

NARRABRI GAS PROJECT

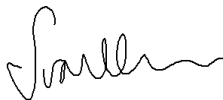

Erosion and Sediment Control Plan

PHASE 1


0041-150-PLA-0021

Date	Revision	Reason for Issue	Author	Checked	Approved
11 November 2022	0B	For approval	Onward Consulting	DG	TD

Prepared by:

Title	Name	Signature	Date
Senior Environmental Manager	S. van der Meulen Onward Consulting		11 November 2022
Director	Mark Vile Onward Consulting		11 November 2022

Reviewed by:

Title	Name	Signature	Date
Principal Environmental Advisor - Hydrogeologist	David Gornall		11 November 2022

Approved by:

Title	Name	Signature	Date
Development Manager NSW	Todd Dunn		11 November 2022

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Onward document number:
NGP-001D-0B PLN

Acronyms and abbreviations

Acronym	Description
AHD	Australian Height Datum
BOM	Australian Bureau of Meteorology
CoC	Conditions of consent for the NGP SSD 6456
CPESC	certified erosion and sediment control specialist
CSG	coal seam gas
DECC	The former NSW Department of Environment and Climate Change
DPE	NSW Department of Planning and Environment
DPE Water	The Water group within DPE
DPI	The former NSW Department of Primary Industries
DPI Water	The Water group within the former NSW Department of Primary Industries
DPIE	The former NSW Department of Planning, Industry and Environment
EIS	environmental impact statement
EMP	environmental management plan
EMS	Environmental Management Strategy
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
EPL	environment protection licence under the POEO Act
ESCP	Erosion and Sediment Control Plan (this document)
EQulS	Environmental Quality Information System
FCNSW	Forestry Corporation of NSW
GMP	Groundwater Management Plan
ha	hectare
IEA	Independent Environmental Audit
IECA	International Erosion Control Association
IMP	Irrigation Management Plan
L	litre
m	metre
m ³	cubic metre
mm	millimetre
NOW	The former NSW Office of Water, as part of the Department of Primary Industries
NRAR	Natural Resources Access Regulator
OEH	NSW Office of Environment and Heritage
PAL	petroleum assessment lease under the PO Act
PEL	petroleum exploration licence under the PO Act
PO Act	<i>Petroleum (Onshore) Act 1991 (NSW)</i>

Acronym	Description
POEO Act	<i>Protection of the Environment Operations Act 1997 (NSW)</i>
POEO Regulation	Protection of the Environment Operations (General) Regulation 2022
PPL	petroleum production lease under the PO Act
PPLA	petroleum production lease application under the PO Act
PWMP	Produced Water Management Plan
RoW	right of way
RREO	Resource Recovery Exemption and Order
SMS	Santos Management System
SSD	State significant development
SWMP	Surface Water Management Plan
TSS	total suspended solids
WMP	Water Management Plan
WTAG	Water Technical Advisory Group

Table of contents

1. Introduction	1
1.1 Narrabri Gas Project	1
1.1.1 Background	1
1.1.2 Current Project	1
1.2 Purpose and scope of the ESCP - Phase 1	3
1.3 Objectives	4
1.4 Performance measures	5
1.5 Consultation	5
1.6 Structure of this Plan	6
1.7 Distribution	7
2. Roles and responsibilities	8
3. Regulatory requirements	9
3.1 Compliance conditions	9
3.1.1 PEL 238	9
3.1.2 PAL 2 and PPL 3	9
3.1.3 EPL 20350	10
3.1.4 Development Consent SSD 6456	10
3.2 Relevant codes, standards, policies and guidelines	11
3.2.1 Managing Urban Stormwater: Soils and Construction	11
3.2.2 Controlled activities on waterfront land	11
3.3 EIS Commitments	12
4. Existing environment	13
4.1 Climate	13
4.1.1 Rainfall	13
4.1.2 Rain days	13
4.1.3 Rainfall intensity frequency duration	14
4.1.4 Rainfall erosivity	14
4.2 Topography, soils and landforms	15
4.2.1 Topography	15
4.2.2 Soil erodibility	15
4.2.3 Hydrology and drainage	15
5. Key management strategies	16
5.1 General measures	16
5.2 Minimising disturbance	16

5.3	Controlling stormwater flows	17
5.4	Erosion control measures	17
5.5	Sediment control measures	18
5.6	Sediment retention basins	18
5.7	Stabilisation measures	18
5.8	Soils and stockpile management	19
5.9	Works in watercourses	19
5.10	Access tracks	20
6.	Risk assessment and mitigation	21
6.1	Erosion hazard assessment	21
7.	Monitoring	23
7.1	Inspections	23
7.2	Maintenance and decommissioning	23
7.3	Severe weather and shutdown periods	24
7.4	Performance indicators	24
8.	Trigger action response plans	25
9.	Record keeping	28
10.	Incidents, non-compliances and complaints	29
10.1	Incidents and non-compliances	29
10.2	Unpredicted impact protocol	29
10.3	Complaint management	30
11.	Reporting, evaluation and review	31
11.1	Annual Review	31
11.2	Independent environmental audits	31
11.3	Management Plan review and evaluation	31
11.4	Improvement measures	32
12.	References	33
13.	Glossary	34
	Appendix A - Consultation records	38
	Appendix B - Compliance conditions relevant to this ESCP	46
	Appendix C - Site-specific ESCP	53
	Appendix D - Intensity frequency duration table	55
	Appendix E - Applicable standard drawings	57
	Appendix F - RoW watercourse crossing standard drawing	74
	Appendix G - Access track SD (unsealed roads)	76

Tables

Table 3.1 - EIS commitments relevant to erosion and sediment control.....	12
Table 4.1 - Monthly rainfall statistics	13
Table 4.2 - Average number of rain days per month leading to erosion on exposed soil	13
Table 4.3 - Fortnightly R-factors.....	14
Table 6.1 - RUSLE factors and values used for the Project.....	21
Table 6.2 - Potential Project ground disturbance impacts.....	22
Table 7.1 - Performance indicators	24
Table 8.1 - TARP for erosion and sediment control inspections	27
Table 10.1 - Unpredicted impact protocol	29

1. Introduction

1.1 Narrabri Gas Project

1.1.1 Background

Resource exploration has been occurring in the north-western area of NSW since the 1960s; initially for oil, but more recently for coal and gas. Santos NSW Pty Ltd began exploring for natural gas from coal seams in north-western NSW in 2008 and is currently conducting coal seam gas (**CSG**) exploration and appraisal activities within Petroleum Exploration Licence (**PEL**) 238, Petroleum Assessment Lease (**PAL**) 2 and Petroleum Production Lease (**PPL**) 3, located in the Gunnedah Basin about 20 kilometres (**km**) south-west of the town of Narrabri. Activities in PAL 2 have focussed on the Bibblewindi and Bohena CSG pilots, whilst recent activities in PEL 238 have focussed on the Dewhurst and Tintfield CSG pilots.

The Narrabri Coal Seam Gas Utilisation Project (Wilga Park Power Station and associated infrastructure) operates under an existing Part 3A approval under the *Environmental Planning and Assessment Act 1979* (NSW) (**EP&A Act**). It was originally approved in 2008, with various modifications approved between 2011 and 2019. It encompasses a gas gathering system, a compressor and associated flare, a gas flow line from Bibblewindi to Wilga Park within a 10 metre (**m**) corridor with a riser at Leewood and an expansion of the existing Wilga Park Power Station from 12 to 40 megawatts.

1.1.2 Current Project

On 30 September 2020, Santos NSW (Eastern) Pty Ltd (**Santos**) obtained consent for State significant development (**SSD**) 6456 to develop the Narrabri Gas Project (**NGP**) (**the Project**). Approval EPBC 2014/7376 under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (**EPBC Act**) was granted on 24 November 2020.

The Project includes the progressive installation of up to 850 new gas wells on up to 425 new well pads over approximately 20 years and the construction and operation of gas processing and water treatment facilities. The Project area covers about 950 square kilometres (95,000 hectares) in size and the Project footprint will only directly impact about 1% of that area.

Four phases of development are defined under the consent, including:

- Phase 1 - exploration and appraisal;
- Phase 2 - construction activities for production wells and related infrastructure;
- Phase 3 - gas production operations; and
- Phase 4 - gas well and infrastructure decommissioning, rehabilitation and closure.

Phase 1 of the Project is defined in the consent as the phase of the development comprising ongoing exploration and appraisal activities in the Project area, including:

- seismic surveys;
- core and chip holes;
- construction and operation of pilot wells (up to 25 wells on up to 25 well pads across the Project area); and
- pilot well ancillary infrastructure, including access tracks, gas and water gathering lines, water balance tanks, safety flaring infrastructure, utilities and services, and environmental monitoring equipment including groundwater monitoring bores.

Santos plans to continue exploration and appraisal of the resource in the near term until a final investment decision can be made. The exploration and appraisal activities will include continued operation of Santos' existing wells, infrastructure and facilities in PEL 238 and PAL 2, and construction and operation of new core holes, pilot wells and supporting infrastructure permitted under Phase 1.

Santos' existing exploration and appraisal activities in PEL 238 and PAL 2 include:

- Tintsville Pilot;
- Bibblewindi East Pilot;
- Bibblewindi West Pilot;
- Dewhurst North Pilot;
- Dewhurst South Pilot;
- Dewhurst northern and southern flow lines;
- Leewood Water Management Facility including ponds, the water and brine treatment plant and the irrigation area;
- Bibblewindi Facility including gathering system, water balance tank, compressor and flare; and
- Bibblewindi to Leewood buried gas pipeline.

These exploration and appraisal activities will continue as part of the NGP. The initial, new-appraisal Phase 1 scope is a relatively minor extension to these existing exploration and appraisal activities.

The Phase 1 scope is planned to include the construction and operation of:

- 4 coreholes;
- 6 pilot wells;
- 2 deep reservoir monitoring bores (converted coreholes);
- new shallow water monitoring bores;
- associated linear infrastructure;
- seismic surveys (length and location to be determined); and
- continued operation of Santos' existing exploration and appraisal activities including workover activities.

The full definitions of the approved activities for Phases 2, 3 and 4 of the Project are provided in the consent. Santos is not prevented from carrying out any or all of the phases concurrently, subject to the conditions of this consent.

Further details regarding the NGP, including a full overview of the regulatory framework and statutory provisions of the NGP and the current approvals, leases and licences related to the management of water are provided in the overarching Water Management Plan (**WMP**). Details regarding the staging of the works and the exact scope for each phase are as per the approved Field Development Plan.

1.2 Purpose and scope of the ESCP - Phase 1

Santos has developed this Erosion and Sediment Control Plan (**ESCP** or the **Plan**) in accordance with the applicable regulatory framework. It provides an overview of the strategy and controls implemented by the Project to manage erosion and sediment. Specifically, it identifies erosion and sediment risk within the Project area and provides an erosion and sediment control strategy cognisant of these risks. It provides a set of standards for the Project to adhere to, whilst allowing the flexibility to select controls most suitable to address the issues relative to the degree of land disturbance, season, and environmental risks. Santos will implement all reasonable and feasible measures and be strategic and proactive in erosion and sediment management so that any potential impacts on the environment are avoided or minimised.

This ESCP has been developed in accordance with the requirements of approval conditions of PEL 238; PAL 2; PPL 3; compliance conditions of Environment Protection Licence (**EPL**) 20350 and the SSD 6456 conditions of consent (**CoC**). It details how Santos manages its erosion and sediment control (**ESC**) obligations during Phase 1 of the development and its current operations of its CSG activities in the Narrabri area for the duration of the EPL. The Plan will be reviewed annually and in accordance with the CoC.

This ESCP replaces the pre-existing Soil and Water Management Plan which was prepared to satisfy the conditions of EPL 20350 and satisfies all relevant EPL conditions as presented in Table B1 in Appendix B. It forms part of a suite of documents prepared as part of the WMP under Condition B41, which consist of the following:

- (i) An Erosion and Sediment Control Plan (this document);
- (ii) A Site Water Balance, which includes but is not limited to details of the inflows and outflows in the Project area; sources and security of water supply for the life of the Project; water storage and treatment capacity; water use and management, including sharing and transfers; licenced discharge points; and reporting procedures, including the annual preparation of an updated site water balance;
- (iii) A Surface Water Management Plan (**SWMP**), which includes but is not limited to specific details on baseline data on surface water flows and quality of watercourses; the surface water management system; detailed plans, design objectives and performance criteria for water infrastructure; performance criteria; a program and procedures for monitoring, evaluation and reporting; and plan to respond to any exceedances of the performance measures or performance criteria, and repair, mitigate and/or offset any adverse surface water impacts of the development;
- (iv) A Groundwater Management Plan (**GMP**), which provides details including but not limited to baseline data of hydrogeology and groundwater levels, formation parameters and quality for groundwater resources; a description of the groundwater management and monitoring system; performance criteria, trigger and response levels; a program and procedures for monitoring, evaluation and reporting; and a plan to respond to any exceedances of the groundwater performance criteria, and repair, mitigate and/or offset any adverse groundwater impacts of the Project;
- (v) A Produced Water Management Plan (**PWMP**) that provides detailed baseline data on produced water yield and quality, and includes but is not limited to details regarding the produced water management system; performance criteria, including trigger levels; and a program and procedures for monitoring, evaluation and reporting;
- (vi) An Irrigation Management Plan (**IMP**), for managing beneficial reuse of treated water for crop irrigation and stock watering, that includes but is not limited to details regarding site selection and assessment; agreements with third parties; baseline soil and groundwater conditions and quality; a protocol for operation of the irrigation management system; and

measures to manage any effects on soils structure, erosion, groundwater quality and maintain a water balance;

- (vii) A Dust Suppression Protocol for managing beneficial reuse of treated water for dust suppression and construction activities including but not limited to details of site selection and assessment; baseline soil and groundwater conditions and quality; a protocol for operation of the dust suppression system; and measures to manage any effects on soils structure, erosion, surface water runoff, groundwater quality and groundwater levels;
- (viii) A Managed Release Protocol for managing disposal of treated water to Bohena Creek, that includes but is not limited to details of water flows, quality and health; predicted plume dispersal; a protocol and detailed procedures for managed release; and measures to manage any effects of water quality, stream and riparian health, erosion and sedimentation and downstream flooding. It is to be noted that it is not proposed to release to Bohena Creek during Phase 1 of the Project and as such this protocol will be developed for Phase 2 of the Project;
- (ix) A Salt Management Plan, which includes but is not limited to details of salt and other waste volumes and composition generated by the produced water management system; a program for investigating and implementing beneficial reuse options for the salt product; a protocol and procedures for the full-cycle management of salt and salt-related waste products; and measures to ensure appropriate storage and disposal of any salt waste. It is to be noted that it is not proposed to generate any salt during Phase 1 of the Project (only brine will be generated) and a description is included as section 7 of the Produced Water Management Plan. A stand-alone plan will be developed for Phase 2 of the Project;
- (x) A Pollution Incident Response Management Plan (**PIRMP**), prepared in accordance with the Protection of the Environment Operations (General) Regulation 2009 (POEO Regulation) and which includes detailed procedures for responding to incidents, spills and leaks associated with the produced water management system; and a Dam Safety Emergency Plan for managing potential incidents and emergencies associated with produced water storages, and
- (xi) A protocol to report on the measures, monitoring results and performance criteria identified above, in the Annual Review referred to in consent condition D8.

A full list of the conditions applicable to this ESCP is presented in Section 3.2.4. A copy of the consent conditions relevant to each of the other sub-plans listed above is provided in each of the individual documents and in Appendix A of the Water Management Plan.

As required by CoC B42, Santos will implement the latest revision of the WMP (including this ESCP) once approved by the Planning Secretary.

1.3 Objectives

The objectives of this ESCP are to provide the following:

- a replacement document for the pre-existing Soil and Water Management Plan which was prepared to satisfy the conditions of EPL 20350;
- details of the relevant statutory requirements (including any relevant approval, licence or lease conditions) and any relevant commitments or recommendations identified in the Environmental Impact Statement (**EIS**) for the Project;
- a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;
- details of the climate, topography, receiving waters, and soils of the Project;

- description of the expected disturbances to soils associated with the range of activities required for construction of the Project and an evaluation of the rainfall erosivity hazards and erosion hazards;
- specification of the design standards for drainage, erosion, and sediment control; and identification of the typical controls expected to be required across the Project;
- description of key strategies required for effective erosion and sediment control management, including site dewatering;
- a program to monitor, evaluate and report on compliance with the requirements, obligations and performance measures and criteria; and
- a program to investigate and implement ways to improve the environmental performance of the erosion and sediment control measures over time.

1.4 Performance measures

As required by consent condition B26 and B37 Table 7, Santos will ensure that the development complies with the following respective management performance measures related to soil erosion riparian and aquatic ecosystems:

- design, install and maintain erosion and sediment controls in accordance with the guidance series *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004) and *2E Mines and Quarries* (DECC, 2008);
- maintain or improve baseline channel stability in affected watercourses; and
- design, install and maintain erosion any infrastructure within 40 metres of watercourses in accordance with guidance series for *Controlled Activities on Waterfront Land* (DPI Water, 2012).

Under Schedule 4 Clause 18 of the *Water Management (General) Regulation 2018* the Project is exempt from obtaining a controlled activity approval since it is carried out under a petroleum title under the *Petroleum (Onshore) Act 1991* (NSW).

1.5 Consultation

Consultation has been undertaken during the preparation and finalisation of each previous revision of the Soil and Water Management Plan, with the initial version released early 2014. All content of the Soil and Water Management Plan has now been incorporated into this ESCP for Phase 1, which has been prepared by a suitably qualified and experienced person, in consultation with the Water group within the NSW Department of Planning and Environment (**DPE**) (generally referred to as **DPE Water**), the NSW Environment Protection Authority (**EPA**) and the Water Technical Advisory Group (WTAG).

The comments received from the Natural Resources Access Regulator (**NRAR**) [on behalf of DPE Water] on the draft ESCP (Revision C) centred around the use of water for dust suppression, and the requirement to reference NRAR guidelines in relation to works within waterfront land.

The EPA commented that the ESCP generally complies with the “Blue Book” standards and requirements of EPL 20350, and provided comments generally focussed on the management of ground disturbance activities, including the implications of dispersive soils. Further comments were related to the development of site-specific and progressive ESCPs for the various development activities.

The comments from the WTAG centred around stockpile and topsoil management, and the impracticality of using a prescriptive set of trigger conditions in a trigger action response plan.

All consultation correspondence and the responses to comments are provided in Appendix A.

1.6 Structure of this Plan

Together with the suite of documents listed in section 1.2, this Plan is a supporting management plan (sub-plan) to the WMP. The WMP sets out the overall details how the documents are related and where information or details are located in the event of any overlap or commonality. The structure of this Plan is as follows:

Section 1	Provides an introduction to the Project and the context, scope, purpose and objectives of this Plan. It further provides the performance measures related to the installation and management of erosion and sediment control measures
Section 2	Defines the roles and responsibilities of personnel involved with the NGP, including consultants, contractors and their subcontractors
Section 3	Outlines the statutory provisions relevant to the management of erosion and any sediment generated by development of the NGP
Section 4	Describes the characteristics of the existing environment of the Project site, including details about the climate, topography, landforms and drainage
Section 5	Provides details of the key management strategies to minimise ground disturbance, control stormwater flows and optimise erosion and sediment control measures
Section 6	Provides an erosion hazard assessment and details the various ground disturbance activities and associated potential impacts related to erosion and the generation of sediment
Section 7	Outlines the monitoring and maintenance program implemented across the Project to ensure appropriate and effective controls are installed and functioning
Section 8	Describes the trigger action and response process to assess and respond to inclement weather conditions and to manage risks to operations and the environment
Section 9	Provides details on the process that is implemented to manage data and records in a consistent, efficient and effective manner
Section 10	Details the actions required for incidents and non-compliances related to ESC management and implementation
Section 11	Describes the reporting, evaluation and review process of this ESCP, including the annual review, independent audits and environmental improvement measures
Section 12	References
Section 13	Glossary
Appendix A	Provides copies of the consultation records and responses to all comments
Appendix B	Approval conditions directly relevant to ESCP
Appendix C	Site specific erosion and sediment control plan

Appendix D	Intensity frequency distribution (IFD) table
Appendix E	Blue Book and IECA Standard drawings
Appendix F	RoW watercourse crossing standard drawing
Appendix G	Access track standard drawings

1.7 Distribution

A copy of the approved ESCP is available to all relevant Santos personnel via the Santos intranet. In accordance with consent condition D13, the latest copy of the Plan including all associated appendices, audits and reports, and summaries of all monitoring data (where relevant), can also be found on the Project website, once these have been approved by the Planning Secretary. This information will be kept up to date.

In accordance with specific licence, approval or code of practice conditions, a copy of this ESCP is available at the Santos Operations Centre located at 300 Yarrie Lake Road in Narrabri. This is where operational and field staff commence and finish each workday.

Note that any printed copies of this ESCP are uncontrolled.

2. Roles and responsibilities

All Santos employees and contractors involved in the Narrabri Gas Project are responsible for the environmental performance of their activities and for complying with all legal requirements and obligations. Project personnel will be required to comply with approval requirements of the activities they undertake and potential environmental impacts from all activities will be managed in accordance with the Project's relevant management plan(s).

ESC planning, installation and maintenance will be supervised by personnel trained in the relevant aspects of *Managing Urban Stormwater: Soils and Construction - Volume 1* (Landcom 2004), more commonly known as the 'Blue Book'.

In accordance with consent condition D1, the Environmental Management Strategy (**EMS**) sets out the roles, responsibilities, authorities and accountabilities of all key personnel involved in the environmental management of the Project, including the requirements and obligations in this ESCP. All roles, responsibilities and accountabilities have been assigned in accordance with Santos Management System SMS-MS_14 *People Management Standard*.

3. Regulatory requirements

The Project is permissible with development consent under the *State Environmental Planning Policy (Resources and Energy) 2021*, and is identified as a 'State significant development' under Section 4.38 of the EP&A Act and the *State Environmental Planning Policy (Planning Systems) 2021*.

The Project was subject to the State significant development assessment and approval provisions of Division 4.7 of Part 4 of the EP&A Act and was approved as a State significant development under the EP&A Act and the EPBC Act.

The Project will be carried out in accordance with the:

- relevant existing development consents and activity approvals;
- the conditions of relevant tenements including PEL 238, PAL 2, PPL 3, the provisions of the *Petroleum (Onshore) Act 1991* (NSW) (**PO Act**) relevant codes of practice and guidelines;
- EPL 20350 issued by the EPA and the provisions of the *Protection of the Environment Operations Act 1997* (NSW) (**POEO Act**); and the
- conditions of consent for the NGP SSD 6456.

3.1 Compliance conditions

Compliance conditions associated with the following licence(s), lease(s) and consent(s) are relevant to this ESCP:

- PEL 238, granted on 1 September 1980 and most recently renewed on 12 April 2022;
- PAL 2, granted on 30 October 2007;
- PPL 3, granted on 15 December 2003;
- PPLs 13, 14, 15 and 16, once issued;
- EPL 20350, as varied; and
- SSD 6456.

3.1.1 PEL 238

There are no specific conditions or obligations in PEL 238 related to erosion and sediment control.

3.1.2 PAL 2 and PPL 3

Lease condition 2 of PAL 2 and PPL 3 state that activities must only be carried out in accordance with a Petroleum Operations Plan (**POP**) which has been approved by the Director-General of the Department of Primary Industries. Further, the POP must (i) identify how operations will be carried out on site in order to prevent and or minimise harm to the environment; and (ii) reflect conditions of approval under the EP&A Act, the POEO Act, and any other approvals relevant to PAL 2 and PPL 3.

The POP was approved on 18 September 2020. This ESCP, just like the Soil and Water Management Plan it replaces, supports the POP and satisfies condition 2 of PAL 2 and PPL 3 by providing information about how Santos manages and controls erosion and sedimentation resulting from its activities within PAL 2 and PPL 3.

3.1.3 EPL 20350

'Petroleum exploration, assessment and production' is a scheduled activity listed in Schedule 1 of the POEO Act. Under section 48 of this Act, all scheduled activities are required to hold an environment protection licence. EPL 20350 is held for CSG activities in PEL 238, PAL 2 and PPL 3. There are several specific conditions related to erosion and sediment control in EPL 20350, presented in Table B1 in Appendix B.

