Draft environmental management plan

Erosion and sediment control management plan

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Santos
GLNG Project

Santos GLNG Upstream

Erosion and Sediment Control Management Plan

GLNG is a Santos PETRONAS Total KOGAS venture.

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Abbreviations and Units

Acronym	Description
CPESC	Certified Professional in Erosion and Sediment Control
CSG	Coal Seam Gas
DEHP	Department of Environment and Heritage Protection
EA	Environmental Authority
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
ESCMP	Erosion and Sediment Control Management Plan
EHS	Environment, Health and Safety
EHSMS	Environment, Health and Safety Management System
EP Act	*Environmental Protection Act 1994*
EPP (Water)	*Environmental Protection (Water) Policy 2009*
EP Reg	*Environmental Protection Regulation 2008*
GED	General Environmental Duty
GLNG	Gladstone Liquefied Natural Gas
IECA	International Erosion Control Association
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
QLD	Queensland
RUSLE	Revised Universal Soil Loss Equation
SCL	Strategic Cropping Land
SWMS	Standard Work Method Statements

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1.0 Introduction

Petroleum activities that result in disturbance to land have the potential to result in the transport of sediment to land and waters during rainfall events. This potential exists throughout the lifecycle of a gas-field development project, including during the exploration, production, and decommissioning phases. However most erosion potential and environmental risk exists during the construction phase when land disturbance and exposed areas are greatest.

Petroleum activities are subject to legal obligations to protect environmental values by preventing releases of contaminants to waters, including sediment. However, reasonability tests apply, providing Santos GLNG the ability to implement erosion and sedimentation management approaches cognisant of environmental risk and costs.

Santos GLNG adopts a strategic approach to the management and minimisation of erosion and sedimentation. The approach aims to deploy erosion and sediment control (ESC) resources appropriate to maintain the integrity of petroleum activities and the risk that petroleum infrastructure presents to adjacent receiving environmental values.

This Erosion and Sediment Control Management Plan (ESCMP) documents the Santos GLNG erosion and sedimentation management strategy and introduces controls and measures for implementation across the Santos GLNG Upstream Project Area.

1.1 Purpose and Scope

1.1.1 Purpose

Santos GLNG has both a legal and social responsibility to manage the potential for erosion and sedimentation generated by its petroleum activities. This ESCMP has been prepared to satisfy these obligations and complements the overarching Santos Environment, Health and Safety Management System (EHSMS).

The objectives of this ESCMP are to:

- facilitate compliance with relevant legislation, regulations and approvals;
- support the Santos Environmental Health and Safety System (EHSMS)*;*
- provide a framework for Santos GLNG to:
  - minimise erosion of land and soil resources from Santos GLNG activities;
  - maintain the integrity of petroleum assets;
  - avoid transport of sediment to waters and manage the transport of sediment to land; and
  - develop procedures where appropriate over time.

1.1.2 Scope

This ESCMP provides an overview of the strategy and controls implemented by Santos GLNG to manage erosion and sediment. Specifically, this ESCMP identifies erosion and sediment risk within the Santos GLNG Upstream Project Area and provides an erosion and sediment control strategy cognisant of these risks.

The ESCMP is to be implemented by all Santos GLNG Project personnel conducting activities throughout exploration, construction, production, decommissioning and rehabilitation phases of the Project.

This ESCMP applies to all activities carried out within the Santos GLNG Upstream Project Area. The Santos GLNG Upstream Project Area consists of Santos GLNG petroleum tenements comprising the Arcadia, Fairview, Roma and Scotia gas fields and as illustrated in Figure 1.

