

Soil and Surface Water Management Sub Plan

Rev 03
Reviewed June 2019

Dewhurst Gas Exploration Project Environmental Sub-Plan – Soil & Surface Water Management Sub Plan

1.1 Background

This Soil and Surface Water Management Plan (SSWMP) is one of the Environmental Sub-Plans under the Project Environmental Management Plan (PEMP)) for the Dewhurst Gas Exploration Pilot Wells Program and the Exploration Pilot Expansion Project (the Project).

This SSWMP outlines the mitigation measures that will be implemented prevent and minimise soil and surface water quality impacts from the activities as well as the monitoring and reporting requirements of the Project.

Mount Pleasant Creek and two unnamed ephemeral watercourses intersect the central gathering system. Water will not be extracted from these watercourses or other surface waters.

Site water management principles will be based on:

- Minimising surface disturbance
- Separating clean and dirty water, including minimising surface water running onto the lease areas; and
- Preventing contaminants from running off the lease area.

Individual Erosion and Sediment Control Plans will be developed for each area in accordance with the NSW ESC Plan which details that 'these may be required for any disturbance where cleared area is >2500m² and groundcover is <70%'.

This Plan should be read in conjunction with the following approved plans:

- Produced Water Management Plan
- Narrabri Gas Field Groundwater Monitoring and Modelling Plan¹.
- Pollution Incident Response Management Plan
- Hazard and Risk Management Sub Plan
- Waste Management Sub Plan

1.2 Key Statutory Requirements

1.2.1 General

- *Protection of the Environment Operations Act 1997.*
 - The project holds an Environmental Protection Licence (EPL No. 20350).
 - It is an offence to wilfully or negligently cause any substance to leak, spill or otherwise escape in a manner that harms or is likely to harm the environment.
 - It is an offence to pollute waters under Section 120 of the Act.
 - Pollution incidents causing or threatening material harm are to be reported to the Environment Protection Authority (EPA).
 - Make publically available on the Santos website all EPL listed monitoring data

¹ This approved plan has been updated to include project scope of works

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within 14 days of obtaining it.

- *Environmental Planning and Assessment Act 1979*
 - Regulated by NSW Department of Planning and Environment (DPE). There is a Project Approval related to the Project that contains the requirement to prepare and implement management plans and monitoring programs.
- *The Contaminated Land Management Act 1997.*
- *Water Management Act 2000.*
 - Controlled activity approval is required under Part 4 development consents for controlled activities when working on 'waterfront land' (within 40 m of a watercourse) (equivalent to former Part 3A permits under the former *Rivers and Foreshore Improvement Act 1948*).
 - Water Access Licences and various other approvals are required for the extraction and use of water.
- *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*
 - On the 19 June 2013 an amendment to the EPBC Act, to provide that water resources are a matter of national environmental significance (MNES), in relation to coal seam gas and large coal mining developments.
 - The water trigger allows the impacts of proposed coal seam gas developments on water resources to be comprehensively assessed at a national level.
 - The amendment will not apply to actions already approved under the EPBC Act. However, if an approved project has a substantial change to how it is conducted or an extension, the new MNES may apply if there is likely to be significant impact on a water resource.
- National Water Quality Management Strategy.
- Australian and New Zealand Guidelines for fresh and marine water quality 2000 (ANZECC/ARMCANZ, 2000).
- NSW Landcom publication Managing Urban Stormwater - Soils and Construction (4th Edition, March 2004); and Managing Urban Stormwater, EPA 1997
- NSW Office of Water Guidelines for Controlled Activities on Waterfront Land (2012):
 - Guidelines for instream works on waterfront land;
 - Guidelines for laying pipes and cables in watercourses on waterfront land;
 - Guidelines for outlet structures on waterfront land;
 - Guidelines for vegetation management plans on waterfront land; and
 - Guidelines for watercourse crossings on waterfront land.
- Minimum Construction Requirements for Water Bores in Australia, Edition 2, (Land and Water Biodiversity Committee, 2003)
- Australian Standard 1940 – 2004; The Storage and Handling of Flammable and Combustible Liquids.

