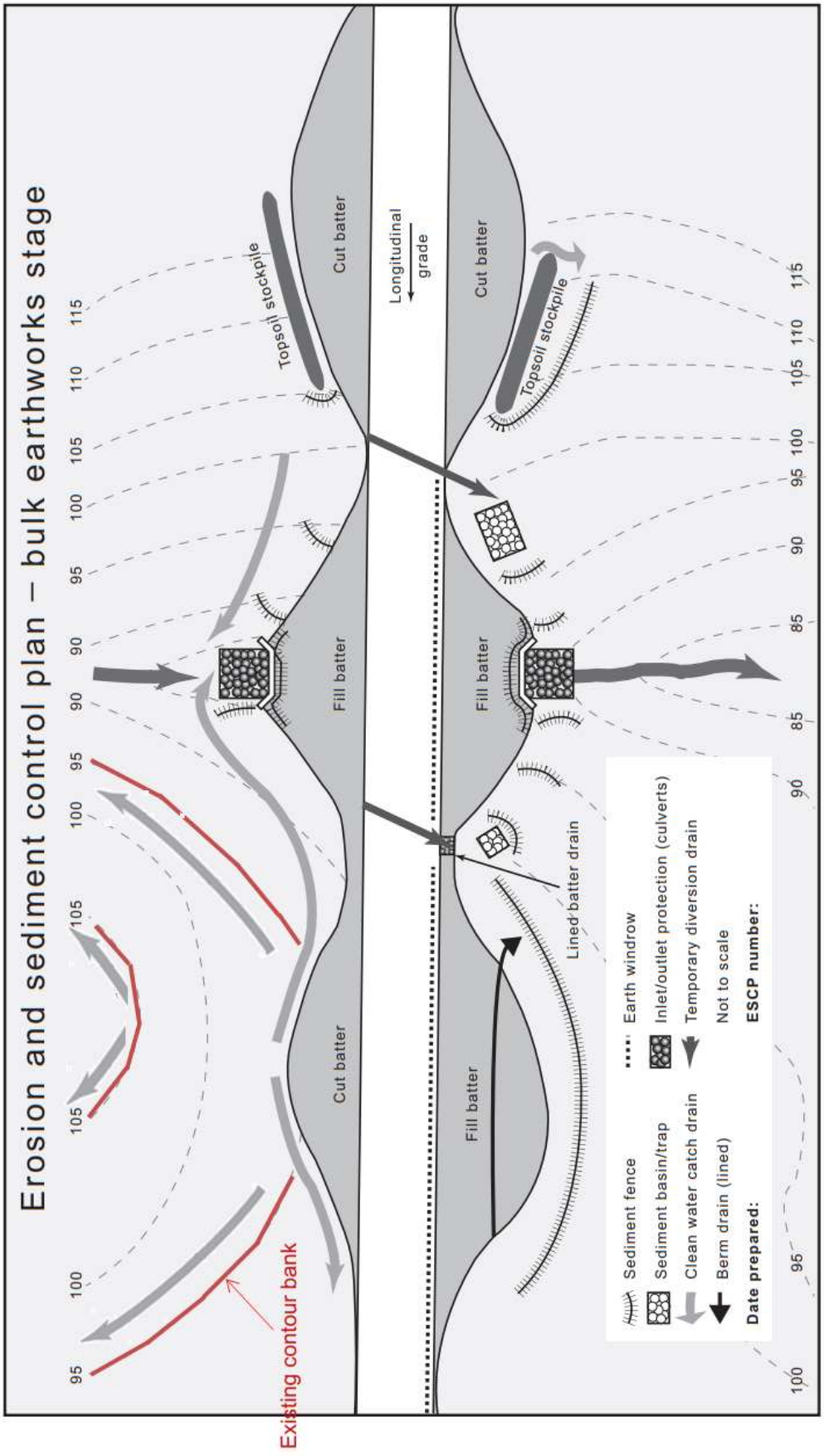


Figure A2.1 ESCP – bulk earthworks stage

Culvert installation

All creek diversions and temporary crossings should be designed for a design storm that reflects the length of time that the diversion/crossing will be present.

1. DWE and DPI (NSW Fisheries) will be consulted regarding the creek diversion.

2. Erosion and sediment control measures will be implemented and maintained as per Managing urban stormwater: soils and construction vol. 1 (Landcom 2004a).

3. The temporary diversion will be designed to cater for a 1 in 2-year storm event.

4. The temporary diversion will be installed before beginning any works associated with culvert installation.

5. A sandbag coffer dam will be installed on the upstream and downstream sides of the diversion and water pumped around the site during the installation of the temporary diversion. The coffer dam will be removed once the diversion is lined.

6. The temporary diversion will be lined with geotextile. The geotextile will be trenched in on the upstream end of the diversion and staked in.

7. Clean aggregate will be used to construct a temporary crossing.

8. Disturbance will be kept to a minimum during the installation of the temporary diversion.

9. Control measures will be inspected regularly (e.g. weekly, before a long weekend and after rain) with maintenance undertaken as necessary.

10. The temporary diversion will be removed once the culvert and upstream and downstream protection works are installed.

11. A sandbag coffer dam will be installed above the temporary diversion, before undertaking bank restoration works associated with rediverting the creek back through the completed culvert.

12. Disturbed areas will be revegetated.

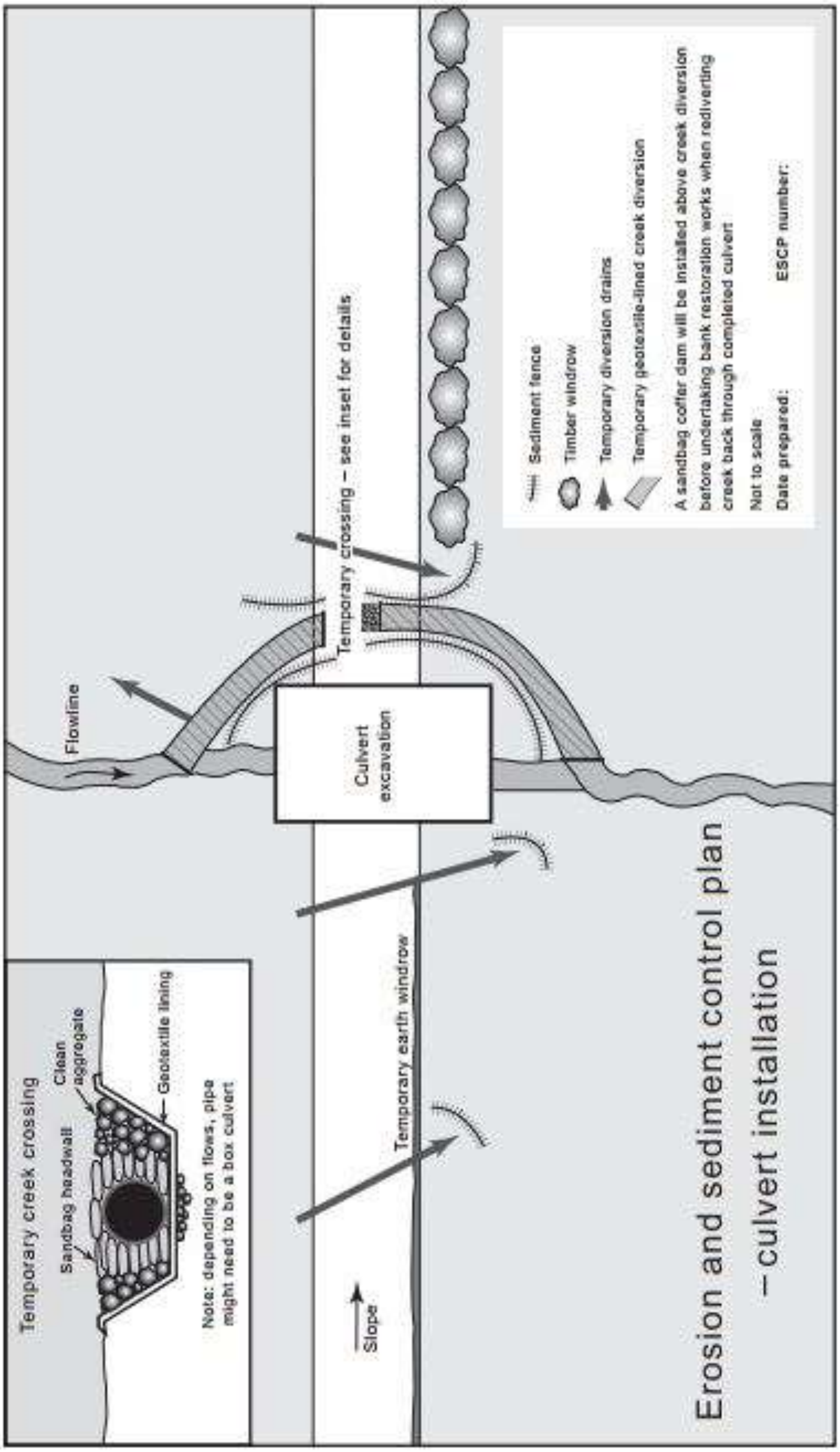


Figure A2.2 ESCP – culvert installation

Ridge-top unsealed roads

1. Erosion and sediment control measures will be implemented and maintained as per Managing urban stormwater: soils and construction vol. 1 (Landcom 2004a).

2. Disturbance will be kept to minimum within the limits of clearing.

3. Cross-banks will have a minimum capacity of 300 millimetres, be track-rolled, have a 2% slope, and will discharge onto a stable area.

4. Mitre drains will be installed early with sediment controls installed at their outlets. The road will be graded to ensure runoff from the road can enter the mitre drains. The distance between mitre drains will be determined by soil erodibility and road gradient, refer to Table 1.of P2007829JR01V03.

5. Control measures will be inspected regularly (e.g. weekly, before a long weekend and after rain) with maintenance undertaken as necessary.

6. Disturbed areas beyond the road shoulder will be progressively revegetated.

7. Mitre drain outflow length should limit disturbance to surrounding area but be of sufficient length to adequately discharge water from swales. Distance between swales/ mitre drains and natural stable surface is dependent on the slope of road and soil type, refer to Table 1.of P2007829JR01V03.

8. Rock or aggregate can be used to armour unstable areas. Culvert outlets should be rock lined. Mitre drains and swales should be armoured if slopes exceed 20% or constructed on dispersive soils with soil loss classes identifying very high erosion hazard risks as defined by the 'Blue Book' (Landcom, 2004). All rockwork should be underlain with geofabric.