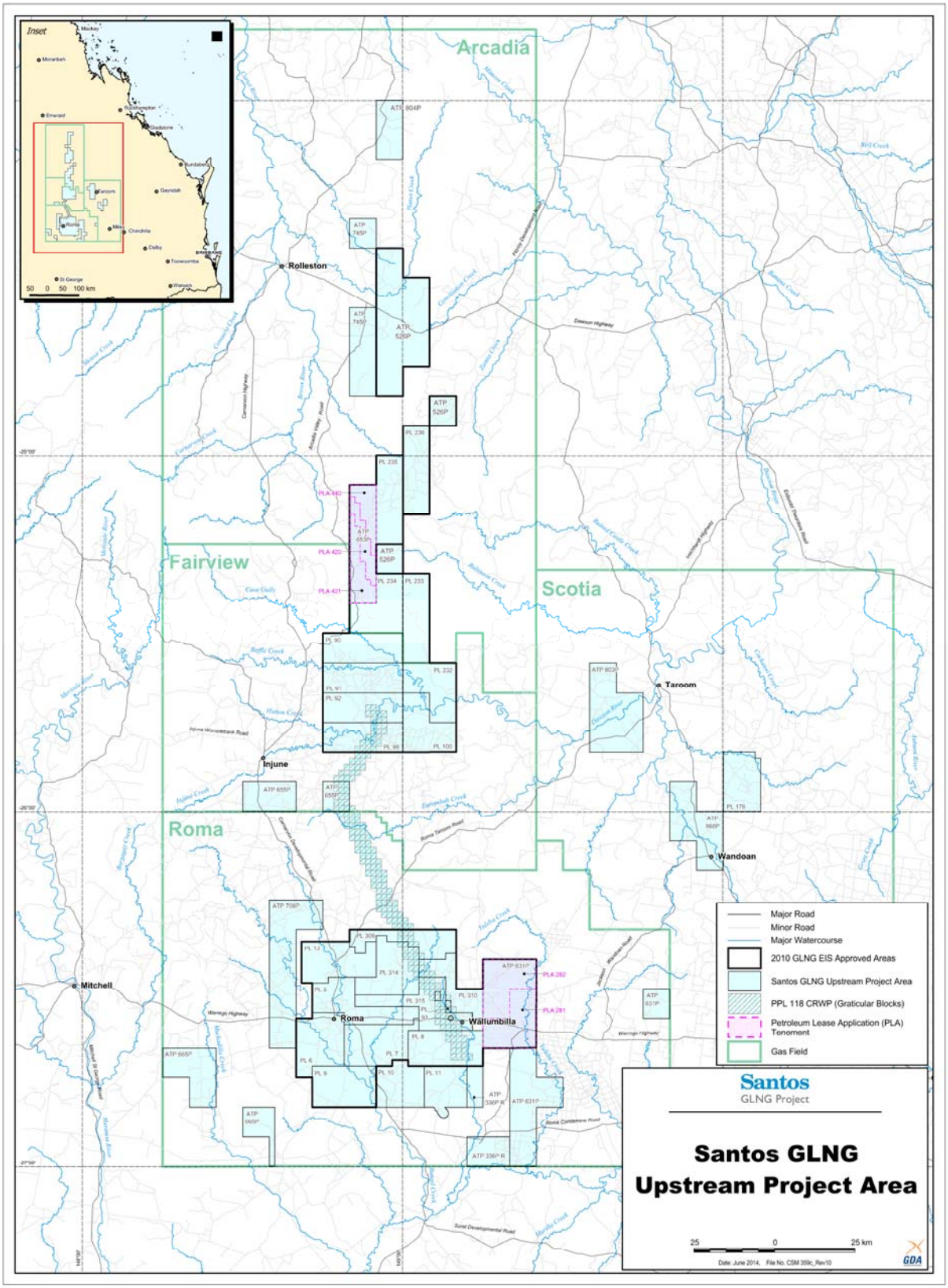

Figure 1: The Santos GLNG Upstream Project Area

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2.0 Roles and Responsibilities

Santos GLNG Project personnel are responsible for the environmental performance of their activities, for complying with relevant approval / permit requirements and for ensuring that all environmental objectives associated with the work are achieved. Santos GLNG Project personnel must also be mindful of the General Environmental Duty (GED) as outlined in the *Environmental Protection Act 1994* (Qld) (EP Act). Section 319(1) of the EP Act states that "*a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practical measures to prevent or minimise the harm.*"

Roles, responsibilities and accountability under the ESCMP will be assigned in accordance with the *Santos EHSMS05 – Responsibility and Accountability*.

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3.0 Legal and Other Requirements

3.1 Legislation

An overview of the legislative requirements relevant to this ESCMP is provided in Table 1 below. The EP Act is the principal legislation governing Santos GLNG's responsibilities in relation to erosion and sediment management.

Table 1: Summary of Relevant Legislative Requirements

Regulatory Instrument	Summary of provisions
Environmental Protection Act 1994 **(EP Act)** ***Environmental Protection Regulation 2008*** **(EP Reg)**	Section 319 of the EP Act, requires individuals and corporations in Queensland to take all reasonable and practicable measures to prevent or minimise environmental harm under the EP Act. It is an offence under Section 440ZG of the EP Act to unlawfully deposit / release a prescribed water contaminant in Queensland waters. However, under Section 493A of the EP Act, releasing contaminants to waters is lawful if provided for by an EA or compliance with Section 319 can be demonstrated. This ESCMP documents how Santos GLNG will satisfy the requirements of compliance with Section 440ZG and Section 319 of the EP Act and relevant conditions of Santos GLNG Upstream Project Area EA conditions. Sediment is a prescribed water contaminant under Schedule 9 of the EP Reg. Santos GLNG holds a number of EAs issued under the EP Act that authorise petroleum activities for the Santos GLNG Project. These EAs include requirements for the implementation of specific erosion and sediment controls.
Environmental Protection (Water) Policy 2009 **(EPP Water)**	The EPP Water provides a process for protecting Queensland waters by establishing environmental values and water quality objectives for many waters (see Schedule 1 of the EPP Water). Section 13 of the EPP Water establishes a management hierarchy for activities that may affect waters through the release of wastewater or contaminants, which when applied, protects the environmental values of waters. This ESCMP applies the management hierarchy by establishing a risk-based approach to the implementation of controls and the environmental performance standards necessary to protect waters from the impacts of petroleum activities.
Land Access Code	Subordinate to the *Petroleum and Gas (Production and Safety) Act 2004*, the Land Access Code imposes mandatory conditions on Projects concerning the conduct of resource activities on private land.

3.2 Santos Environment, Health and Safety Management System

The Santos EHSMS provides a framework for environmental and safety practices across Santos operations worldwide. The framework is consistent with *AS 4801:2000 Occupational Health and Safety Management Systems* and *AS/NZS ISO 14001:2004 Environmental Management Systems.*

This ESCMP complements the requirements of the EHSMS, in particular, the Santos Environmental Hazard Standard *EHS10 – Water Resources* that provides generalised guidance on reducing the risk of erosion and sedimentation associated with Santos activities. Additional relevant EHSMS standards include, *EHS06 – Environmental Impact Assessment and Approvals*.

This ESCMP complements the Santos EHSMS and specifically addresses unique features and requirements relating to the Santos GLNG Project. GLNG specific documentation is based on identified environmental and reputational risks and accounts for Santos GLNG's legal and other obligations, commitments made by the Santos GLNG Project and Santos GLNG's Social Licence to Operate.