1.2.2 **Project Specific**

- Approvals:

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- Department of Primary Industries (DPI) Project Approval for production pilots covering wells 13 to 18H – 21 July 2009 (DPI-PA)².
- Department of Trade and Investment (DT&I) Development Approval for pilot wells 26-29 under Minister for Resources and Energy – 16/8/2013 (MRE-DA).
- Department of Planning and Environment (DPE) Approval – 18 July 2014 (SSD-6038).
- NSW Forests Occupation Permit (OP).
- NSW Office of Water (NOW) Water Supply Works Approval (90WA832266).
- Environment Protection Licence 20350 (EPL 20350).
- Renewal Petroleum Exploration Licence 238 (PEL 238).
- Review of Environmental Factors (REF (3/13)).
- Review of Environmental Factors - Statement of Commitments (REF – SoC (3/13)).

1.2.3 Santos Management System (SMS)

This SSWMP has been developed in accordance with relevant legislative and regulatory requirements and conditions in the **Santos Management System (SMS)**, including the following standards:

- SMS-MS1-ST13 Environmental Hazard Controls Procedure
- SMS-MS11-ST2 Incident Reporting, Investigation and Learning
- EHSMS 14 Monitoring, Measurement and Reporting (including Appendix A Environmental Monitoring Overview)
- SMS-MS1-ST10 Chemical Management Procedure
- SMS-MS1-ST6 Excavation
- Spill Response Management Plan, Drilling and Completions, Revision 1, February 2014.
- Produced Water Management Plan, December 2018.
- Pollution Incident Response Management Plan, 0011-650-PLA-0003, September 2014.

1.3 Objectives

Objectives relating to the SSWMP are described below:

- Manage construction and operational activities so as not to cause pollution (including sediment, fuels, oils, concrete rinse water etc.) to enter surface water courses.
- To ensure that any contaminated water from the Project is captured and stored or treated and beneficially re-used where safe and practicable to do so or appropriately managed.
- Ensure compliance with relevant legislative and other requirements including those detailed in Section 1.2.

1.4 Performance Indicators

Performance indicators relating to this SSWMP are outlined below:

² Note the operational conditions of consent and REF statement of commitments under this approval are addressed within the approved Project Environmental Management Plan (PEMP). This PEMP forms part of the SMS process for the Project

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- Zero valid complaints received from landowners or government agencies concerning land disturbance, contamination or soil stability;
- Zero water contamination incidents from construction and operational activities; and
- Zero incidents concerning water levels or water quality during operations.

1.5 Predicted Impacts

Project activities are described in detail in the PEMP. The following activities taken from the EIS (RPS 2013) have been assessed as having the potential to impact on local soil and surface water resources.

Table 1: Predicted Impacts on soil and water

Activity	Potential Impact
Construction	
Installation/upgrade of access roads	Erosion of stockpiled topsoil
	Discharge sediment laden runoff
Construction of drill pad	Erosion of stockpiled spoil
	Discharge sediment laden runoff
Vehicle access	Erosion from track
	Damage undisturbed areas
Drilling	Discharge sediment laden return water
	Erosion of drill pad
	Surface water becomes sediment laden
	Discharge sediment laden runoff
Construction of Gas Gathering Lines	Erosion of stockpiled spoil
	Damage undisturbed areas, including riparian corridors and native vegetation
	Discharge sediment laden runoff
Production and Operation	
Well Production, Operation, Inspection and Maintenance	Erosion of surface due to disturbance around access and equipment
	Discharge of produced water
Inspection and Maintenance of the Gas Gathering System	Erosion of surface due to disturbance around access and equipment
Inspection and Maintenance of the Sales Gas Pipeline	Erosion of surface due to disturbance around access and equipment
Initial Rehabilitation	
Initial well rehabilitation	Erosion of backfilled and rehabilitated excavation
	Compaction of soil
	Discharge sediment laden runoff
	Damage undisturbed areas
Final Rehabilitation	
Backfilling and rehabilitation of gas gathering line.	Erosion of backfilled and rehabilitated excavation
Decommissioning of wells	Erosion of backfilled and rehabilitated excavation