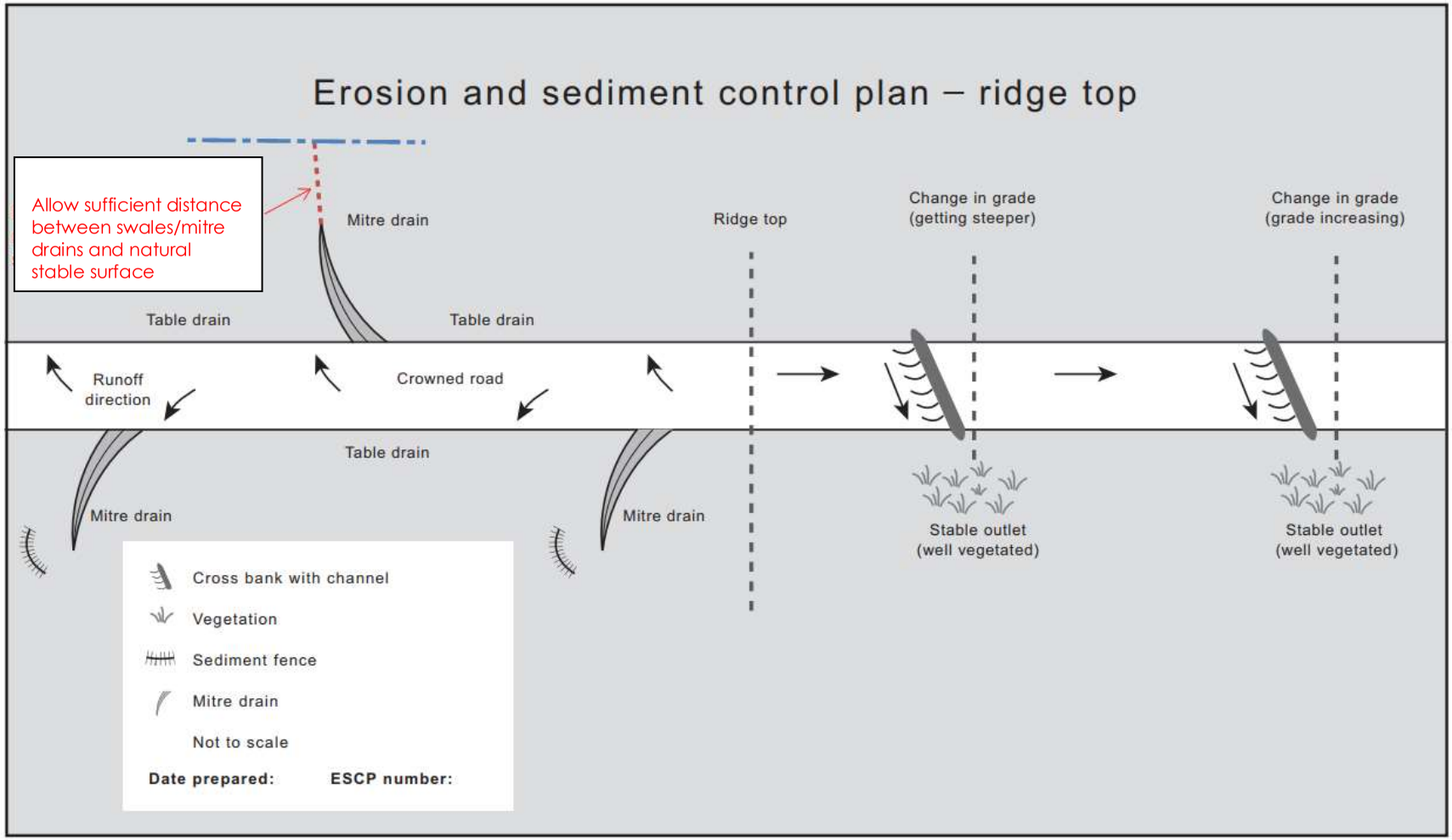


Figure A2.3 ESCP – ridge top

Turbine Pad

Turbine should be constructed so that they are adequately protected from erosion. This can be achieved by undertaking the following:

1. Erosion and sediment control measures will be implemented and maintained as per Managing urban stormwater: soils and construction vol. 1 (Landcom 2004a).

2. Disturbance will be kept to minimum within the limits of clearing.

3. Upstream diversion swales are to divert runoff to bypass turbine pads, either discharge to a level spreader or a culvert crossing at the access road.

4. A more specific ESCP will be prepared for the culvert works shown on this plan.

5. Additional control measures will be installed as required.

6. Control measures will be inspected regularly (e.g. weekly, before a long weekend and after rain) with maintenance undertaken as necessary.

7. Disturbed areas on the battering will be progressively revegetated.

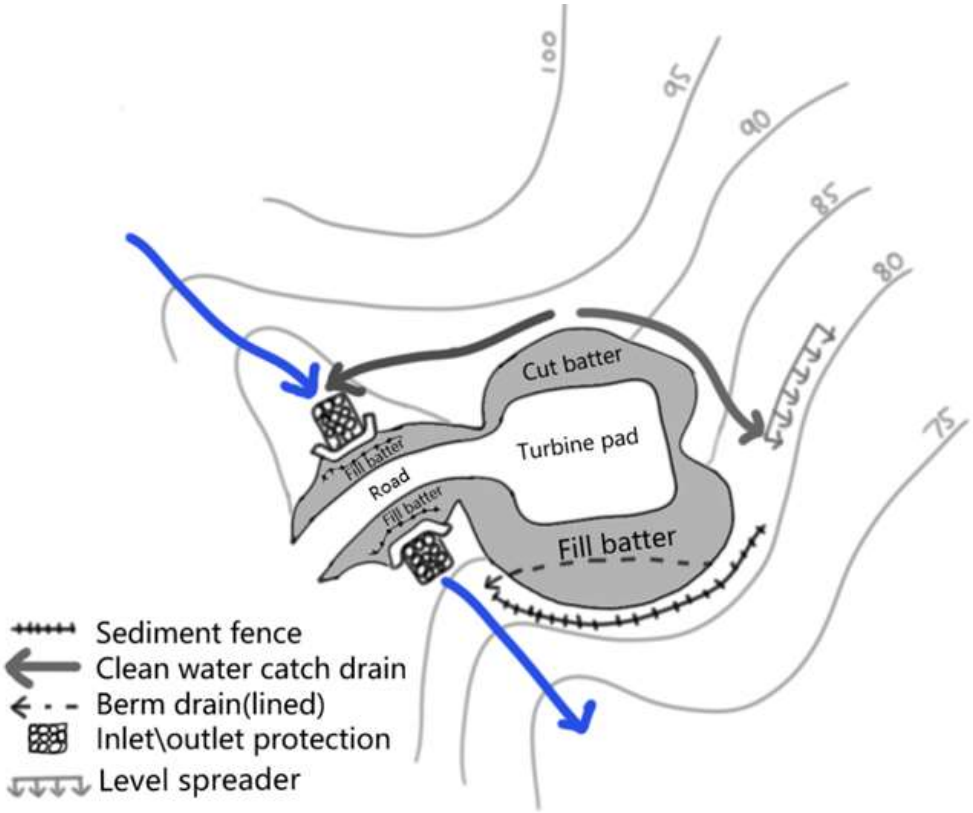


Figure A2.4 Turbine Pad

Service Trenches

Trenches should be constructed so that they are adequately protected from erosion. This can be achieved by undertaking the following:

1. Avoid trenching in areas where water flow is likely to concentrate. Alternatively, schedule work during periods when rainfall erosivity is low (see 1: table 6.2)

2. Ensure trench widths and depths are the minimum necessary. Limiting the width of the disturbed area within the easement is an important management tool, particularly in sensitive environments

3. Divert surface water away from trench openings

4. Use sandbags as plugs or bulkheads across trench inverts to shorten the length of sediment-laden water flow in the trench

5. leave excavations open for the minimum practical time (try to limit the time trenches are left open to fewer than three days). Avoid opening trenches whenever the risks of storms are high

6. Organise service installations to enable progressive backfilling

7. Ensure plugs, collars or trench stops are employed to control tunnel erosion after backfilling is completed. Proper seepage collars or clay/bentonite plugs may be necessary in highly erodible soils

8. Provide an appropriate allowance for settling of uncompacted backfill material (e.g. 10%)

9. After backfilling, remove excess or unsuitable spoil from the site. Then, replace topsoil and vegetate to match surrounding ground levels and vegetation species as soon as possible.

Installing diversion banks (also referred to as cross berms) diagonally across the easement is a key element of erosion control for linear service installations. The banks need to be spaced according to:

1. the erodibility of the soils

2. the slope of the land

3. local rainfall erosivity.

The spacing of berms according to slope is particularly important on down grades.

Cross banks need to discharge away from the disturbed area of the easement into a stabilised area or sedimentation measure. Successive banks down a slope should be designed and constructed to ensure that a bank does not capture the discharge from the previous bank, which would otherwise can lead to a concentration of flows, the failure of down-slope banks and significant erosion and sediment pollution. Figure 6.1 shows important aspects of erosion and sediment control during trenching.

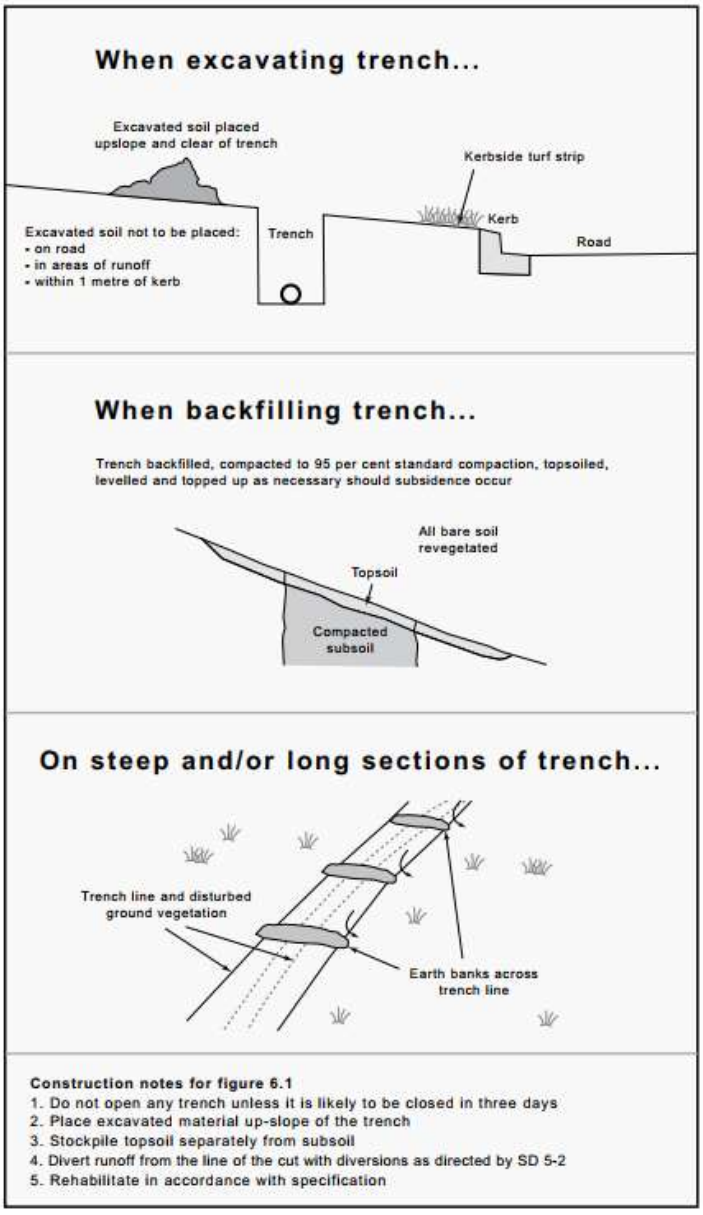


Figure 6.1 Erosion and sediment control during trenching activities

9 Attachment C – Sample Program for Erosion and Sediment Control Awareness Seminars

1 Introduction

This program outlines a half-day seminar designed to raise awareness about the importance of erosion and sediment control during the construction of unsealed roads.