In this context, Santos GLNG implements a collection of issue-specific management plans and procedures designed to support the EHSMS and deliver on company environmental standards. The issue-specific management plans provide additional guidance for the management of environmental issues and support the development of asset / activity / department based guidelines and work instructions, in order to secure compliance with legal requirements.

The Santos approach to environmental management is illustrated in Figure 2.

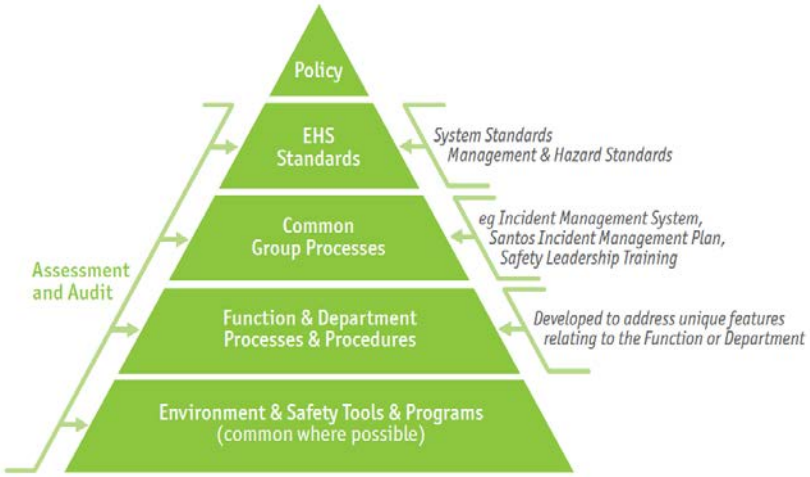

Figure 2: The Santos Approach to Environmental Management

A specific set of procedures has been developed to manage erosion and sediment in the Santos GLNG Upstream Project Area, including:

- Procedure for Undertaking Field Validations of Infiltration Areas;
- Standard Work Method Statement for Wellpads (Construction);
- Standard Work Method Statement for Wellpads (Operational);
- Santos Road Design Guideline;
- Standard Work Method Statement for Linear Infrastructure (excluding Roads/Tracks);

- Standard Work Method Statement for Camps;
- Santos GLNG Erosion and Sediment Control Manual; and,
- Procedure for Undertaking Watercourse Assessments.

The above list will be modified as further procedures and standard work method statements are developed for additional petroleum activities. The relationship between the above Standard Work Method Statements (SWMS), this ESCMP and the erosion and sediment transport risk during construction and operational phases is shown in Figure 3.

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4.0 Erosion Risk in the Santos GLNG Upstream Project Area

A broad scale erosion / soil loss risk assessment was undertaken over the Santos GLNG Upstream Project Areas using the Revised Universal Soil Loss Equation (RUSLE) whereby an expected annual soil loss rate (tonnes of soil per hectare per annum) (t/ha/annum) was calculated in accordance with the International Erosion Control Association (IECA), Best Practice Erosion and Sediment Control Manual. The following inputs were used for this erosion risk assessment:

- rainfall erosivity factor;
- soil erodibility factor;
- topographic factor derived from slope length and slope gradient;
- cover and management factor; and
- erosion control practice factor.

The erosion / soil loss risk assessment identified areas that have low, medium and high erosion risk and the majority of the study area has a low-medium erosion risk as shown in Table 2. The area with the highest erosion risk is located on the escarpments of Expedition National Park adjacent to the Arcadia Valley.

Table 2: Erosion Risk

Erosion Risk	Soil Loss (t/ha/annum)
Very Low	<10
Low	10 to 75
Medium	75 to 150
High	>150

The results of the erosion risk assessment showing low, medium, and high erosion risk areas, is available on the Santos WebGIS under the ‘Erosion Risk’ layer.

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5.0 Management Strategy

The risk of sediment being transported from Santos GLNG activities and impacting adjacent environmental values (i.e. transport of sediment to waters) is dependent on the scale and location of individual petroleum activities, their proximity to sensitive receiving environments and the site ESC response. The Santos GLNG ESC management strategy focuses on the risk that an individual petroleum activity presents to surrounding receiving environments, while maintaining the integrity of petroleum infrastructure.

Erosion and sediment transport risk exists throughout the lifecycle of petroleum activities, beginning with bulk / civil earthworks and reducing through project phases to decommissioning, as disturbances are increasingly stabilised and progressively rehabilitated. Accordingly, ESC measures differ during the construction and operational phases of the Santos GLNG project. Figure 3 provides a pictorial representation of the Santos GLNG ESC management strategy across project phases.

Figures 4-6 provide a graphic presentation of the risk assessment process that will determine the ESC used during the construction phase for well pads, camps, and linear infrastructure only. All other Santos GLNG activities require a site specific ESC plan.

The construction phase erosion and sediment risk assessment process includes consideration of the:

- potential soil loss;
- disturbance size and type;
- location of the proposed disturbance with respect to waters; and
- soil, vegetation and topographic features present at the proposed disturbance and surrounds.

This risk assessment process will determine whether the site and proposed disturbance would constitute a low, medium or high erosion risk. Appropriate ESC documented in Standard Work Method Statements prepared by a suitably qualified person will be implemented, depending on the ESC risk. While the purpose of this ESCMP is to ‘streamline’ internal approvals and provide generic ESC for recurrent activities not located in high ESC risk areas, a site specific ESC plan provides the default level of ESC for ‘ineligible’ activities, or for those activities undertaken in high ESC risk areas.