3.1.4 Development Consent SSD 6456

There are a number of SSD 6456 consent conditions directly relevant to the erosion and sediment management, the key conditions being CoC B26, B37 and B41(d)(i) which have been outlined below. Table B2 in Appendix B specifies where each of the requirements of all the relevant SSD 6456 consent conditions are addressed in this Plan.

Consent condition B26 states that Santos must install and maintain suitable erosion and sediment control measures in the Project area, in accordance with the relevant requirements in the guidance series *Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004)* and *2E Mines and Quarries (DECC, 2008)*.

Consent condition B37 states that Santos must design, install and maintain erosion and sediment controls in accordance with the guidance series *Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004)* and *2E Mines and Quarries (DECC, 2008)*.

Consent condition B41 states that prior to the commencement of Phase 1, Santos must prepare a Water Management Plan for the NGP to the satisfaction of the Planning Secretary and that this plan must:

(d) include a:

- (i) Erosion and Sediment Control Plan, that:
 - is consistent with the requirements of *Managing Urban Stormwater: Soils and Construction - Volume 1: Blue Book*¹ (Landcom, 2004) and Volume 2E: Mines and Quarries (DECC, 2008);
 - identifies all activities that could cause soil erosion, generate sediment or affect flooding;
 - describes measures to minimise soil erosion and the potential for the transport of sediment to downstream waters, and manage flood risk;
 - describes the location, function, and capacity of erosion and sediment control structures and flood management structures; and
 - describes what measures would be implemented to maintain (and if necessary decommission) the structures over time.

There are a number of other consent conditions that stipulate requirements relating to erosion and sediment management, monitoring and control. How these requirements and obligations are complied with are detailed in the relevant management plan(s) associated with the condition(s). These include the IMP, the Dust Suppression Protocol, the Managed Release Protocol, the Surface Water Management Plan and the Biodiversity Management Plan. However, in general, these plans in turn refer to this ESCP to provide all relevant details and information regarding the management of erosion and sediment during Phase 1 of the Project.

¹ The 2004 Landcom publication *Managing Urban Stormwater: Soils and Construction - Volume 1* is commonly known as the 'Blue Book'. This is not part of the publication title.

3.2 Relevant codes, standards, policies and guidelines

Policies regarding creek crossings and related to fish habitat are listed and addressed in the Surface Water Management Plan.

3.2.1 Managing Urban Stormwater: Soils and Construction

Managing Urban Stormwater: Soils and Construction - Volume 1 (Landcom 2004), more commonly known as the 'Blue Book', provides support for developments to reduce the impacts of land disturbance activities on waterways by better management of soil erosion and sediment control. It provides guidance for the design, construction and implementation of measures to improve stormwater management during the construction phase of land development.

Volume 1 is specifically for urban works. It has been complemented by a series of publications in 2007 and 2008 combined as *Managing Urban Stormwater: Soils and Construction - Volume 2* which cover installation of services, waste disposal sites, quarries and other mining sites, major road and highway construction, and construction of unsealed roads access tracks in bushland and rural area. The purpose of the publications in Volume 2 is to provide guidelines, principles and recommended design standards for good management practice in erosion and sediment control during the construction and repair of unsealed roads, services and

This ESCP is based on the requirements of the Blue Book, and the following sections of Volume 2:

- 2A - Installation of Services
- 2C - Unsealed Roads
- 2E - Mines and Quarries

Volume 1 and 2 are complemented by *Erosion and Sediment Control of Unsealed Roads - A Field Guide for Erosion and Sediment Control Maintenance Practices* (OEH 2012) which is largely based on Volume 2C.

3.2.2 Controlled activities on waterfront land

Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary. The *Controlled Activities on Waterfront Land – Guidelines for instream works on waterfront land* (DPI Water, 2012) relate to the design and construction of works within a watercourse or on waterfront land. Instream works include modifications or enhancements to the watercourse, channel realignment, bed control structures, pipe laying and cable trenching etc.

The guidelines state that the design and construction of works or activities within a watercourse or adjoining waterfront land should protect and enhance water flow, water quality, stream ecology and existing riparian vegetation. Impacts on the hydrologic, hydraulic and geomorphic functions of a watercourse should also be minimised. The design and construction footprint and the extent of disturbances within waterfront land should also be minimised.

3.3 EIS Commitments

In the EIS Chapter 31, and updated in Appendix B of the Response to Submissions, Santos has committed to implement a number of measures pending Project approval and a final investment decision. The EIS commitments relevant to ESC have been reproduced below in Table 3.1, in accordance with consent condition D3(c) which states that Santos will ensure that (where relevant) the management plans include any relevant commitments or recommendations identified in the EIS.

Table 3.1 - EIS commitments relevant to erosion and sediment control

Number	EIS Commitment relevant to erosion and sediment control
3.5 / 4.7	The managed release [to Bohena Creek] will be undertaken in a manner that minimises erosion to the bed and banks at the release point and the build-up of sediment at that location.
4.4	Erosion and sediment control measures will be implemented during construction of watercourse crossings
5.1	Erosion and sediment controls for the Project will be implemented based on <i>Managing Urban Stormwater: Soils and Construction – Volume 1</i> (the 'Blue Book')

As described in section 11 of this Plan and section 8 of the EMS, this Plan will be subject to regular evaluation and review. This will include the EIS commitments to ensure they remain current, applicable, and generally improve the environmental performance of the Project.

4. Existing environment

4.1 Climate

4.1.1 Rainfall

Typical rainfall and temperature statistics for the Project works have been sourced from the Bureau of Meteorology (BOM) website for the following nearby weather stations:

- rainfall statistics (1870 to 2012) - Narrabri Bowling Club (BOM No. 54120) (BOM, 2020a); and
- temperature statistics (1876 to 2011) - Gunnedah Pool (BOM No. 55023) (BOM, 2020b).

The data obtained by these weather stations has been used since they are the closest stations to the Project works which provide a reliable record of rainfall/temperature statistics representative of the area. Average annual rainfall for Narrabri Bowling Club is approximately 640 mm/yr. Monthly rainfall and temperature statistics are provided in Table 4.1. They show that:

- rainfall is summer dominant;
- average rainfall is relatively low; and
- temperatures are warm to hot in summer and mild in winter.

Table 4.1 - Monthly rainfall statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean rainfall (mm)	80.2	73.9	53.6	38.2	48.9	50.9	44.9	37.4	39.1	51.2	59.9	67.7
Mean temp (°C)	34.0	32.9	30.7	26.4	21.3	17.6	16.9	18.9	22.8	26.7	30.3	32.9

According to the map in the Blue Book (page 4-16), the site lies close to the borderline of rainfall zones 6 and 8. Therefore, the worst-case scenario will be considered for design purposes.

4.1.2 Rain days

The number of rain days per month may be used as an indicator of how often runoff may occur, and therefore generate erosion and sediment flow. Depending on recent preceding rainfall events, storms with less than 10 mm of water are considered to have little potential to cause erosion as most of the water will infiltrate the soil and runoff will be minimal.

In the summer months the incidence of rainfall days with rainfall greater than 10 mm is 1 to 2 days per month, with rainfall exceeding 25 mm less than once per month. Between April and September, the potential for runoff is less tending to 1 day per month, or less as presented in Table 4.2.

Table 4.2 - Average number of rain days per month leading to erosion on exposed soil

Depth (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
≥ 10	1.7	1.3	1.3	0.8	1.1	1.2	1.0	1.0	1.0	1.3	1.5	1.7	14.9
≥ 25	0.8	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.5	0.5	4.7

4.1.3 Rainfall intensity frequency duration

The intensity frequency duration (IFD) rainfalls for the Project have been produced for design purposes, based on the BOM 2019 data. Rainfall (in mm/h) from this table is used to determine the rainfall intensity associated with the relevant 'time of concentration' for drainage catchments on the Project. The IFD is presented in Table D1 in Appendix D.

4.1.4 Rainfall erosivity

Rainfall erosivity is a measure of the ability of rainfall to cause erosion. The annual rainfall erosivity (R-factor) for the region is estimated at 1600. The distribution of erosive rain throughout the year is relevant in determining erosion and sediment controls. Fortnightly rainfall erosivity values and ratings for the Project are presented in Table 4.3.

Table 4.3 - Fortnightly R-factors

Month	Half	R-Factor	Rainfall erosivity category
January	1 st	144	High
	2 nd	144	High
February	1 st	112	Moderate
	2 nd	128	Moderate
March	1 st	64	Moderate
	2 nd	80	Moderate
April	1 st	48	Low
	2 nd	48	Low
May	1 st	32	Low
	2 nd	48	Low
June	1 st	32	Low
	2 nd	16	Low
July	1 st	32	Low
	2 nd	16	Low
August	1 st	32	Low
	2 nd	32	Low
September	1 st	32	Low
	2 nd	48	Low
October	1 st	64	Moderate
	2 nd	64	Moderate
November	1 st	64	Moderate
	2 nd	96	Moderate
December	1 st	112	Moderate
	2 nd	112	Moderate

4.2 Topography, soils and landforms

4.2.1 Topography

The Project area is located in the Namoi River catchment in the central north of NSW within the Murray Darling Basin and is characterised by gentle north to north-west slopes. The flat, open terrain of the Namoi River floodplains is located north and west of the Project area, with steep and undulating topography to the east and south. The topography in the region is dominated by Mount Kaputar to the north-east and the Warrumbungle Ranges to the south. Elevation in the Project area varies from approximately 200 m Australian Height Datum (AHD) in the north to approximately 500 m AHD in the south-east. The topography remains fairly consistent over the extent of the Project area. It is made up of gentle inclines generally in the range of 1-5 % but up to 10 % leading down to drainage lines.

Sodosols are common in the Project area, as detailed in the IMP. These soils exhibit high erodibility, poor structure and low fertility which has been confirmed during site investigations.

4.2.2 Soil erodibility

Construction activities for Phase 1 will largely occur within forested or previously cleared areas and are expected to encounter Sandy Sodic Duplex Soils, Acidic Sands and / or Recent Alluvium. Disturbance has the potential to aggravate erosion, with exposed soils potentially causing erosion from runoff and/or wind.

Soil erodibility (K factor) across the Project area has been categorised as either:

- low ($K < 0.02$);
- moderate ($K 0.02 - 0.04$);
- high ($K > 0.04$); and
- extreme ($K < 0.06$)

Data on soil erodibility is relevant to:

- calculations to estimate soil loss using the Revised Universal Soil Loss Equation (RUSLE) (refer to section 6);
- selections of appropriate types of sediment controls; and
- spacing of cross banks on right of way (RoW) and access tracks

4.2.3 Hydrology and drainage

Watercourses are generally ephemeral in nature with many resulting from poorly drained and highly dispersive soils causing areas of tunnel or gully erosion and consequent drainage lines. Open forest is dominant across most areas, dominated by eucalypt overstorey, cypress understory, with sedges and native grasses forming the ground cover.

The main watercourse system flowing through the Project area is Bohena Creek. Further information on watercourses and drainage relevant to the Project is provided in the Surface Water Management Plan.

5. Key management strategies

5.1 General measures

Santos will undertake the following general measures across the Project:

- All ESCs will be designed, installed and maintained in accordance with the guidance series *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004) and *2E Mines and Quarries* (DECC, 2008). Refer to Appendix E for further guidance;
- Personnel dedicated for ESC maintenance will be competent in the effective installation and construction of temporary controls including sediment fence installation, applying stabilising products, lining drains etc.
- ESCs when required, will be implemented at all sites associated with construction activities, including:
 - access roads and tracks;
 - standard lease pads or similar;
 - RoWs.
- A Santos representative will monitor weather conditions and forecasts (including rainfall prediction maps) daily and pass on relevant information to the site foremen to allow for adequate planning for significant rain events.
- Relevant documentation for recording ESC activities will be implemented and incorporated into existing systems which will include some or all of the following:
 - Santos Environment, Health and Safety (EHS) Toolbox;
 - compliance checklists;
 - preparation and implementation of progressive site-specific erosion and sediment control plans (Progressive ESCPs) prior to any site disturbance- stored within Santos' electronic database (refer to Appendix C). All site-specific ESCPs will be signed off by a certified erosion and sediment control specialist (CPESC).
 - applicable meeting minutes;
 - formal correspondence (e.g. regulatory bodies);
 - water-quality monitoring results (e.g. receiving waters if required).
- Relevant ESC measures will be implemented for each particular section of works prior to or in conjunction with the commencement of topsoil stripping or earthworks;
- Additional ESC measures will be implemented as required during construction works; and
- Sufficient supplies of ESC materials/products will be available at all times.

5.2 Minimising disturbance

Santos will undertake the following measures to minimise disturbance across the Project:

- Clearing limits and work boundaries will be established and well-defined using barrier tape, survey marks or an effective alternative prior to any construction, clearing or stripping works commencing;
- The extent of clearing will be minimised as much as practicable;
- All vegetation that is to be maintained will be clearly delineated;

- Land clearing will occur progressively and will be limited to the areas associated with the current section/stage of works only;
- Gas and water lines would typically be installed using plough-in construction methods, while larger pipelines would more likely be constructed using traditional trenching methods;
- Critical aspects of in-stream works will be scheduled for forecasted dry weather periods, and watercourses and adjacent areas will be left undisturbed until the point immediately prior to access track works or trenching in these areas commencing; and
- Disturbance and clearing in and around natural watercourses will be minimised as much as possible. Where possible, rock causeway crossings will be used for the construction of access tracks.

5.3 Controlling stormwater flows

Santos will undertake the following measures to control stormwater flows across the Project:

- Separate 'clean' (offsite) run-on water from 'dirty' (onsite) (e.g. turbid) construction area runoff as much as is practicable;
- Wherever possible, construct drainage structures early in the Project including clean and dirty water diversion drains/banks;
- Maximise the diversion of turbid construction runoff into sediment filtration devices including (but not limited to):
 - sediment fence;
 - mulch berms;
 - excavated sediment traps with appropriate outlet controls;
- Install slope breaks (contour berms) in locations where required;
- Establish appropriate surface drainage on all access tracks;
- Implement appropriate measures within watercourses to maintain natural flows across the works; and
- Implement appropriate erosion control measures (refer to Appendix E for erosion control standard drawings) to control runoff volumes from construction areas.

5.4 Erosion control measures

Santos will undertake the following control measures to minimise erosion across the Project:

- The separation of 'clean' (offsite) run-on water from 'dirty' (onsite) (e.g. turbid) construction area runoff will be maximised as much as practicable;
- Offsite run-on water will be diverted around the works site as much as possible using stabilised diversion drains, banks and berms;
- Slope lengths will be maintained at appropriate lengths (where necessary) to slow flows down and minimise erosion;
- Exposed soils will be stabilised with soil stabilisers (where necessary) to minimise erosion;
- Stockpiles of soil material will be sited in low-hazard areas clear of watercourses and outside of the flood prone lands;
- Stockpiles will be stabilised in accordance with the requirements in section 5.8; and

- Dust suppression will be carried out whenever necessary to minimise sediments becoming air borne due to wind erosion. Refer to the Dust Suppression Protocol for details.

5.5 Sediment control measures

Santos will undertake the following sediment control measures across the Project:

- Construct sediment control measures in appropriate areas, if required as per section 6.1;
- Control the tracking of mud and soil material onto local roads by site vehicles using rig mats, shakers or rubble pads (where necessary);
- Sediment controls will be provided downslope of disturbed areas. Various types of sediment controls that may be used include (but are not limited to):
 - sediment fence or coir logs;
 - mulch berms;
 - excavated sediment retention basins (refer also to section 5.6);
- Sediment will be removed from sediment controls when required; and
- Sediment controls will only be removed after adequate stabilisation of disturbed surfaces is achieved.

5.6 Sediment retention basins

No sediment basins will be constructed as part of Phase 1 since sediment retention basins are considered unnecessary for sites that have a soil loss value less than 150 m³ as calculated using the RUSLE method (refer to section 6.1).

5.7 Stabilisation measures

Santos will undertake the following stabilisation measures across the Project:

- In general, all reasonable endeavours would be made to implement the most appropriate stabilisation measures in the shortest practicable timeframe;
- Where possible the seedbank (topsoil layer) will be stripped separately and pushed into a berm/bund on the high side of the worksite. This will be stabilised after formation using an erosion control product such as jute mesh, hydraulic-stabiliser or equivalent, if required;
- Where applicable, gypsum may be spread over the topsoil surface prior to stripping. This will help to achieve final rehabilitation outcomes, especially for sodic/dispersible soils;
- The depth of the remainder of the topsoil will be determined and the topsoil will be stripped and pushed into a berm/bund next to the seedbank berm on the high side of the worksite. This will be stabilised after formation;
- Soil stabilisers or mulch will be used in conjunction with topsoil and seeding² where required to achieve stabilisation requirements;

² This would be applicable at locations on private or crown land, with landholder consultation and agreement. Within State Forest areas, Section 3.9 (No Exotic Plants) of the Forestry Corporation of NSW (FCNSW) Occupation Permit applies, which states that Santos must not plant within the Forest Permit Area any plants or seeds without the prior approval of FCNSW, including those which are not indigenous to the locality except where such plants or seeds may be specified by FCNSW for use in any revegetation works.

- As per the Blue Book, land clearing works during the period from May to September (inclusive) all areas (excluding lands taking concentrated flows) will be stabilised to achieve a C-factor of at least 0.15 (equivalent to 50% grass cover) within 20 working days of completion;
- As per the Blue Book, land clearing works during the period from October to April (inclusive) all areas (excluding lands taking concentrated flows) will be stabilised to achieve a C-factor of at least 0.1 (equivalent to 60 % grass cover) within 20 working days of completion of formation AND a C-factor of at least 0.05 (equivalent to 70 % grass cover) within a further 60 days;
- At all times of the year, lands taking concentrated flows will be stabilised to achieve a C-factor of at least 0.05 (equivalent to 70 % grass cover) within 10 days of completion;
- Stabilisation of waterways including their beds and banks is to be commenced immediately after the completion of any works within these areas; and
- Temporary soil stabilisers will be used where necessary to stabilise exposed construction areas and access tracks.

5.8 Soils and stockpile management

All topsoil stockpiles will be managed in accordance with the Rehabilitation Management Plan. The following management measures will be adopted for subsoil management, in addition to the measures already detailed above:

- stockpiles will be established within the approved construction boundary;
- stockpiles will be located at least 40 m away from any watercourse, drainage line, creek, concentrated flow or hazard area;
- stockpiles (excluding those shaped into berms/bunds on the perimeter of the works area/s) will be secured with the appropriate sediment control downslope, a diversion berm/drain upslope, and will be stabilised after 10 days of completion of formation to a C-factor of 0.1 (i.e. at least 60 % cover); and
- the working face of stockpiles will be battered down to a maximum slope of 3:1 (H:V);

5.9 Works in watercourses

Watercourses and adjacent areas are considered as sensitive environments and are particularly prone to erosion when vegetation has been removed and soils are exposed. Additional controls and provisions will be implemented within watercourses and across all lands within 40 m from the top bank of a watercourse, as follows:

- any creek or watercourse crossing will be designed, installed and maintained generally in accordance with the *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management* (DPI, 2013) and *Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries, 2003);
- vegetation and soil disturbance will be minimised as much as practicable;
- pipelines will most likely be constructed using traditional trenching methods, or directional drilling wherever practicable to minimise disturbance;
- grass vegetation removal and stripping works will only commence in these locations immediately prior to pipeline installation works;
- waterway crossings will be installed for vehicle access in accordance with the RoW Watercourse Crossing Standard Drawing provided in Appendix F;

- works in watercourses will be scheduled for a period when the 3-day weather forecast predicts rainfall is unlikely, and where possible, will be completed within this period;
- if rainfall is imminent while works are occurring in watercourses, reasonable measures will be undertaken to minimise exposed soils within the watercourse (up to the top bank of the watercourse, both sides); and
- where required, exposed access track surfaces will have a trafficable erosion control methodology applied.

It is recommended that the *Guidelines for Controlled Activities on Waterfront Land* (NRAR, 2018) are reviewed as part of the design works in watercourses. It is also recommended that the proposed design for works within waterfront land such as in Appendix E and F are assessed against these guidelines.

Note that the Project activities that could affect flooding are extensively addressed in the SWMP sections 4.3, 5.7, 6.7, Table 6.1, Table 8.1 and section 9.

5.10 Access tracks

Unsealed roads and access tracks will be developed in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 2c Unsealed Roads*. The management principles within this guideline are as follows:

- assess the implications of potential soil loss and water quality during planning;
- plan controls during the design phase;
- minimise the area of disturbance;
- control water flow from the top of and through the designated work area;
- rehabilitate disturbed lands as soon as possible; and
- maintain erosion and sediment control measures appropriately.

A series of standard drawings for unsealed access tracks are provided within Appendix G.

6. Risk assessment and mitigation

6.1 Erosion hazard assessment

An erosion hazard assessment was conducted in accordance with the Blue Book using the Revised Universal Soil Loss Equation (RUSLE):

$$\text{RUSLE: } A = R \times K \times LS \times P \times C$$

A description of the RUSLE equation and the values adopted for the general sites on the Project are contained in Table 6.1.

The maximum slope gradient that applies to this ESCP is 10 %. The soil loss using the above RUSLE equation is calculated to be between 151 and 225 t/ha/yr, and in accordance with Table 4.2 of the Blue Book, this represents a Soil Loss Class 2 with a corresponding low erosion hazard. Soil loss for each work site or sub-catchment, including 'right of ways' (RoWs) will be limited to a maximum of 200 tonne/year (t/yr) (150 m³/yr) using the strategies outlined within section 5 of this ESCP.

Table 6.1 - RUSLE factors and values used for the Project

Factor	Description	Applied value
A	Computed soil loss (tonne/hectare/year)	Varies
R	Rainfall erosivity factor	1,600
K	Soil erodibility factor	0.060 (Assumed for inorganic silty sand, poorly graded topsoils and silty clay subsoils)
LS	Slope length and gradient factor	Varies dependent on slope and slope length, however maximum slope is 10%
P	Soil conservation practice factor	1.3 (compacted)
C	Ground cover factor	1.0 (exposed soils)

The potential risks associated with the Phase 1 activities covered by this Plan have been assessed, and a summary of the key risks associated with ground disturbance and erosion potential are provided in Table 6.2. The key mitigation measures to manage these risks are presented in section 5.

The Santos risk matrix used to determine the risk levels is provided in Table 4.3 in section 4 of the Water Management Plan.

Table 6.2 - Potential Project ground disturbance impacts

Project component	Potential disturbance activity	Potential impact	Impact level ¹
<ul style="list-style-type: none"> • Exploration • Access and maintenance tracks • Exploration wells (conventional and minimal disturbance leases) 	<ul style="list-style-type: none"> • Clearing of surface vegetation and stripping of topsoil which are stockpiled for future rehabilitation 	<ul style="list-style-type: none"> • Increased gully and tunnel erosion of cleared surfaces. • Sedimentation of adjacent water bodies. • Changed soil salinity through changes in hydrology. 	Low
	<ul style="list-style-type: none"> • Earthworks involved in formation of safe and stable tracks 	<ul style="list-style-type: none"> • Increased gully and tunnel erosion on tracks. • Sedimentation of adjacent water bodies. • Loss of fertile soil. 	Low
<ul style="list-style-type: none"> • Appraisal and testing (at well pads, approximately 1 hectare in size) • Appraisal (pilot) wells (conventional and minimal disturbance leases) 	<ul style="list-style-type: none"> • Clearing of surface vegetation and stripping of topsoil which are stockpiled for future rehabilitation 	<ul style="list-style-type: none"> • Increased gully and tunnel erosion of cleared surfaces and stockpiles. • Sedimentation of adjacent water bodies. • Increased soil salinity through changes in hydrology. 	Low
	<ul style="list-style-type: none"> • Levelling the ground surface for the drill rig 	<ul style="list-style-type: none"> • Loss of landform pattern. • Increased gully and tunnel erosion from changes in overland flow. 	Low
	<ul style="list-style-type: none"> • Construction of an earthen pit or sump to contain the cuttings removed from the well by water or air 	<ul style="list-style-type: none"> • Decrease in landform stability. • Increased gully and tunnel erosion during pit or sump construction. • Increased soil salinity through increased water infiltration. • Loss of fertile soil. 	Low
	<ul style="list-style-type: none"> • Constructing a flare pit to contain the flare associated with the combustion of produced gas 	<ul style="list-style-type: none"> • Decrease in landform stability. • Loss of fertile soil. • Increased gully and tunnel erosion during flare pit construction. 	Low
	<ul style="list-style-type: none"> • Installing a cellar (a 2 m³ void through which the drilling assembly passes) and surface conductor pipe 	<ul style="list-style-type: none"> • Decrease in landform stability. • Increased gully and tunnel erosion during cellar construction. • Loss of fertile soil. 	Low

¹ The impact levels are summarised below:

- High: Direct affects or high potential
- Medium: Indirect affects or medium potential
- Low: No effect or low potential

7. Monitoring

A monitoring and maintenance program ensures the progressive and continual implementation and maintenance of temporary erosion and sediment controls, including but not limited to sediment fences, diversion banks, diversion drains, sediment traps and sediment retention basins. At disturbed areas, existing and temporary ESC measures and structures are inspected, cleaned, and appropriately repaired and maintained as required across all works.