2 Environmental impacts

This session focuses on the on-site and off-site environmental impacts of erosion and sedimentation (e.g. water quality, fauna, flora etc.). It concludes with an exercise listing all impacts.

3 Environmental legislation

This session examines relevant legislation (such as the POEO Act) and its practical application in the field.

4 Principles of erosion and sediment control

This session covers nine principles of erosion and sediment control:

• investigation of site features

• planning

• minimum disturbance

• topsoil management

• control of runoff

• minimisation of erosion

• trapping sediment

• progressive rehabilitation

• maintenance.

5 Techniques of erosion and sediment control

This session includes the most common techniques of erosion and sediment control. Aspects covered include:

• clearing

• topsoil management

• drainage and installation of permanent structures (e.g. culverts, catch drains etc.)

• diversions banks

• drains and channels

• batter protection

• revegetation

• sediment basins and management

• sediment traps

• sandbags and their application

• maintenance

• miscellaneous issues (e.g. mud on local roads, dewatering and dust control).

6 Field inspection

This session examines erosion and sediment control measures constructed in the field together with associated discussions on impacts, legislation and principles.

10 Attachment D – Procedure for Water – Quality Management in Sediment Basins

Why sediment basin management is required

Under the *Protection of the Environment Operations Act 1997*, there is a legal responsibility to ensure that runoff leaving a construction site (including water discharged from sediment basins after storm events) meets acceptable water-quality criteria.

The parameters to be monitored in the management of sediment basins and their assessment criteria include:

- total suspended solids (TSS) < 50 mg/L
- pH 6.5 to 8.5
- oil and grease visual assessment.

Pipe outlets

Sediment basins should be designed and constructed with a low-flow pipe through the wall, and have a perforated riser at the inlet within the water storage area and a valve at the outlet below the structure.

Emergency outlets

Every sediment basin should have an emergency outlet that overflows when a rainfall event exceeds the design capacity of the basin.

Procedure

To effectively manage the sediment basins the following procedure should be undertaken:

1. Inspect all sediment basins for capacity and water quality immediately after rain ceases

2. Treat water unless it is to be used for construction purposes (e.g. compaction or dust control). Release stored water within 5–7 days to restore basin storage capacity.

3. If the design capacity has been reduced by 30% or more by sediment, then desilt the basin immediately after treating the water, as outlined below.

4. If the design capacity has been reduced by 30% or more by water, then test the water for pH, TSS and oil and grease and take action as follows:

pH

• test basin water with pH meter

• if pH between 6.5 and 8.5, take no action

• if pH below 6.5, add lime

• if pH above 8.5, as hydrochloric acid (32% muriatic acid)

• determine volume of water in basin

• determine amount of lime or acid required by adding a known amount of lime or acid (initially 0.004%) to a 10-litre sample of basin water until the pH reaches acceptable 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

• mix the water in the sediment basin well

• test and treat water for pH before testing for TSS.

TSS

• test basin water using a turbidity tube that has been calibrated for the site through laboratory testing. This will enable a relatively accurate comparison, which will be verified by laboratory testing approximately every six rainfall events

• if TSS < 50 mg/L, take no action

• if TSS > 50 mg/L, add bulk gypsum evenly as a flocculant immediately across the top of the water at an acceptable rate (determined by trial and error for each basin). Methods of application include broadcast by shovels (on small basins < 200 m^3) or mixing in a drum with water and pumping through a hose (on large basins > 200 m^3).

Oil and grease

• examine surface of water for evidence (e.g. sheen or discolouration)

• if no visual contamination evident, take no action

• if contamination evident, spread oil absorbent material such as Cell-u -sorb.

5. Leave basins to compensate for 24 to 48 hours.

6. After retesting, and once the field tests indicate that water quality is acceptable, release water slowly through the stop valve, opening it no more than two or three notches (approximately 10%). Emptying should take 24–36 hours to prevent sediment from being stirred up.

7. Repeat steps 4 and 5 if acceptable water quality is not achieved initially.

8. Close the stop valve once water in the basins has been released.

9. Keep records of the rainfall events, inspections, fi eld tests, dosage rates and water releases (see checklist, table A5.1).

10. Complete the whole process of water-quality management in sediment basins within 7 days of rain ceasing.

Table A5.1 Checklist for water-quality management in sediment basins

CONTRACT NO:

CONTRACT TITLE:

Rainfall event mm:
days:

Water quality criteria
TSS <50 mg/L
pH 6.5 to 8.5
Oil and grease 10 mg/L max. (by observation)
Desilting>30% reduction in design capacity

Basin no.	Design capacity m^3	Is water to be used for construction?	Water quality before treatment			Rate of acid added	Rate of gypsum added	Oil absorbent added	Water quality after treatment			Date valve opened	Date valve closed	Desilting required?	Date desilted
			pH	TSS	Oil & grease				pH	TSS	Oil & grease				

Basin no./comments_____

Inspected by (name and position)_____ Signed (Environmental manager)_____

Date_____ Date_____

11 Attachment E – Sample Maintenance Checklist for Project Soil Conservationist

LOCATION	CONTROL	RECOMMENDATIONS / COMMENTS	ACTION * WHO & WHEN	CLOSE-OUT DATE

Date of inspection________________________________

Soil conservationist________________________________ Signed (Environmental manager)________________________

Date________________________________ Date________________________

* This column must include person responsible and proposed completion date of action.

12 Attachment F – Sample Maintenance Checklist for Construction Personnel Nominated in ESCP

CONTRACT NO: *CONTRACT TITLE:*

ESCP number:

Current weather conditions:			Chainage :	To
LOCATION	**DATE INSPECTED**	**COMMENTS**	**DATE RECTIFIED**	**INTIALS WHEN RECTIFIED**

Inspected by (name and position)_____ Signed (Environmental manager)_____

Date_____ Date_____

* Refer to following page as memory jogger.

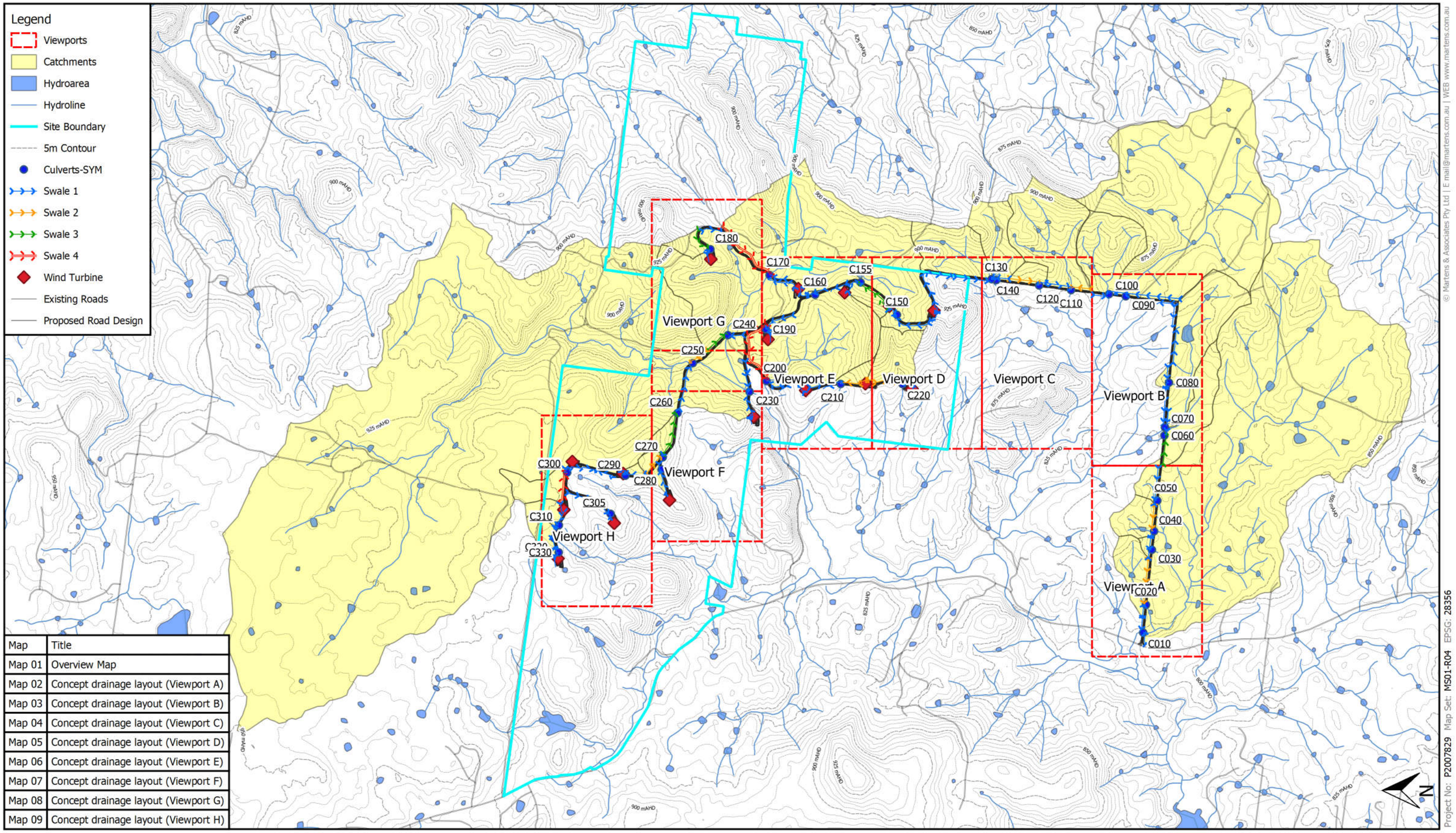
13 Attachment G – Erosion and Sediment Control Checklist and Schedule

Table A8.1 Erosion and sediment control checklist	
Check	**Item to be inspected**
	Topsoil and stockpile sites • Have sediment traps been constructed (e.g. sediment fence, timber windrows)? • Have the areas been seeded and fertilised?
	Drainage lines • Has the minimum area only been disturbed? • Do exposed areas require temporary lining (e.g. with geotextile) • Are any sediment traps required?
	Sediment basins • Have sediment basins been constructed? • Do basins require maintenance (e.g. flocculating, emptying, desilting etc.)? • If yes refer to procedure for sediment basin water-quality management
	Cut section protection • Are catch drains (swales) installed? • Is runoff diverted to pits or sediment control devices?
	Fill batter protection • Are earth windrows installed along the top edges? • Do they have adequate capacity? • Are temporary diversion drains installed? • Do they have adequate capacity? • Do they outlet at batter drains? • If not, are they required? • Are batter drains lined with plastic or geotextile? • If not, is this required? • Are there sandbags at the top of batter drains? • Do windrows, diversion drains or batter drains require maintenance? • Is runoff diverted to pits or sediment control devices?
	Sediment fences • Are sediment fences installed correctly? • Do they require maintenance (e.g. trenching, retying, desilting etc.)? • Are additional fences required?
	Sediment traps (e.g. sandbags, timber windrow, straw bales etc.) • Are traps installed correctly? • Do they require maintenance (replacement, desilting etc)? • Are additional traps required?
	Diversion banks and drains • Are diversion banks and drains installed correctly (e.g. bank on down-slope side, grade OK, outlet stable)? • Is the spacing between diversion bank discharge and drain suitable? Refer to Table 1.of P2007829JR01V03. • Do they have adequate capacity? • Is plastic/geofabric lining in place where required? • Do they require maintenance (e.g. desilting, reshaping)? • Are additional banks or drains required? Refer to Table 1.of P2007829JR01V03. • Is diversion banks and drains armoured? Refer to Attachment B: Ridge-top unsealed roads, point 8.
	Revegetation • Are there any areas to be seeded, fertilised or mulched with straw? • Do any areas require retreatment?