The transport of sediment has the potential to impact the environmental values of both waters and land, in particular, Environmental Sensitive Areas (ESAs – refer Santos GLNG Upstream Project EA’s) and Strategic Cropping Land (SCL). However, Santos GLNG has received qualified ecologist advice that sediment generated by Santos GLNG activities is unlikely to impact adjacent vegetation. Notwithstanding, Santos GLNG activities will be located in accordance with the Land Disturbance conditions of Santos GLNG Upstream Project Area EAs which provide for only limited and/or low impact petroleum activities within ESAs and where no reasonable or practicable alternative exists. Any petroleum activities undertaken on SCL and requiring an SCL Protection Decision or Certificate of Compliance will be undertaken in accordance with the conditions of the respective Protection Decision or SCL Code of Compliance. Accordingly, the proximity of ESAs and SCL is not included as part of the construction phase erosion and sediment risk assessment process shown in Figures 4-6.

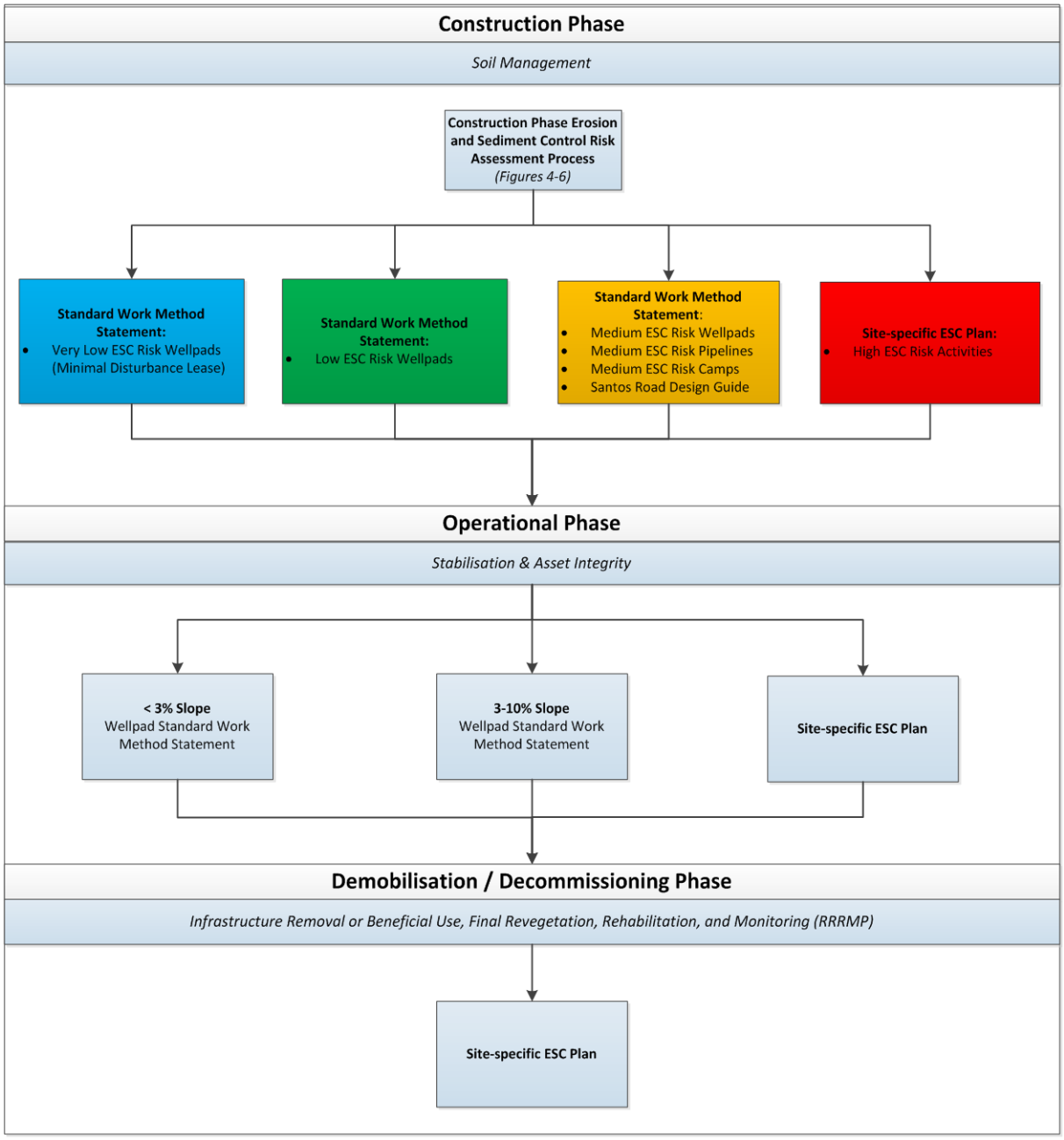

Figure 3: Santos GLNG Upstream Erosion and Sediment Control Strategy

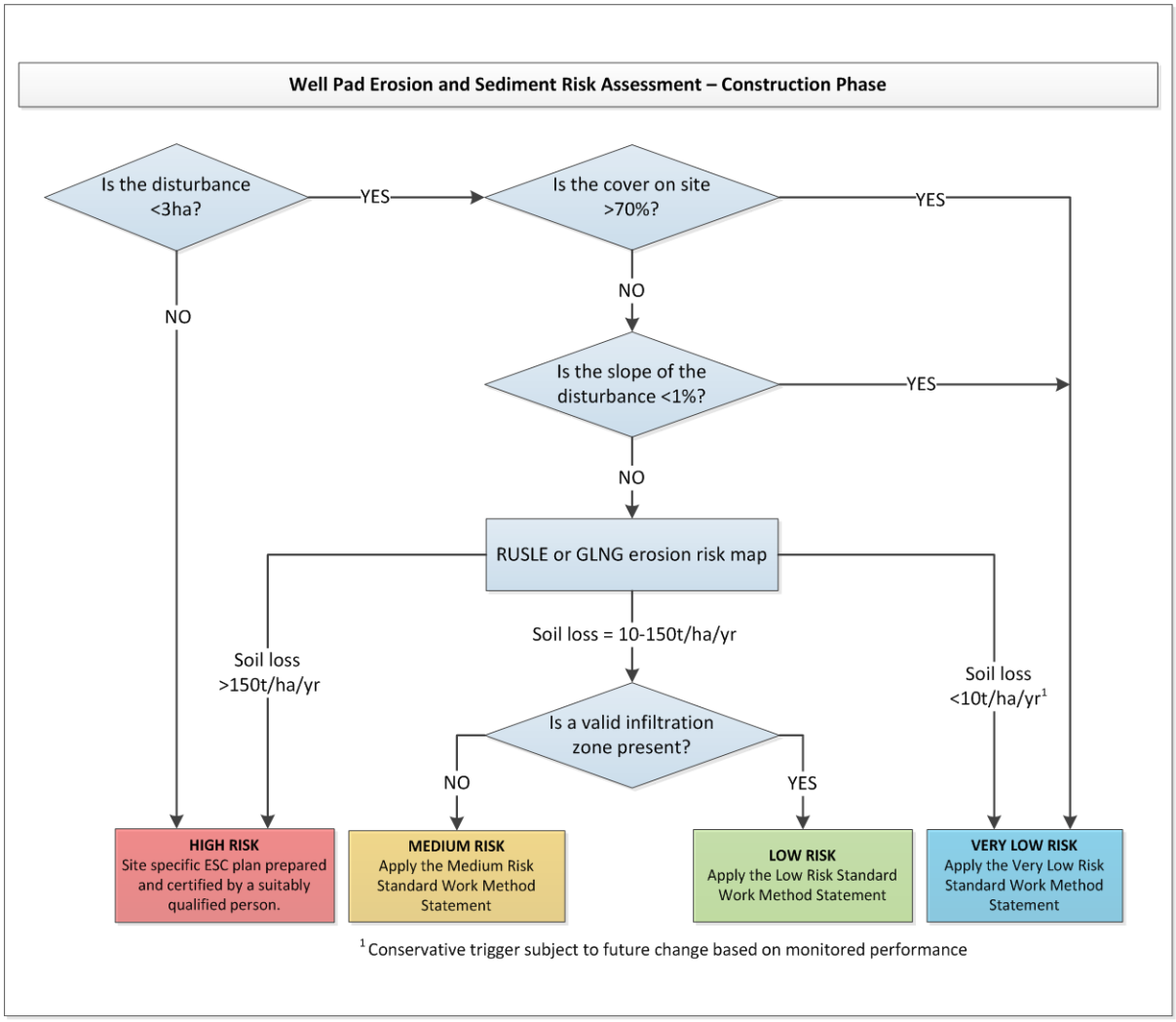

Figure 4: Well Pad Erosion and Sediment Risk Assessment Process – Construction Phase