All site monitoring data including site inspection records, rainfall records, dates of water quality testing, testing results will be documented on-site. The currency of the documentation will be maintained for the duration of the works.

7.1 Inspections

Inspections of construction sites will be conducted at least:

- within 48 hours prior to rainfall for forecasts of at least 50 % probability of 10 mm or higher;
- within 24 hours of the cessation of a rainfall event causing runoff to occur on or from the construction site, pending access availability or practicability;
- daily in 'High Erosion Risk Disturbance Areas' during periods of rainfall of 20 mm or more (note that as per Table 6.2, all disturbance activities during Phase 1 are assessed as low risk);
- weekly throughout January;
- fortnightly throughout February to March; and October to December; and
- monthly throughout April to September.

Inspections will be carried out by competent personnel who have:

- an understanding of site environmental values that could be impacted by site construction and operation;
- a good working knowledge of drainage, erosion and sediment control fundamentals;
- an ability to provide advice and guidance on appropriate erosion and sediment control measures at all times; and
- a good working knowledge of the correct installation, operation and maintenance procedures for the full range of drainage, erosion and sediment control measures used on the site.

7.2 Maintenance and decommissioning

All drainage, erosion and sediment control measures will be maintained until their function is no longer required and adequate surface stabilisation is achieved. Stabilisation is extensively addressed in the Rehabilitation Management Plan, as stated in section 5. The maintenance activities during this period will include:

- all water, debris, and sediment removed from control measures will be disposed of or re-used in a manner that will not create an erosion or pollution hazard;
- effectiveness of sediment traps, check dams and silt fences will be maintained;
- remove spilled soil or other materials from hazard areas, including lands closer than five metres from areas of likely concentrated or high velocity flows especially waterways and paved areas;

- ensure that drains operate properly and to effect any necessary repairs;
- construct additional erosion and/or sediment control works as might become necessary to ensure the desired protection is given to downslope lands and waterways, i.e. make ongoing changes to drawings where it proves inadequate in practice or is subjected to changes in conditions on the work-site or elsewhere in the catchment.

Remedial maintenance works may be indicated by, but are not limited to, the following factors:

- excessive rill or scouring of the surface and drainage lines (e.g. depth greater than 0.15 m);
- compromised integrity of installed structures; and
- ponding of water and flattening out of cross-falls;
- a build-up of sediment or blockage of drains; and
- unstable discharge surfaces; and
- the presence of any unacceptable risk to safety.

Once erosion and sediment control structures are no longer required (as governed by the processes detailed in the Rehabilitation Management Plan), they will be decommissioned. Materials that cannot be reused will be transported off-site for licenced disposal.

7.3 Severe weather and shutdown periods

In the event of forecast inclement weather (e.g., rainfall events greater than 20 mm) and prior to shutdown periods, all effort will be undertaken to stabilise construction areas as much as reasonably practicable. This could include the application of soil binders, mulch, geotextiles or jute matting or a combination thereof. No topsoil stripping or any in-stream or water crossing works would commence until after a severe weather, as detailed in section 5.2.

7.4 Performance indicators

The performance indicators in Table 7.1 will be used to assess the performance of the Project against the potential impacts during Phase 1. These will be reviewed prior to the update of the ESCP for Phase 2.

Table 7.1 - Performance indicators

Performance indicator	Number
Number of complaints received relating to erosion and sediment control	
Number of reportable environmental incidents relating to erosion and sediment control	

A contingency plan for unpredicted erosion and sediment control impacts is provided in section 10.2. In the event that a complaint is received relating to erosion and sediment control, it will be handled in accordance with the complaint management protocol, discussed in section 10.3.

Santos will report on progress against these performance indicators in the Annual Review, detailed in section 11.1.

8. Trigger action response plans

It is considered that a prescriptive set of trigger conditions that would be used to initiate actions in relation to erosion and sediment control emergencies would be impractical to stipulate. This is due to the number of variations in what may occur before, during and after inclement weather. It depends on a large number of local factors - the overall conditions would be exceedingly complex to devise, and would still be unlikely to cover every situation. Examples of complexities include variability in storm conditions including but not limited to rainfall intensity and duration; condition of the existing controls; site access options; antecedent conditions (drought, bushfire, prior storms); and cumulative effects from other environmental conditions.

A more practical approach is to undertake inspections prior to inclement weather to assess when to initiate particular actions as required. The number and type of contingency actions to be implemented in the case of trigger exceedance will depend upon various factors, including the state of the natural surrounding environment, the pending storm event and expected rainfall, the location of the trigger and the construction or maintenance works undertaken at the time of the (potential) exceedance. The required erosion and sediment controls will be identified on the site-specific control plan (Appendix C) based on the controls presented in the standard drawings presented in Appendix E.

Before inclement weather

Monitoring is the key to maximising warning time, preparedness and predictive capability in regard to potential emergency erosion events. Monitoring of physical environmental conditions includes weather conditions (measurements, warnings and forecasts), creek and sediment retention basin water level predictions; real time creek water level data, and understanding of historical creek behaviour at times of storms. In a potential emergency event, it would be expected that active construction areas would be inspected frequently and all existing erosion and sediment control structures maintained and fully functioning.

During inclement weather

Once a storm event has started, there is limited opportunity to either install or maintain existing erosion and sediment control structures. This is generally due to difficult access and personnel safety considerations. However, obtaining information and data regarding the functioning of controls during inclement weather can be important learnings for potential future events.

After inclement weather

Although adverse conditions can persist for many days after inclement weather, particularly if a site remains in an eroded or impacted state, actions after a storm would include, where required:

- obtaining photographic and written records of local impact, including an inventory of any damage;
- installation of temporary safety fencing and associated warning signage;
- removal of debris and remedial works to restore safe access;
- repairing or replacing damaged infrastructure, such as access tracks, stormwater pipes, sediment fencing and local site accesses;
- rehabilitation of damaged vegetation;
- monitoring the performance and impact of any soil and stockpile protection; and
- replenishing any materials and supplies in preparation for any future inclement weather events.

The site-specific erosion and sediment control plans will be critically reviewed by a CPESC to ensure they achieved their performance objectives and revised to address any identified shortcomings. The adequacy of training and inductions would also be reviewed in reflection of the performance of the erosion and sediment control structures and the site-specific ESCPs.

The trigger action response plan (TARP) for erosion and sediment control that will be implemented as part of the site inspection procedure is presented in Table 8.1.

Table 8.1 - TARP for erosion and sediment control inspections

Trigger Level	Trigger	Action	Response
NORMAL	<ul style="list-style-type: none"> No transfer of sediment from the site to downstream watercourses. All controls are appropriately in place and well maintained. Site inspections do not identify any unstable disturbance areas or migration of sediment away from disturbance areas. 	N/A	N/A
LEVEL 1	<p>Controls are in place, however are not maintained.</p> <p>One or more areas have indicated surface erosion in the form of rilling, bank erosion or other movement of sediment from an area of disturbance.</p>	<ul style="list-style-type: none"> Notify the Principal Environmental Advisor - Onshore 	<ul style="list-style-type: none"> Seek to stabilise the area to stop the erosion process. Investigate works undertaken prior to the disturbance activities. Review adequacy of controls and inspection/maintenance schedule.
LEVEL 2	<p>A Stage 1 trigger or other incident leading to sedimentation of a watercourse or off-site discharge.</p>	<ul style="list-style-type: none"> Notify the DPE and other relevant external agencies and departments (refer section 10.1) Notify the EPA in accordance with the PIRMP 	<ul style="list-style-type: none"> Isolate the problem area through diverting contributing surface flows to another appropriate area, while the cause for the water quality exceedances is determined. Review adequacy of controls and inspection/maintenance schedule.

9. Record keeping

Santos has a data management plan for the NGP that outlines the policies and procedures that will be implemented to ensure that data is managed in a consistent, efficient and effective manner in order to provide accurate records of activity operations and enhance the value of the data collected. An overview of Santos' data management plan is presented in Figure B1 of Appendix C of the Water Management Plan, in the form of a data-management flow chart.

Santos uses a number of systems and platforms to manage the documentation and data associated with the activities under this Plan. These include Sharepoint for management plans, procedures and laboratory reports; Santos' EHS Toolbox for capturing inspections and field assessments; and EQUIS³, an advanced environmental data management and decision support system, for capturing all data and any laboratory results.

Key records associated with this ESCP that are stored and managed include:

- field data records including weather station data and records of inclement weather;
- records of any preparation and review of site-specific ESCPs;
- records of any review of this ESCP;
- inspection and maintenance records;
- records of sediment retention basin design, construction and operation;
- records of Bohena Creek water levels at the Newell Highway crossing;
- water sampling and laboratory analytical reports; and
- calibration records for field instruments and continuous water quality monitoring systems;

Monitoring data is subject to quality assurance (QA) and quality control (QC) protocols and procedures that ensure that data is accurate and usable. Data is subjected to consistent validation and verification procedures. Any data that fails QA and QC procedures is rejected for future use. QA and QC procedures include:

- for each batch of water quality samples sent to the laboratory, results are validated against the analysis requested on the chain of custody (COC) to ensure all results have been received;
- all results, including quality control samples (QCS) including method blanks, laboratory control samples, matrix spikes samples and surrogate samples must fall within the specific quality control limits. Appropriate field quality control samples (i.e. duplicates, field blanks, trip blanks and triplicate samples, etc.) will also be used to assist in the quality control of the data obtained from the monitoring programs;
- program monitoring guidelines (minimum and maximum values) will likely be configured in the environmental database for each monitoring compliance requirement or to detect anomalous results. The guidelines act as quality control measures to verify that data falls within an acceptable range.

In accordance with the monitoring and recording conditions of EPL 20350 all relevant records are required to be kept for at least 4 years after the relevant event. Records will be kept in a legible form for production to any inspector of authorised officer for a period of four years following the expiry or termination of a prospecting title (sections 97D and 97E of the PO Act).

³ EQUIS (Environmental Quality Information System) is a proprietary software application.

10. Incidents, non-compliances and complaints

10.1 Incidents and non-compliances

Incident reporting and non-compliance notification will be in accordance with CoC D6 and D7 respectively, as described in section 6 of the EMS. Santos will notify the DPE and any other relevant agency via the Major Projects Portal immediately after becoming aware of an incident.

Within 7 days of becoming aware of a non-compliance with the CoC, Santos will notify the Department of the non-compliance via the Major Projects Portal. This notice will set out the non-compliance, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non-compliance. A non-compliance which has been notified as an incident will not be notified as a non-compliance.

Where incidents or non-compliances associated with this ESCP are identified, Santos will:

- take all reasonable and feasible steps to ensure that the incident or non-compliance ceases and does not reoccur;
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the relevant department(s) describing options and any preferred remediation measures or other courses of action; and
- implement remediation measures as directed by the relevant department(s).

10.2 Unpredicted impact protocol

Erosion and sediment controls and monitoring will be implemented to:

- minimise erosion and sediment generation from areas disturbed by Project activities;
- maintain water quality in downstream water systems adjacent to active Project work areas; and
- reduce the loss of valuable topsoil from land disturbed by Project activities.

It is considered unlikely that the construction activities associated with Phase 1 will result in any unpredicted or unforeseen impacts to surface water quality within the Project area due to erosion or sedimentation. However, in accordance with CoC D3(f), the following strategy outlined in Table 10.1 will be adopted in the event that an unpredicted impact occurs.

Table 10.1 - Unpredicted impact protocol

Step	Strategy
1	Stop any relevant construction activity that may be causing the unexpected event and implement immediate corrective actions to minimise the impact. This will include a review of the existing erosion and sediment controls at the location causing the unpredicted impact.
2	Review the unpredicted effect or impact and consider the following: <ul style="list-style-type: none"> • current activities that may have triggered the event; and • activities that may not have been considered in the ESCP in causing the effect or impact; and • relevant monitoring or inspection data.
3	Notify the relevant agencies and departments

Step	Strategy
4	If appropriate, commission an investigation by a certified erosion and sediment control specialist
5	Based on the results of the investigation, develop the appropriate amendment and amelioration methods to resume relevant construction activities
6	Implement the information from the investigation to review, and if necessary, update this ESCP and associated documents (e.g., the WMP, SWMP) which will include any or all of the following: <ul style="list-style-type: none"> • a review and where required, revision of the monitoring scope and schedule detailed in section 7; • a review of any actions that may have been taken prior to the unpredicted impact; • a review and update of the risk assessment in section 6 (and section 4 of the WMP); and • implement any construction methodology or training based on the findings of the investigation to avoid any recurrence of the unpredicted effect or impact.

10.3 Complaint management

Santos has a documented *Complaint Management Procedure* that is communicated to all relevant staff members. Complaints can be directed to Santos via phone or email 24 hours a day, 7 days a week. Contact details are publicly available on the Project website and are presented in Appendix D of the EMS.

All complaints are logged on a complaint form which includes the following details:

- date and time of the complaint;
- complainant details;
- details of the issue or complaint;
- actions taken to remediate the issue, if any;
- follow up actions required, if any;
- details of further liaison with complainant, if any; and
- closure date and time of the issue.

As per CoC D13, Santos maintains a complaint register which is updated monthly and is publicly available on the Project website.

11. Reporting, evaluation and review

11.1 Annual Review

In accordance with condition D8 and as further described in section 8 of the EMS, Santos will review the performance of its erosion and sediment control management for the previous calendar year and report the relevant results and the environmental performance of the Project within the Annual Review, to the satisfaction of the Planning Secretary. The Annual Review will be submitted to the Department via the Major Projects Portal by the end of March each year and will at minimum provide the following information regarding:

- the effectiveness of the ESC management measures to prevent, and if prevention is not reasonable and feasible, to minimise any impact from ESC issues; and
- any ESC incidents or non-compliances.

Further, the following items will be reviewed or assessed as part of the annual review under consent condition D. In summary these are:

- monitoring results and complaints;
- non-compliances and incidents;
- compliance with performance measures;
- discrepancies between predicted and actual impacts; and
- measures to be implemented to improve environmental performance.

The Annual Review may also make recommendations for any additions, changes or improvements to the ESC strategy and processes.

11.2 Independent environmental audits

Within one year of commencement of Phase 1 and every three years thereafter, Santos will commission an Independent Environmental Audit (IEA) of the operation, to be conducted in accordance with CoC D9. The audit team will be led by a suitably qualified auditor and include experts in groundwater, well integrity, hazards, and any other fields specified by the Planning Secretary.

The IEA process is further described in section 8.3 of the EMS.

11.3 Management Plan review and evaluation

As required by CoC D4, Santos will review the suitability of existing strategies, plans and programs required under this consent, within two months of:

- (a) the submission of an incident report;
- (b) the submission of an Annual Review;
- (c) the submission of an Independent Environmental Audit;
- (d) the submission of a Field Development Plan;
- (e) the submission of a Groundwater Model Update; or
- (f) the approval of any modification of the conditions of SSD 6456.

This is to ensure the ESCP is updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the Project.

In view of the various conditions requiring annual reviews, suitability assessments and performance evaluations, this ESCP will also be reviewed and, if necessary, updated in at least the following circumstances:

- in accordance with any direction from the NSW EPA or the Minister administering the PO Act;
- due to any significant change to the design or operation of the erosion and sediment management processes as described herein. If there is ambiguity in relation to whether there is a significant change, Santos will consult with the Planning Secretary to determine whether the ESCP must be reviewed; and
- otherwise at intervals of no longer than one year.

The review history table in the front of this Plan provides the details of each review, conducted in accordance with condition D4.

As required by consent condition D5, if the review under condition D4 determines that the ESCP requires revision - to either improve the environmental performance of the development, cater for a modification or comply with a direction - then Santos will submit the revised document to the Planning Secretary for approval within 6 weeks of the review.

Further details on the reporting, evaluation and review of the ESCP are provided in section 8 of the EMS.

11.4 Improvement measures

Santos will conduct a program to investigate and implement ways to improve the environmental performance regarding ESC over time, and implement a protocol for the periodic review of the ESCP, in accordance with CoC D3(g) and (i) respectively.

Measures to improve the environmental performance of the Project that will be implemented following review and evaluation include the following:

- regular internal audits of the ESC management process, and ESC implementation and maintenance;
- modifications to the ESCP to reflect changing site conditions; and
- regular monitoring and site inspections as detailed in section 7.

The protocol for review is set out by consent conditions D8, D4 and D5, which have been addressed in sections 11.1 and 11.3 above.

In accordance with CoC D13 and as described in section 8 of the EMS, all relevant monitoring data and associated reports will be made available on the Project website, for the duration of the Project. This information will be kept up to date.

12. References

- Alt S., Jenkins A., Lines-Kelly, R. (2009) *Saving Soil - A landholder's guide to preventing and repairing soil erosion*. Published by the NSW Department of Primary Industries.
- BOM (2020a) *Climate statistics of Australian locations, Narrabri bowling club*. Australian Bureau of Meteorology Accessed 4 November 2020. Bureau of Meteorology.
- BOM (2020b) *Climate statistics of Australian locations, Gunnedah pool*. Australian Bureau of Meteorology Accessed 4 November 2020. Bureau of Meteorology.
- DPE (2015). *Exploration Code of Practice: Rehabilitation*. NSW Department of Planning and Environment
- DECC (2008). *Managing Urban Stormwater: Soils and Construction, Volume 2C, Unsealed Roads*. NSW Department of Environment & Climate Change.
- DECC (2008). *Managing Urban Stormwater: Soils and Construction, Volume 2E Mines and Quarries*. NSW Department of Environment & Climate Change
- DPI Water (2012). *Controlled Activities on Waterfront Land - Guidelines for instream works on waterfront land*.
- GHD (2017). *Narrabri Gas Project Environmental Impact Statement*. Prepared for Santos Ltd.
- Landcom (2004) *Managing Urban Stormwater - Soils and Construction: Volume 1*.
- OEH (2012). *Erosion and Sediment Control of Unsealed Roads - A Field Guide for Erosion and Sediment Control Maintenance Practices*. NSE Office of Environment and Heritage.
- NRAR (2018). *Guidelines for Controlled Activities on Waterfront Land*.

13. Glossary

Term	Definition ⁴
Access track	Cleared and graded track constructed where existing tracks are not available
Alignment	The line or lines that describe a linear-infrastructure route; it defines how linear infrastructure (such as a road, access track or pipeline) will be located in relation to the features encountered along the route
Approved disturbance area	The disturbance areas shown in the EIS as modified by any approved Field Development Plan
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
Baseline	A starting point used for future comparisons. Water baselines in context of the Narrabri Gas Project have been derived from long term water level and quality data presented in the Narrabri Gas Project Water Baseline Report.
Beneficial use	Beneficial use refers to the use of waters, including produced water from an oil or gas well, for a secondary purpose that has a positive value. Potential beneficial use options for produced water include domestic and livestock supply, industrial supply, irrigation supply, dust suppression and recreation.
Bund (or bunding)	Wall of a secondary containment system, usually in the form of an embankment, used to prevent sediment and liquids from entering the environment
Catchment	The area of land that collects and transfers rainwater into a watercourse
Council	Narrabri Shire Council
Department	NSW Department of Planning and Environment (DPE)
Depressurisation	The extraction of coal seam water to facilitate gas production causes depressurisation of the target coal seams, which has the potential to propagate into surrounding formations.
EIS	The Environmental Impact Statement titled Narrabri Gas Project Environmental Impact Statement, dated 31 January 2017, submitted with the development application, including the Applicant's response to submissions and supplementary response to submissions, and the additional information provided by the Applicant to the Department in support of the application
Ephemeral	Relates to the amount of time that surface water persists in a watercourse or wetland; ephemeral watercourses flow only during significant rainfall events and for a short-time following rainfall events. Also known as intermittent.
Erosion	Wearing away of rock or soil caused by physical or chemical processes
Exploration well	A petroleum well that is drilled to: a) Explore for the presence of petroleum or natural underground reservoirs suitable for storing petroleum, or b) obtain stratigraphic information for the purpose of exploring for petroleum. For clarity, an exploration well is not a production well
Feasible	Means what is possible and practical in the circumstances
Gas compression facility	A facility that houses multiple compressor units, either nodal or hub compressors or a mixture of both used to increase the pressure of gas for the purpose of transmission; may be collocated with a gas treatment facility and/or water management facility
Gas field infrastructure	All Project-related infrastructure, excluding the Leewood facility, Bibblewindi facility and the road upgrades required under SSD 6456
Gas well	Pilot wells and production wells

⁴ The majority of the definitions are as provided in the Development Consent for SSD 6456.