	Year							Year												Year		
	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
Environmental management plan – review & appraisal	■																					
Progressive erosion & sediment control plans	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Site induction		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Toolbox meetings		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Awareness seminars							■			■				■							■	
Advanced seminars							■			■				■								
Temporary erosion & sediment controls (e.g. sediment fences, diversion banks etc.)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Clearing		■	■																			
Topsoil – stripping & stockpiling		■	■																			
Sediment basin construction		■	■																			
Catch drain construction		■	■	■	■	■																
Culvert construction		■	■	■	■	■	■	■	■	■	■											
Bulk earthworks		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
Sediment basin management		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Bridge construction		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Water quality monitoring in adjacent watercourses		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Progressive revegetation									■	■	■	■	■	■	■	■	■	■	■	■	■	■
Dust control		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Maintenance of all controls		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Weekly inspections by project soil conservationist		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Fortnightly inspections by nominated construction personnel		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Table A8.2 Sample schedule for erosion and sediment control during construction

14 Attachment H – WaterNSW Response to SMP - Crookwell 3 - SSD 6695 (dated 26/05/21)



Map	Title
Map 01	Overview Map
Map 02	Concept drainage layout (Viewport A)
Map 03	Concept drainage layout (Viewport B)
Map 04	Concept drainage layout (Viewport C)
Map 05	Concept drainage layout (Viewport D)
Map 06	Concept drainage layout (Viewport E)
Map 07	Concept drainage layout (Viewport F)
Map 08	Concept drainage layout (Viewport G)
Map 09	Concept drainage layout (Viewport H)

0 300 600 900 1200 1500 m

1:30000 @ A3

Notes:
1. P2007829MS01 to be read in conjunction with P2007829PS01 and P2007829JR01V03.
2. Swales are to dissipate accumulated flows to reduce the risk of erosion. Refer to Table 1 in P2007829JR01V03 to determine the maximum distance before flow dispersion is required.
3. Swale sizing and location are subject to change based on detailed road design.
4. Swale type typical details provided in P2007829PS01.

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Map Title / Figure:
Overview Map

Map 01	Map
Crookwell, NSW	Site
Crookwell 3 Wind Farm	Project
Concept Drainage Layout	Sub-Project
Crookwell Development Pty Ltd	Client
03/09/2021	Date

Project No: P2007829 Map Set: MS01-R04 EPSG: 28356

Legend
- Hydroarea
- Hydroline
- 1m Contour
- Swale 1
- Swale 2
- Culverts
- Existing Roads
- Proposed Road Design

C010
C020
C030
C040
C050

795 mAHD
800 mAHD
805 mAHD
810 mAHD
815 mAHD
820 mAHD
825 mAHD
830 mAHD
835 mAHD

N

0 40 80 120 160 200 m

1:4000 @ A3

Viewport A

Notes:
1. P2007829MS01 to be read in conjunction with P2007829PS01 and P2007829JR01V03.
2. Swales are to dissipate accumulated flows to reduce the risk of erosion. Refer to Table 1 in P2007829JR01V03 to determine the maximum distance before flow dispersion is required.
3. Swale sizing and location are subject to change based on detailed road design.
4. Swale type typical details provided in P2007829PS01.

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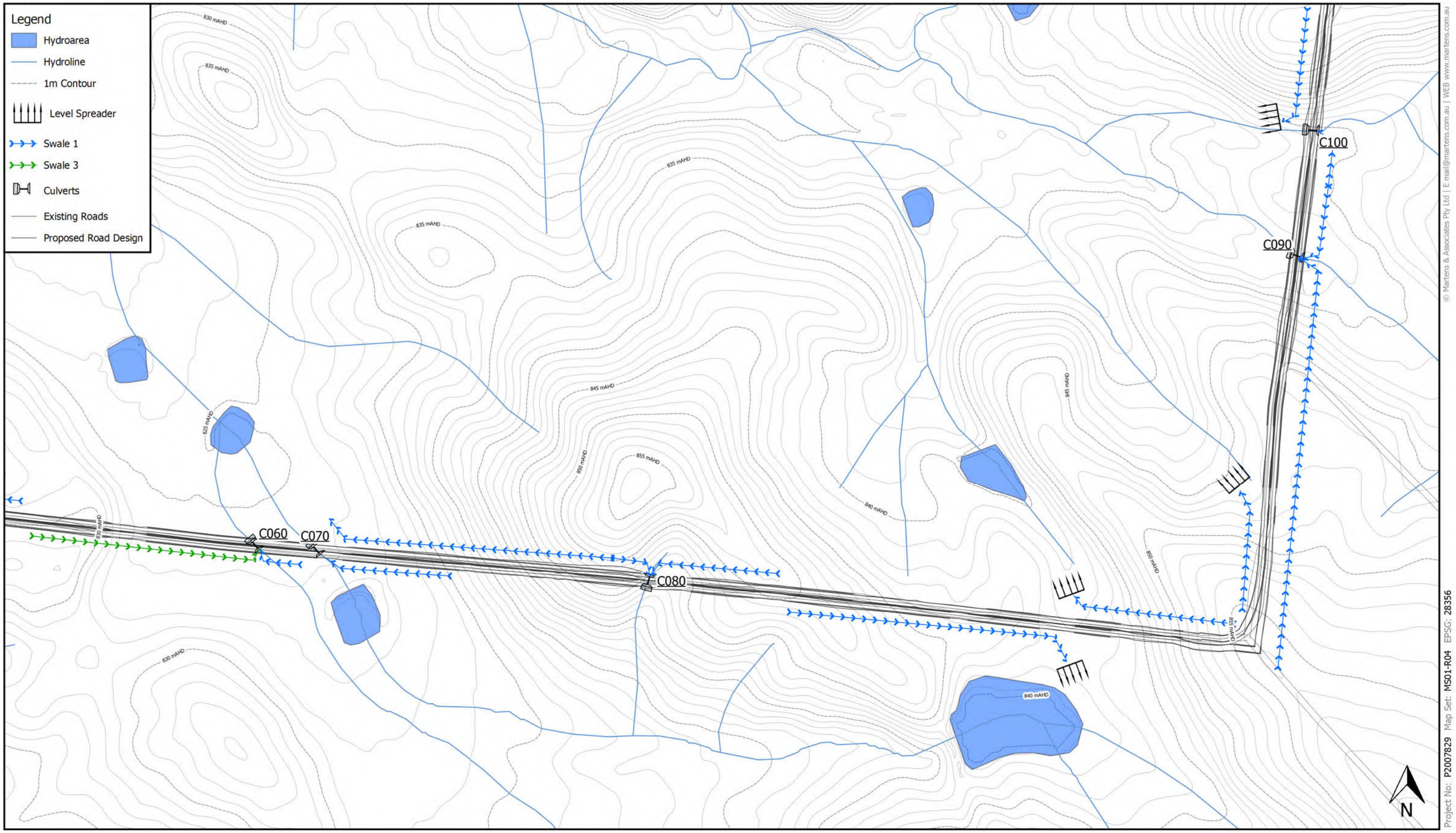
Map Title / Figure:
Concept drainage layout (Viewport A)

Map 02	Map
Crookwell, NSW	Site
Crookwell 3 Wind Farm	Project
Concept Drainage Layout	Sub-Project
Crookwell Development Pty Ltd	Client
03/09/2021	Date

Project No: P2007829 Map Set: MS01-R04 EPSG: 28356



0 40 80 120 160 200 m

1:4000 @ A3

Viewport B

Notes:
1. P2007829MS01 to be read in conjunction with P2007829PS01 and P2007829JR01V03.
2. Swales are to dissipate accumulated flows to reduce the risk of erosion. Refer to Table 1 in P2007829JR01V03 to determine the maximum distance before flow dispersion is required.
3. Swale sizing and location are subject to change based on detailed road design.
4. Swale type typical details provided in P2007829PS01.

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Map Title / Figure:

Concept drainage layout (Viewport B)

Map 03	Map
Crookwell, NSW	Site
Crookwell 3 Wind Farm	Project
Concept Drainage Layout	Sub-Project
Crookwell Development Pty Ltd	Client
03/09/2021	Date

Project No: P2007829 Map Set: MS01-R04 EPSG: 28356

Legend

- Hydroarea
- Hydroline
- 1m Contour
- Level Spreader
- Swale 1
- Swale 2
- Culverts
- Existing Roads
- Proposed Road Design

C140
C130
C120
C110

N

0 40 80 120 160 200 m

1:4000 @ A3

Viewport C

Notes:
1. P2007829MS01 to be read in conjunction with P2007829PS01 and P2007829JR01V03.
2. Swales are to dissipate accumulated flows to reduce the risk of erosion. Refer to Table 1 in P2007829JR01V03 to determine the maximum distance before flow dispersion is required.
3. Swale sizing and location are subject to change based on detailed road design.
4. Swale type typical details provided in P2007829PS01.

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Map Title / Figure:
Concept drainage layout (Viewport C)

Map 04	Map
Crookwell, NSW	Site
Crookwell 3 Wind Farm	Project
Concept Drainage Layout	Sub-Project
Crookwell Development Pty Ltd	Client
03/09/2021	Date

Project No: P2007829 Map Set: MS01-R04 EPSG: 28356

Legend

- Hydroarea
- Hydroline
- Site Boundary
- 1m Contour
- Level Spreader
- Swale 1
- Swale 2
- Swale 3
- Wind Turbine
- Culverts
- Existing Roads
- Proposed Road Design

C220

C150

0 40 80 120 160 200 m

1:4000 @ A3

Viewport D

Notes:
1. P2007829MS01 to be read in conjunction with P2007829PS01 and P2007829JR01V03.
2. Swales are to dissipate accumulated flows to reduce the risk of erosion. Refer to Table 1 in P2007829JR01V03 to determine the maximum distance before flow dispersion is required.
3. Swale sizing and location are subject to change based on detailed road design.
4. Swale type typical details provided in P2007829PS01.