1.6 Topography, Soils and Landforms

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The topography of the Project area is gently undulating with Mount Pleasant Creek and two unnamed ephemeral creeks crossing the area. Sodosols are common in the project area (BASL Site Verification Report, (RPS, 2013). These soils exhibit high erodibility, poor structure and low fertility.

These watercourses flow north-west to Cowallah Creek that is located approximately 1.6 kilometres (km) east of Dewhurst 27. Cowallah Creek is a tributary of Bohena Creek, that is located approximately 8.1 km north-west of the closest pad (Dewhurst 26).

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1.7 Erosion Hazard Assessment

An erosion hazard assessment was conducted in accordance with Landcom (2004) 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 at this site are detailed below.

Table 2: RUSLE factors and values used for this site

Factor	Description	Value Used
A	Computed soil loss (t/ha/yr)	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
P	Soil conservation practice factor	1.3 (compacted)
C	Ground cover factor	1.0

The maximum slope gradient that applies to this SSWMP is 10%. Soil loss for each work site or sub-catchment (ROWs) will be limited to a maximum of 200t/yr (150m³/yr) using the strategies outlined within Section 4 of this SSWMP.

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1.8 Mitigation Measures

Plan Ref	Actions	Timing	Reference
Erosion and Sediment Control Plan			
SSWMP-1	<p>Site specific Erosion and Sediment Control Plans will be prepared and implemented for each lease area. The plans will:</p> <ul style="list-style-type: none"> Describe the measures that will be employed to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters during construction activities. Be prepared in accordance with the requirements for such plans outlined in <i>Managing Urban Stormwater: Soils and Construction</i>, the 'Blue Book' or the <i>Best Practice Erosion and Sediment Control Guidelines (IECA, 2008)</i> (IECA Guidelines). 	<p>Prepared prior to Construction</p> <p>Implemented during Construction, Drilling and Operations</p>	<p>SSD-6038 Schedule 3, Condition 9</p> <p>MRE-DA Condition 13</p> <p>Water Supply Works Approval 90WA832266, Condition 15</p> <p>PEL 238, Conditions 11, 12</p> <p>REF(3.13), Section 2.8.1.1</p>
SSWMP-2	<p>The Erosion and Sediment Control Plans will address the following requirements:</p> <ul style="list-style-type: none"> Priority will be given to minimising exposed bare earth where practicable to minimise sediment loss as the first barrier. Appropriate methods erosion and sediment (ErSed) controls will be installed and maintained on the down slope perimeter of all stockpile areas to capture mobile sediments. A diversion bank will be constructed to direct water around the area of disturbance. The existing diversion bund at Dewhurst 13-18H will be maintained on the up-slope side of the lease areas to divert clean water around the work area. Diversion bunds will be installed and maintained for the Dewhurst 30 and 31 lease areas. 	At all times	<p>REF – SoC (3/13) Conditions 4,</p> <p>SSD-6038 Appendix 4, Conditions 23 & 24</p> <p>REF Section 2.8.1.1</p>
SSWMP-3	<ul style="list-style-type: none"> The erosion and sediment controls will be maintained as appropriate until disturbed areas of the site are stabilised. ErSed devices will be installed around the area of disturbance as necessary. Drainage structures will be maintained for the life of the development. 	At all times	<p>REF Section 6.1.1.2</p> <p>REF – SoC (3/13) Condition 17</p>
Water Flows			
SSWMP-4	<ul style="list-style-type: none"> The crossing of Mt Pleasant Creek will be designed to minimise up and downstream erosion of the bed and banks and changes to flow velocities. River crossings will be rehabilitated such that the natural flow of water is unimpeded and stream bank stability is maintained to prevent erosion. Open trenching works within 20 metres of watercourses will not be undertaken during significant rainfall events Construction activities will not impede lateral water flows. 	<p>During Design</p> <p>During Construction and Drilling</p>	<p>REF SoC (3/13), Condition 18</p> <p>REF Section 2.7.4.1</p> <p>PEL 238, Condition 49</p> <p>SSD-6038 Schedule 3, Condition 10</p>
SSWMP-5	<ul style="list-style-type: none"> Construction activity within 40 m of any watercourse, including construction of the drill pad, upgrades 	Prior to	MRE-DA Condition 9