Term	Definition ⁴
Gathering lines	Pipelines used to transfer gas and produced water from wells
Groundwater	Water contained in the interconnected pore spaces and voids of the saturated zone of sediments and rocks.
Groundwater level (or static / standing water level)	The depth to groundwater from some reference point (usually the natural surface)
Groundwater monitoring network	An arrangement of groundwater monitoring bores that is usually installed to monitor groundwater quantity and quality to inform how a groundwater system is responding to some applied stress, such as irrigation pumping and application, coal seam gas development, municipal water supply and climate variability
Groundwater quality	A measure of groundwater value expressed in physio-chemical terms, such as acidity / alkalinity, dissolved oxygen, dissolved salts, ions and contaminants like hydrocarbons
Groundwater quantity	A measure of the amount of groundwater held within a groundwater system, usually expressed as groundwater head (elevation or pressure) and flux
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance
Irrigation scheme	Treated water is proposed to be used for irrigation as part of the overall Produced Water Management Plan
Linear infrastructure	Project related infrastructure of a linear nature including gas and water gathering lines, gas and water pipelines, access tracks, power lines, communication lines and other service lines
Major facilities	Leewood facility and Bibblewindi facility
Material harm	<p>Is harm that:</p> <ul style="list-style-type: none"> involves actual or potential harm to the health or safety of human beings or to the environment that is not negligible, or results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000 (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment) <p>This definition excludes “harm” that is authorised under either SSD 6456 or any other statutory approval</p>
Minimise	Implement all reasonable and feasible mitigation measures to reduce the impacts of the Project
Mitigation	Activities associated with reducing the impacts of the development
Non-compliance	An occurrence, set of circumstances or development that is a breach of the SSD 6456 consent
Petroleum Assessment Lease 2 (PAL 2)	A PAL is required to hold the exclusive right to prospect for petroleum and to assess any petroleum deposit over a specified area of land in NSW. A lease allows the holder to maintain a title over a potential area, without having to commit to further exploration. The holder can, however, continue prospecting operations and to recover petroleum in the course of assessing the viability of commercial mining. PAL 2 is held by Santos NSW Pty Ltd.
Petroleum Exploration Licence 238 (PEL 238)	Before exploring for minerals or petroleum in NSW, an explorer must first obtain a Petroleum Exploration Licence (PEL) under the <i>Petroleum (Onshore) Act 1991</i> . An exploration licence gives the licence holder exclusive rights to explore for petroleum or specific minerals within a designated area but it does

Term	Definition ⁴
	not permit mining, nor does it guarantee a mining or production lease will be granted. PEL 238 is held by Santos NSW Pty Ltd.
Petroleum Production Lease 3 (PPL 3)	<p>A petroleum production lease gives the holder the exclusive right to extract petroleum within the production lease area during the term of the lease.</p> <p>PPL 3 is held by the following titleholders:</p> <ul style="list-style-type: none"> • Santos QNT Pty Ltd; • Santos NSW (Hillgrove) Pty Ltd; and • Santos NSW (Eastern) Pty Ltd.
Petroleum production lease application (PPLA)	<p>A petroleum production lease gives the holder the exclusive right to extract petroleum within the production lease area during the term of the lease.</p> <p>Development consent under the <i>Environmental Planning and Assessment Act 1979</i> must be in place before a petroleum production lease can be granted.</p> <p>Santos, on behalf of its joint venture partner lodged four petroleum production lease applications under the PO Act in May 2014 for the Project area, being PPLAs 13, 14, 15 and 16. The ownership of the application is now held by Santos NSW Pty Ltd.</p>
Pilot well	A well for gas and water extraction, for the purpose of exploration, appraisal and assessment of the gas field potential
Planning Secretary	Planning Secretary under the EP&A Act, or nominee
Pollution incident	Has the same meaning as in the POEO Act
Produced water	Any form of groundwater that is actively extracted from a borehole, well or excavation, excluding incidental groundwater mixed with drilling fluids
Production well	A well for gas and water extraction, for the purpose of commercial gas production and/or use
Project area	The area of approximately 95,000 hectares that encompasses the Project
Project footprint	The area of surface expression being about 1,000 hectares occupied by the infrastructure components of the Narrabri Gas Project
Project-related infrastructure	All infrastructure and other structures associated with the development. This includes linear infrastructure and non-linear infrastructure, surface infrastructure and subsurface infrastructure, major facilities, wells and well pads and other gas field infrastructure
Public infrastructure	Linear and related infrastructure that provides services to the general public, such as roads, railways, water supply, drainage, sewerage, gas supply, electricity, telephone, telecommunications, etc.
Recharge spring	A spring supported by water that recharges sandstone sediments that outcrop on the margins of the Great Artesian Basin and discharge locally after relatively short residence times.
Reasonable	Means applying judgement in arriving at a decision, considering mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Registered bore	A water bore whose presence has been notified to Water NSW and included in its registered groundwater bore database. The database typically includes details on bore location, construction and where possible, the source aquifer.
Rehabilitation	The restoration of land disturbed by the development to ensure it is safe, stable and non-polluting over the short, medium and long term
Riparian	Situated along or near the bank of a watercourse
Spring	A naturally occurring discharge of groundwater flowing out of the ground, often forming a small stream or pool of water. Typically, it represents the point at

Term	Definition ⁴
	which the water table intersects the ground level.
Scour	Erosion of sediment that occurs around structures in a watercourse due to increased velocity
Sediment	Particles derived from rocks or biological materials that have been transported by air or water
Sedimentation	Deposition or accumulation of mineral or organic matter deposited by air or water
Treated water	Produced water that has undergone treatment to enable it to be used for beneficial reuse purposes including irrigation, stock watering, drilling ⁵ , construction and dust suppression, and/or for managed release to Bohena Creek ⁶
Unacceptable risk	The level of risk at which mitigation actions are deemed to be warranted.
Watercourse	A river, creek or other stream, including a stream in the form of an anabranch or tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events: In a natural channel, whether artificially modified or not, or in an artificial channel that has changed the course of the stream. It also includes weirs, lakes and dams
Water sharing plan	Legislated plans under the <i>Water Management Act 2000</i> that establish rules for sharing water between the environment and water users. Water licences are issued to water users in accordance with water sharing plans
Well	Pilot wells and production wells
Well pad	An area of up to 1 hectare in size upon which the gas wells are to be located, with the area decreasing to no more than 0.25 hectares following rehabilitation ⁷ , or other area as may be approved in the Field Development Plan

⁵ Note that when 'drilling' is stated in consent conditions, where relevant this has been interpreted to mean 'drilling and completions'.

⁶ Note that there will be no managed release to Bohena Creek during Phase 1.

⁷ Workover activities will be contained within the operational area of the well pad area of around 0.2 ha, with an additional laydown area that could be approximately 0.2 ha in size.

Appendix A - Consultation records



Natural Resources Access Regulator

Contact: Tim Baker
Phone: 0428 162 097
Email: Tim.Baker@nrar.nsw.gov.au

Our ref: V15/3875-5#53
File No:
Your Ref:

27 September 2021

Dave Gornall
Santos Limited
email: David.Gornall@santos.com

Dear Dave

Re: Narrabri Gas Project - Water Management Plans second batch

Thank you for the opportunity to provide comment on the second set of plans under the Water Management Plan requirement for Phase 1 of the Narrabri Gas Project. It is understood this consultation is in accordance with the Condition B41 of Project Approval SSD 6456. The plans reviewed include the Water Management Plan, Erosion and Sediment Control Plan, Produced Water Management Plan, Irrigation Management Plan and the Pollution Incident Response Management Plan. NRAR is satisfied the consultation requirements have been met in respect to the plan preparation and provides the following comments.

- It is recommended the Water Management Plan include a map that depicts the location of the existing and proposed infrastructure for the Phase 1 activities.
- In Section 4.2 of the Produced Water Management Plan it is noted 1.26ML/d of produced water is predicted from operation of the existing and proposed pilot wells. It is recommended a reference be included to how this water take is to be accounted for by inclusion of relevant Water Access Licence numbers and entitlement, and relevant linked Work Approval/Miscellaneous Work numbers.
- The Erosion and Sediment Control Plan refers to water needed for dust suppression, but no details are provided on the volumes/water source and any relevant water license details. It is recommended this information be included in this plan or the separate Dust Suppression Protocol.
- It is recommended Section 5.9 of the Erosion and Sediment Control Plan include a reference to the need to design works in watercourses in accordance with the "Guidelines for Controlled Activities on Waterfront Land (NRAR 2018)". It is also recommended that these guidelines are reviewed against the proposed design for works within waterfront land such as Appendix D and E. The guidelines are accessible at the following link: <https://www.nrar.nsw.gov.au/how-to-apply/controlled-activities/guidelines-for-controlled-activities>

2

For further information please contact Tim Baker, Senior Water Regulation Officer on 0428162097 or e: Tim.Baker@nrar.nsw.gov.au

Yours sincerely



Tim Baker

for

Shavaun Tasker

A/Manager Licensing and Approvals – Water Regulatory Operations - West

Natural Resources Access Regulator

Department of Planning, Industry and Environment

Santos

Management Plan Consultation Feedback Form

DOCUMENT TITLE:	Erosion and Sediment Control Plan
STAKEHOLDER:	NSW Environment Protection Authority
CONSULTATION RELEASE DATE:	3 August 2021
COMMENTS DUE DATE:	11 October 2021

General Feedback	
Key Issues	The Erosion and Sediment Control Plan (ESCP) generally seems to comply with Blue book standards and the requirements of EPL 20350. However, there are a number of improvements that should be made, as detailed below.
Suggestions for improvement	<p><u>Locality map</u> Ideally, the document should contain a locality map for better geographical context. It is assumed that a map has not been included as the ESCP is a sub-plan of and the overarching Water Management Plan that contains such a map. Nonetheless, if the document is to be read as a standalone document it would benefit from the inclusion of a locality map(s).</p> <p><u>Progressive ESCPs</u> It appears the ESCP is a primary document that will relate to progressive site-specific ESCPs. However, there is no clear link between the ESCP and progressive site-specific ESCP development. The requirement for their development is alluded to but not specifically mentioned or described. This should be corrected to make the requirement and process clear (i.e. when, how and in relation to what are site specific ESCPs to be planned/developed and implemented?).</p> <p><u>Dispersive soils</u> In section 4.2 Topography, soils and landforms, dispersive soils get only a brief mention, in relation to hydrology and drainage. Dispersive soils are widespread in the project area and should be considered as a constraint in section 4.2. i.e. they should be discussed, including ESC implications. Dispersive soil mitigations should then be mentioned and discussed in section 5. Key management strategies and section 6. Risk assessment and mitigation.</p> <p><u>Use of the word "should" in management strategies</u> The word "should" is used in relation to a couple of management strategies, namely: <ul style="list-style-type: none"> • "Critical aspects of in-stream works should be scheduled for forecasted dry weather periods, and watercourses and adjacent areas will be left undisturbed until the point immediately prior to access track works or trenching in these areas commencing" (5.2 Minimising disturbance, dot point 6); and • "the working face of the stockpile should be battered down to a maximum slope of 3:1 (H:V)" (5.8 Soils and stockpile management, dot point 4) The use of "should" gives the impression that the action is optional. The word "will" should be used instead, to make the requirement clearer and to be consistent with the wording of other management strategies in the ESCP.</p>

Erosion and Sediment Control Plan - NRAR comments received on Revision C (draft)

Item	Section #	Section heading	Existing text	Comment	Final response
1		No reference	No specific text reference	The Erosion and Sediment Control Plan refers to water needed for dust suppression, but no details are provided on the volumes/water source and any relevant water license details. It is recommended this information be included in this plan or the separate Dust Suppression Protocol.	<p>The Dust Suppression Protocol provides full details on the sources of water (treated, amended treated and bore water).</p> <p>The Site Water Balance provides full details on the water access licences and water supply works for direct and indirect water take, and on the associated predicted/modelled volumes of water from each inflow and outflow.</p> <p>To minimise repetition between management plans (and the subsequent potential for discrepancies or inconsistencies) this information will be kept in the Dust Suppression Protocol and the Site Water Balance.</p>
2	5.9	Works in watercourses	No specific text reference	<p>It is recommended section 5.9 of the Erosion and Sediment Control Plan include a reference to the need to design works in watercourses in accordance with the “<i>Guidelines for Controlled Activities on Waterfront Land</i> (NRAR 2018)”. It is also recommended that these guidelines are reviewed against the proposed design for works within waterfront land such as Appendix D and E.</p> <p>The guidelines are accessible at the following link: https://www.nrar.nsw.gov.au/how-to-apply/controlled-activities/guidelines-for-controlled-activities</p>	<p>As stated in section 1.4, Santos will design, install and maintain erosion any infrastructure within 40 metres of watercourses in accordance with guidance series for <i>Controlled Activities on Waterfront Land</i> (DPI Water, 2012). Note that this is not the NRAR 2018 guidelines.</p> <p>Note also that the activity is exempt under Schedule 4 Clause 18 of the <i>Water Management (General) Regulation 2018</i> since it is carried out under a petroleum title under the <i>Petroleum (Onshore) Act 1991</i> (NSW). https://legislation.nsw.gov.au/view/html/inforce/current/sl-2018-0480#sch.4-sec.18</p> <p>However, a reference and a recommendation to review the NRAR guidelines for any design works in watercourses has been added to section 5.9.</p>

Note:

The numbering of the sections and appendices between the draft and final version of the document may have changed.

Erosion and Sediment Control Plan - EPA comments received on Revision C (draft)

Item	Section #	Section heading	Existing text	Comment	Final response
1		No reference	No specific text reference	The Erosion and Sediment Control Plan (ESCP) generally seems to comply with Blue book standards and the requirements of EPL 20350. However, there are a number of improvements that should be made, as detailed below.	Noted. Refer to responses below.
2			No specific text reference	<u>Locality map</u> Ideally, the document should contain a locality map for better geographical context. It is assumed that a map has not been included as the ESCP is a sub-plan of and the overarching Water Management Plan that contains such a map. Nonetheless, if the document is to be read as a standalone document it would benefit from the inclusion of a locality map(s).	A locality map is provided in the overarching WMP. This document forms part of the WMP, and must be read in conjunction with the WMP.
3			No specific text reference	<u>Progressive ESCPs</u> It appears the ESCP is a primary document that will relate to progressive site-specific ESCPs. However, there is no clear link between the ESCP and progressive site-specific ESCP development. The requirement for their development is alluded to but not specifically mentioned or described. This should be corrected to make the requirement and process clear (i.e. when, how and in relation to what are site specific ESCPs to be planned/developed and implemented?).	The wording has been amended to include the requirement of preparing and implementing a progressive ESCP prior to any site disturbance
4			No specific text reference	<u>Dispersive soils</u> In section 4.2 Topography, soils and landforms, dispersive soils get only a brief mention, in relation to hydrology and drainage. Dispersive soils are widespread in the project area and should be considered as a constraint in section 4.2. i.e. they should be discussed, including ESC implications. Dispersive soil mitigations should then be mentioned and discussed in section 5. Key management strategies and section 6. Risk assessment and mitigation.	Section 4.2 has been amended to provide further detail of the soil types expected to be encountered during Phase 1 construction activities. Site-specific assessment will be completed for each well pad and disturbance location to apply the relevant management measures from section 5 (based on the "Blue Book"), and minimise to the greatest extent practicable any negative impacts from clearing and soil disturbance activities.
5			No specific text reference	<u>Use of the word "should" in management strategies</u> The word "should" is used in relation to a couple of management strategies, namely: <ul style="list-style-type: none"> "Critical aspects of in-stream works should be scheduled for forecasted dry weather periods, and watercourses and adjacent areas will be left undisturbed until the point immediately prior to access track works or trenching in these areas commencing" (5.2 Minimising disturbance, dot point 6); and "the working face of the stockpile should be battered down to a maximum slope of 3:1 (H:V)" (5.8 Soils and stockpile management, dot point 4) The use of "should" gives the impression that the action is optional. The word "will" should be used instead, to make the requirement clearer and to be consistent with the wording of other management strategies in the ESCP.	The wording throughout the ESCP has been amended to state 'will' rather than 'should' to show intent, and remove the optionality.
6			No specific text reference	<u>Erosion hazard assessment</u> The key potential risks associated with ground disturbance activities are provided in Table 6.2. It indicates an impact level based on implementation of mitigation measures presented in section 5 of the ESCP. Impacts for all activities are described as being in the low range. It is not possible for the reader to properly analyse this as the risk matrix used to determine the risk levels is contained within a separate document i.e. Table 4.3 in section 4 of the Water Management Plan. Although not a major issue, it would be preferable for the relevant parts of the risk matrix to be presented in the ESCP as well.	All subplans to the WMP refer to and are based on the risk matrix contained within the WMP. As this document forms part of the WMP, it must be read in conjunction with the WMP.

Item	Section #	Section heading	Existing text	Comment	Final response
7	Appendix B		No specific text reference	<p><u>Appendix B - Site-specific erosion and sediment control plan</u></p> <p>The ESCP in Appendix B is for a lease pad only and it is a blank template. If there are other ESCP templates relating to other activities such as ROWs and access roads and tracks, they should be included as well.</p> <p>Ideally, in addition to the site-specific ESC templates, a sample illustrated site-specific ESCP should be included to demonstrate how one would actually look. The sample ESCP (or several sample ESCPs) should show the range of activities being undertaken e.g. standard lease pads or similar, ROWs and access roads and tracks.</p>	<p>The site-specific ESCP in Appendix B (now Appendix C) is a template, which is the same as for linear infrastructure, with the only difference a varied title.</p> <p>As stated in section 2, all ESC planning, installation and maintenance will be supervised by personnel trained in the relevant aspects of the “Blue Book”. The site-specific ESCPs will be based on the examples as provided in the “Blue Book, and on previous site-specific ESCPs prepared by Santos during construction works. All site-specific ESCPs will be signed off by a certified erosion and sediment control specialist (CPESC).</p>
8	5.6		No specific text reference	<p><u>Management of Sediment Basins</u></p> <p>The ECSP briefly addresses sediment basins in section 5.6. Improvements that could be made including more specific detail regarding treatment of water with flocculants (including timing), trigger for/timing of sediment basin drainage following a rainfall event and timing of sediment clean-out.</p>	<p>No sediment basins are expected to be required during the Phase 1 construction activities.</p> <p>Further detail regarding sediment basin management will be included when this ESCP is reviewed and updated for Phase 2.</p>
9	5.6			<p>The section of the ECSP briefly addresses sediment basins. More specific detail should be provided regarding treatment of water with flocculants (including timing), trigger for/timing of sediment basin drainage following a rainfall event and timing of sediment clean-out.</p>	<p>No sediment basins are expected to be required during the Phase 1 construction activities.</p> <p>Further detail regarding sediment basin management will be included when this ESCP is reviewed and updated for Phase 2.</p>

Note:

The numbering of the sections and appendices between the draft and final version of the document may have changed.

Erosion and Sediment Control Plan – WTAG comments received on Revision C (draft)

Comments received from Randall Cox, Jack Warnock and Michael Williams

Item	Section #	Section heading	Existing text	Comment	Final response
1	Various	N/A	No specific text reference	[Randall Cox] I think 'ROW' is the same as 'RoW' – ie 'right of way'. If so, suggest a global check to settle on use of one abbreviation	A global change has been made to 'RoW'
2	1.3	Objectives	<ul style="list-style-type: none"> description of key strategies required to for effective erosion and sediment control management, including site dewatering 	[Jack Warnock] Last paragraph on p 4: delete "to" following "required"	A correction has been made and 'to' has been deleted from the sentence: <ul style="list-style-type: none"> description of key strategies required for effective erosion and sediment control management, including site dewatering
3	1.6	Structure of this Plan	Appendix D - Blue Book and IECA Standard drawings	[Jack Warnock] "Appendix D" Please explain "IECA"	IECA is an acronym for International Erosion Control Association. It has been added to the list of acronyms and abbreviations.
4	4.1	Climate		[Michael Williams] It would be informative if the period of record for each of the weather stations was reported	The period of record has been inserted. A cross-reference has also been added to section 4.1 of the Surface Water Management Plan, where full weather details are provided.
5	5.4	Erosion control measures	Stockpiles will be stabilised in accordance with the requirements in section 5.9 below	[Jack Warnock] 6 th dot point: Should this refer to Section 5.8 below rather than 5.9?	The correction has been made - reference should be to section 5.8 rather than 5.9: Stockpiles will be stabilised in accordance with the requirements in <i>section 5.8</i> .
6	7.3	Sever weather and shutdown periods	No topsoil stripping or any in-stream or water crossing works would commence until after a severe weather, as detailed in section 5.2	[Jack Warnock] Final sentence: "... Until after a severe weather ???? as detailed in section 5.9 (rather than 5.2)???"	Correction has been made and 'event' has been added to the sentence: <i>No topsoil stripping or any in-stream or water crossing works would commence until after the passing of a severe weather event, as detailed in section 5.2.</i>
7	8	Trigger action response plans	No specific text reference	[Randall Cox] Section 8 notes that TARPs are stored in the SANTOS system and are available to staff. The section then reads as a guide to the approach taken in preparing the TARPs that are available on the Santos system but which are not included in the plan. In the overarching Water Management Plan Table 6.1 lists TARPS for three management plans. For the irrigation management plan there are several TARPS listed in Table 6.1 and those TARPS are included in the irrigation management plan itself. Presumably TARPS are included for some plans (e.g. irrigation), but only referred to generally in the ESCP. Perhaps the intent of Section 8 of the ESCP could be made a little clearer. In parallel perhaps the overarching Water Management Plan could include some reference to the existence of TARPs on the system that are not listed in Table 6.1.	The general detail and description regarding TARPs has been moved to the WMP, and the text in section 8 has been simplified. The sections regarding inclement weather have been moved to section 7 - monitoring and reporting. Table 6.1 in the WMP has been updated to include all relevant TARPs.
8	8	Trigger action response plans	(para 2 sentence 3): However, it is considered that a prescriptive set of trigger conditions that would be used to initiate actions in relation to erosion and sediment control emergencies would be impractical to stipulate.	[Michael Williams] The proposal in lieu of specific TARPs seems reasonable (para 2 sentence 3). Has this been agreed with the regulator?	This approach has not yet been agreed with the regulator, however it is a standard mechanism/procedure for erosion and sediment control on construction sites, captured in progressive erosion and sediment control plans. The proposal will be an agreed process once the plan is approved by DPE.
9	10	Evaluation and review	Further details on the reporting, evaluation and review of the ESCP are provided in section 8 of the EMS.	[Jack Warnock] Final sentence: What does "EMS" mean? It is not in the Acronym List	The EMS is the Environmental Management Strategy. It is initially referred to in section 2. It has been added to the list of acronyms and abbreviations.
10	Appendix B	Table B.2	No specific text reference	[Michael Williams] An improved reference for 'the Blue Book' would be helpful. Table B2 indicates it is for Section 5 only but it is relied on heavily in several other sections of this Plan.	Apart from some minor references, the Blue Book is also mentioned in sections 2, 3.3, and 6. These references have been added to the table.

Note:

The numbering of the sections and appendices between the draft and final version of the document may have changed.

Appendix B - Compliance conditions relevant to this ESCP

Table B1 - EPL 20350 conditions directly relevant to this ESCP

EPL 20350 conditions directly relevant to this ESCP	Section reference
O6.1 A Soil and Water Management Plan (SWMP) must be prepared and implemented in accordance with the requirements outlined in <i>Managing Urban Stormwater: Soils and Construction, Vol 1, 4th Edition</i> (Landcom, 2004) within 3 months from the issue date of this licence	This Plan
O6.2 The SWMP must include, but is not limited to, the following:	
1. a discussion around the management of existing and future sediment basins, specifically, how these will be managed to prevent pollution, and	Section 5.6
2. a description of the measures taken to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters for the duration of the licence.	Section 5.4 Section 5.5
O6.3 The SWMP should also refer to relevant Volume 2 guidance including but not limited to <i>Managing Urban Stormwater: Soils and Construction - Volume 2a Installation of Services</i> and <i>Managing Urban Stormwater: Soils and Construction - Vol 2c Unsealed Roads</i>	Section 3.2.1
O6.4 The SWMP must be updated to reflect the proposed irrigation of treated water at the premises, prior to irrigation occurring.	Section 11.3

Table B2 - SSD 6456 consent conditions directly relevant to this ESCP

SSD 6456 consent conditions directly relevant to this ESCP	Section reference
Consent condition A1 In meeting the conditions of this consent, the Applicant must implement all reasonable and feasible measures to prevent and, if prevention is not reasonable and feasible, minimise any material harm to the environment that may result from the construction, operation or rehabilitation of the development.	Section 1.2
Consent condition A5 The Applicant may only undertake the development in the following stages:	Section 1.1.2 Section 1.2
a) Phase 1, comprising ongoing exploration and appraisal activities;	
b) Phase 2, comprising construction activities for production wells and related infrastructure;	
c) Phase 3, comprising gas production operations; and	
d) Phase 4, comprising gas well and infrastructure decommissioning, rehabilitation and mine closure.	
Consent condition A23 With the approval of the Planning Secretary, the Applicant may:	
e) prepare and submit any strategy, plan or program required by this consent on a staged basis (if a clear description is provided as to the specific stage and scope of the development to which the strategy, plan or program applies, the relationship of the stage to any future stages and the trigger for updating the strategy, plan or program	Section 1.2
f) combine any strategy, plan or program required by this consent (if a clear relationship is demonstrated between the strategies, plans or programs that are proposed to be combined);	No combination proposed as part of this Plan
g) update any strategy, plan or program required by this consent (to ensure the strategies, plans and programs required under this consent are updated on a regular basis and incorporate additional measures or amendments to improve the environmental performance of the development); and	Section 1.2 Section 11.4
h) combine any strategy, plan or program required by this consent with any similar strategy, plan or program required by a consent	No combination proposed as part of this Plan
Consent condition B26 The Applicant must install and maintain suitable erosion and sediment control measures in the Project area, in accordance with the relevant requirements in the guidance series <i>Managing Urban Stormwater: Soils and Construction – Volume 1</i> (Landcom, 2004) and <i>2E Mines and Quarries</i> (DECC, 2008).	Section 5.4 Section 5.5 Section 5.6
Consent condition B37 The Applicant must ensure that the development complies with the water management performance measures in Table 7 [of the CoC]:	
<ul style="list-style-type: none"> Riparian and aquatic ecosystems 	
<ul style="list-style-type: none"> <ul style="list-style-type: none"> Maintain or improve baseline channel stability in affected watercourses 	Refer to the SWMP section 4.2 and section 8.4

SSD 6456 consent conditions directly relevant to this ESCP	Section reference
<ul style="list-style-type: none"> Design, install and maintain erosion and sediment controls in accordance with the guidance series <i>Managing Urban Stormwater: Soils and Construction – Volume 1</i> (Landcom, 2004) and <i>2E Mines and Quarries</i> (DECC, 2008). 	Section 1.4 Section 5.4 Section 5.5 Section 5.6 Section 7.1 Section 7.2
<ul style="list-style-type: none"> Design, install and maintain any infrastructure within 40 metres of watercourses in accordance with the guidance series for <i>Controlled Activities on Waterfront Land</i> (DPI Water, 2012). 	Section 1.4 Section 5.9 Refer to the SWMP section 6.6
<ul style="list-style-type: none"> Design, install and maintain any creek crossings generally in accordance with the <i>Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI, 2013) and <i>Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings</i> (NSW Fisheries, 2003) 	Section 5.9 Refer to the SWMP section 6.6
Consent condition B41 Prior to the commencement of Phase 1, the Applicant must prepare a Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	
c) Describes the measures to be implemented to ensure that the Applicant complies with the water management performance measures (see Table 7):	Section 1.4 Section 5
d) include a	
(i) Erosion and Sediment Control Plan, that	
<ul style="list-style-type: none"> is consistent with the requirements of <i>Managing Urban Stormwater: Soils and Construction - Volume 1: Blue Book</i> (Landcom, 2004) and <i>Volume 2E: Mines and Quarries</i> (DECC, 2008); 	Sections 2, 3.3, 5 and 6
<ul style="list-style-type: none"> identifies all activities that could cause soil erosion, generate sediment or affect flooding; 	Section 6 Table 6.2 Refer to the SWMP sections 4.3, 5.7, 6.7, 9, Table 6.1 and Table 8.1 for details on flooding and flood management.
<ul style="list-style-type: none"> describes measures to minimise soil erosion and the potential for the transport of sediment to downstream waters, and manage flood risk; 	Section 5 Refer to the SWMP sections 4.3, 5.7, 6.7, 9, Table 6.1 and Table 8.1 for details on flooding and flood management.