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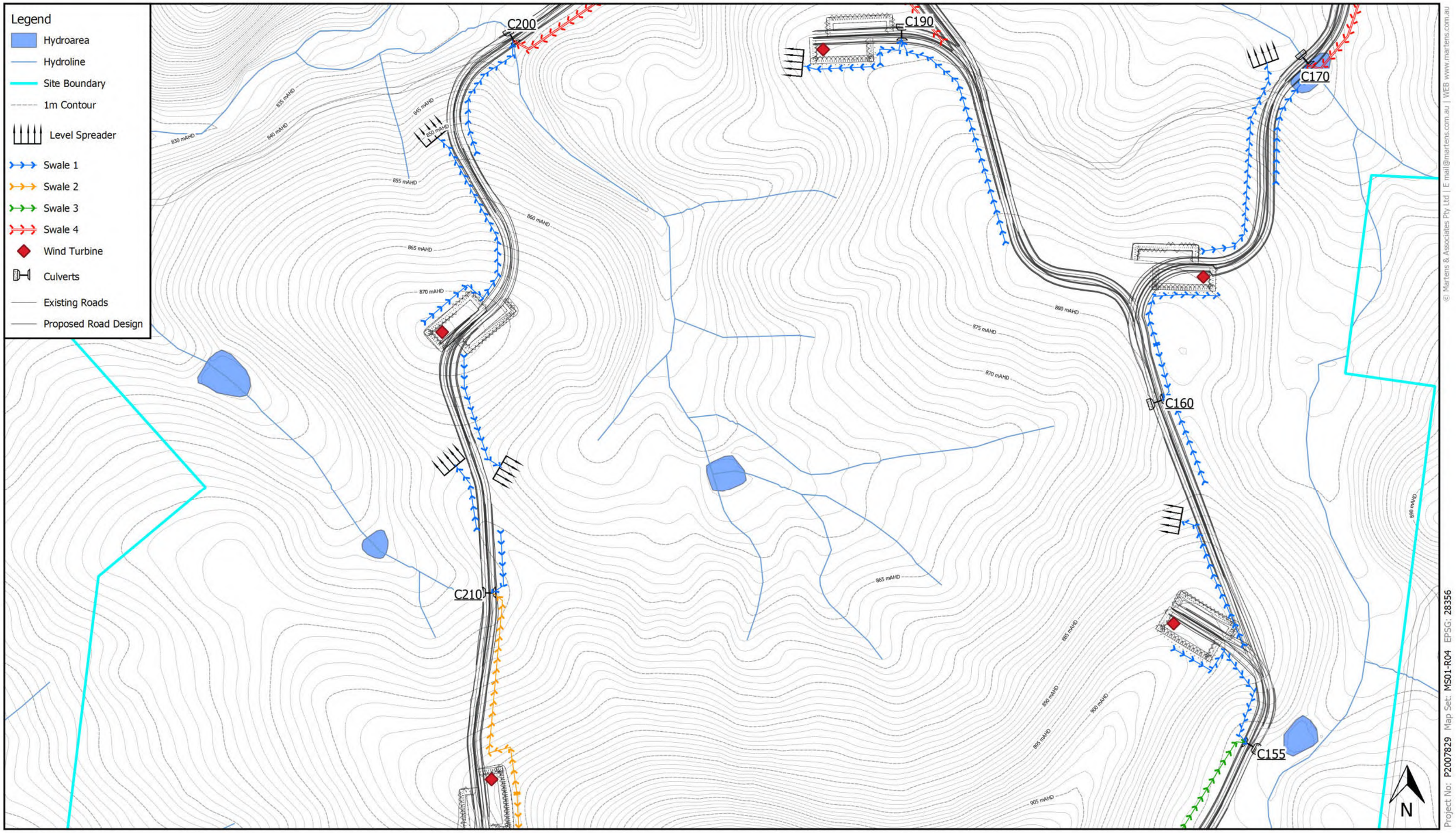
Map Title / Figure:

Concept drainage layout (Viewport D)

Map 05	Map
Crookwell, NSW	Site
Crookwell 3 Wind Farm	Project
Concept Drainage Layout	Sub-Project
Crookwell Development Pty Ltd	Client
03/09/2021	Date

Project No: P2007829 Map Set: MS01-R04 EPSG: 28356



0 40 80 120 160 200 m

1:4000 @ A3

Viewport E

Notes:
1. P2007829MS01 to be read in conjunction with P2007829PS01 and P2007829JR01V03.
2. Swales are to dissipate accumulated flows to reduce the risk of erosion. Refer to Table 1 in P2007829JR01V03 to determine the maximum distance before flow dispersion is required.
3. Swale sizing and location are subject to change based on detailed road design.
4. Swale type typical details provided in P2007829PS01.

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Map Title / Figure:
Concept drainage layout (Viewport E)

Map 06	Map
Crookwell, NSW	Site
Crookwell 3 Wind Farm	Project
Concept Drainage Layout	Sub-Project
Crookwell Development Pty Ltd	Client
03/09/2021	Date

Project No: P2007829 Map Set: MS01-R04 EPSG: 28356

Legend

- Hydroarea
- Hydroline
- Site Boundary
- 1m Contour
- Level Spreader
- Swale 1
- Swale 2
- Swale 3
- Swale 4
- Wind Turbine
- Culverts
- Existing Roads
- Proposed Road Design

C280 C270 C260 C250 C240 C230

910 mAHD 905 mAHD 900 mAHD 895 mAHD 890 mAHD 885 mAHD 880 mAHD 875 mAHD 870 mAHD 865 mAHD 860 mAHD

N

0 40 80 120 160 200 m

1:4000 @ A3

Viewport F

Notes:
1. P2007829MS01 to be read in conjunction with P2007829PS01 and P2007829JR01V03.
2. Swales are to dissipate accumulated flows to reduce the risk of erosion. Refer to Table 1 in P2007829JR01V03 to determine the maximum distance before flow dispersion is required.
3. Swale sizing and location are subject to change based on detailed road design.
4. Swale type typical details provided in P2007829PS01.

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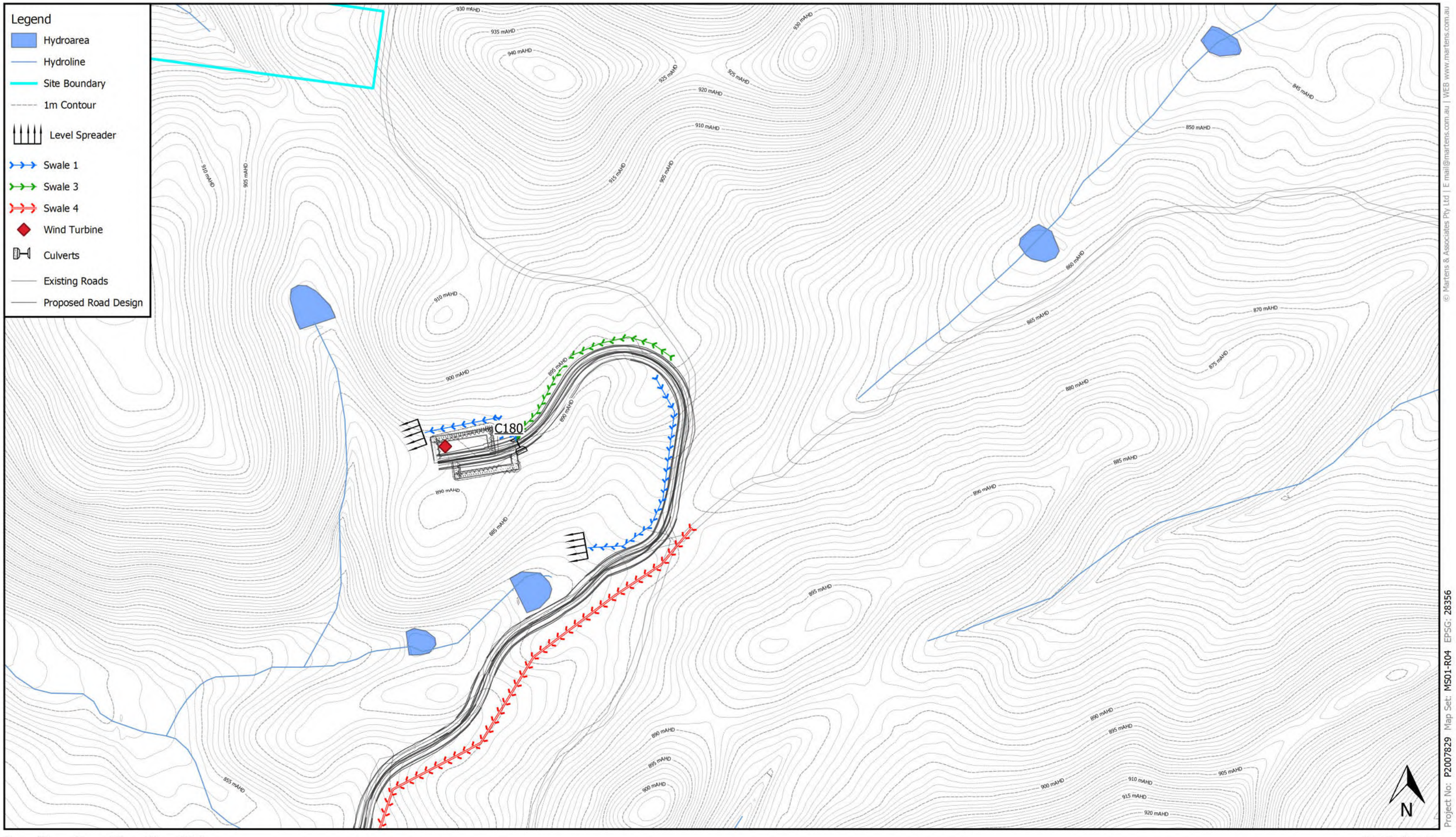
Map Title / Figure:

Concept drainage layout (Viewport F)

Map 07	Map
Crookwell, NSW	Site
Crookwell 3 Wind Farm	Project
Concept Drainage Layout	Sub-Project
Crookwell Development Pty Ltd	Client
03/09/2021	Date

Project No: P2007829 Map Set: MS01-R04 EPSG: 28356



0 40 80 120 160 200 m

1:4000 @ A3

Viewport G

Notes:
1. P2007829MS01 to be read in conjunction with P2007829PS01 and P2007829JR01V03.
2. Swales are to dissipate accumulated flows to reduce the risk of erosion. Refer to Table 1 in P2007829JR01V03 to determine the maximum distance before flow dispersion is required.
3. Swale sizing and location are subject to change based on detailed road design.
4. Swale type typical details provided in P2007829PS01.