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Plan Ref	Actions	Timing	Reference
	to access roads and any watercourse crossing will be designed by a suitably qualified person, consistent with the NSW Guidelines for Controlled activities (July 2012)	Construction	Water Supply Works Approval 90WA832266, Condition 10
Lease Area Establishment			
SSWMP-6	<p>The following will be undertaken during lease area establishment using industrial matting (preferred method – may be suitable for Dewhurst 26, 27 and 29 lease areas):</p> <ul style="list-style-type: none"> • The extent of the lease area will be delineated on site. • Vegetation will be slashed and graded (if required). The top soil layer will remain intact. • Areas of industrial matting will be placed on the ground throughout the lease area. • A designated stockpile area will be marked out and appropriate sediment controls installed along the down slope perimeter of this area. • All excavated spoil will be stockpiled in the designated area. 	During Construction	REF (3/13), Section 2.8.1.1
SSWMP-7	<p>The following will be undertaken during lease area establishment using traditional methods (if required):</p> <ul style="list-style-type: none"> • The extent of the lease area will be delineated on site. • Appropriate sediment catchment controls will be installed along the down slope perimeter of the lease area. • A designated stockpile area will be marked out and appropriate controls installed along the down slope perimeter of this area. • A drainage diversion bund will be constructed upslope of the lease area to divert clean water around the lease area. • Vegetation, topsoil and spoil will be stripped separately and stockpiled in the designated stockpile area. • The lease area will be graded to a low point where the lined sedimentation basin will be constructed. 	During Construction	REF (3/13), Section 2.8.1.1
Stockpiling			
SSWMP-8	<ul style="list-style-type: none"> • ErSed devices will be installed and maintained on the down slope perimeter of all stockpile areas. • Topsoil and subsoil material will be stockpiled separately. • Topsoil and subsoil will be stockpiled at the site for a period of up to approximately six months from release of the drill rig, until partial rehabilitation of the lease area can take place. • Stockpiles will be maintained with a slope of no greater than 2(horizontal): 1(vertical). • Stockpiles will be lightly compacted using the back of an excavator bucket or similar to reduce erosion potential. • Topsoil stockpiles will be maintained at a height no greater than two metres. 	During Construction	REF Section 2.8.1.1