SSD 6456 consent conditions directly relevant to this ESCP	Section reference
<ul style="list-style-type: none"> describes the location, function, and capacity of erosion and sediment control structures and flood management structures; and 	Section 5 Refer to the SWMP sections 4.3, 5.7, 6.7, 9, Table 6.1 and Table 8.1 for details on flooding and flood management.
<ul style="list-style-type: none"> describes what measures would be implemented to maintain (and if necessary, decommission) the structures over time. 	Section 7.2
Consent condition D3 The Applicant must ensure that (where relevant) the management plans required under this consent include:	
a) summary of relevant background or baseline data;	Section 4 Refer to WMP section 1.1.3
b) details of:	
(i) the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 3
(ii) any relevant limits or performance measures and criteria; and	Section 1.4 Section 5 Appendix E, F, G
(iii) the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	Section 7.4
c) any relevant commitments or recommendations identified in the documents that together comprise the NGP EIS;	Section 3.4
d) a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;	Section 5
e) a program to monitor and report on the:	
(i) impacts and environmental performance of the development; and	Section 7
(ii) effectiveness of the management measures set out pursuant to paragraph (d);	Section 11.1
f) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 10.2
g) a program to investigate and implement ways to improve the environmental performance of the development over time	Section 11.4
h) a protocol for managing and reporting any:	
(i) incident, non-compliance or exceedance of any impact assessment criterion and performance criterion	Section 10.1
(ii) complaint; or	Section 10.3
(iii) failure to comply with other statutory requirements; and	Section 10.1
i) a protocol for periodic review of the plan.	Section 11.3

SSD 6456 consent conditions directly relevant to this ESCP	Section reference
Consent condition D4 Within 2 months of: <ul style="list-style-type: none"> (a) the submission of an incident report; (b) the submission of an Annual Review; (c) the submission of an Independent Environmental Audit; (d) the submission of a Field Development Plan; (e) the submission of a Groundwater Model Update; or (f) the approval of any modification of the conditions of this consent, the Applicant must review the suitability of existing strategies, plans and programs required under this consent.	Section 11.3
Consent condition D5 If the review determines that the strategies, plans and programs required under this consent require revision – to either improve the environmental performance of the development, cater for a modification or comply with a direction - then the Applicant must submit the revised document to the Planning Secretary for approval within 6 weeks of the review. Note: <i>This is to ensure strategies, plans and programs are updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the development.</i>	Section 11.3
Consent condition D6 The Applicant must notify the Department and any other relevant agencies via the Major Projects Portal immediately after it becomes aware of the incident. This notice must describe the location and nature of the incident.	Section 10.1
Consent condition D7 Within 7 days of becoming aware of a non-compliance with the conditions of this consent, the Applicant must notify the Department of the non-compliance via the Major Projects Portal. This notice must set out the non-compliance, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non-compliance. Note: <i>A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance</i>	Section 10.1
Consent condition D8 By the end of March each year, unless the Planning Secretary agrees otherwise, the Applicant must submit an Annual Review of the environmental performance of the development to the Department via the Major Projects Portal.	Section 11.1
Consent condition D9 Within one year of commencement of Phase 1 and every 3 years thereafter, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development.	Section 11.2
Consent condition D13 From the commencement of Phase 1, until the completion of all rehabilitation required under this consent, the Applicant must:	

SSD 6456 consent conditions directly relevant to this ESCP	Section reference
<p>a) make copies of the following information publicly available on its website:</p> <ul style="list-style-type: none"> (i) the document/s listed in condition A2(c); (ii) current statutory approvals for the development; (iii) approved strategies, plans and programs; (iv) detailed plans for the Phases of the development; (v) minutes of CCC and Advisory Group meetings; (vi) regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent; (vii) a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs; (viii) a summary of the current phase/s and progress of the development; (ix) contact details to enquire about the development or to make a complaint; (x) a complaint register, updated monthly; (xi) a record of all incidents and non-compliances; (xii) the Annual Reviews of the development; (xiii) audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report; and (xiv) any other matter required by the Planning Secretary; and 	<p>Section 1.7 Section 11.4</p>
<p>b) keep such information up to date.</p>	<p>Section 1.7 Section 11.4</p>

Appendix C - Site-specific ESCP

Form: ESCP_BWD27_PR_REV3 Revision: 3	<h2 style="margin: 0;">EROSION AND SEDIMENT CONTROL PLAN - BIBBLEWINDI 27 (100 X 75m)</h2>	
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General

- Monitor weather forecasts for imminent rainfall.
- Ensure erosion and sediment controls are in place PRIOR to topsoil stripping (where possible) or IMMEDIATELY following topsoil stripping.

Site Access and Clearing

- Do not drive or park outside of the lease pad limits. Access via the nominated track only.
- As much as possible, existing vegetation cover (including grass) is to be left intact.
- Clearing and stripping is not to occur until construction works are about to commence.
- At track entry point install earthen bund/hump to divert water away (for upslope entry point or divert dirty water into a sediment control (for downslope entry point).

Soil & Clean Water Management

- Determine the seed bank depth (approx. 20mm) and strip separately to the underlying topsoil, (where possible). Push into a bund around the high side of the drill pad & stabilise.
- Topsoil will be gypsum treated - (YES or NO): ☒ NO - If YES, spread 2t/ha of gypsum over the topsoil prior to stripping.
- Determine the topsoil depth. Strip or push topsoil into a bund around the high side of the drill pad. This will act as a diversion berm for run-on from upslope so must be adequately stabilised around the toe of the bund.
- Avoid over-working soils when they are very wet or very dry and avoid excessive soil compaction.
- Topsoil stockpiles are to be no more than 2.0m high.
- Stockpiles & bunds that are in place for longer than 10 days are to be provided with at least 60% protective ground cover using polymer spray/binder (or equivalent).
- Stockpiles are to have a sediment fence, mulch berm (or equivalent) around their downslope edge.

Erosion Control Measure

- Is an additional erosion control measure required? (YES or NO): ☒ NO
- If YES, provide at least one or a combination of the following (tick the chosen option):
- ☒ A trafficable erosion control agent with a demonstrated C-factor of 0.1 or less applied over the entire site at least every 2 months and additionally when surface disturbance/degradation has occurred (applied as per manufacturer's specifications). This will also be adequate as the dust suppression control;
- ☐ Slope breaks installed at m spacings prior to rainfall; OR
- ☐ Temporary stabilisation of all exposed soils prior to rainfall with a polymer spray binder.

Dust Suppression

- Keep soil surfaces moist (not wet) to minimise dust rise. Tick the adopted dust suppression control to be used (choose either option):
- ☒ Water application via a water cart, OR
- ☐ Trafficable erosion control agent applied as above.

When Rainfall is Imminent

- If required (refer to Section 4 above) install slope breaks at the required intervals as 300mm high earth berms or drains cut in with a grader.
- If required (refer to Section 4 above) stabilise all exposed soils to achieve 60% cover with a temporary polymer spray binder.

Sediment Control

- The selected sediment control(s) are:
- These controls are to be properly installed around the entire lower edge of the work area.

Site Management and Maintenance

- Ensure settlement tanks, skips or pits used for dirty water are suitably bunded.
- Water in settlement tanks or skips is to be tested (and, if required, treated) before being released from the work area. Preferably reuse water onsite.
- Any active water released from site must have: TSS <50mg/L (or an approved NTU correlation), no visible oil or grease, and pH between 6.5 and 8.5.
- Ground mats or stabilised rock access points are to be used to aid trafficability for machinery on soft or muddy areas (when required).
- All drilling chemicals are to be stored in adequately bunded areas.
- Inspect the entire site at least weekly, prior to forecast rainfall (>50% chance of rainfall 5mm or more) & site shutdown, daily during rainfall & within 24 hrs after rainfall causing runoff. Maintain/repair controls & any areas of erosion & modify or implement additional controls if required.

Stabilisation and Rehabilitation

- Where works (or sections of work areas) are put on hold for more than 20 days during construction, exposed soils to be temporarily stabilised to at least 50% cover with polymer spray/binder.
- Completed areas are to achieve the nominated level of cover within the timeframes detailed in the Table shown.
- Rehabilitation of general surfaces can be achieved by:
 - shallow ripping gypsum at 5t/ha into subgrade (only required where subgrade has been excessively disturbed); AND
 - spreading out topsoil (approx. 50mm thick), applying the stripped seed bank over the topsoil (or using a suitable local seed mix) & covering with site mulch.
 (Note: If mulch is not adequate to achieve the required cover a suitable erosion control product with demonstrated C-factor should be applied every 2 months until vegetation cover is established.)
- Sediment controls (e.g. sediment fences) cannot be removed until the above nominated level of cover is achieved.

SITE DIAGRAM

LEGEND

<ul style="list-style-type: none"> Fence - Lease Fence - Well head Fence - 8ft Flare Fence Fence - Security Fence Blue Metal Only Mulch Only 	<ul style="list-style-type: none"> E&S Control - Coir Log E&S Control - Earthen Bund E&S Control - Mulch Bund E&S Control - Silt Fence E&S Control - EST Mulch and Revegetation Existing Vegetation
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Project Name/No.: BIBBLEWINDI 27	Date: 26/06/2019
Prepared By: S. RILY	Signature: _____
Reviewed By: _____	Signature: _____
Approved By: _____	Signature: _____

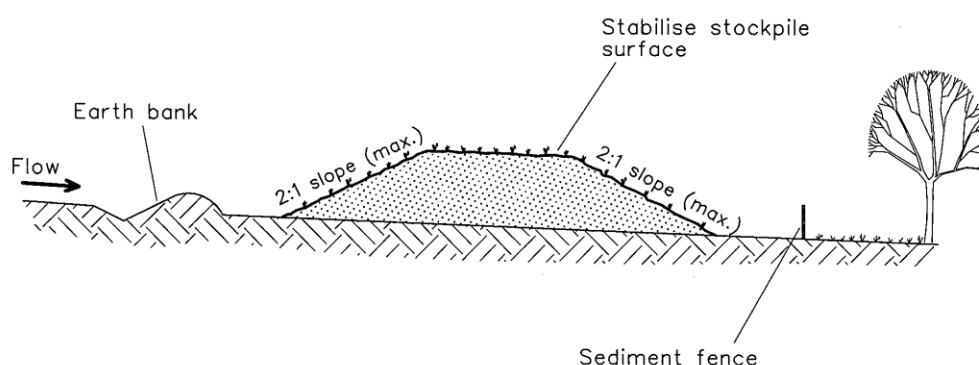
Approx Scale: 10 Metres	North Point →
Slope Direction and Gradient ↙ 2%	

Appendix D - Intensity frequency duration table

Table D1 - Intensity Frequency Duration (IFD)

Duration	Return Period (years)						
	1	2	5	10	20	50	100
	(rainfall intensity in mm/h)						
5 mins	73.3	95.9	126	146	172	209	239
6 mins	68.3	89.3	117	136	160	195	222
10 mins	55.7	72.8	95.7	111	130	158	181
20 mins	40.8	53.4	69.9	80.6	94.9	115	131
30 mins	33.1	43.3	56.6	65.2	76.8	92.9	106
1 hour	22.0	28.7	37.6	43.3	51.0	61.7	70.4
2 hours	13.8	18.0	23.7	27.3	32.2	39.1	44.7
3 hours	10.3	13.5	17.8	20.6	24.3	29.5	33.8
6 hours	6.20	8.14	10.8	12.6	14.9	18.2	20.8
12 hours	3.77	4.96	6.62	7.72	9.19	11.3	12.9
24 hours	2.32	3.06	4.11	4.81	5.73	7.05	8.12
48 hours	1.41	1.86	2.51	2.94	3.51	4.33	5.00
72 hours	1.00	1.33	1.80	2.12	2.54	3.14	3.64

Appendix E - Applicable standard drawings



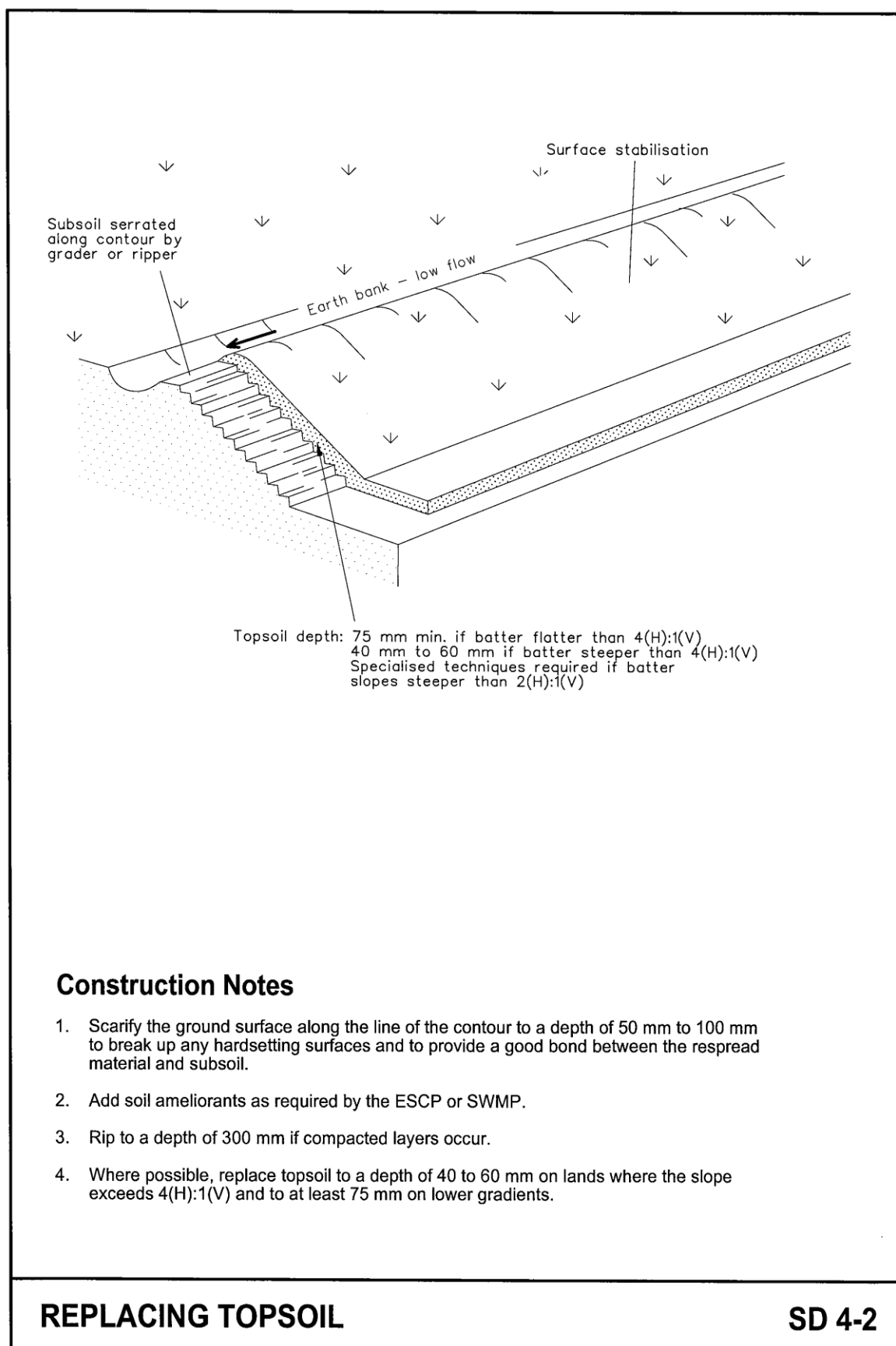
Construction Notes

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.

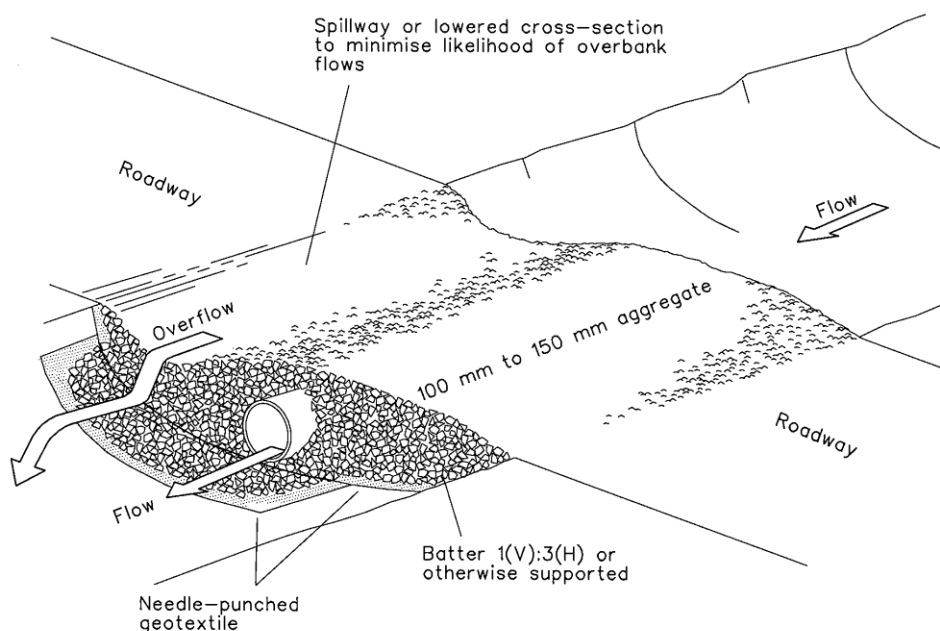
STOCKPILES

SD 4-1

Source: Blue Book



Source: Blue Book



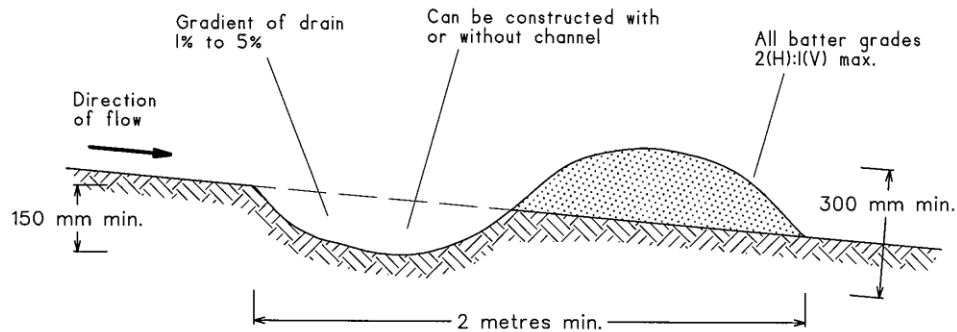
Construction Notes

1. Prohibit all traffic until the access way is constructed.
2. Strip any topsoil and place a needle-punched textile over the base of the crossing.
3. Place clean, rigid, non polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm.
4. Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3(H): 1 (V) slope on side batters.
5. Install a lower section to act as an emergency spillway in greater than design storm events.
6. Ensure that culvert outlets extend beyond the toe of fill embankments.

TEMPORARY WATERWAY CROSSING

SD 5-1

Source: Blue Book



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

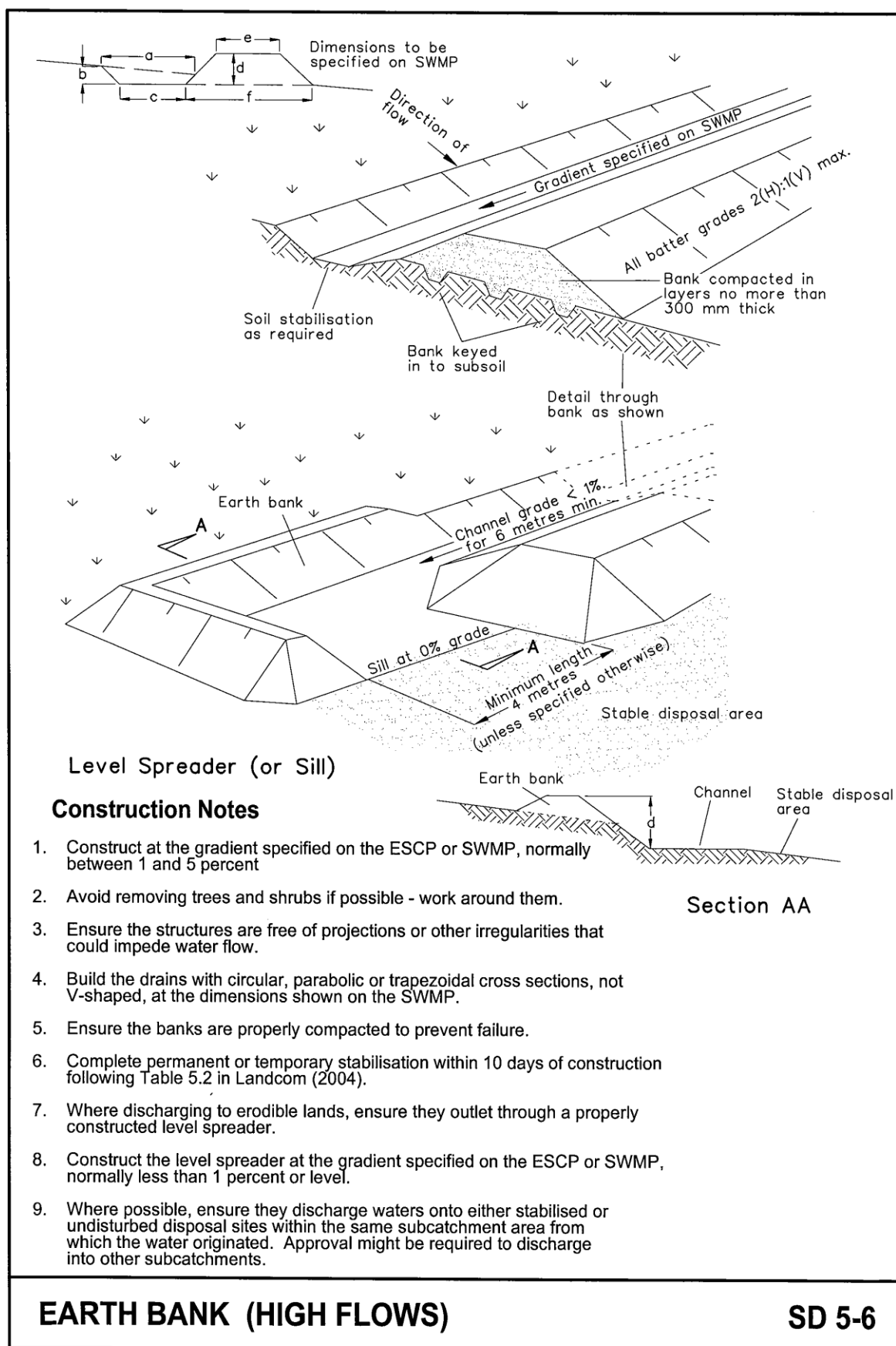
Construction Notes

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.