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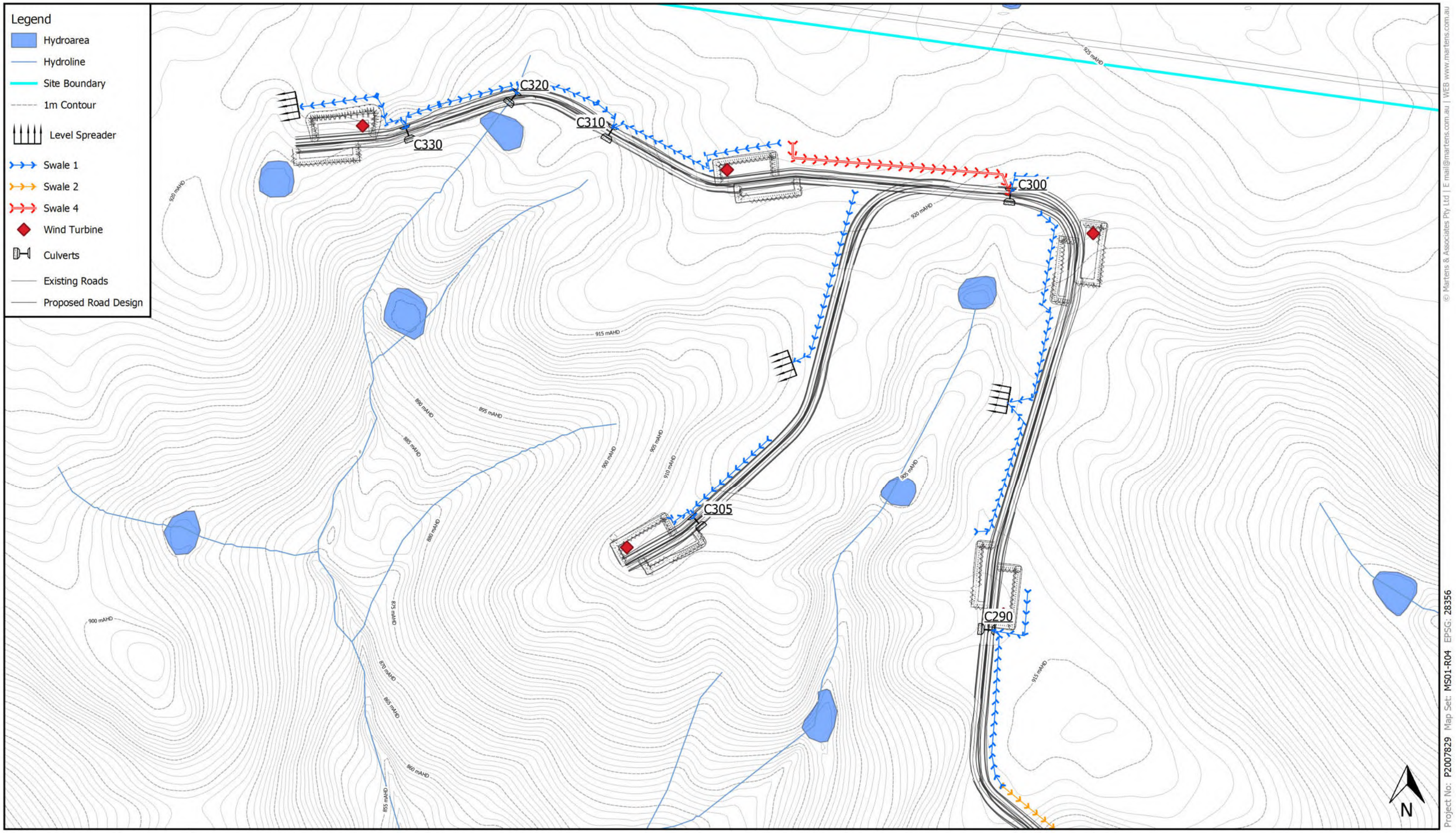
Map Title / Figure:
Concept drainage layout (Viewport G)

Map 08	Map
Crookwell, NSW	Site
Crookwell 3 Wind Farm	Project
Concept Drainage Layout	Sub-Project
Crookwell Development Pty Ltd	Client
03/09/2021	Date

Project No: P2007829 Map Set: MS01-R04 EPSG: 28356



0 40 80 120 160 200 m

1:4000 @ A3

Viewport H

Notes:
1. P2007829MS01 to be read in conjunction with P2007829PS01 and P2007829JR01V03.
2. Swales are to dissipate accumulated flows to reduce the risk of erosion. Refer to Table 1 in P2007829JR01V03 to determine the maximum distance before flow dispersion is required.
3. Swale sizing and location are subject to change based on detailed road design.
4. Swale type typical details provided in P2007829PS01.

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Map Title / Figure:

Concept drainage layout (Viewport H)

Map 09	Map
Crookwell, NSW	Site
Crookwell 3 Wind Farm	Project
Concept Drainage Layout	Sub-Project
Crookwell Development Pty Ltd	Client
03/09/2021	Date

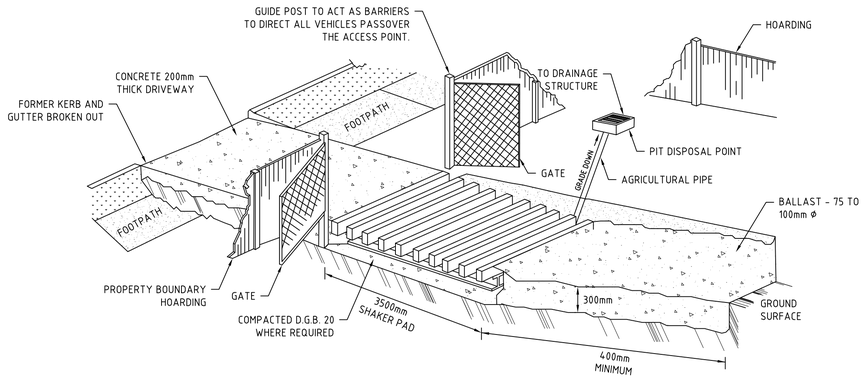
Project No: P2007829 Map Set: MS01-R04 EPSG: 28356

STABILISED ACCESS POINT

TYPE II SAP

THE TYPE II SAP DESIGN IS MORE DEFINED IN THAT IT REQUIRES AN AREA OF BALLAST WITHIN THE SITE COMBINED WITH A SHAKER PAD; ADJACENT THE SHAKER PAD AND IN THE PUBLIC WAY IS A TEMPORARY (CONCRETE) VEHICULAR CROSSING. (SEE DIAGRAM)

STABILISED ACCESS POINT - TYPE 2



IN BOTH TYPE I AND TYPE II SAP'S, THE TEMPORARY VEHICULAR CROSSING MUST:

- CONNECT TO AN EXISTING GUTTER LAYBACK (WHERE THE KERB AND GUTTER EXIST) . IF A GUTTER LAYBACK DOES NOT EXIST THEN THE CONNECTION MUST BE MADE TO THE GUTTER BY REMOVING THE ADJCENT KERB SECTION ONLY.
- CONNECT TO A DISH CROSSING (WHERE KERB AND GUTTER DOES NOT EXIST). IF A DISH CROSSING DOES NOT EXIST, THEN IT MUST BE CONSTRUCTED IN ACCORDANCE WITH DETAILS CONTAINED IN COUNCIL'S ISSUED FOOTPATH CROSSING LEVELS.

IT SHOULD BE NOTED THAT THESE TYPES OF SAPS ARE CONSIDERED TO BE APPLICABLE FOR THE MAJORITY OF ACTIVITIES HOWEVER SOME SITES MAY REQUIRE SPECIAL CONSIDERATION.

WHEEL WASH (BUILT IN OR PORTABLE) TO BE PROVIDED AS PART OF STABILISED ACCESS POINT.

SHAKER PAD (CATTLE GRID)

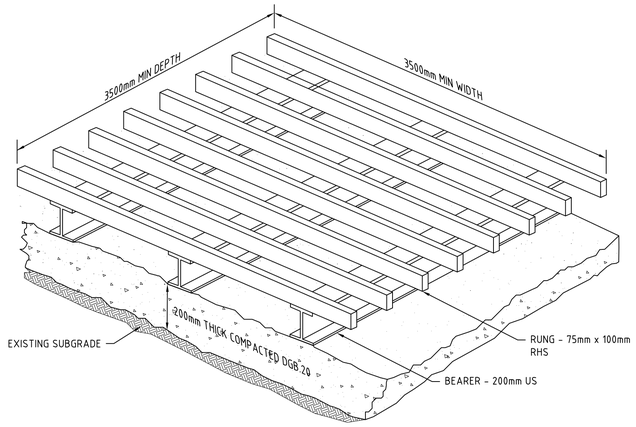
A CORRECTLY DESIGNED AND INSTALLED SHAKER PAD WILL ASSIST IN PREVENTING SEDIMENT TRANSFERE FROM A SITE. ANY STABILISED ACCESS POINT (SAP) CAN BE DESIGNED WITH A SHAKER PAD (COMPULSOPRY IN TYPE II SAP'S)

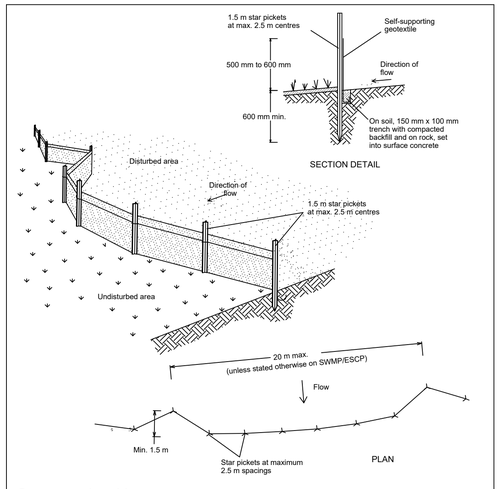
SHAKER PADS CAN BE DESIGNED AND CONSTRUCTED TO ENABLE RE-USE ON FUTURE PROJECTS.

THE SHAKER PAD:

- MUST BE DESIGNED AND CERTIFIED BY A PRACTICING STRUCTURAL ENGINEER. THE CERTIFIED DESIGN SHOULD BE SUBMITTED WITH THE RELEVENT APPLICATION.
- CAN BE CONSTRUCTED FROM ANY SUITABLE MATERIAL.
- MUST BE LOCATED ON A SUITABLY PREPARED AND COMPACTED SUB-GRADE/BASE MATERIAL.
- MUST BE SITUATED SUCH THAT THE RUNGS OF THE SHAKER PAD ARE LEVEL WITH THE ADJOINING NATURAL SURFACE.
- MUST BE A MINIMUM OF 3.5m IN LENGTH.
- MUST BE A MINIMUN OF 3.5m IN WIDTH.
- MUST HAVE CLEAR SPACING BETWEEN RUNGS OF 200 - 250mm.
- RUNGS MUST HAVE A MAXIMUM WIDTH (BEARING AREA) OF 75mm.
- MUST HAVE A MINIMUM CLEAR DEPTH OF 300mm IE FORM THE ROP OF THE RUNG TO THE FINISHED SUB-GRADE/BASE LEVEL.