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SSWMP-9	<ul style="list-style-type: none"> Excess spoil generated during site preparation activities will be stockpiled on site and used as backfill during site rehabilitation. No uncontaminated soil or spoil will be removed from the site. 	During Construction	REF – SoC (3/13), Condition 2 PEL 238, Condition 31
Drilling Activities and Operation			
SSWMP-10	Hydraulic fracturing / fracture stimulation / fracking will not be undertaken.	During Drilling	MRE-DA Condition 4 SSD-6038, Schedule 2, Condition 6
SSWMP-11	<p>If during the construction of the wells, saline or contaminated water is encountered above the production aquifer, Santos will:</p> <ul style="list-style-type: none"> Take all reasonable steps to minimise contamination and environmental harm; Ensure that such water is sealed off by inserting casing to a depth sufficient to exclude the saline or contaminated water from the work, and, if specified by the minister, placing an impermeable seal between the casing(s) and the walls of the work from the bottom of the casing to ground level as specified by the minister; and Comply with any requirements specified by the minister. The above requirements do not apply where the water supply work is being constructed for the purpose of taking saline water through a salinity or water table management access licence and the only contaminated water encountered is saline water. 	At all times	Water Supply Works Approval 90WA832266, Condition 6
SSWMP-12	<ul style="list-style-type: none"> Water that drains to the cellar pit will be circulated with the drilling mud throughout the drilling process. Drilling mud will be stored in surface tanks which will be regularly inspected and maintained. Any spilled liquids or contaminated water that is captured will be removed to a licensed waste facility for treatment or disposal in accordance with the Waste Management Sub Plan. 	During Drilling During Operations	REF (3/13) Section 2.8.1.9 REF – SoC (3/13), Conditions 7
SSWMP-13	<ul style="list-style-type: none"> Over-balanced drill techniques will be used to prevent produced water from rising through the well to the surface. 	During Drilling	REF – SoC (3/13), Condition 20
SSWMP-14	<ul style="list-style-type: none"> No drilling fluid additives containing Benzene, Toluene, Ethylbenzene and Xylene (BTEX) chemicals will be used. Drilling fluids will be managed in accordance with the Santos Fluids Management Plan. Drill cuttings, fluids and groundwater returned to the surface as part of the drilling process will be contained in above-ground tanks or in-ground sumps pending re-circulation or disposal. In-ground sumps will be lined with an impermeable barrier to prevent contamination of groundwater or material will be stored in surface tanks or metal bins. Produced water, and other waste fluids produced from a well, will be disposed of at an authorised wastewater treatment facility or treated to EPL criteria prior to discharging. Drilling fluids will be transported to and from site by an appropriate contractor. 	During Construction, Drilling and Operations	SSD-6038, Schedule 3, Condition 5 Water Supply Works Approval 90WA832266, Condition 6 PEL 238, Condition 15 SSD-6038 Schedule 3, Condition 8

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Plan Ref	Actions	Timing	Reference
	<ul style="list-style-type: none"> Produced water will not be discharged to land, except where approved under Condition 2 [of PEL 238] or the Produced Water Management Plan under Condition 14. At the surface, each pilot well will be connected to a small separator, operating at low pressure (approximately 275 kPag) to separate any coal seam gas from the produced formation water. Both the gas and water will be collected from each well and transferred to the gathering systems. A minimum freeboard of 300 millimetres will be maintained for any tanks or pits containing liquid waste. 		REF – SoC (3/13), Conditions , 19, 25, 27, 28, 30, 33 & 36 REF (3/13) Section 2.7.5.1 SSD-6038 SoC, Condition 3
Pollution Prevention			
SSWMP-15	<ul style="list-style-type: none"> Additives, chemicals, fuels and oils, transported, used and stored on site will managed in accordance with the Hazard and Risk Management Plan and relevant Safety Data Sheet (SDS). 	During Construction & Drilling	REF SoC 8, 9, 11, 12, 13, 14, 22, 24, 29, & 31 EPL 20350 O5.3
SSWMP-16	<ul style="list-style-type: none"> Above ground tanks containing material that is likely to cause environmental harm will be bunded or have an alternative spill containment system in place. 	During Construction & Drilling	EPL 20350, Condition O5.3
SSWMP-17	<ul style="list-style-type: none"> The maintenance and cleaning of vehicles and other equipment or plant will be carried out in areas from where the resultant contaminants cannot be released into any waters. 	During Construction & Drilling	REF- SoC (3/13), Condition 25
SSWMP-18	<ul style="list-style-type: none"> No refuse, garbage, petroleum products, trade waste, building material, earth fill or any offensive or polluting matter or liquid will be placed, tipped or discharged on any land or in any water or watercourse within the Occupation Permit Area. Santos will not place any obstructing matter on any land or in any water or watercourse or act or fail to act so as to cause any flow of water to be restricted, obstructed or diverted and will comply with any requirement of Forestry NSW regarding a watercourse. 	At all times	OP Condition 4.10.1
SSWMP-19	<ul style="list-style-type: none"> Weather forecasts will be monitored and in the event that prolonged, severe wet weather or flooding is predicted, works will cease and plant, machinery and any chemicals will be secured and bunded. This will also occur during drilling. 	During Operations	SSD-6038 SoC, Condition 32
SSWMP-20	<ul style="list-style-type: none"> Spills will be managed in accordance with the Narrabri Gas Project Pollution Incident Response Management Plan (PIRMP) and Santos EHSMS. 	As Required	EPL 20350, Condition O4.1
Other			
SSWMP-21	<ul style="list-style-type: none"> No water will be extracted from waterways or other surface waters including Mount Pleasant Creek, Tuppiari Creek, Cowallah Creek or Jacks Creek. 	During Construction & Drilling	REF (3/13) Section 2.8.1, SSD – 6038 Schedule 3, Condition 22
SSWMP-22	<ul style="list-style-type: none"> Sufficient water for all stages of the development will be maintained, and if necessary, the scale of operations adjusted under the consent to match its available water supply and licenced water 	At all times	SSD – 6038 Schedule 3, Condition 11