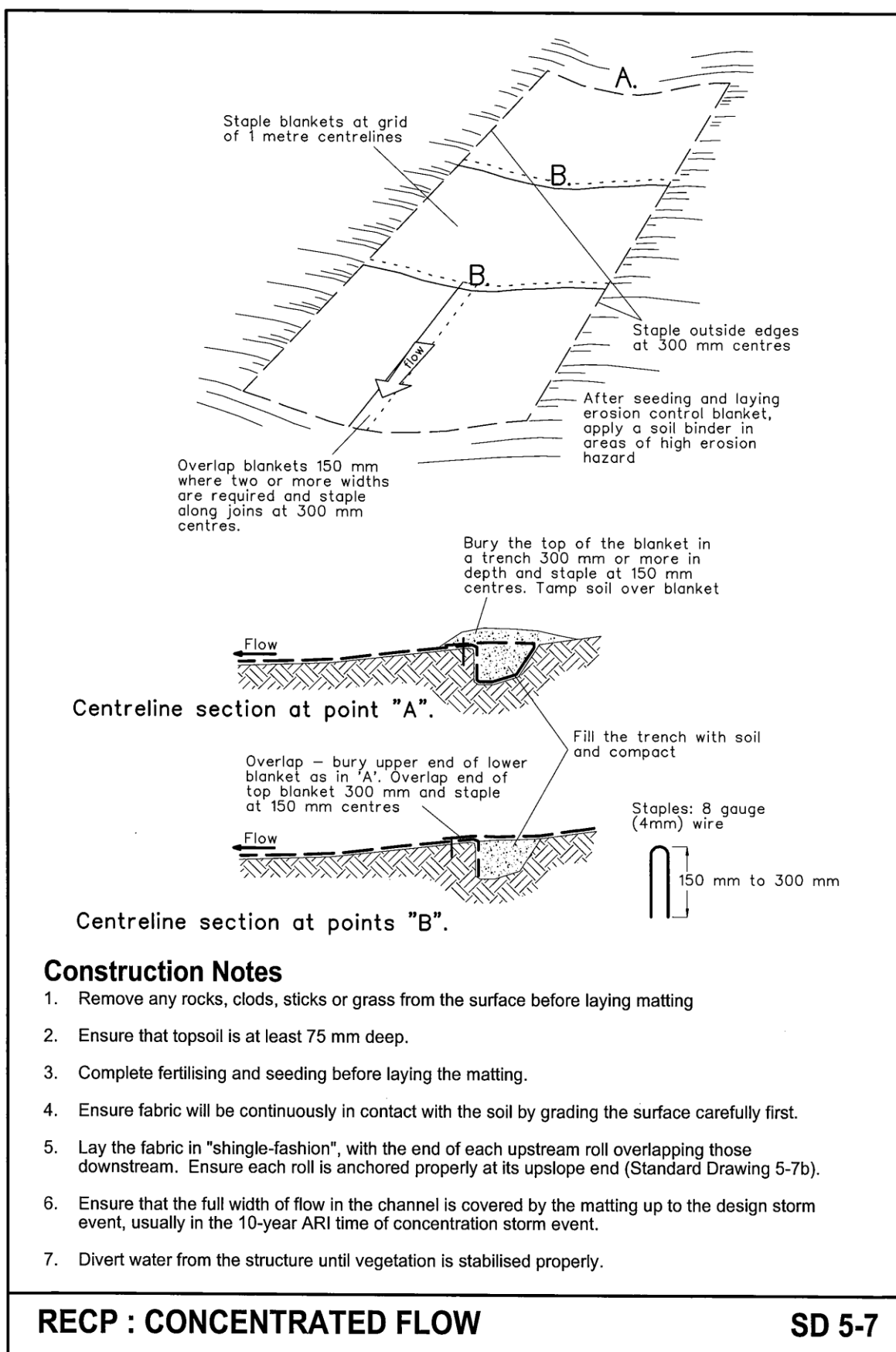
EARTH BANK (LOW FLOW)

SD 5-5

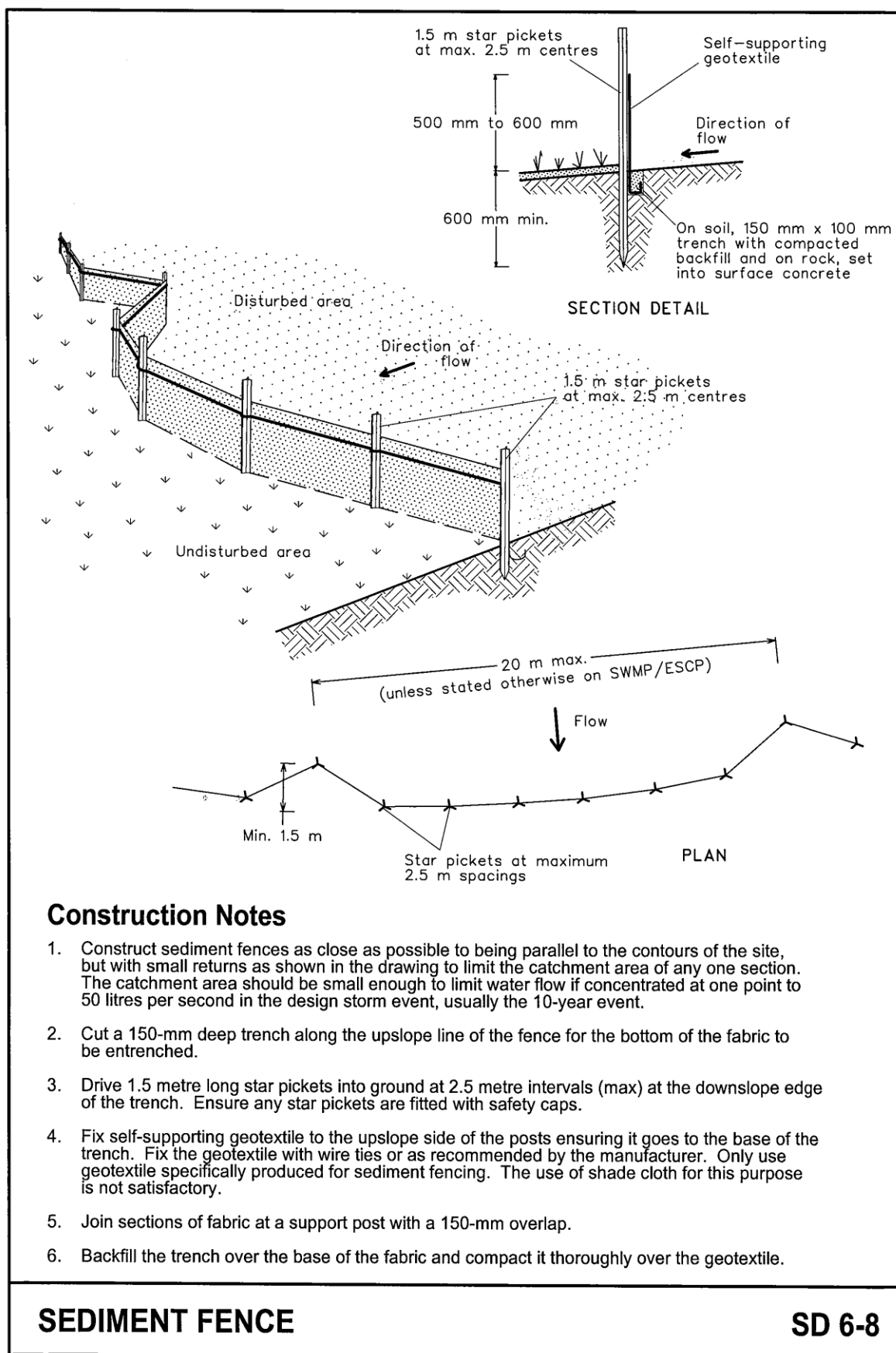
Source: Blue Book



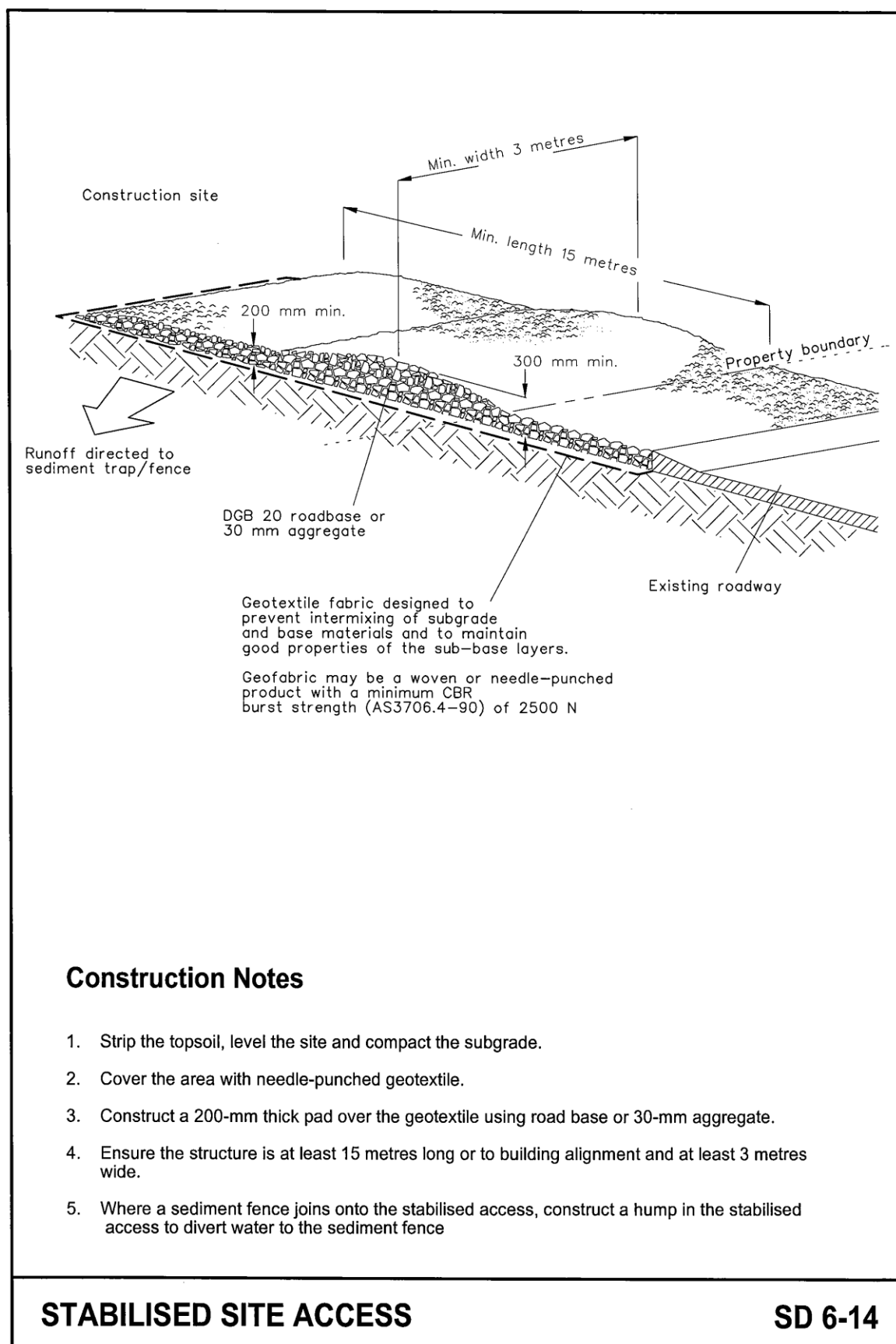
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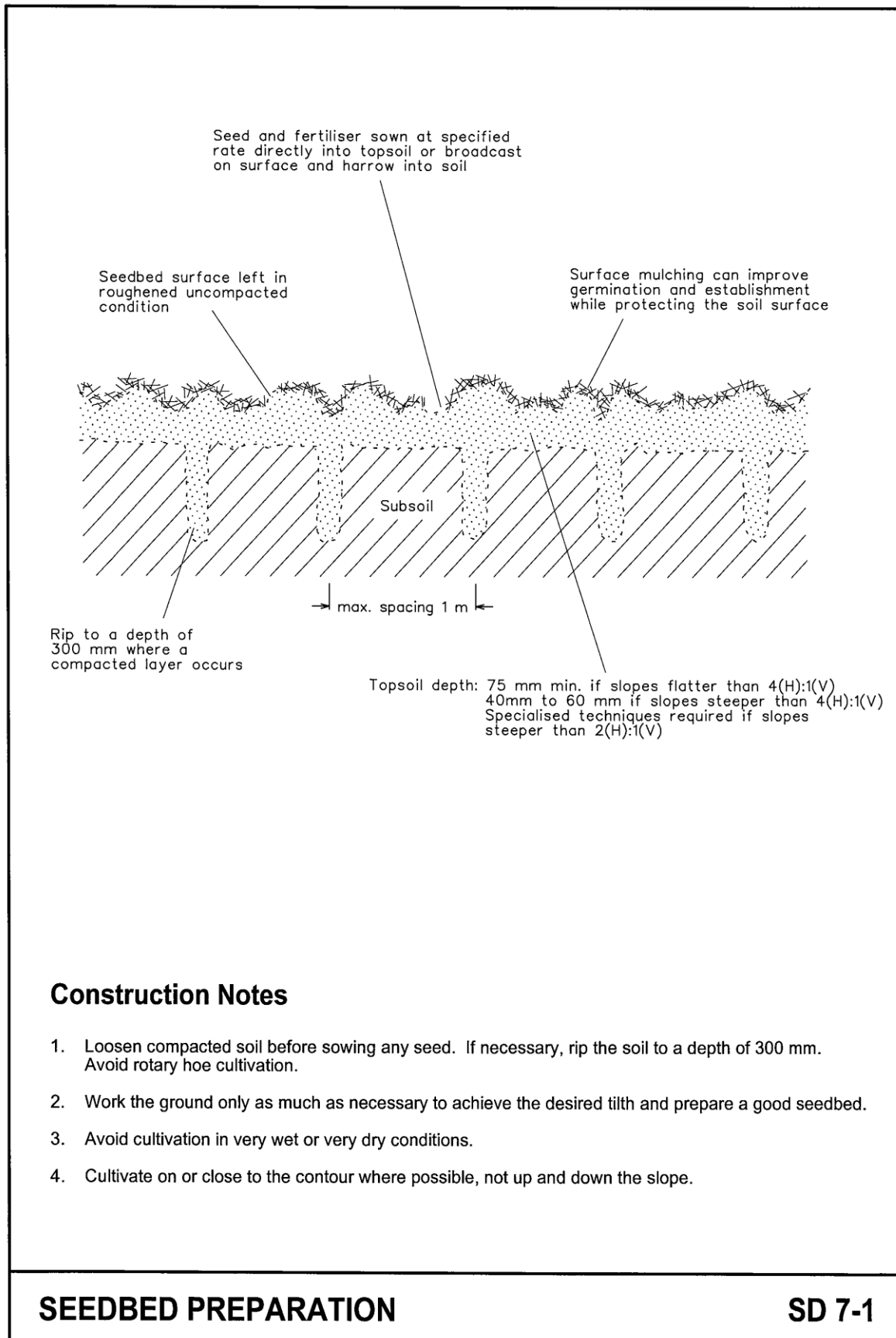
Source: Blue Book



Source: Blue Book



Source: Blue Book



Source: Blue Book

CONSTRUCTION

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE FOUNDATION AREA OF THE OUTLET STRUCTURE (IF ANY), AND INSTALL AS PER SEPARATE INSTRUCTIONS.

3. EXCAVATE THE SETTLING POND IN ACCORDANCE WITH THE APPROVED PLANS. UNLESS OTHERWISE SPECIFIED, THE EXCAVATED PIT SHOULD HAVE A SIDE SLOPE OF 2:1(H:V) OR FLATTER.

4. APPROPRIATELY STABILISE ANY BANK SUBJECT TO DIRECT INFLOW.

5. ESTABLISH ALL NECESSARY UP-SLOPE DRAINAGE CONTROL MEASURES TO ENSURE THAT SEDIMENT-LADEN RUNOFF IS APPROPRIATELY DIRECTED INTO THE SEDIMENT TRAP.

6. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE

1. CHECK EXCAVATED SEDIMENT TRAPS AFTER EACH RUNOFF EVENT AND MAKE REPAIRS IMMEDIATELY.

2. INSPECT THE BANKS FOR SLUMPING OR EXCESSIVE SCOUR.

3. IF FLOW THROUGH THE STRUCTURE IS REDUCED TO AN UNACCEPTABLE LEVEL DUE TO BLOCKAGE OF THE OUTLET

STRUCTURE (IF ANY), THEN MAKE ALL NECESSARY REPAIRS AND MAINTENANCE TO RESTORE THE DESIRED FLOW CONDITIONS.

4. CHECK THE STRUCTURE AND SURROUNDING CHANNEL BANKS FOR DAMAGE FROM OVERTOPPING FLOWS AND MAKE REPAIRS AS NECESSARY.

5. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 30% OF THE PIT VOLUME.

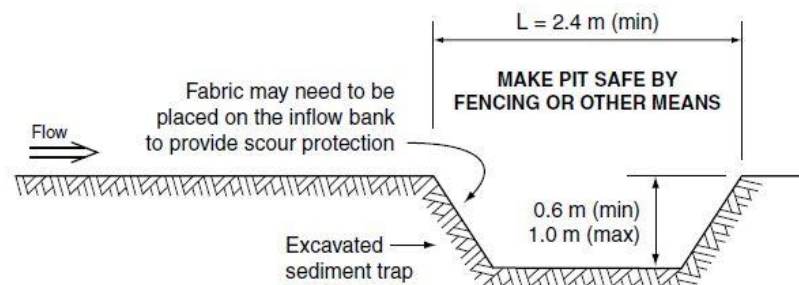
6. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

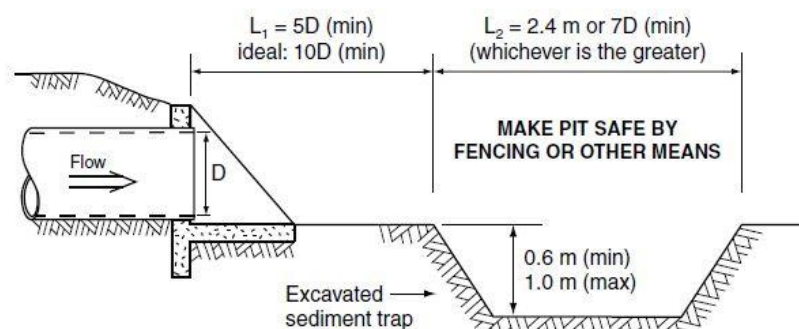
1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

2. ALL WATER AND SEDIMENT SHOULD BE REMOVED FROM THE BASIN PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT AND STABILISE AND/OR REVEGETATE AS REQUIRED.



(a) Excavated sediment trap located within a minor drainage path



Where space is not available, make optimum use of the available space

(b) Excavated sediment trap located downstream of a stormwater outlet

Drawn:	Date:		
GMW	Apr-10	Excavated Sediment Trap	EST-01

Source: International Erosion Control Association Best Practice Erosion and Sediment Control Guideline (IECA, 2008)

MATERIALS

- (i) MULCH MUST COMPLY WITH THE REQUIREMENTS OF AS4454.
- (ii) MAXIMUM SOLUBLE SALT CONCENTRATION OF 5ds/m.
- (iii) MOISTURE CONTENT OF 30 TO 50% PRIOR TO APPLICATION.

INSTALLATION

- 1. REFER TO APPROVED PLANS FOR LOCATION AND EXTENT. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, MATERIAL TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.
- 2. WHEN SELECTING THE LOCATION OF A MULCH FILTER BERM, TO THE MAXIMUM DEGREE PRACTICAL, ENSURE THE BERM IS LOCATED:
 - (i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;
 - (ii) ALONG A LINE OF CONSTANT ELEVATION (PREFERRED, BUT NOT ALWAYS PRACTICAL);
 - (iii) AT LEAST 1m, IDEALLY 3m, FROM THE TOE OF A FILL EMBANKMENT;
 - (iv) AWAY FROM AREAS OF CONCENTRATED FLOW.
- 3. ENSURE THE BERM IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE BERM, OR THE UNDESIRABLE DISCHARGE OF WATER AROUND THE END OF THE BERM.
- 4. ENSURE THE BERM HAS BEEN PLACED SUCH THAT PONDING UP-SLOPE OF THE BERM IS MAXIMISED.

- 5. ENSURE BOTH ENDS OF THE BERM ARE ADEQUATELY TURNED UP THE SLOPE TO PREVENT FLOW BYPASSING PRIOR TO WATER PASSING OVER THE BERM.
- 6. ENSURE 100% CONTACT WITH THE SOIL SURFACE.
- 7. WHERE SPECIFIED, TAKE APPROPRIATE STEPS TO VEGETATE THE BERM.

MAINTENANCE

- 1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL BERMS AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.
- 2. REPAIR OR REPLACE ANY DAMAGED SECTIONS.
- 3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.
- 4. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 100mm OR 1/3 THE HEIGHT OF THE BERM.
- 5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL (IF REQUIRED)

- 1. WHEN DISTURBED AREAS UP-SLOPE OF THE BERM ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE BERM MAYBE REMOVED.
- 2. REMOVE ANY COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
- 3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

Diagram illustrating the typical placement of a mulch filter berm. The berm is shown as a raised mound with a maximum grade of 1:1. The height is indicated as 100 mm (min) and the width as 500 mm (min). The flow is labeled 'Sediment-laden sheet flow' and 'Mulch filter berm'. The recommended maximum berm spacing is provided in the table below:

Land slope	Max spacing
< 2%	30 m
5%	25 m
10%	15 m
20%	8 m

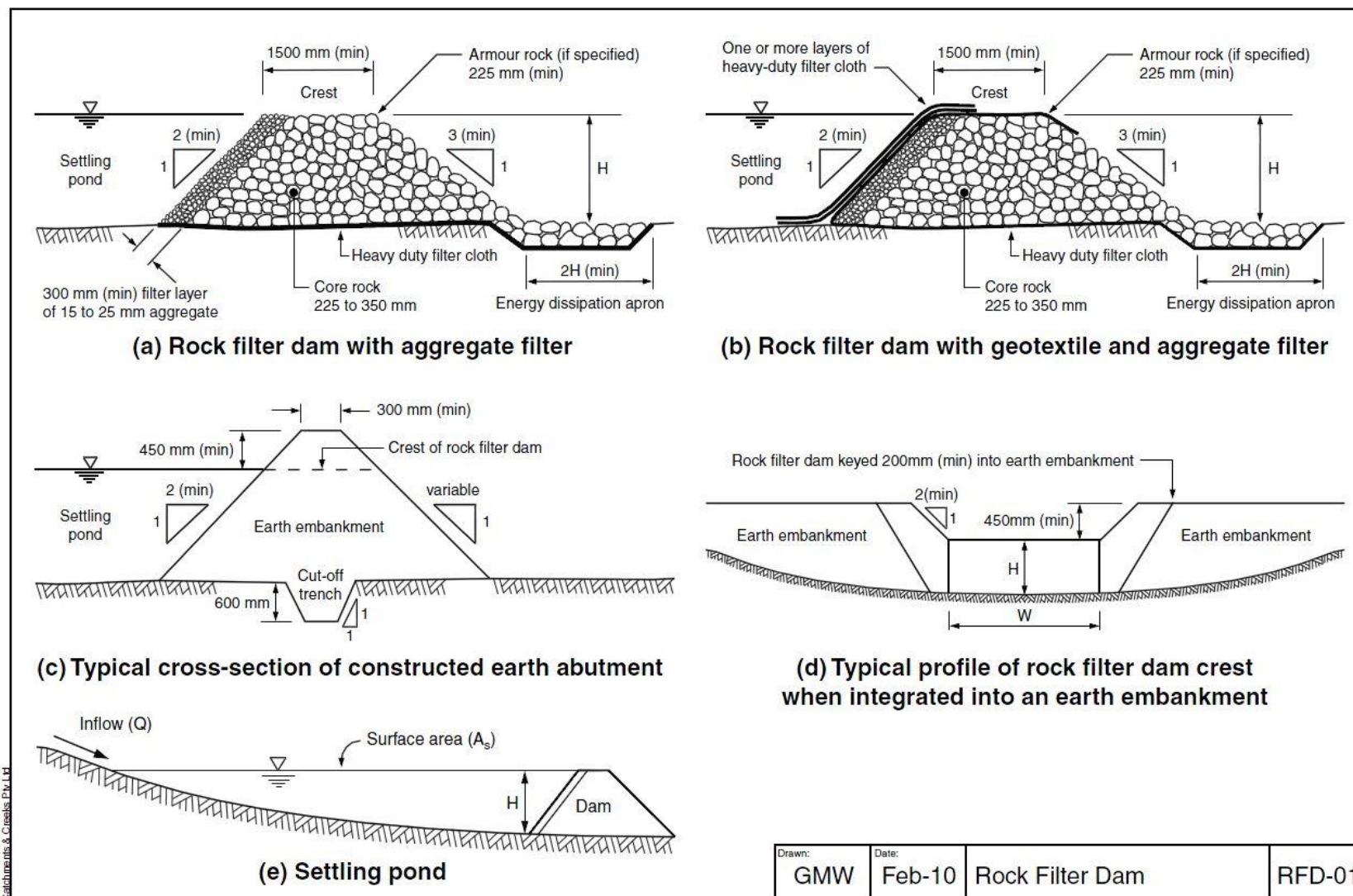
Figure 1 - Typical placement of mulch filter berm