THE SHAKER PAD MUST BE PROVIDED WITH SUITABLE BARRIERS AT THE SIDES TO ENSURE THAT ALL TYERS OF VEHICLES LEAVING THE SITE TRAVERSE THE DEVICE.

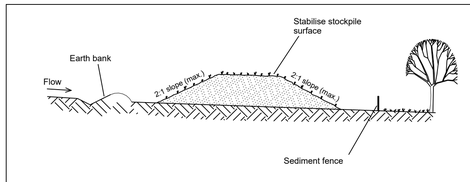




Construction Notes

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.

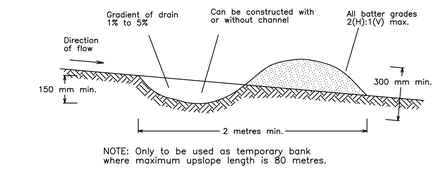
SEDIMENT FENCE — SD 6-8



Construction Notes

1. 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



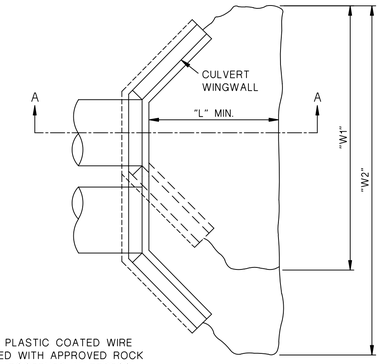
NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

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.

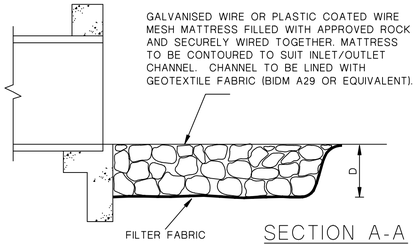
EARTH BANK (LOW FLOW) — SD 5-5

"W1"- MATTRESS WIDTH FOR SINGLE PIPE CULVERT
"W2- MATTRESS WIDTH FOR DOUBLE PIPE CULVERT
"D" - INLET PROTECTION 200mm THICK ROCK MATTRESS
OUTLET PROTECTION 360mm THICK ROCK MATTRESS.



PLAN

GALVANISED WIRE OR PLASTIC COATED WIRE MESH MATTRESS FILLED WITH APPROVED ROCK AND SECURELY WIRED TOGETHER. MATTRESS TO BE CONTOURED TO SUIT INLET/OUTLET CHANNEL. CHANNEL TO BE LINED WITH GEOTEXTILE FABRIC (BIDM A29 OR EQUIVALENT).



SECTION A-A
N.T.S.

NOTES:

1. PROTECT FULL LENGTH OF EXCAVATED CHANNEL AS DIRECTED.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. SIZE OF ROCK FILL : D_{50} = 200mm

PIPE ϕ	"W1"	"W2"	"L"min.
375	1800	2750	1600
450	2100	3130	2400
525	2400	3520	3100
600	2750	4050	3600
750	3350	4810	4300
900	4000	5630	4800
1050	4600	6890	5500
1200	5200	7660	6100
1350	5650	8270	6700

ROCK MATTRESS INLET / OUTLET PROTECTION FOR PIPE CULVERTS

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENT	30/06/2021	GM	GM	SL	TH
A	ADDED SEDIMENT CONTROL INFORMATION	12/05/2021	GM/JS	BN	SL	TH

SCALE

GRID | DATUM | PROJECT MANAGER: TH

CLIENT: CROOKWELL DEVELOPMENT PTY LTD

PROJECT NAME/PLANSET TITLE: CROOKWELL 3 WIND FARM

CROOKWELL, NSW

martens & Associates Pty Ltd
Consulting Engineers
Environment
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Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
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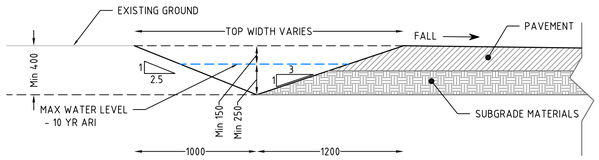
DRAWING TITLE: SEDIMENT AND EROSION CONTROL DETAILS

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2007829	PS01	R03	PS01-B310	B

DRAWING ID: P2007829-PS01-R03-B310

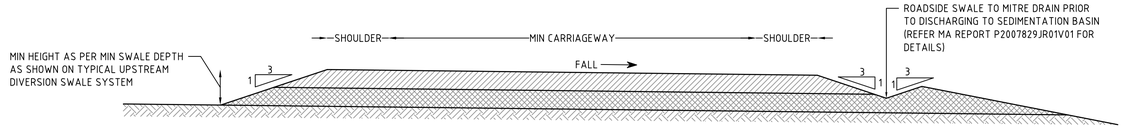
PRINTED: --- - USER OMISSION

A1 / A3 LANDSCAPE (A1LC_v02.0.01)



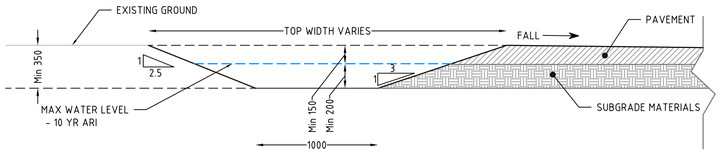
TYPICAL UPSTREAM DIVERSION SWALE TYPE 1

SCALE: 1:25



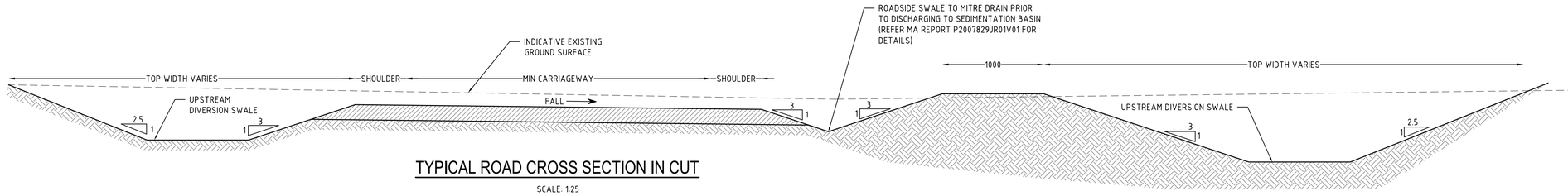
TYPICAL ROAD CROSS SECTION IN FILL

SCALE: 1:25



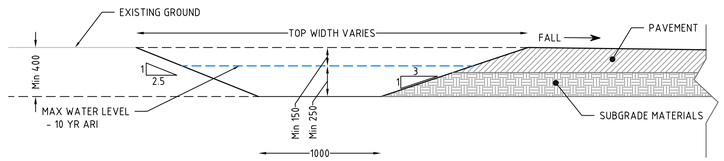
TYPICAL UPSTREAM DIVERSION SWALE TYPE 2

SCALE: 1:25



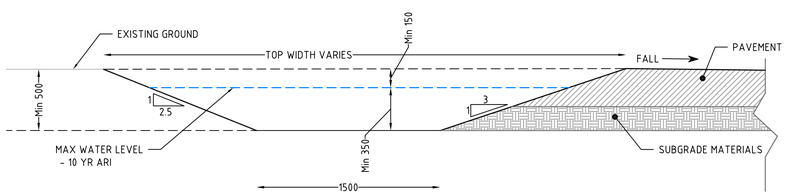
TYPICAL ROAD CROSS SECTION IN CUT

SCALE: 1:25



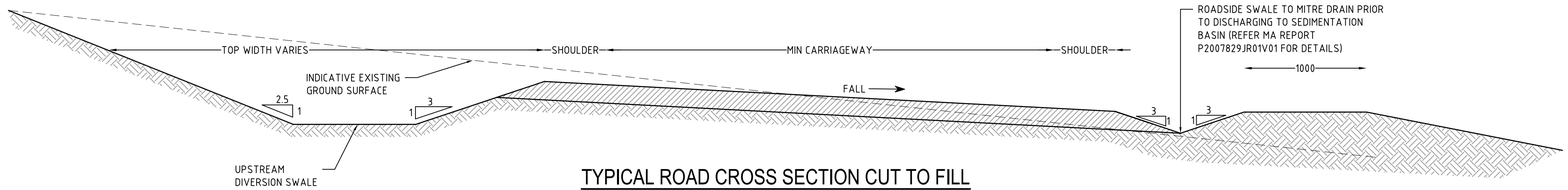
TYPICAL UPSTREAM DIVERSION SWALE TYPE 3

SCALE: 1:25



TYPICAL UPSTREAM DIVERSION SWALE TYPE 4

SCALE: 1:25



TYPICAL ROAD CROSS SECTION CUT TO FILL

SCALE: 1:25

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
C	**MINOR AMENDMENT**	**30/06/2021**	**GM**	**GM**	**SL**	**TH**
B	ADDED SEDIMENT CONTROL INFORMATION	12/05/2021	GM/JS	BN	SL	TH
A	INITIAL RELEASE	19/02/2021	GM/JS	BN	SL	

SCALE
0 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 METRES
A1 (A3) 1:25 (1:50)

GRID | DATUM | PROJECT MANAGER: TH

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CLIENT: CROOKWELL DEVELOPMENT PTY LTD

PROJECT NAME/PLANSET TITLE: CROOKWELL 3 WIND FARM

CROOKWELL, NSW

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DRAWING TITLE: ROAD CROSSINGS DETAILS (SHEET 1)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2007829	PS01	R03	PS01-E200	C

DRAWING ID: P2007829-PS01-R03-E200

PRINTED: --- - USER: GMOSTOFA
A1 / A3 LANDSCAPE (A:\LC_v02.0.01)

PROPOSED CULVERT DETAILS

CULVERT NO.	10 YEAR ARI DESIGN FLOW (M3)	100 YR ARI DESIGN FLOW (M3)	DIAMETER (MM)	NUMBER OF PIPES	N	SLOPE (%)	FLOW CAPACITY PER PIPE (M3/S)
C010	9.118	24.420	1350 ×	2	0.012	1	N/A
C020	0.639	1.771	600	1	0.012	1	0.666
C030	0.097	0.274	375	1	0.012	1	0.105
C040	0.560	1.560	600	1	0.012	1	0.666
C050	0.341	0.958	525	1	0.012	1	0.467
C060	0.916	2.531	750	1	0.012	1	1.207
C070	1.485	4.053	825	1	0.012	1	1.557
C080	0.096	0.270	375	1	0.012	1	0.105
C090	4.689	12.600	1350	1	0.012	1	5.786
C100	1.102	3.017	750	1	0.012	1	1.207
C110	1.524	4.158	825	1	0.012	1	1.557
C120	0.320	0.899	525	1	0.012	1	0.467
C130	0.894	2.470	675	1	0.012	1	0.912
C140	0.939	2.575	750	1	0.012	1	1.207
C150	0.243	0.683	450	1	0.012	1	0.309
C155	0.338	0.948	525	1	0.012	1	0.467
C160	0.029	0.083	375	1	0.012	1	0.049
C170	3.537	9.543	1200	1	0.012	1	4.227
C180	0.311	0.873	525	1	0.012	1	0.467
C190	0.074	0.210	375	1	0.012	1	0.105
C200	2.144	5.828	1050	1	0.012	1	2.961
C210	0.261	0.733	450	1	0.012	1	0.309
C220	0.789	2.184	675	1	0.012	1	0.912
C230	18.249	48.661	1350 ×	4	0.012	1	N/A
C240	4.867	13.070	1350	1	0.012	1	5.786
C250	15.692	41.905	1350 ×	3	0.012	1	N/A
C260	0.313	0.879	525	1	0.012	1	0.467
C270	0.179	0.505	375	1	0.012	1	0.190
C280	0.113	0.317	375	1	0.012	1	0.190
C290	0.096	0.269	375	1	0.012	1	0.105
C300	0.574	1.594	600	1	0.012	1	0.666
C305	0.013	0.036	375	1	0.012	1	0.017
C310	0.333	0.936	525	1	0.012	1	0.467
C320	0.336	0.942	525	1	0.012	1	0.467
C330	0.024	0.067	375	1	0.012	1	0.049

× BOX CULVERT OR BRIDGE CROSSING CAN BE CONSIDERED. TO BE DETERMINED AT DETAILED DESIGN STAGE.