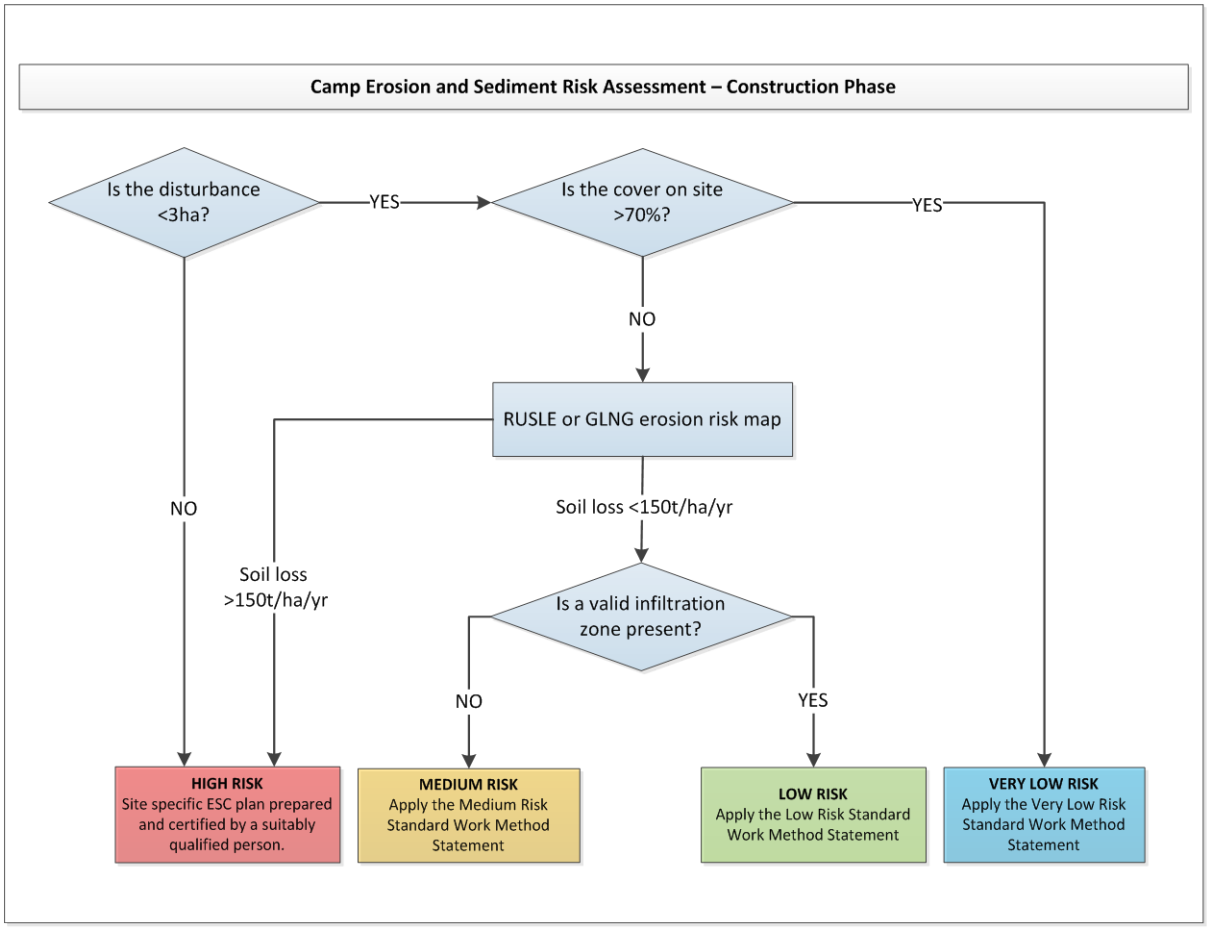

Figure 5: Camp Erosion and Sediment Risk Assessment Process – Construction Phase

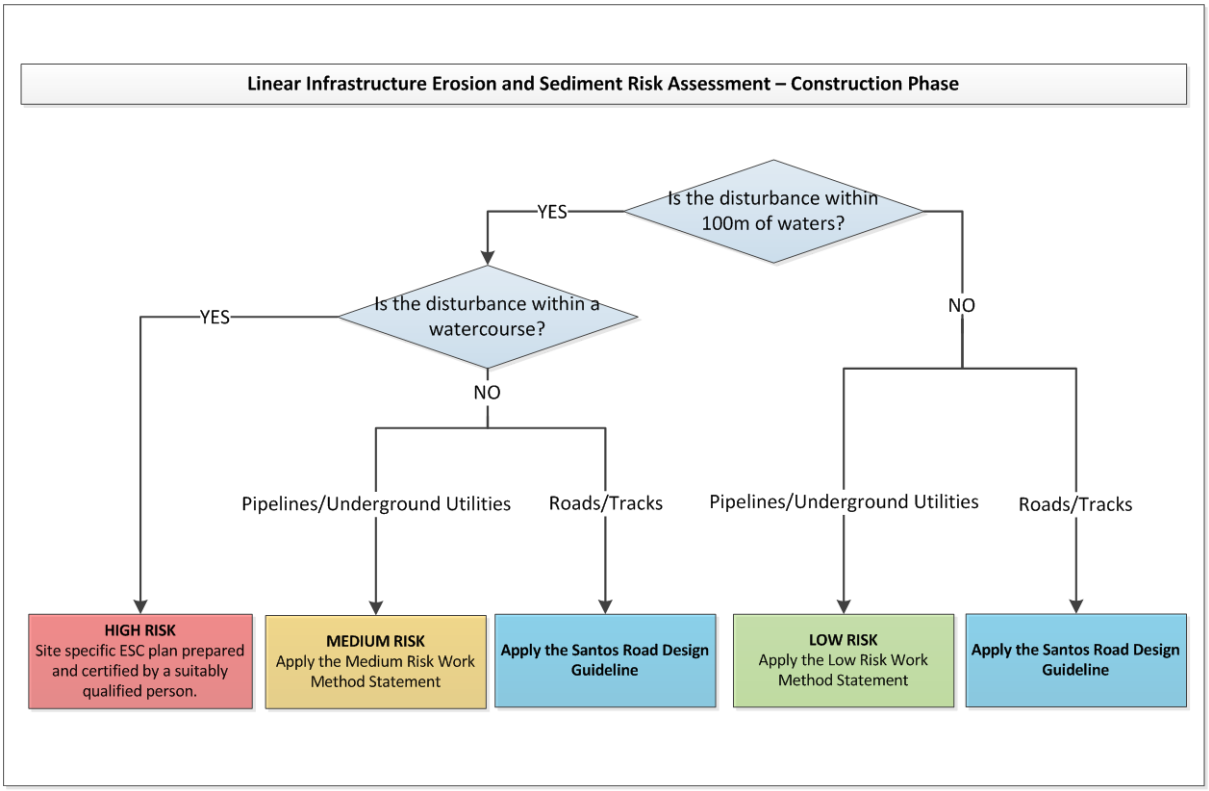

Figure 6: Linear Infrastructure Erosion and Sediment Risk Assessment Process – Construction Phase

5.1 Construction Phase Erosion and Sediment Risk Assessment Process

This section provides an overview of some of the individual decisions / assessments forming part of the construction phase erosion and sediment risk assessment process provided in Section 5.0.

5.1.1 Potential Soil Loss

Consistent with the erosion hazard assessment presented in the IECA *Best Practice Erosion and Sediment Control Guideline 2008*, disturbances with a potential soil loss (calculated using the RUSLE equation use of the Santos GLNG erosion risk map available in the Santos WebGIS) greater than 150t/ha/yr, are considered high erosion risk. Site-specific ESC plans will be prepared for high erosion risk activities / areas (further discussed in Section 5.2.2).

5.1.2 Proximity to Waters

Sediment has the potential to be transported from disturbed areas to waters during rainfall events that create surface water runoff.