Drawn:	Date:		
GMW	Apr-10	Mulch Filter Berms	MB-01

Figure 1 - Typical placement of mulch filter berm

Drawn:	Date:		
GMW	Apr-10	Mulch Filter Berms	MB-01

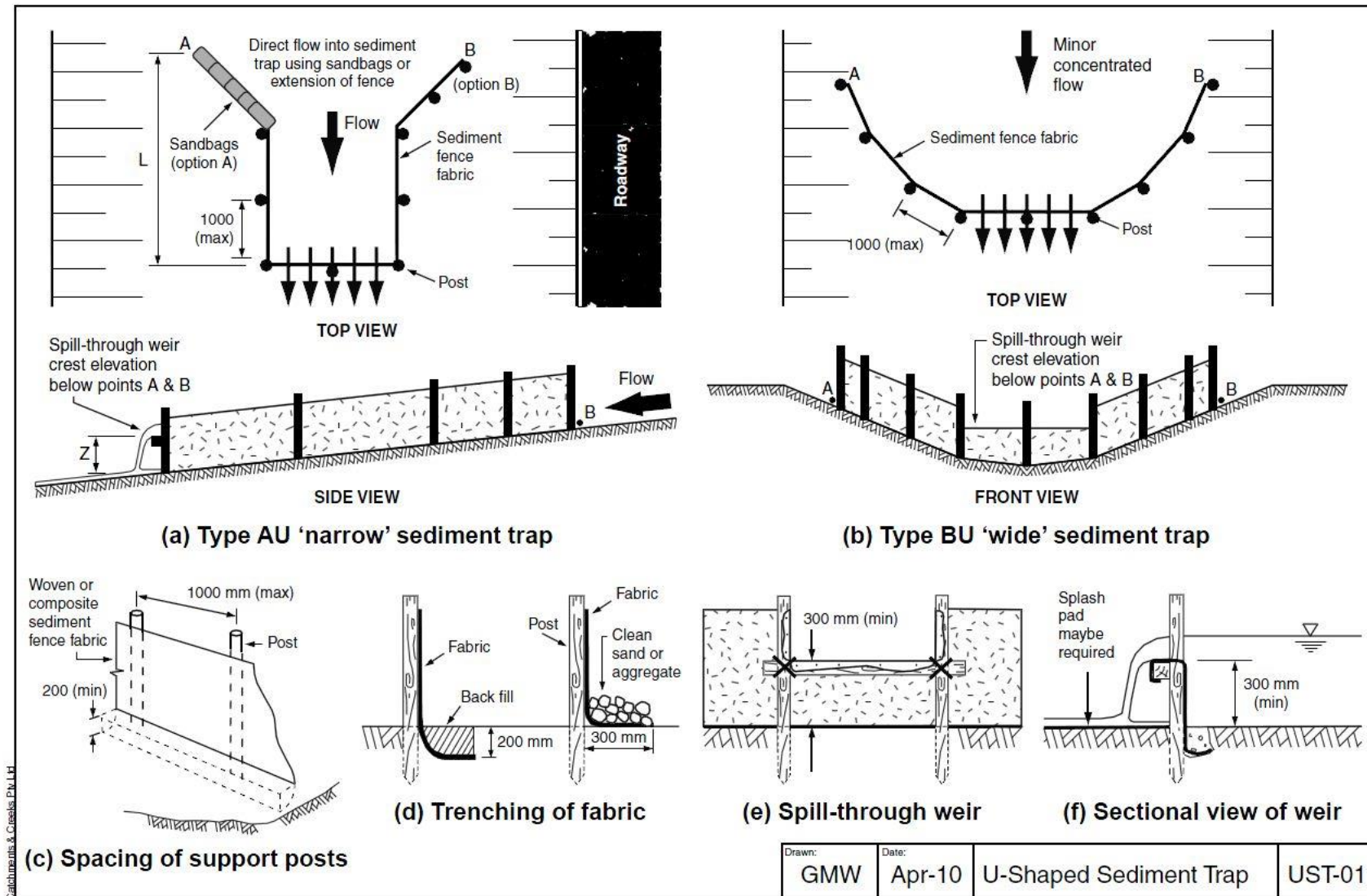
Source: IECA Best Practice Erosion and Sediment Control Guideline (IECA, 2008)



Source: IECA Best Practice Erosion and Sediment Control Guideline (IECA, 2008)

MATERIALS	DOWNSTREAM FACE OF EARTH ABUTMENTS SHOULD BE 3:1(H:V) OR FLATTER. EARTH ABUTMENTS SHOULD BE CONSTRUCTED OF WELL-COMPACTED, EROSION RESISTANT SOIL THAT IS FREE OF VEGETATION AND ROOTS. OVERFILL EARTH ABUTMENTS 150mm TO ALLOW FOR SETTLEMENT.	12. CLEAR THE SETTLING POND AREA OF WOODY VEGETATION AND ORGANIC MATTER TO THE DIMENSIONS SPECIFIED WITHIN THE PLANS.	UPSTREAM FILTER MEDIUM (AGGREGATE OR FILTER CLOTH) SHOULD BE REMOVED AND REPLACED.
PRIMARY CORE ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm, OR GREATER THAN 350mm.	6. PLACE THE CORE ROCK FOR THE ROCK FILTER DAM. ENSURE THE UPSTREAM FACE IS 2:1(H:V) OR FLATTER, AND THE DOWNSTREAM FACE IS 3:1(H:V) OR FLATTER.	13. WHERE NECESSARY, EXCAVATE THE UPSTREAM SETTLING POND AND/OR SEDIMENT STORAGE PIT IN ACCORDANCE WITH THE APPROVED PLANS. EXCAVATED PITS TYPICALLY HAVE SIDE SLOPES OF 2:1(H:V) OR FLATTER UNLESS STEEPER SLOPES ARE KNOWN TO BE STABLE.	5. IF A GREATER DEGREE OF WATER TREATMENT (FILTRATION) IS REQUIRED, EXTRA GEOTEXTILE FILTER FABRIC SHOULD BE PLACED OVER THE UPSTREAM FACE OF THE STRUCTURE.
ARMOUR ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm.	7. ENSURE THE ROCK IS MACHINE PLACED WITH THE SMALLER ROCKS WORKED INTO THE VOIDS OF THE LARGER ROCKS.	14. STABILISE ANY ASSOCIATED EARTH EMBANKMENTS IMMEDIATELY AFTER CONSTRUCTION THROUGH APPROPRIATE COMPACTION, VEGETATION AND/OR EROSION CONTROL MATTING.	6. CHECK THE STRUCTURE AND DOWNSTREAM CHANNEL BANKS FOR DAMAGE FROM OVERTOPPING FLOWS. MAKE REPAIRS AS NECESSARY.
AGGREGATE FILTER: 15 TO 25mm CLEAN AGGREGATE.	8. IF SPECIFIED, CONSTRUCT THE SPILLWAY SECTION USING THE SPECIFIED ARMOUR ROCK. THE SPILLWAY SHOULD HAVE A MINIMUM PROFILE DEPTH OF 300mm. THE SPILLWAY WEIR CREST MUST BE LEVEL ACROSS ITS FULL WIDTH. THE MAXIMUM LONGITUDINAL SLOPE OF THE ROCK SPILLWAY SHOULD BE 3:1(H:V). THE MINIMUM THICKNESS OF ARMOUR ROCK PROTECTION SHOULD BE 500mm, OR TWICE THE NOMINAL ROCK SIZE, WHICHEVER IS THE GREATER.	15. ESTABLISH ALL NECESSARY UP-SLOPE DRAINAGE CONTROL MEASURES TO ENSURE THAT SEDIMENT-LADEN RUNOFF IS APPROPRIATELY DIRECTED INTO THE SEDIMENT TRAP.	7. IMMEDIATELY REPLACE ANY ROCK DISPLACED FROM THE SPILLWAY.
GEOTEXTILE FILTER FABRIC: HEAVY-DUTY NON-WOVEN, NEEDLE-PUNCHED FILTER FABRIC, MINIMUM 'BIDIM' A34 OR EQUIVALENT.	9. ENSURE THE SPILLWAY OUTLET SECTION EXTENDS DOWNSTREAM PAST THE TOE OF THE FORMED EMBANKMENT UNTIL STABLE CONDITIONS ARE REACHED, OR A DISTANCE EQUAL TO THE HEIGHT OF THE DAM, WHICHEVER IS THE GREATER. THE EDGES OF THE SPILLWAY SHOULD BE LEFT FLUSH WITH THE SURROUNDING GROUND.	16. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.	8. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 10% OF THE SPECIFIED STORAGE VOLUME.
INSTALLATION	10. INSTALL THE SPECIFIED FILTER (AGGREGATE AND/OR FILTER CLOTH) ON THE UPSTREAM FACE OF THE ROCK FILTER DAM.	MAINTENANCE	9. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.	11. IF FILTER CLOTH IS USED, THEN: (i) EXTEND THE FABRIC OVER THE CREST OF THE ROCK FILTER DAM INTO THE SPILLWAY CHUTE; (ii) CONSIDER THE PLACEMENT OF SEVERAL LAYERS OF OVERLAPPING FABRIC, THUS ALLOWING EACH LAYER TO BE REMOVED INDIVIDUALLY ONCE THE FABRIC BECOMES BLOCKED WITH SEDIMENT.	1. CHECK ALL ROCK FILTER DAMS AFTER EACH RUNOFF EVENT AND MAKE REPAIRS IMMEDIATELY.	REMOVAL
2. CLEAR THE FOUNDATION AREA OF THE ROCK FILTER DAM OF WOODY VEGETATION AND ORGANIC MATTER. DELAY CLEARING THE UP-SLOPE POND AREA UNTIL THE DAM IS FORMED AND IS ABLE TO ACT AS A SUITABLE SEDIMENT TRAP, OTHERWISE AN ALTERNATIVE TEMPORARY DOWNSTREAM SEDIMENT TRAP MAY BE REQUIRED DURING CONSTRUCTION OF THE ROCK FILTER DAM.		2. INSPECT ALL ROCK AND EARTH EMBANKMENTS FOR UNDERCUTTING OR UNDESIRABLE SEEPAGE FLOWS.	1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
3. IF SPECIFIED ON THE PLANS, EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE-LINE OF THE DAM AND EARTH ABUTMENTS (IF ANY).		3. IDEALLY, ROCK FILTER DAMS SHOULD DISCHARGE (FROM FULL) OVER NO LESS THAN 8 HOURS. IF DRAINAGE IS TOO RAPID, THEN ADDITIONAL FILTER AGGREGATE MAYBE REQUIRED TO ACHIEVE OPTIMUM HYDRAULIC PERFORMANCE.	2. ALL WATER AND SEDIMENT SHOULD BE REMOVED FROM THE SETTLING POND PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
4. COVER THE FOUNDATION AREA AND CUT-OFF TRENCH WITH HEAVY-DUTY FILTER FABRIC BEFORE BACKFILLING WITH THE CORE ROCK. OVERLAP ADJOINING FABRIC SHEETS A MINIMUM OF 600mm.		4. IF FLOW THROUGH THE STRUCTURE IS REDUCED TO AN UNACCEPTABLE LEVEL, THE	3. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT AND STABILISE AND/OR REVEGETATE AS REQUIRED TO MINIMISE THE EROSION HAZARD.
5. CONSTRUCT THE ASSOCIATED EARTH ABUTMENT (IF ANY). ALL CUT AND FILL SLOPES SHOULD BE 2:1(H:V) OR FLATTER. THE			
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Source: IECA Best Practice Erosion and Sediment Control Guideline (IECA, 2008)



Source: IECA Best Practice Erosion and Sediment Control Guideline (IECA, 2008)

MATERIALS	3. ENSURE THAT THE EXPECTED CHANNEL FLOW WILL ENTER THE SEDIMENT TRAP, EITHER BY EXTENDING THE WING WALLS UP THE BANK SLOPE, OR CONSTRUCTING SANDBAG FLOW DIVERSION BANKS.	11. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC AND MESH TO PREVENT WATER FROM FLOWING UNDER THE FENCE.	REMOVAL
FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140g/m ² . ALL FABRICS TO CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).	4. UNLESS DIRECTED BY THE SITE SUPERVISOR, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE ALIGNMENT OF THE SPILL-THROUGH WEIR AND WING WALLS.	MAINTENANCE	1. WHEN DISTURBED AREAS UP-SLOPE OF THE SEDIMENT TRAP ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE SEDIMENT TRAP MUST BE REMOVED.
FABRIC REINFORCEMENT: (IF USED) WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.	5. ALONG THE LOWER SIDE OF THE TRENCH, APPROPRIATELY SECURE THE STAKES INTO THE GROUND SPACED NO GREATER THAN 1m.	1. INSPECT THE SEDIMENT TRAP AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.	2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
SUPPORT POSTS/STAKES: 1500mm ² (MIN) HARDWOOD, 2500mm ² (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.	6. CONSTRUCT THE SEDIMENT TRAP FROM A CONTINUOUS ROLL OF FABRIC.	2. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC FROM POST TO POST.	3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.
INSTALLATION	7. SECURELY ATTACH THE FABRIC TO THE SUPPORT POSTS/STAKES USING 25mm STAPLES OR TIE WIRE AT MAXIMUM 150mm SPACING WITH THE FABRIC EXTENDED AT LEAST 200mm INTO THE TRENCH.	3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.	
1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND REQUIRED TYPE OF FABRIC (IF SPECIFIED). IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, FABRIC TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.	8. INSTALL A SPILL-THROUGH WEIR AT THE LOWEST POINT IN THE FENCE. THE WEIR MUST BE AT LEAST 300mm ABOVE ADJACENT GROUND LEVEL, AND BELOW THE LOWEST GROUND LEVEL AT THE ENDS OF THE WING WALLS.	4. IF THE FABRIC IS SAGGING BETWEEN STAKES, INSTALL ADDITIONAL SUPPORT POSTS/STAKES.	
2. INSTALL THE FABRIC IN A U-SHAPE, EXTENDING THE WING WALLS EITHER UP THE SIDE SLOPES AND/OR UP THE CHANNEL INVERT (AS DIRECTED) TO A POINT WHERE THE GROUND LEVEL IS AT LEAST 100mm HIGHER THAN THE CREST OF THE SPILL-THROUGH WEIR.	9. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE ADJACENT SUPPORT POSTS. CUT THE FABRIC DOWN THE SIDE OF THE POSTS AND FOLD THE FABRIC OVER THE CROSS MEMBER AND APPROPRIATELY SECURE THE FABRIC.	5. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 150mm.	
	10. IF DIRECTED, INSTALL A SUITABLE SPLASH PAD IMMEDIATELY DOWN-SLOPE OF THE SPILL-THROUGH WEIR TO CONTROL SOIL EROSION DOWNSTREAM OF THE SEDIMENT TRAP.	6. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.	
		7. REPLACE THE FABRIC IF THE SERVICE LIFE OF THE EXISTING FABRIC EXCEEDS SIX MONTHS.	
Catchments & Credits Pty Ltd	Drawn: GMW	Date: Apr-10	U-Shaped Sediment Trap
	UST-02		

Source: IECA Best Practice Erosion and Sediment Control Guideline (IECA, 2008)

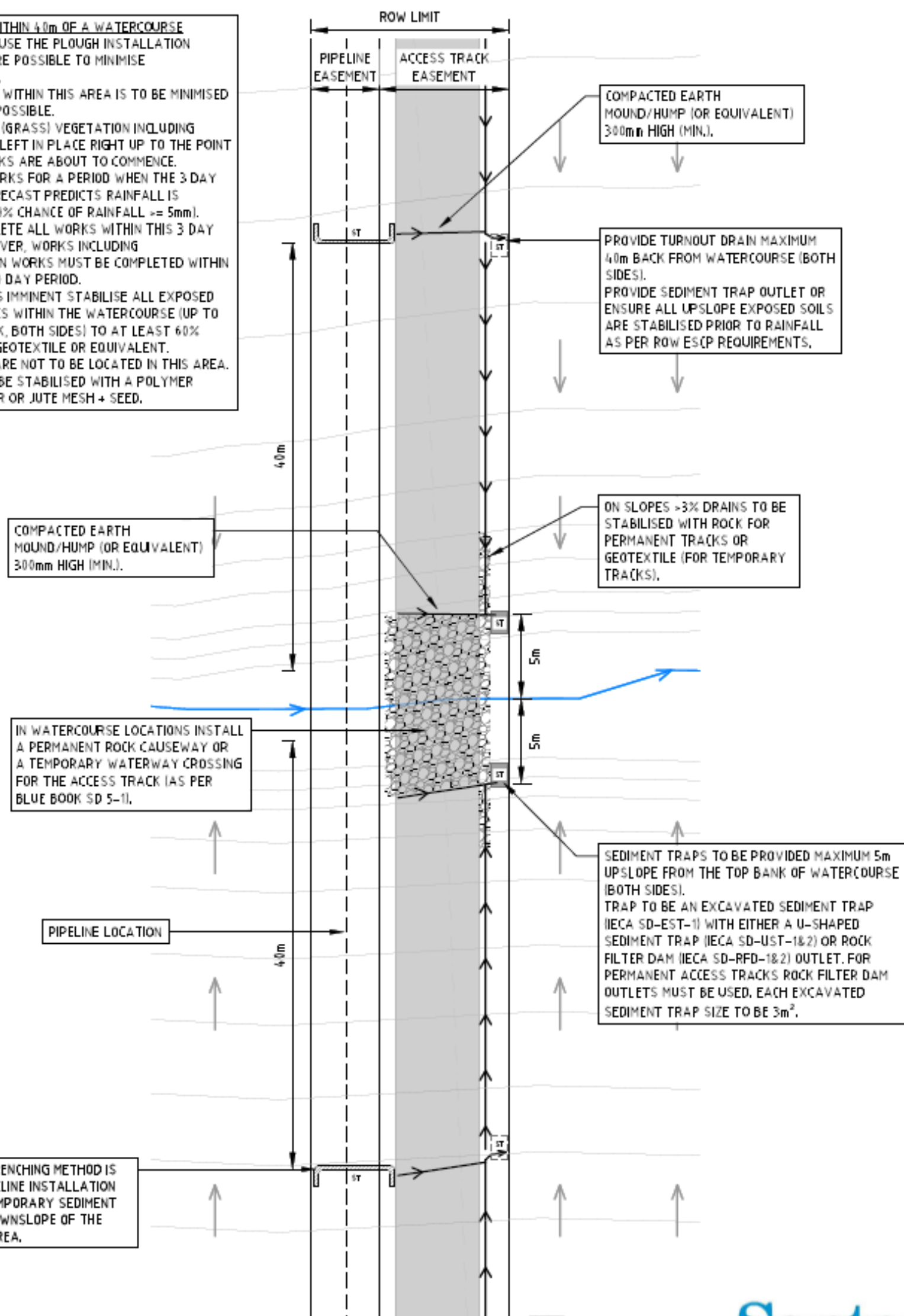
Appendix F - RoW watercourse crossing standard drawing

RIGHT OF WAY WATERCOURSE CROSSING

This standard drawing is only to be used for ROW sites up to 20m wide with slopes less than or equal to 10%.

PIPELINE WORKS WITHIN 40m OF A WATERCOURSE

- PREFERABLY USE THE PLOUGH INSTALLATION METHOD WHERE POSSIBLE TO MINIMISE DISTURBANCE.
- DISTURBANCE WITHIN THIS AREA IS TO BE MINIMISED AS MUCH AS POSSIBLE.
- ALL SURFACE (GRASS) VEGETATION INCLUDING ROOTS TO BE LEFT IN PLACE RIGHT UP TO THE POINT PIPELINE WORKS ARE ABOUT TO COMMENCE.
- SCHEDULE WORKS FOR A PERIOD WHEN THE 3 DAY WEATHER FORECAST PREDICTS RAINFALL IS UNLIKELY (<50% CHANCE OF RAINFALL $\geq 5\text{mm}$).
- AIM TO COMPLETE ALL WORKS WITHIN THIS 3 DAY PERIOD. HOWEVER, WORKS INCLUDING STABILISATION WORKS MUST BE COMPLETED WITHIN A MAXIMUM 10 DAY PERIOD.
- IF RAINFALL IS IMMINENT STABILISE ALL EXPOSED SOIL SURFACES WITHIN THE WATERCOURSE (UP TO THE TOP BANK, BOTH SIDES) TO AT LEAST 60% COVER WITH GEOTEXTILE OR EQUIVALENT.
- STOCKPILES ARE NOT TO BE LOCATED IN THIS AREA.
- BUNDS MUST BE STABILISED WITH A POLYMER SPRAY BINDER OR JUTE MESH + SEED.