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Plan Ref	Actions	Timing	Reference
	entitlements.		
SSWMP-23	<ul style="list-style-type: none"> • If a well is abandoned or replaced it will be decommissioned in compliance with the minimum requirements for decommissioning bores as prescribed in the document 	As Required	Water Supply Works Approval 90WA832266, Condition 1

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1.9 Monitoring Requirements

Aspect	Description	Frequency
Statutory	<p>When directed by the minister by notice in writing, Santos will install metering equipment (complying with Australian technical specifications) to measure and record the flow of water taken through the water supply work (wells).</p> <p>The metering equipment would be sited and installed at a place in the pipe, channel or conduit between the groundwater source and the first discharge outlet and be operated and maintained in a proper and efficient manner.</p> <p>Santos would keep a logbook or data logger to record the following information</p> <ol style="list-style-type: none"> i. Each date and period of time on which water was taken using the water supply work; ii. The volume of water taken on that date; iii. The access licence number of the access licence under which water was taken on that date, or, if water was taken under some other authority (such as basic landholder rights entitlement), the authority under which water was taken iv. The purpose or purposes for which the water taken on that date was used; v. Details of any cropping carried out using the water taken through the water supply work including the type of crop, area cropped, and dates of planting and harvesting; vi. Where metering equipment has been installed for use in connection with the water supply work, the meter reading before water is taken; vii. Where metering equipment has not been installed for use in connection with the water supply work, viii. details of all pumping activities for the water supply work including pump running hours, pump power usage or pump fuel usage, pump start and stop times for water taken and pump capacity per unit of time; <p>The logbook would be produced to the Minister for inspection when requested and be retained for five years from the date to which the information relates.</p>	As required
General – Inspections	<ul style="list-style-type: none"> • Field Superintendent to assess potential soil and water issues during construction and drilling 	Daily during construction and drilling
	<ul style="list-style-type: none"> • Well Operator to undertake 'Well Runs' during operation to assess any potential soil and water issues. • Environmental Advisor inspection of activities to determine if all reasonable and feasible soil and water mitigation measures are in place 	<ul style="list-style-type: none"> • Daily during operation • 6 monthly during operation

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1.10 Reporting Requirements

Description	Timing	Reference
<p>Notify all relevant authorities (DPE, EPA, DRE as well as NSW Health, WorkCover NSW, Local Council and Fire and Rescue NSW).of any incident that has caused or threatens to cause material harm to the environment immediately after becoming aware of the incident.</p> <p>Provide written report within 7 days of the date of the incident. (Refer to PEMP and PIRMP).</p>	As required	<p>PEL 238, Condition 54 EPL 20350, Condition R2 SSD-6038 Schedule 5, Section 6</p>
<p>All other reporting requirements for soil and water reporting will be managed through Santos' Compliance tracking system (currently ComTrack but will use the current approved system)</p>	As required	