Santos GLNG has used the industry standard Model for Urban Stormwater Improvement Conceptualisation (MUSIC) to understand how infiltration reduces sediment movement and estimate the distance that sediment could be transported across land during rainfall events. Model scenarios included a range of soils types and site conditions. Modelling showed that under worst case scenarios, for the design rainfall event[1] and where a valid infiltration area was present (further discussed in Section 5.1.4 below), site-mobilised sediment would not travel beyond 60m from the area of disturbance.

Subject to field validation of model assumptions, petroleum activities more than 100m from waters are therefore conservatively considered low risk and Low Risk SWMS applied. Disturbances within 100m of waters are considered at least medium risk, requiring additional controls and Medium Risk SWMS will be implemented where applicable. SWMS are further discussed in Section 5.2.3.

5.1.3 Infiltration Field Validation

As shown on Figure 4, prior to the implementation of Low Risk wellpad SWMS, assumptions used in the MUSIC model would be verified to validate the suitability of infiltration areas for each disturbance, including:

- Slope and length of infiltration area - a valid infiltration area includes an average slope of less than 10% and a minimum length of the infiltration area of at least 100m.
- Waters and concentrated flow paths - a valid infiltration area does not include waters or topographic features that would concentrate runoff to promote non-sheet flow conditions and concentrated / preferential flow paths.

  Ground cover - a valid infiltration area includes either ground cover vegetation covering at least 70% of the infiltration area or agricultural ploughing. Where ploughing is present in infiltration areas with slopes greater than 3%, ploughing must be located along contour slopes.

[1] 5 day 80th percentile rainfall event – equivalent to best practice Type D sediment basin design basis

- Soil type - a valid infiltration zone includes gravels, sands, sandy loams, and loams soil texture categories. Where clay loams, sandy clay loams, light clays, and medium to heavy clays are present, an Emerson Class test, bleaching test and soil structure / size will be used to determine suitability of the infiltration area.

If the model assumptions are verified through field investigations described generally below, the disturbance would represent a low erosion risk activity and the Low Risk SWMS will be implemented. If the model assumptions are not verified, and the assumptions cannot be satisfied by modifying the disturbance activity or installing additional erosion and sediment controls, the disturbance would represent a medium risk activity and the Medium Risk SWMS will be implemented.

5.2 Construction Phase Erosion and Sediment Controls

5.2.1 Soil Management

Soil management measures will be used for all erosion risk activities (very low, low, medium, and high erosion risk), including consideration of the following:

- soil testing to identify problem soils (i.e. dispersive soils) and amelioration if required (i.e. gypsum treatment);
- stripping the maximum depth of topsoil available from proposed disturbance areas, to maximise reuse for later rehabilitation;
- stockpiling topsoil and subsoil separately;
- stockpiling and mulching (where available) cleared vegetation for spreading over disturbed areas;
- minimising the period that the soil is left exposed to erosion through progressive ground cover revegetation; and
- ripping and seeding of soil stockpiles proposed to be retained for long periods prior to use (i.e. more than six months).

The results of soil testing undertaken during field validation of the construction phase erosion and sediment risk assessment process, will be used to identify problem soils and trigger the need for amelioration (i.e. application of gypsum) during the construction phase.

5.2.2 Controls for High and/or unknown Erosion and Sediment Risk

A site-specific ESC plan will be prepared by a suitably qualified person and implemented for all high erosion risk activities. Site-specific ESC plans will be prepared in accordance with the *GLNG Erosion and Sediment Control Manual*. This manual provides controls for drainage, erosion and sediment and in-stream works, and based on the best management practice guidelines outlined in the IECA *Best Practice Erosion and Sediment Control Guideline 2008*.

5.2.2.1 Drainage Controls

Section 5 of the *GLNG Erosion and Sediment Control Manual* provides a range of potential drainage controls that will be used in site-specific ESC plans depending on site-specific characteristics. These potential drainage controls include the following:

- diversion of up-slope stormwater runoff around disturbed areas including stockpiles and waste storage areas;
- installation of lateral catch drains or flow diversion banks to minimise rill erosion along steep continuous slopes (i.e. >10%) especially associated with linear infrastructure construction (i.e. pipelines, roads/tracks and powerlines);

- placement of velocity control structures such as rock check dams to reduce the flow velocity in channels;
- lining of channel with scour resistant materials including erosion control matting or rock lining; and
- use of energy dissipation structures at the outlets of banks, drains and chutes.

5.2.2.2 Erosion and Sediment Controls

Section 6 and Section 7 of the *GLNG Erosion and Sediment Control Manual* provides a range of potential ESC that will be used in site-specific ESC plans depending on site-specific characteristics. These potential ESC include the following:

- Prioritising drainage and erosion control measures, rather than allowing erosion to occur and trying to trap the resulting sediment.
- Spreading mulch or retained native vegetation over disturbed areas as soon as practicable after construction to reduce rainsplash erosion and to stabilise disturbed landforms.
- Use of erosion blankets (i.e. jute and coir matting) as an alternative to mulching in drainage channels or areas of strong winds or overland flow.
- Use of sediment traps (i.e. sheet flow, kerb inlet and field inlet sediment traps) and sediment basins.
- Amelioration of problem soils (i.e. gypsum treatment of sodic soils).
- Use of 'ripping' or similar techniques on finished soil surfaces to encourage revegetation where required.
- Maintaining access to erosion and sediment controls.

5.2.2.3 In-stream Works Controls

Section 8 of the *GLNG Erosion and Sediment Control Manual* provides water flow control methods (i.e. cofferdams and isolation barriers), and ESC specific to works undertaken in watercourses.