Appendix G - Access track SD (unsealed roads)

ACCESS TRACK - STANDARD DRAWING 1

FOR ACCESS TRACKS RUNNING UP OR DOWN (i.e. PERPENDICULAR TO) THE NATURAL SLOPE

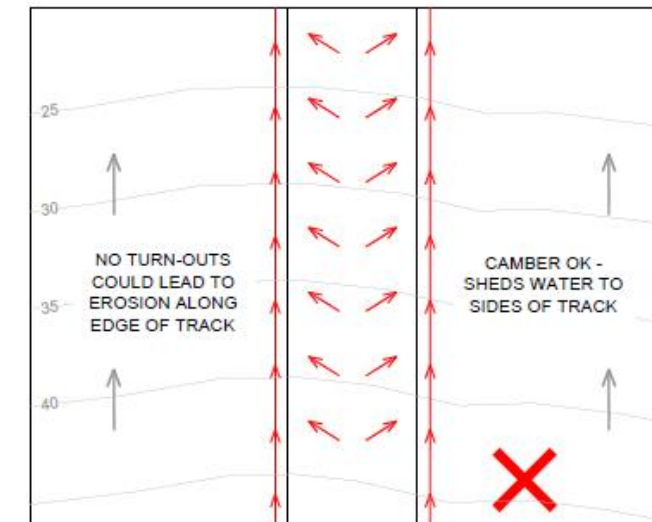
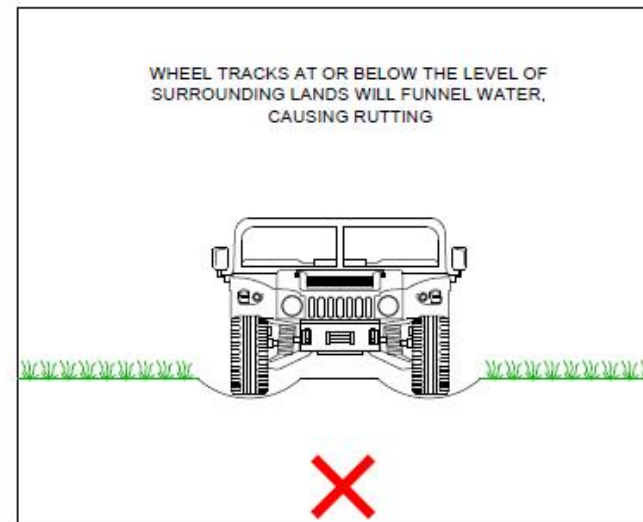
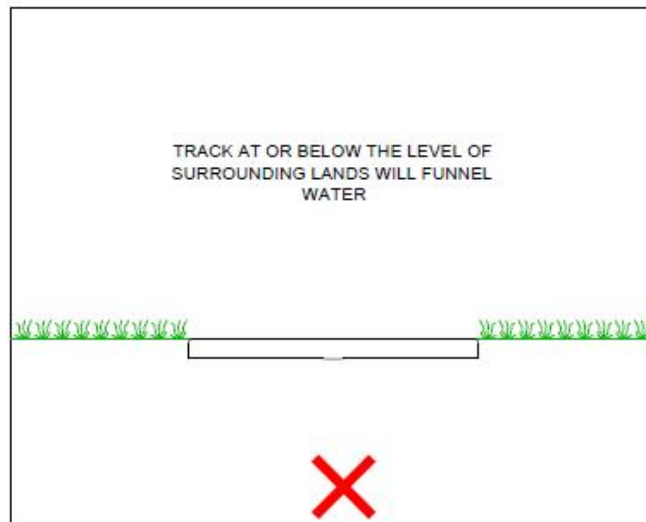
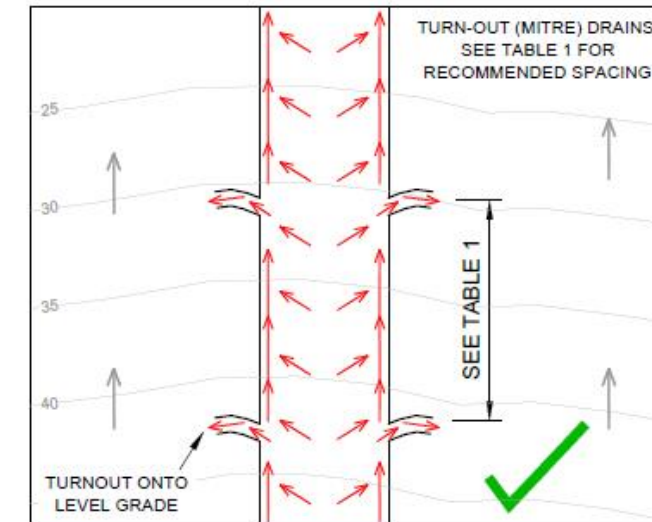
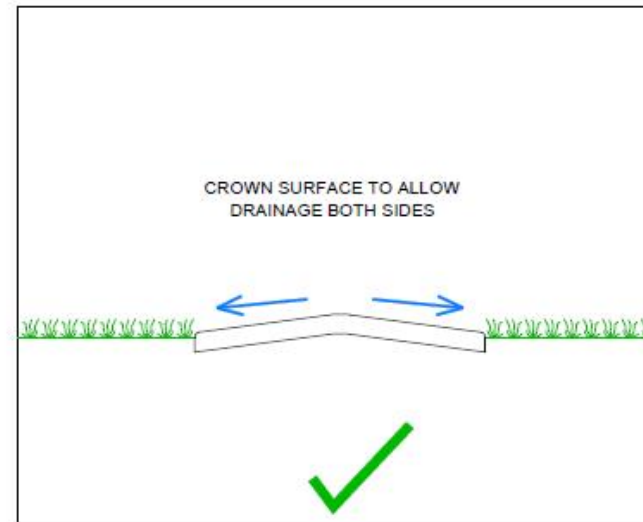
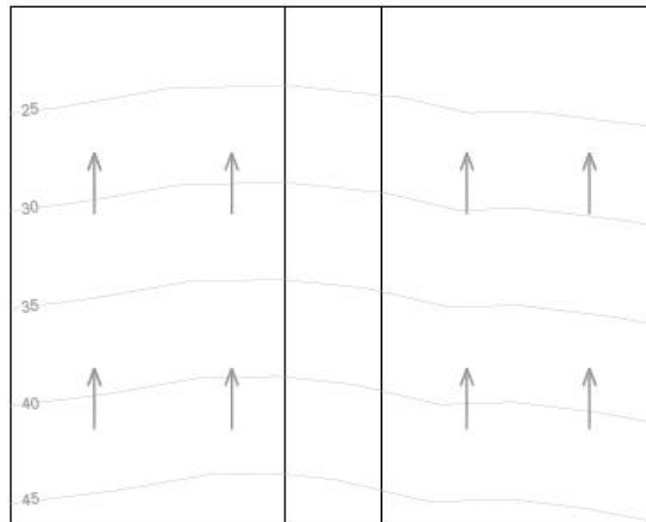


TABLE 1

GRADE	MAX. SPACING OF TURN-OUT (MITRE) DRAINS
0 to 2%	120m
2+ to 4%	60m
4+ to 8%	30m
>8%	15m

UNSEALED ROADS AND TRACKS DO NOT HAVE A PROTECTIVE HARD SEAL AND, AS SUCH, ARE HIGHLY PRONE TO EROSION AND DAMAGE. THE KEY TECHNIQUES TO MINIMISE EROSION AND DAMAGE TO UNSEALED ROADS AND TRACKS ARE:

- GOOD SHAPING (CAMBER, SUPER-ELEVATION ETC)
- GOOD DRAINAGE.

GOOD DRAINAGE IS PARTICULARLY IMPORTANT ON UNSEALED ROADS AND TRACKS, EVEN MORE SO THAN FOR A SEALED ROAD



TRACK AT OR BELOW THE LEVEL OF SURROUNDING LANDS



USE OF TURN-OUT (MITRE) DRAINS TO MOVE WATER AWAY FROM TRACK

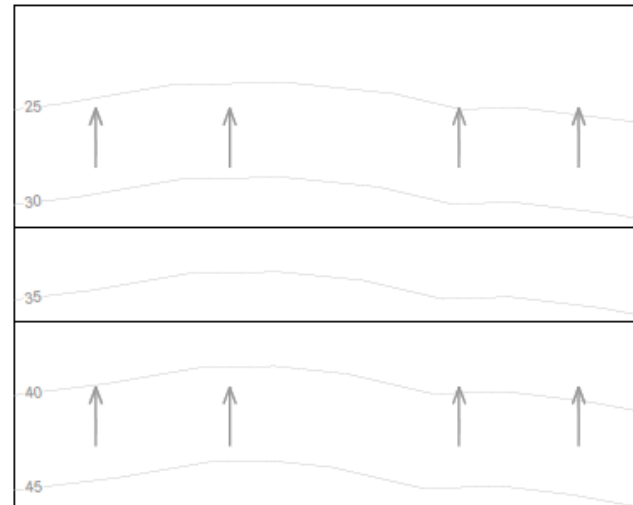
TURN-OUTS TO BE AT LEAST 5m LONG (WHERE POSSIBLE) AND AT 0% GRADE.



SEDIMENT FENCES SHOULD NOT BE REQUIRED IN TURN-OUT DRAINS IF THEY ARE CONSTRUCTED PROPERLY

ACCESS TRACK - STANDARD DRAWING 2

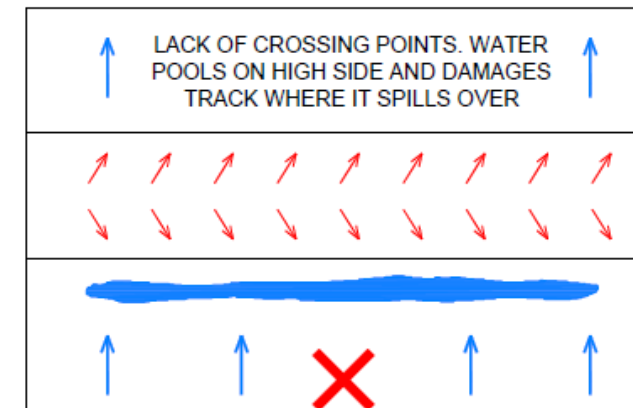
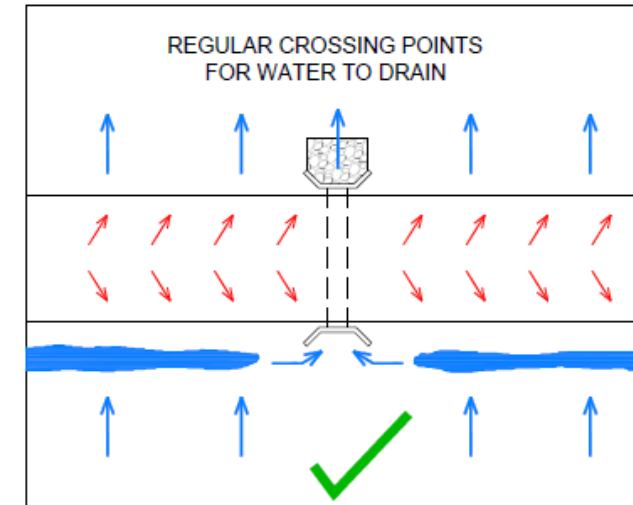
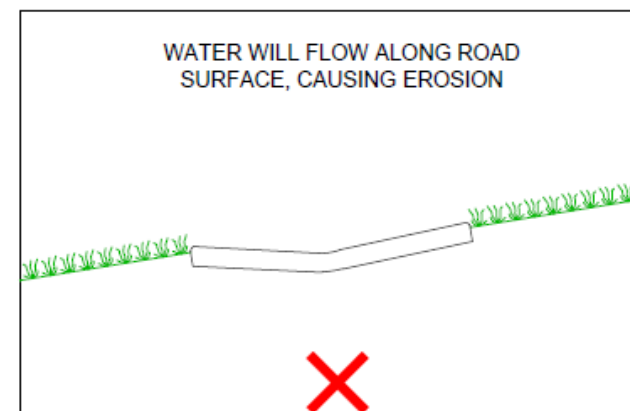
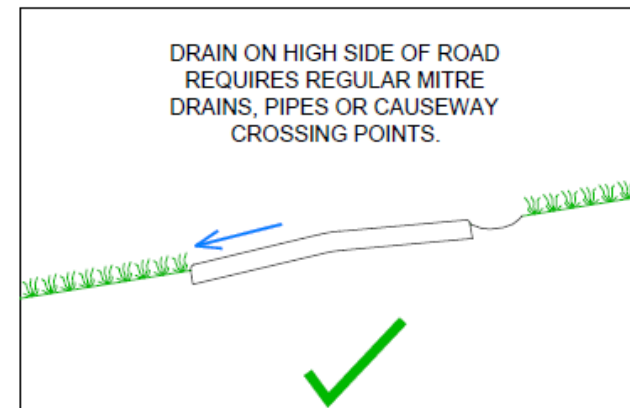
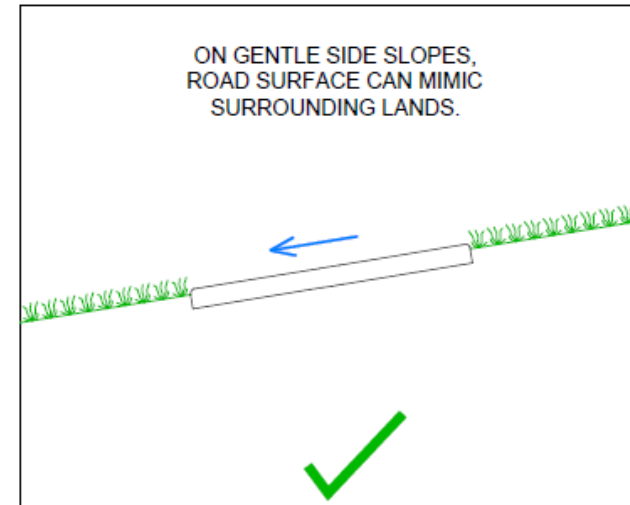
FOR ACCESS TRACKS RUNNING ACROSS
(i.e. PARALLEL TO) THE NATURAL SLOPE



UNCONTROLLED DRAINAGE.
WATER SPILLS ACROSS TRACK AT
LOW POINTS, CAUSING EROSION



WHEEL RUTS FUNNEL WATER
ALONG TRACK, CAUSING EROSION



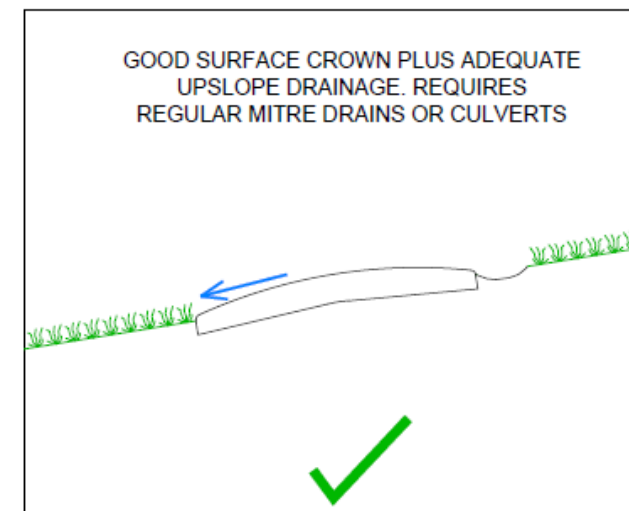
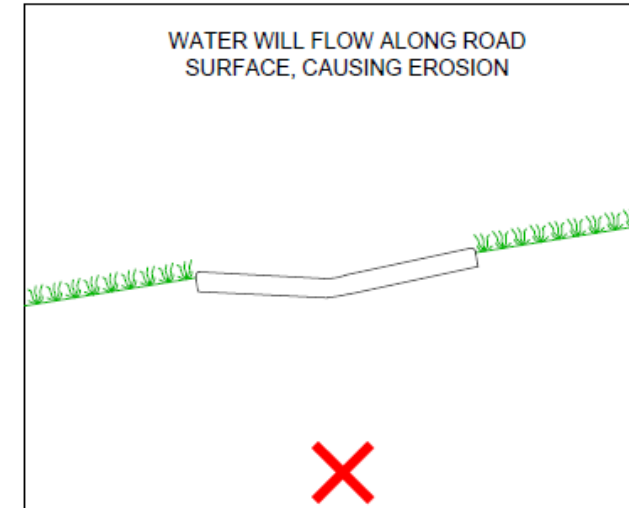
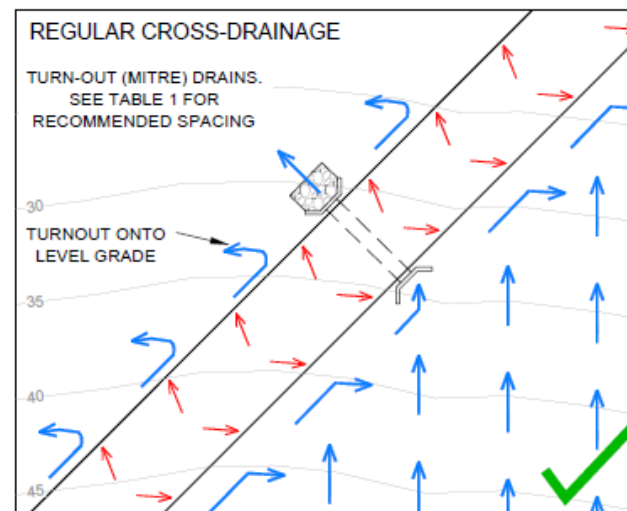
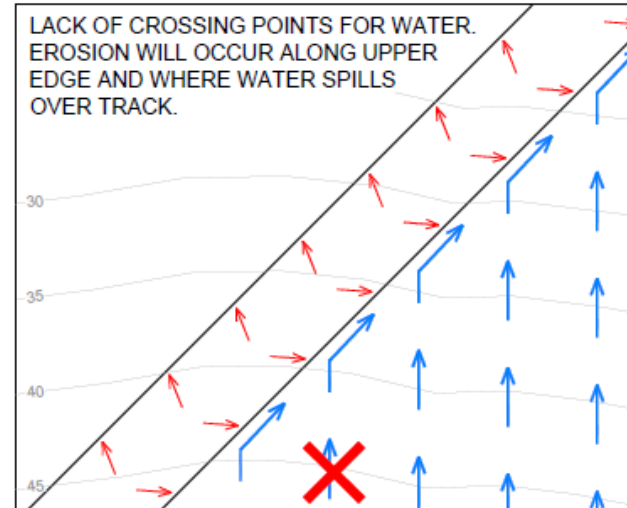
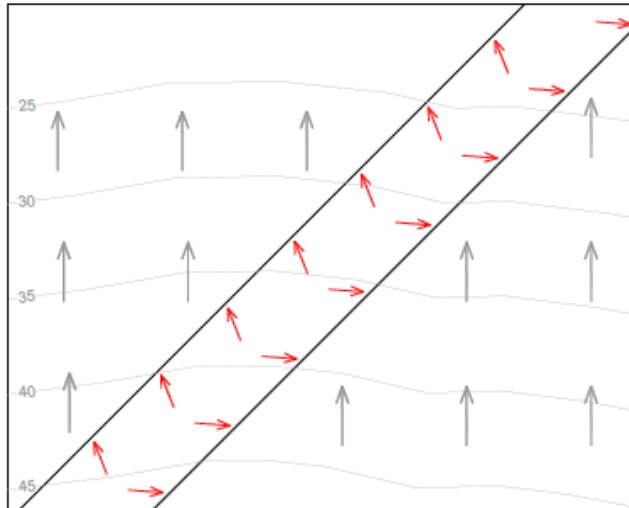
UNSEALED ROADS AND TRACKS DO NOT HAVE A PROTECTIVE
HARD SEAL AND, AS SUCH, ARE HIGHLY PRONE TO EROSION
AND DAMAGE. THE KEY TECHNIQUES TO MINIMISE EROSION AND
DAMAGE TO UNSEALED ROADS AND TRACKS ARE:

- GOOD SHAPING (CAMBER, SUPER-ELEVATION ETC)
- GOOD DRAINAGE.

GOOD DRAINAGE IS PARTICULARLY IMPORTANT ON UNSEALED
ROADS AND TRACKS, EVEN MORE SO THAN FOR A SEALED ROAD

ACCESS TRACK - STANDARD DRAWING 3

FOR ACCESS TRACKS RUNNING
DIAGONAL TO THE NATURAL SLOPE



UNSEALED ROADS AND TRACKS DO NOT HAVE A PROTECTIVE HARD SEAL AND, AS SUCH, ARE HIGHLY PRONE TO EROSION AND DAMAGE. THE KEY TECHNIQUES TO MINIMISE EROSION AND DAMAGE TO UNSEALED ROADS AND TRACKS ARE:

- GOOD SHAPING (CAMBER, SUPER-ELEVATION ETC)
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GOOD DRAINAGE IS PARTICULARLY IMPORTANT ON UNSEALED ROADS AND TRACKS, EVEN MORE SO THAN FOR A SEALED ROAD



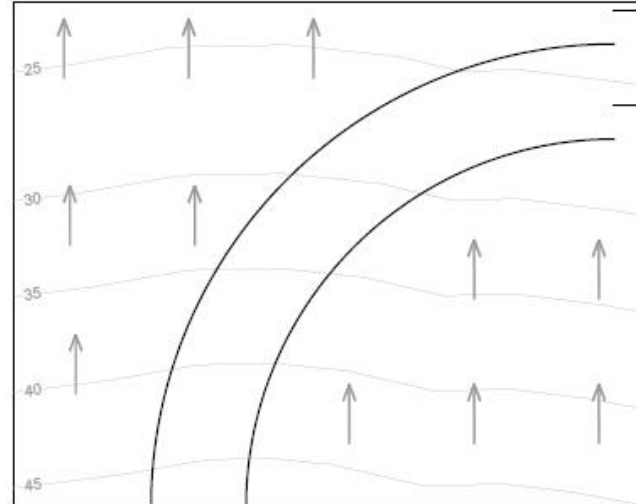
LACK OF DRAINAGE AT EDGE OF TRACK. WATER FLOWS ALONG THE TRACK AS A RESULT, CAUSING EROSION



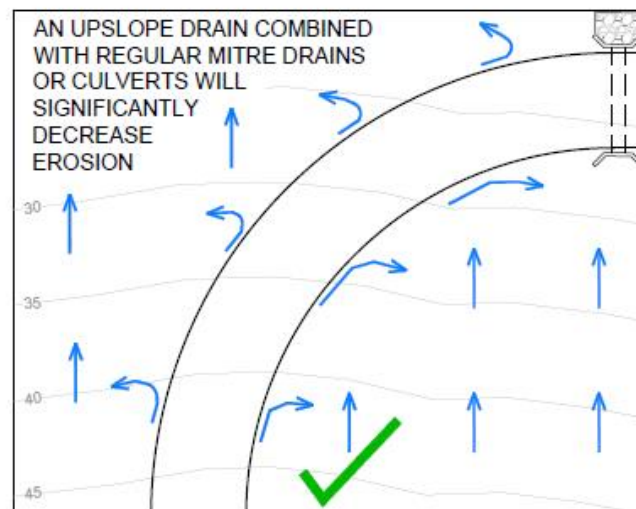
NOTE THAT THE TRACK AVOIDS EXISTING VEGETATION AND IS WELL BUILT-UP, ALTHOUGH REQUIRES ADEQUATE DRAINAGE TO MINIMISE THE RISK OF EROSION ON THE UPSLOPE EDGE.

ACCESS TRACK - STANDARD DRAWING 4

FOR ACCESS TRACKS WRAPPING AROUND THE NATURAL SLOPE

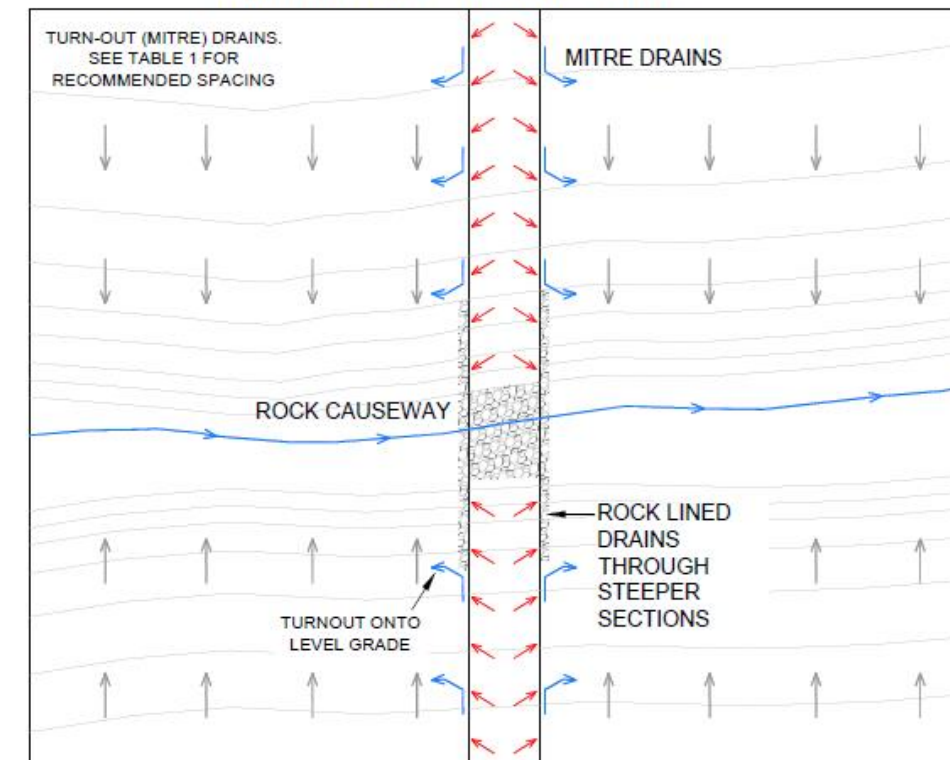


AN UPSLOPE DRAIN COMBINED WITH REGULAR MITRE DRAINS OR CULVERTS WILL SIGNIFICANTLY DECREASE EROSION



LACK OF STABLE DRAINAGE ON A STEEP SECTION OF TRACK

FOR WATERCOURSE AND GULLY CROSSINGS



THIS WILL ERODE WHENEVER THERE IS GULLY FLOW, RESULTING IN ONGOING MAINTENANCE COSTS. IN ADDITION, THE SIDES OF THE TRACK WILL SCOUR DUE TO THE LACK OF STABLE DRAINAGE.



POOR STABILISATION OF WATERCOURSE CROSSINGS MEANS ADDITIONAL ONGOING COSTS FOR MAINTENANCE AND REPAIR.

UNSEALED ROADS AND TRACKS DO NOT HAVE A PROTECTIVE HARD SEAL AND, AS SUCH, ARE HIGHLY PRONE TO EROSION AND DAMAGE. THE KEY TECHNIQUES TO MINIMISE EROSION AND DAMAGE TO UNSEALED ROADS AND TRACKS ARE:

- GOOD SHAPING (CAMBER, SUPER-ELEVATION ETC)
- GOOD DRAINAGE.

GOOD DRAINAGE IS PARTICULARLY IMPORTANT ON UNSEALED ROADS AND TRACKS, EVEN MORE SO THAN FOR A SEALED ROAD