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
C	**MINOR AMENDMENT**	**30/06/2021**	**GM**	**GM**	**SL**	**TH**
B	ADDED SEDIMENT CONTROL INFORMATION	12/05/2021	GM/JS	BN	SL	TH
A	INITIAL RELEASE	19/02/2021	GM/JS	BN	SL	

SCALE

GRID | DATUM | PROJECT MANAGER: TH

CLIENT: CROOKWELL DEVELOPMENT PTY LTD

PROJECT NAME/PLANSET TITLE: CROOKWELL 3 WIND FARM

CROOKWELL, NSW

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DRAWING TITLE: ROAD CROSSINGS DETAILS (SHEET 2)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2007829	PS01	R03	PS01-E203	C

DRAWING ID: P2007829-PS01-R03-E203

SEDIMENT AND EROSION CONTROL PLAN

1 TEMPORARY SEDIMENTATION AND EROSION CONTROLS (SEC) ARE TO BE CONSTRUCTED PRIOR TO COMMENCEMENT OF ANY WORK TO ELIMINATE THE DISCHARGE OF SEDIMENT FROM THE SITE. THE CONTROLS ARE TO BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF LANDCOM'S "MANAGING URBAN STORMWATER: SOILS AND CONSTRUCTION", VOLUME 1, 4TH EDITION, MARCH 2004, (THE BLUE BOOK).

2 THE CONTRACTOR IS TO INFORM ALL SUBCONTRACTORS OF THEIR RESPONSIBILITIES IN RELATION TO SEC.

3 THE CONTRACTOR SHALL REGULARLY MAINTAIN SEC DEVICES AND REMOVE ACCUMULATED SILT FROM SUCH DEVICES BEFORE NO MORE THAN 60% OF THEIR SEDIMENT STORAGE CAPACITY IS LOST. ALL THE SILT REMOVED SHALL BE DISPOSED OF AS DIRECTED BY THE SUPERINTENDENT. NO SILT IS TO BE PLACED OUTSIDE THE LIMIT OF WORKS. THE PERIOD FOR MAINTAINING THESE DEVICES SHALL BE AT LEAST UNTIL ALL DISTURBED AREAS ARE REVEGETATED AND FURTHER AS MAY BE DIRECTED BY THE SUPERINTENDENT OR ENGINEER.

4 AREAS OF SITE DISTURBANCE ARE TO BE MINIMISED AT ANY ONE TIME WITH DEVELOPMENT STAGED SUCH THAT A NEW AREA IS NOT TO COMMENCE UNTIL THE PREVIOUS DISTURBED AREA IS FULLY STABILISED.

5 ALL WORKS MUST BE PERFORMED IN ACCORDANCE WITH THE SEDIMENT AND EROSION CONTROL PLAN.

6 THE CONTRACTOR SHALL PROTECT OVERLAND FLOW PATHS, DRAINS, ADJOINING LAND AND DOWNSTREAM WATER QUALITY FROM SEDIMENTATION. ACCORDINGLY, SEDIMENT AND EROSION CONTROL MEASURES MUST BE IMPLEMENTED PRIOR TO EXCAVATION, AND MAINTAINED DURING CONSTRUCTION.

7 ACCESS TO AND EXIT FROM THE SITE SHALL BE RESTRICTED TO ONE DESIGNATED APPROVED AREA. INCLUDE ADEQUATE MEASURES TO REMOVE SOIL FROM VEHICLES LEAVING THE SITE SO AS TO MAINTAIN PUBLIC ROADS IN A CLEAN CONDITION.

8 VEGETATION NOT DIRECTLY AFFECTED BY THE PROPOSAL MUST BE PROTECTED BY A "NO GO" BOUNDARY TO FACILITATE THE FILTRATION AND COLLECTION OF RUNOFF POLLUTION EMANATING FROM THE WORKS. CONTRACTOR TO ENSURE THAT NO SPOIL OR FILL ENCROACHES UPON ADJACENT BUSHLAND FOR THE DURATION OF THE WORKS.

9 DISTURBED AREAS OUTSIDE THE SPECIFIED WORKS AREAS SHALL BE REHABILITATED/REINSTATED BY THE CONTRACTOR USING APPROVED METHODS OF EROSION MITIGATION SUCH AS MULCHING WITH INDIGENOUS PLANT SPECIES OR OTHER SUITABLE APPROVED STABILISING PROCESSES WITHIN SEVEN DAYS AS DIRECTED BY THE SUPERINTENDENT.

10 TOPSOIL IS TO BE LIGHTLY ROLLED TO AVOID EROSION.

11 THE FOLLOWING SEDIMENT CONTROL MEASURES ARE REQUIRED TO BE PROVIDED IN CONJUNCTION WITH THE ATTACHED SEDIMENT AND EROSION CONTROL PLANS.

A ALL RUNOFF AND EROSION CONTROLS ARE TO BE INSTALLED BEFORE ANY WORKS ARE CARRIED OUT AT THE SITE.

B ALL CONTAMINATED SURFACE WATERS AND DEBRIS FROM THE SITE MUST BE SCREENED, COLLECTED AND POLLUTANTS CAPTURED WITHIN THE SITE.

C STORMWATER INLETS AND DRAINS RECEIVING STORMWATER MUST BE PROTECTED AT ALL TIMES DURING WORK ON SITE.

D MOVEMENT OF WATER MUST BE CONTROLLED BY DIVERTING UPSLOPE CLEAN SURFACE RUNOFF (VIA DIVERSION DRAINS AND SEDIMENT FENCING) AROUND THE DISTURBED AREAS.

E CONTAMINATION OF SURFACE WATERS ON DOWNSLOPE LANDS MUST BE MITIGATED BY INSTALLING SEDIMENT CONTROL FENCES DOWNSLOPE OF THE DISTURBED AREAS TO CAPTURE SEDIMENT AND DEBRIS ESCAPING FROM THE SITE.

F GEOFABRIC SEDIMENT FENCING MUST BE INSTALLED PARALLEL TO THE PROPOSED WORKS OR ALONG THE NATURAL CONTOURS OF THE SITE.

G SEDIMENT FENCING MUST BE SECURED BY POST (WHERE METAL STAR PICKETS ARE USED, PLASTIC SAFETY CAPS SHALL BE USED) AT TWO-METRE INTERVALS WITH THE GEOTEXTILE FABRIC EMBEDDED 200MM INTO SOIL. ONE METRE RETURNS MUST BE INSTALLED AT TWENTY-METRE INTERVALS ALONG THE SEDIMENT FENCING.

H STOCKPILES OF TOPSOIL, SAND, AGGREGATE, SPOIL OR OTHER MATERIAL SHALL BE STORED CLEAR OF ANY DRAINAGE PATH OR EASEMENT, NATURAL WATERCOURSE, FOOTPATH, KERB OR ROAD SURFACE AND SHALL HAVE MEASURES IN PLACE TO THE SATISFACTION OF THE SUPERINTENDENT ACTING REASONABLY, TO PREVENT THE MOVEMENT OF SUCH MATERIAL OFF SITE.

I DRIVEWAY ACCESS PATHS MUST BE STABILISED WITH NEEDLE-PUNCHED GEOTEXTILE COVERED BY A MINIMUM 150MM THICK LAYER OF COARSE GRAVEL, AGGREGATE, OR RECYCLED CRUSHED CONCRETE.

J SEDIMENT TRAPS ARE TO BE INSTALLED DOWNSLOPE OF THE SITE TO FACILITATE THE CAPTURE OF SEDIMENT.

K STREET SWEEPING MUST BE UNDERTAKEN AS REQUIRED DURING AND AFTER EXCAVATION AND CONSTRUCTION UNTIL THE SITE IS FULLY ESTABLISHED.

L THE CONTRACTOR SHALL MAINTAIN DUST CONTROL UNTIL FINAL COMPLETION OF WORKS.

M DURING WINDY WEATHER, LARGE, DISTURBED, UNPROTECTED AREAS SHALL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL.

N SEDIMENT AND EROSION CONTROL MEASURES MUST BE MAINTAINED IN GOOD WORKING ORDER, AND BE REPAIRED OR REPLACED THROUGHOUT THE COURSE OF WORKS ON SITE.

O THE CONTRACTOR'S RESPONSIBILITY IS TO ENSURE ALL NECESSARY MEASURES ARE TAKEN SO AS TO PROTECT ALL DISTURBED AREA. ALL ADDITIONAL COSTS ARE TO BE REFLECTED IN THE CONTRACT PRICE EVEN IF SUCH MEASURES ARE NOT INDICATED ON THE SEDIMENT AND EROSION CONTROL PLANS.

P THE CONTRACTOR MUST COMMENCE REHABILITATION IMMEDIATELY FOLLOWING ANY SITE DISTURBANCE INCLUDING REGRADING, FORMATION AND REVEGETATION WORKS.

Q THE CONTRACTOR SHALL REGULARLY WATER REVEGETATED AREAS UNTIL EFFECTIVE COVER HAS PROPERLY ESTABLISHED AND VEGETATION IS GROWING VIGOROUSLY. MAINTENANCE IS TO CONTINUE UNTIL ALL VEGETATION IS WELL ESTABLISHED AND INDEPENDENT OF FURTHER WATER APPLICATIONS.

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENT	30/06/2021	GM	GM	SL	TH
A	ADDED SEDIMENT CONTROL INFORMATION	12/05/2021	GM/JS	BN	SL	TH

SCALE

GRID | DATUM | PROJECT MANAGER: TH

CLIENT: CROOKWELL DEVELOPMENT PTY LTD

PROJECT NAME/PLANSET TITLE: CROOKWELL 3 WIND FARM

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DRAWING TITLE: GENERAL NOTES

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
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