5.2.3 Controls for Very Low, Low and Medium Erosion and Sediment Risk

SWMS will be implemented for wellpad, camp, and linear infrastructure standard designs where appropriate and as determined by the construction phase erosion and sediment risk assessment process. Erosion and sediment controls in construction phase SWMS include:

- Erosion
  - 70% ground cover
  - Batters < 1m high
- Drainage
  - Clean water diversions
  - Dirty water diversions
  - Lateral drainage/berms
- Sediment
  - Runoff dissipation / spreading to achieve laminar / sheet flow
  - Infiltration zones
  - Sediment trap or filter tube dam

5.3 Operational Phase Erosion and Sediment Controls

SWMS will be implemented during the operational phase of wellpads, where available. Operational phase SWMS have been prepared for wellpads and additional SWMS will be prepared for other petroleum activities as required. Operational phase SWMS for wellpads include:

- removal of fluid storages (i.e. turkeys nests containing drilling fluids);
- spreading of stockpiled topsoil across disturbed areas;
- revegetation;
- stabilisation of batters; and
- establishment of permanent drainage.

Site-specific erosion and sediment control plans will be implemented in the absence of operational phase SWMS, similar to the construction phase site-specific erosion and sediment control plans described in Section 5.2.2.

5.3.1 Progressive Stabilisation / Rehabilitation

Progressive stabilisation and rehabilitation of disturbed areas will be undertaken to reduce erosion and sediment risk. Stabilisation / rehabilitation will be undertaken to achieve the rehabilitation objectives of Santos GLNG Upstream EAs and *the Santos GLNG Upstream Rehabilitation Management Plan*, including:

- backfilling of pipeline trenches as soon as practicable after pipeline laying / construction;
- replacement of topsoil and subsoil consistent with existing soil profiles (i.e. replacement of subsoil prior to topsoil replacement);
- reshape disturbed areas to a stable landform;
- re-profiling disturbed areas consistent with existing contours; and
- establishing groundcover.

5.4 Monitoring and Inspection

5.4.1 Erosion and Sediment Controls

Erosion and sediment controls (e.g. sediment basins, rock check dams, sediment fences, drainage controls etc.) will be routinely inspected and maintained for capacity and structural integrity, particularly following significant rainfall events.

5.4.2 Surface Water

Sediment basin water quality will be monitored prior to discharge to determine compliance with any relevant EA water quality release limits.

Where linear petroleum activities are being constructed within or adjacent watercourses, water quality monitoring will be undertaken at upstream (background) and downstream (20m from watercourse crossing works) locations to determine compliance with EA conditions requiring downstream turbidity levels are no more than 10% above upstream turbidity levels.

5.5 Training

Training suited to the different roles and responsibilities (refer Section 2) will be undertaken in accordance with appropriate Santos Standards including *EHSMS06 Training and Competency*. Regular toolbox meetings and pest and weed awareness sessions are also conducted. Topics addressed by these session include erosion and sediment control principles to maintain compliance with regulatory requirements and to reinforce solutions or increase awareness of any erosion and sediment control related issues that arise during the course of exploration, construction, operations, decommissioning and rehabilitation.

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6.0 Evaluation and Review

6.1 Evaluation

The implementation and effectiveness of the Santos GLNG ESCMP and associated SWMS and procedures will be regularly assessed and reviewed to ensure that:

- Santos GLNG is demonstrating compliance with legal and other obligations;
- The overall management strategy remains relevant and up to date; and
- ESC are adequate to manage the environmental risks.

Effectiveness is to be assessed by a number of methods as shown in Table 3.

Table 3: Methods to Assess Procedural Effectiveness

Assessment Tool	Description
Checklists – Santos GLNG Compliance Management System	• Checklists, developed to reflect procedural requirements / outcomes will be used by individual Santos GLNG Departments to assess and manage compliance. • The results of the checklists will be evaluated for trending non-compliances that may be resolved through procedural change or by implementing another measure or process.
Audits	• Conduct internal and third party audits to formally assess the level of compliance with both regulatory requirements and with Santos GLNG procedures. • Audit outcomes are used to develop corrective actions which may include changes to this plan and/or procedures.
Review of Incidents	• A review of internal incidents, near misses or hazards will be undertaken to identify recurrences of similar incident types. This may highlight a requirement for a change in the existing plan and/or procedure or require the development of a new procedure or by implementation of another measure or process to address the recurring issue.
Review of Data	• Analyse all relevant data collected for negative and/or undesirable trends that may be prevented by procedural changes or by implementing another measure or process.

6.2 Review

The ESCMP will be reviewed at least every three years or sooner if required or if any of the following occur:

- Changes to legislative requirements.
- Changes to the Santos GLNG Upstream Project Area.
- Changes to Santos GLNG CSG activities.
- In response to offences to the legislative requirements described in Section 3.

Reviews and changes to the ESCMP will be communicated to relevant Santos GLNG Project personnel.

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7.0 References

International Erosion Control Association (2008) *Best Practice Erosion and Sediment Control – Erosion Hazard Assessment Form*

Santos GLNG (2014) *Upstream Management Plans Library* http://teams-bne.santos.com/sites/USSUS/ENV/PlansProcedures/Forms/AllItems.aspx

Santos Limited (2013) *Environment, Health and Safety Management System Library* http://teams.santos.com/sites/ehsmsadministration-00401-c/sitepages/home.aspx

Standards Association of Australia (2004) *AS/NZS ISO 14001:2004 Environmental Management Systems*

Standards Association of Australia (2000) *AS 4801:2000 Occupational Health and Safety Management System*